

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering

More Washington, D.C. 20594

December 18, 2008

Aircraft Performance Study

I. ACCIDENT

NTSB Number:	MIA08MA203
Description:	Collision with terrain during approach to ADW, runway 19R
Location:	Walker Mill Regional Park, District Heights, Maryland
Date:	September 27, 2008
Time:	2358 eastern daylight time
Aircraft:	Aerospatiale (Eurocopter) AS365 N1, N92MD
Operator:	Maryland State Police

II. Vehicle Performance Specialist

Kevin J. Renze, Ph.D.
National Transportation Safety Board
Vehicle Performance Engineer, RE-60

1.0 INTRODUCTION

On September 27, 2008, at 2358, eastern daylight time, an Aerospatiale (Eurocopter) AS365 N1, N92MD, call sign Trooper 2 (T2), registered to and operated by the Maryland State Police, as a Public Use medical evacuation flight, was substantially damaged when it collided with trees and terrain in Walker Mill Regional Park, District Heights, Maryland. The flight had been cleared by air traffic control for an instrument landing system (ILS) approach to runway 19R at Andrews Air Force Base (ADW), Camp Springs, Maryland. Instrument meteorological conditions prevailed at the time of the accident. The commercial pilot, one flight paramedic, one field provider, and one of two automobile accident patients being transported were killed. The other patient being transported survived the helicopter accident and was taken to a local hospital with serious injuries. The flight originated from a landing zone located at Wade Elementary School, Waldorf, Maryland, on September 27, 2008, at 2337, destined for the Prince George's County Hospital (PGH), Cheverly, Maryland.

Available Airport Surveillance Radar (ASR) data, Automatic Dependent Surveillance Broadcast (ADS-B), and Air Traffic Control (ATC) transcript data were processed and plotted to define the aircraft flight path, ground track, ground speed, rate of climb, and ATC communication event time history. No aircraft acceleration, airspeed, attitude, engine, flight control input, flight control surface position, or external atmosphere parameters were recorded. However, true altitude, calibrated airspeed, flight path angle, estimated bank angle, and true heading parameters were derived. The calculated N92MD flight path was compared to the runway 19R calculated glideslope parameters. The initial aircraft descent was consistent with the expected glideslope centerline guidance. At the request of the Safety Board, Honeywell used the ADS-B data to calculate the pilot alerts expected from a

hypothetical scenario¹ in which N92MD was equipped with an Enhanced Ground Proximity Warning System (EGPWS).

2.0 FACTUAL EVIDENCE

2.1 Aircraft Engineering Drawing

A three-view engineering drawing and a longitudinal reference station diagram for the Aerospatiale (Eurocopter) 365 N1 helicopter are included in Attachment 1.

2.2 Airport Diagram and Approach Charts

The Federal Aviation Administration (FAA) Andrews Air Force Base airport diagram, ILS or LOC runway 19R approach chart, runway 19R/01L technical data, and runway 19R ILS (glideslope and localizer) technical data are available in Attachment 2.

2.3 Accident Site

The aircraft wreckage was located in Walker Mill Regional Park, District Heights, Maryland at latitude N38° 52.148', longitude W076° 52.366'.² A copy of the Maryland State Police wreckage diagram is provided in Attachment 3.

2.4 Accident Site Weather

The weather conditions that existed at the accident site were wind 080° at 3 knots; visibility 4 miles; mist; 200 feet scattered, ceiling 500 feet broken; temperature 20°C, dew point temperature 20°C, and altimeter 29.91 inches of Hg.

2.5 Radar Data

The Andrews Air Force Base (ADW) ASR-9 radar³ antenna parameters are summarized in Table 1 below. The native radar data are documented in Attachment 4. The measurement tolerance⁴ on the ASR radar range data is ±380 feet ($\pm 1/16$ nautical mile). The ASR radar azimuth data are subject to a measurement tolerance of ±0.18° (± 2 azimuth pulse counts).

Table 1: ASR radar antenna data

Identifier	Location	Equipment Type	Latitude	Longitude	Elevation (feet)	Magnetic Variation
ADW	Camp Springs, Maryland	ASR-9	N38-48-44.14	W076-52-01.39	270.3	W10°

¹ The accident aircraft, N92MD, was not equipped with a Terrain Awareness Warning System (TAWS).

² The Maryland State Police survey documents the fuselage location as latitude N38° 52.156', longitude W076° 52.359'.

³ An Airport Surveillance Radar (ASR) is an approach control radar used to detect and display an aircraft's position in the terminal area.

⁴ The aircraft position derived from radar data may not place the aircraft precisely in an expected location. For example, the aircraft may not appear to be aligned on the runway centerline during landing even though the aircraft ground track may be parallel to the runway.

2.6 Automatic Dependent Surveillance Broadcast (ADS-B) Data

The accident flight was documented by Global Position System (GPS) data captured by an ADS-B sensor network. The ADS-B data were obtained in electronic, comma-separated-variable (.csv) file format. The electronic data and corresponding parameter field definitions are documented in Attachment 5. The available ADS-B data do not include aircraft acceleration, airspeed, attitude, engine, flight control input, flight control surface position, or external atmosphere parameters.

2.7 Weight and Balance

A copy of the N92MD weight/balance and performance tables is included in Attachment 6.

2.8 Excerpt of Air Traffic Control (ATC) Group Transcript

A continuous segment of communication events excerpted from the *ATC Group Transcript of ATC Communications with or about Trooper 2* is reproduced in Table 2 below. Time is referenced to Greenwich Mean Time (GMT) and reported in hours (HH), minutes (MM), and seconds (SS).

Table 2: Trooper 2 communication events excerpted from the ATC Group transcript

HH	MM	SS	Source	Event
3	37	45	Trooper 2	Washington Tower lifeguard Trooper 2
3	37	47	DCA LC	Trooper 2 go.
3	37	48	Trooper 2	Lifeguard Trooper 2 Waldorf like to go to PG hospital.
3	37	52	DCA LC	Trooper 2 approved the altimeter at Washington 2991
3	37	56	Trooper 2	Trooper 2 roger
3	37	57	DCA LC	And Trooper 2 uh Medstar came up about half an hour ago coming up on the uh he was right over the 210/295 area he said the uh bases coming up on that side of the uh river's right around 900 feet and it gets a little lower the closer you get to the city.
3	38	15	Trooper 2	Uh k thank you
3	44	15	Trooper 2	Washington Tower lifeguard Trooper 2
3	44	22	DCA LC	Trooper 2 go
3	44	24	Trooper 2	Uh yes sir we just ran into some heavy stuff. I don't think we're going to be able to make it all the way to the hospital.
3	44	30	DCA LC	Trooper 2 roger you gonna turn back around and go south?
3	44	33	Trooper 2	Uh yes sir I'd like to continue on about 3 more miles and see what happens and if I don't get a hole I'll have to go IFR back to Andrews.
3	44	43	DCA LC	Trooper 2 roger altitude's your discretion there's no other traffic in the area and uh just let me know what your intentions are.
3	44	50	Trooper 2	Lifeguard Trooper 2 roger
3	47	20	Trooper 2	Washington Tower Trooper 2
3	47	27	DCA LC	Trooper 2 go ahead sir
3	47	29	Trooper 2	Uh yes sir it's solid up here I'd like to climb to 2000 feet and go over to radar and shoot an approach back into Andrews.

HH	MM	SS	Source	Event
3	47	36	DCA LC	Trooper 2 approved as requested contact approach on uh let's try them on 118.95, 118.95.
3	47	47	DCA LC	Trooper 2 approved contact approach 118.95 eighteen ninety five.
3	47	51	Trooper 2	Eighteen ninety five Trooper 2
3	48	2	Trooper 2	Potomac approach, Trooper 2.
3	48	7	PCT MTV	Trooper 2, Potomac
3	48	12	Trooper 2	Potomac approach Trooper 2 we tried to make a medevac up at PG hospital, we're about 7 miles northwest of Andrews, like to climb to 2,000 feet and shoot an approach to runway 1L at Andrews.
3	49	19	Trooper 2	Approach Trooper 2
3	49	21	PCT MTV	Trooper 2 Potomac
3	49	23	Trooper 2	Yes sir, I was waiting for a reply. Climbing to 2,000 feet and my course is uh... 200 degrees.
3	49	36	PCT MTV	All right Trooper 2 present position 200 degrees is approved the altimeter 2991 Washington tower 120.75.
3	49	44	Trooper 2	No sir I want to shoot the approach at Andrews.
3	49	54	PCT MTV	All right tell you what go direct to the wha - you want to shoot the ILS to 19 what runway?
3	50	1	Trooper 2	Are they using 19? Uh, runway 19R.
3	50	6	PCT MTV	All right runway 19R. Turn left go northbound for runway 19R 360 heading Trooper 2.
3	50	13	Trooper 2	360 trooper 2
3	50	16	PCT MTV	Trooper 2 and I'll get you a transponder code here momentarily. Tell you what you can just stay on that transponder code Trooper 2. 360 heading vectors to the ILS 19R just one approach into Andrews or you coming back out for another?
3	50	28	Trooper 2	No sir I've got patients on board I'm trying to get them down.
3	50	31	PCT MTV	All right.
3	50	34	PCT MTV	Are you landing Andrews or are you going to try to break off and go somewhere else?
3	50	37	Trooper 2	Uh I'm gonna land at Andrews.
3	51	53	PCT MTV	Trooper 2 the latest weather at Andrews is 7 miles uh 1,800 broken and the temperature uh right now is uh 21 dew point 19.
3	52	6	Trooper 2	Trooper 2 roger and we're level at 2000 feet.
3	52	48	PCT MTV	Trooper 2 you want a short approach or you want to go out to the standard 3 miles from the final approach fix?
3	52	56	Trooper 2	I'll take a short approach.
3	52	58	PCT MTV	All right Trooper 2 you can turn right to a heading of 100.
3	53	50	PCT MTV	Trooper 2 mile and a half from the final approach fix turn right heading 1 uh 70 maintain 2000 until you're established on the localizer cleared ILS runway 1R approach into Andrews.
3	54	1	Trooper 2	Turn right to 170 pick up the localizer cleared for the approach Andrews.
3	54	53	PCT MTV	Trooper 2 report established on the localizer.
3	54	56	Trooper 2	Trooper 2 roger.

HH	MM	SS	Source	Event
3	54	59	PCT MTV	Trooper 2 are you on the localizer?
3	55	1	Trooper 2	Trooper 2 affirmative.
3	55	3	PCT MTV	Trooper 2 ah you're number 1 Andrews tower's 118.4.
3	55	12	Trooper 2	Andrews tower Trooper 2
3	55	19	ADW	Trooper 2 Andrews tower
3	55	21	Trooper 2	Andrews tower Trooper 2's with you on only the localizer for runway 19R
3	55	30	ADW	Trooper 2 roger runway 19<unintelligible> cleared for the option wind 090 at 5.
3	55	35	Trooper 2	Trooper 2 roger we'll be landing at the base of the tower.
3	55	38	ADW	OK you can break it off your discretion for the ramp. Just use caution for the closure of [taxiway] whiskey just abeam the tower [unintelligible] rows it looks like 2 and 3.
3	55	48	Trooper 2	Trooper 2 roger.
3	56	44	Trooper 2	Andrews tower Trooper 2 I'm not picking up the glideslope.
3	56	50	ADW	Trooper 2 roger it's showing green on the panel but you're the only aircraft we've had in a long time so I don't really know if it's working or not.
3	56	59	Trooper 2	OK could I get an ASR approach in?
3	57	4	ADW	There isn't anybody to do that I'm, I'm not current on that I can't do it.

3.0 METHOD AND RESULTS

The data sources, study methods, and results are presented in this section. All ADS-B data presented in this study were obtained by sorting the “Seconds Since Midnight” parameter in chronological order and dropping duplicate values.

3.1 Aircraft Ground Track

The N92MD radar data were converted from range-azimuth format to distance north and distance east of the ADW ASR-9 radar antenna and to latitude-longitude coordinates. These derived radar data were subsequently used to estimate the aircraft ground speed, rate of climb, and ground track angle.

The aircraft ground track derived from radar data (red circular symbols) is compared to the recorded ADS-B data (blue circular symbols) in Figures 1-2. The accident flight originated near Waldorf, MD (see bottom of Figure 1), proceeded north to Cheverly, MD, turned south and continued to Capitol Heights, MD, turned north and proceeded to Landover Hills, MD, and finally turned south on approach to ADW runway 19R. The accident location (identified by the red flag symbol) is about 3.2 miles north of the ADW runway 19R threshold. The runway 19R/01L threshold locations are denoted by the blue flag symbols.

3.2 Data Consistency Check (ASR-9, ADS-B, and ATC Data)

The calculated radar data and recorded ADS-B data parameters for the 21-minute duration of the flight, last nine minutes of the flight, and last minute of the flight are compared in Figures

3, 4, and 5, respectively, as a function of GMT time. Ordered top to bottom, Figures 3-5 present time history data for altitude, speed, rate of climb, flight path angle, estimated bank angle, heading, latitude, and longitude. Calculated radar data are depicted by black/green lines and square symbols. Blue lines and circular symbols document the recorded ADS-B data. The solid red lines identify derived parameters such as true altitude, calibrated airspeed, flight path angle, estimated bank angle, and true heading. Comparable calculated ASR-9 radar and recorded ADS-B data parameter values are generally consistent.

The calculated N92MD flight path is compared to the runway 19R calculated glideslope parameters in the Figure 6 profile view. The initial N92MD descent was consistent with the expected glideslope centerline guidance.

The ATC communication events presented in Table 2 were overlaid on Figure 3 to construct the annotated⁵ plots in Attachment 7, pages A7.2-23. Each plot depicts a one-minute time interval. The native time sources for the respective ASR-9, ADS-B, and ATC data were not adjusted.

3.3 Enhanced Ground Proximity Warning System (EGPWS) Simulation Data

At Safety Board request, Honeywell engineers calculated the pilot alert messages expected if N92MD had been equipped with an EGPWS Mark 22. The Honeywell EGPWS simulation⁶ used the recorded ADS-B pressure altitude as the source for the aircraft altitude and derived radio altitude by subtracting the terrain elevation⁷ from the pressure altitude. A Vertical Figure of Merit (VFOM) of 50 feet was used to simulate the Look-Ahead function. In addition, the simulation assumed that the glideslope signal was valid and the aircraft was not in autorotation.

Given the stated simulation assumptions, Honeywell engineers calculated the pilot alert events (see Table 3) and plotted them on the N92MD flight path (see Attachment 8 for annotated alert plots, alert criteria, and alert priority). Time and date data are referenced to GMT. Based on the available ADS-B data, three terrain alerts would be expected prior to terrain impact, independent of glideslope signal operation. However, the Honeywell EGPWS simulation did not attempt to evaluate other helicopter states, operational procedures, or terrain avoidance scenarios.⁸

Table 3: Calculated EGPWS pilot alert messages

Alert Type	Event condition	Comments
[Mode 5 Glideslope]	Local Date: 9/28/2008 3:59:00 AM Local MS: 14369781 Latitude: 38.8788986 Longitude: -76.8708444 Pressure altitude (Altitude Ft): 1150 ft (when radio altitude is 1000 feet)	This assumes valid glideslope signal, below 1,000' radio altitude, greater than 1.3 Dots Fly-Up, and Landing Gear down. A "glideslope" alert is repeated every time the Fly-Up glideslope deviation increases by 20%.

