



U.S. Department
of Transportation
**Federal Aviation
Administration**

Copy

A

Memorandum

77 Radar Issue

Subject: Information: AAL77 Flight Path Information

Date: September 17, 2001

From: Automation Manager, AOS-370.ZID

Reply to
Attn. of:

To: Air Traffic Manager, ZID-1 *amb*

Our office has been asked to provide analysis on the flight path of beacon code target 3743 (AAL77) from September 11, 2001. Specifically, we were asked to analyze any data available from the time of the loss of a transponder response (approximately 12:56:19Z, Point A) and the time that a plausible "primary" radar target was identified (approximately 13:04:32Z, Point B). Although our office holds no certification in analyzing radar data, we periodically compile and analyze this form of data in reviewing HOST/NAS performance.

Several of the specialists from this office, contractors and AF personnel conducted a manual analysis and plotting of radar data available. The results from this activity include a depiction of the route of flight that is supported by the data available and is deemed to be most likely by the participants. This attached depiction is a manual reconstruction of this analysis. This reconstruction is an approximation and is not intended to give the exact flight path.

At the time the transponder stopped responding, the radar sort box area for the flight was QHY (Higby, WV), which is a "beacon only" site and does not report "primary" radar data. Once the transponder stopped responding, QHY could not provide any radar data on the flight. The secondary source of radar data for this radar sort box area was QRI (Lynch, KY). QRI did not provide conclusive primary radar data in ascertaining the aircraft position or flight path.

The most useful data used in this activity was derived from data recordings of the QBE (Bedford, VA) radar site. QBE reported a radar reinforced beacon target up until the transponder stopped responding. At the time the transponder stopped responding, QBE reported a primary target that is consistent with the expected radar values and matches the route of flight, which would be expected, given the approximate location of the plausible "primary" radar target observed at Point B.

The approximate location of the plausible "primary" radar target is derived from the SATORI analysis and other supporting data, which indicate a "primary" radar target displayed to the Air Traffic Control Specialists at Point B of the depiction. The availability of a "primary" target display to the ATCSs at Point B is likely the result of better data being available from QRI radar at that point. Between the time of the lost transponder data (Point A) and the time of the "primary" target being displayed (Point B), no radar data was available to the Air Traffic Control Specialists. The reconstruction attached was only possible through the compilation of other radar data sources not ordinarily displayed to the controllers under these circumstances.

If you have any questions regarding this information, please contact me at extension 591.

A handwritten signature in black ink, appearing to read 'REM', followed by a horizontal line.

Robert E. Mount
Automation Manager
AOS-370.ZID

cc: William A. Orr, SMQA, Indianapolis ARTCC
Jim May, Manager, En Route Operations Support Branch, AOS-370

Information Paper AAL77 Flight Path

Subject: AOS-310 analysis of AAL77 Flight Path

Date: January 21, 2003. ²⁰⁰⁴

From: Stephen Snyder (National En Route Automation Host System Support, AOS-310)

