EXHIBIT 20 - LOCATING THE MISSILE AIRBURST

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Large anti-aircraft missiles equipped with proximity fusing are designed to burst as much as 40' from the aircraft. The preponderance of eyewitness accounts and physical evidence prove TWA Flight 800 was destroyed by such weapons. The FBI purposely searched for only MANPADS weapon evidence on the aircraft.

By using evidence from various sources, this exhibit will physically place the first weapon airburst in space, relative to the aircraft. The sources are: Inertial Navigation System, Digital Flight Data Recorder, Cockpit Voice recorder, Nose Gear Door Damage, Left Wing Skin Damage, Debris Field Evidence, Nose Tire witness marks above R-3 door and on tip of right Horizontal Stabilizer, Foreign Object Damage failure of number three engine, forward left Cargo Bay damage and crack propagation & fuselage skin tension/compression failure modes.

Using the above evidence, assuming a generic weapon size (90 lb. High explosive blast) and compensating for Doppler effects caused by the velocity of the aircraft; weapon burst location should be possible. If the weapon size assumption is relatively accurate, a more precise placement is possible.

We have both gross or imprecise indicators of where the weapon detonated as well as a few precise indicators.

Gross Airburst Indicators:

1. Airburst must be forward below the aircraft belly line because nose gear doors are pushed in.
2. Airburst must be left side below level of left wing because of hydraulic RAM damage to underside left wing top skin. See Exhibit 7 on page 47.
3. Airburst must be below the nose because nose pitched up to over 8° from 2° in a fraction of a second on the DFDR. See Exhibit 12 on page 55.
4. Airburst must be left side forward because nose tire witness marks above R-3 door and tip of right horizontal stabilizer would place the aircraft in at least a 6° right yaw and pitched up over 8°. See Exhibit 6 on page 46.
5. Airburst must have imparted a huge side load from left or right because the very strong vertical stabilizer failed.
6. Airburst must have been forward of aircraft station 800 because earliest aircraft parts separations were from this belt.
7. Airburst must have been left side forward because 1st class passengers and crew were hit by shrapnel left side forward.
8. Airburst must have been low left side forward because forward left cargo compartment back to under center wing components, air packs, etc. were stripped off first.
9. Airburst must have been left and forward of the center of gravity because the inertial navigation system show both a yaw right (heading) and drift right (lateral motion) relative to flight path.

Precision Indicators:

1. Cockpit voice recorder proves overpressure shock from airburst struck the airframe first between aircraft stations 667 and 738, left side, 48 to 54 ft. back from nose. See loud sound Doppler schematics at Exhibit 19 on page 73.
2. Airburst overpressure shock wave breached the hull first at or near aircraft station 615, ejecting a passenger sitting in Row 10, Seat 2, who landed thousands of feet before the first large metal pieces hit the debris field.
3. The Digital Flight Data Recorder captured an angle of attack (AOA) reading of 106°. The AOA gauge, vertically mounted, is located left side below and aft of the cockpit windows, has a 360° range of motion and always points at the relative wind (like a weather vane). In this case, the AOA pointed at the airburst, located behind and below the vane. See drawings at Exhibit 19 on page 73.
4. The airburst overpressure wave registered on the Altimeter (Fine) Flight Data Recorder line. The altimeter Fine line normally only measures altitudes within 5,000' blocks. Although the NTSB data originally showed a drop from 13,772' to 10, 127', the reading really means a drop from 3,772' to 127' on the 0-5,000 ft. scale. The 127' reading could just as easily mean 5,127' altitude or 127' altitude or even –4,873'. Obviously, the lower the actual altitude reading, the higher the pressure in the blast wave. See page 81. This chart represents the various pressures and corresponding distances from a blast that altitude Fine readings would represent.
5. The Airspeed Indicator recorded the airburst overpressure as an instantaneous loss of 198 knots airspeed on the Digital Flight Data Recorder. Indicated airspeed is a product of the Pitot system that measures the dynamic pressure of the air stream against the static pressure (ambient pressure) to produce an airspeed indication.

Discussion: If the actual airspeed doesn't change (the situation with TWA Flight 800) but the ambient pressure suddenly goes up from an explosion, the airspeed indication will drop correspondingly. In the case of Flight 800, the drop was precipitous, from 298 knots indicated to 100 knots instantly. The formula for computing dynamic air pressure is:

Dynamic pressure q = ((Rho, air density) x (v, velocity) ^{2})/2

$q = \frac{gV^2}{2}$ or for 300 knots indicated @ 13,800 ft. =

$$(lb/in^2) = \frac{.0000273 lb/in^3 x 633 ft/\sec^2}{2} = 5.47 lbs$$

for 100 knots indicated @ 13,800 ft. = $\frac{.0000273 lb/in^3 x (212 ft/\sec)^2}{2} = .61 lb/in^2$

The difference between 5.47 psi and .61 psi is 4.86 psi. If we assume the sudden 100 knot reading on the airspeed indicator was due to a pressure wave striking the static pressure ports of the left side pilots Pitot system, we can then assume at least 4.86 psi of overpressure was detected at the Pitot tube. However, nothing is quite that simple, the static half of the Pitot system is linked to multiple static ports so a sudden unnatural pressure spike on a static port will partially vent causing a lessor effect on the gauge. Understanding that leads us to believe the minimum pressure at the Pitot static ports left side was 4.51 psi.

