ATT had bought out my cable server and as of tomorrow, March 15th, my e-mail address will change.

Please use jking1@attbi.com from here on.

Thanks

John

--
Subject: E-mail change

ATT had bought out my cable server and as of tommorow, March 15th, my e-mail address will change.

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Thanks

John

--

From: "John King" <jking1@attbi.com>
Date: May 28, 2002 5:09:15 AM PDT
To: "John Barry Smith" <barry@corazon.com>, "David Evans" <devans@phillips.com>, "Jaswinder" <parmar@cybersurf.net>, "Ken Smart" <ksmart@aaib.gov.uk>, "Kevin & Susan Campbell" <smandkjc@internet.co.nz>, <Russell.Young@PSS.Boeing.com>, "Santokh Singh" <maan100@worldonline.nl>, "Shyrone Kaur" <KaurSingh@webtv.net>, <Glenwood@mweb.co.za>, <burt528@earthlink.net>, <hnorth@thebestisp.com>, <robert.donaldson@verizon.net>, <jimb@entelchile.net>, <newyork@fbi.gov>, "Gordon E. Smith" <gesmith@ee.net>
Subject: Re: Maybe another shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup

There is certainly enough history with United 811 and the two 'near misses' prior to it.
Of course fuel tank explosion (TWA 800) also comes to mind. The question is open to if a fuel quantity wire surge protection system (FQIS/TSU was used, e.g. Smiths, BF Goodrich, who installed it and when?

Also remember, its not just the 747s that are susceptible to fuel tank ignition but the other, as well. See the SDR and one image document attached of a FQIS wire within a DC-10 fuel tank. Look to the right of the finger tip in the picture and see the electrical burn mark through the insulation. The report filed with this SDR also said the metal rib to which this wire was chafing had to be "dressed out" due to the severity of the electrical burn.

The question becomes; where did that unwanted and dangerous electrical energy come from if not from cross arcing in shared wire bundles outside the tank?

JK
--

----- Original Message ----- 
From: Gordon E. Smith
To: John Barry Smith; David Evans; Jaswinder; jking1@attbi.com; Ken Smart; Kevin & Susan Campbell; Russell.Young@PSS.Boeing.com; Santokh Singh; Shyrone Kaur; Glenwood@mweb.co.za; burt528@earthlink.net; hnorth@thebestisp.com; robert.donaldson@verizon.net; jimb@entelchile.net; newyork@fbi.gov
Sent: Monday, May 27, 2002 10:59 AM
Subject: Re: Maybe another shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup

Hi all,

Apparently, much like many other shorted wiring/forward cargo door rupture/explosive decompression/inflight breakdowns. Age is right at 22yrs. Engines may be P&W types??, This was about the last of the 747-200 early freighter designs converted to passenger configuration.
More info needed..

Gordon Smith

PS American Airlines has dropped all B-747s from their equipment list.

At 08:11 AM 5/25/2002 -0700, John Barry Smith wrote:

Saturday, 25 May, 2002, 14:34 GMT 15:34 UK
Taiwan airliner crashes into sea

A China Airlines plane crashed in Hong Kong in 1993

Officials say there is little hope of finding survivors after a Taiwanese airliner carrying 225 people crashed into the sea on its way to Hong Kong.

The Boeing 747-200 belonging to the national carrier China Airlines disappeared from radar screens near the Taiwanese island of Penghu at 0730 GMT, shortly after leaving the capital Taipei.

Anxious relatives are awaiting news

Ten bodies have been found and up to 100 sighted after the crash of Flight C1611, Taiwanese officials say.

It was carrying 206 passengers, including three infants, and 19 crew.
"There is almost no chance for survivors," said Chang Kuo-cheng, director of Taiwan's Civil Aeronautics Administration (CAA).

"Given the high altitude when it started plunging into sea, I don't think any person could stand the impact," the AFP news agency quoted him as saying.

**Explosion report**

One Taiwanese TV report said a mid-air explosion may have occurred - but this has not been confirmed, and airline officials said no distress signals were recorded.

Rescue aircraft have spotted life jackets and an oil slick floating nearby.

Military planes, helicopters and vessels are now scouring the area for survivors.

After presiding over a meeting of the government's emergency response team, Prime Minister Yu Shyi-kun confirmed the plane had plunged into the sea off Penghu, about 50 kilometres (31 miles) west of Taiwan.

"Some life jackets have been found by rescuers floating some 25 nautical miles northeast of Penghu," Mr Yu said.

One cable TV station quoted Penghu fishermen as saying they
saw many bodies floating in the water.

The flight to Hong Kong usually takes one and a half hours.

**Informing relatives**

Most of the passengers were Taiwanese according to Wang Cheng-yu, an official with China Airlines.

**China Airlines accidents**

1999 - MD11 airliner crash lands in Hong Kong, killing three people
1998 - A300-600 airliner crashes near Taipei in fog and rain, killing all 197 on board and at least seven on ground
1994 - A300-600 crashes during approach in Nagoya, Japan, killing 264 people
1989 - 737-200 hits mountain near Hualien, Taiwan, killing 56 people

Also on board were two Singaporeans, 14 people from Hong Kong, Macau or China and one European.

The BBC's Duncan Hewitt in Shanghai said that the route between Taiwan and Hong Kong is often used by people travelling onwards from Hong Kong to mainland China and other destinations.

At Hong Kong's Chek Lap Kok airport, officials issued an announcement for people waiting for friends and relatives on the flight to go to the China Airlines counter.

**Safety problems**
One man, who gave only his surname Chan, said he had arrived about 1600 (0800 GMT) to pick up a friend, a Hong Kong man studying in Taiwan.

Helicopters are scouring the area

"I'm worried about my friend. I've heard from the radio that the plane has apparently crashed into the sea," he said.

China Airlines said that the Boeing 747-200 was built in 1979 and was the last plane of its kind in the airline's fleet.

Our correspondent says China Airlines has been seeking to improve a poor safety record which has seen several crashes over the past decade, including a major accident at Taipei's international airport in 1998.

The crash of Flight C1611 follows two major accidents in the region involving mainland Chinese airlines during the past month.

Saturday, May 25, 2002

China Airlines plane crashes near Taiwan
By WILLIAM IDE -- The Associated Press

TAIPEI, Taiwan -- A China Airlines flight from Taipei to Hong
Kong crashed Saturday in the Taiwan Strait with 225 people on board. There were no immediate reports of survivors.
Flight CI611 was reported missing near Penghu, a group of islands off Taiwan's western coast, at about 3:30 p.m. (3:30 a.m. EDT) Saturday -- 50 minutes into its flight, said Kuo Yao-chi, a government official investigating the crash.
The Taiwanese airline's Boeing 747-200 was carrying 206 passengers and 19 crew, Chang Chia-chu, a vice transportation minister, said at a news conference.
"Things such as the plane's cabin door, life jackets and other things related to the crash were being discovered," Chang said.
There was a large oil slick about 20 miles northeast of Penghu, Chang said. The islands are about 170 miles southwest of Taipei, about 30 miles off the coast.
ETTV cable news quoted Penghu fishermen as saying they saw bodies floating in the water.
China Airlines official Wang Cheng-yu confirmed at a news conference that the plane crashed near Penghu. He said that the Boeing 747-200, built in 1979, was the last plane of its kind in the airline's fleet.
Taiwan's air force and coast guard were using ships and helicopters to look for the aircraft, he said.
Due to a series of crashes in the 1990s, China Airlines -- Taiwan's biggest carrier -- used to be considered one of the world's most dangerous airlines. But in recent years, the carrier has reshuffled its board and has put a greater emphasis on safety. The last known fatal China Airlines accident was in 1999 when a jetliner flipped over and burst into flames during a crash landing in Hong Kong, killing three people.
According to the aviation safety website, Airsafe.com, China Airlines has had nine fatal accidents since 1970.
On May 7, another jetliner owned by China Northern Airlines crashed on approach to the northeastern Chinese port city of
Dalian, killing all 112 people on board.

Saturday, May 25, 2002

**China Airline crashed overr Penghu waters**

*2002/5/25*

*Taipei, The China Post Staff*

China Airlines (CAL) Boeing 747-200 disappeared at 300 pm (0730 GMT) from radar screens near the Taiwanese island of Penghun as it flew from Taipei to Hong Kong.

The flight, CI611, was orginally scheduled to arrive in Hong Kong airport at 418 p.m.

By 515 p.m. the rescue team, which consist of six planes and eight ships, has found the debris of the crashed airplane, according to TV news cast. The rescue team spotted large stretch of floated fuel oil above the waters about 50 kilometers to the Ma-Goan port.

Premier Yu Shye-kun has arrived at Civil Aeronautics Administration at Chiang Kai-shek International Airport to coordinate the rescue efforts by 515 p.m. He told the press that the defense minister has also instructed military personnel to undertake the rescue mission. A rescue beachhead was set up by 400 p.m. by the military personnel stationed in Penghu.

There were 225 persons on board the flight, including 206 passengers and 19 crew members. Three children were also reported on board the plane. The airplane was suspected to crash in the waters close to Penghu (Pescadores) islands.

The first body of the victims was discovered at 610 p.m. Names of the passengers were posted on TV screens throughout the late
afternoon hours. Duh Ching-ming, a reporter of the United Daily News, and another reporter were on board the flight, which carried five outbound Taiwan tourist groups.

The airplane was already sold to an identified customer, but has not been delivered, according to news report.

Premier Yu Shye-kun was on his way to the Civil Aeronautics Administration at Chiang Kai-shek International Airport in order to coordinate the rescue efforts, according to news report by 5:05 p.m.

At 515 p.m. rescue ships and air forces planes have begun searching debris of the airplane near the waters of Penghu islands.

CAL spokesman Paul Wang told AFP it was unclear what had happened to flight CI611 and that he was on his way to Taipei international airport for further information.

The plane took off at about 200 p.m. (0650 GMT) from Taipei's international airport and was reported missing near Penghu, a group of islands off Taiwan's western coast, TVBS reported. It could not be seen on radar, the report said.
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The Taiwanese airline's Boeing 747-200 was carrying 206 passengers and 19 crew, Chang Chia-chu, a vice transportation minister, said at a news conference.

"Things such as the plane's cabin door, life jackets and other things related to the crash were being discovered," Chang said.

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China Airlines official Wang Cheng-yu confirmed at a news conference that the plane crashed near Penghu. He said that the Boeing 747-200, built in 1979, was the last plane of its kind in the airline's fleet.

Taiwan's air force and coast guard were using ships and helicopters to look for the aircraft, he said.

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Saturday, May 25, 2002

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2002/5/25

*Taipei, The China Post Staff*

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From: John Barry Smith <barry@corazon.com>
What is the type of wiring on 747-400? Is it polyX or TKT? When did Boeing switch from PolyX? Was it after or before the -300? The -300 went into service about Oct 1982.

What type of wiring in -300 and -400?

Appreciate the answers, John, if you have them.

Cheers,
Barry

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Cheers,
Barry

From: "John King" <jking1@attbi.com>
Date: June 19, 2002 4:53:23 AM PDT
I used to work the Electra dry bays; they are big.

No different, dry bays or vacant fuel tanks go boom.

JK

----- Original Message ----- 
From: John Sampson
To: 'John Barry Smith'
Sent: Wednesday, June 19, 2002 3:22 AM
Subject: RE: C 130 crash like that in 1994

JBS
This is the other accident's opening report below with a link (also) to the full report (which you've provided in full further down). It's significant that arcing and ticking faults can be extant and just waiting for a fuel leak to develop. Flattened, crimped, dried-out, pinched and perished O-rings in the dry bay area's 17 psi fuel system lines are a quite likely cause of what was seen. I'm not sure that bailed aircraft receive superior maintenance (i.e. they come out of desert storage, get minimal refurbishment and then just carry on in service as if they'd not been out-of-service). Dried out rubber seals and wiring can still suffer from storage, notwithstanding the dry desert air.

JS

NTSB Identification: LAX94FA323 . The docket is stored in the (offline) NTSB Imaging System.

Accident occurred Saturday, August 13, 1994 at PEARBLOSSOM, CA Air force LOCKHEED C-130A registration N135FF.
Aircraft: LOCKHEED C-130A, registration: N135FF
Injuries: 3 Fatal.

The National Transportation Safety Board determines the probable cause(s) of this accident/incident as follows.

the ignition of fuel leaking from the pressurized fuel system lines in or adjacent to the No. 3 dry bay, most likely due to electrical arcing and/or hot surfaces in the No. 3 engine.

http://www.ntsb.gov/ntsb/brief.asp?ev_id=20001206X02066&key=1

Full Report
http://www.ntsb.gov/ntsb/brief2.asp?ev_id=20001206X02066&ntsbno=LAX94FA323&akey=1

-----Original Message-----
From: John Barry Smith [mailto:barry@corazon.com]
Sent: Wednesday, 19 June 2002 9:00 AM
To: sampsonj@bigpond.net.au
Subject: C 130 crash like that in 1994

Plane fighting wildfire crashes in California; 3 dead

ByTOM GARDNER, Associated Press
Published 4:39 a.m. PDT Tuesday, June 18, 2002
WALKER, Calif. (AP) - Television reporter Terri Russell was watching the sky over a wildfire as a plane flew over and dumped a red cloud of fire retardant on the blaze. Suddenly, both wings snapped off and flashed with flames.

The plane's fuselage rolled left and nosed into the ground, exploding in flames and a mushroom of black smoke and killing
all three crew members.

"It was almost surreal," Russell said. "You saw it go down and for a second, I thought, 'Is that really what I saw?"

The C-130 transport was fighting a 10,000-acre wildland blaze that forced 400 people to evacuate and continued to threaten this Northern California resort town.

Russell's news crew from KOLO-TV in Reno, Nev., caught the crash on tape Monday afternoon while interviewing a man who was watching with his own camcorder.

The cause of the crash was under investigation. Two other air tankers and helicopters used to drop water on the flames were grounded as a precaution. "Right now, we're working on gathering information and we're just beginning," National Transportation Safety Board investigator George Petersen said by telephone before leaving for the crash site.

The Interagency Incident Management Team at the fire said the plane was under contract to the government from Hawkins & Powers Aviation Inc. of Greybull, Wyo.

Hawkins & Powers Aviation confirmed one of its planes had crashed, but provided no comment or additional details.

The plane was based in Redmond, Ore., said David Widmark, a spokesman for the Northwest Interagency Coordination Center in Portland, Ore.

About eight companies nationwide perform air tanker work, and Hawkins & Powers is one of the oldest, in business since 1969.
In 2000, the company sent 11 air tankers to fires in about a dozen states. It also trains the two- or three-person crews that man the planes and owns firefighting helicopters.

The C-130 crashed in a field just east of U.S. Highway 395 - within 150 feet of an auto shop.

"I'm standing here looking at the tail section," shop owner Mike Mandichak said. "My shop is right next door. It almost hit it."

He said an employee saw the plane pull up, then a brief explosion.

"The wings let go upwards. The fuselage went across the highway, which is about another 50 yards, hundred yards. He nosed in on an angle and he just broke apart," he told Associated Press Radio.

The fire caused by the crash threatened about 10 structures in the immediate area, including homes, trailers and the mechanic's shop before it was brought under control.

A firefighter in a water tanker truck sent to the crash site was injured when the truck overturned. His condition was being evaluated at a Reno hospital.

The wildfire the C-130 was fighting began Saturday in a remote section of the Humbolt-Toiyabe National Forest. Fire spokesman Kirk Frosdick said the blaze was caused by humans but had no other details. The fire was 10 percent contained Monday evening, and fire bosses hoped to have it surrounded by Thursday.

One house, a garage and a travel trailer burned.
Firefighters look through the remains of a C-130 air tanker that crashed while fighting a fire near Walker Monday afternoon. AP Photo / Gazette-Journal, Candice Towell

Investigators probe cause of air-tanker crash

Bee Metro Staff
Published 11:29 a.m. PDT Tuesday, June 18, 2002

[Updated 2:20 p.m. June 18] Investigators from the National Transportation Safety Board arrived Tuesday at the crash site of an air tanker that lost its wings and burst into flames Monday, killing its three-person crew while fighting a wildfire in the Humboldt-Toiyabe National Forest near Yosemite National Park.

The U.S. Forest Service also grounded all C-130A firefighting planes as the investigation into the crash continued.

The air tanker that went down was trying to slow the spread of the Cannon fire, which has burned 15,000 acres since it started Saturday. The fire, which is 10 percent contained, forced nearly 400 residents to temporarily evacuate the town of Walker in Mono County, about 25 miles north of Yosemite and 90 miles south of Reno.

The crash victims were identified by the Mono County Sheriff's Department as pilot Steven Wass, 42, of Gardnerville, Nev.; co-pilot Craig Labare, 36, of Loomis, and crew member Michael Davis, 59, of Bakersfield.
While Walker residents were allowed to return to their homes, people in Camp Antelope and numerous residences east of Highway 395 have been evacuated. Evacuation centers are open in Coleville and Topaz. Highway 395 is closed.

Three other major fires are burning in California, closing highways and threatening structures. A total of 19 large fires are currently burning in 11 states, according to the National Interagency Fire Center, and acreage burned for this time of year is nearly double the 10-year average at 1,546,742 acres.

Hot, dry conditions have made for severe fire conditions throughout the country and officials in California have said this fire season may be among the worst.

The Walker fire has drawn 671 firefighters from California, Oregon and Nevada in addition to equipment, such as helicopters and planes.

According to witnesses, the C-130 air tanker crashed just before 3 p.m. on the east side of Highway 395 in Walker, just missing an auto repair shop.

"I saw the air tanker coming down the canyon, and after dropping some borate, he started to pull up," said shop owner Michael Mandichak. "The wings folded up and one of the wings burst into flame and flew across (Highway) 395. The rest of the plane flew all over the field, starting another grass fire."

One of his mechanics ran into the shop minutes later, the back of his hair singed from the fire, said Mandichak, a retired volunteer
fire chief.

Medical crews were sent to Walker after the plane went down in flames, said Laura Williams, spokeswoman for the Sierra Front Interagency Dispatch Center in Minden, Nev.

Although 270 evacuees were allowed to return to their homes at 1 p.m. Monday, an additional 220, whose homes are on the east side of the Walker River, were told to evacuate at 2:30 p.m. Evacuees were being sent to Topaz Lodge, eight miles north of Coleville, and to Coleville Elementary School, said Kirk Frosdick, a public information officer for Sierra Front.

The wildfire jumped across Highway 395 and the Walker River on Monday and has burned 10 structures, including one home. No civilian injuries have been reported as a result of the fire, authorities said.

The fire began Saturday in a remote section of the Humboldt-Toiyabe National Forest that the Marines use for survival training. Unexploded ordnance in the steep, rugged area was slowing containment efforts.

Frosdick said the fire had a human cause, but it isn't clear whether that cause was intentional or accidental.

The following are summaries by the national fire center of other major California fires:

-- In the San Bernardino National Forest, three firefighters were injured battling a blaze that has charred 5,500 acres, is 10 percent contained and threatens about 500 structures. This fire is one mile north of the junction for interstates 15 and 215, with I-15
closed. In addition to the structures, power lines and liquid fuel pipelines are threatened and evacuations have been ordered in the communities of Summit Estates, Oakhills and Baldy Mesa. Two California Department of Forestry and Fire Protection engines were burned over. Three crew members who were injured were treated at a local hospital.

-- Firefighters have the upperhand in the Sequoia National Forest, where a fire that has burned 3,430 acres is 90 percent contained.

-- At 25 percent containment, a 7,161-acre fire is burning six miles west of Lompoc near Vandenberg Air Force Base. Several ranches, two military facilities, a flight-tracking station and Jalama County Beach day use area are threatened.

-- The Associated Press contributed to this report.

Feds ground air tanker planes following crash

By TOM GARDNER, Associated Press
Published 1:10 p.m. PDT Tuesday, June 18, 2002
(AP) - Air tanker planes similar to one that lost its wings and crashed while battling a wildfire in Northern California were grounded by the federal government Tuesday pending an investigation.

All three people aboard were killed Monday near Walker, Calif., in the crash of a C-130A under contract from a civilian company.

On Tuesday, all five remaining C-130A aircraft under contract to the National Interagency Fire Center were grounded, said Nancy Lull, spokeswoman for the federal agency in Boise, Idaho. They
are the only C-130As in use out of seven that the agency has under contract, officials said.

Unlike other C-130s, they are modified with internal tanks and systems to spray flame retardant on wildfires.

C-130s, made in the 1950s and '60s, are among the workhorses of the world's air fleet and were the primary transport used in Vietnam. They are among the most important weapons in the government's aerial firefighting arsenal because they can carry heavy loads of retardant.

The Northern California fire, in the Sierra Nevada near Yosemite National Park, destroyed at least one house and forced 400 people to evacuate as it charred some 10,000 acres of brush and forest. The crash came on the same day that a U.S. Forest Service worker in Colorado appeared in court on charges she started that state's biggest fire. Terry Barton told investigators she was burning a letter from her estranged husband. If convicted, she get up to 20 years in prison and a $250,000 fine.

The C-130A had just made a pass over the fire when it crashed. TV news video showed its wings snapping off and flames erupting as the fuselage spiraled to the ground.

LAX94FA323

HISTORY OF FLIGHT

On August 13, 1994, at 1331 hours Pacific daylight time, a civilian Lockheed C-130A, N135FF, operating as Tanker 82, crashed in steep mountainous terrain near Pearblossom,
California. The aircraft was destroyed and the crew of three received fatal injuries. The aircraft was owned by Aero Firefighting Service Company, Inc., and was operated by Hemet Valley Flying Service, Inc., on lease to the U.S. Forest Service as a public use aircraft.

The flight originated from Hemet-Ryan airport at 1310 on the day of the accident. Visual meteorological conditions were prevalent at the time of the accident and a company flight plan was filed for the operation.

According to the U.S. Forest Service personnel, the aircraft was responding to a fire near the Tehachapi Mountains at the request of the California Department of Forestry. The aircraft was flight following with High Desert TRACON (Joshua approach control) and its encoding altimeter was indicating 7,800 feet msl. A review of air traffic control communication tapes revealed two unidentified transmissions; one of an unintelligible squeal, followed by a brief expletive at 1331.

Witnesses in the vicinity of the San Gabriel Mountains reported seeing the aircraft in level flight, on a west-northwesterly heading, when they saw a bright orange flash near a wing root. The first flash was reportedly followed about 1 second later by a much larger, darker orange fireball accompanied by black
smoke. At that time, witnesses stated that the main wing separated from the aircraft and the aircraft began to roll. Both the separated right wing and remaining fuselage impacted on the north face of Pleasant View Ridge in the vicinity of Pechner Canyon at about the 6,500 foot level.

Witnesses stated that the ground impact of the main wing and fuselage resulted in an additional fireball and explosion with a column of black smoke, causing several small brush fires. At least one witness stated that the smoke from the ground fire rose vertically in an undisturbed column. Individual witness statements are attached to this report.

PERSONNEL INFORMATION

The pilot, copilot, and flight engineer were rated in the aircraft. A review of the pilot/operator accident report prepared by the operator showed the crew had current flight experience in the accident aircraft. According to FAA inspectors, at the time of the accident, the flight was being operated in accordance with applicable FARs.

AIRCRAFT INFORMATION

The aircraft was delivered to the U.S. Air Force in December,
1957. In April, 1959, it was modified to become a C-130A-II to perform an electronic reconnaissance mission. In September, 1964, it was de-modified and reconfigured to a "near standard C-130A" and transferred to the Air National Guard. In August, 1986, the aircraft was transferred to Davis-Monthan Air Force Base for storage. In June, 1988, the aircraft was removed from storage. In June, 1990, modification as a restricted category firefighting aircraft was approved per FAA Form 337. A Restricted Category Special Airworthiness Certificate, which authorized aerial dispensing of fire retardant, was issued in May, 1990.

A review of aircraft maintenance records revealed that on April 22, 1994, the aircraft had been returned to service after an entire progressive inspection cycle. The inspection program was an FAA approved and authorized airplane inspection program (AAIP). The aircraft had completed an eddy current inspection in April, 1991. All parts tested met the inspection standard. Investigators estimated that at the time of the accident, the aircraft was within weight and balance limitations and had sufficient fuel to complete the planned flight. An FAA review of the maintenance records and the Hemet Valley Flying Service Return to Service Inspection are appended to this report.
On July 17, 1994, (the most recent record available) the operator completed a Day Off Inspection (seven day checks), which included the initialed item No. 20 b, "Check dry bay area for leaks, fuel press. on." The records of subsequent checks were onboard the aircraft and were destroyed. The Hemet Valley flying Service Day Off Inspection is attached to this report.

METEOROLOGICAL CONDITIONS

According to a readout from the Bureau of Land Management's Automatic Lightning Detection System (ALDS), there was lightning activity in the area of the accident site at the time of the crash.
Witnesses both on the ground and in the air near the accident site reported that the aircraft was clear of clouds and that there was no visible electrical activity at the time of the in-flight explosion. The NTSB weather factual report and the California Department of Forestry lightning strike analysis are attached to this report.

AIDS TO NAVIGATION

The aircraft was on a flight conducted under visual flight rules, and was flight following on frequency 124.55 with Joshua approach control at the time of the accident. The crash site was
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an imaginary line connecting the Hemet-Ryan
airport and Tehachapi, California. At 1330, the pilot reported to Joshua
approach that he intended to "go straight for the next
42 miles" when he was asked to say his destination. The assigned
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According to U.S. Forest Service officials, dispatch information includes
magnetic direction to the fire and distance from the
departure airport, along with the latitude and longitude of the
fire's
location. The operator reported that the crew was familiar
with the area and that the aircraft was equipped with a global
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system (GPS).

COMMUNICATIONS

After takeoff, the crew had initiated two-way radio contact with Ontario
approach control for the purpose of flight following.
The crew had been responding to radio calls without delay or
difficulty until
1330 (about 1.5 minutes before the crash). All
communications were routine with no indication of any in-flight
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transcript of radio communications is appended to
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WRECKAGE AND IMPACT INFORMATION

The structures group chairman report is attached to this report. A total of six center wing pieces, five of the upper wing surface and one piece of stringer, were found approximately 1,000 feet in advance of the separated main wing. Numerous pieces of 1-inch thick yellow styrofoam, a green interior wing panel, and a torn portion of a fuel cell liner were also found in the same general area. None of this debris had been involved in the resulting ground fire. The styrofoam material was reported to have been located beneath the auxiliary fuel cell. Portions of the styrofoam exhibited evidence of surface charring. Light sooting of the wing pieces was consistent with normal service.

Crush on the separated right wing components indicated a near-level attitude at impact. The identification was made by serial numbered components recorded as being located on the right side of the aircraft. Examination of the debris showed the outline of a burned and melted main wing structure extending from the right wing tip to a section inboard of the No. 3 engine nacelle. The ground fire had melted or consumed all fracture surfaces on the inboard portion.

The powerplant group chairman report is appended to this report.
A tear down inspection of the No. 3 and 4 engines showed no evidence of rotational scarring. Although the supporting structure was fractured or consumed by fire, the engines still maintained their relative positions on the right wing. The persistent odor of ammonia was detected in and about the No. 3 engine.

Both the No. 3 and 4 propellers and hubs were found separated from the engines. The No. 3 propeller was found in the feathered position while the No. 4 propeller was found in reverse. There was no bending, twisting, or leading edge damage on any blade from either the No. 3 or No. 4 hubs. Two blades from the No. 3 hub had been consumed by fire up to the blade root.

The main fuselage and remaining left wing impacted a rising terrain finger. The impact resulted in major structural collapse and disintegration, and was accompanied by postcrash fire.

The cockpit area was identified, but efforts to access the interior portion were unsuccessful. Attempts at an aerial recovery of the cockpit were also unsuccessful and resulted in disintegration of the structure.
The No. 1 and 2 engines were recovered and both exhibited evidence of rotational scarring. Both engines were displaced from their position relative to the left wing. Crush on the engine cases indicated a near 90-degree terrain impact angle on both engines.

The No. 1 and 2 propellers and hubs were separated from the engines. None of the No. 1 or 2 propeller components were recovered.

MEDICAL AND PATHOLOGICAL INFORMATION

No autopsy or toxicological examination was performed on any of the aircraft crewmembers.

FIRE

Witnesses reported an in-flight explosion and fire. The accident was followed by a postcrash fire, which involved the separated right wing and the remainder of the aircraft. Firefighting helicopters responded to the accident site, dumping water directly on the wreckage and surrounding area. In spite of those efforts, the wreckage continued to smolder for over 24 hours.

TESTS AND RESEARCH
Lockheed reported that in 1978, a C-130A experienced an in-flight fire and explosion, which resulted in a wing separation due to a lightning strike on a fuel probe.

A section of the center wing section which was found early in the debris path, was submitted to the Materials Directorate at Wright-Patterson Air Force Base for analysis. Examination disclosed no evidence of a lightning strike. None of the fuel probes from the accident aircraft were identified or recovered. The USAF analysis of C-130A wing section and NTSB Metallurgist's factual report are appended to this report.

The U.S. Air Force reported that the fuel systems in C-130A aircraft have experienced fuel leaks due to O-ring failure. The Air Force does not track the rate of O-rings failures associated with the fuel system. Lockheed engineers confirmed that report, saying that while O-ring failure is a relatively rare event, it does occur. According to the Air Force, there have been no known C-130A accidents in which an external fuel leak was determined to be the probable cause. Fuel system schematic drawings are attached to this report.

According to Lockheed, failures that have occurred were the result of fuel line flexing or thermal expansion. They reported that
a failure is more likely to occur in a fuel line coupling as opposed to a fuel valve, although the possibility exists for both. They stated that an O-ring failure can range from seeping or dripping occurring over time, up to a failure that results in a sudden a high pressure spray. They expressed the opinion that prolonged storage (such as occurred at Davis-Monthan Air Force Base from 1986 to 1989) could result in the O-rings drying out or shrinking. They also acknowledged that the flight profile of aerial firefighting results in wing flexing.

A review of maintenance procedures, followed by both the U.S. Air Force and the operator and confirmed by Lockheed, revealed that O-rings are an on-condition item and are not life limited. Lockheed did report that once O-rings are removed, they are not to be reused. A review of maintenance records of the accident aircraft did not identify any reported fuel leaks or the removal or replacement of any fuel line, coupling, or valve. According to the operator's records, an inspection of the fuel system was completed on April 22, 1994. The operator reported that an item on the preflight inspection of the aircraft specifies checking the dry bay for fuel odor. Emergency procedures contained in T.O. 1C-130A-1 and the top of aircraft inspection check list are appended to this report.
The fuel system of the C-130A is pressurized to 15-17 psi for the lines that transfer fuel from the main fuel tanks to the engine. Cross-feed lines that transfer fuel from the main tanks in the opposite wing are pressurized to 15-17 psi when utilized. The fuel valves in the C-130A operate on a 28-volt DC current single phase circuit. The valve motors are powered only when the valves are in transit to open or close; however, the cannon plugs are powered whenever DC power is energized. The external cannon plugs on the valves are not shielded. The electrical wiring is open within the corresponding wing section and is in proximity to the fuel system. Lockheed reported that there has been some history of insulation chaffing or cracking, but did not report any known incidents or accidents in which an electrical short had contributed to a fuel-fed fire.

U.S. Air Force T.O. 1C-130A-1 states that external fuel leaks present a fire hazard if the leak is in the proximity of an engine. If a leak occurs, it is recommended that an emergency be declared and that the aircraft land at the nearest airfield with sufficient runway to complete the landing roll without use of reverse thrust. Lockheed reported that with sufficient fuel leaking in the dry bay it would be possible for fuel to drain through the engine
pylon and into
the engine nacelle. The hot section of the No. 3
engine is located below the No. 3 dry bay. The tattletale drain for
the dry bay
exits out of the lower engine nacelle forward of
the hot section.

The fuel used in the aircraft, Jet-A1, has a flash point of 40
degrees
centigrade (100 degrees Fahrenheit) according to a
publication by the U.S. Air Force Systems Command at Wright-
Patterson Air
Force Base, Ohio.

From: "John King" <jking1@attbi.com>
Date: June 19, 2002 4:53:23 AM PDT
To: "John Sampson" <sampsonj@bigpond.net.au>, "John Barry
Smith" <barry@corazon.com>
Subject: Re: C 130 crash like that in 1994

I used to work the Electra dry bays; they are big.

No different, dry bays or vacant fuel tanks go boom.

JK
--
----- Original Message -----~
From: John Sampson
To: 'John Barry Smith'
Sent: Wednesday, June 19, 2002 3:22 AM
Subject: RE: C 130 crash like that in 1994
JBS
This is the other accident's *opening* report below with a link (also) to the full report (which you've provided in full further down). It's significant that arcing and ticking faults can be extant and just waiting for a fuel leak to develop. Flattened, crimped, dried-out, pinched and perished O-rings in the dry bay area's 17 psi fuel system lines are a quite likely cause of what was seen. I'm not sure that bailed aircraft receive superior maintenance (i.e. they come out of desert storage, get minimal refurbishment and then just carry on in service as if they'd not been out-of-service). Dried out rubber seals and wiring can still suffer from storage, notwithstanding the dry desert air.

JS

NTSB Identification: **LAX94FA323**. The docket is stored in the (offline) NTSB Imaging System.

Accident occurred Saturday, August 13, 1994 at PEARBLOSSOM, CA
Aircraft: LOCKHEED C-130A, registration: N135FF
Injuries: 3 Fatal.

WITNESSES SAW THE AIRCRAFT IN LEVEL FLIGHT AND OBSERVED A BRIGHT ORANGE FLASH NEAR THE WING ROOT. THE FIRST FLASH WAS FOLLOWED ABOUT 1 SECOND LATER BY A MUCH LARGER DARK ORANGE FIREBALL AND BLACK SMOKE. THE RIGHT MAIN WING THEN SEPARATED FROM THE AIRCRAFT. THE WRECKAGE WAS DISTRIBUTED OVER 1 MILE IN MOUNTAINOUS TERRAIN. UNBURNED CENTER WING BOX SKIN, FOAM INSULATION PIECES, AND AUX TANK FRAGMENTS (ALL FROM THE AREA WHERE THE
FRAGMENTS (ALL FROM THE AREA WHERE THE FIRST FLASH WAS OBSERVED BY THE WITNESSES) WERE THE FIRST DEBRIS FOUND IN THE WRECKAGE DISTRIBUTION PATH. THE DRY BAY AREA OF THE RIGHT WING CONTAINS HIGH PRESSURE FUEL LINES, UNSHIELDED AND EXPOSED ELECTRICAL WIRING, AND IS IN CLOSE PROXIMITY TO THE NO. 3 ENGINE. THE MAIN FUEL TANK IS LOCATED OUTBOARD OF THE DRY BAY. NO LIGHTNING ACTIVITY WAS REPORTED IN THE VICINITY OF THE AIRCRAFT. C-130 AIRCRAFT HAVE A HISTORY OF FUEL LEAKS IN THE DRY BAY. THE SOURCE OF THE LEAKS, FLATTENED OR PINCHED O-RINGS, ARE ON-CONDITION REPLACEMENT ITEMS. THE AIRCRAFT WAS IN LONG TERM STORAGE IN THE DESERT FOR 2 YEARS PRIOR TO ACQUISITION BY THE OPERATOR FOR FIRE TANKER DUTIES. U.S. AIR FORCE EMERGENCY PROCEDURES WARN OF FUEL LEAKS IN THIS AREA AND REQUIRE INSPECTIONS PRIOR TO EACH FLIGHT.

The National Transportation Safety Board determines the probable cause(s) of this accident/incident as follows.

the ignition of fuel leaking from the pressurized fuel system lines in or adjacent to the No. 3 dry bay, most likely due to electrical arcing and/or hot surfaces in the No. 3 engine.

http://www.ntsb.gov/ntsb/brief.asp?ev_id=20001206X02066&key=1

Full Report

http://www.ntsb.gov/ntsb/brief2.asp?
Plane fighting wildfire crashes in California; 3 dead

By TOM GARDNER, Associated Press
Published 4:39 a.m. PDT Tuesday, June 18, 2002
WALKER, Calif. (AP) - Television reporter Terri Russell was watching the sky over a wildfire as a plane flew over and dumped a red cloud of fire retardant on the blaze. Suddenly, both wings snapped off and flashed with flames.

The plane's fuselage rolled left and nosed into the ground, exploding in flames and a mushroom of black smoke and killing all three crew members.

"It was almost surreal," Russell said. "You saw it go down and for a second, I thought, 'Is that really what I saw?'"

The C-130 transport was fighting a 10,000-acre wildland blaze that forced 400 people to evacuate and continued to threaten this Northern California resort town.

Russell's news crew from KOLO-TV in Reno, Nev., caught the crash on tape Monday afternoon while interviewing a man who was watching with his own camcorder.
The cause of the crash was under investigation. Two other air tankers and helicopters used to drop water on the flames were grounded as a precaution. "Right now, we're working on gathering information and we're just beginning," National Transportation Safety Board investigator George Petersen said by telephone before leaving for the crash site.

The Interagency Incident Management Team at the fire said the plane was under contract to the government from Hawkins & Powers Aviation Inc. of Greybull, Wyo.

Hawkins & Powers Aviation confirmed one of its planes had crashed, but provided no comment or additional details.

The plane was based in Redmond, Ore., said David Widmark, a spokesman for the Northwest Interagency Coordination Center in Portland, Ore.

About eight companies nationwide perform air tanker work, and Hawkins & Powers is one of the oldest, in business since 1969. In 2000, the company sent 11 air tankers to fires in about a dozen states. It also trains the two- or three-person crews that man the planes and owns firefighting helicopters.

The C-130 crashed in a field just east of U.S. Highway 395 - within 150 feet of an auto shop.

"I'm standing here looking at the tail section," shop owner Mike Mandichak said. "My shop is right next door. It almost hit it."

He said an employee saw the plane pull up, then a brief explosion.
"The wings let go upwards. The fuselage went across the highway, which is about another 50 yards, hundred yards. He nosed in on an angle and he just broke apart," he told Associated Press Radio.

The fire caused by the crash threatened about 10 structures in the immediate area, including homes, trailers and the mechanic's shop before it was brought under control.

A firefighter in a water tanker truck sent to the crash site was injured when the truck overturned. His condition was being evaluated at a Reno hospital.

The wildfire the C-130 was fighting began Saturday in a remote section of the Humboldt-Toiyabe National Forest. Fire spokesman Kirk Frosdick said the blaze was caused by humans but had no other details. The fire was 10 percent contained Monday evening, and fire bosses hoped to have it surrounded by Thursday.

One house, a garage and a travel trailer burned.

Firefighters look through the remains of a C-130 air tanker that crashed while fighting a fire near Walker Monday afternoon. AP Photo / Gazette-Journal, Candice Towell

Investigators probe cause of air-tanker crash

Bee Metro Staff
Published 11:29 a.m. PDT Tuesday, June 18, 2002
[Updated 2:20 p.m. June 18] Investigators from the National Transportation Safety Board arrived Tuesday at the crash site of an air tanker that lost its wings and burst into flames Monday, killing its three-person crew while fighting a wildfire in the Humboldt-Toiyabe National Forest near Yosemite National Park.

The U.S. Forest Service also grounded all C-130A firefighting planes as the investigation into the crash continued.

The air tanker that went down was trying to slow the spread of the Cannon fire, which has burned 15,000 acres since it started Saturday. The fire, which is 10 percent contained, forced nearly 400 residents to temporarily evacuate the town of Walker in Mono County, about 25 miles north of Yosemite and 90 miles south of Reno.

The crash victims were identified by the Mono County Sheriff's Department as pilot Steven Wass, 42, of Gardnerville, Nev.; co-pilot Craig Labare, 36, of Loomis, and crew member Michael Davis, 59, of Bakersfield.

While Walker residents were allowed to return to their homes, people in Camp Antelope and numerous residences east of Highway 395 have been evacuated. Evacuation centers are open in Coleville and Topaz. Highway 395 is closed.

Three other major fires are burning in California, closing highways and threatening structures. A total of 19 large fires are currently burning in 11 states, according to the National Interagency Fire Center, and acreage burned for this time of year is nearly double the 10-year average at 1,546,742 acres.

Hot, dry conditions have made for severe fire conditions
throughout the country and officials in California have said this fire season may be among the worst.

The Walker fire has drawn 671 firefighters from California, Oregon and Nevada in addition to equipment, such as helicopters and planes.

According to witnesses, the C-130 air tanker crashed just before 3 p.m. on the east side of Highway 395 in Walker, just missing an auto repair shop.

"I saw the air tanker coming down the canyon, and after dropping some borate, he started to pull up," said shop owner Michael Mandichak. "The wings folded up and one of the wings burst into flame and flew across (Highway) 395. The rest of the plane flew all over the field, starting another grass fire."

One of his mechanics ran into the shop minutes later, the back of his hair singed from the fire, said Mandichak, a retired volunteer fire chief.

Medical crews were sent to Walker after the plane went down in flames, said Laura Williams, spokeswoman for the Sierra Front Interagency Dispatch Center in Minden, Nev.

Although 270 evacuees were allowed to return to their homes at 1 p.m. Monday, an additional 220, whose homes are on the east side of the Walker River, were told to evacuate at 2:30 p.m. Evacuees were being sent to Topaz Lodge, eight miles north of Coleville, and to Coleville Elementary School, said Kirk Frosdick, a public information officer for Sierra Front.
The wildfire jumped across Highway 395 and the Walker River on Monday and has burned 10 structures, including one home. No civilian injuries have been reported as a result of the fire, authorities said.

The fire began Saturday in a remote section of the Humboldt-Toiyabe National Forest that the Marines use for survival training. Unexploded ordnance in the steep, rugged area was slowing containment efforts.

Frosdick said the fire had a human cause, but it isn't clear whether that cause was intentional or accidental.

The following are summaries by the national fire center of other major California fires:

-- In the San Bernardino National Forest, three firefighters were injured battling a blaze that has charred 5,500 acres, is 10 percent contained and threatens about 500 structures. This fire is one mile north of the junction for interstates 15 and 215, with I-15 closed. In addition to the structures, power lines and liquid fuel pipelines are threatened and evacuations have been ordered in the communities of Summit Estates, Oakhills and Baldy Mesa. Two California Department of Forestry and Fire Protection engines were burned over. Three crew members who were injured were treated at a local hospital.

-- Firefighters have the upperhand in the Sequoia National Forest, where a fire that has burned 3,430 acres is 90 percent contained.

-- At 25 percent containment, a 7,161-acre fire is burning six miles west of Lompoc near Vandenburg Air Force Base. Several
ranches, two military facilities, a flight-tracking station and Jalama County Beach day use area are threatened.

-- The Associated Press contributed to this report.

Feds ground air tanker planes following crash

By TOM GARDNER, Associated Press
Published 1:10 p.m. PDT Tuesday, June 18, 2002

(AP) - Air tanker planes similar to one that lost its wings and crashed while battling a wildfire in Northern California were grounded by the federal government Tuesday pending an investigation.

All three people aboard were killed Monday near Walker, Calif., in the crash of a C-130A under contract from a civilian company.

On Tuesday, all five remaining C-130A aircraft under contract to the National Interagency Fire Center were grounded, said Nancy Lull, spokeswoman for the federal agency in Boise, Idaho. They are the only C-130As in use out of seven that the agency has under contract, officials said.

Unlike other C-130s, they are modified with internal tanks and systems to spray flame retardant on wildfires.

C-130s, made in the 1950s and '60s, are among the workhorses of the world's air fleet and were the primary transport used in Vietnam. They are among the most important weapons in the government's aerial firefighting arsenal because they can carry heavy loads of retardant.

The Northern California fire, in the Sierra Nevada near Yosemite
National Park, destroyed at least one house and forced 400 people to evacuate as it charred some 10,000 acres of brush and forest. The crash came on the same day that a U.S. Forest Service worker in Colorado appeared in court on charges she started that state’s biggest fire. Terry Barton told investigators she was burning a letter from her estranged husband. If convicted, she get up to 20 years in prison and a $250,000 fine.

The C-130A had just made a pass over the fire when it crashed. TV news video showed its wings snapping off and flames erupting as the fuselage spiraled to the ground.

LAX94FA323

HISTORY OF FLIGHT

On August 13, 1994, at 1331 hours Pacific daylight time, a civilian Lockheed C-130A, N135FF, operating as Tanker 82, crashed in steep mountainous terrain near Pearblossom, California. The aircraft was destroyed and the crew of three received fatal injuries. The aircraft was owned by Aero Firefighting Service Company, Inc., and was operated by Hemet Valley Flying Service, Inc., on lease to the U.S. Forest Service as a public use aircraft. The flight originated from Hemet-Ryan airport at 1310 on the day of the accident. Visual meteorological conditions were prevalent at the time of the accident and a company flight plan was filed for the operation.
According to the U.S. Forest Service personnel, the aircraft was responding to a fire near the Tehachapi Mountains at the request of the California Department of Forestry. The aircraft was flight following with High Desert TRACON (Joshua approach control) and its encoding altimeter was indicating 7,800 feet msl. A review of air traffic control communication tapes revealed two unidentified transmissions; one of an unintelligible squeal, followed by a brief expletive at 1331.

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Witnesses stated that the ground impact of the main wing and fuselage resulted in an additional fireball and explosion with a column of black smoke, causing several small brush fires. At
least one witness stated that the smoke from the ground fire rose vertically in an undisturbed column. Individual witness statements are attached to this report.

PERSONNEL INFORMATION

The pilot, copilot, and flight engineer were rated in the aircraft. A review of the pilot/operator accident report prepared by the operator showed the crew had current flight experience in the accident aircraft. According to FAA inspectors, at the time of the accident, the flight was being operated in accordance with applicable FARs.

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According to U.S. Forest Service officials, dispatch information includes magnetic direction to the fire and distance from the
departure airport, along with the latitude and longitude of the fire's location. The operator reported that the crew was familiar with the area and that the aircraft was equipped with a global positioning system (GPS).

COMMUNICATIONS

After takeoff, the crew had initiated two-way radio contact with Ontario approach control for the purpose of flight following. The crew had been responding to radio calls without delay or difficulty until 1330 (about 1.5 minutes before the crash). All communications were routine with no indication of any in-flight problems. A transcript of radio communications is appended to this report.

WRECKAGE AND IMPACT INFORMATION

The structures group chairman report is attached to this report. A total of six center wing pieces, five of the upper wing surface and one piece of stringer, were found approximately 1,000 feet in advance of the separated main wing. Numerous pieces of 1-inch thick yellow styrofoam, a green interior wing panel, and a torn portion of a fuel cell liner were also found in the same general area. None of this debris had been involved in the resulting ground
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Crush on the separated right wing components indicated a near-level attitude at impact. The identification was made by serial numbered components recorded as being located on the right side of the aircraft. Examination of the debris showed the outline of a burned and melted main wing structure extending from the right wing tip to a section inboard of the No. 3 engine nacelle. The ground fire had melted or consumed all fracture surfaces on the inboard portion.

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The No. 1 and 2 engines were recovered and both exhibited evidence of rotational scarring. Both engines were displaced from their position relative to the left wing. Crush on the engine cases indicated a near 90-degree terrain impact angle on both engines.

The No. 1 and 2 propellers and hubs were separated from the engines. None of the No. 1 or 2 propeller components were recovered.
MEDICAL AND PATHOLOGICAL INFORMATION

No autopsy or toxicological examination was performed on any of the aircraft crewmembers.

FIRE

Witnesses reported an in-flight explosion and fire. The accident was followed by a postcrash fire, which involved the separated right wing and the remainder of the aircraft. Firefighting helicopters responded to the accident site, dumping water directly on the wreckage and surrounding area. In spite of those efforts, the wreckage continued to smolder for over 24 hours.

TESTS AND RESEARCH

Lockheed reported that in 1978, a C-130A experienced an in-flight fire and explosion, which resulted in a wing separation due to a lightning strike on a fuel probe.

A section of the center wing section which was found early in the debris path, was submitted to the Materials Directorate at Wright-Patterson Air Force Base for analysis. Examination disclosed no evidence of a lightning strike. None of the fuel probes from the accident aircraft were identified or recovered. The USAF analysis of
C-130A wing section and NTSB Metallurgist's factual report are appended to this report.

The U.S. Air Force reported that the fuel systems in C-130A aircraft have experienced fuel leaks due to O-ring failure. The Air Force does not track the rate of O-rings failures associated with the fuel system. Lockheed engineers confirmed that report, saying that while O-ring failure is a relatively rare event, it does occur. According to the Air Force, there have been no known C-130A accidents in which an external fuel leak was determined to be the probable cause. Fuel system schematic drawings are attached to this report.

According to Lockheed, failures that have occurred were the result of fuel line flexing or thermal expansion. They reported that a failure is more likely to occur in a fuel line coupling as opposed to a fuel valve, although the possibility exists for both. They stated that an O-ring failure can range from seeping or dripping occurring over time, up to a failure that results in a sudden a high pressure spray. They expressed the opinion that prolonged storage (such as occurred at Davis-Monthan Air Force Base from 1986 to 1989) could result in the O-rings drying out or shrinking. They also acknowledged that the flight profile of aerial firefighting results in wing flexing.
A review of maintenance procedures, followed by both the U.S. Air Force and the operator and confirmed by Lockheed, revealed that O-rings are an on-condition item and are not life limited. Lockheed did report that once O-rings are removed, they are not to be reused. A review of maintenance records of the accident aircraft did not identify any reported fuel leaks or the removal or replacement of any fuel line, coupling, or valve. According to the operator's records, an inspection of the fuel system was completed on April 22, 1994. The operator reported that an item on the preflight inspection of the aircraft specifies checking the dry bay for fuel odor. Emergency procedures contained in T. O. 1C-130A-1 and the top of aircraft inspection check list are appended to this report.

The fuel system of the C-130A is pressurized to 15-17 psi for the lines that transfer fuel from the main fuel tanks to the engine. Cross-feed lines that transfer fuel from the main tanks in the opposite wing are pressurized to 15-17 psi when utilized. The fuel valves in the C-130A operate on a 28-volt DC current single phase circuit. The valve motors are powered only when the valves are in transit to open or close; however, the cannon plugs are powered whenever DC power is energized. The external
cannon plugs on the valves are not shielded. The electrical wiring is open within the corresponding wing section and is in proximity to the fuel system. Lockheed reported that there has been some history of insulation chaffing or cracking, but did not report any known incidents or accidents in which an electrical short had contributed to a fuel-fed fire.

U.S. Air Force T.O. 1C-130A-1 states that external fuel leaks present a fire hazard if the leak is in the proximity of an engine. If a leak occurs, it is recommended that an emergency be declared and that the aircraft land at the nearest airfield with sufficient runway to complete the landing roll without use of reverse thrust. Lockheed reported that with sufficient fuel leaking in the dry bay it would be possible for fuel to drain through the engine pylon and into the engine nacelle. The hot section of the No. 3 engine is located below the No. 3 dry bay. The tattletale drain for the dry bay exits out of the lower engine nacelle forward of the hot section.

The fuel used in the aircraft, Jet-A1, has a flash point of 40 degrees centigrade (100 degrees Fahrenheit) according to a publication by the U.S. Air Force Systems Command at Wright-Patterson Air Force Base, Ohio.
From: EdwBlock@aol.com
Date: June 19, 2002 6:47:46 AM PDT
To: jking1@attbi.com, barry@corazon.com
Subject: Re: Fw: What type of wiring in -300 and -400?/

In a message dated 6/19/02 7:33:35 AM Eastern Daylight Time, jking1@attbi.com writes:

Let's ask Ed Block, the wire expert.

JK
--
----- Original Message ----- 
From: "John Barry Smith" <barry@corazon.com>
To: <jking1@attbi.com>
Sent: Tuesday, June 18, 2002 12:24 PM
Subject: What type of wiring in -300 and -400?

> What is the type of wiring on 747-400? Is it polyX or TKT? When did
> Boeing switch from PolyX? Was it after or before the -300? The -300
> went into service about Oct 1982.
> 
> > What type of wiring in -300 and -400?
> >
> > Appreciate the answers, John, if you have them.
> >
> > Cheers,
> > Barry
> >
Dear John and Barry:

Boeing used Poly-X from fuselage # 51 (1970-75), switched to Stilan in 1975, switched to crosslinked Tefzel in 1978, switched to Kapton on the 400 in 1989, switched back to crosslinked Tefzel in 1993. Hope this helps.

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From: EdwBlock@aol.com
Date: June 19, 2002 11:32:59 AM PDT
To: barry@corazon.com
Subject: Re: Prediction/tefzel

In a message dated 6/19/02 12:14:10 PM Eastern Daylight Time, barry@corazon.com writes:

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Dear Ed, thanks.
China Airlines Flight 611 had crosslinked Tefzel, Delivered 1979
Air India Flight 182 had crosslinked Tefzel, 1978
Pan Am Flight 103 1970 but line number 15, what was used before fuselage #51?
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What is crosslinked Tefzel? Is it the same type of polyimide aromatic teflon coated insulation? Is prone to the cracking, chafing, etc that poly X has?

Can it be called Poly X type wiring?

I'm afraid China Airlines Flight 611 is another of my shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanations. Wiring will surely get the attention it deserves after it is determined the wiring caused that door to rupture open in flight.

Wiring does worse things than start fires.

Thanks again, Ed.

Cheers,
Barry

John Barry Smith
(831) 659 3552
541 Country Club Drive,
Prediction: Will have sudden loud sound followed by abrupt power cut: It's fast air molecules and nose off. Monday Night, 17 June 2002 John Barry Smith
Taiwan
'Black boxes' likely to be retrieved today, declares ASC chief Chinese boats join search and recovery efforts, complain direct link restriction causing delay
2002-06-18 / Taiwan News, Staff Writer /
The Aviation Safety Council Managing Director Kay Yong (??) yesterday said that the so-called "black boxes" of the ill-fated China Airlines CI-611 jetliner are expected to be retrieved early this morning.

As the signals of the plane's data and voice recorders are weakening 24 days now after the crash, rescue efforts are concentrating on the recovery of the recorders - which may stop emitting signals soon since the batteries have an estimated life span of 30 days.

Ships and underwater photography equipment sent by the companies Jan Steen of Singapore and Global Industries of America have contributed to boosting the search efforts. In addition to the participation of the Taiwanese navy and local rescuers.

The ASC official yesterday was confident of recovering the recorders by this morning.
"Taking a look at the recent rescue efforts - which are very effective - I believe it is very possible for us to recover the black boxes early in the morning," said Yong at yesterday's press conference.

The ASC also made public some pictures of the wreckage the divers successfully took under the water. Yong said that the pictures are very helpful for the team to recover the black boxes.

Chinese boats also joined the search for the plane's wreckage and the victims' bodies, but they complained that the ban on direct links postponed the return of the wreckage they retrieved from the Taiwan Strait.

The rescue team has recovered 121 bodies as of yesterday with one body still needing to be identified.

The Hong Kong-bound jetliner dived into the sea near the outlying Penghu island after breaking into four chunks in mid-air on May 25. The crash has killed 225 passengers and crew on board.

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Dear John & Barry:

Before # 51 it was Mil-W-81044/6. radiation crosslinked polyalkene inner with a Kynar jacket. Over rated in temperature rating, cut-thru, and scrape abrasion resistance. Cross-linked Tefzel is flammable, smoky (97% smoke obscurity rating), and toxic. It should be rated at 150 C but was given 200 C rating to compete with Kapton. The FAA has deemed it flammable, yet Boeing continues to use it on new twin aisle aircraft. TKT is being used on single aisle. Politics and money is the justification given to me by a Boeing representative as to why they are a house divided on wire types. In 1978 it was only used in non-pressurized areas, because NASA found it could explode in oxygen enriched areas (i.e. cargo bay area). When it was resurrected in 1993 after the Kapton crunch, it was put in all areas of the aircraft. At rated
temperature you could remove it with your thumbnail. It is prone to 360 degree cracking when nicked.

It is definitely not Poly-X wiring however these wires were all made by raychem Corp. They would take material that Dupont threw away, crosslink it and get a patent. They would then sell it to the military and get a specification written for it. They would then sell it to Boeing/McDonnell-Douglas as having military approval.

I agree wiring does worse things then start fires. I believe it is responsible for all of the uncommanded inputs to the rudder servo actuators via the yaw dampeners on the A300. Their rudders are automatically put in when you enter a turn, no matter whether the autopilot system is engaged or not. There are no transducers on the rudder pedals themselves so you can't tell if they were moved by the pilots or backdrove by the rudder. There was a multiple rudder deflection caused by miswiring on an A300 in 1999. There was also a crash in 1962, a 707 that had defective wiring on the rudder servos.

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Ed Block

From: EdwBlock@aol.com
Date: June 20, 2002 7:51:44 AM PDT
To: barry@corazon.com
Subject: Re: General term to cover all 747 wiring...

In a message dated 6/20/02 2:27:27 AM Eastern Daylight Time, barry@corazon.com writes:

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No not all are polyimide. I explained the types above. Yes all types will crack, chafe and arc-track.
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Ed Block

From: EdwBlock@aol.com
Date: June 20, 2002 12:34:02 PM PDT
To: barry@corazon.com
Subject: Re: General term to cover all 747 wiring...dangerous

Dear Barry:

The Raychem Corp is the match. They are owned by TYCO Int'l now. Crosslinked means bombarded with an electron beam fed by a nuclear reactor. It imparts qualities unseen and unknown. What it really does is allow for patents and exorbitant sole source pricing of $31/ft on the Cruise Missle. TKT stands for Teflon-Kapton-Teflon. It is tape wraps. The teflon melts and puts out the arc-tracking of Kapton. China Air 611 was crosslinked Tefzel not regular Tefzel. Make sure you show the distinction. BMS-13-42 is Boeing's specification covering Poly-X (BMS 13-42B), and Stilan (BMS-13-42D).

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Ed

From: EdwBlock@aol.com
Date: June 21, 2002 8:01:40 AM PDT
To: barry@corazon.com
Subject: Re: Raychem

In a message dated 6/21/02 12:36:37 AM Eastern Daylight Time, barry@corazon.com writes:

Dear Barry:

    The Raychem Corp is the match.

Ahhh....But they sold all the wiring so no coincidence.

They are owned by TYCO Int'l now.

Crosslinked means bombarded with an electron beam fed by a nuclear reactor. It imparts qualities unseen and unknown.
Why do it then?

What it really does is allow for patents and exorbitant sole source pricing of $31/ft on the Cruise Missle.

Only used once so really don't have to worry about aging.

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China Airlines Flight 611 crosslinked Tefzel 1979
Air India Flight 182 crosslinked Tefzel 1978
Pan Am Flight 103 Mil-W81044/6 1970
Trans World Airlines Flight 800 Poly X 1971 BMS-13-42
China Airlines crash at Wanli about 81 or 82, probably crosslinked Tefzel
El Al Amsterdam Plane delivered in 1979 crosslinked Tefzel
Pan Am Flight 125 Mil-W81044/6 1970
Boeing 747-222B, N152UA preflight line 675 mar 87 crosslinked Tefzel
United post flight serial number 28717, after 1992 could be crosslinked Tefzel

Make sure you show the distinction.

Righto. Crosslinked Tefzel seems more the villain than Poly X. No Stilan.
Discrepancy/Corrective Action: FWD CARGO DOOR OPENED BY ITSELF WHEN CB PUSHED IN. ON ARRIVAL, CIRCUIT BREAKERS WERE PUSHED IN, WHEN PRESSURE RELIEF DOOR HANDLE WAS OPENED THE DOOR LATCHES OPENED AND THEN THE DOOR OPENED ON ITS OWN. COULD NOT DUPLICATE PROBLEM AFTER INITIAL OPENING.

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Right, thanks Ed.

Now, can you imagine the interest in wiring after China Airlines Flight 611 is determined to be hull rupture in flight and that is forward of the wing on the right side near the forward cargo door? That leads to United Airlines Flight 811 and that leads to wiring/switch.

And that leads to Air India Flight 182, Pan Am Flight 103, and Trans World Airlines Flight 800.

So, first things first: Hull rupture. Location, similar event, to similar events. I hope the Chinese can see the forest while looking at their one tree.

Cheers,
Barry

On June 13, 1991, UAL maintenance personnel were unable to electrically open the aft cargo door on a Boeing 747-222B,
N152UA, at JFK Airport, Jamaica, New York. The airplane was one of two used exclusively on nonstop flights between Narita, Japan, and JFK. This particular airplane had accumulated 19,053 hours and 1,547 cycles at the time of the occurrence. The airplane was being prepared for flight at the UAL maintenance hangar when an inspection of the circuit breaker panel revealed that the C-288 (aft cargo door) circuit breaker had popped. The circuit breaker, located in the electrical equipment bay just forward of the forward cargo compartment, was reset, and it popped again a few seconds later. A decision was made to defer further work until the airplane was repositioned at the gate for the flight. The airplane was then taxied to the gate, and work on the door resumed.

The aft cargo door was cranked open manually, the C-288 circuit breaker was reset, and it stayed in place. The door was then closed electrically and cycled a couple of times without incident. With the door closed, one of the two "cannon plug" (multiple pin) connectors was removed from the J-4 junction box located on the upper portion of the interior of the door. The wiring bundle from the junction box to the fuselage was then manipulated while readings were taken on the cannon plug pins using a volt/ohmmeter. Fluctuations in electrical resistance were noted. When the plug was reattached to the J-4 junction box, the door began to open with no activation of the electrical door open switches. The C-288 circuit breaker was pulled, and the door operation ceased. When the circuit breaker was reset, the door continued to the full open position, and the lift actuator motor continued to run for several seconds until the circuit breaker was again pulled. At this time, a flexible conduit, which covered a portion of the wiring bundle, was slid along the bundle toward the J-4 junction box, revealing several wires with insulation breaches and damage. UAL personnel notified the Safety Board of the occurrence, and the airplane was examined at JFK by representatives of the Safety Board, United Airlines, and Boeing. After the wires in the damaged area were electrically isolated, electrical operation of the door was normal when the door was unlocked. When the door was locked (master latch lock handle closed), activation of the
door control switches had no effect on the door. This indicated that the S2 master latch lock switch was operating as expected (removing power from the door when it was locked). After the on-site examinations, the wiring bundle was cut from the airplane and taken to the Safety Board's materials laboratory for further examination.

The wiring bundle with the damaged wires contained all electric control wires (28 volt DC) and power wires (115 volt AC) that pass between the fuselage and the aft cargo door. From the forward side of the J-4 junction box, the bundle progresses in the forward direction, just above the forward pressure relief door, then upward, following the forward lift actuator arms. The bundle then enters an empty space between two floor beams, where the bundle has an approximate 180-degree bend when the door is closed. From this location, the wiring bundle progresses inboard, through a fore-to-aft intercostal between two floor beams. The wiring bundle then splits, with wires going in several directions. The bundle is covered by the flexible conduit approximately from the lower end of the lift actuator arms to the fore-to-aft intercostal between the floor beams.

The conduit covering the wiring bundle is intended to prevent the wire bundle from being damaged during opening and closing of the door and during cargo handling operations. The conduit is a sealed flexible interconnector consisting of a convoluted helical brass innercore covered by a bronze braid. The innercore is soldered at every other convolute, and should be capable of withstanding pressures exceeding 1,000 pounds per square inch (psi). Boeing has indicated that the conduit is an evolutionary improvement and that it has been installed on all B-747 airplanes produced since 1981 (from line number 489 on). Airplane N152UA was delivered in April 1987.

Airplanes produced prior to 1981, including N4713U, used a bungee retraction system, to retract the cargo door wire bundle. Guidelines for the replacement of the bungee system with the flexible conduit were covered in Boeing Service Bulletin 747-752-2170, dated August 1981. The service bulletin was prompted by reports that the wire bundle bungee retraction system had not retracted the wire bundle sufficiently to prevent
trapping the bundle between the cargo door and the door frame. UAL did not perform the retrofit on N4713U, which was line number 89, nor was the company required to do so. Examination of the wires in the damaged area on the wiring bundle revealed that four of the wires were similar in appearance, with insulation breaches that progressed through to the underlying conductor. Adjacent to the breach on these four wires, the insulation was blackened, as if it had been burned. Another wire contained an extensive breach but no evidence of burned insulation. The damaged area was located on the bundle at a position approximately corresponding to a conduit support bracket and attached standoff pin on the upper arm of the forward lift actuator mechanism. This support bracket was found bent in the forward direction. In addition, mechanical damage was noted on adjacent components in this area. A second damaged area was noted on the wiring bundle at a position approximately corresponding to the conduit swivel clamp at the elbow between the two arms of the forward lift actuator mechanism. Wires in this area were missing portions of their exterior coating, but no breaches to the underlying conductors were noted. The exterior braid on the conduit contained minor rub marks and was slightly kinked at a position corresponding to the area on the wires with breached insulation. Additional examinations revealed that the innercore of the conduit contained multiple circumferential cracks in the areas corresponding to the damage areas on the wires. The cracks were in the convoluted innercore directly adjacent to the inside diameter of the conduit. The lock sectors, latch cams, and latch pins from the aft cargo door were examined on the incident airplane and were generally in excellent condition. There was no evidence to suggest that the cams had ever been electrically (or manually) driven into or through the lock sectors. Boeing also informed the Safety Board that, in May of 1991, a B-747 operated by Quantas was found to have chafing of the wires in the wire bundle to the aft cargo door. This airplane also had a flexible conduit protecting the wires, and the chafing was located approximately at the standoff pin on the bracket at the
The Safety Board determined that the chafing of the wires on the airplane involved in the JFK occurrence was caused by, or was greatly accelerated by, the circumferential cracks in the conduit and that the cracks in the conduit were caused either by repeated flexing of the conduit as the cargo door opens and shuts or by unusual stresses on the conduit generated concurrently with damage to the conduit guide bracket and attached standoff pin on the upper end of the forward lift actuator upper arm.

A portion of the wire bundle for the forward cargo door on many B-747 airplanes is also covered by a flexible conduit that is very similar to the conduit for the aft cargo door. However, there are substantial differences between the orientation of the flexible conduits for the two doors, and the Safety Board has not become aware of problems associated with the flexible conduit for the forward door.

Nevertheless, because of the concerns about the chafed wires and possible electrical short circuits, on August 28, 1991, the Safety Board recommended that the FAA: Issue an Airworthiness Directive applicable to all Boeing 747 airplanes with a flexible conduit protecting the wiring bundle between the fuselage and aft cargo door to require an expedited inspection of:

(1) the wiring bundle in the area normally covered by the conduit for the presence of damaged insulation (using either an electrical test method or visual examination);
(2) the conduit support bracket and attached standoff pin on the upper arm of the forward lift actuator mechanism;
(3) the flexible conduit for the presence of cracking in the convoluted innercore.

Wires with damaged insulation should be repaired before further service. Damage to the flexible conduit, conduit support bracket and standoff pin should result in an immediate replacement of the conduit as well as the damaged parts. The inspection should be repeated at an appropriate cyclic interval. (Class II, Priority Action) (A-91-83)

Evaluate the design, installation, and operation of the forward cargo door flexible conduits on Boeing 747 airplanes so equipped
and issue, if warranted, an Airworthiness Directive for inspection and repair of the flexible conduit and underlying wiring bundle, similar to the provisions recommended in A-91-83. (Class II, Priority Action) (A-91-84)
The FAA responded to these safety recommendations on November 1, 1991, stating that it agreed with the intent of the recommendations and that the issuance of an NPRM was being considered to address the issues in the safety recommendations. The Safety Board replied on November 27, 1991, classifying each of the recommendations as "Open--Acceptable Response," pending the completion of the rulemaking process. Since that exchange of correspondence, the FAA has published an NPRM which is now being reviewed by the Safety Board. Safety Recommendations A-91-83 and -84 will continue to be classified as "Open--Acceptable Response" until an acceptable final rule is published.

Dear barry:

Thanks for the info. The reason to keep doing it? Pre-planned obsolescence or attrition. If the plane lasts forever like say the DC-3, you don't need new ones do you. I know how bad that sounds but it is the only explanation I can come up with.

Ed

From: EdwBlock@aol.com
Date: June 21, 2002 8:01:40 AM PDT
To: barry@corazon.com
Subject: Re: Raychem

In a message dated 6/21/02 12:36:37 AM Eastern Daylight Time, barry@corazon.com writes:

Dear Barry:
The Raychem Corp is the match.

Ahhh....But they sold all the wiring so no coincidence.

They are owned by TYCO Int'l now.

Crosslinked means bombarded with an electron beam fed by a nuclear reactor. It imparts qualities unseen and unknown.

Why do it then?

What it really does is allow for patents and exorbitant sole source pricing of $31/ft on the Cruise Missle.

Only used once so really don't have to worry about aging.

TKT stands for Teflon-Kapton-Teflon. It is tape wraps. The teflon melts and puts out the arc-tracking of Kapton.
China Air 611 was crosslinked Tefzel not regular Tefzel.

Thanks.

Boeing used Poly-X from fuselage # 51(1970-75), switched to Stilan in 1975, switched to crosslinked Tefzel in 1978, switched to Kapton on the 400 in 1989, switched back to crosslinked Tefzel in 1993.

