Central Intelligence Agency

Washington, D.C. 20505

28 February 2005

Captain H. Ray Lahr (ret.)
18254 Coastline Drive
Malibu, CA 90265

References: F-2004-00078
F-2004-01212

Dear Captain Lahr:

This concerns your 8 October 2003 Freedom of Information Act (FOIA) request and subsequent litigation (H. Ray Lahr v. National Transportation Safety Board and Central Intelligence Agency, Civil Action No. 03CV08023-AHM, filed 6 November 2003) for "all records upon which...[the CIA-produced video-animation of TWA Flight 800] flight path climb conclusion was based". Your request was processed in accordance with the FOIA, 5 U.S.C. § 552, et seq., and the CIA Information Act, 50 U.S.C. § 431. Our processing included a search for records in existence as of 8 October 2003.

We have completed a thorough search for records responsive to your request, located material, and have made the following determinations:

Enclosed at Tab A are 27 documents, which can be released in their entirety. With regard to MORI document #1147400, please be advised that this document may contain information which is or may be copyrighted and accordingly may not be copied or further disseminated without the permission of the copyright owner.

Enclosed at Tab B are 13 documents (MORI documents 1176341-1176345, and 1176347-1176354), which can be released in segregable form with deletions made on the basis of FOIA exemptions (b)(3), (b)(6), and/or (b)(7)(c). An explanation of exemptions is enclosed.

Enclosed at Tab C are two CIA-originated documents (MORI documents 1175601 and 1175603) which were located by the National Transportation Safety Board (Request #2004-0027) and referred to CIA for review and direct response to you (F-2004-01212). These documents can be released in segregable form with deletions made on the basis of FOIA exemptions (b)(3), (b)(6), and (b)(7)(c).

During our searches, we identified ten documents that require this Agency to consult with other federal agencies or entities. Coordination of four of these documents has been completed, and the documents are among those addressed in Tab B above. Once the consultation process on the remaining documents is complete, we will provide a supplemental response concerning those documents.

Also, during our searches, we located additional United States Government material that was not originated by CIA. This material appears to be relevant to your request, and has been referred to the originating agencies for review and direct response to you.

The CIA regulations governing administrative appeals are set forth at 32 C.F.R. § 1900.42. Those regulations state that no appeal shall be accepted if the information in question is the subject of litigation in the federal courts.

Sincerely,

Scott Koch
Information and Privacy Coordinator

Enclosures

Explanation of Exemptions

Freedom of Information Act:

(b)(l) applies to material which is properly classified pursuant to an Executive order in the interest of national defense or foreign policy;

(b)(2) applies to information which pertains solely to the internal personnel rules and practices of the Agency;

(b)(3) applies to information pertaining to the CIA Director's statutory obligations to protect from disclosure intelligence sources and methods, as well as the organization, functions, names, official titles, salaries or numbers of personnel employed by the Agency, in accordance with the National Security Act of 1947 and/or the CIA Act of 1949;

(b)(4) applies to information such as trade secrets and commercial or financial information obtained from a person on a privileged or confidential basis;

(b)(5) applies to inter- and intra-agency memoranda or letters which are predecisional and deliberative in nature, or consist of attorney work-product or attorney-client information;

(b)(6) applies to information, the release of which would constitute an unwarranted invasion of the personal privacy of other individuals; and

(b)(7) applies to investigatory records, the release of which could: (A) interfere with enforcement proceedings, (C) constitute an unwarranted invasion of the personal privacy of others, (D) disclose the identity of a confidential source, (E) disclose investigative techniques and procedures, or (F) endanger the life or physical safety of an individual.

Privacy Act:

(d)(5) applies to information compiled in reasonable anticipation of a civil action or proceeding;

(j)(1) applies to polygraph records; documents or segregable portions of documents, the release of which would disclose intelligence sources and methods, including names of certain Agency employees and organizational components; and documents or information provided by foreign governments;

(k)(1) applies to material properly classified pursuant to an Executive order in the interest of national defense or foreign policy;

(k)(2) applies to investigatory material compiled for law enforcement purposes;

(k)(5) applies to investigatory material compiled solely for the purpose of determining suitability, eligibility, or qualifications for Federal civilian employment, or access to classified information, the release of which would disclose a confidential source; and

(k)(6) applies to testing or examination material used to determine individual qualifications for appointment or promotion in Federal Government service, the release of which would compromise the testing or examination process.

SECTION A

26

26 Jan 98

1. Cur TBDs
   - Compute residuals ✓
   - Sum & Compute ✓
   - Plot alt ✓
   - Plot resid ✓
   - new wts? ✓
   - clean plots
     - mark explos ✓
     - clean ftoz
     - cog trim
     - AE to order complete
   - FITLINE

2. Print residuals to FTC1-4
   Source opening files for import! ✓

3. Print altplot ± σ ±3σ
   σ = 162 (but very variable)

4. Dir & HPN from expl.

HPN =	41.0612	73.7142
Expl	40.6485	72.6708
Δ =	.4127	1.0434
ratio =	.3955	1.0000

Check 2-3 HPN Δλ Δφ after expl vs ΔAZ ΔEL prob OK

Review
1. Plots for residuals & altitude

27

15 Jan 98

1. TBDs
   - plot alt + σ_s
   - program st. line fit to secondaries
   - put explosion position plots
   - plot residuals - plot as tracks

2. Run w wts = .03/.3
   RMS → .778 $r_1 \to .36^{+01}$, $r_3 \to 1.42^{-01}$
   Run w wts = .02/.3
   RMS → .575 $r_1 \to .37$, $r_3 \to 1.42$
   plot
   Bulk .03/.025

3. A/A at wp 0.001 deg ~ .06 nm 111110

Review
1. Ran prog w various weights. First pt "improved" with increasing weights on rng

14 Jan 88

1. Try cubic alt eqn

[35 alt]
[note- ~~quad should be (t-4)~~

[solve alt poly before t=0

$$H = a + bt + ct^2 + dt^3$$
$$a = 13700$$
$$b = 0$$
$$0 = a + ct_i^2 + dt_i^3$$
$$d = -(a + ct_i^2)/t_i^3$$

2. Change quadratic equation
to $TP = T - TPALTO$ ≈ 4.0

RMS → .863, b → 355, max alt = 15,700

If TPALTO = 1.0

RMS → .855, b = 404, max alt = 16,500

3. Put in cubic eqn

RMS → .865, c → 8.03 ±5.5, max alt = 14,600

$$H = a + ct^2 + dt^3$$
$$\ddot{H} = 2c + 6dt \qquad \ddot{H}(0) = 2c = 16\ ft/s^2$$
$$d \to -.2805 \Rightarrow \ddot{H}(49) = 16 - .28 * 49 = -6.6$$

4. Cubic to 35 sec

$$H = a + ct^2 + dt^3 \qquad t \le 35$$
$$H = H_{35} + \dot{H}_{35}(t - 35), \quad \dot{H}_{35} = 2ct_{35} + 3dt_{35}^2$$

$H(49) = 0 \Rightarrow$

$$0 = a + ct_{35}^2 + dt_{35}^3 + (2ct_{35} + 3dt_{35}^2) * (t_i - t_{35})$$
$$0 = a + c[t_{35}^2 + 2t_{35}(t_i - t_{35})] + d[t_{35}^3 + 3t_{35}^2(t_i - t_{35})]$$
$$d = -[a + c(t_{35}^2 + 2t_{35}(t_i - t_{35}))]/[t_{35}^3 + 3t_{35}^2(t_i - t_{35})]$$

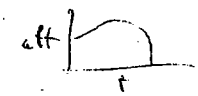
2

Run

RMS → .870, max alt = 14.5, c = 11.1 ± 7.3

$\ddot{H}(35) = 2c + 6d\,t_{35}$

$= 2 * 11.1 \mp 6 * .406 * 35 = -6.3$ m/s²



8 Great small curve - start at zero

RMS → .871

5 Return to quad front t=4

RMS → .863, b = 355 ± 162, max alt = 15.8

$c = -(a + bt_i)/t_i^2$

$= -(13700 + 355 * \cancel{45}\,45)/\cancel{45}\,45^2 = \cancel{-12.95}\ -14.65$

$\ddot{H} = 2c = \cancel{-29.4}\ -29.3$

$H = a + bt + ct^2$

$\dot{H} = b + 2ct$

Apogee time $= -b/(2c) = 355/\cancel{29.4}\,29.3 = \cancel{12.7}\ 12.1\ (+4)$

Apogee $= a + bt_a' + ct_a'^2$

$= 13700 + 355 * \cancel{13.7}\,12.1 \mp \cancel{12.55}\,14.65 * \cancel{13.7}\,12.1^2 = \cancel{14763}\ 15850$

+15 b = 355 + 162 517

$c = -(13700 + 517 * 45)/45^2 = -18.25$

$t_a = -b/(2c) = 517/(36.5) = 14.2$

$H_a = a + bt_a' + ct_a'^2 = \cancel{13700}$

$= 13700 + 517 * 14.2 - 18.25 * 14.2^2 = 17361$

−15 b = 355 − 162 = 193

$c = -(13700 + 193 * 45)/45^2 = -11.05$

$t_a = -b/(2c) = 8.7$

$H_a = 13700 + 193 * 8.7 - 11.05 * 8.7^2 = 14543$

6. **Results**

AZ biases

		INPUT	
JFK	−0.78 ± .1	−12.5	−13.3
ISP	+0.25 ± .2	−13.0	−12.7
HPN	−0.38 ± .1	−12.5	−12.9
RHD	−0.36 ± .2	0.0	−0.4

Distance from NTSP at t=0 to t=0

NTSB	40.6490	72.6708
Fit	40.6485	72.6708
Δ	.0005	

t .0012 {no mult by RAS}

↳ .072 ⊕ .072 cos 41

= .09

* 60 = .03

Speed

t	r	rc	Δ
−24.2	−2.616	−2.623	.007
−19.5	−2.100	−2.112	.011
−14.8	−1.607	−1.602	−.005
−10.4	−1.097	−1.124	+.027
−5.4	−0.591	−0.581	−.010
0.0	0.0	.005	−.005

Ave ≠ 0

$$[A^TA]^{-1} = \begin{bmatrix} .543708 & .030571 \\ .030571 & .002478 \end{bmatrix}$$ [22 Dec]

$$A^TR = [8.012,\ 142.6605]^T$$

$$\Delta a = [.005,\ 0.10856]$$

rms = .013

$$\sigma_b = \sqrt{.002478} * 0.013 = .00065 \quad *3600 = 2.3$$

Solve TB4
RMS → .8624, TB → −2.6 ± 0.6

Cross range deviation
From Fole 9, at 22.8, λ1 = 40 39 55 72 38 09
= 40.6653 72.6358
Existing str line 40.6587 72.631
Δ = .0080 .005
nm = .42 .23
.477

Pt/Pt uncert in alt determ before t=0
In current setup, solve Alt 1-6
RMS → .808 conv?
Alt → 6908, 5149, 8605, 15624, 14478, 14344
± 5997 7513 5219 3242, 3339, 3816
note b = 60

Add Alt 7-12 + conv out poly eqns
RMS → .779 nc #iter = 17 vs 7
RMS → .756
note Alt - very different
Alt → 7852, 12787, 12919, 10594, 2707, 4018,
4930 3552 4235 2872 18580 808

Review
1. Put in code for cubic alt. More realistic alt accel, but worse fit.
2. Returned to quadratic fit as standard. Calculated 1σ apogee range
3. Revised paper with new standard

13 Jan 98

1. 3 Separate alt histories

Flat: 13700, 13700, 13600, 13,500, 13300, 13000,
12000, 10000, ~~[illegible]~~ 8000, ~~[illegible]~~ 5000 2000, 0

Dropping 13500, 12000, 10000 8000 6000 5000,
4000 3500 2000 2500 1500 0

Run as (23Dec) ~~[illegible]~~ RRS → .8062

Put in flat alt: RRS → .8029

Put in dropping alt: RRS → .8172

$a+bt+ct^2$ $a=13800$

$a+bt+ct^2 = 0$ at $t=50$

$a+bt_i = -ct_i^2 \Rightarrow c = -(a+bt_i)/t_i^2 = -a/t_i^2 - b/t_i$

2. Data wt .030, .25 / original alts

RMS → .8533

3. If $t > 4$,

$A = a + bt + ct^2$

$a = 13700$ ft

$b = 0 \Rightarrow c = -a/t_i^2 - b/t_i$ $t_i = 49$

$= -13800/49^2 = -5.74761$ X

Run with ALTB = 0 (no setting)

RRS → .8718

Solve ALTB RMS → .834

↳ → 413 ± 138

2

Calc alt - print FT05
Reset ALTP(2) → 13700
RMS → .831

4. Retbnd in 1 HPNt at 00.44
RMS → .8537

5. ~~Plots + Prints~~ Solve TB - JFK, 07
RMS → .8537 TB → -.8 ± .3

6. Plots + Prints
FT08, 9 -
latlon, fort71-4, fort51-4
redo 72.
near rvt, fort2

rlogin gooty
lp -dmprint

fort.71 fort51
~~18, 19~~ 21 43 21/43
67

Review
1. Tried putting in 3 alt profiles. Best possible between rising + flat
2 Changed data weights to 0.03 + 0.25
3. Put in polynomial alt (quad). Retbnd in 1 HPNpt
4. Solved JFKTB. Est = -0.8 ± 0.3 with essentially no improvement

8 Jan 98

1. Fix code for grid range in output
   Replot RVT

New run
- diff wts
- put in one HPN?
- New alt history?

2. Put in code for sight line from OBS

			λ_0	λ_0	
Front	10.2	-102.0	40.6481	72.6704	solved for
~~Dp 1~~	~~8.3~~	~~-99.8~~			
t=0	9.68	-102.6	40.6478	-72.6727	

Diff calc with # 2.25 gos in as 4.0
2.2547 gos in as 4.0752
Must be DP
[Check this to ROT → 90. + DP]

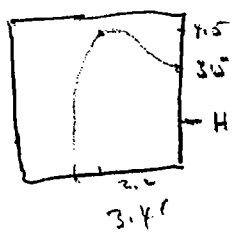
90. − AZ = AZ_{int}

90 − AZ_{INT} = AZ

Window − 15 ft

13.5 → 17.5 *15'

→ 3.5 → 4.5



270 − AZ

0 = 192

Review
1. Fixed error in calcd ground range for FORT.9 & replotted
2. Put in code for AZ/EL diff & wrote & plotted (with fixed alt-to 46 kft)
3. Possible changes for new run.
   - Data weights (?)
   - Put back one HPN (neg). (Are all pos plots in?)
   - New altitude history (seems to 3 profiles)

7 Jun 98

1. For map plot, use
   fort.50 (d, l, nodes)
   radar.loc.
2. Diff FTD9 vs FTD8 - rng? - see change

Review

1. Setup mapplot
2. Identify error in output of range-range from P_0 vs range along flightpath

6 Jan 98

1. Plot all rng data vs calc
   Put input files ntsb.jfk, ntsb.isp, ntsb.hpn, ~~nt~~ noy44.dat
2. Add other hits to noy44.dat /plot
3. Try JFK lower, RMS → .851 vs .806.
   Return to Yypre
4. AZ biases.

$$AOBS = 90 - (AZ_0 + MAG)$$

~~COMPUTE=~~

$$AOTRUE = AOBS - BA$$
$$= 90 - (AZ_0 + MAG) - BA$$
$$= 90 - (AZ_0 + MAG + BA)$$

	AZ	MAG	BA	
JFK		−12.5	−.85 ± .1	= −13.3 ± 0.1
ISP		−13.0	.3 ± .2	= −12.7 ± 0.2
HPN		−12.3	−.3 ± .1	= −12.6 ± 0.1
RHD		0	−.5 ± .3	= −0.5 ± 0.3

[Also for lower]

Review

1. Put "bad" data for RHD in & resulted out. Plotted all range data vs computed range.
2. Made one run with "JFK lower" - RMS increased
3. Table of AZ biases for writeup

34

5 jun 98

1. Put subroutine PRNODE in OUTPUT
Put in subroutine PRRALL
~~[clsort.2]~~
Set up sort71. splt for all data

- print sort
- alter plot 7x
- (able ~~plot~~ print
(doc
- more ~~HEAT~~ RHO?

Review
1. Modify format for more output.

23 Dec 97

1. How far left did it go?

From run 971222b

Setup neg AZ to ~ 22.8

$\Lambda = -72.632 \quad \lambda = 40.660$

At 22.8, (From FTOS) 40 39 53 / 72 38 07

$= 40.6647 \quad 72.6353$

$\Delta\Lambda = \cancel{.033}\ .003 \quad \Delta\lambda = \cancel{.025}\ .065$

$= \cancel{1.50\ nm}\ 0.14 \quad \cancel{1.50\ nm}\ 0.30$

RSS = [redacted] 0.33 nm (2000 ft)

2. Note error - JFK main 1* → 2*

ISP ranges 11.27 21.35] .26

16.22 21.609] .40

20.91 22.016

Run to alternate JFK main (quadrant to 35 sec

RMS → .733

Put back in HPN #2

24.04 54.203 -26.108

RMS → .749

Shift ISP #2

RMS → .717 NC - large alt diff / P1 → .16

Put back in ISP #2 → .749

Take out alt solve - RMS → .806 → quad to 40 sec RMS → .810, NC

→ Pilots: ~~17, 14, 13, 6~~ / 19, 16, 13, 7

2

2. Recalc over ~~[illegible]~~ speed range

t	r	c	Δ	ΔT/Δt
-24.2	-2.600	-2.601	.001	398
-19.5	-2.084	-2.100	.016	367
-14.8	-1.601	-1.599	-.002	375
-10.1	-1.112	-1.097	-.015	383
-5.4	-0.611	-.596	-.015	406
0	0	-.020	+.020	

$$[A^TA]^{-1} = \begin{bmatrix} .543708 & .030571 \\ .030571 & .00247 \end{bmatrix}$$

$$A^TR = \begin{bmatrix} -8.008 \\ 141.783 \\ 144.665 \end{bmatrix}$$

$$\Delta\bar{a} = [.019, .10535]$$ 20 .10667

↳ ~~379~~ 384

~~Comp = .02~~ rms = ~~0.023~~ 0.014 nm [~~*0.8~~] ? ~~→ .018~~

$\sigma_b = \sqrt{.00247} * .014 = .0009$ nm/s (.050)

↳ ~~*.018~~ 3600 = ±3.9 m/s 2.5

3 initial pt diff

.0005, .0004 = .048, .018 = .051 nm / = 311 ft

±.0015 ±.0018 = ±.090 / ±.082 nm

Review

1. Calculated deviation from pre expl path to b/f - using 97/7223 plots. Deviation is ~ 0.33 nm
2. Spent more time. Corrected JFK main choice Runs with Quadratic approach to 35 sec, then constant Take out all others for alt. RMS → .806. Plot & Print

19 Dec 97

1. Check selected HPN pts again
$\Delta R = .07$ km – .0015°

Put in HPN #7
RMS → .778
Solve TB4
RMS → .777 / → -2.6 ± .6
Take out HPN + #2 / no TB
RMS → .753
Take out HPN neg #3+4
RMS → .667

Review
1. Found another HPN hit. Put it in – fit well
2. Solved for TB4. Value fit was -2.6 (vs -2.8) ±0.6. ~~Take~~ NTSB value of -2.8 is probably best to use
3. Took out HPN (pos) #2, + HPN (neg) #3, 4. No big change in results.

18 Dec 97

1. In OUTPUT

C Calculate calc pos at radar/obs time
CALL DXDY(DX, DY, RPATH, TPATH, AZFPD, ...)
LATC = LATO + DY/60.
LONC = LONO - DX/60/DCOS(LAT*CDR)
~~LONC = -LONO~~

- ch main ✓
- edit out? ✓
- wrong pos at list
- solve PB4 ✓

4th line # col ✓
-72.74 - -72.62 / 40.62 - 40.68
in 51 = 19✓/52 = 16✓/53 = 14✓/54 = 9

Review

1. Finished plots for 16 Dec runs.
2. Put in code for 2 obs vs computed position for each radar.
3. ~~Solve for~~ Started looking for pts to edit.

16 Dec 97

1. Alter usnrp44.raz for input in FORT19
   5 pts starting at 30:10
   3 pts starting at 30:34
   Set NOBSNT(4) = 2 30:48/48/51/46
   t_{n_0} = -24.2 12.3 - 24.2 = 48.1
   Put in RHD 2nd
   Time bias - for JFK, ISP, HPN → 2nd day →
   Δt should be -4.7
   from bef to aft, Δt -4.9 ⇒
   scale to (B(=-.25) from before)
   Run. RMS → .756
   Fix alt 62 RMS → .777
   Add alt 72 RMS → .767 → 2624 ± ~10K (-6K)
   Back to fix alt 62
   [For plots
   Lat lon - put in all RHD
   [Note pass over in RHD interp
   - no - due to alt variations.]

Review
1. Put in 2 RHD 2nd day pts test run. Corrected for bias error - ie internally reset corrected 2nd day times back to biased times. With current setup, 2nd altitude (#62) is bad. Fixed it & solved for others. Started plots.
2. Note that lat/lon interpolated to common times does not fall on line between data at lat/lon due to altitude variations

12 Dec 97

1. Current FP08 → w/ch all calts
Look at 1st before + 1st after event

	ΔR	ΔAZ	t	
JFK bef	-.001	.13	11.88	4.87
JFK aft	+.003	-.04	16.75	
ISP bef	-.057	-.03	11.27	4.95
ISP aft	.032	-.01	16.22	
HPN bef	.003	-.09	9.69	4.96
HPN aft	.006	-.07	14.65	

~~RAD aft~~ Note pos .25 sec bias before vs after

2. File from Mike O'R - FACSFAC.RAZ
→ usn rp44.raz
→ FORT.19 +66

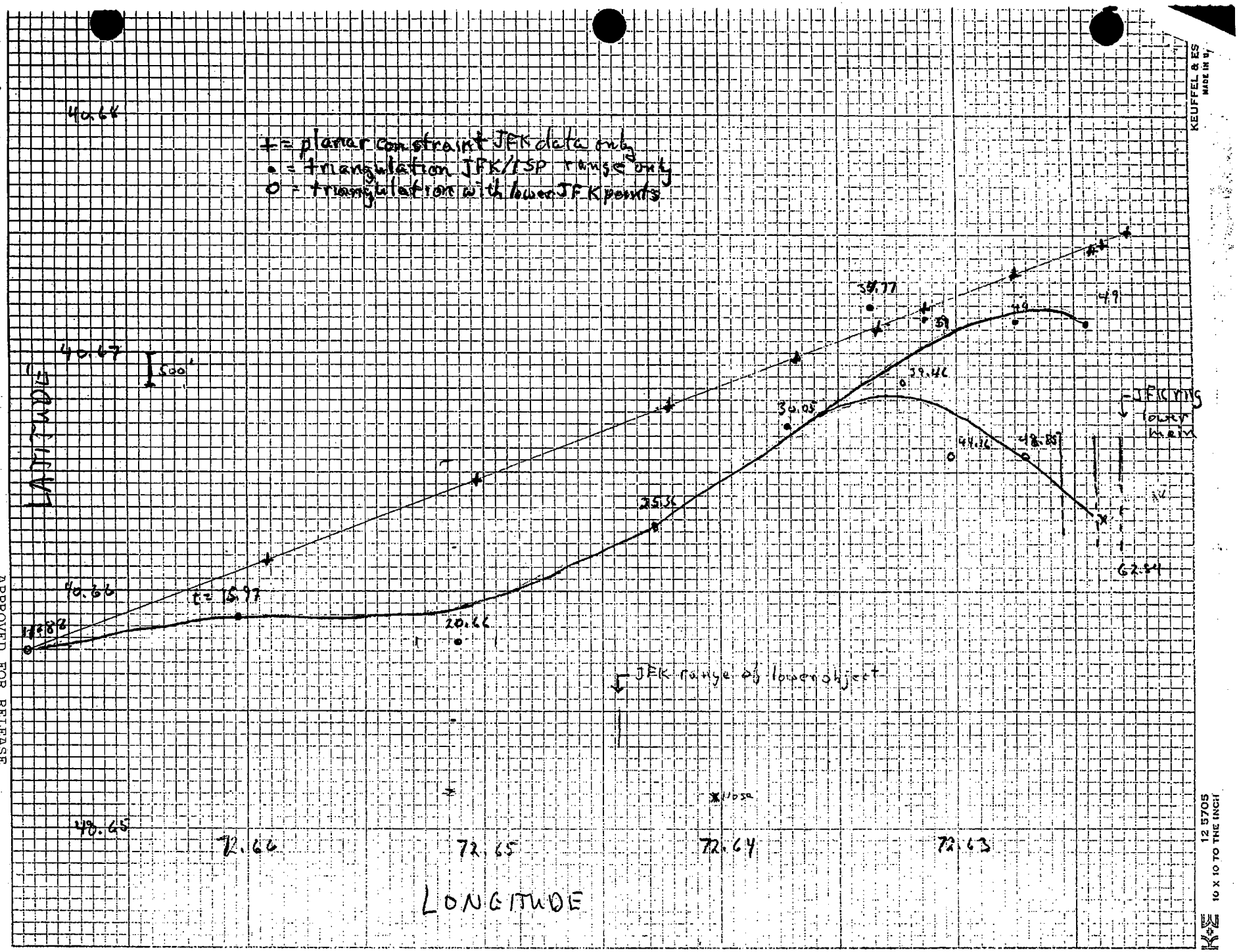
[pre event in FT16-19]
↳ not required in script

Note: one pt missing at 9.6 31:0

Review
1. Looked at residuals of 1st pt before + after event
2. Noted 0.25 bias in bef/aft data
3. Stated conversion of data from Mike from Fo6 FACSFAC.RAZ to input.

Output files

fort. 1	Temporary output
fort. 2	λ, Λ from interpolated radar data to node times (Fig 13?)
fort. 3	λ, Λ from bruise ← fort. 4 alt vs t at nodes
fort. 8	CSQ output
fort. 9	Basic location output tables
fort. 10-13	Typed in XY data
fort. 14	RADAR system data
fort. 16-19	Data from MOR files - secondaries
fort. 20	CSQ input file
fort. 21-24	Data from Charles P files - primaries
fort. 33	Data from Charles P files - "
fort. 50	λ, Λ of node points
fort. 51-4	λ, Λ of radar pts + λ_c, Λ_c of traj at same time (Fig 7 & 10)
fort. 61-4	t vs observed range & computed range from each radar - main only (4 rsd(s))
fort. 71-4	t vs obs + computed range from each radar - all data - primary only (Fig 2-5)



24A

```
C:\WINDOWS>e:

E:\DACS>cd\for

E:\FOR>dir lats*

 Volume in drive E is DRIVE E
 Volume Serial Number is 332C-1908
 Directory of E:\FOR

LATS     EXE        46,650 04-04-92   3:49p
LATS     FOR         8,149 01-24-92   1:43p
LATSN91  EXE        46,650 06-19-91   8:29a
LATSN91  FOR         8,149 06-19-91   8:29a
LATSFEET EXE        46,710 02-18-92  10:36a
LATSFEET FOR         8,199 02-18-92  10:34a
        6 file(s)        164,507 bytes
                     945,356,800 bytes free

E:\FOR>
```

```
      PROGRAM LATSn91
C
C     THIS PROGRAM CALCULATES DISTANCE BETWEEN TWO LAT/LONG DATA
C     POINTS AND CONVERTS TO A LAMBERT CONFORMAL CONIC PROJECTION
C     X-Y COORDINATE SYSTEM, AS USED ON AERONAUTICAL MAPS
C
C     USE ONLY FOR NORTHERN HEMISPHERE
C
C     REFERENCE "MAP PROJECTIONS USED BY THE USGS, GS BULLETIN 1532"
C     PAGES 101 TO 109
C
C     SAME AS LATS EXCEPT ADDS TOTAL TIME FOR GRAFTOOL
C
      CHARACTER*80 BUF
C
      DIMENSION X(100),Y(100),ALT(100),IH(100),MIN(100),TSEC(100),
     +DPLATD(100),DPLATM(100),DPLATS(100),DPLOND(100),DPLONM(100),
     +DPLONS(100),DPLATRAD(100),DPLATDEG(100),DPLONRAD(100),
     +DPLONDEG(100)
C
      REAL ORNSFL,OREWFL,DPNSFL,DPEWFL
C
      KLOKEY = 0
5     CONTINUE
C
C     SET LAT/LON FLAGS
C
      ORNSFL=+1.0
      OREWFL=-1.0
      DPNSFL=+1.0
      DPEWFL=-1.0
C
C
      PRINT 555
```

```
555   FORMAT(//,' WARNING, USE ONLY FOR NORTHERN HEMISPHERE!!')
      PRINT 10
10    FORMAT(//,' ENTER INPUT FILENAME :    '$)
      READ(*,20)BUF
20    FORMAT(A)
      OPEN (UNIT=3, FILE=BUF, STATUS='OLD')
      PRINT 30
30    FORMAT(' ENTER OUTPUT FILENAME :    '$)
      READ (*,20)BUF
      OPEN (UNIT=9, FILE=BUF, STATUS='UNKNOWN')
      IF (KLOKEY . EQ. 1) GOTO 43
      PRINT 40
40    FORMAT(' ENTER ORIGIN LATITUDE AND LONGITUDE :    ',/,
     +' IN DD,MM,SS,DD,MM,SS  :  '$)
      READ(*,50)ORLATD,ORLATM,ORLATS,ORLOND,ORLONM,ORLONS
50    FORMAT(6F10.0)
49    PRINT 52
      PRINT 53
      PRINT 54
      PRINT 55
      PRINT 56
52    FORMAT(//,' ENTER AERO CHART STANDARD PARALLELS: ')
53    FORMAT(//,' FOR ALASKA AND OTHER PARALLELS                TYPE 1: ')
54    FORMAT(' FOR NORTHERN STATES ----- 41:20 AND 46:40   TYPE 2: ')
55    FORMAT(' FOR MID STATES ---------- 33:20 AND 38:40   TYPE 3:  ')
56    FORMAT(' FOR SOUTHERN STATES ----- 25:20 AND 30:40   TYPE 4:  '$)
      READ(*,57)LATREF
57    FORMAT(1I1)
      IF(LATREF.GT.4) GOTO 49
58    FORMAT(//,' ENTER STANDARD PARALLES FOR CHART: DEG,MIN,
     +DEG,MIN: '$)
59    FORMAT(4F20.0)
C
      IF(LATREF.EQ.2) THEN
        REF1DEG = 41.
        REF1MIN = 20.
        REF2DEG = 46.
        REF2MIN = 40.
      ENDIF
C
      IF(LATREF.EQ.3) THEN
        REF1DEG = 33.
        REF1MIN = 20.
        REF2DEG = 38.
        REF2MIN = 40.
      ENDIF
C
      IF(LATREF.EQ.4) THEN
        REF1DEG = 25.
        REF1MIN = 20.
        REF2DEG = 30.
        REF2MIN = 40.
      ENDIF
C
      IF(LATREF.EQ.1) THEN
        PRINT 58
        READ(*,59)REF1DEG,REF1MIN,REF2DEG,REF2MIN
      ENDIF
      REF1SEC = 0.
      REF2SEC = 0.
```

— set to 0 [illegible]

λ_0 Λ_0

read origin

Northern 4120 - 4640

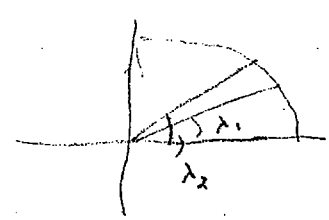
mid 3320 - 3840

ref lats

South 2520 - 3040

read ref

```
C
43    CONTINUE
C     FIND WHICH QUADRANT THE ORIGIN AND DATA POINTS ARE IN
C
      PRINT 77
77    FORMAT(//, ' SET FOR NORTH AND WEST, IF OK TYPE Y OR y: '$)
      READ(*,20)BUF
      IF(BUF.EQ.'Y'.OR.BUF.EQ.'y') GOTO 755
                  +1      -1      +1      -1
C     CALL NOSSET(ORNSFL,OREWFL,DPNSFL,DPEWFL)   no to North+West
                                                 sent flags if origin & data E or S
C
755     CONTINUE
C
C     CHANGE ORIGIN LATLON INTO RADIANS, ETC.
C
      ORLATDEG = ORLATD + ORLATM/60. + ORLATS/3600.
      ORLONDEG = OREWFL * (ORLOND + ORLONM/60. + ORLONS/3600.)
      CALL RADIAN(ORLATDEG,ORLATRAD)
      CALL RADIAN(ORLONDEG,ORLONRAD)
C
C
C     CHANGE REFERENCE PARALLES INTO RADIANS, ETC.
C
      REF1DG = REF1DEG + REF1MIN/60. + REF1SEC/3600.
      REF2DG = REF2DEG + REF2MIN/60. + REF2SEC/3600.
      CALL RADIAN(REF1DG,REF1RAD)                    ref lats -> rad
      CALL RADIAN(REF2DG,REF2RAD)
C
C
C     READ IN THE DATA FILE USING A LOOP
      N=1
C                          alt
60    CONTINUE                                        time
      READ(3,70,END=110)ALT(N),IH(N),MIN(N),TSEC(N),
     +DPLATD(N),DPLATM(N),DPLATS(N),   - Δλ
     +DPLOND(N),DPLONM(N),DPLONS(N)    Δλ ?
70    FORMAT(1F20.0,2I10,7F10.0)
      N=N+1
      GOTO 60
110   CONTINUE
C
C     CALCUALTE CONSTANTS
C
      RA = 3444.054   radii Earth in nm
      RB = 3432.458
      E2 = (RA**2. - RB**2.)/RA**2.     e^2
      E = SQRT(E2)                      e
      COS1 = COS(REF1RAD)   cos λ1
      SIN1 = SIN(REF1RAD)   sin λ1
      COS2 = COS(REF2RAD)   cos λ2
      SIN2 = SIN(REF2RAD)   sin λ2
      SIN0 = SIN(ORLATRAD)  sin λ0
      XM1 = COS1/((1-E2*SIN1**2)**.5)
      XM2 = COS2/((1-E2*SIN2**2)**.5)
C
      ANGREF = 45.                  45° -> rad
      CALL RADIAN(ANGREF,ANGRAD)
      XXX1 = ANGRAD - REF1RAD/2. = (90° - λ1)/2  (rad)
      XX1 = TAN(XXX1)                            = tan[(90-λ1)/2]
      YY1 = ((1-E*SIN1)/(1+E*SIN1))**(E/2.) = [(1-e sin λ1)/(1+e sin λ1)]^(e/2)
```



```
      T1 = XX1/YY1

      XXX2 = ANGRAD - REF2RAD/2.
      XX2 = TAN(XXX2)
      YY2 = ((1-E*SIN2)/(1+E*SIN2))**(E/2.)
      T2 = XX2/YY2

      XXX0 = ANGRAD - ORLATRAD/2.
      XX0 = TAN(XXX0)
      YY0 = ((1-E*SIN0)/(1+E*SIN0))**(E/2.)
      T0 = XX0/YY0

      XN = ORNSFL * (ALOG(XM1)-ALOG(XM2))/(ALOG(T1)-ALOG(T2))
      F = XM1/(XN*T1**(XN))
      RHO0 = ORNSFL * RA * F * T0**XN

      CONVERT THE DATA POINTS TO RADIANS

      NPTS=N-1
      DO 200 I=NPTS,1,-1

      DPLATDEG(I) = DPLATD(I) + DPLATM(I)/60. + DPLATS(I)/3600.
      DPLONDEG(I) = DPEWFL * (DPLOND(I) + DPLONM(I)/60. +
     +DPLONS(I)/3600.)
      CALL RADIAN(DPLATDEG(I),DPLATRAD(I))
      CALL RADIAN(DPLONDEG(I),DPLONRAD(I))

      CALL DIST(ANGRAD,DPLATRAD(I),E,XN,F,RA,DPLONRAD(I),ORLONRAD,
     +RHO0,ALT(I),X(I),Y(I),DPNSFL)

200   CONTINUE
      DO 400 N=1,NPTS
      TOTTIM = MIN(N) * 60. + TSEC(N)
      WRITE(9,300)IH(N),MIN(N),TSEC(N),X(N),Y(N),ALT(N),TOTTIM
300   FORMAT(2X,2(I3','),3(F10.2',')1F15.2',',F8.2)
400   CONTINUE

1100  CONTINUE
      CLOSE (3)
      CLOSE (9)

      LOOP THE PROGRAM AROUND FOR ANOTHER SWATH THRU?
      WRITE(*,1110)
1110  FORMAT(///,
     +'  ENTER LETTER OF YOUR CHOICE <A> OR <B> : ',/,
     +'       A. CONTINUE PROGRAM      ',/,
     +'       B. END PROGRAM           ',/,
     +'  PLEASE ENTER CHOICE HERE:  '$)
      READ(*,1111)CONTLE
1111  FORMAT(1A1)
      If (CONTLE.EQ.'A'.OR.CONTLE.EQ.'a') then
5432  WRITE (*,1112)
      WRITE (*,1114)
1112  FORMAT (' USE OLD ORIGIN OR ENTER NEW ORIGIN')
1114  FORMAT (' 1) OLD ORIGIN OK  2)  ENTER NEW ORIGIN: '$)
      READ (*,1113) KLOKEY
1113  FORMAT (1I1)
      IF (KLOKEY . NE . 1 . AND . KLOKEY . NE . 2) GOTO 5432
      GOTO 5
      ELSE
```

$$t_1 = \frac{\tan[(90-\lambda_1)/2]}{\left[\frac{1-e\sin\lambda_1}{1+e\sin\lambda_1}\right]^{e/2}}$$

$$t_2 = \frac{\tan[(90-\lambda_2)/2]}{\left[\frac{1-e\sin\lambda_2}{1+e\sin\lambda_2}\right]^{e/2}}$$

$$= \quad \text{"} \quad \text{"}$$

$$x_n = \frac{\ln\left(\cos\lambda_1/(1-e^2\sin\lambda_1^2)^{1/2}\right) - \ln\left(\cos\lambda_2/(1-e^2\sin\lambda_2^2)^{1/2}\right)}{\ln(T_1) - \ln(T_2)}$$

$\Delta\lambda$ (rad) from origin?

```
      ENDIF
C
1500  CONTINUE
      END
C
C
C
      SUBROUTINE RADIAN(ANGLIN,RADOUT)
      REAL*8 DEG2RAD
C     RETURNS RADIAN ANGLE BETWEEN 0 AND TWO PI
      DEGREES=ANGLIN
C
C     DEGREES TO RADIANS CONVERSION
      DEG2RAD = 2.0 * 3.141592653589793238 / 360.0
  100 CONTINUE
      IF(DEGREES.LT.360.0.AND.DEGREES.GE.0.) GOTO 200
      IF(DEGREES.GE.360.) DEGREES=DEGREES-360.
      IF(DEGREES.LT.0.) DEGREES=DEGREES+360.
      GOTO 100
  200 CONTINUE
      RADOUT=DEGREES * DEG2RAD
      RETURN
      END
C
C
      SUBROUTINE DIST(ANGRAD,DPLATX,E,XN,F,RA,DPLONY,
     +ORLONRAD,RHO0,ALT,X,Y,DPNSFL)
C
      XXX = ANGRAD - DPLATX/2.
      XX = TAN(XXX)
      SINDP = SIN(DPLATX)
      COSDP = COS(DPLATX)
      YY = ((1-E*SINDP)/(1+E*SINDP))**(E/2.)
      TDP = XX/YY
      RHO = DPNSFL * RA * F * TDP ** XN
      THETADP = XN * (DPLONY - ORLONRAD)
      X = RHO * SIN(THETADP)
      Y = RHO0 - RHO * COS(THETADP)
      Z=ALT
      RETURN
      END
C
C
      SUBROUTINE NOSSET(ORNSFL,OREWFL,DPNSFL,DPEWFL)
C     THIS SUBROUTINE FINDS THE QUADRANT WHICH THE POINTS OF
C     INTEREST ARE LOCATED.
C
      REAL ORNSFL,OREWFL,DPNSFL,DPEWFL
      ORNSFL=ORNSFL
      DPNSFL=DPNSFL
      PRINT 10
10    FORMAT(//,' USE ONLY FOR NORTHERN HEMISPHERE! ')
C10    FORMAT(//,
C     +'  NORTH OR SOUTH ORIGIN LATITUDE?  ',/,
C     +'  ENTER <N> OR <S>  :   '$)
C      READ(*,20)ORNSLE
C20    FORMAT(1A1)
C      ORNSFL= 1.0
C      IF(ORNSLE.EQ.'S'.OR.ORNSLE.EQ.'s')ORNSFL=-1.0
      PRINT 30
```

```
30    FORMAT(//,
     +'  EAST OR WEST ORIGIN LONGITUDE ?  ',/,
     +'  ENTER <E> OR <W>  :     '$)
      READ(*,40)OREWLE                    read W here
40    FORMAT(1A1)
      OREWFL = 1.0
      IF(OREWLE.EQ.'W'.OR.OREWLE.EQ.'w')OREWFL=-1.0
C      PRINT 50
C50    FORMAT(//,
C     +'  DOES DATA HAVE NORTH OR SOUTH LATITUDE ?',/,
C     +'  ENTER <N> OR <S> :  '$)
C      READ(*,60)DPNSLE                    read N here
C60    FORMAT(1A1)
C      DPNSFL = 1.0
C      IF(DPNSLE.EQ.'S'.OR.DPNSLE.EQ.'s')DPNSFL=-1.0
      PRINT 70
70    FORMAT(//,
     +'  DOES DATA HAVE EAST OR WEST LONGITUDE ?',/,
     +'  ENTER <E> OR <W> :   '$)
      READ(*,80)DPEWLE
80    FORMAT(1A1)
      DPEWFL = 1.0
      IF(DPEWLE.EQ.'W'.OR.DPEWLE.EQ.'w')DPEWFL=-1.0
      RETURN
      END
```

31.A
52

19

10/27/97
fitrng.pri

```
&PRIME
 $ITNRY= 1,5,
 $VIC=   4,
 LNEFCR= 40.6362,        -73.7669,       4.,             88.5,
 ICOND=  92600.,         56.,            3517.,
         182.,           -91.,           0.,
 LNCORD= 40.6362,        -73.7669,       4.,             88.5,
 STAG01= 00000.,         200.,           15.,            0.,
         500000.,        1.,             1.,             1.,
 STAG02= 0.,             0.,             40.,            0.,
         500000.,        1.,             1.,             1.,
 STAG03= 0.,             0.,             60.,            0.,
         500000.,        1.,             1.,             1.,
 $OUTPT= 1,
 MAXITR= 25.,
 EROTR=  0.,
&END
&SENS
 SENID=  'JFKR'
 SENSOR= 40.6362,        -73.7669,       4.,
 STBIAS= -12.27,
 SSIGMA= 19,             1.,
&END
&SENS
 SENID=  'ISPR'
 SENSOR= 40.7940,        -73.1001,       26.,
 STBIAS= -12.27,
 SSIGMA= 19,             1.,
&END
TITLE
  MATCH RANGE FROM RADARS
DRAG
 1    5
 2 2
   0.0   1.0
  -90.   90.
          20.   20.
          20.   20.
 2 8
   0.0   1.0
  -15.  -10.   -5.    0.    5.   15.   35.   75.
          -250. -250.
          -130. -130.
             0.    0.
           130.  130.
           250.  250.
           400.  400.
           600.  600.
           800.  800.
 2  1 SAME
 3    5
 2 2
   0.0   1.0
  -90.   90.
          20.   20.
          20.   20.
 2 2
   0.0   1.0
  -90.   90.
             0.    0.
```

← need bridge

APPROVED FOR RELEASE
DATE: FEB 2005

```
            0.    0.
PITCH
                                          90.          4.
                        -20.                           6.
                        -3.                            12.
                        10.                            20.
                                                       40.
                                                       60.

SOLVE
            LNEFCR 4                       2.
            PITCH 4 2                      2.
            PITCH 2 2                      5.
            ICOND 1         10.            1000.
            ICOND 4                        50.
CONS
            LNCORD 4        1.             LNEFCR 4
DVRBL
            19.        JFKR 50.46          16.65
            19.        JFKR 50.87          21.25
            19.        JFKR 51.25          25.88
            19.        JFKR 51.50          30.48
            19.        JFKR 51.65          35.11
            19.        JFKR 51.75          39.72
            19.        JFKR 51.93          44.36
            19.        JFKR 52.06          48.96
            19.        JFKR 52.09          53.60
            19.        JFKR 52.15          58.21
            19.        JFKR 52.12          62.84
            19.        ISPR 21.60          15.97
            19.        ISPR 22.01          20.66
            19.        ISPR 22.26          25.26
            19.        ISPR 22.42          30.05
            19.        ISPR 22.46          34.77
            19.        ISPR 22.57          39.46
            19.        ISPR 22.87          48.85
```

33A
52

20
10/29/57

OBJECT NUMBER: 0

DVRBL CODE 19

SENSOR ID JFKR

TIME	INPUT VALUE	COMPUTED VALUE	RESIDUAL
4.38000000	50.46000000	50.61481294	-0.15481294
8.98000000	50.87000000	50.98415877	-0.11415877
13.61000000	51.25000000	51.24396098	0.00603902
18.21000000	51.50000000	51.43641358	0.06358642
22.84000000	51.65000000	51.60331829	0.04668171
27.45000000	51.75000000	51.75010978	-0.00010978
32.09000000	51.93000000	51.87593944	0.05406056
36.69000000	52.06000000	51.97673993	0.08326007
41.33000000	52.09000000	52.05341533	0.03658467
45.94000000	52.15000000	52.11724802	0.03275198
50.57000000	52.12000000	52.17125832	-0.05125832

RMS	MEAN	NUMBER OF RESIDUALS
0.07270832	0.00023860	11

'GOODNESS OF FIT'

0.34976114

OBJECT NUMBER: 0
DVRBL CODE 19
SENSOR ID JFKR

RMS = 0.07271 'GOODNESS OF FIT'

0.34976114

OBJECT NUMBER: 0

```
TIME     -3 RMS          -2 RMS          -1 RMS          0          1 RMS
         2 RMS           3 RMS RESID
  4.38   :               *  .                .          :             .
         .                  :   -0.155
  8.98   :                  .      *         .          :             .
         .                  :   -0.114
 13.61   :                  .                .          :*            .
         .                  :    0.006
 18.21   :                  .                .          :          *  .
         .                  :    0.064
 22.84   :                  .                .          :       *     .
         .                  :    0.047
 27.45   :                  .                .          *:            .
         .                  :    0.000
 32.09   :                  .                .          :          *  .
         .                  :    0.054
 36.69   :                  .                .          :             . *
         .                  :    0.083
 41.33   :                  .                .          :       *     .
         .                  :    0.037
 45.94   :                  .                .          :       *     .
         .                  :    0.033
 50.57   :                  .                .     *    :             .
         .                  :   -0.051
```

OBJECT NUMBER: 0

DVRBL CODE 19

SENSOR ID ISPR

TIME	INPUT VALUE	COMPUTED VALUE	RESIDUAL
3.70000000	21.60000000	21.51705948	0.08294052
8.39000000	22.01000000	21.90734733	0.10265267
12.99000000	22.26000000	22.18220995	0.07779005
17.78000000	22.42000000	22.38986026	0.03013974
22.50000000	22.46000000	22.56048640	-0.10048640
27.19000000	22.57000000	22.70734679	-0.13734679
36.58000000	22.87000000	22.92809814	-0.05809814

RMS	MEAN	NUMBER OF RESIDUALS	'GOODNESS OF FIT'
0.09001067	-0.00034405	7	0.27395983

OBJECT NUMBER: 0
DVRBL CODE 19
SENSOR ID ISPR

RMS = 0.09001 'GOODNESS OF FIT' 0.27395983

OBJECT NUMBER: 0

```
TIME    -3 RMS          -2 RMS          -1 RMS          0          1 RMS
        2 RMS           3 RMS RESID
  3.70   :              .               .               :          * .
         .              :    0.083
  8.39   :              .               .               :            . *
         .              :    0.103
 12.99   :              .               .               :        * .
         .              :    0.078
 17.78   :              .               .               :    *       .
         .              :    0.030
 22.50   :              .             * .               :            .
         .              :   -0.100
 27.19   :              .       *       .               :            .
         .              :   -0.137
 36.58   :              .               .     *         :            .
         .              :   -0.058
```

CURRENT RMS = 0.079884

PREVIOUS RMS = 0.079895

BEST RMS = 0.079884

35A
54

21

2

10/28/97

&PRIME

$ITNRY = 5,

$VIC = -4,

LNEFCR = 40.6362, 73.7669, 26, ~~[illegible]~~ 88.5

ICOND = 50.0 nm = 92600,

+.03 nm = 56,

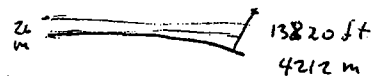
17

~~[illegible]~~ 3509,

182,

−91,

0,



$R/\cos(\frac{50}{60})^\circ - R$

$R(1/\cos .833 - 1)$

6400 000 = 677 m

$Z \simeq 4212 - 677 - \cancel{[illegible]}4$

$|V| = 667.5$ kt/s = 203 m/s

$\dot{x} \sim V \sin A$

$\sim 203 \sin 26.5$

~~$CFTYP = 3~~

~~CUTOFF = 52~~

LNCORD = 40.6362, 73.7669, 26, 88.5,

STAGO1 = 80 000, 200, 65, 0,

500000, 10, 1, 1

STAGO2 0, 0, 62, 0

500000, 10, 1, 1

~~[illegible]~~

MAXITR = 5,

&END

&SENS

SENID = 'JFK'

$SNDEF = 11, —

SENSOR = 40.6362, 73.7669, 26,

STBIAS = −12.27

SIGMA = 19, 1

&END

K/R ISP

3

DRAG

ALL 5

0210

0.0 1.0

-40. -12. 0. 4. 8. 12. 16. 20. 30. 60.

-1.45 -1.45

-0.89 -0.89

0.0147

0.3542 CN

0.6791 0.7m²pa SA

0.8972

1.0476

1.1600

1.3400

1.5700

0210

0.0 1.0

-40. -12.

-0.008

-0.230

0.0196

0.0001

-0.0411

-0.0524

-0.0456

-0.0210

-0.0114

-0.0035

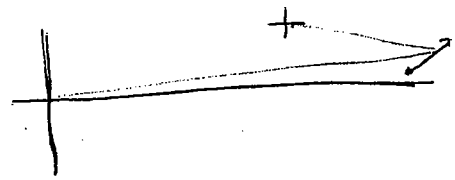
$q = 350\ lb/ft^2$

$C_N = L/(qA) = 500000\ lb / (350\ lb/ft^2 \times 10.8\ ft^2)$

$= 132$

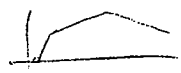
Degrees							
		0	5	10	20		
-15	-10	-5	0	5	15	35	75
-260	-130	0	130	260	400	600	800

$C_A = T/(qA) = 60000/(350 \times 10.8) = 21.$



Solve P42, Az
↳ 3.2 ↳ 91.8

Take out left after 40 sec



Solve AZ_{cs}, P42, Xpos . RCS → .084

Add P22 .082

~~Add Stagor 1~~

Add ICOND 4/5 .074 NC

correct 1,6/5,6

Take out ICOND5 .0805

Put in STAG013 -.079 NC

Take out " / not that .080

Add P32 change

Take on P32, add P44 change

Take on P44, change to 30

Guess C_N

$\alpha = 0$	$RN = 20$	-5	-10
5	40	-10	-20
10	60	~~-20~~	
20	100		
40	150		
80	200		

Axial ~~Rating~~ = Thrust

$T = q\, C_A A$

$C_A = T/q/A$

$= 80000/(2391 \times 10.8) = 80000/25000$

$= 3.0$

22

17 Mar 98

1 Gen el cos from MW for Leo's vs 17 kft w no turn in
0 4 9.6 13.4
13800, 13800, 14000, 14600, 13200, 10800, 8600, 7000, 5800, 3500, 1200, 0

Compile, S
Run

RMS → .864 (vs .863 - (no turn))

→ splet/bridge.splt Plot

Alt rise to 16800
14200 15000 16700
" ~~14000~~ 15000, 16500, 15500, 13000, 9200, 7000

Best run. AZFPo = #3 = 19.30 = AZFPN

Copy xyzrng.f → xyzrng.a3fx.f

Set AZFPo = 19.3, AZFPD(1) = 0

In ~~Esq~~ xyzrng.lsq.inc

AZFPo, ID, DD, AZFPN ~ no solve

#IV = 28, NC = 0

No – solves ALTB → 15.7 kft

$A = a + b(t-4) + c(t-4)^2$

$c = -a/t'^2 - b/t'$

$A' = b + 2ct'$

$A' = 0 \Rightarrow b = -2ct'_a \Rightarrow t'_a = -b/2/c$

Copy xyzrng.f → xyzrng.146.f

Try B = 170. fix #IV = 29, NC = 1

RMS → .870, Max alt = 14.4

B = 180.

