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Dear Executive:

SPECIAL ANALYSIS: THE SEQUEL

Investigators Stick to Their Crash Scenario for ValuJet Flight 592

Claims that airplane got closer to Miami airport than 17 miles rejected

Investigators of the 1996 crash of **ValuJet** Flight 592 insist they have correctly interpreted the radar data of the stricken jet's final moments.

No question, they say, the airplane plunged into the Everglades 17 miles away from Miami International Airport and never got closer to the airport.

"There is virtually no chance that we are wrong," asserted Bernard Loeb, chief of aircraft investigations for the **National Transportation Safety Board** (NTSB).

Some independent investigators, utilizing radar data obtained through the Freedom of Information Act (FOIA), have claimed the airplane approached to within 12 miles of the airport, then turned, flew in a meandering circle at low altitude and finally nosed into the swamp at a point 17 miles away.

The Confusion Over the Term "Coast"

From various air traffic control veterans:

"Coast is when an aircraft fails to emit the transponder signal...the target will be a primary radar target only (and remain so for 2-10 sweeps)."

"Coast means he's lost secondary but is still getting primary."

"Coast doesn't mean you've lost the airplane, just the ability to interrogate (its transponder)."

"If primary and secondary (radar returns) are *both* lost, it'll coast about 10 seconds and then the aircraft identification goes into a suspense list."

From the NTSB:

"When the radar is looking for a beacon and can't make sense of the target, with or without a primary return, it goes into coast."
-- John Clark, deputy director, office of aviation safety

What the book says:

"Tracks that fail to correlate are placed in active coast status and the track's firmness is decreased..."

"Successful correlation will be determined by...(a) the target's Reported Beacon Code...(b) The target is radar only..."

"Correlation is disallowed if the track coasted for more than two consecutive scans or was not previously radar reinforced."
-- ARTS IIIA Computer Program Functional Specification, Target Processing, NAS-MD-637, January 1994, pages 3-11 and 3-12.

Compiled from multiple sources

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These individuals, notably aviation safety equipment inventor Bertil Werjefelt, have argued that the airplane's low altitude maneuverings imply that had improved procedures and equipment been available for dealing with smoke in the cockpit and smoke in the cabin, the airplane might have been able to effect an emergency landing, and perhaps not all 110 aboard would have died. His assertions have prompted some of the victims' relatives to call for a re-opening of the investigation (*see ASW, June 1, pg. 1 and pg. 7*).

The main point of contention is a 40 second block of radar data from the Miami air surveillance radar (ASR). It shows that the transponder signals from the ValuJet airplane were lost moments before the jet crashed. NTSB officials put the impact at 13 minutes and 42 seconds after 2 p.m. local time. The transponder signal is known as the "secondary return." The radar data also show that after the transponder signal was lost the airplane's distance from the airport continued to decrease from 17 miles to a range of 12 miles. The decreasing range, the skeptics assert, is evidence that the radar was continuing to receive reflections from the airplane (i.e., "skin paint"), or what is known as the "primary return".

Throughout this 40 second period, the radar was in the so-called "coast" mode. This term, as it turns out, is something of a metaphysical swamp. Numerous radar experts polled by *Air Safety Week* vigorously asserted that "coast" means loss of the transponder but *not* of the primary return. Others, a distinct minority, thought "coast" meant the loss of *both* primary and secondary return. Even two individuals in the same tower disagreed (*see page 1 box*).

The skeptics' case

The critics base their case on these points:

- The time clocks for the various radar returns don't match each other, or the timeline of the air traffic control (ATC) transcript, suggesting some manipulation of data to support a pre-ordained crash scenario.
- The fact that the "firmness of track" recorded by the Miami ASR did not drop instantly to zero after the transponder signal was lost, suggesting that the radar was continuing to receive primary returns from the accident airplane (*see table, pg.* 3).
- The fact that the predicted and displayed range values recorded by the Miami ASR were different, again suggesting that the radar was continuing to receive (and display) primary radar returns (*see table, pg.* 3).
- The fact that the plot of the aircraft's path during "coast" is not a straight line (as would be expected for a computerized prediction of the aircraft's flight path after loss of secondary return), but one that weaves slightly down to the 12 mile point.
- Controller Jesse Fisher's statement that he lost ValuJet Flight 592 from his radar scope when it was 12 miles distant. Further, his instructions to the pilots to descend and maintain a 3,000 ft. altitude after they already had descended to about 1,000 ft.