China Airlines Flight 611 crosslinked Tefzel 1979
Air India Flight 182 crosslinked Tefzel 1978
Pan Am Flight 103 Mil-W81044/6 1970
Trans World Airlines Flight 800 Poly X 1971 BMS-13-42
China Airlines crash at Wanli about 81 or 82, probably crosslinked Tefzel
El Al Amsterdam Plane delivered in 1979 crosslinked Tefzel
Pan Am Flight 125 Mil-W81044/6 1970
Boeing 747-222B, N152UA preflight line 675 mar 87
crosslinked Tefzel
United post flight serial number 28717, after 1992 could be crosslinked Tefzel

Make sure you show the distinction.

Righto. Crosslinked Tefzel seems more the villain than Poly X.
No Stilan.


BMS-13-42 is Boeing's specification covering Poly-X (BMS 13-42B), and Stilan (BMS-13-42D).

Right, thanks Ed.

Now, can you imagine the interest in wiring after China Airlines Flight 611 is determined to be hull rupture in flight and that is forward of the wing on the right side near the forward cargo door? That leads to United Airlines Flight 811 and that leads to wiring/switch.

And that leads to Air India Flight 182, Pan Am Flight 103, and
Trans World Airlines Flight 800.

So, first things first: Hull rupture. Location, similar event, to similar events.
I hope the Chinese can see the forest while looking at their one tree.

Cheers,
Barry

On June 13, 1991, UAL maintenance personnel were unable to electrically open the aft cargo door on a Boeing 747-222B, N152UA, at JFK Airport, Jamaica, New York. The airplane was one of two used exclusively on nonstop flights between Narita, Japan, and JFK. This particular airplane had accumulated 19,053 hours and 1,547 cycles at the time of the occurrence. The airplane was being prepared for flight at the UAL maintenance hangar when an inspection of the circuit breaker panel revealed that the C-288 (aft cargo door) circuit breaker had popped. The circuit breaker, located in the electrical equipment bay just forward of the forward cargo compartment, was reset, and it popped again a few seconds later. A decision was made to defer further work until the airplane was repositioned at the gate for the flight. The airplane was then taxied to the gate, and work on the door resumed.

The aft cargo door was cranked open manually, the C-288 circuit breaker was reset, and it stayed in place. The door was then closed electrically and cycled a couple of times without incident. With the door closed, one of the two "cannon plug" (multiple pin) connectors was removed from the J-4 junction box located on the upper portion of the interior of the door. The wiring bundle from the junction box to the fuselage was then manipulated while readings were taken on the cannon plug pins using a volt/ohmmeter. Fluctuations in electrical resistance were noted. When
the plug was reattached to the J-4 junction box, the door began to open with no activation of the electrical door open switches. The C-288 circuit breaker was pulled, and the door operation ceased. When the circuit breaker was reset, the door continued to the full open position, and the lift actuator motor continued to run for several seconds until the circuit breaker was again pulled. At this time, a flexible conduit, which covered a portion of the wiring bundle, was slid along the bundle toward the J-4 junction box, revealing several wires with insulation breaches and damage. UAL personnel notified the Safety Board of the occurrence, and the airplane was examined at JFK by representatives of the Safety Board, United Airlines, and Boeing. After the wires in the damaged area were electrically isolated, electrical operation of the door was normal when the door was unlocked. When the door was locked (master latch lock handle closed), activation of the door control switches had no effect on the door. This indicated that the S2 master latch lock switch was operating as expected (removing power from the door when it was locked). After the on-site examinations, the wiring bundle was cut from the airplane and taken to the Safety Board's materials laboratory for further examination. The wiring bundle with the damaged wires contained all electric control wires (28 volt DC) and power wires (115 volt AC) that pass between the fuselage and the aft cargo door. From the forward side of the J-4 junction box, the bundle progresses in the forward direction, just above the forward pressure relief door, then upward, following the forward lift actuator arms. The bundle then enters an empty space between two floor beams, where the bundle has an approximate 180-degree bend when the door is closed. From this location, the wiring bundle progresses inboard, through a fore-to-aft intercostal between two floor beams. The wiring bundle then splits, with wires going in several directions. The bundle is covered by the flexible conduit approximately from the lower end of the lift actuator arms to the fore-to-aft intercostal between the floor beams. The conduit covering the wiring bundle is intended to prevent the wire bundle from being damaged during opening and closing of the door and during cargo handling operations. The conduit is a
sealed flexible interconnector consisting of a convoluted helical brass innercore covered by a bronze braid. The innercore is soldered at every other convolute, and should be capable of withstanding pressures exceeding 1,000 pounds per square inch (psi). Boeing has indicated that the conduit is an evolutionary improvement and that it has been installed on all B-747 airplanes produced since 1981 (from line number 489 on). Airplane N152UA was delivered in April 1987.

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Examination of the wires in the damaged area on the wiring bundle revealed that four of the wires were similar in appearance, with insulation breaches that progressed through to the underlying conductor. Adjacent to the breach on these four wires, the insulation was blackened, as if it had been burned. Another wire contained an extensive breach but no evidence of burned insulation. The damaged area was located on the bundle at a position approximately corresponding to a conduit support bracket and attached standoff pin on the upper arm of the forward lift actuator mechanism. This support bracket was found bent in the forward direction. In addition, mechanical damage was noted on adjacent components in this area.

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From: "John King" <jking1@attbi.com>  
Date: September 29, 2002 5:07:29 AM PDT  
To: <gstoller@usatoday.com>, "Dan Rupp"  
<dan.rupp@lethalinteractive.com>, <GADunham@aol.com>,  
"John Barry Smith" <barry@corazon.com>,  
<mbusch@avweb.com>, <RCOULTHART@ninenet.com.au>,  
"Tim van Beveren" <avsafty@bellsouth.net>,  
<whistleblowers@defraudingaamericia.com>, "MRD"  
<mdef@quixnet.net>, "LYN" <rosebush@bestweb.net>, "John  
Sampson" <sampson1@iinet.net.au>, "Ralph Omholt"  
<skydrifter@attbi.com>, "TimGrizzle@Netscape>,  
<RITACOZ@aol.com>, <mschiavo@baumhedlundlaw.com>,  
<LarryC@AirlinInvestigationUnit.com>, "James P. Stevenson"  
<jamesstevenson@sprintmail.com>, "Edward Block"  
<EdwBlock@aol.com>, <bacohido@seattletimes.com>  
Subject: From Steve Elson  

Dear all:

See below for Steve's (former FAA Red Team member) latest  
missive.

JK

There are smoking guns out there. Soon one will become public  
or made available to certain media outlets and lawyers! The  
document has a senior government official ADMITTING, in  
writing, that the government KNEW that aviation security was  
nothing but a facade. That's correct -- ADMITTING it and also  
admitting that there was NO effort made or desired to correct  
these security vulnerabilities. In fact, this official essentially  
states that the FAA's job was NOT to counter terrorism or thwart  
hijackings.
Excellent article below from "The St. Petersburg Times." Ms. Hill's testimony before the hearings absolutely chilling. Each CONFIRMs that the FAA, particularly Jane Garvey and Cathal Flynn are consummate liars and were intentionally/willfully negligent in "well and faithfully discharging the duties of their office which they entered." Each (Garvey and Flynn) has stated publicly that there was no way (s)he could have foreseen someone seizing a plane and using it as a missile, that there was no way (s)he could have prevented the 9/11 debacle. My written comment in response to these lies, months ago (before the recent hearing's revelations), was that the FAA did NOT have to foresee any such event. They had only to foresee PREVENTING a hijacking. FAA Security was formed for just that reason -- PREVENTING HIJACKINGS. Had the 9/11 hijackings been prevented, then the follow-on intentions would have been essentially inconsequential. FAA/airline industry continuing with the ludicrous 1960 era procedures for giving up the cockpit and cooperating with hijackers goes beyond intentional/willful negligence and stupidity. It is Criminal. The reasons for hijacking planes in the 1960s have absolutely NO relevance in the 2000 era reasons for hijacking -- just look at the 1960/2000 political/geopolitical structures of each era. Neither do the associated "prophylactic" procedures maintained these last 40 years. Especially now that it has been revealed that the FAA/airline industry had been warned of possible attempts to seize and use aircraft as missiles, FAA/DoT willful/intentional inaction and thwarting of security are criminal and at best, facilitated the debacle the 9/11 disaster.

"The St. Petersburg " Times article and Ms. Hill's testimony only spotlight the lies and willful/intentional negligence of Garvey, Flynn, DoT, and the congress. There is still much left unsaid. Since notification of hijacking and flying planes into buildings was provided to FAA on several occasions, whether corroborated or not, the ideas WERE there and the only way the Garvey/Flynn could not have "envisioned" such was to close their eyes, stop up their ears, look the other way, and intentionally/willfully ignore the warnings. This they
The hearings revealed that such information was provided to FAA in 1998. *ALL* that Garvey and Flynn had to envision/do was mandate some Quick, Simple, Cheap, and Easy fixes to thwart cockpit takeover. They didn't. Without even talking to the airlines, they simply caved for apparently nothing more than greed/money and to curry the favor of the airline industry/congress. All violated the oath of office, which according to Webster's dictionary makes them traitors and guilty of treason. If you think this rhetoric, look up the (1) oath of office, then (2) the DoT/FAA mission statements, (3) what was known about AVSEC vulnerabilities, and finally (4) the definition of treason and traitor. Speaks for itself.

**NO ACCOUNTABILITY; NO REMEDIES**

A few in the media are moving towards the ONE and ONLY thing that might change and improve the situation -- ACCOUNTABILITY. While Lieberman talks of an independent commission, he states that he doesn't want to point fingers. In other words, NO ACCOUNTABILITY. "Finger pointing" IS ACCOUNTABILITY. Finger pointing is EXACTLY what must be done to achieve REMEDY! It must be pointed at people like Garvey, Cathal Flynn, Lee Longmire, Willie Gripper, Joanne Oxford, Mary Carol Turano, et. al. Each has flourished but "FAA got alerts but no blame in attacks." (see article below of this title) To the contrary, they have been promoted, rewarded, and awarded. The finger must be pointed at those in congress who were given hundreds of pages of documentation years before 9/11 about FAA corruption, abuse of employees thinking "outside the box, HUGE AVSEC vulnerabilities, and cover-up. These same congressional personnel are still there and likely still the ones getting millions in PAC and Soft money contributions from the air transport industry even while the congress has "lent" (payback we are unlikely to see) Billions of taxpayer dollars in the bailout. Think about it. The airlines are bleeding like a
stuck pig and getting billions (more requested this week) in bailout, yet they still make contributions to congress and political parties. Much of that money has got to come from the Billions of OUR taxpayer dollars "lent" to the airlines.

Some in congress have stated that while there were gross failures in the intelligence community, but that there is no smoking gun. This is possibly true, BUT ONLY in the intelligence/law enforcement arena. There IS a smoking gun in DoT/FAA. Intelligence is an art, is cumbersome, and is uncoordinated in the United States. Too much infighting; too much information control; too much bureaucracy, too much collection, too little analysis, and too much managerial "conservatism." All centered on getting the big slice of the budget pie. To solve, the intelligence-sharing problem, I reiterate my call for the formation of a CENTRAL Intelligence Agency, a fusion center to reduce infighting.

Like the corporations and corporate corruption, it is all about MONEY. Where did the corporations learn about greed and corruption? Certainly a lot of it from the government which they (corporations) have been buying off for years. The "business of America is business" may be so, but at what cost and to what length? Nihilism?

Some have claimed that the problems that led to the 9/11 debacle were a matter of "missed communication." Nonsense. There was no missed communication; there was hindered communication -- hindered by Management! Simple endemic bureaucratic stultification caused the problem. In most of the federal agencies, we are finding out what we in those agencies have long known and complained about -- that the FIELD AGENTS/workers, discovered threats and problems, and forwarded them up the chain of command to upper management. Some Field Agents spent their own money to do so. THE problem is that management, the same management that continues to fester and grow like an anaplastic carcinoma -- thwarts, holds back, crushes, and punishes those who discovered the threats and
vulnerabilities and forwarded them for evaluation and use. That's right -- punished. Management would NOT allow us to do our sworn jobs.

I personally called Cathal Flynn (then head of FAA Security) in D.C. late one Friday night in Jan 1999 to tell him of the abuses of FAA Field Office Managers Joanne Oxford at Houston's George Bush Airport, Luz Ponce at DFW, and MARY CAROL TURANO of BOSTON LOGAN. He quickly and responsibly sent his executive assistant Kay Payne to these offices to investigate. I thought Ms. Payne had betrayed the Field in her report to Flynn. I subsequently found out that she did NOT; I later called and apologized. She told Flynn how bad things were and that there were serious problems in those offices. According to my inside source, Flynn, irresponsibly, told her to forget it. Like the FBI and Customs Managers, Flynn supported the management coterie and its stasis above all else, in this case Oxford, Ponce, and TURANO. Results on 9/11 speak for themselves.

The Independent Hearing is ESSENTIAL if we are to have a chance. Virtually everyday, TSA proves itself dangerously arrogant and an expensive hoax; former FAA Agents contact me and gagging on the words, tell me that though it seems impossible, the TSA is actually worse than FAA. Hopefully, we'll be able to present the "smoking gun" admission to the hearing. If not, the media will get it -- the media outlets that have been so aggressive and professional in bringing the NEW, "Improved," and far more expensive TSA facade to the fore. Perhaps the media are beginning to name names and focus on ACCOUNTABILITY. Copies will also go to the lawyers who are fighting for the basic, constitutional rights of the surviving families who simply want to know "why" and "what" happened. Then the government can answer the people through the media and courts.

Stand by.

S

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FAA got alerts but no blame in attacks
WASHINGTON -- In April 2000, a man walked into the FBI field office in Newark and gave an extraordinary confession. He said he was involved in a plot by Osama bin Laden to hijack a Boeing 747. He told agents that he had learned hijacking techniques at a training camp in Pakistan and was meeting five or six other hijackers in the United States who planned to overpower the plane's crew, according to the report released last week by the congressional panel investigating the Sept. 11 attacks.

In the summer of 1998, the government had received other warnings about plans to use airplanes for terrorism. The Federal Aviation Administration got an intelligence report that a group of Arab terrorists planned to get a plane filled with explosives in Libya and fly it into the World Trade Center. U.S. intelligence agencies received a separate report that said bin Laden might try to fly an explosive-laden plane into a U.S. airport and detonate it.

Those reports and several others provided lots of clues about the Sept. 11 attacks. So why didn't the FAA or the airlines do more to prevent them?

Officials say some reports were discredited because they could not be corroborated. Some apparently never got to the FAA. Others were dismissed because CIA analysts considered truck and car bombings more likely or because they did not believe hijackers could fly a plane into the U.S. without detection.

Government officials say they alerted the airlines about hijackings and many other possibilities. But those alerts weren't given much urgency because the information was so vague.

The FAA provided 15 "information circulars" about security
threats to airlines and airports last year, including at least one that mentions bin Laden. But there were so many that airline officials grew numb to them.

"Those information circulars were always nonspecific, especially to any domestic flight," said John Hotard, a spokesman for American Airlines. "There were also quite a few of them issued, which tended to be somewhat confusing and repetitive."
The FAA also sends "security directives," more urgent messages that require a specific action, but there were only a handful before the attacks. The agency has not said whether any were related to bin Laden or Sept. 11.
The FAA, the primary agency for aviation security until the Transportation Security Agency was created in November, could have ordered precautions such as reinforced cockpit doors, more air marshals or additional scrutiny of certain types of passengers. The agency might also have changed its 30-year-old directions on how pilots handle hijackings, which emphasized cooperation and appeasement.
But there's been virtually no criticism of the FAA. Members of Congress and safety experts who have criticized the agency on other issues say the FAA is not at fault for failing to prevent the attacks.

"It's not their responsibility," said Rep. John Mica, the Orlando area Republican who chairs the House aviation subcommittee. "The FAA is not an intelligence-gathering agency."
Says Douglas Laird, a consultant who formerly headed security for Northwest Airlines, "I don't fault the FAA as much as I fault the intelligence community for not being more forceful with the FAA."
With hindsight, the clues are chilling.
In addition to the much-publicized case of Zacarias Moussaoui, the alleged 20th hijacker, the congressional report reveals intelligence items that have not been discussed publicly before.
In the Newark case in 2000, the man simply appeared in the FBI office and began spouting details about his involvement in the hijacking plot. Some details were different from what happened Sept. 11. The man said they would hijack the plane in the United States and try to fly it to Afghanistan. They would blow it up if they were unable to reach that country, he told the agents. The man passed a polygraph test, but the FBI was unable to verify his story or identify others involved in the plot. Likewise, the CIA told the FBI and FAA in 1998 about the tip that Arabs might fly a plane from Libya into the World Trade Center. CIA analysts regarded the tip as far-fetched, according to a U.S. intelligence official, but passed it on because of the high-profile target. The tip had no connection to al-Qaida or bin Laden. The FBI and FAA decided the threat was not serious because of doubts that a 747 from Libya could fly undetected into New York. FAA spokeswoman Rebecca Trexler said the agency did the best it could with the information provided by the CIA and FBI. "We are customers of the intelligence community," Trexler said. Laird, the former security director at Northwest Airlines, said even if the FAA had more specifics predicting the nature of the attack, the airlines would have balked at making costly modifications to cockpit doors. "I'm afraid everybody has responsibility for this one," he said. "We're all guilty to some degree."
The Air Transport Association, the main airline trade group, says it is satisfied that the FAA did everything it could. "The FAA provided the information to us in the best form it was made available to them," said Michael Wascom, a spokesman for association. "I don't fault the FAA at all."
-- Staff writer Bill Adair can be reached at (202) 463-0575 or adair@sptimes.com.
From: "John King" <john.king19@comcast.net>
Date: September 27, 2003 4:18:14 AM PDT
To: <safety@iasa-intl.com>, "John Barry Smith"
    <vigilante3@redshift.net>
Subject: Re: Queering your Pitch//Queering the Facts

Have either of you guys done the following;

1. A review of the NTSB Monthlies. A line-by-line search because there is no search engine provided us but I find it not creditable that the NTSB hasn't one. Go Fish. The Monthlies do appear to mirror the NTSB Rule 803.5 **required filings** for control problems (they accurately did so for some 30 Rule 830.5 filings the NTSB sent me some time back).

2. A review of the NTSB Recommendations Letters. Also a line-by-line search because of no search engine.

3. A review of the FAA Incidents. At least this has a search engine, abet, but of dubious quality. Down side is that this database was a very low performer and producer of events. It supplied less than 10% of those "400 events of smoke/fire" I had listed in 2000.

4. A review of the Service Bulletins. As we know, these are closely held and the only place they I know to find them is at the Federal Register in D.C. because they are filed along with the ADs. The SBs make references to the history and past number of complaints. It is reasonable to believe these mirror but some of the SDR filings.

**SECOND BEST SOURCE**
5. A review of the Aviation Safety Reporting System. A high quality and productive source if the "de-identifying" doesn't get in the way of recognizing the Beeches or Embraers and the search engine will spit out everything from balloons to 747s. Suggested search words; "trim, horizontal, stabilizers, pitch" etc..

**BEST SOURCE: The SDRs**

JKs 1st Choice

6. The latter (ASRS) and the SDRs were, by far, the best source in that "400 events of smoke/fire" as they supplied about 3 for every 1 of the reports from all other sources. I find the web-supplied SDR data useless because the spreadsheet offered is like trying to find a name in a telephone book with the name not alphabetically listed. Hopefully, and after the loss of Mickey Kedigh, a request to the FAA Data Center for "all Beeche and Embraer SDRs" wouldn't take but a few days for a response and the list wouldn't be that lengthy for a reasonable review.

A word of caution here is to not describe yourself, or interests, as having anything to do with publicity or media. A Readers Digest chap I know is still waiting for his April request for SDRs with the words "emergency landing, return, diverted" etc.

Like all the other issues we have visited, I have no doubt there is relevant data out there. I hear the NTSB is still exercising their view that pilots don't know how to use the rudder pedals even though there are a dozen reports of errant A-300 rudder uncommanded movements out there.

Remember the Heindrich Pyramid --

"For every major accident--up to 200 unreported occurrences--up to 7-10 incidents and up to 5 less significant accidents".

----- Original Message -----  
From: safety@iasa-intl.com  
To: John Barry Smith  
Cc: john.king19@comcast.net  
Sent: Friday, September 26, 2003 1:15 PM  
Subject: FW: Queering your Pitch  

JBS  
Any more incidents along these lines would be appreciated. you seem to be good at finding things. Looking in particular for similar incidents (priority being Beech/Raytheon -but Embraer and all similar gladly accepted.

JK, if you're out there - same same, matey.

JS

-----Original Message-----  
From: David P Evans [mailto:DEvans@pbimedia.com]  
Sent: Saturday, September 27, 2003 12:57 AM  
To: 'safety@iasa-intl.com'  
Subject: RE: Queering your Pitch  

Unbelievable! PBI's Maintenance Magazine editor Matt Thurber and I will both be meeting with Mbr. Goglia early next week. This material is very useful.

I have to provide transportation and other support to aged good-'ol-Dad on Monday (eye surgery, on the lens, no less). I may be knocked out for the day tending to that matter (brother provided most of parental support during Isabel disruption, so I must do my share for peacable family relations).
David
Link to the full narrative is highlit at the page bottom.
Thought that I'd pitch a few of these at you as you will be examining the NTSB's maint manuals on the Beech1900D and quizzing them further - and because these Embraers are very similar beasts....with seemingly similar pitch control deficiencies. This first incident goes way beyond redundancy and back to that airworthiness certification question again perhaps?
alternate trim switch: no go either backup system: not going to play either (no pitch control, need to think, no time to think) deploy the spoilers? Whoops!!
At least this guy had the presence of mind to tilt the lift vector and get the nose down (which would have been a great help at Charlotte NC (and perhaps even a solution). The damn abnormal ops in the POH's never seem to cover the actual emergencies. I wonder if the pax swore off the Embraer brand name - for life.

NTSB Identification: CHI01IA055. The docket is stored on NTSB microfiche number DMS.
Scheduled 14 CFR Part 121: Air Carrier operation of AMERICAN EAGLE AIRLINES, INC. (D.B.A. AMERICAN EAGLE AIRLINES)
Incident occurred Wednesday, December 27, 2000 in CHICAGO, IL
Probable Cause Approval Date: 8/26/02
Aircraft: Embraer EMB-135LR, registration: N721HS
Injuries: 12 Uninjured.
The captain said that during takeoff from O'Hare International Airport (ORD) the airplane accelerated normally, rotated, and "jumped into the air". At 800 feet agl, the captain called for the climb checklist. It was about this time that the captain noticed that he could not trim nose down. The captain had the first officer check his trim switch and the backup system. They did not respond. The captain elected to bring the airplane back to ORD. The captain said that both he and the first officer had their control yokes pushed forward to the stop and were still climbing. The captain said he was finally able to stop the climb and level the airplane at approximately 8,000 feet. The captain said they declared an emergency and referred to the Pitch Trim 1 and 2 Failure checklists. The checklist directed they lower flaps to 9 degrees. "When we brought in the flaps, the aircraft pitched way nose high. We were out of control." The captain regained control of the airplane and had the first officer retract the flaps. The captain said they lowered the landing gear. It improved the airplane's stability slightly. They pulled and reset the trim circuit breakers twice. These actions did nothing. The captain said he lined up for an approach to runway 9R. The captain determined he was too high to land, so he executed a 360-degree descending turn. On completion of the turn, the captain said they needed to slow down so they deployed the spoilers. The captain said the airplane abruptly pitched way up. The captain said he and the first officer pushed both yokes forward. The captain advanced the throttles, and retracted the spoilers. "That second, I banked hard left, 50 to 60 degrees as I recall, and chopped the power. It took all our abilities to get the nose down." After they got the airplane back under control, the captain said approach control informed them that runway 4R was straight ahead. The captain elected to land on runway 4R. The captain said he left the airplane...
runway 4R. The captain said he left the airplane configured as it was (landing gear down, flaps and spoilers retracted) and flew a long shallow approach. "I said to myself, God please let me land this airplane. Over the runway, I chopped the power and let it settle on the runway." A post-incident examination of the airplane's spoiler control unit revealed that when the spoilers were given the command to retract, the unit was not sending an input to the horizontal stab control unit (HSCU) to put in 1 unit of nose down stabilizer trim. Examinations of the trim system components and the other airplane systems revealed no anomalies. Following the incident, the airplane's manufacturer revealed that the horizontal stab actuator was determined to be inadequate to move the horizontal stabilizer in all flight conditions. "The incidents are most likely caused when the flight crew fails to trim the airplane after takeoff before reaching a certain airspeed where the air loads on the stabilizer may overpower the trim actuator, resulting in the horizontal stabilizer not responding to the pitch trim command from the flight crew." The manufacturer issued an alert service bulletin mandating the installation of a cockpit placard and revisions to the airplane flight manual establishing a maximum speed of 160 knots to pitch-trim after takeoff. The FAA issued an emergency AD mandating the installation of the cockpit placard and revisions to the airplane flight manual. The FAA has also tasked the manufacturer to make design changes that will enable the trim actuator to handle increased load limits. The FAA has also mandated changes that will provide improved pitch trim failure indications and ergonomic improvements of the yoke trim switches.

The National Transportation Safety Board determines the probable cause(s) of this incident as follows:
The jammed horizontal stabilizer trim that occurred during the airplane's initial climb after takeoff. Factors relating to the incident were the inadequate capability of the horizontal stabilizer trim actuator to move the stabilizer during all flight phases, and the inadequate design of the system by the manufacturer.

Full narrative available

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from this link

-----Original Message-----
From: safety@iasa-intl.com [mailto:safety@iasa-intl.com]
Sent: Friday, September 26, 2003 4:03 PM
To: devans@pbimedia.com
Cc: Adam Smyth (Yahoo); Charlene FRENETTE; Lyn S Romano
Subject: Very Relevant to the Hyannis Beech 1900D - similar NTSB Conundrum

But also Very similar to Charlotte accident

NTSB Identification: DCA85AA004 . The docket is stored on NTSB microfiche number 27485.
Scheduled 14 CFR Part 135: Air Taxi & Commuter Accident occurred Thursday, December 06, 1984 in JACKSONVILLE, FL
Aircraft: Embraer EMB-110P1, registration: N96PB
Injuries: 13 Fatal.

PROVINCIETOWN-BOSTON AIRLINES FLT 1039, AN EMBRAER EMB-110P1 WAS CLEARED TO TAKEOFF
EMBRAER EMB-110PT, WAS CLEARED TO TAKEOFF ON RWY 31 AT 1812 EST. DRG THE INITIAL CLimb NR THE DEPARTURE END OF THE RWY, THE CAPT ROUTINELY ACKNOWLEDGED AN INSTRN TO CONTACT DEP CONTROL (CTL). SHORTLY THEREAFTER, THE ACFT ENTERED A STEEP DSCNT & CRASHED IN AN INVERTED, NOSE DWN ATTITUDE, THEN BURNED. AN INVESTIGATION REVEALED THE ELEVATOR (ELEV) & HORIZONTAL STABILIZER (STAB) HAD SEPARATED IN FLT. THE STAB WAS FND ABOUT 1100 FT FM THE MAIN WRECKAGE. THE ELEV TRIM WAS FND IN A PSN TO TRIM THE ACFT FULL NOSE DWN. THERE WAS EVIDENCE OF A MALFUNCTION OF THE ELEV CTL SYS OR ELEV TRIM SYS, WHICH RESULTED IN A PITCH CTL PROBLEM; THEN REACTION OF THE FLT CREW TO CORRECT THE PROBLEM OVERSTRESSED THE LEFT ELEV CTL ROD. ALSO, THERE WAS EVIDENCE THAT THIS RESULTED IN AN ASYMMETRICAL ELEV DEFLCTION & OVERSTRESS FAILURE OF THE STAB ATTACHMENT STRUCTURE. HOWEVER, THE SAFETY BOARD WAS UNABLE TO DETERMINE THE PRECISE PROBLEM WITH THE PITCH CTL SYS.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

FLIGHT CONTROL SYSTEM..UNDETERMINED
FLT CONTROL SYST,ELEVATOR
CONTROL..FAILURE,TOTAL

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From: "John King" <john.king19@comcast.net>  
Date: September 29, 2003 6:05:22 AM PDT  
To: <safety@iasa-intl.com>, "John Barry Smith"  
<vigilante3@redshift.net>  
Subject: Re: Queering the Facts

My question to David is not only just how many prior control problems are there?....but also how sure is he that the SDRs on the record do not indicate a error in the maintenance manual? If there is, than this whole story moves right into the FAA's front door.

We know their zeal to shield the industry from costs is great. The attached story of how the O2 canister lanyards breakage problem has persisted since 1989 and will see a final fix in 2005 is instructive.

JK
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----- Original Message -----  
From: safety@iasa-intl.com  
To: 'John King'; 'John Barry Smith'  
Sent: Saturday, September 27, 2003 12:02 PM  
Subject: RE: Queering your Pitch//Queering the Facts

JK
As always, good advice. I shall try and I know JBS will - because he's a researcher of note and has been sending out much useful info to a user list (not sure if you're on that or not JK).
Obviously I'm trying to find some supporting data to assist the Thurber/Evans sortie to the NTSB next Thursday. They are already aware of a number of very similar Beech 1900D events that the NTSB and FAA have not thought fit to surface in the Charlotte inquiry - lest they should cloud investigators' judgement.
- like a judge and jury needing to remain unaware of a lengthy criminal history - until the verdict is in (and if then found guilty, for assessing the appropriate sentencing). I'm not sure that that is a valid approach for air-crash inquiry.

IASA is also going to the NTSB soonish on the subject of the slippage of dates on CVR upgrades (one of the long-standing NTSB and America's "Most Wanted"). Essentially CVR and DFDR upgrading is being deferred until they get the new EAFR up and running (with specs and the TSO yet to be finalized for a combi CVR/DFDR/CCTV/transmissible data set). However as usual there are already a few systems out there, such as AmeriSpace's SightRecorder (see link at www.amerispace.net/news.html) who have taken the gamble on what's likely to be in the new TSO.

For one reason or another CVR recordings have the least reliability of any aircraft system. Besides crashworthiness and the vagaries of mag tape, the NTSB is citing short duration, over-recording, intentional over-recording or just plain long-term failed and never checked. As soon as all that changes and CCTV recordings are in, long-term crash investigations should become a thing of the past.

JS

-----Original Message-----
From: John King [mailto:john.king19@comcast.net]
Sent: Saturday, September 27, 2003 7:18 PM
To: safety@iasa-intl.com; John Barry Smith
Subject: Re: Queering your Pitch//Queering the Facts

Have either of you guys done the following;

1. A review of the NTSB Monthlies. A line-by-line search because there is no search engine provided us but I find it not creditable that the NTSB hasn't one. Go Fish.
The Monthlies do appear to mirror the NTSB Rule 803.5 required filings for control problems (they accurately did so for some 30 Rule 830.5 filings the NTSB sent me some time back).

2. A review of the NTSB Recommendations Letters. Also a line-by-line search because of no search engine.

3. A review of the FAA Incidents. At least this has a search engine, abet, but of dubious quality. Down side is that this database was a very low performer and producer of events. It supplied less than 10% of those "400 events of smoke/fire" I had listed in 2000.

4. A review of the Service Bulletins. As we know, these are closely held and the only place they I know to find them is at the Federal Register in D.C. because they are filed along with the ADs. The SBs make references to the history and past number of complaints. It is reasonable to believe these mirror but some of the SDR filings.

SECOND BEST SOURCE

5. A review of the Aviation Safety Reporting System. A high quality and productive source if the "de-identifying" doesn't get in the way of recognizing the Beeches or Embraers and the search engine will spit out everything from balloons to 747s. Suggested search words; "trim, horizontal, stabilizers, pitch" etc..

BEST SOURCE: The SDRs       JKS 1st Choice

6. The latter (ASRS) and the SDRs were, by far, the best source in that "400 events of smoke/fire" as they supplied about 3 for every 1 of the reports from all other sources. I find the web-supplied SDR data useless because the spreadsheet offered is like trying to find a name in a telephone book with the name not alphabetically listed. Hopefully, and after
the loss of Mickey Kedigh, a request to the FAA Data Center for "all Beeche and Embraer SDRs" wouldn't take but a few days for a response and the list wouldn't be that lengthy for a reasonable review.

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Remember the Heindrich Pyramid --

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I have to provide transportation and other support to aged good-'ol-Dad on Monday (eye surgery, on the lens, no less). I may be knocked out for the day tending to that matter (brother provided most of parental support during Isabel disruption, so I must do my share for peacable family relations).
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At least this guy had the presence of mind to tilt the lift vector and get the nose down (which would have been a great help at Charlotte NC (and perhaps even a solution). The damn abnormal ops in the POH's never seem to cover the actual emergencies. I wonder if the pax swore off the Embraer brand name - for life.

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Probable Cause Approval Date: 8/26/02
Aircraft: Embraer EMB-135LR, registration: N721HS
Injuries: 12 Uninjured.
The captain said that during takeoff from O'Hare International Airport (ORD) the airplane accelerated normally, rotated, and "jumped into the air". At 800 feet agl, the captain called for the climb checklist. It was about this time that the captain noticed that he could not trim nose down. The captain had the first officer check his trim switch and the backup system. They did not respond. The captain elected to bring the airplane back to ORD. The captain said that both he and the first officer had their control yokes pushed forward to the stop and were still climbing. The captain said he was finally able to stop the climb and level the airplane at approximately 8,000 feet. The captain said they declared an emergency and referred to the Pitch Trim 1 and 2 Failure checklists. The checklist directed they lower flaps to 9 degrees. "When we brought in the flaps, the aircraft pitched way nose high. We were out of control." The captain regained control of the airplane and had the first officer retract the flaps. The captain said they lowered the landing gear. It improved the airplane's stability slightly. They pulled and reset the trim circuit breakers twice. These actions did nothing. The captain said he lined up for an approach to runway 9R. The captain determined he was too high to land, so he executed a 360-degree descending turn. On completion of the turn, the captain said they needed to slow down so they deployed the spoilers. The captain said the airplane abruptly pitched way up. The captain said he and the first officer pushed both yokes forward. The captain advanced the throttles, and retracted the spoilers. "That second, I banked hard left, 50 to 60 degrees as I recall, and chopped the power. It took all our abilities to get the nose down." After they got the airplane back under control, the captain said approach control informed them that runway 4R was straight ahead. The captain elected to land on runway 4R. The
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The National Transportation Safety Board determines the probable cause(s) of this incident as follows:
The jammed horizontal stabilizer trim that occurred during the airplane's initial climb after takeoff. Factors relating to the incident were the inadequate capability of the horizontal stabilizer trim actuator to move the stabilizer during all flight phases, and the inadequate design of the system by the manufacturer.

Full narrative available

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From: safety@iasa-intl.com [mailto:safety@iasa-intl.com]
Sent: Friday, September 26, 2003 4:03 PM
To: devans@pbimedia.com
Cc: Adam Smyth (Yahoo); Charlene FRENETTE; Lyn S Romano
Subject: Very Relevant to the Hyannis Beech 1900D - similar NTSB Conundrum

But also Very similar to Charlotte accident


PROVINCE TOWN-BOSTON AIRLINES FLT 1039, AN
EMBRAER EMB-110P1, WAS CLEARED TO TAKEOFF ON RWY 31 AT 1812 EST. DRG THE INITIAL CLimb NR THE DEPARTURE END OF THE RWY, THE CAPT ROUTINELY ACKNOWLEDGED AN INSTRN TO CONTACT DEP CONTROL (CTL). SHORTLY THEREAFTER, THE ACFT ENTERED A STEEP DSCNT & CRASHED IN AN INVERTED, NOSE DWN ATTITUDE, THEN BURNED. AN INVESTIGATION REVEALED THE ELEVATOR (ELEV) & HORIZONTAL STABILIZER (STAB) HAD SEPARATED IN FLT. THE STAB WAS FND ABOUT 1100 FT FM THE MAIN WRECKAGE. THE ELEV TRIM WAS FND IN A PSN TO TRIM THE ACFT FULL NOSE DWN. THERE WAS EVIDENCE OF A MALFUNCTION OF THE ELEV CTL SYS OR ELEV TRIM SYS, WHICH RESULTED IN A PITCH CTL PROBLEM; THEN REACTION OF THE FLTCREW TO CORRECT THE PROBLEM OVERSTRESSED THE LEFT ELEV CTL ROD. ALSO, THERE WAS EVIDENCE THAT THIS RESULTED IN AN ASYMMETRICAL ELEV DEFLECTION & OVERSTRESS FAILURE OF THE STAB ATTACHMENT STRUCTURE. HOWEVER, THE SAFETY BOARD WAS UNABLE TO DETERMINE THE PRECISE PROBLEM WITH THE PITCH CTL SYS.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows: FLIGHT CONTROL SYSTEM..UNDETERMINED FLT CONTROL SYST,ELEVATOR CONTROL..FAILURE,TOTAL

Index for Dec1984 | Index of months
From: "John King" <john.king19@comcast.net>
Date: September 29, 2003 3:06:13 PM PDT
To: "John Barry Smith" <barry@corazon.com>
Subject: Re: This is the idea behind the Valujet cause of O2 cannisters years later. Valujet was probably electrical, not o2.

Thanks John and I do believe this one was included in that NTSB VJ Final report, as well.

I've got a FOIA response from the Tech Center here that said the exterior surface of a operating can measured at 405 degrees F and thats very close to the "430 degrees" stated here.

Of course that's about 70 to 100 degrees short of the ignition temperature of either cardboard or bubble wrap and a bubble wrap Safety Data Sheet I have from Sealed Air Corporation, a producer of bubble wrap, says "Flash point Above 500 degrees F".

Too bad they can't be trusted.

JK
--
----- Original Message ----- 
From: John Barry Smith
To: John King
Sent: Monday, September 29, 2003 10:13 AM
Subject: This is the idea behind the Valujet cause of O2 cannisters years later. Valujet was probably electrical, not o2.

My question to David is not only just how many prior control problems are there ?....but also how sure is he that the SDRs on the record do not indicate a error in the maintenance manual ? If there is, than this whole story moves right into the FAA's front
We know their zeal to shield the industry from costs is great. The attached story of how the O2 canister lanyards breakage problem has persisted since 1989 and will see a final fix in 2005 is instructive.

JK
==

NTSB Identification: DCA86IA037. The docket is stored on NTSB microfiche number 32301.
Nonscheduled 14 CFR Part 121: Air Carrier AMERICAN TRANS AIR, INC.
Incident occurred Sunday, August 10, 1986 in CHICAGO, IL
Aircraft: MCDONNELL DOUGLAS DC-10-40, registration: N184AT
Injuries: Unavailable

A CHARTER FLT ARRIVED & DEPLANED WITHOUT INCIDENT & WITH NO INDICATION OF SMOKE, FUMES OR HEAT. COMPANY MAINT PSNL HAD PLACED DAMAGED PASSENGER SEATBACKS (INCORPORATING SOLID-STATE CHEMICAL OXYGEN GENERATORS) IN THE FWD CARGO COMPARTMENT WITH SEAT COVERS & OIL. A COMPANY MECHANIC EXAMINED THE SEATBACKS TO FIND A SERVICEABLE UNIT. HE FOUND A LOOSE OXYGEN CANISTER & HandLED IT IMPROPERLY BY ITS OXYGEN HOSE. SUCH HANDLING CAN RELEASE THE FIRING PIN, FIRE THE PERCUSSION CAP, TRIGGER A CHEMICAL REACTION, & GENERATE OXYGEN. THIS CAN GENERATE UP TO 430 DEG OF HEAT OUTSIDE THE CANISTER. A FIRE BGNIN THE FWD
CARGO COMPARTMENT IN THE VICINITY OF WHERE AN OXYGEN CANISTER WAS FND (LATER) WITH A DENTED STRIKER PLATE. THE SEAT COVERS IGNITED, FIRE BURNED THRU THE CABIN FLOOR, & SUBSEQUENTLY, IT SPREAD THROUGHOUT THE ENTIRE CABIN. COMPANY MAINT PSNL DID NOT KNOW THAT OXYGEN GENERATORS, CARRIED AS COMPANY SUPPLIES, WERE HAZARDOUS MATERIALS. THE MECHANIC WAS NOT FAMILIAR WITH THE REPAIR OR INSTALLATION OF THE PASSENGER SUPPLEMENTAL OXYGEN EQUIPMENT.

The National Transportation Safety Board determines the probable cause(s) of this incident as follows:

OXYGEN SYSTEM..INFORMATION INSUFFICIENT..COMPANY MAINTENANCE PERSONNEL

Contributing Factors

SUPERVISION..IMPROPER..COMPANY/OPERATOR MANAGEMENT
LACK OF FAMILIARITY WITH AIRCRAFT..COMPANY/OPERATOR MANAGEMENT
TIE DOWN..IMPROPER..COMPANY/OPERATOR MANAGEMENT
OXYGEN SYSTEM..NOT UNDERSTOOD..COMPANY MAINTENANCE PERSONNEL
LACK OF FAMILIARITY WITH AIRCRAFT..COMPANY MAINTENANCE PERSONNEL
From: "John King" <john.king19@comcast.net>
Date: September 30, 2003 1:46:40 AM PDT
To: "John Barry Smith" <barry@corazon.com>
Subject: Re: This is the idea behind the Valujet cause of O2 canisters years later. Valujet was probably electrical, not o2.

Someone (might have been Larry Costanzo of Air Investigations Inc) told me a few years back that "a FBI agent familiar with Flight 103 said the "amount of explosive residue found amounted to next to zilch".

The effort we have seen by the FAA and the NTSB to protect industry interests have come through in so many ways, i.e.

In the NTSB Sioux City Report versus the earlier National Airlines Report, the NTSB changed the findings of unknown vibrations to "engine overspeed", a cause specifically addressed and debunked as "pure speculation" in the National Report. Moreover, the National Report references to two other fan failures on the ground, and so similar as to be used as "comparison analysis", were not mentioned in the Sioux City 'prior' or 'historical references'. The FAA cinched the scheme by adding "Sioux City was the first of it's kind". Add to that, it was the FAA who allowed GE to use its billet sources and their assurances that the materials had no defects (ALPA partial inclusions) whereas Pratt accepted no vendors words for the purity and metallurgical properties of it's materials and had a 'check-double check' metallurgical program to assure the quality of all metals going into its engines. I know because I was a QC manager for a GE/Pratt supplier and when I gave this information to the NTSB (Bob MacIntosh) back then, the NTSB said it had never heard of this. Consequently, the FAA dropped it's accusations that United "missed the crack" and one of the corrective actions in that NTSB Final Report was that "all materials, and prior to being released for production, must pass metallurgical checks".

In the Aloha 737 fuselage peelback, it was the FAA who reduced
the industries own recommendations for review and inspections
of seven sites to two. When asked why, the FAA said because of
"cost considerations" said a AW&ST article.

The ValuJet Final Report is the most contradictory and biased
report I have ever read. I had no trouble in finding 17
contradictions just by reading the report.
Add to that the FAA Tech Center Reports that say the O2 cans
burn too cold to start any fire and that the oxygen emitted is way
short of supporting any fire of consequence.
Comparing the NTSB Final Report against the Canadian TSB
Report on Swissair Flight 111 is like comparing a comic book
against any scientific journal.

Indeed wiring may have caused that TWA 800 tank explosion. It
has a terrible history and the FAA/NTSB Web databases severely
understate the wiring and electrical problems. For every incident
found there an additional three more can be found in the Service
Difficulty reports by maintenance and in the Aviation Safety
Reporting System by the flight crews. Cuffing this data serves to
understate fleet wide problems and saves the industry lots of
money.
I'll always wonder if was our efforts to shine the light on the wiring
and electrical issues and that gave the NTSB another explanation
for TWA 800. I'll never wonder about those dozens of
industry and military witnesses and that they truly believed that
they saw a missile rising towards that plane. My long industry
and military experience is that such men don't lie...not about this.

Add to this your own review of doors that open on their own and
one can only marvel there aren't more smoking holes on US soil
and that's not to say that US manufactured aircraft haven't killed
many a non US citizen. When they fall off our shores the FAA?
NTSB likes to presume they are suicidal or don't know how to fly.

The battle continues...
Thanks for the good fight.

JK

--

----- Original Message ----- 
From: John Barry Smith 
To: John King 
Sent: Monday, September 29, 2003 6:03 PM 
Subject: Re: This is the idea behind the Valujet cause of O2 cannisters years later. Valujet was probably electrical, not o2.

Dear John,

The urinalysis machines that the military uses to boot out any officer with a 'positive' are advertised as '99%' accurate. They do 2 million a year so that means about 20000 careers ruined...

The idea for Pan American World Airways Flight 103 bomb/timer/suitcase in forward cargo compartment came for UTA event months later thought up by French. Copycat explanations that are not supported by facts but supported by public opinion.

The other John...Smith

Thanks John and I do believe this one was included in that NTSB
VJ Final report, as well.

I've got a FOIA response from the Tech Center here that said the exterior surface of a operating can measured at 405 degrees F and that's very close to the "430 degrees" stated here.

Of course that's about 70 to 100 degrees short of the ignition temperature of either cardboard or bubble wrap and a bubble wrap Safety Data Sheet I have from Sealed Air Corporation, a producer of bubble wrap, says "Flash point Above 500 degrees F".

Too bad they can't be trusted.

JK
--

From: "John King" <john.king19@comcast.net>
Date: September 30, 2003 1:51:56 AM PDT
To: <safety@iasa-intl.com>, "'John Barry Smith'"
<vigilante3@redshift.net>
Subject: Re: Queering your Pitch//Hello ground

Seen this gem...A-330 elevators dropping to full down position ??


From: "John King" <john.king19@comcast.net>
Date: September 30, 2003 5:11:08 AM PDT
To: <safety@iasa-intl.com>, "'John Barry Smith'"
<vigilante3@redshift.net>
Cc: "David P Evans" <DEvans@pbimedia.com>
Subject: Re: Queering your Pitch//Hello ground -relevant to AA587?

Could be and it also sounds like a single point failure...something that FAA Certification & Standards is supposed to assure doesn't happen.

The machine was only following 'orders'....be it a componet or the wiring systems. Orders is orders!!

JK
--

----- Original Message ----- 
From: safety@iasa-intl.com
To: 'John King' ; 'John Barry Smith'
Cc: David P Evans
Sent: Tuesday, September 30, 2003 6:13 AM
Subject: RE: Queering your Pitch//Hello ground -relevant to AA587?

Makes you wonder whether the rudder servos are similarly vulnerable on A300's?? (AA587)
"This resulted in displacement of the transducer"

The transducer provides the control surface positional feedback to the FCS  (and if that info was wrong, what effect would that have on the flight-control system's reactive/responsive inputs?)

Airbus flight-control integrity seems not to be as sacrosanct as it should be (Like Raytheon/Beech)

JS
SCHEDULE OF AIRWORTHINESS DIRECTIVES

Airbus Industrie A330 Series Aeroplanes
Background: Two cases have been reported of the elevator dropping to the full down position, without ECAM warning, while the flight crew were carrying out pre-flight controls check. This occurred after hydraulic power-up and prior to engine start. The cause has been identified as cracking of the elevator servo control mode selector valve position transducer body attachment lugs. This resulted in displacement of the transducer, external hydraulic fluid leakage and subsequent loss of the corresponding hydraulic circuit. The intent of this Directive is to introduce additional flight crew elevator control checks and a once-only inspection to detect possible cracks of the transducer attachment lugs.

-----Original Message-----
From: John King [mailto:john.king19@comcast.net]
Sent: Tuesday, September 30, 2003 4:52 PM
To: safety@iasa-intl.com; 'John Barry Smith'
Subject: Re: Queering your Pitch//Hello ground

Seen this gem...A-330 elevators dropping to full down
position ??


From: "John King" <john.king19@comcast.net>  
Date: September 30, 2003 7:16:25 PM PDT  
To: "John Barry Smith" <barry@corazon.com>  
Subject: Re: shorted wiring/ruptured open cargo door/ explosive decompression/inflight breakup explanation

Indeed we are singing from the same book when we speak critically of the alternative scenarios presented by the FAA and found in so many recent NTSB Reports and our countering views and documents come from their own files.

Be it 767 reversers that deploy in flight, 737 rudders with a mind of their own, A-300 rudders that wag the dog; errant 747 cargo doors are yet but another variation of wiring system calamities and the FAA and the NTSB have done a very good job of dodging the root cause. We know their game and that's a help.

It's clear they have long chosen to side with the industry to minimize costs, maintain ridership and deflect questions of FAA oversight, Flight Standards and Certification of systems and materials. They do this with the full belief that nothing will become of it and that all the presumed 'checks and balances' of congressional oversight, justice department actions, IG investigations have been co oped by the flow and power of money flowing through the hill for so many years.

It's an ugly scene and it is so contrary to our very core of beliefs, the Rule of Law and the education we received beginning in elementary school. Few see this with the major exceptions to the very few, that for reasons of conscience or outrage, came forward to speak the truth.
Presently I am working with about eight of these men whom all have come from United over the past two years. As individuals and in small groups they have approached every agency (IG, GAO, Justice, congress, DOT, DOL, OSHA, etc) but only to find that even though their claims of maintenance fraud were found to be true, they remain without careers; some now for up to two years. In spite of the Wendall Homes Aviation Act and promises, retaliation works to keep them off the property and sends a chilling message to any others who may do the same. Some time has now been spent just to have them understand that what has happened to them at United is no different than to those before and from a virtual cross section of the entire industry.

With some luck their story, not of United, but of industry wide retaliation, may appear in USA Today soon.

Deflecting the issues of wiring is just but another manner in which the FAA/NTSB has obscured fleet-wide and systemic problems to keep the trusting flying public on board and the aviation economic engine humming. Other examples could include ignoring the SDRs and ASRS reports from maintenance and flight crews, changing prior positions and reports to arrive at 'less costly fixes', avoiding any mandatory actions and costs until forced to by the occasional spot light and smoking hole in the ground. There are others but all to the same ends.

I have been doing this since 87 John and how I wish that I indeed had more' influence' but I do not. It's a guerilla like war and against deep rooted and systemic flaw in our society. So many times I have come so close to a major rout with a eye popping media story but, with few exceptions, someone gets the word that there are "complications" or I don't get the "big picture" and the interest and the story die. I have most recently heard this from a major union who asked my support in helping these United mechanics and from a major aviation safety advocacy group in DC. That union also asked if they could give me some money but
I said "give to these men out of work for so long".

IASA tied my hands, as well, with worries that my more aggressive style might get in the way of some efforts to meet with the decision makers in DC. It's taken some time but now they realize these decision makers were not part of the solution but rather key figures in the problem. I'm not good at politics because, like the bonus systems in carrier maintenance programs, it has no place in safety deliberations.

Buried in that Air Safety Week article I pushed back in September 2000 was the story that United had not even filed (72 hour) the required SDR for all of 2000 up to October. The FAA guys there then called to say that over 5,000 SDRs had now been sent and they were bring in two additional stall to enter the data. But yet, nothing became of it and the FAA did not confront United for such a lapse. The fines would have been enormous but to do so would have brought attention to the FAA's loose grip here on the entire industry. If you hadn't seen that article I have attached here in PDF.

That's it my friend and there are very few of us out here that do this work. But do it we will because its the right thing to do to honor those before us who also believed in this country and we want something better for our kids and our grandchildren, as well. Its our legacy to them to have tried to make this a better place.

I don't know how specifically to help you but I'm always looking.

In a conversation with Gary Stoller of USA Today, I had mentioned your name. He said he hadn't heard of you so I sent the message below...

TO GARY...

An ex pilot, military man and a long time safety
advocate extraordinaire who's specialty is 747s and forward cargo doors that open on their own. See his site at http://www.corazon.com

----- Original Message -----  
From: John Barry Smith  
To: John King  
Cc: John Sampson  
Sent: Tuesday, September 30, 2003 10:51 AM  
Subject: shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation

Someone (might have been Larry Costanzo of Air Investigations Inc) told me a few years back that "a FBI agent familiar with Flight 103 said the "amount of explosive residue found amounted to next to zilch".

Dear John, if I can't persuade you of the plausibility, the reasonableness, and the logic of the shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation for Air India Flight 182, Pan American World Airways Flight 103, United Airlines Flight 811, and Trans World Airlines Flight 800, then I can't persuade anyone and the fight is truly lost.

You believe the NTSB makes erroneous AAR, I do too and say it is so with AAR 0003 for Trans World Airlines Flight 800. You believe in precedent for newer accidents, I do too with United Airlines Flight 811. You believe wiring causes initial problems which cause other problems which are blamed, so do I with Air India Flight 182 not a bomb, Pan American World Airways Flight 103 not a bomb but a shotgun after wiring short, United Airlines Flight 811 not
improper latching but wiring, Trans World Airlines Flight 800 not center fuel tank explosion but on fire engine number three igniting the fuel vapor cloud of disintegrating aircraft. You believe in documenting your refutations of conventional wisdom with reports, I do too with my Smith AAR for the three aircraft above and available on corazon.com in pdf format.

Just think how much our cause, your cause first, of faulty wiring would be helped when confirmed that the three early model Boeing 747 accidents that have killed a thousand and caused billions to be transferred were not bombs but wiring. Action would be taken instead of these delays and band aid fixes to entertainment systems and procedural changes. The fleets would be grounded and wiring replaced, the non plug cargo doors would be made plug type.

When you believe that the center tank exploded on Trans World Airlines Flight 800 you are believing the media and the government agency that you profess to debunk. When you wonder how the media can continue to publish erroneous information over and over again when you know the facts refute the claims, look to yourself when you believe that those 747s inflight breakups were 'bombs' when an alternative explanation exists, the shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation.

You have influence with some aviation safety media, with IASA, with some government officials. I am trying to get an audience with them to present the explanation for consideration. That is not happening and has not happened. I've been trying since 1990 and since then cargo doors have opened in the air and on the ground causing hundreds of fatalities. In 1996 I found out the cause of the inadvertent cargo door openings and it was wiring,
then I discovered that the faulty wiring was well known and you were attempting to bring attention to the problem.

If you can assist in my attempts to get authorities to realize the danger of aging wiring in early model Boeing 747s which are causing explosive decompression and inflight breakups, I would appreciate it. I don't know how specifically.

Cheers,
Barry
Tuesday, September 30, 2003 7:48 AM

John Barry Smith
541 Country Club Drive
Carmel Valley, California 93924
831 659 3552
barry@corazon.com
http://www.corazon.com
The effort we have seen by the FAA and the NTSB to protect industry interests have come through in so many ways, i.e.

In the NTSB Sioux City Report versus the earlier National Airlines Report, the NTSB changed the findings of unknown vibrations to "engine overspeed", a cause specifically addressed and debunked as "pure speculation" in the National Report. Moreover, the National Report references to two other fan failures on the ground, and so similar as to be used as "comparison analysis", were not mentioned in the Sioux City 'prior' or 'historical references'. The FAA cinched the scheme by adding "Sioux City was the first of it's kind". Add to that, it was the FAA who allowed GE to use its billet sources and their assurances that the materials had no defects (ALPA partial inclusions) whereas Pratt accepted no vendors words for the purity and metallurgical properties of it's materials and had a 'check-double check' metallurgical program to assure the quality of all metals going into its engines. I know because I was a QC manager for a GE/Pratt supplier and when I gave this information to the NTSB (Bob MacIntosh) back then, the NTSB said it had never heard of this. Consequently, the FAA dropped it's accusations that United "missed the crack" and one of the corrective actions in that NTSB Final Report was that "all materials, and prior to being released for production, must pass metallurgical checks".

In the Aloha 737 fuselage peelback, it was the FAA who reduced the industries own recommendations for review and inspections of seven sites to two. When asked why, the FAA said because of "cost considerations" said a AW&ST article.

The ValuJet Final Report is the most contradictory and biased report I have ever read. I had no trouble in finding 17
contradictions just by reading the report. Add to that the FAA Tech Center Reports that say the O2 cans burn too cold to start any fire and that the oxygen emitted is way short of supporting any fire of consequence. Comparing the NTSB Final Report against the Canadian TSB Report on Swissair Flight 111 is like comparing a comic book against any scientific journal.

Indeed wiring may have caused that TWA 800 tank explosion. It has a terrible history and the FAA/NTSB Web databases severely understate the wiring and electrical problems. For every incident found there an additional three more can be found in the Service Difficulty reports by maintenance and in the Aviation Safety Reporting System by the flight crews. Cuffing this data serves to understate fleet wide problems and saves the industry lots of money. I'll always wonder if was our efforts to shine the light on the wiring and electrical issues and that gave the NTSB another explanation for TWA 800. I'll never wonder about those dozens of industry and military witnesses and that they truly believed that they saw a missile rising towards that plane. My long industry and military experience is that such men don't lie...not about this.

Add to this your own review of doors that open on their own and one can only marvel there aren't more smoking holes on US soil and that's not to say that US manufactured aircraft haven't killed many a non US citizen. When they fall off our shores the FAA? NTSB likes to presume they are suicidal or don't know how to fly.

The battle continues...
Thanks for the good fight.

JK

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----- Original Message ----- 
From: John Barry Smith
To: John King
Sent: Monday, September 29, 2003 6:03 PM
Subject: Re: This is the idea behind the Valujet cause of O2 cannisters years later. Valujet was probably electrical, not o2.

Dear John,

The urinalysis machines that the military uses to boot out any officer with a 'positive' are advertised as '99%' accurate. They do 2 million a year so that means about 20000 careers ruined...

The idea for Pan American World Airways Flight 103 bomb/timer/suitcase in forward cargo compartment came for UTA event months later thought up by French. Copycat explanations that are not supported by facts but supported by public opinion.

The other John...Smith
Thanks John and I do believe this one was included in that NTSB VJ Final report, as well.

I've got a FOIA response from the Tech Center here that said the exterior surface of a operating can measured at 405 degrees F and that's very close to the "430 degrees" stated here.

Of course that's about 70 to 100 degrees short of the ignition temperature of either cardboard or bubble wrap and a bubble wrap Safety Data Sheet I have from Sealed Air Corporation, a producer of bubble wrap, says "Flash point Above 500 degrees F".

Too bad they can't be trusted.

JK
--

From: "John King" <john.king19@comcast.net>
Date: September 30, 2003 7:28:26 PM PDT
To: "John Barry Smith" <barry@corazon.com>
Subject: Attachment to my last

Forgot to attach

From: "John King" <john.king19@comcast.net>
Date: September 30, 2003 7:31:11 PM PDT
To: "John Barry Smith" <barry@corazon.com>
Subject: P.S. SDRs ???
Have you ever seen the SDRs on file for 747s

From: "John King" <john.king19@comcast.net>
Date: October 1, 2003 4:34:34 AM PDT
To: "John Barry Smith" <barry@corazon.com>
Subject: Re: P.S. SDRs ???//Data attached

I have a 3,200 report data run from the FAA Data Center in Oklahoma from 1995 to the summer of 2000.

I've attached it here.

I had a contact at the Data Center, Mickey Kedigh but he died in the spring of 2002. His manager called and did say that he would assign another to answer any of my subsequent requests. I hadn't requested any since because of family issues (my oldest daughter died five months later) but I'll soon be taking that manager up on his offer.

They would probably do the same for you as an individual and as an ex-pilot with a interest in air safety issues.

I journo I directed there from Readers Digest though is still waiting for his April request for some SDRs. I guess they don't like the media.

At first, and as I did, call them at 405-954-6509 and ask if you could be e-mailed data runs for all 747 SDRs filed from one date to another.

See the attached

JK
--

----- Original Message -----
To: John King
Sent: Wednesday, October 01, 2003 12:16 AM
Subject: Re: P.S. SDRs ???

Have you ever seen the SDRs on file for 747s

I have read a few Service Difficulty Reports by searching through FAA documents but I'm sure I've missed most. I've attached them here 103 which includes all types as Appendix F to my Smith AAR for Pan American World Airways Flight.

What's your procedure to get them?

Sort of gilding the lily.....

Cheers,

Barry

From: "John King" <john.king19@comcast.net>
Date: October 1, 2003 8:44:49 PM PDT
To: "John Sampson" <phoebus@iinet.net.au>, "John Barry Smith" <barry@corazon.com>
Subject: Re: Air India trial back on again/

It's true John. It's truly a lawyer's world still and the Romans were right way back then (feed them to the lions).

Stitch had it right, as well, with fast grabs for the settlement monies, sign the privacy/gag agreements and wait for the next grieving family members with wide eyes and a feigned ignorance to how it all works. Its an industry.

The dark skinned guys make a easy target now as we all rally around the flag and nobody is accountable as to why, and how,
this all has been escalating a notch at a time.

September 11, 2002 was the second time the WTC was attacked.

There are so many ways things have gone downhill. See this message I just got in while just reading yours..

----- Original Message -----  
From: elsonatasf  
To: Undisclosed-Recipient;  
Sent: Wednesday, October 01, 2003 3:21 PM  
Subject: Fw: JIGSAW PIECES PUT TOGETHER FORM A PICTURE FOR YOU TO SEE AND JUDGE

----- Original Message -----  
From: elsonatasf  
To: President@whitehouse.gov ; Vice.President@whitehouse.gov ; First.Lady@whitehouse.gov ; senatorlott@lott.senate.gov ; dhastert@mail.house.gov ; john_mccain@mccain.senate.gov ; senator_stevens@stevens.senate.gov ; john_kerry@kerry.senate.gov ; senator@cochran.senate.gov ; senator@feinstein.senate.gov ; senator_lieberman@lieberman.senate.gov ; senator@biden.senate.gov ; talk2hal@mail.house.gov ; tom_daschle@daschle.senate.gov ; gephardt@mail.house.gov ; jane.Harman@mail.house.gov ; senator@shelby.senate.gov ; john.mica@mail.house.gov ; don.young@mail.house.gov ; senator_byrd@byrd.senate.gov ; david.vitter@mail.house.gov ; sf.nancy@mail.house.gov ; arlen_specter@specter.senate.gov ; tom.tancredo@mail.house.gov  
Cc: laura brown ; ROCHELLE CLAYPOOLE ; DoTHOTLINE ; Snooz Gooper ; lying robert johnson ; LYING ROBERT JOHNSON ; GERALD. LAVEY ; ruth leverenz ; james loy ; JAMES LOY ; nico the clown melendez ; chris rat-again ; SECDOT ; TELL TSA ; TURMOIL THE BOIL ; BOIL TURMOIL  
Sent: Wednesday, October 01, 2003 2:18 PM  
Subject: JIGSAW PIECES PUT TOGETHER FORM A PICTURE FOR YOU TO SEE AND JUDGE

Truth is ALWAYS the strongest argument.ä

Sophocles
WAIT. DONÂT PANIC!

This not a name calling e-mail but one that presents facts, government statements, GAO reports, screener/tsa employee e-mails, and media reports that allow YOU the reader to analyze what is going on with the tsa and decided if it is a failure, if it is telling the truth, and if you think it is protecting you from terrorism. This e-mail looks long, but much of it is a series of supporting data including selected e-mails from tsa employees and ācapturedā data, not my words. For those who have had the fortitude and endurance to read my e-mails, you KNOW that the information I present is ācursoryā and that I have a LOT more documentation. What I am doing here is āputting the jigsaw puzzle pieces together so that a picture is formed.ā I think the evidence is overwhelming and irrefutable.

Like us or hate us, since the late 90s, our predictions have been true and to the best of my knowledge, NEVER WRONG. Yes, I do keep saying the same thing over and over, but that is because they keep coming true and to-date, the government has refused to make any changes. Thus we are left spending a lot of money to make security, particularly Aviation Security (AVSEC), worse. The good news is that a few of the House of Representative aviations āpowerhousesā have recently made some very strong statements which hopefully will be followed by even stronger actions. Chairman Hal Rogers of the Homeland Security Appropriations Committee has castigated loy and the tsa and given them deadlines. Chairman Mica (someone I have long bashed for talking but not doing) has recently come out (following the GAO testing) with some very strong and positive statements in favor of protecting the public. This is refreshing and gratifying. On the Senate side, we continue to see a lot of talking and NO doing. The Executive Branch owns tsa but has done absolutely nothing about the gross failures.
The failures that led to 9/11 and those of the tsa (both of which we accurately predicted) are all summed up in the short phrase -- **NO ACCOUNTABILITY!**

Take a look at the functional areas below, particularly you media folks. These might provide good topics for future articles, articles which hopefully will name names. Hopefully you will call and interview those elected officials failing us, and equally important those very few who are out there fighting for us.

**Steve Elson**

**THE GAO REPORTS -- The LITMUS TEST**

**IF nothing else, read this section (written in red) because this is the litmus test of whether tsa is telling the truth, doing its job, and fulfilling its mission.**

I. The media recently reported that GAO had conducted testing around the Country and successfully, with **100% success**, gotten boxcutters aboard aircraft. loy and tsa changed from their normal response of stating how many items they have seized and told of the difficulty of finding boxcutters, blaming it on a lack of technology, something heretofore not stated. It should also be noted that the media reported that GAO OSI also got GUNS and KNIVES (also possibly BOMBS) aboard. ë(USA TODAY WASHINGTON ÷ Guns and knives, along with box cutters like those used by the Sept. 11 hijackers, slipped past
screeners in recent airport security tests by undercover agents.)
Ä This is something that Loy and TSA did not address and tried to distract attention from with other statements.

II. Airport Passenger Screening: Preliminary Observations on Progress
Made and Challenges Remaining. GAO-03-1173, September 24.
http://www.gao.gov/cgi-bin/getrpt?GAO-03-1173

A. This report, while interim and VERY gentle/tolerant of TSA, did make a number of salient points. The litmus test deals with TSA capturing (or more appropriately refusing to capture) critical performance indicators.

1. ÄAdmiral James Loy's comments follow a U.S. General Accounting Office report that this week that found the TSA currently collects little information regarding screener performance in detecting threat objects. ÄPerformance measurements and evaluations at airports where the use of private screeners is being tested have not been developed, nor has TSA determined how airports can apply to opt out of using federal screeners, which they will be allowed to do starting in November 2004, the GAO said. Ä

2. From the above referenced GAO report: ÄTSAÂ’s Performance Management Information System ÷PMIS÷ for passenger and baggage screening operations contains little data
screener performance in detecting threat objects. PMIS collects information on workload, staffing, and equipment and is used to identify some performance and policy issues, such as the level of absenteeism, average time for equipment repairs, and status of TSA’s efforts to meet goals for 100 percent baggage screening.

3. Critical Points.

a. EACH and EVERY single one of these tsa officials’ careers, awards, and promotions literally hinged on PERFORMANCE indicators. In law enforcement, THE critical buzzword is āSTATS,ā or Performance Indicators and inspections of Performance Indicators. In the military Performance Indicators are measured by such things as āORIs/OREs (Operational Readiness Inspectors/Exercises), administrative and operational inspections, and readiness.

b. The manager or leader of EVERY organization survives by Performance Indicators. From NASA to 7-11, Performance Indicators determine survivability. If the manager of the 7-11 down the street does not have good Performance Indicators, i.e., profitability, he is GONE!

c. tsa upper management is comprised primarily of former/retired senior law enforcement officials (FBI, DEA, ATF, USSS); retired senior military flag officers (Admirals and Generals); and retired US Coast Guard Officers (Admirals). All achieved his/her rank through good (actual or contrived) Performance Indicators.
d. Setting up Performance measures and indicators are absolutely BASIC to any organization and something that is done immediately upon establishment, EXCEPT according to GAO, in the tsa.

e. Over a year ago a reporter asked if I could help obtain tsa performance indicators. I responded that it was unlikely because the tsa did not want to record those indicators since they knew of the abject and abysmal failures that would result even from (what Bogdan calls) “pink team” testing.

f. The PMIS system seems to measure everything BUT the critical Performance Indicators, i.e. the effectiveness of tsa measures in preventing or at least reducing the likelihood of a successful terrorist event(s). This is what the tsa was formed to do, directed to do, and funded to do.

What is going on here? There seem to be only two (2) possibilities:

1. tsa is intentionally/willfully/negligently NOT collecting this information because they KNOW how bad the results are. From a tsa field agent e-mail received this week, “Loy is a liar……..TSA will not allow the field to test its own...only inexperienced ‘controlled’ personnel from D.C. are allowed to test. TSA has spent money on such stupid things as palm pilots for screening managers, but won't fund research…and correct training. and let us not forget who is running the training out of D.C.”
2. tsa has collected the information, perhaps in a medium other than PMIS, is hiding it, and is lying. (I suspect this is the case since I have had several phones calls and e-mails from tsa field personnel telling me that tsa testing was going on.)

tsa claims it does more realistic testing the faa or the faa Red Team. We say otherwise. But this is all a matter of record. Congress just needs to demand the records to get the truth. The frequency, success rate and methodology of the tests are all classified, but Rhatigan did say that the tests were "always covert, always unannounced ... to test our screeners to the max."â

My response:

(Watch, listen to, and read a San Francisco screener discuss tsa testing. This type information is verified by tsa personnel and screeners from other airports in the country. The screeners and tsa employees in the field directly contradict rhatiganâs assertion.