⁵ As a result of the plotting process, ATC comments that exceed 119 characters in length are simply truncated.

⁶ The simulation used the EGPWS MK-22 Software Version -026 "Fast Helo" algorithm.

⁷ The terrain elevation was extracted from the USGS National Elevation Dataset (NED).

⁸ According to Honeywell, "Whether or not the pilot could have responded to the alerts or the machine allowed a recovery in time to prevent hitting the trees is unknown."

Alert Type	Event condition	Comments
[Caution Terrain]	Local Date: 9/28/2008 3:59:00 AM Local MS: 14386921 Latitude: 38.8729119 Longitude: -76.8722606 Pressure altitude (Altitude Ft): 550 ft	
[Warning Terrain]	Local Date: 9/28/2008 3:59:00 AM Local MS: 14389656 Latitude: 38.8719463 Longitude: -76.8724108 Pressure altitude (Altitude Ft): 475 ft	
[Mode 1 Pullup]	Local Date: 9/28/2008 3:59:00 AM Local MS: 14391781 Latitude: 38.8710022 Longitude: -76.8725181 Pressure altitude (Altitude Ft): 400 ft	

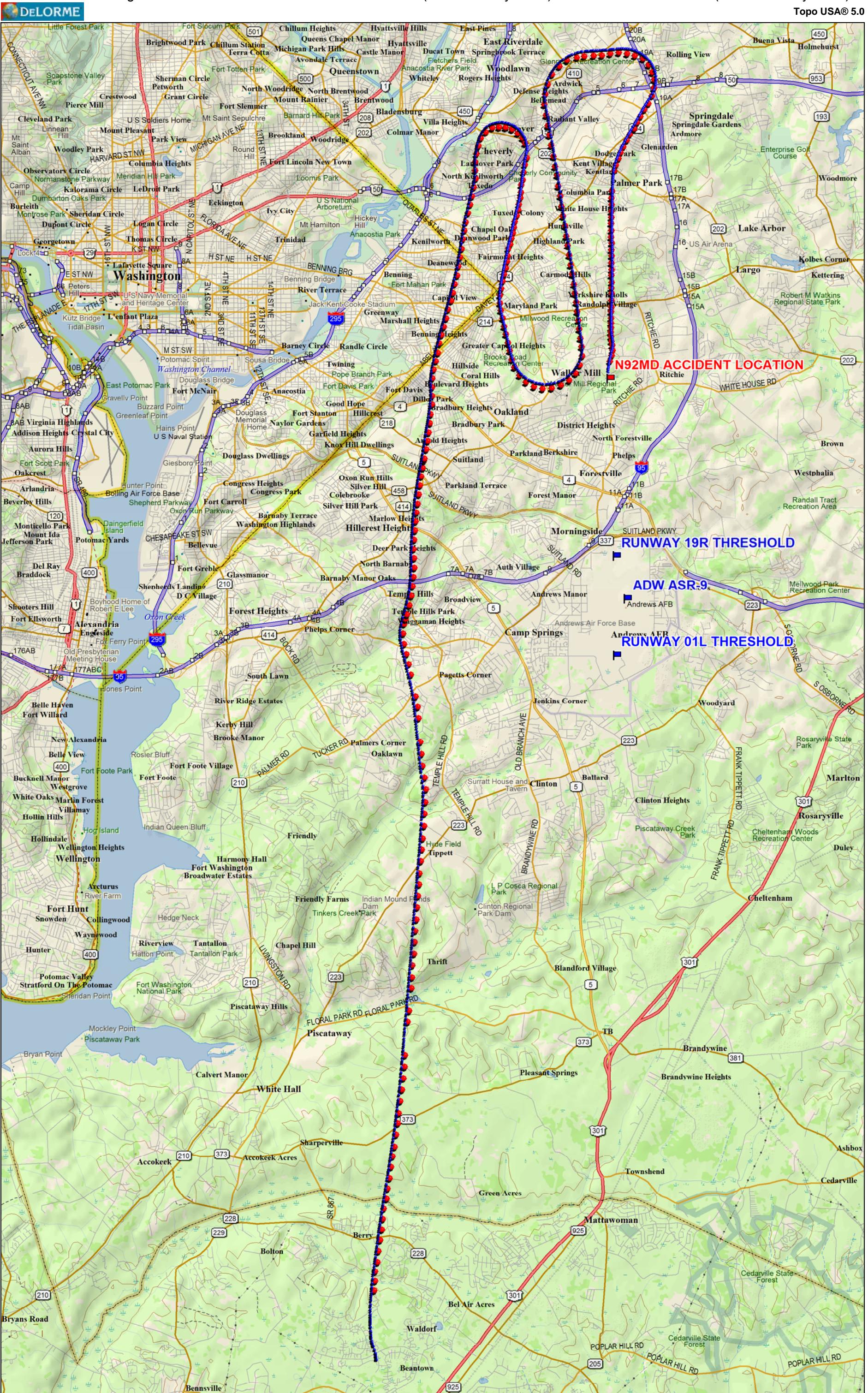
4.0 SUMMARY

Available ASR-9 radar, ADS-B, and ATC transcript data were processed and plotted to define the aircraft flight path, ground track, ground speed, rate of climb, and ATC communication event time history. Comparable calculated ASR-9 radar and recorded ADS-B data parameter values are generally consistent. The available ADS-B data do not include aircraft acceleration, airspeed, attitude, engine, flight control input, flight control surface position, or external atmosphere parameters. However, true altitude, calibrated airspeed, flight path angle, estimated bank angle, and true heading parameters were derived.

The calculated N92MD flight path was compared to the runway 19R calculated glideslope parameters. The initial aircraft descent was consistent with the expected glideslope centerline guidance.

A Honeywell EGPWS simulation of expected pilot alerts indicated that, had N92MD been equipped with an EGPWS Mark 22 system, three terrain alerts would be expected prior to terrain impact, independent of glideslope signal operation. However, the EGPWS simulation did not attempt to evaluate other helicopter states, operational procedures, or terrain avoidance scenarios.

FIGURE 1: N92MD ground track based on derived ASR-9 radar data (red circular symbols) and recorded ADS-B data (blue circular symbols).

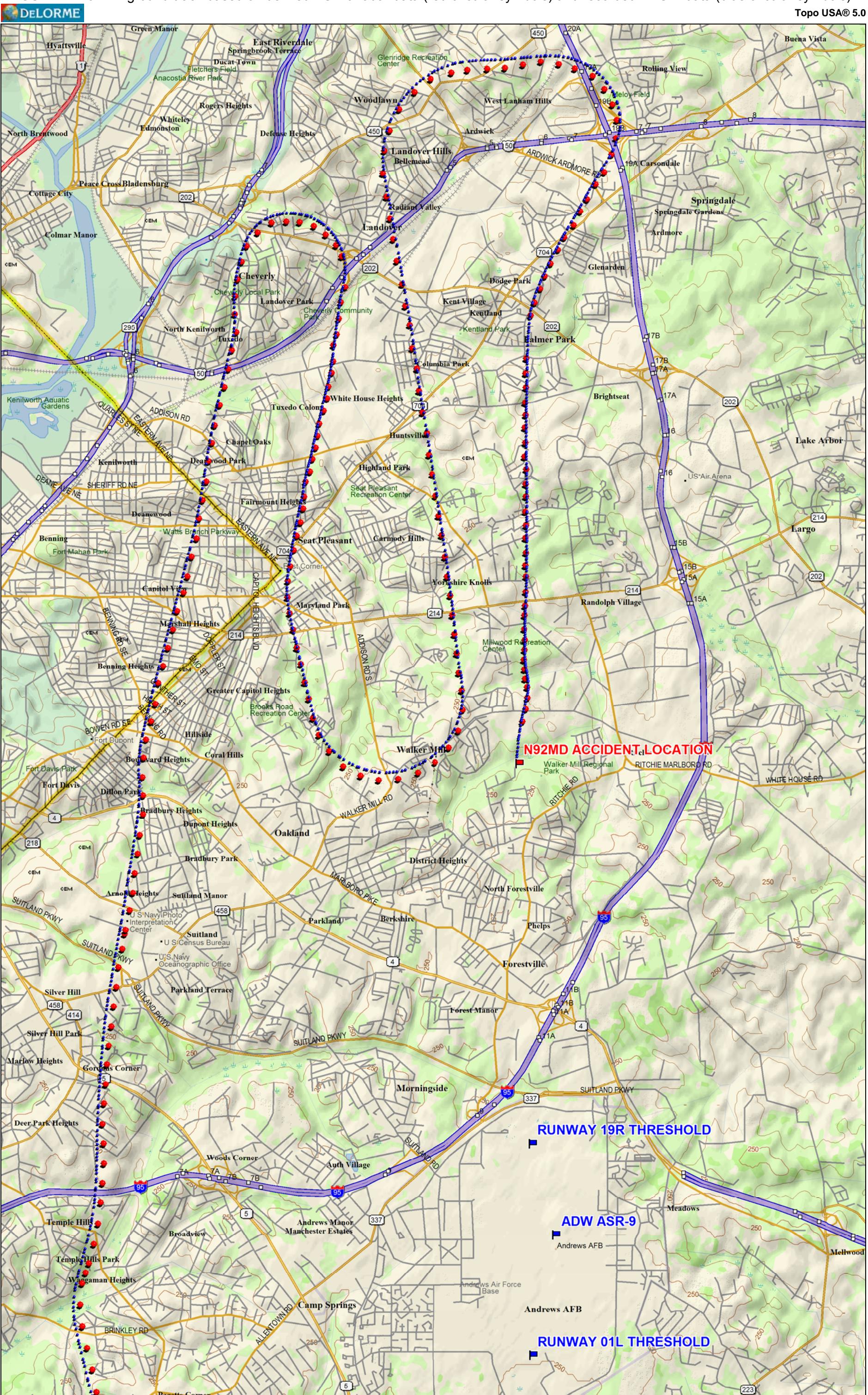


Data use subject to license.

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FIGURE 2: N92MD ground track based on derived ASR-9 radar data (red circular symbols) and recorded ADS-B data (blue circular symbols).



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FIGURE 3: MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]

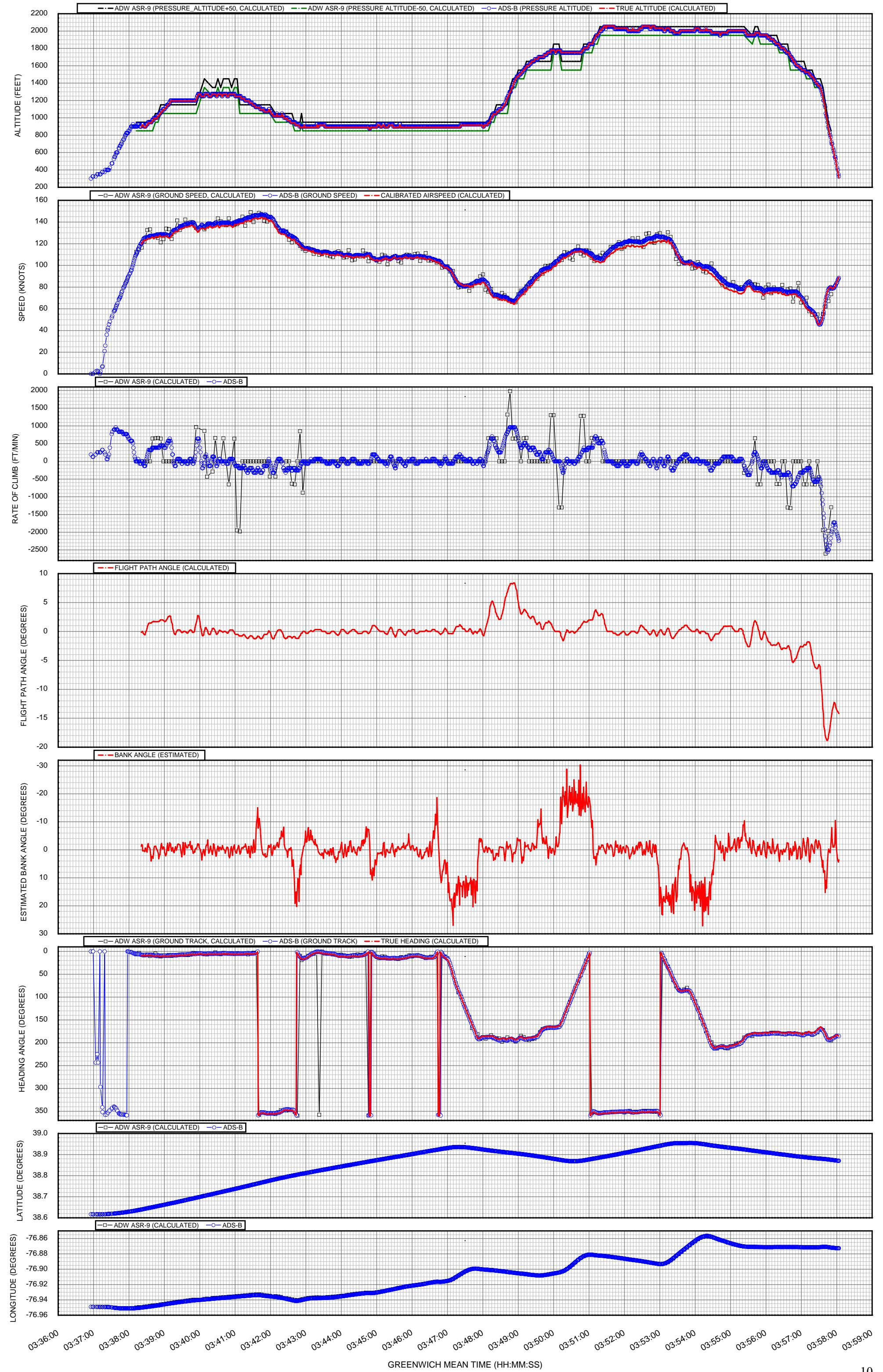


FIGURE 4: MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]