RMS → .870, Max alt = 14.44 Pl

B = 650 RMS → .887, Max alt = 18.6

B = 500 .868, 17.2

2

Jan xg21ns.146.f

Set AZFPO/N = 19.3 , AZFPD/2 = 0

.log.inp → 26 IVs, 0-FCs

RMS → 2.17

Solve AZFPO in Exp

RMS → 2.48

Solve AZ half alt constr

RMS → 1.63 AZ → 234

Pl

[redacted]

Pl

26 Jan 98

1. Arrow. splt 1-2 = NW / 1-3 = W / 4-5 = N

2. Put splat.ps → PC X
   In splat - plot - creat cgm.
   FTP → PC (use binary opt)
   In MSW - get picture
   - squeeze from top page #s
   - Indent - 1/2"

3. splat.ps → fort71.ps

2 Feb
   Create cgm files for all = "fign.cgm" + "map.cgm"

3 Feb
   Revise cgm only - leave split files same
   map, fign → pc

5 Feb
   TBD - Fig 9-12 - put Radar name back in/wherever .72.68, λ", 2.0
   - (delete title + class + all black)
   Fig 6-7 - Box bigger - all black
   - (size of ~~opt~~ bdy = 1.0)
   → split file ± cgm

23 Jan 78

1. Change in elev range

$\tan^{-1}(2.2/8) = 15.38$ 2.25/9.6 13.2

$\tan^{-1}(2.2/10)$ 12.41 2.25/8.6 14.7

$3\,kft/10.00\,nm \sim 1°$

2. Total Avg RMS $(\Sigma r_i^2)^{1/2}$

RMS	n	SS	Σ SS
16	6	1536	
27	11	8019	9555
13	6	1014	10569
22	8	3872	14441
17	5	1445	15886
27	7	5103	20989
48	2	4808	25797
13	4	676	26273
	49		÷49 = 536 √ = 23.1 ×3 = 69.5

Fig 56 explains: at the one JFK point at top is ~~near 35~~ a peculiar outlier

Review

1. Showed that level flt for 15-20 sec causes elev angle error of ±1.5°
2. Calculated Total RMS of all Range data = 0.023

25

APPROVED FOR RELEASE
DATE: FEB 2005

21 Jan 98

1. Transfer for at plot
to 20/60 ave

162
2
324
3
972

2. Explosion location
40.6485, -72.6708 → expl. pt
Fnt51.splt - li 21/+6

3. Typed in linefit.f
Speed → 388 ± 0.8
R, ΔR -2.616, 2.101, 1.607, 1.097, 0.591, 0.000
-0.001, 0.007, -0.006, -0.003, -0.004, 0.005
RMS = .0047 S
SIGB = RMS * 3600 * $\sqrt{AI_{22}}$
$\sqrt{AI_{22}} = (0.8/3600/0.0047)^2 = .0022$

4. Air to JFK

	-40.6362	73.7669	
Expl	40.6485	72.6708	
	-.0123	1.0961	rat = -.01
APN	41.0612	73.7142	
	40.6485	72.6708	
	.4127	1.0434	rat = .396
RHD	40.8785	72.6878	
	40.6485	72.6708	
	.2300	0.0170	rat = 13.5 r = .07

→ arrow.splt 1-2 = NW / 1-3 = W / 4-5 = N

41

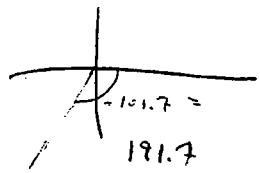
5 Dec 97

1. TBDs
   - MW loc ✓
   - RHD 2nd ary ✓
   - AZ change at 0 ✓ ← AZFPDD
2. RHD secondary data
   File NVYALL1.CSV has r/az from RHD (+others) (primary)
   File CODE2633.CIA has r/az (secondary) from HPN, ISP, JFK
   Need RHD secondaries
   Mike O'R 4375521 or 7429428 [~~plotting to t~~] [no tb correct for tn]
   RHD - stored as λΛ & XY
   Need - stored as R/AZ
   will send
3. Changes for AZFPN (exp + DX)
   Run w/o changes
   Set AZFPN = 24, no solve, RMS → .955
   Solve AZFPN → RMS → .778 → 17.1
   Avg gnd speed 2.63/24.2 = 381 kt
   Solve alt 1-5 RMS → .771
   Alt → 15, 12, 17, 16, 12, ±4-5 kft
   Back to no alt solve RMS → .778
4. Plot: Delete 4 pts before 6:34 from FT02 → 50 lines
   Delete pts from FT54 / 51=19, / 52=14, 53=14, 54=4 / 50=17
5. Modify for AZFPD(2)
   Solve both RMS → .753, AZFPDD → -.1
   OK but prob driven by last two pts

2

6. W/O rate - Range not - print
7. Pshire

	EVT		IMP	
AZ	~101.7	→	-88.8	/ Δ = 12.9°
From Nrich ~~From RT~~ =	191.7	→	178.8	
From RT Houses	189.8	→	170.8	



8. Solve Alt 8, 9, 10 (Pos 3, 4, 5)
   RMS → ~~.778~~ .761 → 17, 20, 14 ± 2-3
   Add Alt$_p$ 6 → bad
   Solve Alt$_p$ 6 only - ± 35k → 1k/-13
   Solve All P7 only → ± 14k → -1k/-4
   Solve Alt 1-5, 8-10
   RMS → .754

Add Alt 6 RMS → 7.51 Solve Alt 7

t	alt	±	*.75	Alt	+/-	*.75
-24.2	16.3	5.7	4.3	16.4	5.6	
75.5	12.4	7.5	5.6	13.1	7.2	
-14.8	17.7	5.3	4.0	18.5	5.1	
-10.1	16.8	5.3	4.0	18.0	5.1	
-5.4	14.0	6.6	5.0	15.8	6.1	
0.0	9.2	8.5	6.4	13.4	7.6	
4.0				18.1	4.0	
8.7	17.4	3.8	2.9	16.5	3.8	
13.4	20.5	4.6	3.5	21.0	4.6	
18.1	14.4	2.7	2.0	14.7	2.7	

Try Alt 7

3

Review

1. Put in code for MW sighting. See plot.
2. Requested RHD secondaries
3. Changes for fixed azimuth before event. Plotted flightpath results.
4. Runs with showing for alt before + after (to 18.1). See plots

76

TWA Flight 800 data/animation notes
Last Modified: 03-24-97

T(0) represents 20:31:11.3, the exact time of the first explosion

The entire animation time for the main reconstruction will be 74.3 seconds.

The main reconstruction animation will begin at T(0) - 25.3s (approximately 9.5 seconds before the 737 and P3 cross paths).

The elapsed time from explosion to impact is 49 seconds.

Hard Data Points

TWA Flight 800

1. Start Position
   time : 20:30:46.0 (T(0) - 25.3s)
   frame : 1
   latitude : N40.6321°
   ztran :
   longitude : W72.7381°
   xtran :
   altitude : 13,645 ft.
   heading : 67°

2. Radar Track (with transponder)
   time : 20:30:58.0 (T(0) - 13.3s)
   frame :
   latitude : N40.6407°
   ztran :
   longitude : W72.7113°
   xtran :
   altitude : 13,725 ft.
   heading : 73.5°

3. Radar Track (with transponder)
   time : 20:31:10.0 (T(0) - 1.3s)
   frame :
   latitude : N40.6472°
   ztran :
   longitude : W72.6837°
   xtran :
   altitude : 13,810 ft.
   heading : 73.5°

4. Explosion
   time : 20:31:11.3 (T(0))
   frame :
   latitude : N40.6478°
   ztran :
   longitude : W72.6807°

xtran :
altitude : 13,820 ft.
heading : 72.0°

5. Radar Track (without transponder)
time : 20:31:22.0 (T(0) + 10.7s)
frame :
latitude : N40.6518°
ztran :
longitude : W72.6649°
xtran :
altitude : 16,200 ft.
heading :72.0°

6. Apogee (derived)
time : 20:31:26.3 (T(0) + 15.0s)
frame :
latitude : N40.6557°
ztran :
longitude : W72.6561°
xtran :
altitude : 16,500 ft.
heading :59.5°

7. Radar Track (without transponder)
time : 20:31:34.0 (T(0) + 22.7s)
frame :
latitude : N40.6627°
ztran :
longitude : W72.6406°
xtran :
altitude : 15,600 ft.
heading : 59.5°

8. Radar Track (without transponder)
time : 20:31:46.0 (T(0) + 34.7s)
frame :
latitude : N40.6670°
ztran :
longitude : W72.6324°
xtran :
altitude : ?
heading : 57.0°

9. Radar Track (without transponder)
time : 20:31:58.0 (T(0) + 46.7s)
frame :
latitude : N40.6647°
ztran :
longitude : W72.6296°
xtran :
altitude : ?
heading : 136.0°

10. Impact
    time : 20:32:00.3 (T(0) + 49s)
    frame :
    latitude : N40.6647°
    ztran :
    longitude : W72.6296°
    xtran :
    altitude : 0 ft.
    heading : 136.0°

USAir Flight 217

1. Start position
    time : 20:30:46.0 (T(0) - 25.3s)
    frame : 1
    latitude : N40.5777°
    ztran :
    longitude : W72.7256°
    xtran :
    altitude : 21,700 ft.
    heading : 17°

2. Position when crossing paths with USAF P-3
    time : 20:30:55.5 (T(0) - 15.8s)
    frame :
    latitude : N40.5953°
    ztran :
    longitude : W72.7183°
    xtran :
    altitude : 21,700 ft.
    heading : 17°

3. Position at TWA 800 explosion
    time : 20:31:11.3 (T(0))
    frame :
    latitude : N40.6245°
    ztran :
    longitude : W72.7105°
    xtran :
    altitude : 21,700 ft.
    heading : 11°

4. Position at TWA 800 splashdown
    time : 20:32:00.3 (T(0) + 49s)
    frame :
    latitude : N40.7173°
    ztran :
    longitude : W72.6828°
    xtran :
    altitude : 21,700 ft.
    heading : 12.5°

USAF P-3

1. Position at beginning of animation
   time : 20:30:46.0 (T(0) - 25.3s)
   frame :1
   latitude : N40.6051°
   ztran :
   longitude : W72.7053°
   xtran :
   altitude : 20,000 ft.
   heading : 225°

2. Position when crossing paths with USAir flight 217
   time : 20:30:55.5 (T(0) - 15.8s)
   frame :
   latitude : N40.5953°
   ztran :
   longitude : W72.7183°
   xtran :
   altitude : 20,000 ft.
   heading : 225°

3. Position at TWA 800 splashdown
   time : 20:32:00.3 (T_0 + 49 sec)
   frame :
   latitude : N40.5295
   ztran :
   longitude : W72.8074°
   xtran :
   altitude : 20,000 ft.
   heading : 225°

GREAT CIRCLE NAVIGATION

This program computes the great circle distance between two points and the initial heading from the first, given the latitude and longitude of the source (L_1, λ_1) and destination (L_2, λ_2).

Equations:

$$D = 60 \cos^{-1} [\sin L_1 \sin L_2 + \cos L_1 \cos L_2 \cos (\lambda_2 - \lambda_1)]$$

$$H = \cos^{-1} \left[\frac{\sin L_2 - \sin L_1 \cos (D/60)}{\sin (D/60) \cos L_1} \right]$$

$$H_i = \begin{cases} H & ; \sin (\lambda_2 - \lambda_1) < 0 \\ 360\text{-}H; & \sin (\lambda_2 - \lambda_1) \geq 0 \end{cases}$$

Notes:

1. Southern latitudes and eastern longitudes must be entered as negative numbers.
2. Truncation and round off errors occur when the source and destination are very close together (1 mile or less).
3. Do not use coordinates located at diametrically opposite sides of the earth.
4. Do not use latitudes of +90° or -90°.
5. Do not try to compute initial heading along a line of longitude $(L_1 = L_2)$.

DISPLAY LINE	DISPLAY CODE	KEY ENTRY
00		
01	24 00	RCL 0
02	14 04	f SIN
03	24 01	RCL 1
04	14 04	f SIN
05	61	x
06	24 00	RCL 0
07	14 05	f COS
08	24 01	RCL 1
09	14 05	f COS
10	61	x
11	24 02	RCL 2
12	14 05	f COS
13	61	x
14	51	+
15	23 03	STO 3
16	15 05	g COS⁻¹
17	23 04	STO 4
18	06	6
19	00	0
20	61	x
21	74	R/S
22	24 01	RCL 1
23	14 04	f SIN
24	24 00	RCL 0

DISPLAY LINE	DISPLAY CODE	KEY ENTRY
25	14 04	f SIN
26	24 03	RCL 3
27	61	x
28	41	–
29	24 00	RCL 0
30	14 05	f COS
31	71	÷
32	24 04	RCL 4
33	14 04	f SIN
34	71	÷
35	15 05	g COS⁻¹
36	24 02	RCL 2
37	14 04	f SIN
38	15 41	g x<0
39	13 47	GTO 47
40	22	R↓
41	03	3
42	06	6
43	00	0
44	21	x⇄y
45	41	–
46	13 00	GTO 00
47	22	R↓
48	13 00	GTO 00
49		

REGISTERS
R_0 L_1
R_1 L_2
R_2 $\lambda_2 - \lambda_1$
R_3 cos (D/60)
R_4 D/60
R_5
R_6
R_7

51 A
52

GREAT CIRCLE NAVIGATION

This program computes the great circle distance between two points and the initial heading from the first, given the latitude and longitude of the source (L_1, λ_1) and destination (L_2, λ_2).

Equations: (nmi)

$$D = 60 \cos^{-1} [\sin L_1 \sin L_2 + \cos L_1 \cos L_2 \cos (\lambda_2 - \lambda_1)]$$

$$H = \cos^{-1} \left[\frac{\sin L_2 - \sin L_1 \cos (D/60)}{\sin (D/60) \cos L_1} \right]$$

$$H_i = \begin{cases} H & ; \sin (\lambda_2 - \lambda_1) < 0 \\ 360\text{-}H; & \sin (\lambda_2 - \lambda_1) \geqslant 0 \end{cases}$$

Notes:

1. Southern latitudes and eastern longitudes must be entered as negative numbers.
2. Truncation and round off errors occur when the source and destination are very close together (1 mile or less).
3. Do not use coordinates located at diametrically opposite sides of the earth.
4. Do not use latitudes of +90° or -90°.
5. Do not try to compute initial heading along a line of longitude ($L_1 = L_2$).

DISPLAY LINE	DISPLAY CODE	KEY ENTRY
00		
01	24 00	RCL 0
02	14 04	f SIN
03	24 01	RCL 1
04	14 04	f SIN
05	61	x
06	24 00	RCL 0
07	14 05	f COS
08	24 01	RCL 1
09	14 05	f COS
10	61	x
11	24 02	RCL 2
12	14 05	f COS
13	61	x
14	51	+
15	23 03	STO 3
16	15 05	g COS^{-1}
17	23 04	STO 4
18	06	6
19	00	0
20	61	x
21	74	R/S
22	24 01	RCL 1
23	14 04	f SIN
24	24 00	RCL 0

DISPLAY LINE	DISPLAY CODE	KEY ENTRY
25	14 04	f SIN
26	24 03	RCL 3
27	61	x
28	41	–
29	24 00	RCL 0
30	14 05	f COS
31	71	÷
32	24 04	RCL 4
33	14 04	f SIN
34	71	÷
35	15 05	g COS^{-1}
36	24 02	RCL 2
37	14 04	f SIN
38	15 41	g x<0
39	13 47	GTO 47
40	22	R↓
41	03	3
42	06	6
43	00	0
44	21	x⇄y
45	41	–
46	13 00	GTO 00
47	22	R↓
48	13 00	GTO 00
49		

REGISTERS
R_0 L_1
R_1 L_2
R_2 $\lambda_2 - \lambda_1$
R_3 cos (D/60)
R_4 D/60
R_5
R_6
R_7

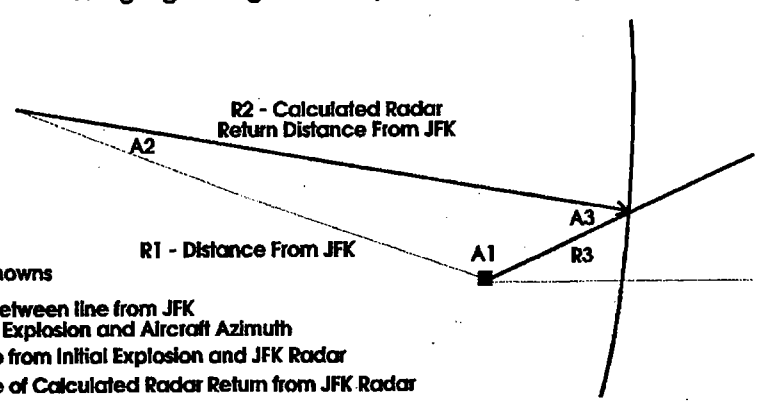
A Study of the JFK 4.6 Second Radar and
Its Effect on the TWA Flight 800 Trajectory Model

New FBI-provided radar data from the JFK 4.6 second radar has not resulted in a substantial change in the CIA scenario of what happened to TWA Flight 800.

In order to use the new JFK radar data (presented in Appendix A), the radar returns from the aircraft's main body have to be determined. FBI investigators identified several potential radar returns for the trajectory of the main body. However, several of the points exhibit large out-of-plane maneuvers and other time periods have no radar returns associated with them. The JFK radar measures both the azimuth and the distance to place each radar return on a map. The most accurate radar measurement is the distance, with most errors occurring on the azimuth measurement. The total distance from the JFK radar site can be determined by taking the root-sum-square of the downrange and crossrange distances. By determining the intersection of this distance from JFK, along an assumed azimuth[1] from the initial explosion, the distance form the initial explosion can be determined.

Figure 1:

Problem: Solve for the distance R3, from the intersection of the JFK radar measured distance, R2, along a given flight azimuth, from the initial explosion.



Knowns

A1 - Angle between line from JFK to Initial Explosion and Aircraft Azimuth
R1 - Distance from Initial Explosion and JFK Radar
R2 - Distance of Calculated Radar Return from JFK Radar

From the Law of Sines

$$A3 = \sin^{-1}(\sin(A1)*(R1/R2))$$

and

$$A2 = 180 - A1 - A3$$

$$R3 = R2*\frac{\sin(A2)}{\sin(A1)}$$

The calculated distances of each radar return from the initial explosion, R3, was plotted against the time of its return and the most likely trajectory for the aircraft's main body was determined(figure 2, 3). The resulting time and distance traveled for each radar point was used as the basis of a trajectory reconstruction of the aircraft following the initial explosion.

---

[1] Based on the JFK radar plots, it is likely the main body flew in a fairly constant azimuth for about 30 seconds.

Two scenarios were investigated. In the first scenario, the nose of the aircraft separated very soon after the initial explosion at 0831:12. The second scenario involved keeping the nose attached until 0831:16, or 4 seconds later. For each scenario, the horizontal distance traveled for each radar return had to be matched, starting with the aircraft's initial conditions, and the total flight time had to be approximately 50 seconds[2].

Scenario 1: Nose Off at 0831.12

The first scenario data points, based on the nose coming off at 0831:12, and the modeled match are shown in Table 1.

Table 1: Comparison of Calculated and Modeled Aircraft Locations

Time from 0831:12	Distance Traveled Calculated from Radar	Distance Traveled Modeled
4.77	3082 ft	3033 ft
9.37	5823 ft	5857 ft
14.00	8361 ft	8168 ft
18.60	10027 ft	9807 ft
23.00	11027 ft	11183 ft
27.84	11693 ft	12114 ft
32.48	12890 ft	12932 ft
37.08	13755 ft	13951 ft

The modeled reconstruction gives a very good match to the JFK radar data.

The resulting reconstruction is shown in figures 4-7, showing the distance, altitude, and speed of the main body. The main body started a slow pitchup shortly after the initial explosion, and really started to climb about 5 seconds later. The aircraft eventually reached an altitude of almost 16000 feet, before descending to an altitude of 4950 feet at 41 seconds, close to the wing separation time. Although the aircraft does not ascend quickly (figure 5), to eyewitnesses on Long Island the aircraft would still appear to be rising since it is approaching their location[3].

A trajectory based on the aircraft initially descending was also attempted. However, an examination of the change in horizontal distances based on the JFK radar data (Table 2) show why the model could not be made to fit this assumption.

Table 2: Distance Traveled Between Calculated Aircraft Locations

Time from 0831:12	Distance Traveled Calculated from Radar	Delta Distance Traveled	Average Horizontal Velocity
4.77	3082 ft	3082 ft	646 ft/sec
9.37	5823 ft	2741 ft	596 ft/sec
14.00	8361 ft	2538 ft	548 ft/sec
18.60	10027 ft	1666 ft	362 ft/sec
23.00	11027 ft	1000 ft	227 ft/sec
27.84	11693 ft	666 ft	138 ft/sec
32.48	12890 ft	1197 ft	258 ft/sec
37.08	13755 ft	865 ft	188 ft/sec

Initially, the horizontal distance traveled is close to the aircraft's initial speed, indicating that the aircraft did not pitch up nor down *substantially* for the first 5 seconds. However, the quick loss of horizontal

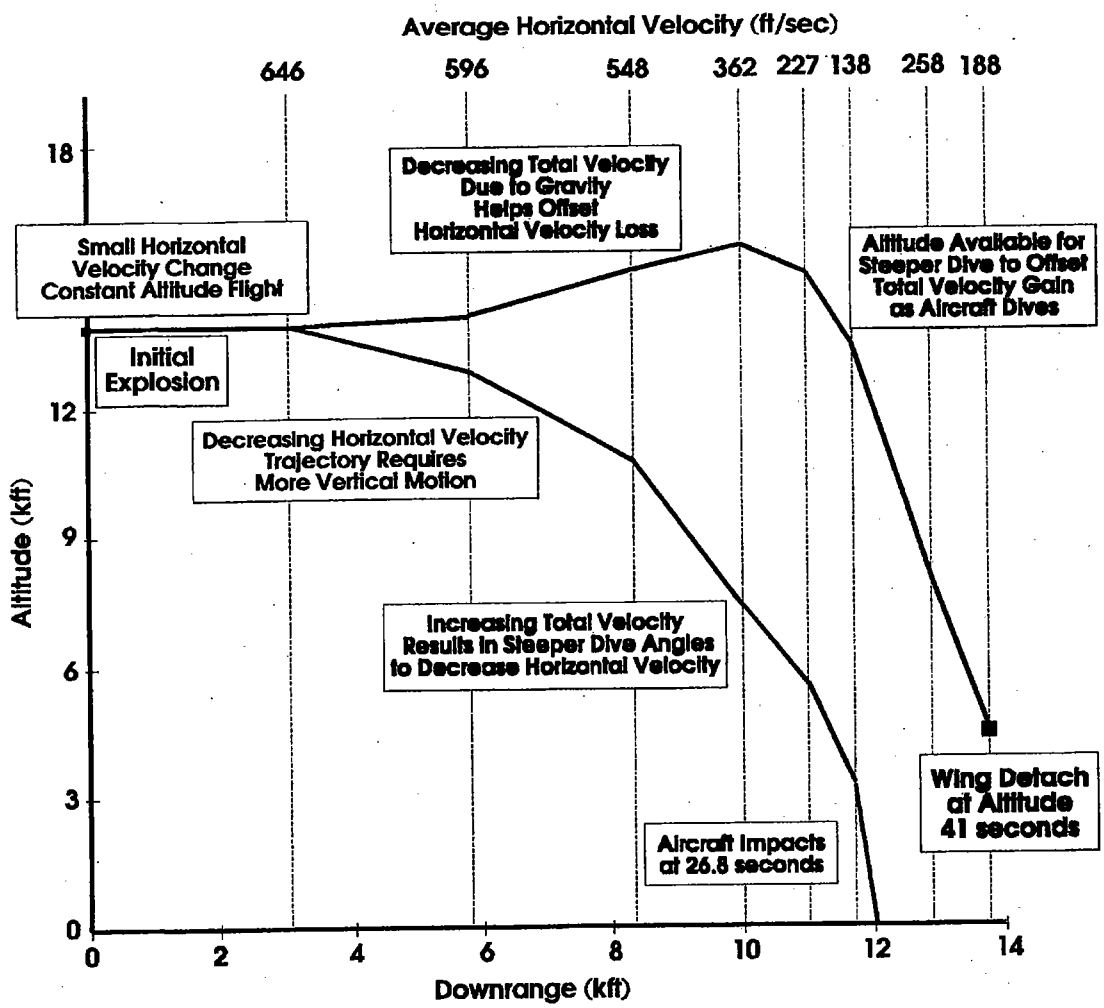
---

[2] Based on sound propagation analysis of the initial explosion sound.

[3] This trajectory is similar to the one used in the TWA 800 video, which clearly shows the initial white light rising relative to Michael Wire's perspective.

speed up to 28 seconds is more than drag forces alone can accomplish, requiring some motion in the vertical. If this motion is upward, then the aircraft's total velocity will slow more due to working against gravity. If the aircraft's motion is downward, then the aircraft's total velocity is increased due to a gravity assist. However, as the aircraft's total speed is increased for the pitch down case, the horizontal speed continues to slow according to the JFK radar hits. This is only possible if the aircraft continues to dive in a steeper and steeper angle. Eventually, the aircraft no longer has any altitude left to allow for a steep dive angle, resulting in the aircraft either impacting to soon, or developing a very large horizontal speed error. On the other hand, if the initial motion is upward, the aircraft gains altitude which can be used to increase the aircraft's dive angle later in its flight to offset the high speeds due to the gravity assist on the downward leg.

Figure 8:



Scenario 2: Nose Off at 08:31.16

The second scenario data points, based on the nose coming off at 0831:16, and the modeled match are shown in Table 3.

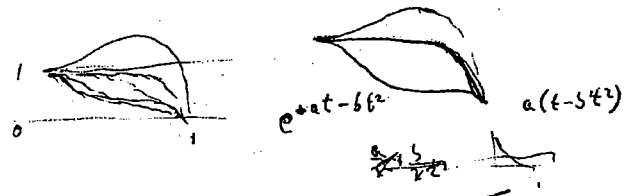
Table 3: Comparison of Calculated and Modeled Aircraft Locations

Time from 0831:16	Distance Traveled Calculated from Radar	Distance Traveled Modeled	Average Horizontal Velocity
4.60	2741 ft	2872 ft	596 ft/sec
9.23	5279 ft	5320 ft	548 ft/sec
13.83	6945 ft	6941 ft	362 ft/sec
18.46	7945 ft	8452 ft	216 ft/sec
23.07	8611 ft	9295 ft	144 ft/sec
27.71	9808 ft	9808 ft	258 ft/sec
32.31	10673 ft	10615 ft	188 ft/sec

The modeled reconstruction gives a very good match to the JFK radar data except at the 23.07 second data point. The modeled downrange, altitude and velocity are shown in figures 8-11 The trajectory required a much steeper climb sooner due to quick drop off in horizontal speed, however, the apogee was still only 16100 feet, slightly higher than the first scenario.

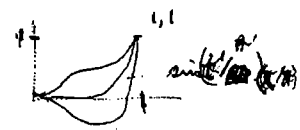
A comparison of the pitch angles of the two trajectories (figure # and #) show that the first scenario, with the early nose separation, resulted in a smaller pitch rates as compared to the second scenario. Although both scenario trajectories can be fit, the smoother pitch angle history of the first scenario indicate that it is most likely the actual one.

SECTION B



9 Jan 98 RedTeam

1. Overview
   - Suggest joint DOD/IC report to Hill (b) (3)
   - Hill asked study on [redacted]
     - 3 areas CTB, aero systems, auto SDI
2. MM Paper
   (b) (3) [redacted]
   - PN - imbalance bet com & tm agency
3. C&C paper - [redacted] (b) (3)
   - Team - [redacted] (b) (3)
   - Goal - 1Q98
   - 9 Investigations Search S/W, Nucl Oper, Nucl C³
     Metrics study
4. BW Team Ron?
5. Have briefed several plans
   Will brf Hill soon
   Ques - how will this be internalized?



22 Dec 97

1. Prud Latest FORT8/9
   Plot – Cathom, Fortz, Fort51-4

$2.60 = a + b(24.2) + c\ 24.2^2$

$$A = \begin{bmatrix} 1 & -24.2 & 24.2^2 \\ 1 & -19.5 & 19.5^2 \\ 1 & -14.8 & 14.8^2 \\ 1 & -10.1 & 10.1^2 \\ 1 & -5.4 & 5.4^2 \\ 1 & 0 & 0 \end{bmatrix} \qquad R = \begin{bmatrix} -2.60 \\ -2.09 \\ -1.56 \\ -1.14 \\ -0.64 \\ 0.00 \end{bmatrix}$$

V_i	Δ
391	4
406	19
321	66
393	4
426	39
387	39

$$A^TA = \begin{bmatrix} 6 & \Sigma t & \Sigma t^2 \\ \Sigma t & \Sigma t^2 & \Sigma t^3 \\ \Sigma t^2 & \Sigma t^4 & \Sigma t^4 \end{bmatrix}$$

for linear

$\Sigma t = -74.0 / \Sigma t^2 = 1316.1 / \Sigma r = -8.03 / \Sigma rt = 141.733$

$$A^TA = \begin{bmatrix} 6.0 & -74.0 \\ -74.0 & 1316.1 \end{bmatrix} \quad A^TA^{-1} = \frac{\begin{bmatrix} 1316.1 & 74.0 \\ 74.0 & 6.0 \end{bmatrix}}{6.0 \times 1316.1 - 74.0^2 = 2420.6} \begin{bmatrix} .5437^{04} & .0306^{571} \\ .0306^{571} & .00248^{28} \end{bmatrix}$$

$-4.365 \quad 4.354$

$$[A^TA]^{-1} A^TR = \begin{bmatrix} .5437 & .0306 \\ .0306 & .00248 \end{bmatrix} \begin{bmatrix} -8.03 \\ 141.733 \end{bmatrix} = \begin{bmatrix} -.05 \\ .1058 \end{bmatrix}$$

$\hookrightarrow 380.1$

Corr = −.03/−.60/−1.10/−1.60/−2.09/2.59

r = .03/−.04/.04/−.04/0/.01

rms = .031 nm

$9 + 16 \times 3 + 1 = 58/6 = 9.6\dot{6}$

$\sigma_a = .73\,[*.031) = .02 \qquad \sigma_b = .0306 * .03 = .0015$

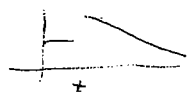
$\hookrightarrow 5.6$

3. NTSB#s Bernie [redacted] (secretary) (b) (6)

2

Questions

1. Speed of AC before explosion
2. Location of AC at time of explosion (dist to impact)
3. What can be said about the speed of the AC after the explosion - did it slow down, continue up, or did it speedup; ~~or did it~~ {slow down then speedup then slow down again} first then slow down
4. ~~turn~~ Did the flightpath return to more the constant azimuth or did it drift out of plane
5. ~~Can th~~ Do the data indicate whether the AC rose after the explosion?
6. How long ~~from~~ explosion to impact

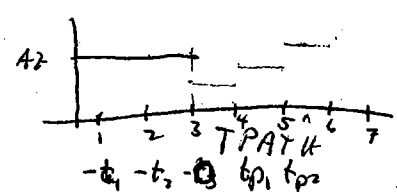


3 Alt trends

time				
61	-24.2	12.9	2.0	1.3
62	-19.5	13.4	Fix	0
63	-14.8	7.0	7.1	4.8
64	-10.1	16.3	5.1	3.4
65	-5.4	15.9	5.5	3.7
66	0	14.4	6.7	4.5
67	4.0	18.4	3.6	2.4
68	8.7	17.0	3.6	2.4
69	13.4	22.1	4.4	2.9
70	18.1	15.4	2.5	1.7

4. Try two yaw rates

AZFPD2 , ~~AZ1~~ (APARAM(8))



IF(TPATH(I). GE. 13.0 13.5)

AZFP = AZFP + AZFPD(2) * TP * CDR

Solve code 7 RMS → .640

AZ0 = 30.1 / AZFP1 = 1.2 / AZFP2 = -.09

Redo - uses quad - replace azfp1 b/ne 13.0

*

Constr AZFP0 = AZFPN + solve quad

RMS → .625 → 90.0

Quad to 30 sec RMS → .664 try other stt

" " 35 sec RMS → .6635

62 B

4

Review

1. Calculated ave speed before explosion from range points — 380 ± 6 km/hr
2. List of questions in possible writeup
3. Brute out another "output" purchase
   - already yaw at t=0, yaw rate after
   - some editing of 30 points
4. Tried more yaw models. Just was constant of AZFPO to AZFPN, solve quadratic terms to 35 sec, const ~~az~~ thereafter. See plot

1

~~UNCLASSIFIED~~

NOTE FOR: [redacted] (b)(3)

FROM:
DATE: 02-12-97 10:38:04 AM
SUBJECT: TWA800 Witness Questions

[redacted] here are some questions that should be put to the witnesses in some form or other. (b)(3)

(b)(6) (b)(7)(c) 3) [redacted] - Direction that flare went... when witness says flare 'initiated from East' does this mean it was East of here or went East to West?

5) [redacted] - Timing and position of fireball... the end fireball should be seperated from the apex location by 4.6 degrees (b)(6) (b)(7)(c)

(b)(6) (b)(7)(c) 6) [redacted] - Timing between initial observation and cascade of red/orange light

7) [redacted] - Which direction was 'smaller' aircraft traveling? Was aircraft coming 'from NE' traveling in NE direction? WHat elevation were each of the objects (high/low)? relative to each other? (b)(6) (b)(7)(c)

(b)(6) (b)(7)(c) 8) [redacted] - How high up did flare start? Water level or in sky?

34) [redacted] determine direction of objects arch? (b)(6) (b)(7)(c)

(b)(6) (b)(7)(c) 37) [redacted] - better description of objects, directions and size of events. (make a diagram?)

44) [redacted] - When witness claims 'flare ascending in the SE direction' does this mean in flare originated to SE or moved SE to NW? (b)(6) (b)(7)(c)

(b)(6) (b)(7)(c) 54) [redacted] - describe loaction and direction of object moving West to East and its location relative to the explosion.

The following witnesses all report seeing an object rise and hit the aircraft. It is important that the witness report actually seeing the aircraft before the object hit it. It is possible that the plane moved upward trailing a small smoke trail, pitched over, and then suffered two more explosions. These explosions could be mistaken for the object striking an 'aircraft', which then proceeded down. If the witness saw an aircraft before the 'collision' then it is a missile. If they do not see an aircraft before the 'collision', then it could be only the aircraft.

47) [redacted] 54) [redacted] 58) [redacted] 61) [redacted] 68) [redacted] (b)(6) (b)(7)(c)
75) [redacted] 78) [redacted] 81) [redacted]

Get [redacted] drawing

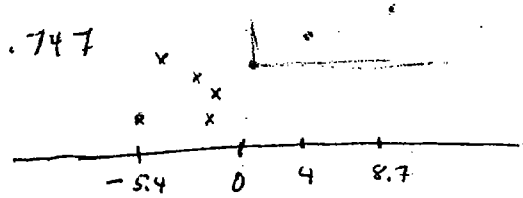
CC: (b)(6) (b)(7)(c)

APPROVED FOR RELEASE
DATE: FEB 2005

~~UNCLASSIFIED~~

4 Dec 97

1. Note LSQSETUP.F has print t/fite 9
xyzrng.f has NPATHN = 0 - should be liter old
No print t/fite 9
Comm out O/L print
Set NPATHN = 1 / solve R43
RMS → .747

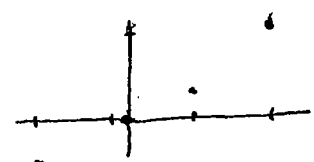


Curr - include 1 neg pt in solve, ~~no solve 1 neg node~~
1 neg node, no solve 1 neg node

Try solve neg node #31
RMS → .714
R_n = -1.2, 0, .06, .96

Try putting in all neg data
Set NOBSNT = ~~NOBSN~~ 6, 6, 5, 1,
Set NPATHN = 5 5×4.7 + 1.7 = 24.2
Solve RP#1-5, 7-18
→ singular

Update t/o 1/2 history
Bucket 1 & loo, 1 solve (neg) (RP#1, 3-13 2=0 3=4
RMS → .747
R_N → -0.65, 0, .23, 1.13 ...



Up # obs to 6, 6, 5, 1 / Same solve / NPATHN = 1 / R_N → -.57, .27, 1.04
Set NPATHN = 2 / Solve 12.45, 7-14 / R_N → -.5, -1.0, .26
→ R_N → ?

Add R_1, RMS → 1.13

2

[redacted]

Slice 5 DOS → 1.13

-5.4 0 +4

DN → -2.71, -2.18, -1.72, -1.18, -0.65, +0.12, .91

.53 .46 .55 .52 .77

-5.4/0 0/8.7

406 352 421 398 433 376

File 2 base neg+/File 6 base ✓

Review

1. Got prevent run to 80.

66B

~~Why did TWA the aircraft rise after it exploded?~~
TWA 800 Analysis and the Science of Aerodynamics.

(b) (3)

3 Dec 97

1. Get files from Mike's dir
   → MIKE.TXT + CODE2633.CIA
   Last 8 pts end → 2633-jfk.cia
   2633-csp.cia
   2633-hpn.cia on radar data
   Copy to output/ fort.16, 17, 18
   For FORT.19 - dummy

9.5	14	180 * (360/4096)$^{-1}$ = 2048	
139.	15	180 * "	1934

   Dave B 70675
   70035

2. Some dumps for negative data - No data
   Runs OK
   Put in setting for neg data w/o neg PART 11
   RRS → .760 (slightly off) - (one type in old)

3. [redacted] 40.8008/72.6276 (b) (6) (b) (7) (c)

4. Put in code for neg modes
   - ~~2 R+/J(IV) = ∞~~
   RRS → .747
   But core dump
   Bust from 2SQSETSJ

Review
1. Created files for neg time radar data.
2. Started changes for neg time fit - Ended with core dump.

68B

2 Dec 97

1. Put in changes for putting radar loc at nodes
~~Also no Azimuth bias~~ go to File2
Run - ~~this~~ w/o alt search
Rms → .757
To plot, - remove
- 1st 2 pts in FT02
- 1st pt from FT54
- 1st pt from FT64

Err - should be 4pts at t=0, 1pt at t=46 ✓
[chTBias sign]

For λ1 plot, change subplot# for FT54 → 4pts
Subplot-adc/FORT.2/col 2,3

Files 50 = node λ1
2 = rdr λ1 at node times
9 = paper
51 = rdr λ1 at rdr times
61 = rms obs as trj rms at rdr time

2 From FT08

t	Rms	σ			
0	0	0	32.2	2.28	.06
4.0	0.27	.06	36.9	2.42	.06
8.7	1.14	.07	41.6	2.45	.07
13.4	1.56	.07	46.3	2.55	.09
18.1	1.85	.06		2.50	.09
22.8	1.96	.07			
27.5	2.09	.06			

69B

2

3. Plot range resid
Could add 27 to 1SP vs 25
~~[illegible]~~

Review
1. Put in changes for printing radar loc get node times
2. Setup export files for latlongplot + for rngresidplot
✓ 3. Note – time bias sign diff from rng bias sign

11/25/97

1. Changes in DX - AZFP set at start of segment
   RMS → .401
2. Set SE=1 in Fix
   Range looks OK, error in Az
   Reverse d rot, neg M, In ROT neg ΔS
   RMS → .403
   Add 4 alts RMS → .355
   Alt 2 → 20kft, R_1 → .18
   Take out ALT2 RMS → .364

3. Data from O'Rourke
   Alt # 7429428
   send to [redacted] (b)(3)
   Will have corrected time

4. Compare bias to mag off
   $90 - AZ_M$ + mag$_0$ = [$AZ_{T,M}$] comp + bias
   comp + bias = obs
   Comp = $90 - AZ_M$ + (mag + bias)

Biases =	-.27,	0.50,	0.58,	-.41
Mag$_0$ =	-13	-13	-13	0
Mag$_c$ =	-13.27	-12.85, -12.50	-12.42	.41
NTSP	-12.5,	-13.0,	-12.3,	

Put NTSP's AZ biases in as 1st guess
RMS → .376

71 B

2

Review
1. Tested changes for SE.
2. Set secondary data from MOR
3. Put in all time biases.
4. Reweight all data to 0.0625/0.2
5. Tried solve some alts. Can't solve ALT 6.

5. Put in -.25TB for 3 rudms
RMS → 3.79
Change TB_4 → 2.5, RMS → 3.86
[Where 2.8 from?]

6. Solve ALT 3-8
- Large Δ's, unwt
Solve Alt 3-6
Alt 6 → -27000/-29000 ± 70000(×4)

7. MOR data
mlse.txt
2633-HPN.CIA / 2633-ISP.CIA / 2633-JFK.CIA
code 2633, CIA

8. Just XP
HPN 9.69 53.34, 1483 (*360/4096) [-130.34]
Fat prem 14.64 53.609, 129.53
ISP 11.27 21.35 1445 (.08789) [-127.00]
JFK 11.88 50.00 1161 (") [-102.04]
Cur RMS = 3.75
Put in R/A₀ data
Wt_0 → 0.2/0.0625, ~~except~~ #4
[Have?]

Run - RMS → .412
Set all to .0625/.2
RMS = .72

9. Try
No R Bias, ~~[illegible]~~ RMS = ~~[illegible]~~ .902
Add more RCBs Alt 4 - still bad

72 B

24Nov97

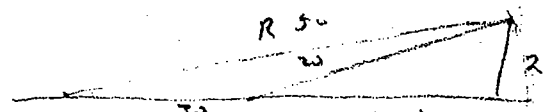
1. CP 3146569
2. Changes for prelim subs
3. W(3) → w/ tin rngo / W(11) .. / W(8) w/ out A30,2
   Run RMS → .432. Store Fort.8. 1124.1048
4. Changes for DXDY
   [should AZFP(t) be at mode?]
   Run old code - OK [Also speed] LB
   Run new code
   RMS → .432
   AZ0 = 45.1, AZFPD → -1.14
5. No R Bias / solve alt 2-5
   RMS → .65
   w R Biases RMS → .39
   σ_{ALL} → 5-8 kft (.4)
   [alt cut the array?]
6. [No alt, 12 ranges (vs 11)
   Get ROT RMS → .419
7. Changes for X2 RAZ tot w FE OK
8. Changes for RAH2X tot w FE - OK

Review

1. Tried solve for (4) alts. Larger RMS w/ no R biases. Both R biases, σ → 2-4 kft.
2. Put in all changes for SE. Tested only w SE

11/27/47

Sensitivity



$R_g = 50 - .0400$ $\quad$ $20 - .100$

$$\frac{\partial R_g}{\partial H}$$

$R_g = 50$ $\quad$ $e = 2.29$

$R_o = 20$ $\quad$ $e = 5.$

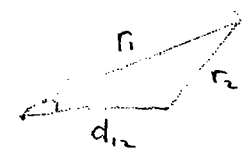
For $H = 3$,

$R_g = 50 - .0500$ $\quad$ $e = 3.43$

$R_g = 40 - .226$ $\quad$ $e = 8.62$

For 24, 14

$r_2^2 = r_1^2 + d^2 - 2r_1 d \cos e_1$



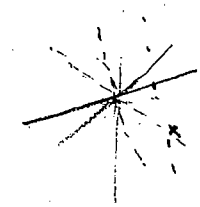
$$\cos e_1 = \frac{r_2^2 - r_1^2 - d^2}{2 r_1 d}$$

$$\frac{\partial \cos e_1}{\partial r_2} = \frac{\cancel{2} r_2}{\cancel{2} r_1 d} = \frac{20}{50}\,\frac{1}{30} = \frac{.4}{30} = .01333$$

$$\frac{\partial \cos e_1}{\partial r_2} = \frac{r_2}{r_1 d} = \frac{14}{22}\,\frac{1}{10} = .0636$$

$e_1 = 2.29$

$\cos e_1 = .99920$



$e_1 = 2/22 = 5.22$ Rad.

$\cos e_1 = .996 \quad 5.003$

$e_1 = [2.7, 6.8]$ [illegible]

$$\frac{\partial \cos e_1}{\partial r_2}\,\Delta r_2 = .0133 * .05 = .0006$$

$e_1 \to [1.14, 3.03]$

$H \to [1.0, 2.6]$

$d^2 = (r_1 \cos e_1)^2 + (r_2 \cos e_2)^2$

$r_1^2 \cos^2 e_1 = r_2^2 \cos^2 e_2 - d^2$

$$\cos^2 e_1 = \frac{r_2^2 \cos^2 e_2 - d^2}{r_1^2}$$

$$\frac{\partial \cos e_1}{\partial r_1} = \frac{-2r_1}{2 r_1 d} - \frac{r_2^2 - r_1^2 - d^2}{2 r_1 d}\,\frac{1}{r_1}$$

$$= -\frac{1}{d} - \cos e_1 \frac{1}{r_1}$$

$$= -\frac{1}{30} - \frac{1}{50} = -.0333 - .02 = -.0533$$

$\sin^2 e_1 = H^2/r_1^2 \,/\, \sin^2 e_2 = H^2/r_2^2$

$r_1^2 \sin^2 e_1 = r_2^2 \sin^2 e_2$

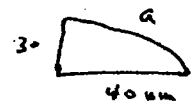
$\sin^2 e_2 = r_1^2 \sin^2 e_1 / r_2^2 = 1 - \cos^2 e_2$

$$\cos^2 e_1 = \left[r_2^2 \left(1 - r_1^2 \sin^2 e_1 / r_2^2\right) - d^2\right]/r_1^2 = \left[r_2^2/r_1^2 - \sin^2 e_1 - d^2/r_1^2\right.$$

$$= \frac{r_2^2 - r_1^2 - r_2^2}{r}$$

26 Nov 97

1. Run with all 4 as R/AZ
   RMS → .503
2. Spherical trig



$\cos a = \cos b \cos c + \sin b \sin c \cos A$

$\cos a = \cos b \cos c$ $\qquad$ 30°/40° → 48.44°

$= \cos 30' \cos 40' =$

$a = .83333° = 49.9996$ min $\qquad$ = 50 − .75m

3. Changes for AZFP$_0$
   Run RMS → .505?
   Solve AZFPD → ~~[illegible]~~, −.27°/s, RMS → .40
4. Changes for XOFRDR(3,8) − run OK

.30, 1.21		
.070, .13		
.14, .54, .01, .72	.01, .14	.08, 1.21
.055, .16	.047, .17	.047, .16

But now can't do both FE & SE in same run unless calc twice w/ options

5. CP: 314 6569 X
6. Changes for MAGOFF RMS → .56°
   Reset all to −13 RMS → .40
   Changes for conversion scales w/o scales − RMS → .399998
7. Changes for Z_0^* (alt at least X1°)
   X [no − don't know if xy is equiv to nonmonotonic]
8. Put in 2LA2X

Review

1. Run all four radars with R/AZ.
2. Put in changes for (simple) AZFP + rate.
3. Put in other non-substant changes

75 B

20 Nov 97

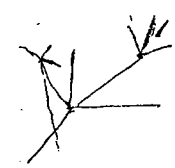
1. create ntsb.isp w RAZ
   Change in script + fort for ISP-RAZ
   Run - RMS => .50
   create ntsb.lpn w RAZ
   Change in script + fort

```
SUBROUTINE LLAZX (LAT, LON, ALT, XE)
IR*8 (A-H, O-Z)
DIMENSION XE(3)
REAL*8 LAT, LON
DATA RE/ 6440 000./
CDR= 3.14159265D0/180.
R=RE+ALT
XE(1) = R * DCOS(LAT*CDR) * DCOS (LON*CDR)
XE(2) = R * DCOS (LAT*CDR) * DSIN(LON*CDR)
XE(3) = R * DSIN(LAT*CDR)
RETURN
END
```

X2 RAZ

```
SUBROUTINE RNGAZ(X, LATO, LONO, KR, RNG, AZ)
IR*8 (A-H, O-Z)
COMMON/LOCRDR/ XERDR(3,9), LATRDR(9), LONRDR(9) ---
                                  ← R*8 LATRDR(9), LONRDR(9)
DIMENSION X(3), XT(3), XO(3), XTT(3), XM(3)
REAL*8 LATO, LONO
CDR= 3.14159265D0/180.  & CNMM= 1/1852.
                                  ← DO 2 I=1,3
                                      XM(I) = X(I)*CNMM
CALL LLAZX(LATO, LONO, 0, XO)
CALL ROT(X, XT, (90-LATO)*CDR, 1)
CALL ROT(XT, XTT, (270-LONO)*CDR, 3)
DO 1 I=1,3
    XT(I) = XTT(I) + XO(I) - XERDR(I)
1 Continue
CALL ROT(XT, XTT, (LONRDR(KR)+90.)*CDR), 3)
CALL ROT(XTT, XT, (LATRDR(KR)-90.) *CDR), 1)
RNG= DSQRT( XT(1)**2 +XT(2)**2 +XT(3)**2)/CNMM
AZ= DATAN2(XT(2), XT(1))/CDR
RETURN
END
```

EF pos of tgt to P CS



(over)

76B

19 Nov 97

1. Look at bias search - 1X

$\partial \Delta_I / \partial B_{AZ1} = -1770$?

$\partial \Delta_I / \partial B_{AZ2} = -1770$

Fix

2. Full search - RMS → .55

Add $B_{JFK,R}$ → .54

Note B_R = .07, -.31, -.33, -.30

Remove $B_{R,RHD}$

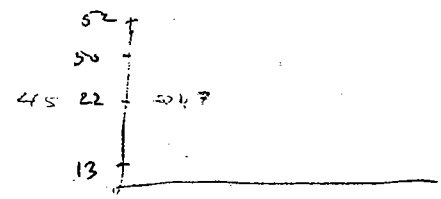
RMS → .68

Solve only B_{RJFK} RMS → .78

3. Range plots

Output plot [illegible] by

25+42



[What's Filtpost [illegible] at CO? (AA) [illegible]

4. Create

ntsb.jfk

change output for jfk only

RMS → .639 (vs .545)

- Note P_0 now decoupled

If fixed P_0 (JFK) → RMS → .507

Correct input files - JFK - RAZ, ISP - XYrelISP, HPN - XYrelISP,

RHD - RAZ (mag or true?)

Review

1. Fixed error in bias partial calculation
2. Tried searches w bias fixed to zero for several combos
3. Code for range resid plot
4. [illegible] RAZ.

18/Dec 97

1. ~~Range to RHD~~
   Run with RHD data
   - not - best offset - change
   RMS → 1.03
   Put in solve rng bias, JFK
   Div - best 1.38
   No solve RBias JFK
   TB.4S(4) = -2.8
   RMS → .94
   Solve TB 4 = code 54 → -3.8/+37

2. Range to RHD

t	t-2.8	R-obs
21.4	18.6	13.75
33.3	30.5	13.27
45.2	42.4	13.13
57.1	54.3	13.25

Rlet -

4.7
?
329

3. Get files from de Lutte to radar data
   Read de Lutte to
   NTSB, etc

M

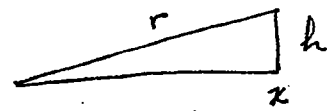
4. Put in code for ΔN plots - file 50; 51, 52, 53, 54
   Run w/o time bias search

- XY scale ✓
- reverse ε (neg)
- de Lutte ✓
- interp?
- inverter
- update ✓

78B

5. Alt adjustment

RNG = DSQRT((X-XOFRDR(KRDR))
2 + (Y- YOFRDR(KRDR))2 + h²



CBNM

HNM = RNTRP(T, ALT, TPATH, NPATH) * 0.3048/1852.

RRS → .73

Update

1. 40.6401/2.72.6711/3. 30.703
32.0.395/33. 4097/1.513/1.625/1.962/2.097/2.298/2.437/2.411/
2.658/2.636

RRS → .719

Solve biases only
RRS → 1.5 ?

Review

1. Ran program with RHD data
Tried range bias on all radars - diverged
Put in time bias for RHD. Tried to solve - ~~see~~ diverge
(prob wrong sign)
2. Put files (RAZ) from NTSB on TAZ
3. First attempt at plot
4. Put in alt correction
5. Tried solve biases only - still problem

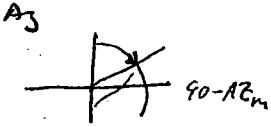
17 Nov 47

1. All changes for generalized sensors
(Note output field code bad)
└ BASFR not defined?
[ok MO' for secondary]
[LB - data [illegible]]

2. Riverhead data R/AZ
From NVYALL1.CSV → file NVY44.~~CSV~~ DAT

21.4	13.75	175.25
33.3	13.25	170.33
45.2	13.13	168.84
57.1	13.25	168.05
69.0	13.25	168.31

Make code changes for 4th random
" surgt " " "
For input (lsq.inp),
Solve R/A biases
Need to convert measurg to initial Az



Review
1. Made all changes for 3 radars [illegible]
2. Typed in input file for RHD (AZ/R)
3. TBD
- Review/get secondary data from MOR
- Plot range for RHD
- Pass error in LSQSET in RMS about mean

80 B

(b)(6)

14/Nov 97

1. Charlie P - Drug B [redacted]

Primaries AZ, R
HPN, JFK, ISP

2 men - 5 women

in NY tracing agent

R/A JFK
+ special bureau

+ text -

Review

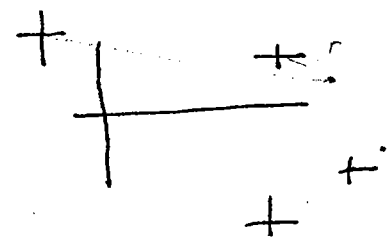
1. Nelson with CP. He will send A/R data for 3 students.