Bottom line here is that PERFORMANCE MEASURING is basic and one of the very first things any organization does to ensure that it is meeting its mission requirements. Do it make any sense at all that tsa, particularly with an upper management staff as described above would NOT measure the effectiveness of their BILLIONS of dollars screeners and equipment?
tsa’s answer to testing, particularly to compare tsa and non-tsa airports

Quote

“TSA spokesman Nico Melendez said the agency is hiring a consultant to compare the performance of its screeners with those of privately employed screeners who still work at five pilot airports. The report, which Melendez said will cost less than $3 million, is going to be the determining factor for how things move forward with the screeners.”

End Quote

1. This statement seems to indicate that tsa, despite the assertion that it doesn’t have Performance Data, does in fact, yet is planning spend about $3 million dollars to compare existing data???

2. If tsa in fact does not have the data, tsa has employees who could, literally in a few hours: write the testing standards, the testing protocols, and the matrices for comparison. A high school class could do this in a day for nothing. And tsa which complains having to make drastic cuts is going to spend approximately $3 million dollars for this????? (This complete disregard for the taxpayer dollar is addressed in part in a section below.)

3. If tsa is hiring a consultant to ensure āindependentā objective results, it is still a waste. Dan Noyes of KGO San Francisco already did some of this. GAO already did so to the
satisfaction of Chairman Mica who strongly criticized tsa. Interesting since Mr. Mica is a republican -- as is the owner of the tsa, the republican White House. Kudos for his courage. Now he has but to follow through and take action. WE THE PEOPLE now know he knows; what will he do?

AVIATION SECURITY SYSTEM

1. The greater SYSTEM is comprised of ALL entities and assets that identify threats and vulnerabilities. The system includes the Defensive System (primarily tsa); Law Enforcement (Federal, State, and Local); Intelligence Agencies (US and foreign); and all those involved in air transport (viz. airlines, airports, employees, , freight forwarders, cleaners, passengers, etc.).

2. Often I refer to the AVSEC system, when in fact it is a subsystem. For ease of writing, I’ll continue to talk about the AVSEC SYSTEM which includes, but is not limited to such things as:

   a. Passenger and Bag screening (where tsa has put nearly all its money).

   b. Access Control

   c. Security of perimeters (fence lines, Airport Operations Areas, SIDAs (areas where airplanes are parked)

   d. Dangerous goods, HAZMAT, Cargo security

   e. Explosives detection (some of which is a subset of āaā
above)

f. Background Checks

g. Law Enforcement

h. Caterers, cleaners, mechanics, etc.

i. Aircraft security (doors, wheel wells, cargo holds) and prevention of sabotage

3. Remember that tsa is charged, by law, with responsibility for security of seven (7) modes of transportation, not just aviation.

tsa

I. tsa spin and comments.

A. tsa’s primary focus was aviation screening because that is what the passengers see, what passengers think is AVSEC, and because the primary goal after 9/11 was to get people back onto planes and airline revenue up.

B. The continuing tsa failures are but the tip of the iceberg. The hierarchy of failures: failures, failures known locally to airports/airlines; failures known to tsa locally; failures known to tsa HQ; failures reported in the media. I doubt if we know even 1% of the actual vulnerabilities and failures
that occur every single day, 7/24/366. The best current example is that of the gentleman who shipped himself in a box to Texas. Literally, had he waited five (5) additional minutes, we'd have never known about that incident and Mr. Markey would be talking without evidence. (CNN - Wed, 01CT03- The Transportation Security Administration on Wednesday will hear recommendations from three industry groups on ways to plug those holes in cargo security.)

As in most AVSEC measures, the tsa does virtually NOTHING until forced. That may well be too late.

The myriad of failures we read about doesn't even begin to detail the vulnerabilities and failures that exist and which are easily exploitable.

C. When reports of tsa screening failures have become public in the past and before 9/11 anniversaries, the tsa public affairs office starts lauding all the confiscated articles accumulated -- â(Screeners have confiscated more than 5 million prohibited items at checkpoints in the last 13 months, including more than 1,160 firearms.ä A spokesman for the TSA, Nico Melendez, said screeners have found more than 1,000 prohibited guns, more than 2 million knives and 50,000 box cutters.ä

1. The points to be considered here are:

   a. tsa is generally finding what people don't think tsa would be concerned with or what they the passenger forgot they had in their bag.

   b. It is not the items that tsa finds that present a threat, but those they don't. As I pointed out shortly after 9/11, a few reporters in NYC made 14 attempts to get boxcutters aboard planes and were 100% successful. Thus one cannot extrapolate, without theoretical math, what is getting through. It would seem infinitesimal.

   c. Since tsa inception, I have been fortunate
enough to have been called upon by some good reporters who were professional, disinterested, and objective. Since Feb 02, I calculate roughly that between 130 and 150 lead filmbags have gone through screening checkpoints, both tsa and non-tsa with roughly the same degrees of failures (approximately 90% to 95%). These are IMPOSSIBLE to miss on x-ray. Yet the screeners fail to detect AND properly resolve these bags. Nothing wrong with the screeners, just the poor training and lack of leadership and supervision.

D. In the last few weeks, reports of GAO OSI testing and an interim GAO Screening report were promulgated. In the words of Chairman John Mica, Aviation Subcommittee: The frequency and types of weapons remain classified. "You wouldn't want to know. ... It's gruesome," said Rep. John Mica, R-Fla., chairman of a House aviation panel. "We have a huge army (of screeners) that's not working well." Following a classified General Accounting Office briefing on the post-Sept. 11 federal aviation security programs, Rep. John L. Mica, R-Fla., chairman of the House Transportation and Infrastructure Subcommittee on Aviation, said he was "very disturbed" by the state of airport security in the United States.

1. The points to be considered here are:

   a. loyâs and tsaâs (revisionist) responses:

   (1) ãHe noted that checkpoint screening is only part of a multilayered security system that includes reinforced cockpit doors, thousands of armed federal air marshals, hundreds of armed pilots and screening of checked bags for explosives.
Taken together, he said, they provide *the best security of our transportation system in our nation's history.*

(2) *I DON'T DISPUTE* the fact that you can get a blade of a boxcutter set on edge through the system, Loy said during a briefing with reporters. *That is a technology issue more than it's a screener performance issue.* Herein lies one of the BIGGEST problems and something that will lead to continuing failures -- the near absolute hope/reliance on technology. To repeat our long preached mantra: *Technology, for now and the foreseeable future is a mere adjunct to properly selected, well-trained, highly motivated, closely supervised, and inspirationally led PEOPLE, PEOPLE, PEOPLE.*

(3) Loy said the agency is more focused on evaluating the *system as a whole*, but is working on training and testing programs. He also said the TSA has developed a layered system of security including air marshals, reinforced cockpit doors and background checks on screeners because no one layer is foolproof. *...multilayered* security system that includes reinforced cockpit doors, thousands of armed federal air marshals, hundreds of armed pilots and screening of checked bags for explosives. Taken together, he said, they provide *"the best security of our transportation system in our nation's history."* (Note that Loy's idea of a system has only to do with screening and the plane. He addresses air marshals here, pilot's with guns [although he fought that and was right in that case], and cockpit doors. This is NOT the system as a whole as noted above. Loy and TSA have now switched from, *We confiscated millions of items* to *We can't find knives and are looking at the system as a whole.* Revisionism.

(4) Loy countered that there was no *silver bullet* for aviation security, acknowledging that potential weapons can occasionally get past screeners. But the administrator, speaking to reporters in a teleconference from Washington, said *the key to security was a series of deterrents.* *Wrong!* Failure to understand security concepts is evident in this erroneous statement.
Our congress.

a. Mr. Mica is right on track; sadly his counterpart, Mr. Defazio has made comments that are despicable and erroneous.

b. "Oregon Rep. Peter DeFazio, ranking Democrat on the House aviation subcommittee, said the Republican administration and members of Congress have been unwilling to give the TSA enough money for people or research. "We should be spending the money," he said.ä Despicable because he is politicizing something critical to our well-being. I delivered to Mr. DeFazio’s chief of staff, documentation and predictions of air terrorism events. (Representative DeFazio) Kathie Eastman, Chief of Staff, 16Jun00, 2:00 PM, Rayburn SOB 2134). When his staff refused to see me this year, I had to go in early one morning and āambushă her to even get a hearing. As will be detailed below, the administration is guilty of indifference, not holding its tsa accountable, but mostly of giving tsa money which it has thrown away (will be addressed below). Mr. DeFazio by training is a gerontologist; he should be people oriented and want money spent well. Instead of money for we old people, he chastises the president for not throwing more away on tsa.

c. Our senators who talk a lot, McCain, Lieberman, Hutchison, Stevens, Rockefeller, and Kerry have done absolutely nothing substantive of which I am aware. They have been given visual proof of tsa failures and have not taken any action.

II. FUNDING, APPROPRIATIONS, BUDGET
A. tsa spending
   1. magaw immediately built himself a $400,000+ office
   2. tsa under magaw and loy let many sole source contracts (many of which are very questionable; I had copies. These can be requested from tsa since they are not classified) and competitive contracts. Best example in the competitive
field is the NCS-Pearson contract for hiring screeners. It was let at $104M and according to the DoTIG, tsa paid $700M. NCS-Pearson spent millions vacationing as already addressed by congress and the media. NCS-Pearson also abused many of the applicants as noted in numerous screener e-mails and complaints.

3. Staff members on the House Homeland Security Appropriations Subcommittee are particularly bewildered in their search for nearly $1.4 billion in funding appropriated to the TSA. The subcommittee believes the TSA has diverted the EDS funds to pay for other programs or consultants, Gupta said.

4. tsa complains that it is broke, had to cancel air marshals because it was out of funds and had to cancel research funds, because of a deficit. Meanwhile, from a senior tsa manager: 

   Sent: Saturday, September 13, 2003 6:08 AM
   Subject: $10,000 TEN GRAND each

   Thanks for the scoop...TSA continues its slide toward the abyss. Hey you should have some of your pals do a FOIA on all cash awards handed out at TSA to all employees since the beginning...hear thru the grape vine that there were folks at TSA HQ who got awards like $10,000 TEN GRAND each...OMG I mean the outfit is friggen bankrupt....no money for supplies...training etc...we are forced to "recon" supplies and they reward the chosen few with $10,000 each...Mica should know about this. he would have a field day. The TSA is more concerned about PR than security...I mean I can see awarding folks maybe $500 if they really did something outstanding or worked like a wildman for months at a time....or a letter of appreciation BUT $10,000 each OMG!

5. tsa is in the two large MCI buildings (601/701) across from Pentagon City Mall, 12-story buildings. Yet they continue to walk across the street to the Residence Inn or down
the block to the Double Tree to hold meetings. Are there no large meeting rooms in those two large buildings? I doubt Residence or Double Tree are doing this gratis.

6. loy claimed he had to cancel research funds because of budget shortfalls. If he retrieves the $1.4B missing and the $600M overpayment to NCS-Pearson, he will have $2 BILLION dollars available. Furthermore, there is not much need for research funds. The private sector is in a frenzy producing everything imaginable for the tsa to buy. Security is now the big cash cow. THEY, the private sector, are doing the research.

III. tsa SCREENER TRAINING

A. The Mission.
Offices & Responsibilities
Office of Screener Performance and Training

Office Description:

Located in the Office of Law Enforcement and Security Training, the mission of the Office of Screener Performance and Training is to design, develop, distribute, administer and evaluate sound and effective performance and training support directly related to the screening of people and property to address threats across all transportation modes. We create performance support and training interventions through partnership and outreach to screeners, field support staff, and headquarters staff and coordinate our efforts across all TSA organizational boundaries to create system level solutions.

Responsibilities & Services:

Design, develop and deploy all transportation security technical training and performance support for the Transportation Security Screener workforce.
Provide expertise, advice, and recommendations regarding the processes used to analyze, design, develop, implement, and evaluate both traditional and innovative performance improvement systems and state-of-the-art performance interventions for improving the training and performance of transportation security screeners
Design new security training programs using both resident training and alternative deliveries; and ensuring the instructional adequacy and technical/security related course content of course materials
Continually revise the Passenger Screener and Checked Baggage Screener Basic Training courses
Design and implement all On-the Job Training (OJT) Programs
Design and develop all screener cross training and administer the development of the Cross Training Train the Trainer Program
Design, develop and implement all transportation security in-service and recurrent training
B. The Managers and Backgrounds (as far as can be ascertained)

1. Keith Curran, Director. Apparently a US Coast Guard officer who later taught at their academy. Obtaining a Masterâs Degree from U. of Md, Baltimore Campus in training related field. No information indicating ANY experience or knowledge of screening, security, or aviation.

2. Mary Carol Turano, Deputy Director. Program Analyst at faa; Acting director faa K-9 program (wonât go into the associated prurient stories). NO knowledge of Aviation, Security, or Screening. Apparently because of a grievance in faa, was given choice of duty stations. Attended BASIC faa security training in fall 1998, where fellow students reported that she failed tests and had difficulty with concepts. Though acknowledged IN WRITING, by faa senior management that Turano was unqualified, they placed her in charge of the Logan Field Security Office. In that position, she caused repeated turnover of personnel. Enforcement cases languished on her desk (because she had ZERO experience and knowledge on the issues of security, HAZMAT, Dangerous goods, cargo security, etc) until faa counsels REFUSED to process the cases due to time lapse. Turano did not have a ramp access badge. To the best knowledge of those in her office, Turano did ONE faa checkpoint test in her entire life after which she giggled, said, âthat was fun,â and went back to her office. Following the FOX 25 Investigative report on Logan, shown on 06May01, which debunked any semblance of any security at Logan, Turano did NOTHING. Following 9/11, she was quickly removed from the office and hidden at the Regional HQ. Shortly thereafter she received a positional promotion to the job to which she previously reported. Then she was moved, at taxpayer expense to faa HQ, in D.C. where she was placed in training. Then moved to tsa where she is currently the Deputy Director of Office of Screener Training and Performance.

Perhaps Mr. Curran, the director, has a strong training background (even though he apparently has none in screening, aviation, or security). Perhaps he is a superb manager and leader. In this case, he may well be good as a Director PROVIDED that he has a Deputy with subject knowledge.
expertise. Turano (his deputy), is a PROVEN failure and disaster in AVSEC and knows nothing about screening.

C. SOME of THE REST OF THE SCREENER STORY
   tsa, apparently hired Lockheed Martin to set up the screener training program and screening checkpoints. Lockheed Martin seems to make wonderfully accurate and reliable weapons and weaponsâ systems, but has NO experience or knowledge in screening. So they took the tsa (taxpayer) money and subcontracted out the training to ?????????  Apparently to a lot of cops, retired federal agents, and some who were involved in screening before 9/11. In other words, to those who knew nothing and those who had failed previously. tsa did hire a Marriott Customer Service Manager and Disney Line Manager, who seemed conversant with their disciplines. The same cannot be said for screening.

D. Results. Abysmal failures as PROVEN by the Media Lead filmbag assessments and now -- the GAO. There was no reason to expect otherwise. Totally incompetent/proven incompetent people such as Turano in charge as the äsubject matter expertä and a company (Lockheed Martin) with no experience.

E. tsa continues to claim that screeners received 5 times the training of pre 9/11 screeners, a statement repeatedly refuted by tsa screeners and also by senior tsa managers. Loy went so far as to say that they were doing 3 times as much. He failed to finish the sentence, äas much as what?ä

BACKGROUND INFO

I. E-MAILS FROM tsa PERSONNEL AND SCREENERS:
From a Senior tsa HQ manager:

S:

And the never ending story continues...what ...I'm shocked...airlines
gaffing security off say it ain't so!
Hey by the way it has been related to me that BWI/IAD are
nightmares. Southwest
is the BIG DOG at BWI what they say goes....gates being left
wide open, doors
unsecured ...could dress up like big bird from sesame street
and make it out
on the ramp from the street! Friggen scary! would make for a
great story!
TSA Security no longer Special Agents now...Regulatory
Agents...Inspectors.... are so beaten down itâs not even funny.
all answer to
tyrrannical FSDs who are worse than our boy NAME DELETED.
Thatâs why I take Amtrak. At least if the skata hits the fan I
stand a 50/50 shot if I jump off!

Wait for the green light and jump!

Loy is a liar.......TSA will not allow the field to test its own...only inexperienced
"controlled" personal from D.C. are allowed to test. TSA has spent money on such stupid
things as palm pilots for screening managers, but won't fund research...and correct
training. and let us not forget who is running the training out of D.C.

We need your help at Norfolk International Airport (TSA)
I must remain anonymous for fear of being physically hurt by
our Scheduling Operations Officer Ken Bowers.
This man is crazy. He has been abusing his authority by using
fear, intimidation and threatening all of the TSA screeners at our airport.

If we try to go to the Federal Security Director (FSD) for help he said he will make sure it will be the last thing we ever do.

The FSD has given Ken Bowers FULL POWER to run the TSA screeners at our airport.

He has abused his power and treats us like crap. He has made sexual advances to some of us females and then threaten to have us fired if we say anything. When he gets you alone in his office he rubs up against you with his penis and leans on you so you can't move.

He has violated so many civil rights and has committed criminal acts and he keeps getting a way with it and it seems like nobody can stop him.

He fires people that talks back to him or stand up for their rights. If he doesn't like someone, he finds a way to fire them or force them to quite. He fires people just because he don't like them. But he keeps the people he likes as long as they kiss his ass and makes an informant out of them. Even the screeners managers are afraid of him.

The FSD is never in the airport, so we can't talk to him about the problem. If we want to see the FSD we have to full out a form and request an appointment and give it to Ken Bowers. Then Ken Bowers throws it away. He keeps all the information from getting to the FSD. The FSD is making $108,000.00 a year and we can't even talk to him about this monster.

The FSD will cover up for him anyway and we will look likes fools and be fired.

This man is on a POWER TRIP and he needs to be put out of office before he hurts somebody real bad.

He is not supposed to be in charge of anything except the weekly schedule. But because the FSD put him in charge and the FSD is never in the airport so he dose what ever he wants.
He doesn't even do the scheduling, he as a screener do it for him. He also has screeners do all his paperwork for him. This man is making $68,000.00 a year and all he dose is intimidate the screeners and rules this airport with fear.

There needs to be an investigation as to who is in charge of our airport and to stop Ken Bowers from hurting any more people.

I know if we go to the police and have him arrested we will be signing our own pink slips.

PLEASE HELP US. This man needs to get out of this airport before it's to late or he rapes someone.

I hope you now understand why I must remain anonymous.

We need your help at Norfolk International Airport (TSA)

I must remain anonymous for fear of being physically hurt by our Scheduling Operations Officer Ken Bowers.

This man is crazy. He has been abusing his authority by using fear, intimidation and threatening all of the TSA screeners at our airport.

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rights. If he doesn't like someone, he finds a way to fire them or force them to quite. He fires people just because he don't like them. But he keeps the people he likes as long as they kiss his ass and makes an informant out of them. Even the screeners managers are afraid of him.

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I hope you now understand why I must remain anonymous.

SCREENER E-MAIL, 26SEP
Leslie;

Once again Brian Turmail of the TSA is misrepresenting the facts when it comes to training - specifically training of Supervisors. There has been a CD-ROM out since July 2002 for Supervisor Training that has NOT been made available to TSA Supervisors. How do I know this? I completed the course shortly after receiving it last year. My colleague, Phil May, can attest to this since it was sent to him via FedEx. Also included with this CD-ROM course for Supervisors was the TSA "Model Workplace" training video that has still not been completed despite the fact that this training was mandated by Admiral Loy for all TSA personnel. This is why TSA employees are not aware of their rights under the EEO system, their rights to file a grievance and the procedures for doing so, what constitutes harassment and discrimination and the procedures for reporting it, etc., etc., etc. At Norfolk International Airport and at a large number of other airports, TSA has employed Training Coordinators drawing large salaries (in excess of $100,000/yr.) and yet these airports do NOT have a training program. I hear this all the time from Screeners all across the country. In fact, I heard it two nights ago in an hour-long phone call from a Screener who wanted to know what his rights were and how to file a grievance against a Manager. I asked if he had received the training a "Model Workplace," and his answer was: "No." And yet, his airport has one of these highly paid Training Coordinators assigned to it.

E-Mail from a former Kansas City Screener:

Subject: Loyâs recent visit to KC

Wednesday, September 24, 2003 6:50 PM

I heard a funny story when I returned from my vacation. I have a girl I work with at the Jones Store whose husband is an APO. She has no idea about us or anything I may be involved with so she will tell me funny airport stories. Seems like when Loy arrived at "our" lovely city he had a hard time
locating APO and LEO's ..well it was Monday evening and you guessed it -- they were kinda sorta standing outside the Bar watching the Monday night NFL game. I also noticed that when I arrived on Air Tran which is terminal A on Saturday that several cars were parked up next to the terminal and NO ONE was anywhere asking them to move...I would say I was outside around 20 minutes while my husband was getting our car from park and fly Hilton...

Your article and the work of Rep. Mica from Florida are the types of things that will ultimately force TSA to tell the truth. I hope that you will continue to doggedly pursue TSA because you are starting to get beneath the veneer and are on your way to exposing the truth.

Best regards,

Thom Moriarty

II. MEDIA ARTICLES AND QUOTES FROM THE PRINCIPALS:

A spokesman for the TSA, Nico Melendez, said screeners have found more than 1,000 prohibited guns, more than 2 million knives and 50,000 box cutters.

He noted that checkpoint screening is only part of a multilayered security system that includes reinforced cockpit doors, thousands of armed federal air marshals, hundreds of armed pilots and screening of checked bags for explosives. Taken together, he said, they provide "the best security of our transportation system in our nation's history."

The frequency and types of weapons remain classified. "You wouldn't want to know. ... It's gruesome," said Rep. John Mica, R-Fla., chairman of a House aviation panel. "We have a huge army (of screeners)
that's not working well."

"I DON'T DISPUTE the fact that you can get a blade of a boxcutter set on edge through the system, Loy said during a briefing with reporters. "That is a technology issue more than it's a screener performance issue."

Loy disagreed with the GAO report's conclusion that the TSA tests fewer screeners than the Federal Aviation Administration did when it was responsible for airport screening.

"We're doing three times as much," (AS WHAT?) he said.

Several federal screeners said the problem is insufficient training.

"It's real easy to spot scissors, but people who want to get weapons on board are going to be more clever," said a screener at Los Angeles International Airport. "We are not getting familiar with the stuff I think we need to get familiar with, particularly explosives."

Some also said that the agency, in its rush to hire staff last year, took on some screeners who don't take the job seriously.

"Part of the problem is they've got incompetent people who don't realize they are guarding a plane that's going to be 35,000 feet in the air, as opposed to guarding your local Target store," said a senior screener at a Bay Area airport.
Screeners have confiscated more than 5 million prohibited items at checkpoints in the last 13 months, including more than 1,160 firearms.

But among the more than 55,000 federal screeners checking passengers and bags, some joke that TSA's initials stand for "taking scissors away" and they worry about their ability to spot more deadly objects.

"We find box cutters because they have tendency to leap out at you, but when you are talking about a block of Semtex [explosive], some little wiring and a battery pack, I don't feel like we have been given enough training," said a TSA supervisor who works in Southern California.

The TSA appears to be making uneven use of a computerized training tool for X-ray screeners that the government has touted for years.

A General Accounting Office report released this week said the TSA isn't keeping close enough track of its airport security screeners' performance.

Loy said the agency is focused on researching and developing better technology. But the TSA cut most of its $75 million research budget for 2003 to try to address a deficit.

Rep. John Mica, R-Fla., and chairman of the House aviation subcommittee, said Loy should have spent his budget on more efficient technology that could replace thousands of TSA screeners as well as detect more kinds of dangerous materials. Most of the metal detectors and X-ray machines currently in use at airports can't pick up plastic knives or explosives, Mica said.

"If he would spend the money on developing the technology, then you don't
need the money for salaries to hire an army of personnel," Mica said.

Oregon Rep. Peter DeFazio, ranking Democrat on the House aviation subcommittee, said the Republican administration and members of Congress have been unwilling to give the TSA enough money for people or research.

"We should be spending the money," he said.

But the problem isn't related to airport screeners. It's the technology that's lacking, said James Loy, who nonetheless has trimmed the agency's research budget.

"I don't dispute the fact that you can get a blade of a boxcutter set on edge through the system," Loy said during a briefing with reporters. "That is a technology issue more than it's a screener performance issue."

But while the industry is frustrated with the proposed cuts by the Bush administration, lawmakers are perplexed with the TSAâs spending habits. Staff members on the House Homeland Security Appropriations Subcommittee are particularly bewildered in their search for nearly $1.4 billion in funding appropriated to the TSA since the 9/11 terrorist attacks for installation of EDS machines at airports. The TSA has not spent all of its FY2002 funding for EDS installation at airports and has spent only $30 million of the $500 million appropriated in FY2003 as far as the subcommittee can tell, said staffer Stephanie Gupta.

The subcommittee believes the TSA has diverted the EDS funds to pay for other programs or consultants, Gupta said.

**U.S. transportation security chief cites 'diligent' training for airport screeners**
BY RON MARSICO
Star-Ledger Staff The U.S. Transportation Security Administration is "working diligently to make sure the training system is as good as can be" for roughly 50,000 airport screeners, the TSA administrator said yesterday after a critical federal report.

Admiral James Loy's comments follow a U.S. General Accounting Office report that this week that found the "TSA currently collects little information regarding screener performance in detecting threat objects."

Loy countered that there was no "silver bullet" for aviation security, acknowledging that potential weapons can occasionally get past screeners. But the administrator, speaking to reporters in a teleconference from Washington, said the key to security was a series of deterrents.

He said that testing checked baggage for explosives, putting federal air marshals on flights, hardening cockpit doors and arming pilots are among the "various obstacles" built into the aviation security system in addition to checkpoint screeners.

"It is that array of things that we have stacked up as a series of challenges for any terrorist to deal with," said Loy.

The GAO also determined that the TSA conducts fewer tests than the Federal Aviation Administration did on private screeners before the Sept. 11, 2001, terrorist attacks.
While Loy said efforts are being made to improve training, he countered that the TSA actually does more tests on its screeners than did the FAA, saying the GAO made a factual error in its report.

Meanwhile, the TSA administrator said his agency continues to research ways to improve cargo security on airplanes and at the nation's ports. He noted that while only 2 percent of ship cargo containers were inspected two years ago, that figure has risen to slightly above 5 percent now.

Loy also said the agency continues to develop a computer security system that assigns risk evaluations of passengers, while seeking to address the concerns of civil libertarians concerned about privacy violations. He said he is hopeful a system can be in place by sometime next summer.

Ron Marsico covers aviation security. He can be reached at rmarsico@starledger.com or (973) 392-7860.

DAN NOYES AND THE ABC KGO I-TEAM -- nico, tsa doesnât need to hire anyone and waste any more money. You need to pay Dan Noyes $1M because he has already compared a tsa and a private checkpoint, albeit only on x-ray. BUT he also has this assessment on video plus he already knows how to deal with the tsa.

I-Team Puts SFO Airports To The Security Test

Feb. 26 + You might expect the security at Bay Area airports to be extremely tight, but an I-Team investigation has found serious security failures at all our major airports. Dan Noyes takes a look at SFO in Part Three of our series.

How good is the security at the Bay Area's largest airport? During the past day, we've revealed serious security failures at Oakland and San Jose. Now the I-Team focuses on SFO. Dan Noyes reports.

With the help of a former security expert for the Federal Aviation Administration (FAA), we ran "ten tests" on screeners at SFO.

Steve Elson, former FAA inspector: "The rule is they have to clear that bag and clear everything in it."

We put a lead-lined bag packed with rolls of film into our suitcases. But, on the X-ray machine, the lead bag looks like a big, black blob.

The screeners wouldn't know if it's packed with film or something much more dangerous unless they check the bag by hand.

Steve Elson, former FAA inspector: "If they don't open the lead-lined bag, how can they tell there's not a gun or a bomb or a grenade in there?"

In two of our tests, SFO screeners didn't catch the lead bag. They let the suitcase sail on through. The second time, an I-Team producer got well into the terminal before a screener chased him down. But, back at the checkpoint, the screener failed again.

Screener: "It's a camera shield, a film ... film shield."

Not only does the lead-lined bag conceal its contents from the X-ray, it also hides whatever is packed beneath it. So, the screener should have removed the lead bag, set it aside, and sent the suitcase through the X-ray again. In fact, screeners failed to do that
on each of the 10 tests we ran at SFO.

Just four times out of ten, they swabbed the suitcase or film canisters for explosive residue. The rest of the time, they failed to check the film as closely as they should.

Ron Wilson, ABC7 aviation consultant: "This unit filled with plastic explosive can blow a door off its hinges."

Ron Wilson was the spokesman for San Francisco International for 20 years. He's now an aviation consultant for ABC7. He showed us an easy test the screeners should have used.

Ron Wilson, ABC7 aviation consultant: "What you do and you're not ruining anybody's film by doing this, is you pull the film out just a little and you see the spool starting to turn. Well, you know there's film in there wrapped around the spool."

We found all the same problems during tests at each of our major airports. The failure rate at San Francisco and Oakland + 100 percent; at San Jose + 60 percent.

Despite that evidence, the federal agency in charge of the screeners ÷ the Transportation Security Administration or TSA ÷ released a statement saying, "the reality is that TSA screeners performed their jobs exactly as trained and proper screening procedures were followed."

But, this security expert says the TSA has been ignoring his warnings for months now about problems such as the ones we documented here in the Bay Area.

Steve Elson, former FAA inspector: "Why are we spending these billions and they can't solve the most basic, simple problem? If we can't solve the simple problems, we'll never get to the complex problems."

There are calls from Congress for a full investigation of the problems we found. San Francisco's Nancy Pelosi sent us an e-mail complaining about how the federal government has handled airport security. She writes, "all of the experienced screeners at SFO were laid off and none were rehired, not even those who were U.S. citizens. It is very unfortunate that no experienced screeners were retained."


**Screeners Fail Security Test Again**

May 4 ÷ It's been two months since the ABC7 I-Team revealed serious security failures at
SFO. Now, we've learned that the federal government has taken action after our investigation but it's not the action you might expect. Dan Noyes reports.

Watch This Report

After the I-Team ran tests that showed severe problems with SFO's screeners, the Transportation Security Administration ran its own tests. But, inspectors warned the screeners ahead of time, told them what to look for, provided hours of additional training and still, the screeners failed again.

Dan Noyes: "We've spent billions of dollars with this new federal system, the TSA taking over. Are passengers safer today?"

Richard Schnайдт: "No, no, absolutely not."

Richard Schnaidt is worried about security at San Francisco International. He was a supervisor at the passenger checkpoints in February when the I-Team tested the screeners, with the help of a former undercover investigator for the Federal Aviation Administration.

Steve Elson, former FAA investigator: "We did use the lead-lined bag because it's impossible to miss. It's simply the most basic x-ray test you can do."

The I-Team packed their suitcases with lead-lined bags, commonly used to protect film. The airport x-ray machines can't see through them so unless the screeners look inside, they don't know whether the lead bags contain film, a gun, or enough box cutters to arm a dozen terrorists.

The lead bag also hides whatever is beneath it in the suitcase, so the screeners are supposed to remove the lead bag, and run the luggage through the x-ray again. But, on each of our ten passes, the screeners failed the test. Twice, the suitcase just sailed on through. The rest of the time, the screeners found the lead bag, but did not search the suitcase properly.

Richard Schnaidt: "There's still continuous mistakes that are being done."

Now, the I-Team has learned the TSA ran its own tests at the airport, shortly after our first report aired.

Richard Schnaidt: "They wanted to really truthfully find out if items could get through, and they did."

Several sources inside the TSA tell us the inspectors warned the screeners about the test beforehand, told them what to look for and even provided additional training. Still, the screeners missed a gun, a bomb, and a knife carried by a female agent.

Richard Schnaidt: "One of them was physically strapped onto a female, underneath her
skirt right up around her groin area."

The former FAA investigator does not blame the screeners. He says it's up to the people in charge of security to provide better training and direction for their workers.

Steve Elson, former FAA investigator: "This is extremely easy to correct, they just simply refuse to, and that I can't understand other than it's just arrogance."

Ed Gomez: "Hello, ma'am, how are you? I'm Ed Gomez, the federal security director here for TSA."

The TSA director at San Francisco International refused to discuss these issues with the I-Team. But, Ed Gomez was happy to take ABC7's Janelle Wang on a tour two weeks ago.

Ed Gomez: "Look at this, there's a camera there, Frankie. Do you see that?"

He wanted to show off the bomb-sniffing dogs and his screeners.

Ed Gomez: "Are you getting all the training and equipment you need?"

Screener: "Yes, sir."

Ed Gomez: "Okay, good, well, you look sharp."

Our reporter did ask Gomez about passengers carrying lead-lined film bags.

Ed Gomez: "I would probably recommend against them having lead-lined bags, but if they do, we will be looking at those. People are very sensitive to that."

When Janelle Wang tried to follow up, a TSA PR person shut the conversation down.

Janelle Wang: "So, the lead-lined bags, some people I've heard. Nico Melendez, PIO: "We're not going to get into lead-lined bags."

The TSA also refuses to discuss another apparent security lapse. A screener came to Supervisor Richard Schnaidt March 21, worried that a passenger might have gotten through with a gun. Schnaidt tried to call his TSA superiors on the radio for help.

Richard Schnaidt: "And I got absolutely no response whatsoever, none."

Dan Noyes: "What did you think about that, when you're calling on the radio?"

Richard Schnaidt: "I panicked, I panicked, because I was not prepared to deal with this type of total silence."

Schnaidt says he tried the radio again and again and went to other checkpoints, but could
find none of his TSA supervisors. Finally, he decided to make a bold move. He bypassed
the normal security procedures, went straight to the United Airlines ticket counter, and told
them what was happening.

Richard Schnaidt: "And I basically said we have a possible breach with a gun, an
emergency and I need to talk to someone now."

United security rushed to the gate, where Flight 844 headed for Washington, D.C. had
already pulled away. They brought the plane back, cleared the passenger in question. He
had no gun and the flight departed 43 minutes late. After the incident, Schnaidt got fired.

Richard Schnaidt: "I basically had to take these necessary steps as a supervisor to
ensure that nothing went wrong, and because of that, I ended up being terminated within
that 24 hour period."

Steve Elson, former FAA investigator: "The guy did something heroic, and I think that's
the kind of person we need leading, he's got those qualities."

Dan Noyes: "So, you're saying he shouldn't have been fired?"

Steve Elson, former FAA investigator: "Absolutely not. That's absolutely disgraceful."

The TSA won't discuss the incident, calling it a personnel issue.

After seeing the I-Team stories, Congressman Mike Thompson of Napa has been pressing
the TSA for answers.

The head of the agency, James Loy, sent Thompson a letter saying:

"It is TSA policy that screeners open and visually inspect the contents of lead-lined bags
which shield x-ray examination."

He issued a security directive after the I-Team investigation in February, urging screeners
to follow that policy. But, clearly, questions remain about airport security. That's why
members of Congress are calling for a full, independent investigation of the TSA. The
General Accounting Office is expected to formally announce the start of that inquiry this
week.

The TSA has a comment and complaint line. If you're interested, call (866) 289 - 9673.

Read Original Reports On Security At Bay Area's Largest Airports:

San Francisco | San Jose | Oakland
I-Team Puts Oakland Airport To The Security Test

Feb. 26 + You might expect the security at Bay Area airports to be extremely tight, but an I-Team investigation has found serious security failures at all our major airports. Dan Noyes takes a look at Oakland International in Part Two of our series.

We used a common FAA test that features a lead-lined film bag. But some of the mistakes we captured on tape at Oakland International were so odd, they have security experts wondering what is going on there.

Dan Noyes: "Should people be concerned getting on airplanes?"

Steve Elson, former FAA inspector: "Absolutely."

Steve Elson worked for the federal government, looking for holes in airport security. Now, he has tough words for the Transportation Security Administration, or TSA, that's in charge of the new federal screeners at local airports, including Oakland International.

Steve Elson, former FAA inspector: "We're paying billions of taxpayer dollars for an organization that is supposed to protect us, when the organization is basically doing nothing but just trying to look good." There's no question there are more security screeners and guards at Oakland. But Elson showed us how to test their performance using a lead-lined film bag. The airport X-ray machines can't see into it. The bag appears on the screen like a big, black blob.

Steve Elson, former FAA inspector: "You could have a pistol, knives, grenades, explosive devices, you could probably get enough explosive in there to bring a plane down."

So it's important for screeners to check the lead bag by hand. We packed our suitcases with lead bags containing film, bought tickets and ran 10 tests on Oakland's security.

The lead bag got by these screeners without being checked at all. Two other
**screeners found the lead bag, but failed to open it + major security failures.**

Steve Elson, former FAA inspector: "They should take that lead-lined bag out, they should open it, check the contents, put that aside and then the best thing to do is to put the suitcase back in the X-ray."

The X-ray can't see what's inside the lead bag or what's beneath it in the suitcase. That's why the luggage should be X-rayed a second time, without the lead bag inside.

But, Oakland screeners failed to do that in each of our ten tests.

Ron Wilson, ABC7 aviation consultant: "You can't afford to make mistakes. You don't know whether it's a terrorist or someone who has just slipped up in packing their bag."

One screener found the lead bag and actually suggested doing the job properly, by removing the lead bag and running the suitcase through the X-ray separately.

His co-worker disagreed.

Screener #1: "What is inside?"

Screener #2: "Well, you better check, you better check. Run the bag without it."

Screener #1: "Uh, no."

The screener running the machine ignores the suitcase, and X-rays the lead bag again. No matter how many times she tries, it will still look the same + like a big, black blob.

Ron Wilson, ABC7 aviation consultant: "If they slipped up, they're humans. I guess they can slip up, but they shouldn't have."

ABC7 aviation consultant Ron Wilson says he has never seen a mistake like this. Two members of the *I-Team* approach a checkpoint at Oakland.

The screener finds a lead-lined film bag in the first suitcase, opens it, finds the other lead bag, fails to open that one and shows them both to his supervisor. Then, he switches the lead bags, and puts them back in the wrong suitcases.

And both passengers are on their way, without being properly screened.

The former FAA inspector is now performing tests like these at airports around the country.

Dan Noyes: "What have you seen?"

Steve Elson, former FAA inspector: "Generally, about a 90-95 percent failure rate. All over
the country."

In our tests, Oakland International had a 100 percent failure rate. That's why North Bay Congressman Mike Thompson has sent letters to his colleagues on the House transportation committee and to the Secretary of Transportation, demanding a full investigation of what we found.

Rep. Mike Thompson, (D) Napa: "I'm hopeful the Transportation Department will contact you guys, find out exactly what you found out, maybe we can make the airways safer as a result of your work."

But, the Transportation Department and the spokeswoman for Oakland International referred us to the TSA. It released a statement saying, "the reality is that TSA screeners performed their jobs exactly as trained and proper screening procedures were followed."

**Hard to believe, given the 100 percent failure rate we found.**

Ron Wilson, ABC7 aviation consultant: "I think this is a wake-up call. We are living in times now that can potentially be dangerous. These screeners have to avoid complacency."

But, the former FAA inspector tells us, the problems are not with the screeners.

Steve Elson, former FAA inspector: "These are good people, they're bright people, they're polite people, they're trying as hard as they can. The simple fact: their failure goes back to the total lack of leadership at the very top of the organization."

----- Original Message ----- 
From: John Barry Smith
To: John Sampson; John King.
Sent: Wednesday, October 01, 2003 5:06 PM
Subject: Re: Air India trial back on again

VANCOUVER (CBC) - The Air India trial resumes Wednesday after being adjourned for a week to allow one of the accused time to work out a new financial arrangement with his lawyers and the provincial government.
Dear John, another trial, another no questions to me who says 'no bomb'. The irrefutable evidence is there that there was no bomb on that plane based on United Airlines Flight 811 and circumstances.

But nobody cares, just get revenge on foreign looking fellows, in this case Sikhs.

Below was sent to Globe and Mail reporter.

I'm past clutching at straws, I'd love to have a straw to clutch to.

Cheers,
Barry

To: "Matas, Robert" <RMatas@globeandmail.ca>
From: John Barry Smith <barry@corazon.com>
Subject: RE: "I made no bomb," he told the court.
Cc:
Bcc:
X-Attachments:
Good to hear from you again. Hope you had a good summer. Reyat does not appear to be helping the conspiracy. The next few days should be quite interesting.
Regards, Robert

Dear Robert, Friday, September 12, 2003 12:07 PM

Please note that Reyat's attorney was the only attorney for the accused for Air India Flight 182 and Pan American World
Airways Flight 103 who disputed the 'bomb' explanation for the inflight explosions and that soon thereafter the Crown promptly settled by offering a five year deal, a ludicrously lenient offer for the murder of 329 people.

Please do not stand by quietly when the Crown says the explosion occurred in the aft compartment when you know the Canadians and the Indians both said it was in the forward and therefore the 'bomb' could not have been loaded at Vancouver. To print the conclusions of the CASB and the Kirpal report using quotes is relevant and not forbidden.

Actually the defense believes it was a bomb and therefore does not care where it was so may not even query the location. No pictures permitted of the actual location either, locked up by the RCMP.

Anyway, Pan American World Airways Flight 103 looks dead forever since Libya said they were not involved but paid 2.7 billion anyway. The statement which the press says Libya accepted blame actually does no such thing, but then who actually reads what the facts are when money is involved?

"I made no bomb," he told the court....and that means for the Narita event also.

With defence attorneys like the accused have, who needs prosecutors? Note that when the money ran out, Dave Crossin ran out.

I have informed TSB of all of this information about the forward/ aft compartment illogic. Why not get an interview with TSB? Does it not seem strange that the foremost aviation authority in
Canada is silent on the most important aviation accident in Canadian history? Ms. Delorme will answer you, I bet.

Cheers,
Barry

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Transportation Safety Board of Canada/
Bureau de la sÉcuritÉ des transports du Canada
Tel.: (819) 994-8002
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From: "John King" <john.king19@comcast.net>
Date: October 1, 2003 9:14:52 PM PDT
To: "John Barry Smith" <barry@corazon.com>
Subject: Flight 990

Yea, on Flight 990 and not to leave them out. No father calls his son to say he's got the leather jacket and the car tires when he never intends to get there.

JK
--

Indeed we are singing from the same book when we speak critically of the alternative scenarios presented by the FAA and found in so many recent NTSB Reports and our countering views and documents come from their own files.
Hoist them on their own petard...and yet they don't trust their own data.

Be it 767 reversers that deploy in flight, 737 rudders with a mind of their own, A-300 rudders that wag the dog; errant 747 cargo doors are yet but another variation of wiring system calamities and the FAA and the NTSB have done a very good job of dodging the root cause. We know their game and that's a help.

Add 767 split elevators and autopilot uncommanded disconnects and non suicidal Egyptian copilots....

It's clear they have long chosen to side with the industry to minimize costs, maintain ridership and deflect questions of FAA oversight, Flight Standards and Certification of systems and materials. They do this with the full belief that nothing will become of it and that all the presumed 'checks and balances' of congressional oversight, justice department actions, IG investigations have been co oped by the flow and power of money flowing through the hill for so many years.

Cynicism....does not taste good. FAA is profit driven but...NTSB should be and must independent and safety first and damn the cost. Or ground them.

It's an ugly scene and it is so contrary to our very core of beliefs,
the Rule of Law and the education we received beginning in elementary school. Few see this with the major exceptions to the very few, that for reasons of conscience or outrage, came forward to speak the truth.

I read a good thing in Harpers about dissent. We are the dissenters and it's hard. By Hoagland. I know the truth so much that I can say I might be wrong. I might be wrong and when dealing with life and death issues, it is very important to be right. So that means checking and rechecking. Over and over again.

My complaint is not the harassment or the lies but being ignored. No questions is tough when I am reporting a safety issue that involves the lives of literally hundreds of men women and children. See below in over the top email to TSB.

Presently I am working with about eight of these men whom all have come from United over the past two years. As individuals and in small groups they have approached every agency (IG, GAO, Justice, congress, DOT, DOL, OSHA, etc) but only to find that even though their claims of maintenance fraud were found to be true, they remain without careers; some now for up to two years. In spite of the Wendall Homes Aviation Act and promises, retaliation works to keep them off the property and sends a chilling message to any others who may do the same. Some time has now been spent just to have them understand that what has happened to them at United is no different than to those before and from a virtual cross section of the entire industry.

Interesting. And tragic.
With some luck their story, not of United, but of industry wide retaliation, may appear in USA Today soon.

Water off a duck's back.

IASA tied my hands, as well, with worries that my more aggressive style might get in the way of some efforts to meet with the decision makers in DC.

Aart Van de Wal blackmarked me when IASA started because of my controversial point of view on no bombs but mechanical problems. We think they will be sorry some day when they find out they were wrong, but not so. They don't care one way or the other. NTSB guys get their pensions and documentaries about how hard they work and it's over. No justice.

It's taken some time but now they realize these decision makers were not part of the solution but rather key figures in the problem.

Absolutely, Jim Hall, Bernard Loeb, Jim Wildey, Tom Thurman, John Garstang, and others up and down the chain.

I'm not good at politics because, like the bonus systems in carrier maintenance programs, it has no place in safety deliberations.
I call it Barry grows up when I realize the silent agreement that safety is only a coincidence to profit. The military is not like that. The Navy cared about me and did its best to keep me alive, even in combat. The callousness of the airlines and manufacturer and government to the lives of the people entrusted to it is astounding.

Buried in that Air Safety Week article I pushed back in September 2000 was the story that United had not even filed (72 hour) the required SDR for all of 2000 up to October. The FAA guys there then called to say that over 5,000 SDRs had now been sent and they were bring in two additional stall to enter the data. But yet, nothing became of it and the FAA did not confront United for such a lapse. The fines would have been enormous but to do so would have brought attention to the FAA's loose grip here on the entire industry. If you hadn't seen that article I have attached here in PDF.

Good work.

That's it my friend and there are very few of us out here that do this work. But do it we will because its the right thing to do to honor those before us who also believed in this country and we want something better for our kids and our grandchildren, as well. Its our legacy to them to have tried to make this a better place.

I do it I think to repay the debt of my pilot who saved my life. I can't think of any other rational reason and either can my wife. I love a good mystery too.
I don't know how specifically to help you but I'm always looking.

Thanks. I will always bring your name up when wiring comes up. I usually can't get them past ruptured cargo door inflight with pictures attached.

Comparing the NTSB Final Report against the Canadian TSB Report on Swissair Flight 111 is like comparing a comic book against any scientific journal.

So true. Reading other AAR is a pleasure after the confusing and misleading NTSB crap. Well, the early NTSB stuff is OK before they went political. Also interesting are AAR in which the tower or other FAA people screwed up and killed people but the report always seems to blame the pilot and clears the ATC people.

I'll always wonder if was our efforts to shine the light on the wiring and electrical issues and that gave the NTSB another explanation for TWA 800.

I think so. It was wiring but not the center fuel tank. Like uh, no ignition source is like saying a two legged stool can stand. Need source, fuel, and air for that explosion. The shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation gives one with on fire engine number three
as the source of ignition, but then you have to have inflight breakup first and then fuel vapor cloud explosion, not reverse.

I'll never wonder about those dozens of industry and military witnesses and that they truly believed that they saw a missile rising towards that plane. My long industry and military experience is that such men don't lie...not about this.

They saw the streak and it was there, it was the shiny cargo door and skin pieces peeling away reflecting sunlight into a streak. The sun angle had to be just right and the timing had to be just right and it was. That was all analyzed by me and sent to NTSB. The shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation fits all the facts of streak and center tank explosion and of course the pictures of the forward cargo door with obvious ruptures at the midspan latches and paint transfers and all that other matching United Airlines Flight 811 stuff like sudden loud sound on the CVR followed by abrupt power cut to the recorders...and on and on....

Add to this your own review of doors that open on their own and one can only marvel there aren't more smoking holes on US soil and that's not to say that US manufactured aircraft haven't killed many a non US citizen. When they fall off our shores the FAA? NTSB likes to presume they are suicidal or don't know how to fly.

China Airlines Flight 611 is a possible aft cargo door rupture open but very little data comes out and NTSB and FAA are being
so very helpful to the Taiwanese over there.

Well, John, you have given me a pep talk. Thanks, it's good to know I'm not alone. I always come back to United Airlines Flight 811 to reassure me I'm not a crank, kook, or just nutty. It's the conspiracy guys that call me crazy and that's funny.

Cheers,
Barry

John Barry Smith
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831 659 3552
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http://www.corazon.com

To: "Delorme, Paulette" <Paulette.Delorme@tsb.gc.ca>
From: John Barry Smith <barry@corazon.com>
Subject: Air India Flight 182 questions
Cc: Terry.Burtch@tsb.gc.ca
Bcc:
X-Attachments:
From Bill Tucker, former Director of Investigations TSB.

However, I have obtained a personal commitment from both the Director of Engineering and the Director of Air Investigations that they will follow-up on this at the end of the summer and see if there is anything that can be made available to you.
Dear Ms. Delorme,

Tuesday, September 2, 2003 6:15 PM

I'm at my wits end. Desperate thinking men do desperate thinking things. My desperate thinking thing, Ms. Delorme, is to appeal directly to you via email and metaphor. I don't know your background, responsibility, or authority but I do know you are in the chain of command for aviation accidents in Canada for probable causes.

I wish to report to you a danger which exists as I type. The danger is to passengers in early model Boeing 747s, some of which belong to Canadian airlines and fly Canadians. The danger of fatalities is because of defective wiring and non plug cargo doors. I can prove that assertion in general and specifically for Air India Flight 182, if given the opportunity.

I've tried facts, data, and evidence in support of the shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation but have received no queries from aviation safety officials in the TSB. Air India Flight 182 was not a bank robbery but an airplane crash but I have been referred to the RCMP which would normally be for criminal matters not airplane crashes.

Sooooo...... Ms. Delorme, I, as a witness, am going to appeal to you, as police officer, using a metaphor of crime. The crime is rape.
The Metaphor: I am a witness to a rape and I am reporting the crime to the RCMP. I am saying who is being raped, who the rapist is, where it is occurring, and why. I am saying to the rape police that the culprit they think they have is not the culprit. I have identified a different culprit rapist. I can prove this rapist has done the rapes.

The sergeant in charge of the Rape Squad looks at me and refers me to astronomers because the events took place at night. I protest to the police and say it's impossible for the culprit you think you have to have done the crime because he has an airtight alibi. The Sergeant ignores me and asks no questions.

I present evidence which was obtained by the RCMP itself of the alibi. The Sergeant ignores me and asks no questions.

I submit much official evidence of the previous rapes by the rapist, evidence of the mode of operation in several other rapes, and in particular I present much official evidence in support of the accusation of the new rapist. The Sergeant ignores me and asks no questions.

I tell the sergeant I have been raped myself by a different rapist earlier in my life and I know what I'm talking about when I talk about rape and rapists. The Sergeant ignores me and asks no questions.

Who can I go to? The astronomers? The police not expert in rape cases? Private Detectives, politicians, the media? Who cares?

Yes, who cares.
The metaphor of a crime of rape related to Air India Flight 182 is explained:

I was in a fatal jet sudden airplane crash. My pilot died. I have discovered through years of research and analysis that a mechanical problem and a design flaw in early model Boeing 747s is killing passengers and crew. I am reporting to the TSB the killings occurred off Ireland on June 23, 1985 in which 329 persons died. It occurred because machines have to obey the laws of nature regarding pressure equalization and electrical discharges. The culprits are faulty wiring and non plug doors. I am reporting it to the government officials in charge of aviation safety. The official in charge of aviation safety refers me to the police who know little about why airplanes crash.

I present evidence that the accused culprit of terrorists is innocent because all luggage from Vancouver was loaded into the aft cargo compartment and the explosion occurred in the forward cargo compartment. The two compartments are solidly separated in the air and on the ground. The Canadians and the Indians agree that the explosion occurred in the forward cargo compartment and did not occur in the aft cargo compartment. The accused are said to have loaded a bomb onto Air India Flight 182 at Vancouver airport which then could not have caused the explosive decompression/inflight breakup, something else did. The official in charge of aviation safety ignores me and asks no questions.

I present evidence to the TSB of the shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation for Air India Flight 182 using aircraft accidents reports submitted by Indian, Canadian, American, and British aviation safety authorities. I show pictures, charts, text, diagrams,
schematics, and tables. The official in charge of aviation safety ignores me and asks no questions.

I present evidence of my own airplane accident of June 14th, 1967 and state I know what I'm talking about when I talk about airplane crashes and their causes. The official in charge of aviation safety ignores me and asks no questions.

Who can I go to? The RCMP? The safety experts whose specialty is trains? Private Detectives, politicians, the media? Who cares?

Ms. Delorme, I'm hoping against hope that you care.

Regarding the police and the sergeant in my rape metaphor:

Would you accuse the police of negligence for not asking any questions to check out the story of the witness who is reporting a rape?

Would you accuse the sergeant of negligence for not asking any questions to the witness about the evidence he has submitted regarding the location, the duration, and the severity of the rape and indeed, names the rapist himself?

Would you not feel frustration, especially if you had been raped yourself, at the nonchalance and indifference of the police as you report a very very serious crime of which you have ample proof?

Well, if you do, please ask me questions about my report to you of faulty wiring and a design flaw in early model Boeing 747s and in particular, Air India Flight 182. I can be as sophisticated or as basic as you wish, Ms. Delorme.
Will you ask others to ask me questions? Mr. Terry Burtch, Mr. Nick Stoss, Mr. Vic Gergen, Mr. John Garstang, and the Director of Engineering should be able with just a few questions each be able to determine if my report of a potential existing aviation danger is real and worthy of action or not real and should be rejected.

The negligence of the RCMP in not investigating the rape metaphor above is not that they made an error in the accusation of the culprit but they did not check out an alternative explanation with precedent by a reputable witness. They have a responsibility to investigate all reported crimes under their jurisdiction and rape qualifies.

I am reporting to the TSB that the accused did not commit the bombing crime because 'nobody did it'; it was a mechanical explanation, the shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation for Air India Flight 182 and the precedent is United Airlines Flight 811. I believe that the TSB has a responsibility to investigate all reported probable causes to aviation accidents that occur with Canadians aboard and Air India Flight 182 qualifies.

I await questions from the aviation accident investigators.

Respectfully,

John Barry Smith
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Commercial pilot, instrument rated, former FAA Part 135
certificate holder.
US Navy reconnaissance navigator, RA-5C 650 hours.
US Navy patrol crewman, P2V-5FS 2000 hours.
Air Intelligence Officer, US Navy
Retired US Army Major MSC
Owner Mooney M-20C, 1000 hours.
Survivor of sudden night fiery fatal jet plane crash in RA-5C

From: "John King" <john.king19@comcast.net>
Date: October 1, 2003 9:24:12 PM PDT
To: "John Barry Smith" <barry@corazon.com>
Subject: Not just a wiring guy

P.S. don't forget I'm not just a wiring guy but also the data guy.
Didn't you love those 3,200 reports. I cull them down into for
favorite picks for the month. See the attachment.

The most important thing to remember about the data is that the
FAA and the NTSB doesn't include in their FAA Incidents or NTSB
Monthlies any of the SDRs or the ASRS reports from the
maintenance and flight crews.

At that, the SDR submittal rates are low. No carrier is going to
submit a fleet wide problem. The ASRS reports are "de identified"
so that sometimes they are useless (no aircraft type).
In that 400 smoke and fire survey I did; for every FAA and NTSB report, I found 3 more in the SDRs or ASRS reports. That means the FAA and NTSB are offering the public only about 25% on the net.

JK
--

From: "John King" <john.king19@comcast.net>
Date: October 11, 2003 5:27:24 AM PDT
To: "John Barry Smith" <barry@corazon.com>
Subject: Re: TSB report on 727 open cargo door/legal definitions of negligence....Plea for questions...

The FAA and NTSB's wall of silence and indifference only comes with the knowledge that nothing will become of it.

That is none of the 'check and balances" (congress, media for two) work.

There are many fronts on this ongoing war against such unaccountability. Below is just but another from a fellow 'soldier' on another front (security) from Steve Elson.

JK
--

AN ANSWER. NO NEED TO HOLD OFF ANY MORE IF YOU WANT TO USE ANY OF THIS.

S

----- Original Message ----- 
From: elsonatasf
To: Schaffer, David
Sent: Friday, October 10, 2003 12:19 PM
Subject: Re: 16OCT03 AVIATION SUBCOMMITTEE HEARINGS
I had not intention of trying to buy you and don't know where you got that idea. I also was not making a threat. I think the public, the media, and the families MUST hear what is going on.

As I said, talk is talk and action is action and I hope the committee chooses the later.

Thanks for the quick response and answer.

V/R,

S

----- Original Message -----
From: Schaffer, David
to: 'elsonatasf'
sent: Friday, October 10, 2003 11:15 AM
subject: RE: 16OCT03 AVIATION SUBCOMMITTEE HEARINGS

The purpose of the hearing is to give the TSA an opportunity to answer the charges leveled against them. Even those accused of heinous crimes are given an opportunity to do so in this country. Bogdan had not been invited to testify and whoever misled him to think that he was did him a great disservice for which I apologized to him.
Feel free to take this to the media or anybody else.
I CANNOT BE BOUGHT!
AND I CANNOT BE THREATENED!

David

-----Original Message-----
From: elsonatasf [mailto:elson.atasf@verizon.net]
Sent: Friday, October 10, 2003 12:52 PM
To: Schaffer, David
Subject: 16OCT03 AVIATION SUBCOMMITTEE HEARINGS
Importance: High

Good Morning Sir,
I write you because I am confounded by the upcoming 16Oct03 Hearings, their purpose, and mostly the witness(es).

I would expect and hope that the Hearing dealt with the issue the 9/11 (hopefully) Independent Hearing Chairman Kean stated at the recent press conference. Mr. Kean stated that early on in the process, when he asked the families their objective or end goal, one of the members stated words to the effect, “To make sure that no one ever has to go thought what we are going through or be in this situation.” Mr. Kean then stated that goal was always in his mind. THAT should be what your Hearing is about. That is all summed up in one word -- ACCOUNTABILITY!

When I first heard about the Hearing, I understood that those who wanted to testify were invited to do so and could call you. I was ready to call when I found out that the invitation was to tsa personnel. I will say that if I were to testify, I will always open by stating my name and then, “I, Stephen J. Elson, do solemnly swear to tell the truth, the whole truth, and nothing but the truth as I know it, under penalty of perjury, so help me God.” All testimony needs to be sworn because I already know and am willing to bet that Loy will do what he has done in the many hearings he as attended and his many public statements -- and that is LIE. He is a consummate liar and traitor and I would have called him such to his lying face.

However, my testifying turned out not to be an option. Bogdan had seen the invitation and subsequently called you about testifying. That was an act of tremendous courage since he was willing do something Loy wonât ö tell the truth. He was and is willing to stand there before
the committee, before the cameras, and before his boss, and tell the truth, which in effect means contradicting loyalty and calling him a liar. You politely turned him down. This brings to question immediately the purpose of the Hearing.

Let me just give a quick précis of the TSA, which of course began with an equally depraved individual, John Magaw.

1. Oct 01. Bogdan, Retired Navy SEAL Team CAPT Rick Woolard, Congressman Tauzin Staffer Garret Graves (for part of the meeting) and I met with House Transportation Chief Investigative Counsel Graham Hill. We discussed the new organization that would replace FAA security and accountability. Mr. Hill, in all honesty and sincerity, assured us that there would be accountability and that most of the FAA managers would not go to the new organization. That was wrong. In front of these people, I told Mr. Hill that the new organization (which became known as TSA) was virtually 100% guaranteed to fail.

2. Late 2001/early 2002. John Magaw was appointed to head the TSA. Many of us had very serious doubts about Magaw, but e-mailed that we all needed to give him support until he proved he didn’t deserve it. That didn’t take long. The guy was an unmitigated idiot who was self-serving ($400,000+ office) and who hired his cronies. He got fired.

3. Summer 2002. James Loy was appointed to replace Magaw. Again we wrote among ourselves that we needed to support him and give him a chance. Nominally he looked like a pretty good choice. Some of his early comments lent a bit of hope. That lasted but a short time.
4. Over the last year of his reign, loy has met virtually all of our predictions of failure and corruption:

   a. EDS. Chairman Mica has long criticized the CTX and justifiably so. Neither the CTX nor L3 are explosive detectors. They are chemically blind. The apparently better of the two, the CTX, has false alarm rates of between 30% and 70%. BILLIONS have been wasted. Not only are the machines a problem, but the operators and manner in which they are employed and going to be employed as in-line units. The government resisted offers of hybrid machines which held out far greater hope. Why?

   b. Screening. A sad joke. A near complete failure and faïade. The seizure of millions of items that the tsa loves to roll out when criticized means absolutely NOTHING as far a security. You know well that tsa canâ€™t successfully find and resolve the very obvious, a lead filmbag. I brought you the tape and documentation on April Foolâ€™s day just after noon. I donâ€™t know if you remember our conversation or the question I asked you but I certainly do. I know you donâ€™t control matters but I do know that you KNOW how bad tsa is.

(1) The media has reported many screening failures. Reporters get boxcutters on planes with 100% success rates.

(2) With many media, I have conducted the lead filmbag assessments all over the Country with near 100% failures. Meanwhile, loy and his propaganda people lie and for some inexplicable reason refuse to fix something so easy to fix. I have copies of loyâ€™s letters to the Honorable Mike Thompson. They are instructive as is the following loy statement regarding the second
failure at SFO on the 04May ABC-KGO report:
"It is **TSA policy** that screeners open and visually inspect the contents of lead-lined bags which shield x-ray examination."

He issued a security directive after the I-Team investigation in February, urging screeners to follow that policy. But, clearly, questions remain about airport security. That's why members of Congress are calling for a full, independent investigation of the TSA. The General Accounting Office is expected to formally announce the start of that inquiry this week.

I donât have a copy of the directive and am not sure of the exact wording, but tsa conveyed the above impression to KGO. Loy was supposed to have been a USCG Admiral. Simple fact, Sir, is that you donât âurgeâ people to follow policy, you direct/ demand that they do so.

(3) GAO recently released two reports as well as conducted testing at the Chairmanâs behest. Chairman Micaâs comments ("**You wouldn't want to know. ... It's gruesome,**" said Rep. John **Mica**, R-Fla., chairman of a House aviation panel) regarding the results need absolutely no elaboration. They say it all. Those GAO results did, in effect, nothing but confirm what a small army of us have said and predicted since tsa inception. Of note, GAO was trying to be sneaky in its testing. The assessments you have on the tape I gave you are the antipode of sneaky ô blatantly obvious/ impossible to miss. Yet, the failure rates were near 100%.

(4) Checkpoint breaches. Many reported in the media. All because tsa refuses to grasp the essential concept of **CONTROL**. ALL of this is ridiculously cheap and easy to remedy; all of this is basic. Instead tsa lies and in fact is the worst OPSEC/ COMSEC violator. It is they who repeatedly tell the terrorist and the media how to test and beat their system. Simply watching and listening told me what I needed to set up the media
assessments.

(5) What about the investigation I requested regarding a senior tsa manager’s comment that loy had personally intervened on the second day of a proposed 12-day tsa testing program because the results were so abysmal? This tracks with the GAO report of tsa’s refusal to keep performance measures, something ludicrous and unheard of by any organization from a 7-11 store to NASA.

c. Access Control. Numerous breaches including drunk and diminished capacity individuals obliviously strolling across ramps and boarding planes; driver abandoning a car at Gerald Ford airport, climbs fence, trots across the ramps, and boards an COMAIR jets where the pilots beat him up and tsa comments that they had the guy under surveillance even before he climbed the fence; and yesterday in N.H. some nutcase woman crashes through security and attacks Air Force One. In this last case, it wasn’t tsa, but it shows how lousy security indeed is.

d. Huge wastes of money. Gupta on Chairman Roger’s committee “bewildered” at the missing $1.4B. NCS-Pearson, 700% overrun. That’s $2B right here. All kinds of nutty sole source contracts (I have some). Competitive contracts including the $2M to SAIC, where cathal flynn went to work after he left Argenbright to dispose of garbage. From an inside tsa manager reports of $10,000 bonuses given out like M&Ms. tsa’s meeting and conferences in the Double Tree and Residence Inn within easy walking distance of tsa HQ, blgds. 601 and 701.

e. Cargo security. The ship yourself to Texas
program

f. DG and HAZMAT. A joke according to agents who work the program.

g. The lies and cover-ups. Look back at tsa comments and actions following the screening failures. The tsa āanswerā was to roll out all the superfluous items taken from passengers and to say the screeners are performing as trained. That was under lying robert johnson. Now we have brian turmoil with his āsnapshot in timeā excuses. This is the answer he and loy give in response to GAO reports and findings, in response to the recent DHS IG report on screener cheating and bogus testing. Notice, they never say they made mistakes. They lie, alibi, and it is ALWAYS someone elseâs fault or mistake. Check out Sara Gooâs excellent article in the Post today which tells of loyâs attempts to cover-up by abusing and misusing the āsensitive informationā caveat. Or when loy lied to the OSC and President on Bogdanâs case and tried to hide that information from Bogdan.

h. FSDs. Many incompetent. Many believe they are laws unto themselves. Some criminals. Some who have promoted secretaries because of sexual favors to jobs for which they are unqualified, accepted gifts, been involved in tsa proscribed transactions, and excluded Black Americans from functions. What about the reprisals against tsa personnel who did nothing more than tell the truth when questioned in official tsa investigations? Let me know if you want me to name names. You know I can and am more than ready to do so.

i. The director and assistant director of tsa screener training and performance. The Director
apparently has no background in security or aviation. The Deputy Director, who should be the subject matter expert is Mary Carol Turano, who was the FAA field office manager at Logan and who allowed 9/11. As best as can be determined her experience with screening is to have conducted on of the old FAA bogus tests, giggle, said that was fun, and went back to her office. She didn’t even have an airport access badge. She did nothing after the Fox 25 report on 06May01 PROVING (you have that on the tape I gave you) that screening was hoax at Logan. This is another one who helped allow 9/11 and has profited from the death and destruction on 9/11.

5. You have seen a lot of my writings. Thus, you KNOW I could go on for pages, but my intent here is to merely present a very, very brief history of the gross and worsening malfeasance in the TSA. AVSEC is worse today under TSA than it was pre 9/11 under FAA!

Back to the basic question. WHAT IS THE PURPOSE OF THIS HEARING? You already KNOW that Loy is going to lie. He has thumbed his nose at Chairman Roger’s on screener hiring and lied about background investigations in his statement (read by McHale) at the 9/11 commission and at the subsequent Roger’s hearings. Loy as an Admiral knows and understands ACCOUNTABILITY. He is responsible and accountable for his ship (TSA) and the employees. His placement of Lunner at the head of 6 modes of transportation indicates to me that the interest is in spin, not security.

Chairman Mica has made some very strong and dramatic comments recently. I had hoped and still do the Chairman Mica is going to do something unique ï hold Loy accountable. Time for niceness and games is long past; it is time for truth and accountability. I know that
an answer will be that this is an open hearing and the real ACCOUNTABILITY issues will be discussed in closed or memberâs only hearings. loy has already been through those and emerged to continue his betrayal of his oath and public. Sadly, I have the feeling the closed hearings are where the congress and loy do the âsecret handshakeâ and decide on how they will âabradeâ tsa a bit in public to look good, but in fact decide how to cover-up and permit continue the betrayal and misfeasance. The refusal to have Bogdan Dzakovic testify lends credence, strong credence, to my belief. Why did yâall invite testimony if you didnât want it? Was that a mistake or merely an âappearanceâ issue. The proof will be in the pudding -- the ACTION following the hearing. I have heard excuses of how a particular congressman can only do so much. Fact is the Chairman Mica, Chairman Rogers and their senate counterparts have tremendous power. Allied with the ranking members, they could, with tremendous easy, gain Mr. Bushâs attention and have loy and other miscreant mangers fired. I suspect a chat with Mr. Ridge would work. All you have to do is to tell him you are going to cut off all his money. I see where the tsa budget is going -- right back into already failed endeavors.

I would like a prompt answer. If I donât get one, then my only choice is to share this with the media and the families. How are you going to explain another tragedy now that all of you have removed those âstupid, indolent, and uncaringâ contract screeners (who did every bit as well or better than the highly advantaged tsa screeners) and replaced them with your own highly paid, highly trained (more loy lies) FEDERAL GOVERNMENT screeners?
I eagerly await your response. Iâll wait until Monday morning before going forth on these issues.

I want to share with you just a portion of an e-mail I received two nights ago from a father who lost his son on 9/11. He has served this Country long and well in the military in Viet Nam and as a NYC police detective. I read and reread, through tears, his e-mail. One short section haunted me and caused me to awaken in the middle of the night with tears in my eyes. It haunts me because it captures the very quintessence of the matter ö that the fight against faa/tsa/government indifference (such as meaningless hearings and commissions ö which I hope yours will not be) is not about money, office, political gain. It IS about the depths of human sorrow and tragedy, for 9/11 was so easily preventable and tsa is a horrifying d/j vu picture of pre 9/11 faa.