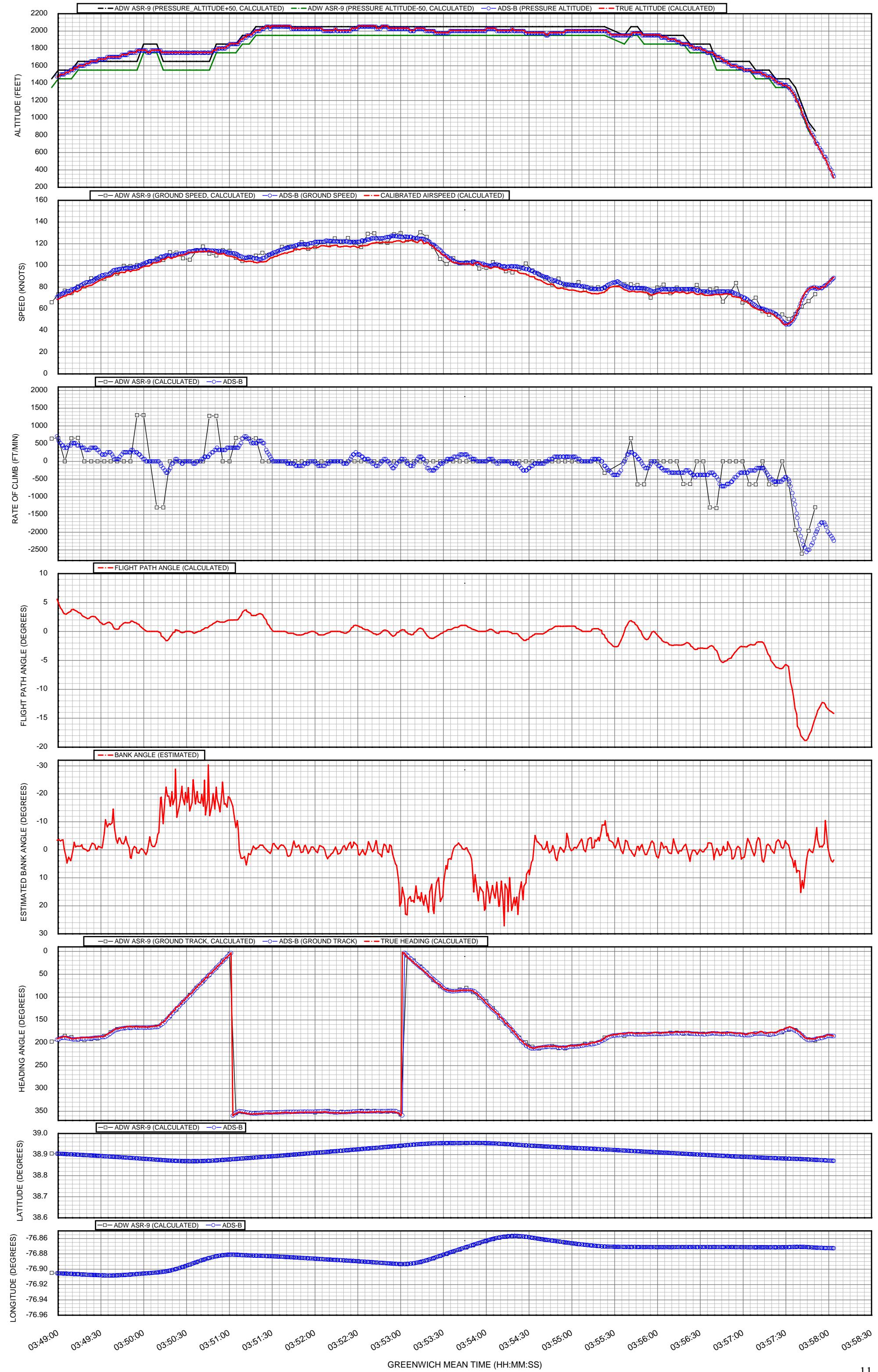


FIGURE 5: MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]

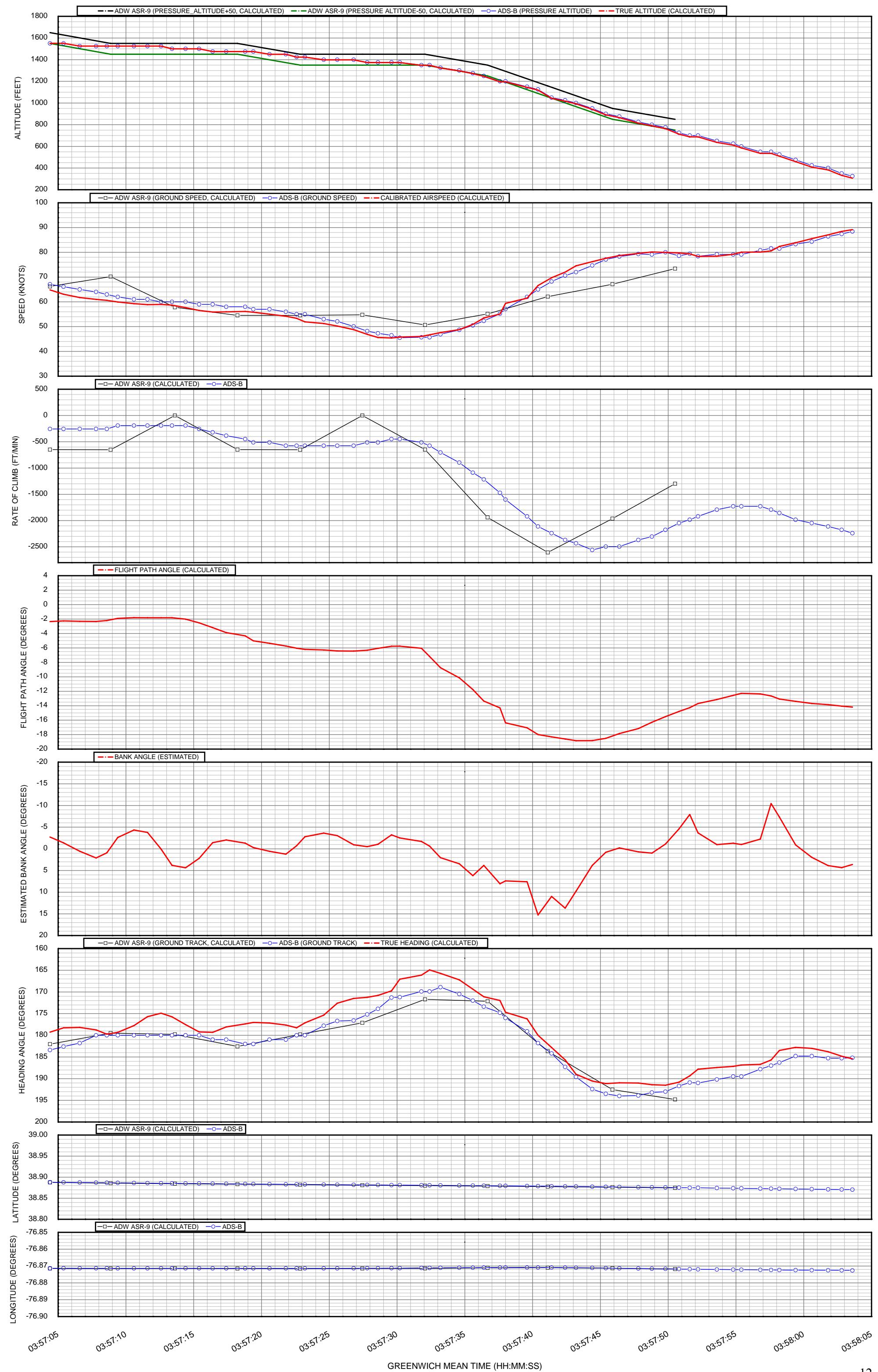
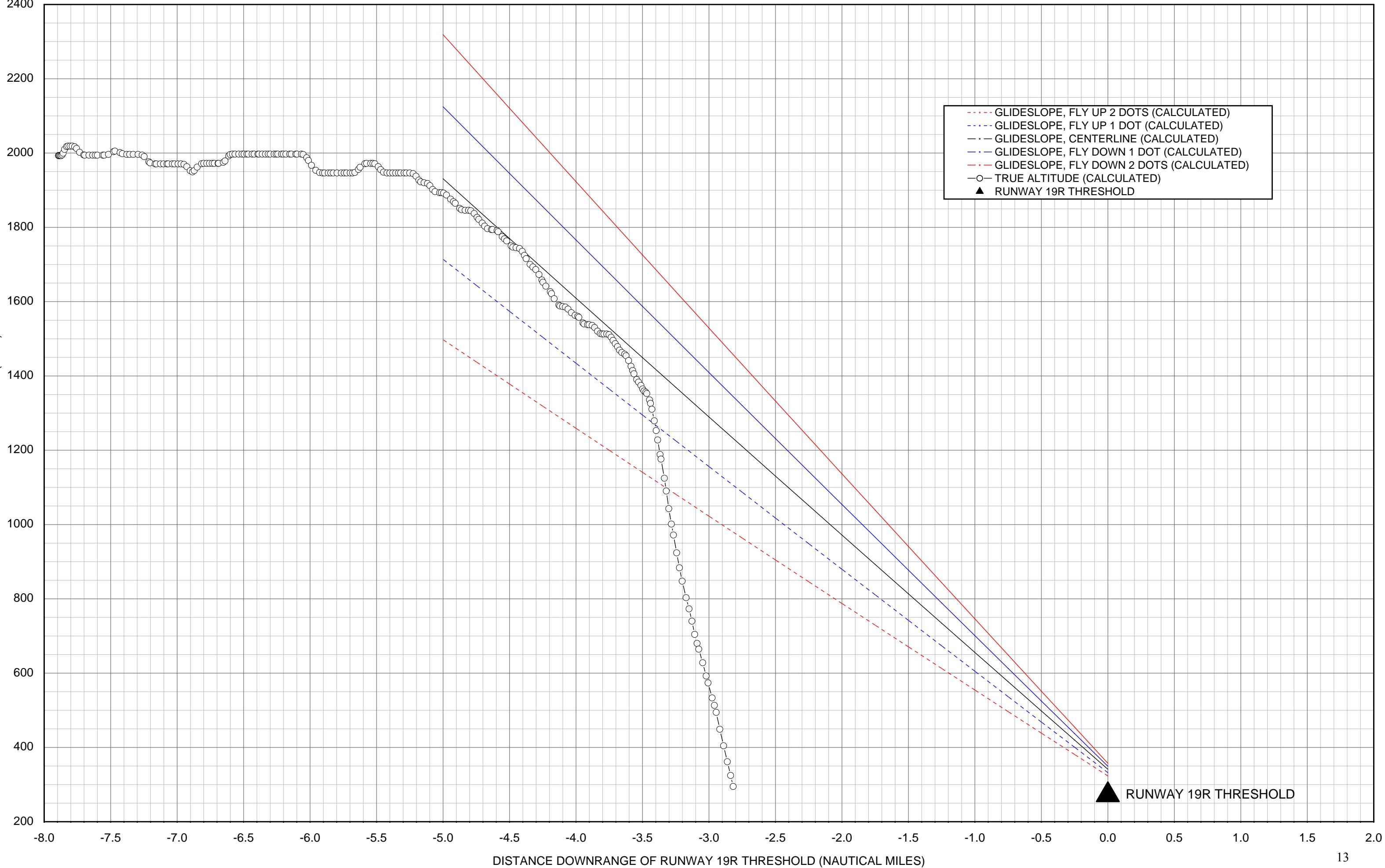


FIGURE 6: MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ADS-B DATA]

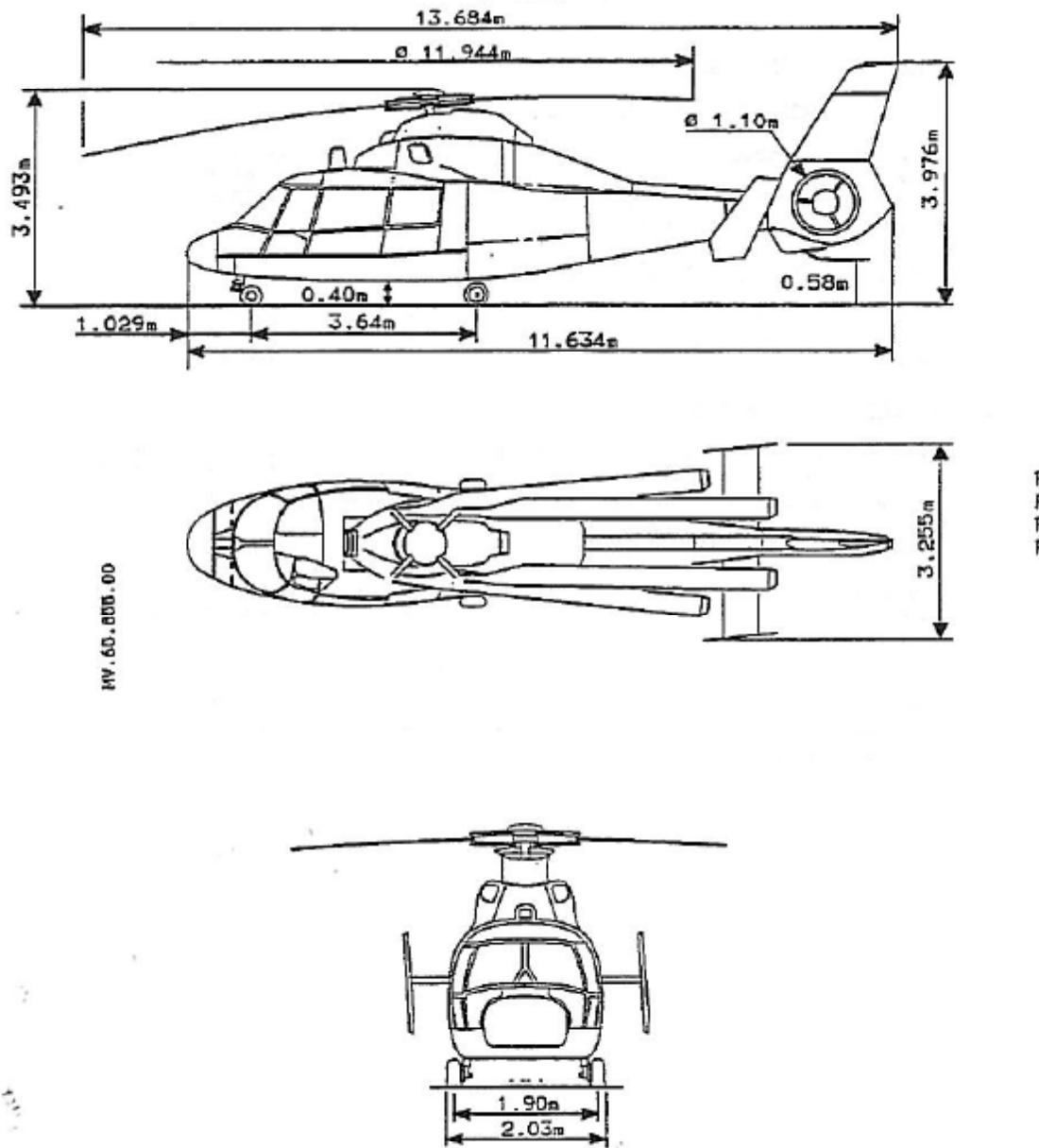
NATIONAL TRANSPORTATION SAFETY BOARD



Attachment 1: Aerospatiale (Eurocopter) 365 N1 Drawings

Figure A1.1: Aerospatiale (Eurocopter) 365 N1 3-view engineering drawing.