To: Air Traffic Service Investigation Division, AAT-200

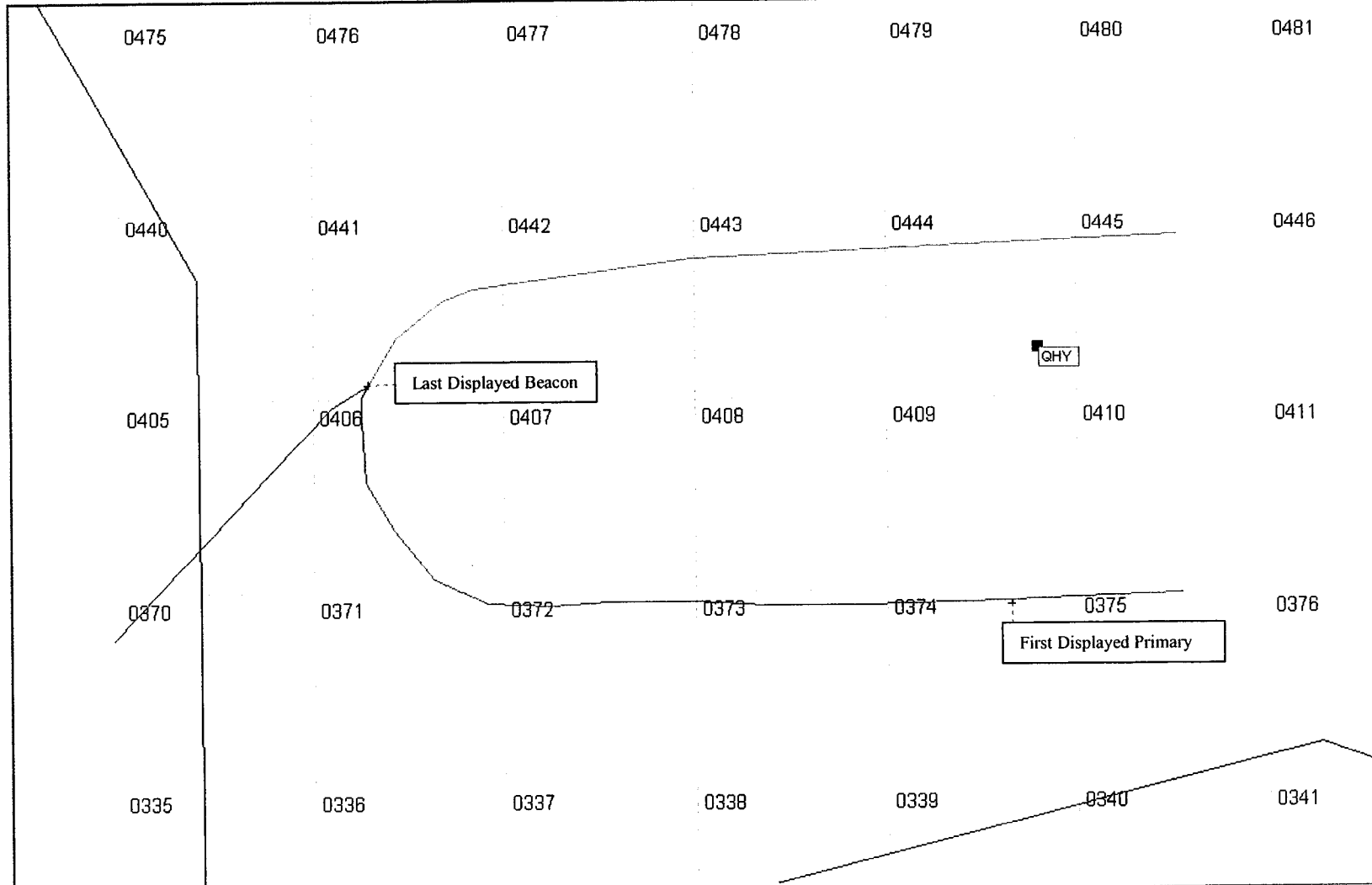
Background: AOS-310 has been asked to provide analysis on the flight path of AAL77, and validation of the initial analysis performed by Indianapolis Air Route Traffic Control Center (ZID ARTCC). Refer to the Memorandum titled: Information: AAL77 Flight Path Information, dated September 17, 2001.