He wrote: Sometimes I lay in bed at night and silently ask God when the pain will subside. I've never received an answer. Maybe he is too sad to respond even though he has my son beside him.

Thank you for your time and attention.

V/R,

Steve Elson

From: "John King" <john.king19@comcast.net>
Date: December 17, 2003 6:00:59 PM PST
To: "John Barry Smith" <barry@corazon.com>
Subject: Re: Merry Christmas!

Thanks John and tomorrow I'm taking the kids to the airport...see
this link ...

file:///C:/Documents%20and%20Settings/Administrator/Local %20Settings/Temporary%20Internet%20Files/Content.IE5/5Z3J910E/takeYourKidToWorkDay.jpg

JK
--

----- Original Message ----- 
From: John Barry Smith  
To: aanderle@mindspring.com ; stanleywatson@sbcglobal.net ; beanbag@mbay.net ;  
chrisolsson@btopenworld.com ; john@johnlord.demon.co.uk ; jbrink1998@aol.com ;  
lewisteam@aol.com ; spmayes@email.msn.com ; bfoster@sunline.net ; DaveAnderson ;  
Gordon E. Smith ; harvey.abrams@med.va.gov ; Ivan and Maggie ;  
je_hoffmann2001@yahoo.com ; John King ; JohnTarsikes ;  
Kate.Fitzgerald@chase.com ; Kevin & Susan Campbell ; burt528@earthlink.net ; Rick  
Elger ; barhowarth@email.msn.com ; John Sampson ; Santokh Singh ;  
Glenwood@mweb.co.za ; Zoe Rosselle  
Sent: Tuesday, December 16, 2003 8:15 PM  
Subject: Merry Christmas!

From: "John King" <john.king19@comcast.net>  
Date: May 2, 2004 5:10:14 AM PDT  
To: "John Barry Smith" <barry@corazon.com>  
Subject: SDRs  

Note a new URL here for SDRs with a search engine.

Attached is my lookabout for SDRs of interest and note the very last...a uncommanded cargo door opening.

JK
--

From: "John King" <john.king19@comcast.net>  
Date: May 2, 2004 5:30:06 PM PDT
To: "John Barry Smith" <barry@corazon.com>
Subject: Re: SDRs/Wiring

My money is on the wiring, and not only because of the many examples of uncommanded inputs, but in the way that the industry and the agencies have denied it for so long.

For example; in the American Airlines A-300 loss (Flight 587) over Queens, the NTSB tells me they have but three incidents of uncommanded rudder movements, the FAA Incidents list but one of these..... but the SDRs and the Aviation Safety Reporting System list, no less than, TEN MORE!

JK
--

----- Original Message -----  
From: John Barry Smith  
To: John King  
Sent: Sunday, May 02, 2004 12:45 PM  
Subject: Re: SDRs  

Note a new URL here for SDRs with a search engine.

Attached is my lookabout for SDRs of interest and note the very last...a uncommanded cargo door opening.

Thank you John, Sunday, May 2, 2004 9:42AM

Now, my question, yes or no:

Do you believe that faulty Poly x wiring has caused the forward cargo doors of Air India Flight 182, Pan American World Airways Flight 103, United Airlines Flight 811, and Trans World Airlines Flight 800 to rupture open in flight as the initial event?
If not, then OK, stick with the authorities and their bombs, missiles, and fire with no ignition source.

If yes, then your position is much strengthened because wiring is the culprit that needs immediate replacement.

If maybe, then ask questions to resolve the doubt.

Barry

John Barry Smith
541 Country Club Drive
Carmel Valley, California 93924
831 659 3552
barry@corazon.com
http://www.corazon.com

From: "John King" <john.king19@comcast.net>
Date: May 3, 2004 6:19:37 PM PDT
To: "John Barry Smith" <barry@corazon.com>
Subject: Re: SDRs//Wiring// I digress

Doors are part of it.

Add to this fuel tanks that go 'BOOM', uncommanded flight control inputs (there are 16, or so, SDRs and ASRS reports and not just the other 3 the NTSB is looking at on A-300 uncommanded rudder movements) and lots and lots (over 400) of in-flight 'Smokers' where the only difference between life and death is getting down soon enough.

There are no questions as to whether bad wiring kills. The problem is how to force this issue out into the open where the trusting public (short the tiny fraction of the bereaved) can see
what the FAA, the NTSB and the corporate media has done to protect the industry.

Have you tried that new SDR search engine I mentioned? Our friends, the 'Data Guys' did a great job getting this on-line and I wonder how long it will stand before 'national security' requires it be taken down. As a sampler; take any local paper and story of another 'smoker' doing a quick return and run the date and aircraft type through this SDR search engine a week later (SDR must be filed in 92 hours)

You will be doing well to get a 20% positive result to any report being filed.

The NTSB has the same problem with their companion Rule 830.5 Requirement which mimics the SDR Requirements for such events (Flight controls, down to single source electrical or hydraulics are others).

Not reporting is in itself a violation of the FARs (felonies) but why should the carriers report when neither the FAA nor the NTSB will enforce it's own reporting requirements?

No reports...no need for costly regulations and fleet-wide fixes. Better yet...no questions to Certification Standards or methods nor any talk of liabilities. Settlements are so much more ......simpler.

Ahh...but I digress.

P.S. Have you seen any of the articles in Aviation Safety Week? I can forward them to you. At least some ground is being gained there.

JK
My money is on the wiring, and not only because of the many examples of uncommanded inputs, but in the way that the industry and the agencies have denied it for so long.

If you want to change the bad wiring to good, you will need proof that the bad wiring is killing lots of people. The shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation does that for you.

Absence of questions noted.

Regards,
Barry

Doors are part of it.

Add to this fuel tanks that go 'BOOM',

For Trans World Airlines Flight 800 officially there is no ignition source so that tank going up as an initial event is wrong. I know
the ignition source.

uncommanded flight control inputs (there are 16, or so, SDRs and ASRS reports and not just the other 3 the NTSB is looking at on A-300 uncommanded rudder movements)

I checked out the Egyptair plane and it was not suicidal copilot but uncommanded flight control inputs which have happened before the same type AC.

There are no questions as to whether bad wiring kills.

But you don't have the emotional hook. United Airlines Flight 811 is still listed as improperly latched cargo door, not even electrical wiring or switch gets the blame. And that was supposed to be all fixed anyway. That's the party line on wiring causing fatalities and it was only nine anyway is the thinking.

The problem is how to force this issue out into the open

If you show to yourself by asking questions that Air India Flight 182, Pan American World Airways Flight 103, and Trans World Airlines Flight 800 exploded because of wiring then you would be invigorated to get John Sampson to check it out, then he can get Evans to check it out, then it would be out in the open. Then let the aviation press examination my research. Let the evidence speak. The wiring/cargo door explanation will stand on its own. The the aviation world will listen to you and the hazards of wiring shorting enough to actually ground these planes and replace the wiring and make the cargo doors plug type.
But you don't ask, and no one else asks. It's assumed bomb cause and conspiracy and when someone comes along who says mechanical that has happened since and before and hazard still exists, that someone is crazy and unworthy of even being asked to document his assertions. So today, the conspiracy paranoid guys rule the asylum and the rare sane person who say look at the real evidence and match it up to a similar case and you have the plain old mechanical reason....which yes, does put blame on a lot of people other than foreigners in funny hats. Matching it up means using research tools like the SDRs and AARs and bulletins from all over the world.

You have done the research but have not reached the conclusion: Poly X wiring has caused Air India Flight 182 Pan American World Airways Flight 103 United Airlines Flight 811 and Trans World Airlines Flight 800 to crash.

That would get you your goal. But you don't ask questions to confirm or rule it out. You assume a wrong thing such as a fuel tank exploding with no ignition source. Or bombs...

Have you tried that new SDR search engine I mentioned ?

Yes, I like it, thanks.

No reports...no need for costly regulations and fleet-wide fixes. Better yet...no questions to Certification Standards or methods nor any talk of liabilities. Settlements are so much more .....simpler.
Ahh...but I digress.

P.S.
Have you seen any of the articles in Aviation Safety Week? I can forward them to you. At least some ground is being gained there.

Thanks. I get it. I still think Evans could ask me questions but he doesn't.

If you or Sampson or Evans believed that Air India Flight 182, Pan American World Airways Flight 103 and Trans World Airlines Flight 800 were brought down by wiring, you/they would do something. Since nothing happens such as questions to rule it in or out, I have to assume you three all believe that Air India Flight 182 was a conspiracy bomb cause, Pan American World Airways Flight 103 was a conspiracy bomb cause, and Trans World Airlines Flight 800 was spontaneous center tank explosion.

That is the pity, you three rail against the inadequacies of the aviation government apparatus yet you go along with it. The deficiencies the government have, you have, lack of curiosity, wishful thinking affecting scientific deductions, and not wanting to rock the boat/offer alternative explanations for fear of appearing crazy.

And that's why things are the way they are and will stay the way they are.

And you have the answer right in front of you.
Regards,
Barry

From: Carol Chapman and Fred Slautterback
<fslautterback@gmail.com>
Date: July 6, 2006 9:30:31 AM PDT
To: <barry@qp6.com>
Subject: Gallery North-Carmel - Summer Color Reception this Saturday
Reply-To: Carol Chapman and Fred Slautterback
<fslautterback@gmail.com>

We're New Member Artists at Gallery North - Carmel

Please come to our reception

This Saturday, July 8, 5:30-7:30

Attachment converted: NewMaster:=?utf-8?B?R2FsbGVyeSBOb3#1FD2A0 (JPEG/ÇICÈ) (001FD2A0)

This message has the following attachments:
   file://localhost/Users/barry/Library.Mail/
   Attachments/.DS_Store

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:10 AM PDT
To: EdwBlock@aol.com
Subject: Prediction/tefzel
Dear John and Barry:

Boeing used Poly-X from fuselage # 51(1970-75), switched to Stilan in 1975, switched to crosslinked Tefzel in 1978, switched to Kapton on the 400 in 1989, switched back to crosslinked Tefzel in 1993. Hope this helps.

Ed

Dear Ed, thanks.

China Airlines Flight 611 had crosslinked Tefzel, Delivered 1979
Air India Flight 182 had crosslinked Tefzel, 1978
Pan Am Flight 103 1970 but line number 15, what was used before fuselage #51?
Trans World Airlines Flight 800 poly X 1971
United Airlines Flight 811 had poly X 1970

What is crosslinked Tefzel? Is it the same type of polyimide aromatic teflon coated insulation? Is prone to the cracking, chafing, etc that poly X has?

Can it be called Poly X type wiring?

I'm afraid China Airlines Flight 611 is another of my shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanations. Wiring will surely get the attention it deserves after it is determined the wiring caused that door to rupture open in flight.

Wiring does worse things than start fires.

Thanks again, Ed.
Cheers,
Barry

John Barry Smith
(831) 659 3552
541 Country Club Drive,
Carmel Valley, CA 93924
www.corazon.com
barry@corazon.com

Prediction: Will have sudden loud sound followed by abrupt power cut: It's fast air molecules and nose off. Monday Night, 17 June 2002 John Barry Smith
Taiwan
'Black boxes' likely to be retrieved today, declares ASC chief Chinese boats join search and recovery efforts, complain direct link restriction causing delay
2002-06-18 / Taiwan News, Staff Writer /
The Aviation Safety Council Managing Director Kay Yong (??) yesterday said that the so-called "black boxes" of the ill-fated China Airlines CI-611 jetliner are expected to be retrieved early this morning.

As the signals of the plane's data and voice recorders are weakening 24 days now after the crash, rescue efforts are concentrating on the recovery of the recorders - which may stop emitting signals soon since the batteries have an estimated life span of 30 days.
Ships and underwater photography equipment sent by the companies Jan Steen of Singapore and Global Industries of America have contributed to boosting the search efforts. In addition to the participation of the Taiwanese navy and local rescuers.

The ASC official yesterday was confident of recovering the recorders by this morning.

"Taking a look at the recent rescue efforts - which are very effective - I believe it is very possible for us to recover the black boxes early in the morning," said Yong at yesterday's press conference.

The ASC also made public some pictures of the wreckage the divers successfully took under the water. Yong said that the pictures are very helpful for the team to recover the black boxes.

Chinese boats also joined the search for the plane's wreckage and the victims' bodies, but they complained that the ban on direct links postponed the return of the wreckage they retrieved from the Taiwan Strait.

The rescue team has recovered 121 bodies as of yesterday with one body still needing to be identified.

The Hong Kong-bound jetliner dived into the sea near the outlying Penghu island after breaking into four chunks in mid-air on May 25. The crash has killed 225 passengers and crew on board.

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From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:10 AM PDT
To: EdwBlock@aol.com
Subject: General term to cover all 747 wiring...

Dear John, are all the wire types on 747s 'polyimide' type?

What is a general term which covers all? Kapton Type? Poly x Type?

Is it true that all wiring on all 747s are known to be susceptible to chafing cracking and arc tracking?

Barry

Dear John & Barry:
Before # 51 it was Mil-W-81044/6. radiation crosslinked polyalkene inner with a Kynar jacket. Over rated in temperature rating, cut-thru, and scrape abrasion resistance. Cross-linked Tefzel is flammable, smoky (97% smoke obscurity rating), and toxic. It should be rated at 150 C but was given 200 C rating to compete with Kapton. The FAA has deemed it flammable, yet Boeing continues to use it on new twin aisle aircraft. TKT is being used on single aisle. Politics and money is the justification given to me by a Boeing representative as to why they are a house divided on wire types. In 1978 it was only used in non-pressurized areas, because NASA found it could explode in oxygen enriched areas (i.e. cargo bay area). When it was resurrected in 1993 after the Kapton crunch, it was put in all areas of the aircraft. At rated temperature you could remove it with your thumbnail. It is prone to 360 degree cracking when nicked.

It is definitely not Poly-X wiring however these wires were all made by raychem Corp. They would take material that Dupont
threw away, crosslink it and get a patent. They would then sell it to the military and get a specification written for it. They would then sell it to Boeing/McDonnell-Douglas as having military approval.

I agree wiring does worse things then start fires. I believe it is responsible for all of the uncommanded inputs to the rudder servo actuators via the yaw dampeners on the A300. Their rudders are automatically put in when you enter a turn, no matter whether the autopilot system is engaged or not. There are no transducers on the rudder pedals themselves so you can't tell if they were moved by the pilots or backdrove by the rudder. There was a multiple rudder deflection caused by miswiring on an A300 in 1999. There was also a crash in 1962, a 707 that had defective wiring on the rudder servos.

Ed Block

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:10 AM PDT
To: EdwBlock@aol.com
Subject: General term to cover all 747 wiring...dangerous

Dear Ed, thanks for help...

No not all are polyimide. I explained the types above. Yes all types will crack, chafe and arc-track.
Ed Block

I've had to change my table in my reports since I said all of the suspect aircraft had poly X and that's not so.

There was a 747-400 that had door open uncommanded on ground, so it -100, -200, and -400 have had open cargo doors in
flight or on the ground.

So, wiring....

Also, yaw dampers on 737 would explain two mystery crashes so controversial, Colorado Springs and Pittsburgh. Below is Bournemouth example of what might have happened to them.

I'm saying the wiring is causing cargo doors to open on 747s because of United Airlines Flight 811 which was wiring/switch probable cause and because of the Trans World Airlines Flight 800 hearings in which Poly X was singled out. You singled out Kapton.

Any documentation of accidents caused by crosslinked Tefzel?

Air India Flight 182 could have been Stilan or Tefzel since it was a 1978 plane.

Ah, looking for matches. Is it Raychem?

At 9:47 AM -0400 6/19/02, EdwBlock@aol.com wrote:

Boeing used Poly-X from fuselage # 51(1970-75), switched to Stilan in 1975, switched to crosslinked Tefzel in 1978, switched to Kapton on the 400 in 1989, switched back to crosslinked Tefzel in 1993. Hope this helps.

China Airlines Flight 611 had crosslinked Tefzel, Delivered 1979
Air India Flight 182 had crosslinked Tefzel or Stilan, 1978
Pan Am Flight 103 1970 had Mil-W81044/6, 1970, fuselage 15
Trans World Airlines Flight 800 poly X 1971
United Airlines Flight 811 had poly X 1970

: Before # 51 it was Mil-W-81044/6, radiation crosslinked polyalkene inner with a Kynar jacket. Over rated in temperature rating, cut-thru, and scrape abrasion resistance.

OK Pan Am 103 had Mil-W81044/6, thanks.

Cross-linked Tefzel is flammable, smoky (97% smoke obscurity rating), and toxic. It should be rated at 150 C but was given 200 C rating to compete with Kapton. The FAA has deemed it flammable, yet Boeing continues to use it on new twin aisle aircraft.

What does TKT stand for?

What does 'crosslinked' mean?

Do all of the suspect aircraft have Switch S2, which was implicated in the United Airlines Flight 811 accident? Below had data on that event.

What is BMS 13-42?

I need to know what type of wiring for these planes:

China Airlines Flight 611 Tefzel 1979
Air India Flight 182 Tefzel 1978
United Airlines Flight 811 Poly X 1970
Pan Am Flight 103 Mil-W81044/6 1970
Trans World Airlines Flight 800 Poly X 1971
China Airlines crash at Wanli unknown manufacture date.
El Al Amsterdam Plane delivered in 1979 Tefzel

Cheers,
Barry

John Barry Smith
(831) 659 3552
541 Country Club Drive,
Carmel Valley, CA 93924
www.corazon.com
barry@corazon.com

December 29, 1991, Boeing 747-2R7 China Airlines (Taiwan) Freighter, five on board, all killed. Wanli; near (Taiwan) Aircraft reported two starboard engines lost and crashed shortly after takeoff.

October 4, 1992, Boeing 747-258F El Al (Israel) Four on board, all killed and 47 on the ground Amsterdam (Netherlands) Aircraft crashed shortly after takeoff.

TKT is being used on single aisle. Politics and money is the justification given to me by a Boeing representative as to why they are a house divided on wire types. In 1978 it was only used in non-pressurized areas, because NASA found it could explode in oxygen enriched areas (i.e. cargo bay area). When it was resurrected in 1993 after the Kapton crunch, it was put in all areas of the aircraft. At rated temperature you could remove it with your thumbnail. It is prone to 360 degree cracking when nicked.

It is definitely not Poly-X wiring however these wires were all made by raychem Corp. They would take material that Dupont threw away, crosslink it and get a patent. They would then sell it to the military and get a specification written for it. They would then sell it to Boeing/McDonnell-Douglas as having military approval.
I agree wiring does worse things then start fires.

See below for Bournemouth 737 urine/water in yaw damper episode.

I believe it is responsible for all of the uncommanded inputs to the rudder servo actuators via the yaw dampeners on the A300.

1.16.2.2 After Recovery of the Door Switches--General
The cargo door was recovered with all of its position sensing switches installed in their proper locations. The electrical junction box was found attached to the door but damaged. The switches recovered and examined were: S2 Master Latch Lock; S3 Door Warning; S4 Latch Close; S5 Hook Position; S6 Fwd Mid-Span Latch Open; S7 Door Close; S8 Hook Close; and S9 Aft Mid-Span Latch Open. Figure 17 provides a diagram of the cargo door's electrical circuitry.

Five of the eight position-sensing switches installed on the door had evidence of external damage to the switch housing. The damage on four switches (S2,S3,S4,S8) consisted of primarily compression dimpling on the housing. The S5 switch exhibited mechanical impact damage on the switch housing and mounting bracket. The striker assembly for switch S8 was loose (2 of 3 rivet fasteners sheared). The electrical wiring recovered with the door exhibited signs of tensile separation from overload at all failure points examined.

Each switch was photographed and its installed position was documented. Electrical continuity readings were taken with an ohmmeter across the poles of each switch at the first point of
wire separation as found on the door. After the readings were recorded, all switches were removed from the door so that photographs and x-rays of each switch could be taken. Electrical continuity readings were retaken. Disassembly of each switch consisted of: (1) drilling two holes in the switch housing to release trapped water from the switch (2) cutting a small window in the switch housing to examine the internal basic switches (3) removing the housing, (4) removing the internal bracket, and (5) removing basic switch covers. During the drilling step, water was released from every switch when the holes were drilled in the switch housing. The water was filtered into a glass container. The quantity was not measured but appeared to be less than 5 mL. The residue from the filtered water trapped on the filter media had a blue-green color. After the switch housing was removed, an ohmmeter was connected across the 1-2 poles of the switches that would not transfer electrical continuity (S2,S3,S4,S6,S7) when actuated. The rivets were then drilled out of the internal bracket. After the last of the two rivets were drilled out, the switch contacts transferred to the other pole on S2, S3, and S4. On S6, the used basic switch was held closed by its plunger. S7 transferred after the switch housing and water inside were removed. During removal of the basic switch covers, a trend was noted in the discoloration of some of the basic switches. The used switch had a reddish-brown coloration. The unused switch was not discolored. Each switch was found to be wired correctly to its poles and through its contacts within the basic switches. All contacts operated with light finger pressure after removal of the basic switch covers. There was no evidence of pitting, excessive corrosion, or heat distress in the contacts of any of the switches. The following sections detail pertinent observations concerning
each switch.
The S2 master latch lock is given particular significance because of its function to protect against inadvertent door operation and is thus described in more detail. It is a single-pole double-throw (SPDT) switch used to sense the unlocked position of the door lock sectors. The switch is mounted in the aft lower corner of the door. A bracket attached to the No. 7 lock sector depresses the switch when the door lock sectors are rotated to their unlocked position. When the bracket attached to the lock sector contacts the switch plunger and depresses it, the circuit path through the switch is closed and 28VDC electrical control power to the door is established. When the force on the plunger is relaxed, the circuit is opened and 28VDC electrical control circuit is removed.
The wires leading to the S2 switch had been cut by the team after the recovery in an attempt to test continuity through the switch. The door recovery team reported that it found continuity through the 1-3 contacts but not through the 1-2 contacts. The switch plunger was actuated by the recovery team. The recovery team noted that the switch did not transfer continuity during these tests. The operation of the switch plunger would normally transfer continuity. Subsequent detailed examination of the S2 switch confirmed the findings of the recovery team.
The area around the upper face of the internal bracket was bent toward the basic switches and had evidence of corrosion residue. The bracket was found broken. The switch contacts transferred from the 1-3 actuated position to the 1-2 nonactuated position when the bracket was removed. Scanning electron microscope examination of the fracture surfaces revealed evidence of overload and corrosion.
The external switch housing was dented. The final examination performed on the switch consisted of removing the plastic covers on the basic switches. Prior to removal of the basic switch
covers, it was noted that the cover to the used basic switch was cracked. The contacts functioned normally when exercised by light finger pressure. Microscopic examination revealed a black discoloration near one of the lower contact posts of the used basic switch. Energy dispersive spectrometric examination of the residue disclosed the presence of gold, iron, magnesium, sodium, and chlorine. No mechanical or electrical anomalies were detected with the basic switch contacts.

Additional testing was performed by Boeing on switches of a similar design to those used on the accident airplane's cargo door. The testing was conducted to identify conditions that would result from salt water immersion at a pressure depth of 14,200 feet for 18 months. The testing verified that external damage to the switch housing occurred at pressure depths of 7,000 feet and greater. Switch seal leakage and subsequent internal corrosion was also noted. None of the testing performed by Boeing duplicated internal switch damage that caused basic switch contact closure or internal damage to the switch support bracket.

Wiring:
The electrical wiring recovered with the cargo door was documented in place before being removed for further tests. About 40 percent or 112 feet of wire from the original length of approximately 274 feet was recovered and examined. Of this amount, about 46 feet of wire installed in the aircraft forward of the cargo door was not examined. Most of the wires leading from the door to the fuselage were not recovered. There was no visible external evidence of burning, arcing, or heat distress in any of the wires removed. Several areas of wire insulation damage were found.

Thirty five wires were identified that could provide a possible short circuit path that could drive the latch actuator open with or without failures of other door electrical components if the ground
handling bus was energized. The wires were schematically coded by function. Wires coded (-..-..-) were denoted for wiring that provides open command logic to the latch actuator. Wires coded (--.--.--.) were denoted for additional wiring enabled by an activated (failed) S2 switch. Wires coded (-o-o-o-o) were denoted for wiring providing 28VDC power from the C285 circuit.

Potential short circuit paths were identified for the cargo door that could provide 28VDC to the latch actuator control circuit relay. These potential short circuit paths can cause the latch actuator to drive the latches toward their open position if 115VAC power is available to the latch actuator motor. The potential short circuit paths include two bare wires shorting against each other, bare wire-to-metal structure-to-bare wire contact, wire to conductive fluid (such as water) to wire, or a combination of the aforementioned. Conductive contact of (-o-o-o-o) or (--.--.--.) coded wire with (-..-..-) coded wire could potentially result in providing a 28VDC circuit path to the latch actuator open circuit. Direct wire-to-wire paths are coded in Figure 17 as defined above. The two-wire short circuit paths are identified as wire pairs consisting of wire 101-20 shorting with any of the following wires: 108-20, 121-20, 122-20, 124-20, 135-20, or 136-20. If the S2 master latch lock switch fails in the "Not Locked" position, there are additional wire pairs that provide short circuit paths. These are coded in Figure 17 as (--.--.--.) to (-..-..-) wire pairs.

Short Circuit Wire Damage Simulation Tests:
Tests were conducted by Boeing and United to simulate typical examples of bare wire short circuiting to determine the extent of visible wire damage that would be expected in the 28VDC cargo door control circuit. United performed tests on BMS 13-42 wire, the wire type used in
the B-747 cargo door control circuit. Visible electrical short circuit damage on bare BMS 13-42 wire surfaces was difficult to create at 28VDC. Surface damage was considered visible when detected by microscopic examination at 15X magnification. United testing simulated the relay coil resistance variations that would be found during typical in-service conditions. A current of 1.0 A at 28VDC created visible surface damage on momentary bare wire-to-bare wire contact. Multiple contacts at 1.0 A provided a more positive indication. A single momentary contact between two bare BMS 13-42 wires with 0.160 A at 28VDC did not create visible surface damage. Contact between a BMS 13-42 bare wire and Alclad 2024-T3 metal (airplane and cargo door structure) with 0.160A at 28VDC did not create visible surface damage. Boeing performed wire tests on BMS 13-48 20 gauge wire. The test setup used the MS27418-2B door latch actuator control relay in parallel with the 60B00311-2 door restraint solenoid, the actual electrical loads used in the B-747 cargo door latch actuator control circuit. A single momentary contact of a bare 28VDC power wire, with a bare wire connecting to the relay of the solenoid, showed small pithead area developed at the point of wire contact that was visible without magnification.

Wire Examination Procedure:
All of the recovered wires were examined in the Safety Board's Materials Laboratory on a mylar sheet to simulate their installed positions. Labels were used to identify the coded wires using the manufacturer's original wire identification numbers imprinted on each wire's insulation. Wire pairs for direct electrical short circuiting were located in two common wire bundles installed on the cargo door. One common wire bundle was associated with the P3 plug connector, the other with the P4 plug junction box. The wire bundles were examined visually for areas of obvious insulation damage. Each individual wire was also examined with
a stereo-microscope. Representative wire damage features were photographed.

Wire Damage Found:
Seven wires numbered 101-20, 102-20, 105-20, 107-20, 108-20, 122-20, and 135-20 had visible damage located near a 3.8 inch position as measured from the P3 plug pin tips. This common position on the wire corresponds to a 360-degree loop in the wire bundle, which is located immediately below the junction box. Figures 18 and 19 show typical wire damage. Wire 122-20 had an open insulation area approximately 0.25 inch long. The other four wires had flattened insulation damage areas.

In the P4 plug connector wire bundle, three wires displayed insulation damage. Wires 113-20, 121-20, and 124-20 had transverse insulation nicks, which exposed bare conductors. All three had insulation nicks 3 inches from the P4 plug pin tips; wires 121-20 and 124-20 had additional insulation nicks 34 inches from the plug pin tips. The two P4 insulation damage locations corresponded to wire bundle clamp positions.

http://www.open.gov.uk/aaib/gbgji.htm
Air Accidents Investigation Branch

Aircraft Incident Report No: 1/98 (EW/C95/10/4)

Report on the incident to Boeing 737-236 Advanced, G-BGJI 15 nm north-west of Bournemouth International Airport on 22 October 1995

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Appendix 9 - Aircraft manufacturer's Operational Bulletin

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Registered Owner: British Airways PLC
Operator: British Airways PLC
Aircraft Type:
Boeing 737-236 Advanced

Nationality: British

Registration: G-BGJI

Place of Incident: 15 nm north-west of Bournemouth International Airport

Latitude: 50° 55.72' North
Longitude: 002° 12.55' East

Date and Time: 22 October 1995 at 1609 hrs
All times in this report are UTC

Synopsis

The incident was notified promptly to the Air Accidents Investigation Branch (AAIB) by the operator and the investigation began that evening. The AAIB team comprised Mr D F King (Investigator-in-Charge), Mr P D Gilmartin (Operations), Mr C G Pollard (Engineering), Mr S W Moss (Engineering), Mr A N Cable (Engineering) Ms A Evans (Flight Recorders).

The crew reported at 1330 hrs at Gatwick to carry out a post-heavy maintenance check, test flight on the aircraft. The first officer (F/O) completed the external check, while
the commander completed the 'Flight Deck Preparation' items of the aircraft checklist. A Standby (STBY) Rudder system check was carried out with no abnormalities noted and during taxi before take-off, the Yaw Damper indicator showed normal response to turns.

When the aircraft was in straight and level flight at FL200 with an indicated airspeed of 290 kt, Autopilot and Autothrottle engaged and Yaw Damper ON, the aircraft experienced roll/yaw oscillations. The Flight Data Recorder (FDR) showed that the Autopilot and Autothrottle were disengaged, and the commander reported that the Yaw Damper was switched OFF but the crew were unable to stop the oscillations. A MAYDAY call was broadcast at 1609 hrs. The crew had the impression that the bank angle would have continued to increase had opposite roll control inputs not been applied.

A descent was made to around FL75 and as the airspeed was allowed to reduce towards 250 kt the oscillations began to decay rapidly and stopped. The total duration of the roll/yaw event was about seven minutes.

A low speed handling check was carried out, and it was found that the aircraft handled well at a speed 150 kt, with Flap 15 selected and with the landing gear down. It was decided to return to London Gatwick
Airport in this configuration, and the MAYDAY was downgraded to a PAN. The crew recovered the aircraft to Gatwick without further incident.

The investigation identified the following causal factors:

(i) Contamination of the connector on the Yaw Damper Coupler, in the Electronic and Equipment Bay, by an unidentified fluid had occurred at some time prior to the incident flight and compromised the function of its pin to pin insulation.

(ii) Sufficiently conductive contaminant paths between certain adjacent pins had affected the phase and magnitude of the signals transmitted to the Yaw Damper Actuator, thereby stimulating a forced Dutch Roll mode of the aircraft.

(iii) The location of the Electronic and Equipment (E&E) Bay, beneath the cabin floor in the area of the aircraft doors, galleys and toilets made it vulnerable to fluid ingress from a variety of sources.

(iv)
The crew actions immediately following the onset of the Dutch Roll oscillations did not result in the disengagement of the malfunctioning Yaw Damper system.

Four safety recommendations were made.

1 Factual information

1.1 History of the flight

1.1.1 Pre-flight checks

The crew reported at 1330 hrs at Gatwick to carry out a post-P6 maintenance check (参1.6.6.1) test flight on the aircraft. The first officer (F/O) completed the external check, while the commander completed the 'Flight Deck Preparation' items of the aircraft checklist. The fuel load was 10,500 kg, with about 2,000 kg in the centre tank. Neither wing tank was full, with the right wing containing more fuel than the left because of earlier ground running of the engines and the Auxiliary Power Unit (APU).

As the APU was not available, due to the unserviceability of its fire detection system which was damaged during final closure of its cover panels, a ground air start was made on both engines. A Standby
(STBY) Rudder system check was carried out with no abnormalities noted. The take-off configuration warning check was carried out which entailed selecting Flap 25°. During this selection there was a momentary double hydraulic 'A' system low pressure warning, indicating failure of the output from both engine driven pumps, but this quickly cleared and did not repeat itself.

During taxi before take-off, the Yaw Damper indicator showed normal response to turns.

1.1.2 Incident flight

The commander was the handling pilot when, at about 1555 hrs, the take-off was made from Runway 26L with full power and Flap 1° selected. After take-off, the aircraft was found to be out of trim laterally, needing left rudder and left aileron trims to achieve wings level flight. The crew assessed this to be due to the fuel imbalance. The crossfeed was opened, and fuel was used from the right wing tank until lateral balance was achieved. The fuel system was then returned to normal and the flight controls then felt normal until the incident occurred. The remainder of the flight until the recovery to Gatwick was conducted in an area between the Southampton VOR and Boscombe Down Airfield.

The pressurisation system was put in Standby (STBY)
mode, with a cabin altitude of 4,000 feet set and the rate selector set to high rate. A climb was then carried out in stages to FL200. Handling was transferred to the F/O, Autopilot B was engaged in Command (CMD) mode and the Autothrottle engaged. The STBY cabin altitude was reset to 13,990 feet to check the passenger oxygen mask automatic deployment system, in accordance with the test schedule.

A Spoiler Isolation/upfloat check was also carried out, which involved selecting the Speedbrake to the 'Flight' detent, then operating the Spoiler A and B switches to OFF. The commander went into the cabin to visually check the spoiler upfloat. The left outboard spoiler trailing edge was approximately 3 inches up, all others were about 2 inches up. The ground spoilers were fully retracted. The commander returned to the flight deck, reset the Speedbrake lever to down and reset the Spoiler switches to ON. This was carried out less than two minutes prior to the start of the incident.

The crew attention then turned to the cabin altitude, which was climbing as required by the test schedule. Both pilots donned their oxygen masks as the cabin altitude passed through 10,000 feet and the cabin altitude horn began to sound. (Note: after the incident, it was found that the passenger masks had not deployed, indicating that the cabin altitude had remained below the nominal 14,000 feet activation altitude)
The aircraft was heading 270°M at FL200 with an indicated airspeed of 290 kt, Autopilot B in CMD mode, Autothrottle engaged and Yaw Damper ON. The aircraft started to roll, which was initially countered by the Autopilot applying opposite roll control. The aircraft then began to oscillate in roll, and oscillatory activity was noted on the Yaw Damper indicator. On instructions from the commander the F/O disconnected the Autopilot and Autothrottle and attempted to stop the roll oscillations using control wheel inputs. The timing of these actions was confirmed by the FDR. The commander recalled switching OFF the Yaw Damper at this time in accordance with Flight Crew Notice FCN 38/95, issued in August of 1995. This FCN, issued by the commander in his capacity as Flight Manager Boeing 737 (Technical Projects), reflected the revised Boeing procedure for Uncommanded Yaw or Roll (Appendix 9). The commander then took control and continued to use control wheel inputs in an effort to stop the rolling. He also decided to initiate an immediate descent so that crew oxygen was no longer a consideration and requested the F/O to retard the thrust levers.

A MAYDAY call was broadcast at 1609 hrs. In response, Air Traffic Control (ATC) offered radar vectors to the nearest airport, which was initially a left turn onto 170°M. The commander was reluctant to apply too much bank in order to turn as the roll excursions would have resulted in too steep a bank angle at the
extremity of the oscillations. The crew had the impression that the bank angle would have continued to increase had opposite roll control inputs not been applied.

A descent was made to around FL75, with the airspeed maintained at 290 kt or greater. During the descent, control was passed between the pilots, with no change in the oscillations. A further change of handling pilot occurred when the crew oxygen masks were removed, again with no noticeable change in aircraft behaviour. Neither pilot could recall any movement of the rudder pedals and no deliberate rudder pedal inputs were made by the crew. Some power was re? applied once the aircraft had levelled off, and the airspeed was allowed to decay towards 250 kt. As the aircraft approached this speed, the oscillations began to decay rapidly and stopped. The total duration of the roll/yaw event was about seven minutes.

After the oscillations had stopped, the F/O went back into the cabin to check for any abnormalities on the wings but found none. A low speed handling check was carried out, and it was found that the aircraft handled well at a speed 150 kt with Flap 15? selected and with the landing gear down. It was decided to return to London Gatwick Airport in this configuration, and the MAYDAY was downgraded to a PAN. The weather at Gatwick for the landing was surface wind southerly at 5 kt, CAVOK and Runway 08R was in use. The
crew considered that the most appropriate checklist for landing in a Flap 15¡ configuration was the One Engine Inoperative Descent/Approach/Landing checklist, which was actioned.

On checking the Master Caution Recall in the Landing Checklist, the commander noted that the amber FLT CTL caption was illuminated. On checking he saw that the Yaw Damper OFF amber light was illuminated and he switched the system back ON. However, on final approach, at about 3,000 feet, he felt that there may have been a small roll/yaw oscillation commencing. He therefore switched OFF the Yaw Damper, and continued the approach for an uneventful landing at 1644 hrs.

On reaching the maintenance hangar the circuit breaker for the Cockpit Voice Recorder (CVR) was 'pulled', but due to the 30 minute duration of the CVR tape the period of the incident had been erased.

Following the event the crew recalled that, during the initial climb out, a layer of cloud had been encountered between 3,000 and 4,000 feet, thickness about 500 feet, but the total temperature was in excess of +10¡C at that time. There was no cloud above this and no icing was encountered. At the time of the incident, it was daylight, in clear air, no turbulence and with a good horizon above a general overcast.
During debriefing the crew reported that the oscillations were similar to Dutch Roll, with a period of about 2 to 3 seconds. The roll control felt normal to apply, with no signs of any mechanical reversion. There were no indications of any abnormalities associated with the hydraulic systems throughout the flight. The characteristics of the oscillations did not appear to change when the Autopilot was disengaged.

Following an initial examination of the aircraft (§1.12.1-2), a test flight (§1.16.2) was carried out on 10 November 1995. With additional recording equipment installed on the aircraft attempts were made to reproduce the roll/yaw oscillations.

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1.2 Injuries to persons

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1.3 Damage to aircraft

A small panel, the left wing fuel booster pump access panel, was found to be missing after the incident flight.

1.4 Other damage

None.

1.5 Personnel information

1.5.1

Commander: Male, aged 44 years
Licence: Airline Transport Pilot's
Aircraft ratings: Boeing 737, Viscount, Beech 55/58
Medical certificate: Class 1, Renewed 26 September 1995
Instrument rating:
Other Ratings: Instrument Rating Examiner
             Type Rating Examiner -
Boeing 737 CAA Approved C of A Test
Pilot
Last base check: 12 October 1995
Last line check: 20 October 1995
Flying experience:
    Total all Types: - 8,290 hours
    Total on Boeing 737: - 5,500 hours
Duty time: 2 hours 39 minutes
Previous rest: In excess of 24 hours
1.5.2
First officer: Male, aged 44 years
Licence: Airline Transport Pilot's Licence
Aircraft ratings: Boeing 737, Vanguard,
Beech 55/58
Other ratings: Instrument Rating Examiner
Boeing 737

Medical certificate: Class 1, Renewed 27 July 1995

Instrument rating: Renewed 3 November 1994

Last base check: 29 March 1995

Last line check: 18 December 1994

Flying experience:
- Total all Types: - 8,600 hours
- Total on Boeing 737: - 6,000 hours

Duty time: 2 hours 39 minutes

Previous rest: In excess of 24 hours

1.6 Aircraft information

1.6.1

Leading particulars
Type: Boeing 737-236 Advanced
Constructor's number: 22030
Date of manufacture:
1980

Certificate of registration:
British Airways, 5

September 1983
Certificate of airworthiness:
issued 3 October 1995

Total airframe hours:
37,871 hours (20,267 landings)

Engines:
2 Pratt & Whitney JT8D-15 turbofan

Maximum weight authorised for take-off:
52,750 kg

Actual take-off weight:
39,376 kg

Estimated weight at time of incident:
38,300 kg

Estimated fuel remaining at time of incident:
9,300 kg

Centre of gravity (CG) at time of incident:
205 inches AoD (Within limits)
1.6.2 Dutch Roll

The Dutch Roll lateral-directional interaction mode is a coupled banking, sideslipping and yawing motion. It is often oscillatory, and when lightly damped creates control difficulties for pilots and discomfort for passengers. The Dutch Roll motion can begin with a yawing motion produced by a gust or a rudder input or with a rolling motion, which in turn results in adverse yaw. If the aircraft is designed with positive directional stability the fin tends to re-align the aircraft into the airflow when the temporary yawing moment stops. However, the nose does not return to a position of zero sideslip but tends to overshoot, setting up the cyclic roll/yaw motion of Dutch Roll. The degree of dihedral and wing sweep dictate the lateral qualities and the fin and rudder size influence the directional qualities. If the oscillation is positively stable the roll and yaw amplitudes reduce over successive oscillations and eventually damp out.

The Boeing 737 has natural positive damping in the Dutch Roll mode, (i.e. the motions reduce in amplitude with each cycle), and therefore meets the airworthiness requirements for lateral-directional oscillations without the need for an active Dutch Roll (yaw) damping system. Nevertheless, a Yaw Damper is fitted, which, although not required for flight dispatch, is provided to improve passenger comfort.
by more quickly damping the Dutch Roll oscillations. To provide active Dutch Roll damping, a rate gyro in the Yaw Damper Coupler senses yaw motion and feeds a signal to the Yaw Damper Actuator in the rudder Power Control Unit (PCU), to oppose the yaw. The period of the basic aircraft Dutch Roll oscillation for the Boeing 737 without Yaw Damping varies with airspeed, reducing from just over 4 seconds at 200 kt to 3 seconds at 280 kt (about 0.25 to 0.33 Hz).

1.6.3 Description of the Yaw Damper system (Appendix 1)

As described in § 1.6.2, the Boeing 737 series of aircraft have positive lateral directional stability but the aircraft still have a tendency to 'Dutch Roll' when disturbed, although the oscillations damp-out over a period of time. The aircraft are fitted with a Yaw Damper system which moves the rudder, with limited authority, to oppose such oscillations. Since it is not essential to the controllability of the aircraft, the system is simplex and powered by the 'B' hydraulic system. It should be noted that the Yaw Damper is independent of the Autopilot, since the latter has no input into the rudder control.

The principal components of the Yaw Damper system are the Yaw Damper Coupler located in the E&E Bay and the Yaw Damper Actuator which is part of the main rudder PCU. The Yaw Damper Coupler contains a rate gyro which senses lateral oscillations and,
where these are of a frequency corresponding to the aircraft's natural Dutch Roll, a signal is output to the actuator to oppose the motion.

The Yaw Damper Actuator receives the electrical signals from the Yaw Damper Coupler which modulate an electro-hydraulic valve which ports hydraulic fluid to the appropriate ends of the actuator piston. Movement of this piston is mechanically linked to the input mechanism of the main PCU, which moves to command rudder movement. Rudder response is monitored by a Linear Variable Displacement Transducer (LVDT) and a feedback position signal is transmitted back to the Yaw Damper Coupler. The geometry of the linkage is such that the Yaw Damper authority is limited to $\pm 3^\circ$ of rudder movement on this Boeing 737-200. Yaw Damper motion is not transmitted back to the pilot through the rudder pedals. A small indicator in the cockpit advises the pilot of any Yaw Damper activity.

1.6.4 Activation of the Yaw Damper system

The pilot can select the Yaw Damper ON and OFF using an engage switch on the flight deck overhead panel. Appendix 1 shows the layout of the Flight Control panel in the cockpit overhead (Figure 1) and a highly simplified electrical schematic diagram (Figure 2) which shows only those circuits involved in effecting engagement of the Yaw Damper system. All the major
electrical circuits affecting the operation of the Yaw Damper system are supplied from dedicated 28V dc and 115V ac circuit breakers. As depicted in the schematic, the Yaw Damper is switched OFF but the B Flight Control switch is in the normal, guarded, ON position.

For the system to become active, the Yaw Damper Actuator has to be supplied with hydraulic power via a solenoid-controlled hydraulic shut-off valve (SOV). This solenoid opens the valve when it receives a 28V dc supply from the Yaw Damper engage switch on the Flight Controls panel, via contacts in the k12 relay which is in the Autopilot Accessory Unit. The solenoid of relay k12 is supplied with 28V dc from the Yaw Damper Coupler (pin 12 of Connector D295), provided that a logic circuit within the coupler senses that 115V ac is available at pin 2, and that 28V dc has been applied to pin 14 of D295 from the Yaw Damper engage switch. D295 is the connector joining the Yaw Damper Coupler to the aircraft wiring. The solenoid of k12 relay is earthed through the time delay circuits within the Autopilot Accessory Unit, which cause this relay to operate 2 seconds after the engage switch is operated.

When relay k12 is energised, three sets of contacts relevant to the Yaw Damper system, annotated a, b, & c on the schematic, are switched. When switched ON, the contact 'a' supplies 28V dc to a number of
additional circuits in the Yaw Damper Coupler; contact 'b' supplies the 28V dc from the Yaw Damper switch to the SOV solenoid (as above); contact 'c' breaks an earth path for the 'Yaw Damper' light on the Flight Control panel and extinguishes the light which, when illuminated, indicates that the Yaw Damper is not in operation.

The Yaw Damper switch is spring loaded to the OFF position and is held ON electro-magnetically. The hold on solenoid is permanently connected to the 28V dc supply to the switch and takes its earth from the Yaw Damper interrupter circuits in the Autopilot Accessory Unit. This earth is routed via a set of contacts in the B Flight Control switch. When the Yaw Damper switch is in the OFF position, the terminal which supplies 28V dc power to the actuator SOV is earthed.

1.6.5 Description of the E&E Bay

The E&E Bay on the Boeing 737 contains avionics equipment including the Yaw Damper Coupler. It is an area of the lower fuselage below the passenger floor and extends from the nosewheel bay aft bulkhead to the forward face of the forward cargo bay (stations 304.5 to 378.9). On the Boeing 737-200 most of the equipment is mounted in three racks labelled E1, E2 and E3 (Appendix 2) with three or four shelves in each rack. These are labelled -1, -2, -3 etc from the top, so
that the upper shelf of rack E1, for example, is designated E1-1. In general, each individual avionic unit is designed for rapid removal from or refitting to its location in the rack. This is achieved by mounting it in a tray equipped with a multi-pin socket so that, as it is slid into engagement in the tray, a mating plug in the back of the unit connects with the socket. The unit is then locked in place with quick-release fasteners at the front.

The trays and racks themselves are commonly removed during major maintenance and thus a further connection is required to interface with the main aircraft wiring looms which are not routinely disturbed for avionics component removal. This is achieved by a series of rack disconnect connectors which are mostly located behind the relevant rack and are sealed against moisture ingress. It should be noted that this is not the case with the unit/tray plug-and-socket arrangement described above.

On the Boeing 737 (and indeed other types of aircraft) the location of the E&E Bay is directly underneath the forward left passenger door vestibule area. With the cabin configuration used on G-BGJI, the galley and forward toilet areas are also above the forward end of the bay, but generally outboard of the equipment racks themselves. G-BGJI was equipped with hydraulically actuated airstairs below the forward left door. As the stairs were retracted, they were stowed in the
E&E Bay between racks E1 and E2 and E3 (Appendix 2). Although not directly above the racks, the airstairs are an obvious potential source of moisture ingress into the bay. A fibreglass drip-tray was fitted under the full length of the retracted stairs, with an overboard drain tube to dispose of any water brought into the bay by this route. An early modification further introduced a rubberised fabric 'shroud' which clipped on to the top forward lip of the drip tray and was stretched forward over the E1 rack to attach to the nosewheel bay aft bulkhead, thus forming a moisture barrier over the bay in this area. The fall on the shroud was such that fluid leakage from above should run down the shroud and into the drip-tray.

In addition to the shroud, other measures were taken to prevent fluid spilt above the floor from dripping into the E&E Bay area, principally concerned with sealing the floor panels and toilet/galley areas. Procedures are laid-down in the Boeing Maintenance Manual for these measures but many operators adapt them according to their own custom and practice, and to use locally available materials.

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1.6.6 Maintenance history

1.6.6.1 P6 inspection
Immediately prior to the incident flight, a major inspection of G-BGJI had been completed, known as a 'P6 Check' in the operator's Maintenance Schedule. It is scheduled every 5 calendar years or 11,200 hours flying time, whichever occurs first, and typically takes about 30 days to accomplish. One of the major objectives of the check is to inspect the structure for corrosion or other defects and to achieve this requires extensive dismantling of the airframe and systems. The individual elements of the check are too numerous to mention in this report, which will concentrate on the activity surrounding the E&E Bay area and the rudder/Yaw Damper system.

Prior to entering the hangar, the aircraft was washed externally and the toilet and potable water systems drained. Early in the check itself, the toilet and galley components were removed from the aircraft. The floor panels were also removed and several required renewal, as is quite usual for an aircraft of this age.

The airstairs and drip-tray were removed from the E&E Bay as were the avionics racks, the individual avionics units being stored on covered shelving alongside the aircraft awaiting refitment. All soundproofing bags were removed and, having gained access to the basic fuselage structure, the area was given a high-pressure wash of water and detergent. To achieve this it was necessary to protect the rack disconnect connectors which, apart from the looms themselves, were
the only electrical components of the E&E Bay remaining in the aircraft. Plastic bags were taped around the connectors in an attempt to guard against contamination by the cleaning process.

Visual inspection of the structure was carried out and evidence from the technical records along with the recollections of the individuals involved indicated that the degree of corrosion found and rectified was typical of any aircraft on such a check. There were no indications of any abnormalities which may have indicated heavy fluid contamination. Evidence of dried blue fluid (toilet sanitising fluid) contamination was noted on the floor structure under the toilet but again this was considered commonplace. AAIB examination of several similar aircraft after a few years post-check service confirmed this to be so.

Upon completion of the structural inspection, the E&E Bay was re-assembled and the avionics units re-fitted. The records show that no relevant units required rectification or replacement and thus the ones removed were re-installed. As the aircraft approached completion, when electrical and hydraulic power were re-applied, every system on the aircraft was subjected to a full function test since every system had been disturbed during the check. In the case of the Yaw Damper system this included a Built-in Test Equipment (BITE) check on the Yaw Damper Coupler. No malfunctions were found. The main rudder PCU
had been replaced by a unit modified to Boeing SB 737-27-1185 (Rudder PCU - Replacement of the Dual Servo Valve) but in all other respects the rudder/Yaw Damper system components were the same as those fitted prior to the P6 maintenance check.

1.6.6.2 Technical Logs

The Technical Log for the aircraft was examined for evidence of any Yaw Damper problems reported by crews since February 1995 up to the P6 check. Although the Log revealed a very large number of repetitive defects affecting system 'B' Autopilot over the period, there were no entries for the Yaw Damper system. Later, the Technical Log and the Cabin Log were examined for entries which might suggest that significant fluid spillage may have occurred in the forward toilet/galley area over the same period. Only one entry was found, dated 5 March 1995, in which the cabin crew reported:

"Fwd galley floor area wet, no spillages reported. Please check for leaks."

The Action Taken column reported:

"Slight leak traced to toilet sink drain seeping under floor & wetting carpet. Drain fitting tightened, now no leak."

The technical records also showed that the aircraft had
departed on the incident flight with the APU inoperative because its fire detection system was unserviceable, the rear toilet servicing panel was 'speedtaped' shut and the forward toilet was not serviced. In addition there was some cosmetic furnishing work to complete in the passenger cabin and the airstairs drip-tray access and drain panel was not fitted. All the above was permissible in accordance with the operator's Despatch Deviation Manual.

It had been intended to charge the forward toilet for normal service which involved introducing an initial charge of one gallon of fresh water via the recharging point in the toilet servicing panel. However, it was found that the forward toilet tank would not retain the water due to a misrigged and therefore improperly seated dump valve. As there was some urgency in despatching the aircraft, the decision was taken to rectify the fault after the flight.

Such a fault would allow the water to flow into the 4 inch drain pipe shown in Appendix 2 and, assuming the outboard flap valve was closed, it would stay in the pipe. If the charging process was continued in this situation, the pipe would fill up and, in the presence of the improper sealing described in 1.12.4, fluid could run down the outside of the pipe and into the E&E Bay. However, the leaking dump valve was found early in the charging process and the quantity required to fill the pipe (estimated at about 5 gallons) was
never introduced. The toilet system was completely drained prior to the flight.

1.6.6.3 Yaw Damper Coupler history

The Yaw Damper Coupler, part number 4030952-902, serial number 79100850 was manufactured in 1979. Although the recorded history of the unit showed that it had been subject to removals since that time, the records suggested that these were to service other aircraft shortages and not for any unserviceability reasons. Indeed, there was no record of the unit ever having entered workshops since new, nor would there be any requirement for it to do so unless it was defective since the part is operated 'on condition'. Physical inspection internally also showed that the rate gyro, probably the most likely component to cause problems over a period of time, was in original condition and had not been subject to repair or overhaul.

1.7 Meteorological information

1.7.1 Incident flight

At the time of the incident a south to south-westerly airstream was established over the area. The visibility was greater than 20 km, with scattered cloud, base 2,500 feet. The mean sea level pressure was 1022 mb.
The winds/temperatures were:

<table>
<thead>
<tr>
<th>Height</th>
<th>Wind Direction</th>
<th>Wind Speed</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>180°</td>
<td>10 kt</td>
<td>+15°C</td>
</tr>
<tr>
<td>2,000 feet</td>
<td>240°</td>
<td>17 kt</td>
<td>+10°C</td>
</tr>
<tr>
<td>5,000 feet</td>
<td>220°</td>
<td>15 kt</td>
<td>+03°C</td>
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<tr>
<td>10,000 feet</td>
<td>230°</td>
<td>15 kt</td>
<td>+01°C</td>
</tr>
<tr>
<td>18,000 feet</td>
<td>230°</td>
<td>15 kt</td>
<td>-16°C</td>
</tr>
<tr>
<td>24,000 feet</td>
<td>230°</td>
<td>25 kt</td>
<td>-28°C</td>
</tr>
</tbody>
</table>

1.7.2 Test flight
The weather prevailing at the time of the test flight on 10 November 1995 was significantly worse than that on the day of the incident. A waving warm front was lying across the Boscombe Down area, moving slowly and erratically north-west. Occasional rain and drizzle was associated with the frontal zone, with surface visibility of 3 to 5 km. The mean sea level pressure was 1003 mb and the zero degree isotherm was at 6,300 feet. The cloud was broken, base 1,000 feet, tops 5,000 feet. Higher level overcast prevailed from 6,000 feet, tops 12,000 feet. There were further broken layers between 16,000 and 18,000 feet and between 21,000 and 24,000 feet. The winds/temperatures were:

<table>
<thead>
<tr>
<th>Height (feet)</th>
<th>Wind Speed (kt)</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000</td>
<td>160</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+01</td>
</tr>
<tr>
<td>10,000</td>
<td>195</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-05</td>
</tr>
<tr>
<td>18,000</td>
<td>195</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-22</td>
</tr>
<tr>
<td>24,000</td>
<td>200</td>
<td>53</td>
</tr>
</tbody>
</table>
Moderate icing and moderate turbulence were forecast in cloud.

1.8 Aids to navigation

Not relevant.

1.9 Communications

The crew was being provided with a Radar Advisory Service outside controlled airspace by London Military Radar on VHF frequency 128.7 MHz at the time of the incident. A recording of the radiotelephony transmissions was available for this investigation.

1.10 Aerodrome information

Not applicable

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1.11 Flight recorders

1.11.1 Flight Data Recorder

The aircraft was equipped with a Davall 1198 re-cycling wire, accident protected digital Flight Data Recorder
(FDR). This had a recording duration of 25 hours and was part of a Teledyne recording system. This system also incorporated a Quick Access Recorder (QAR) which recorded essentially the same information as the mandatory recorder onto a cassette. The FDR was replayed satisfactorily by the AAIB and the data checked with the readout from the QAR performed by the operator. There were some areas of invalid data on the FDR which were not evident on the QAR. A total of 27 analogue parameters plus 73 discrete parameters (events) were recorded.

Among the analogue parameters recorded were Pitch Attitude, Roll Attitude, Rudder Pedal Position (RPP), Control Position Pitch (CPP) and Control Position Roll (CPR). After the incident these parameters were calibrated and a number of anomalies were found. Roll Attitude had a datum error of approximately 4¡. The CPP was found to be indicating -4.4¡ throughout the incident but there were some indications during large movements of the control column, such as during the control checks, or at rotation. CPP was found to have been unserviceable on the flights prior to the incident for which recordings remained on the FDR. Other parameters checked were within calibration limits.

The RPP is measured by a position sensor on the rudder control system forward quadrant situated just below and aft of the pedals. This therefore only detects the pedal
movement from the pilots; there is no feedback to the pedals of the Yaw Damper movement. No recording is made on the FDR of the rudder surface position. The engagement of the Autopilot is recorded on the FDR, however the Yaw Damper engagement is not recorded.

1.11.2 Data timing

Data is acquired by the Digital Flight Data Acquisition Unit (DFDAU) in 0.125 second time slots, parameters acquired in the same time slot will be synchronised to within 0.125 seconds. Lateral Acceleration, CPR and RPP are all sampled 4 times a second, within the same time slot. Roll Attitude is only sampled twice per second, and is sampled 0.125 seconds after the first and third samples of the previous parameters.

The following table shows the relationship between the parameters:

<table>
<thead>
<tr>
<th>Timing Offset</th>
<th>0</th>
<th>0.125</th>
<th>0.25</th>
<th>0.375</th>
<th>0.5</th>
<th>0.675</th>
<th>0.75</th>
</tr>
</thead>
</table>

0.875
Normal Accel
2
10
18
26
34
42
50

58
Lateral Accel
15
31
47

63
Long Accel
28

60
Heading
3
CPR
16
32
48

64
Note: the numbers in the boxes above are the DFDR word slots for the parameters in the 64 word frame.

1.11.3 Cockpit Voice Recorder

The aircraft was equipped with a Fairchild model A100 recycling Cockpit Voice Recorder (CVR) which records the latest 30 minutes of audio information on four tracks. In
this case aircraft power had been re-applied to the aircraft after landing which allowed the CVR to continue to record, automatically erasing the recording of the incident and thus providing no useful information.

1.11.4 Data interpretation

Pre-flight control checks were carried out and the aircraft took off at 15:53 hrs and climbed normally to 20,000 feet. During the climb there were some small oscillations evident from the lateral acceleration record. These small oscillations occurred between 200 and 260 kt with a frequency of 0.26 Hz and varied in both magnitude, up to ±0.03g lateral acceleration, and duration. As such, they went unnoticed by the crew or were regarded as insignificant.

At 16:02:08, as the aircraft approached 20,000 feet at 288 kt on a heading of 270¡M, the crew began the spoiler upfloat check, identified from the Speedbrake lever being moved to the 'Flight Detent' position for approximately four minutes. The Autothrottle was already engaged and the 'B' Autopilot was engaged at the top of the climb. Intermittent small oscillations were still evident during the test. Figure 1 at Appendix 3 shows the data throughout the incident, from the movement of the Speedbrake lever to the 'Down' Position; Figure 2 at Appendix 3 shows an expanded plot of the initial part of the incident. Two
seconds after the Speedbrake lever was returned to the 'Down' position, at 16:06:28, there was a 2° CPR input to the right and there were coincident small lateral accelerations of ±0.018g with a frequency of 0.36 Hz at an airspeed of 294 kt. These small oscillations continued with varying amplitude for the next minute, with a slight rise in airspeed to 296 kt and did not cause any detectable roll movement.

At 16:07:35 there was a more significant lateral acceleration oscillation, frequency 0.35 Hz, and up to 0.06g which lasted for three cycles. This was accompanied by a roll of 3° left wing down, and an opposing CPR movement, from the Autopilot of -4.9° to 8.5° right wing down within two seconds. There was no further input of CPR during this initial oscillation. The amplitude of the lateral acceleration cycles increased, by approximately 0.04g per cycle, and reached a maximum in around 20 seconds. The Roll Attitude and CPR began to oscillate in opposition as the Autopilot tried to correct the roll of the aircraft. The Autopilot and Autothrottle were disconnected 15 seconds after the initial left roll, at 16:07:53 with the aircraft at 20,000 feet, 296 kt.

The large oscillations continued, with a frequency of 0.36 Hz, and a magnitude of around ±0.5g lateral acceleration, and ±15° roll around a varying datum with opposing CPR inputs of around ±30° from the pilot. After the Autopilot disconnect the airspeed initially
reduced to 277 kt. At 16:07:58 the engine power reduced from 1.48 to 1.11 Engine Pressure Ratio (EPR); the aircraft descended and airspeed increased to a maximum of 313 kt.

Ten seconds after the Autopilot disconnect there were some oscillations evident in the rudder pedal position, however the movement was only ±0.25¡ with the same frequency as the lateral acceleration. There were also oscillations in other parameters, including Pitch Attitude (up to ±1¡) and heading (±5¡ about a varying datum between 270¡ and 040¡M).

The aircraft levelled at 7,000 feet with an increase in EPR from 1.0 to 1.24/1.19 on Nos 1 and 2 engines respectively; and then decelerated through 275 kt when the oscillations began to damp out. Throughout the oscillations the aircraft was in a left turn, finally reaching a heading of 040¡. Figure 3 at Appendix 3 shows this data in expanded form; the oscillations lasted for over 7 minutes and finally disappeared at an airspeed of 250 kt.

After the large oscillations there were some minor, quickly damped oscillations in lateral acceleration of up to ±0.002g. At 16:17:52 flap was selected initially to 1¡ at a speed of 212 kt and then to 5¡ and 15¡ at airspeeds of 200 kt and 165 kt respectively. As the airspeed further reduced, 15 seconds after passing through 170 kt coincident with the scheduled Yaw Damper gain change,
there was a kick of 0.025g in lateral acceleration, followed by small oscillations lasting around 12 cycles. There were then some similar small oscillations with a magnitude of ±0.02g and frequency of 0.2 Hz, which occur periodically during the rest of the flight. The oscillations in lateral acceleration are accompanied by oscillations in roll of up to ±0.5¡. Figure 4 at Appendix 3 shows one of these oscillations which lasted for around a minute before damping out. At 16:45 the aircraft landed without incident, with a flap setting of 15¡ and a touchdown speed of 135 kt.

1.11.5 Quick Access Recorder data

The Quick Access Recorder (QAR) recorded essentially the same information as the mandatory recorder onto a readily removable cassette. The operator routinely removed and replayed the cassettes from the QAR; approximately two weeks of flying data from each aircraft having been kept as an archive. This archived QAR data was analysed for G-BGJI, consisting of 85 flights having taken place prior to the P6 check. On two separate flights on the 8 and 11 September, small oscillations were found; firstly at 36,000 feet between 240 to 245 kt there were intermittent oscillations of ±0.05g with a frequency of 0.35 Hz. On another separate flight one period of small oscillations was observed, damping out in 3 cycles, with a frequency of 0.4 Hz. No other significant oscillations were found on the
flights reviewed.

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1.12 Aircraft examination

1.12.1 General

Examination of the aircraft began on the evening of the incident flight. It had been impounded in a hangar at Gatwick Airport and had not been disturbed since that flight, other than by those actions necessary to tow it into the hangar.

1.12.2 Non-intrusive tests conducted between incident and test flight

Initial analysis of the recorded aircraft behaviour during the incident flight had indicated that the characteristics were most consistent with erroneous operation of the Yaw Damper system. Therefore, immediately after the incident had occurred, a policy decision was made not to disturb, by disconnection or disassembly, any of the aircraft systems which might have any influence on the operation of the Yaw Damper before a test flight was made. The object of the test flight was to attempt to induce the aberrant behaviour, with additional flight monitoring systems temporarily fitted. It was, however, decided to perform, together with functional tests, such isolation and
continuity testing as could be done within this stricture.

It was agreed that the examination would commence by subjecting the aircraft to practically every check in the Maintenance Manual of the flying control, Autopilot and Yaw Damper systems which could be achieved without breaking in to any systems (non-intrusive).

The airframe was inspected visually, including the E&E and landing gear bays, the angle-of-attack sensors and pitot probes. Nothing significant was found with the exception that the hydraulic oil quantity was approximately 1/8” below the FULL line on the sight gauge and the left wing fuel booster pump access panel was found to be missing.

The next stage involved a rigging check on all of the flying control surfaces and cables which could be accessed without extensive removal of panels. Some discrepancies were found relative to the Maintenance Manual requirements for both control surface rigging and cable tensions but there was nothing found which could have been responsible for the aircraft's aberrant behaviour during the incident flight. It was noted that, when the technicians attempted to check cable tensions, they found that nearly all their stock of tensiometers gave different readings. Some instruments were considerably at variance with others despite all being within their calibration dates. There was
no system at the operators engineering facility at Gatwick for checking the accuracy of tensiometers upon issue from stores.

The next phase involved full flying control, Autopilot and Yaw Damper function tests and BITE checks where appropriate. Although the Autopilot failed one of its parameter checks on the BITE test, analysis showed this could have had no effect which would explain the aircraft's behaviour. None of the wiring checks performed at this stage revealed any abnormalities.

Since the exhaustive series of checks generally had not revealed any significant defects or abnormalities, it was decided that the aircraft would be left in this condition for the next phase of testing, which was to be a pressurisation test of the aircraft in a simulated flight condition (§1.16.1). The minor defects remained unrectified and no rigging adjustments were made to the flying controls between the incident and test flights (§1.16.2).

In consultation with Boeing and the Civil Aviation Authority (CAA) and after analysis of the DFDR data from the incident flight, a series of structural checks were required, mainly concerned with the fin and rudder attachments, before the aircraft could be allocated a 'B' conditions certificate for the test flight. These checks did not reveal any damage or excessive clearances in the attachment fittings or structure.
1.12.3 Directional control system component examination

Following completion of the test flight and non-intrusive checks which had not revealed any significant abnormalities with the directional control system, the decision was taken to subject the individual components of the system and the associated wiring to function and strip examination as necessary. In addition, the three hydraulic system filter elements were removed from each system and, together with fluid samples, were despatched to an independent laboratory for analysis. The laboratory report did not indicate any abnormalities with either the fluid or filter elements associated with either system. The wiring checks are described in §1.12.5.

The components returned to their respective manufacturers for testing/examination under AAIB supervision were:

a  Yaw Damper Coupler
b  Rudder PCU
c  Standby Rudder PCU
d  Rudder Feel and Centring Unit
e  ...
Digital Air Data Computer (DADC)

In addition, the Autopilot Accessory Unit was examined in the AAIB laboratories.

1.12.3.1 The Yaw Damper Coupler

This unit was returned to the manufacturer, Honeywell and placed on their Automatic Test Equipment (ATE). Tested repeatedly at ambient conditions, these comprehensive tests did not reveal any significant defects in the unit. The Yaw Damper Coupler was also subjected to the same test regime but manually executed. It was then hot-soaked and tested on the ATE, again performing to specification. There was no facility for performing these checks under humid conditions, so this was not achieved.

The above tests were able to prove the serviceability of all the Yaw Damper Coupler circuitry but could not fully check the rate gyro which is incorporated in the unit. Accordingly, the unit was opened to remove and despatch the rate gyro to another facility for testing as an isolated component. It was at this point that apparent contamination/corrosion deposits were found on the back of the multi-pin connector inside the unit. This took the form of bluish-white powdery deposits around some of the wire-wrapped connections to the back of the pins (Appendix 4, Figure 1).
Closer inspection also showed evidence of light grey deposits on the outside of the connector shell (Figure 2). These observations, which pointed towards moisture impingement on the outside of the connector and subsequent ingress into the unit, were reinforced when the lower cover plate for the unit was examined and signs of dried fluid residue were seen on its inner face (Figure 3). There was, however, no sign of moisture on the outside of the black casing itself.

The decision was made to return the unit (minus the rate gyro) to the UK to embark on humidity and other tests described in §1.16.5. The rate gyro, when tested, proved to be in good serviceable condition.

1.12.3.2 Rudder PCU

The rudder PCU, incorporating the Yaw Damper Actuator, was tested at the unit manufacturer's facility on a rig used for acceptance tests on production and overhauled components. The rig essentially operates the PCU with hydraulic and electrical power connected and plots the response of the unit to mechanical (pilot) and electrical (Yaw Damper) inputs. The performance of the unit was satisfactory in all respects. Measurements were taken of the Yaw Damper solenoid pull-in voltage which were requested in connection with the testing described in §1.16.7.
1.12.3.3 Standby rudder PCU

This was examined at the Boeing Equipment Quality Analysis Laboratory in Seattle, USA under AAIB supervision. It passed an overhaul function test with only minor out-of-limits measurements in two areas. Strip examination showed no abnormalities apart from some scoring of the input lever bearing, the origin of which was not clear but did not appear to affect its operation.