FLIGHT MANUAL



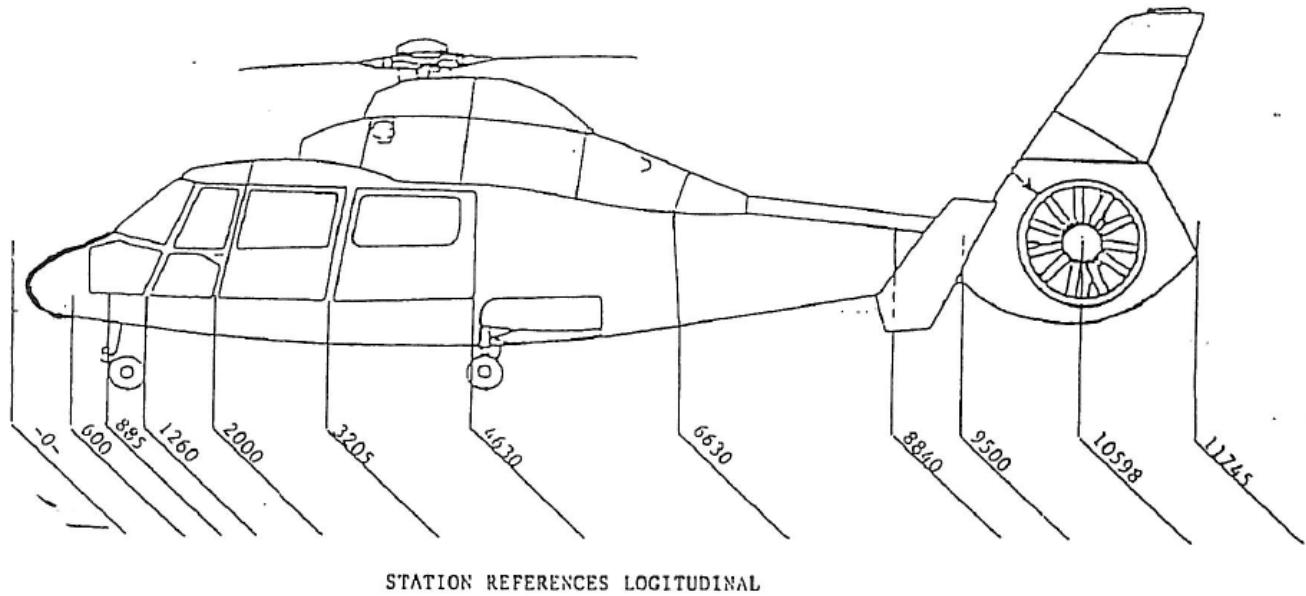
365 N1

1.1

90-26

Page 2
=01=

Figure A1.2: Aerospatiale (Eurocopter) 365 N1 longitudinal reference stations.



Attachment 2: Airport and Approach Charts

08297

AIRPORT DIAGRAM

AFD-561 [USAF]

ANDREWS AFB/NAF (KADW)

CAMP SPRINGS, MARYLAND

ATIS 113.1 251.05
 ANDREWS TOWER
 118.4 349.0
 GND CON
 121.8 275.8
 CLINC DEL
 127.55 285.475

483

PAD 14

300 x 800

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MB60

250 x 500

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ILS or LOC RWY 19R

CAMP SPRINGS, MARYLAND

LOC I-MXK 111.5	APCH CRS 190°	Rwy Idg 0300 TDZE 273 Appt Elev 280
AL-561 [USAF]		

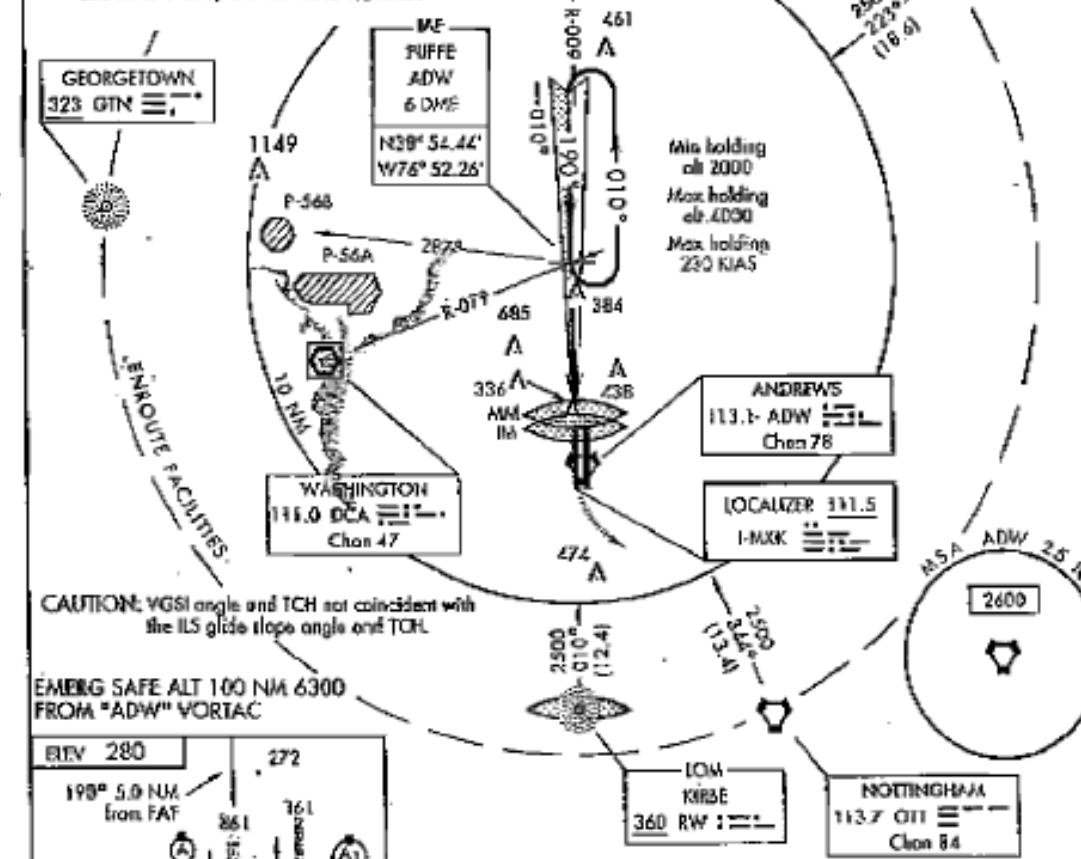
ANDREWS AFB/NAF (KADW)

- V * When ALS inop, increase CAT ABCD RVR to 40 and vis to ½ mile.
 ** When ALS inop, increase CAT ABC RVR to 50 and vis to 1 mile, CAT CD RVR to 60 and vis to 1½ miles.
 *** Circling not authorized W of Rwy 1L-19R.

ALSF-2 MISSED APPROACH: Climbing left turn to 2000 direct OTT VORTAC. Expect further clearance from APP CONN.

AWIS 113.1 261.05	POTOMAC APP CON 119.3 335.6	ANDREWS TOWER 118.4 349.0	GND CON 121.8 275.8	CINC DEL 127.55 285.475	ASR
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- † When ALS inop, increase CAT AB RVR to 50 and vis to 1 mile, CAT CD vis to 1½ miles.



CAUTION: VGS angle and TCH not coincident with the ILS glide slope angle and TCH.
 EMERG SAFE ALT 100 NM 6300 FROM "ADW" VORTAC

ELEV 280	272
190° 5.0 NM from FAF	

483	TDZE 273	161	361	A1

IOM KIRBE	360 RW :--
NOTTINGHAM	113.7 OTT :-- Chan 84

TUFFE DCA R-079 ADW 6 GTN BRG 247°	2000	OTT
190°	010°	

483	TDZE 273	161	361	A1

483	TDZE 273	161	361	A1

483	TDZE 273	161	361	A1

483	TDZE 273	161	361	A1

483	TDZE 273	161	361	A1

483	TDZE 273	161	361	A1

483	TDZE 273	161	361	A1

483	TDZE 273	161	361	A1

483	TDZE 273	161	361	A1

483	TDZE 273	161	361	A1

483	TDZE 273	161	361	A1

Knots	60	90	120	150	180
Min:Sec	4:24	2:56	2:12	1:46	1:28

S-ASR 19R	780/24	507	1600-5	780/50	507	(600-4)
-----------	--------	-----	--------	--------	-----	---------

S-ASR 19R	780/24	507	1600-5	780/50	507	(600-4)
-----------	--------	-----	--------	--------	-----	---------

ILS or LOC RWY 19R

CAMP SPRINGS, MARYLAND

LOC I-MXK 111.5	APCH CRS 190°	Rwy Idg 0300 TDZE 273 Appt Elev 280
AL-561 [USAF]		

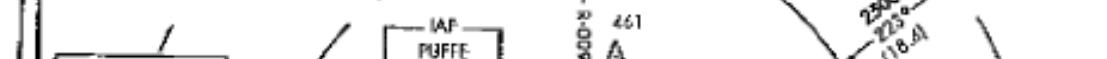
ANDREWS AFB/NAF (KADW)

- V * When ALS inop, increase CAT ABCD RVR to 40 and vis to ½ mile.
 ** When ALS inop, increase CAT ABC RVR to 50 and vis to 1 mile, CAT CD RVR to 60 and vis to 1½ miles.
 *** Circling not authorized W of Rwy 1L-19R.

ALSF-2 MISSED APPROACH: Climbing left turn to 2000 direct OTT VORTAC. Expect further clearance from APP CON.

AWIS 113.1 261.05	POTOMAC APP CON 119.3 335.6	ANDREWS TOWER 118.4 349.0	GND CON 121.8 275.8	CINC DEL 127.55 285.475	ASR
----------------------	--------------------------------	------------------------------	------------------------	----------------------------	-----

- † When ALS inop, increase CAT AB RVR to 50 and vis to 1 mile, CAT CD vis to 1½ miles.



CAUTION: VGS angle and TCH not coincident with the ILS glide slope angle and TCH.
 EMERG SAFE ALT 100 NM 6300 FROM "ADW" VORTAC

ELEV 280	272
190° 5.0 NM from FAF	

483	TDZE 273	161	361	A1

483</

CAMP SPRINGS, MARYLAND

LOC I-MXK 111.5	APCH CRS 190°	Rwy Idg 9300 TDZE 273 Apt Elev 280
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AL-561 [USAF]

ILS or LOC RWY 19R

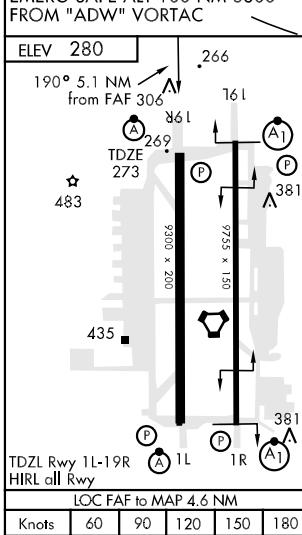
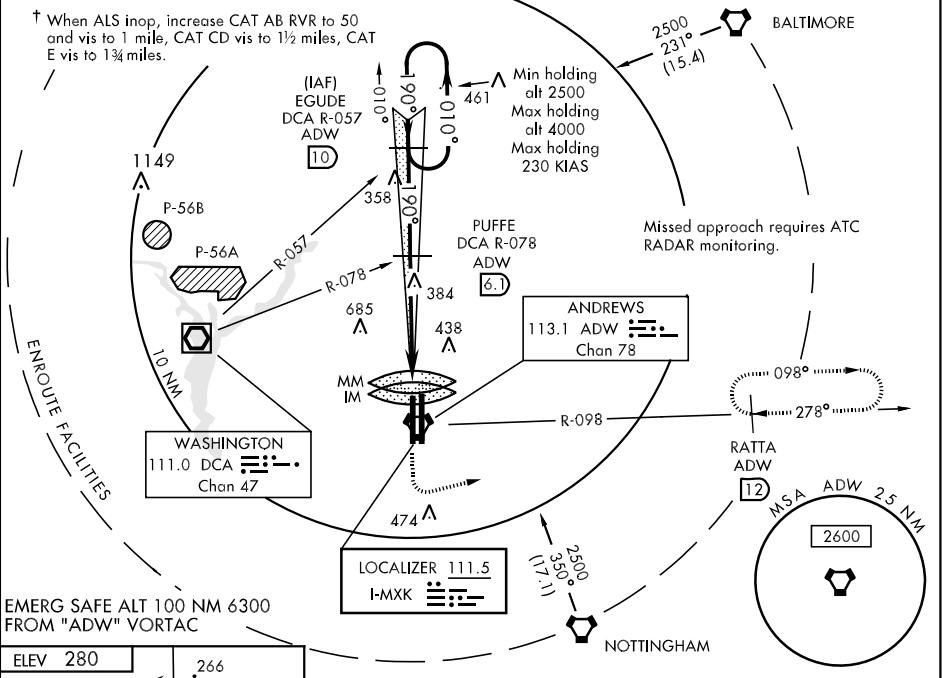
ANDREWS AFB/NAF (KADW)

▼ * When ALS inop, increase CAT ABCDE RVR to 40 and vis to $\frac{3}{4}$ mile.
 ** When ALS inop, increase CAT AB RVR to 50 and vis to 1 mile, CAT CD RVR to 60 and vis to $\frac{1}{4}$ miles, CAT E vis to $\frac{1}{2}$ miles.
 *** Circling not authorized W of Rwy 1L-19R.



MISSSED APPROACH: Climb to 900, then climbing left turn to 2500 direct RATA and hold.

ATIS 113.1 251.05	POTOMAC APP CON 119.3 335.5	ANDREWS TOWER 118.4 349.0	GND CON 121.8 275.8	CLNC DEL 127.55 285.475	ASR
-----------------------------	---------------------------------------	-------------------------------------	-------------------------------	-----------------------------------	-----



CAMP SPRINGS, MARYLAND

38° 49'N-76° 52'W

ANDREWS AFB/NAF (KADW)

Orig 08297

ILS or LOC RWY 19R

CAMP SPRINGS, MARYLAND

LOC I-MXK 111.5	APCH CRS 190°	Rwy Idg 9300 TDZE 273 Arpt Elev 280
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AL-561 [USAF]

ILS or LOC RWY 19R

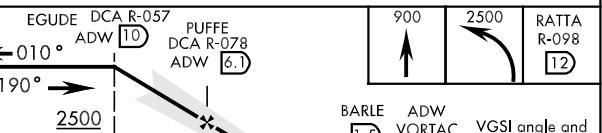
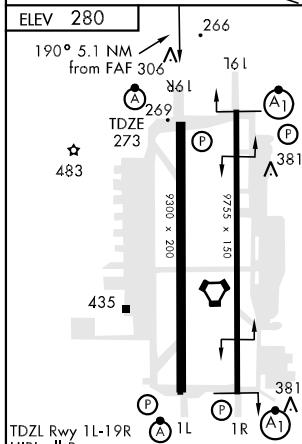
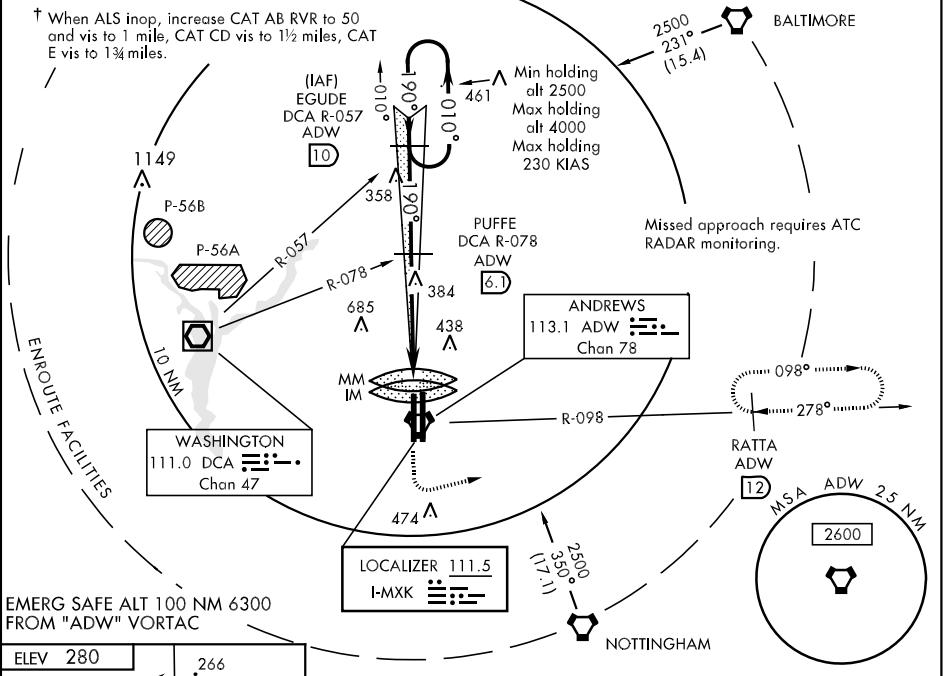
ANDREWS AFB/NAF (KADW)

▼ * When ALS inop, increase CAT ABCDE RVR to 40 and vis to $\frac{3}{4}$ mile.
 ** When ALS inop, increase CAT AB RVR to 50 and vis to 1 mile, CAT CD RVR to 60 and vis to $\frac{1}{4}$ miles, CAT E vis to $\frac{1}{2}$ miles.
 *** Circling not authorized W of Rwy 1L-19R.