81 B

11/13/97

1. Put in changes for REF

2. HPN Data from CP XY rel ISP
SEN3.xyz



Pick out main object
~~2, 3, 5, 12, 17, 18, 20~~
1 2 4 11 16, 17, 19

Check last XP from HPN
MO' → 46.93, -25.30 (r = 53.315)
CP → 18.10, -16.14 dx file input
temp print X, Y rel hpn for pt #1
~~to~~ 9.94, 46.0006, -27.1693 = 53.42
→ wrong pt - no secondary
Go back to MO's - but dest

Run
—

Take out HPN # 16 from Main

Review
1. Put in changes for general XY ref.
2. Put in HPN secondary data from CP. Doesn't have last transponder. Kept in MO'Rs last transponder, but downweighted because it is different ref from CPs

12 Nov 92

1. Make changes for HPN data in dbs
   Put in +to pts, add new bases

✓ 2. From CP got more HPN Primaries (prep to ISP)/need R/A
   Got prog to convert R/A to XY
   For R/A → ROTATET.for → XY, used zero alt
   For LL → LATSNY1 → XY, used zero alt
   Note: center data will prob use closest (Riverhead)
   Got locations of
   0 = RP43 = ZNYC = TREVOS - 40 08 03.40, 74 55 11.91 200'
   1 = RP44 = ZBWH = Riverhead = 40 52 42.66 (.8785), 72 41 15.55 (.6878) 260'
   2 = RP47 = ZBW1 = N. Truro = 42 02 02.40, 70 03 11.10 162'
✓ May need to adjust things.
   ~~Got~~
3. Make changes for data type #s — same — OK
4. Try plot runs → rns res. spt. inp
   killed system

Review
1. Some changes to prog. Put in HPN data (from O'R)
2. Meeting with Charlie
   - Got more HPN (xy) data - need R/A
   - Got location of 3 Mil radars
   - Need to check time biases
3. Try plot system - debug work

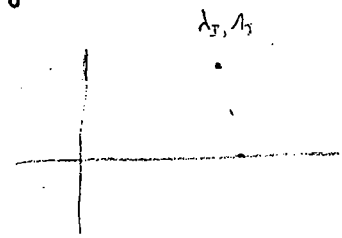
83B

11 Nov 87

1. Questions for DC, CP
   - ~~[illegible]~~ appears to be several radar beta behind row, discussion
   - use of alt in convert r, az to x y for primaries only
   - loc radars
2. From radar files
   - need radar locs
   - compare RT-N wcelDYCPRI.CSV – yes but time off
   - get data – if any – from NVYALL.CSV
   - check transformation
     - note CP [illegible] offset too

10/20/97

1. Run xyzrng.f with cos λ vs cos λ_J
   NC RMS → 1.09
   Rerun A_J obs → .4/.2
   RMS → .91 → worse



Put in Range bias - ISP
RMS → .50 (NC)

2 Rev TBD
- Prog
  - more subs ✓ clean code
  - generalize to ref origin ✓ test
  + better code for To ✓
  - Rev all I/O inputs ✓
  - More data - HPN/Center?/RH random ✓
  - Print λ, Λ all pts/plot ?
  - Use FAA code for xform. or SPHE
  + Ques re alt used for primaries - CP no
  - Try FAA code & compare to flt earth
  + Print ✓ & label Chubin data ✓
  - Ch OSP data
  - Pos bias for Prim
  - Rev Sol
  - Better plots
  + Write notes - SR ✓
  - lower obj (VFKS main - lower)

Ques for CP for Wed
- alt
- now!

3. From CP's disk,
NVYPRI*1.XY → RP43PRI.XY
Put BOS_97LL.CSV, BOS_97.CSV, NY_97, NRDALL.,
NRD4x., BOSPRI97., BOSPRI2, NYCPRI, NYCPRI2., NYYALL1.,
RP43PRI.,

4. ISPTRF
27/40 vs 30/1.7

Review
1. Corrected zyzing code for longitude → x using cos d. Fit was worse. Downgraded zy sbs to 0.4. Put in code for range bins for ISP. Good fit.
2. More rearrangement / subroutines

11/8/97

DIST

$XXX = (90 - \lambda)/2$

$XX = \tan[(90 - \lambda)/2]$

$SINDP = \sin \lambda$

$COSDP = \cos \lambda$

$YY = 1$

$TDP = XX = \tan[(90 - \lambda)/2]$

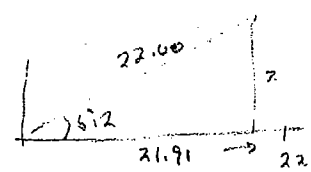
$\rho = r_a * F * [\tan[(90 - \lambda)/2]]^{XN}$

$THETADP = XN * (\Lambda - \Lambda_0)$

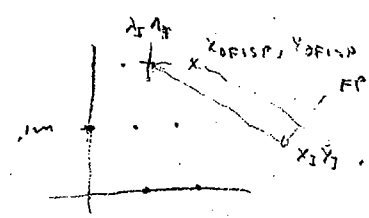
$X = \rho \sin(XN * (\Lambda - \Lambda_0))$

$Y = \rho_0 - \rho \cos(XN(\Lambda - \Lambda_0))$

If alt. grounds, will put XY_{xy} out/either



Ques



nm/long diff at higher d

For JFK vs ISP, 40.6362 vs 40.7840

11.1.10.0
00005

$XOFISP(\lambda_{JFK}) = \Delta\Lambda * 60 * \cos\lambda_J$

$= (73.7669 - 73.1001) * 60 * .7589$

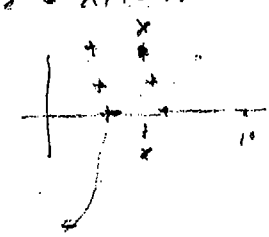
$= \cancel{57.721}\ 30.362$

$XOFISP(\lambda_{ISP}) = (73.7669 - 73.1001) * 60 * .7571$

$= \cancel{57.846}\ 30.290$

$\Delta X = \cancel{57.846}\ 30.343 - \cancel{57.721}\ 30.290$

$= \cancel{.125}\ .0072\ nm = \cancel{760}\ 437'$

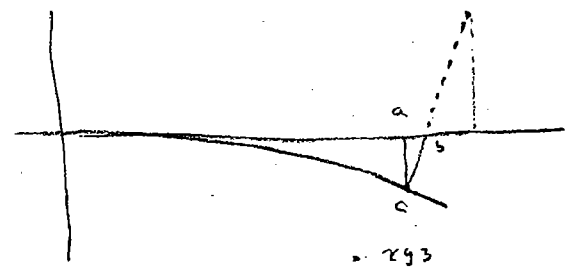


X→Lon use lat/pt + VV.

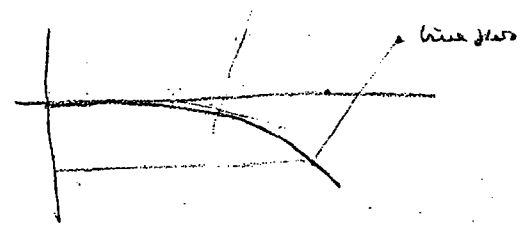
wrong long

11/8/57

For zero alt, is $x = a$ or b or c (PL)?



If xy is PL to subvehicle,



In XY program,

Let $RA = RB = RE$

$Ez = 0 \;/\; E = 0$

$XM1 = \cos\lambda_1 \qquad XM2 = \cos\lambda_2$

$XXX1 = (90 - \lambda_1)/2$ rad

$XX1 = \tan[(90-\lambda)/2]$

$YY1 = 1$

$T1 = XX1 = \tan[(90-\lambda_1)/2]$

$$XN = [\ln(\cos\lambda_1) - \ln(\cos\lambda_2)] / [\ln(\tan[(90-\lambda_1)/2]) - \ln(\tan[(90-\lambda_2)/2])]$$

$$F = \cos\lambda_1 / (XN * \tan[(90-\lambda_1)/2]^{XN})$$

$$\rho_0 = r_a \frac{\cos\lambda_1}{XN * [\tan(90-\lambda_1)/2]^{XN}} \tan[(90-\lambda_0)/2]^{XN}$$

$$= r_a \cos\lambda_1 \frac{[\tan(90-\lambda_0)/2]^{XN}}{[\tan(90-\lambda_1)/2]^{XN}} \quad \frac{\ln[\tan(90-\lambda_1)/2] - \ln(\tan[(90-\lambda_2)/2]}{\ln(\cancel{\cos[(90-\lambda_1)/2]}) - \ln(\cos\lambda_2}$$

$$\cancel{= [r_a \cos\lambda_1 e[\ln(\cos\lambda_1) - \ln(\cos\lambda_2)]]}$$

883

Review

1. XY may be ground distance
2. Want them O'N's program for e.o. little insight. Try to run?
3. Still ques - was alt used to calc dA of radar pts.
4. For ref to quiz bc, x of other hosts should be left of that pt. Need to do w/ prog

11/2/57

1. xyzrns-f

$t = 4.4$, $x_0 = \cancel{0}$, $y_0 = \cancel{0.6}$ 1.4, $r = \cancel{2}$ 0.5, $\cancel{0}$

$\lambda_0 = 3.067$, $\Lambda_0 = 3.284$, $\lambda_J = 40.64$, $\Lambda_J = 73.77$

Obs type 3 = 50.43003

First Cut

$R = .58, .97, 2.\cancel{8}\,1.4, 2.2, 2.4, 2.75, 2.75,$
$2.82, 2.87, 2.97, 3.12$

$\lambda_0 = 40.6428$ $\Lambda_0 = 72.6841$

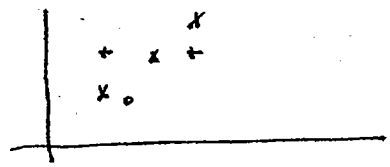
4.7 1
9.4 2
... 47.0 10

2. Output

Print lat, lon - computed at ✓

Print lat, lon of obs pt (main) ✓

Print lat, lon of all pts (?)



3. pts 3+4 resid J

	obs	comp		obs	comp	
	50.87	50.985	-.115	22.01	22.15	-.140
	50.25	50.243	.007	22.26	22.39	-.131
	50.50	50.4575	.042	22.42	22.55	-.131

Try nodes at $t = 0, 4, 8.7, \cdots$

Review

1. Got fit to work. Put in ~~[illegible]~~ code/or "output." Plotted range from P_0; noted large change from pt 2 to pt 3. Why?

6 Nov 97

1. Put in code for LSQ fit
2. Trial - solve ATFP
   Get loc impact
   From RT Plots 40.6632, 72.6238, t = 49

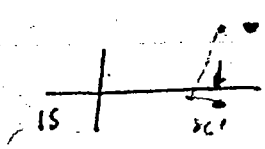
3. Initial location:
   Charlie: ISP → 19.60E, -8.65S rel ISP at 12.26 — rotation?
   [= last XP; adjusted time?, any rotation?]
   Pilot: ISP → 19.50E -8.68S rel ISP at 11.27
   [~~Why different?~~]

4. Dennis 202 314 6564
   Charlie " " 6569
   <i

5. Is Charlie's last XY as hypothesized? — Who is ahead — last ISP XP?
   Δ pos = 0.1 bm lon, 0.03 bm lat
   = 607.i', 182' → run = 634 ft (~1 sec)
   From Lee's, ~ 400 ~~kts~~ kt = 675 ft/s
   Check loc
   $\lambda = \lambda_{ISP} - 8.65/60 = 40.7940 - .1442 = 40.6498$ (vs CP = 40.6491 649)
   $\Lambda = \Lambda_{ISP} - 19.60/60/\cos\lambda = 73.1001 - .4309 = 72.6692$ (" 72.6714 670; 5491)

   Why? corr for alt?

   For last XP
   $\lambda = \lambda_{ISP} - 8.68/60 = 40.7940 - .1446 = 40.6493$
   $\Lambda = \Lambda_{ISP} - 19.50/60/\cos 40.71 = 73.1001 - .4287 = 72.6714$



2

radars R.O, Hd, PA, Truro, North Truro MA
NTAP prog

BOS-97CL.CSV
lat, lon alt, H, M, S, Lat, lon

BOS-97
H, M, S, X, Y (rel ISP), MS alt/100^, 1810 alt±100 radar time 1 time → -1.25, -1.50 → used

radar time also defective

NY-97 XY

(no alert lat, lon) Δ = 2.25
Det/Inc data ~ same

NRDALL Rocal - ~~[illegible]~~ Sensing - same 3 radars
RP43 - Truro PA, 44 - Riverh/47 North T

All times
NRD44 - strip out
HMS, code, rng, azimuth, alt/100, sensor#, time, +75 sec, NXEOTS
0 = 12P43 Truro
1 = RH
2 = NT

cal
MSL alt adj, ±50'

BOSPRIG7.LAT
Alt, HMS, λ°, λ°,
BOS PRI2;XY converted to XY
HMS, X, Y, Alt, sec, corrected time (-1.25)
NYC PRI.850
Alt, H, M, S, λ°, λ°, tot time
PRI2.XY
HMS, X, Y, t, t corrected (-2.25)

3

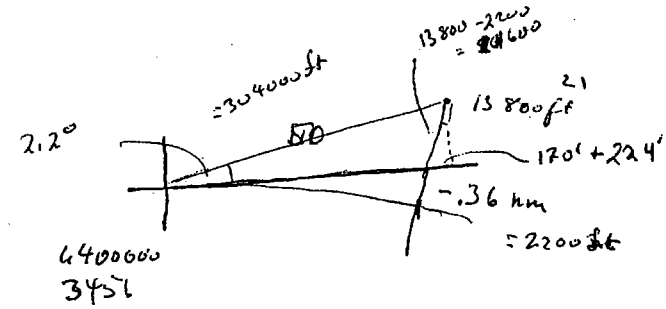
NUYALLI.CSU
HMS, alt, Rng, Az,
RP43PRI.XY
HMS, X, Y, t, t correct
-2.8 sec
sel t → BC time

RP44PRI
HMS, X, Y, t, # (sensor), t-2.8

Ca who's chance
All - must sel time from time to get BC time
BC 12.00
actual 13.25

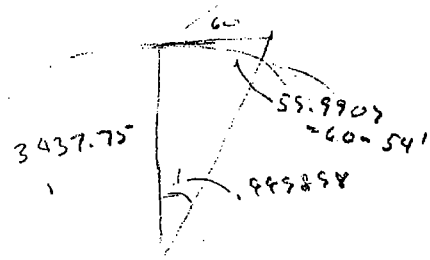
Review
1. Working on LSQ fit
2. Looked at initial location. Charlie's extrapolation doesn't appear to be consistent with what he gave as Δ + Λ at on 11/4. Need to check with Prime
3. Disc with Charlie P see files - Need to print & label
4. Was alt used in conversion from Δ1 to XY
Was alt used to get Δ1 for primaries?

11/5/57

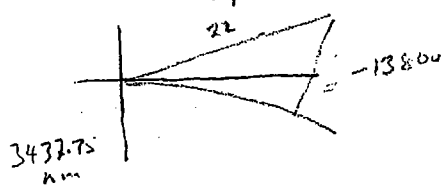


For zero elev, rng = 60,
X (Alt E) pos give loc 54' too/on
for rng = 50nm, alt at zero° = 2200ft

For elev = 2.2°,
FE pos gives are 170' too/on
+ 220
390'



For 22 nm,



60 nm + 54' = 1°
6 nm = 1 deg - 50

$$\frac{\sin \alpha_c}{22\,nm} = \frac{\sin(90 + \varepsilon_e)}{3437.75\,nm + 13800'}$$

$d^2 = r_0^2 + r^2 - 2 r_0 r \cos \alpha_c$

$\cos \alpha_c = (r_0^2 + r^2 - d^2)/2/r_0/r$

$= .364587°$ [slide c]

equiv → 21.875 nm

⇒ gives pos 0.125 nm too long = 758'

$$\cos \alpha_c = \left(\frac{r_0}{r} + \frac{r}{r_0} - \frac{d}{r_0}\frac{d}{r}\right)/2$$

alt = 2.27 nm

alt = 0

Elev = 0
alt = .36 nm
50 - 21'

d = 50, α_c = .832264
*60 = 49.935 = 50 - 390'

d = 22 α_c = .364750
*60 = 21.885 = 22 - 698'

22.00

alt = 430'/.09
21.8998
= 22 - 1'

Review
1. Equations for correction for non Flat Earth + altitude

4/Nov 97 Brf to NTSB

Question: Bernie: Anyone actually saw plane on fire
[Look at [redacted] data]

Have radar from 9 sites (b) (3)
Fire damage to rt wing
How many saw plane on way up -
- PP - prob ~6
Whether to use NTSB numbers?
Heading → ground track
Need to get from Chas + Dennis
RT - not everyone heard sound - poss preferential direction
(appears to correlate)
Using Riverhead (12 sec) not JFK
Nita Sturgeon alt showed 21000 ft - may be inaccurate
Re Sturgeon B - change in elev is small
LB - video shows roll
"up to 17 deg"

Video
Com: Need to change ppoint

Disc
12.26 end of 12.50
Troose PA - ARSR

Boston voice time

8 31 12.0 Trevore PA ARBR 20° mi way ?

8 31 12.26

8 31 12.50

9 Radars

3 Short range, 3 long range (1210)

Use 1 (ISP) as control

Riverhead, 12.0 sec - is at 08.

± 1/16 nm

AZ - 2ACP

4096ACP/360°

Make all lines up w/ "center" data

Round 1 ∩

Heading → Grd track → Direction - true

Best est mag offset - 13.3°

1960 E, -8.65 S of ISP - extrapolated 12.26 all BUT

11.51 T ISP -25 ~1 sec 11.26 extrapolation

= 40° 38' 56" / 72° 40' 17" (40.6489, 72.6714)

11/7 → 40 38 56.5 / 72 40 15.0 (40.6490, 72.6708

Bost Center & NY Center - diff = 1.00 sec

NY Center ahead voice 2.25

Review

1. Notes from briefing to NTSP
2. Notes from discussion with Charlie
   - Accuracy of ranges as measurement
   -

4 Nov 87

1. TBDs
   - Rev new mtg NTSB/gues - see note
   - Fit - see lists/eqpm
   - Prep gues.

2.

97B

11/2/97

Equations for observations

Parameters

λ_0 pos at t_0

Λ_0 pos at t_0

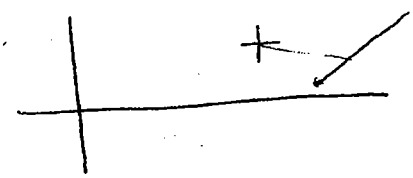
A_{FP} = flight azimuth rel initial position

$B_{A,JFK}$ = bias in JFK azimuth data

$B_{A,ISP}$ = " " ISP "

$\bar{R}(i)$ = range ~~rate~~ along flight path at time nodes; ~~i=0 at t=0~~; $i=1,n$ at ~4.6 sec

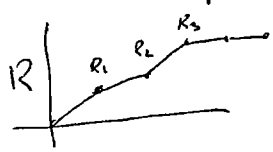
Δt = time between nodes



Calculate range along FP at time t

$$\cancel{R = \sum_{i=0}^{n} (\dot{R}_i + \dot{R}_{i+1})\Delta t/2}$$

$$R = R_{i-1} + (R_{i+1} - R_{i-1})(t - t_{i-1})/\Delta t$$



i = ~~first~~ last time less than t

Initial x_0 y_0 in N/E coordinates

$$y_0 = (\lambda_0 - \lambda_{JFK}) \times 60$$

$$x_0 = (\Lambda_{JFK} - \Lambda_0) \times 60 / \text{last } \lambda_{JFK}$$

$$x = x_0 + R \cos A_{FP}$$

$$y = y_0 + R \sin A_{FP}$$

$$a_J = \tan^{-1}(y/x) + B_{J,ISP} \text{ (rad)}$$

$$r_J^2 = x^2 + y^2$$

$$a_I = \tan^{-1}((y - y_{ISP}), (x - x_{ISP})) + B_{a,ISP} \text{ (rad)}$$

$$r_I^2 = (x - x_{ISP})^2 + (y - y_{ISP})^2$$

$$\lambda = \lambda_{JFK} + (y)/60. \qquad \text{(need } \lambda_{JFK})$$

$$\Lambda = \Lambda_{JFK} - x/60/\cos\lambda_{JFK}$$

98 B

11/2/97

Angelmeyer/A.C at 10mi

$\alpha = (40m\ ? = 120\,ft)/10 \times 6000 = .002 = .11\,deg$

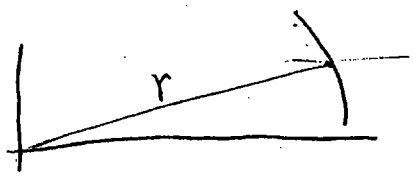
for 1" w opens dist = 1/.002 = 500" = 41.6 ft

for 1/2" ~21 ft

10/31/97

1. TBDs
   - Range data to LB (upper) – / along path
   - Code
     - Mark ISP main obj ✓
     - RMS of plane pos * → fit
   - Effect alt, earth
   - Uncert triangulation ✓
   - + Add HPN
     - Compare ✓
     - solve? spt soln X
   - Get + add 12 sec data? → disk
   - Question (NTSB/O'R)
     - Hongaline radar times ✓
     - Other radars? eg JFK 12 → disk
     - What in XP ✓
   - Time of last XP NTSB ✓
   - Pos bridge (Pr az?)
   - Mtg at NTSB? ✓
   - Rev EDs, etc
   - Plots/presentation

2. Given lat, calc lon



$Lat_{JFK} = 40.6362$

Δy for 40.66

40.660 $\Delta y = 0.0238 \times 60 = 1.428$ nm

For 40.665, $\Delta y = .0288 \times 60 = 1.728$

40.655 $\Delta y = .0188 \times 60 = 1.128$

40.670 $\Delta y = .0338 \times 60 = 2.028$

2

$\Delta y = 1.128$ $\Delta y = 1.428$

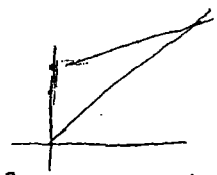
T	R_{JFK}	$\Delta x_{55}/\Lambda$	Δx_{60}
16.65	50.46	50.447/72.6587	50.440/72.6587

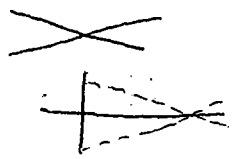
Lee has path length time

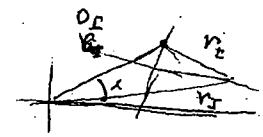
3. Code for HPN
See plot - 2 motions

to hpn
← 1

4. ~~Uncertainty~~
~~Set HD = 0~~



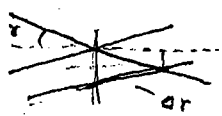


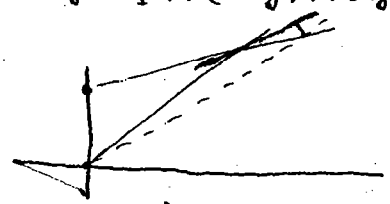


$$x = r_J \cos(\alpha - \cos^{-1}((d_I^2 + r_J^2 - r_I^2)/(2 d r_J)))$$

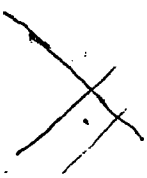
$$y = r_J \sin(\alpha - \cos^{-1}((d^2 + r_J^2 - r_I^2)/(2 d r_J)))$$

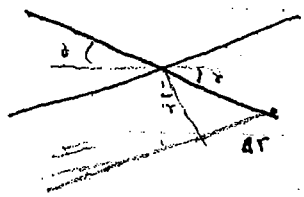
$$\frac{\partial x}{\partial r_J} = \cos(\alpha - \cos^{-1}(\cos\alpha_I)) + r_J \sin(\alpha - \cos^{-1}(\cos\alpha_I))$$
$$* \, \partial \cos^{-1}[(d_I^2 + r_J^2 - r_I^2)/(2 d r_J)]/\partial r_J$$



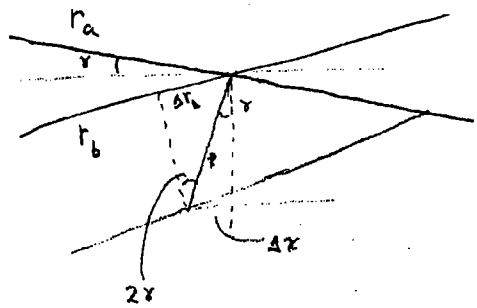


Δx ~~= [illegible]~~ γ = lin angle
Δy ~~= [illegible]~~





3



$p = \Delta r_b / \sin 2\gamma$

$\Delta x \quad p \sin\gamma = \Delta r_b \dfrac{\sin\gamma}{\sin 2\gamma}$

$\Delta y = p\cos\gamma = \Delta r_b \dfrac{\cos\gamma}{\sin 2\gamma}$

Compute γ for pstpt

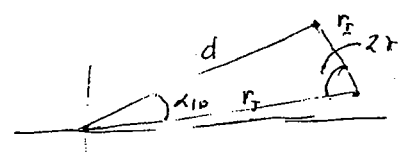
$d_y = \Delta\lambda \times 60 = (.7840 - .6362) \times 60 = 9.468$

$d_x = \Delta\lambda \times 60 \times \cos\lambda = (.7669 - .1001) \times 60 \times \cos 40.6 =$ [redacted] 30.363

$d = (d_y^2 + d_x^2)^{1/2} = 31.805$

$r_{\text{[redacted]}} =$ ~~21.51~~ 21.60

$r_I = 50.46$



$\cos\alpha_{ID} = (d^2 + r_J^2 - r_I^2)/(2 d r_J)$

$= .9630$

$\alpha_{ID} = 15.6207$

$\alpha_I = \tan^{-1}(d_y/d_x) = \tan^{-1}(9.468/30.363) = 17.319$ dont need

$\dfrac{\sin\alpha_{ID}}{r_I} = \dfrac{\sin 2\gamma}{d}$

$\sin 2\gamma = (d/r_I)\sin\alpha_{ID} = (31.805/21.60)\sin 15.6207$
$= .3965$

$2\gamma = \sin^{-1}(.3965) = 23.36$

$\gamma = 11.68$

$\sin\gamma = .2024$

$\cos\gamma = .9793$

$\dfrac{\partial x}{\partial r} = \dfrac{\sin\gamma}{\sin 2\gamma} = \dfrac{.2024}{.3965} = .51$ $\quad \dfrac{\partial y}{\partial r} = \dfrac{\cos\gamma}{\sin 2\gamma} = \dfrac{.9793}{.3965} = 2.47$

$\sigma^2(x) = \left(\dfrac{\partial x}{\partial r}\right)^2 \sigma_r^2 \rightarrow \sigma_x^2 = \sqrt{2} \times .51 = .72$ $\quad \sigma_y = 3.49$

If $\sigma(r) = 230\,m$

$\sigma_x = 166\,m = 545'$

$\sigma_y = 802\,m = 2634'$

$\sigma_{Az,J} = \sigma_y / R_J = 802/50/1852 = .0087 = .50°$

Review

1. Calculation uncertainty

31 Oct 97

Mtg w NTSB (Jim Clark, Dennis Crouter) XP data ✓ time align ✓

1. Lees sim

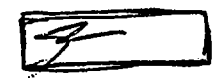
Solve:

Boeing → extend to 160 C_N, C_A

Var in CP → solve offset from Boeing / table

Left engine on

IC - ? NTSB - 358 gnd speed



1/2 x 5 = 2.5°

10mm

2.5/57

.05 x 10mm

.5mm

2. Radar plots

Cooperative targets

± 0.1° / ± 1/16 mi - transponder

8/6000

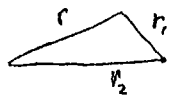
Dynamic → ± 1/8 mi

230 m

8/1852

16/25

≈ ± 760'



- Boston Center - VR - hang WWW

Key all to ATC

Mute hands -

Cover CVR FDR → BC

Shift FDR - vs radar ATC

50' radar resol

Calibrate time

XP - 1/16 mi

Calibrated mag - 12.5 for JFK departed 13.9

12 Sec → NY Center

XP - hand good mag ✓ 12 sec data

- 6d vs 3d
  - get fit with roll w/o up
  - start putts before break

10/30/87

1. Changes for triangulation

2. TBDs
   - Code
     - clean doc ✓
     - mark main ✓
     - number ISP ✓/mark ISP
     - RMS of plane ~~data~~ position
     - print λ_0, Ω_0 ✓
     - effect alt + earth
   - Add NPN
   - Get tad & JFK 12 sec
   - try other ~~data~~ track ✓
   - time of last XP
   - error ellipse triangulate

- Questions
  - How design radar times (0'R?)
  - other radars, JFK, etc.
- Posbridge

Print point
impact
~~correct TPT~~
~~plot track~~
~~- in top PL rng &~~
~~ISP + RMS~~
λ_0 Ω_0

3. Use 4 3 lowest pts for Δ

48.85	40.6657	72.6271
39.46	40.6687	72.6327
34.77	40.6661	72.6365
~~34.77~~	~~40.6720~~	~~72.6357~~ same
44.14	40.6656	72.6304

$\bar{X}_0$ = 40.6575, 72.7669 x

From RT map

P_0 = 40.6502, 72.4663

2 out 3 JFK pts

		lower	upper
Δr_1 from #2 &	.07 or .16 nm =	.0015°	or .0035°
Δr_2 from "	.13 or .23 nm =	.0029°	or .0051
Δr_3 "	.19 nm =	.0042°	

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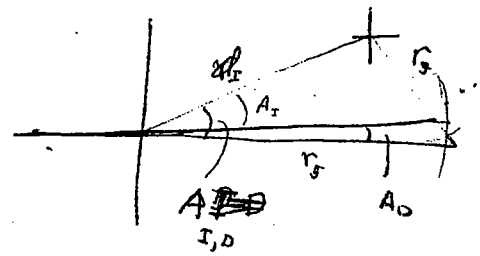
Review

1. Plotted tri pts for last 4 pts
2. Marked range from JFK for pts with no ISP
3. Typed in HPN in faa_Hpn1.dat
4. Mod program for triangulation

10/29/57

$$\cos A_{ID} = \frac{d_I^2 + r_J^2 - r_I^2}{2 d_I r_J}$$



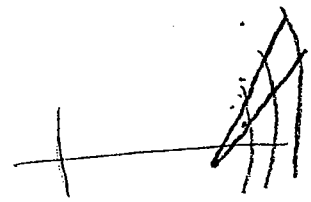
$$A_D = A_I - A_{ID}$$

In xyzrng.f

10/29/97

1. Put in changes for magnetic offset
   Test with zero OK

2. "MAIN" JFK points -
   1, 3, 9, 12, 14, 19, 23, 27, 31, 33, 37



3. Run w 19° W offset / 1.2° / 1.5° (pretty good)
   [λ_0 λ_0 alt not]

4. From RT plots
   Front = 40.6514, 72.6403
   Main = 40.6632, 72.6238
   Last pt JFK from calcs.
   40.6748 = 40 40 29
   72.6233 = 72 37 24

5. Type in prior upset bitrnspri

   [Note prior AZ J] LNZFCR → -88.5 ~~Aug LP~~

   Let Ref area = 1.0 m²
   $L = q\, C_N A$ → $C_N = L/q/A$
   $q = 2391$ lb/ft²
   $C_N = L/q/A = 500000$ lb / 2391 lb/ft² / 10.8 ft²
   $= 500000/25000 = 20$

Review
1. Put in changes for magnetic offset. Not good fit with 1.5°.
2. Not debris locations from RT maps. / 3 Stated prior - see dep notes

10/28/97

1. Initial position (lat + XP)

JFK – 50nm east of 73.7669

50 = .8333 ~~.8333~~ ~~= .1324~~ 1.0982

* cos 40.6 * ~~72.9336~~ 72.6687

Lee's = 72.6806

Last XP = 72.6687

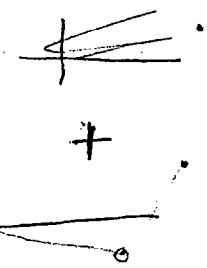
Δ = .0.012° east

= 0.54nm

2. Calc lat, lon

$\lambda_{CALC} = \lambda_{JFK} + y_{calc}/60$

$\Lambda_{CALC} = \Lambda_{JFK} + x_{calc}/60/\cos\lambda_{JFK}$

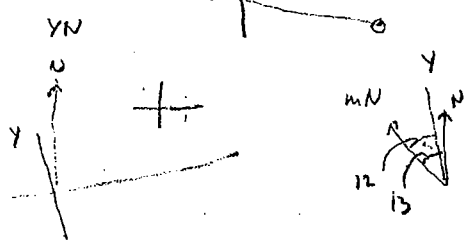


3. Rotate x, y of JFK

Rotate all x, y to NE – x_N y_N

$x_N = x\cos\Delta\theta_M - y\sin\Delta\theta_M$

$y_N = x\sin\Delta\theta_M + y\cos\Delta\theta_M$



4. Pass LSQSET

Data = rns from ISP (/HPN)

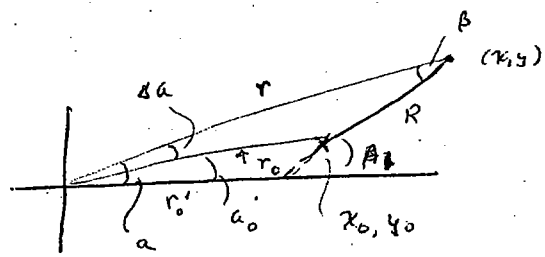
Calc x-calc, y-calc 1st time thru

Review

1. Compared last JFKXP pos to LB's run ~ .54nm east
2. Equations for calculating lat + lon (flat earth)
3. Outlined pass LSQSET setup.

10/28/57

1. Adjustment for Y_0



$a = A - \beta$

$\beta = \sin^{-1}\left(\frac{r_0'}{r}\sin A\right)$

$r_0' = x_0 - y_0 / \tan A$ $\qquad \tan A = y_0/\Delta x$

$\beta = \sin^{-1}\left(\frac{\left(x_0 - y_0\frac{\cos A}{\sin A}\right)}{r}\sin A\right)$

$= \sin^{-1}\left(\frac{x_0 \sin A - y_0 \cos A}{r}\right)$

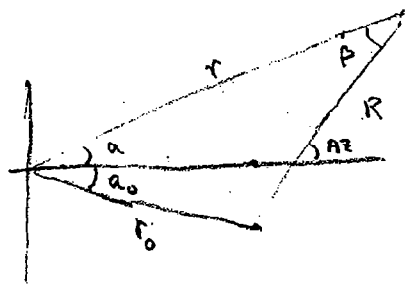
$a = 180 - (180 - A) - \beta \qquad r = A - \beta$

$R^2 = r^2 + r_0'^2 - 2 r r_0' \cos(A - \beta)$

$a_0 =$ AZ2XP $= \tan^{-1}(Y_0/X_0)$

$\Delta a = a - a_0 = (A - \beta) - a_0$

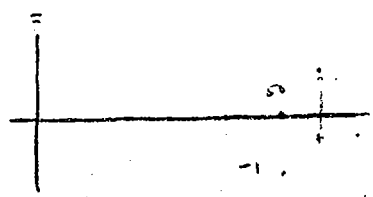
$R^2 = r^2 + r_0^2 - 2 r r_0 \cos(\Delta a)$



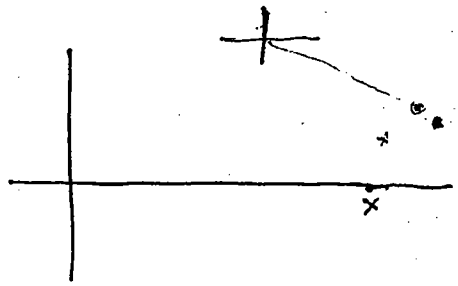
2. Try to $Y_0 = -1$

$RR_1 = .8069$ vs $.5136$

$A_0 = a_0 = -1.18$ / $\beta_1 = 27.41$ / $\Delta a = A - \beta - a_0 = 26.8 - 27.41 -$



10/28/97 2



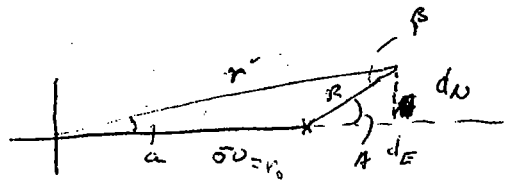
TBD
- ~~another JSK pt~~ ✓
- ~~pnt tr of ISP data~~ ✓
- ~~pnt #~~
- ~~rotate a cs. (?)~~ ✓
- ~~offset alt~~
- ~~offset search~~
- true/fluct XP each?
- 12 sec data / OIR?
- ~~cust lat, lon~~ ✓
- where debris? ✓

3. Modify file + script for ISP data

Review
1. Modified prog xyz2ongsd to account for y offset at t_0.
2. put more points in both input files

27 Oct 97

1. From jfk



$A \sim \tan^{-1}(.5) \approx 27^\circ$

$d_N = R \cos A = r \cos a$

$$\frac{r}{\sin A} = \frac{R}{\sin a} = \frac{50}{\sin \beta} \quad (50 = r_0)$$

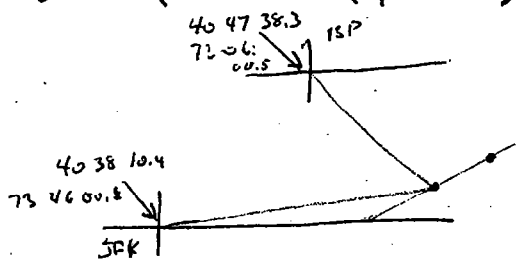
$$\sin \beta = \frac{r_0}{r} \sin A$$

$$a = 180 - (180 - A) - \beta = A - \beta$$

have guy – need A_0

$$R^2 = r^2 + r_0^2 - 2 r r_0 \cos\left(A - \sin^{-1}\left(\frac{r_0}{r} \sin A\right)\right)$$

2. ISP in JFK coord.



$\Delta\lambda$: 40 47 38.3
40 38 10.4
9 : 27.9

$\Delta\Lambda$: 73 46 00.8
73 06 00.5
40 00.3

Approx $y \rightarrow$ 9:27.9 = 9.465 mm = 9.464 nm

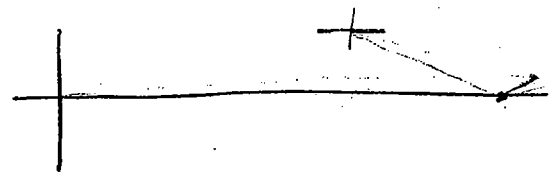
$x \rightarrow$ 40:00.3 = 40.005 min = 40.005 * cos λ_J = 40.005 cos 40.636

= 30.358

For ISP, r_0 = (19.52, −8.69) = 21.37 from plot

2

[redacted]



Compute rng to ISP wrt JFK traj using AZ

$x_{ISP} = 30.36$

$y_{ISP} = 9.46$

$r_{ISP}^2 = (x_{JFK} - x_{ISP})^2 + (y_{JFK} - y_{ISP})^2$

$x_{JFK} = R\cos A + r_0$

$y_{JFK} = R\sin A$

Compare last xpnd each

$x_0\ ISP = 19.52$
$y_0\ ISP = -8.70$] 21.37

$(x_{ISP} - x_0 JFK)^2 + (y_{ISP} - y_0 JFK)^2 =$

$(30.358 - 50)^2 + (9.464 - 0)^2 = 21.80$

$\neq ?$

Review

1. Expanded xyzrng.f to calculate range from last transpanded point, assuming flight azimuth. Ran data from ISP. Calculated range from ISP to JFK points. Why ½ nm difference?

26 Oct 97 Run program to

1. Type in faa_jfk1.dat (1st 4 pts true)
   work/twa800

2. Type in xy2rng.f
   Create xy2rng.run.s
   chmod +x ~~faa~~ xy2rng.run.s
   Create compute.s
   Run xy2rng with faa_jfk1.dat

Review

1. On work/twa800 wrote program to convert x, y to range from radar (xy2rng.f). Typed in 1st 4 scans /r jfk from FBI package.tr.m.

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52

47

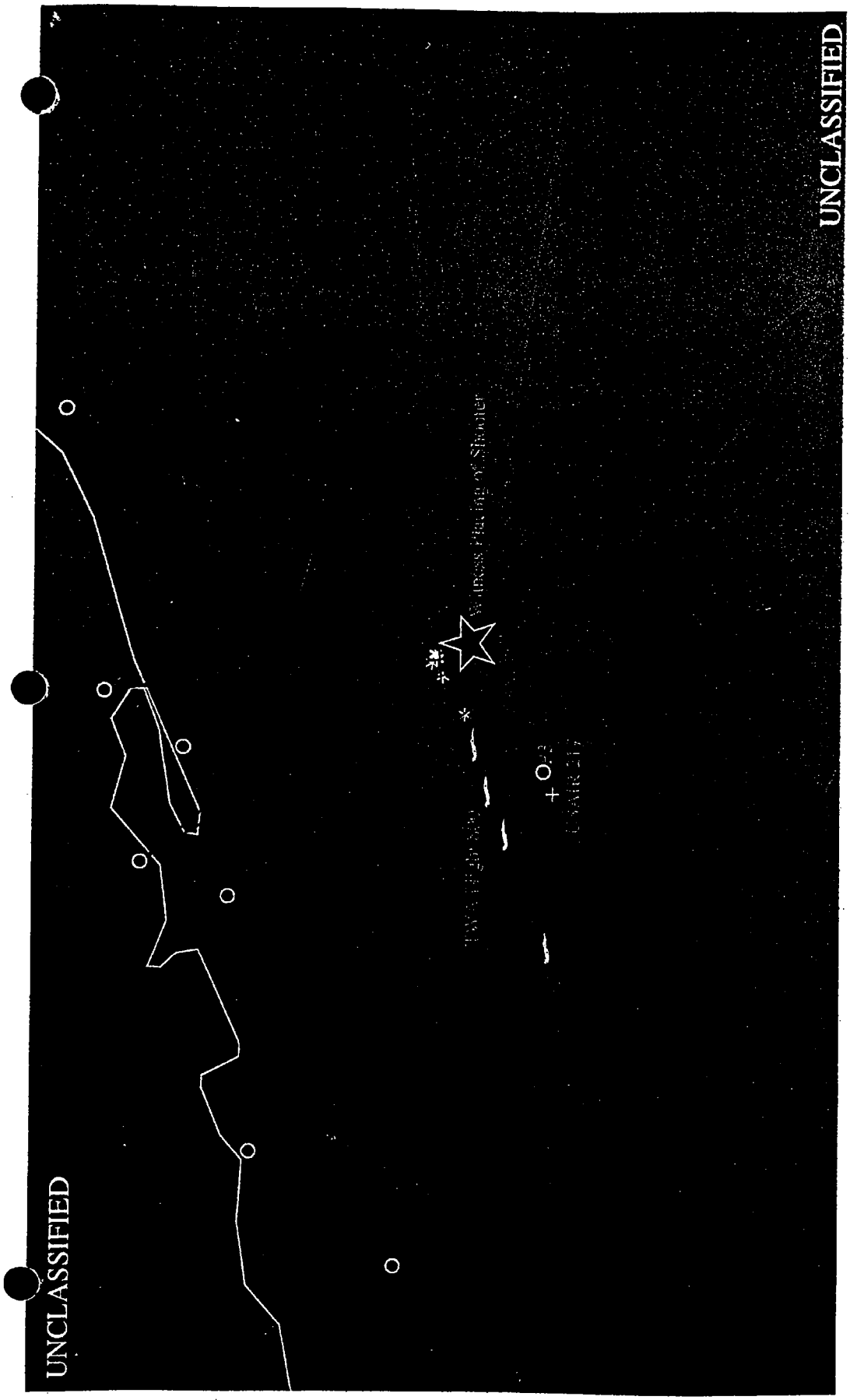
ROTATET.FOR RANGE/AZ → X/Y

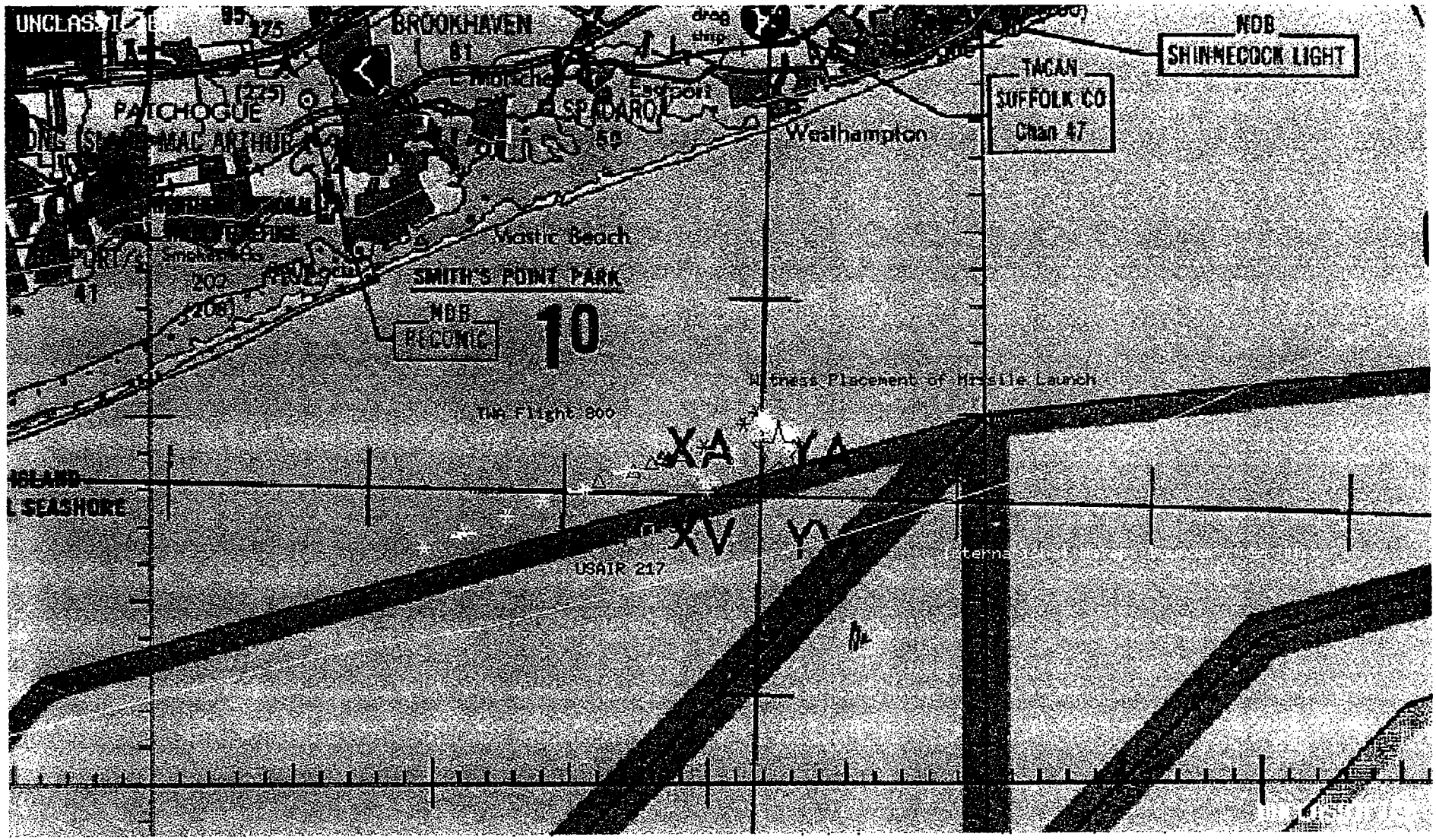
```
C
C       PROGRAM ROTATE MLM 15-OCT-81
C
C       THIS PROGRAM TAKES DATA FROM AN ARTS LISTING,
C       MANUALLY ENTERED , AND CONVERTS THE RANGE AZIMUTH
C       VALUES TO X Y VALUES.
C       IT WILL ALSO ACCEPT A MAGNETIC DEVIATION AND
C       ROTATE THE AXIS TO MAKE THE DATA ALIGN WITH TRUE NORTH.
C
C       BECAUSE THE AZIMUTH VALUES START AT 0=NORTH AND
C       PROGRESS CLOCKWISE, WHILE THE SINE COSINE FUNCTIONS
C       ARE ESTABLISHED FOR 0=+EAST AND PROGRESS COUNTERCLOCKWISE,
C       AN ALGORITHM WAS NEEDED TO MAKE THIS CONVERSION.
C       [redacted] SUGGESTED THE FOLLOWING:          (b)(6)
C       SIMPLY EXCHANGE THE X AND Y VALUES CALCULATED USING
C       THE ANGLES OF THE ARTS SYSTEM AND VOILA EVERYTHING
C       WORKS OUT FINE. THANK YOU JIM.
C
C       THE OUTPUT IS IN THE FORM OF A FILE WHICH IS
C       READY FOR SUBMISSION TO MANAT OR FIXIT.
C
        CHARACTER*80 BUF
        DATA ANGL,ACPS,DEGS/'    ','ACPS','DEGS'/
        DATA PI/3.14159/
        PI=PI/180.
        PRINT 60
 60     FORMAT(' ENTER INPUT FILENAME :  '$)
        READ (5,2)BUF
        OPEN (UNIT=3,FILE=BUF,STATUS='OLD')
        PRINT 1
 1      FORMAT(' ENTER OUTPUT FILENAME :  '$)
        READ (5,2)BUF
 2      FORMAT(A)
        OPEN (UNIT=4,FILE=BUF,STATUS='UNKNOWN')
        PRINT 50
        PRINT 3
 3      FORMAT(' ENTER MAGNETIC VARIATION HERE IN DEGREES  :')
        PRINT 33
 33     FORMAT(' OR ENTER 0.0, ENTER VARIATION WITH A DECIMAL POINT :   ')
        PRINT 3003
 3003   FORMAT(' ENTER WEST VAR AS POS. AND EAST VAR AS NEG. :  '$)
        READ(5,4)VAR
 4      FORMAT(F10.0)
        PRINT 50
 50     FORMAT(/)
 8      PRINT 5
 5      FORMAT(' DO YOU WISH TO ENTER AZIMUTHS IN <DEGS> OR <ACPS> :  '$)
        READ (5,2)ANGL
C       TYPE 50
        IF (ANGL.EQ.ACPS) GO TO 10
        IF(ANGL.NE.DEGS) GO TO 8
        GO TO 10
 10     CONTINUE
 100    CONTINUE
        IPTS=0
 200    CONTINUE
        IF(ANGL.EQ.DEGS) GO TO 250
        IRET=213
 213    CONTINUE
        READ(3,202,END=1000)IH,MIN,SS,RR,rAZ,RA
```

```
202     FORMAT(2I18,F20.0,F20.0,f20.0,F23.0)
cdufus  IF(RR.EQ.0.0) GO TO 1000
        RAZ=RAZ/4096.
        ANG=RAZ*360.
        GO TO 300
 250    CONTINUE
        IRET=263
 263    CONTINUE
        READ(3,252,ERR=2000,END=1000)IH,MIN,SS,RR,ANG,RA
252     FORMAT(2I18,F20.0,2F20.0,F23.0)
cdufus  IF(RR.EQ.0.0) GO TO 1000
 300    CONTINUE
        IPTS=IPTS+1
        ANG=ANG-VAR
        IF(ANG.GT.360.) ANG=ANG-360.
        IF(ANG.LT.0.) ANG=ANG+360.
        X=RR*SIN(ANG*PI)
        Y=RR*COS(ANG*PI)
        TOTTIM = MIN * 60.0 + SS
        WRITE(4,44)IH,MIN,SS,X,Y,RA,TOTTIM
44      FORMAT(1X,2(I2,','),F7.3,',',2(F9.4,','),2(F11.2,','))
        GO TO 200
 2000   CONTINUE
        PRINT 50
        PRINT 2002
 2002   FORMAT(' ERROR ON INPUT... REENTER')
        PRINT 50
        PRINT 2050,IPTS+1
 2050   FORMAT(' IN INPUT LINE c',I8)
        IF(IRET.EQ.213) GO TO 213
        GO TO 263
 1000   CLOSE(4)
        CLOSE(3)
        PRINT 50
        PRINT 1001
 1001   FORMAT(' FILE CLOSED... PROGRAM NORMALLY TERMINATING')
        END
```