1.12.3.4 Feel and Centring Unit

No evidence was found of failure, defect or malfunction of this unit. Functional testing did not reveal any abnormal behaviour although some excessive backlash in the system was identified, predominantly in the trim actuator. It was uncertain whether this was simply a feature which might be expected on a unit with some considerable time in service but was not considered to have been capable of precipitating the aberrant behaviour of the aircraft during the incident flight.

1.12.3.5 Digital Air Data Computer (DADC)

The DADC was initially tested at the Honeywell facility in Seattle, USA at the same time as the Yaw Damper Coupler. Its interface with the Yaw Damper system is limited to switching the gain of the Yaw Damper Coupler output according to the aircraft's
indicated airspeed. In this respect it functioned normally.

1.12.3.6 Autopilot Accessory Unit

Amongst the functions of the Autopilot Accessory Unit is the enabling of the Yaw Damper system. It was tested to establish its conformity with specification with respect to those features which might affect the operation of the Yaw Damper. These tests involved the measurement of contact to contact resistance and the insulation of the terminals of the k12 relay within the unit, in both its switched conditions and testing of the time delay and interrupter circuits. The results of all these tests indicated that the functions under consideration operated correctly and within limits.

It was decided to establish, additionally, the voltages at which the k12 relay engaged and disengaged. This was done by adjusting, in both the rising and falling senses, the voltage applied to the actuating solenoid. Under the test conditions the relay pulled in at 18.7 (Volts) V and dropped out at 18.4V. It was observed, whilst adjusting the voltage very slowly around the changeover voltages, that the relay sounded as if it operated in two stages, as it emitted a double click. The change of voltage over the double click was very slight and it was established that all contacts operated simultaneously on one of the clicks.
At a later stage of the investigation, studies of the characteristics of the Autopilot Accessory Unit, Yaw Damper Coupler and Shut-off Valve Solenoid as a group showed slightly different operating voltages for the k12 relay with an engage voltage of 18.16V and 17 ma current and a dropout voltage of 17.71V and 9 ma current. (☞1.16.7)

1.12.4 The E&E Bay

With the discovery of apparent moisture contamination of the Yaw Damper Coupler connector, described in ☞1.12.3.1, attention was turned to the E&E Bay in an effort to determine whether there were any obvious sources of such contamination. The P6 check items included washing and so there was little chance of finding evidence of a source of moisture occurring in the past.

Examination commenced with an inspection of the avionics cooling plenum which is situated directly above the E1-1 rack which houses the Yaw Damper Coupler. This had clearly been washed and bore numerous watermarks on its polished aluminium alloy surface. One of these marks, however, was of particular interest since it ran directly above the Yaw Damper Coupler in the rack. The fluid appeared to run forwards from about the mid-point of the plenum on the top surface and then run rearwards to about the same point on the lower surface. A search for a corresponding leak in the rubberised shroud above this
apparent path proved negative.

The shroud itself was then removed and examined. Although it had evidently been partially cleaned during the P6 check it was still heavily stained on its upper surface and bore heavy deposits of a waxy substance similar to that used during the floor panel sealing operation. When tested for leakage, the shroud proved water-tight apart from a small area of porosity which had resulted from chafing where it was folded and fastened over the lip of the airstairs drip-tray. This area was fairly remote from the E1-1 rack and it was difficult to conceive any situation whereby fluid entering the bay by this route could contaminate the rack. Doubts were expressed concerning the installation status of the shroud during the incident flight. This arose because, initially, it was not suspected that fluid contamination of the Yaw Damper Coupler was responsible for the incident and investigation was centred on the key components of the directional control system. At an early stage the airstairs drip-tray was removed to greatly facilitate access in the E&E Bay requiring the shroud to be unclipped and rolled back. There is no doubt that it was in the aircraft, attached to the nosewheel bay bulkhead but the inspection team could not recall with absolute certainty that it had been fully fitted. The technician involved with preparing the aircraft for the incident flight had, however, stated that it was completely and correctly installed prior to the flight.
The large-diameter toilet drain pipe, routed laterally across the E&E Bay (Appendix 2), was a potential source of contamination in precisely the area to affect the back of the E1-1 rack components, although such a scenario would still require penetration of the shroud before fluid could reach this location. The pipe is normally empty of fluid except during the toilet drain operation on the ground, although any improper seating of the toilet dump valve in the tank would result in the pipe starting to fill-up. The operator indicated that this was a commonly reported defect and just such a condition was present immediately before the incident flight (see §1.6.6.2). In this case, however, the leaking dump valve was detected and the aircraft despatched with the forward toilet empty.

Externally, the pipe had a number of dried fluid residue paths visible, some of which were probably by-products of the cleaning and corrosion protection processes during the P6 check. Tests on the pipe itself showed that it did not leak but the potential for leakage did exist because of faulty assembly at the interface of the pipe with the tank. Essentially, a screw had been trapped between two mating flanges such that, if the pipe filled up as described above to the level of the aircraft floor, fluid could have escaped and run down the exterior of the pipe into the E&E Bay. As described in §1.6.6.2, there should not have been sufficient fluid introduced to allow this to happen.
A further imperfect seal was discovered around the area where the handbasin drain pipe passed through the toilet compartment floor. Any fluid escaping from the toilet/handbasin systems behind the vanity unit would run onto the floor. Since this area is not subject to passenger weight, floor panels are not used and a thin metal diaphragm is used instead. This has to be sealed to prevent leakage below the floor, including the holes where utility piping passes through it. As noted an improper seal had been achieved with the handbasin drain pipe such that, when the diaphragm was deliberately flooded, the fluid dripped down the flexible tube below the floor. However, this location was well forward of the E&E Bay and it was not considered that it could have migrated back towards the Yaw Damper Coupler.

A potential path for fluid dripping forward of the E&E Bay to migrate rearwards was discovered during examination of another Boeing 737?200. The aircraft had extensive toilet fluid contamination of the E1-3 rack disconnect shelf on the left side of the E&E Bay (note: not the racks themselves). Testing showed numerous leak paths allowing fluid to drip below the floor forward of the E&E Bay where the drips impinged on the two Captain's instruments pitot-static drain tubes. These run aft and downwards towards the bay, where they are routed above the E1-3 rack disconnect shelf. The somewhat encrusted and
corroded appearance of the pipes suggested that this had been happening for some time. Fluid from a leaking toilet dump valve was thought to have been the source of the contamination. Boeing has recognised this path as an undesirable feature and proposed a simple modification to put 'drip-triggers' on the line to prevent fluid running aft along the pipes. (The E&E Bay Assessment Team report on this subject is discussed in $\S1.16.8$.)

1.12.5 Post-test flight intrusive wiring and connector checks

A programme was drawn up so that, immediately following the test flight, electrical integrity testing of all the wiring and connectors which might affect operation of the Yaw Damper system could be conducted. This involved the wiring of all systems which had any connection, direct or via other equipment, to the connector D295 of the Yaw Damper Coupler.

Before doing some of these tests, which included high voltage insulation checks, it was necessary to remove the electronic modules involved, both to avoid damaging them and to gain access to the connectors. It was also necessary to isolate the affected wiring by disengaging the 28V dc and 115V ac circuit breakers. Apart from the Yaw Damper Coupler, which had to be removed to gain access to the pins and sockets of connector D295, other units disconnected were:
Component Location Connector

i. Air Data Computer No 1 E&E Bay D309A

ii. Autopilot Accessory Unit E&E Bay D293(A & B)

iii. Flight Control Module Flight Deck Overhead D630

iv. Rudder Power Control Unit Fin base D291

v. Yaw Damper Position Indicator Centre Instrument Panel D309A

The first test applied to connector D295 was a check of the physical engagement of the two halves; both of the tightness of individual pin to socket connections and the depth of engagement of the pins as a group into the sockets.

The first part of this test was done by inserting a single pin, with a light wire 'pull' attached, into each socket of the aircraft rack connector and established that it required perceptible force to draw the pin out of the socket. A similar test was done using a single socket pushed over each individual pin of the connector on the Yaw Damper Coupler itself. Both the elements of connector D295 were demonstrated to have satisfactory grip on all electrical contacts.
The second part of the test, to determine the depth of engagement, was done by impaling a sheet of .004 inch thick paper, cut to remain inside the connector periphery, on all the pins of the Yaw Damper Coupler connector. The connection was then made and secured and then released and separated. The depth to which the paper had been driven down the pins showed that the depth of engagement was satisfactory.

Before disturbing the rudder PCU connectors, other than D295, measurement of the resistance of components within the rudder PCU, together with the intervening wiring and connectors, was made. This showed that all the electrical components in the rudder PCU which could affect the Yaw Damper system were within specification and their connections through to D295 were good. After this, the measurements were repeated whilst the connector at the PCU (D291) was shaken, by hand, to simulate the effects of vibration. This showed that the connection was sound.

Following these tests, the electrical bonding of all the components listed above was verified. They were then removed and the wiring, with all intermediate connectors, was subjected to continuity and insulation tests. These demonstrated that there were no detectable breakdowns in the isolation of any wire resulting in unwanted wire/wire or wire/earth faults; nor were there any breaks in the continuity of any tested
The final action in this series of tests was to perform pin grip and connector depth of engagement tests on the rack connector of the Autopilot Accessory Unit (D293A) and the connector of the rudder PCU (D291). All proved satisfactory.

1.12.6 Tests on Yaw Damper engagement circuits (Appendix 1, Figures 1 & 2)

After examination of the Yaw Damper Coupler unit had raised concerns about the possibility of electrolytic activity between the pins of connector D295 inside it, consideration was given to the possibility that unwanted electrical paths could be generated between pins. The theoretical effects of these paths could be broadly divided into those which affected the behaviour of the electronic control circuits, which are reported on at paragraph 1.16.3, and those affecting the power switching which activates the Yaw Damper.

An initial test was made to establish the resistance, to aircraft ground, of the path from pin 14 on the rack side of connector D295 (with the Yaw Damper Coupler removed), through the earthed OFF pole of the Yaw Damper engage switch on the Flight Control panel. Comparison of this resistance on the incident switch with another showed the incident switch to have a persistently higher resistance of about 2 Ohms.
As a result of these tests, the switch itself was later subjected to destructive examination; see paragraph 1.12.7

A series of tests was then performed, on the subject aircraft, which demonstrated that the Yaw Damper engagement interlocks and indications could, under dormant fault conditions, be defeated by the addition of particular unwanted paths bridging between the pins of connector D295. These were performed using a specially constructed extension lead which permitted electrical access to pins 4, 12 & 14 of connector D295 by means of breakout flyleads. These tests were extended by setting up electrolytically formed conductive paths between the breakout leads and are described at §1.16.6.

1.12.7 Yaw Damper system engage switch examination

As a result of finding that the engage switch had a persistently high resistance on the ground contact, approximately 2 Ohms, it was decided that it should be fully examined in the presence of the aircraft and switch manufacturers. The switch was presented for this examination still installed in the flight controls module from the flight deck. Since the incident flight and before the time of first checking the switch OFF pole earth resistance, the switch had been functioned an indeterminate number of times.
When subjected to laboratory testing, both whilst installed in and later after removal from the flight controls module, the switch did not demonstrate any high resistance earth path. The switch unit was tested and found to be in compliance with its manufacture specification, both in terms of contact resistances and electromagnetic hold-on characteristics. Testing of the wiring within the flight controls module did not reveal any evidence of potential intermittently high resistance paths.

The switch unit was disassembled and the basic micro switches from within operated whilst being observed by real-time X-ray techniques. This showed that the movement of the contacts during switching was correct and effecting the designed self wiping action.

The basic micro switches were then dismantled and the contacts examined. This revealed the presence of a carbon rich contamination of the earth switch contacts but no evidence of loose particle contamination. It was considered that the carbon rich contamination of the contacts might have accounted for the earlier measurements of high contact resistance but did not appear to be sufficient to have been responsible for a contact resistance greater than the measured 2 Ohms observed whilst fitted in the aircraft.

1.13 Medical and pathological information
Not applicable.

1.14 Fire

Not applicable.

1.15 Survival information

Not applicable.

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1.16 Tests and research

1.16.1 Function tests of the flying control and Yaw Damper systems

Although the detailed series of checks described in 1.12.1 had involved several function tests of the flying control and Yaw Damper systems, it was decided that further testing should be carried out with the aircraft pressurised and undergoing a depressurisation cycle, as occurred during the incident flight. To this end the aircraft was towed out of the hangar and placed in a 'flight' condition by disabling the air/ground sensors and using a pitot-static test set to simulate an airspeed of roughly 290 kt. Using a ground pneumatic rig and the APU, the aircraft was pressurised to a differential appropriate to flight at 20,000 feet and hydraulic and electrical power was applied.
The Autopilot and Yaw Damper were engaged with no malfunctions evident. The entire aircraft was 'nudged' several times using the nosewheel steering tiller to evoke a response from the Yaw Damper, and also by using the Yaw Damper test switch. This was repeated during the depressurisation cycle, again with no abnormal responses from either the Autopilot or the Yaw Damper.

1.16.2 High speed taxi and test flight

A Portable Airborne Digital Data System (PADDS) was installed in G-BGJI by the aircraft manufacturer to record parameters additional to those available on the FDR/QAR. These included rudder control system aft quadrant and surface position, Yaw Damper engaged signal and other Yaw Damper system control parameters, plus lateral accelerations at the fin and rudder.

Ground tests were performed by the manufacturer to determine whether the rudder and Yaw Damper system were operating correctly prior to the flight test. These included a frequency response check of the rudder and Yaw Damper LVDT, the results showing the correct phase and gain data for both. Yaw Damper engagement and disengagement via the flight deck overhead switch and the circuit breaker were also checked, and found to operate correctly.

Initially a high speed taxi run was carried out to identify
whether any unusual rudder/Yaw Damper system characteristics could be generated during normal taxiing and by applying aggressive nosewheel steering inputs to produce yaw rate inputs to the Yaw Damper Coupler. Cyclic nosewheel steering inputs with a period of 3 seconds (approximately the Dutch Roll frequency) were used during normal taxi, and a high speed run up to 80 kt was carried out; no unusual system characteristics were observed.

A flight test was then planned in an attempt to reproduce the oscillations seen in the incident. The aircraft was loaded to a similar gross weight and CG position and prepared for flight under 'B' conditions. It was crewed by the same commander as the incident flight together with a Boeing 737 test pilot provided by the manufacturer. The manufacturer's regular complement of a flight test director and observers were also on board. The flight test plan was to incrementally approach the flight conditions of the incident (290 kt and FL200), initially with the Yaw Damper OFF to ensure that there was no basic airframe/flight control anomaly. The aircraft was equipped with an alternative method of electrically isolating the Yaw Damper system.

The aircraft took off from Runway 08R at Gatwick and was flown to the same test area, between the Southampton VOR and Boscombe Down Airfield. The weather conditions on the day of the test flight (10 November 1995) were significantly worse than those
existing at the time of the incident. There was light to 
moderate turbulence present generally, and the crew had 
to ensure that the aircraft did not sustain 
any ice accretion by avoiding cloud layers as much as 
possible during the climb to test altitude.

At each test point, the test pilot performed rudder doublets 
in order to excite the Dutch Roll mode and the aircraft 
response was monitored. Final tests were conducted with 
the aircraft depressurised, again to 
simulate the actual incident flight conditions. Some testing 
was also carried out with the Autopilot engaged, as on the 
incident flight.

The testing was unable to reproduce the forced lateral 
oscillations experienced during the incident flight. All of 
the tests indicated that the rudder/Yaw Damper systems 
on the aircraft were operating correctly.

1.16.3 Simulator studies

The aircraft manufacturer provided access to and support 
in using a mathematical computer model and a versatile 
three axis engineering simulator in attempts to simulate 
the incident flight characteristics.

1.16.3.1 Initial Engineering Simulator Evaluation (M-Cab)

The aircraft Manufacturer's Engineering Simulator was 
used to perform an evaluation of the pilot's influence over
driven Dutch Roll oscillations. In this case the oscillations were driven from the rudder deflection calculated as a function of yaw rate. The relationship between rudder and yaw rate was chosen to generate behaviour consistent with the aircraft during the incident in terms of lateral g oscillations and magnitude of maximum and minimum bank angle, and thus demonstrated the effect of driving the Dutch Roll mode. Figure 1 and 2 at Appendix 5 show this effect.

The simulation was performed at flight conditions representative of the incident, level at 20,000 feet and 295 kt. During the manufacturers tests with a company test pilot in the left-hand seat, "the pilot's first reaction was to reduce airspeed which resulted in the oscillations becoming damped....further cases involved maintaining the flight condition which provided a continuous oscillation with controls free. The pilot was not able to reduce the oscillation nor did he drive the oscillation to greater amplitude while using normal control inputs."

1.16.3.2 EASY 5 computer simulation

A manufacturer's control system simulation/analysis tool, EASY 5, was used to investigate the effect of fluid contamination of the Yaw Damper Coupler connector causing shunt resistance between pins. The EASY 5 consists of a control system model of the Yaw Damper Coupler with mathematical approximations for
the behaviour of the hydraulic system and aerodynamics at various flight conditions. The simulation is excited using a crosswind pulse gust, and the response of the model is then computed and output as a time history of various parameters.

Theoretical analysis of the Yaw Damper Coupler circuitry was carried out by the manufacturer to identify shunt resistances between pins which could have been possible candidates to cause the aircraft response seen in the incident flight. The coupler connector has 57 pins, and for this analysis the unused pins and those used as part of the BITE were not considered. The analysis also assumed that the fluid saturated the region of the connector surrounding pins 3, 4, 12 and 14 (Appendix 6, Figure 1) and below these pins it was assumed that pins were coupled to each other by a fluid film which ran along the adjacent wires. Only the effects of shunt resistances between adjacent pins were considered. The effects of both 400 Hz and dc power shunts were discounted. The bandwidth of the hydraulic servos are two orders of magnitude less than 400 Hz, so any signals injected with a frequency of 400 Hz would have no effect. Similarly any dc power shunts would have introduced a bias into the system, an effect which would have been shown in the incident flight, and was not evident. A summary of the pin to pin shunt analysis is at Appendix 7.

Of the possible candidates identified, the effects of three
shunt resistances were modelled in the EASY 5, both singly and in combination. These were the most likely to have caused the effects seen during the incident. The first was between pins 46 to 47, the case where the rudder feedback signal from the LVDT is attenuated, and corresponded to the open feedback condition. It produced an oscillation with a frequency in the 0.8 to 1.0 Hz range, and only small bank angle changes. This response had been predicted in the Failure Modes and Effects Analysis (FMEA), and was not the response seen in the incident case.

The second case was a shunt between pins 37 to 38, which established a path from the output of the rate gyro demodulator directly, rather than applying the normal 180° phase shift necessary for the rudder motion to be applied in a direction which would counter the yaw rate. The shunt bypassed the phase shift, so the gyro signal was in phase with the yaw rate. The effect of this shunt therefore was to produce an instability which resembled that seen during the incident. A gain of -10 was used in the simulation which approximated to a shunt resistance across the pins of 89 Kilohms. This produced a rudder demand from the Yaw Damper Coupler which saturated to maximum within 7 seconds at 350 kt; the frequency of the oscillation produced was about 0.4 Hz, with ± 25° roll oscillations within 17 seconds of the disturbance; the oscillation was undamped but stable. At an airspeed of
250 t the same gain produced a damped oscillation. Figures 2 and 3 at Appendix 6 show the results from the EASY 5 for these cases.

A shunt resistance between pins 40 to 51 would change the gain characteristics of the rate gyro path; it does not produce a phase change. The effect of this shunt is to attenuate the signal going into the washout filter and thus reduces the ability of the Yaw Damper Coupler to provide control. It was reasonable to model the effect of a shunt between pins 40 to 51 as pins 40 to 50 are adjacent and pins 50 to 51 are electrically equivalent. Simulation of this shunt had no effect on the response on its own, but with a combination of this and a shunt between 37 to 38 the effect was to modify the frequency from 0.43 Hz to 0.35 Hz.

1.16.3.3 Final M-Cab simulation

The EASY 5 simulation had shown that there were possible shunt resistances which could cause the aircraft response seen in the incident. In order to model the complete system it was necessary to have a better aerodynamic model and include a production Yaw Damper Coupler unit. The manufacturer's M-Cab simulator was used for these tests. The M-Cab is a full motion engineering simulator capable of being flown either from the simulator cab flight deck, or from data inputs. In this case the yaw rate signals from the simulator
were input to a Yaw Damper Coupler unit, and the subsequent rudder demand signal was output to the M-Cab simulation of the rudder hydraulic system. The M-Cab was set up at the airspeed, altitude and configuration required for the test and then either allowed to respond without intervention, or flown from the simulator cab to maintain the required conditions. The Yaw Damper Coupler system gain changes with airspeed in the Autopilot Accessory Unit were accomplished manually. The shunt resistances were simulated using a set of decade resistance boxes which could be put between any two individual or combination of pairs of pins. A beta (yaw) release and/or a gust (turbulence) model was used to excite the simulation.

The first tests were to reproduce the shunt resistance from the EASY 5 simulation. An open circuit between pins 46 to 47 produced a 1 Hz oscillation, confirming again the FMEA. A shunt resistance of 110 and 89 K Ohms between pins 37 to 38 produced no oscillations. Reducing the resistance to 30 K Ohms, lower than the value of the shunt resistance in the EASY 5 simulation, produced an oscillation similar to the incident, with roll angles of ±15°, and lateral acceleration of ±0.5 g. This case is shown in Figure 1 at Appendix 8. The rudder demand saturated in 20 seconds, and the frequency of the oscillation was 0.4 Hz at 350 kt IAS, and 20,000 feet.
The effect of a shunt resistance between pins 40 to 51 was then investigated, varying between 60 and 500 Kilohms at 20,000 feet, 290 kt and using light and medium turbulence as well as a beta release to excite the simulation. A shunt resistance up to 300 Kilohms produced small oscillations after the beta release, which in medium turbulence had a frequency of 0.33 Hz and ±0.02 g oscillations in lateral acceleration. Figure 2 at Appendix 8 shows the oscillation produced with a shunt resistance of 230 Kilohms. In light turbulence the lateral acceleration was ±0.01 g. This compared with the oscillations seen in the Yaw Damper disengaged case which in medium turbulence has the same frequency and magnitude of lateral accelerations. Figures 3 and 4 show the normal aircraft response with Yaw Damper engaged and disengaged respectively. At 500 Kilohms the oscillations had a smaller magnitude, similar to the Yaw Damper engaged case, showing that at this value of resistance the Yaw Damper was able to reassert control. These tests were repeated at 7,000 feet, 250 kt, shunt resistance varying between 120 and 300 Kilohms with light and medium turbulence. Similar small oscillations were evident.

A combination of the shunt resistance varying from 200 to 400 Kilohms between pins 37 to 38 and 40 to 51, was then tested. At 20,000 feet and 290 kt, the results showed that the combination of resistances on both pins produced an oscillation which resulted in roll
angles of up to ±15¡, and lateral accelerations of up to ±0.46 g, with a frequency of 0.3 Hz. The time of the Yaw Damper rudder demand to saturate to maximum increased with the resistance; above 250 K Ohms the oscillation was slow to develop and above 350 K Ohms the oscillation was damped. The same shunt resistance test conditions were used at 7,000 feet, 250 kt. This generated an oscillation which, at shunt resistances at and above 230 Kilohms damped out. The time for the oscillations to damp decreased with increasing resistance. Figures 5 and 6 at Appendix 8 show these oscillations.

A number of flight profiles were then flown in the M-Cab, following the descent and speed reduction seen on the incident flight. Figure 7 at Appendix 8 shows one of these profiles using a shunt resistance of 230 K Ohms between both 37 to 39 and 40 to 51.

1.16.4 Normal aircraft behaviour with and without Yaw Damper

The QAR data was examined from another Boeing 737-200 aircraft, where the Yaw Damper had been engaged and disengaged for periods during the flight. This data showed that when the Yaw Damper was disengaged, small oscillations similar to those seen on G-BGJI prior to the incident, were present. This demonstrated also the basic Dutch Roll mode of the aircraft. The oscillations had a frequency of around
0.32 Hz and produced small lateral accelerations of less than ±0.05 g. With the Yaw Damper engaged there were no significant lateral oscillations.

1.16.5 Humidity testing and detailed examination of Yaw Damper Coupler connector

The presence of corrosion/electrolytic deposits around the wire-wrap posts of the Yaw Damper Coupler connector first discovered during the manufacturer's testing and examination of the unit (∝ 1.12.3.1) had not apparently had any effect on the coupler's operation during testing at ambient and high-temperature conditions.

It was therefore decided to test the electrical properties of the Yaw Damper Coupler in humid conditions having first taken samples of the deposits on the connector shell and the cover plate in an attempt to discover the nature of the apparent fluid contaminant. A description of this examination appears in ∝1.16.6.

Unfortunately, there were no facilities which could subject the unit to functional testing equivalent to that achieved by the ATE whilst it was in an humidity chamber. An attempt was made to measure the resistance between adjacent pins of the connector at ambient conditions (18°C/46%RH) and under conditions of about 94% RH at 35 to 40°C. Measurements of the ambient impedance values between adjacent
pins were taken and the unit placed in a humidity chamber with a 'breakout' lead routed outside the chamber to measure the impedances under humid conditions.

As expected, there was a wide variation in impedance values, without exception the humid values were less than the ambient. The significance of these findings is, however, open to question when it is realised that the impedances measured are not simply those between adjacent pins of the connector. Since it was considered unwise at that stage to isolate the connector from the internal circuitry, the impedance values measured had to include those of the individual components and printed circuits of the Yaw Damper Coupler itself as well as the resistance between the connector pins. Typically, impedances measured as greater than 30 Megohms in ambient conditions fell to fractions of a Megohm when placed in the chamber.

Since it was impossible to determine how much, if any, of the lost impedance was due to shorting between the connector pins, it was then decided to compare the performance of a known serviceable Yaw Damper Coupler under the same conditions to see whether the impedances were markedly different under humid conditions. Only certain selected pins on the latter were sampled under humid conditions. At ambient conditions, similar impedance readings were obtained between adjacent pins and, as expected, these values fell off markedly under humid conditions.
general, the results were similar to those measured on the incident Yaw Damper Coupler, with only a few, apparently random, occasions where the humid impedance of the spare unit was better by an order of magnitude.

1.16.6 Connector pin contamination testing

Connector D295, and the Yaw Damper Coupler lower closing panel, with the evidence of a dried fluid run on its inside face, were submitted to a specialist company of electrical research engineers for laboratory analysis. The focus of this effort was to determine the nature of the fluid contaminant and to confirm that electrical current had flowed between the pins. It was considered that the latter would be proven if it could be established that the blue/green and white deposits seen around the wire-wrapping of the pins were the products of electrolysis as opposed to simple corrosion.

The chemical tests could only be conducted using an X-ray dispersive technique which can only detect the individual elements of a substance and cannot identify the compound which is constructed from these elements. Such a method will detect all elements present in the sample, such as those used in the construction of the connector, not just those from the contamination. Thus metals such as copper, gold, cadmium, nickel and zinc were present in nearly all the
sampled areas along with a range of other elements, including chlorine, phosphorous, calcium and sulphur. Unfortunately, it was not possible to positively identify the nature of the contaminant fluid, despite comparing it with samples of toilet sanitising fluid used by the aircraft operator. This was largely because, although the specimens and the fluid samples both contained similar elements, it appears that samples of other common fluids found on aircraft, such as waste water and galley waste would yield similar results. An independent analysis conducted by the Boeing Company came to a similar conclusion with the additional observation that there were no signs of urea, which could be reasonably expected were the contaminant to contain toilet waste. During dismantling of the connector, however, it was found that the contaminant had also penetrated between the two halves of the insulator block (Appendix 6, Figure 1b) as evidenced by dried stains. Also noted was the fact that none of the pins themselves seemed to have suffered from corrosive attack - the gold plating was intact and not pitted. However, when the pins were later sectioned, repolished and examined under high magnification small pits were identified beneath the gold plating.

Whilst contamination was observed on most of the pins to a greater or lesser degree, the blue/green and white deposits were mainly in evidence around the pins and wires in the top-left quadrant of the connector
(viewed from the back). Some of these pins were found to be those which would carry 28V dc for the Yaw Damper engage circuitry and were therefore most likely to cause electrolysis of the contaminant to occur if partial short-circuiting did take place. Variations were found in the composition of the deposits on various pins, most notably on pin 4, which exhibited a strong chlorine peak as expected for negative ions in an electrolyte, and pin 14 which had strong sodium peaks. Pin 14 is at 0V when the Yaw Damper is turned OFF and pin 4 is at 28V. It was therefore concluded that electrolysis of some form of liquid contaminant containing sodium chloride (salt) had occurred and that current had flowed between the pins.

1.16.7 Generation of errant electrical paths in connector D295 (Appendix 1, Figs 1 & 2)

As considerable amounts of the products of electrolysis had been found at pins 4, 12 & 14 of connector D295 inside the Yaw Damper Coupler, consideration was given to how this might have caused bridging between pins leading to errant electrical paths, capable of sustaining Yaw Damper system engagement for 7 minutes after it was selected from ON to OFF. To establish the viability of such bridges required the formulation of a series of tests and trials based on conditions which other testing indicated to have existed.

The operation of the Yaw Damper system electrical
engagement interlocks has been described in \S 1.6.4, but
the rationale for sustaining the engaged state even though
the Yaw Damper engage switch was
selected to OFF, the basis for formulation of the test series,
can be summarised as follows:

1

For the Yaw Damper Actuator to be active, the
solenoid valve on
the rudder PCU must be held open to allow
hydraulic pressure to
the actuator. This required that sufficient voltage was
present at
the solenoid 'live' terminal to maintain it in the open
position.
Tests on the Yaw Damper solenoid valve , when
isolated from
the Yaw Damper system, indicated that the
minimum current
for holding this valve in the 'active' position was 56
ma. and
about 3.2V was required to sustain this.

2

As the basic aircraft wiring tests showed no evidence
of
insulation weaknesses in any of the Yaw Damper
system wiring,
the electrical supply to activate the solenoid valve
had to be
provided from the 'b' contacts of the relay k12 in the
Autopilot
   Accessory Unit.

3
   For the 'b' contact supplying the PCU solenoid to be 'live', relay
   k12 had to remain activated.
   Again, as there was no evidence of insulation weaknesses in any
   of the Yaw Damper system wiring, the electrical supply to
   activate the relay had to be supplied from pin 12 of the connector
   D295 at the Yaw Damper Coupler.
   Initial tests at the AAIB, showed that the voltage at pin 12 had
   to rise above 18.7V to activate the relay k12 and remain above
   18.4V to maintain relay engagement. Similar tests were made
   on a later occasion, with the whole Yaw Damper engagement
   system connected together complete with actuator valve
   solenoid. These showed that to activate relay k12 the voltage at
   pin 12 had to rise above 18.2V with a current of 17 ma. and
   remain above 17.8V with 10 to 11 ma to maintain engagement.
   The maximum current that the relay would draw
was about 40
ma when full aircraft dc voltage was applied. Pin 12
could be
supplied from pin 14 through circuits within the Yaw
Damper
Coupler. In that event, the minimum voltage which
would be
required at pin 14 would imply a current of at least
380 ma
flowing from pin 14.
4
With the 'b' contact supplying the PCU solenoid
'live', the voltage
required to hold the solenoid in the open position
had to be
present at pin 14.
5
If the Yaw Damper system was selected to OFF, pin
14 of
connector D295 should be connected to 'aircraft
earth' through
contacts in the Yaw Damper engage switch.
If any voltage was to be sustained at pin 14, the earth
of the
Yaw Damper switch would have to have had
significant
resistance.
6
Unintended dc supply to either pin 12 or pin 14,
within connector
D295, was judged to be viable only from pin 4; the other permanently 'live' dc pins, 8 and 57, being considered too remote. (Appendix 6, Figure 1) Dc supply to pin 4 was via a 5 amp circuit breaker; implying a minimum resistance of about 0.7 Ohms in the engage switch earth path if pin 14 were to sustain only about 3V but more if the voltage on pin 14 were allowed to rise.

In order to test the viability of such a mechanism, under conditions most conducive to success, the series of tests on the subject aircraft using the breakout flylead (Appendix 6) was extended into an electrolytic bridge growth trial. The techniques used and the scope of this 'ad hoc' trial were reviewed and amended as it progressed.

In this trial, the pins were represented by the two single strand copper conductors of a length of domestic power cable (2.5mm2), with their insulation cut back for about 1cm. The bare conductors were placed parallel separated by about 1mm for the preliminary tests, and for the later test at the same separation as the pins within D295 (0.1 inch). During this later test, to simulate the effect of the insulated wirewrap
looming of the connector, a single short length of this wire was used as a non-conducting physical bridge between the two conductors. One of the copper strands was connected to pin 4 and the other to pin 12 of the breakout leads with meters connected to measure both voltage at pin 12 and current from pin 4 to pin 12. Normal operation of the engage system was checked at this point.

Two preliminary tests were done, with the electrodes only separated by about 1 mm, one using tap water and the second using a saline solution. To start electrolysis, the Yaw Damper engage switch was set to ON, the electrolyte placed between the conductors and the switch then set to OFF. In both cases, electrolysis started immediately the system was switched OFF. In the water test however, although the current rose to the measured 'sustain' value, when the system was switched ON and OFF again, the electrolytic cell would not sustain engagement for more than a few seconds. With the saline solution, however, the current rose to the point where the relay k12 pulled into engagement and held, even though the system was not selected ON.

The electrodes were then reconfigured to the more realistic geometry, separated by 0.1 inch, with the insulated wire bridge. Having started the electrolysis with weak saline solution, as in the preliminary tests, the current rose to the 'sustain' level. The system was then switched ON and OFF again and the bridge maintained
relay k12 closed. The current through the electrolytic cell continued to increase and finally peaked at about 40 ma, the potential drop across the cell being only 1.5V. No additional electrolyte was added from this point but the current remained stable at 40 ma for about 20 minutes.

In the preliminary tests the electrolyte was introduced as a drop of liquid which was suspended between the two conductors by wetting and surface tension. When the realistic separation of the pins was modelled the gap was too wide for this mechanism to be feasible but, with the insulated wire bridging between the two electrodes, the electrolyte clung to this bridge and the conductors and thus formed an electrolytic bridge between the two. It was noted during the second test that the current increased as the electrolyte clinging to the bridging wire dried out. It remained stable for a long time when there was little apparent moisture bridging the gap between the electrodes.

Following this test, an attempt was made to support the complete Yaw Damper system through the electrolytic cell. Before doing this the engage switch earth was taken out of the circuitry by removing the flight control panel. The electrolytic bridge was re-established and then pins 4 & 12 were connected together with a conductor. Pins 12 & 14 were then connected and the connection between 4 & 12 removed. This left the electrolytic bridge supporting the currents to
maintain the engagement of relay k12 and the solenoid shut-off valve. It was able to do this with little moisture apparent, supplying a current of approximately 300 ma for about 10 minutes; the current flow stopped abruptly, however, when the bridge dried out completely. Confirmation that the system had been active was demonstrated by operating the system test switch and observing appropriate rudder response.

Whilst these tests were being conducted, there was clear evidence of electrolysis occurring and deposits formed on the two electrodes which were similar to those found on pins 4 and 14 within connector D295. It was also noted that little obvious surface damage was inflicted on the electrodes although closer inspection revealed that surface damage had occurred. The appearance of the bridge formed between the electrodes was blackish and appeared to be an oxidised copper film deposition.

Having demonstrated that electrolytic bridges, in particular those with limited moisture apparent, were able to maintain engagement of the system, with no earth path available through the engage switch OFF contacts, it was decided to attempt to generate electrolytically formed bridges between representative connector pins; first between correctly spaced pins and subsequently within a replica of connector D295. It was also decided to simulate a high resistance earth rather
than no earth at the engage switch.

A comprehensive series of tests and experiments was formulated by the AAIB, the manufacturer and the operator jointly, and performed at the manufacturer's physical laboratories. The intent of the tests was to resolve whether it was possible to generate and maintain suitable pin to pin bridges without damaging the pins significantly more than those of connector D295 were observed to be. The sustained currents which it was considered essential to demonstrate in these tests were the minima established for the individual components of the Yaw Damper system and assuming an open circuit on the engage switch earth.

The preliminary tests of this series involved a large number of simple pin to pin bridges with specific electrolyte mixes which were done in two batches; the first using wet bath electrolyte bridges and the second using electrolyte drops on physical bridges of wirewrap wire. These tests were intended to establish the amount of damage which the pins sustained under the test conditions and, therefrom, the electrolyte most likely to have been involved. The electrolytes were those determined from the results of the earlier analysis on the connector performed by the specialist laboratory. These had shown the presence, amongst other elements, of chlorine, phosphorus and some sulphur, implying the presence of chloride, phosphate and sulphate ions.
These tests showed that if chlorine was a significant element in the electrolyte, its activity was so aggressive that the pins suffered far more severe damage than had been seen on the pins from the incident connector. However, both phosphate and sulphate ions were able to act as charge carriers without inflicting significant damage on the pins. It was also observed that, in the 'near-dry' bridges formed in the second batch of preliminary tests, copper, in some form, was deposited on physical bridge paths as they became dryer. It was noted, however, that where new insulated wiring was used to form physical bridges, it did not 'wet' readily and, consequently, it was difficult to achieve the electrolyte bridge necessary to start the process of generating a stable pin to pin path.

As a result of the findings of these preliminary tests it was decided to proceed with tests on wirewrap connectors configured as nearly as possible identical to connector D295 from the incident aircraft; particular attention being given to the geometry of the wire wrapping around the pins of greatest interest. Having reviewed the possible scenarios for generation of conductive bridges and features noted in the initial tests, it was decided to attempt to form 'near-dry' conductive paths by two different methods one which was predominantly a steady slow generation process and the other a pulsed generation process. The 'slow' process was intended to imitate what might happen if
power were left on the aircraft for about ten days, the approximate period that this condition was estimated to have existed during the P6 inspection, following a single run of contaminated fluid onto the connector followed by an afterdrip. The 'pulsed' method representing persistent slow dripping of contaminated fluid onto the connector throughout the same period.

The wirewrap wired connectors were artificially aged before testing to improve the tendency of the new insulated wires to be wetted. Each connector was, in turn, then used as part of the circuitry of a near complete Yaw Damper electrical system (the BITE and indicator circuits were not connected) so that it fed and received power from the appropriate components, including the Yaw Damper Actuator solenoid. To do this the connector was installed in the middle of a fly?lead connection to the Yaw Damper Coupler and placed in an agreed controlled environment which attempted to emulate estimated conditions in the E&E Bay during the P6 check. The currents in and out of the relevant connector pins and their voltages relative to ground were continuously monitored and recorded throughout the attempts to grow the bridges as well as during the subsequent test phases. The resistance of the earth path on the OFF side of the Yaw Damper engage switch was initially very high but it was intended to reduce this if sustained 'hung' engagement was achieved. The method of initiating
sustained hung engagement was agreed to be:- to engage the system normally, add a small amount of extra wetting to the connector and then switch OFF the system. The rationale behind this procedure was that it was only necessary to generate electrical paths capable of carrying enough current to sustain engagement but not to initiate it.

For the slow path growth, the conditioned connector was moistened, in the area of pins 4, 12 & 14, with a spray of composite contaminant consisting of 0.5% Sodium Chloride solution combined with 6% saturated solutions of Potassium Phosphate and Sodium Sulphate. Six hours later, the same area was rewetted using a micro-pipette. At the time of rewetting, the voltages on pins 12 & 14 rose sharply, relay k12 activated and the solenoid pulled in. This caused the pin voltages to fall sharply, k12 then deactivated, the solenoid dropped out and the pin voltages then rose sharply again. This cycle persisted for about 23 minutes but stable solenoid engagement was not achieved. Following this episode the circuit was then left for about 10 days for the unwanted paths to develop without any further wettings. At the end of this period, the voltage on pin 12 resulting from leakage along the 'near-dry' bridge which had developed was not of the right order to hold the relay k12 in the activated state and an attempt to demonstrate hung engagement of the system failed. The area around pins 4, 12 & 14 was rewetted using a pipette but even after this,
'hung' engagement would not occur. A final attempt to produce conditions in which 'hung' engagement could be demonstrated was made by spraying the area of the pins. This lead to a wet path short circuit between the 115V ac resident on pin 2 and the earth pin 3 which rendered this connector useless for further testing.

Post-test examination of this connector showed that much of the electrolytic activity had been taking place between pin 4 and its two adjacent earths at pins 3 and 5 rather than the intended activity between pin 4 and pins 12 & 14. It was also observed that, ignoring the damage caused by the final wet short circuit, the damage inflicted on pin 4 by the electrolytic activity was considerably greater than had been seen on the incident connector.

For the pulsed path growth, a good sized drop of fairly clean water (provided from Gatwick) was dropped onto the pin 4, 12 & 14 area of the connector for three days and then a 50/50 mix of this water with the solution used in the slow growth experiment was applied twice daily for the remainder of the 10 days. Attempts were then made to induce 'hung' engagement, with a series of rewettings being performed, and the assembly left with power applied to achieve a subsequent 'slow' bridge growth several times. Although short periods of 'hung' engagement were observed, the longest being 28 seconds, several periods of rapid
cycling of relay k12 occurred. Examination of the connector after testing again revealed much greater pin damage than in the incident connector and evidence of copper deposition between the pins.

1.16.8 E&E Bay Assessment Team

Arising from concern that fluid contamination might be more widespread than they were aware, Boeing launched an 'E&E Bay Assessment Team' initiative in January 1996. In addition to a large number of Boeing personnel, airlines and vendors were co-opted and canvassed for their experience with this problem.

The terms of reference of the team were; 'To develop recommendations that when implemented will preclude liquid leakage and contamination within the E&E Bay from having an adverse effect on the equipment/systems'. The team's strategy was essentially to define the scope of the problem, and to attempt to see whether individual operator experience and aircraft build/ modification standard might give clues as to which modifications or operator practices were effective in minimising E&E Bay contamination.

The team's findings and recommendations were extensive, reflecting the very large number of man-hours spent in producing the report. Much of the report deals with detail improvements both to hardware and maintenance practices. As an example of the latter, the
team found that many airlines treated water/waste system components as 'on-condition' items and recommended that periodic inspection and overhaul should be performed.

In general, however, the team found a wide variation in operator experience but the findings may have been influenced by a lack of appreciation by some operators that they had an E&E Bay fluid contamination problem. For example, one aircraft showed a history of a particular item of avionics equipment being returned from the repair shop repeatedly with reports of fluid contamination over a period of four months. Clearly the operator had failed to make the connection between the high removal rate of this component and a persistent leak somewhere in the aircraft. Equally so, there was variation in operator expectation regarding the condition of the underfloor area, with some, including the operator of G?BGJI, apparently accepting that evidence of blue staining is inevitable after a few years in-service whilst others managed to achieve high standards of cleanliness.

This underlines the report's conclusion that most problems with E&E Bay contamination '....related to aircraft maintenance and servicing, rather than how components are originally designed and installed". The report also "....did not uncover any evidence that a specific fluid leakage event will produce a near term, unexpected, aircraft flight path deviation.'
1.17 Organisational and management information

None relevant.

1.18 Additional information

1.18.1 Aircraft manufacturer's Operational Bulletin

On 4 August 1995, the aircraft manufacturer issued an Operational Bulletin detailing the 'Uncommanded Yaw or Roll Procedure'. The procedure is reproduced below and the full contents of the Bulletin is at Appendix 9.

UNCOMMANDED YAW OR ROLL

Accomplish this procedure if uncommanded yaw or roll occurs in flight.

AUTOPILLOT (if engaged) .............

DISENGAGE
The pilot should be prepared to make control wheel
corrections to return to wings level upon disengagement.
The autopilot may be putting in an appropriate correction
for an uncommanded yaw or roll.
Allowing the control wheel to go to neutral after
disengagement may allow the aircraft to roll even more.

If yaw and/or roll forces continue:

YAW DAMPER SWITCH ......................
OFF

The YAW DAMPER Light illuminates when the yaw
damper is disengaged.

If it is confirmed that the autopilot is not the cause of the
uncommanded yaw or roll, the autopilot may be re-
engaged at the pilot’s discretion.

1.19 Useful or effective investigative techniques

None new.

2 Analysis

2.1 General

The uncommanded roll activity experienced during this
incident was unusual. The flight crew carried out the
correct initial actions, as defined by the manufacturer earlier in 1995. These actions were intended as part of a memory recall drill in the event of an uncommanded yaw or roll occurring in flight. The initial action was to disengage the Autopilot, while being prepared to make control wheel corrections to return the aircraft to wings level upon disengagement, as the Autopilot may have been putting in an appropriate correction for an uncommanded roll or yaw induced roll. In this case, after Autopilot disengagement, the roll oscillations continued despite the best efforts of the crew to control the aircraft using opposite roll inputs. The next item in the sequence (if the roll/yaw continues) was to select the Yaw Damper switch, which is located on the overhead panel just above the Captain's head, to OFF. During the post-incident debrief, the crew stated that the Yaw Damper had been switched OFF at the time in accordance with the procedure, but again this had no noticeable effect on the roll/yaw motion being experienced. With two pilots making individual attempts at reducing the oscillation in sequence, and with a handover occurring between the two, it is most unlikely that the continuation of the oscillation was a result of 'pilot coupling' with the aircraft, inducing the motion, without some form of additional input from an aircraft control system.

With the Autopilot removed from the control loop and the Yaw Damper manually switched off, then all of the flight
controls should have been in the hydraulically actuated/mechanically signalled state, with pilot inputs causing essentially linear control responses at the elevators, ailerons and rudder. In this basic configuration, there should have been no mechanism for an oscillation to continue. The fact that it did so meant that the flight crew were initially somewhat alarmed and unsure as to the precise nature of their situation. The possibility of the Yaw Damper system remaining active after its control switch on the overhead panel had been switched OFF had never been considered as a possible scenario by the aircraft manufacturer.

During this investigation, some consideration was given to the possibility that the crew may have misidentified the Yaw Damper ON/OFF switch and operated some other switch. The switches adjacent on the same overhead panel are shown diagramatically in Appendix 1. The majority of these switches have lift-flap type, guard covers. Of the remainder, there is no other switch on this panel which, when switched off, would produce a FLIGHT CONTROLS amber warning caption on the Master Caution system. The flight crew recalled that this amber Master Caution caption was illuminated during the pre-landing checklist completion at the Master Caution recall check and that the commander switched the Yaw Damper back on at that time. He sensed a further roll/yaw disturbance and so switched it OFF again prior to
landing. It was not possible to confirm, from the DFDR, when these switch selections had been made.

2.2 M-Cab simulator analysis

From the M-Cab simulator testing it was possible to conclude that shunt resistances between combinations of pins in the Yaw Damper Coupler connector could cause an aircraft response similar to that experienced by G-BGJI during the incident. Initially a shunt resistance of at least 300 K Ohms between pins 40 to 51 would have caused the small oscillations that were seen prior to and post the large oscillations. Similar oscillations were detectable on the QAR data from flights prior to the maintenance activity which could be caused by a shunt, or due indeed to the Yaw Damper being disengaged. The effect of this shunt was to reduce the ability of the Yaw Damper Coupler to provide control, and so the response of the aircraft was similar to the Yaw Damper disengaged case.

However, when a resistance of at least 230 Kilohms was applied between pins 37 to 38 and 40 to 51, the aircraft immediately would have started to experience the large oscillations. It can be concluded that the pin 40 to 51 shunt resistance may have been an incipient problem, the only symptoms of which were to produce aircraft behaviour consistent with the Yaw Damper being disengaged. However when a shunt resistance appeared between pins 37 and 38, in conjunction
with the pre-existing condition, the Yaw Damper system would immediately start to drive the Dutch Roll mode, and the aircraft would respond accordingly with the rolling/yawing motion seen during the incident.

2.3 Continued engagement of Yaw Damper system

Analysis of the aircraft's flightpath, from the recorded Flight Data, showed that its aberrant motion was consistent, in form and frequency, with a fairly constant amplitude 'Dutch Roll' motion. Because the aircraft type has a naturally damped 'Dutch Roll' mode, this indicated that the motion was being forced. This conclusion directed attention to the Yaw Damper system early in the investigation.

The occurrence of unstable Yaw Damper characteristics should not have been a continuing problem if the system had been switched OFF. Since the crew recollection was that they had selected it OFF early in the sequence of events following the onset of the aberrant behaviour (ref; ∂2.1), it was necessary to investigate if and how it might be possible for the system to remain active when selected OFF.

Critical analysis of the Yaw Damper system (Appendix 1) had shown that, in addition to the two faults required to destabilise it (see ∂2.2), two further stray connections had to be made to keep it engaged when
switched off; one supplying dc power to relay k12 in the Autopilot Accessory Unit and the other supplying dc power to the engage solenoid valve. Furthermore, it required the earth path attached to the OFF terminal of the Yaw Damper engage switch to have considerable resistance if the 28V dc supply circuit breaker were not to trip.

The physical evidence of liquid ingress into the connector D295 in the Yaw Damper Coupler module and the fact that this connector appeared to be the only single place where all the necessary stray connections and reduced resistances could be made, further focused the investigation onto this connector. The evidence of fluid ingress did not indicate that the whole connector had been affected but only a few pins. However, the contaminated pins included those indicated by the M-Cab analysis to be critical. The analysis made of the contaminants observed within the connector showed that some electrolytic activity had taken place there; an undesirable state of affairs even if it were not to give rise to instability or loss of control of the Yaw Damper system.

The tests on the aircraft using breakout flyleads (1.12.7) confirmed the analysis that in order for the Yaw Damper System to remain engaged due to stray connections at connector D295, after it had been switched OFF, the interlock relay k12 in the Autopilot Accessory Unit had to remain made. Furthermore,
sufficient current had to continue to flow through the contacts 'b', of this relay, and the solenoid of the Yaw Damper Actuator solenoid valve, in order to hold this valve in the 'active' position. These tests also confirmed that the OFF terminal earth path of the Yaw Damper engage switch had to have significantly raised resistance, if the necessary stray connections to engage the system were not to cause the 28V dc circuit breaker to trip.

To get these conditions to occur due to stray connections at connector D295 required that current paths became available from pin 4, which carries dc power directly from the system circuit breaker, to pin 12, to keep the engage relay k12 activated, and to pin 14, to supply the actuator solenoid valve. It can be seen, in the diagram of connector D295 at Appendix 6, Figure 1, that the pins 4, 12 & 14, are grouped together. Furthermore, these pins showed evidence of contamination and local electrolytic activity.

A scenario was postulated that, if contaminated water got into the wire wrapping at the back of the plug unit of the Yaw Damper Coupler (D295), an electrolytically driven process might generate electrically conductive paths from pin 4 to both pins 12 & 14.

For electrolysis to have taken place, the presence of 28V dc on pin 4 was required, which would be true whenever the dc bus was live. It would also have required paths to earth
to exist from pins 12 & 14; from pin 12 via the k12 relay coil and from pin 14 via the engage switch earth path or, if this were open circuit, through the solenoid valve coil after k12 relay had been activated. If dc power were available on the bus and the Yaw Damper selected ON, pins 12 & 14 would also be at 28V dc and so the conditions for the electrolysis to take place would not exist. It is, therefore, only when the dc bus is live and the Yaw Damper selected OFF that the right conditions can exist.

The electrical system status for it to be possible to lay down the requisite conductive paths by this kind of mechanism had been available as the aircraft had just been on a major check during which it spent many days with dc power live but the Yaw Damper switched OFF. However, the physical conditions and the effect of the connector's history, over the 17 years it had been in service, were recognised as potentially important in influencing the likelihood of a path forming. Another unquantifiable influence was the unique lie of the wirewrap wires between the pins of the connector which could be seen to affect the likelihood of damp paths between the relevant pins being a possibility.

When the Yaw Damper is switched off, the electrical paths to earth which exist, by design, from pins 12 & 14 are fundamentally different. That from pin 12 is through the (k12) engage relay coil and the time
Delay circuits in the Autopilot Accessory Unit, which limit the maximum current to about 40 ma even when full aircraft dc voltage is applied. By contrast, the earth path from pin 14 is through the engage switch OFF contact which should be a dead short to aircraft earth and effectively maintain pin 14 at aircraft earth potential whenever the switch is selected to OFF.

This difference was reflected in the relative ease of generating effective stray paths during test. The natural current limiting characteristics of the relay k12 coil circuits meant that the stray path between pins 4 & 12 was only required to carry a maximum of 40 ma and to have sufficiently low resistance to maintain at least 18.2V at pin 12.

The path to pin 14, however, had to be able to satisfy a more demanding role, one affected by both its own resistance and the resistance of the engage switch earth path. As an absolute minimum, on the assumption that the engage switch earth path was close to being an open circuit, the 4 to 14 path had to be capable of carrying 60 ma whilst dropping the voltage to 3.2V dc at pin 14, to keep the solenoid valve energised. The lower the resistance of the pin 4 to 14 stray path, the higher the voltage at pin 14 and consequently an increased current flow through the solenoid so the more robust the stray path would need to be.
The minimum permissible resistance of the engage switch earth path would have been about 0.7 Ohms if pin 14 were to sustain only about 3V as the dc supply to pin 4 was via a 5 amp circuit breaker. However, if the voltage on pin 14 were to be higher, the resistance at the engage switch earth path would also have to be higher in order to limit the total current to 5 amps, the capacity of the circuit breaker which did not trip on the incident flight. In order to reduce the current flow through the stray connection, 5 amps demanding a very robust path, the resistance at the engage switch earth path would need to have been higher still.

Therefore, a very particular set of circumstances had to pertain for a stray path to develop between pins 4 and 14 capable of supplying the 'hold on' voltage and current requirements of the Yaw Damper Actuator solenoid valve without the 5 amp circuit breaker tripping. For the 4 to 14 path to develop at the same time as the 4 to 12 path, the engage switch earth path had to be sufficiently resistive to restrict the total current and be sufficiently conductive enough to allow the electrolytic formation of the path. If the engage switch earth path were open circuit, formation of the 4 to 14 path could not occur until a sufficiently robust path had been generated between pins 4 & 12 for the k12 relay to have pulled in without being selected.

The basic aircraft wiring integrity testing had not revealed
any relevant discrepancies of continuity or isolation except the persistent existence of a relatively high resistance (about 2 Ohms) at the earth contacts of the engage switch. During the course of testing, this resistance was established to be associated only with the Flight Controls module which was fitted during the incident flight. This indicated that it was possible that a raised switch earth resistance had existed at the time of the incident. Detailed examination of the module wiring and the switch itself indicated neither evidence of undue contact or joint resistance nor a possible explanation for it, beyond the presence of some deposits around the micro switch contacts but these were not confirmation of an open circuit. However, the switch had been functioned an indeterminate number of times since the incident with an unquantifiable effect.

The Yaw Damper system had to be positively engaged by the crew, as part of the pre-flight checks. It can be inferred that if the stray paths to pins 12 & 14 existed at that time, they were not sufficiently conductive to cause the system to engage itself and thus extinguish the warning light. The crew would have been expecting to energise the system and its being live without being selected should have been noticed and, if so, would have been a matter of concern. If, however, the stray paths had developed to the point where once the Yaw Damper was engaged, they were sufficiently robust to sustain the requisite
voltage and current combinations at pins 12 & 14 (see 1.16.7) to maintain engagement, they could have been exploited when the crew selected the system OFF.

The experimentation and tests, using both plain copper conductors and gold plated pins as used in D295, showed that it was relatively easy to form an electrolytic current path capable of sustaining the currents needed to keep the Yaw Damper system engaged. It was observed, however, that the degree of damage sustained, particularly by the pins, was considerably more severe than that suffered by the pins of the incident Yaw Damper connector. This indicated that pure electrolytic conduction of the stray currents needed to keep the system engaged had not been a potential mechanism for causing this incident.

The experimentation was, therefore, focused on developing, what were called 'near-dry', current bridges which were, in effect, attempts to see if it was possible to lay down a basic metallic current path using phosphate and sulphate ions as charge carriers; rather than chlorides which were chemically too aggressive to leave the pins of the connector as little damaged as was found in the incident connector.

The current carrying capacity of those paths and the voltages which had to be sustained at the pins were specific to the units of the system which were installed at the time of the incident. The tests done on the
aircraft system to prove which stray connections were needed had shown that actuator solenoids, in particular, could vary considerably in their voltage and current demands for the 'held on' condition. The tests to see if it was possible to reproduce any 'hold on' condition were, therefore, conducted using the components fitted to the aircraft at the time of the incident.

When looking at the attempts to introduce the necessary stray connections into a representatively wired up connector, it was seen that none could be classified as successful, in the sense that the Yaw Damper system did not remain solidly engaged after being selected OFF, although some type of stray connection had clearly formed.

In summary, the experiments demonstrated that it might be possible to generate stray current paths capable of sustaining engagement of the Yaw Damper system when selected to OFF, but only in the presence of a high resistance in the engage switch earth path. Although the evidence was tenuous, the possibility that such a resistance was present during the incident flight cannot be discounted.

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2.4 Possible sources of connector contamination

The nature of the deposits observed on the Yaw Damper
Coupler connector pins appeared to be relatively long term, almost certainly pre-dating the P6 check activity. As such, it was highly unlikely that the investigation and testing would reveal a contamination source from that period and indeed none was found. The only evidence indicating a fluid path into the connector was the whitish dried deposit on the connector shell, suggesting a very particular localised drip (as opposed to a more general soaking of the unit). The tray in which the Yaw Damper Coupler was located bore no signs of any contamination although its mating connector did have some of the dried residue similar to that found on the Yaw Damper Coupler connector, indicating that the two were joined at the time of the contamination. The Technical Log entry in March 1995 indicating a leak in the toilet handbasin drain may be relevant, but for the same reasons discussed below, moisture should still have been prevented from contaminating the E1 rack.

Attempts to analytically determine the origin of the deposits were unsuccessful. The conclusion in 1.16.6 that electrolysis of a solution containing sodium chloride had definitely occurred, whilst demonstrating the passage of current, did not assist in identifying the contaminant since this is obviously such a common substance and could have come from almost any source.

The scenario connecting the incident to the connector contamination requires a further source of moisture nearer
to the time of the incident to activate the electrical 'bridge' between the pins. Chemical analysis of the dried deposits did not point towards any particular source of fluid and, although some defects were found in the wet systems of the aircraft, these systems were essentially non-functional and drained during the incident flight. The weather was dry whilst the aircraft was outside the hangar preparing for the flight.

It would appear that for any fluid leak to drip onto the subject connector, it is necessary to penetrate the rubberised fabric shroud which is fitted above it. Once through this, it may drip onto the cooling plenum, whose forward lip coincides with the array of connectors at the back of each unit on the E1 rack, particularly the Yaw Damper Coupler which is at the top. The evidence of a dried fluid run on the upper and lower surfaces of the plenum was of interest because it did indeed correspond to the centreline of the Yaw Damper Coupler but there was no indication of a leak in the shroud at the location from where the run appeared to originate. Notwithstanding this, G-BGJI's operator has developed a modification which puts an aluminium tray between the plenum and the shroud which completely covers the forward face of the E1 rack thus preventing any fluid which penetrates the shroud from dripping onto the connectors. A Boeing modification to achieve a similar standard of protection already existed but was not applicable to aircraft fitted with airstairs.
The E&E Bay Assessment Team were not specifically tasked with finding the cause of contamination which caused this incident but it formed part of their statistics and the operator of G-BGJI was one of the airlines whose procedures and aircraft were examined, after the operator had conducted their own internal checks. As mentioned in ¶1.16.8, the team generally found that occasional E&E Bay contamination was an accepted fact-of-life by many airlines. This appeared to be the case at the operator's Gatwick facility, where the condition of aircraft after a few years service following a P6 check, both by physical examination and discussion with the technicians, was expected to show signs of the characteristic blue staining of toilet sanitising fluid under the floor area. G-BGJI's operator did not necessarily regard water/waste system components as 'on-condition' as they were generally overhauled or renewed at each P6 check, but this represents 5 years service of systems which are often troublesome and prone to abuse. This incident led the operator to review all aspects of E&E Bay protection and maintenance practices and it might be speculated that other airlines would be well advised to do the same rather than wait until they, too, have an in-flight incident. By its nature, a contamination event is unpredictable as is demonstrated by this incident. It is unlikely that anyone could have foreseen the dramatic effect that contamination of the connector had on the behaviour of the aircraft.
The following recommendations were made in January 1996:

It is recommended that the FAA:

1) Require as soon as practical a visual inspection of all Boeing 737 aircraft Electrical and Equipment (E&E) Bays to check for fluid ingress into avionics components, their connectors and associated wiring. Such inspection should involve the minimum disturbance of equipment and connectors commensurate with a thorough examination for contamination. Where such contamination is found, the component should be removed and despatched to workshops for examination.

2) Require as soon as practical an inspection of the area in and around the E&E Bay for evidence on the structure and fittings of recent fluid leakage such as wet corrosion, staining and crystallised deposits. Such evidence should be investigated to ensure that, where the source of the leak is not apparent or readily rectifiable, no potential exists for it to impinge upon the avionics components, their connectors or wiring.

(Recommendation 96-3)

It is also recommended that the FAA and Boeing:
3) Conduct an urgent review of the measures incorporated into the Boeing 737 to prevent fluid ingress into the E&E Bay, its equipment, connectors and wiring and as necessary require modifications to ensure that the equipment, connectors and wiring are provided with protection consistent with reliable operation.

4) Conduct a review of the Aircraft Maintenance Manual to ensure that clear and specific instructions are contained therein to enable evidence of fluid ingress, even if not apparently directly impinging on electrical equipment, to be identified during routine maintenance. It should also be ascertained that any routine testing for leaks in the toilet, galley and airstairs systems should be done with the systems functioning fully throughout their normal operational cycle to ensure that any leaks which only occur during, for example, draining or replenishment cycles are detected.

(Recommendation 96-4)

It is accepted that the findings of the E&E Bay review team identified differing maintenance practices as being highly significant in determining the in-service condition of the E&E Bay and its associated avionics components, their connectors and wiring. However, the location of the bay, below the cabin floor in areas susceptible to fluid leaks from toilets, galleys and aircraft doors does make the bay
unnecessarily vulnerable. Although the chances of fluid contamination directly affecting aircraft handling, as in this case, would appear to be a most unlikely outcome, the wetting of sensitive avionics equipment will undoubtedly lead to unserviceabilities. This will become of more significance as aircraft continue to develop an increased dependence on electronic equipment. The location of the E&E Bay was undoubtedly arrived at following a variety of design considerations but in modern aircraft is possibly based on historic precedent as much as current design constraints.

It is therefore further recommended that:

The Boeing Airplane Company promulgate the findings of the E&E Bay Assessment Team to all operators and that the recommendations be actioned through Service Bulletins to maximise the protection from fluid ingress of bay housed electronic components in current aircraft.

(Recommendation 97-60)

The CAA with the FAA review FARs and JARs with a view to requiring that the location of electronic equipment be arranged during the aircraft design so as to minimise the potential for contamination by fluid ingress, with the intention of ensuring that the equipment, connectors and wiring are provided with protection consistent with reliable operation less heavily dependant
on maintenance practices.

(Recommendation 97-61)

3 Conclusions

(a) Findings

1. The crew members were properly licensed, medically fit, adequately rested and technically qualified to conduct the test flight.

2. The aircraft was on a test flight before being returned to line service following a scheduled major (P6) service and was operating within the normal limits of weight and centre of gravity.

3. The aircraft was being operated within the normal flight envelope at the time of the incident, using the Autopilot and Autothrottle systems and with the Yaw Damper system engaged.
The aircraft entered a cyclic oscillation in roll and yaw which was consistent with a critically damped Dutch Roll motion and persisted for seven minutes. The aircraft type has natural positive damping of the Dutch Roll mode.

The crew's initial actions, as they recalled them, of disconnecting the Autopilot and Autothrottle, and switching OFF the Yaw Damper were in accordance with the manufacturer's recommended procedure.

The commander's decision to issue a MAYDAY call in response to the incident was appropriate.

The ATC response to the MAYDAY call was timely, helpful and appropriate.

The crew's decision to conduct a low speed handling check to determine a suitable configuration in which to carry out a landing demonstrated good airmanship.

The decision to maintain the Flap 15, landing gear
down
configuration for the return to London Gatwick was
judicious.
10
The decision to re-engage the Yaw Damper system
during the
final approach sequence was unwise, but the
system was
switched OFF once again prior to landing.
11
The main rudder PCU had been replaced but in all other
respects the rudder/Yaw Damper system components were the
same as those fitted prior to the check.
12
After the incident, all components (mechanical, electrical and
electronic) capable of affecting rudder movement were tested
and none was found to be significantly out of specification.
13
From the M-Cab simulator testing it was possible to conclude
that shunt resistances, simulating the effect of fluid ingress,
between combinations of pins in the Yaw Damper Coupler
connector could cause an aircraft response similar
to that experienced during the incident.

14 The Yaw Damper Coupler had not been overhauled during its life and had run 17 years and about 34,000 hours without any recorded defects.

15 Examination of the aircraft’s Technical Log did not reveal entries related to Yaw Damper defects during the last two years.

16 No component defects were found in the Yaw Damper Coupler apart from those on the connector D295.

17 The portion of the connector D295 on the outside of the Yaw Damper Coupler enclosure had evidence of liquid spillage onto it.

18 Despite various attempts it was not possible to analyse the contaminant and hence identify its origin.

19 There was a considerable build up of products of
corrosion
   and electrolysis between pins of the connector
D295, within
   the Yaw Damper Coupler enclosure.

20
   The nature of the deposits observed on the Yaw Damper
   Coupler connector pins appeared similar to those produced
   when attempting to create stray electrical paths.

21
   The pins most affected by these deposits were related to the
   28V dc power supply and the circuits involved in activation of
   the Yaw Damper system.

22
   The scenario connecting the incident to the connector
   contamination, requires a further source of moisture nearer to
   the time of the incident to activate the electrical 'bridge'
   between the pins but no such source of moisture was
   identified.

23
   The airframe wiring affecting the Yaw Damper circuits was
   found not to have any deficiencies.
Tests using a 'breakout fly-lead' confirmed theoretical analysis that it was possible to maintain engagement of the Yaw Damper system after it had been switched OFF by introducing stray connections between pins within the Yaw Damper Coupler connector (D295) but only if the engage switch OFF earth was high resistance or open circuit.

Experimentation demonstrated that possibilities existed to build the necessary stray connections to achieve continued Yaw Damper engagement after it had been selected OFF.

The experimentation demonstrated that it was very difficult to generate robust stray connections between pins of connector D295 without causing more severe damage to the pins than had been observed on the unit involved in the incident.

None of the experimentally produced stray
connections with
appropriately damaged pins was sufficiently robust
to sustain
continuing Yaw Damper engagement after it had been
selected OFF.
28
There was little chance of finding evidence that a source of
moisture existed in the past, as the electronic units in the E&E
Bay (including the Yaw Damper Coupler) were removed and
the E&E Bay and structure immediately above it were cleaned
or replaced during the P6 check.
29
Visual inspection of the structure was carried out and
evidence from the technical records along with the recollections of the individuals involved indicated that the
degree of corrosion found and rectified was typical of any
aircraft on such a check and there were no indications of any
abnormalities which may have indicated heavy fluid contamination.
30
The E&E Bay was vulnerable to fluid leaks because it housed the forward airstairs, was located immediately below the main entry vestibule and forward galley and just aft of the forward toilet.

31 Examination of the aircraft technical documents only revealed one entry relating to a fluid leak capable of affecting the E&E Bay, dated 5 March 1995, when a leak was traced to the forward toilet sink drain.

32 The E&E Bay Assessment Team's findings and recommendations were extensive and identified detailed improvements both to hardware and maintenance practices to maintain a desirable environment in the bay.

(b) Causal factors

The investigation identified the following causal factors:

1 Contamination of the connector on the Yaw Damper
Coupler, in the E&E Bay, by an unidentified fluid had occurred at some time prior to the incident flight and compromised the function of its pin to pin insulation.

2 Sufficiently conductive contaminant paths between certain adjacent pins had affected the phase and magnitude of the signals transmitted to the Yaw Damper Actuator, thereby stimulating a forced Dutch Roll mode of the aircraft.

3 The location of the E&E Bay, beneath the cabin floor in the area of the aircraft doors, galleys and toilets made it vulnerable to fluid ingress from a variety of sources.

4 The crew actions immediately following the onset of the Dutch Roll oscillations did not result in the disengagement of the malfunctioning Yaw Damper system.

4 Safety recommendations
4.1 It is recommended that the FAA:

1) Require as soon as practical a visual inspection of all Boeing 737 aircraft Electrical and Equipment (E&E) Bays to check for fluid ingress into avionics components, their connectors and associated wiring. Such inspection should involve the minimum disturbance of equipment and connectors commensurate with a thorough examination for contamination. Where such contamination is found, the component should be removed and despatched to workshops for examination.

