How does nose come off when forward cargo door pops?

When the forward cargo door on Boeing 747s opens inadvertently several consequences can occur.

1. Door opens and minor consequences if plane is on ground. (UAL preflight)

2. Door opens two inches but the mid span latches hold and no baggage is sucked into number 3 engine: Minor consequences as plane turns around and lands. (Pan Am 125).

3. Door opens, mid span latches hold but baggage is possibly sucked into number three engine: Severe consequences as number 3 engine is fodded, blades nicked, vibration, fire, and engine separates and strikes number 4 engine which fails and separates from wing also. Plane then crashes with total destruction and death. (Possibly El Al 747 and China Airlines 747 freighters)

4. Door opens, mid span latches hold for 1.5 seconds, then give way and door is torn away exposing huge hole in side of nose: Moderate consequences as nine people are sucked out to deaths, number three engine is fodded and throws engine parts into number 4 engine which fails also. Engines stay on wing if shut down in time and plane lands if near airport. (UAL 811)

5. Door opens, mid span latches don't delay full opening, door tears up and away exposing huge hole in nose into which 300 knot slipstream enters and same force presses on weakened, damaged nose, tearing it off, severing power and destroying airworthiness: Severe consequences as headless plane crashes with total destruction and death (AI 182, PA 103, and TWA 800)

How can nose come off when door opens and tears away?

The door is eight feet by nine feet in size and outward opening, hinged on top. When it bulges out into the 300 knot slipstream just a few inches, or just a few degrees of its opening arc, the slipstream pushes against the door and flips it up and away tearing off fuselage skin and stringers with it. The amount of skin torn away is a minimum additional area of nine feet by ten feet. So a hole estimated officially of between nine by 15 feet or estimated by others of ten by forty feet is opened on the front right side of the airborne 747. Assuming a conservative estimate of ten by fifteen feet, that is one hundred and fifty square feet of hole exposed to the slipstream.

The structurally important floor beams above the absent door are bent, missing, and fractured during the explosive decompression and the pressure equalizing process.

The slipstream is 300 knots or 330 miles per hour of air flowing over the nose and into the hole. The same high pressure air is also pressing on the front of the now weakened and slightly canted nose. The 300 knots is not ground speed or true air speed but the actual speed of the air molecules pressing against the speed sensor, the pitot tube. Three hundred knots is twice as fast but ten times the power of the fastest winds on earth. Ten times the force of the hurricanes that tear boarded up buildings apart enters the nose of the 747.

The nose of the 747 has been considerably weakened when the door comes off and exposes the huge hole. The door is a structural member and contributes to the strength of the forward fuselage when pressurized. When the door goes the nose is now weakened by the absence of that structural member which departs taking the top reinforced sill. The reinforced frame is now compromised on one side, the top. When the door goes, explosive decompression occurs, the severity of which is dependent upon the altitude of the plane, that is, the pressure differential between the inside cargo compartment and the outside free air. If the plane is high enough when the door comes off, the higher pressure air in the cargo compartment rushes out to equalize with the lower pressure outside air. The passenger compartment high pressure air now tries to equalize with the now lower pressure cargo compartment air. It does and pushes down on the structural member floor beams, breaking, bending, and fracturing them downward. The nose is now severely weakened by the missing door, missing skin and stringers, and bent and fractured floor beams.

The passing 300 knot air molecules alongside the nose enter the huge hole and puff up and blow out the side of the fuselage on the other side of the nose, the port side. Now debris from the left side and the right side enter the number two and three engines causing them to fail, throwing off parts which are ingested by numbers one and four engines. All four engines fail and tear away with their pylons from the wing destroying the structural integrity of the fuel laden wing which disintegrates into a ball of parts, fuel, and hot spinning jet engines.

The nose of the 747 now has a huge amount of fuselage skin torn away, the structural beams are weakened, the flight attitude of the plane is askew, and extremely high wind pressure is pressing into and onto the compromised nose of the 747 forward of the wing as well as the front of the nose. The ejection of the cargo door to the right may have yawed the nose to the left or induced a roll to the left wing down position. The autopilot may attempt to correct the yaw with stabilizer inputs putting directional stress on the airframe. The nose crumples into the huge hole on the starboard side. The entire forward section of the plane, (one of the three sections joined

in construction,) is torn away and falls alone in a dense heap on the ground or under the water. The sequence takes under three seconds to twenty four seconds from the time the door opens just a few inches to nose separation.