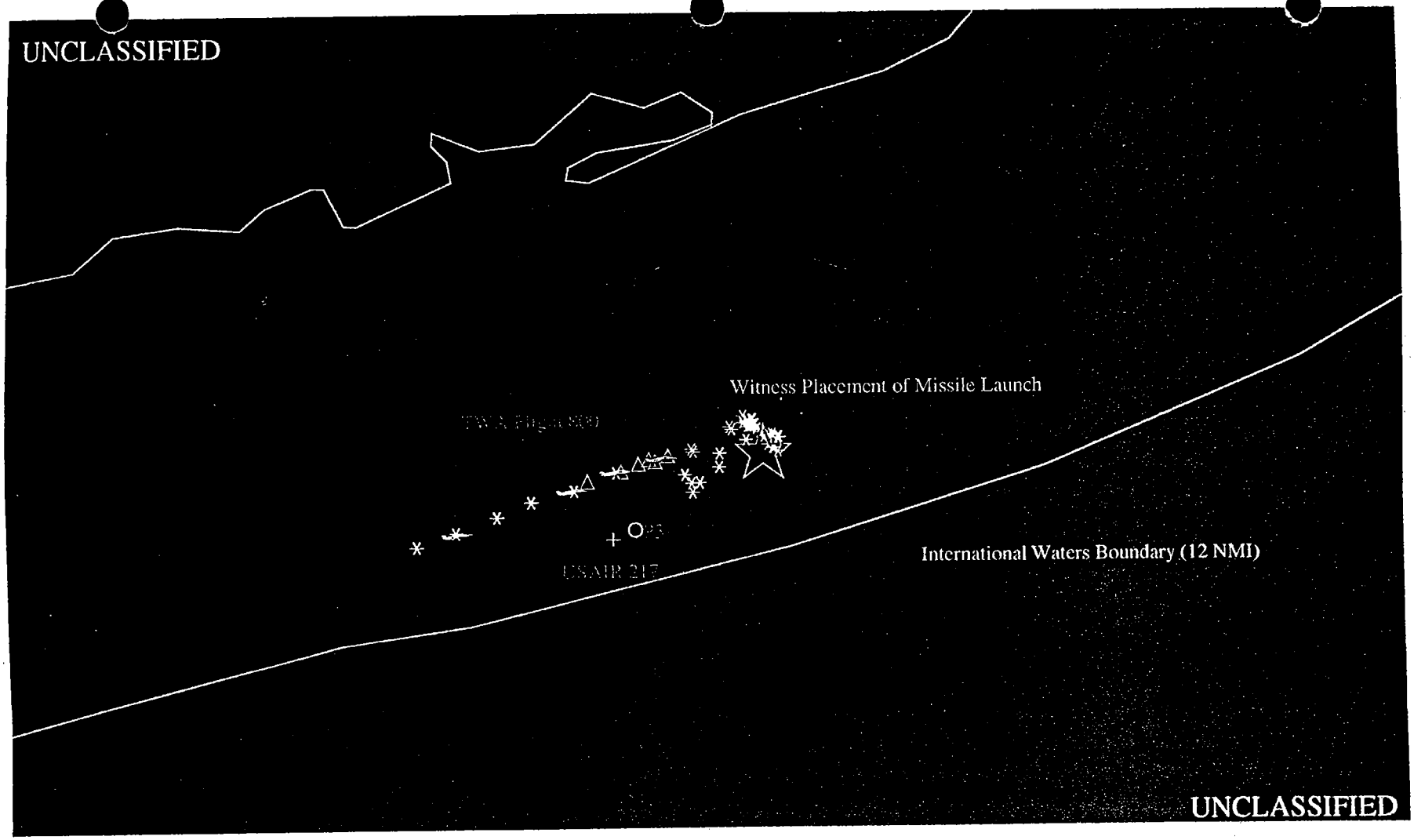
 117 B 541

55



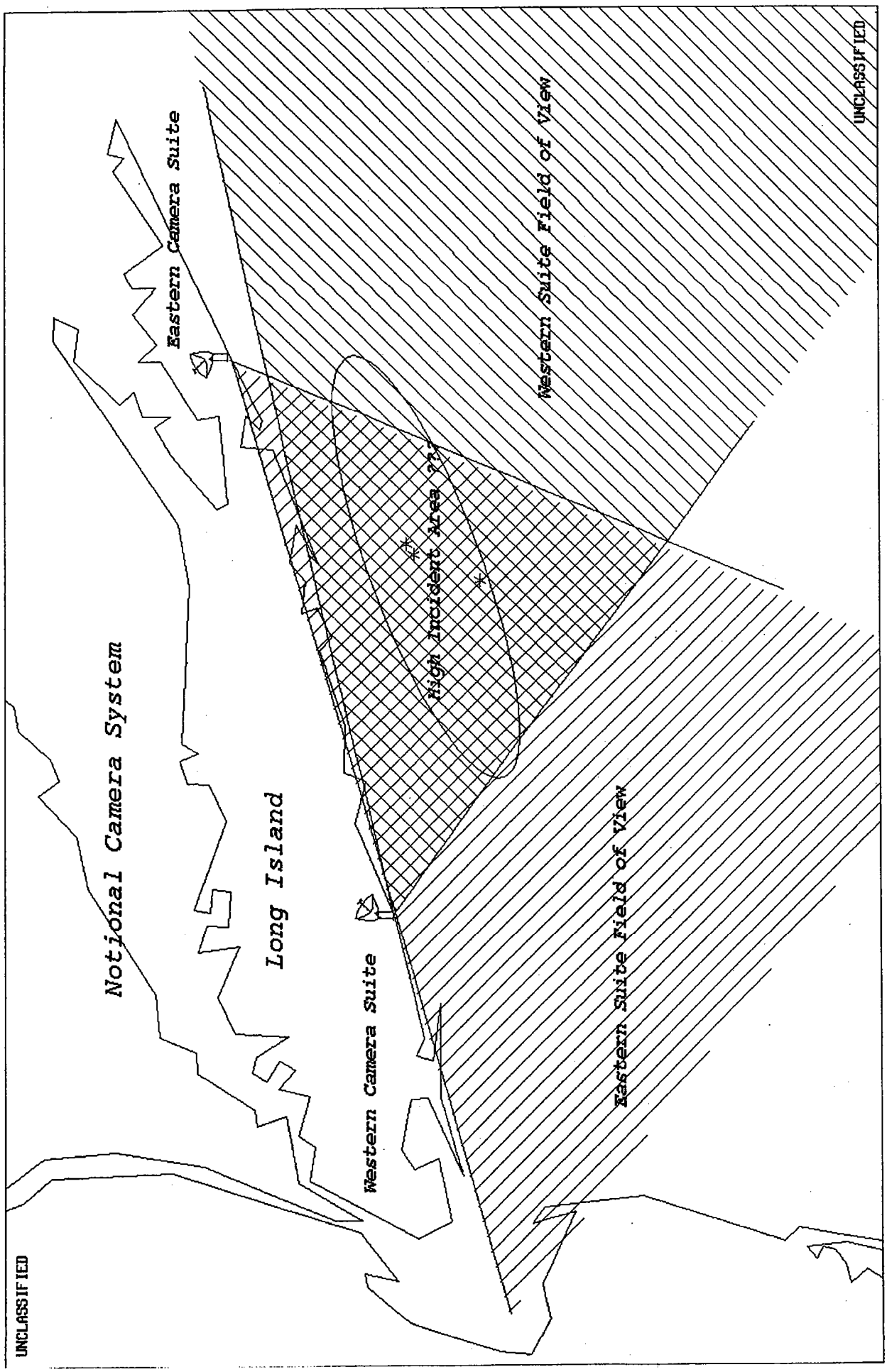


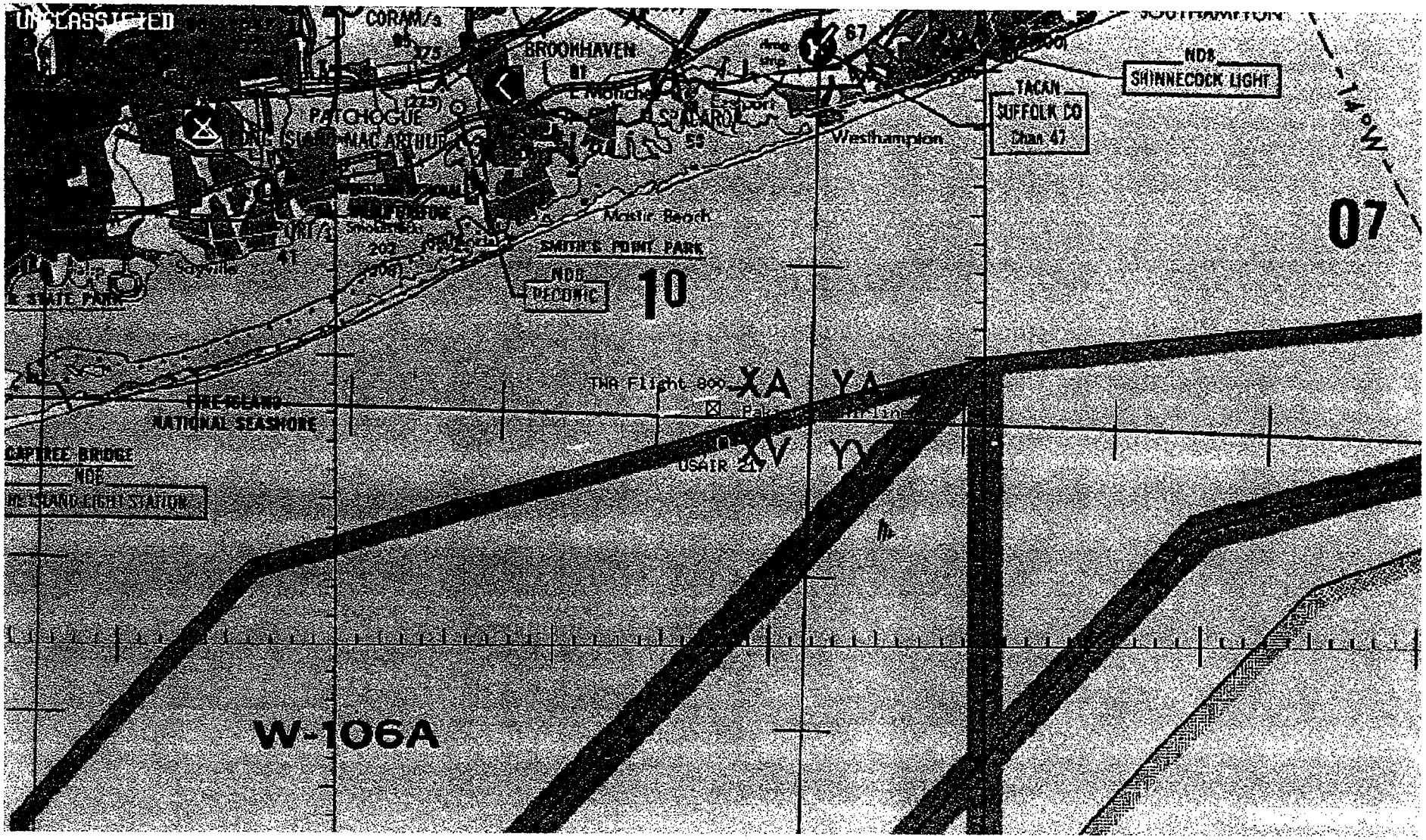
118 B

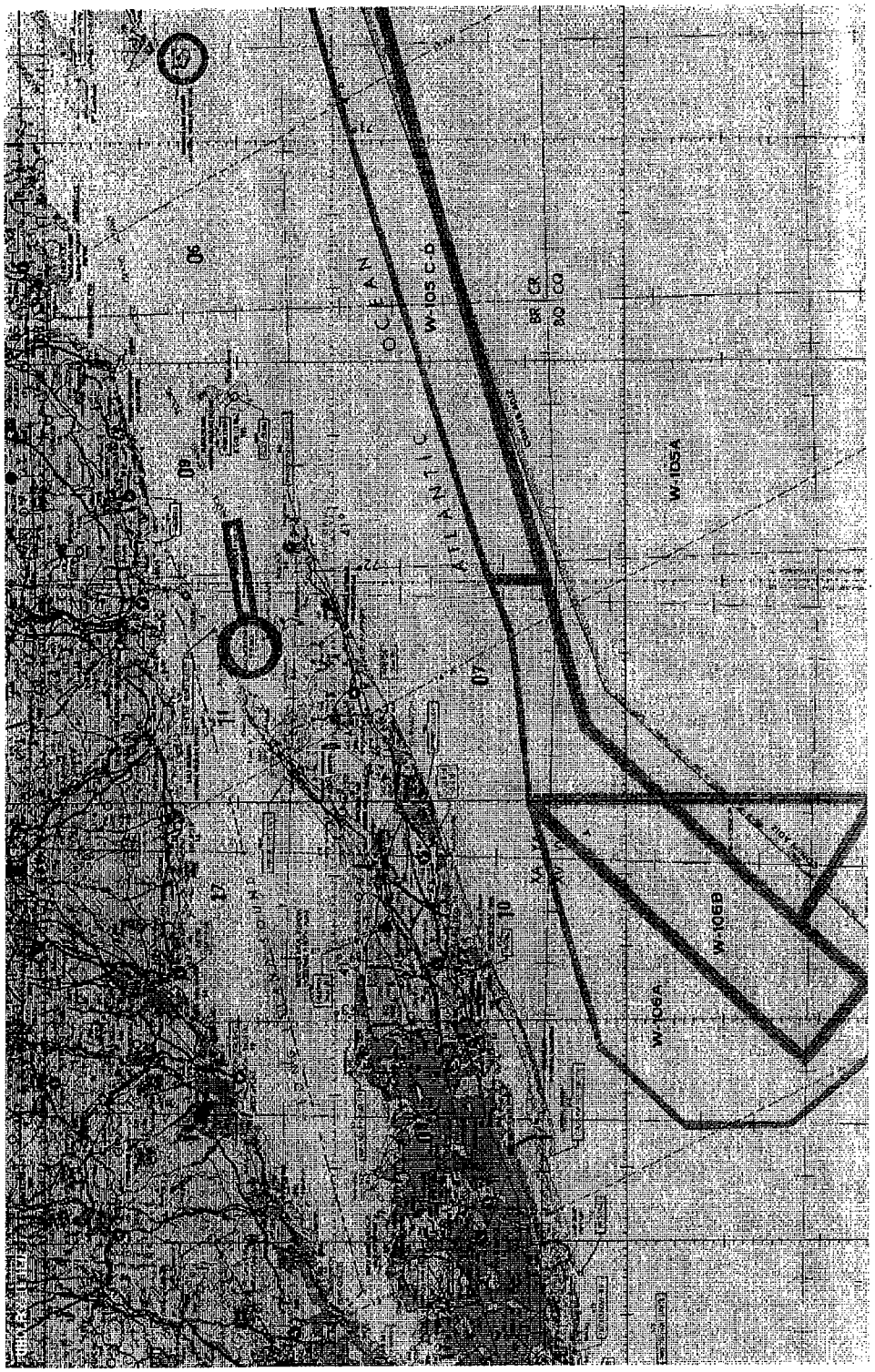


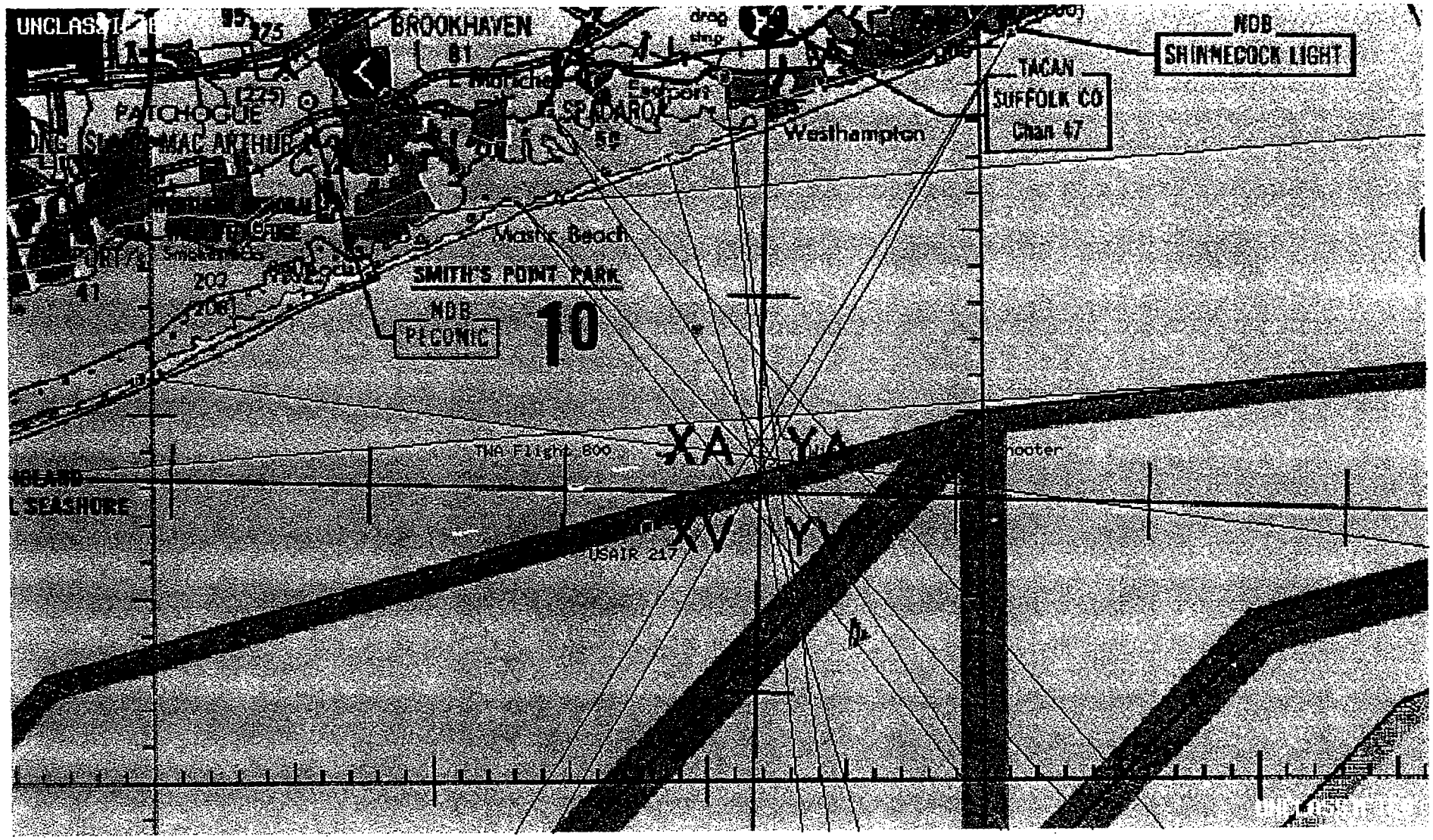
119 B

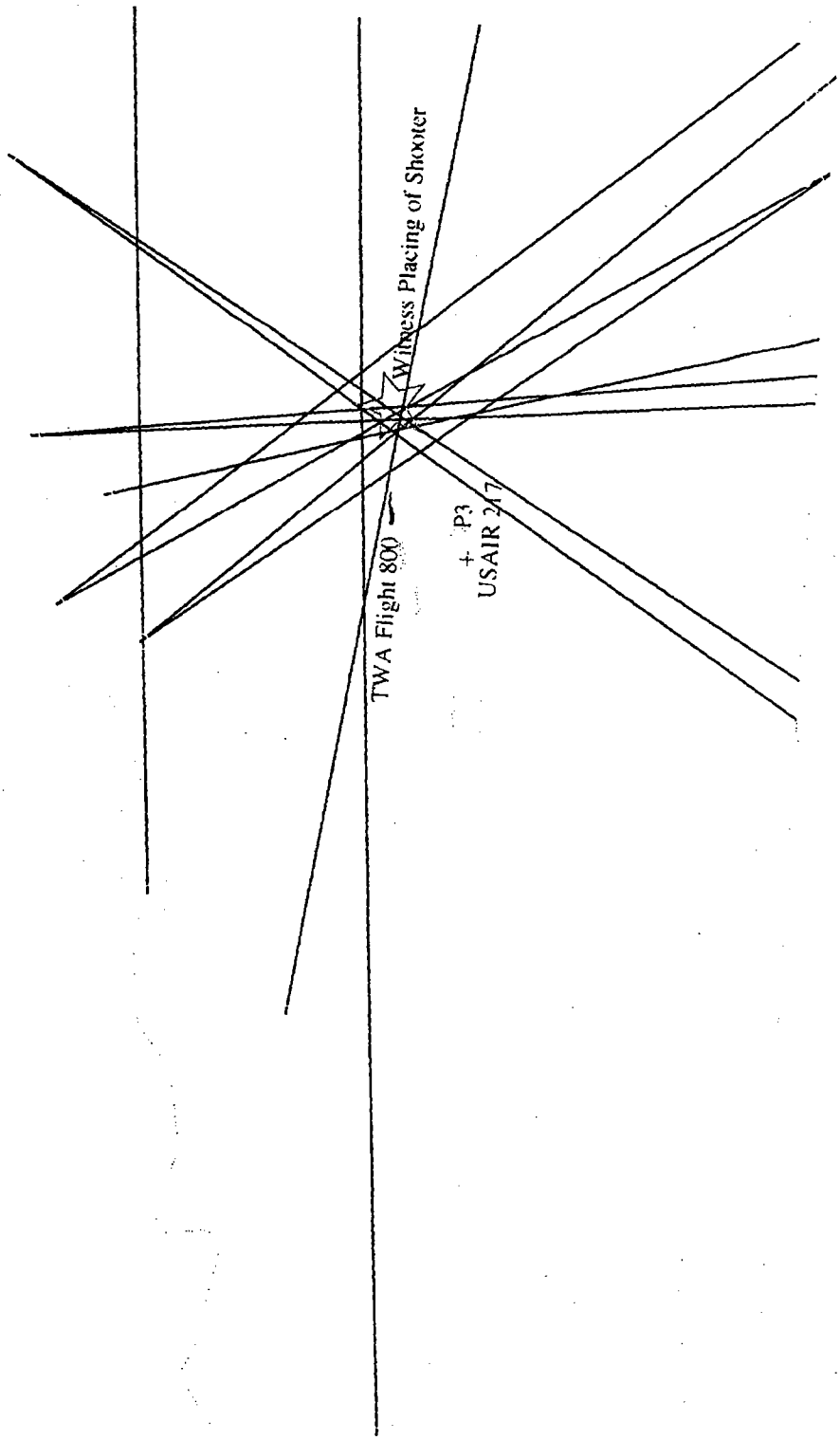
120 B

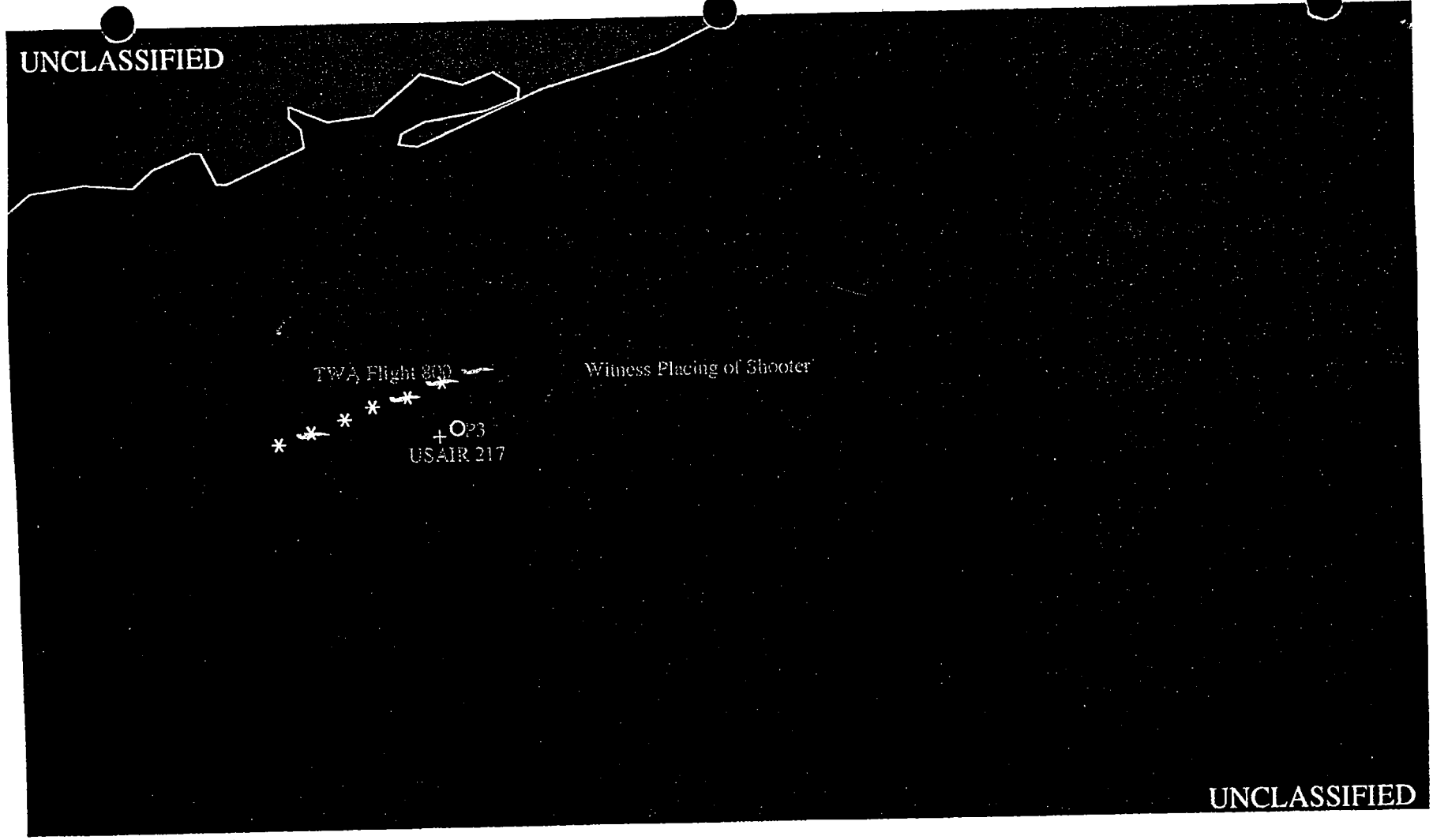

UNCLASSIFIED
Notional Camera System
Eastern Camera Suite
Western Suite Field of View
Long Island
High Incident Area ??
Western Camera Suite
Eastern Suite Field of View
UNCLASSIFIED

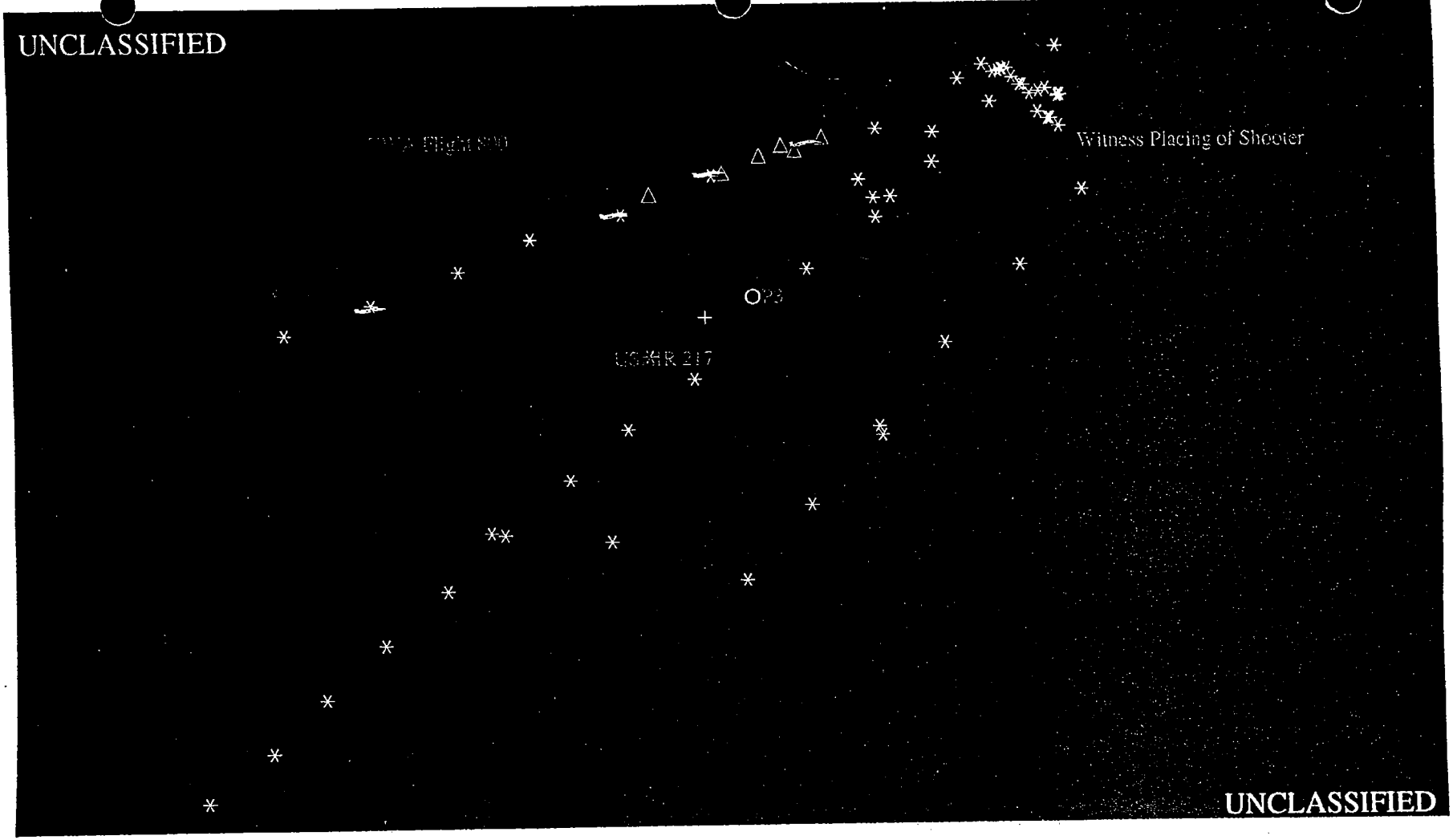


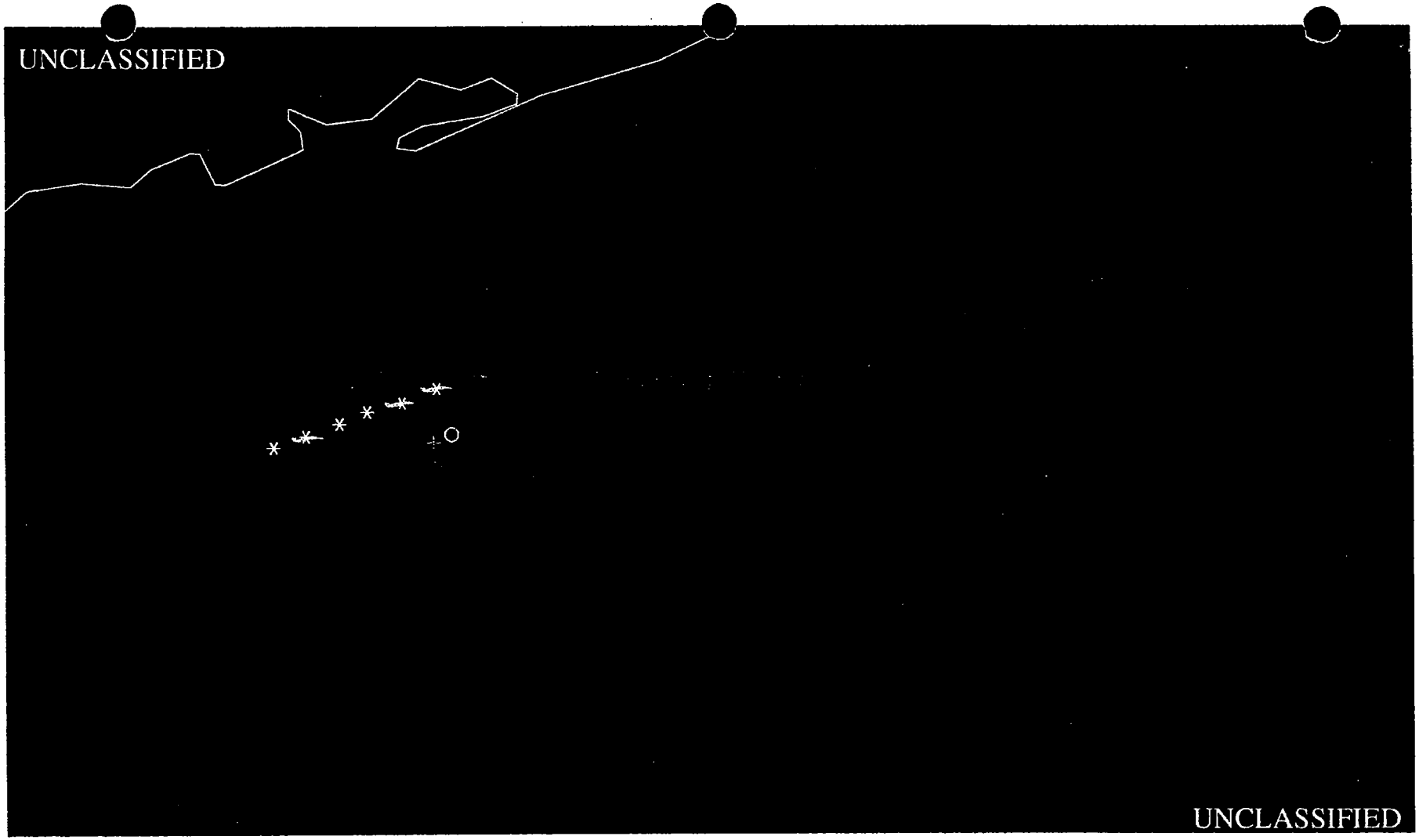

OCEAN
ATLANTIC
W-105 C-9
W-105A
W-106A
W-106B




Witness Placing of Shooter
TWA Flight 800
P3
USAIR 247







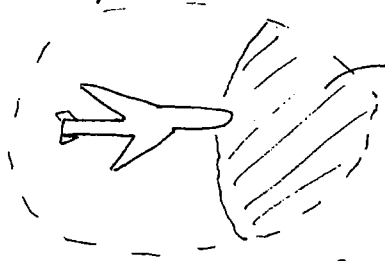
TWA Flight 800

Missile Theory

Projected point of shooter from witness testimony: 40:39 N
72:37.2 W

An alternative position was calculated by FBI to be:
40:40.65 N
72:41 W

Footprint of where shooter would have to be to have brought down the plane at that spot was made by OWTP.



The projected point falls within the "most likely" area.

Last instrument readings: 13,820 ft → altimete
330 knots → airspee

Most damage to plane and passengers occured on the mid-right side of the plane. (rows 17-28)

Observations Made Prior to July 17, 1996

Sunday, June 30th: in the vicinity of Port Jefferson on the North Shore of Long Island

Sunday, July 7th: Aquebogue, NY on the south side of the north fork of Long Island

Friday, July 12th (4:50 am): Smithtown, NY
azimuth: 70°-72° north magnetic
(in the vicinity of Long Island Sound over towns of Rocky Pt. & Miller Place)
An Airborne Express flight (516) from J.F.K. to RI was flying through there at ≈ 13,000 ft.

Wed. July 17 (20:20): Westhampton, NY
(20:00): location not specified

Transponder : (has 12-sec. sweep)

Second-to-last at 20:30:57 EST

Last at 20:31:09 EST

Sikorsky (last) at 20:31:12 (has 4-sec sweep) 4.6

Non-transponder (skin paint)

20:31:21 EST

20:31:32 EST

20:31:44 EST

Impact occured (of plane ~~[illegible]~~ body & engines)

≈ 20:33:32 EST No.

Fist part that came off plane landed

20:33:32 EST

@ 0031 51 [redacted] 0031:57.5 (b) (3)

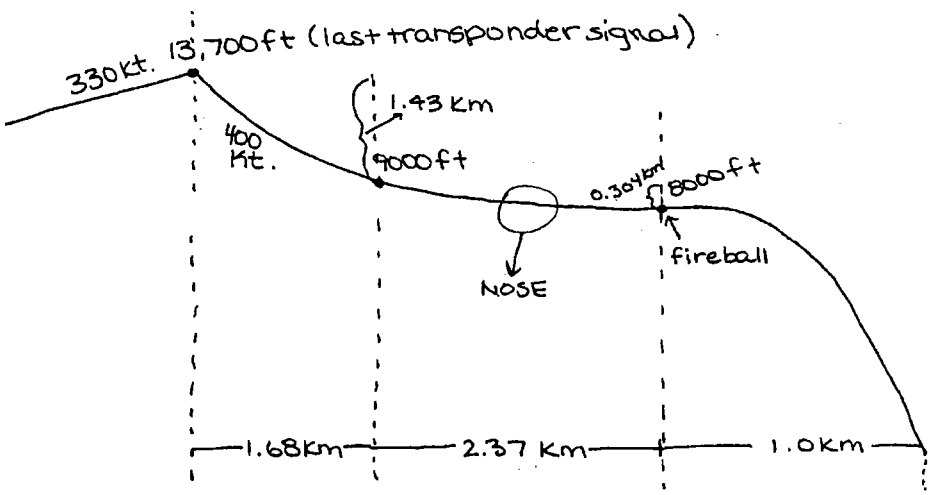
Estimated Explosion : 003123 - 003130

[redacted] detection 27 to 34 seconds after explosion. 43.5 (b) (3)

NOTE: [redacted] (b) (3)

ELAPSED TIME		
0	003110	LAST BEACON
12	003122	SKIN TRACK HIT
24	003134	1ST DEBRIS HIT
41	003151	DSP

TIM'S PROPOSED SCENARIO



From last transponder to radar scan plane traveled 1.7 Km at ground speed of 270 Kt.

Next, traveled 2.4 Km in ground speed of about 380 Kt.

Then traveled 1 Km to impact.

Airline positions at 00:31:10 (8:31:10 pm EST)

USAIR 217 (2237)	40:36:33N 072:42:45W
P3	40:36:49N 072:41:56W
TWA 800 (2633)	

TWA (transponded)

time	Position
8:21:04	40:34:04 N 073:47:26 W
8:21:16	40:33:18 N 073:47:04 W
8:21:28	40:32:42 N 073:46:23 W
8:21:40	40:32:05 N 073:45:42 W
8:21:52	40:31:30 N 073:44:52 W
8:29:59	40:36:25 N 072:49:58 W
8:30:11	40:36:43 N 072:48:30 W
8:30:23	40:37:14 N 072:47:03 W
8:30:35	40:37:38 N 072:45:44 W
8:30:47	40:37:55 N 072:44:17 W

time	Position
8:30:59	40:38:26 N 072:42:40 W
8:31:10	40:38:49 N 072:41:01 W

non-transponder

~~time~~	~~Position~~
~~8:31:22~~	~~40:36:03 N~~ ~~072:42:54 W~~
~~8:31:35~~	~~40:35:25 N~~ ~~072:44:02 W~~
~~8:31:47~~	~~40:34:45 N~~ ~~072:45:11 W~~

?

AT 0831:08 PM (from onboard recordings only),
TWA 800 at: 40° 38' 45" N
72° 41' 12" W

ALTITUDE: 13,700 FT.

GROUND SPEED: 380 KNOTS = 641 FT/SEC

HEADING (TRUE) = 71°

Discrepancies w/ Witness Accounts

- military SAMS use smoke-less gas to avoid the enemy knowing where the missile came from (retaliation)
- witnesses see the object ascend and then describe the fire ball as occuring "2 seconds", "immediately", "just after" the event.

<Something happened (whatever happened) was 20 seconds before the fire ball.>

CASA

Zoom in to 40.5 - 40.75
-73.0 - -72.5

Time to ~~1900~~ 2000

NON-TRANSPONDER

40:39:03 (40.6508)
-72:39:51 (-72.6642)

40:39:41 (40.6614)
-72:38:26 (-72.6405)

40:~~[illegible]~~ 40:00 (40.6667)
-72:37:56 (-72.6323)

~~40:39:50 (40.6639)~~
~~-72:37:44 (-72.6289)~~

DEBRIS

40:39:52.2 (40.6645)
-72:37:46.2 (-72.6295)

40:39:51.5 (40.6643)
-72:37:46.2 (-72.6295)

40:39:51.5 (40.6643)
-72:37:44.8 (-72.6291)

DEBRIS (cont)

40:39:53.6 (40.6649)
-72:37:37.2 (-72.627)

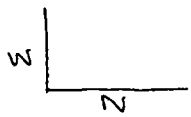
40:39:53.6 (40.6649)
-72:37:36.1 (-72.6267)

135 B

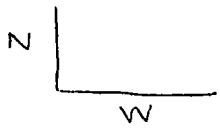
CASA files

c3, c2, c1

c1, c2, c3



c2, c1, c3



c2 is W
c1 is N
c3 is #

40·38-42
72-41-24

2342?
2633
2237

The following message is a 6.43mb MIME complient attached file from [redacted] Telephonics Corp. (b)(6)
Bellow is a readme. (b)(7)(c)

[redacted]telephonics.com (b)(6) (b)(7)(c)

AT 120-9200

README:

STRATFORD (CHAN 2) LAT=> 41 17'42'' LNG=>73 04' 59'' AZIMUTH TRUE ???

RIVERHEAD (CHAN 1) LAT=> 40 52' 42'' LNG=>72 41' 17'' AZIMUTH TRUE

VARIABLE SPECIFICATIONS:

No	Name	
1	TYPE	3&4=>BEACON 20 & 9=>SEARCH 0=>WEATHER???
2	CHAN	2=>SIKORSKY BEACON @ STRATFORD 1=>FAA @ RIVERHEAD
3	SCAN	INTERNAL SCAN COUNTER(SEPERATE FOR EACH RADAR)
4	RTQC	REAL TIME QUALITY CONTROL TEST TARGET
5	TRKNUM	NOT USED WITH RAW DATA
6	RANGE_8	RANGE IN 1/8 NMI'S
7	AZ_4096	AZIMUTH IN ACP'S 4096=360 DEGREES
8	M3CODE	MODE 3 CODE
9	M2CODE	MODE 2 CODE
10	ALT_SIGN	MODE C CODE SIGN BIT
11	ALT_100	MODE C ALTITUDE IN 100 FOOT STEPS
12	M2VAL	MODE 2 VALIDATION BIT
13	M3VAL	MODE 3 VALIDATION BIT
14	MCVAL	MODE C VALIDATION BIT
15	SPI	SPECIAL POSITION INDICATOR
16	RR	RADAR REINFORCED
17	MTI	MOVING TARGET INDICATOR
18	RL_ENAB	RUN LENGTH ENABLE FLAG
19	RUNLENGH	RUNLENGTH DATA
20	COL21	NOT USED WITH RAW DATA
21	VEL_2	NOT USED WITH RAW DATA
22	TRKSTAT	NOT USED WITH RAW DATA
23	TIME_MS	INTERNAL COMPUTER TIME IN MILI-SECONDS

99378 lines
real A-H D-Z

TWA transponded data from FAA
(run through rae211.f)

last few detections:

40.6125	72.5680	→ 40-36-45	72-34-05
40.6198	72.5930	40-37-11	72-35-35
40.6267	72.6139	40-37-36	72-36-50
40.6316	72.6400	40-37-54	72-38-24
40.6401	72.6659	40-38-24	72-39-57

Sikorsky

last few detections

40.2194	73.0408	40-13-10	73-02-27
40.2239	73.0616	40-13-26	73-03-42
40 2274	73.0720	40-13-38	73-04-19
40.2297	73.0785	40-13-47	73-04-42
40.2287	73.0823	40-13-43	73-04-56
40.2315	73.0900	40-13-53	73-05-24

FAA transponded data (rae211.f)

	40.6061	72.8329	40-36-22	72-49-58
	40.6125	72.8081	40-36-45	72-48-29
	40.6198	72.7831	40-37-11	72-46-59
	40.6267	72.7623	40-37-36	72-45-44
	40.6316	72.7361	40-37-54	72-44-10
<23:55:02	40.6401	72.7102	40-38-24	72-42-37

Sikorsky (rae211.f)

223:54:57	40.6361	72.7281	40-38-10	72-43-41
<23:55:02	40.6406	72.7072	40-38-26	72-42-26
	40.6441	72.6967	40-38-39	72-41-48
	40.6464	72.6902	40-38-47	72-41-25
	40.6454	72.6864	40-38-43	72-41-11
	40.6482	72.6786	40-38-53	72-40-43

Sikorsky (non-transponded) – Limited > 805920 s. (223:52)
> 40.4N > 71W

41.1651	73.123	→ (41-09-54)(73-07-23)
41.1649	73.1220	→ (41-09-54)(73-07-19)

TWA 800 Transponded data from FAA Radar

HR	MIN	SEC	LAT	LONG	ALT
223	50	5	40.5480	73.3456	3078.5
223	49	54	40.5454	73.3664	2987.0
223	50	17	40.5484	73.3195	3139.4
223	50	29	40.5482	73.2958	3261.4
223	50	41	40.5526	73.2727	3413.8
223	50	53	40.5521	73.2480	3596.6
223	51	5	40.5535	73.2250	3688.1
223	51	17	40.5548	73.2017	3718.6
223	51	29	40.5555	73.1773	3718.6
223	51	41	40.5562	73.1486	3779.5
223	51	52	40.5579	73.1243	3810.0
223	52	4	40.5590	73.0946	3840.5
223	52	16	40.5601	73.0680	3871.0
223	52	28	40.5614	73.0406	3901.4
223	52	40	40.5629	73.0125	3931.9
223	52	52	40.5663	72.9865	3962.4
223	53	4	40.5727	72.9601	3992.9
223	53	16	40.5795	72.9336	3931.9
223	53	27	40.5856	72.9094	3931.9
223	53	39	40.5935	72.8826	3901.4
223	53	51	40.5986	72.8589	3901.4
223	54	3	40.6061	72.8329	3931.9
223	54	15	40.6125	72.8081	3931.9
223	54	27	40.6198	72.7831	3931.9
223	54	38	40.6267	72.7623	3992.9
223	54	50	40.6316	72.7361	4053.8
223	55	2	40.6401	72.7102	4053.8

121.9 m/sec
2.065 mph
6.78 ft/sec

USAIR Transponded data from FAA Radar

HR	MIN	SEC	LAT	LONG	ALT
223	39	8	39.1164	74.3385	8991.6
223	39	20	39.1407	74.3268	9083.0
223	39	32	39.1536	74.2945	9205.0
223	40	32	39.2511	74.1967	10027.9
223	40	44	39.2682	74.1718	10119.4
223	40	56	39.2940	74.1628	10241.3
223	41	8	39.3094	74.1396	10363.2
223	41	20	39.3250	74.1164	10454.6
223	42	19	39.4151	74.0143	10942.3
223	42	31	39.4372	74.0032	11033.8
223	42	43	39.4531	73.9807	11094.7
223	42	55	39.4676	73.9556	11186.2
223	43	7	39.4881	73.9417	11277.6
223	43	19	39.5089	73.9234	11277.6
223	43	31	39.5264	73.9041	11277.6
223	43	43	39.5440	73.8847	11277.6
223	43	55	39.5589	73.8602	11277.6
223	44	7	39.5793	73.8463	11277.6
223	44	19	39.5957	73.8246	11277.6
223	44	31	39.6139	73.8015	11277.6
223	44	42	39.6318	73.7826	11277.6
223	44	54	39.6484	73.7613	11277.6
223	45	6	39.6664	73.7425	11277.6
223	45	18	39.6855	73.7261	11277.6
223	45	30	39.7035	73.7074	11277.6
223	45	42	39.7222	73.6850	11277.6
223	45	54	39.7380	73.6620	11277.6
223	46	6	39.7540	73.6391	11277.6
223	46	18	39.7701	73.6164	11277.6
223	46	30	39.7938	73.6091	11277.6
223	46	42	39.8089	73.5845	11277.6
223	46	54	39.8273	73.5664	11277.6
223	47	6	39.8475	73.5470	11277.6
223	47	18	39.8633	73.5367	274.3
223	47	29	39.8845	73.5112	11277.6
223	47	41	39.9021	73.4914	11277.6
223	47	53	39.9189	73.4699	11277.6
223	48	5	39.9385	73.4542	11277.6
223	48	17	39.9545	73.4312	11216.6
223	48	29	39.9716	73.4102	11155.7
223	48	41	39.9880	73.3877	11094.7
223	48	53	40.0061	73.3689	11033.8
223	49	5	40.0228	73.3469	10972.8
223	49	17	40.0412	73.3285	10911.8
223	49	29	40.0581	73.3070	10850.9
223	49	41	40.0760	73.2873	10789.9
223	50	5	40.1132	73.2458	10668.0
223	49	53	40.0944	73.2634	10729.0
223	50	16	40.1321	73.2283	10607.0
223	50	28	40.1486	73.2051	10576.6
223	50	40	40.1684	73.1840	10485.1
223	50	52	40.1848	73.1603	10363.2
223	51	4	40.2036	73.1425	10241.3
223	51	16	40.2228	73.1198	10088.9
223	51	28	40.2394	73.0963	9906.0
223	51	40	40.2591	73.0746	9723.1
223	51	52	40.2781	73.0571	9509.8
223	52	4	40.2974	73.0340	9296.4
223	52	16	40.3147	73.0116	9052.6
223	52	27	40.3348	72.9899	8839.2
223	52	39	40.3531	72.9699	8595.4
223	52	51	40.3731	72.9475	8351.5
223	53	3	40.3918	72.9279	8107.7

223	53	15	40.4131	72.9090	7894.3
223	53	39	40.4502	72.8647	7589.5
223	53	51	40.4686	72.8401	7467.6
223	54	3	40.4882	72.8195	7345.7
223	54	15	40.5081	72.7986	7223.8
223	54	26	40.5260	72.7770	7101.8
223	54	38	40.5443	72.7544	6979.9
223	55	2	40.5858	72.7223	6736.1
223	55	26	40.6317	72.7065	6583.7
223	55	38	40.6462	72.7012	2468.9
223	55	50	40.6763	72.6950	6461.8
223	56	2	40.6979	72.6880	6400.8
223	56	13	40.7200	72.6823	6400.8
223	56	25	40.7426	72.6762	6400.8
223	56	37	40.7660	72.6703	6400.8
223	56	49	40.7862	72.6635	6400.8

VIRGIN 009 Transponded data from FAA Radar

HR	MIN	SEC	LAT	LONG	ALT

STINGER Transponded data from FAA Radar

HR	MIN	SEC	LAT	LONG	ALT
223	56	59	40.7901	72.4976	4846.3
223	57	12	40.7736	72.5164	4846.3
223	57	24	40.7540	72.5366	4846.3
223	57	48	40.7178	72.5744	4846.3
223	58	0	40.6994	72.5931	4846.3
223	58	12	40.6808	72.6123	4846.3
223	58	37	40.6451	72.6455	4846.3
223	58	49	40.6264	72.6667	4846.3
223	59	1	40.6090	72.6815	4846.3
223	59	13	40.5902	72.7008	4846.3
223	59	25	40.5719	72.7183	4846.3

Non-transponded data from FAA Radar

HR	MIN	SEC	LAT	LONG	ALT
223	52	15	40.4814	72.6207	0.0
223	52	4	40.6230	72.9951	0.0
223	52	7	40.4598	73.4662	0.0
223	52	16	40.7352	72.8601	0.0
223	52	16	40.6209	73.0043	0.0
223	52	19	40.4625	73.4688	0.0
223	52	28	40.6222	72.9941	0.0
223	52	28	40.7342	72.8628	0.0
223	52	29	40.7329	72.9250	0.0
223	52	40	40.4445	73.0316	0.0
223	52	40	40.6228	73.0030	0.0
223	52	43	40.5963	73.1389	0.0
223	52	43	40.4613	73.4710	0.0
223	52	52	40.6221	73.0019	0.0
223	52	55	40.4611	73.4741	0.0
223	53	7	40.7265	72.9286	0.0
223	53	7	40.4592	73.4724	0.0
223	53	15	40.7614	72.7383	0.0
223	53	16	40.4487	73.0247	0.0
223	53	16	40.4486	73.2386	0.0
223	53	19	40.7251	72.9271	0.0
223	53	19	40.4620	73.4749	0.0
223	53	27	40.7592	72.7382	0.0
223	53	27	40.4260	72.8885	0.0
223	53	28	40.4519	73.0211	0.0
223	53	28	40.4558	73.1425	0.0
223	53	30	40.4617	73.4780	0.0
223	53	39	40.4794	72.9379	0.0
223	53	39	40.4537	73.0197	0.0
223	53	40	40.6229	72.9990	0.0
223	53	40	40.7207	72.9294	0.0
223	53	43	40.4589	73.4755	0.0
223	53	51	40.4541	73.0206	0.0
223	53	52	40.4411	73.2363	0.0
223	53	54	40.4571	73.4738	0.0
223	54	14	40.6674	72.6114	0.0
223	54	3	40.7606	72.7348	0.0
223	54	3	40.4518	72.9572	0.0
223	54	4	40.6221	72.9980	0.0
223	54	26	40.6554	72.6303	0.0
223	54	15	40.4577	73.0178	0.0
223	54	16	40.6247	72.9977	0.0
223	54	16	40.4377	73.2355	0.0
223	54	18	40.5944	73.1404	0.0
223	54	18	40.4596	73.4794	0.0
223	54	18	40.4047	73.6022	0.0
223	54	38	40.6427	72.6470	0.0
223	54	27	40.4576	73.0122	0.0
223	54	28	40.7342	72.8628	0.0
223	54	28	40.4355	73.2365	0.0
223	54	30	40.4584	73.4816	0.0
223	54	50	40.6310	72.6636	0.0
223	54	39	40.4115	72.9859	0.0
223	54	39	40.4597	73.0116	0.0
223	54	42	40.4593	73.4825	0.0
223	54	42	40.4007	73.5919	0.0
223	55	2	40.6199	72.6834	0.0
223	54	50	40.5598	72.7402	0.0
223	54	50	40.4597	72.8006	0.0
223	54	51	40.4615	73.0103	0.0
223	54	51	40.6221	72.9980	0.0
223	54	54	40.4584	73.4816	0.0
223	55	26	40.6498	72.6631	0.0