MISSSED APPROACH: Climb to 900, then climbing left turn to 2500 direct RATA and hold.

ATIS 113.1 251.05	POTOMAC APP CON 119.3 335.5	ANDREWS TOWER 118.4 349.0	GND CON 121.8 275.8	CLNC DEL 127.55 285.475	ASR
----------------------	--------------------------------	------------------------------	------------------------	----------------------------	-----



CATEGORY	A	B	C	D	E
S-ILS 19R *	473/18 200 (200-½)		473/24 200 (200-½)		
S-LOC 19R **	680/24 407 (400-½)		680/40 407 (400-¾)		680/50 407 (400-1)
CIRCLING ***	720-1 440 (500-1)	740-1 460 (500-1)	740-1½ 460 (500-1½)	840-2 560 (600-2)	
S-ASR 19R †	780/24 507 (500-½)	780/50 507 (500-1)	780/60 507 (500-1½)		

CAMP SPRINGS, MARYLAND

38° 49'N-76° 52'W

ANDREWS AFB/NAF (KADW)

Orig 08297

ILS or LOC RWY 19R

KADW
ANDREWS AFB
CAMP SPRINGS
AL# :561

Dir:	W	Variance:	10	Year:	1995
Magnetic Variation/Year:					
Surface:	CONC	Width:	200	Physical Length:	9301

Rwy Number: 19R

Status: A Survey: 8

Markings: PIR-G

Threshold

Latitude: N 38° 49' 23.7300"
Longitude: W 076° 52' 14.4100"
Elevation: 272.9
Elipsoid Elev: 166.4 S
Horz. Datum: NAD83
Vert. Datum: NAVD88

Displaced Threshold

Latitude:
Longitude:
Elevation:
Elipsoid Elev:
Horz. Datum: NAD83
Vert. Datum: NAVD88

Landing Strip**Rwy Number: 01L**

Status: A Survey: 8

Markings: PIR-G

Threshold

Latitude: N 38° 47' 51.8000"
Longitude: W 076° 52' 14.1300"
Elevation: 254.3
Elipsoid Elev: 147.7 S
Horz. Datum: NAD83
Vert. Datum: NAVD88

Displaced Threshold

Latitude:
Longitude:
Elevation:
Elipsoid Elev:
Horz. Datum: NAD83
Vert. Datum: NAVD88

RWY Survey:**Assoc. Fac:** MXK ILS**VGSI Lights**

Commissioned	Type	Thres Cross Ht	High Angle
Date: 11/10/1992	PAPI-4R	101.8	

Owner	Pilot Cntrl Freq
A	

DownWind Bar	Reference Point:
Elevation: Threshold:	Latitude: N 38° 49' 03.7600" Longitude: W 076° 52' 14.3600" Elevation: 269.9 Threshold: 2020.0

Config	Len	Owner	Com Dt	Pilot Cntl
SSALR		A		
HIRL		A		
TD ZONE		A		

Reference Point:	Config	Len	Owner	Com Dt	Pilot Cntl
Latitude: N 38° 48' 10.1000" Longitude: W 076° 52' 14.2000" Elevation: 258.9 Threshold: 1850.0	SSALR		A		
DownWind Bar	HIRL		A		
TD ZONE	TD ZONE		A		

Associated APM:

<u>APM Ident</u>	<u>APM Procedure Type</u>
KADW19P	STRAIGHT-IN

GPS Procedures

Procedure

<u>Control</u>	<u>Description</u>	<u>Proc Type</u>	<u>Amendment</u>
6394	RNAV (GPS) RWY 19R	PROC/N	ORIG
6393	RNAV (GPS) RWY 01L	PROC/N	ORIG

SIAP

<u>Nav ID</u>	<u>Nav Type</u>	<u>Description</u>	<u>Amendment</u>	<u>Type</u>
ADW	VORTAC	TACAN RWY 19R	ORIG	A
MXK	ILS	ILS OR LOC RWY 19R	ORIG	A
RWS	ILS	ILS OR LOC RWY 1L	ORIG	A
RWSRW	NDB/C	NDB RWY 1L	ORIG	A
ADW	VORTAC	TACAN RWY 1L	ORIG	A

NON IFP SIAPS

<u>Nav ID</u>	<u>Nav Type</u>	<u>Description</u>	<u>Amendment</u>	<u>Type</u>
ADW	ASR	RADAR RWY 19R	NA	A
ADW	ASR	RADAR RWY 1L	NA	A
RWS	ILS	ILS RWY 1L (CAT II)	ORIG	A
MXK	ILS	ILS RWY 19R (CAT II)	ORIG	A

Date:12/02/08 16:07pm

*** ILS INQUIRY - ACTIVE ***

DATUMS Horz: NAD83 Vert: NAVD88

CTRY: US

AIRPORT: ANDREWS AFB

ARPT-ID: KADW

RWY: 19R

LCTN: CAMP SPRINGS

ST: MD

REG: EA

FIFO: ACY

OWN: F

*** AFIS DATA ***

*** AIRPORT DATA ***

ILS-ID	MXK	GS-ALN	3.00	OM-DIS	28996	FC-ALN	1.0 - 0.0	ARP-LAT	N38-48-38.90
APT-ID	KADW	GS-WID	0.70	RW-BRG	179.86	BC-ALN		ARP-LON	W076-52-01.30
TH-HGT	273	TH-DIS	1320	RW-LEN	9301	UPDATE-DIS	9301	FIELD-ELEV	280.3
RE HGT	254	TH-LAT	N38-49-23.73	COUNTRY-CODE	US	UPDATE-ELV_MLS	254.3	FLD-ELIP-ELEV	N38-49-23.73
RWY-ID	19R	TH-LON	W76-52-14.41	ACTIVE-FLAG	A	TH-ELLIP-HGT		TH-LON	W076-52-14.41
CAT	II	DME-DIS		LC-OFF		GEOID-SEP	106.5	TH-ELIP-ELEV	272.9
GS-LAT	N38-49-10.69	DME-OFF		LC-DIS	9257			RE-LAT	166.4 S
GS-LON	W076-52-14.37	DME HGT		LC-FCB	179.86			RE-LON	N38-47-51.80
GS-HGT	262	FREQ	111.500	LC-BCB	359.86			RE-ELEV	W076-52-14.13
GS-OFF	L1	MVAR	1995/W10	LC-WID	3.78			RE-ELIP-ELEV	254.3
								RWY-LGTH/WIDT	147.7 S
								DSPLCD-TH-DIST	9301/200
								DSPLCD-TH-LAT	
								DSPLCD-TH-LON	

*** LOCALIZER ***

(DFL CODE - ILS/L)

ANT LAT	N38-47-39.19	XMTR	DUAL	LOC-RE	1276/ 0.210	LCW-TAIL	YES	DSPLCD-TH-ELEV
ANT LON	W076-52-14.09	EQUIP-TYPE	TI	LOC-TH	10577/ 1.741	LCW-FT-TH	698	DISP-TH-ELIP-ELEV
ELEV	246.0	STBY-POWER	B	LOC-IM	11726/ 1.930	DATE-COMM	04/27/95	RWY-LDG-LGTH
ANT-TYPE	TRAV-WAVE	ESV	N	LOC-MM	14026/ 2.308	DATE-RECON		TDZ-ELEV
DUAL-FREQ	YES	RESTRICTED	N	LOC-OM		SURVEY-ACCY	8	FAR PART 139
US-DIST: FC	4747/ 18.0	BC		LOC-FAF		VOICE	NONE	Yes
CLRNC-CVG:FC	90/35 150/35	BC		MON-AL-WID	W 4.42 N 3.14	REC TYPE		
CKPT-DESC: FC	PUFFE INT/DCA R-079/ADW 6.0DME			BC				
LOC-WIDTH-MX-ALERT:	4.16/ 3.40	LOC-AL-MX-ALERT:	6uA	ROLLOUT:	S			
LOC-WIDTH-INITIAL:	4.30/ 3.26							

DECISION-HEIGHTS:

DH DIST/RALT

(100)	701	100
(150)	1655	157
(200)	0	0

*** GLIDE SLOPE ***

(DFL CODE - ILS/G)

ELEV	267.1	XMTR	DUAL	DIST-TH-PT-C	637.7/ 0.105	GS-ANT-OFF	L475	PERFORMANCE-CLASS
ANT-TYPE	CAP-EFF	EQUIP-TYPE	TI	GS-TH	1320 / 0.217	MON-AL-ANG	H 3.30/L 2.78	FPC PUBLISHED
CL-ELEV-ABM	270.3	FREQ	332.900	GS_IM	2469/ 0.406	DATE-COMM	05/03/96	
RDH	58.0(58.20)	ESV	N	GS-MM	4769/ 0.785	DATE-RECON		
ELEV-FOR-CALC	CROWN	RESTRICTED	N	GS-OM		SURVEY-ACCY	8	
AFIS-CORDS	AIMING PT	GPI-TH	1110.1	GS-FAF		STBY-POWER		
ANT: LAT	N38-49-10.70	RPI-TH	1320.0	AIM-PT:LAT	N38-49-10.69	CBP-TH	S	
LON	W076-52-08.38			LON	W076-52-14.37			
GS-WID-MX-ALERT	.82/.58	GS-ANG-MX-ALERT	3.18/ 2.87					

GENERAL DATA:

YR/MVAR	1995/W10
ICAO	K
BC-STATUS	
MON-CAT	1
REM-MON	ADW ATCT
NFPO-PROCEDURES	110

*** OTHER-DME ***

DFL CODE - VTAC/T

CHAN	78X	DME-ANT-OFF	L1245	DME-DIS-FAF/CHKPT	6.0	ELEVATION	260
RESTRICTED	Y	DME-AER-DIST	5848	DME-GS-ABM-DIST	4528	DME-SER-DIST	-3453

A2.8

	* FAF *	* MIDDLE-MARKER *	* INNER-MARKER *	APL	A	P	Y	Z
LAT		N38-49-57.82	N38-49-35.09					
LON		W076-52-14.59	W076-52-14.60					
ELEV								
DIST-TH		3449/ 0.568	1149/ 0.189					
DIST-DIR-CL		R6	R12					
DATE-COMM		04/28/95	04/28/95					
DATE-RECON								
NAME/USE								
SURVEY-ACCY		8	8					
TAPELINE	0.0	249.9	129.4					
EARTH-CURVE	0.0	0.0	0.0					
MSL-ALTITUDE	0.0	520.8	399.8					
DFL CODE		ILS/MM	ILS/MI					

RESTRICTION:

ESV:

SIAPS:

<u>AirId</u>	<u>State</u>	<u>Description</u>	<u>Amdt</u>	<u>Type</u>	<u>AirId</u>	<u>State</u>	<u>Description</u>	<u>Amdt</u>	<u>Type</u>
KADW MD	ILS OR LOC RWY 19R		ORIG	A					

NON IFP PROCEDURES:

<u>AirId</u>	<u>State</u>	<u>Description</u>	<u>Amdt</u>	<u>Type</u>	<u>AirId</u>	<u>State</u>	<u>Description</u>	<u>Amdt</u>	<u>Type</u>
KADW MD	ILS RWY 19R (CAT II)		ORIG	A					

ASSOCIATED APPROACH PATH MONITOR

<u>Ident</u>	<u>Procedure Type</u>	<u>Associated Type</u>
KADW19P	STRAIGHT-IN	SECONDARY

REMARKS

COMM IAW 8240.47C 01/28/03 ARDH = 64.6 REF ELEV = 261.9 PROC TCH = 66.6 PROC GPI = 1270.4 BASED ON CROWN ELEV.

03/01/2000 NGS 405 SURVEY DATED 12/3/99

07/10/2007 ALL OM/ZOOTE LOM DATA REMOVED FROM DATASHEET PER EASTERN FLT PROCS TEAM (-20). NO LONGER USED ON APPROACH.