2) Require as soon as practical an inspection of the area in and around the E&E Bay for evidence on the structure and fittings of recent fluid leakage such as wet corrosion, staining and crystallised deposits. Such evidence should be investigated to ensure that, where the source of the leak is not apparent or readily rectifiable, no potential exists for it to impinge upon the avionics components, their connectors or wiring.

(Recommendation 96-3)

4.2 It is recommended that the FAA and Boeing:

3) Conduct an urgent review of the measures incorporated into the Boeing 737 to prevent fluid ingress into the E&E Bay, its equipment, connectors and wiring and as necessary
require modifications to ensure that the equipment, connectors and wiring are provided with protection consistent with reliable operation.

4) Conduct a review of the Aircraft Maintenance Manual to ensure that clear and specific instructions are contained therein to enable evidence of fluid ingress, even if not apparently directly impinging on electrical equipment, to be identified during routine maintenance. It should also be ascertained that any routine testing for leaks in the toilet, galley and airstairs systems should be done with the systems functioning fully throughout their normal operational cycle to ensure that any leaks which only occur during, for example, draining or replenishment cycles are detected.

(Recommendation 96-4)

It is further recommended that:

4.3 The Boeing Airplane Company promulgate the findings of the E&E Bay Assessment Team to all operators and that the recommendations be actioned through Service Bulletins to maximise the protection from fluid ingress of bay housed electronic components in current aircraft.

(Recommendation 97-60)

4.4 The CAA with the FAA review FARs and JARs with a
view to requiring that the location of electronic equipment be arranged during the aircraft design so as to minimise the potential for contamination by fluid ingress, with the intention of ensuring that the equipment, connectors and wiring are provided with protection consistent with reliable operation less heavily dependant on maintenance practices.

(Recommendation 97-61)

D F King
Inspector of Air Accidents
Air Accidents Investigation Branch
Department of the Environment, Transport and the Regions
November 1997

CLICK HERE TO RETURN TO INDEX
To: "John King" <jking1@attbi.com>
Subject: Re: Maybe another shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup

Dear John,

Trans World Airlines Flight 800 does come to mind and how it was impossible to be center tank fire as an initial event based on data facts evidence.

Shorts cause fires, yes, but they also cause a lot more than that.

JB

There is certainly enough history with United 811 and the two 'near misses' prior to it.

Of course fuel tank explosion (TWA 800) also comes to mind. The question is open to if a fuel quantity wire surge protection system (FQIS/TSU was used, e.g. Smiths, BF Goodrich, who installed it and when ?

Also remember, its not just the 747s that are susceptible to fuel tank ignition but the other , as well. See the SDR and one image document attached of a FQIS wire within a DC-10 fuel tank. Look to the right of the finger tip in the picture and see the electrical burn mark through the insulation. The report filed with this SDR
also said the metal rib to which this wire was chafing had to be "dressed out" due to the severity of the electrical burn.

The question becomes; where did that unwanted and dangerous electrical energy come from if not from cross arcing in shared wire bundles outside the tank?

JK

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: "John King" <jking1@attbi.com>
Subject: Re: C 130 crash like that in 1994

I used to work the Electra dry bays; they are big.

No different, dry bays or vacant fuel tanks go boom.

JK
--

I used to fly in P3A as radar operator in Navy. We worried about the nacelles flying off like gyroscopes like the Electra did a few times.

Still a great plane.

Wiring is so complex.....

Barry
Dear John and Barry:

Boeing used Poly-X from fuselage # 51(1970-75), switched to Stilan in 1975, switched to crosslinked Tefzel in 1978, switched to Kapton on the 400 in 1989, switched back to crosslinked Tefzel in 1993. Hope this helps.

Ed

Dear Ed, thanks.

China Airlines Flight 611 had crosslinked Tefzel, Delivered 1979
Air India Flight 182 had crosslinked Tefzel, 1978
Pan Am Flight 103 1970 but line number 15, what was used before fuselage #51?
Trans World Airlines Flight 800 poly X 1971
United Airlines Flight 811 had poly X 1970

What is crosslinked Tefzel? Is it the same type of polyimide aromatic teflon coated insulation? Is prone to the cracking, chafing, etc that poly X has?

Can it be called Poly X type wiring?

I'm afraid China Airlines Flight 611 is another of my shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanations. Wiring will surely get the attention it deserves after it is determined the wiring caused that door to rupture open in flight.

Wiring does worse things than start fires.

Thanks again, Ed.

Cheers,
Prediction: Will have sudden loud sound followed by abrupt power cut: It's fast air molecules and nose off. Monday Night, 17 June 2002 John Barry Smith
Taiwan
'Black boxes' likely to be retrieved today, declares ASC chief Chinese boats join search and recovery efforts, complain direct link restriction causing delay 2002-06-18 / Taiwan News, Staff Writer /
The Aviation Safety Council Managing Director Kay Yong (??) yesterday said that the so-called "black boxes" of the ill-fated China Airlines CI-611 jetliner are expected to be retrieved early this morning.

As the signals of the plane's data and voice recorders are weakening 24 days now after the crash, rescue efforts are concentrating on the recovery of the recorders - which may stop emitting signals soon since the batteries have an estimated life span of 30 days.

Ships and underwater photography equipment sent by the companies Jan Steen of Singapore and Global Industries of
America have contributed to boosting the search efforts. In addition to the participation of the Taiwanese navy and local rescuers.

The ASC official yesterday was confident of recovering the recorders by this morning.

"Taking a look at the recent rescue efforts - which are very effective - I believe it is very possible for us to recover the black boxes early in the morning," said Yong at yesterday's press conference.

The ASC also made public some pictures of the wreckage the divers successfully took under the water. Yong said that the pictures are very helpful for the team to recover the black boxes.

Chinese boats also joined the search for the plane's wreckage and the victims' bodies, but they complained that the ban on direct links postponed the return of the wreckage they retrieved from the Taiwan Strait.

The rescue team has recovered 121 bodies as of yesterday with one body still needing to be identified.

The Hong Kong-bound jetliner dived into the sea near the outlying Penghu island after breaking into four chunks in mid-air on May 25. The crash has killed 225 passengers and crew on board.

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From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: EdwBlock@aol.com  
Subject: Raychem

Dear Barry:

The Raychem Corp is the match.

Ahhh....But they sold all the wiring so no coincidence.

They are owned by TYCO Int'l now.

Crosslinked means bombarded with an electron beam fed by a nuclear reactor. It imparts qualities unseen and unknown.

Why do it then?

What it really does is allow for patents and exorbitant sole source pricing of $31/ft on the Cruise Missle.

Only used once so really don't have to worry about aging.

TKT stands for Teflon-Kapton-Teflon. It is tape wraps. The teflon melts and puts out the arc-tracking of Kapton.

China Air 611 was crosslinked Tefzel not regular Tefzel.

Thanks.
Boeing used Poly-X from fuselage # 51(1970-75), switched to Stilan in 1975, switched to crosslinked Tefzel in 1978, switched to Kapton on the 400 in 1989, switched back to crosslinked Tefzel in 1993.

China Airlines Flight 611 crosslinked Tefzel 1979
Air India Flight 182 crosslinked Tefzel 1978
Pan Am Flight 103 Mil-W81044/6 1970
Trans World Airlines Flight 800 Poly X 1971 BMS-13-42
China Airlines crash at Wanli about 81 or 82, probably crosslinked Tefzel
El Al Amsterdam Plane delivered in 1979 crosslinked Tefzel
Pan Am Flight 125 Mil-W81044/6 1970
Boeing 747-222B, N152UA preflight line 675 mar 87 crosslinked Tefzel
United post flight serial number 28717, after 1992 could be crosslinked Tefzel

Make sure you show the distinction.

Righto. Crosslinked Tefzel seems more the villain than Poly X.
No Stilan.

Operator Design: UALA
Precautionary Procedure: NONE
Nature: OTHER Stage of Flight: INSP/MAINT
District Office: Western/Pacific US office #29
A/C N Number: 199UA
Aircraft Serial No.: 28717
Discrepancy/Corrective Action: FWD CARGO DOOR OPENED BY ITSELF WHEN CB PUSHED IN. ON ARRIVAL, CIRCUIT BREAKERS WERE PUSHED IN, WHEN PRESSURE RELIEF DOOR HANDLE WAS OPENED THE DOOR LATCHES OPENED AND THEN THE DOOR OPENED ON ITS OWN. COULD NOT DUPLICATE PROBLEM AFTER INITIAL OPENING.
BMS-13-42 is Boeing's specification covering Poly-X (BMS 13-42B), and Stilan (BMS-13-42D).

Right, thanks Ed.

Now, can you imagine the interest in wiring after China Airlines Flight 611 is determined to be hull rupture in flight and that is forward of the wing on the right side near the forward cargo door? That leads to United Airlines Flight 811 and that leads to wiring/switch.

And that leads to Air India Flight 182, Pan Am Flight 103, and Trans World Airlines Flight 800.

So, first things first: Hull rupture. Location, similar event, to similar events. I hope the Chinese can see the forest while looking at their one tree.

Cheers,
Barry
On June 13, 1991, UAL maintenance personnel were unable to electrically open the aft cargo door on a Boeing 747-222B, N152UA, at JFK Airport, Jamaica, New York. The airplane was one of two used exclusively on nonstop flights between Narita, Japan, and JFK. This particular airplane had accumulated 19,053 hours and 1,547 cycles at the time of the occurrence. The airplane was being prepared for flight at the UAL maintenance hangar when an inspection of the circuit breaker panel revealed that the C-288 (aft cargo door) circuit breaker had popped. The circuit breaker, located in the electrical equipment bay just forward of the forward cargo compartment, was reset, and it popped again a few seconds later. A decision was made to defer further work until the airplane was repositioned at the gate for the flight. The airplane was then taxied to the gate, and work on the door resumed. The aft cargo door was cranked open manually, the C-288 circuit breaker was reset, and it stayed in place. The door was then closed electrically and cycled a couple of times without incident. With the door closed, one of the two "cannon plug" (multiple pin) connectors was removed from the J-4 junction box located on the upper portion of the interior of the door. The wiring bundle from the junction box to the fuselage was then manipulated while readings were taken on the cannon plug pins using a volt/ohmmeter. Fluctuations in electrical resistance were noted. When the plug was reattached to the J-4 junction box, the door began to open with no activation of the electrical door open switches. The C-288 circuit breaker was pulled, and the door operation ceased. When the circuit breaker was reset, the door continued to the full open position, and the lift actuator motor continued to run for several seconds until the circuit breaker was again pulled. At this time, a flexible conduit, which covered a portion of the wiring bundle, was slid along the bundle toward
the J-4 junction box, revealing several wires with insulation breaches and damage.
UAL personnel notified the Safety Board of the occurrence, and the airplane was examined at JFK by representatives of the Safety Board, United Airlines, and Boeing. After the wires in the damaged area were electrically isolated, electrical operation of the door was normal when the door was unlocked. When the door was locked (master latch lock handle closed), activation of the door control switches had no effect on the door. This indicated that the S2 master latch lock switch was operating as expected (removing power from the door when it was locked). After the on-site examinations, the wiring bundle was cut from the airplane and taken to the Safety Board's materials laboratory for further examination.

The wiring bundle with the damaged wires contained all electric control wires (28 volt DC) and power wires (115 volt AC) that pass between the fuselage and the aft cargo door. From the forward side of the J-4 junction box, the bundle progresses in the forward direction, just above the forward pressure relief door, then upward, following the forward lift actuator arms. The bundle then enters an empty space between two floor beams, where the bundle has an approximate 180-degree bend when the door is closed. From this location, the wiring bundle progresses inboard, through a fore-to-aft intercostal between two floor beams. The wiring bundle then splits, with wires going in several directions.

The bundle is covered by the flexible conduit approximately from the lower end of the lift actuator arms to the fore-to-aft intercostal between the floor beams. The conduit covering the wiring bundle is intended to prevent the wire bundle from being damaged during opening and closing of the door and during cargo handling operations. The conduit is a sealed flexible interconnector consisting of a convoluted helical
brass innercore covered by a bronze braid. The innercore is soldered at every other convolute, and should be capable of withstanding pressures exceeding 1,000 pounds per square inch (psi). Boeing has indicated that the conduit is an evolutionary improvement and that it has been installed on all B-747 airplanes produced since 1981 (from line number 489 on). Airplane N152UA was delivered in April 1987.

Airplanes produced prior to 1981, including N4713U, used a bungee retraction system, to retract the cargo door wire bundle. Guidelines for the replacement of the bungee system with the flexible conduit were covered in Boeing Service Bulletin 747-752-2170, dated August 1981. The service bulletin was prompted by reports that the wire bundle bungee retraction system had not retracted the wire bundle sufficiently to prevent trapping the bundle between the cargo door and the door frame. UAL did not perform the retrofit on N4713U, which was line number 89, nor was the company required to do so.

Examination of the wires in the damaged area on the wiring bundle revealed that four of the wires were similar in appearance, with insulation breaches that progressed through to the underlying conductor. Adjacent to the breach on these four wires, the insulation was blackened, as if it had been burned. Another wire contained an extensive breach but no evidence of burned insulation. The damaged area was located on the bundle at a position approximately corresponding to a conduit support bracket and attached standoff pin on the upper arm of the forward lift actuator mechanism. This support bracket was found bent in the forward direction. In addition, mechanical damage was noted on adjacent components in this area.

A second damaged area was noted on the wiring bundle at a position approximately corresponding to the conduit swivel clamp at the elbow between the two arms of the forward lift actuator mechanism. Wires in this area were missing portions of
their exterior coating, but no breaches to the underlying conductors were noted.

The exterior braid on the conduit contained minor rub marks and was slightly kinked at a position corresponding to the area on the wires with breached insulation. Additional examinations revealed that the innercore of the conduit contained multiple circumferential cracks in the areas corresponding to the damage areas on the wires. The cracks were in the convoluted innercore directly adjacent to the inside diameter of the conduit. The lock sectors, latch cams, and latch pins from the aft cargo door were examined on the incident airplane and were generally in excellent condition. There was no evidence to suggest that the cams had ever been electrically (or manually) driven into or through the lock sectors.

Boeing also informed the Safety Board that, in May of 1991, a B-747 operated by Quantas was found to have chafing of the wires in the wire bundle to the aft cargo door. This airplane also had a flexible conduit protecting the wires, and the chafing was located approximately at the standoff pin on the bracket at the upper arm of the forward lift actuator.

The Safety Board determined that the chafing of the wires on the airplane involved in the JFK occurrence was caused by, or was greatly accelerated by, the circumferential cracks in the conduit and that the cracks in the conduit were caused either by repeated flexing of the conduit as the cargo door opens and shuts or by unusual stresses on the conduit generated concurrently with damage to the conduit guide bracket and attached standoff pin on the upper end of the forward lift actuator upper arm.

A portion of the wire bundle for the forward cargo door on many B-747 airplanes is also covered by a flexible conduit that is very similar to the conduit for the aft cargo door. However, there are substantial differences between the orientation of the flexible conduits for the two doors, and the Safety Board has not become
aware of problems associated with the flexible conduit for the forward door. Nevertheless, because of the concerns about the chafed wires and possible electrical short circuits, on August 28, 1991, the Safety Board recommended that the FAA:

Issue an Airworthiness Directive applicable to all Boeing 747 airplanes with a flexible conduit protecting the wiring bundle between the fuselage and aft cargo door to require an expedited inspection of:

(1) the wiring bundle in the area normally covered by the conduit for the presence of damaged insulation (using either an electrical test method or visual examination);
(2) the conduit support bracket and attached standoff pin on the upper arm of the forward lift actuator mechanism;
(3) the flexible conduit for the presence of cracking in the convoluted innercore.

Wires with damaged insulation should be repaired before further service. Damage to the flexible conduit, conduit support bracket and standoff pin should result in an immediate replacement of the conduit as well as the damaged parts. The inspection should be repeated at an appropriate cyclic interval. (Class II, Priority Action) (A-91-83)

Evaluate the design, installation, and operation of the forward cargo door flexible conduits on Boeing 747 airplanes so equipped and issue, if warranted, an Airworthiness Directive for inspection and repair of the flexible conduit and underlying wiring bundle, similar to the provisions recommended in A-91-83. (Class II, Priority Action) (A-91-84)

The FAA responded to these safety recommendations on November 1, 1991, stating that it agreed with the intent of the recommendations and that the issuance of an NPRM was being considered to address the issues in the safety recommendations. The Safety Board replied on November 27, 1991, classifying
each of the recommendations as "Open--Acceptable Response," pending the completion of the rulemaking process. Since that exchange of correspondence, the FAA has published an NPRM which is now being reviewed by the Safety Board. Safety Recommendations A-91-83 and -84 will continue to be classified as "Open--Acceptable Response" until an acceptable final rule is published.

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: EdwBlock@aol.com
Subject: Why do it?

At 11:01 AM -0400 6/21/02, EdwBlock@aol.com wrote:
Dear barry:

Thanks for the info. The reason to keep doing it? Pre-planned obsolescence or attrition. If the plane lasts forever like say the DC-3, you don't need new ones do you. I know how bad that sounds but it is the only explanation I can come up with.

Ed

Well, I'd like to think they aimed low and hit it. 15 years for wiring life is not bad and when they fly 20 years it's hard to blame the wiring. The blame is that the product is defective in the first place over time and no action is taken.

I don't think Boeing purposely installed faulty wiring or Raychem purposely made faulty wiring but I do believe they do not want to accept the truth that faulty wiring is causing many accidents. They bandaid the symptom instead of fixing the problem.
We shall see when China Airlines Flight 611 turns out to be cargo door rupture and everyone gets to say why. I will have United Airlines Flight 811 and you will have wiring.

It will get very interesting, Ed.

I want the doors to be plug type and wireless used instead of wiring when feasible.

Cheers,
Barry

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: "John King" <john.king19@comcast.net>
Subject: Searching databases

Have either of you guys done the following;

1. A review of the NTSB Monthlies. A line-by-line search because there is no search engine provided us but I find it not creditable that the NTSB hasn't one. Go Fish.
The Monthlies do appear to mirror the NTSB Rule 803.5 required filings for control problems (they accurately did so for some 30 Rule 830.5 filings the NTSB sent me some time back).

"For every major accident--up to 200 unreported occurrences--up to 7-10 incidents and up to 5 less significant accidents".

JK
--
Thanks John, I have done the NTSB monthly thing, line by line. Your other advice is very timely too, thanks. I did it for ramp deaths, cargo doors, and now control problems. It's amazing how many close calls there were/are. The close midairs are more nightmares.

The data on airline incidents in the monthlies is very scanty too.

I add, for every major accident correctly explained probable cause, up to three incorrectly explained.

Cheers,
Barry the other John

John Barry Smith
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Carmel Valley, California 93924
831 659 3552
barry@corazon.com
http://www.corazon.com

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: "John King" <john.king19@comcast.net>
Subject: This is the idea behind the Valujet cause of O2 cannisters years later. Valujet was probably electrical, not o2.

My question to David is not only just how many prior control problems are there ?....but also how sure is he that the SDRs on the record do not indicate a error in the maintenance manual ? If there is, than this whole story moves right into the FAA's front door.
We know their zeal to shield the industry from costs is great. The attached story of how the O2 canister lanyards breakage problem has persisted since 1989 and will see a final fix in 2005 is instructive.

JK
==

NTSB Identification: DCA86IA037. The docket is stored on NTSB microfiche number 32301.
Nonscheduled 14 CFR Part 121: Air Carrier AMERICAN TRANS AIR, INC.
Incident occurred Sunday, August 10, 1986 in CHICAGO, IL
Aircraft: MCDONNELL DOUGLAS DC-10-40, registration: N184AT
Injuries: Unavailable

A CHARTER FLT ARRIVED & DEPLANED WITHOUT INCIDENT & WITH NO INDICATION OF SMOKE, FUMES OR HEAT. COMPANY MAINT PSNL HAD PLACED DAMAGED PASSENGER SEATBACKS (INCORPORATING SOLID-STATE CHEMICAL OXYGEN GENERATORS) IN THE FWD CARGO COMPARTMENT WITH SEAT COVERS & OIL. A COMPANY MECHANIC EXAMINED THE SEATBACKS TO FIND A SERVICEABLE UNIT. HE FOUND A LOOSE OXYGEN CANISTER & HANDLED IT IMPROPERLY BY ITS OXYGEN HOSE. SUCH HANDLING CAN RELEASE THE FIRING PIN, FIRE THE PERCUSSION CAP, TRIGGER A CHEMICAL REACTION, & GENERATE OXYGEN. THIS CAN GENERATE UP TO 430 DEG OF HEAT OUTSIDE THE CANISTER. A FIRE BGNIN THE FWD CARGO COMPARTMENT IN THE VICINITY OF WHERE
AN OXYGEN CANISTER WAS FND (LATER) WITH A DENTED STRIKER PLATE. THE SEAT COVERS IGNITED, FIRE BURNED THRU THE CABIN FLOOR, & SUBSEQUENTLY, IT SPREAD THROUGHOUT THE ENTIRE CABIN. COMPANY MAINT PSNL DID NOT KNOW THAT OXYGEN GENERATORS, CARRIED AS COMPANY SUPPLIES, WERE HAZARDOUS MATERIALS. THE MECHANIC WAS NOT FAMILIAR WITH THE REPAIR OR INSTALLATION OF THE PASSENGER SUPPLEMENTAL OXYGEN EQUIPMENT.

The National Transportation Safety Board determines the probable cause(s) of this incident as follows: OXYGEN SYSTEM..INFORMATION INSUFFICIENT..COMPANY MAINTENANCE PERSONNEL

Contributing Factors

SUPERVISION..IMPROPER..COMPANY/OPERATOR MANAGEMENT LACK OF FAMILIARITY WITH AIRCRAFT..COMPANY/OPERATOR MANAGEMENT TIE DOWN..IMPROPER..COMPANY/OPERATOR MANAGEMENT OXYGEN SYSTEM..NOT UNDERSTOOD..COMPANY MAINTENANCE PERSONNEL LACK OF FAMILIARITY WITH AIRCRAFT..COMPANY MAINTENANCE PERSONNEL

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: "John King" <john.king19@comcast.net>
Subject: Re: This is the idea behind the Valujet cause of O2 cannisters years later. Valujet was probably electrical, not o2.

Dear John,

The urinalysis machines that the military uses to boot out any officer with a 'positive' are advertised as '99%' accurate. They do 2 million a year so that means about 20000 careers ruined...

The idea for Pan American World Airways Flight 103 bomb/timer/suitcase in forward cargo compartment came for UTA event months later thought up by French. Copycat explanations that are not supported by facts but supported by public opinion.

The other John...Smith

Thanks John and I do believe this one was included in that NTSB VJ Final report, as well.

I've got a FOIA response from the Tech Center here that said the exterior surface of a operating can measured at 405 degrees F and that's very close to the "430 degrees" stated here.

Of course that's about 70 to 100 degrees short of the ignition temperature of either cardboard or bubble wrap and a bubble wrap Safety Data Sheet I have from Sealed Air Corporation, a producer of bubble wrap, says "Flash point Above 500 degrees F".

Too bad they can't be trusted.
Someone (might have been Larry Costanzo of Air Investigations Inc) told me a few years back that "a FBI agent familiar with Flight 103 said the "amount of explosive residue found amounted to next to zilch".

Dear John, if I can't persuade you of the plausibility, the reasonableness, and the logic of the shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation for Air India Flight 182, Pan American World Airways Flight 103, United Airlines Flight 811, and Trans World Airlines Flight 800, then I can't persuade anyone and the fight is truly lost.

You believe the NTSB makes erroneous AAR, I do too and say it is so with AAR 0003 for Trans World Airlines Flight 800. You believe in precedent for newer accidents, I do too with United Airlines Flight 811. You believe wiring causes initial problems which cause other problems which are blamed, so do I with Air India Flight 182 not a bomb, Pan American World Airways Flight 103 not a bomb but a shotgun after wiring short, United Airlines Flight 811 not
improper latching but wiring, Trans World Airlines Flight 800 not center fuel tank explosion but on fire engine number three igniting the fuel vapor cloud of disintegrating aircraft. You believe in documenting your refutations of conventional wisdom with reports, I do too with my Smith AAR for the three aircraft above and available on corazon.com in pdf format.

Just think how much our cause, your cause first, of faulty wiring would be helped when confirmed that the three early model Boeing 747 accidents that have killed a thousand and caused billions to be transferred were not bombs but wiring. Action would be taken instead of these delays and band aid fixes to entertainment systems and procedural changes. The fleets would be grounded and wiring replaced, the non plug cargo doors would be made plug type.

When you believe that the center tank exploded on Trans World Airlines Flight 800 you are believing the media and the government agency that you profess to debunk. When you wonder how the media can continue to publish erroneous information over and over again when you know the facts refute the claims, look to yourself when you believe that those 747s inflight breakups were 'bombs' when an alternative explanation exists, the shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation.

You have influence with some aviation safety media, with IASA, with some government officials. I am trying to get an audience with them to present the explanation for consideration. That is not happening and has not happened. I've been trying since 1990 and since then cargo doors have opened in the air and on the ground causing hundreds of fatalities. In 1996 I found out the cause of the inadvertent cargo door openings and it was wiring,
then I discovered that the faulty wiring was well known and you were attempting to bring attention to the problem.

If you can assist in my attempts to get authorities to realize the danger of aging wiring in early model Boeing 747s which are causing explosive decompression and inflight breakups, I would appreciate it. I don't know how specifically.

Cheers,
Barry
Tuesday, September 30, 2003 7:48 AM

John Barry Smith
541 Country Club Drive
Carmel Valley, California 93924
831 659 3552
barry@corazon.com
http://www.corazon.com
The effort we have seen by the FAA and the NTSB to protect industry interests have come through in so many ways, i.e.

In the NTSB Sioux City Report versus the earlier National Airlines Report, the NTSB changed the findings of unknown vibrations to "engine overspeed", a cause specifically addressed and debunked as "pure speculation" in the National Report. Moreover, the National Report references to two other fan failures on the ground, and so similar as to be used as "comparison analysis", were not mentioned in the Sioux City 'prior' or 'historical references'. The FAA cinched the scheme by adding "Sioux City was the first of its kind". Add to that, it was the FAA who allowed GE to use its billet sources and their assurances that the materials had no defects (ALPA partial inclusions) whereas Pratt accepted no vendors words for the purity and metallurgical properties of its materials and had a 'check-double check' metallurgical program to assure the quality of all metals going into its engines. I know because I was a QC manager for a GE/Pratt supplier and when I gave this information to the NTSB (Bob MacIntosh) back then, the NTSB said it had never heard of this. Consequently, the FAA dropped its accusations that United "missed the crack" and one of the corrective actions in that NTSB Final Report was that "all materials, and prior to being released for production, must pass metallurgical checks".

In the Aloha 737 fuselage peelback, it was the FAA who reduced the industries own recommendations for review and inspections of seven sites to two. When asked why, the FAA said because of "cost considerations" said a AW&ST article.

The ValuJet Final Report is the most contradictory and biased report I have ever read. I had no trouble in finding 17
contradictions just by reading the report. Add to that the FAA Tech Center Reports that say the O2 cans burn too cold to start any fire and that the oxygen emitted is way short of supporting any fire of consequence. Comparing the NTSB Final Report against the Canadian TSB Report on Swissair Flight 111 is like comparing a comic book against any scientific journal.

Indeed wiring may have caused that TWA 800 tank explosion. It has a terrible history and the FAA/NTSB Web databases severely understate the wiring and electrical problems. For every incident found there an additional three more can be found in the Service Difficulty reports by maintenance and in the Aviation Safety Reporting System by the flight crews. Cuffing this data serves to understate fleet wide problems and saves the industry lots of money. I'll always wonder if was our efforts to shine the light on the wiring and electrical issues and that gave the NTSB another explanation for TWA 800. I'll never wonder about those dozens of industry and military witnesses and that they truly believed that they saw a missile rising towards that plane. My long industry and military experience is that such men don't lie...not about this.

Add to this your own review of doors that open on their own and one can only marvel there aren't more smoking holes on US soil and that's not to say that US manufactured aircraft haven't killed many a non US citizen. When they fall off our shores the FAA? NTSB likes to presume they are suicidal or don't know how to fly.

The battle continues...
Thanks for the good fight.

JK
--

----- Original Message -----
From: John Barry Smith
To: John King
Sent: Monday, September 29, 2003 6:03 PM
Subject: Re: This is the idea behind the Valujet cause of O2 cannisters years later. Valujet was probably electrical, not O2.

Dear John,

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Too bad they can't be trusted.

JK
--

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: "John King" <john.king19@comcast.net>
Subject: Re: P.S. SDRs ???

Have you ever seen the SDRs on file for 747s

I have read a few Service Difficulty Reports by searching through FAA documents but I'm sure I've missed most. I've attached them here 103 which includes all types as Appendix F to my Smith AAR for Pan American World Airways Flight.
What's your procedure to get them?

Sort of gilding the lily.....

Cheers,

Barry

---

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: "John King" <john.king19@comcast.net>
Subject: Re: Attachment to my last

Forgot to attach

Attachment converted: MrX:ASW 9 11 1of5.pdf (PDF /CARO) (0019031A)
Attachment converted: MrX:ASW 9 11 2of5.pdf (PDF /CARO) (0019031B)
Attachment converted: MrX:ASW 9 11 3of5.pdf (PDF /CARO) (0019031F)
Attachment converted: MrX:ASW 9 11 4of5.pdf (PDF /CARO) (00190320)
Attachment converted: MrX:ASW 9 11 5of5.pdf (PDF /CARO) (00190328)

Thanks, I'm checking the issue about SDRs now.

Barry

---

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: "John King" <john.king19@comcast.net>
Subject: Re: P.S. SDRs ??//Data attached

I have a 3,200 report data run from the FAA Data Center in Oklahoma from 1995 to the summer of 2000.

I've attached it here.

Reviewing it today, thank you very much. Came across perfectly in .rtf.

>( my oldest daughter died five months latter)

Ugh, nightmare. My daughter is 11 and the light of my life. Sorry for you. I thought this morning waking up how I would cope with loss of her and remembered the quote from Mr. Dean Martin after her son, Dino, died in a flight of two F4 taking off from base in LA and flying into a mountain, "Of course, I'll never feel joy again."

Premature death is what we fight to delay. These politicians who 'represent' the people do not care about life but embrace death. Lenny Bruce said, "On TV you can show a breast being sliced off, but not kissed." True today with violence condoned and any sex censored.

Traffic deaths of 40000 a year are a social scandal. And that's just the USA. It's like we are making human sacrifices to the machine god to placate the machines.

JBS
Indeed we are singing from the same book when we speak critically of the alternative scenarios presented by the FAA and found in so many recent NTSB Reports and our countering views and documents come from their own files.

Hoist them on their own petard...and yet they don't trust their own data.

Be it 767 reversers that deploy in flight, 737 rudders with a mind of their own, A-300 rudders that wag the dog; errant 747 cargo doors are yet but another variation of wiring system calamities and the FAA and the NTSB have done a very good job of dodging the root cause. We know their game and that's a help.

Add 767 split elevators and autopilot uncommanded disconnects and non suicidal Egyptian copilots....

It's clear they have long chosen to side with the industry to minimize costs, maintain ridership and deflect questions of FAA oversight, Flight Standards and Certification of systems and materials. They do this with the full belief that nothing will become of it and that all the presumed 'checks and balances' of
congressional oversight, justice department actions, IG investigations have been co oped by the flow and power of money flowing through the hill for so many years.

Cynicism....does not taste good. FAA is profit driven but...NTSB should be and must independent and safety first and damn the cost. Or ground them.

It's an ugly scene and it is so contrary to our very core of beliefs, the Rule of Law and the education we received beginning in elementary school. Few see this with the major exceptions to the very few, that for reasons of conscience or outrage, came forward to speak the truth.

I read a good thing in Harpers about dissent. We are the dissenters and it's hard. By Hoagland. I know the truth so much that I can say I might be wrong. I might be wrong and when dealing with life and death issues, it is very important to be right. So that means checking and rechecking. Over and over again.

My complaint is not the harassment or the lies but being ignored. No questions is tough when I am reporting a safety issue that involves the lives of literally hundreds of men women and children. See below in over the top email to TSB.

Presently I am working with about eight of these men whom all have come from United over the past two years. As individuals and in small groups they have approached every agency (IG, GAO, Justice, congress, DOT, DOL, OSHA, etc) but only to find that even though their claims of maintenance fraud were found to
be true, they remain without careers; some now for up to two years. In spite of the Wendall Homes Aviation Act and promises, retaliation works to keep them off the property and sends a chilling message to any others who may do the same. Some time has now been spent just to have them understand that what has happened to them at United is no different than to those before and from a virtual cross section of the entire industry.

Interesting. And tragic.

With some luck their story, not of United, but of industry wide retaliation, may appear in USA Today soon.

Water off a duck's back.

IASA tied my hands, as well, with worries that my more aggressive style might get in the way of some efforts to meet with the decision makers in DC.

Aart Van de Wal blackmarked me when IASA started because of my controversial point of view on no bombs but mechanical problems. We think they will be sorry some day when they find out they were wrong, but not so. They don't care one way or the other. NTSB guys get their pensions and documentaries about how hard they work and it's over. No justice.

It's taken some time but now they realize these decision makers were not part of the solution but rather key figures in the
problem.

Absolutely, Jim Hall, Bernard Loeb, Jim Wildey, Tom Thurman, John Garstang, and others up and down the chain.

I'm not good at politics because, like the bonus systems in carrier maintenance programs, it has no place in safety deliberations.

I call it Barry grows up when I realize the silent agreement that safety is only a coincidence to profit. The military is not like that. The Navy cared about me and did its best to keep me alive, even in combat. The callousness of the airlines and manufacturer and government to the lives of the people entrusted to it is astounding.

Buried in that Air Safety Week article I pushed back in September 2000 was the story that United had not even filed (72 hour) the required SDR for all of 2000 up to October. The FAA guys there then called to say that over 5,000 SDRs had now been sent and they were bring in two additional stall to enter the data. But yet, nothing became of it and the FAA did not confront United for such a lapse. The fines would have been enormous but to do so would have brought attention to the FAA's loose grip here on the entire industry. If you hadn't seen that article I have attached here in PDF.

Good work.
That's it my friend and there are very few of us out here that do this work. But do it we will because its the right thing to do to honor those before us who also believed in this country and we want something better for our kids and our grandchildren, as well. Its our legacy to them to have tried to make this a better place.

I do it I think to repay the debt of my pilot who saved my life. I can't think of any other rational reason and either can my wife. I love a good mystery too.

I don't know how specifically to help you but I'm always looking.

Thanks. I will always bring your name up when wiring comes up. I usually can't get them past ruptured cargo door inflight with pictures attached.

Comparing the NTSB Final Report against the Canadian TSB Report on Swissair Flight 111 is like comparing a comic book against any scientific journal.

So true. Reading other AAR is a pleasure after the confusing and misleading NTSB crap. Well, the early NTSB stuff is OK before they went political. Also interesting are AAR in which the tower or other FAA people screwed up and killed people but the report always seems to blame the pilot and clears the ATC people.
I'll always wonder if was our efforts to shine the light on the wiring and electrical issues and that gave the NTSB another explanation for TWA 800.

I think so. It was wiring but not the center fuel tank. Like uh, no ignition source is like saying a two legged stool can stand. Need source, fuel, and air for that explosion. The shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation gives one with on fire engine number three as the source of ignition, but then you have to have inflight breakup first and then fuel vapor cloud explosion, not reverse.

I'll never wonder about those dozens of industry and military witnesses and that they truly believed that they saw a missile rising towards that plane. My long industry and military experience is that such men don't lie...not about this.

They saw the streak and it was there, it was the shiny cargo door and skin pieces peeling away reflecting sunlight into a streak. The sun angle had to be just right and the timing had to be just right and it was. That was all analyzed by me and sent to NTSB. The shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation fits all the facts of streak and center tank explosion and of course the pictures of the forward cargo door with obvious ruptures at the midspan latches and paint transfers and all that other matching United Airlines Flight 811 stuff like sudden loud sound on the CVR followed by abrupt power cut to the recorders...and on and on....
Add to this your own review of doors that open on their own and one can only marvel there aren't more smoking holes on US soil and that's not to say that US manufactured aircraft haven't killed many a non US citizen. When they fall off our shores the FAA? NTSB likes to presume they are suicidal or don't know how to fly.

China Airlines Flight 611 is a possible aft cargo door rupture open but very little data comes out and NTSB and FAA are being so very helpful to the Taiwanese over there.

Well, John, you have given me a pep talk. Thanks, it's good to know I'm not alone. I always come back to United Airlines Flight 811 to reassure me I'm not a crank, kook, or just nutty. It's the conspiracy guys that call me crazy and that's funny.

Cheers,
Barry

John Barry Smith
541 Country Club Drive
Carmel Valley, California 93924
831 659 3552
barry@corazon.com
http://www.corazon.com

To: "Delorme, Paulette" <Paulette.Delorme@tsb.gc.ca>
From: John Barry Smith <barry@corazon.com>
Subject: Air India Flight 182 questions
Cc: Terry.Burtch@tsb.gc.ca
Bcc:
X-Attachments:
From Bill Tucker, former Director of Investigations TSB.

However, I have obtained a personal commitment from both the Director of Engineering and the Director of Air Investigations that they will follow-up on this at the end of the summer and see if there is anything that can be made available to you.

Paulette G. Delorme
Executive Assistant / Adjointe executive
Transportation Safety Board of Canada
Bureau de la securite des transports du Canad

Dear Ms. Delorme, Tuesday, September 2, 2003 6:15 PM

I'm at my wits end. Desperate thinking men do desperate thinking things. My desperate thinking thing, Ms. Delorme, is to appeal directly to you via email and metaphor. I don't know your background, responsibility, or authority but I do know you are in the chain of command for aviation accidents in Canada for probable causes.

I wish to report to you a danger which exists as I type. The danger is to passengers in early model Boeing 747s, some of which belong to Canadian airlines and fly Canadians. The danger of fatalities is because of defective wiring and non plug cargo doors. I can prove that assertion in general and specifically for Air India Flight 182, if given the opportunity.

I've tried facts, data, and evidence in support of the shorted
wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation but have received no queries from aviation safety officials in the TSB. Air India Flight 182 was not a bank robbery but an airplane crash but I have been referred to the RCMP which would normally be for criminal matters not airplane crashes.

Sooooo...... Ms. Delorme, I, as a witness, am going to appeal to you, as police officer, using a metaphor of crime. The crime is rape.

The Metaphor: I am a witness to a rape and I am reporting the crime to the RCMP. I am saying who is being raped, who the rapist is, where it is occurring, and why. I am saying to the rape police that the culprit they think they have is not the culprit. I have identified a different culprit rapist. I can prove this rapist has done the rapes.

The sergeant in charge of the Rape Squad looks at me and refers me to astronomers because the events took place at night. I protest to the police and say it's impossible for the culprit you think you have to have done the crime because he has an airtight alibi. The Sergeant ignores me and asks no questions.

I present evidence which was obtained by the RCMP itself of the alibi. The Sergeant ignores me and asks no questions.

I submit much official evidence of the previous rapes by the rapist, evidence of the mode of operation in several other rapes, and in particular I present much official evidence in support of the accusation of the new rapist. The Sergeant ignores me and asks no questions.
I tell the sergeant I have been raped myself by a different rapist earlier in my life and I know what I'm talking about when I talk about rape and rapists. The Sergeant ignores me and asks no questions.

Who can I go to? The astronomers? The police not expert in rape cases? Private Detectives, politicians, the media? Who cares?

Yes, who cares.

The metaphor of a crime of rape related to Air India Flight 182 is explained:

I was in a fatal jet sudden airplane crash. My pilot died. I have discovered through years of research and analysis that a mechanical problem and a design flaw in early model Boeing 747s is killing passengers and crew. I am reporting to the TSB the killings occurred off Ireland on June 23, 1985 in which 329 persons died. It occurred because machines have to obey the laws of nature regarding pressure equalization and electrical discharges. The culprits are faulty wiring and non plug doors. I am reporting it to the government officials in charge of aviation safety. The official in charge of aviation safety refers me to the police who know little about why airplanes crash.

I present evidence that the accused culprit of terrorists is innocent because all luggage from Vancouver was loaded into the aft cargo compartment and the explosion occurred in the forward cargo compartment. The two compartments are solidly separated in the air and on the ground. The Canadians and the Indians agree that the explosion occurred in the forward cargo compartment and did not occur in the aft cargo compartment. The accused are said to have loaded a bomb onto Air India Flight
182 at Vancouver airport which then could not have caused the explosive decompression/inflight breakup, something else did. The official in charge of aviation safety ignores me and asks no questions.

I present evidence to the TSB of the shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation for Air India Flight 182 using aircraft accidents reports submitted by Indian, Canadian, American, and British aviation safety authorities. I show pictures, charts, text, diagrams, schematics, and tables. The official in charge of aviation safety ignores me and asks no questions.

I present evidence of my own airplane accident of June 14th, 1967 and state I know what I'm talking about when I talk about airplane crashes and their causes. The official in charge of aviation safety ignores me and asks no questions.

Who can I go to? The RCMP? The safety experts whose specialty is trains? Private Detectives, politicians, the media? Who cares?

Ms. Delorme, I'm hoping against hope that you care.

Regarding the police and the sergeant in my rape metaphor:

Would you accuse the police of negligence for not asking any questions to check out the story of the witness who is reporting a rape?

Would you accuse the sergeant of negligence for not asking any questions to the witness about the evidence he has submitted regarding the location, the duration, and the severity of the rape
and indeed, names the rapist himself?

Would you not feel frustration, especially if you had been raped yourself, at the nonchalance and indifference of the police as you report a very very serious crime of which you have ample proof?

Well, if you do, please ask me questions about my report to you of faulty wiring and a design flaw in early model Boeing 747s and in particular, Air India Flight 182. I can be as sophisticated or as basic as you wish, Ms. Delorme.

Will you ask others to ask me questions? Mr. Terry Burtch, Mr. Nick Stoss, Mr. Vic Gergen, Mr. John Garstang, and the Director of Engineering should be able with just a few questions each be able to determine if my report of a potential existing aviation danger is real and worthy of action or not real and should be rejected.

The negligence of the RCMP in not investigating the rape metaphor above is not that they made an error in the accusation of the culprit but they did not check out an alternative explanation with precedent by a reputable witness. They have a responsibility to investigate all reported crimes under their jurisdiction and rape qualifies.

I am reporting to the TSB that the accused did not commit the bombing crime because 'nobody did it'; it was a mechanical explanation, the shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation for Air India Flight 182 and the precedent is United Airlines Flight 811. I believe that the TSB has a responsibility to investigate all reported probable causes to aviation accidents that occur with Canadians aboard and Air India Flight 182 qualifies.
I await questions from the aviation accident investigators.

Respectfully,

John Barry Smith
541 Country Club Drive
Carmel Valley, California 93924
831 659 3552
barry@corazon.com
http://www.corazon.com
Commercial pilot, instrument rated, former FAA Part 135 certificate holder.
US Navy reconnaissance navigator, RA-5C 650 hours.
US Navy patrol crewman, P2V-5FS 2000 hours.
Air Intelligence Officer, US Navy
Retired US Army Major MSC
Owner Mooney M-20C, 1000 hours.
Survivor of sudden night fiery fatal jet plane crash in RA-5C

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: "John King" <john.king19@comcast.net>, John Sampson <phoebus@iinet.net.au>
Subject: A/C mechanic..

P.S. don't forget I'm not just a wiring guy but also the data guy.
Didn't you love those 3,200 reports.

Yes.

That means the FAA and NTSB are offering the public only about 25% on the net.

My favorite story is the Monthly report and AAR for United Airlines Flight 811 that still shows the wrong probable cause, improper latching. Anybody doing a search on electrical problems on 747s will miss it. I told them about it years ago and they will not put the new AAR up. Anybody researching United Airlines Flight 811 will get the wrong probable cause if they rely on the NTSB web site.

I had to turn off TV tonight on puff piece on NTSB about how hard they worked to get the JFK crash solved. All the suspects were on the show as heroes, Goeltz and Loeb. Smug and arrogant as only the corrupt can be.

Now I know why this is such a litigious society, only money in lawsuits gets their attention. In my case the victims who can sue are full of hate and want revenge and shorted wiring is too cruel to be the cause of death for their loved ones, but evil conspiracy terrorists on worldwide basis is understandable.

Cargo doors open inadvertently on an average of every two years, either on the ground or in the air. Another one is due in under year. You will know when it happens when I do, it will be an early model 747 that suffers a sudden inflight breakup within an hour of takeoff with a sudden loud sound on the CVR and abrupt power cut.
China Airlines Flight 611 had that but they are blaming a repair doubler failure...that did not fail but had cracks emanating from it and that type of failure has been shown not to be catastrophic which would give a minute or so or more on the CVR of problems. The cargo door pictures resemble all the other ruptured open cargo doors.

Well, we are still alive and the future is unpredictable.

Obit>John MacPherson

John C. MacPherson, 82, a retired aviation mechanic, died Sunday at Katherine Convalescent Hospital in Salinas.

He was born Dec. 18, 1920 in Ekalaka, Mont., and lived in Lancaster for 25 years before moving to Salinas 33 years ago.

Mr. MacPherson graduated from Chaffee Junior College in Ontario with an aeronautics degree. He served in the U.S. Army Air Corps during World War II, retiring from the Air Force Reserves as a lieutenant colonel. He was the youngest flight instructor in the military at the time. He continued his service as a flight instructor at Muroc Air Base (now known as Edwards Air Force Base), where he once test-flew the Flying Wing.

Mr. MacPherson worked in the aviation industry sporadically throughout his life. He began as an aviation mechanic for numerous years, and had owned an auto wrecking company for 25 years before moving to Salinas.

He then worked as a commercial fisherman in Moss Landing before returning to the aviation industry.
Mr. MacPherson was an active pilot who flew regularly until the last year of his life. He owned a 1940 Harlow plane. He was a member of Retired Air Force Reserves, Experimental Aircraft Association, Salinas Owners and Pilots Association, American Legion and United Flying Octogenarians.

He is survived by his wife, Julia; a son, John MacPherson of Rancho Santa Margarita; two daughters, Diana MacPherson of Connecticut and Marguerite Kelley of Soledad; and six grandchildren.

Memorial services will be at 10:30 a.m. Friday at Northminster Presbyterian Church in Salinas. Struve and Laporte Funeral Chapel handled arrangements.

JBS>"Mac" was my mechanic who solely worked on my Mooney for the four years I owned it. I put my life in his hands and he did not disappoint. He was fair, honest, competent, and a teacher. I spent many hours watching and talking with Mac as he did my annual and various repairs. His opinion was gospel.

He was 82. He flew the flying wing back in the late 40s. He had a Harlow 1930's single engine classic antique. He took me up once. Loud, uncomfortable, cold and a whole lot of fun. Flew it to Oshkosh one year.

Rare fellow, worked out of his hangar in Salinas. Well liked by everybody. Knew more about airplanes than most anyone I knew from all aspects.

So be it.
Cheers,
Barry

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: John King <john.king19@comcast.net>
Subject: Ah, wiring in cargo compartments in Boeing 747s...


History of the flight

Shortly after take-off from runway 34L at Sydney, the flight crew of the Boeing 747-400 aircraft received a forward cargo compartment fire warning on the Engine Indicating and Crew Alerting System (EICAS). On receiving the warning message the crew actioned the appropriate checklist, activated the fire suppression system and transmitted a MAYDAY. At the same time, flight attendants noticed a fine mist and the smell of smoke in the passenger cabin. The crew then returned the aircraft to Sydney, where an uneventful overweight landing was conducted.

Prior to landing, the EICAS fire warning message ceased. This indicated that the aircraft fire suppression system may have successfully extinguished any fire, however the cabin fumes were still evident. After landing, the flight crew stopped the aircraft on
the runway where emergency services came to their assistance. After confirming with the flight crew that the fire warning message was no longer present, the emergency services assessed the aircraft from the ground, then allowed the passengers and cabin crew to disembark to a safe distance via mobile stairs positioned at the aircraft’s front left door. Once the passengers and cabin crew were clear of the aircraft, the emergency services opened the forward cargo door.

A hot spot was detected on the left side of the forward cargo bay at body station STA900, where the side wall lining was found to be heat affected. Removal of the lining revealed burned insulation blanket material, discolouration of the aircraft skin and burned/broken electrical wires that powered the forward galley chiller boost fan situated in the area (see Fig 1). As the fire was no longer evident, ground engineers isolated the chiller boost fan electrical circuit and towed the aircraft clear of the runway.

FIGURE 1: Forward cargo bay with expanded view of chiller boost fan location

Aircraft structural damage

Non-destructive testing to check for cracking and conductivity of the aircraft skin adjacent to the affected area was carried out. No cracks were detected, however the conductivity test revealed three locations where the skin had been substantially affected by heat (see Fig 2). The most severely affected area required a temporary skin repair before the aircraft could be flown back to the operator’s maintenance facility in the United Kingdom, where the heat-affected aircraft skin was replaced.
Sidewall lining and insulation blankets

The fibreglass sidewall lining between STA880 to STA900 was visibly heat damaged with discolouration observed on the side facing into the cargo compartment. Inspection of the reverse side revealed burned layers of fibreglass confined to a localised area approximately 30cm x 45cm (see Fig. 3). The insulation blankets that lined the aircraft skin were made of a fibreglass core with a metallised TedlarTM film on one side and a MylarTM film on the other and had been subjected to localised heat and fire (see Fig. 4).

Samples of the sidewall lining and insulation blanket were sent to the United States of America, Federal Aviation Administration (FAA) technical centre and the aircraft manufacturer for analysis and testing.

The examinations determined that both the sidewall lining and insulation blanket samples complied with the appropriate material specifications for aircraft use.

The flammability testing, conducted by the FAA, on samples of the insulation blanket included a vertical Bunsen burner test,
which was mandated in Federal Aviation Regulation FAR 25.853 Appendix F. The samples tested met the requirements, but due to their limited size, the result was not conclusive as to the integrity of the entire blanket.

The aircraft manufacturer's tests revealed contamination on the insulation blanket samples. This contamination consisted of environmental dust, fibres and corrosion inhibiting compound. These contaminants were consistent with general contamination found during evaluations of other in-service insulation blankets and were considered to be normal.

The aircraft manufacturer's flame propagation cotton swab tests found areas on the blanket samples that were self extinguishing while other areas showed flame propagation uncharacteristic of that expected for new insulation blankets. It was unknown whether contamination, in-service ageing, or heat exposure, or a combination of these, altered the blanket's flame propagation characteristics.

Boost fan system

A galley chiller boost fan system was installed in the aircraft to provide forced air circulation over the forward galley chiller units increasing their cooling efficiency. The system incorporated a vaneaxial-type three-phase fan, powered by the aircraft's number-3 alternating current electrical system. Control power was supplied by the aircraft's direct current electrical system, with operation being automatic on selection of the galley chillers to ON. Circuit protection was provided by a 20 ampere circuit breaker and a cargo fire cutoff relay.

Chiller boost fan
An inspection of the boost fan revealed a burn hole and sooting on its casing adjacent to the electrical terminal (see Fig. 5). The electrical wiring to the fan was found to have four of its seven wires broken, with all of the wires displaying sooting discoloration (see Fig. 6 and 7). The soot marks corresponded to those on the fan casing and when positioned together, revealed that the wires had separated at a point adjacent to the corner of the electrical terminal. The failure of the wires produced electrical arcing, which melted the casing, resulting in the burn hole observed.

Further inspection found that all of the fan impeller blades had failed just above their roots (see Fig. 8). Neither the impeller nor the fan shroud showed signs of hard body impact damage.

FIGURE 5: Electrical terminal
FIGURE 6: Broken wires
FIGURE 7: Sooting evident
FIGURE 8: Fan impeller blades failed

Technical examination of the fan found that the impeller was made from a moulded resin material. There was no evidence of any pre-existing defects or cracking found on the blade fracture surfaces. However, a number of blades showed breakage of a curved lip of material from their forward corner. This condition was consistent with overload fatigue possibly due to the blade tips contacting the fan shroud. Such a condition may have occurred prior to the blades total failure. The inside surface of the impeller was coated with a brown powder, determined to be
primarily iron oxide.

The aluminium alloy shroud contained several circumferential wear marks that were adjacent to the impeller blade path. Although there were random scratches, no evidence of gouging or penetration of the shroud skin was found.

Further disassembly of the fan revealed wear on the electrical motor stator, indicating that it had been subjected to armature rubbing. The armature did not display similar wear patterns. Rubbing of this nature usually occurs as a result of bearing failure or excessive wear, leading to armature oscillations. For the full technical report see Attachment ÔAÔ

Chiller boost fan service history

The chiller boost fan entered service in 1994, with the last overhaul being in June 2000, after removal from service because of electrical failure. The maintenance records for that overhaul stated: ÔUnit noisy due worn bearings, all other parameters ok. Reported defect not confirmed. Disassembled, cleaned and inspected, bearings renewed, unit reassembled and tested to specÔ. The fan was then fitted to the incident aircraft on 2 August 2000. No subsequent maintenance was recorded.

Chiller boost fan circuit breaker and electrical relay

The installed circuit breaker was a 20 ampere three-phase, push-pull high performance, trip free type, designed for aircraft installations. Its design allowed for increased amperage through the circuit for a specific time before tripping (breaking the circuit) and was used in large motor load applications where the inrush current would trip a standard circuit breaker. The
length of time taken to cause the circuit breaker to trip varied according to the current it received. The aircraft manufacturer advised that ÔAt 385 per cent or 400 per cent [load rating], this breaker will trip between 2.3 to 10 secondsÓ. This prevented aircraft electrical power surges from ÔnuisanceÓ tripping of the circuit breaker and rendering the boost fan inoperative.

A number of tests were conducted on the circuit breaker, including a Ôload withstanding testÕ. This required the controlled increase in current through the circuit breaker, with time to trip recorded. This test was conducted at 105 per cent, 140 per cent and 200 per cent values, as per the manufacturers test procedures.

The installed relay was a 25 ampere, electromagnetic, three pole, single throw, normally open type. This was also subjected to a number of tests including ÔCoil resistanceÕ, ÔCoil hold and drop voltageÕ and ÔVoltage drop and switching test across all three phasesÕ.

These tests were performed under the supervision of the United Kingdom Air Accident Investigation Branch. Both components were found to comply with their operational specifications, with no adverse mechanical or operational functions found during the testing. As a result, both components were considered to be serviceable.

Quick Access Recorder

The aircraftÕs Quick Access Recorder (QAR) data was analysed by the Australian Transport Safety Bureau with the following information retrieved.
During climb the number-3 alternating current system showed a momentary increase in load from a nominal 31 per cent to 54 per cent, which equated to an increase in current draw of 57 amperes.

Four seconds later, the load was again recorded and had returned to the nominal 30 percentage range, where it remained for the rest of the flight.

Approximately 1 minute later the QAR recorded a forward cargo fire.

Approximately 3 minutes later, the first cargo fire bottle low quantity message appeared, indicating that extinguishant had been discharged successfully.

Other recorded data received from the aircraft’s central maintenance computer (CMC) confirmed the arming of the fire bottles approximately 2 minutes after the fire warning and the discharging of the last two fire bottles after the aircraft landed.

Cargo fire detection/extinguishing system

The aircraft incorporated two dual loop smoke detectors in each cargo compartment. Air from throughout the compartment was drawn through the detectors and sampled. In normal operation, both loops must sense smoke for a fire warning to be activated. If the system detects a loop fault during self-test at aircraft power on, it would reconfigure to a single loop operation.

The cargo fire module located on the overhead instrument panel in the flight deck incorporated forward and aft compartment ARM buttons and a DISCH discharge button. On sensing smoke, the relevant ARM button, along with an EICAS message would
be illuminated, alerting the crew of the fire. The crew must then push the ARM button in. This action disables electrical power to a number of circuits, including the galley chiller fan circuit. Extinguishing is then achieved by pressing the DISCH button (see Fig. 9).

FIGURE 9: Overhead instrument panel with expanded view of cargo fire panel

Four fire extinguisher bottles (A, B, C and D) service the cargo compartments, each having discharge lines to both the forward or aft compartments. On depression of the DISCH switch, bottles A and B discharge flooding the selected compartment with extinguishing agent. Bottles C and D are not discharged until 30 minutes later. If the aircraft reaches the ground before the 30 minutes are up, the bottles will discharge on touch down. The system was designed to give up to 180 minutes of discharge time.

ANALYSIS

Chiller boost fan

The impeller blade’s fracture surfaces did not show evidence of material flaws, foreign object impact, or any other pre-existing damage. However, as no blade remnants were found, these conditions could not be ruled out. The resin materials used to manufacture the impeller made it prone to cracking and failure under impact, or excessive stress conditions, due to its lack of ductility. Some blades displayed preferential tip breakage before
complete blade failure.

Maintenance records for the fan indicated that, prior to its fitment to the aircraft, it had been removed from service and overhauled because of electrical failure. The records stated Ò Unit noisy due worn bearingsÓ.

Due to the close tolerance between the impeller blades and the fan shroud, excessive wear in the bearings most probably led to oscillations of the armature and impeller, resulting in armature and blade tip rubbing. There was evidence of rubbing wear on the fan shroud and the motor stator. The lack of wear on the motor armature indicated that the rubbing condition had occurred prior to the fanÕs last overhaul. The brown iron oxide dust observed on the inside of the impeller was believed to be from the worn bearing. This confirmed that the impeller was the same one that had been fitted at that time.

The shroud rubbing may have predisposed the blade tips to cracking that could have resulted in their subsequent failure in service. Once the tips were released, their impacting on additional blades would have led to the total failure of the blades due to their brittleness.

Fire initiation

The position of the broken/ burned wires and the localised burning and soot marks on the fan case electrical terminal housing, indicated that a probable chafing event had occurred, leading to electrical arcing. The chafing was most likely the result of the excessive vibration induced by the fanÕs imbalance after the impeller blades failed.
Molten material from the fan case dripped onto the adjacent insulation blanket where it smouldered and burned. It is possible that the fan continued to operate for a short period of time after the arcing had initiated. This condition would have provided a positive airflow into the confined area, feeding the fire.

Insulation blanket and sidewall lining

Although the insulation blanket had been subjected to in-use contamination, the material composition of the insulation blanket (and sidewall lining) was able to prevent a rapid spread of fire. However, due to the temperatures involved, localised burning had occurred.

Boost fan circuit isolation

The electrical short-circuiting of the boost fan was indicated by the momentary increase in current load on the aircraft’s number-3 generator. Due to the circuit breakers’ “trip free” design, the short time frame of the overload condition would not have resulted in the circuit breaker tripping and isolating power from the fan. Ground engineers reported that they isolated the fan circuit prior to towing the aircraft confirming that the circuit breaker had not tripped.

Electrical power would only have been removed from the fan circuit when the forward cargo ARM button was depressed. This was recorded on the CMC approximately 2 minutes after the fire was detected.

SIGNIFICANT FACTORS
1. Worn bearings led to impeller and shroud rubbing, weakening the blade tips.
2. The fan blade tips failed, creating an out of balance condition and vibration.
3. Chiller boost fan vibration resulted in the wires chafing and electrical short circuit initiating the fire.
4. The trip free capability of the circuit breaker in the chiller boost fan electrical circuit prevented rapid electrical isolation.

SAFETY ACTION

As a result of this incident the following local safety actions have been carried out.

Aircraft manufacturer

The manufacturer issued alert service bulletin SB747-21A2427, directing the inspection and corrective routing of the electrical wire loom to the boost fan.

Operator

The operator conducted a fleet inspection of the fan wiring for condition and routing and has undertaken to pay particular attention to the balancing of the boost fan assembly during overhaul. The incorporation of SB747-21A2427 on their fleet was scheduled for commencement from June 2003.

Related Documents: \Technical Analysis Report 200203671\
Note a new URL here for SDRs with a search engine.

Attached is my lookabout for SDRs of interest and note the very last...a uncommanded cargo door opening.

Thank you John, Sunday, May 2, 2004 9:42AM

Now, my question, yes or no:

Do you believe that faulty Poly x wiring has caused the forward cargo doors of Air India Flight 182, Pan American World Airways Flight 103, United Airlines Flight 811, and Trans World Airlines Flight 800 to rupture open in flight as the initial event?

If not, then OK, stick with the authorities and their bombs, missiles, and fire with no ignition source.

If yes, then your position is much strengthened because wiring is the culprit that needs immediate replacement.

If maybe, then ask questions to resolve the doubt.

Barry

John Barry Smith
541 Country Club Drive
Carmel Valley, California 93924
From: John Barry Smith <barry@corazon.com>  
Date: September 6, 2009 12:04:11 AM PDT  
To: "John King" <john.king19@comcast.net>  
Subject: Re: SDRs//Wiring

My money is on the wiring, and not only because of the many examples of uncommanded inputs, but in the way that the industry and the agencies have denied it for so long.

If you want to change the bad wiring to good, you will need proof that the bad wiring is killing lots of people. The shorted wiring/ruptured open cargo door/explosive decompression/inflight breakup explanation does that for you.

Absence of questions noted.

Regards,  
Barry

From: John Barry Smith <barry@corazon.com>  
Date: September 6, 2009 12:04:11 AM PDT  
To: EdwBlock@aol.com  
Subject: Prediction/tefzel

Dear John and Barry:
Boeing used Poly-X from fuselage # 51(1970-75), switched to Stilan in 1975, switched to crosslinked Tefzel in 1978, switched to Kapton on the 400 in 1989, switched back to crosslinked Tefzel in 1993. Hope this helps.

Ed

Dear Ed, thanks.

China Airlines Flight 611 had crosslinked Tefzel, Delivered 1979
Air India Flight 182 had crosslinked Tefzel, 1978
Pan Am Flight 103 1970 but line number 15, what was used before fuselage #51?
Trans World Airlines Flight 800 poly X 1971
United Airlines Flight 811 had poly X 1970

What is crosslinked Tefzel? Is it the same type of polyimide aromatic teflon coated insulation? Is prone to the cracking, chafing, etc that poly X has?

Can it be called Poly X type wiring?

I'm afraid China Airlines Flight 611 is another of my shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanations. Wiring will surely get the attention it deserves after it is determined the wiring caused that door to rupture open in flight.

Wiring does worse things than start fires.

Thanks again, Ed.

Cheers,
Barry
Prediction: Will have sudden loud sound followed by abrupt power cut: It's fast air molecules and nose off. Monday Night, 17 June 2002

Taiwan

'Black boxes' likely to be retrieved today, declares ASC chief
Chinese boats join search and recovery efforts, complain direct link restriction causing delay

2002-06-18 / Taiwan News, Staff Writer /
The Aviation Safety Council Managing Director Kay Yong (??) yesterday said that the so-called "black boxes" of the ill-fated China Airlines CI-611 jetliner are expected to be retrieved early this morning.

As the signals of the plane's data and voice recorders are weakening 24 days now after the crash, rescue efforts are concentrating on the recovery of the recorders - which may stop emitting signals soon since the batteries have an estimated life span of 30 days.

Ships and underwater photography equipment sent by the companies Jan Steen of Singapore and Global Industries of America have contributed to boosting the search efforts. In
addition to the participation of the Taiwanese navy and local rescuers.

The ASC official yesterday was confident of recovering the recorders by this morning.

"Taking a look at the recent rescue efforts - which are very effective - I believe it is very possible for us to recover the black boxes early in the morning," said Yong at yesterday's press conference.

The ASC also made public some pictures of the wreckage the divers successfully took under the water. Yong said that the pictures are very helpful for the team to recover the black boxes.

Chinese boats also joined the search for the plane's wreckage and the victims' bodies, but they complained that the ban on direct links postponed the return of the wreckage they retrieved from the Taiwan Strait.

The rescue team has recovered 121 bodies as of yesterday with one body still needing to be identified.

The Hong Kong-bound jetliner dived into the sea near the outlying Penghu island after breaking into four chunks in mid-air on May 25. The crash has killed 225 passengers and crew on board.

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From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: EdwBlock@aol.com
Subject: General term to cover all 747 wiring...

Dear John, are all the wire types on 747s 'polyimide' type?

What is a general term which covers all? Kapton Type? Poly x Type?

Is it true that all wiring on all 747s are known to be susceptible to chafing cracking and arc tracking?

Barry

Dear John & Barry:

Before # 51 it was Mil-W-81044/6. radiation crosslinked polyalkene inner with a Kynar jacket. Over rated in temperature rating, cut-thru, and scrape abrasion resistance. Cross-linked Tefzel is flammable, smoky (97% smoke obscurity rating), and toxic. It should be rated at 150 C but was given 200 C rating to compete with Kapton. The FAA has deemed it flammable, yet Boeing continues to use it on new twin aisle aircraft. TKT is being used on single aisle. Politics and money is the justification given to me by a Boeing representative as to why they are a house divided on wire types. In 1978 it was only used in non-pressurized areas, because NASA found it could explode in oxygen enriched areas (i.e. cargo bay area). When it was resurrected in 1993 after the Kapton crunch, it was put in all areas of the aircraft. At rated temperature you could remove it with your thumbnail. It is prone to 360 degree cracking when nicked.

It is definitely not Poly-X wiring however these wires were all made by raychem Corp. They would take material that Dupont threw away, crosslink it and get a patent. They would then sell it to the military and get a specification written for it. They would then sell it to Boeing/McDonnell-Douglas as having military
approval.

I agree wiring does worse things then start fires. I believe it is responsible for all of the uncommanded inputs to the rudder servo actuators via the yaw dampeners on the A300. Their rudders are automatically put in when you enter a turn, no matter whether the autopilot system is engaged or not. There are no transducers on the rudder pedals themselves so you can't tell if they were moved by the pilots or backdrove by the rudder. There was a multiple rudder deflection caused by miswiring on an A300 in 1999. There was also a crash in 1962, a 707 that had defective wiring on the rudder servos.

Ed Block

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: EdwBlock@aol.com
Subject: General term to cover all 747 wiring...dangerous

Dear Ed, thanks for help...

No not all are polyimide. I explained the types above. Yes all types will crack, chafe and arc-track.

Ed Block

I've had to change my table in my reports since I said all of the suspect aircraft had poly X and that's not so.

There was a 747-400 that had door open uncommanded on ground, so it -100, -200, and -400 have had open cargo doors in flight or on the ground.
So, wiring....

Also, yaw dampers on 737 would explain two mystery crashes so controversial, Colorado Springs and Pittsburgh. Below is Bournemouth example of what might have happened to them.

I'm saying the wiring is causing cargo doors to open on 747s because of United Airlines Flight 811 which was wiring/switch probable cause and because of the Trans World Airlines Flight 800 hearings in which Poly X was singled out. You singled out Kapton.

Any documentation of accidents caused by crosslinked Tefzel?

Air India Flight 182 could have been Stilan or Tefzel since it was a 1978 plane.

Ah, looking for matches. Is it Raychem?

At 9:47 AM -0400 6/19/02, EdwBlock@aol.com wrote:

Boeing used Poly-X from fuselage # 51(1970-75), switched to Stilan in 1975, switched to crosslinked Tefzel in 1978, switched to Kapton on the 400 in 1989, switched back to crosslinked Tefzel in 1993. Hope this helps.

China Airlines Flight 611 had crosslinked Tefzel, Delivered 1979
Air India Flight 182 had crosslinked Tefzel or Stilan, 1978
Pan Am Flight 103 1970 had Mil-W81044/6, 1970, fuselage 15
Trans World Airlines Flight 800 poly X 1971

United Airlines Flight 811 had poly X 1970
Before # 51 it was Mil-W-81044/6. radiation crosslinked polyalkene inner with a Kynar jacket. Over rated in temperature rating, cut-thru, and scrape abrasion resistance.

OK Pan Am 103 had Mil-W81044/6, thanks.

Cross-linked Tefzel is flammable, smoky (97% smoke obscurity rating), and toxic. It should be rated at 150 C but was given 200 C rating to compete with Kapton. The FAA has deemed it flammable, yet Boeing continues to use it on new twin aisle aircraft.

What does TKT stand for?

What does 'crosslinked' mean?

Do all of the suspect aircraft have Switch S2, which was implicated in the United Airlines Flight 811 accident? Below had data on that event.

What is BMS 13-42?

I need to know what type of wiring for these planes:

China Airlines Flight 611 Tefzel 1979
Air India Flight 182 Tefzel 1978
United Airlines Flight 811 Poly X 1970
Pan Am Flight 103 Mil-W81044/6 1970
Trans World Airlines Flight 800 Poly X 1971
China Airlines crash at Wanli unknown manufacture date.
El Al Amsterdam Plane delivered in 1979 Tefzel
Cheers,
Barry

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December 29, 1991, Boeing 747-2R7 China Airlines (Taiwan) Freighter, five on board, all killed. Wanli; near (Taiwan) Aircraft reported two starboard engines lost and crashed shortly after takeoff.

October 4, 1992, Boeing 747-258F El Al (Israel) Four on board, all killed and 47 on the ground Amsterdam (Netherlands) Aircraft crashed shortly after takeoff.