Non-transponded data from Sikorsky Radar

HR	MIN	SEC	LAT	LONG	ALT
223	54	38	41.1651	73.1230	0.0
223	54	42	41.1649	73.1220	0.0

223 59	36	40.5561	72.7366	4846.3
223 59	40	40.5530	72.7318	4846.3

STINGER Transponded data from Sikorsky Radar

HR	MIN	SEC	LAT	LONG	ALT
223	55	1	40.9316	72.2669	6583.7
223	55	5	40.9338	72.2747	6492.2
223	55	9	40.9313	72.2831	6431.3
223	55	16	40.9240	72.3051	6248.4
223	55	20	40.9228	72.3158	6157.0
223	55	24	40.9286	72.3296	12679.7
223	55	32	40.9143	72.3462	5913.1
223	55	36	40.9129	72.3507	5852.2
223	55	40	40.9077	72.3622	5760.7
223	55	44	40.9064	72.3667	5669.3
223	55	48	40.8978	72.3784	5577.8
223	55	52	40.8953	72.3808	5516.9
223	55	56	40.8877	72.3920	5425.4
223	56	0	40.8828	72.3969	5364.5
223	56	4	40.8765	72.4036	5303.5
223	56	8	40.8733	72.4070	5242.6
223	56	11	40.8640	72.4173	5181.6
223	56	15	40.8632	72.4182	5120.6
223	56	19	40.8540	72.4287	5059.7
223	56	23	40.8405	72.4451	4998.7
223	56	27	40.8405	72.4450	4968.2
223	56	31	40.8375	72.4487	4937.8
223	56	39	40.8251	72.4608	4876.8
223	56	43	40.8186	72.4656	4876.8
223	56	51	40.8079	72.4764	4876.8
223	56	55	40.8017	72.4854	4876.8
223	56	59	40.7898	72.4987	4846.3
223	57	3	40.7891	72.4997	4846.3
223	57	6	40.7829	72.5051	4846.3
223	57	10	40.7726	72.5170	4846.3
223	57	14	40.7726	72.5170	4846.3
223	57	18	40.7639	72.5270	4846.3
223	57	22	40.7558	72.5361	4846.3
223	57	26	40.7529	72.5367	4846.3
223	57	30	40.7437	72.5483	4846.3
223	57	34	40.7402	72.5500	4846.3
223	57	38	40.7318	72.5609	4846.3
223	57	42	40.7289	72.5616	4846.3
223	57	46	40.7212	72.5715	4846.3
223	57	50	40.7194	72.5700	4846.3
223	57	54	40.7095	72.5849	4846.3
223	57	57	40.7048	72.5894	4846.3
223	58	1	40.7008	72.5927	4846.3
223	58	5	40.6934	72.6034	4846.3
223	58	9	40.6849	72.6116	4846.3
223	58	13	40.6820	72.6127	4846.3
223	58	17	40.6746	72.6187	4846.3
223	58	21	40.6703	72.6254	6065.5
223	58	25	40.6661	72.6274	4846.3
223	58	29	40.6572	72.6376	4846.3
223	58	33	40.6503	72.6492	4846.3
223	58	37	40.6460	72.6481	4846.3
223	58	45	40.6316	72.6683	4846.3
223	58	52	40.6202	72.6745	4846.3
223	58	56	40.6183	72.6733	4846.3
223	59	4	40.6037	72.6896	4846.3
223	59	8	40.6003	72.6860	4846.3
223	59	12	40.5934	72.7004	4846.3
223	59	16	40.5869	72.7069	4846.3
223	59	20	40.5809	72.7120	4846.3
223	59	24	40.5744	72.7187	4846.3
223	59	28	40.5684	72.7241	4846.3
223	59	32	40.5624	72.7296	4846.3

223	58	29	40.8739	72.8856	3566.2
223	58	33	40.8713	72.8872	3566.2
223	58	37	40.8666	72.8880	3535.7
223	58	41	40.8620	72.8976	3505.2
223	58	45	40.8589	72.9011	3505.2
223	58	49	40.8565	72.9020	3474.7
223	58	53	40.8520	72.9119	3444.2
223	58	56	40.8464	72.9176	3413.8
223	59	0	40.8433	72.9224	3383.3
223	59	4	40.8407	72.9244	3352.8
223	59	8	40.8370	72.9320	3322.3
223	59	12	40.8328	72.9316	3291.8
223	59	16	40.8289	72.9413	3261.4
223	59	20	40.8255	72.9482	3230.9
223	59	24	40.8213	72.9480	3200.4
223	59	28	40.8177	72.9571	3169.9
223	59	32	40.8131	72.9589	3139.4
223	59	36	40.8099	72.9662	3078.5
223	59	40	40.8054	72.9682	3048.0

VIRGIN 009 Transponded data from Sikorsky Radar

HR	MIN	SEC	LAT	LONG	ALT
223	54	18	40.9950	72.4241	5181.6
223	54	22	40.9964	72.4293	5120.6
223	54	26	40.9785	72.4509	30.5
223	54	29	40.9944	72.4471	5029.2
223	54	33	40.9930	72.4548	4998.7
223	54	37	40.9924	72.4618	4937.8
223	54	41	40.9925	72.4683	4907.3
223	54	45	40.9889	72.4813	4846.3
223	54	49	40.9898	72.4871	4785.4
223	54	53	40.9874	72.4959	4754.9
223	54	57	40.9851	72.5048	4693.9
223	55	1	40.9867	72.5134	4633.0
223	55	5	40.9839	72.5228	4602.5
223	55	9	40.9813	72.5323	4572.0
223	55	13	40.9813	72.5392	4511.0
223	55	17	40.9825	72.5448	4480.6
223	55	20	40.9814	72.5529	4450.1
223	55	28	40.9801	72.5719	4358.6
223	55	32	40.9798	72.5794	4328.2
223	55	36	40.9801	72.5861	4297.7
223	55	40	40.9760	72.5980	4267.2
223	55	44	40.9782	72.6028	4236.7
223	55	48	40.9749	72.6140	4175.8
223	55	52	40.9761	72.6200	4145.3
223	55	56	40.9770	72.6226	4114.8
223	56	0	40.9740	72.6338	4053.8
223	56	4	40.9707	72.6456	4023.4
223	56	8	40.9702	72.6501	3992.9
223	56	11	40.9686	72.6560	3931.9
223	56	15	40.9657	72.6639	3901.4
223	56	19	40.9635	72.6750	3840.5
223	56	23	40.9631	72.6795	3810.0
223	56	27	40.9595	72.6888	3749.0
223	56	31	40.9575	72.6960	3718.6
223	56	35	40.9569	72.7013	3718.6
223	56	39	40.9536	72.7106	3688.1
223	56	43	40.9506	72.7199	3657.6
223	56	47	40.9647	72.7409	15118.1
223	56	51	40.9460	72.7322	3657.6
223	56	55	40.9441	72.7402	3627.1
223	56	59	40.9415	72.7497	3627.1
223	57	3	40.9413	72.7548	3627.1
223	57	7	40.9379	72.7613	3627.1
223	57	10	40.9370	72.7679	3627.1
223	57	14	40.9345	72.7782	3627.1
223	57	18	40.9373	72.7775	3627.1
223	57	22	40.9331	72.7862	3627.1
223	57	26	40.9315	72.7950	3627.1
223	57	30	40.9305	72.7972	3627.1
223	57	34	40.9285	72.8075	3657.6
223	57	38	40.9244	72.8172	3657.6
223	57	42	40.9201	72.8219	3657.6
223	57	46	40.9189	72.8250	3657.6
223	57	50	40.9135	72.8329	3657.6
223	57	54	40.9093	72.8379	3657.6
223	57	58	40.9060	72.8407	3657.6
223	58	2	40.9016	72.8466	3657.6
223	58	5	40.8970	72.8535	3657.6
223	58	9	40.8948	72.8532	3657.6
223	58	13	40.8903	72.8603	3627.1
223	58	17	40.8851	72.8700	3627.1
223	58	21	40.8834	72.8681	3596.6
223	58	25	40.8790	72.8755	3596.6

223	56	47	40.7871	72.6632	6400.8
223	56	55	40.7993	72.6634	6400.8
223	57	3	40.8139	72.6591	6400.8
223	57	7	40.8241	72.6541	6400.8
223	57	10	40.8305	72.6516	6400.8
223	57	14	40.8382	72.6516	6400.8
223	57	18	40.8441	72.6503	6400.8
223	57	22	40.8525	72.6445	6400.8
223	57	26	40.8605	72.6441	6400.8
223	57	30	40.8659	72.6440	6400.8
223	57	34	40.8749	72.6422	6400.8
223	57	38	40.8833	72.6372	6400.8
223	57	42	40.8881	72.6382	6400.8
223	57	50	40.9044	72.6342	6400.8
223	57	53	40.9096	72.6347	6400.8
223	57	57	40.9206	72.6268	6400.8
223	58	1	40.9242	72.6298	6400.8
223	58	5	40.9326	72.6261	6400.8
223	58	9	40.9414	72.6220	6400.8
223	58	13	40.9508	72.6174	6400.8
223	58	17	40.9532	72.6152	30.5
223	58	21	40.9647	72.6151	6400.8
223	58	25	40.9730	72.6125	6400.8
223	58	33	40.9879	72.6100	6400.8
223	58	36	40.9953	72.6053	6400.8
223	58	40	40.9991	72.6084	6400.8
223	58	44	41.0111	72.6027	6400.8
223	58	48	41.0163	72.6008	6400.8
223	58	52	41.0239	72.6002	6400.8
223	58	56	41.0324	72.5954	6400.8
223	59	0	41.0388	72.5962	6400.8
223	59	4	41.0434	72.5954	6400.8
223	59	8	41.0525	72.5940	6400.8
223	59	12	41.0650	72.5867	6400.8
223	59	16	41.0707	72.5854	6400.8
223	59	20	41.0735	72.5864	6400.8

223	52	29	40.3384	72.9947	8808.7
223	52	32	40.3454	72.9819	8717.3
223	52	36	40.3523	72.9712	8656.3
223	52	40	40.3558	72.9811	8595.4
223	52	44	40.3633	72.9630	8503.9
223	52	48	40.3706	72.9490	8412.5
223	52	52	40.3781	72.9352	8351.5
223	52	56	40.3820	72.9376	8260.1
223	53	0	40.3887	72.9331	8168.6
223	53	4	40.3940	72.9432	8107.7
223	53	8	40.4017	72.9280	8016.2
223	53	12	40.4076	72.9108	7924.8
223	53	15	40.4138	72.9120	7863.8
223	53	19	40.4216	72.8991	7802.9
223	53	23	40.4253	72.9035	7772.4
223	53	27	40.4343	72.8822	7711.4
223	53	31	40.4391	72.8780	7681.0
223	53	35	40.4459	72.8744	7620.0
223	53	39	40.4512	72.8669	7589.5
223	53	43	40.4597	72.8533	7559.0
223	53	47	40.4659	72.8410	7498.1
223	53	51	40.4675	72.8571	7467.6
223	53	55	40.4777	72.8341	7437.1
223	53	59	40.4826	72.8304	7376.2
223	54	2	40.4879	72.8251	7345.7
223	54	6	40.4954	72.8190	7315.2
223	54	10	40.5016	72.8091	7284.7
223	54	14	40.5063	72.8073	7223.8
223	54	18	40.5139	72.7914	7193.3
223	54	22	40.5219	72.7843	7162.8
223	54	26	40.5270	72.7812	7132.3
223	54	30	40.5334	72.7719	7071.4
223	54	34	40.5388	72.7675	7040.9
223	54	38	40.5439	72.7646	7010.4
223	54	42	40.5523	72.7482	6949.4
223	54	46	40.5571	72.7553	6919.0
223	54	49	40.5665	72.7364	6888.5
223	54	53	40.5752	72.7290	6827.5
223	54	57	40.5779	72.7352	6797.0
223	55	1	40.5862	72.7295	6766.6
223	55	5	40.5925	72.7229	6705.6
223	55	13	40.6088	72.7135	6644.6
223	55	17	40.6163	72.7111	6614.2
223	55	21	40.6246	72.7061	6614.2
223	55	25	40.6317	72.7053	6583.7
223	55	29	40.6374	72.7086	6553.2
223	55	33	40.6454	72.7052	6553.2
223	55	36	40.6542	72.6995	6522.7
223	55	40	40.6603	72.7016	6492.2
223	55	44	40.6696	72.6948	6492.2
223	55	48	40.6766	72.6945	6461.8
223	55	52	40.6795	72.6994	6461.8
223	55	56	40.6855	72.7017	6431.3
223	56	0	40.6956	72.6930	6400.8
223	56	4	40.6916	72.7172	6400.8
223	56	8	40.7110	72.6896	6400.8
223	56	12	40.7211	72.6817	6400.8
223	56	16	40.7262	72.6808	6400.8
223	56	19	40.7364	72.6734	6400.8
223	56	23	40.7396	72.6830	6400.8
223	56	27	40.7531	72.6682	6400.8
223	56	31	40.7572	72.6698	6400.8
223	56	35	40.7660	72.6664	6400.8
223	56	39	40.7728	72.6675	6400.8
223	56	43	40.7793	72.6640	6400.8
223	56	51	40.7935	72.6600	6400.8

USAIR Transponded data from Sikorsky Radar

HR	MIN	SEC	LAT	LONG	ALT
223	45	57	39.7405	73.6466	11277.6
223	46	2	39.7517	73.6790	30.5
223	46	56	39.8302	73.5557	11277.6
223	47	3	39.8444	73.5512	11277.6
223	47	15	39.8590	73.5134	11277.6
223	47	39	39.8930	73.5033	30.5
223	47	47	39.9060	73.4619	11277.6
223	47	54	39.9174	73.4532	11277.6
223	47	58	39.9235	73.4373	11277.6
223	48	2	39.9285	73.4276	11277.6
223	48	6	39.9358	73.4342	11247.1
223	48	18	39.9521	73.3996	11216.6
223	48	26	39.9629	73.3862	11155.7
223	48	37	39.9822	73.4088	30.5
223	48	41	39.9854	73.3463	11094.7
223	48	45	39.9975	73.3918	11064.2
223	48	49	40.0000	73.3619	11064.2
223	48	53	40.0075	73.3709	11033.8
223	48	57	40.0107	73.3465	11003.3
223	49	5	40.0207	73.3030	10972.8
223	49	9	40.0288	73.3197	10942.3
223	49	13	40.0372	73.3386	10942.3
223	49	17	40.0349	73.3057	30.5
223	49	28	40.0582	73.2992	10850.9
223	49	32	40.0639	73.2932	10820.4
223	49	44	40.0838	73.2825	10759.4
223	49	48	40.0869	73.2453	10759.4
223	49	52	40.0951	73.2685	10729.0
223	50	0	40.1050	73.2357	10698.5
223	50	4	40.1132	73.2586	10668.0
223	50	8	40.1172	73.2294	10668.0
223	50	15	40.1285	73.2116	10607.0
223	50	19	40.1360	73.2295	10607.0
223	50	23	40.1416	73.2195	10576.6
223	50	27	40.1489	73.2025	10576.6
223	50	35	40.1608	73.1921	10515.6
223	50	39	40.1653	73.1554	10485.1
223	50	43	40.1719	73.1640	10454.6
223	50	47	40.1819	73.1968	10424.2
223	50	51	40.1852	73.1809	10393.7
223	50	55	40.1903	73.1538	10332.7
223	50	58	40.1959	73.1359	10302.2
223	51	2	40.2022	73.1378	10241.3
223	51	6	40.2083	73.1309	10210.8
223	51	10	40.2143	73.1220	10149.8
223	51	14	40.2206	73.1261	10119.4
223	51	18	40.2268	73.1237	10058.4
223	51	22	40.2326	73.0958	9997.4
223	51	26	40.2388	73.0936	9936.5
223	51	30	40.2450	73.0915	9875.5
223	51	34	40.2512	73.0851	9814.6
223	51	38	40.2575	73.0747	9753.6
223	51	42	40.2637	73.0665	9692.6
223	51	45	40.2699	73.0666	9601.2
223	51	49	40.2762	73.0606	9540.2
223	51	53	40.2826	73.0506	9479.3
223	51	57	40.2888	73.0508	9387.8
223	52	1	40.2952	73.0430	9326.9
223	52	5	40.3015	73.0392	9265.9
223	52	13	40.3127	73.0121	9113.5
223	52	17	40.3194	73.0027	9022.1
223	52	21	40.3257	72.9994	8961.1
223	52	25	40.3315	73.0096	8869.7

223	53	27	40.5888	72.9120	3931.9
223	53	31	40.5902	72.9021	3931.9
223	53	35	40.5925	72.9012	3901.4
223	53	39	40.5938	72.8927	3901.4
223	53	43	40.5958	72.8800	3901.4
223	53	47	40.5995	72.8708	3901.4
223	53	51	40.6018	72.8582	3901.4
223	53	55	40.6026	72.8541	3901.4
223	54	2	40.6091	72.8326	3931.9
223	54	6	40.6091	72.8326	3931.9
223	54	10	40.6109	72.8243	3962.4
223	54	14	40.6149	72.8064	3931.9
223	54	18	40.6152	72.8050	3931.9
223	54	22	40.6162	72.8009	3931.9
223	54	26	40.6202	72.7846	3931.9
223	54	30	40.6216	72.7791	3962.4
223	54	34	40.6223	72.7764	3962.4
223	54	38	40.6260	72.7629	3992.9
223	54	42	40.6297	72.7495	3992.9
223	54	46	40.6305	72.7468	4023.4
223	54	49	40.6341	72.7348	4053.8
223	54	53	40.6357	72.7295	4053.8
223	54	57	40.6361	72.7281	4053.8
223	55	1	40.6406	72.7072	4053.8
223	55	5	40.6441	72.6967	4084.3
223	55	9	40.6464	72.6902	4114.8
223	55	13	40.6454	72.6864	4145.3
223	55	17	40.6482	72.6786	4175.8

TWA 800 Transponded data from Sikorsky Radar

HR	MIN	SEC	LAT	LONG	ALT
223	49	18	40.5432	73.4355	2407.9
223	49	21	40.5445	73.4315	2712.7
223	49	25	40.5429	73.4170	2712.7
223	49	29	40.5445	73.4146	2743.2
223	49	34	40.5450	73.4077	2773.7
223	49	36	40.5462	73.4038	2804.2
223	49	40	40.5449	73.3894	2834.6
223	49	44	40.5466	73.3871	2895.6
223	49	48	40.5459	73.3743	2926.1
223	49	52	40.5456	73.3630	2956.6
223	49	56	40.5476	73.3622	3017.5
223	50	0	40.5477	73.3525	3048.0
223	50	4	40.5491	73.3488	3078.5
223	50	8	40.5496	73.3405	3078.5
223	50	15	40.5508	73.3242	3139.4
223	50	19	40.5502	73.3086	3169.9
223	50	23	40.5502	73.3086	3200.4
223	50	27	40.5520	73.3065	3230.9
223	50	31	40.5525	73.2969	3261.4
223	50	35	40.5529	73.2859	3322.3
223	50	39	40.5520	73.2799	3383.3
223	50	43	40.5521	73.2659	3444.2
223	50	47	40.5533	73.2595	3505.2
223	50	51	40.5531	73.2580	3566.2
223	50	55	40.5540	73.2486	3596.6
223	50	59	40.5545	73.2347	3657.6
223	51	2	40.5528	73.2198	3657.6
223	51	6	40.5552	73.2224	3688.1
223	51	10	40.5559	73.2086	3688.1
223	51	14	40.5619	73.2438	3688.1
223	51	18	40.5567	73.1949	3718.6
223	51	22	40.5556	73.1815	3718.6
223	51	26	40.5574	73.1768	3718.6
223	51	30	40.5567	73.1664	3718.6
223	51	34	40.5588	73.1662	3749.0
223	51	38	40.5578	73.1499	3749.0
223	51	42	40.5601	73.1541	3779.5
223	51	46	40.5593	73.1379	3779.5
223	51	49	40.5592	73.1334	3779.5
223	51	53	40.5608	73.1185	3810.0
223	51	57	40.5606	73.1126	3810.0
223	52	1	40.5604	73.0978	3840.5
223	52	5	40.5603	73.0949	3840.5
223	52	9	40.5603	73.0860	3840.5
223	52	13	40.5604	73.0698	3871.0
223	52	17	40.5625	73.0654	3871.0
223	52	21	40.5626	73.0580	3901.4
223	52	25	40.5629	73.0462	3901.4
223	52	29	40.5629	73.0462	3901.4
223	52	32	40.5633	73.0344	3901.4
223	52	36	40.5639	73.0212	3931.9
223	52	40	40.5647	73.0065	3931.9
223	52	44	40.5646	73.0080	3931.9
223	52	48	40.5652	72.9991	3931.9
223	52	52	40.5686	72.9818	3962.4
223	52	56	40.5692	72.9745	3962.4
223	53	0	40.5709	72.9792	3992.9
223	53	4	40.5749	72.9577	3992.9
223	53	8	40.5782	72.9465	3962.4
223	53	12	40.5804	72.9278	3931.9
223	53	15	40.5812	72.9383	3931.9
223	53	19	40.5856	72.9201	3931.9
223	53	23	40.5864	72.9144	3962.4

223	58	50	40.4133	73.0262	0.0
223	58	50	40.6251	72.9860	0.0
223	58	53	40.4564	73.5064	0.0
223	59	12	40.6566	72.6113	0.0
223	59	12	40.6364	72.6044	0.0
223	59	12	40.6519	72.6131	0.0
223	59	2	40.4028	73.0463	0.0
223	59	2	40.6279	72.9819	0.0
223	59	5	40.4552	73.5086	0.0
223	59	24	40.6567	72.6109	0.0
223	59	24	40.6517	72.6140	0.0
223	59	14	40.6258	72.9871	0.0
223	59	14	40.7356	72.8607	0.0
223	59	15	40.4307	73.3558	0.0
223	59	17	40.4552	73.5086	0.0
223	59	36	40.6567	72.6104	0.0
223	59	36	40.6502	72.6111	0.0
223	59	25	40.4212	72.8262	0.0
223	59	27	40.6418	73.0126	0.0
223	59	29	40.5847	73.2205	0.0
223	59	29	40.4521	73.5092	0.0

223	57	5	40.6623	73.0781	0.0
223	57	5	40.4580	73.4979	0.0
223	57	25	40.6590	72.6215	0.0
223	57	25	40.6391	72.6683	0.0
223	57	14	40.4838	72.8474	0.0
223	57	14	40.4930	72.8747	0.0
223	57	15	40.6241	72.9845	0.0
223	57	15	40.7352	72.8601	0.0
223	57	17	40.4503	73.4368	0.0
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223	57	37	40.6589	72.6219	0.0
223	57	37	40.6391	72.6683	0.0
223	57	26	40.4388	72.8163	0.0
223	57	26	40.4833	72.8949	0.0
223	57	27	40.6253	72.9822	0.0
223	57	27	40.6227	72.9907	0.0
223	57	27	40.4090	73.2430	0.0
223	57	27	40.7356	72.8607	0.0
223	57	27	40.6908	72.9417	0.0
223	57	29	40.4345	73.3710	0.0
223	57	29	40.5847	73.2273	0.0
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223	57	49	40.6590	72.6211	0.0
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223	57	39	40.4061	73.2429	0.0
223	57	41	40.4576	73.2808	0.0
223	57	41	40.4559	73.4993	0.0
223	57	50	40.4350	72.8193	0.0
223	57	50	40.4607	72.9303	0.0
223	57	51	40.4052	73.2457	0.0
223	57	51	40.6257	72.9909	0.0
223	57	53	40.5878	73.2303	0.0
223	58	13	40.6491	72.6467	0.0
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223	59	0	40.6205	72.6224	0.0
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223	55	27	40.7053	72.9333	0.0
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223	56	49	40.6623	72.6266	0.0
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223	56	39	40.6241	72.9928	0.0
223	56	40	40.4564	73.4931	0.0
223	56	41	40.6594	73.1418	0.0
223	57	1	40.6626	72.6253	0.0
223	56	50	40.5142	72.8376	0.0
223	56	51	40.6248	72.9855	0.0
223	56	51	40.4140	73.2422	0.0
223	56	51	40.7369	72.8585	0.0
223	56	53	40.4573	73.4940	0.0
223	57	13	40.6607	72.6239	0.0
223	57	13	40.6391	72.6683	0.0
223	57	2	40.5035	72.8561	0.0
223	57	3	40.6237	72.9840	0.0
223	57	3	40.4112	73.2421	0.0
223	57	5	40.4500	73.4398	0.0

Technical Analysis Briefing

TWA Flight 800

PREPARED FOR

James K. Kallstrom, Assistant Director, FBI

[redacted]

March 1997

(b) (6)
(b) (7) (c)

158B
538

"Terrorist implications..."

If the TWA Flight 800 disaster was foreign terrorism, it would be one of the most horrific foreign terrorist acts ever committed against the U.S.

March 1997

159 B

"Most expensive air disaster investigation..."

"Flight 800 is already the most complex and expensive air disaster investigation in American history...and officials are hoping to keep it from becoming one of the greatest unsolved tragedies."

--- CBS's "60 Minutes" (21 December 1996)

March 1997

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Most Expensive "Criminal Investigation" in History

- Federal Bureau of Investigation
- Central Intelligence Agency
- National Security Agency
- Defense Intelligence Agency
  -- Missile and Space Intelligence Center
- Federal Aviation Administration
- National Transportation Safety Board
- U.S. Navy
- National Labs (Sandia, Brookhaven, Lawrence Livermore)

March 1997

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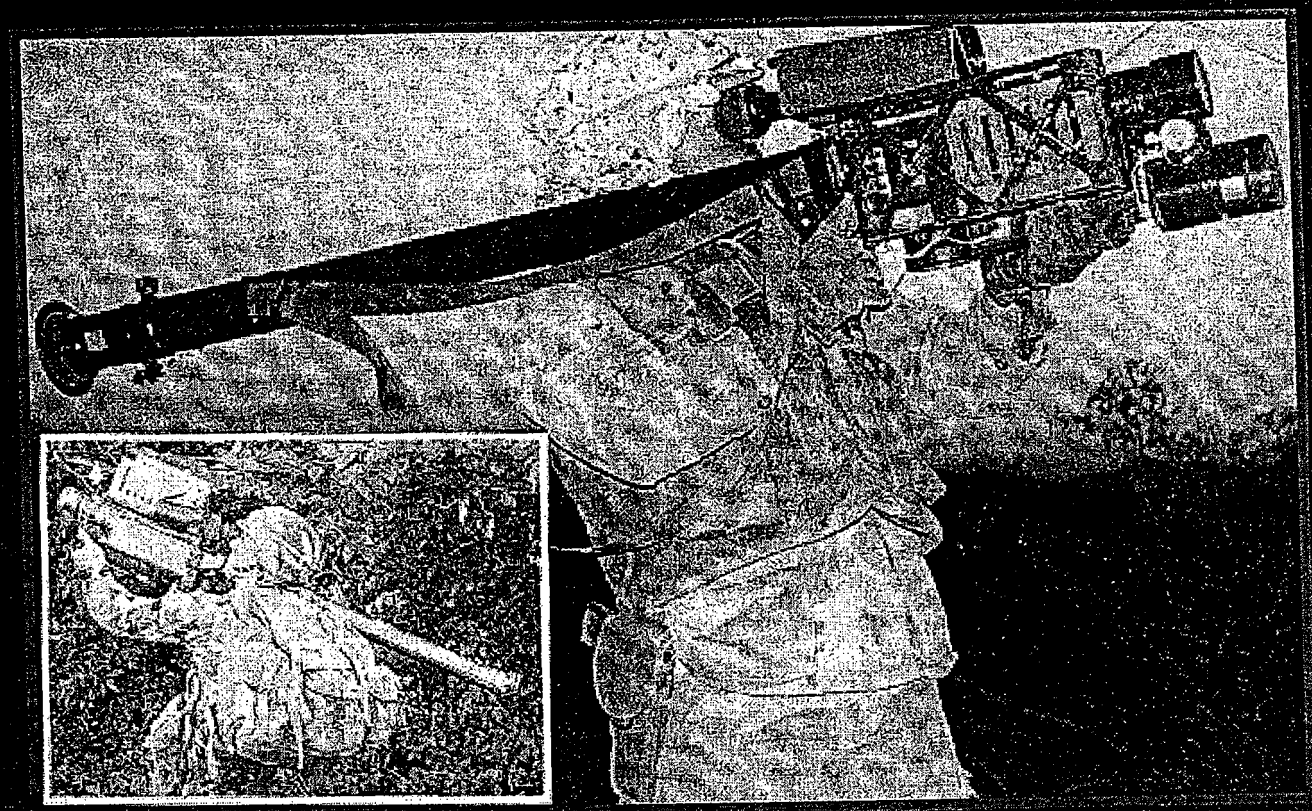
Was a Missile Used to Shoot Down TWA Flight 800?



Almost certainly not.

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Why This Conclusion?

There is <u>no</u> evidence that any "missile" sighting occurred <u>before</u> Flight 800 exploded.

March 1997

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Eyewitnesses

Many witnesses describe seeing "flare" or "firework" ascend toward plane just before explosion...

What did they see?

March 1997

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Answer

Only the plane in various stages of destruction.

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Data Sources

- Cockpit Voice Recorder (CVR)
- Flight Data Recorder (FDR)
- Infrared data (one sample)
- Locations of major debris on ocean floor
- Radar data
- Eyewitness accounts
  - -- Sight
  - -- Sound

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Data Deficiencies

- Power off just after initial explosion:
  - -- Cockpit Voice Recorder (CVR)
  - -- Flight Data Recorder (FDR)
  - -- Aircraft Radar Transponder (altitude data)

- JFK Airport Radar limitations:
  - -- Provides only latitude and longitude
  - -- Samples only every 12 seconds

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Analytical Approach

- Determine precise latitude, longitude, altitude, speed and heading of TWA 800 when onboard voice and data recordings ended.
- Precisely locate each witness using GPS and/or mapping software.
- For as many witnesses as possible, determine precise azimuth of "flare/firework" sightings and "fireball" sightings.
- Determine what each witness heard ... and when (with respect to visual observations).
- Determine how long sound takes to travel from TWA 800 to each witness.
- Combine results, along with infrared data and radar tracking (transponded and "skin tracking"), to determine what the witnesses most likely saw and heard.

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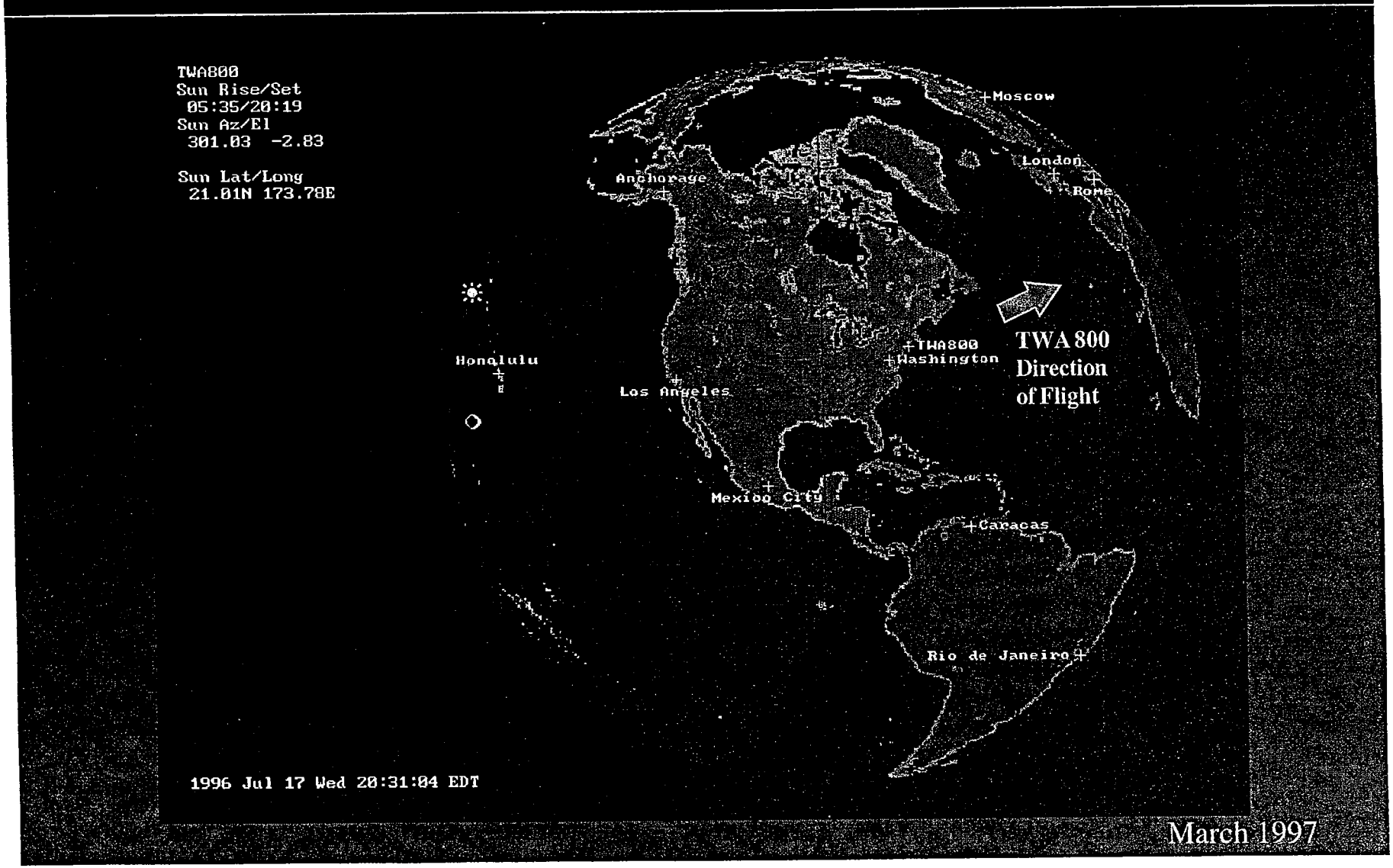
TWA 800 Conditions When Onboard Voice and Data Recordings Ended

- Time recordings ended: 831:07.496 PM.
- Lat/Long = 40° 38' 45" north; 72° 41' 12" west;
  = 40° 38.76' north; 72° 41.22' west;
  = 40.646° north/72.687° west.
- Altitude = 13,820 ft.
- Ground Speed = 380 knots (= 641 ft/sec = MACH 0.60).
- Air Speed = 330 knots (= 557 ft/sec = MACH 0.52).
- Heading = 70.93 degrees.
- Other Fact: Average speed of sound from plane at 13,820 ft. altitude (1,062 ft/sec) to observers on ground or water (1,116 ft/sec) = 1,089 ft/sec.

March 1997

TWA 800: Lighting Conditions When Recordings End



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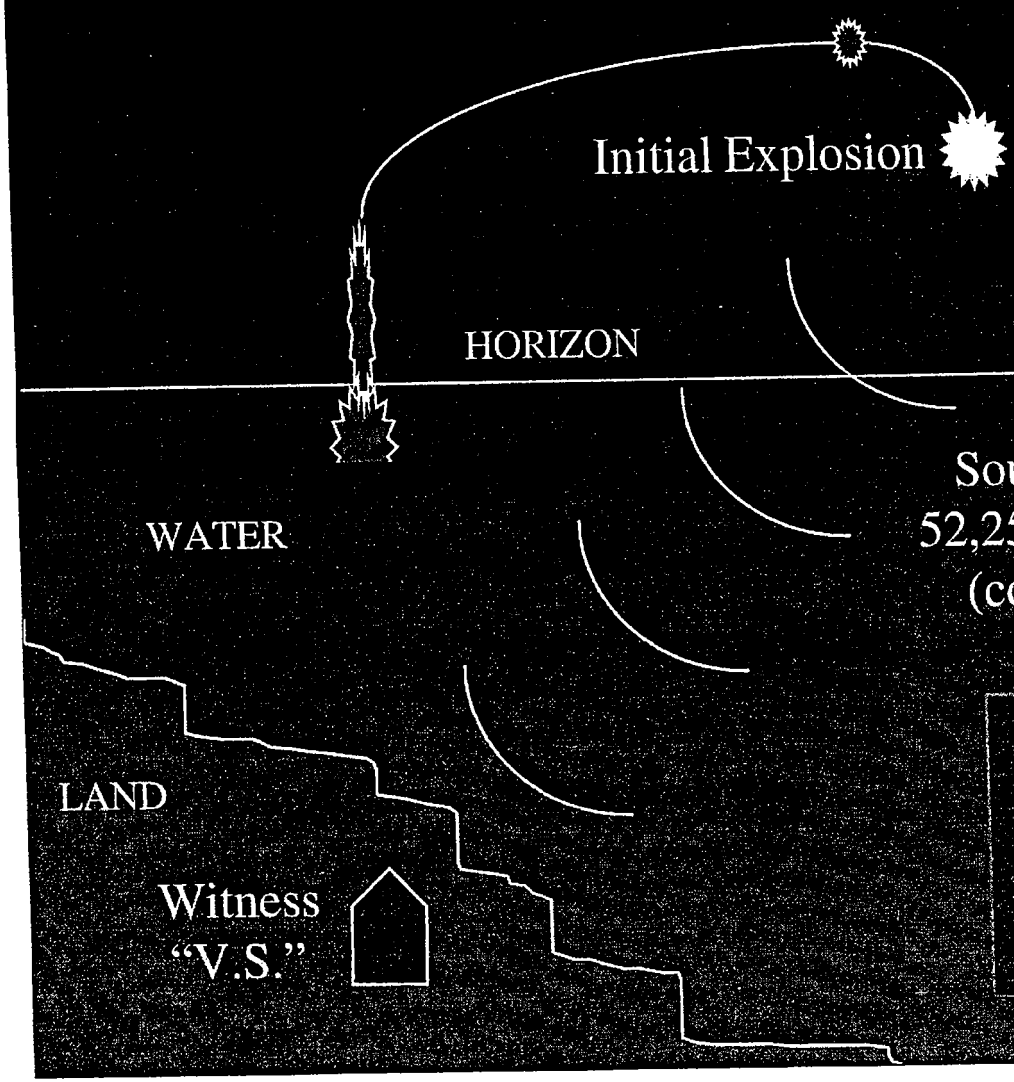
180 B

How Long From Initial Explosion to Water Impact?

Answer: Slightly Less Than 49 Seconds



Sound takes 48.6 sec to travel 52,250 ft. from aircraft to witness (corrected for "winds aloft").

Witness "V.S."

- Saw "huge, intense, orange, yellow and red fireball, that looked pear-shaped, drop from the sky into the ocean."
- "Two large...booms reached the condo and shook the ground [just]...after the fireball reached the surface of the water."

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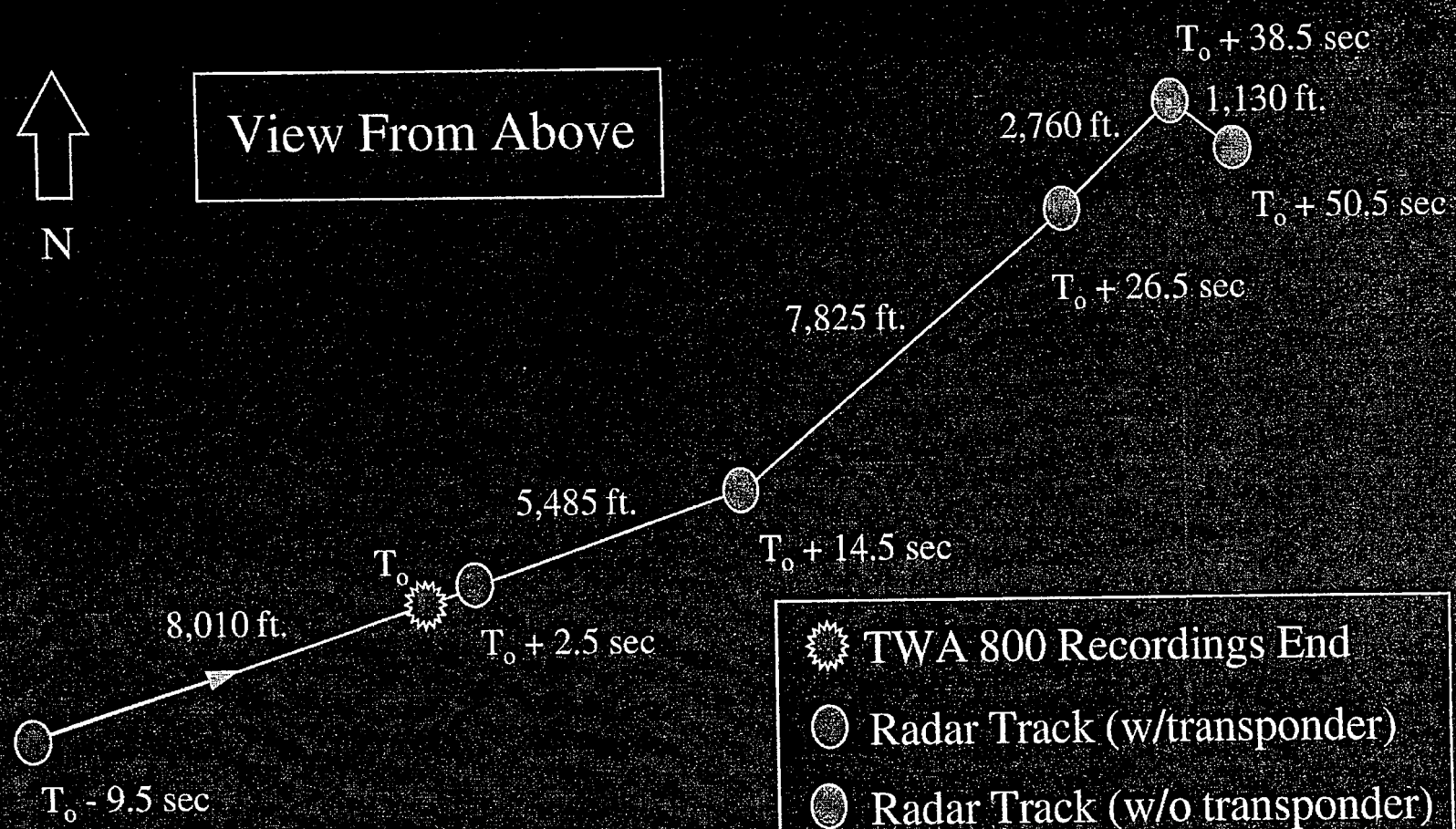
TWA Flight 800 Radar Tracking



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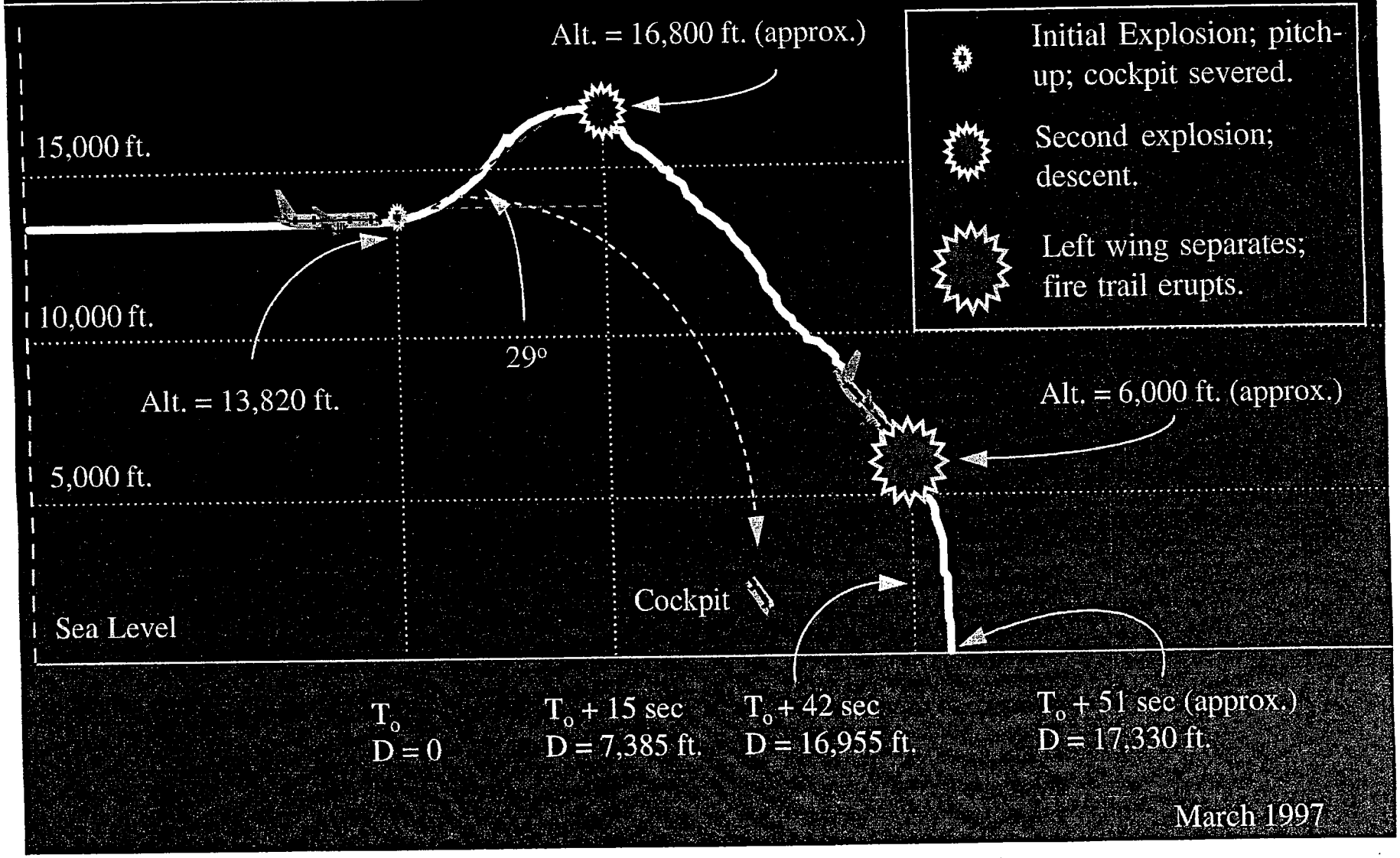
Estimated Flight Profile After First Explosion



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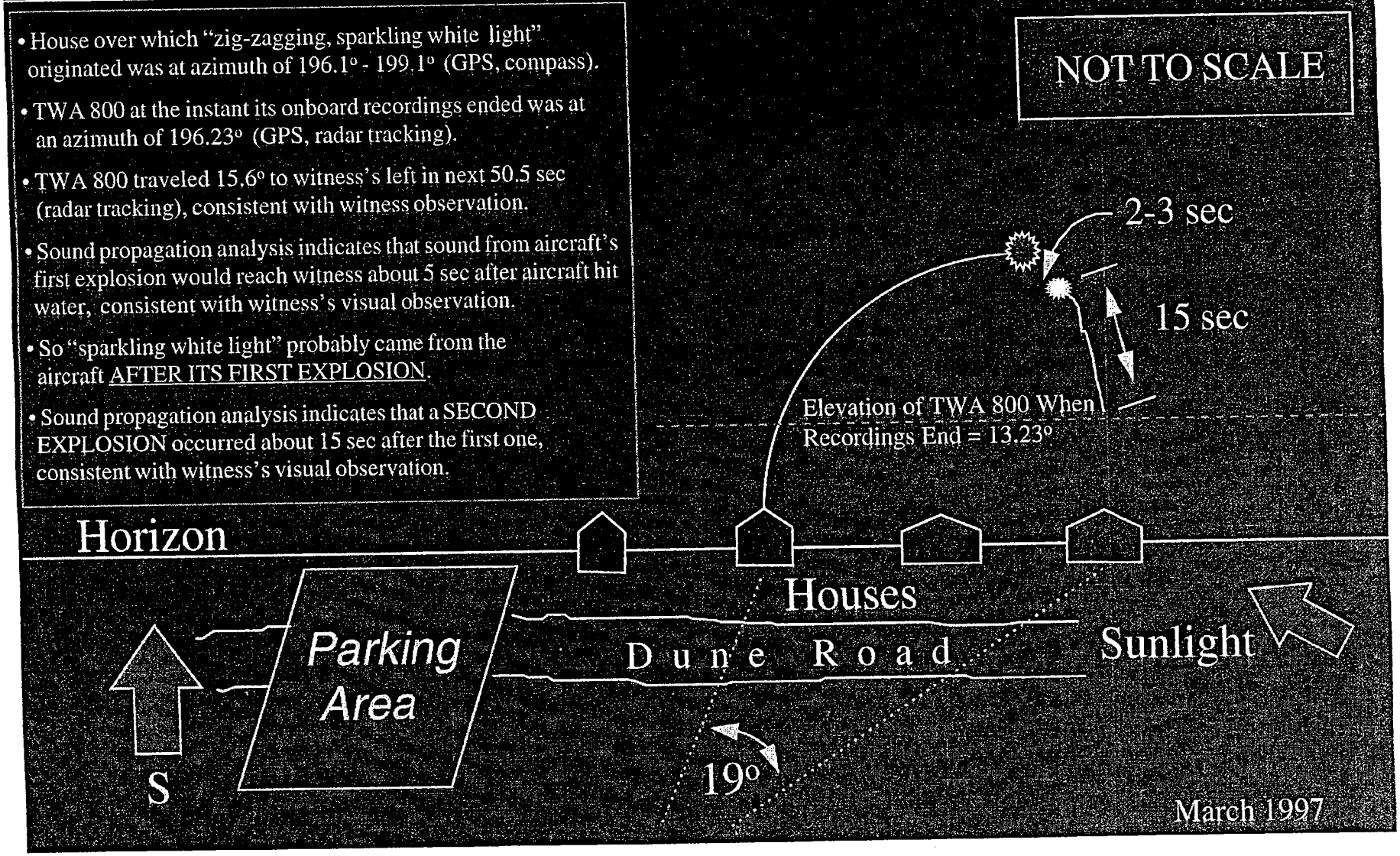
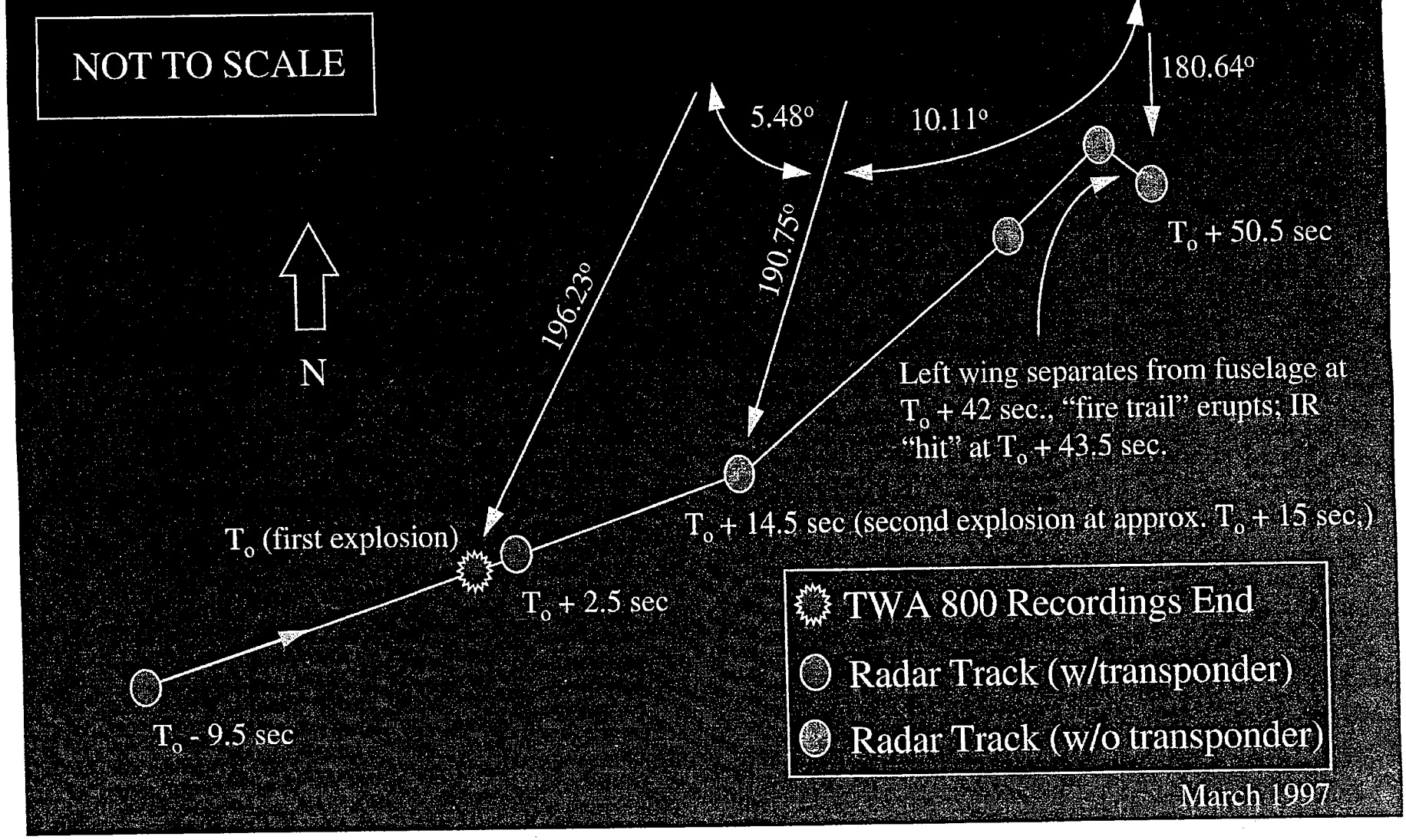
Perspective of Witness "M.W."

- House over which "zig-zagging, sparkling white light" originated was at azimuth of 196.1° - 199.1° (GPS, compass).
- TWA 800 at the instant its onboard recordings ended was at an azimuth of 196.23° (GPS, radar tracking).
- TWA 800 traveled 15.6° to witness's left in next 50.5 sec (radar tracking), consistent with witness observation.
- Sound propagation analysis indicates that sound from aircraft's first explosion would reach witness about 5 sec after aircraft hit water, consistent with witness's visual observation.
- So "sparkling white light" probably came from the aircraft AFTER ITS FIRST EXPLOSION.
- Sound propagation analysis indicates that a SECOND EXPLOSION occurred about 15 sec after the first one, consistent with witness's visual observation.