(suggesting that the times of events on the ATC tape were inappropriately adjusted by investigators).

- An indisputable primary radar return on the Miami ASR some six seconds after the declared crash time, suggesting that the airplane was still airborne, but with a non-functioning transponder at this point.
- A primary and secondary return from a National Track Analysis Program (NTAP) radar, placing the aircraft at an altitude of 900 ft. and about one-half to three-quarters of a mile north of the impact site at a time of one second after the NTSB claims the airplane crashed. Again, this data point has been used to suggest that the accident airplane continued to fly for some period of time before its final fatal plummet.

The Track Down to 12 miles From Miami Airport

From Miami Air Surveillance Radar (ASR) Data Obtained Through the Freedom of Information Act

Time[i]	Firmness of track	Radar altitude	Predicted range	Displayed range	Displayed Speed
14:13:36	38	900 ft	17.24 nm	17.63 nm	367 kts
14:13:41[ii]	38	---	16.74	17.18	380
14:13:45	35	CST	16.26	16.66	380
14:13:50	33	CST	15.78	16.17	380
14:13:54	30	CST	15.38	15.72	380
14:13:59	27	CST	14.82	15.23	380
14:14:04	25	CST	14.34	14.74	380
14:14:08	23	CST	13.86	14.23	380
14:14:13	21	CST	13.38	13.75	380
14:14:17	19	CST	12.91	13.26	380
14:14:22	17	CST	12.43	12.80	380[iii]
End of data					

Source: Raw Miami Air Surveillance Radar (ASR) Tracking

i *Local time, marks each sweep of the radar.*
ii *Investigators concluded that the crash occurred at 14:13:42.*
iii *Investigators maintain that the constancy of speed at 380 kts suggests the radar system is predicting the aircraft's flight path, and is not receiving any primary radar data on which to gauge its speed.*

- The statement of a Chinese student pilot, Zhi Hweng Zheng, who was flying in the area at the time, that the stricken ValuJet DC-9 crossed from his 10 o'clock position to a crash point at 2 o'clock, suggesting that Zheng was seeing the airplane in the final moments after it had circled back around.
- The statement of Walton "Bo" Little, a pilot fishing near the crash site, that he used his cell phone to call "911" just moments after he witnessed the impact. But the time of his call at 15 minutes and 24 seconds after 2 p.m. was almost a minute and a half after the declared crash time. The time line here, too, skeptics say, suggests the airplane was maneuvering for about a minute *after* the crash time declared by the NTSB.

The investigators' case

To each of these points, NTSB officials have responses.

- Regarding mismatches in timing. The radars were not all synchronized. The Miami ASR's internal clock can drift as much as 17 seconds in 24 hours and, for this reason, is set three times daily, manually using a time hack over the telephone. An error of four seconds in timing would not be unusual. Investigators were faced with the challenge of correlating returns from the various radars (Miami ASR, Ft. Lauderdale ASR, NTAP) with data from the ATC transcript, the flight data and cockpit voice recorders on the airplane.