When we cross this pressure to the pressure versus burst radius chart on page 81 we get an airburst distance form the Pitot system of 40 to 41 ft.

Because we can assume some venting loss explained above, it is advisable to use one of the higher pressure multiples of the altitude Fine pressure readings. The altimeter uses the same static pressure but measures it against a sealed pressure chamber and should be more accurate.

That minimum pressure then becomes 6.1 psi at a burst distance of 37 ½ feet or 8.6 psi at 33 ½ feet or over 10psi at a distance of 31 ½ feet.

Two points should be made here: (1) There is no guarantee the timing of the DFDR caught the maximum pressure spike of the shock and (2) without expensive whole component shock wave testing of the B747 Pitot/static system (from various angles) there is no way to know what percentage of the shock registers as a pressure spike. In other words, a shockwave hitting the static ports directly (from any side) would probably cause the biggest drop in airspeed. Conversely, the same shockwave hitting the Pitot dynamic port head-on (same as normal airstream) would cause the airspeed to spike way up, not down.

Because of the above reasons and the high-energy damage to the cockpit and forward fuselage evident in the debris and its distribution, we will estimate the burst distance to the Pitot/static ports at 32 feet.

Estimated Position of Airburst

- Low left side forward abeam aircraft station 576.
- 9 feet below the aircraft belly line.
- 19 feet outboard from the aircraft centerline.
- 32 feet from Pitot/static ports, Port side.
- 17 feet from closest aircraft hull.
- 14 feet aft of nose gear well aft bulkhead line.

A burst of a 90 pound warhead at the above location, after computing the effects of Doppler, would produce the following overpressure values / effects.

1. Nose gear doors, 8.2 psi overpressure; would produce a 14 ton force pushing in a 4’x6’ nose gear door into the wheel well, hypo-extending the nose gear door hydraulic actuator, bursting the cylinder.

2. Low left fuselage aircraft stations 615 to 860; to 40 psi overpressure over large area would instantly yaw the aircraft right and pitch it up. The totality of the lateral displacement force could easily exceed 5000 tons. The pressure hull would breach releasing 3.5 psi cabin pressure taking passengers and interior cabin debris out into the earliest debris field.

3. Left wing root fillet at aircraft station 854; 100 psi would blast away aerodynamic fairings in small pieces.

4. Forward left corner, center wing box (CW504) and forward right leading edge number two main tank; 45 psi overpressure would hydraulically RAM charge #2 main, #1 main and #1 reserve tanks, collapse the left side body wall into the dry bay behind the front spar also into the center wing tank and snap off the first large metal part to hit the debris field (CW504). Hydraulic RAM charge would vent through top wing skin putting small wing skin pieces in the debris field.

5. Engine #2 is struck by shockwave first at 25 milliseconds after burst, 12 psi hitting from right side low on a 45° angle. See illustration on page 81.

6. Engine #1 is struck at 50 milliseconds after burst, 2.0 psi from right side, low on 60° angle.

7. Engine #3 is struck at 50 milliseconds after burst, 2.0 psi from left side, low on 89° angle.

8. Engine #4 is struck at 85 milliseconds after burst, .5 psi from left side, low on 83° angle.

Airburst effect on Lift and Acceleration

1. The aircraft inertial system, DFDR, and debris "witness-marks" clearly show the aircraft yawing right at least 6° from blast effects, they also show the aircraft pitched up 5.8° from its previous attitude of 3°.

2. A violent yaw right would swing the left wing tip forward and the right tip aft. This dynamically increases lift on the left wing through reduction of spanwise flow, and decreases lift on right wing due to dramatic increase in spanwise flow. The yaw brings the left wing forward and effectively lengthens it with respect to the airflow, while the right wing is effectively shortened and partially blocked by the fuselage.

3. The airburst overpressure itself produces a huge lifting force applied under the aircraft and asymmetrically to the left wing. The totality of the net momentary lifting force does two things simultaneously;[5]
   a. It radically reduces induced drag, this will cause a momentary increase in longitudinal acceleration. This increase was recorded on the DFDR 12-second line.
   b. The asymmetrical airburst lifting force under the left wing will couple with spanwise flow lift vectors to roll the aircraft rapidly right!

This force was huge. TWA Flight 800's wing area was 5500 ft^2 and wing loading about 103 lbs. per square foot. This means every square inch of wing was carrying .71 pounds. Now note on page 81 the 2psi asymmetric lifting force under the number one to the number three engines at 50 ms after the first airburst.

Just a one-lb/in^2 higher lift differential on the left wing would generate:

$$5500 \text{ ft.}^2 /2 = 2750 \text{ ft}^2 \times 144 \text{ in}^2 /\text{ft}^2 = 396{,}000 \text{ in}^2 \times 1\text{lb} = 396{,}000 \text{ lbs. differential lift.}$$

<u>The lift differential was significantly higher than 1 psi, the aircraft "snap-rolled" right! The 12-second line of the DFDR shows the aircraft rolled right 144° in less than 1 second.</u>

[5] Induced drag is that substantial percent of total aircraft drag that is produced by the wing only when the wing is generating lift. (When military tactical pilots wish to rapidly accelerate in air combat maneuvering, they will unload the wings by pushing forward stick toward zero gravity (g)).

Airburst Shockwave impingement on wing and engines