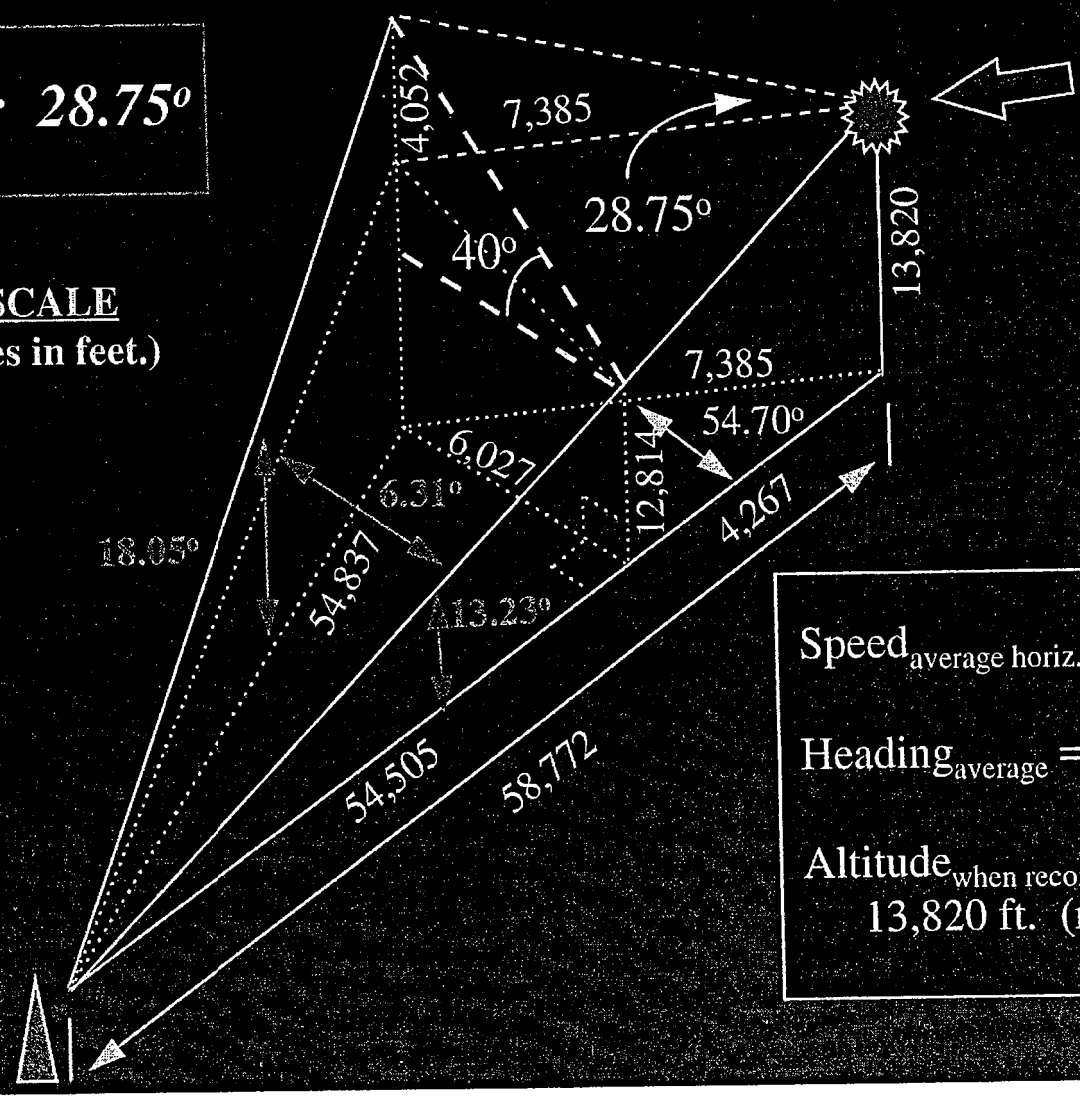
TWA Flight 800 Radar Tracking (Azimuths to Witness "M.W.")



Witness "M.W." Perspective: At What Climb Angle After Recordings End Would TWA 800 Mimic "40° Ascending Firework For 15 Seconds" ?

ANSWER: 28.75°

NOT TO SCALE
(All distances in feet.)



$\text{Speed}_{\text{average horiz.}}$ = 492 ft/sec (radar)

$\text{Heading}_{\text{average}}$ = 70.93° (radar)

$\text{Altitude}_{\text{when recordings end}}$ = 13,820 ft. (radar and altimeter)

March 1997

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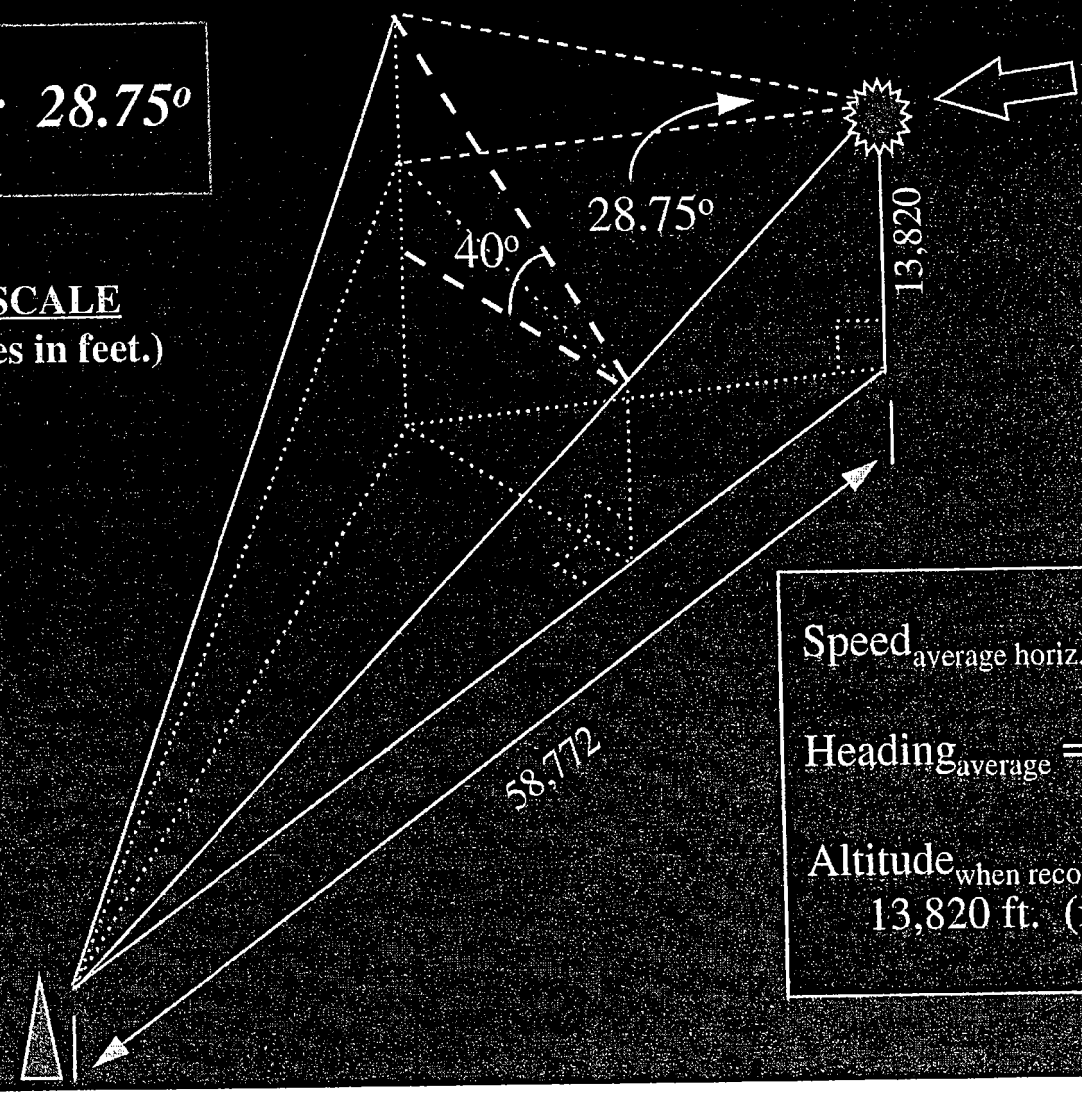
Witness "M.W." Perspective: At What Climb Angle After Recordings End Would TWA 800 Mimic "40° Ascending Firework For 15 Seconds" ?

ANSWER: 28.75°

NOT TO SCALE
(All distances in feet.)



TWA 800:
Heading = 70.93°

$Speed_{average\ horiz.}$ = 492 ft/sec (radar)

$Heading_{average}$ = 70.93° (radar)

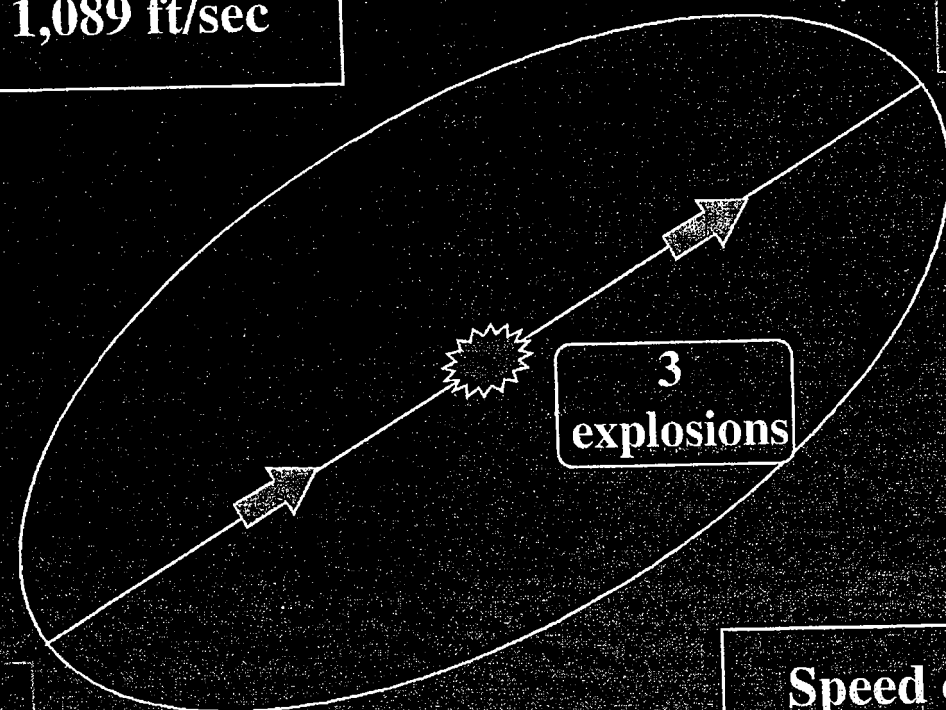
$Altitude_{when\ recordings\ end}$ =
13,820 ft. (radar and altimeter)

March 1997

TWA 800 Sound Propagation Analysis

Average speed of sound to observers = 1,089 ft/sec

Sounds 10 sec apart appear 4.1 sec apart



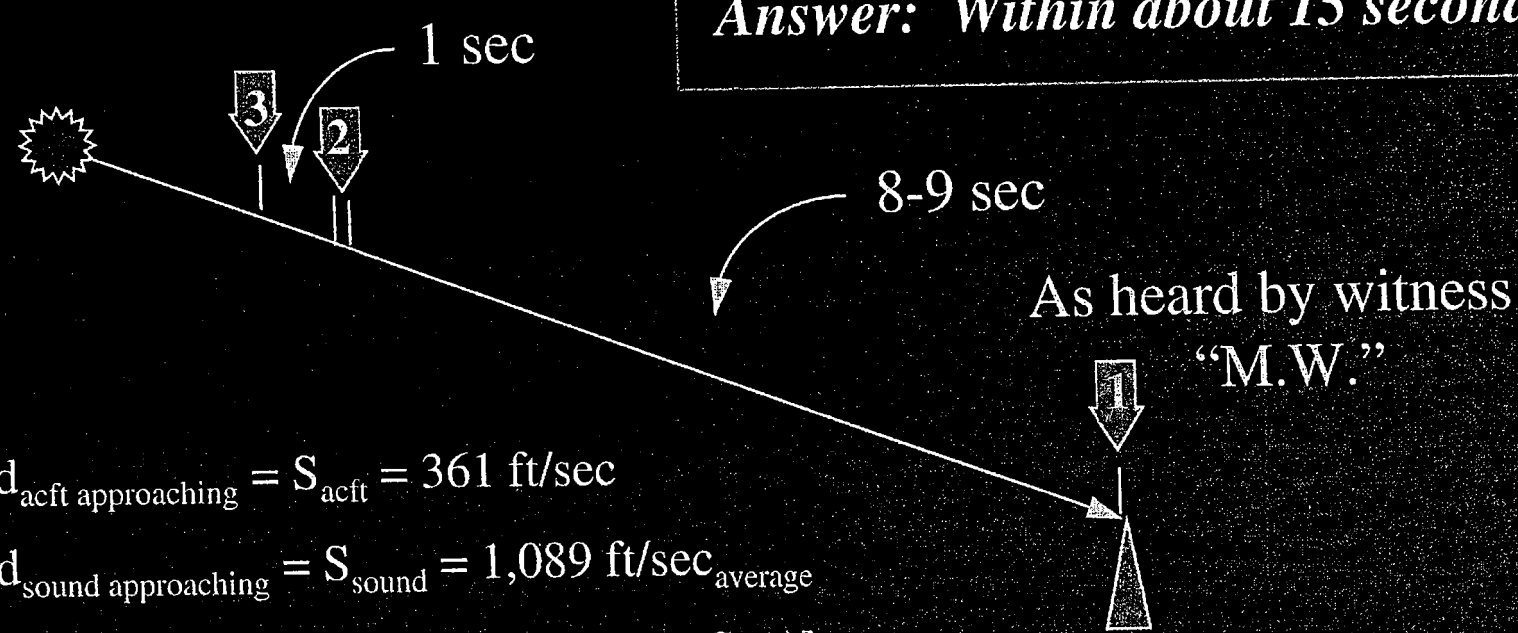
Sounds 10 sec apart appear 15.9 sec apart

Speed of TWA 800 = 641 ft/sec

March 1997

When Did "Three Explosions" on Plane Occur?

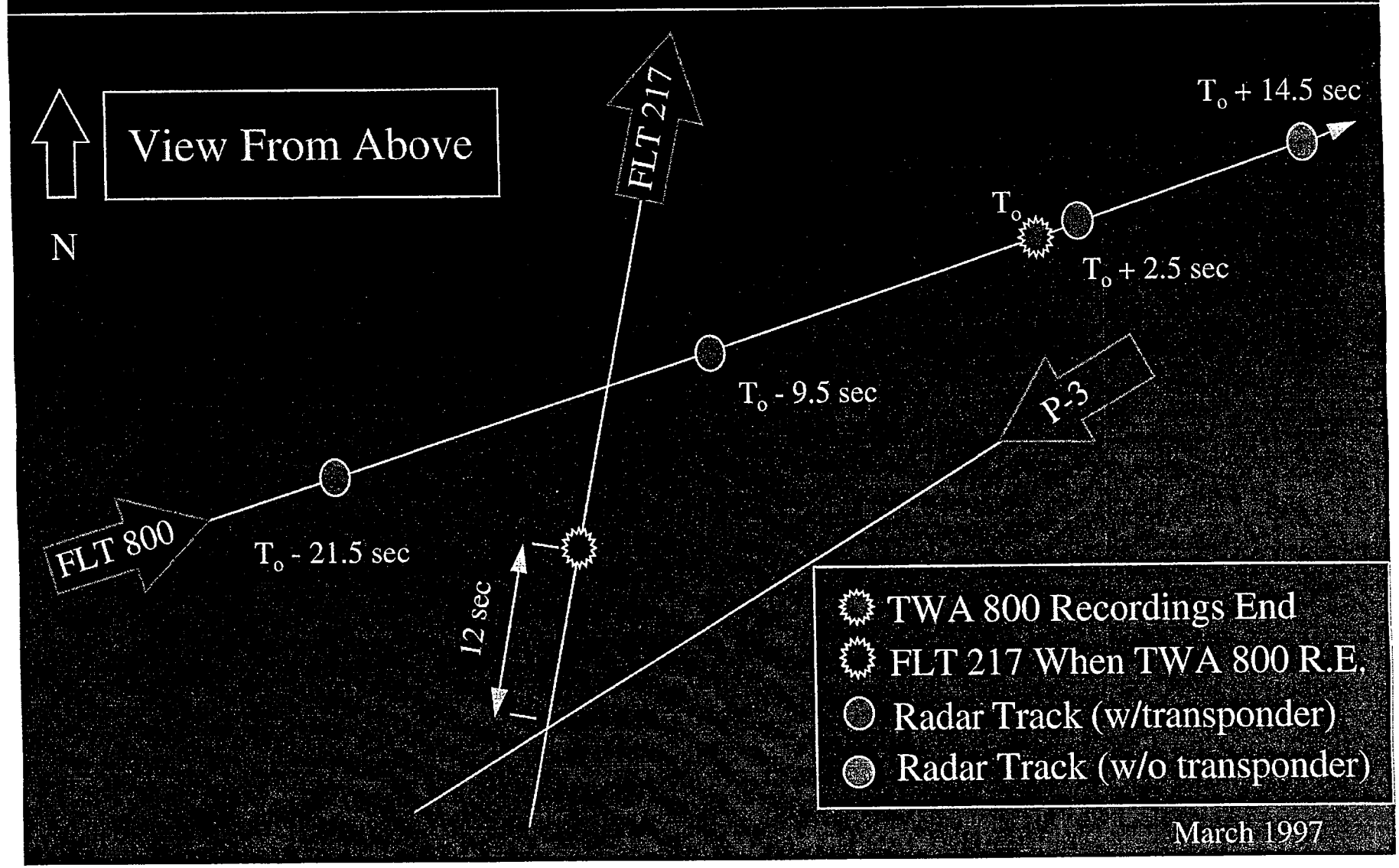
Answer: Within about 15 seconds



- $\text{Speed}_{\text{acft approaching}} = S_{\text{acft}} = 361$ ft/sec
- $\text{Speed}_{\text{sound approaching}} = S_{\text{sound}} = 1{,}089\ \text{ft/sec}_{\text{average}}$
- $\text{Time}_{\text{between sounds on acft}} = [S_{\text{sound}} / (S_{\text{sound}} - S_{\text{acft}})] \times \text{Time}_{\text{between sounds heard on ground}} = (1{,}089\ \text{ft/sec}) / [(1{,}089\ \text{ft/sec}) - (361\ \text{ft/sec})] \times 10\ \text{sec} = 15.0\ \text{sec}$
- So sounds heard by witness "M.W." 10 seconds apart were produced on plane <u>15 seconds apart</u>.

March 1997

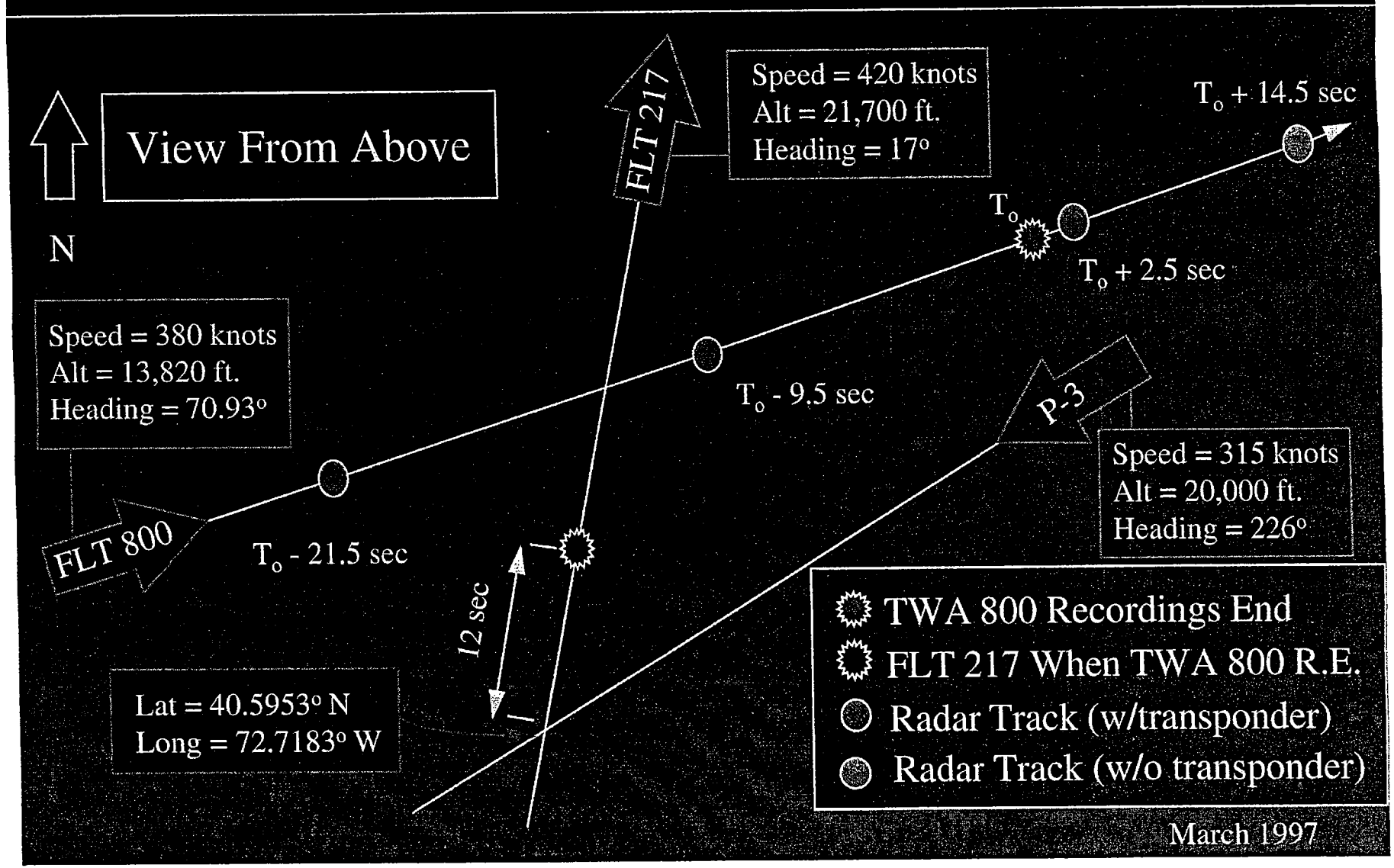
TWA Flight 800 Witnessed By "D.B." On US Air Flight 217



March 1997

190B

TWA Flight 800 Witnessed By "D.B." On US Air Flight 217



191 B

TWA 800 Timeline

Initial Explosion (T_o = 0831:07.496 PM)

T_o + 15 sec

T_o + 42 sec

T_o + 50.5+ sec

Onboard flight data and voice recordings end at T_o = 0; cockpit separates within 4 sec (last transponded radar signal received at 0831:12.133 PM); aircraft pitches up dramatically.

Two or 3 secondary explosions occur over a 2-sec period beginning at about T_o + 15 sec (witness and sound propagation analysis).

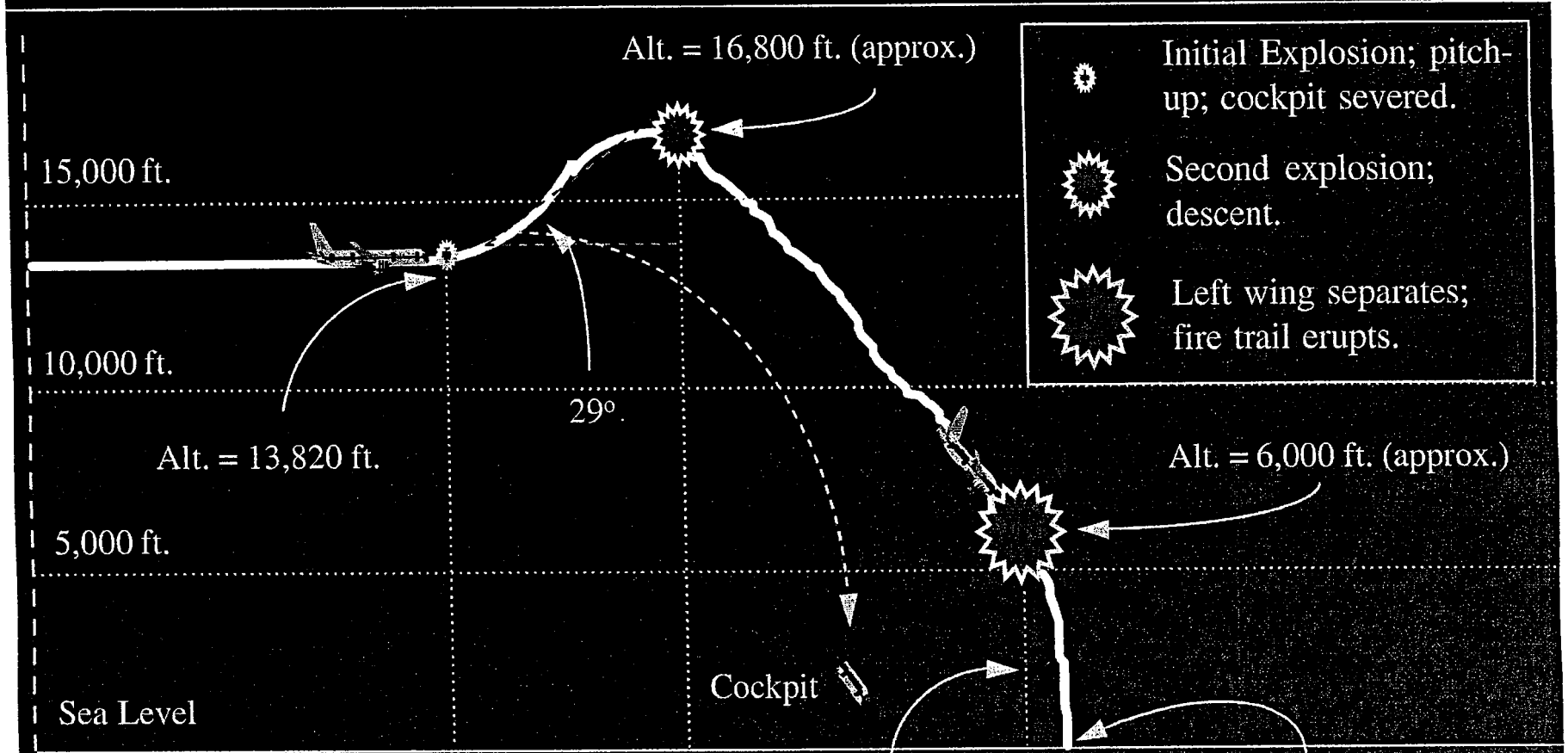
While at altitude of about one mile, aircraft hooks to left and downward; left wing separates from fuselage at T_o + 42 sec (witness and sound propagation analysis); "fire trail" erupts. (Infrared "hit" at T_o + 43.5 sec, detects heat of "fire trail.")

Left wing and most of rest of plane impact water; wing trails rest of plane by 1-2 sec (witness and radar "skin track" [0831:58 PM].

March 1997

192 B

Estimated Flight Profile After First Explosion



March 1997

1936

TWA Flight 800
Eyewitnesses Summary

How do the eyewitness accounts match the proposed trajectory of TWA Flight 800?

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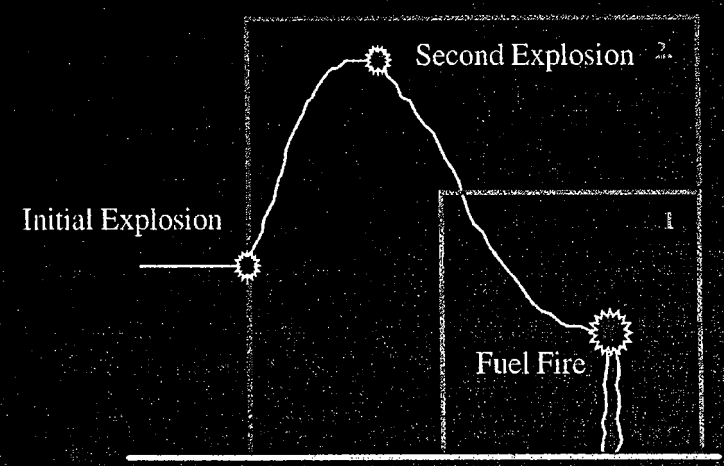
Method of Grouping TWA 800 Eyewitnesses

Group

1. Observes only end event
2. Observations begin close to but after initial explosion
3. Observations consistent with Group 1 or 2, but description includes "object hitting aircraft"
4. Observations inconclusive

Groups 1 & 2 limit observations to *after* initial explosion



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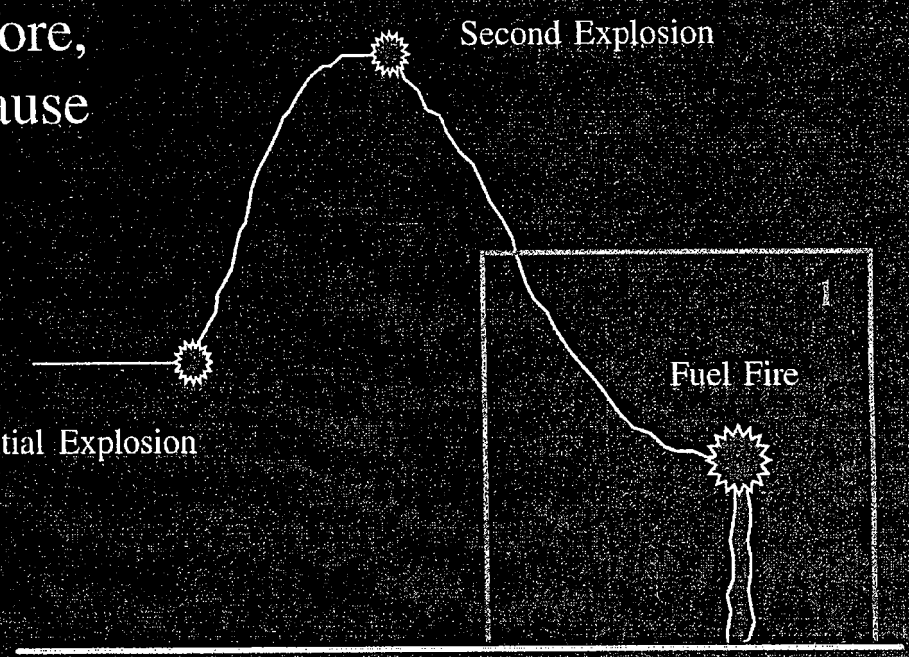
195 B

Group 1: 146 Eyewitnesses

Eyewitnesses assigned to Group 1, only observe events at the end of TWA 800's flight, and, therefore, *could not* have seen missile cause the initial explosion.



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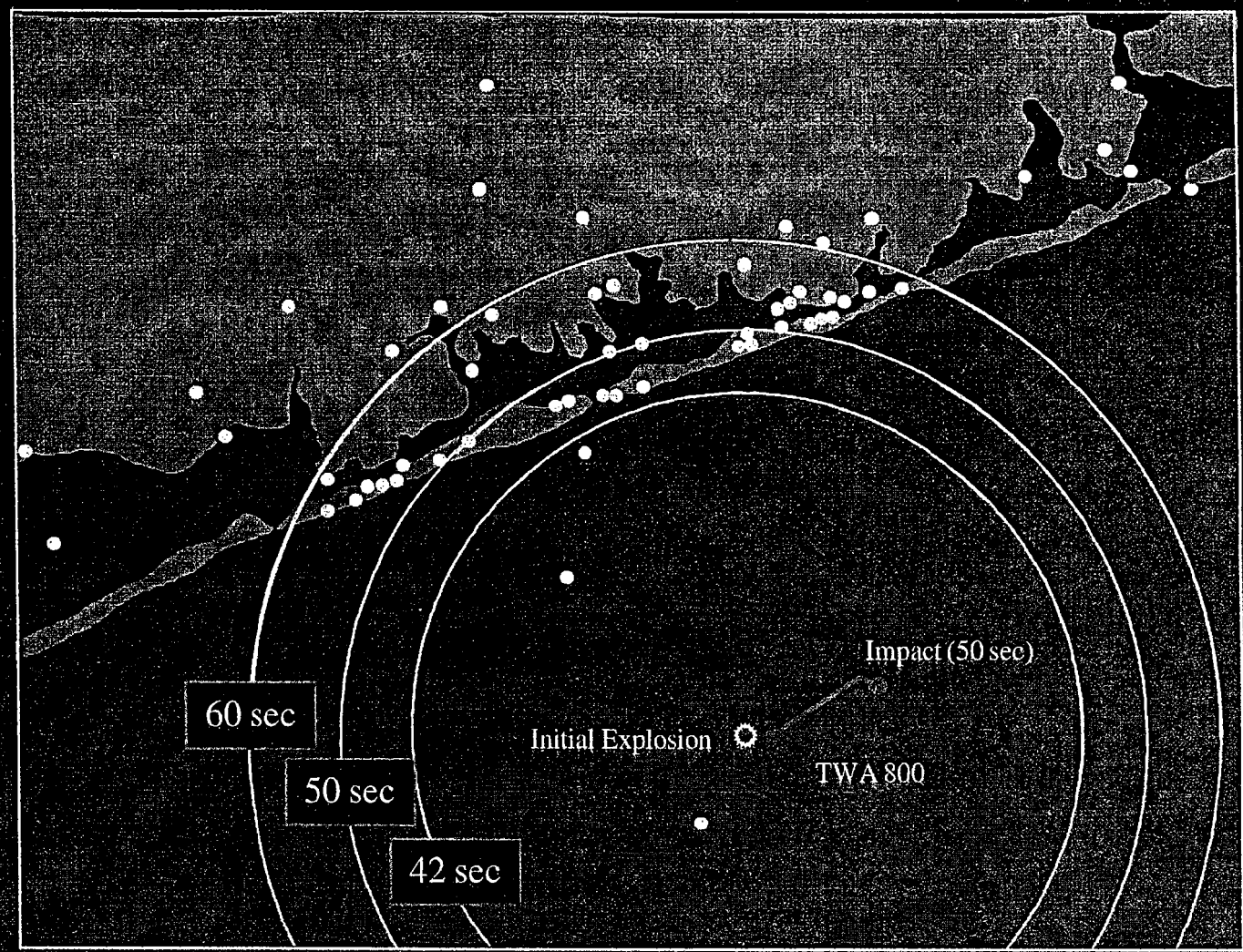
196 B

Group 1: Observations Begin Close to Hearing First Sound



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Wing Separation

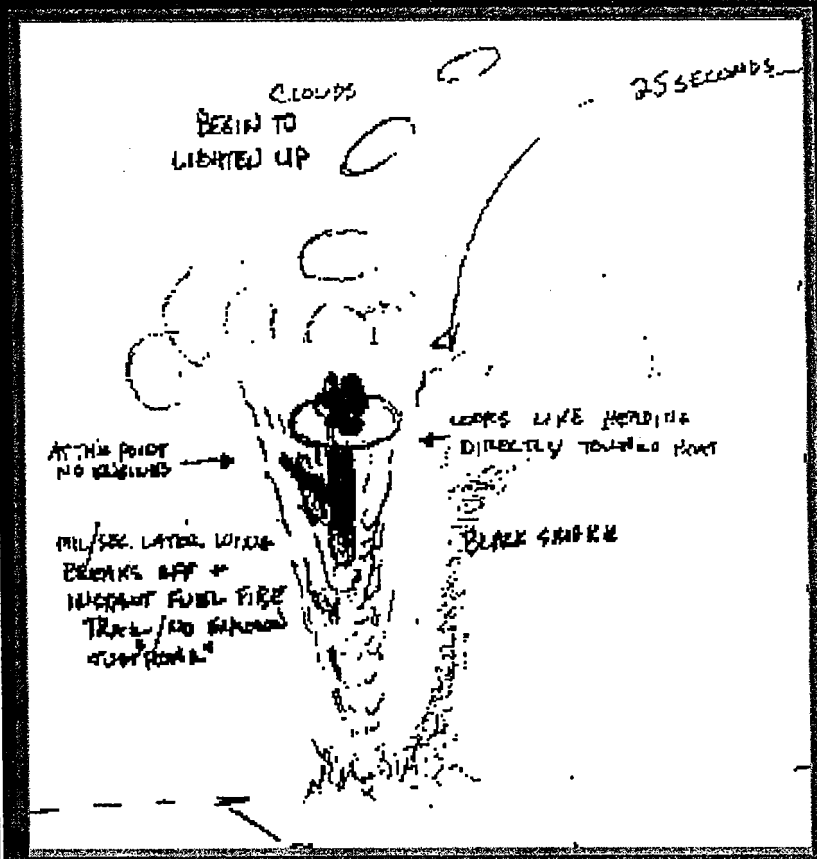
-- Debris show the left wing separated from the aircraft and was intact

-- W.P. [21] "It (the light) then grew more intense in brightness and broke into two, red balls of fire".

-- A.L. [26] "...entire right wing separates from fuselage, and peeled back, alongside the fuselage...". The entire wing was intact and did not observe engines.

-- D.G. [29] "..the fireball broke into two pieces; one pencil-shaped or telephone shaped, and one shaped like a circle".

-- A.C. [47] "...witnessed a small explosion, followed by two (2) 'tremendous' explosions, then two large objects falling toward horizon".



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TWA 800 Timeline

Initial Explosion (T_o = 0831:07.496 PM)

T_o + 15 sec

T_o + 42 sec

T_o + 50.5+ sec

Onboard flight data and voice recordings end at T_o = 0; cockpit separates within 4 sec (last transponded radar signal received at 0831:12.133 PM); aircraft pitches up dramatically.

Two or 3 secondary explosions occur over a 2-sec period beginning at about T_o + 15 sec (witness and sound propagation analysis).

While at altitude of about one mile, aircraft hooks to left and downward; right wing separates from fuselage at T_o + 42 sec (witness and sound propagation analysis); "fire trail" erupts. (Infrared "hit" at T_o + 43.5 sec, detects heat of "fire trail.")

Left wing and most of rest of plane impact water; wing trails rest of plane by 1-2 sec (witness and radar "skin track" [0831:58 PM].

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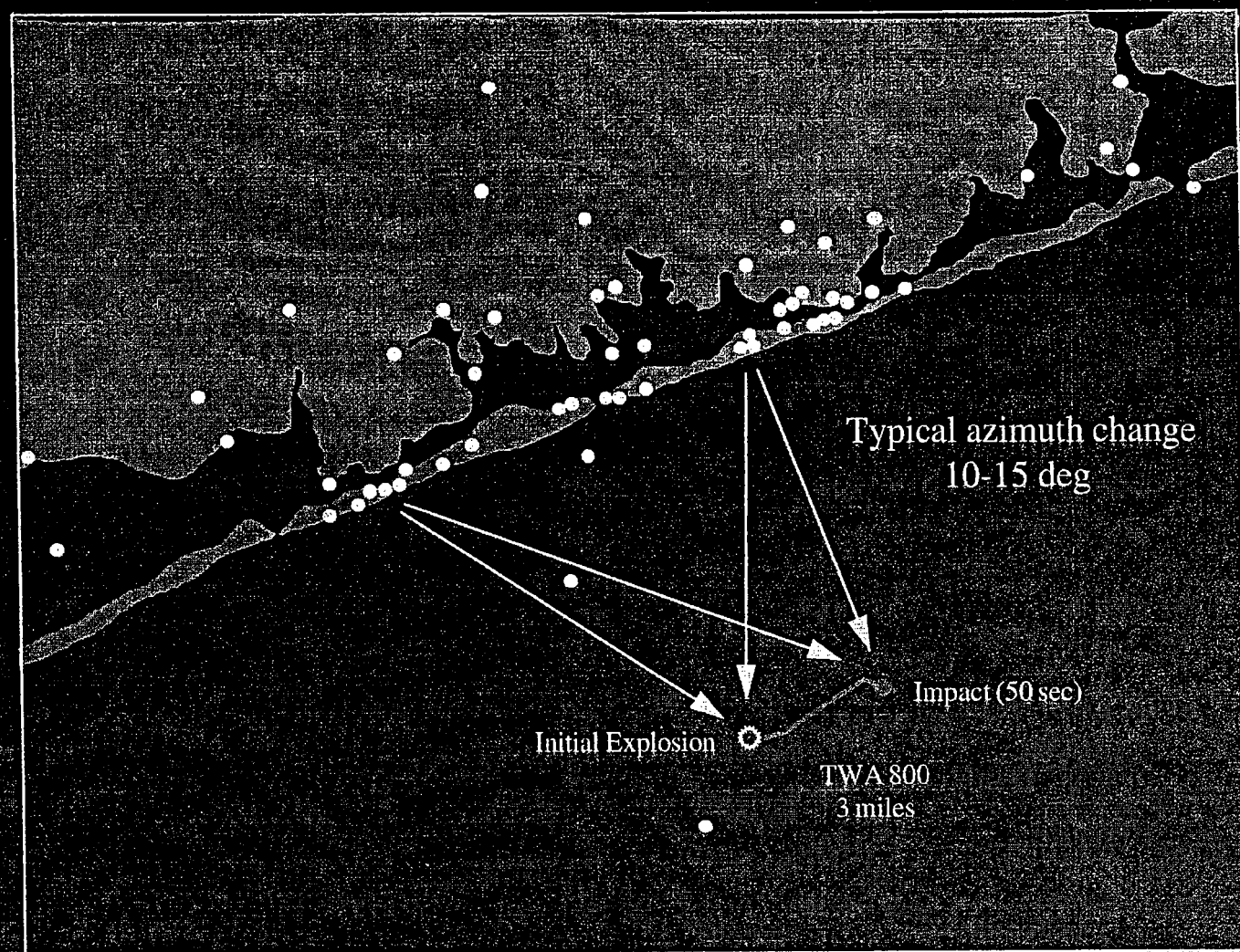
Group 1: Eyewitnesses Observe Only Vertical Motion



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200 B

Where Were Eyewitnesses Looking?

WITNESS	AZIMUTH TO TWA 800 WHEN RECORDINGS END	AZIMUTH TO TWA 800 "WING SEPARATION: FIRE ERUPTION"	AZIMUTH CITED BY WITNESS
J. & T.C. [--]	87.31°	85.00°	84.1°
K.B. [--]	98.58°	93.07°	96.1°
A.C. [47]	119.48°	110.31°	84.1°
B.K. & D.F. [73]	149.82°	131.15°	136.1°/141.1°
A. & J.C. [112/113]	161.69°	145.52°	138.1°/146.1°
V. & S.S. [114/115]	180.73°	161.19°	163.1°
J.D. [52]	189.15°	174.98°	171.1°/173.1°
R. & L.C. [50]	219.89°	214.82°	211.1°/209.1°

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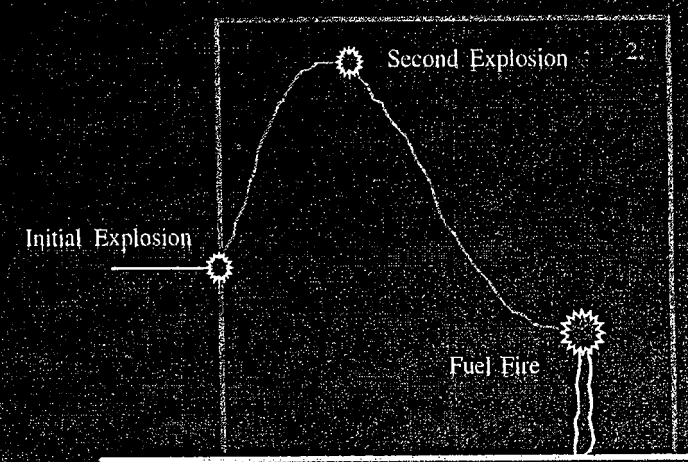
Group 2: 18 Eyewitnesses' Observations Begin Near Initial Event

- See only single object...hence did not see missile <u>and</u> aircraft
- See object ascend and descend... most see end fireball



Observations correlate with TWA 800 trajectory

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"One Continuous Motion..."

- Most eyewitnesses describe observations as "one continuous motion."
  - -- Airborne witness "V.S.": *"...it seemed all integral, transitioning from ascent to descent in a fluid motion."*
- This is inconsistent with "missile hitting aircraft," because aircraft and missile most likely would be traveling at different speeds and in different directions.

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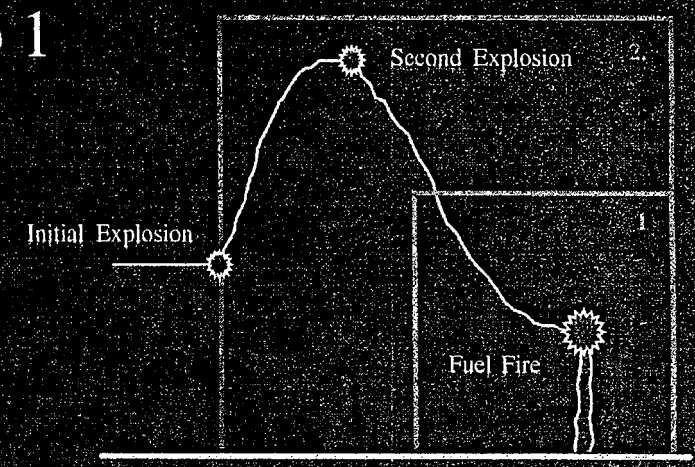
Group 3: 8 Eyewitnesses See "Object Hit Aircraft"

Eyewitnesses *do not* describe an object and aircraft simultaneously

Seven (7) eyewitnesses are in Group 1 (End Event Only) and could *not* have seen missile strike aircraft



One (1) eyewitness is in Group 2

- Witness probably interpreting observations incorrectly
- Need to re-interview witness

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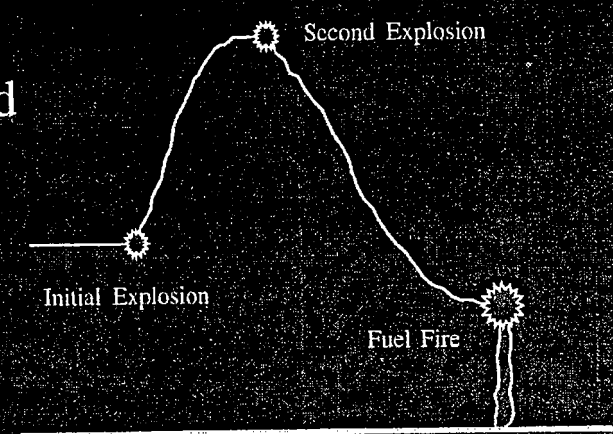
2 of 13

Remaining Eyewitness - A.C. [47]

Observations

- Observed red object ascending for 30 sec from *East to West*
- As object reached zenith, it arced over, traveled horizontally for 10 sec, followed by a small explosion and 2 tremendous explosions
- Finally, saw two objects fall toward horizon



Conclusions

- Likely saw most of event due to extended observation time
- Observed end event with explosion and two falling objects
- Observations consistent with aircraft hypothesis *except for East to West motion*

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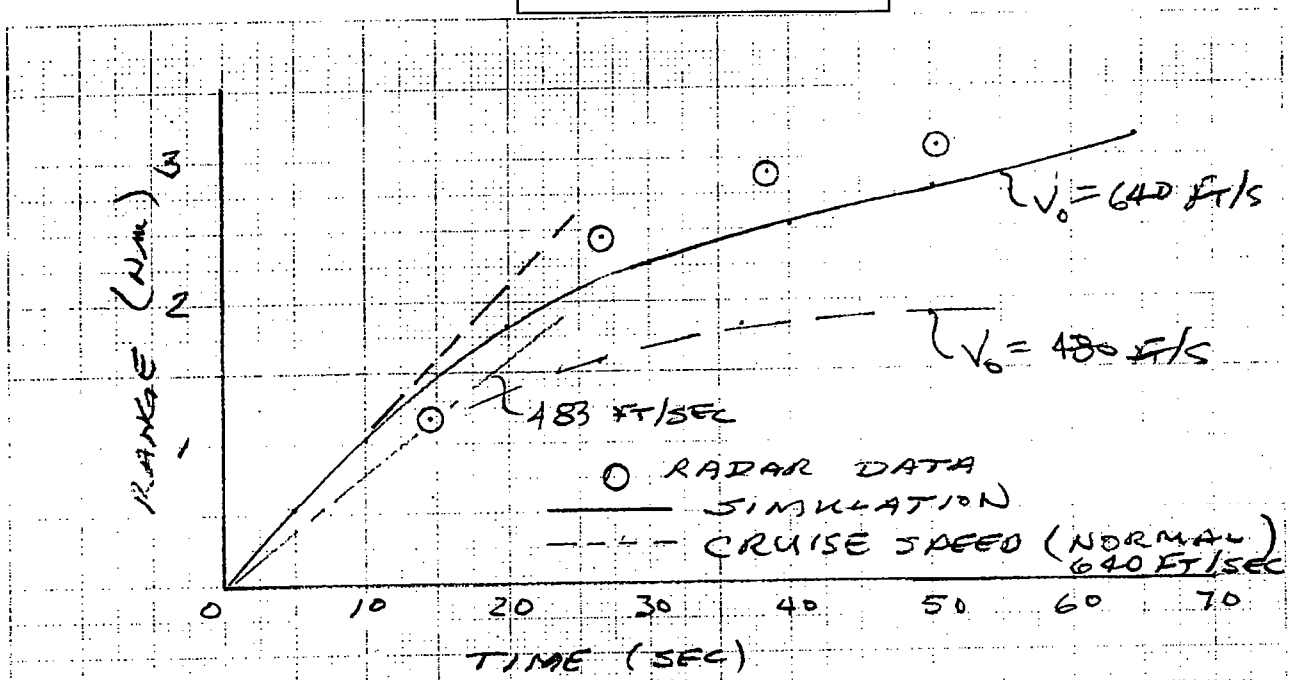
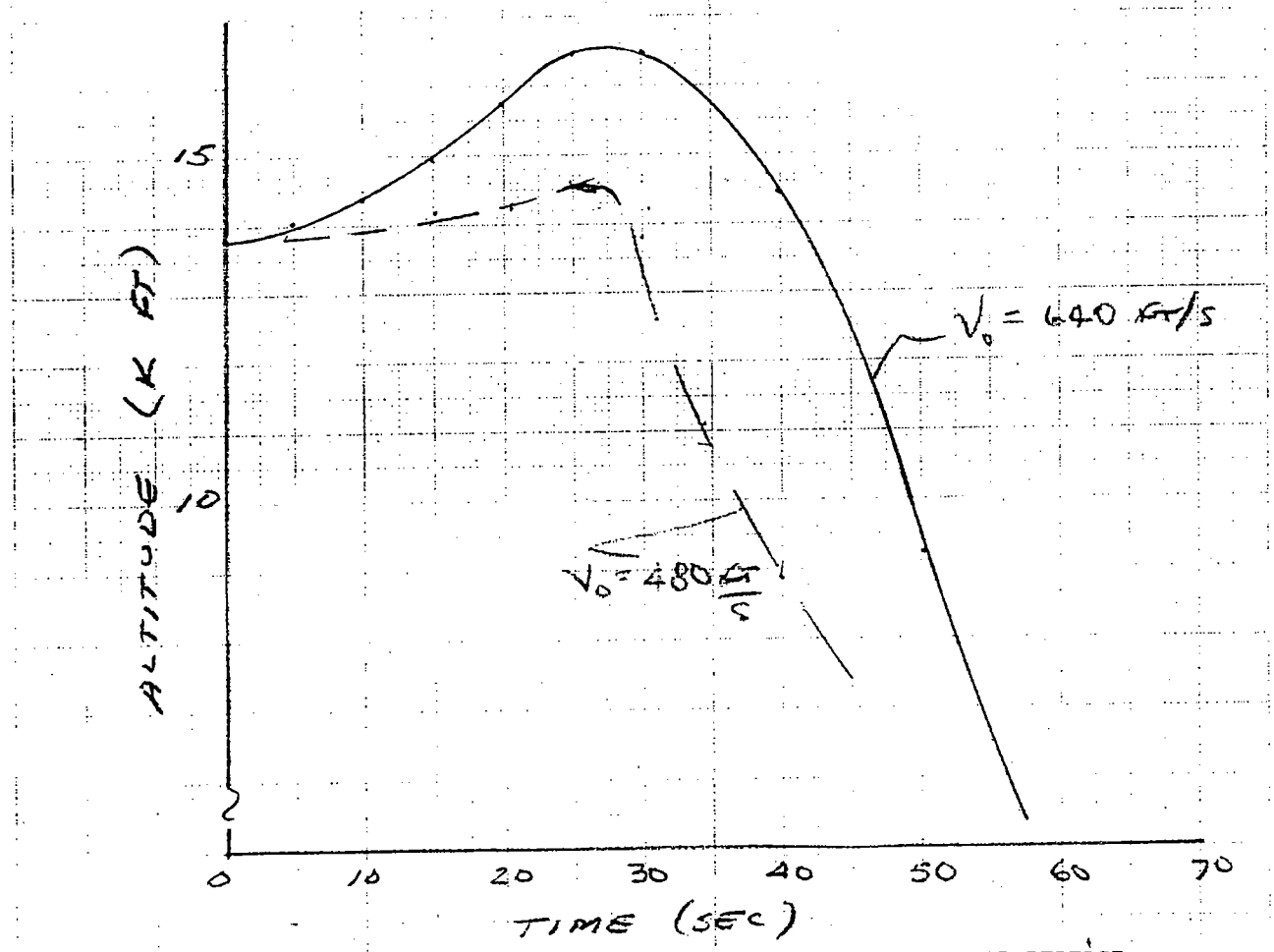
[redacted] - 18 MAR 97 68
(b)(3)





ASSUMING SKIN THICKNESS = 0.25 IN

A BODY DIAMETER OF 23 FT GIVES A CIRCUMFERENCE OF 72 FT. THIS GIVES A SURFACE AREA 0 220 IN^2. ALUMINUM (2130) IS GOOD TO ABOUT 40,000 PSI. WHICH GIVES A BREAKING LOAD ≈ 9×10^6 LBS

IF THIS LOAD EXISTED FOR 0.2 SECONDS THE IMPULSE WOULD BE ≈ 1.8×10^6 LB.SEC.