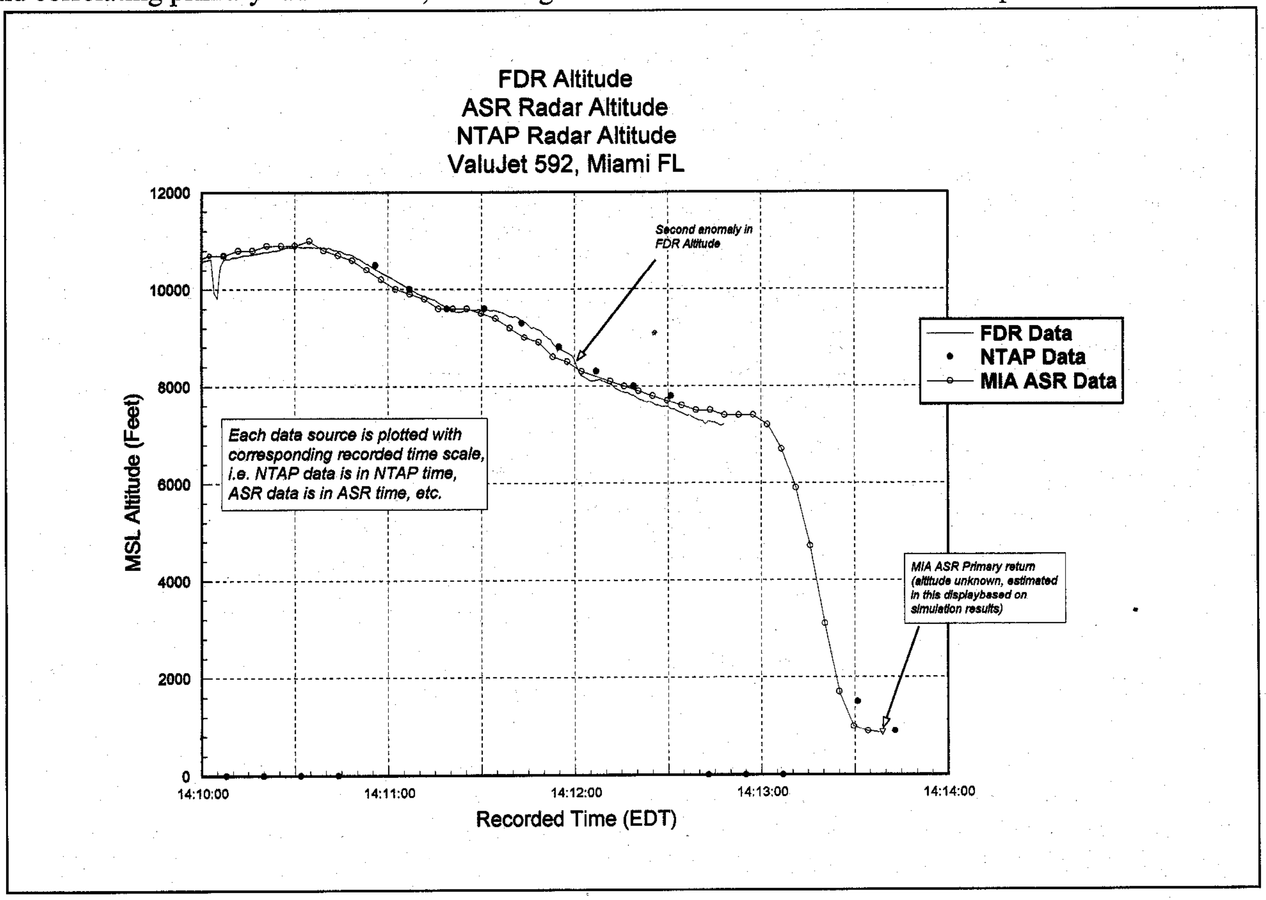
Dan Bower, who integrated all the data, said the best common reference point was the altitude history of the airplane. When the Miami ASR data is shifted four seconds so that its altitude readings match those recorded by the NTAP radar, the "fit" makes sense. The second-to-the-last primary return on the Miami ASR and the final NTAP primary and secondary return match in both the vertical and the horizontal plane. The final NTAP return about a half-mile north of the impact site accords with the speed the plane was traveling moments before impact, according to Bower's analysis.

NTSB officials believe the picture that emerges is very consistent (*see chart pg. 4*). The one thing investigators cannot wholly explain is the final primary return, some six seconds after the crash, recorded by the Miami ASR. However, that return, said John Clark, the deputy chief of aviation accident investigations, "is co-located exactly at the crash site." The primary return could have been caused by the plume of water hurled into the air, by smoke, heated air or by parts from the airplane – investigators can only speculate.