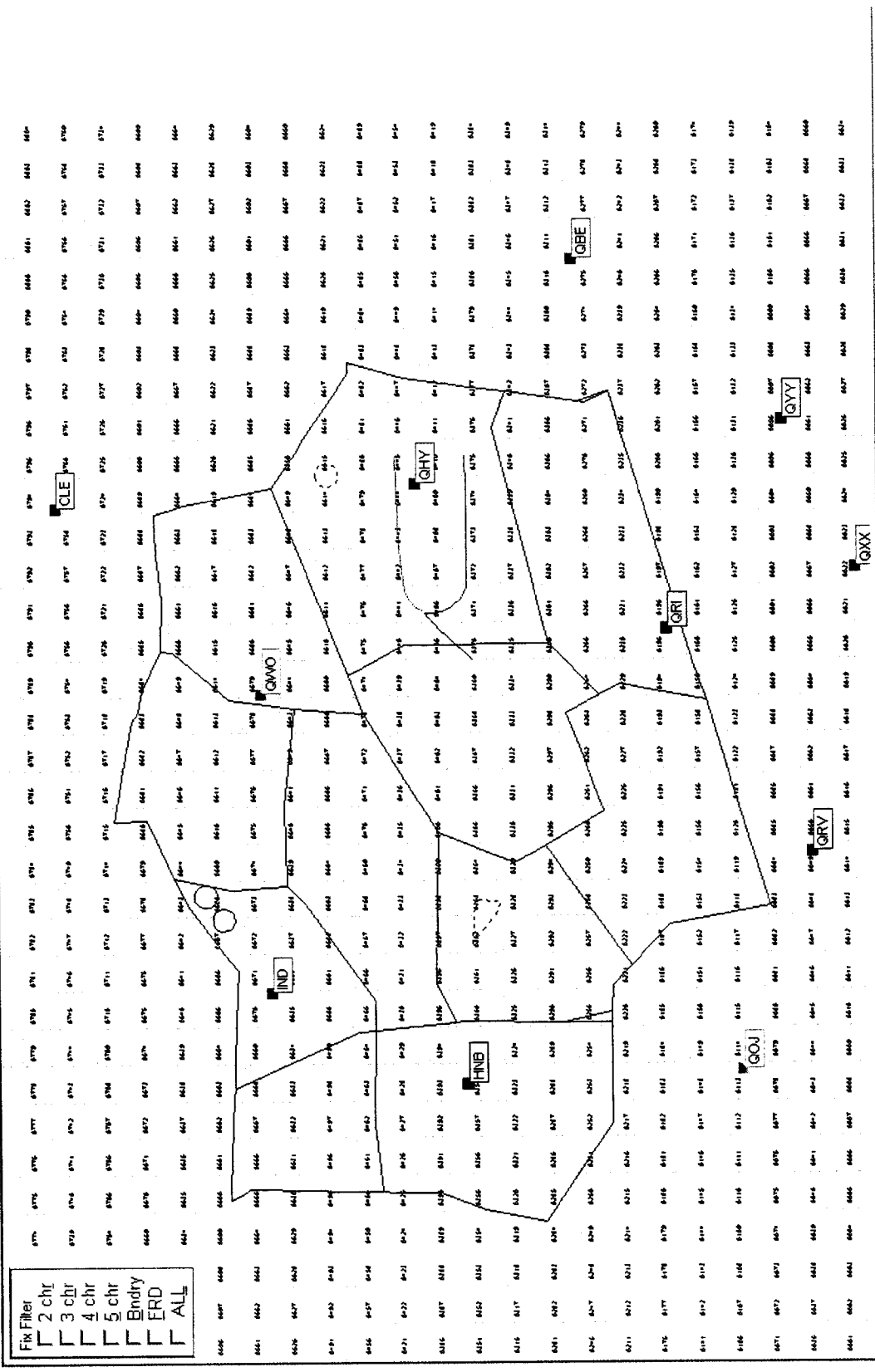
Conclusions:

1. A beacon target was last *displayed* at 12:56:19z.
2. A beacon target was last *received* at 12:56:30z. This target was not displayed due to Radar Sort Box (RSB) assignments.

Note: The beacon target received at 12:56:30z from the Supplemental Radar was not displayed because a return was expected from the Preferred Radar at 12:56:37z. Because no subsequent beacon target was reported, it can be assumed that the transponder was disabled between 12:56:30z and 12:56:37z.

3. The track position presented to the controller beyond 12:56:19z consisted of extrapolated track positions (i.e., 'coasting' track) based upon last known track position and heading. The presentation first indicated lack of Mode 3/a at 12:56:59z (per system requirements), and indicated the track to be in 'coast' status at 12:57:20z (per system requirements).
4. ZID's initial analysis and description of the radar reporting capability is accurate (refer to Memorandum of September 17, 2001). The flight path depiction appears to contain moderate positional inaccuracies; most probably the result of limited time constraints and rudimentary transformation techniques. It should be noted the ZID paper stated the depiction to be an "approximation and is not intended to give the exact flight path".
5. The flight path was re-plotted to reflect the results of the AOS-310 analysis to provide a more accurate depiction of flight position and situation display. The 'first displayed primary' was the first primary target presented for display that fell along the calculated flight path. This target was received from Lynch Radar and presented for display at 13:04:32z.
6. The following diagrams accurately depict the flight path from 12:46:58z through 13:06:30z:
 - a. The green path depicts the beacon track as received and presented to the display (12:46:58z through 12:56:19z)
 - b. The blue path depicts the trail of primary returns (12:56:45z through 13:06:30z). Note that the majority of these returns were not presented for display due to RSB assignments and lack of target reporting by the Preferred and Supplemental Radar.
 - c. The red path depicts the track display as presented to the controller beyond 12:56:19z
 - d. Each 'box' represents 256 square nmis.