TKT is being used on single aisle. Politics and money is the justification given to me by a Boeing representative as to why they are a house divided on wire types. In 1978 it was only used in non-pressurized areas, because NASA found it could explode in oxygen enriched areas (i.e. cargo bay area). When it was resurrected in 1993 after the Kapton crunch, it was put in all areas of the aircraft. At rated temperature you could remove it with your thumbnail. It is prone to 360 degree cracking when nicked.

It is definitely not Poly-X wiring however these wires were all made by raychem Corp. They would take material that Dupont threw away, crosslink it and get a patent. They would then sell it to the military and get a specification written for it. They would then sell it to Boeing/McDonnell-Douglas as having military approval.
I agree wiring does worse things then start fires.

See below for Bournemouth 737 urine/water in yaw damper episode.

I believe it is responsible for all of the uncommanded inputs to the rudder servo actuators via the yaw dampeners on the A300.

1.16.2.2 After Recovery of the Door Switches--General
The cargo door was recovered with all of its position sensing switches installed in their proper locations. The electrical junction box was found attached to the door but damaged. The switches recovered and examined were: S2 Master Latch Lock; S3 Door Warning; S4 Latch Close; S5 Hook Position; S6 Fwd Mid-Span Latch Open; S7 Door Close; S8 Hook Close; and S9 Aft Mid-Span Latch Open. Figure 17 provides a diagram of the cargo door's electrical circuitry. Five of the eight position-sensing switches installed on the door had evidence of external damage to the switch housing. The damage on four switches (S2,S3,S4,S8) consisted of primarily compression dimpling on the housing. The S5 switch exhibited mechanical impact damage on the switch housing and mounting bracket. The striker assembly for switch S8 was loose (2 of 3 rivet fasteners sheared). The electrical wiring recovered with the door exhibited signs of tensile separation from overload at all failure points examined. Each switch was photographed and its installed position was documented. Electrical continuity readings were taken with an ohmmeter across the poles of each switch at the first point of wire separation as found on the door. After the readings were recorded, all switches were removed from the door so that
photographs and x-rays of each switch could be taken. Electrical continuity readings were retaken. Disassembly of each switch consisted of: (1) drilling two holes in the switch housing to release trapped water from the switch (2) cutting a small window in the switch housing to examine the internal basic switches (3) removing the housing, (4) removing the internal bracket, and (5) removing basic switch covers. During the drilling step, water was released from every switch when the holes were drilled in the switch housing. The water was filtered into a glass container. The quantity was not measured but appeared to be less than 5 mL. The residue from the filtered water trapped on the filter media had a blue-green color. After the switch housing was removed, an ohmmeter was connected across the 1-2 poles of the switches that would not transfer electrical continuity (S2,S3,S4,S6,S7) when actuated. The rivets were then drilled out of the internal bracket. After the last of the two rivets were drilled out, the switch contacts transferred to the other pole on S2, S3, and S4. On S6, the used basic switch was held closed by its plunger. S7 transferred after the switch housing and water inside were removed. During removal of the basic switch covers, a trend was noted in the discoloration of some of the basic switches. The used switch had a reddish-brown coloration. The unused switch was not discolored. Each switch was found to be wired correctly to its poles and through its contacts within the basic switches. All contacts operated with light finger pressure after removal of the basic switch covers. There was no evidence of pitting, excessive corrosion, or heat distress in the contacts of any of the switches. The following sections detail pertinent observations concerning each switch. The S2 master latch lock is given particular significance because
of its function to protect against inadvertent door operation and is thus described in more detail. It is a single-pole double-throw (SPDT) switch used to sense the unlocked position of the door lock sectors. The switch is mounted in the aft lower corner of the door. A bracket attached to the No. 7 lock sector depresses the switch when the door lock sectors are rotated to their unlocked position. When the bracket attached to the lock sector contacts the switch plunger and depresses it, the circuit path through the switch is closed and 28VDC electrical control power to the door is established. When the force on the plunger is relaxed, the circuit is opened and 28VDC electrical control circuit is removed.

The wires leading to the S2 switch had been cut by the team after the recovery in an attempt to test continuity through the switch. The door recovery team reported that it found continuity through the 1-3 contacts but not through the 1-2 contacts. The switch plunger was actuated by the recovery team. The recovery team noted that the switch did not transfer continuity during these tests. The operation of the switch plunger would normally transfer continuity. Subsequent detailed examination of the S2 switch confirmed the findings of the recovery team.

The area around the upper face of the internal bracket was bent toward the basic switches and had evidence of corrosion residue. The bracket was found broken. The switch contacts transferred from the 1-3 actuated position to the 1-2 nonactuated position when the bracket was removed. Scanning electron microscope examination of the fracture surfaces revealed evidence of overload and corrosion.

The external switch housing was dented. The final examination performed on the switch consisted of removing the plastic covers on the basic switches. Prior to removal of the basic switch covers, it was noted that the cover to the used basic switch was cracked. The contacts functioned normally when exercised by
light finger pressure.
Microscopic examination revealed a black discoloration near one of the lower contact posts of the used basic switch. Energy dispersive spectrometric examination of the residue disclosed the presence of gold, iron, magnesium, sodium, and chlorine. No mechanical or electrical anomalies were detected with the basic switch contacts.
Additional testing was performed by Boeing on switches of a similar design to those used on the accident airplane's cargo door. The testing was conducted to identify conditions that would result from salt water immersion at a pressure depth of 14,200 feet for 18 months. The testing verified that external damage to the switch housing occurred at pressure depths of 7,000 feet and greater. Switch seal leakage and subsequent internal corrosion was also noted. None of the testing performed by Boeing duplicated internal switch damage that caused basic switch contact closure or internal damage to the switch support bracket.
Wiring:
The electrical wiring recovered with the cargo door was documented in place before being removed for further tests. About 40 percent or 112 feet of wire from the original length of approximately 274 feet was recovered and examined. Of this amount, about 46 feet of wire installed in the aircraft forward of the cargo door was not examined. Most of the wires leading from the door to the fuselage were not recovered. There was no visible external evidence of burning, arcing, or heat distress in any of the wires removed. Several areas of wire insulation damage were found.
Thirty five wires were identified that could provide a possible short circuit path that could drive the latch actuator open with or without failures of other door electrical components if the ground handling bus was energized. The wires were schematically coded by function. Wires coded (---..--.) were denoted for wiring that
provides open command logic to the latch actuator. Wires coded (---.--.--.) were denoted for additional wiring enabled by an activated (failed) S2 switch. Wires coded (-o-o-o-o) were denoted for wiring providing 28VDC power from the C285 circuit.

Potential short circuit paths were identified for the cargo door that could provide 28VDC to the latch actuator control circuit relay. These potential short circuit paths can cause the latch actuator to drive the latches toward their open position if 115VAC power is available to the latch actuator motor. The potential short circuit paths include two bare wires shorting against each other, bare wire-to-metal structure-to-bare wire contact, wire to conductive fluid (such as water) to wire, or a combination of the aforementioned.

Conductive contact of (-o-o-o-o) or (---.--.--.) coded wire with (-..-..-) coded wire could potentially result in providing a 28VDC circuit path to the latch actuator open circuit. Direct wire-to-wire paths are coded in Figure 17 as defined above. The two-wire short circuit paths are identified as wire pairs consisting of wire 101-20 shorting with any of the following wires; 108-20, 121-20, 122-20, 124-20, 135-20, or 136-20.

If the S2 master latch lock switch fails in the "Not Locked" position, there are additional wire pairs that provide short circuit paths. These are coded in Figure 17 as (---.--.--.) to (-..-..-..) wire pairs.

Short Circuit Wire Damage Simulation Tests:
Tests were conducted by Boeing and United to simulate typical examples of bare wire short circuiting to determine the extent of visible wire damage that would be expected in the 28VDC cargo door control circuit.

United performed tests on BMS 13-42 wire, the wire type used in the B-747 cargo door control circuit. Visible electrical short circuit damage on bare BMS 13-42 wire surfaces was difficult to
create at 28VDC. Surface damage was considered visible when detected by microscopic examination at 15X magnification. United testing simulated the relay coil resistance variations that would be found during typical in-service conditions. A current of 1.0 A at 28VDC created visible surface damage on momentary bare wire-to-bare wire contact. Multiple contacts at 1.0 A provided a more positive indication. A single momentary contact between two bare BMS 13-42 wires with 0.160 A at 28VDC did not create visible surface damage. Contact between a BMS 13-42 bare wire and Alclad 2024-T3 metal (airplane and cargo door structure) with 0.160A at 28VDC did not create visible surface damage. Boeing performed wire tests on BMS 13-48 20 gauge wire. The test setup used the MS27418-2B door latch actuator control relay in parallel with the 60B00311-2 door restraint solenoid, the actual electrical loads used in the B-747 cargo door latch actuator control circuit. A single momentary contact of a bare 28VDC power wire, with a bare wire connecting to the relay of the solenoid, showed small pithead area developed at the point of wire contact that was visible without magnification.

Wire Examination Procedure:
All of the recovered wires were examined in the Safety Board's Materials Laboratory on a mylar sheet to simulate their installed positions. Labels were used to identify the coded wires using the manufacturer's original wire identification numbers imprinted on each wire's insulation. Wire pairs for direct electrical short circuiting were located in two common wire bundles installed on the cargo door. One common wire bundle was associated with the P3 plug connector, the other with the P4 plug junction box. The wire bundles were examined visually for areas of obvious insulation damage. Each individual wire was also examined with a stereo-microscope. Representative wire damage features were photographed.
Wire Damage Found:
Seven wires numbered 101-20, 102-20, 105-20, 107-20, 108-20, 122-20, and 135-20 had visible damage located near a 3.8 inch position as measured from the P3 plug pin tips. This common position on the wire corresponds to a 360-degree loop in the wire bundle, which is located immediately below the junction box. Figures 18 and 19 show typical wire damage. Wire 122-20 had an open insulation area approximately 0.25 inch long. The other four wires had flattened insulation damage areas.
In the P4 plug connector wire bundle, three wires displayed insulation damage. Wires 113-20, 121-20, and 124-20 had transverse insulation nicks, which exposed bare conductors. All three had insulation nicks 3 inches from the P4 plug pin tips; wires 121-20 and 124-20 had additional insulation nicks 34 inches from the plug pin tips. The two P4 insulation damage locations corresponded to wire bundle clamp positions.

http://www.open.gov.uk/aaib/gbgji.htm
Air Accidents Investigation Branch

Aircraft Incident Report No: 1/98 (EW/C95/10/4)

Report on the incident to Boeing 737-236 Advanced, G-BGJI 15 nm north-west of Bournemouth International Airport on 22 October 1995

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Registered Owner: British Airways PLC
Operator: British Airways PLC
Aircraft Type: Boeing 737-236 Advanced
Nationality:
British Registration: G-BGJI

Place of Incident: 15 nm north-west of Bournemouth International Airport

Latitude: 50° 55.72' North
Longitude: 002° 12.55' East

Date and Time: 22 October 1995 at 1609 hrs
All times in this report are UTC

Synopsis

The incident was notified promptly to the Air Accidents Investigation Branch (AAIB) by the operator and the investigation began that evening. The AAIB team comprised Mr D F King (Investigator-in-Charge), Mr P D Gilmartin (Operations), Mr C G Pollard (Engineering), Mr S W Moss (Engineering), Mr A N Cable (Engineering) Ms A Evans (Flight Recorders).

The crew reported at 1330 hrs at Gatwick to carry out a post-heavy maintenance check, test flight on the aircraft. The first officer (F/O) completed the external check, while the commander completed the 'Flight Deck Preparation' items of the aircraft checklist. A Standby
(STBY) Rudder system check was carried out with no abnormalities noted and during taxi before take-off, the Yaw Damper indicator showed normal response to turns.

When the aircraft was in straight and level flight at FL200 with an indicated airspeed of 290 kt, Autopilot and Autothrottle engaged and Yaw Damper ON, the aircraft experienced roll/yaw oscillations. The Flight Data Recorder (FDR) showed that the Autopilot and Autothrottle were disengaged, and the commander reported that the Yaw Damper was switched OFF but the crew were unable to stop the oscillations. A MAYDAY call was broadcast at 1609 hrs. The crew had the impression that the bank angle would have continued to increase had opposite roll control inputs not been applied.

A descent was made to around FL75 and as the airspeed was allowed to reduce towards 250 kt the oscillations began to decay rapidly and stopped. The total duration of the roll/yaw event was about seven minutes.

A low speed handling check was carried out, and it was found that the aircraft handled well at a speed 150 kt, with Flap 15¡ selected and with the landing gear down. It was decided to return to London Gatwick Airport in this configuration, and the MAYDAY was downgraded to a PAN. The crew recovered the aircraft to
Gatwick without further incident.

The investigation identified the following causal factors:

(i) Contamination of the connector on the Yaw Damper Coupler, in the Electronic and Equipment Bay, by an unidentified fluid had occurred at some time prior to the incident flight and compromised the function of its pin to pin insulation.

(ii) Sufficiently conductive contaminant paths between certain adjacent pins had affected the phase and magnitude of the signals transmitted to the Yaw Damper Actuator, thereby stimulating a forced Dutch Roll mode of the aircraft.

(iii) The location of the Electronic and Equipment (E&E) Bay, beneath the cabin floor in the area of the aircraft doors, galleys and toilets made it vulnerable to fluid ingress from a variety of sources.

(iv) The crew actions immediately following the onset of the Dutch Roll
oscillations did not result in the disengagement of the malfunctioning Yaw Damper system.

Four safety recommendations were made.

1 Factual information

1.1 History of the flight

1.1.1 Pre-flight checks

The crew reported at 1330 hrs at Gatwick to carry out a post-P6 maintenance check (Accessorised 1.6.6.1) test flight on the aircraft. The first officer (F/O) completed the external check, while the commander completed the 'Flight Deck Preparation' items of the aircraft checklist. The fuel load was 10,500 kg, with about 2,000 kg in the centre tank. Neither wing tank was full, with the right wing containing more fuel than the left because of earlier ground running of the engines and the Auxiliary Power Unit (APU).

As the APU was not available, due to the unserviceability of its fire detection system which was damaged during final closure of its cover panels, a ground air start was made on both engines. A Standby (STBY) Rudder system check was carried out with no abnormalities noted. The take-off configuration warning
check was carried out which entailed selecting Flap 25j. During this selection there was a momentary double hydraulic 'A' system low pressure warning, indicating failure of the output from both engine driven pumps, but this quickly cleared and did not repeat itself.

During taxi before take-off, the Yaw Damper indicator showed normal response to turns.

1.1.2 Incident flight

The commander was the handling pilot when, at about 1555 hrs, the take-off was made from Runway 26L with full power and Flap 1j selected. After take-off, the aircraft was found to be out of trim laterally, needing left rudder and left aileron trims to achieve wings level flight. The crew assessed this to be due to the fuel imbalance. The crossfeed was opened, and fuel was used from the right wing tank until lateral balance was achieved. The fuel system was then returned to normal and the flight controls then felt normal until the incident occurred. The remainder of the flight until the recovery to Gatwick was conducted in an area between the Southampton VOR and Boscombe Down Airfield.

The pressurisation system was put in Standby (STBY) mode, with a cabin altitude of 4,000 feet set and the rate selector set to high rate. A climb was then carried out in
stages to FL200. Handling was transferred to the F/O, Autopilot B was engaged in Command (CMD) mode and the Autothrottle engaged. The STBY cabin altitude was reset to 13,990 feet to check the passenger oxygen mask automatic deployment system, in accordance with the test schedule.

A Spoiler Isolation/upfloat check was also carried out, which involved selecting the Speedbrake to the 'Flight' detent, then operating the Spoiler A and B switches to OFF. The commander went into the cabin to visually check the spoiler upfloat. The left outboard spoiler trailing edge was approximately 3 inches up, all others were about 2 inches up. The ground spoilers were fully retracted. The commander returned to the flight deck, reset the Speedbrake lever to down and reset the Spoiler switches to ON. This was carried out less than two minutes prior to the start of the incident.

The crew attention then turned to the cabin altitude, which was climbing as required by the test schedule. Both pilots donned their oxygen masks as the cabin altitude passed through 10,000 feet and the cabin altitude horn began to sound. (Note: after the incident, it was found that the passenger masks had not deployed, indicating that the cabin altitude had remained below the nominal 14,000 feet activation altitude)

The aircraft was heading 270¡M at FL200 with an indicated airspeed of 290 kt, Autopilot B in CMD mode, Autothrottle
engaged and Yaw Damper ON. The aircraft started to roll, which was initially countered by the Autopilot applying opposite roll control. The aircraft then began to oscillate in roll, and oscillatory activity was noted on the Yaw Damper indicator. On instructions from the commander the F/O disconnected the Autopilot and Autothrottle and attempted to stop the roll oscillations using control wheel inputs. The timing of these actions was confirmed by the FDR. The commander recalled switching OFF the Yaw Damper at this time in accordance with Flight Crew Notice FCN 38/95, issued in August of 1995. This FCN, issued by the commander in his capacity as Flight Manager Boeing 737 (Technical Projects), reflected the revised Boeing procedure for Uncommanded Yaw or Roll (Appendix 9). The commander then took control and continued to use control wheel inputs in an effort to stop the rolling. He also decided to initiate an immediate descent so that crew oxygen was no longer a consideration and requested the F/O to retard the thrust levers.

A MAYDAY call was broadcast at 1609 hrs. In response, Air Traffic Control (ATC) offered radar vectors to the nearest airport, which was initially a left turn onto 170¡M. The commander was reluctant to apply too much bank in order to turn as the roll excursions would have resulted in too steep a bank angle at the extremity of the oscillations. The crew had the impression that the bank angle would have
continued to increase had opposite roll control inputs not been applied.

A descent was made to around FL75, with the airspeed maintained at 290 kt or greater. During the descent, control was passed between the pilots, with no change in the oscillations. A further change of handling pilot occurred when the crew oxygen masks were removed, again with no noticeable change in aircraft behaviour. Neither pilot could recall any movement of the rudder pedals and no deliberate rudder pedal inputs were made by the crew. Some power was re? applied once the aircraft had levelled off, and the airspeed was allowed to decay towards 250 kt. As the aircraft approached this speed, the oscillations began to decay rapidly and stopped. The total duration of the roll/yaw event was about seven minutes.

After the oscillations had stopped, the F/O went back into the cabin to check for any abnormalities on the wings but found none. A low speed handling check was carried out, and it was found that the aircraft handled well at a speed 150 kt with Flap 15 selected and with the landing gear down. It was decided to return to London Gatwick Airport in this configuration, and the MAYDAY was downgraded to a PAN. The weather at Gatwick for the landing was surface wind southerly at 5 kt, CAVOK and Runway 08R was in use. The crew considered that the most appropriate checklist for landing in a Flap 15 configuration
was the One Engine Inoperative Descent/Approach/Landing checklist, which was actioned.

On checking the Master Caution Recall in the Landing Checklist, the commander noted that the amber FLT CTL caption was illuminated. On checking he saw that the Yaw Damper OFF amber light was illuminated and he switched the system back ON. However, on final approach, at about 3,000 feet, he felt that there may have been a small roll/yaw oscillation commencing. He therefore switched OFF the Yaw Damper, and continued the approach for an uneventful landing at 1644 hrs.

On reaching the maintenance hangar the circuit breaker for the Cockpit Voice Recorder (CVR) was 'pulled', but due to the 30 minute duration of the CVR tape the period of the incident had been erased.

Following the event the crew recalled that, during the initial climb out, a layer of cloud had been encountered between 3,000 and 4,000 feet, thickness about 500 feet, but the total temperature was in excess of +10°C at that time. There was no cloud above this and no icing was encountered. At the time of the incident, it was daylight, in clear air, no turbulence and with a good horizon above a general overcast.

During debriefing the crew reported that the oscillations were similar to Dutch Roll, with a period of about 2 to 3
seconds. The roll control felt normal to apply, with no signs of any mechanical reversion. There were no indications of any abnormalities associated with the hydraulic systems throughout the flight. The characteristics of the oscillations did not appear to change when the Autopilot was disengaged.

Following an initial examination of the aircraft (1.12.1-2), a test flight (1.16.2) was carried out on 10 November 1995. With additional recording equipment installed on the aircraft attempts were made to reproduce the roll/yaw oscillations.

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1.2 Injuries to persons

<table>
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<th>Passengers</th>
<th>Others</th>
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<tr>
<td>Serious</td>
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<tr>
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</tr>
</tbody>
</table>
1.3 Damage to aircraft

A small panel, the left wing fuel booster pump access panel, was found to be missing after the incident flight.

1.4 Other damage

None.

1.5 Personnel information

1.5.1

Commander: Male, aged 44 years
Licence: Airline Transport Pilot's Licence
Aircraft ratings: Boeing 737, Viscount, Beech 55/58
Medical certificate: Class 1, Renewed 26 September 1995
Instrument rating: Renewed 4 May 1995
Other Ratings:
Boeing 737

Pilot

Last base check: 12 October 1995
Last line check: 20 October 1995
Flying experience:
Total all Types: - 8,290 hours
Total on Boeing 737: - 5,500 hours

Duty time: 2 hours 39 minutes
Previous rest: In excess of 24 hours

1.5.2
First officer: Male, aged 44 years
Licence: Airline Transport Pilot's

Aircraft ratings:
Boeing 737, Vanguard,
Beach 55/58

Other ratings:
Instrument Rating Examiner
Type Rating Examiner -

Boeing 737
Medical certificate: Class 1, Renewed 27 July 1995

Instrument rating: Renewed 3 November 1994

Last base check: 29 March 1995

Last line check: 18 December 1994

Flying experience: Total all Types: - 8,600 hours
Total on Boeing 737: - 6,000 hours

Duty time: 2 hours 39 minutes

Previous rest: In excess of 24 hours

1.6 Aircraft information

1.6.1

Leading particulars
Type: Boeing 737-236 Advanced
Constructor's number: 22030
Date of manufacture: 1980
Certificate of registration:
September 1983
Certificate of airworthiness:

Total airframe hours:
37,871 hours (20,267 landings)

Engines:
2 Pratt & Whitney JT8D-15 turbofan
Maximum weight authorised for take-off:
52,750 kg

Actual take-off weight:
39,376 kg

Estimated weight at time of incident:
38,300 kg

Estimated fuel remaining at time of incident:
9,300 kg

Centre of gravity (CG) at time of incident:
205 inches AoD (Within limits)

1.6.2 Dutch Roll
The Dutch Roll lateral-directional interaction mode is a coupled banking, sideslipping and yawing motion. It is often oscillatory, and when lightly damped creates control difficulties for pilots and discomfort for passengers. The Dutch Roll motion can begin with a yawing motion produced by a gust or a rudder input or with a rolling motion, which in turn results in adverse yaw. If the aircraft is designed with positive directional stability the fin tends to re-align the aircraft into the airflow when the temporary yawing moment stops. However, the nose does not return to a position of zero sideslip but tends to overshoot, setting up the cyclic roll/yaw motion of Dutch Roll. The degree of dihedral and wing sweep dictate the lateral qualities and the fin and rudder size influence the directional qualities. If the oscillation is positively stable the roll and yaw amplitudes reduce over successive oscillations and eventually damp out.

The Boeing 737 has natural positive damping in the Dutch Roll mode, (i.e. the motions reduce in amplitude with each cycle), and therefore meets the airworthiness requirements for lateral-directional oscillations without the need for an active Dutch Roll (yaw) damping system. Nevertheless, a Yaw Damper is fitted, which, although not required for flight dispatch, is provided to improve passenger comfort by more quickly damping the Dutch Roll oscillations. To provide active Dutch Roll damping, a rate gyro in the Yaw
Damper Coupler senses yaw motion and feeds a signal to the Yaw Damper Actuator in the rudder Power Control Unit (PCU), to oppose the yaw. The period of the basic aircraft Dutch Roll oscillation for the Boeing 737 without Yaw Damping varies with airspeed, reducing from just over 4 seconds at 200 kt to 3 seconds at 280 kt (about 0.25 to 0.33 Hz).

1.6.3 Description of the Yaw Damper system (Appendix 1)

As described in § 1.6.2, the Boeing 737 series of aircraft have positive lateral directional stability but the aircraft still have a tendency to 'Dutch Roll' when disturbed, although the oscillations damp-out over a period of time. The aircraft are fitted with a Yaw Damper system which moves the rudder, with limited authority, to oppose such oscillations. Since it is not essential to the controllability of the aircraft, the system is simplex and powered by the 'B' hydraulic system. It should be noted that the Yaw Damper is independent of the Autopilot, since the latter has no input into the rudder control.

The principal components of the Yaw Damper system are the Yaw Damper Coupler located in the E&E Bay and the Yaw Damper Actuator which is part of the main rudder PCU. The Yaw Damper Coupler contains a rate gyro which senses lateral oscillations and, where these are of a frequency corresponding to the aircraft's natural Dutch Roll, a signal is output to the
actuator to oppose the motion.

The Yaw Damper Actuator receives the electrical signals from the Yaw Damper Coupler which modulate an electro-hydraulic valve which ports hydraulic fluid to the appropriate ends of the actuator piston. Movement of this piston is mechanically linked to the input mechanism of the main PCU, which moves to command rudder movement. Rudder response is monitored by a Linear Variable Displacement Transducer (LVDT) and a feedback position signal is transmitted back to the Yaw Damper Coupler. The geometry of the linkage is such that the Yaw Damper authority is limited to +/-3° of rudder movement on this Boeing 737-200. Yaw Damper motion is not transmitted back to the pilot through the rudder pedals. A small indicator in the cockpit advises the pilot of any Yaw Damper activity.

1.6.4 Activation of the Yaw Damper system

The pilot can select the Yaw Damper ON and OFF using an engage switch on the flight deck overhead panel. Appendix 1 shows the layout of the Flight Control panel in the cockpit overhead (Figure 1) and a highly simplified electrical schematic diagram (Figure 2) which shows only those circuits involved in effecting engagement of the Yaw Damper system. All the major electrical circuits affecting the operation of the Yaw Damper system are supplied from dedicated 28V
dc and 115V ac circuit breakers. As depicted in the schematic, the Yaw Damper is switched OFF but the B Flight Control switch is in the normal, guarded, ON position.

For the system to become active, the Yaw Damper Actuator has to be supplied with hydraulic power via a solenoid-controlled hydraulic shut-off valve (SOV). This solenoid opens the valve when it receives a 28V dc supply from the Yaw Damper engage switch on the Flight Controls panel, via contacts in the k12 relay which is in the Autopilot Accessory Unit. The solenoid of relay k12 is supplied with 28V dc from the Yaw Damper Coupler (pin 12 of Connector D295), provided that a logic circuit within the coupler senses that 115V ac is available at pin 2, and that 28V dc has been applied to pin 14 of D295 from the Yaw Damper engage switch. D295 is the connector joining the Yaw Damper Coupler to the aircraft wiring. The solenoid of k12 relay is earthed through the time delay circuits within the Autopilot Accessory Unit, which cause this relay to operate 2 seconds after the engage switch is operated.

When relay k12 is energised, three sets of contacts relevant to the Yaw Damper system, annotated a, b, & c on the schematic, are switched. When switched ON, the contact 'a' supplies 28V dc to a number of additional circuits in the Yaw Damper Coupler; contact 'b' supplies the 28V dc from the Yaw Damper switch to the
SOV solenoid (as above); contact 'c' breaks an earth path for the 'Yaw Damper' light on the Flight Control panel and extinguishes the light which, when illuminated, indicates that the Yaw Damper is not in operation.

The Yaw Damper switch is spring loaded to the OFF position and is held ON electro-magnetically. The hold on solenoid is permanently connected to the 28V dc supply to the switch and takes its earth from the Yaw Damper interrupter circuits in the Autopilot Accessory Unit. This earth is routed via a set of contacts in the B Flight Control switch. When the Yaw Damper switch is in the OFF position, the terminal which supplies 28V dc power to the actuator SOV is earthed.

1.6.5 Description of the E&E Bay

The E&E Bay on the Boeing 737 contains avionics equipment including the Yaw Damper Coupler. It is an area of the lower fuselage below the passenger floor and extends from the nosewheel bay aft bulkhead to the forward face of the forward cargo bay (stations 304.5 to 378.9). On the Boeing 737-200 most of the equipment is mounted in three racks labelled E1, E2 and E3 (Appendix 2) with three or four shelves in each rack. These are labelled -1, -2, -3 etc from the top, so that the upper shelf of rack E1, for example, is designated E1-1. In general, each individual avionic unit is designed
for rapid removal from or refitting to its location in the rack. This is achieved by mounting it in a tray equipped with a multi-pin socket so that, as it is slid into engagement in the tray, a mating plug in the back of the unit connects with the socket. The unit is then locked in place with quick-release fasteners at the front.

The trays and racks themselves are commonly removed during major maintenance and thus a further connection is required to interface with the main aircraft wiring looms which are not routinely disturbed for avionics component removal. This is achieved by a series of rack disconnect connectors which are mostly located behind the relevant rack and are sealed against moisture ingress. It should be noted that this is not the case with the unit/tray plug-and-socket arrangement described above.

On the Boeing 737 (and indeed other types of aircraft) the location of the E&E Bay is directly underneath the forward left passenger door vestibule area. With the cabin configuration used on G-BGJI, the galley and forward toilet areas are also above the forward end of the bay, but generally outboard of the equipment racks themselves. G-BGJI was equipped with hydraulically actuated airstairs below the forward left door. As the stairs were retracted, they were stowed in the E&E Bay between racks E1 and E2 and E3 (Appendix 2). Although not directly above the racks, the airstairs are an
obvious potential source of moisture ingress into the bay. A fibreglass drip-tray was fitted under the full length of the retracted stairs, with an overboard drain tube to dispose of any water brought into the bay by this route. An early modification further introduced a rubberised fabric 'shroud' which clipped on to the top forward lip of the drip tray and was stretched forward over the E1 rack to attach to the nosewheel bay aft bulkhead, thus forming a moisture barrier over the bay in this area. The fall on the shroud was such that fluid leakage from above should run down the shroud and into the drip-tray.

In addition to the shroud, other measures were taken to prevent fluid spilt above the floor from dripping into the E&E Bay area, principally concerned with sealing the floor panels and toilet/galley areas. Procedures are laid-down in the Boeing Maintenance Manual for these measures but many operators adapt them according to their own custom and practice, and to use locally available materials.

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1.6.6 Maintenance history

1.6.6.1 P6 inspection

Immediately prior to the incident flight, a major inspection of G-BGJI had been completed, known as a 'P6 Check' in
the operator's Maintenance Schedule. It is scheduled every 5 calendar years or 11,200 hours flying time, whichever occurs first, and typically takes about 30 days to accomplish. One of the major objectives of the check is to inspect the structure for corrosion or other defects and to achieve this requires extensive dismantling of the airframe and systems. The individual elements of the check are too numerous to mention in this report, which will concentrate on the activity surrounding the E&E Bay area and the rudder/Yaw Damper system.

Prior to entering the hangar, the aircraft was washed externally and the toilet and potable water systems drained. Early in the check itself, the toilet and galley components were removed from the aircraft. The floor panels were also removed and several required renewal, as is quite usual for an aircraft of this age.

The airstairs and drip-tray were removed from the E&E Bay as were the avionics racks, the individual avionics units being stored on covered shelving alongside the aircraft awaiting refitment. All soundproofing bags were removed and, having gained access to the basic fuselage structure, the area was given a high-pressure wash of water and detergent. To achieve this it was necessary to protect the rack disconnect connectors which, apart from the looms themselves, were the only electrical components of the E&E Bay remaining in the aircraft. Plastic bags were taped around the
connectors in an attempt to guard against contamination by the cleaning process.

Visual inspection of the structure was carried out and evidence from the technical records along with the recollections of the individuals involved indicated that the degree of corrosion found and rectified was typical of any aircraft on such a check. There were no indications of any abnormalities which may have indicated heavy fluid contamination. Evidence of dried blue fluid (toilet sanitising fluid) contamination was noted on the floor structure under the toilet but again this was considered commonplace. AAIB examination of several similar aircraft after a few years post-check service confirmed this to be so.

Upon completion of the structural inspection, the E&E Bay was re-assembled and the avionics units re-fitted. The records show that no relevant units required rectification or replacement and thus the ones removed were re-installed. As the aircraft approached completion, when electrical and hydraulic power were re-applied, every system on the aircraft was subjected to a full function test since every system had been disturbed during the check. In the case of the Yaw Damper system this included a Built-in Test Equipment (BITE) check on the Yaw Damper Coupler. No malfunctions were found. The main rudder PCU had been replaced by a unit modified to Boeing SB 737-27-1185 (Rudder PCU - Replacement of the Dual Servo
Valve) but in all other respects the rudder/Yaw Damper system components were the same as those fitted prior to the P6 maintenance check.

1.6.6.2 Technical Logs

The Technical Log for the aircraft was examined for evidence of any Yaw Damper problems reported by crews since February 1995 up to the P6 check. Although the Log revealed a very large number of repetitive defects affecting system 'B' Autopilot over the period, there were no entries for the Yaw Damper system. Later, the Technical Log and the Cabin Log were examined for entries which might suggest that significant fluid spillage may have occurred in the forward toilet/galley area over the same period. Only one entry was found, dated 5 March 1995, in which the cabin crew reported:

"Fwd galley floor area wet, no spillages reported. Please check for leaks."

The Action Taken column reported:

"Slight leak traced to toilet sink drain seeping under floor & wetting carpet. Drain fitting tightened, now no leak."

The technical records also showed that the aircraft had departed on the incident flight with the APU inoperative because its fire detection system was unserviceable, the
rear toilet servicing panel was 'speedtaped' shut and the forward toilet was not serviced. In addition there was some cosmetic furnishing work to complete in the passenger cabin and the airstairs drip-tray access and drain panel was not fitted. All the above was permissible in accordance with the operator's Despatch Deviation Manual.

It had been intended to charge the forward toilet for normal service which involved introducing an initial charge of one gallon of fresh water via the recharging point in the toilet servicing panel. However, it was found that the forward toilet tank would not retain the water due to a misrigged and therefore improperly seated dump valve. As there was some urgency in despatching the aircraft, the decision was taken to rectify the fault after the flight.

Such a fault would allow the water to flow into the 4 inch drain pipe shown in Appendix 2 and, assuming the outboard flap valve was closed, it would stay in the pipe. If the charging process was continued in this situation, the pipe would fill up and, in the presence of the improper sealing described in §1.12.4, fluid could run down the outside of the pipe and into the E&E Bay. However, the leaking dump valve was found early in the charging process and the quantity required to fill the pipe (estimated at about 5 gallons) was never introduced. The toilet system was completely drained prior to the flight.
1.6.6.3 Yaw Damper Coupler history

The Yaw Damper Coupler, part number 4030952-902, serial number 79100850 was manufactured in 1979. Although the recorded history of the unit showed that it had been subject to removals since that time, the records suggested that these were to service other aircraft shortages and not for any unserviceability reasons. Indeed, there was no record of the unit ever having entered workshops since new, nor would there be any requirement for it to do so unless it was defective since the part is operated 'on condition'. Physical inspection internally also showed that the rate gyro, probably the most likely component to cause problems over a period of time, was in original condition and had not been subject to repair or overhaul.

1.7 Meteorological information

1.7.1 Incident flight

At the time of the incident a south to south-westerly airstream was established over the area. The visibility was greater than 20 km, with scattered cloud, base 2,500 feet. The mean sea level pressure was 1022 mb.

The winds/temperatures were:
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<th>Height (feet)</th>
<th>Wind Direction (°)</th>
<th>Wind Speed (kt)</th>
<th>Temperature (°C)</th>
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<td>230</td>
<td>15</td>
<td>-16</td>
</tr>
<tr>
<td>24,000 feet</td>
<td>230</td>
<td>25</td>
<td>-28</td>
</tr>
</tbody>
</table>

1.7.2 Test flight

The weather prevailing at the time of the test flight on 10 November 1995 was significantly worse than that on the
day of the incident. A waving warm front was lying across
the Boscombe Down area, moving
slowly and erratically northwest. Occasional rain and
drizzle was associated with the frontal zone, with surface
visibility of 3 to 5 km. The mean sea level pressure was
1003 mb and the zero degree isotherm
was at 6,300 feet. The cloud was broken, base 1,000 feet,
tops 5,000 feet. Higher level overcast prevailed from 6,000
feet, tops 12,000 feet. There were further broken layers
between 16,000 and 18,000 feet
and between 21,000 and 24,000 feet. The winds/
temperatures were:

<table>
<thead>
<tr>
<th>Height</th>
<th>Wind Speed</th>
<th>Wind Direction</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000 feet</td>
<td>160¡</td>
<td>11 kt</td>
<td>+01¡C</td>
</tr>
<tr>
<td>10,000 feet</td>
<td>195¡</td>
<td>21 kt</td>
<td>-05¡C</td>
</tr>
<tr>
<td>18,000 feet</td>
<td>195¡</td>
<td>37 kt</td>
<td>-22¡C</td>
</tr>
<tr>
<td>24,000 feet</td>
<td>200¡</td>
<td>53 kt</td>
<td>-32¡C</td>
</tr>
</tbody>
</table>
Moderate icing and moderate turbulence were forecast in cloud.

1.8 Aids to navigation

Not relevant.

1.9 Communications

The crew was being provided with a Radar Advisory Service outside controlled airspace by London Military Radar on VHF frequency 128.7 MHz at the time of the incident. A recording of the radiotelephony transmissions was available for this investigation.

1.10 Aerodrome information

Not applicable

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1.11 Flight recorders

1.11.1 Flight Data Recorder

The aircraft was equipped with a Davall 1198 re-cycling wire, accident protected digital Flight Data Recorder (FDR). This had a recording duration of 25 hours and was part of a Teledyne recording system.
This system also incorporated a Quick Access Recorder (QAR) which recorded essentially the same information as the mandatory recorder onto a cassette. The FDR was replayed satisfactorily by the AAIB and the data checked with the readout from the QAR performed by the operator. There were some areas of invalid data on the FDR which were not evident on the QAR. A total of 27 analogue parameters plus 73 discrete parameters (events) were recorded.

Among the analogue parameters recorded were Pitch Attitude, Roll Attitude, Rudder Pedal Position (RPP), Control Position Pitch (CPP) and Control Position Roll (CPR). After the incident these parameters were calibrated and a number of anomalies were found. Roll Attitude had a datum error of approximately 4¡. The CPP was found to be indicating -4.4¡ throughout the incident but there were some indications during large movements of the control column, such as during the control checks, or at rotation. CPP was found to have been unserviceable on the flights prior to the incident for which recordings remained on the FDR. Other parameters checked were within calibration limits.

The RPP is measured by a position sensor on the rudder control system forward quadrant situated just below and aft of the pedals. This therefore only detects the pedal movement from the pilots; there is no feedback to the pedals of the Yaw Damper movement.
recording is made on the FDR of the rudder surface position. The engagement of the Autopilot is recorded on the FDR, however the Yaw Damper engagement is not recorded.

1.11.2 Data timing

Data is acquired by the Digital Flight Data Acquisition Unit (DFDAU) in 0.125 second time slots, parameters acquired in the same time slot will be synchronised to within 0.125 seconds. Lateral Acceleration, CPR and RPP are all sampled 4 times a second, within the same time slot. Roll Attitude is only sampled twice per second, and is sampled 0.125 seconds after the first and third samples of the previous parameters.

The following table shows the relationship between the parameters:

<table>
<thead>
<tr>
<th>Timing Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>0.125</td>
</tr>
<tr>
<td>0.25</td>
</tr>
<tr>
<td>0.375</td>
</tr>
<tr>
<td>0.5</td>
</tr>
<tr>
<td>0.675</td>
</tr>
<tr>
<td>0.75</td>
</tr>
<tr>
<td>0.875</td>
</tr>
</tbody>
</table>
Normal Accel

2
10
18
26
34
42
50

Lateral Accel

58

15
31
47

Long Accel

63

28

Heading

60

3

CPR

16
32
48

CPP

64

13
Note: the numbers in the boxes above are the DFDR word slots for the parameters in the 64 word frame.

1.11.3 Cockpit Voice Recorder

The aircraft was equipped with a Fairchild model A100 recycling Cockpit Voice Recorder (CVR) which records the latest 30 minutes of audio information on four tracks. In this case aircraft power had been re-applied to the aircraft after landing which allowed the
CVR to continue to record, automatically erasing the recording of the incident and thus providing no useful information.

1.11.4 Data interpretation

Pre-flight control checks were carried out and the aircraft took off at 15:53 hrs and climbed normally to 20,000 feet. During the climb there were some small oscillations evident from the lateral acceleration record. These small oscillations occurred between 200 and 260 kt with a frequency of 0.26 Hz and varied in both magnitude, up to ±0.03g lateral acceleration, and duration. As such, they went unnoticed by the crew or were regarded as insignificant.

At 16:02:08, as the aircraft approached 20,000 feet at 288 kt on a heading of 270¡M, the crew began the spoiler upfloat check, identified from the Speedbrake lever being moved to the 'Flight Detent' position for approximately four minutes. The Autothrottle was already engaged and the 'B' Autopilot was engaged at the top of the climb. Intermittent small oscillations were still evident during the test. Figure 1 at Appendix 3 shows the data throughout the incident, from the movement of the Speedbrake lever to the 'Down' Position; Figure 2 at Appendix 3 shows an expanded plot of the initial part of the incident. Two seconds after the Speedbrake lever was returned to the 'Down' position, at 16:06:28, there was a 2¡ CPR input to
the right and there were coincident small lateral accelerations of ±0.018g with a frequency of 0.36 Hz at an airspeed of 294 kt. These small oscillations continued with varying amplitude for the next minute, with a slight rise in airspeed to 296 kt and did not cause any detectable roll movement.

At 16:07:35 there was a more significant lateral acceleration oscillation, frequency 0.35 Hz, and up to 0.06g which lasted for three cycles. This was accompanied by a roll of 3¡ left wing down, and an opposing CPR movement, from the Autopilot of -4.9¡ to 8.5¡ right wing down within two seconds. There was no further input of CPR during this initial oscillation. The amplitude of the lateral acceleration cycles increased, by approximately 0.04g per cycle, and reached a maximum in around 20 seconds. The Roll Attitude and CPR began to oscillate in opposition as the Autopilot tried to correct the roll of the aircraft. The Autopilot and Autothrottle were disconnected 15 seconds after the initial left roll, at 16:07:53 with the aircraft at 20,000 feet, 296 kt.

The large oscillations continued, with a frequency of 0.36 Hz, and a magnitude of around ±0.5g lateral acceleration, and ±15¡ roll around a varying datum with opposing CPR inputs of around ±30¡ from the pilot. After the Autopilot disconnect the airspeed initially reduced to 277 kt. At 16:07:58 the engine power reduced from 1.48 to 1.11 Engine Pressure Ratio (EPR); the aircraft
descended and airspeed increased to a maximum of 313 kt.

Ten seconds after the Autopilot disconnect there were some oscillations evident in the rudder pedal position, however the movement was only ±0.25¡ with the same frequency as the lateral acceleration. There were also oscillations in other parameters, including Pitch Attitude (up to ±1¡) and heading (±5¡ about a varying datum between 270¡ and 040¡M).

The aircraft levelled at 7,000 feet with an increase in EPR from 1.0 to 1.24/1.19 on Nos 1 and 2 engines respectively; and then decelerated through 275 kt when the oscillations began to damp out. Throughout the oscillations the aircraft was in a left turn, finally reaching a heading of 040¡. Figure 3 at Appendix 3 shows this data in expanded form; the oscillations lasted for over 7 minutes and finally disappeared at an airspeed of 250 kt.

After the large oscillations there were some minor, quickly damped oscillations in lateral acceleration of up to ±0.002g. At 16:17:52 flap was selected initially to 1¡ at a speed of 212 kt and then to 5¡ and 15¡ at airspeeds of 200 kt and 165 kt respectively. As the airspeed further reduced, 15 seconds after passing through 170 kt coincident with the scheduled Yaw Damper gain change, there was a kick of 0.025g in lateral acceleration, followed by small oscillations lasting
around 12 cycles. There were then some similar small oscillations with a magnitude of ±0.02g and frequency of 0.2 Hz, which occur periodically during the rest of the flight. The oscillations in lateral acceleration are accompanied by oscillations in roll of up to ±0.5¡. Figure 4 at Appendix 3 shows one of these oscillations which lasted for around a minute before damping out. At 16:45 the aircraft landed without incident, with a flap setting of 15¡ and a touchdown speed of 135 kt.

1.11.5 Quick Access Recorder data

The Quick Access Recorder (QAR) recorded essentially the same information as the mandatory recorder onto a readily removable cassette. The operator routinely removed and replayed the cassettes from the QAR; approximately two weeks of flying data from each aircraft having been kept as an archive. This archived QAR data was analysed for G-BGJI, consisting of 85 flights having taken place prior to the P6 check. On two separate flights on the 8 and 11 September, small oscillations were found; firstly at 36,000 feet between 240 to 245 kt there were intermittent oscillations of ±0.05g with a frequency of 0.35 Hz. On another separate flight one period of small oscillations was observed, damping out in 3 cycles, with a frequency of 0.4 Hz. No other significant oscillations were found on the flights reviewed.
1.12 Aircraft examination

1.12.1 General

Examination of the aircraft began on the evening of the incident flight. It had been impounded in a hangar at Gatwick Airport and had not been disturbed since that flight, other than by those actions necessary to tow it into the hangar.

1.12.2 Non-intrusive tests conducted between incident and test flight

Initial analysis of the recorded aircraft behaviour during the incident flight had indicated that the characteristics were most consistent with erroneous operation of the Yaw Damper system. Therefore, immediately after the incident had occurred, a policy decision was made not to disturb, by disconnection or disassembly, any of the aircraft systems which might have any influence on the operation of the Yaw Damper before a test flight was made. The object of the test flight was to attempt to induce the aberrant behaviour, with additional flight monitoring systems temporarily fitted. It was, however, decided to perform, together with functional tests, such isolation and continuity testing as could be done within this stricture.
It was agreed that the examination would commence by subjecting the aircraft to practically every check in the Maintenance Manual of the flying control, Autopilot and Yaw Damper systems which could be achieved without breaking in to any systems (non-intrusive).

The airframe was inspected visually, including the E&E and landing gear bays, the angle-of-attack sensors and pitot probes. Nothing significant was found with the exception that the hydraulic oil quantity was approximately 1/8” below the FULL line on the sight gauge and the left wing fuel booster pump access panel was found to be missing.

The next stage involved a rigging check on all of the flying control surfaces and cables which could be accessed without extensive removal of panels. Some discrepancies were found relative to the Maintenance Manual requirements for both control surface rigging and cable tensions but there was nothing found which could have been responsible for the aircraft's aberrant behaviour during the incident flight. It was noted that, when the technicians attempted to check cable tensions, they found that nearly all their stock of tensiometers gave different readings. Some instruments were considerably at variance with others despite all being within their calibration dates. There was no system at the operators engineering facility at Gatwick for checking the accuracy of tensiometers upon issue from
stores.

The next phase involved full flying control, Autopilot and Yaw Damper function tests and BITE checks where appropriate. Although the Autopilot failed one of its parameter checks on the BITE test, analysis showed this could have had no effect which would explain the aircraft's behaviour. None of the wiring checks performed at this stage revealed any abnormalities.

Since the exhaustive series of checks generally had not revealed any significant defects or abnormalities, it was decided that the aircraft would be left in this condition for the next phase of testing, which was to be a pressurisation test of the aircraft in a simulated flight condition (31.16.1). The minor defects remained unrectified and no rigging adjustments were made to the flying controls between the incident and test flights (31.16.2).

In consultation with Boeing and the Civil Aviation Authority (CAA) and after analysis of the DFDR data from the incident flight, a series of structural checks were required, mainly concerned with the fin and rudder attachments, before the aircraft could be allocated a 'B' conditions certificate for the test flight. These checks did not reveal any damage or excessive clearances in the attachment fittings or structure.

1.12.3 Directional control system component examination
Following completion of the test flight and non-intrusive checks which had not revealed any significant abnormalities with the directional control system, the decision was taken to subject the individual components of the system and the associated wiring to function and strip examination as necessary. In addition, the three hydraulic system filter elements were removed from each system and, together with fluid samples, were despatched to an independent laboratory for analysis. The laboratory report did not indicate any abnormalities with either the fluid or filter elements associated with either system. The wiring checks are described in §1.12.5.

The components returned to their respective manufacturers for testing/examination under AAIB supervision were:

a  Yaw Damper Coupler
b  Rudder PCU
c  Standby Rudder PCU
d  Rudder Feel and Centring Unit
e  Digital Air Data Computer (DADC)
In addition, the Autopilot Accessory Unit was examined in the AAIB laboratories.

1.12.3.1 The Yaw Damper Coupler

This unit was returned to the manufacturer, Honeywell and placed on their Automatic Test Equipment (ATE). Tested repeatedly at ambient conditions, these comprehensive tests did not reveal any significant defects in the unit. The Yaw Damper Coupler was also subjected to the same test regime but manually executed. It was then hot-soaked and tested on the ATE, again performing to specification. There was no facility for performing these checks under humid conditions, so this was not achieved.

The above tests were able to prove the serviceability of all the Yaw Damper Coupler circuitry but could not fully check the rate gyro which is incorporated in the unit. Accordingly, the unit was opened to remove and despatch the rate gyro to another facility for testing as an isolated component. It was at this point that apparent contamination/corrosion deposits were found on the back of the multi-pin connector inside the unit. This took the form of bluish-white powdery deposits around some of the wire-wrapped connections to the back of the pins (Appendix 4, Figure 1). Closer inspection also showed evidence of light grey deposits on the outside of the connector shell (Figure
2). These observations, which pointed towards moisture impingement on the outside of the connector and subsequent ingress into the unit, were reinforced when the lower cover plate for the unit was examined and signs of dried fluid residue were seen on its inner face (Figure 3). There was, however, no sign of moisture on the outside of the black casing itself.

The decision was made to return the unit (minus the rate gyro) to the UK to embark on humidity and other tests described in §1.16.5. The rate gyro, when tested, proved to be in good serviceable condition.

1.12.3.2 Rudder PCU

The rudder PCU, incorporating the Yaw Damper Actuator, was tested at the unit manufacturer's facility on a rig used for acceptance tests on production and overhauled components. The rig essentially operates the PCU with hydraulic and electrical power connected and plots the response of the unit to mechanical (pilot) and electrical (Yaw Damper) inputs. The performance of the unit was satisfactory in all respects. Measurements were taken of the Yaw Damper solenoid pull-in voltage which were requested in connection with the testing described in §1.16.7.

1.12.3.3 Standby rudder PCU
This was examined at the Boeing Equipment Quality Analysis Laboratory in Seattle, USA under AAIB supervision. It passed an overhaul function test with only minor out-of-limits measurements in two areas. Strip examination showed no abnormalities apart from some scoring of the input lever bearing, the origin of which was not clear but did not appear to affect its operation.

1.12.3.4 Feel and Centring Unit

No evidence was found of failure, defect or malfunction of this unit. Functional testing did not reveal any abnormal behaviour although some excessive backlash in the system was identified, predominantly in the trim actuator. It was uncertain whether this was simply a feature which might be expected on a unit with some considerable time in service but was not considered to have been capable of precipitating the aberrant behaviour of the aircraft during the incident flight.

1.12.3.5 Digital Air Data Computer (DADC)

The DADC was initially tested at the Honeywell facility in Seattle, USA at the same time as the Yaw Damper Coupler. Its interface with the Yaw Damper system is limited to switching the gain of the Yaw Damper Coupler output according to the aircraft's indicated airspeed. In this respect it functioned normally.
1.12.3.6 Autopilot Accessory Unit

Amongst the functions of the Autopilot Accessory Unit is the enabling of the Yaw Damper system. It was tested to establish its conformity with specification with respect to those features which might affect the operation of the Yaw Damper. These tests involved the measurement of contact to contact resistance and the insulation of the terminals of the k12 relay within the unit, in both its switched conditions and testing of the time delay and interrupter circuits. The results of all these tests indicated that the functions under consideration operated correctly and within limits.

It was decided to establish, additionally, the voltages at which the k12 relay engaged and disengaged. This was done by adjusting, in both the rising and falling senses, the voltage applied to the actuating solenoid. Under the test conditions the relay pulled in at 18.7 (Volts) V and dropped out at 18.4V. It was observed, whilst adjusting the voltage very slowly around the changeover voltages, that the relay sounded as if it operated in two stages, as it emitted a double click. The change of voltage over the double click was very slight and it was established that all contacts operated simultaneously on one of the clicks.

At a later stage of the investigation, studies of the characteristics of the Autopilot Accessory Unit, Yaw
Damper Coupler and Shut-off Valve Solenoid as a group showed slightly different operating voltages for the k12 relay with an engage voltage of 18.16V and 17 ma current and a dropout voltage of 17.71V and 9 ma current. (☞1.16.7)

1.12.4 The E&E Bay

With the discovery of apparent moisture contamination of the Yaw Damper Coupler connector, described in ☞1.12.3.1, attention was turned to the E&E Bay in an effort to determine whether there were any obvious sources of such contamination. The P6 check items included washing and so there was little chance of finding evidence of a source of moisture occurring in the past.

Examination commenced with an inspection of the avionics cooling plenum which is situated directly above the E1-1 rack which houses the Yaw Damper Coupler. This had clearly been washed and bore numerous watermarks on its polished aluminium alloy surface. One of these marks, however, was of particular interest since it ran directly above the Yaw Damper Coupler in the rack. The fluid appeared to run forwards from about the mid-point of the plenum on the top surface and then run rearwards to about the same point on the lower surface. A search for a corresponding leak in the rubberised shroud above this apparent path proved negative.
The shroud itself was then removed and examined. Although it had evidently been partially cleaned during the P6 check it was still heavily stained on its upper surface and bore heavy deposits of a waxy substance similar to that used during the floor panel sealing operation. When tested for leakage, the shroud proved water-tight apart from a small area of porosity which had resulted from chafing where it was folded and fastened over the lip of the airstairs drip-tray. This area was fairly remote from the E1-1 rack and it was difficult to conceive any situation whereby fluid entering the bay by this route could contaminate the rack. Doubts were expressed concerning the installation status of the shroud during the incident flight. This arose because, initially, it was not suspected that fluid contamination of the Yaw Damper Coupler was responsible for the incident and investigation was centred on the key components of the directional control system. At an early stage the airstairs drip-tray was removed to greatly facilitate access in the E&E Bay requiring the shroud to be unclipped and rolled back. There is no doubt that it was in the aircraft, attached to the nosewheel bay bulkhead but the inspection team could not recall with absolute certainty that it had been fully fitted. The technician involved with preparing the aircraft for the incident flight had, however, stated that it was completely and correctly installed prior to the flight.

The large-diameter toilet drain pipe, routed laterally across
the E&E Bay (Appendix 2), was a potential source of contamination in precisely the area to affect the back of the E1-1 rack components, although such a scenario would still require penetration of the shroud before fluid could reach this location. The pipe is normally empty of fluid except during the toilet drain operation on the ground, although any improper seating of the toilet dump valve in the tank would result in the pipe starting to fill-up. The operator indicated that this was a commonly reported defect and just such a condition was present immediately before the incident flight (see §1.6.6.2). In this case, however, the leaking dump valve was detected and the aircraft despatched with the forward toilet empty.

Externally, the pipe had a number of dried fluid residue paths visible, some of which were probably by-products of the cleaning and corrosion protection processes during the P6 check. Tests on the pipe itself showed that it did not leak but the potential for leakage did exist because of faulty assembly at the interface of the pipe with the tank. Essentially, a screw had been trapped between two mating flanges such that, if the pipe filled up as described above to the level of the aircraft floor, fluid could have escaped and run down the exterior of the pipe into the E&E Bay. As described in §1.6.6.2, there should not have been sufficient fluid introduced to allow this to happen.

A further imperfect seal was discovered around the area
where the handbasin drain pipe passed through the toilet compartment floor. Any fluid escaping from the toilet/handbasin systems behind the vanity unit would run onto the floor. Since this area is not subject to passenger weight, floor panels are not used and a thin metal diaphragm is used instead. This has to be sealed to prevent leakage below the floor, including the holes where utility piping passes through it. As noted an improper seal had been achieved with the handbasin drain pipe such that, when the diaphragm was deliberately flooded, the fluid dripped down the flexible tube below the floor. However, this location was well forward of the E&E Bay and it was not considered that it could have migrated back towards the Yaw Damper Coupler.

A potential path for fluid dripping forward of the E&E Bay to migrate rearwards was discovered during examination of another Boeing 737?200. The aircraft had extensive toilet fluid contamination of the E1-3 rack disconnect shelf on the left side of the E&E Bay (note: not the racks themselves). Testing showed numerous leak paths allowing fluid to drip below the floor forward of the E&E Bay where the drips impinged on the two Captain's instruments pitot-static drain tubes. These run aft and downwards towards the bay, where they are routed above the E1-3 rack disconnect shelf. The somewhat encrusted and corroded appearance of the pipes suggested that this had been happening for some time. Fluid from a leaking toilet
dump valve was thought to have been the source of the contamination. Boeing has recognised this path as an undesirable feature and proposed a simple modification to put 'drip-triggers' on the line to prevent fluid running aft along the pipes. (The E&E Bay Assessment Team report on this subject is discussed in \(\S 1.16.8\).)

1.12.5 Post-test flight intrusive wiring and connector checks

A programme was drawn up so that, immediately following the test flight, electrical integrity testing of all the wiring and connectors which might affect operation of the Yaw Damper system could be conducted. This involved the wiring of all systems which had any connection, direct or via other equipment, to the connector D295 of the Yaw Damper Coupler.

Before doing some of these tests, which included high voltage insulation checks, it was necessary to remove the electronic modules involved, both to avoid damaging them and to gain access to the connectors. It was also necessary to isolate the affected wiring by disengaging the 28V dc and 115V ac circuit breakers. Apart from the Yaw Damper Coupler, which had to be removed to gain access to the pins and sockets of connector D295, other units disconnected were:

Component Location Connector
i. Air Data Computer No 1 E&E Bay D309A

ii. Autopilot Accessory Unit E&E Bay D293(A & B)

iii. Flight Control Module Flight Deck Overhead D630

iv Rudder Power Control Unit Fin base D291

v Yaw Damper Position Indicator Centre Instrument Panel D309A

The first test applied to connector D295 was a check of the physical engagement of the two halves; both of the tightness of individual pin to socket connections and the depth of engagement of the pins as a group into the sockets.

The first part of this test was done by inserting a single pin, with a light wire 'pull' attached, into each socket of the aircraft rack connector and established that it required perceptible force to draw the pin out of the socket. A similar test was done using a single socket pushed over each individual pin of the connector on the Yaw Damper Coupler itself. Both the elements of connector D295 were demonstrated to have satisfactory grip on all electrical contacts.

The second part of the test, to determine the depth of engagement, was done by impaling a sheet of .004 inch
thick paper, cut to remain inside the connector periphery, on all the pins of the Yaw Damper Coupler connector. The connection was then made and secured and then released and separated. The depth to which the paper had been driven down the pins showed that the depth of engagement was satisfactory.

Before disturbing the rudder PCU connectors, other than D295, measurement of the resistance of components within the rudder PCU, together with the intervening wiring and connectors, was made. This showed that all the electrical components in the rudder PCU which could affect the Yaw Damper system were within specification and their connections through to D295 were good. After this, the measurements were repeated whilst the connector at the PCU (D291) was shaken, by hand, to simulate the effects of vibration. This showed that the connection was sound.

Following these tests, the electrical bonding of all the components listed above was verified. They were then removed and the wiring, with all intermediate connectors, was subjected to continuity and insulation tests. These demonstrated that there were no detectable breakdowns in the isolation of any wire resulting in unwanted wire/wire or wire/earth faults; nor were there any breaks in the continuity of any tested conductive path.
The final action in this series of tests was to perform pin grip and connector depth of engagement tests on the rack connector of the Autopilot Accessory Unit (D293A) and the connector of the rudder PCU (D291). All proved satisfactory.

1.12.6 Tests on Yaw Damper engagement circuits (Appendix 1, Figures 1 & 2)

After examination of the Yaw Damper Coupler unit had raised concerns about the possibility of electrolytic activity between the pins of connector D295 inside it, consideration was given to the possibility that unwanted electrical paths could be generated between pins. The theoretical effects of these paths could be broadly divided into those which affected the behaviour of the electronic control circuits, which are reported on at paragraph 1.16.3, and those affecting the power switching which activates the Yaw Damper.

An initial test was made to establish the resistance, to aircraft ground, of the path from pin 14 on the rack side of connector D295 (with the Yaw Damper Coupler removed), through the earthed OFF pole of the Yaw Damper engage switch on the Flight Control panel. Comparison of this resistance on the incident switch with another showed the incident switch to have a persistently higher resistance of about 2 Ohms.

As a result of these tests, the switch itself was later
subjected to destructive examination; see paragraph 1.12.7

A series of tests was then performed, on the subject aircraft, which demonstrated that the Yaw Damper engagement interlocks and indications could, under dormant fault conditions, be defeated by the addition of particular unwanted paths bridging between the pins of connector D295. These were performed using a specially constructed extension lead which permitted electrical access to pins 4, 12 & 14 of connector D295 by means of breakout flyleads. These tests were extended by setting up electrolytically formed conductive paths between the breakout leads and are described at \( \equiv \) 1.16.6.

1.12.7 Yaw Damper system engage switch examination

As a result of finding that the engage switch had a persistently high resistance on the ground contact, approximately 2 Ohms, it was decided that it should be fully examined in the presence of the aircraft and switch manufacturers. The switch was presented for this examination still installed in the flight controls module from the flight deck. Since the incident flight and before the time of first checking the switch OFF pole earth resistance, the switch had been functioned an indeterminate number of times.

When subjected to laboratory testing, both whilst installed in and later after removal from the flight controls module,
the switch did not demonstrate any high resistance earth path. The switch unit was tested and found to be in compliance with its manufacture specification, both in terms of contact resistances and electromagnetic hold-on characteristics. Testing of the wiring within the flight controls module did not reveal any evidence of potential intermittently high resistance paths.

The switch unit was disassembled and the basic micro switches from within operated whilst being observed by real-time X-ray techniques. This showed that the movement of the contacts during switching was correct and effecting the designed self wiping action.

The basic micro switches were then dismantled and the contacts examined. This revealed the presence of a carbon rich contamination of the earth switch contacts but no evidence of loose particle contamination. It was considered that the carbon rich contamination of the contacts might have accounted for the earlier measurements of high contact resistance but did not appear to be sufficient to have been responsible for a contact resistance greater than the measured 2 Ohms observed whilst fitted in the aircraft.

1.13 Medical and pathological information

Not applicable.
1.14 Fire

Not applicable.

1.15 Survival information

Not applicable.

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1.16 Tests and research

1.16.1 Function tests of the flying control and Yaw Damper systems

Although the detailed series of checks described in \( \S \) 1.12.1 had involved several function tests of the flying control and Yaw Damper systems, it was decided that further testing should be carried out with the aircraft pressurised and undergoing a depressurisation cycle, as occurred during the incident flight. To this end the aircraft was towed out of the hangar and placed in a 'flight' condition by disabling the air/ground sensors and using a pitot-static test set to simulate an airspeed of roughly 290 kt. Using a ground pneumatic rig and the APU, the aircraft was pressurised to a differential appropriate to flight at 20,000 feet and hydraulic and electrical power was applied.

The Autopilot and Yaw Damper were engaged with no
malfunctions evident. The entire aircraft was 'nudged' several times using the nosewheel steering tiller to evoke a response from the Yaw Damper, and also by using the Yaw Damper test switch. This was repeated during the depressurisation cycle, again with no abnormal responses from either the Autopilot or the Yaw Damper.

1.16.2 High speed taxi and test flight

A Portable Airborne Digital Data System (PADDS) was installed in G-BGJI by the aircraft manufacturer to record parameters additional to those available on the FDR/QAR. These included rudder control system aft quadrant and surface position, Yaw Damper engaged signal and other Yaw Damper system control parameters, plus lateral accelerations at the fin and rudder.

Ground tests were performed by the manufacturer to determine whether the rudder and Yaw Damper system were operating correctly prior to the flight test. These included a frequency response check of the rudder and Yaw Damper LVDT, the results showing the correct phase and gain data for both. Yaw Damper engagement and disengagement via the flight deck overhead switch and the circuit breaker were also checked, and found to operate correctly.

Initially a high speed taxi run was carried out to identify whether any unusual rudder/Yaw Damper system characteristics could be generated during normal taxiing
and by applying aggressive nosewheel steering inputs to produce yaw rate inputs to the Yaw Damper Coupler. Cyclic nosewheel steering inputs with a period of 3 seconds (approximately the Dutch Roll frequency) were used during normal taxi, and a high speed run up to 80 kt was carried out; no unusual system characteristics were observed.

A flight test was then planned in an attempt to reproduce the oscillations seen in the incident. The aircraft was loaded to a similar gross weight and CG position and prepared for flight under 'B' conditions. It was crewed by the same commander as the incident flight together with a Boeing 737 test pilot provided by the manufacturer. The manufacturer's regular complement of a flight test director and observers were also on board. The flight test plan was to incrementally approach the flight conditions of the incident (290 kt and FL200), initially with the Yaw Damper OFF to ensure that there was no basic airframe/flight control anomaly. The aircraft was equipped with an alternative method of electrically isolating the Yaw Damper system.

The aircraft took off from Runway 08R at Gatwick and was flown to the same test area, between the Southampton VOR and Boscombe Down Airfield. The weather conditions on the day of the test flight (10 November 1995) were significantly worse than those existing at the time of the incident. There was light to moderate turbulence present generally, and the crew had
to ensure that the aircraft did not sustain any ice accretion by avoiding cloud layers as much as possible during the climb to test altitude.

At each test point, the test pilot performed rudder doublets in order to excite the Dutch Roll mode and the aircraft response was monitored. Final tests were conducted with the aircraft depressurised, again to simulate the actual incident flight conditions. Some testing was also carried out with the Autopilot engaged, as on the incident flight.

The testing was unable to reproduce the forced lateral oscillations experienced during the incident flight. All of the tests indicated that the rudder/Yaw Damper systems on the aircraft were operating correctly.

1.16.3 Simulator studies

The aircraft manufacturer provided access to and support in using a mathematical computer model and a versatile three axis engineering simulator in attempts to simulate the incident flight characteristics.

1.16.3.1 Initial Engineering Simulator Evaluation (M-Cab)

The aircraft Manufacturer's Engineering Simulator was used to perform an evaluation of the pilot's influence over driven Dutch Roll oscillations. In this case the oscillations were driven from the rudder
deflection calculated as a function of yaw rate. The relationship between rudder and yaw rate was chosen to generate behaviour consistent with the aircraft during the incident in terms of lateral g oscillations and magnitude of maximum and minimum bank angle, and thus demonstrated the effect of driving the Dutch Roll mode. Figure 1 and 2 at Appendix 5 show this effect.

The simulation was performed at flight conditions representative of the incident, level at 20,000 feet and 295 kt. During the manufacturers tests with a company test pilot in the left-hand seat, "the pilot's first reaction was to reduce airspeed which resulted in the oscillations becoming damped....further cases involved maintaining the flight condition which provided a continuous oscillation with controls free. The pilot was not able to reduce the oscillation nor did he drive the oscillation to greater amplitude while using normal control inputs."

1.16.3.2 EASY 5 computer simulation

A manufacturer's control system simulation/analysis tool, EASY 5, was used to investigate the effect of fluid contamination of the Yaw Damper Coupler connector causing shunt resistance between pins. The EASY 5 consists of a control system model of the Yaw Damper Coupler with mathematical approximations for the behaviour of the hydraulic system and aerodynamics at various flight conditions. The
simulation is excited using a crosswind pulse gust, and the response of the model is then computed and output as a time history of various parameters.

Theoretical analysis of the Yaw Damper Coupler circuitry was carried out by the manufacturer to identify shunt resistances between pins which could have been possible candidates to cause the aircraft response seen in the incident flight. The coupler connector has 57 pins, and for this analysis the unused pins and those used as part of the BITE were not considered. The analysis also assumed that the fluid saturated the region of the connector surrounding pins 3, 4, 12 and 14 (Appendix 6, Figure 1) and below these pins it was assumed that pins were coupled to each other by a fluid film which ran along the adjacent wires. Only the effects of shunt resistances between adjacent pins were considered. The effects of both 400 Hz and dc power shunts were discounted. The bandwidth of the hydraulic servos are two orders of magnitude less than 400 Hz, so any signals injected with a frequency of 400 Hz would have no effect. Similarly any dc power shunts would have introduced a bias into the system, an effect which would have been shown in the incident flight, and was not evident. A summary of the pin to pin shunt analysis is at Appendix 7.

Of the possible candidates identified, the effects of three shunt resistances were modelled in the EASY 5, both singly and in combination. These were the most likely to have
caused the effects seen during the incident. The first was between pins 46 to 47, the case where the rudder feedback signal from the LVDT is attenuated, and corresponded to the open feedback condition. It produced an oscillation with a frequency in the 0.8 to 1.0 Hz range, and only small bank angle changes. This response had been predicted in the Failure Modes and Effects Analysis (FMEA), and was not the response seen in the incident case.