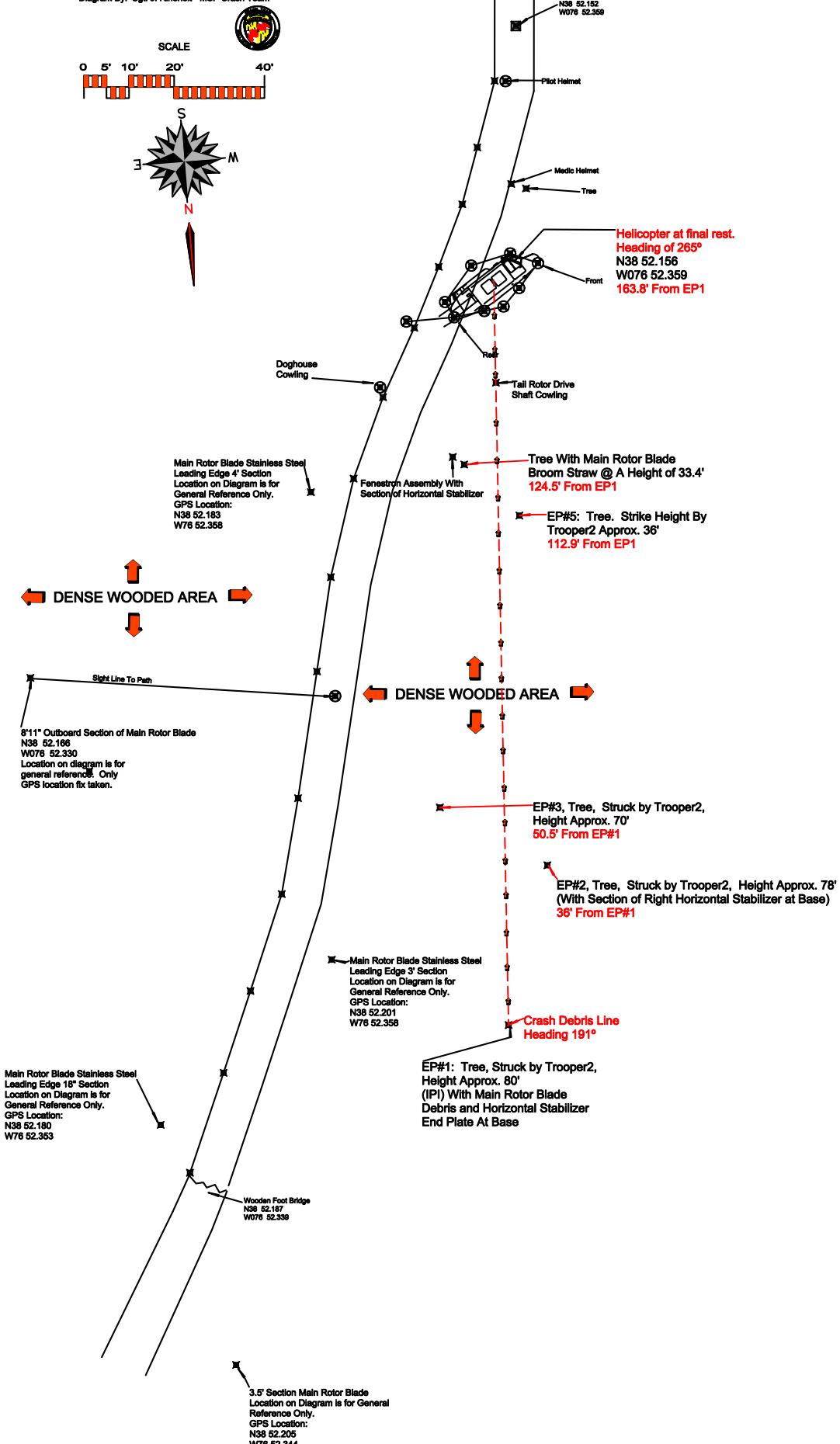
SAFETY ALERTS

Attachment 3: Wreckage Diagram

Wreckage Diagram

NTSB Case#: MIA08MA203

Date: Sept. 26, 2008
 Location: 6840 Walker Mill Regional Park
 District Heights,
 Prince George's Co., MD 20747
 MSP Case#: 08-40H-00061
 Diagram By: Sgt. J. Rinehart - MSP Crash Team



Attachment 4: ADW ASR-9 Radar Data for Accident Flight

Table A4.1: ADW ASR-9 radar data for N92MD accident flight on September 27, 2008

SAMPLE	HOURS	MINUTES	SECONDS	ALTITUDE (FT)	RANGE (NM)	ACP (COUNTS)
1	3	38	3.19	0	11.56	2388
2	3	38	12.4	900	11.31	2391
3	3	38	17.02	900	11.17	2393
4	3	38	21.61	900	11.03	2396
5	3	38	26.23	900	10.88	2397
6	3	38	30.97	900	10.72	2400
7	3	38	35.47	900	10.55	2402
8	3	38	40.06	900	10.39	2404
9	3	38	44.8	1000	10.23	2407
10	3	38	49.27	1000	10.08	2410
11	3	38	53.89	1100	9.92	2411
12	3	38	58.66	1100	9.77	2414
13	3	39	3.13	1100	9.61	2416
14	3	39	7.75	1100	9.44	2419
15	3	39	12.34	1100	9.28	2422
16	3	39	16.96	1100	9.13	2424
17	3	39	21.73	1100	8.95	2428
18	3	39	26.2	1100	8.78	2431
19	3	39	30.79	1100	8.63	2435
20	3	39	35.41	1100	8.45	2439
21	3	39	40.03	1100	8.28	2443
22	3	39	44.65	1100	8.11	2447
23	3	39	49.24	1100	7.94	2452
24	3	39	53.86	1100	7.78	2458
25	3	40	7.84	1400	7.3	2475
26	3	40	12.46	0	7.14	2480
27	3	40	21.67	1300	6.81	2493
28	3	40	26.29	1300	6.66	2500
29	3	40	30.79	1400	6.5	2509
30	3	40	35.5	1300	6.33	2516
31	3	40	40.12	1400	6.17	2525
32	3	40	44.74	1400	6.02	2534
33	3	40	49.36	1400	5.86	2543
34	3	40	53.95	1300	5.7	2554
35	3	40	58.72	1400	5.55	2564
36	3	41	3.34	1400	5.39	2575
37	3	41	7.96	1100	5.25	2587
38	3	41	12.43	1100	5.09	2599
39	3	41	17.17	1100	4.94	2613
40	3	41	21.79	1100	4.8	2626
41	3	41	26.26	1100	4.64	2641
42	3	41	31	1100	4.5	2659

43	3	41	35.77	1100	4.36	2676
44	3	41	40.39	1100	4.22	2697
45	3	41	44.98	1100	4.11	2720
46	3	41	49.45	1100	4.02	2746
47	3	41	54.35	1100	3.92	2771
48	3	41	58.97	1100	3.83	2799
49	3	42	8.33	1000	3.66	2855
50	3	42	12.95	1000	3.59	2884
51	3	42	17.54	1000	3.55	2914
52	3	42	26.78	1000	3.5	2976
53	3	42	31.4	1000	3.48	3007
54	3	42	36.29	1000	3.48	3037
55	3	42	40.91	900	3.48	3067
56	3	42	45.5	900	3.47	3097
57	3	42	50.12	900	3.44	3125
58	3	42	52.55	1000	4.25	1175
59	3	42	54.74	900	3.38	3152
60	3	42	59.33	900	3.34	3179
61	3	43	4.13	900	3.31	3208
62	3	43	8.72	900	3.3	3238
63	3	43	13.34	900	3.3	3266
64	3	43	17.96	900	3.31	3294
65	3	43	22.55	900	3.34	3322
66	3	43	27.32	900	3.38	3348
67	3	43	31.94	900	3.41	3376
68	3	43	36.53	900	3.44	3402
69	3	43	41.27	900	3.48	3428
70	3	43	45.77	900	3.52	3452
71	3	43	50.51	900	3.56	3477
72	3	43	55.1	900	3.61	3502
73	3	43	59.72	900	3.66	3526
74	3	44	4.34	900	3.72	3549
75	3	44	9.08	900	3.77	3571
76	3	44	12.56	900	4.69	2635
77	3	44	13.55	900	3.83	3593
78	3	44	18.32	900	3.89	3615
79	3	44	22.91	900	3.95	3634
80	3	44	27.53	900	4.03	3653
81	3	44	32.3	900	4.11	3672
82	3	44	36.77	900	4.19	3689
83	3	44	41.39	900	4.28	3708
84	3	44	46.13	900	4.38	3722
85	3	44	50.75	900	4.48	3735
86	3	44	55.34	900	4.58	3749
87	3	44	59.96	900	4.67	3763
88	3	45	4.58	900	4.75	3778

89	3	45	9.2	900	4.83	3792
90	3	45	13.82	900	4.94	3806
91	3	45	18.41	900	5.02	3819
92	3	45	23.18	900	5.11	3832
93	3	45	27.62	900	5.2	3845
94	3	45	32.39	900	5.3	3857
95	3	45	36.86	900	5.39	3870
96	3	45	41.45	900	5.48	3880
97	3	45	46.22	900	5.59	3891
98	3	45	50.84	900	5.69	3902
99	3	45	55.43	900	5.81	3911
100	3	46	5.00E-02	900	5.92	3920
101	3	46	4.67	900	6.03	3929
102	3	46	9.41	900	6.16	3937
103	3	46	13.88	900	6.27	3945
104	3	46	18.5	900	6.38	3952
105	3	46	23.12	900	6.5	3961
106	3	46	27.74	900	6.61	3969
107	3	46	32.33	900	6.72	3976
108	3	46	37.1	900	6.84	3983
109	3	46	41.69	900	6.95	3990
110	3	46	46.31	900	7.08	3993
111	3	46	50.78	900	7.2	3997
112	3	46	55.52	900	7.31	4002
113	3	46	59.99	900	7.42	4008
114	3	47	4.61	900	7.52	4014
115	3	47	9.23	900	7.59	4023
116	3	47	13.97	900	7.63	4033
117	3	47	18.59	900	7.61	4042
118	3	47	23.21	900	7.58	4050
119	3	47	27.68	900	7.53	4058
120	3	47	32.42	900	7.45	4064
121	3	47	37.04	900	7.36	4069
122	3	47	41.66	900	7.27	4071
123	3	47	50.87	900	7.05	4069
124	3	47	55.49	900	6.95	4064
125	3	48	0.11	900	6.84	4060
126	3	48	4.73	900	6.73	4056
127	3	48	9.32	900	6.66	4052
128	3	48	13.94	1000	6.55	4049
129	3	48	18.53	1000	6.47	4046
130	3	48	23.18	1100	6.38	4041
131	3	48	27.77	1100	6.3	4038
132	3	48	32.39	1100	6.22	4033
133	3	48	37.01	1100	6.14	4027
134	3	48	41.63	1100	6.06	4023

135	3	48	46.1	1300	5.98	4019
136	3	48	50.72	1400	5.91	4014
137	3	48	55.46	1400	5.83	4009
138	3	49	8.00E-02	1500	5.77	4003
139	3	49	4.67	1500	5.67	3998
140	3	49	9.29	1500	5.59	3994
141	3	49	13.91	1600	5.5	3988
142	3	49	18.35	1600	5.42	3981
143	3	49	23.12	1600	5.33	3974
144	3	49	27.59	1600	5.23	3966
145	3	49	32.33	1600	5.14	3959
146	3	49	36.83	1600	5.03	3953
147	3	49	41.42	1600	4.92	3949
148	3	49	46.04	1600	4.8	3946
149	3	49	50.66	1600	4.67	3942
150	3	49	55.28	1600	4.55	3939
151	3	49	59.87	1800	4.42	3935
152	3	50	4.49	1800	4.3	3932
153	3	50	9.11	1800	4.16	3927
154	3	50	13.7	1600	4.03	3925
155	3	50	18.32	1600	3.89	3928
156	3	50	22.94	1600	3.75	3936
157	3	50	27.53	1600	3.64	3952
158	3	50	32.3	1600	3.56	3972
159	3	50	36.92	1600	3.52	3997
160	3	50	41.51	1600	3.52	4025
161	3	50	45.98	1600	3.56	4051
162	3	50	50.87	1800	3.64	4073
163	3	50	55.34	1800	3.75	4089
164	3	51	8.00E-02	1800	3.89	3
165	3	51	4.58	1800	4.03	6
166	3	51	9.17	1900	4.16	6
167	3	51	13.91	1900	4.3	7
168	3	51	18.56	2000	4.44	8
169	3	51	23.15	2000	4.58	9
170	3	51	27.62	2000	4.72	10
171	3	51	32.36	2000	4.86	10
172	3	51	36.83	2000	5	11
173	3	51	41.6	2000	5.16	11
174	3	51	46.07	2000	5.3	11
175	3	51	50.66	2000	5.45	11
176	3	51	55.28	2000	5.61	11
177	3	52	5.00E-02	2000	5.75	11
178	3	52	4.52	2000	5.91	12
179	3	52	9.26	2000	6.06	11
180	3	52	13.88	2000	6.22	11

181	3	52	18.5	2000	6.38	12
182	3	52	23.09	2000	6.53	11
183	3	52	27.71	2000	6.7	12
184	3	52	32.33	2000	6.84	11
185	3	52	36.95	2000	7	11
186	3	52	41.54	2000	7.17	10
187	3	52	46.13	2000	7.33	10
188	3	52	50.75	2000	7.48	10
189	3	52	55.37	2000	7.64	10
190	3	52	59.99	2000	7.81	10
191	3	53	4.58	2000	7.97	13
192	3	53	9.2	2000	8.11	18
193	3	53	13.82	2000	8.25	25
194	3	53	18.29	2000	8.36	35
195	3	53	22.91	2000	8.44	45
196	3	53	27.65	2000	8.47	57
197	3	53	32.27	2000	8.48	66
198	3	53	36.89	2000	8.48	77
199	3	53	41.48	2000	8.48	87
200	3	53	46.1	2000	8.5	97
201	3	53	50.72	2000	8.52	107
202	3	53	55.16	2000	8.5	117
203	3	54	8.00E-02	2000	8.47	126
204	3	54	4.7	2000	8.42	136
205	3	54	9.17	2000	8.33	143
206	3	54	13.79	2000	8.22	148
207	3	54	18.38	2000	8.11	151
208	3	54	23.15	2000	7.98	151
209	3	54	27.74	2000	7.86	149
210	3	54	32.36	2000	7.73	145
211	3	54	36.98	2000	7.64	140
212	3	54	41.45	2000	7.53	135
213	3	54	46.22	2000	7.44	131
214	3	54	50.66	2000	7.34	127
215	3	54	55.28	2000	7.25	121
216	3	55	2.00E-02	2000	7.16	117
217	3	55	4.67	2000	7.06	112
218	3	55	9.11	2000	6.97	108
219	3	55	13.76	2000	6.88	105
220	3	55	18.35	2000	6.78	101
221	3	55	22.94	2000	6.69	98
222	3	55	36.8	1900	6.38	94
223	3	55	41.42	2000	6.27	93
224	3	55	46.01	2000	6.17	93
225	3	55	50.63	1900	6.06	92
226	3	55	55.25	1900	5.97	92

227	3	55	59.87	1900	5.88	91
228	3	56	4.31	1900	5.77	91
229	3	56	9.08	1900	5.67	90
230	3	56	13.52	1900	5.58	91
231	3	56	18.14	1900	5.47	90
232	3	56	22.91	1800	5.38	90
233	3	56	27.53	1800	5.27	89
234	3	56	32.15	1800	5.17	89
235	3	56	36.74	1800	5.08	88
236	3	56	41.36	1600	4.97	88
237	3	56	45.83	1600	4.88	87
238	3	56	50.57	1600	4.8	87
239	3	56	55.04	1600	4.69	86
240	3	56	59.63	1600	4.59	85
241	3	57	4.4	1600	4.52	84
242	3	57	8.87	1500	4.42	83
243	3	57	13.61	1500	4.34	83
244	3	57	18.23	1500	4.27	82
245	3	57	22.85	1400	4.2	81
246	3	57	27.44	1400	4.13	81
247	3	57	32.06	1400	4.06	81
248	3	57	36.68	1300	4	83
249	3	57	41.12	0	3.92	83
250	3	57	45.89	900	3.84	80
251	3	57	50.51	800	3.75	75

Attachment 5: ADS-B Data and Data Field Definitions

The N92MD Automatic Dependent Surveillance-Broadcast (ADS-B) data are available in electronic form as a comma-separated-variable file (Attachment 5 Supplement, N92MD.csv). The corresponding ADS-B data field definitions listed in Table A5.1 below were provided by the Johns Hopkins University Applied Physics Laboratory, which is located in Laurel, Maryland.

Table A5.1: ADS-B data field definitions.