- Fix Filter
- 2 chr
 - 3 chr
 - 4 chr
 - 5 chr
 - Endry
 - ERD
 - ALL

WITHDRAWAL NOTICE

RG: 148 Exposition, Anniversary, and Memorial Commissions

SERIES: 9/11 Commission: Team 8

NND PROJECT NUMBER: 51248

FOIA CASE NUMBER: 30441

WITHDRAWAL DATE: 07/08/2008

BOX: 00001

FOLDER: 0005

TAB: 1

DOC ID: 31180483

COPIES: 1 PAGES: 9

ACCESS RESTRICTED

The item identified below has been withdrawn from this file:

FOLDER TITLE: FAA GL Region

DOCUMENT DATE: 01/21/2004 DOCUMENT TYPE: Briefing Slides

FROM:

TO:

SUBJECT: Detail of Indianapolis ARTCC Surveillance Configuration

This document has been withdrawn for the following reason(s):

9/11 Law Enforcement Sensitive

WITHDRAWAL NOTICE

Kevin Shaeffer

From: Miles Kara
Sent: Thursday, January 29, 2004 2:30 PM
To: Kevin Shaeffer
Subject: FW: Mosaic

Kevin, FYI. I said we need to know when AA77 entered TRACON airspace, how far out they could pick it up, given the existence of Martinsburg, and how far out does Martinsburg extend TRACON coverage. Also, did AA77 ever actually enter ZDC airspace.

Miles

-----Original Message-----

From: shirley.miller@faa.gov [mailto:shirley.miller@faa.gov]
Sent: Thursday, January 29, 2004 1:25 PM
To: Miles Kara
Cc: anthony.ferrante@faa.gov; kshaeffer@9-11commission.giv
Subject: RE: Mosaic

Miles,
maybe you can tell us what information you need tomorrow on the feeds from Dulles and Martinsburg radars because I believe that we will need AOS assistance again. There is no AOS presence at Potomac TRACON.

"Miles Kara"
<mkara@9-11commis
<kshaeffer@9-11commission.giv>
sion.gov>
01/24/04 03:56 PM

To: Shirley Miller/AWA/FAA@FAA,
cc: Anthony Ferrante/AWA/FAA@FAA
Subject: RE: Mosaic

Shirley. Kevin and I had to stay over in Rome and got in early this morning, Saturday. Thanks for making Steve Culbertson available. It was a good session.

Kevin and I are available at a mutual agreeable time. Let us sort our schedules out on Monday.

We, Kevin and I also need to make a short trip to Potomac TRACON to interview Mark Masaitis. While there, we would like to meet with the most knowledgeable person about the feed from the Dulles and Martinsburg radars on 9/11, as well.

Miles

-----Original Message-----

From: shirley.miller@faa.gov [mailto:shirley.miller@faa.gov]
Sent: Fri 1/23/2004 9:38 AM
To: Miles Kara; kshaeffer@9-11commission.giv
Cc: anthony.ferrante@faa.gov
Subject: Mosaic

Miles/Kevin
answers to your questions from AOS below. I think it might be useful if we got together again next week and go over

the presentation we gave you last time that AOS has revised. Please let me know when might be a good time next week.

----- Forwarded by Shirley Miller/AWA/FAA on 01/16/04 09:09 AM

"Miles Kara"

Shirley Miller/AWA/FAA@FAA
Azzarello" <jazzarello@9-11commission.gov>, "Kevin Shaeffer"
<kshaeffer@9-11commission.gov>, "John Farmer" <jfarmer@9-11commission.gov>,
<dhyde@9-11commission.gov>
To: <mkara@9-11commission.gov>
cc: "John
"Dana Hyde"
Subject: Mosaic
01/16/04 08:29 AM

Shirley, pardon the piecemeal approach here, but my perspective is we have now established a continuous dialogue on this issue. We can document that thru e-mails.

Here is another analytic question.