The second case was a shunt between pins 37 to 38, which established a path from the output of the rate gyro demodulator directly, rather than applying the normal 180° phase shift necessary for the rudder motion to be applied in a direction which would counter the yaw rate. The shunt bypassed the phase shift, so the gyro signal was in phase with the yaw rate. The effect of this shunt therefore was to produce an instability which resembled that seen during the incident. A gain of -10 was used in the simulation which approximated to a shunt resistance across the pins of 89 Kilohms. This produced a rudder demand from the Yaw Damper Coupler which saturated to maximum within 7 seconds at 350 kt; the frequency of the oscillation produced was about 0.4 Hz, with ± 25° roll oscillations within 17 seconds of the disturbance; the oscillation was undamped but stable. At an airspeed of 250 t the same gain produced a damped oscillation. Figures 2 and 3 at Appendix 6 show the results from the EASY 5
for these cases.

A shunt resistance between pins 40 to 51 would change the gain characteristics of the rate gyro path; it does not produce a phase change. The effect of this shunt is to attenuate the signal going into the washout filter and thus reduces the ability of the Yaw Damper Coupler to provide control. It was reasonable to model the effect of a shunt between pins 40 to 51 as pins 40 to 50 are adjacent and pins 50 to 51 are electrically equivalent. Simulation of this shunt had no effect on the response on its own, but with a combination of this and a shunt between 37 to 38 the effect was to modify the frequency from 0.43 Hz to 0.35 Hz.

1.16.3.3 Final M-Cab simulation

The EASY 5 simulation had shown that there were possible shunt resistances which could cause the aircraft response seen in the incident. In order to model the complete system it was necessary to have a better aerodynamic model and include a production Yaw Damper Coupler unit. The manufacturer's M-Cab simulator was used for these tests. The M-Cab is a full motion engineering simulator capable of being flown either from the simulator cab flight deck, or from data inputs. In this case the yaw rate signals from the simulator were input to a Yaw Damper Coupler unit, and the subsequent rudder demand signal was output.
to the M-Cab simulation of the rudder hydraulic system. The M-Cab was set up at the airspeed, altitude and configuration required for the test and then either allowed to respond without intervention, or flown from the simulator cab to maintain the required conditions. The Yaw Damper Coupler system gain changes with airspeed in the Autopilot Accessory Unit were accomplished manually. The shunt resistances were simulated using a set of decade resistance boxes which could be put between any two individual or combination of pairs of pins. A beta (yaw) release and/or a gust (turbulence) model was used to excite the simulation.

The first tests were to reproduce the shunt resistance from the EASY 5 simulation. An open circuit between pins 46 to 47 produced a 1 Hz oscillation, confirming again the FMEA. A shunt resistance of 110 and 89 K Ohms between pins 37 to 38 produced no oscillations. Reducing the resistance to 30 K Ohms, lower than the value of the shunt resistance in the EASY 5 simulation, produced an oscillation similar to the incident, with roll angles of ±15¡, and lateral acceleration of ±0.5 g. This case is shown in Figure 1 at Appendix 8. The rudder demand saturated in 20 seconds, and the frequency of the oscillation was 0.4 Hz at 350 kt IAS, and 20,000 feet.

The effect of a shunt resistance between pins 40 to 51 was then investigated, varying between 60 and 500 Kilohms at
20,000 feet, 290 kt and using light and medium turbulence as well as a beta release to excite the simulation. A shunt resistance up to 300 Kilohms produced small oscillations after the beta release, which in medium turbulence had a frequency of 0.33 Hz and ±0.02 g oscillations in lateral acceleration. Figure 2 at Appendix 8 shows the oscillation produced with a shunt resistance of 230 Kilohms. In light turbulence the lateral acceleration was ±0.01 g. This compared with the oscillations seen in the Yaw Damper disengaged case which in medium turbulence has the same frequency and magnitude of lateral accelerations. Figures 3 and 4 show the normal aircraft response with Yaw Damper engaged and disengaged respectively. At 500 Kilohms the oscillations had a smaller magnitude, similar to the Yaw Damper engaged case, showing that at this value of resistance the Yaw Damper was able to reassert control. These tests were repeated at 7,000 feet, 250 kt, shunt resistance varying between 120 and 300 Kilohms with light and medium turbulence. Similar small oscillations were evident.

A combination of the shunt resistance varying from 200 to 400 Kilohms between pins 37 to 38 and 40 to 51, was then tested. At 20,000 feet and 290 kt, the results showed that the combination of resistances on both pins produced an oscillation which resulted in roll angles of up to ±15¡, and lateral accelerations of up to ±0.46 g, with a frequency of 0.3 Hz. The time of the Yaw Damper
udder demand to saturate to maximum increased with the resistance; above 250 K Ohms the oscillation was slow to develop and above 350 K Ohms the oscillation was damped. The same shunt resistance test conditions were used at 7,000 feet, 250 kt. This generated an oscillation which, at shunt resistances at and above 230 Kilohms damped out. The time for the oscillations to damp decreased with increasing resistance. Figures 5 and 6 at Appendix 8 show these oscillations.

A number of flight profiles were then flown in the M-Cab, following the descent and speed reduction seen on the incident flight. Figure 7 at Appendix 8 shows one of these profiles using a shunt resistance of 230 K Ohms between both 37 to 39 and 40 to 51.

1.16.4 Normal aircraft behaviour with and without Yaw Damper

The QAR data was examined from another Boeing 737-200 aircraft, where the Yaw Damper had been engaged and disengaged for periods during the flight. This data showed that when the Yaw Damper was disengaged, small oscillations similar to those seen on G-BGJI prior to the incident, were present. This demonstrated also the basic Dutch Roll mode of the aircraft. The oscillations had a frequency of around 0.32 Hz and produced small lateral accelerations of less than ±0.05 g. With the Yaw Damper engaged there were no
significant lateral oscillations.

1.16.5 Humidity testing and detailed examination of Yaw Damper Coupler connector

The presence of corrosion/electrolytic deposits around the wire-wrap posts of the Yaw Damper Coupler connector first discovered during the manufacturer's testing and examination of the unit (☞ 1.12.3.1) had not apparently had any effect on the coupler's operation during testing at ambient and high-temperature conditions.

It was therefore decided to test the electrical properties of the Yaw Damper Coupler in humid conditions having first taken samples of the deposits on the connector shell and the cover plate in an attempt to discover the nature of the apparent fluid contaminant. A description of this examination appears in ☞1.16.6.

Unfortunately, there were no facilities which could subject the unit to functional testing equivalent to that achieved by the ATE whilst it was in an humidity chamber. An attempt was made to measure the resistance between adjacent pins of the connector at ambient conditions (18°C/46%RH) and under conditions of about 94% RH at 35 to 40°C. Measurements of the ambient impedance values between adjacent pins were taken and the unit placed in a humidity chamber with a 'breakout' lead routed outside the chamber to
measure the impedances under humid conditions.

As expected, there was a wide variation in impedance values, without exception the humid values were less than the ambient. The significance of these findings is, however, open to question when it is realised that the impedances measured are not simply those between adjacent pins of the connector. Since it was considered unwise at that stage to isolate the connector from the internal circuitry, the impedance values measured had to include those of the individual components and printed circuits of the Yaw Damper Coupler itself as well as the resistance between the connector pins. Typically, impedances measured as greater than 30 Megohms in ambient conditions fell to fractions of a Megohm when placed in the chamber.

Since it was impossible to determine how much, if any, of the lost impedance was due to shorting between the connector pins, it was then decided to compare the performance of a known serviceable Yaw Damper Coupler under the same conditions to see whether the impedances were markedly different under humid conditions. Only certain selected pins on the latter were sampled under humid conditions. At ambient conditions, similar impedance readings were obtained between adjacent pins and, as expected, these values fell off markedly under humid conditions. In general, the results were similar to those measured on the incident Yaw Damper Coupler, with only
a few, apparently random, occasions where the humid impedance of the spare unit was better by an order of magnitude.

1.16.6 Connector pin contamination testing

Connector D295, and the Yaw Damper Coupler lower closing panel, with the evidence of a dried fluid run on its inside face, were submitted to a specialist company of electrical research engineers for laboratory analysis. The focus of this effort was to determine the nature of the fluid contaminant and to confirm that electrical current had flowed between the pins. It was considered that the latter would be proven if it could be established that the blue/green and white deposits seen around the wire-wrapping of the pins were the products of electrolysis as opposed to simple corrosion.

The chemical tests could only be conducted using an X-ray dispersive technique which can only detect the individual elements of a substance and cannot identify the compound which is constructed from these elements. Such a method will detect all elements present in the sample, such as those used in the construction of the connector, not just those from the contamination. Thus metals such as copper, gold, cadmium, nickel and zinc were present in nearly all the sampled areas along with a range of other elements, including chlorine, phosphorous, calcium and sulphur.
Unfortunately, it was not possible to positively identify the nature of the contaminant fluid, despite comparing it with samples of toilet sanitising fluid used by the aircraft operator. This was largely because, although the specimens and the fluid samples both contained similar elements, it appears that samples of other common fluids found on aircraft, such as waste water and galley waste would yield similar results. An independent analysis conducted by the Boeing Company came to a similar conclusion with the additional observation that there were no signs of urea, which could be reasonably expected were the contaminant to contain toilet waste. During dismantling of the connector, however, it was found that the contaminant had also penetrated between the two halves of the insulator block (Appendix 6, Figure 1b) as evidenced by dried stains. Also noted was the fact that none of the pins themselves seemed to have suffered from corrosive attack - the gold plating was intact and not pitted. However, when the pins were later sectioned, repolished and examined under high magnification small pits were identified beneath the gold plating.

Whilst contamination was observed on most of the pins to a greater or lesser degree, the blue/green and white deposits were mainly in evidence around the pins and wires in the top-left quadrant of the connector (viewed from the back). Some of these pins were found to be those which would carry 28V dc for the Yaw Damper
engage circuitry and were therefore most likely to cause electrolysis of the contaminant to occur if partial short-circuiting did take place. Variations were found in the composition of the deposits on various pins, most notably on pin 4, which exhibited a strong chlorine peak as expected for negative ions in an electrolyte, and pin 14 which had strong sodium peaks. Pin 14 is at 0V when the Yaw Damper is turned OFF and pin 4 is at 28V. It was therefore concluded that electrolysis of some form of liquid contaminant containing sodium chloride (salt) had occurred and that current had flowed between the pins.

1.16.7 Generation of errant electrical paths in connector D295 (Appendix 1, Figs 1 & 2)

As considerable amounts of the products of electrolysis had been found at pins 4, 12 & 14 of connector D295 inside the Yaw Damper Coupler, consideration was given to how this might have caused bridging between pins leading to errant electrical paths, capable of sustaining Yaw Damper system engagement for 7 minutes after it was selected from ON to OFF. To establish the viability of such bridges required the formulation of a series of tests and trials based on conditions which other testing indicated to have existed.

The operation of the Yaw Damper system electrical engagement interlocks has been described in \( \star \) 1.6.4, but the rationale for sustaining the engaged state even though
the Yaw Damper engage switch was selected to OFF, the basis for formulation of the test series, can be summarised as follows:

1.

For the Yaw Damper Actuator to be active, the solenoid valve on the rudder PCU must be held open to allow hydraulic pressure to the actuator. This required that sufficient voltage was present at the solenoid 'live' terminal to maintain it in the open position.

Tests on the Yaw Damper solenoid valve, when isolated from the Yaw Damper system, indicated that the minimum current for holding this valve in the 'active' position was 56 ma. and about 3.2V was required to sustain this.

2.

As the basic aircraft wiring tests showed no evidence of insulation weaknesses in any of the Yaw Damper system wiring, the electrical supply to activate the solenoid valve had to be provided from the 'b' contacts of the relay k12 in the Autopilot Accessory Unit.
For the 'b' contact supplying the PCU solenoid to be 'live', relay k12 had to remain activated.
Again, as there was no evidence of insulation weaknesses in any of the Yaw Damper system wiring, the electrical supply to activate the relay had to be supplied from pin 12 of the connector D295 at the Yaw Damper Coupler. Initial tests at the AAIB, showed that the voltage at pin 12 had to rise above 18.7V to activate the relay k12 and remain above 18.4V to maintain relay engagement. Similar tests were made on a later occasion, with the whole Yaw Damper engagement system connected together complete with actuator valve solenoid. These showed that to activate relay k12 the voltage at pin 12 had to rise above 18.2V with a current of 17 ma. and remain above 17.8V with 10 to 11 ma to maintain engagement.
The maximum current that the relay would draw was about 40 ma when full aircraft dc voltage was applied. Pin 12
could be supplied from pin 14 through circuits within the Yaw Damper Coupler. In that event, the minimum voltage which would be required at pin 14 would imply a current of at least 380 ma flowing from pin 14.

4 With the 'b' contact supplying the PCU solenoid 'live', the voltage required to hold the solenoid in the open position had to be present at pin 14.

5 If the Yaw Damper system was selected to OFF, pin 14 of connector D295 should be connected to 'aircraft earth' through contacts in the Yaw Damper engage switch. If any voltage was to be sustained at pin 14, the earth of the Yaw Damper switch would have to have had significant resistance.

6 Unintended dc supply to either pin 12 or pin 14, within connector D295, was judged to be viable only from pin 4; the other
permanently 'live' dc pins, 8 and 57, being considered too remote. (Appendix 6, Figure 1) Dc supply to pin 4 was via a 5 amp circuit breaker; implying a minimum resistance of about 0.7 Ohms in the engage switch earth path if pin 14 were to sustain only about 3V but more if the voltage on pin 14 were allowed to rise.

In order to test the viability of such a mechanism, under conditions most conducive to success, the series of tests on the subject aircraft using the breakout flylead (À1.12.6) was extended into an electrolytic bridge growth trial. The techniques used and the scope of this 'ad hoc' trial were reviewed and amended as it progressed.

In this trial, the pins were represented by the two single strand copper conductors of a length of domestic power cable (2.5mm2), with their insulation cut back for about 1cm. The bare conductors were placed parallel separated by about 1mm for the preliminary tests, and for the later test at the same separation as the pins within D295 (0.1 inch). During this later test, to simulate the effect of the insulated wirewrap looming of the connector, a single short length of this wire was used as a non-conducting physical bridge between the
two conductors. One of the copper strands was connected to pin 4 and the other to pin 12 of the breakout leads with meters connected to measure both voltage at pin 12 and current from pin 4 to pin 12. Normal operation of the engage system was checked at this point.

Two preliminary tests were done, with the electrodes only separated by about 1 mm, one using tap water and the second using a saline solution. To start electrolysis, the Yaw Damper engage switch was set to ON, the electrolyte placed between the conductors and the switch then set to OFF. In both cases, electrolysis started immediately the system was switched OFF. In the water test however, although the current rose to the measured 'sustain' value, when the system was switched ON and OFF again, the electrolytic cell would not sustain engagement for more than a few seconds. With the saline solution, however, the current rose to the point where the relay k12 pulled into engagement and held, even though the system was not selected ON.

The electrodes were then reconfigured to the more realistic geometry, separated by 0.1 inch, with the insulated wire bridge. Having started the electrolysis with weak saline solution, as in the preliminary tests, the current rose to the 'sustain' level. The system was then switched ON and OFF again and the bridge maintained relay k12 closed. The current through the electrolytic cell continued to increase and finally
peaked at about 40 ma, the potential drop across the cell being only 1.5V. No additional electrolyte was added from this point but the current remained stable at 40 ma for about 20 minutes.

In the preliminary tests the electrolyte was introduced as a drop of liquid which was suspended between the two conductors by wetting and surface tension. When the realistic separation of the pins was modelled the gap was too wide for this mechanism to be feasible but, with the insulated wire bridging between the two electrodes, the electrolyte clung to this bridge and the conductors and thus formed an electrolytic bridge between the two. It was noted during the second test that the current increased as the electrolyte clinging to the bridging wire dried out. It remained stable for a long time when there was little apparent moisture bridging the gap between the electrodes.

Following this test, an attempt was made to support the complete Yaw Damper system through the electrolytic cell. Before doing this the engage switch earth was taken out of the circuitry by removing the flight control panel. The electrolytic bridge was re-established and then pins 4 & 12 were connected together with a conductor. Pins 12 & 14 were then connected and the connection between 4 & 12 removed. This left the electrolytic bridge supporting the currents to maintain the engagement of relay k12 and the solenoid shut-off valve. It was able to do this with little moisture
apparent, supplying a current of approximately 300 ma for about 10 minutes; the current flow stopped abruptly, however, when the bridge dried out completely. Confirmation that the system had been active was demonstrated by operating the system test switch and observing appropriate rudder response.

Whilst these tests were being conducted, there was clear evidence of electrolysis occurring and deposits formed on the two electrodes which were similar to those found on pins 4 and 14 within connector D295. It was also noted that little obvious surface damage was inflicted on the electrodes although closer inspection revealed that surface damage had occurred. The appearance of the bridge formed between the electrodes was blackish and appeared to be an oxidised copper film deposition.

Having demonstrated that electrolytic bridges, in particular those with limited moisture apparent, were able to maintain engagement of the system, with no earth path available through the engage switch OFF contacts, it was decided to attempt to generate electrolytically formed bridges between representative connector pins; first between correctly spaced pins and subsequently within a replica of connector D295. It was also decided to simulate a high resistance earth rather than no earth at the engage switch.
A comprehensive series of tests and experiments was formulated by the AAIB, the manufacturer and the operator jointly, and performed at the manufacturer's physical laboratories. The intent of the tests was to resolve whether it was possible to generate and maintain suitable pin to pin bridges without damaging the pins significantly more than those of connector D295 were observed to be. The sustained currents which it was considered essential to demonstrate in these tests were the minima established for the individual components of the Yaw Damper system and assuming an open circuit on the engage switch earth.

The preliminary tests of this series involved a large number of simple pin to pin bridges with specific electrolyte mixes which were done in two batches; the first using wet bath electrolyte bridges and the second using electrolyte drops on physical bridges of wirewrap wire. These tests were intended to establish the amount of damage which the pins sustained under the test conditions and, therewith, the electrolyte most likely to have been involved. The electrolytes were those determined from the results of the earlier analysis on the connector performed by the specialist laboratory. These had shown the presence, amongst other elements, of chlorine, phosphorus and some sulphur, implying the presence of chloride, phosphate and sulphate ions.

These tests showed that if chlorine was a significant
element in the electrolyte, its activity was so aggressive that the pins suffered far more severe damage than had been seen on the pins from the incident connector. However, both phosphate and sulphate ions were able to act as charge carriers without inflicting significant damage on the pins. It was also observed that, in the 'near-dry' bridges formed in the second batch of preliminary tests, copper, in some form, was deposited on physical bridge paths as they became dryer. It was noted, however, that where new insulated wiring was used to form physical bridges, it did not 'wet' readily and, consequently, it was difficult to achieve the electrolyte bridge necessary to start the process of generating a stable pin to pin path.

As a result of the findings of these preliminary tests it was decided to proceed with tests on wirewrap connectors configured as nearly as possible identical to connector D295 from the incident aircraft; particular attention being given to the geometry of the wire wrapping around the pins of greatest interest. Having reviewed the possible scenarios for generation of conductive bridges and features noted in the initial tests, it was decided to attempt to form 'near-dry' conductive paths by two different methods one which was predominantly a steady slow generation process and the other a pulsed generation process. The 'slow' process was intended to imitate what might happen if power were left on the aircraft for about ten days, the approximate period that this condition was estimated to
have existed during the P6 inspection, following a single run of contaminated fluid onto the connector followed by an afterdrip. The 'pulsed' method representing persistent slow dripping of contaminated fluid onto the connector throughout the same period.

The wirewrap wired connectors were artificially aged before testing to improve the tendency of the new insulated wires to be wetted. Each connector was, in turn, then used as part of the circuitry of a near complete Yaw Damper electrical system (the BITE and indicator circuits were not connected) so that it fed and received power from the appropriate components, including the Yaw Damper Actuator solenoid. To do this the connector was installed in the middle of a fly?lead connection to the Yaw Damper Coupler and placed in an agreed controlled environment which attempted to emulate estimated conditions in the E&E Bay during the P6 check. The currents in and out of the relevant connector pins and their voltages relative to ground were continuously monitored and recorded throughout the attempts to grow the bridges as well as during the subsequent test phases. The resistance of the earth path on the OFF side of the Yaw Damper engage switch was initially very high but it was intended to reduce this if sustained 'hung' engagement was achieved. The method of initiating sustained hung engagement was agreed to be: to engage the system normally, add a small amount of extra wetting
to the connector and then switch OFF the system. The rationale behind this procedure was that it was only necessary to generate electrical paths capable of carrying enough current to sustain engagement but not to initiate it.

For the slow path growth, the conditioned connector was moistened, in the area of pins 4, 12 & 14, with a spray of composite contaminant consisting of 0.5% Sodium Chloride solution combined with 6% saturated solutions of Potassium Phosphate and Sodium Sulphate. Six hours later, the same area was rewetted using a micro-pipette. At the time of rewetting, the voltages on pins 12 & 14 rose sharply, relay k12 activated and the solenoid pulled in. This caused the pin voltages to fall sharply, k12 then deactivated, the solenoid dropped out and the pin voltages then rose sharply again. This cycle persisted for about 23 minutes but stable solenoid engagement was not achieved. Following this episode the circuit was then left for about 10 days for the unwanted paths to develop without any further wettings. At the end of this period, the voltage on pin 12 resulting from leakage along the 'near-dry' bridge which had developed was not of the right order to hold the relay k12 in the activated state and an attempt to demonstrate hung engagement of the system failed. The area around pins 4, 12 & 14 was rewetted using a pipette but even after this, 'hung' engagement would not occur. A final attempt to produce conditions in which 'hung'
engagement could be demonstrated was made by spraying the area of the pins. This lead to a wet path short circuit between the 115V ac resident on pin 2 and the earth pin 3 which rendered this connector useless for further testing.

Post-test examination of this connector showed that much of the electrolytic activity had been taking place between pin 4 and its two adjacent earths at pins 3 and 5 rather than the intended activity between pin 4 and pins 12 & 14. It was also observed that, ignoring the damage caused by the final wet short circuit, the damage inflicted on pin 4 by the electrolytic activity was considerably greater than had been seen on the incident connector.

For the pulsed path growth, a good sized drop of fairly clean water (provided from Gatwick) was dropped onto the pin 4, 12 & 14 area of the connector for three days and then a 50/50 mix of this water with the solution used in the slow growth experiment was applied twice daily for the remainder of the 10 days. Attempts were then made to induce 'hung' engagement, with a series of rewettings being performed, and the assembly left with power applied to achieve a subsequent 'slow' bridge growth several times. Although short periods of 'hung' engagement were observed, the longest being 28 seconds, several periods of rapid cycling of relay k12 occurred. Examination of the connector after testing again revealed much greater pin damage than
in the incident connector and evidence of copper deposition between the pins.

1.16.8 E&E Bay Assessment Team

Arising from concern that fluid contamination might be more widespread than they were aware, Boeing launched an 'E&E Bay Assessment Team' initiative in January 1996. In addition to a large number of Boeing personnel, airlines and vendors were co-opted and canvassed for their experience with this problem.

The terms of reference of the team were; 'To develop recommendations that when implemented will preclude liquid leakage and contamination within the E&E Bay from having an adverse effect on the equipment/systems'. The team's strategy was essentially to define the scope of the problem, and to attempt to see whether individual operator experience and aircraft build/modification standard might give clues as to which modifications or operator practices were effective in minimising E&E Bay contamination.

The team's findings and recommendations were extensive, reflecting the very large number of manhours spent in producing the report. Much of the report deals with detail improvements both to hardware and maintenance practices. As an example of the latter, the team found that many airlines treated water/waste system components as 'on-condition' items and recommended that
periodic inspection and overhaul should be performed.

In general, however, the team found a wide variation in operator experience but the findings may have been influenced by a lack of appreciation by some operators that they had an E&E Bay fluid contamination problem. For example, one aircraft showed a history of a particular item of avionics equipment being returned from the repair shop repeatedly with reports of fluid contamination over a period of four months. Clearly the operator had failed to make the connection between the high removal rate of this component and a persistent leak somewhere in the aircraft. Equally so, there was variation in operator expectation regarding the condition of the underfloor area, with some, including the operator of G?BGJI, apparently accepting that evidence of blue staining is inevitable after a few years in-service whilst others managed to achieve high standards of cleanliness.

This underlines the report's conclusion that most problems with E&E Bay contamination '....related to aircraft maintenance and servicing, rather than how components are originally designed and installed". The report also "....did not uncover any evidence that a specific fluid leakage event will produce a near term, unexpected, aircraft flight path deviation.'
1.17 Organisational and management information

None relevant.

1.18 Additional information

1.18.1 Aircraft manufacturer's Operational Bulletin

On 4 August 1995, the aircraft manufacturer issued an Operational Bulletin detailing the 'Uncommanded Yaw or Roll Procedure'. The procedure is reproduced below and the full contents of the Bulletin is at Appendix 9.

UNCOMMANDED YAW OR ROLL

Accomplish this procedure if uncommanded yaw or roll occurs in flight.

AUTOPILOT (if engaged) ............... 

DISENGAGE

The pilot should be prepared to make control wheel corrections to return to wings level upon disengagement.
The autopilot may be putting in an appropriate correction for an uncommanded yaw or roll. Allowing the control wheel to go to neutral after disengagement may allow the aircraft to roll even more.

If yaw and/or roll forces continue:

**YAW DAMPER SWITCH .........................**

**OFF**

The YAW DAMPER Light illuminates when the yaw damper is disengaged.

If it is confirmed that the autopilot is not the cause of the uncommanded yaw or roll, the autopilot may be re-engaged at the pilot's discretion.

1.19 Useful or effective investigative techniques

None new.

2 Analysis

2.1 General

The uncommanded roll activity experienced during this incident was unusual. The flight crew carried out the correct initial actions, as defined by the manufacturer earlier in 1995. These actions were intended as
part of a memory recall drill in the event of an uncommanded yaw or roll occurring in flight. The initial action was to disengage the Autopilot, while being prepared to make control wheel corrections to return the aircraft to wings level upon disengagement, as the Autopilot may have been putting in an appropriate correction for an uncommanded roll or yaw induced roll. In this case, after Autopilot disengagement, the roll oscillations continued despite the best efforts of the crew to control the aircraft using opposite roll inputs. The next item in the sequence (if the roll/yaw continues) was to select the Yaw Damper switch, which is located on the overhead panel just above the Captain's head, to OFF. During the post-incident debrief, the crew stated that the Yaw Damper had been switched OFF at the time in accordance with the procedure, but again this had no noticeable effect on the roll/yaw motion being experienced. With two pilots making individual attempts at reducing the oscillation in sequence, and with a handover occurring between the two, it is most unlikely that the continuation of the oscillation was a result of 'pilot coupling' with the aircraft, inducing the motion, without some form of additional input from an aircraft control system.

With the Autopilot removed from the control loop and the Yaw Damper manually switched off, then all of the flight controls should have been in the hydraulically actuated/mechanically signalled state, with
pilot inputs causing essentially linear control responses at the elevators, ailerons and rudder. In this basic configuration, there should have been no mechanism for an oscillation to continue. The fact that it did so meant that the flight crew were initially somewhat alarmed and unsure as to the precise nature of their situation. The possibility of the Yaw Damper system remaining active after its control switch on the overhead panel had been switched OFF had never been considered as a possible scenario by the aircraft manufacturer.

During this investigation, some consideration was given to the possibility that the crew may have misidentified the Yaw Damper ON/OFF switch and operated some other switch. The switches adjacent on the same overhead panel are shown diagramatically in Appendix 1. The majority of these switches have lift-flap type, guard covers. Of the remainder, there is no other switch on this panel which, when switched off, would produce a FLIGHT CONTROLS amber warning caption on the Master Caution system. The flight crew recalled that this amber Master Caution caption was illuminated during the pre-landing checklist completion at the Master Caution recall check and that the commander switched the Yaw Damper back on at that time. He sensed a further roll/yaw disturbance and so switched it OFF again prior to landing. It was not possible to confirm, from the DFDR, when these switch selections had been made.
2.2 M-Cab simulator analysis

From the M-Cab simulator testing it was possible to conclude that shunt resistances between combinations of pins in the Yaw Damper Coupler connector could cause an aircraft response similar to that experienced by G-BGJI during the incident. Initially a shunt resistance of at least 300 K Ohms between pins 40 to 51 would have caused the small oscillations that were seen prior to and post the large oscillations. Similar oscillations were detectable on the QAR data from flights prior to the maintenance activity which could be caused by a shunt, or due indeed to the Yaw Damper being disengaged. The effect of this shunt was to reduce the ability of the Yaw Damper Coupler to provide control, and so the response of the aircraft was similar to the Yaw Damper disengaged case.

However, when a resistance of at least 230 Kilohms was applied between pins 37 to 38 and 40 to 51, the aircraft immediately would have started to experience the large oscillations. It can be concluded that the pin 40 to 51 shunt resistance may have been an incipient problem, the only symptoms of which were to produce aircraft behaviour consistent with the Yaw Damper being disengaged. However when a shunt resistance appeared between pins 37 and 38, in conjunction with the pre-existing condition, the Yaw Damper system would immediately start to drive the Dutch Roll mode,
and the aircraft would respond accordingly with the rolling/yawing motion seen during the incident.

2.3 Continued engagement of Yaw Damper system

Analysis of the aircraft’s flightpath, from the recorded Flight Data, showed that its aberrant motion was consistent, in form and frequency, with a fairly constant amplitude 'Dutch Roll' motion. Because the aircraft type has a naturally damped 'Dutch Roll' mode, this indicated that the motion was being forced. This conclusion directed attention to the Yaw Damper system early in the investigation.

The occurrence of unstable Yaw Damper characteristics should not have been a continuing problem if the system had been switched OFF. Since the crew recollection was that they had selected it OFF early in the sequence of events following the onset of the aberrant behaviour (ref; 2.1), it was necessary to investigate if and how it might be possible for the system to remain active when selected OFF.

Critical analysis of the Yaw Damper system (Appendix 1) had shown that, in addition to the two faults required to destabilise it (see 2.2), two further stray connections had to be made to keep it engaged when switched off; one supplying dc power to relay k12 in the Autopilot Accessory Unit and the other supplying dc
power to the engage solenoid valve. Furthermore, it required the earth path attached to the OFF terminal of the Yaw Damper engage switch to have considerable resistance if the 28V dc supply circuit breaker were not to trip.

The physical evidence of liquid ingress into the connector D295 in the Yaw Damper Coupler module and the fact that this connector appeared to be the only single place where all the necessary stray connections and reduced resistances could be made, further focused the investigation onto this connector. The evidence of fluid ingress did not indicate that the whole connector had been affected but only a few pins. However, the contaminated pins included those indicated by the M-Cab analysis to be critical. The analysis made of the contaminants observed within the connector showed that some electrolytic activity had taken place there; an undesirable state of affairs even if it were not to give rise to instability or loss of control of the Yaw Damper system.

The tests on the aircraft using breakout flyleads (1.12.7) confirmed the analysis that in order for the Yaw Damper System to remain engaged due to stray connections at connector D295, after it had been switched OFF, the interlock relay k12 in the Autopilot Accessory Unit had to remain made. Furthermore, sufficient current had to continue to flow through the contacts 'b', of this relay, and the solenoid of the
Yaw Damper Actuator solenoid valve, in order to hold this valve in the 'active' position. These tests also confirmed that the OFF terminal earth path of the Yaw Damper engage switch had to have significantly raised resistance, if the necessary stray connections to engage the system were not to cause the 28V dc circuit breaker to trip.

To get these conditions to occur due to stray connections at connector D295 required that current paths became available from pin 4, which carries dc power directly from the system circuit breaker, to pin 12, to keep the engage relay k12 activated, and to pin 14, to supply the actuator solenoid valve. It can be seen, in the diagram of connector D295 at Appendix 6, Figure 1, that the pins 4, 12 & 14, are grouped together. Furthermore, these pins showed evidence of contamination and local electrolytic activity.

A scenario was postulated that, if contaminated water got into the wire wrapping at the back of the plug unit of the Yaw Damper Coupler (D295), an electrolytically driven process might generate electrically conductive paths from pin 4 to both pins 12 & 14.

For electrolysis to have taken place, the presence of 28V dc on pin 4 was required, which would be true whenever the dc bus was live. It would also have required paths to earth to exist from pins 12 & 14; from pin 12 via the k12 relay coil and from pin 14 via the engage
switch earth path or, if this were open circuit, through the solenoid valve coil after k12 relay had been activated. If dc power were available on the bus and the Yaw Damper selected ON, pins 12 & 14 would also be at 28V dc and so the conditions for the electrolysis to take place would not exist. It is, therefore, only when the dc bus is live and the Yaw Damper selected OFF that the right conditions can exist.

The electrical system status for it to be possible to lay down the requisite conductive paths by this kind of mechanism had been available as the aircraft had just been on a major check during which it spent many days with dc power live but the Yaw Damper switched OFF. However, the physical conditions and the effect of the connector's history, over the 17 years it had been in service, were recognised as potentially important in influencing the likelihood of a path forming. Another unquantifiable influence was the unique lie of the wirewrap wires between the pins of the connector which could be seen to affect the likelihood of damp paths between the relevant pins being a possibility.

When the Yaw Damper is switched off, the electrical paths to earth which exist, by design, from pins 12 & 14 are fundamentally different. That from pin 12 is through the (k12) engage relay coil and the time delay circuits in the Autopilot Accessory Unit, which limit the maximum current to about 40 ma even when full
aircraft dc voltage is applied. By contrast, the earth path from pin 14 is through the engage switch OFF contact which should be a dead short to aircraft earth and effectively maintain pin 14 at aircraft earth potential whenever the switch is selected to OFF.

This difference was reflected in the relative ease of generating effective stray paths during test. The natural current limiting characteristics of the relay k12 coil circuits meant that the stray path between pins 4 & 12 was only required to carry a maximum of 40 ma and to have sufficiently low resistance to maintain at least 18.2V at pin 12.

The path to pin 14, however, had to be able to satisfy a more demanding role, one affected by both its own resistance and the resistance of the engage switch earth path. As an absolute minimum, on the assumption that the engage switch earth path was close to being an open circuit, the 4 to 14 path had to be capable of carrying 60 ma whilst dropping the voltage to 3.2V dc at pin 14, to keep the solenoid valve energised. The lower the resistance of the pin 4 to 14 stray path, the higher the voltage at pin 14 and consequently an increased current flow through the solenoid so the more robust the stray path would need to be.

The minimum permissible resistance of the engage switch earth path would have be about 0.7 Ohms if pin 14 were to
sustain only about 3V as the dc supply to pin 4 was via a 5 amp circuit breaker. However, if the voltage on pin 14 were to be higher, the resistance at the engage switch earth path would also have to be higher in order to limit the total current to 5 amps, the capacity of the circuit breaker which did not trip on the incident flight. In order to reduce the current flow through the stray connection, 5 amps demanding a very robust path, the resistance at the engage switch earth path would need to have been higher still.

Therefore, a very particular set of circumstances had to pertain for a stray path to develop between pins 4 and 14 capable of supplying the 'hold on' voltage and current requirements of the Yaw Damper Actuator solenoid valve without the 5 amp circuit breaker tripping. For the 4 to 14 path to develop at the same time as the 4 to 12 path, the engage switch earth path had to be sufficiently resistive to restrict the total current and be sufficiently conductive enough to allow the electrolytic formation of the path. If the engage switch earth path were open circuit, formation of the 4 to 14 path could not occur until a sufficiently robust path had been generated between pins 4 & 12 for the k12 relay to have pulled in without being selected.

The basic aircraft wiring integrity testing had not revealed any relevant discrepancies of continuity or isolation except the persistent existence of a relatively high resistance
(about 2 Ohms) at the earth contacts of the engage switch. During the course of testing, this resistance was established to be associated only with the Flight Controls module which was fitted during the incident flight. This indicated that it was possible that a raised switch earth resistance had existed at the time of the incident. Detailed examination of the module wiring and the switch itself indicated neither evidence of undue contact or joint resistance nor a possible explanation for it, beyond the presence of some deposits around the micro switch contacts but these were not confirmation of an open circuit. However, the switch had been functioned an indeterminate number of times since the incident with an unquantifiable effect.

The Yaw Damper system had to be positively engaged by the crew, as part of the pre-flight checks. It can be inferred that if the stray paths to pins 12 & 14 existed at that time, they were not sufficiently conductive to cause the system to engage itself and thus extinguish the warning light. The crew would have been expecting to energise the system and its being live without being selected should have been noticed and, if so, would have been a matter of concern. If, however, the stray paths had developed to the point where once the Yaw Damper was engaged, they were sufficiently robust to sustain the requisite voltage and current combinations at pins 12 & 14 (see 1.16.7) to maintain engagement, they could have been
exploited when the crew selected the system OFF.

The experimentation and tests, using both plain copper conductors and gold plated pins as used in D295, showed that it was relatively easy to form an electrolytic current path capable of sustaining the currents needed to keep the Yaw Damper system engaged. It was observed, however, that the degree of damage sustained, particularly by the pins, was considerably more severe than that suffered by the pins of the incident Yaw Damper connector. This indicated that pure electrolytic conduction of the stray currents needed to keep the system engaged had not been a potential mechanism for causing this incident.

The experimentation was, therefore, focused on developing, what were called 'near-dry', current bridges which were, in effect, attempts to see if it was possible to lay down a basic metallic current path using phosphate and sulphate ions as charge carriers; rather than chlorides which were chemically too aggressive to leave the pins of the connector as little damaged as was found in the incident connector.

The current carrying capacity of those paths and the voltages which had to be sustained at the pins were specific to the units of the system which were installed at the time of the incident. The tests done on the aircraft system to prove which stray connections were needed had shown that actuator solenoids, in particular,
could vary considerably in their voltage and current demands for the 'held on' condition. The tests to see if it was possible to reproduce any 'hold on' condition were, therefore, conducted using the components fitted to the aircraft at the time of the incident.

When looking at the attempts to introduce the necessary stray connections into a representatively wired up connector, it was seen that none could be classified as successful, in the sense that the Yaw Damper system did not remain solidly engaged after being selected OFF, although some type of stray connection had clearly formed.

In summary, the experiments demonstrated that it might be possible to generate stray current paths capable of sustaining engagement of the Yaw Damper system when selected to OFF, but only in the presence of a high resistance in the engage switch earth path. Although the evidence was tenuous, the possibility that such a resistance was present during the incident flight cannot be discounted.

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2.4 Possible sources of connector contamination

The nature of the deposits observed on the Yaw Damper Coupler connector pins appeared to be relatively long term, almost certainly pre-dating the P6 check activity. As
such, it was highly unlikely that the investigation and testing would reveal a contamination source from that period and indeed none was found. The only evidence indicating a fluid path into the connector was the whitish dried deposit on the connector shell, suggesting a very particular localised drip (as opposed to a more general soaking of the unit). The tray in which the Yaw Damper Coupler was located bore no signs of any contamination although its mating connector did have some of the dried residue similar to that found on the Yaw Damper Coupler connector, indicating that the two were joined at the time of the contamination. The Technical Log entry in March 1995 indicating a leak in the toilet handbasin drain may be relevant, but for the same reasons discussed below, moisture should still have been prevented from contaminating the E1 rack.

Attempts to analytically determine the origin of the deposits were unsuccessful. The conclusion in 1.16.6 that electrolysis of a solution containing sodium chloride had definitely occurred, whilst demonstrating the passage of current, did not assist in identifying the contaminant since this is obviously such a common substance and could have come from almost any source.

The scenario connecting the incident to the connector contamination requires a further source of moisture nearer to the time of the incident to activate the electrical 'bridge' between the pins. Chemical analysis of
the dried deposits did not point towards any particular source of fluid and, although some defects were found in the wet systems of the aircraft, these systems were essentially non-functional and drained during the incident flight. The weather was dry whilst the aircraft was outside the hangar preparing for the flight.

It would appear that for any fluid leak to drip onto the subject connector, it is necessary to penetrate the rubberised fabric shroud which is fitted above it. Once through this, it may drip onto the cooling plenum, whose forward lip coincides with the array of connectors at the back of each unit on the E1 rack, particularly the Yaw Damper Coupler which is at the top. The evidence of a dried fluid run on the upper and lower surfaces of the plenum was of interest because it did indeed correspond to the centreline of the Yaw Damper Coupler but there was no indication of a leak in the shroud at the location from where the run appeared to originate. Notwithstanding this, G-BGJI's operator has developed a modification which puts an aluminium tray between the plenum and the shroud which completely covers the forward face of the E1 rack thus preventing any fluid which penetrates the shroud from dripping onto the connectors. A Boeing modification to achieve a similar standard of protection already existed but was not applicable to aircraft fitted with airstairs.

The E&E Bay Assessment Team were not specifically
tasked with finding the cause of contamination which caused this incident but it formed part of their statistics and the operator of G-BGJI was one of the airlines whose procedures and aircraft were examined, after the operator had conducted their own internal checks. As mentioned in ¶1.16.8, the team generally found that occasional E&E Bay contamination was an accepted fact-of-life by many airlines This appeared to be the case at the operator's Gatwick facility, where the condition of aircraft after a few years service following a P6 check, both by physical examination and discussion with the technicians, was expected to show signs of the characteristic blue staining of toilet sanitising fluid under the floor area. G-BGJI's operator did not necessarily regard water/waste system components as 'on-condition' as they were generally overhauled or renewed at each P6 check, but this represents 5 years service of systems which are often troublesome and prone to abuse. This incident led the operator to review all aspects of E&E Bay protection and maintenance practices and it might be speculated that other airlines would be well advised to do the same rather than wait until they, too, have an in-flight incident. By its nature, a contamination event is unpredictable as is demonstrated by this incident. It is unlikely that anyone could have foreseen the dramatic effect that contamination of the connector had on the behaviour of the aircraft.

The following recommendations were made in January
1996:

It is recommended that the FAA:

1) Require as soon as practical a visual inspection of all Boeing 737 aircraft Electrical and Equipment (E&E) Bays to check for fluid ingress into avionics components, their connectors and associated wiring. Such inspection should involve the minimum disturbance of equipment and connectors commensurate with a thorough examination for contamination. Where such contamination is found, the component should be removed and despatched to workshops for examination.

2) Require as soon as practical an inspection of the area in and around the E&E Bay for evidence on the structure and fittings of recent fluid leakage such as wet corrosion, staining and crystallised deposits. Such evidence should be investigated to ensure that, where the source of the leak is not apparent or readily rectifiable, no potential exists for it to impinge upon the avionics components, their connectors or wiring.

(Recommendation 96-3)

It is also recommended that the FAA and Boeing:

3) Conduct an urgent review of the measures incorporated
into the Boeing 737 to prevent fluid ingress into the E&E Bay, its equipment, connectors and wiring and as necessary require modifications to ensure that the equipment, connectors and wiring are provided with protection consistent with reliable operation.

4) Conduct a review of the Aircraft Maintenance Manual to ensure that clear and specific instructions are contained therein to enable evidence of fluid ingress, even if not apparently directly impinging on electrical equipment, to be identified during routine maintenance. It should also be ascertained that any routine testing for leaks in the toilet, galley and airstairs systems should be done with the systems functioning fully throughout their normal operational cycle to ensure that any leaks which only occur during, for example, draining or replenishment cycles are detected.

(Recommendation 96-4)

It is accepted that the findings of the E&E Bay review team identified differing maintenance practices as being highly significant in determining the in-service condition of the E&E Bay and its associated avionics components, their connectors and wiring. However, the location of the bay, below the cabin floor in areas susceptible to fluid leaks from toilets, galleys and aircraft doors does make the bay unnecessarily vulnerable. Although the chances of fluid contamination directly affecting aircraft handling, as in this
case, would appear to be a most unlikely outcome, the wetting of sensitive avionics equipment will undoubtedly lead to unserviceabilities. This will become of more significance as aircraft continue to develop an increased dependence on electronic equipment. The location of the E&E Bay was undoubtedly arrived at following a variety of design considerations but in modern aircraft is possibly based on historic precedent as much as current design constraints.

It is therefore further recommended that:

The Boeing Airplane Company promulgate the findings of the E&E Bay Assessment Team to all operators and that the recommendations be actioned through Service Bulletins to maximise the protection from fluid ingress of bay housed electronic components in current aircraft.

(Recommendation 97-60)

The CAA with the FAA review FARs and JARs with a view to requiring that the location of electronic equipment be arranged during the aircraft design so as to minimise the potential for contamination by fluid ingress, with the intention of ensuring that the equipment, connectors and wiring are provided with protection consistent with reliable operation less heavily dependant on maintenance practices.
3 Conclusions

(a) Findings

1. The crew members were properly licensed, medically fit, adequately rested and technically qualified to conduct the test flight.

2. The aircraft was on a test flight before being returned to line service following a scheduled major (P6) service and was operating within the normal limits of weight and centre of gravity.

3. The aircraft was being operated within the normal flight envelope at the time of the incident, using the Autopilot and Autothrottle systems and with the Yaw Damper system engaged.

4. The aircraft entered a cyclic oscillation in roll and
yaw which
    was consistent with a critically damped Dutch Roll motion
    and persisted for seven minutes. The aircraft type has natural
    positive damping of the Dutch Roll mode.
5
    The crew's initial actions, as they recalled them, of disconnecting the Autopilot and Autothrottle, and switching
    OFF the Yaw Damper were in accordance with the manufacturer's recommended procedure.
6
    The commander's decision to issue a MAYDAY call in response to the incident was appropriate.
7
    The ATC response to the MAYDAY call was timely, helpful
    and appropriate.
8
    The crew's decision to conduct a low speed handling check to determine a suitable configuration in which to carry out a landing demonstrated good airmanship.
9
    The decision to maintain the Flap 15¡, landing gear down configuration for the return to London Gatwick was
judicious.

10 The decision to re-engage the Yaw Damper system during the final approach sequence was unwise, but the system was switched OFF once again prior to landing.

11 The main rudder PCU had been replaced but in all other respects the rudder/Yaw Damper system components were the same as those fitted prior to the check.

12 After the incident, all components (mechanical, electrical and electronic) capable of affecting rudder movement were tested and none was found to be significantly out of specification.

13 From the M-Cab simulator testing it was possible to conclude that shunt resistances, simulating the effect of fluid ingress, between combinations of pins in the Yaw Damper Coupler connector could cause an aircraft response similar to that experienced during the incident.
14 The Yaw Damper Coupler had not been overhauled during its life and had run 17 years and about 34,000 hours without any recorded defects.

15 Examination of the aircraft's Technical Log did not reveal entries related to Yaw Damper defects during the last two years.

16 No component defects were found in the Yaw Damper Coupler apart from those on the connector D295.

17 The portion of the connector D295 on the outside of the Yaw Damper Coupler enclosure had evidence of liquid spillage onto it.

18 Despite various attempts it was not possible to analyse the contaminant and hence identify its origin.

19 There was a considerable build up of products of corrosion and electrolysis between pins of the connector
D295, within
the Yaw Damper Coupler enclosure.

20
The nature of the deposits observed on the Yaw Damper Coupler connector pins appeared similar to those produced when attempting to create stray electrical paths.

21
The pins most affected by these deposits were related to the 28V dc power supply and the circuits involved in activation of the Yaw Damper system.

22
The scenario connecting the incident to the connector contamination, requires a further source of moisture nearer to the time of the incident to activate the electrical 'bridge' between the pins but no such source of moisture was identified.

23
The airframe wiring affecting the Yaw Damper circuits was found not to have any deficiencies.

24
Tests using a 'breakout fly-lead' confirmed
theoretical analysis
that it was possible to maintain engagement of the
Yaw Damper system after it had been switched OFF by introducing
stray connections between pins within the Yaw Damper Coupler connector (D295) but only if the engage switch OFF earth was high resistance or open circuit.

25 Experimentation demonstrated that possibilities existed to build the necessary stray connections to achieve continued Yaw Damper engagement after it had been selected OFF.

26 The experimentation demonstrated that it was very difficult to generate robust stray connections between pins of connector D295 without causing more severe damage to the pins than had been observed on the unit involved in the incident.

27 None of the experimentally produced stray connections with appropriately damaged pins was sufficiently robust
to sustain continuing Yaw Damper engagement after it had been selected OFF.

28 There was little chance of finding evidence that a source of moisture existed in the past, as the electronic units in the E&E Bay (including the Yaw Damper Coupler) were removed and the E&E Bay and structure immediately above it were cleaned or replaced during the P6 check.

29 Visual inspection of the structure was carried out and evidence from the technical records along with the recollections of the individuals involved indicated that the degree of corrosion found and rectified was typical of any aircraft on such a check and there were no indications of any abnormalities which may have indicated heavy fluid contamination.

30 The E&E Bay was vulnerable to fluid leaks because it housed
the forward airstairs, was located immediately below the main entry vestibule and forward galley and just aft of the forward toilet.

31 Examination of the aircraft technical documents only revealed one entry relating to a fluid leak capable of affecting the E&E Bay, dated 5 March 1995, when a leak was traced to the forward toilet sink drain.

32 The E&E Bay Assessment Team's findings and recommendations were extensive and identified detailed improvements both to hardware and maintenance practices to maintain a desirable environment in the bay.

(b) Causal factors

The investigation identified the following causal factors:

1 Contamination of the connector on the Yaw Damper Coupler, in the E&E Bay, by an unidentified fluid had
occurred at some
time prior to the incident flight and compromised the function
of its pin to pin insulation.

2 Sufficiently conductive contaminant paths between certain
adjacent pins had affected the phase and magnitude of the
signals transmitted to the Yaw Damper Actuator, thereby
stimulating a forced Dutch Roll mode of the aircraft.

3 The location of the E&E Bay, beneath the cabin floor in the
area of the aircraft doors, galleys and toilets made it vulnerable
to fluid ingress from a variety of sources.

4 The crew actions immediately following the onset of the Dutch
Roll oscillations did not result in the disengagement of the
malfunctioning Yaw Damper system.

4 Safety recommendations

4.1 It is recommended that the FAA:
1) Require as soon as practical a visual inspection of all Boeing 737 aircraft Electrical and Equipment (E&E) Bays to check for fluid ingress into avionics components, their connectors and associated wiring. Such inspection should involve the minimum disturbance of equipment and connectors commensurate with a thorough examination for contamination. Where such contamination is found, the component should be removed and despatched to workshops for examination.

2) Require as soon as practical an inspection of the area in and around the E&E Bay for evidence on the structure and fittings of recent fluid leakage such as wet corrosion, staining and crystallised deposits. Such evidence should be investigated to ensure that, where the source of the leak is not apparent or readily rectifiable, no potential exists for it to impinge upon the avionics components, their connectors or wiring.

(Recommendation 96-3)

4.2 It is recommended that the FAA and Boeing:

3) Conduct an urgent review of the measures incorporated into the Boeing 737 to prevent fluid ingress into the E&E Bay, its equipment, connectors and wiring and as necessary require modifications to ensure that the equipment, connectors and wiring are provided
with protection consistent with reliable operation.

4) Conduct a review of the Aircraft Maintenance Manual to ensure that clear and specific instructions are contained therein to enable evidence of fluid ingress, even if not apparently directly impinging on electrical equipment, to be identified during routine maintenance. It should also be ascertained that any routine testing for leaks in the toilet, galley and airstairs systems should be done with the systems functioning fully throughout their normal operational cycle to ensure that any leaks which only occur during, for example, draining or replenishment cycles are detected.

(Recommendation 96-4)

It is further recommended that:

4.3 The Boeing Airplane Company promulgate the findings of the E&E Bay Assessment Team to all operators and that the recommendations be actioned through Service Bulletins to maximise the protection from fluid ingress of bay housed electronic components in current aircraft.

(Recommendation 97-60)

4.4 The CAA with the FAA review FARs and JARs with a view to requiring that the location of electronic equipment be arranged during the aircraft design so as to minimise
the potential for contamination by fluid ingress, with the intention of ensuring that the equipment, connectors and wiring are provided with protection consistent with reliable operation less heavily dependant on maintenance practices.

(Recommendation 97-61)

D F King

Inspector of Air Accidents

Air Accidents Investigation Branch

Department of the Environment, Transport and the Regions

November 1997

CLICK HERE TO RETURN TO INDEX

Click here for other Formal Investigations
From: John Barry Smith <barry@corazon.com>  
Date: September 6, 2009 12:04:11 AM PDT  
To: "John King" <jking1@attbi.com>  
Subject: Re: Maybe another shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup

Dear John,

Trans World Airlines Flight 800 does come to mind and how it was impossible to be center tank fire as an initial event based on data facts evidence.

Shorts cause fires, yes, but they also cause a lot more than that.

JB

There is certainly enough history with United 811 and the two 'near misses' prior to it.

Of course fuel tank explosion (TWA 800) also comes to mind. The question is open to if a fuel quantity wire surge protection system (FQIS/TSU was used, e.g. Smiths, BF Goodrich, who installed it and when ?

Also remember, its not just the 747s that are susceptible to fuel tank ignition but the other , as well. See the SDR and one image document attached of a FQIS wire within a DC-10 fuel tank. Look to the right of the finger tip in the picture and see the electrical burn mark through the insulation. The report filed with this SDR also said the metal rib to which this wire was chafing had to be "dressed out" due to the severity of the electrical burn.
The question becomes; where did that unwanted and dangerous electrical energy come from if not from cross arcing in shared wire bundles outside the tank?

JK

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: "John King" <jking1@attbi.com>
Subject: Re: C 130 crash like that in 1994

I used to work the Electra dry bays; they are big.

No different, dry bays or vacant fuel tanks go boom.

JK
--

I used to fly in P3A as radar operator in Navy. We worried about the nacelles flying off like gyroscopes like the Electra did a few times.

Still a great plane.

Wiring is so complex.....

Barry

Dear John and Barry:
Boeing used Poly-X from fuselage # 51(1970-75), switched to
Stilan in 1975, switched to crosslinked Tefzel in 1978, switched to Kapton on the 400 in 1989, switched back to crosslinked Tefzel in 1993. Hope this helps.
Ed

Dear Ed, thanks.

China Airlines Flight 611 had crosslinked Tefzel, Delivered 1979
Air India Flight 182 had crosslinked Tefzel, 1978
Pan Am Flight 103 1970 but line number 15, what was used before fuselage #51?
Trans World Airlines Flight 800 poly X 1971
United Airlines Flight 811 had poly X 1970

What is crosslinked Tefzel? Is it the same type of polyimide aromatic teflon coated insulation? Is prone to the cracking, chafing, etc that poly X has?

Can it be called Poly X type wiring?

I'm afraid China Airlines Flight 611 is another of my shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanations. Wiring will surely get the attention it deserves after it is determined the wiring caused that door to rupture open in flight.

Wiring does worse things than start fires.

Thanks again, Ed.

Cheers,
Barry
Prediction: Will have sudden loud sound followed by abrupt power cut: It's fast air molecules and nose off. Monday Night, 17 June 2002

John Barry Smith
Taiwan
'Black boxes' likely to be retrieved today, declares ASC chief
Chinese boats join search and recovery efforts, complain direct link restriction causing delay
2002-06-18 / Taiwan News, Staff Writer /
The Aviation Safety Council Managing Director Kay Yong (??) yesterday said that the so-called "black boxes" of the ill-fated China Airlines CI-611 jetliner are expected to be retrieved early this morning.

As the signals of the plane's data and voice recorders are weakening 24 days now after the crash, rescue efforts are concentrating on the recovery of the recorders - which may stop emitting signals soon since the batteries have an estimated life span of 30 days.

Ships and underwater photography equipment sent by the companies Jan Steen of Singapore and Global Industries of America have contributed to boosting the search efforts.
addition to the participation of the Taiwanese navy and local rescuers.

The ASC official yesterday was confident of recovering the recorders by this morning.

"Taking a look at the recent rescue efforts - which are very effective - I believe it is very possible for us to recover the black boxes early in the morning," said Yong at yesterday's press conference.

The ASC also made public some pictures of the wreckage the divers successfully took under the water. Yong said that the pictures are very helpful for the team to recover the black boxes.

Chinese boats also joined the search for the plane's wreckage and the victims' bodies, but they complained that the ban on direct links postponed the return of the wreckage they retrieved from the Taiwan Strait.

The rescue team has recovered 121 bodies as of yesterday with one body still needing to be identified.

The Hong Kong-bound jetliner dived into the sea near the outlying Penghu island after breaking into four chunks in mid-air on May 25. The crash has killed 225 passengers and crew on board.

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From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: EdwBlock@aol.com
Subject: Raychem

Dear Barry:

The Raychem Corp is the match.

Ahh....But they sold all the wiring so no coincidence.

They are owned by TYCO Int'l now.

Crosslinked means bombarded with an electron beam fed by a nuclear reactor. It imparts qualities unseen and unknown.

Why do it then?

What it really does is allow for patents and exorbitant sole source pricing of $31/ft on the Cruise Missle.

Only used once so really don't have to worry about aging.

TKT stands for Teflon-Kapton-Teflon. It is tape wraps. The teflon melts and puts out the arc-tracking of Kapton.

China Air 611 was crosslinked Tefzel not regular Tefzel.

Thanks.

Boeing used Poly-X from fuselage # 51(1970-75), switched to
Stilan in 1975, switched to crosslinked Tefzel in 1978, switched to Kapton on the 400 in 1989, switched back to crosslinked Tefzel in 1993.

China Airlines Flight 611 crosslinked Tefzel 1979
Air India Flight 182 crosslinked Tefzel 1978
Pan Am Flight 103 Mil-W81044/6 1970
Trans World Airlines Flight 800 Poly X 1971 BMS-13-42
China Airlines crash at Wanli about 81 or 82, probably crosslinked Tefzel
El Al Amsterdam Plane delivered in 1979 crosslinked Tefzel
Pan Am Flight 125 Mil-W81044/6 1970
Boeing 747-222B, N152UA preflight line 675 mar 87 crosslinked Tefzel
United post flight serial number 28717, after 1992 could be crosslinked Tefzel

Make sure you show the distinction.

Righto. Crosslinked Tefzel seems more the villain than Poly X. No Stilan.

Difficulty Date : 10/11/00 Operator Type : Air Carrier ATA
Code : 5210 Part Name : CONTROLLER Aircraft
Engine Model : PW4056 Part/Defect Location : CARGO DOOR
Part Condition : MALFUNCTIONED Submitter Code : Carrier
Operator Desig. : UALA Precautionary Procedure : NONE
Discrepancy/Corrective Action: FWD CARGO DOOR OPENED BY ITSELF WHEN CB PUSHED IN. ON ARRIVAL, CIRCUIT BREAKERS WERE PUSHED IN, WHEN PRESSURE RELIEF DOOR HANDLE WAS OPENED THE DOOR LATCHES OPENED AND THEN THE DOOR OPENED ON ITS OWN. COULD NOT DUPLICATE PROBLEM AFTER INITIAL OPENING. BMS-13-42 is Boeing's specification covering Poly-X (BMS 13-42B), and Stilan (BMS-13-42D).

Right, thanks Ed.

Now, can you imagine the interest in wiring after China Airlines Flight 611 is determined to be hull rupture in flight and that is forward of the wing on the right side near the forward cargo door? That leads to United Airlines Flight 811 and that leads to wiring/switch.

And that leads to Air India Flight 182, Pan Am Flight 103, and Trans World Airlines Flight 800.

So, first things first: Hull rupture. Location, similar event, to similar events. I hope the Chinese can see the forest while looking at their one tree.

Cheers,
Barry

On June 13, 1991, UAL maintenance personnel were unable to
electrically open the aft cargo door on a Boeing 747-222B, N152UA, at JFK Airport, Jamaica, New York. The airplane was one of two used exclusively on nonstop flights between Narita, Japan, and JFK. This particular airplane had accumulated 19,053 hours and 1,547 cycles at the time of the occurrence.

The airplane was being prepared for flight at the UAL maintenance hangar when an inspection of the circuit breaker panel revealed that the C-288 (aft cargo door) circuit breaker had popped. The circuit breaker, located in the electrical equipment bay just forward of the forward cargo compartment, was reset, and it popped again a few seconds later. A decision was made to defer further work until the airplane was repositioned at the gate for the flight. The airplane was then taxied to the gate, and work on the door resumed.

The aft cargo door was cranked open manually, the C-288 circuit breaker was reset, and it stayed in place. The door was then closed electrically and cycled a couple of times without incident. With the door closed, one of the two "cannon plug" (multiple pin) connectors was removed from the J-4 junction box located on the upper portion of the interior of the door. The wiring bundle from the junction box to the fuselage was then manipulated while readings were taken on the cannon plug pins using a volt/ohmmeter. Fluctuations in electrical resistance were noted. When the plug was reattached to the J-4 junction box, the door began to open with no activation of the electrical door open switches. The C-288 circuit breaker was pulled, and the door operation ceased. When the circuit breaker was reset, the door continued to the full open position, and the lift actuator motor continued to run for several seconds until the circuit breaker was again pulled. At this time, a flexible conduit, which covered a portion of the wiring bundle, was slid along the bundle toward the J-4 junction box, revealing several wires with insulation.
breaches and damage.
UAL personnel notified the Safety Board of the occurrence, and the airplane was examined at JFK by representatives of the Safety Board, United Airlines, and Boeing. After the wires in the damaged area were electrically isolated, electrical operation of the door was normal when the door was unlocked. When the door was locked (master latch lock handle closed), activation of the door control switches had no effect on the door. This indicated that the S2 master latch lock switch was operating as expected (removing power from the door when it was locked). After the on-site examinations, the wiring bundle was cut from the airplane and taken to the Safety Board's materials laboratory for further examination.

The wiring bundle with the damaged wires contained all electric control wires (28 volt DC) and power wires (115 volt AC) that pass between the fuselage and the aft cargo door. From the forward side of the J-4 junction box, the bundle progresses in the forward direction, just above the forward pressure relief door, then upward, following the forward lift actuator arms. The bundle then enters an empty space between two floor beams, where the bundle has an approximate 180-degree bend when the door is closed. From this location, the wiring bundle progresses inboard, through a fore-to-aft intercostal between two floor beams. The wiring bundle then splits, with wires going in several directions. The bundle is covered by the flexible conduit approximately from the lower end of the lift actuator arms to the fore-to-aft intercostal between the floor beams. The conduit covering the wiring bundle is intended to prevent the wire bundle from being damaged during opening and closing of the door and during cargo handling operations. The conduit is a sealed flexible interconnector consisting of a convoluted helical brass innercore covered by a bronze braid. The innercore is
soldered at every other convolute, and should be capable of withstanding pressures exceeding 1,000 pounds per square inch (psi). Boeing has indicated that the conduit is an evolutionary improvement and that it has been installed on all B-747 airplanes produced since 1981 (from line number 489 on). Airplane N152UA was delivered in April 1987. Airplanes produced prior to 1981, including N4713U, used a bungee retraction system, to retract the cargo door wire bundle. Guidelines for the replacement of the bungee system with the flexible conduit were covered in Boeing Service Bulletin 747-752-2170, dated August 1981. The service bulletin was prompted by reports that the wire bundle bungee retraction system had not retracted the wire bundle sufficiently to prevent trapping the bundle between the cargo door and the door frame. UAL did not perform the retrofit on N4713U, which was line number 89, nor was the company required to do so. Examination of the wires in the damaged area on the wiring bundle revealed that four of the wires were similar in appearance, with insulation breaches that progressed through to the underlying conductor. Adjacent to the breach on these four wires, the insulation was blackened, as if it had been burned. Another wire contained an extensive breach but no evidence of burned insulation. The damaged area was located on the bundle at a position approximately corresponding to a conduit support bracket and attached standoff pin on the upper arm of the forward lift actuator mechanism. This support bracket was found bent in the forward direction. In addition, mechanical damage was noted on adjacent components in this area. A second damaged area was noted on the wiring bundle at a position approximately corresponding to the conduit swivel clamp at the elbow between the two arms of the forward lift actuator mechanism. Wires in this area were missing portions of their exterior coating, but no breaches to the underlying
conductors were noted. The exterior braid on the conduit contained minor rub marks and was slightly kinked at a position corresponding to the area on the wires with breached insulation. Additional examinations revealed that the innercore of the conduit contained multiple circumferential cracks in the areas corresponding to the damage areas on the wires. The cracks were in the convoluted innercore directly adjacent to the inside diameter of the conduit. The lock sectors, latch cams, and latch pins from the aft cargo door were examined on the incident airplane and were generally in excellent condition. There was no evidence to suggest that the cams had ever been electrically (or manually) driven into or through the lock sectors. Boeing also informed the Safety Board that, in May of 1991, a B-747 operated by Quantas was found to have chafing of the wires in the wire bundle to the aft cargo door. This airplane also had a flexible conduit protecting the wires, and the chafing was located approximately at the standoff pin on the bracket at the upper arm of the forward lift actuator. The Safety Board determined that the chafing of the wires on the airplane involved in the JFK occurrence was caused by, or was greatly accelerated by, the circumferential cracks in the conduit and that the cracks in the conduit were caused either by repeated flexing of the conduit as the cargo door opens and shuts or by unusual stresses on the conduit generated concurrently with damage to the conduit guide bracket and attached standoff pin on the upper end of the forward lift actuator upper arm. A portion of the wire bundle for the forward cargo door on many B-747 airplanes is also covered by a flexible conduit that is very similar to the conduit for the aft cargo door. However, there are substantial differences between the orientation of the flexible conduits for the two doors, and the Safety Board has not become aware of problems associated with the flexible conduit for the
forward door.
Nevertheless, because of the concerns about the chafed wires and possible electrical short circuits, on August 28, 1991, the Safety Board recommended that the FAA:
Issue an Airworthiness Directive applicable to all Boeing 747 airplanes with a flexible conduit protecting the wiring bundle between the fuselage and aft cargo door to require an expedited inspection of:
(1) the wiring bundle in the area normally covered by the conduit for the presence of damaged insulation (using either an electrical test method or visual examination);
(2) the conduit support bracket and attached standoff pin on the upper arm of the forward lift actuator mechanism;
(3) the flexible conduit for the presence of cracking in the convoluted innercore.
Wires with damaged insulation should be repaired before further service. Damage to the flexible conduit, conduit support bracket and standoff pin should result in an immediate replacement of the conduit as well as the damaged parts. The inspection should be repeated at an appropriate cyclic interval. (Class II, Priority Action) (A-91-83)
Evaluate the design, installation, and operation of the forward cargo door flexible conduits on Boeing 747 airplanes so equipped and issue, if warranted, an Airworthiness Directive for inspection and repair of the flexible conduit and underlying wiring bundle, similar to the provisions recommended in A-91-83. (Class II, Priority Action) (A-91-84)
The FAA responded to these safety recommendations on November 1, 1991, stating that it agreed with the intent of the recommendations and that the issuance of an NPRM was being considered to address the issues in the safety recommendations. The Safety Board replied on November 27, 1991, classifying each of the recommendations as "Open--Acceptable Response,"
pending the completion of the rulemaking process. Since that exchange of correspondence, the FAA has published an NPRM which is now being reviewed by the Safety Board. Safety Recommendations A-91-83 and -84 will continue to be classified as "Open--Acceptable Response" until an acceptable final rule is published.

From: John Barry Smith <barry@corazon.com>
Date: September 6, 2009 12:04:11 AM PDT
To: EdwBlock@aol.com
Subject: Why do it?

At 11:01 AM -0400 6/21/02, EdwBlock@aol.com wrote:
Dear barry:
   Thanks for the info. The reason to keep doing it? Pre-planned obsolescence or attrition. If the plane lasts forever like say the DC-3, you don't need new ones do you. I know how bad that sounds but it is the only explanation I can come up with.
    Ed

Well, I'd like to think they aimed low and hit it. 15 years for wiring life is not bad and when they fly 20 years it's hard to blame the wiring. The blame is that the product is defective in the first place over time and no action is taken.

I don't think Boeing purposely installed faulty wiring or Raychem purposely made faulty wiring but I do believe they do not want to accept the truth that faulty wiring is causing many accidents. They bandaid the symptom instead of fixing the problem.

We shall see when China Airlines Flight 611 turns out to be
cargo door rupture and everyone gets to say why. I will have United Airlines Flight 811 and you will have wiring.

It will get very interesting, Ed.

I want the doors to be plug type and wireless used instead of wiring when feasible.

Cheers,
Barry

From: John Barry Smith <barry@qp6.com>
Date: September 6, 2009 12:04:11 AM PDT
To: fslutterback@gmail.com
Subject: Thanks for invite, Fred, I'll try to be there.

At 9:56 AM -0700 7/6/06, =?utf-8?B?Q2Fyb2wgQ2hhcG1hbiBhbmdQgRnJlZCBSbGF1dHRlcmJhY2s=?=
 wrote:
We're New Member Artists at Gallery North - Carmel

Please come to our reception
This Saturday, July 8, 5:30-7:30