Item	Description	Comment
1	CRABS Message Type	Internal Field
2	IntMessageType	Internal Field
3	SerializationVersion	Internal Field
4	SerializationLevel	Internal Field
5	Local Date	Date and time that report was recorded by CRABS system
6	Local MS	Milliseconds past midnight that report was recorded by CRABS system
7	Source Date	
8	Source MS	GPS seconds past midnight * 1000
9	Longitude	Longitude of ADS-B report
10	Latitude	Latitude of ADS-B report
11	Altitude Ft	Pressure altitude of ADS-B report
12	Speed Kts	Sqrt of (North velocity ^2 + East Velocity ^2)
13	Heading Degs	Direction of velocity vector
14	Ascent Rate Ft/Min	ADS-B report
15	Track ID	ICAO address of Aircraft
16	Aircraft ID	ADS-B report
17	Sensor ID	GBT SAC code that received the ADS-B report
18	Unique Key	Internal Field
19	ExtDataInfo LocalMS	Internal Field
20	ExtDataInfo GeoLocation	Internal Field
21	ExtDataInfo Port	Internal Field
22	ExtDataInfo Expected Type	Internal Field
23	ExtDataInfo Lcl USec this MS	Internal Field
24	ExtDataInfo PrePxByte	Internal Field
25	ExtDataInfo UAP	Internal Field
26	ExtDataInfo Physical Layer	Internal Field
27	Message Is Valid	Internal Field
28	FSPEC (HEX)	ASTERIX 33 FSPEC
29	Message Length	ASTERIX message length
30	Has Version Number	ADS-B report
31	Version Status	ADS-B report
32	Version Number	ADS-B report
33	Has Service Provider	ADS-B report
34	SAC	ADS-B report
35	SIC	ADS-B report
36	Has Link Tech Indicator	ADS-B report
37	Link 1090 1090 ES	ADS-B report
38	Link UAT	ADS-B report
39	Link VDL4	ADS-B report

40	Link Other	ADS-B report
41	Link Version	ADS-B report
42	Has Time Of Applicability	ADS-B report
43	Seconds Since Midnight	ADS-B report
44	Has Target Address	ADS-B report
45	Address Qualifier	ADS-B report
46	Address 24 Bit	ADS-B report
47	Has Int And Acc Params	ADS-B report
48	UTC Is Coupled	ADS-B report
49	NIC	ADS-B report
50	SIL Available	ADS-B report
51	SIL	ADS-B report
52	NAC Available	ADS-B report
53	NAC	ADS-B report
54	Position Is Estimated	ADS-B report
55	Velocity Is Estimated	ADS-B report
56	Has Lat & Lon	ADS-B report
57	Reported Latitude	ADS-B report
58	Reported Longitude	ADS-B report
59	Has Pressure Altitude	ADS-B report
60	Press Alt Resolution	ADS-B report
61	Pressure Altitude Ft	ADS-B report
62	Has Airborne Velocity	ADS-B report
63	Airborne Vel VV SRC	ADS-B report
64	Airborne Vel SO	ADS-B report
65	Airborne Vel NS	ADS-B report
66	Airborne Vel NS Vel	ADS-B report
67	Airborne Vel EW	ADS-B report
68	Airborne Vel EW Vel	ADS-B report
69	Airborne Vel UD	ADS-B report
70	Airborne Vel Vert Rate	ADS-B report
71	Has Surface Velocity	ADS-B report
72	Surf Vel Trk Hdg Valid	ADS-B report
73	Surf Vel Trk Hdg	ADS-B report
74	Surf Vel True Or Mag	ADS-B report
75	Surf Vel Grnd Trk Heading	ADS-B report
76	Surf Vel Ground Speed	ADS-B report
77	Has Mode 3A Code	ADS-B report
78	Mode 3A Code Valid	ADS-B report
79	Mode 3A Code	ADS-B report
80	Has Target ID	ADS-B report
81	Target ID	ADS-B report
82	Has Emitter Category	ADS-B report
83	Emitter Category	ADS-B report
84	Has Target Status	ADS-B report
85	Receiving ATC Services	ADS-B report

86	Is In IDENT Conditions	ADS-B report
87	Status Code	ADS-B report
88	Has Geometric Altitude	ADS-B report
89	Geometric Altitude	ADS-B report
90	Has Time of Msg Tx	ADS-B report
91	Time Of Msg Tx ns	ADS-B report
92	Precise TOMT	ADS-B report
93	Has Time of Msg Rx	ADS-B report
94	Time Of Msg Rx ns	ADS-B report
95	Precise TOMR	ADS-B report
96	TAMDAR Is Available	Internal Field
97	TAMDAR Data Quality	Internal Field
98	TAMDAR Temperature	Internal Field
99	TAMDAR Wind Speed	Internal Field
100	TAMDAR Wind Direction	Internal Field
101	TAMDAR Icing	Internal Field
102	TAMDAR Humidity	Internal Field
103	TAMDAR Turbulance	Internal Field
104	TAMDAR Aircraft Constant	Internal Field
105	TAMDAR Spare Long	Internal Field
106	TAMDAR Spare Long2	Internal Field
107	Target Category	ADS-B report
108	Surface Info	ADS-B report
109	NIC Available	Internal Field
110	NIC Rotation Offset	Internal Field
111	NIC Major Axis Meters	Internal Field
112	NIC Minor Axis Meters	Internal Field
113	NIC Vertical Axis Meters	Internal Field
114	NAC Available	Internal Field
115	NAC Rotation Offset	Internal Field
116	NAC Major Axis Meters	Internal Field
117	NAC Minor Axis Meters	Internal Field
118	NAC Vertical Axis Meters	Internal Field
119	CRC Test Result	Internal Field
120	Raw Data (Hex)	Raw data of ASTERIX 33 message

Attachment 6: N92MD Weight and Balance Table

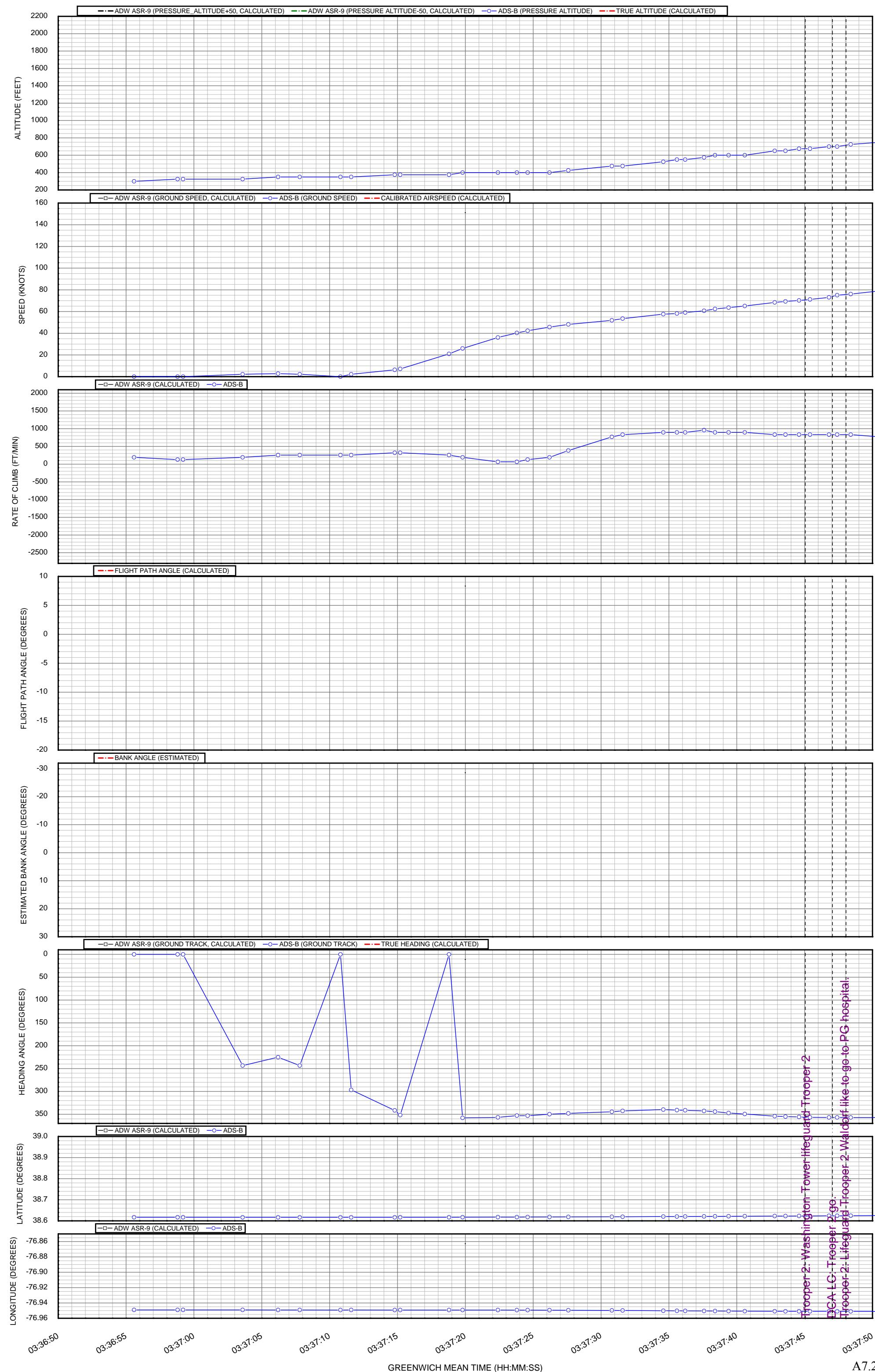
Figure A6.1: N92MD weight and balance table.

DAUPHIN WEIGHT / BALANCE AND PERFORMANCE TABLES SOUTHERN MARYLAND																																
AIRCRAFT	N92MD NoHoist	N1	DATE	09/27/08	Sat	SHIFT	LATE																									
PILOT	Mr. Bunker			MEDIC	TFC. Lippy																											
OTHER PILOTS		OTHER MEDICS	1		OAPs																											
TODAY'S MAX PRESSURE ALT (Ft):	500																															
TODAY'S MAX OUTSIDE AIR TEMP (C):	25																															
	25 C = 77 F																															
B/EW OVERRIDE	6407.3	MANUALLY ENTER BASIC EMPTY WEIGHT IF MASTER LIST HAS NOT BEEN UPDATED																														
MOMENT OVERRIDE	1030491.8	MANUALLY ENTER AC MOMENT IF MASTER LIST HAS NOT BEEN UPDATED																														
WEIGHTS LAST UPDATED	02/20/08																															
Hoist Removed				* Torque values have a coefficient of determination > 98%. Except for very hot, high, and heavy, most charted and predicted torque values will be within ± 1% of each other. T.O. charted values for CGs are with installed-aerotow chart values. Begin at 100.																												
SCENARIO 1-INITIAL CONFIGURATION																																
CATEGORY	WEIGHT POUNDS	ARM INCHES	MOMENT INCHES	FUEL WEIGHT GROUP 1	GROSS WEIGHT REPORT	CG REPORT	* MAX HOGE TORQUE																									
PILOT	260	11.80	1030491.8	900	900	8943	95	98	85																							
COPilot	210	21.92	152056	800	800	8743	295	93	82																							
PATIENT 1	0	21.79	0	700	700	8543	495	91	80																							
PATIENT 2	0	18.38	0	600	600	8343	695	88	77																							
PATIENT 3	0	18.80	0	500	500	8143	895	86	75																							
PATIENT 4	0	18.80	0	400	400	7943	1095	83	72																							
HOLDING WEIGHT	0	143.50	0	300	300	7743	1295	81	70																							
MESSAGE COMPT. (112 LBS)	112	208.30	233294																													
Medical Bag w/ P.A. (22 LBS)	122	137.8	188118	200	200	7543	1495	78	67																							
Chassis Weight (10 LBS)	32	77.60	2451.1																													
Other Equipment	0	0.00	0	100	100	7343	1695	76	65																							
TOTAL	745	198.32	112000																													
SCENARIO 2-																																
CATEGORY	WEIGHT POUNDS	ARM INCHES	MOMENT INCHES	FUEL WEIGHT GROUP 1	GROSS WEIGHT REPORT	CG REPORT	* MAX HOGE TORQUE																									
PILOT	260	11.80	1030491.8	900	900	9518	480	103	92																							
COPilot	0	21.92	0	800	800	9318	-280	100	89																							
PATIENT 1	0	18.38	0	700	700	9118	-80	98	87																							
PATIENT 2	0	18.80	0	600	600	8918	120	95	84																							
PATIENT 3	0	18.80	0	500	500	8718	320	93	82																							
PATIENT 4	0	18.80	0	400	400	8518	520	90	79																							
HOLDING WEIGHT	0	143.50	0	300	300	8318	720	88	77																							
MESSAGE COMPT. (112 LBS)	112	208.30	233294																													
Medical Bag w/ P.A. (22 LBS)	122	137.8	188118	200	200	8118	920	85	74																							
Chassis Weight (10 LBS)	32	77.60	2451.1																													
Other Equipment	0	0.00	0	100	100	7918	1120	83	72																							
TOTAL	776	198.36	112000																													
THE A/C IN SCENERO 1, BUT WITH ONLY A 260 LB. PILOT ON BOARD WILL BE WITHIN CG LIMITS AT ALL FUEL WEIGHTS.																																
					TIMES for Baltimore, MD. 2008 (Add 1 hour for Daylight Savings Time)																											
<ul style="list-style-type: none"> — CG ENVELOPE — T11 LIMIT — N2 LIMIT — SCENARIO 1 — SCENARIO 2 					<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2">CIVIL TWILIGHT TIMES: TODAY 9/27 TOMORROW 9/28</td> </tr> <tr> <td>BEGIN MORNING C</td> <td>0532</td> <td>0533</td> </tr> <tr> <td>END EVENING C.T.</td> <td>1821</td> <td>1820</td> </tr> <tr> <td>SUNRISE</td> <td>0559</td> <td>0600</td> </tr> <tr> <td>SUNSET</td> <td>1755</td> <td>1753</td> </tr> <tr> <td>MOONRISE</td> <td>0408</td> <td>0515</td> </tr> <tr> <td>MOONSET</td> <td>1657</td> <td>1720</td> </tr> <tr> <td>ILLUMINATION AT MIDNIGHT</td> <td>0.05</td> <td>0.01</td> </tr> </table>					CIVIL TWILIGHT TIMES: TODAY 9/27 TOMORROW 9/28		BEGIN MORNING C	0532	0533	END EVENING C.T.	1821	1820	SUNRISE	0559	0600	SUNSET	1755	1753	MOONRISE	0408	0515	MOONSET	1657	1720	ILLUMINATION AT MIDNIGHT	0.05	0.01
CIVIL TWILIGHT TIMES: TODAY 9/27 TOMORROW 9/28																																
BEGIN MORNING C	0532	0533																														
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SUNRISE	0559	0600																														
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MOONSET	1657	1720																														
ILLUMINATION AT MIDNIGHT	0.05	0.01																														