Given:

- Each sort box has 4 radars that feed it, selected and prioritized based primarily on distance from the sort box

Each sort box has up to 4 radars feeding it.

- Unless there is a failure only the top two priority radars feed the box
- There were no failures that day

Has this been verified or is it known as fact? AOS-310 made no such determination.

- In all cases, with perhaps one exception (don't have chart in front of me) Higby was one of the two radars feeding the boxes thru which AA77 flew

There were no exceptions, Higby was the Preferred or Supplemental site for each RSB profiled. Also note that RSBs are not 'fed' by certain Radars; RSBs are calculated for each given Radar return as a precursor to selective rejection.

- Higby is beacon only

Therefore: Does the act of a controller to turn on primaries move Higby out of the equation and promote the tertiary radar in its place? Did the system allow for and provide for that or did Higby remain as one of the two radar feeds in all concerned sort boxes.

We are not sure what is meant by a controller 'turning on primaries'. A controller has no such ability. The Commission may be referencing the Primary Filtering key, or perhaps the manual request to track primary. Regardless, neither of these actions will result in promotion of subordinate radars.

Also, when a radar is declared failed, it is not necessarily replaced by the tertiary; it is replaced by the subordinate radar with highest ranking.

Kevin Shaeffer

From: Kevin Shaeffer
Sent: Friday, January 09, 2004 1:30 PM
To: Miles Kara (mkara@9-11commission.gov); Dana Hyde (dhyde@9-11commission.gov); John Azzarello (jazzarello@9-11commission.gov); John Farmer (jfarmer@9-11commission.gov)
Subject: FAA MTG 1/9/04
Importance: Low

Tracking:	Recipient	Read
	Miles Kara (mkara@9-11commission.gov)	
	Dana Hyde (dhyde@9-11commission.gov)	
	John Azzarello (jazzarello@9-11commission.gov)	
	John Farmer (jfarmer@9-11commission.gov)	
	Miles Kara	Read: 1/9/2004 1:45 PM
	John Farmer	Read: 1/9/2004 3:07 PM
	Dana Hyde	Read: 1/9/2004 3:26 PM

All,

I met with the FAA folks this morning (me only as Miles was at a doctor appointment). At the meeting Miles and I attended with Doug Gould and Ferrante yesterday, they told us an FAA radar expert, Steve Schneider, was in town and could talk to us if we thought it would be useful. Shriley, Ferrante, Gould and Schneider were present. SS is from FAA's "AOS-310", which is their national enroute maintenance division, also known as "Operational Support." SS's primary job involves analyzing and correcting "host" software problems, at the national level and at centers.

First, some background:

I used the 9/17/01 memorandum from ZID on "AAL77 Flight Path Information" as a reference in the discussion. For those who haven't seen it yet, it was produced in the immediate days following 9/11 by a verbal tasking from Doug Gould to ZID to figure out "why we missed the turn of AA77." Everyone needs to get a copy of this memo, and its attachments. I was told today by FAA that it is the only assessment done that even comes close to #1 below.

Yesterday, Dana, Miles and I put our heads together on mapping out our goals with the AA77 radar issue. It basically comes down to two parts:

1. Definitely assess all of the technical aspects as to why AA77 was "lost" after it began its turn to the east.
 - * The ZID memo concludes that ""Between the time of the lost transponder data (Point A) and the time of the "primary" target being displayed (Point B), no radar data was available to the Air Traffic Control Specialists. The reconstruction attached was only possible through the compilation of other radar data sources not ordinarily displayed to the controllers under these circumstances." ***The central aspect of the technical assessment is to answer why the above is true.***
 - * The ZID memo does provide some assessment as to why that is true, but there are some key questions remaining. Such as (*there will be more*):
 - i. Did 77 ever truly "disappear" from FAA's radar system? If it did, comprehensively explain exactly why. If it did, when and where exactly did it disappear and reappear? When it reappeared, which tower site(s) picked it up, and what sort boxes and centers did that

1/12/2004

site(s) feed into?