- The meaning of "coast." NTSB radar expert Scott Dunham said "coast" means the radar's computer tracking system cannot correlate a system track with an observed target during a given sweep of the antenna.

This could be for a variety of reasons, including that there are no returns. In sum, the NTSB position is that the track displayed on the radar scope from 17 miles to 12 miles was a computer-generated prediction.

The reason why firmness of track did not drop immediately to zero is explained by the functioning of the computer: with each sweep of the radar in which the system cannot correlate a return with a track, the firmness drops by two. From a maximum value of 38, the data clearly show firmness gradually dropping by two to three points with each sweep of the radar; it would *not* have been dropping if the radar were receiving and correlating primary radar returns, according to Dunham and other NTSB radar experts.



Investigators believe data from the flight data recorder and two radars portray a consistent picture of the doomed aircraft's final moments. *Source: NTSB*

Regarding the difference between predicted and displayed ranges during coast, Dunham said, "We had the same question." Investigators discovered (1) that predicted range is displayed before the next primary return, and (2) that the system employs two different "smoothing routines" for predicted and displayed data during coast — "When the radar is not seeing anything," Dunham explained.

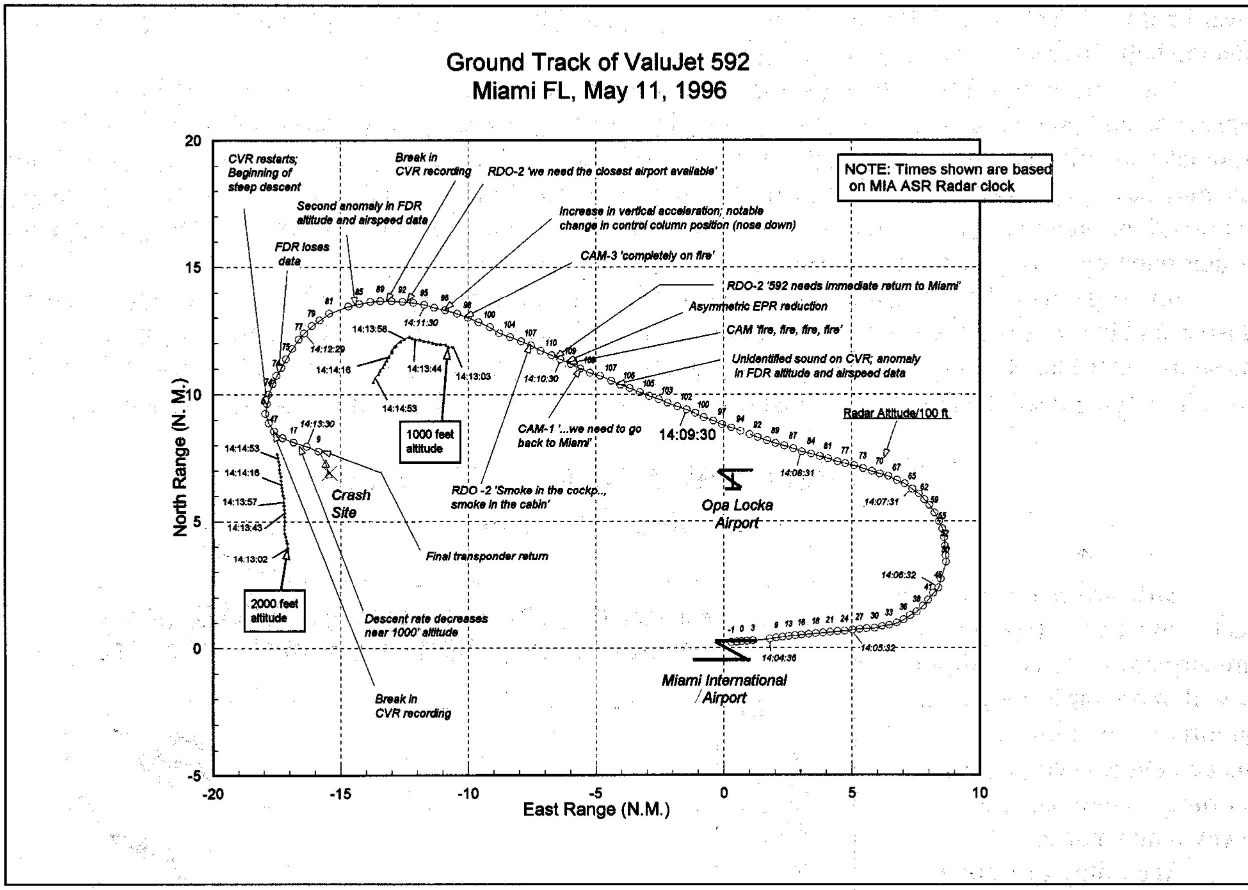
Clark said investigators poured over the data, looking for any primary returns after the final one at 13 min. and 48 seconds after 2 p.m. "If there had been a primary any time after that, we'd have seen it," he said. "We looked for the next one and a half minutes and found no primary returns that could be tied to this airplane."