Brutal analogy: The nose of the 747 is really the head which holds the brain of the main electrical compartment and the flight crew. The neck of the 747 is the area just forward of the wing. The body of the 747 is the wings and center fuselage. The tail of the 747 is the aft fuselage and vertical and horizontal stabilizers.

When the door goes it tears a gash in the neck which severs tendons and muscles holding the head on and up. A huge outside force then pushes into the hole in the neck blowing out the other side of the neck, cutting more muscles and tendons.The weakened head lolls about and is then decapitated by the fast wind force. The head smashes to the surface in a dense heap. The lifeless body and tail fall to the surface coming apart as they fall laying a large destruction pattern.

A less brutal anthropomorphic analogy is an egg which is strong until creased with a spoon, then weak. Or a soda can strong until tab pops can, then weak. Or a balloon is strong until pricked. Comet jet airliners were strong until metal fatigue around a large window tore away. Boeing 747s are strong until door opens, gets torn out, up and away taking skin, stringers with it and bending and fracturing floor beams. Then all those wonderfully designed strong objects are weak, and fail.

That's how the nose of a Boeing 747 comes off when the forward cargo door opens inadvertently in flight. (AI 182, PA 103, and TWA 800.)

Above is how they are put together and how they come apart, at the seams. Note forward cargo door open.

The Amateur Scientist was a series that ran in the Scientific American for years. It showed that a layman with ordinary tools could simulate and create the same results as expensive experiments. I have done this Boeing 747 at 300 knots and door opens experiment with a four window American sedan at 70 knots on long stretch of highway. At 70 knots, (75 mph) in smooth air with all windows up, no unwanted air enters the car/passenger cabin. Air entering via the air conditioning is equal by air venting outside. The passengers inside the car feel no wind and no pressure difference. As soon as the right front window is 'cracked' by lowering it using the electric switch, air enters the cabin and pressure difference is felt as air is pressed

inside car. Even though the window is flush with outside of car and the air flow is parallel, the fast air enters cabin at high speed about twelve inches after the forward part of the window. The right front passenger is buffeted by air. The air is completely felt by passenger in right rear seat. The windstream continues to be felt to a lesser degree in entire rear seating area of six passenger, two bench seat sedan. If the right rear window is lowered to create a large hole on the right side of the car, two widows wide, the buffeting in right forward seating area is reduced but the full force of the windstream is now felt in entire rear seating area. The buffeting continues as long as car is at speed. The rear windows did not pop out, the frame was not bent, the floor beams were not fractured, and the car did not split in two. The windows are not structural members of the body of the car. The wind was not 300 knots. The window did not open suddenly. The inside pressure was not different from the outside. The window was designed to be opened during movement of the car.
A Boeing 747 has a large nine foot by eight foot door that is a important structural member of the forward fuselage which is already weak by design of changing a military front loading cargo plane into a civilian cargo side loading plane. The door tears much more skin, stringers, and frame with it when it gets torn away exposing a huge hole of nine feet by 15 or more feet to the outside fast moving air. The hole appears suddenly allowing no stretching. The hole is not designed to be there when the aircraft is moving; only at zero airspeed is it supposed to open. Structural floor beams are bent and fractured by the explosive decompression as nature attempts to equalize the outside low pressure. 300 knots is twice the highest speed of wind on earth and ten times the force. When that strong force meets the weakened defense, destruction occurs.
My conclusion based upon this amateur research is that fast moving parallel air passing a large hole in the side of a body will enter that hole and press against the opposite side of the body. Assuming a very high airspeed of 300 knots and a damaged and extensively weakened nose it is reasonable to conclude that the entire aircraft aft of the cargo door hole will be torn away from the nose when the slipstream ruptures the opposite fuselage side, presses onto the front, and the severely structurally compromised and aerodynamically unstable aircraft crumples and disintegrates by the force of the 300 knot wind.

Reference:Pressure differential at different altitudes for Boeing 747

10000--4.588 psid
15000--6.405 psid
20000--7.943 psid
22000--8.493 psid
23000--8.753 psid
25000--8.9 psid
All altitudes above 25000 maintain
8.9 psid while the cabin altitude climbs to 7600 ft

Comment: The chasm of disbelief is 'how can a door opening hole have such severe consequences?' 27 Mar 97 14 Aug 97

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