- ii. If it never disappeared from the system, what sort boxes received the primary radar data? What FAA centers received the primary radar data?
 - iii. If it never disappeared, did the tower(s) that had the AA77 primary radar data (QBE, "Bedford", or others) transmit that data to ZID? If not, why not? Where did the AA77 primary radar from Bedford or others get transmitted to? If the data was transmitted to ZID, why was it "unavailable" (ZID memo 9/17/01) to ZID's Air Traffic Control Specialists?
 - iv. Explain why, though AA 77 stopped transponding in QHY ("Higby") which was a "beacon only" site, other radar sites with primary radar capability did not report the AA77 primary track data?
 - v. The secondary source of radar data for the radar sort box area where AA77 turned around was QRI ("Lynch, KY"). Why did QRI "not provide conclusive primary radar data in ascertaining the aircraft position or flight path" as the ZID memo states? Was QRI the only other potential source of radar data where/when AA 77 made its turn (if the sort box area can take in up to 4 separate feeds, and we know QHY and QRI *did* feed the sort box area in question, what other two radar sites could possibly have been available?)
2. Reconstruct the entire eastbound flight path of AA77 (including the turn) and ascertain exactly who's airspace it traveled through (to include center airspace and center sectors).

- * Upon talking about it and thinking though it, D+M and I think that #2 above is much less relevant and very likely doesn't need to be done. Let's assume we complete that assessment, so what? What would we do with it? JF & JZ – *what do you think?*

Now, turning to today's meeting:

I laid out to them the technical assessment requirements (similar to the points in #1 above) we have. I asked them what organization within the FAA is best qualified to conduct the technical analysis of these AA 77 issues, and SS's response was "AOS."

FAA is willing and able to assist in completing #1 above ~ *from their side*. I certainly still feel strongly that we'll need to employ our own radar expert, or the NTSB as an independent organization with this expertise, to work with and verify what the FAA does.

As a starting point, SS has been tasked with ascertaining two items (to provide us next Thursday):

1. Identify all radar sites that were available on 9/11 to feed into the sort box area that the turn of AA 77 occurred in.
2. Identify and overlay all FAA radar sites within ~500mi of the sort box area.

Throughout the meeting, Ferrante, Gould, and SS mentioned facts and factors that are important and add "context" (as I like to say). I explained to them that, simply put, we want FAA's assessment of #1 above – including all of the contextual aspects they deem necessary to fully understand why AA77 was "lost."

Bottom line is that they are willing to provide us their "answer" so-to-speak as to why AA77 was lost - technical and contextual aspects presented in a way that will allow us and the public to understand "why". Importantly, I don't think this should be done by the FAA in a vacuum, with no communication or collaboration with us (and hopefully our Radar guy). In my opinion, this will be a "process" that we'll engage in with them.

That's were I left it. Thoughts and comments welcome.

1/12/2004

AA 77

1. Did 77 ever truly "disappear" from FAA's radar system?\
2. If it did truly disappear, comprehensively explain exactly why.
 - Who is best qualified to conduct the technical assessment? FAA (who exactly?), NTSB? *AOS - yes*
3. If it did truly disappear:
 - When and where exactly did it disappear and reappear?
 - When it reappeared, which tower site(s) picked it up?
4. If it never disappeared from the system, which sort boxes was the primary radar data transmitting to? What FAA centers are fed by that/those sort boxes?
5. If it never disappeared, why didn't the tower(s) (Bedford) feeding ZID transmit that data to ZID? If the data was transmitted to ZID, why wasn't it "unavailable" (ZID memo 9/17/01) to ATCS?
6. What program would be best suited to graphically reconstruct the entire flight path of AA 77 (with more accuracy than currently publicly available or the FAA's "Power Point" presentation)?

Detailed questions about the ZID Memo:

1. Explain QHY (Higby) being a "beacon only" site that doesn't report primary radar data. Even though AA 77 stopped transponding in Higby, why couldn't other radar sites with primary capability report the track data?
2. QRI (Lynch, KY) Secondary Source of radar data: "QRI did not provide conclusive primary radar data in ascertaining the aircraft position or flight path."
 - Why?
 - Was QRI the only other potential source of radar data where/when AA 77 made its turn?
3. "The approximate location...." – What does that mean?
4. "Between the time of the lost transponder data (Point A) and the time of the "primary" target being displayed (Point B), no radar data was available to the Air Traffic Control Specialists." – What does this mean?

> Sort box
is near.
4 feeds
but doesn't
always
have
4
could have
2 etc.

** Who in the FAA is responsible for radar equipment?

** What exactly is Atlantic City?