THE VELOCITY INCREMENT IS

$$\Delta V = \frac{gI}{W} = \frac{32(1.8 \times 10^6)}{580\,000} \approx 100 \text{ FT/SE}$$

16

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27 October 1997

MEMORANDUM FOR: [redacted] (b) (3)

FROM: [redacted] (b) (3)

OFFICE: OWTP

SUBJECT: New Radar Plots Impact on TWA800 Analysis

REFERENCE:

Gentlemen, I have reviewed the new radar plots and [redacted] concerns and here are the findings. (b) (6) (b) (7) (c)

The location of the initial explosion has changed. CIA has used 40.646 N, 072.687 W (at 0831:08) as the location based on the initial reporting from the FBI and NTSB. The new radar plots include additional transponder hits (mainly the JFK 4.6 second radar) which leads the FBI to claim a location of 40.6483 N, 072.6733 W (at 0831:12.25) as the intial location. Further, based on NTSB reconstruction and front end trajectory analysis (which I do not believe we have the latter), the nose separated 4 seconds later at 0831:16 (plus or minus 1/2 second) at 40.6525 N, 072.6617 W. Finally, the FBI (and O'Roarke) have determined that the JFK 4.6 second radar is the most accurate and have decided to use this radar for the trajectory plot.

What is the impact of this? First the timing of the arrival of the intial explosion changes slightly for the eyewitnesses we have been concentrating on (adding winds aloft will add about .5 - .7 seconds to the time of arrivals).

(b) (6)
(b) (7) (c)

Eyewitness	Time for Initial Explosion to Arrive	
	40.646N, 072.687 W	40.6483N, 072.6733W
[redacted]	55.44 seconds	53.87 seconds
	41.00 seconds	42.15 seconds
	47.75 seconds	47.09 seconds

(b) (6)
(b) (7) (c)

Here is the first problem for our scenario. The DSP IR hit occured at 0831:51. Based on [redacted] statement, the aircraft wing separated either 41 seconds or 42.15 seconds after the initial explosion. This results in the start of the end fireball event at 0831:49 or 0831:54, respectively. Obviously the latter time is after DSP's sweep and therefore no IR hit should have been registered (the original time of 0831:49 is still good if used). Assuming the new radar data to be correct, three possible explanations for this discrepency exist. First, the time of the sound arrival from the initial explosion to [redacted] is in reality after the start of the fuel explosion (and he mistakenly thinks they are at the same time). Second, the times oon the JFK radar and DSP are not the same. And finally, the location of [redacted] is not that well known. For him to hear the sound sooner, he would have to be *further* offshore than he reported by about 3/4 of mile. ([redacted] reported being 1 mile offshore). (b) (6) (b) (7) (c) (b) (6) (b) (7) (c) (b) (6) (b) (7) (c)

Another concern for the FBI is the change in azimuth of the aircraft in regards to [redacted] At the original point, his reported azimuth to the initial explosion, and the calculated azimuth were fairly close. However, the new explosion point moves the calculated azimuth to the East by 3.4 degrees, well off the first [redacted] reported. To make matters worse, if the nose of the aircraft doesnt come off (b) (6) (b) (7) (c) (b) (6) (b) (7) (c)

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until 4 seconds later, the aircraft should not start pitching up later, pushing the azimuth reading 6.3 degrees further East from the original calculated azimuth. Hence the question comes up, if [redacted] did see a white light ascending above the first house, what could it have been because the aircraft should not have exhibited that behavior at that location? As a matter of fact, it appears that it could have been a missile rising up and striking the aircraft. (*Now the problems with that last statement are two-fold. One, according to* [redacted] *the aircraft would not ascended since only the white light ascended. Second, a manpad would not have a engine burn that would last 15 seconds, nor burn all the way up to 13800 feet*). (b) (6) (b) (7) (c) (b) (6) (b) (7) (c)

Flanlly, some good news. [redacted] was arguing that the aircraft could not possible make the first two JFK 4.6 second radar location because the average speed between them was 375 knots, close to the 380 knots tha aircraft was traveling at before the explosion. [redacted] determined that the radar locations match his simulation that he created previously better than the old data. However, this analysis was based on the aircraft nose coming off immediately at 0831:12.25 and not 4 seconds later. [redacted] has not been able to run new runs based on the 4 second delay in the nose coming off due to problems in running the trajectory ananlysis program on a different host than the VM mainframe. (b) (6) (b) (7) (c) (b) (3) (b) (3)

To summarize,
1) the new radar data most likely will not impact the trajecotry analysis too much [redacted] correct me if I am overstating this), (b) (3)
2) the time difference in the DSP hit needs to be addresses, and
3) the [redacted] observations are in question. (b) (6) (b) (7) (c)

CC: [redacted] (b) (3)

Sent on 27 October 1997 at 09:45:00 AM

~~ADMINISTRATIVE - INTERNAL USE ONLY~~

SUBJECT: TWA800 beacon datasets (3)
DATE: Tue, 25 Nov 1997 12:52:44 -0800
FROM: Mike O'Rourke

TO: [redacted] (b)(3)

The datasets you requested this AM are attached. As I mentioned on the phone, the timing indicates adjustments to raw time based on the final CVR & DFDR time values. The range, ACPS, and Mode "C" altitude are raw (as extracted from FAA data).

Data format is: HH,MM,SS.SS, NM RANGE, ACPS, MODE C ALT IN ft MSL
00,00,00.00, 00.00, 0000, 000

Feel free to call if you have any questions. I should be in all week.

Mike O'Rourke
wmor@ix.netcom.com
(703)437-5521 or 742-9428

==========

211 B

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NOTE FOR: [redacted] (b) (3)
FROM:
DATE: 04-21-97 11:11:01 AM
SUBJECT: Inputs for TWA Flight 800 Video (16 June 1997 distribution date)

(b) (3)

[redacted] over the weekend, I read the TWA Flight 800 Metallurgy/Structures Sequencing Group Report, provided to me by [redacted] of the FBI. The Sequencing Group is chaired by a member of the NTSB, and includes engineers from Boeing and TWA. The purpose of this report is to document the sequence in which Flight 800 came apart. (b) (6) (b) (7) (c)

After reading it, two things are apparent:

1) The eyewitnesses who described the last 15 seconds or so of the disaster did a credible job. The details of their descriptions are very consistent with the progression of events postulated by the Sequencing Group.

2) The complexity of the destruction makes cursory aerodynamic modeling of the postulated flight profile after the first explosion a futile endeavor. (I think [redacted] has been trying to tell us this for about a month.) (b) (3)

So here are my recommendations for how to proceed in developing inputs for the Flight 800 video ---

Generate a spline fit (or equivalent smoothed fit) to the following latitude/longitude sequence. These points are based on the JFK radar data, and three of them include associated altitude points. The first altitude (high confidence) is derived from an onboard altimeter monitored in the flight recorder data and corroborated by the JFK radar data; the second (medium confidence) is an approximation based on eyewitness descriptions and [redacted] modeling work; and the third (high confidence) is based on the calculated time of water impact, derived from analysis of sound propagation. (b) (3)

T = 0 (first explosion, 831:11.3 PM): lat = N40.6478 deg; long = W72.6807 deg; alt = 13,820 ft

T = +10.7 sec: lat = N40.6518 deg; long = W72.6649 deg; alt = 16,500 ft [note that aircraft in free-fall remains within 200 feet of apex altitude for about 7 seconds, 3.5 seconds before apex and 3.5 seconds after apex --- so this altitude does not vary too much with assumed time of apex]. Based on analysis of eyewitness data, apex occurs at about 15 seconds after first explosion.

T = +22.7 sec: lat = N40.6627 deg; long = W72.6406 deg; alt = ?

T = +34.7 sec: lat = N40.6670 deg; long = W72.6324 deg; alt = ?

T = +46.7 sec: lat = N40.6647 deg; long = W72.6296 deg; alt = ?

T = +49 sec: alt = 0.

Our current schedule calls for distributing the video on 16 June 1997, and the DI TV Center needs two weeks to integrate the animation into the overall production. So all the final animation renderings will be needed by COB Friday, 30 May 1997.

CC: [redacted] (b) (3)

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SECTION C

Sheet1

bridge	40.8008N	72.6276w
boat	40.7471N	72.7633w
condo	40.7835N	72.6847W

From [redacted] at CIA (b)(3)

(b) (6)
(b) (7) (c)

Sheet1

	40.64889	72.67139								
	Recorder Down t=0			Apex t=15 sec			Right Wing Fail t=42			
Witness name	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	
1.	**40.64889**	**72.67139**	**13760**	**40.6522**	**72.664**	**16800**	**40.6661**	**72.6315**	**6000**	**0.017453**
2.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
3.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
4.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
5.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
6.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
7.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
8.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
9.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
10	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
11	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
12	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
13	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
14	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
15	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
16	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
17	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
18	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
19	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
20	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
21	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
22	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
23	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
24	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
25	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
26	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
27	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
28	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
29	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
30	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
31	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
32	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
33	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315		

(b) (6)
(b) (7) (c)

Sheet1

	Recorder Down t=0			Apex t=15 sec			Right Wing Fail t=42			
Witness name	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	
34.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
35.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
36.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
37.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
38.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
39.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
40.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
41.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
42.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
43.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
44.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
45.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
46.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
47.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
48.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
49.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
50.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
51.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
52.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
53.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
54.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
55.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
56.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
57.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
58.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
59.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
60.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
61.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
62.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
63.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
64.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
65.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
66.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453

	Recorder Down t=0			Apex t=15 sec			Right Wing Fail t=42			
Witness name	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	
67.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
68.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
69.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
70.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
71.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
72.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
73.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
74.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
75.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
76.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
77.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
78.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
79.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
80.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
81.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
82.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
83.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
84.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
85.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
86.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
87.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
88.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
89.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
90.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
91.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
92.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
93.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
94.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
95.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
96.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
97.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
98.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
99.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453

(b) (6)
(b) (7) (c)

		Recorder Down t=0			Apex t=15 sec			Right Wing Fail t=42			
	Witness name	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	
100.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
101.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
102.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
103.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
104.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
105.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
106.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
107.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
108.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
109.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
110.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
111.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
112.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
113.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
114.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
115.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
116.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
117.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
118.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
119.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
120.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
121.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
122.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
123.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
124.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
125.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
126.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
127.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
128.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
129.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
130.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
131.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
132.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453

(b) (6)
(b) (7) (c)

		Recorder Down t=0			Apex t=15 sec			Right Wing Fail t=42			
	Witness name	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	
133.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
134.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
135.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
136.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
137.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
138.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
139.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
140.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
141.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
142.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
143.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
144.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
145.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
146.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
147.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
148.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
149.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
150.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
151.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
152.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
153.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
154.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
155.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
156.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
157.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
158.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
159.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
160.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
161.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
162.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
163.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
164.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
165.		40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453

(b) (6)
(b) (7) (c)

	Recorder Down t=0			Apex t=15 sec			Right Wing Fail t=42			
Witness name	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	
166.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
167.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
168.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
169.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
170.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
171.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
172.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
173.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
174.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
175.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
176.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
177.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
178.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
179.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
180.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
181.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
182.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
183.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
184.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
185.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
186.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
187.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
188.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
189.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
190.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
191.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
192.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
193.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
194.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
195.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
196.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
197.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
198.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453

(b)(6)
(b)(7)(c)

Sheet1

	Recorder Down t=0			Apex t=15 sec			Right Wing Fail t=42			
Witness name	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	
199.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
200.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
201.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
202.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
203.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
204.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
205.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
206.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
207.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
208.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
209.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
210.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
211.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
212.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
213.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
214.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
215.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
216.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
217.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
218.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
219.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
220.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
221.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
222.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
223.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
224.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
225.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
226.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
227.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
228.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
229.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
230.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
231.	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453

(b)(6)
(b)(7)(c)

Sheet1

	Recorder Down t=0			Apex t=15 sec			Right Wing Fail t=42			
Witness name	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	Latitude	Longitude	Altitude (ft)	
232. [redacted]	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
233. [redacted]	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453
	40.64889	72.67139	13760	40.6522	72.664	16800	40.6661	72.6315	6000	0.017453

222 C

(b) (6)
(b) (7) (c)

Witness name	Witness Location Latitude	Witness Location Longitude	Witness Azimuth	Ground Dist (ft) t=0	Ground Dist (ft) t=15	Ground Dist (ft) t=42	Az (deg) [1] t=0	Az (deg) [2] t=15	Az (deg) [3] t=42	Closest Az (deg)
1.	40.8008	72.6276	?	56687	55099	49118	192.34	190.53	181.26	#VALUE!
2.	40.7669	72.7539	?	48691	48638	49943	152.05	149.25	137.33	#VALUE!
3.	40.74	72.85	?	59503	60561	66125	123.87	121.85	113.97	#VALUE!
4.	40.7198	73.094	?	119657	121398	129332	102.34	101.57	98.56	#VALUE!
5.	40.6532	73.1575	?	134462	136493	145543	90.51	89.99	87.98	#VALUE!
6.	41.0171	72.2448	?	178506	176255	166578	221.38	221.13	219.94	#VALUE!
7.	40.767	72.7539	?	48723	48670	49969	152.07	149.28	137.36	#VALUE!
8.	40.7358	72.8542	?	59644	60768	66589	122.03	120.04	112.36	#VALUE!
9.	40.7333	72.8667	?	62143	63352	69469	119.62	117.75	110.57	#VALUE!
10.	40.794	72.807	?	64827	65064	67266	144.65	142.56	133.82	#VALUE!
11.	40.794	72.807	?	64827	65064	67266	144.65	142.56	133.82	#VALUE!
12.	40.7988	72.64	?	55335	53854	48434	189.03	187.08	177.22	#VALUE!
13.	40.8009	72.7565	?	60200	59932	60061	156.98	154.73	144.86	#VALUE!
14.	40.7897	72.6695	?	51337	50150	46266	180.58	178.26	166.87	#VALUE!
15.	40.7841	72.7358	?	52407	52017	51778	160.13	157.56	146.15	#VALUE!
16.	40.74	72.85	?	59503	60561	66125	123.87	121.85	113.97	#VALUE!
17.	40.74	72.85	?	59503	60561	66125	123.87	121.85	113.97	#VALUE!
18.	40.9783	73.0444	?	158158	158583	161026	139.28	138.44	134.84	#VALUE!
19.	41.25	72.2	?	254694	252620	243771	210.79	210.53	209.31	#VALUE!
20.	40.8418	72.5538	?	77465	75525	67552	204.83	203.80	198.55	#VALUE!
21.	40.7815	72.7515	?	53172	52977	53564	155.37	152.82	141.72	#VALUE!
22.	40.8383	72.8117	?	79184	79165	80110	150.65	148.93	141.54	#VALUE!
23.	40.5945	73.5029	?	230939	233077	242502	84.80	84.55	83.54	#VALUE!
24.	40.8125	72.6876	?	59814	58802	55576	175.70	173.63	163.79	#VALUE!
25.	40.7495	72.8193	?	54923	55683	60149	131.85	129.52	120.30	#VALUE!
26.	40.7471	72.7633	?	43901	44161	46890	144.61	141.54	128.99	#VALUE!
27.	40.5784	73.3654	?	193774	195958	205577	82.15	81.88	80.81	#VALUE!
28.	40.8278	72.6268	?	66377	64836	58964	190.71	189.13	181.26	#VALUE!
29.	40.7367	72.8542	?	59819	60933	66714	122.30	120.31	112.62	#VALUE!
30.	40.8443	72.5035	?	85001	82882	73959	213.11	212.38	208.59	#VALUE!
31.	40.7125	73.0758	?	114185	115949	123977	101.59	100.79	97.70	#VALUE!
32.	40.7833	72.6904	?	49282	48347	45720	173.87	171.31	159.13	#VALUE!
33.	40.7748	72.8151	?	60697	61164	64372	139.09	136.90	127.94	#VALUE!

223 C

(b)(6)
(b)(7)(c)

	Witness name	Witness Location Latitude	Witness Location Longitude	Witness Azimuth	Ground Dist (ft) t=0	Ground Dist (ft) t=15	Ground Dist (ft) t=42	Az (deg) [1] t=0	Az (deg) [2] t=15	Az (deg) [3] t=42	Closest Az (deg)
34.		40.9783	73.0449	?	158247	158674	161124	139.24	138.40	134.81	#VALUE!
35.		40.8514	72.515	?	85533	83468	74822	210.38	209.59	205.50	#VALUE!
36.		40.7687	72.7527	?	49119	49037	50205	152.75	149.98	138.12	#VALUE!
37.		40.74	72.85	?	59503	60561	66125	123.87	121.85	113.97	#VALUE!
38.		40.9192	72.2576	?	150855	148521	138431	229.35	229.18	228.32	#VALUE!
39.		40.7698	72.7349	?	47445	47137	47387	158.27	155.42	142.89	#VALUE!
40.		40.7915	72.6552	?	52182	50841	46182	184.92	182.74	171.84	#VALUE!
41.		40.7982	72.6638	?	54473	53226	48978	182.21	180.06	169.49	#VALUE!
42.		40.7369	72.8845	?	67078	68324	74536	118.51	116.80	110.18	#VALUE!
43.		40.7961	72.6397	?	54377	52888	47447	189.28	187.30	177.26	#VALUE!
44.		40.762	72.7763	?	50408	50650	53134	144.85	142.18	131.10	#VALUE!
45.		40.9083	72.1838	?	164504	162138	151879	235.07	235.00	234.60	#VALUE!
46.		40.9231	72.844	?	110740	110553	110534	154.46	153.24	147.89	#VALUE!
47.		40.7517	72.9328	?	81393	82673	88920	117.33	115.94	110.45	#VALUE!
48.		40.7939	72.6461	?	53325	51894	46765	187.54	185.47	175.05	#VALUE!
49.		40.8383	72.4754	?	87741	85536	76154	218.16	217.58	214.53	#VALUE!
50.		40.8383	72.4754	?	87741	85536	76154	218.16	217.58	214.53	#VALUE!
51.		40.7811	72.6944	?	48616	47737	45384	172.48	169.86	157.46	#VALUE!
52.		40.8198	72.6501	?	62584	61221	56268	185.40	183.60	174.76	#VALUE!
53.		40.7356	73.0822	?	117873	119527	127116	105.42	104.60	101.35	#VALUE!
54.		40.7223	73.1542	?	136127	137899	145924	101.18	100.52	97.90	#VALUE!
55.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
56.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
57.		40.7928	72.6503	?	52787	51397	46481	186.34	184.23	173.58	#VALUE!
58.		40.802	72.6594	?	55916	54626	50140	183.40	181.33	171.15	#VALUE!
59.		40.8244	72.6663	?	64000	62780	58505	181.26	179.42	170.53	#VALUE!
60.		40.8742	72.8079	?	90376	90160	90152	155.30	153.80	147.24	#VALUE!
61.		40.7311	72.8771	?	64279	65553	71899	117.72	115.96	109.16	#VALUE!
62.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
63.		40.7669	72.7539	?	48691	48638	49943	152.05	149.25	137.33	#VALUE!
64.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
65.		40.8194	72.6507	?	62424	61065	56138	185.26	183.45	174.57	#VALUE!
66.		40.8038	72.6125	?	58771	57069	50474	196.09	194.45	185.97	#VALUE!

(b) (6)
(b) (7) (c)

Witness name	Witness Location Latitude	Witness Location Longitude	Witness Azimuth	Ground Dist (ft) t=0	Ground Dist (ft) t=15	Ground Dist (ft) t=42	Az (deg) [1] t=0	Az (deg) [2] t=15	Az (deg) [3] t=42	Closest Az (deg)
67.	40.7669	72.7539	?	48691	48638	49943	152.05	149.25	137.33	#VALUE!
68.	40.797	72.8313	?	69768	70165	72965	140.66	138.74	130.78	#VALUE!
69.	40.7431	73.0287	?	104563	106109	113305	109.06	108.08	104.21	#VALUE!
70.	40.7669	72.7539	?	48691	48638	49943	152.05	149.25	137.33	#VALUE!
71.	40.7535	73.1828	?	146398	148062	155645	104.93	104.27	101.63	#VALUE!
72.	40.8007	72.7406	?	58555	58127	57586	160.92	158.62	148.41	#VALUE!
73.	40.7624	72.7762	?	50512	50749	53210	144.98	142.30	131.24	#VALUE!
74.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
75.	40.7478	73.0101	?	100322	101808	108785	110.95	109.91	105.77	#VALUE!
76.	40.8045	72.7499	?	60735	60381	60129	159.05	156.83	147.01	#VALUE!
77.	40.7747	72.815	?	60651	61118	64328	139.09	136.90	127.93	#VALUE!
78.	40.7807	72.8542	?	69720	70403	74373	133.51	131.65	124.10	#VALUE!
79.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
80.	40.8282	72.7621	?	70007	69650	69234	159.00	157.07	148.56	#VALUE!
81.	40.796	72.6705	?	53631	52454	48566	180.26	178.04	167.17	#VALUE!
82.	40.785	72.7981	?	60729	60965	63226	144.75	142.53	133.23	#VALUE!
83.	40.623	73.2595	?	162975	165085	174423	86.49	86.11	84.63	#VALUE!
84.	40.7998	72.6454	?	55483	54054	48893	187.44	185.46	175.49	#VALUE!
85.	40.7822	72.7369	?	51862	51496	51375	159.55	156.95	145.44	#VALUE!
86.	40.8244	72.6664	?	63999	62781	58509	181.24	179.39	170.51	#VALUE!
87.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
88.	40.6167	72.7097	?	15813	18093	28148	42.08	44.32	50.20	#VALUE!
89.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
90.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
91.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
92.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
93.	40.7631	72.7542	?	47512	47497	48990	151.18	148.31	136.17	#VALUE!
94.	40.7134	73.0144	?	97703	99407	107240	103.82	102.86	99.13	#VALUE!
95.	40.7303	72.8725	?	63019	64283	70603	118.03	116.22	109.28	#VALUE!
96.	40.7661	72.7486	?	47762	47653	48744	153.44	150.59	138.37	#VALUE!
97.	41.0833	73.3956	?	254842	255694	259802	128.18	127.69	125.58	#VALUE!
98.	41.2201	73.0046	?	227565	227292	226597	156.11	155.51	152.91	#VALUE!
99.	41.254	72.4417	?	229485	227770	220602	196.07	195.66	193.76	#VALUE!

225 c

(b) (6)
(b) (7) (c)

Witness name	Witness Location Latitude	Witness Location Longitude	Witness Azimuth	Ground Dist (ft) t=0	Ground Dist (ft) t=15	Ground Dist (ft) t=42	Az (deg) [1] t=0	Az (deg) [2] t=15	Az (deg) [3] t=42	Closest Az (deg)
100.	41.2227	73.0566	?	234552	234406	234258	152.98	152.40	149.88	#VALUE!
101.	41.2227	73.0566	?	234552	234406	234258	152.98	152.40	149.88	#VALUE!
102.	41.2672	72.6526	?	225471	224226	219214	181.32	180.81	178.47	#VALUE!
103.	41.0678	73.3748	?	246857	247717	251869	127.99	127.47	125.31	#VALUE!
104.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
105.	40.7632	72.7723	?	50144	50331	52600	146.18	143.48	132.25	#VALUE!
106.	40.6167	72.7097	?	15813	18093	28148	42.08	44.32	50.20	#VALUE!
107.	40.8752	72.5084	?	93981	91952	83463	208.67	207.91	204.07	#VALUE!
108.	40.7807	72.8542	?	69720	70403	74373	133.51	131.65	124.10	#VALUE!
109.	40.7883	72.6687	?	50829	49634	45719	180.84	178.50	167.00	#VALUE!
110.	40.8383	72.4754	?	87741	85536	76154	218.16	217.58	214.53	#VALUE!
111.	40.7961	72.9032	?	83560	84378	88769	129.88	128.36	122.18	#VALUE!
112.	40.8009	72.7565	?	60200	59932	60061	156.98	154.73	144.86	#VALUE!
113.	40.8009	72.7565	?	60200	59932	60061	156.98	154.73	144.86	#VALUE!
114.	40.7835	72.6847	?	49211	48207	45253	175.71	173.18	161.03	#VALUE!
115.	40.7835	72.6847	?	49211	48207	45253	175.71	173.18	161.03	#VALUE!
116.	40.7835	72.6847	?	49211	48207	45253	175.71	173.18	161.03	#VALUE!
117.	40.6627	73.3696	?	193169	195179	204112	91.27	90.89	89.41	#VALUE!
118.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
119.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
120.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
121.	40.7961	72.9032	?	83560	84378	88769	129.88	128.36	122.18	#VALUE!
122.	40.6491	73.4577	?	217491	219532	228578	89.76	89.45	88.18	#VALUE!
123.	40.752	72.9336	?	81640	82919	89165	117.33	115.94	110.46	#VALUE!
124.	40.752	72.9336	?	81640	82919	89165	117.33	115.94	110.46	#VALUE!
125.	40.7632	72.7723	?	50144	50331	52600	146.18	143.48	132.25	#VALUE!
126.	40.7667	72.7465	?	47702	47562	48526	154.18	151.33	139.06	#VALUE!
127.	40.7687	72.7527	?	49119	49037	50205	152.75	149.98	138.12	#VALUE!
128.	40.8125	72.6876	?	59814	58802	55576	175.70	173.63	163.79	#VALUE!
129.	40.7424	72.8314	?	55841	56764	61853	127.57	125.35	116.66	#VALUE!
130.	40.7252	72.8868	?	65726	67093	73782	114.97	113.30	106.90	#VALUE!
131.	40.735	72.8602	?	60905	62067	68017	120.97	119.04	111.60	#VALUE!
132.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

(b) (6)
(b) (7) (c)

	Witness name	Witness Location Latitude	Witness Location Longitude	Witness Azimuth	Ground Dist (ft) t=0	Ground Dist (ft) t=15	Ground Dist (ft) t=42	Az (deg) [1] t=0	Az (deg) [2] t=15	Az (deg) [3] t=42	Closest Az (deg)
133.		40.8196	72.5635	?	69003	67045	59028	205.62	204.49	198.58	#VALUE!
134.		40.767	72.7539	?	48723	48670	49969	152.07	149.28	137.36	#VALUE!
135.		40.7368	72.8542	?	59838	60952	66728	122.32	120.34	112.65	#VALUE!
136.		40.7894	72.664	?	51265	50018	45838	182.28	0.00	168.69	#VALUE!
137.		40.7355	72.86	?	60951	62107	68033	121.14	119.21	111.76	#VALUE!
138.		40.6784	73.6758	?	277963	279954	288783	91.89	91.63	90.55	#VALUE!
139.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
140.		40.767	73.003	?	101253	102605	109043	115.06	113.96	109.59	#VALUE!
141.		40.8196	72.5635	?	69003	67045	59028	205.62	204.49	198.58	#VALUE!
142.		40.7665	72.7552	?	48732	48698	50080	151.60	148.80	136.92	#VALUE!
143.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
144.		40.7626	72.7755	?	50461	50689	53113	145.20	142.53	131.43	#VALUE!
145.		40.8313	72.7548	?	70378	69944	69186	160.86	158.96	150.47	#VALUE!
146.		40.9581	72.6208	?	113587	112154	106492	187.08	186.12	181.59	#VALUE!
147.		40.737	72.8524	?	59458	60560	66298	122.64	120.63	112.87	#VALUE!
148.		40.7909	72.661	?	51851	50571	46221	183.18	180.94	169.83	#VALUE!
149.		40.7228	73.0744	?	114622	116333	124154	103.46	102.65	99.44	#VALUE!
150.		40.7823	72.6889	?	48876	47926	45233	174.31	171.74	159.46	#VALUE!
151.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
152.		40.7304	72.8746	?	63549	64820	71163	117.81	116.02	109.15	#VALUE!
153.		40.7399	73.0314	?	104896	106464	113749	108.32	107.36	103.55	#VALUE!
154.		40.7387	73.0312	?	104706	106282	113594	108.10	107.14	103.34	#VALUE!
155.		40.7851	72.6829	?	49759	48731	45648	176.33	173.84	161.86	#VALUE!
156.		40.8174	72.6137	?	63466	61807	55377	194.56	193.01	185.10	#VALUE!
157.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
158.		40.6419	72.2306	?	121954	119939	111230	271.34	271.94	274.68	#VALUE!
159.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
160.		40.7961	72.9032	?	83560	84378	88769	129.88	128.36	122.18	#VALUE!
161.		40.7664	72.754	?	48543	48496	49827	151.92	149.12	137.17	#VALUE!
162.		40.785	72.7977	?	60666	60898	63145	144.84	142.61	133.30	#VALUE!
163.		40.785	72.7977	?	60666	60898	63145	144.84	142.61	133.30	#VALUE!
164.		40.7434	72.8691	?	64603	65719	71456	122.17	120.32	113.15	#VALUE!
165.		40.7953	72.8073	?	65261	65491	67655	144.83	142.76	134.07	#VALUE!

(b)(6)
(b)(7)(c)

	Witness name	Witness Location Latitude	Witness Location Longitude	Witness Azimuth	Ground Dist (ft) t=0	Ground Dist (ft) t=15	Ground Dist (ft) t=42	Az (deg) [1] t=0	Az (deg) [2] t=15	Az (deg) [3] t=42	Closest Az (deg)
166.		40.8498	72.4762	?	90943	88766	79524	216.42	215.81	212.68	#VALUE!
167.		40.7979	72.6326	?	55371	53820	48050	191.17	189.29	179.64	#VALUE!
168.		40.8477	72.5031	?	86101	83990	75101	212.73	212.00	208.21	#VALUE!
169.		41.0615	73.4344	?	258633	259593	264157	125.31	124.83	122.81	#VALUE!
170.		40.8644	72.4114	?	106430	104164	94443	222.51	222.12	220.12	#VALUE!
171.		40.91	72.6439	?	95493	94147	88982	184.57	183.39	177.79	#VALUE!
172.		40.4868	73.8607	?	334616	336836	346579	79.44	79.30	78.73	#VALUE!
173.		40.7909	72.7532	?	56491	56251	56572	156.39	153.99	143.50	#VALUE!
174.		40.8361	72.4966	?	83599	81440	72311	215.33	214.65	211.06	#VALUE!
175.		40.8528	72.4114	?	103352	101067	91250	224.09	223.73	221.84	#VALUE!
176.		40.9168	72.6621	?	97703	96464	91785	181.51	180.31	174.71	#VALUE!
177.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
178.		40.7971	72.6547	?	54228	52887	48185	184.88	182.79	172.35	#VALUE!
179.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
180.		40.8255	72.6454	?	64784	63387	58238	186.37	184.66	176.22	#VALUE!
181.		40.7134	73.0144	?	97703	99407	107240	103.82	102.86	99.13	#VALUE!
182.		40.7671	72.9964	?	99621	100957	107341	115.53	114.41	109.94	#VALUE!
183.		40.9435	72.86205	?	119601	119437	119476	153.84	152.70	147.75	#VALUE!
184.		40.7909	72.6587	?	51890	50586	46113	183.88	181.66	170.61	#VALUE!
185.		40.8011	72.8671	?	77478	78071	81597	135.68	133.98	127.02	#VALUE!
186.		40.8555	72.5605	?	81310	79436	71777	202.16	201.12	195.87	#VALUE!
187.		40.7895	72.7893	?	60738	60860	62645	147.52	145.29	135.85	#VALUE!
188.		40.7431	72.0287	?	180930	178693	168942	259.27	259.52	260.63	#VALUE!
189.		40.7655	72.7743	?	51148	51334	53573	146.18	143.54	132.52	#VALUE!
190.		40.7905	72.6609	?	51707	50426	46073	183.22	180.97	169.84	#VALUE!
191.		40.7971	72.6547	?	54228	52887	48185	184.88	182.79	172.35	#VALUE!
192.		40.8664	72.4509	?	99975	97778	88423	217.59	217.07	214.39	#VALUE!
193.		40.7375	72.8512	?	59278	60369	66064	122.96	120.94	113.13	#VALUE!
194.		40.7361	72.8571	?	60382	61517	67372	121.71	119.75	112.18	#VALUE!
195.		40.8507	72.8598	?	90114	90337	92214	144.67	143.17	136.79	#VALUE!
196.		40.738	72.847	?	58409	59472	65072	123.74	121.67	113.68	#VALUE!
197.		40.7446	72.7978	?	49379	50023	54141	134.92	132.29	121.86	#VALUE!
198.		?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

(b) (6)
(b) (7) (c)

Witness name	Witness Location Latitude	Witness Location Longitude	Witness Azimuth	Ground Dist (ft) t=0	Ground Dist (ft) t=15	Ground Dist (ft) t=42	Az (deg) [1] t=0	Az (deg) [2] t=15	Az (deg) [3] t=42	Closest Az (deg)
199.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
200.	40.6294	73.2283	?	154226	156324	165617	87.18	86.77	85.17	#VALUE!
201.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
202.	40.7699	73.0236	?	106863	108240	114760	114.27	113.24	109.13	#VALUE!
203.	40.807	72.6	?	60922	59139	52098	198.91	197.42	189.62	#VALUE!
204.	40.7469	73.2567	?	165675	167413	175272	102.26	101.71	99.47	#VALUE!
205.	40.7811	72.6944	?	48616	47737	45384	172.48	169.86	157.46	#VALUE!
206.	40.7647	72.7537	?	47958	47922	49318	151.66	148.82	136.75	#VALUE!
207.	40.785	72.7981	?	60729	60965	63226	144.75	142.53	133.23	#VALUE!
208.	41.2655	72.6569	?	224827	223593	218629	181.02	180.50	178.16	#VALUE!
209.	40.807	72.6	?	60922	59139	52098	198.91	197.42	189.62	#VALUE!
210.	40.7961	72.9032	?	83560	84378	88769	129.88	128.36	122.18	#VALUE!
211.	40.8438	72.6314	?	71910	70428	64782	188.85	187.36	180.02	#VALUE!
212.	40.802	72.6594	?	55916	54626	50140	183.40	181.33	171.15	#VALUE!
213.	40.8256	72.6455	?	64818	63421	58276	186.34	184.63	176.19	#VALUE!
214.	40.7358	72.8566	?	60207	61343	67202	121.69	119.73	112.14	#VALUE!
215.	40.7694	72.8482	?	65708	66457	70735	131.90	129.95	122.10	#VALUE!
216.	40.7954	72.6403	?	54098	52614	47200	189.15	187.16	177.04	#VALUE!
217.	40.777	72.7553	?	52143	52024	52958	153.57	150.96	139.73	#VALUE!
218.	40.6245	72.7105	?	14005	16354	26599	50.58	51.85	55.21	#VALUE!
219.	40.7352	72.8583	?	60493	61644	67556	121.28	119.33	111.82	#VALUE!
220.	?	?	?	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
221.	40.6257	73.241	?	157807	159912	169235	86.74	86.35	84.81	#VALUE!
222.	40.8034	72.6619	?	56390	55125	50754	182.67	180.60	170.47	#VALUE!
223.	40.8438	72.6314	?	71910	70428	64782	188.85	187.36	180.02	#VALUE!
224.	40.7228	73.0744	?	114622	116333	124154	103.46	102.65	99.44	#VALUE!
225.	40.6394	73.3127	?	177431	179497	188658	88.67	88.30	86.82	#VALUE!
226.	40.6836	73.0048	?	93061	94930	103411	97.71	96.81	93.42	#VALUE!
227.	40.6884	73.2691	?	165903	167835	176471	94.79	94.31	92.43	#VALUE!
228.	40.8438	72.6314	?	71910	70428	64782	188.85	187.36	180.02	#VALUE!
229.	40.649	73.1591	?	134899	136945	146047	89.86	89.35	87.38	#VALUE!
230.	40.8323	72.433	?	93844	91553	81710	224.64	224.26	222.20	#VALUE!
231.	40.8323	72.433	?	93844	91553	81710	224.64	224.26	222.20	#VALUE!

229 c

(b)(6)
(b)(7)(c)

Sheet1

	Witness Location		Witness	Ground Dist (ft)	Ground Dist (ft)	Ground Dist (ft)	Az (deg) [1]	Az (deg) [2]	Az (deg) [3]	Closest Az
Witness name	Latitude	Longitude	Azimuth	t=0	t=15	t=42	t=0	t=15	t=42	(deg)
232. [redacted]	**40.7647**	**72.7532**	?	47893	47851	49223	151.80	148.96	136.87	**#VALUE!**
233. [redacted]	**40.777**	**72.7553**	?	52143	52024	52958	153.57	150.96	139.73	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**
	?	**?**	**?**	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	**#VALUE!**

(b) (6)
(b) (7) (c)

Witness name	Elevation (deg) t=0	Elevation (deg) t=15	Elevation (deg) t=42	Explos. Delta Time t=0 to 15	Explos. Delta Time t=0 to 42	Explos. Delta Time t=15 to 42	Time For Sound t=0	Time For Sound t=15	Time For Sound t=38.5
1.	13.64	16.96	6.96	14.62	33.24	18.61	53.95887	52.56915	46.23163
2.	15.78	19.06	6.85	16.05	41.08	25.03	47.44199	47.58641	47.55988
3.	13.02	15.50	5.18	16.95	46.03	29.08	57.48246	58.30468	62.8435
4.	6.56	7.88	2.66	17.56	48.62	31.06	113.2418	113.5591	122.3513
5.	5.84	7.02	2.36	17.87	49.77	31.90	126.8219	127.172	137.3724
6.	4.41	5.44	2.06	14.08	28.51	14.43	163.595	159.5402	153.2423
7.	15.77	19.04	6.85	16.05	41.08	25.02	47.47082	47.61358	47.58487
8.	12.99	15.45	5.15	17.01	46.32	29.32	57.61413	58.49144	63.27608
9.	12.49	14.85	4.94	17.07	46.68	29.61	59.90951	60.80382	65.98409
10.	11.98	14.48	5.10	16.19	42.29	26.10	62.23317	62.2209	63.8793
11.	11.98	14.48	5.10	16.19	42.29	26.10	62.23317	62.2209	63.8793
12.	13.96	17.33	7.06	14.73	33.83	19.10	52.81592	51.55388	45.66633
13.	12.88	15.66	5.70	15.77	39.94	24.18	57.8294	57.48667	57.0016
14.	15.00	18.52	7.39	15.03	35.43	20.40	49.39224	48.49433	43.80983
15.	14.71	17.90	6.61	15.72	39.44	23.72	50.69803	50.45046	49.21157
16.	13.02	15.50	5.18	16.95	46.03	29.08	57.48246	58.30468	62.8435
17.	13.02	15.50	5.18	16.95	46.03	29.08	57.48246	58.30468	62.8435
18.	4.97	6.05	2.13	16.47	42.11	25.64	149.2145	147.7523	152.4015
19.	3.09	3.80	1.41	14.55	28.55	14.00	234.1112	229.1439	225.1952
20.	10.07	12.54	5.08	14.19	31.15	16.96	72.39754	70.22439	62.9192
21.	14.51	17.59	6.39	15.88	40.36	24.48	51.45569	51.35413	50.92798
22.	9.86	11.98	4.28	15.92	40.93	25.01	75.38102	74.8439	75.90815
23.	3.41	4.12	1.42	18.33	49.18	30.85	216.7847	215.8218	228.5168
24.	12.96	15.95	6.16	15.11	36.25	21.14	57.14068	56.16484	52.54146
25.	14.06	16.79	5.70	16.71	44.74	28.02	53.26537	53.93887	57.22048
26.	17.40	20.83	7.29	16.38	42.55	26.17	43.20365	43.75626	44.73391
27.	4.06	4.90	1.67	18.22	49.82	31.60	181.9085	181.5222	193.6037
28.	11.71	14.53	5.81	14.60	33.41	18.82	62.74652	61.1579	55.37353
29.	12.95	15.41	5.14	17.00	46.28	29.28	57.77404	58.63886	63.3953
30.	9.20	11.46	4.64	14.02	30.11	16.09	78.95522	76.48002	68.54739
31.	6.87	8.24	2.77	17.57	48.77	31.20	108.122	108.5477	117.2803
32.	15.60	19.16	7.48	15.28	36.76	21.49	47.66644	47.04397	43.40184
33.	12.77	15.36	5.33	16.42	43.38	26.97	58.49837	58.78005	61.18352

(b)(6)
(b)(7)(c)

	Witness name	Elevation (deg) t=0	Elevation (deg) t=15	Elevation (deg) t=42	Explos. Delta Time t=0 to 15	Explos. Delta Time t=0 to 42	Explos. Delta Time t=15 to 42	Time For Sound t=0	Time For Sound t=15	Time For Sound t=38.5
34.		4.97	6.04	2.13	16.47	42.12	25.65	149.2994	147.8372	152.4943
35.		9.14	11.38	4.58	14.06	30.41	16.34	79.52983	77.09048	69.43436
36.		15.65	18.91	6.82	16.02	40.94	24.92	47.82044	47.92746	47.8014
37.		13.02	15.50	5.18	16.95	46.03	29.08	57.48246	58.30468	62.8435
38.		5.21	6.45	2.48	13.91	28.35	14.44	137.9683	134.2481	126.9465
39.		16.17	19.62	7.22	15.84	39.88	24.04	46.24599	46.21036	45.123
40.		14.77	18.29	7.40	14.89	34.61	19.72	50.06816	49.0142	43.65944
41.		14.18	17.52	6.98	14.94	35.08	20.14	52.18088	51.14259	46.29656
42.		11.59	13.81	4.60	17.09	46.82	29.74	64.45293	65.27187	70.75989
43.		14.20	17.62	7.21	14.73	33.79	19.06	51.94946	50.70727	44.7491
44.		15.27	18.35	6.44	16.29	42.43	26.14	49.0672	49.41453	50.59215
45.		4.78	5.92	2.26	13.93	28.03	14.10	150.0173	146.0805	138.9116
46.		7.08	8.64	3.11	15.78	39.75	23.97	104.5701	103.316	104.4749
47.		9.60	11.49	3.86	17.10	46.89	29.79	77.69799	78.26156	84.33601
48.		14.47	17.94	7.31	14.79	34.12	19.32	51.04122	49.87812	44.15156
49.		8.91	11.11	4.50	13.93	29.61	15.67	81.26318	78.66277	70.39008
50.		8.91	11.11	4.50	13.93	29.61	15.67	81.26318	78.66277	70.39008
51.		15.80	19.39	7.53	15.33	37.05	21.72	47.09274	46.53664	43.10703
52.		12.40	15.35	6.09	14.78	34.39	19.61	59.43963	58.09313	52.99569
53.		6.66	8.00	2.70	17.48	48.24	30.77	111.617	111.883	120.3092
54.		5.77	6.95	2.35	17.63	48.59	30.96	128.6181	128.7022	138.002
55.		#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
56.		#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
57.		14.61	18.10	7.36	14.84	34.34	19.50	50.58234	49.46914	43.91047
58.		13.82	17.10	6.82	14.89	34.84	19.95	53.4569	52.34258	47.35208
59.		12.13	14.98	5.86	14.90	35.14	20.24	60.81976	59.5639	55.16007
60.		8.66	10.56	3.81	15.74	39.86	24.12	85.64698	84.7243	85.28471
61.		12.08	14.37	4.77	17.12	46.96	29.84	61.87331	62.77738	68.2678
62.		#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
63.		15.78	19.06	6.85	16.05	41.08	25.03	47.44199	47.58641	47.55988
64.		#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
65.		12.43	15.38	6.10	14.78	34.42	19.64	59.2974	57.95896	52.87825
66.		13.18	16.40	6.78	14.50	32.59	18.09	55.74791	54.20543	47.40188

(b)(6)
(b)(7)(c)

Witness name	Elevation (deg) t=0	Elevation (deg) t=15	Elevation (deg) t=42	Explos. Delta Time t=0 to 15	Explos. Delta Time t=0 to 42	Explos. Delta Time t=15 to 42	Time For Sound t=0	Time For Sound t=15	Time For Sound t=38.5
67.	15.78	19.06	6.85	16.05	41.08	25.03	47.44199	47.58641	47.55988
68.	11.16	13.47	4.70	16.32	42.98	26.67	66.82429	66.8436	69.26976
69.	7.50	9.00	3.03	17.35	47.88	30.53	99.2274	99.61598	107.3079
70.	15.78	19.06	6.85	16.05	41.08	25.03	47.44199	47.58641	47.55988
71.	5.37	6.47	2.21	17.57	48.00	30.43	138.2927	138.12	147.2617
72.	13.22	16.12	5.95	15.63	39.19	23.55	56.26759	55.82701	54.63775
73.	15.24	18.32	6.43	16.29	42.41	26.12	49.15982	49.49998	50.66225
74.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
75.	7.81	9.37	3.16	17.29	47.66	30.37	95.28549	95.69337	103.0575
76.	12.77	15.55	5.70	15.69	39.53	23.84	58.2856	57.8561	57.04096
77.	12.78	15.37	5.33	16.42	43.38	26.97	58.45657	58.73944	61.14192
78.	11.16	13.42	4.61	16.58	44.30	27.72	66.84244	67.11318	70.62559
79.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
80.	11.12	13.56	4.95	15.64	39.40	23.76	66.77816	66.1342	65.57801
81.	14.39	17.76	7.04	15.01	35.46	20.45	51.46115	50.50646	45.94819
82.	12.77	15.41	5.42	16.21	42.32	26.11	58.47369	58.5545	60.07701
83.	4.83	5.81	1.97	18.03	49.83	31.79	153.3212	153.3134	164.4567
84.	13.93	17.27	7.00	14.77	34.11	19.33	52.98193	51.76068	46.12115
85.	14.86	18.07	6.66	15.74	39.56	23.82	50.21256	50.00068	48.84114
86.	12.13	14.98	5.86	14.90	35.14	20.24	60.81979	59.56471	55.16481
87.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
88.	41.03	42.88	12.03	18.55	48.81	30.26	19.34978	22.49046	26.80491
89.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
90.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
91.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
92.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
93.	16.15	19.48	6.98	16.10	41.26	25.17	46.3881	46.59873	46.67304
94.	8.02	9.59	3.20	17.49	48.64	31.16	92.78311	93.43123	101.51
95.	12.32	14.65	4.86	17.12	46.92	29.80	60.71466	61.63764	67.04651
96.	16.07	19.42	7.02	16.01	40.82	24.81	46.58853	46.71216	46.42864
97.	3.09	3.76	1.32	17.25	42.93	25.68	240.1577	237.6692	245.9649
98.	3.46	4.23	1.52	16.10	37.88	21.78	213.5462	210.4586	213.695
99.	3.43	4.22	1.56	14.78	30.70	15.92	212.3308	207.9951	205.1544

(b) (6)
(b) (7) (c)

Witness name	Elevation (deg) t=0	Elevation (deg) t=15	Elevation (deg) t=42	Explos. Delta Time t=0 to 15	Explos. Delta Time t=0 to 42	Explos. Delta Time t=15 to 42	Time For Sound t=0	Time For Sound t=15	Time For Sound t=38.5
100.	3.36	4.10	1.47	16.24	38.41	22.17	220.2502	217.1737	221.0691
101.	3.36	4.10	1.47	16.24	38.41	22.17	220.2502	217.1737	221.0691
102.	3.49	4.28	1.57	15.19	33.12	17.93	209.8656	205.9776	205.1009
103.	3.19	3.88	1.36	17.22	43.07	25.85	232.6582	230.2904	238.4606
104.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
105.	15.34	18.46	6.51	16.25	42.18	25.94	48.81513	49.12363	50.08475
106.	41.03	42.88	12.03	18.55	48.81	30.26	19.34978	22.49046	26.80491
107.	8.33	10.35	4.11	14.09	30.54	16.45	87.25879	84.69382	77.45183
108.	11.16	13.42	4.61	16.58	44.30	27.72	66.84244	67.11318	70.62559
109.	15.15	18.70	7.48	15.03	35.39	20.36	48.93203	48.04143	43.29868
110.	8.91	11.11	4.50	13.93	29.61	15.67	81.26318	78.66277	70.39008
111.	9.35	11.26	3.87	16.68	44.79	28.11	79.67986	79.79383	84.21926
112.	12.88	15.66	5.70	15.77	39.94	24.18	57.8294	57.48667	57.0016
113.	12.88	15.66	5.70	15.77	39.94	24.18	57.8294	57.48667	57.0016
114.	15.62	19.21	7.55	15.22	36.41	21.19	47.57248	46.89276	42.94244
115.	15.62	19.21	7.55	15.22	36.41	21.19	47.57248	46.89276	42.94244
116.	15.62	19.21	7.55	15.22	36.41	21.19	47.57248	46.89276	42.94244
117.	4.07	4.92	1.68	18.06	49.05	30.99	181.7346	181.1897	192.6363
118.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
119.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
120.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
121.	9.35	11.26	3.87	16.68	44.79	28.11	79.67986	79.79383	84.21926
122.	3.62	4.38	1.50	18.18	48.91	30.72	204.4426	203.5774	215.6478
123.	9.57	11.45	3.85	17.10	46.89	29.79	77.92675	78.48569	84.56764
124.	9.57	11.45	3.85	17.10	46.89	29.79	77.92675	78.48569	84.56764
125.	15.34	18.46	6.51	16.25	42.18	25.94	48.81513	49.12363	50.08475
126.	16.09	19.45	7.05	15.99	40.68	24.69	46.52641	46.62583	46.21936
127.	15.65	18.91	6.82	16.02	40.94	24.92	47.82044	47.92746	47.8014
128.	12.96	15.95	6.16	15.11	36.25	21.14	57.14068	56.16484	52.54146
129.	13.84	16.49	5.54	16.85	45.45	28.60	54.12082	54.91277	58.8238
130.	11.82	14.06	4.65	17.20	47.36	30.16	63.20152	64.15592	70.02927
131.	12.73	15.15	5.04	17.04	46.48	29.45	58.77205	59.65314	64.61918
132.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

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(b) (6)
(b) (7) (c)

Witness name	Elevation (deg) t=0	Elevation (deg) t=15	Elevation (deg) t=42	Explos. Delta Time t=0 to 15	Explos. Delta Time t=0 to 42	Explos. Delta Time t=15 to 42	Time For Sound t=0	Time For Sound t=15	Time For Sound t=38.5
133.	11.28	14.07	5.80	14.21	31.11	16.90	64.7233	62.71554	55.04569
134.	15.77	19.04	6.85	16.05	41.08	25.02	47.47082	47.61358	47.58487
135.	12.95	15.41	5.14	17.00	46.28	29.28	57.79188	58.65531	63.40862
136.	15.02	18.57	7.46	14.98	35.11	20.14	49.29632	47.20823	43.38548
137.	12.72	15.14	5.04	17.03	46.46	29.43	58.81482	59.68941	64.63489
138.	2.83	3.43	1.19	18.41	47.96	29.55	261.2018	259.4355	272.5546
139.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
140.	7.74	9.30	3.15	17.17	47.04	29.87	96.17417	96.44489	103.3372
141.	11.28	14.07	5.80	14.21	31.11	16.90	64.7233	62.71554	55.04569
142.	15.77	19.03	6.83	16.07	41.17	25.10	47.48393	47.6431	47.69143
143.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
144.	15.25	18.34	6.45	16.28	42.36	26.09	49.11168	49.4453	50.57019
145.	11.06	13.51	4.96	15.57	39.03	23.46	67.0834	66.36495	65.50591
146.	6.91	8.52	3.22	14.65	33.50	18.86	106.0632	103.6749	99.63993
147.	13.03	15.50	5.17	16.99	46.23	29.24	57.44273	58.30514	63.00378
148.	14.86	18.38	7.40	14.94	34.94	19.99	49.80479	48.81257	43.72539
149.	6.85	8.22	2.77	17.52	48.53	31.01	108.556	108.9267	117.4797
150.	15.72	19.32	7.56	15.27	36.69	21.42	47.29566	46.67146	42.94311
151.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
152.	12.22	14.53	4.82	17.12	46.95	29.83	61.20166	62.11936	67.57364
153.	7.47	8.97	3.02	17.37	47.98	30.61	99.53155	99.93501	107.7188
154.	7.49	8.98	3.02	17.38	48.01	30.63	99.35318	99.76589	107.5692
155.	15.46	19.02	7.49	15.19	36.28	21.09	48.05274	47.33623	43.30025
156.	12.23	15.21	6.18	14.51	32.80	18.29	60.01584	58.39393	51.96317
157.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
158.	6.44	7.97	3.09	14.13	30.15	16.02	110.3262	107.3636	100.6152
159.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
160.	9.35	11.26	3.87	16.68	44.79	28.11	79.67986	79.79383	84.21926
161.	15.83	19.11	6.87	16.06	41.11	25.05	47.30993	47.46334	47.45286
162.	12.78	15.42	5.43	16.21	42.31	26.10	58.41447	58.49379	60.00086
163.	12.78	15.42	5.43	16.21	42.31	26.10	58.41447	58.49379	60.00086
164.	12.02	14.34	4.80	16.98	46.27	29.29	62.17083	62.93013	67.86794
165.	11.91	14.39	5.07	16.18	42.25	26.06	62.63052	62.60177	64.24367

(b) (6)
(b) (7) (c)