"If this airplane was above 300 ft., we'd have seen the primary returns," Clark stressed.

• The witnesses. Investigators know where Zhi Hweng Zheng was flying because of the transponder in his light plane. Interviewed by the NTSB on March 30, 1998, Zheng said he saw the ValuJet about two miles in front, passing from west to east. The plane's steep descent angle moments before impact caught his attention. Zheng's account is consistent with the radar plots of flight paths of his aircraft and the ValuJet plane. Zheng reported the crash to ATC, and his crash time is consistent with the NTSB's timing (*see graphic, pg. 5*).

Regarding witness "Bo" Little, even if the accident airplane had been 12 miles distant from Miami airport at 14 minutes and 22 seconds after 2 p.m. (the last time recorded in the "coast" data on the Miami ASR), the time line does not fit. Little made his 911 call just 62 seconds later. Loeb and other investigators believe the aircraft could not have made a 3-4G turn to reverse course and cover five miles (from 12 to 17 miles) in the one minute between such a reverse course and Little's 911 call reporting the crash.

- The air traffic controller. Investigators believe the target that controller Jesse Fisher was tracking on his radar scope down to a 12-mile range was the computerized prediction of the flight path for an airplane which already had crashed. Even though Fisher was telling the crew to descend to 3,000 ft. when the radar returns showed the aircraft below 1,000 ft. just two seconds later, Dunham and other investigators think the explanation is straightforward. "The situation was unraveling; the airplane was descending like a rock," he said.



Crash investigators believe the accounts of two witnesses flying in the vicinity, at 1,000 ft. and 2,000 ft. respectively, support a crash scenario where the airplane impacts at 14:13:42. The Chinese student pilot, flying almost due north, said the crash occurred at his 2 o'clock position. *Source: NTSB*

For all of these reasons, investigators believe the scenario they have presented is amply supported by the data. "It's impossible for this airplane to have wallowed around in the sky from 12 miles back out to the crash site at 17 miles," Loeb declared.

The cause of the fire

One of the other issues critics have raised is the possibility that an electrical fire was the initiating event, to which the illegally stowed oxygen canisters in the forward cargo hold contributed. "We are convinced the fire was not electrical in nature," Loeb declared.

He explained that "electrical problems would have been evident *way* before pandemonium broke out in the cabin."

"We would have gotten indications (of electrical failures) in the cockpit, and we didn't," he said.

Given the voracious rate at which this fire burned, Loeb said "you needed an accelerant (*sic*), and the oxygen canisters provided the accelerant." It is important to note, he added, that once the electrical problems and fire or smoke were noticed, frantic shouts from the cabin quickly followed, indicating that the fire was already well developed.

On the other hand, the plane was experiencing electrical problems throughout the day of the accident. Further, the crew did report massive electrical failures ("We're losing everything") and had decided to return to Miami moments before there was any indication of fire or smoke.

Regarding the oxygen canister tests conducted at the FAA's William J. Hughes Technical Center in New Jersey, Loeb said those trials were intended only to demonstrate "if you kicked one off, how fast would a fire develop?"

"We were looking to see if it took a minute and a half or two hours," he added. The results of those tests, showing the temperature rocketing up sharply after hovering at less than 100° F for about 12 minutes, should not be taken too literally. The test compartment was that of a DC-10, about five times bigger than the forward hold on a DC-9. Investigators do believe, although they cannot prove, that a canister was initiated when the belly hold was loaded, and not during takeoff.

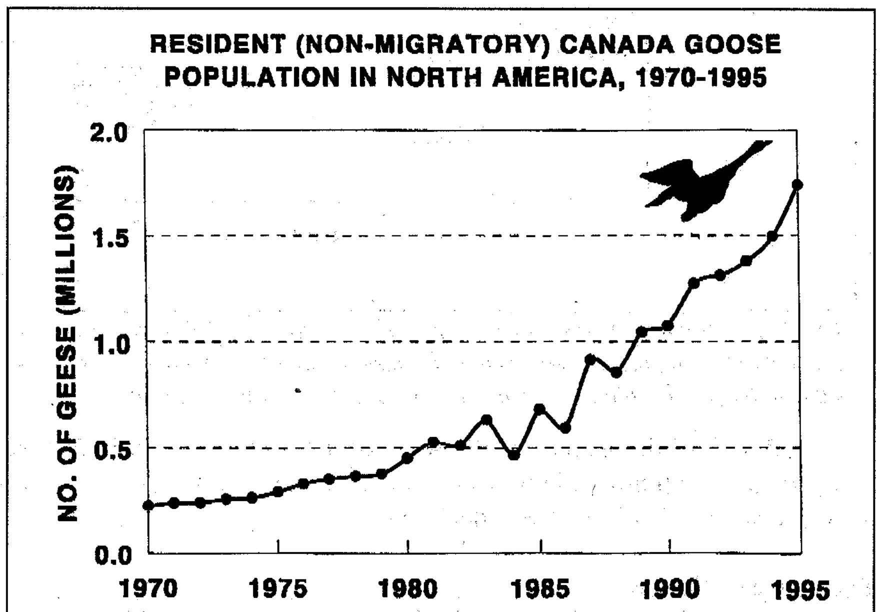
They fervently maintain that had the airplane been equipped with smoke detection and fire suppression equipment, the crew most likely would have had an indication of a problem in the belly hold before takeoff and could have aborted the flight. Indeed, the liner in the cargo hold, intended to contain any fires, may have prevented heat, smoke or flames from penetrating into the cabin or cockpit. Then, when the fire burned through the liner, the flames burst out of the cargo compartment, causing devastation analogous to water bursting through a fractured dam.

Investigators believe the fireproof liners provided a false sense of security throughout the airline industry, and that the active detection and suppression equipment now being installed in all belly holds represents a significant safety advance. That equipment could have saved the victims of ValuJet Flight 592 from a horrifying death by fire, but their sacrifice may prevent others from suffering a similar fate. ✈

Potential for Bird Strikes is Growing
An agenda for action

Bird strikes are a serious threat to aviation safety, and with more airplane activity at airports, and with more birds congregating near airports, wildlife management is becoming as important a safety issue as runway maintenance.

According to Sandra Wright, who maintains the FAA's bird strike data base at the Agriculture Department's Wildlife Research Center in Sandusky, Ohio, the problem is seriously under-reported. "By keeping track of the carcasses found around airports, compared to the number of bird strike reports we receive, we think the reports cover only 20 percent of all bird strikes," she explained in a telephone interview.



Populations of many federally protected bird species have increased dramatically and they have adapted to urban environments, making the risk of bird strikes at airports much greater.

Source: National Wildlife Research Center

With 3,200 such reports in 1997, multiplied by a factor of five, the number of bird strikes in the U.S. on civil aircraft could be as high as 15,000 annually (an average of more than 40 per day). The danger could be growing (*see box*).

According to a presentation by the Center's Richard Dolbeer, titled "Feathered and Furry FOD" (it includes the growing danger of ever more errant deer wandering around airports being hit by airplanes, too), birds have caused several recent near-disasters to commercial jetliners in the U.S.