	Witness name	Elevation (deg) t=0	Elevation (deg) t=15	Elevation (deg) t=42	Explos. Delta Time t=0 to 15	Explos. Delta Time t=0 to 42	Explos. Delta Time t=15 to 42	Time For Sound t=0	Time For Sound t=15	Time For Sound t=38.5
166.		8.60	10.72	4.31	13.96	29.74	15.79	84.2208	81.58476	73.54408
167.		13.96	17.34	7.12	14.67	33.45	18.78	52.80159	51.47933	45.26902
168.		9.08	11.31	4.57	14.02	30.14	16.12	79.96466	77.47476	69.61097
169.		3.05	3.70	1.30	17.37	43.39	26.03	243.7571	241.312	250.1095
170.		7.37	9.16	3.64	13.88	29.13	15.26	98.01472	95.03488	86.99424
171.		8.20	10.12	3.86	14.71	34.15	19.44	89.5228	87.52053	83.43225
172.		2.35	2.86	0.99	18.88	48.31	29.43	313.3698	311.0505	326.1133
173.		13.69	16.63	6.05	15.82	40.12	24.30	54.45784	54.23089	53.7371
174.		9.35	11.66	4.74	13.98	29.89	15.91	77.61369	75.13131	66.95992
175.		7.58	9.44	3.76	13.86	29.05	15.19	95.16522	92.22182	84.00501
176.		8.02	9.88	3.74	14.81	34.67	19.87	91.66155	89.71211	86.14448
177.		#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
178.		14.24	17.62	7.10	14.86	34.59	19.72	51.90658	50.7949	45.51444
179.		#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
180.		11.99	14.84	5.88	14.73	34.19	19.46	61.41084	59.98261	54.80152
181.		8.02	9.59	3.20	17.49	48.64	31.16	92.78311	93.43123	101.51
182.		7.86	9.45	3.20	17.15	46.99	29.83	94.6538	94.93883	101.7313
183.		6.56	8.01	2.87	15.82	39.76	23.94	112.8318	111.4519	112.9061
184.		14.85	18.37	7.41	14.92	34.81	19.89	49.82632	48.81194	43.6137
185.		10.07	12.14	4.21	16.48	43.82	27.34	73.99705	74.03055	77.43308
186.		9.61	11.94	4.78	14.24	31.49	17.24	75.96952	73.77578	66.89999
187.		12.76	15.43	5.47	16.11	41.79	25.68	58.45032	58.43214	59.51244
188.		4.35	5.37	2.03	14.10	28.43	14.33	163.5816	159.5638	153.1717
189.		15.06	18.12	6.39	16.24	42.17	25.93	49.72462	50.00434	50.99824
190.		14.90	18.43	7.42	14.94	34.93	19.99	49.67477	48.68563	43.5873
191.		14.24	17.62	7.10	14.86	34.59	19.72	51.90658	50.7949	45.51444
192.		7.84	9.75	3.88	13.94	29.57	15.63	92.36042	89.54781	81.67046
193.		13.07	15.55	5.19	16.98	46.18	29.20	57.27736	58.13386	62.78415
194.		12.84	15.27	5.09	17.01	46.37	29.36	58.29157	59.16151	64.01332
195.		8.68	10.53	3.72	16.14	41.96	25.82	85.60395	85.07151	87.37834
196.		13.26	15.77	5.27	16.96	46.06	29.10	56.47977	57.33252	61.85056
197.		15.57	18.56	6.32	16.65	44.25	27.59	48.20717	48.92625	51.5632
198.		#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

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(b) (6)
(b) (7) (c)

Witness name	Elevation (deg) t=0	Elevation (deg) t=15	Elevation (deg) t=42	Explos. Delta Time t=0 to 15	Explos. Delta Time t=0 to 42	Explos. Delta Time t=15 to 42	Time For Sound t=0	Time For Sound t=15	Time For Sound t=38.5
199.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
200.	5.10	6.13	2.07	17.99	49.86	31.87	145.1743	145.2852	156.1851
201.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
202.	7.34	8.82	2.99	17.20	47.10	29.90	101.4057	101.6038	108.7348
203.	12.73	15.86	6.57	14.42	32.13	17.71	57.61546	55.9487	48.83522
204.	4.75	5.73	1.96	17.70	48.12	30.42	156.3013	155.9058	165.7541
205.	15.80	19.39	7.53	15.33	37.05	21.72	47.09274	46.53664	43.10703
206.	16.01	19.32	6.94	16.07	41.17	25.09	46.785	46.96519	46.97717
207.	12.77	15.41	5.42	16.21	42.32	26.11	58.47369	58.5545	60.07701
208.	3.50	4.30	1.57	15.20	33.18	17.98	209.2925	205.4223	204.5781
209.	12.73	15.86	6.57	14.42	32.13	17.71	57.61546	55.9487	48.83522
210.	9.35	11.26	3.87	16.68	44.79	28.11	79.67986	79.79383	84.21926
211.	10.83	13.42	5.29	14.62	33.67	19.05	67.82078	66.15905	60.81297
212.	13.82	17.10	6.82	14.89	34.84	19.95	53.4569	52.34258	47.35208
213.	11.99	14.84	5.88	14.73	34.19	19.46	61.44161	60.0134	54.83758
214.	12.87	15.32	5.10	17.02	46.37	29.36	58.13101	59.00564	63.85369
215.	11.83	14.19	4.85	16.65	44.63	27.98	63.15476	63.56875	67.19742
216.	14.27	17.71	7.24	14.74	33.82	19.08	51.70223	50.47155	44.52366
217.	14.78	17.90	6.46	15.96	40.73	24.78	50.54613	50.53699	50.37485
218.	44.50	45.77	12.71	18.62	48.66	30.04	18.18698	21.42183	25.44709
219.	12.81	15.24	5.08	17.03	46.44	29.41	58.394	59.27479	64.18579
220.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
221.	4.98	6.00	2.03	18.01	49.86	31.85	148.5032	148.5681	159.5785
222.	13.71	16.95	6.74	14.91	34.97	20.06	53.89873	52.79366	47.93494
223.	10.83	13.42	5.29	14.62	33.67	19.05	67.82078	66.15905	60.81297
224.	6.85	8.22	2.77	17.52	48.53	31.01	108.556	108.9267	117.4797
225.	4.43	5.35	1.82	18.05	49.48	31.43	166.9131	166.6505	177.9583
226.	8.41	10.04	3.32	17.63	49.40	31.77	88.38634	89.26467	97.79958
227.	4.74	5.72	1.95	17.88	49.00	31.12	156.3302	156.1113	166.6791
228.	10.83	13.42	5.29	14.62	33.67	19.05	67.82078	66.15905	60.81297
229.	5.82	6.99	2.35	17.88	49.82	31.94	127.2126	127.5687	137.8285
230.	8.34	10.40	4.20	13.85	29.08	15.23	86.55074	83.76755	75.25108
231	8.34	10.40	4.20	13.85	29.08	15.23	86.55074	83.76755	75.25108

237 c

(b)(6)
(b)(7)(c)

	Elevation	Elevation	Elevation	Explos.	Explos.	Explos.	Time For	Time For	Time For
	(deg)	(deg)	(deg)	Delta Time	Delta Time	Delta Time	Sound	Sound	Sound
Witness name	t=0	t=15	t=42	t=0 to 15	t=0 to 42	t=15 to 42	t=0	t=15	t=38.5
232. [redacted]	16.03	19.35	6.95	16.07	41.14	25.07	46.7245	46.90156	46.88777
233. [redacted]	14.78	17.90	6.46	15.96	40.73	24.78	50.54613	50.53699	50.37485
	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
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	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

TWA800 @ t=-12			USAIR FLT217 @ t=-12			USAIR FLT217 @ t=0			Distance From Witnes		
									TWA800	TWA800	FLT217
Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	t=-12	t=0	t=-12
40.6397	**72.7144**	**13800**	**40.5953**	**72.7183**	**21695**	**40.6183**	**72.7097**	**21700**	63439	56687	78665
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47640	48691	63504
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52365	59503	64720
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	108935	119657	114374
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	122663	134462	124409
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	188971	178506	201090
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47675	48723	63540
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52162	59644	64172
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	54194	62143	65611
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	61797	64827	76827
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	61797	64827	76827
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	61537	55335	76985
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	59907	60200	75851
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	56074	51337	71949
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52974	52407	69083
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52365	59503	64720
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52365	59503	64720
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	153391	158158	166711
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	263754	254694	277568
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	86001	77465	100223
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52701	53172	68651
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	77229	79184	92578
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	218821	230939	218273
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	63430	59814	79528
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	49427	54923	63257
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	41421	43901	56968
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	181553	193774	180337
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	72718	66377	88149
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52383	59819	64434
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	94641	85001	107870
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	103386	114185	108704
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52769	49282	68858
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	56570	60697	71114

TWA800 @ t=-12			USAIR FLT217 @ t=-12			USAIR FLT217 @ t=0			Distance From Witnes		
									TWA800	TWA800	FLT217
Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	t=-12	t=0	t=-12
40.6397	**72.7144**	**13800**	**40.5953**	**72.7183**	**21695**	**40.6183**	**72.7097**	**21700**	153473	158247	166786
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	94813	85533	108406
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	48205	49119	64095
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52365	59503	64720
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	162124	150855	172787
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47766	47445	63868
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	57707	52182	73375
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	59450	54473	75280
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	58878	67078	69838
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	60638	54377	76060
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47755	50408	63136
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	176201	164504	185723
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	109335	110740	124746
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	72878	81393	83051
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	59298	53325	74822
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	97981	87741	110494
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	97981	87741	110494
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	51844	48616	67961
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	68018	62584	83751
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	107516	117873	113844
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	125262	136127	130143
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	58557	52787	74149
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	61088	55916	76873
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	68633	64000	84572
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	89303	90376	104905
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	55976	64279	66898
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47640	48691	63504
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	67834	62424	83573
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	66118	58771	81061

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									Distance From Witnes		
TWA800 @ t=-12			USAIR FLT217 @ t=-12			USAIR FLT217 @ t=0			TWA800	TWA800	FLT217
Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	t=-12	t=0	t=-12
40.6397	**72.7144**	**13800**	**40.5953**	**72.7183**	**21695**	**40.6183**	**72.7097**	**21700**	47640	48691	63504
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	65816	69768	80318
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	94704	104563	102256
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47640	48691	63504
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	135950	146398	141770
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	59139	58555	75230
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47882	50512	63269
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	90739	100322	98873
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	60875	60735	76895
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	56525	60651	71069
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	64302	69720	77858
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	69971	70007	85923
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	58258	53631	74167
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	57800	60729	72925
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	150935	162975	151200
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	61401	55483	76953
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52321	51862	68420
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	68627	63999	84567
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	8485	15813	7909
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	46312	47512	62155
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	87188	97703	93478
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	54783	63019	65831
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47040	47762	62981
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	247845	254842	258743
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	226184	227565	241403
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	236203	229485	251609

TWA800 @ t=-12			USAIR FLT217 @ t=-12			USAIR FLT217 @ t=0			Distance From Witnes		
									TWA800	TWA800	FLT217
Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	t=-12	t=0	t=-12
40.6397	**72.7144**	**13800**	**40.5953**	**72.7183**	**21695**	**40.6183**	**72.7097**	**21700**	232498	234552	247394
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	232498	234552	247394
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	229393	225471	245539
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	239829	246857	250708
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47782	50144	63268
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	8485	15813	7909
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	102990	93981	116835
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	64302	69720	77858
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	55626	50829	71485
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	97981	87741	110494
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	77281	83560	89900
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	59907	60200	75851
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	59907	60200	75851
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	53062	49211	69100
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	53062	49211	69100
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	53062	49211	69100
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	181414	193169	182938
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	77281	83560	89900
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	205637	217491	206609
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	73123	81640	83287
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	73123	81640	83287
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47782	50144	63268
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47141	47702	63113
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	48205	49119	64095
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	63430	59814	79528
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	49475	55841	62630
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	56949	65726	67199
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	53212	60905	64956
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!

											Distance From Witnes	
		TWA800 @ t=-12			USAIR FLT217 @ t=-12			USAIR FLT217 @ t=0			TWA800	TWA800	FLT217
		Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	t=-12	t=0	t=-12
		40.6397	**72.7144**	**13800**	**40.5953**	**72.7183**	**21695**	**40.6183**	**72.7097**	**21700**	77712	69003	91791
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47675	48723	63540
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52408	59838	64463
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	56324	51265	72119
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	53289	60951	65065
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	266253	277963	267687
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	92280	101253	101411
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	77712	69003	91791
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47582	48732	63424
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47881	50461	63287
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	70736	70378	86757
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	118915	113587	134763
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52091	59458	64225
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	57062	51851	72820
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	104035	114622	109876
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52462	48876	68536
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	55269	63549	66245
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	94937	104896	102287
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	94719	104706	102015
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	53717	49759	69739
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	70503	63466	85618
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	133836	121954	134952
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	77281	83560	89900
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	47469	48543	63330
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	57756	60666	72890
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	57756	60666	72890
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	57077	64603	68883
		40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	62263	65261	77301

TWA800 @ t=-12			USAIR FLT217 @ t=-12			USAIR FLT217 @ t=0			Distance From Witnes		
									TWA800	TWA800	FLT217
Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	t=-12	t=0	t=-12
40.6397	**72.7144**	**13800**	**40.5953**	**72.7183**	**21695**	**40.6183**	**72.7097**	**21700**	100971	90943	113752
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	61944	55371	77243
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	95687	86101	108973
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	251129	258633	261404
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	117101	106430	128962
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	100444	95493	116367
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	322324	334616	320027
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	56154	56491	72110
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	93520	83599	106435
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	114188	103352	125779
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	102046	97703	118093
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	59706	54228	75396
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	70366	64784	86061
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	87188	97703	93478
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	90726	99621	100004
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	118013	119601	133325
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	57230	51890	72951
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	72403	77478	86083
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	89420	81310	103952
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	58401	60738	73763
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	193253	180930	197112
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	48758	51148	64220
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	56929	51707	72682
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	59706	54228	75396
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	110117	99975	122747
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	51974	59278	64175
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52831	60382	64745
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	86774	90114	101405
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	51262	58409	63646
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	44653	49379	59113
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!

TWA800 @ t=-12			USAIR FLT217 @ t=-12			USAIR FLT217 @ t=0			Distance From Witnes		
									TWA800	TWA800	FLT217
Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	t=-12	t=0	t=-12
40.6397	**72.7144**	**13800**	**40.5953**	**72.7183**	**21695**	**40.6183**	**72.7097**	**21700**	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	142223	154226	142763
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	97750	106863	106576
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	68694	60922	83403
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	154909	165675	159809
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	51844	48616	67961
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	46847	47958	62705
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	57800	60729	72925
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	228690	224827	244841
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	68694	60922	83403
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	77281	83560	89900
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	77858	71910	93451
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	61088	55916	76873
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	70394	64818	86090
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52656	60207	64574
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	60026	65708	73462
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	60342	54098	75769
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	51314	52143	67199
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	5645	14005	10700
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	52863	60493	64689
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	145781	157807	146161
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	61416	56390	77240
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	77858	71910	93451
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	104035	114622	109876
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	165511	177431	166345
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	81888	93061	86545
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	154417	165903	157153
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	77858	71910	93451
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	123058	134899	124600
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	104749	93844	116239
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	104749	93844	116239

									Distance From Witnes		
TWA800 @ t=-12			USAIR FLT217 @ t=-12			USAIR FLT217 @ t=0			TWA800	TWA800	FLT217
Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	t=-12	t=0	t=-12
40.6397	**72.7144**	**13800**	**40.5953**	**72.7183**	**21695**	**40.6183**	**72.7097**	**21700**	46815	47893	62681
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	51314	52143	67199
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!
40.6397	72.7144	13800	40.5953	72.7183	21695	40.6183	72.7097	21700	#VALUE!	#VALUE!	#VALUE!

245 c

(b)(6)
(b)(7)(c)

FLT217 t=0	Witness Name	AT TIME= -12 SEC Azimuth TWA800	Elevation TWA800	Azimuth USA217	Elevation USA217	AT TIME= 0 SEC Azimuth TWA800	Elevation TWA800	Azimuth USA217	Elevation USA217
70294	1.	202.24	12.27	197.79	15.42	192.34	13.64	198.86	17.16
55534	2.	166.74	16.15	170.09	18.86	152.05	15.78	167.28	21.34
58932	3.	134.25	14.76	144.55	18.53	123.87	13.02	138.79	20.21
112522	4.	105.43	7.22	113.26	10.74	102.34	6.56	109.07	10.92
124536	5.	92.16	6.42	99.62	9.89	90.51	5.84	95.72	9.88
193878	6.	223.43	4.18	220.27	6.16	221.38	4.41	221.57	6.39
55570	7.	166.75	16.14	170.09	18.85	152.07	15.77	167.28	21.33
58575	8.	132.15	14.82	142.91	18.68	122.03	12.99	136.95	20.33
60348	9.	128.97	14.29	140.02	18.30	119.62	12.49	133.95	19.78
69468	10.	155.51	12.59	160.51	15.77	144.65	11.98	157.20	17.35
69468	11.	155.51	12.59	160.51	15.77	144.65	11.98	157.20	17.35
68564	12.	199.54	12.64	195.52	15.74	189.03	13.96	196.34	17.56
67813	13.	168.79	12.97	171.16	15.96	156.98	12.88	168.99	17.74
63466	14.	192.80	13.83	189.95	16.78	180.58	15.00	190.10	18.88
60873	15.	173.58	14.60	175.08	17.43	160.13	14.71	173.19	19.62
58932	16.	134.25	14.76	144.55	18.53	123.87	13.02	138.79	20.21
58932	17.	134.25	14.76	144.55	18.53	123.87	13.02	138.79	20.21
160488	18.	143.48	5.14	146.77	7.41	139.28	4.97	144.75	7.70
269703	19.	212.65	3.00	210.87	4.47	210.79	3.09	211.53	4.60
92162	20.	211.10	9.12	206.33	12.21	204.83	10.07	207.91	13.25
60607	21.	168.77	14.67	171.40	17.54	155.37	14.51	169.00	19.70
85010	22.	159.60	10.13	163.09	13.19	150.65	9.86	160.61	14.32
219707	23.	85.42	3.61	89.67	5.68	84.80	3.41	87.48	5.64
71060	24.	186.71	12.27	185.35	15.26	175.70	12.96	184.94	16.98
56620	25.	144.05	15.60	152.67	18.93	131.85	14.06	147.61	20.97
49238	26.	160.94	18.43	166.25	20.85	144.61	17.40	162.47	23.78
182084	27.	82.72	4.35	87.83	6.86	82.15	4.06	85.20	6.80
79736	28.	199.47	10.75	195.97	13.83	190.71	11.71	196.72	15.22
58815	29.	132.41	14.76	143.09	18.61	122.30	12.95	137.17	20.25
100165	30.	218.06	8.30	212.77	11.37	213.11	9.20	214.73	12.22
106903	31.	104.76	7.60	113.03	11.29	101.59	6.87	108.62	11.47
60388	32.	187.23	14.66	185.54	17.49	173.87	15.60	185.07	19.77
64061	33.	150.50	13.71	156.92	16.97	139.09	12.77	152.92	18.71

(b) (6)
(b) (7) (c)

FLT217	Witness Name		AT TIME= -12 SEC				AT TIME= 0 SEC			
		Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation
t=0		TWA800	TWA800	USA217	USA217	TWA800	TWA800	USA217	USA217
160567	34.	143.44	5.14	146.73	7.41	139.24	4.97	144.71	7.70
100569	35.	215.58	8.28	210.61	11.32	210.38	9.14	212.39	12.18
56103	36.	167.30	15.98	170.48	18.70	152.75	15.65	167.75	21.15
58932	37.	134.25	14.76	144.55	18.53	123.87	13.02	138.79	20.21
166176	38.	231.21	4.87	227.04	7.16	229.35	5.21	228.84	7.44
55668	39.	173.18	16.11	174.90	18.76	158.27	16.17	172.80	21.30
64913	40.	196.49	13.45	192.91	16.47	184.92	14.77	193.43	18.48
66800	41.	193.62	13.07	190.72	16.08	182.21	14.18	190.96	18.00
64846	42.	126.95	13.19	137.61	17.26	118.51	11.59	131.76	18.50
67644	43.	199.92	12.82	195.78	15.92	189.28	14.20	196.64	17.79
55528	44.	158.99	16.12	164.25	18.96	144.85	15.27	160.62	21.35
179621	45.	236.41	4.48	232.27	6.66	235.07	4.78	234.12	6.89
117141	46.	160.86	7.19	163.29	9.87	154.46	7.08	161.50	10.49
78543	47.	124.00	10.72	133.28	14.64	117.33	9.60	128.18	15.44
66386	48.	198.58	13.10	194.64	16.17	187.54	14.47	195.37	18.10
103065	49.	222.44	8.02	216.78	11.11	218.16	8.91	218.98	11.89
103065	50.	222.44	8.02	216.78	11.11	218.16	8.91	218.98	11.89
59501	51.	186.13	14.91	184.67	17.70	172.48	15.80	184.08	20.04
75282	52.	195.16	11.47	192.27	14.52	185.40	12.40	192.66	16.08
111514	53.	108.86	7.31	116.58	10.79	105.42	6.66	112.43	11.01
128623	54.	103.77	6.29	110.70	9.46	101.18	5.77	107.00	9.58
#VALUE!	55.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!	56.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
65700	57.	197.63	13.26	193.85	16.31	186.34	14.61	194.49	18.28
68397	58.	194.42	12.73	191.42	15.76	183.40	13.82	191.74	17.60
76087	59.	191.18	11.37	189.06	14.39	181.26	12.13	189.08	15.92
97153	60.	163.16	8.78	165.72	11.68	155.30	8.66	163.76	12.59
61914	61.	126.48	13.85	137.68	17.97	117.72	12.08	131.57	19.31
#VALUE!	62.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
55534	63.	166.74	16.15	170.09	18.86	152.05	15.78	167.28	21.34
#VALUE!	64.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
75104	65.	195.06	11.50	192.18	14.55	185.26	12.43	192.56	16.12
72765	66.	205.24	11.79	200.36	14.98	196.09	13.18	201.69	16.61

2486

(b) (6)
(b) (7) (c)

			AT TIME= -12 SEC				AT TIME= 0 SEC		
FLT217		Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation
t=0	Witness Name	TWA800	TWA800	USA217	USA217	TWA800	TWA800	USA217	USA217
55534	67.	166.74	16.15	170.09	18.86	152.05	15.78	167.28	21.34
73303	68.	150.57	11.84	156.24	15.12	140.66	11.16	152.67	16.49
99237	69.	113.35	8.29	121.70	11.98	109.06	7.50	117.18	12.33
55534	70.	166.74	16.15	170.09	18.86	152.05	15.78	167.28	21.34
139765	71.	107.62	5.80	113.85	8.70	104.93	5.37	110.50	8.83
67042	72.	172.96	13.13	174.47	16.09	160.92	13.22	172.67	17.94
55656	73.	159.08	16.08	164.31	18.93	144.98	15.24	160.69	21.30
#VALUE!	74.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
95528	75.	115.64	8.65	124.12	12.38	110.95	7.81	119.52	12.80
68784	76.	170.72	12.77	172.66	15.76	159.05	12.77	170.69	17.51
64016	77.	150.51	13.72	156.93	16.98	139.09	12.78	152.92	18.73
71416	78.	143.03	12.11	150.19	15.57	133.51	11.16	145.95	16.90
#VALUE!	79.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
77879	80.	169.13	11.16	171.16	14.17	159.00	11.12	169.27	15.57
65682	81.	192.03	13.33	189.43	16.31	180.26	14.39	189.51	18.28
65499	82.	156.38	13.43	161.47	16.57	144.75	12.77	158.07	18.33
152147	83.	87.51	5.22	93.65	8.17	86.49	4.83	90.47	8.12
68512	84.	198.11	12.67	194.37	15.74	187.44	13.93	195.05	17.57
60222	85.	173.17	14.78	174.78	17.59	159.55	14.86	172.82	19.82
76082	86.	191.16	11.37	189.04	14.39	181.24	12.13	189.06	15.92
#VALUE!	87.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
583	88.	351.19	58.41	0.00	69.97	42.08	41.03	0.00	88.46
#VALUE!	89.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!	90.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!	91.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!	92.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
54203	93.	166.25	16.59	169.79	19.24	151.18	16.15	166.87	21.82
91112	94.	107.85	8.99	117.33	13.07	103.82	8.02	112.27	13.40
60773	95.	127.03	14.14	138.33	18.24	118.03	12.32	132.16	19.65
54944	96.	168.40	16.35	171.35	19.01	153.44	16.07	168.70	21.55
253991	97.	130.51	3.19	133.21	4.79	128.18	3.09	131.64	4.88
233949	98.	159.21	3.49	160.56	5.14	156.11	3.46	159.58	5.30
243220	99.	198.63	3.34	197.46	4.93	196.07	3.43	197.75	5.10

(b) (6)
(b) (7) (c)

				AT TIME= -12 SEC			AT TIME= 0 SEC		
s			Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation
FLT217			TWA800	TWA800	USA217	USA217	TWA800	TWA800	USA217	USA217
t=0		Witness.Name								
240169		100.	155.97	3.40	157.49	5.01	152.98	3.36	156.44	5.16
240169		101.	155.97	3.40	157.49	5.01	152.98	3.36	156.44	5.16
237085		102.	184.27	3.44	184.00	5.05	181.32	3.49	183.82	5.23
245965		103.	130.38	3.29	133.18	4.95	127.99	3.19	131.56	5.04
#VALUE!		104.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
55587		105.	160.41	16.11	165.33	18.93	146.18	15.34	161.84	21.32
583		106.	351.19	58.41	0.00	69.97	42.08	41.03	0.00	88.46
108915		107.	213.60	7.63	209.21	10.52	208.67	8.33	210.76	11.27
71416		108.	143.03	12.11	150.19	15.57	133.51	11.16	145.95	16.90
63003		109.	193.14	13.93	190.19	16.88	180.84	15.15	190.37	19.01
103065		110.	222.44	8.02	216.78	11.11	218.16	8.91	218.98	11.89
84030		111.	137.48	10.12	144.45	13.57	129.88	9.35	140.41	14.48
67813		112.	168.79	12.97	171.16	15.96	156.98	12.88	168.99	17.74
67813		113.	168.79	12.97	171.16	15.96	156.98	12.88	168.99	17.74
60620		114.	188.91	14.58	186.83	17.43	175.71	15.62	186.55	19.70
60620		115.	188.91	14.58	186.83	17.43	175.71	15.62	186.55	19.70
60620		116.	188.91	14.58	186.83	17.43	175.71	15.62	186.55	19.70
183265		117.	92.44	4.35	97.51	6.76	91.27	4.07	94.85	6.75
#VALUE!		118.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!		119.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!		120.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
84030		121.	137.48	10.12	144.45	13.57	129.88	9.35	140.41	14.48
207246		122.	90.71	3.84	95.21	5.99	89.76	3.62	92.86	5.98
78784		123.	123.98	10.69	133.23	14.60	117.33	9.57	128.15	15.40
78784		124.	123.98	10.69	133.23	14.60	117.33	9.57	128.15	15.40
55587		125.	160.41	16.11	165.33	18.93	146.18	15.34	161.84	21.32
55049		126.	169.14	16.32	171.91	18.97	154.18	16.09	169.34	21.51
56103		127.	167.30	15.98	170.48	18.70	152.75	15.65	167.75	21.15
71060		128.	186.71	12.27	185.35	15.26	175.70	12.96	184.94	16.98
56382		129.	139.14	15.59	148.86	19.11	127.57	13.84	143.32	21.05
62584		130.	123.13	13.62	134.75	17.89	114.97	11.82	128.46	19.12
59510		131.	130.71	14.54	141.59	18.47	120.97	12.73	135.59	20.03
#VALUE!		132.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

2506

(b)(6)
(b)(7)(c)

			AT TIME= -12 SEC				AT TIME= 0 SEC		
FLT217		Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation
t=0	Witness Name	TWA800	TWA800	USA217	USA217	TWA800	TWA800	USA217	USA217
83770	133.	212.49	10.07	207.07	13.30	205.62	11.28	208.88	14.52
55570	134.	166.75	16.14	170.09	18.85	152.07	15.77	167.28	21.33
58842	135.	132.44	14.75	143.11	18.60	122.32	12.95	137.19	20.24
63642	136.	194.33	13.77	191.15	16.74	182.28	15.02	191.46	18.83
59602	137.	130.90	14.52	141.72	18.44	121.14	12.72	135.75	20.01
268118	138.	92.72	2.97	96.18	4.63	91.89	2.83	94.37	4.63
#VALUE!	139.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
97527	140.	120.10	8.51	128.02	12.08	115.06	7.74	123.67	12.54
83770	141.	212.49	10.07	207.07	13.30	205.62	11.28	208.88	14.52
55472	142.	166.28	16.17	169.74	18.88	151.60	15.77	166.88	21.36
#VALUE!	143.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
55662	144.	159.33	16.08	164.50	18.92	145.20	15.25	160.91	21.30
78645	145.	170.91	11.04	172.59	14.04	160.86	11.06	170.87	15.43
126284	146.	192.58	6.62	191.09	9.15	187.08	6.91	191.23	9.75
58559	147.	132.87	14.84	143.50	18.66	122.64	13.03	137.60	20.33
64346	148.	195.00	13.60	191.71	16.59	183.18	14.86	192.09	18.64
107798	149.	106.81	7.56	114.91	11.17	103.46	6.85	110.58	11.38
60064	150.	187.73	14.74	185.91	17.57	174.31	15.72	185.50	19.86
#VALUE!	151.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
61228	152.	126.69	14.02	137.98	18.13	117.81	12.22	131.82	19.51
99377	153.	112.53	8.27	120.92	11.97	108.32	7.47	116.39	12.32
99133	154.	112.29	8.29	120.72	12.01	108.10	7.49	116.18	12.35
61258	155.	189.34	14.41	187.18	17.28	176.33	15.46	186.95	19.51
77279	156.	203.27	11.07	199.00	14.22	194.56	12.23	200.11	15.68
#VALUE!	157.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
132834	158.	269.81	5.89	262.93	9.13	271.34	6.44	266.44	9.28
#VALUE!	159.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
84030	160.	137.48	10.12	144.45	13.57	129.88	9.35	140.41	14.48
55363	161.	166.66	16.21	170.03	18.91	151.92	15.83	167.21	21.40
65458	162.	156.49	13.44	161.56	16.58	144.84	12.78	158.16	18.34
65458	163.	156.49	13.44	161.56	16.58	144.84	12.78	158.16	18.34
63419	164.	131.43	13.59	141.56	17.48	122.17	12.02	135.93	18.89
69938	165.	155.62	12.50	160.57	15.68	144.83	11.91	157.28	17.24

(b) (6)
(b) (7) (c)

			AT TIME= -12 SEC				AT TIME= 0 SEC			
FLT217			Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation
t=0		Witness Name	TWA800	TWA800	USA217	USA217	TWA800	TWA800	USA217	USA217
106223		166.	220.74	7.78	215.43	10.80	216.42	8.60	217.47	11.55
68855		167.	201.43	12.56	197.05	15.69	191.17	13.96	198.05	17.49
101249		168.	217.65	8.21	212.46	11.26	212.73	9.08	214.38	12.10
257012		169.	127.52	3.15	130.32	4.74	125.31	3.05	128.71	4.83
121812		170.	225.71	6.72	220.57	9.55	222.51	7.37	222.66	10.10
107883		171.	191.20	7.82	189.65	10.56	184.57	8.20	189.72	11.37
322404		172.	79.67	2.45	82.53	3.88	79.44	2.35	81.07	3.85
64061		173.	168.98	13.81	171.43	16.74	156.39	13.69	169.17	18.71
98847		174.	220.11	8.39	214.50	11.52	215.33	9.35	216.63	12.38
118737		175.	227.23	6.89	221.82	9.79	224.09	7.58	224.04	10.36
109612		176.	188.15	7.70	187.04	10.41	181.51	8.02	186.90	11.20
#VALUE!		177.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
66932		178.	196.06	13.01	192.66	16.05	184.88	14.24	193.14	17.96
#VALUE!		179.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
77598		180.	195.74	11.10	192.82	14.15	186.37	11.99	193.26	15.62
91112		181.	107.85	8.99	117.33	13.07	103.82	8.02	112.27	13.40
96036		182.	120.70	8.65	128.68	12.24	115.53	7.86	124.30	12.73
125793		183.	159.75	6.67	162.15	9.24	153.84	6.56	160.42	9.79
64482		184.	195.62	13.56	192.20	16.56	183.88	14.85	192.64	18.60
79581		185.	144.31	10.79	150.59	14.15	135.68	10.07	146.82	15.25
95793		186.	208.43	8.77	204.19	11.79	202.16	9.61	205.53	12.76
66176		187.	159.22	13.29	163.67	16.39	147.52	12.76	160.56	18.15
193692		188.	258.98	4.08	254.36	6.28	259.27	4.35	256.64	6.39
56556		189.	160.13	15.80	165.04	18.67	146.18	15.06	161.57	20.99
64210		190.	195.07	13.63	191.76	16.62	183.22	14.90	192.14	18.67
66932		191.	196.06	13.01	192.66	16.05	184.88	14.24	193.14	17.96
115285		192.	221.45	7.14	216.46	10.02	217.59	7.84	218.40	10.66
58471		193.	133.27	14.87	143.84	18.68	122.96	13.07	137.96	20.36
59204		194.	131.65	14.64	142.40	18.53	121.71	12.84	136.45	20.13
94326		195.	152.38	9.04	156.61	12.08	144.67	8.68	153.87	12.96
57838		196.	134.31	15.07	144.78	18.82	123.74	13.26	138.94	20.57
52089		197.	148.89	17.17	157.01	20.15	134.92	15.57	152.09	22.62
#VALUE!		198.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

252c

(b) (6)
(b) (7) (c)

				AT TIME= -12 SEC			AT TIME= 0 SEC		
FLT217			Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation
t=0	Witness Name		TWA800	TWA800	USA217	USA217	TWA800	TWA800	USA217	USA217
#VALUE!	199.		#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
143554	200.		88.32	5.54	94.83	8.64	87.18	5.10	91.45	8.60
#VALUE!	201.		#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
102872	202.		118.95	8.04	126.57	11.51	114.27	7.34	122.39	11.91
75175	203.		207.43	11.36	202.32	14.58	198.91	12.73	203.82	16.10
158323	204.		104.44	5.09	110.06	7.73	102.26	4.75	107.05	7.80
59501	205.		186.13	14.91	184.67	17.70	172.48	15.80	184.08	20.04
54740	206.		166.58	16.41	170.01	19.08	151.66	16.01	167.15	21.62
65499	207.		156.38	13.43	161.47	16.57	144.75	12.77	158.07	18.33
236391	208.		183.99	3.45	183.73	5.06	181.02	3.50	183.54	5.24
75175	209.		207.43	11.36	202.32	14.58	198.91	12.73	203.82	16.10
84030	210.		137.48	10.12	144.45	13.57	129.88	9.35	140.41	14.48
85006	211.		197.15	10.05	194.23	13.07	188.85	10.83	194.77	14.32
68397	212.		194.42	12.73	191.42	15.76	183.40	13.82	191.74	17.60
77627	213.		195.71	11.09	192.80	14.14	186.34	11.99	193.23	15.62
59030	214.		131.66	14.69	142.44	18.57	121.69	12.87	136.48	20.18
67082	215.		141.93	12.95	149.72	16.45	131.90	11.83	145.16	17.93
67352	216.		199.86	12.88	195.71	15.98	189.15	14.27	196.57	17.86
59213	217.		167.26	15.05	170.30	17.89	153.57	14.78	167.70	20.13
2271	218.		348.98	67.75	174.21	63.75	50.58	44.50	174.41	84.03
59196	219.		131.15	14.63	141.99	18.54	121.28	12.81	136.00	20.13
#VALUE!	220.		#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
147040	221.		87.82	5.41	94.18	8.44	86.74	4.98	90.88	8.40
68761	222.		193.68	12.66	190.85	15.69	182.67	13.71	191.09	17.52
85006	223.		197.15	10.05	194.23	13.07	188.85	10.83	194.77	14.32
107798	224.		106.81	7.56	114.91	11.17	103.46	6.85	110.58	11.38
167015	225.		89.77	4.77	95.35	7.43	88.67	4.43	92.44	7.40
85022	226.		101.18	9.57	111.74	14.07	97.71	8.41	106.16	14.32
156814	227.		96.42	5.11	102.29	7.86	94.79	4.74	99.20	7.88
85006	228.		197.15	10.05	194.23	13.07	188.85	10.83	194.77	14.32
124834	229.		91.43	6.40	98.89	9.88	89.86	5.82	95.00	9.86
109227	230.		228.00	7.51	222.08	10.57	224.64	8.34	224.51	11.24
109227	231.		228.00	7.51	222.08	10.57	224.64	8.34	224.51	11.24

253c

(b) (6)
(b) (7) (c)

s				AT TIME= -12 SEC				AT TIME= 0 SEC		
FLT217			Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation	Azimuth	Elevation
t=0		Witness Name	TWA800	TWA800	USA217	USA217	TWA800	TWA800	USA217	USA217
54709		232. [redacted]	166.75	16.42	170.13	19.09	151.80	16.03	167.29	21.64
59213		233. [redacted]	167.26	15.05	170.30	17.89	153.57	14.78	167.70	20.13
#VALUE!			#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!			#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!			#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!			#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!			#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!			#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
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#VALUE!			#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
#VALUE!			#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

254 c

(b) (6)
(b) (7) (c)

Sheet1

Witness Name	Witness Location Latitude	Witness Location Longitude	Primary Shooter Location Latitude	Primary Shooter Location Longitude	Ground Distance (ft)	Azimuth (deg)
1.	40.8008	72.6276	40.60833	72.64667	70363	184.30
2.	40.7669	72.7539	40.60833	72.64667	64964	152.82
3.	40.74	72.85	40.60833	72.64667	73924	130.42
4.	40.7198	73.094	40.60833	72.64667	130206	108.04
5.	40.6532	73.1575	40.60833	72.64667	142277	96.44
6.	41.0171	72.2448	40.60833	72.64667	185746	216.78
7.	40.767	72.7539	40.60833	72.64667	64997	152.83
8.	40.7358	72.8542	40.60833	72.64667	73839	128.93
9.	40.7333	72.8667	40.60833	72.64667	76007	126.75
10	40.794	72.807	40.60833	72.64667	80902	146.74
11	40.794	72.807	40.60833	72.64667	80902	146.74
12	40.7988	72.64	40.60833	72.64667	69461	181.52
13	40.8009	72.7565	40.60833	72.64667	76483	156.58
14	40.7897	72.6695	40.60833	72.64667	66420	174.54
15	40.7841	72.7358	40.60833	72.64667	68650	158.94
16	40.74	72.85	40.60833	72.64667	73924	130.42
17	40.74	72.85	40.60833	72.64667	73924	130.42
18	40.9783	73.0444	40.60833	72.64667	173900	140.73
19	41.25	72.2	40.60833	72.64667	264303	207.89
20	40.8418	72.5538	40.60833	72.64667	88896	196.81
21	40.7815	72.7515	40.60833	72.64667	69462	155.31
22	40.8383	72.8117	40.60833	72.64667	95434	151.41
23	40.5945	73.5029	40.60833	72.64667	237053	88.50
24	40.8125	72.6876	40.60833	72.64667	75286	171.35
25	40.7495	72.8193	40.60833	72.64667	70189	137.10
26	40.7471	72.7633	40.60833	72.64667	59992	147.45
27	40.5784	73.3654	40.60833	72.64667	199264	86.63
28	40.8278	72.6268	40.60833	72.64667	80197	183.93
29	40.7367	72.8542	40.60833	72.64667	74046	129.13
30	40.8443	72.5035	40.60833	72.64667	94682	204.74
31	40.7125	73.0758	40.60833	72.64667	124604	107.60
32	40.7833	72.6904	40.60833	72.64667	64921	169.25
33	40.7748	72.8151	40.60833	72.64667	76489	142.45

(b) (6)
(b) (7) (c)

Witness Name	Witness Location Latitude	Witness Location Longitude	Primary Shooter Location Latitude	Primary Shooter Location Longitude	Ground Distance (ft)	Azimuth (deg)
34.	40.9783	73.0449	40.60833	72.64667	173988	140.69
35.	40.8514	72.515	40.60833	72.64667	95788	202.36
36.	40.7687	72.7527	40.60833	72.64667	65399	153.34
37.	40.74	72.85	40.60833	72.64667	73924	130.42
38.	40.9192	72.2576	40.60833	72.64667	156156	223.60
39.	40.7698	72.7349	40.60833	72.64667	63717	157.46
40.	40.7915	72.6552	40.60833	72.64667	66817	177.97
41.	40.7982	72.6638	40.60833	72.64667	69380	176.08
42.	40.7369	72.8845	40.60833	72.64667	80754	125.40
43.	40.7961	72.6397	40.60833	72.64667	68479	181.61
44.	40.762	72.7763	40.60833	72.64667	66503	147.35
45.	40.9083	72.1838	40.60833	72.64667	168214	229.60
46.	40.9231	72.844	40.60833	72.64667	127030	154.54
47.	40.7517	72.9328	40.60833	72.64667	94813	123.36
48.	40.7939	72.6461	40.60833	72.64667	67650	180.13
49.	40.8383	72.4754	40.60833	72.64667	96269	209.50
50.	40.8383	72.4754	40.60833	72.64667	96269	209.50
51.	40.7811	72.6944	40.60833	72.64667	64351	168.15
52.	40.8198	72.6501	40.60833	72.64667	77098	179.29
53.	40.7356	73.0822	40.60833	72.64667	129054	110.93
54.	40.7223	73.1542	40.60833	72.64667	146368	106.33
55.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
56.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
57.	40.7928	72.6503	40.60833	72.64667	67257	179.14
58.	40.802	72.6594	40.60833	72.64667	70691	177.14
59.	40.8244	72.6663	40.60833	72.64667	78956	176.05
60.	40.8742	72.8079	40.60833	72.64667	106666	155.27
61.	40.7311	72.8771	40.60833	72.64667	77865	125.01
62.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
63.	40.7669	72.7539	40.60833	72.64667	64964	152.82
64.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
65.	40.8194	72.6507	40.60833	72.64667	76955	179.17
66.	40.8038	72.6125	40.60833	72.64667	71882	187.56

(b) (6)
(b) (7) (c)

Witness Name	Witness Location Latitude	Witness Location Longitude	Primary Shooter Location Latitude	Primary Shooter Location Longitude	Ground Distance (ft)	Azimuth (deg)
67.	40.7669	72.7539	40.60833	72.64667	64964	152.82
68.	40.797	72.8313	40.60833	72.64667	85642	143.37
69.	40.7431	73.0287	40.60833	72.64667	116494	114.82
70.	40.7669	72.7539	40.60833	72.64667	64964	152.82
71.	40.7535	73.1828	40.60833	72.64667	157386	109.47
72.	40.8007	72.7406	40.60833	72.64667	74780	159.66
73.	40.7624	72.7762	40.60833	72.64667	66611	147.44
74.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
75.	40.7478	73.0101	40.60833	72.64667	112612	116.72
76.	40.8045	72.7499	40.60833	72.64667	76995	158.22
77.	40.7747	72.815	40.60833	72.64667	76444	142.45
78.	40.7807	72.8542	40.60833	72.64667	85084	137.54
79.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
80.	40.8282	72.7621	40.60833	72.64667	86267	158.26
81.	40.796	72.6705	40.60833	72.64667	68732	174.49
82.	40.785	72.7981	40.60833	72.64667	76811	146.93
83.	40.623	73.2595	40.60833	72.64667	169676	91.61
84.	40.7998	72.6454	40.60833	72.64667	69802	180.29
85.	40.7822	72.7369	40.60833	72.64667	68115	158.49
86.	40.8244	72.6664	40.60833	72.64667	78958	176.03
87.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
88.	40.6167	72.7097	40.60833	72.64667	17709	99.90
89.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
90.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
91.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
92.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
93.	40.7631	72.7542	40.60833	72.64667	63774	152.18
94.	40.7134	73.0144	40.60833	72.64667	108670	110.52
95.	40.7303	72.8725	40.60833	72.64667	76659	125.38
96.	40.7661	72.7486	40.60833	72.64667	64047	153.87
97.	41.0833	73.3956	40.60833	72.64667	269518	129.73
98.	41.2201	73.0046	40.60833	72.64667	243852	156.03
99.	41.254	72.4417	40.60833	72.64667	242059	193.55

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(b)(6)
(b)(7)(c)

Witness Name	Witness Location Latitude	Witness Location Longitude	Primary Shooter Location Latitude	Primary Shooter Location Longitude	Ground Distance (ft)	Azimuth (deg)
100.	41.2227	73.0566	40.60833	72.64667	250833	153.11
101.	41.2227	73.0566	40.60833	72.64667	250833	153.11
102.	41.2672	72.6526	40.60833	72.64667	240202	179.61
103.	41.0678	73.3748	40.60833	72.64667	261511	129.59
104.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
105.	40.7632	72.7723	40.60833	72.64667	66285	148.36
106.	40.6167	72.7097	40.60833	72.64667	17709	99.90
107.	40.8752	72.5084	40.60833	72.64667	104516	201.48
108.	40.7807	72.8542	40.60833	72.64667	85084	137.54
109.	40.7883	72.6687	40.60833	72.64667	65891	174.69
110.	40.8383	72.4754	40.60833	72.64667	96269	209.50
111.	40.7961	72.9032	40.60833	72.64667	98552	133.91
112.	40.8009	72.7565	40.60833	72.64667	76483	156.58
113.	40.8009	72.7565	40.60833	72.64667	76483	156.58
114.	40.7835	72.6847	40.60833	72.64667	64718	170.64
115.	40.7835	72.6847	40.60833	72.64667	64718	170.64
116.	40.7835	72.6847	40.60833	72.64667	64718	170.64
117.	40.6627	73.3696	40.60833	72.64667	200981	95.42
118.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
119.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
120.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
121.	40.7961	72.9032	40.60833	72.64667	98552	133.91
122.	40.6491	73.4577	40.60833	72.64667	224888	93.53
123.	40.752	72.9336	40.60833	72.64667	95058	123.34
124.	40.752	72.9336	40.60833	72.64667	95058	123.34
125.	40.7632	72.7723	40.60833	72.64667	66285	148.36
126.	40.7667	72.7465	40.60833	72.64667	63991	154.42
127.	40.7687	72.7527	40.60833	72.64667	65399	153.34
128.	40.8125	72.6876	40.60833	72.64667	75286	171.35
129.	40.7424	72.8314	40.60833	72.64667	70694	133.68
130.	40.7252	72.8868	40.60833	72.64667	78895	122.61
131.	40.735	72.8602	40.60833	72.64667	74956	127.96
132.	?	?	40.60833	72.64667	#VALUE!	#VALUE!

(b) (6)
(b) (7) (c)

Witness Name	Witness Location Latitude	Witness Location Longitude	Primary Shooter Location Latitude	Primary Shooter Location Longitude	Ground Distance (ft)	Azimuth (deg)
133.	40.8196	72.5635	40.60833	72.64667	80375	196.64
134.	40.767	72.7539	40.60833	72.64667	64997	152.83
135.	40.7368	72.8542	40.60833	72.64667	74069	129.15
136.	40.7894	72.664	40.60833	72.64667	66183	175.84
137.	40.7355	72.86	40.60833	72.64667	75025	128.10
138.	40.6784	73.6758	40.60833	72.64667	285821	94.79
139.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
140.	40.767	73.003	40.60833	72.64667	114231	120.31
141.	40.8196	72.5635	40.60833	72.64667	80375	196.64
142.	40.7665	72.7552	40.60833	72.64667	65000	152.48
143.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
144.	40.7626	72.7755	40.60833	72.64667	66568	147.61
145.	40.8313	72.7548	40.60833	72.64667	86602	159.78
146.	40.9581	72.6208	40.60833	72.64667	127711	183.21
147.	40.737	72.8524	40.60833	72.64667	73730	129.44
148.	40.7909	72.661	40.60833	72.64667	66674	176.59
149.	40.7228	73.0744	40.60833	72.64667	125426	109.29
150.	40.7823	72.6889	40.60833	72.64667	64487	169.56
151.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
152.	40.7304	72.8746	40.60833	72.64667	77153	125.15
153.	40.7399	73.0314	40.60833	72.64667	116689	114.14
154.	40.7387	73.0312	40.60833	72.64667	116460	113.96
155.	40.7851	72.6829	40.60833	72.64667	65216	171.15
156.	40.8174	72.6137	40.60833	72.64667	76760	186.83
157.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
158.	40.6419	72.2306	40.60833	72.64667	115772	264.07
159.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
160.	40.7961	72.9032	40.60833	72.64667	98552	133.91
161.	40.7664	72.754	40.60833	72.64667	64815	152.72
162.	40.785	72.7977	40.60833	72.64667	76751	147.00
163.	40.785	72.7977	40.60833	72.64667	76751	147.00
164.	40.7434	72.8691	40.60833	72.64667	78783	128.61
165.	40.7953	72.8073	40.60833	72.64667	81344	146.87

(b) (6)
(b) (7) (c)

Witness Name	Witness Location Latitude	Witness Location Longitude	Primary Shooter Location Latitude	Primary Shooter Location Longitude	Ground Distance (ft)	Azimuth (deg)
166.	40.8498	72.4762	40.60833	72.64667	99835	208.20
167.	40.7979	72.6326	40.60833	72.64667	69218	183.22
168.	40.8477	72.5031	40.60833	72.64667	95854	204.49
169.	41.0615	73.4344	40.60833	72.64667	272949	126.99
170.	40.8644	72.4114	40.60833	72.64667	113746	214.92
171.	40.91	72.6439	40.60833	72.64667	109978	180.40
172.	40.4868	73.8607	40.60833	72.64667	339211	82.10
173.	40.7909	72.7532	40.60833	72.64667	72779	156.10
174.	40.8361	72.4966	40.60833	72.64667	92811	206.58
175.	40.8528	72.4114	40.60833	72.64667	110305	216.18
176.	40.9168	72.6621	40.60833	72.64667	112535	177.82
177.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
178.	40.7971	72.6547	40.60833	72.64667	68853	178.15
179.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
180.	40.8255	72.6454	40.60833	72.64667	79171	180.25
181.	40.7134	73.0144	40.60833	72.64667	108670	110.52
182.	40.7671	72.9964	40.60833	72.64667	112680	120.79
183.	40.9435	72.86205	40.60833	72.64667	135888	153.98
184.	40.7909	72.6587	40.60833	72.64667	66640	177.14
185.	40.8011	72.8671	40.60833	72.64667	93005	139.01
186.	40.8555	72.5605	40.60833	72.64667	93198	194.83
187.	40.7895	72.7893	40.60833	72.64667	76917	149.12
188.	40.7431	72.0287	40.60833	72.64667	177782	254.16
189.	40.7655	72.7743	40.60833	72.64667	67289	148.33
190.	40.7905	72.6609	40.60833	72.64667	66527	176.61
191.	40.7971	72.6547	40.60833	72.64667	68853	178.15
192.	40.8664	72.4509	40.60833	72.64667	108515	209.95
193.	40.7375	72.8512	40.60833	72.64667	73591	129.72
194.	40.7361	72.8571	40.60833	72.64667	74532	128.61
195.	40.8507	72.8598	40.60833	72.64667	106179	146.25
196.	40.738	72.847	40.60833	72.64667	72820	130.41
197.	40.7446	72.7978	40.60833	72.64667	64915	139.88
198.	?	?	40.60833	72.64667	#VALUE!	#VALUE!

(b) (6)
(b) (7) (c)

Witness Name	Witness Location Latitude	Witness Location Longitude	Primary Shooter Location Latitude	Primary Shooter Location Longitude	Ground Distance (ft)	Azimuth (deg)
199.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
200.	40.6294	73.2283	40.60833	72.64667	161133	92.54
201.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
202.	40.7699	73.0236	40.60833	72.64667	119691	119.36
203.	40.807	72.6	40.60833	72.64667	73565	190.11
204.	40.7469	73.2567	40.60833	72.64667	176063	106.47
205.	40.7811	72.6944	40.60833	72.64667	64351	168.15
206.	40.7647	72.7537	40.60833	72.64667	64227	152.53
207.	40.785	72.7981	40.60833	72.64667	76811	146.93
208.	41.2655	72.6569	40.60833	72.64667	239593	179.32
209.	40.807	72.6	40.60833	72.64667	73565	190.11
210.	40.7961	72.9032	40.60833	72.64667	98552	133.91
211.	40.8438	72.6314	40.60833	72.64667	85945	182.82
212.	40.802	72.6594	40.60833	72.64667	70691	177.14
213.	40.8256	72.6455	40.60833	72.64667	79207	180.23
214.	40.7358	72.8566	40.60833	72.64667	74356	128.61
215.	40.7694	72.8482	40.60833	72.64667	80941	136.44
216.	40.7954	72.6403	40.60833	72.64667	68220	181.48
217.	40.777	72.7553	40.60833	72.64667	68429	153.94
218.	40.6245	72.7105	40.60833	72.64667	18622	108.43
219.	40.7352	72.8583	40.60833	72.64667	74588	128.25
220.	?	?	40.60833	72.64667	#VALUE!	#VALUE!
221.	40.6257	73.241	40.60833	72.64667	164591	92.01
222.	40.8034	72.6619	40.60833	72.64667	71238	176.61
223.	40.8438	72.6314	40.60833	72.64667	85945	182.82
224.	40.7228	73.0744	40.60833	72.64667	125426	109.29
225.	40.6394	73.3127	40.60833	72.64667	184639	93.30
226.	40.6836	73.0048	40.60833	72.64667	102793	105.37
227.	40.6884	73.2691	40.60833	72.64667	174621	99.42
228.	40.8438	72.6314	40.60833	72.64667	85945	182.82
229.	40.649	73.1591	40.60833	72.64667	142553	95.80
230.	40.8323	72.433	40.60833	72.64667	100757	215.94
231.	40.8323	72.433	40.60833	72.64667	100757	215.94

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(b)(6)
(b)(7)(c)

			Witness Location		Primary Shooter Location		Ground Distance	
		Witness Name	Latitude	Longitude	Latitude	Longitude	(ft)	Azimuth (deg)
		232. [redacted]	40.7647	72.7532	40.60833	72.64667	64163	152.64
		233. [redacted]	40.777	72.7553	40.60833	72.64667	68429	153.94
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!
			?	?	40.60833	72.64667	#VALUE!	#VALUE!