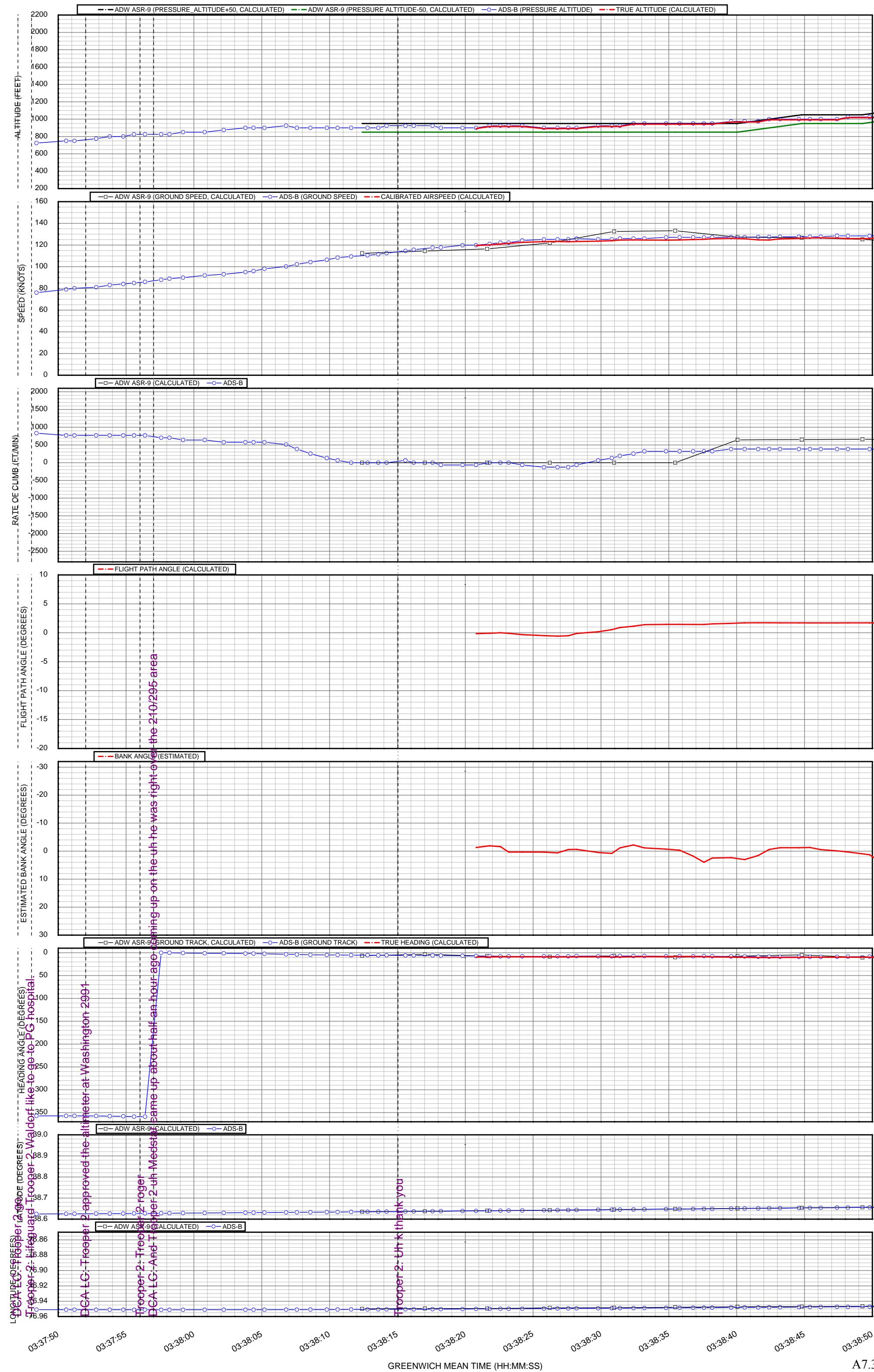
Weight Balance

Attachment 7: ASR-9, ADS-B, and ATC Transcript Plots

MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]

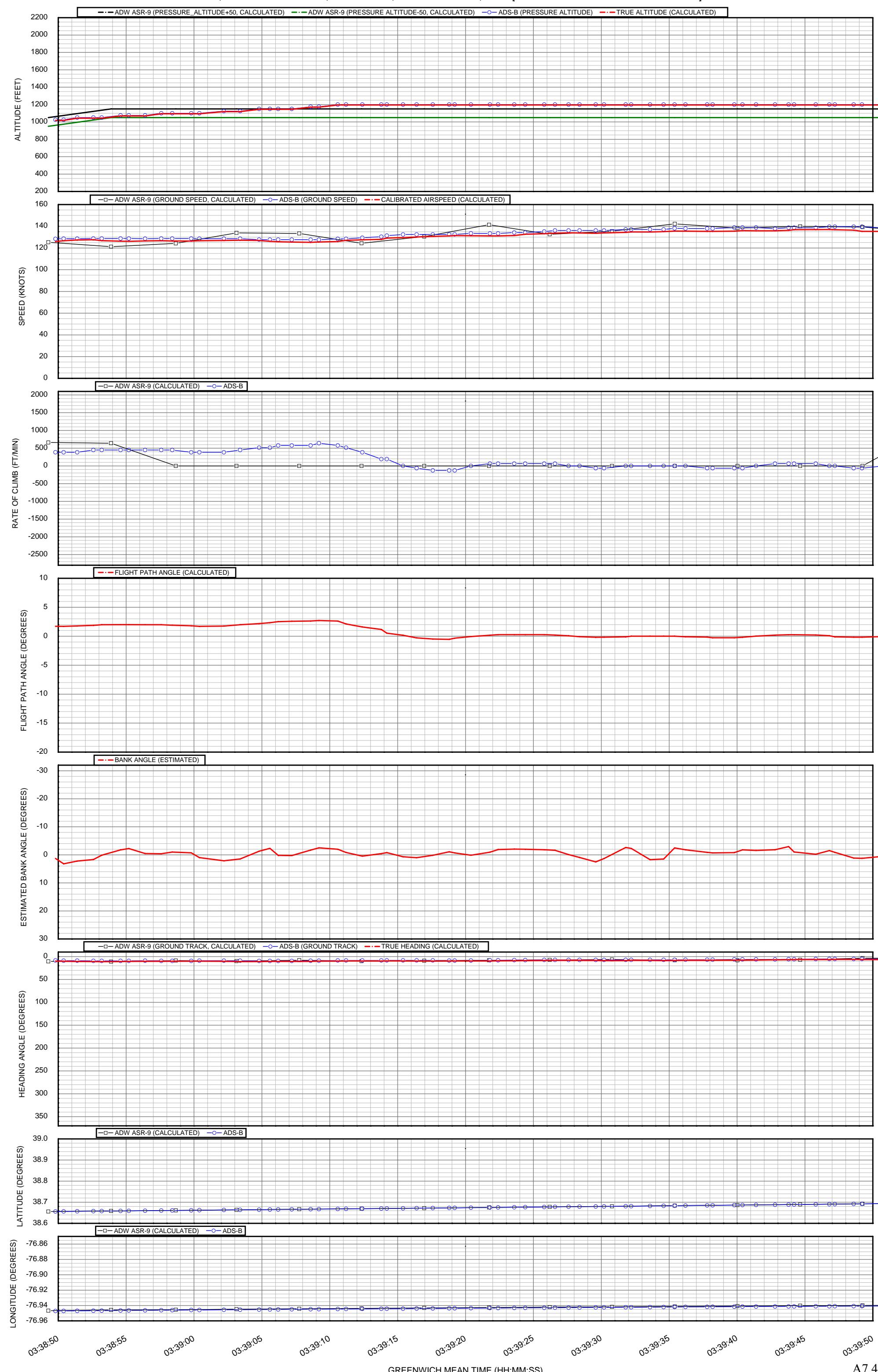


MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



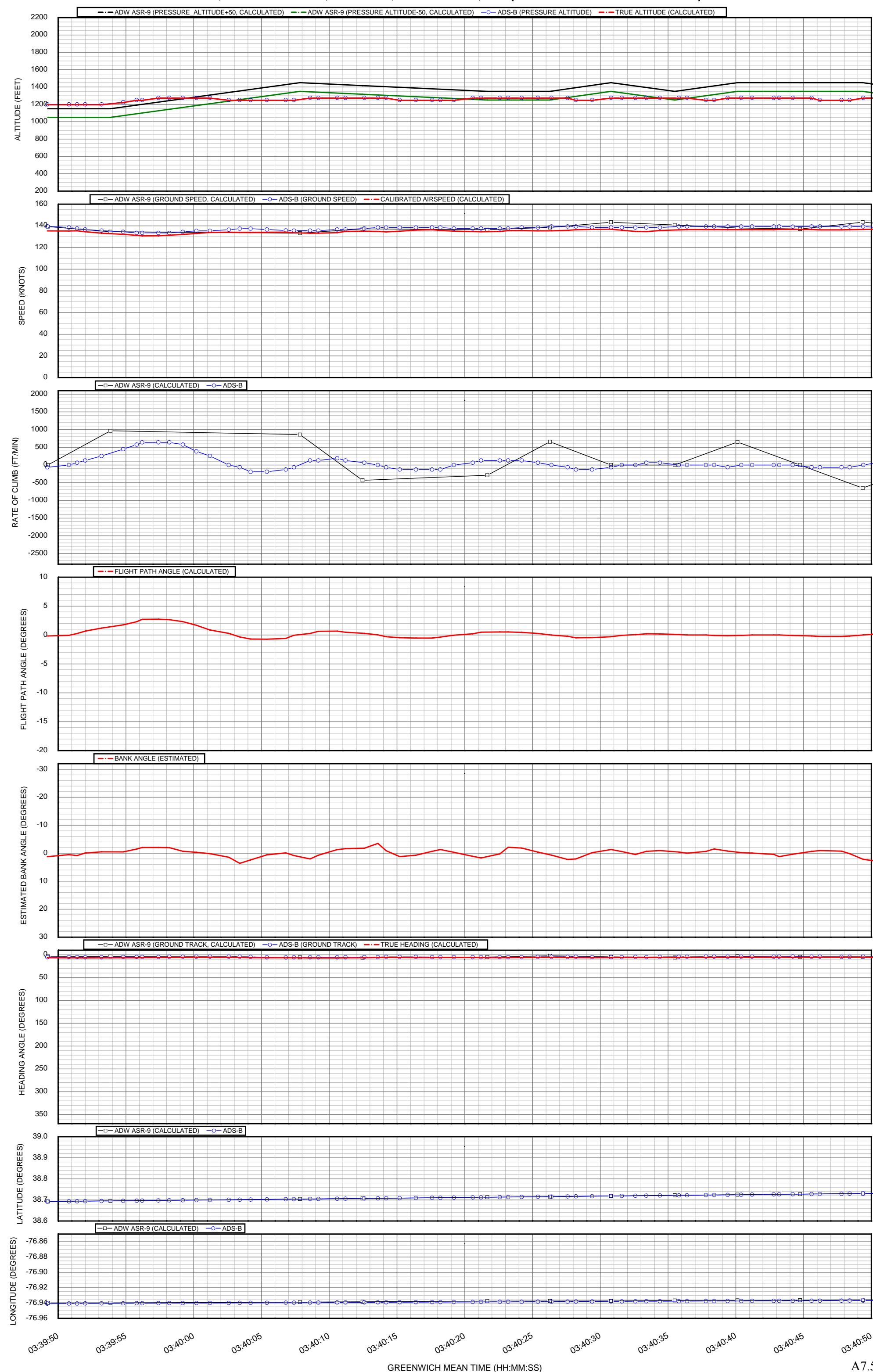
NATIONAL
TRANSPORTATION
SAFETY
BOARD

MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



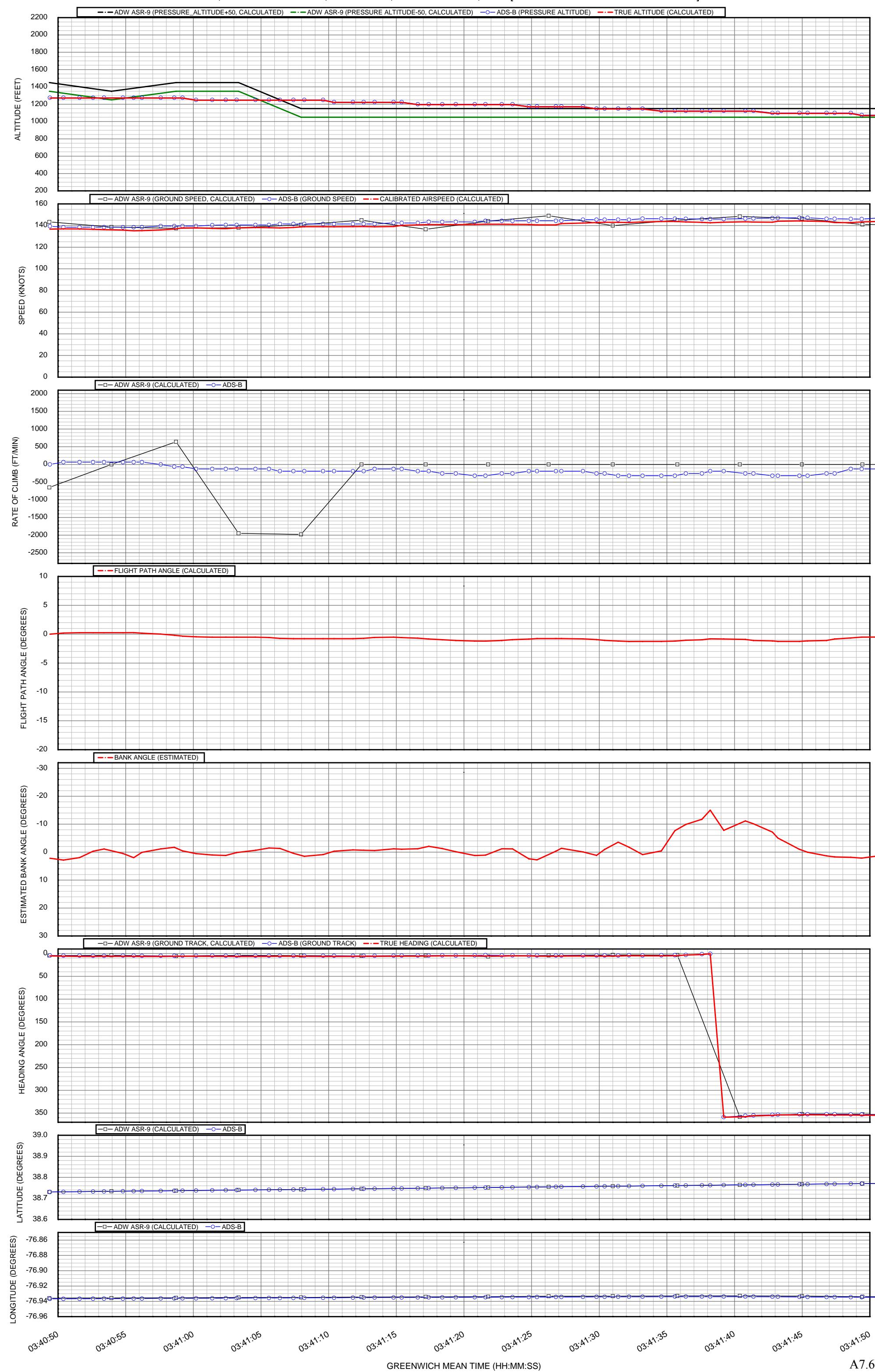
NATIONAL TRANSPORTATION SAFETY BOARD

MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



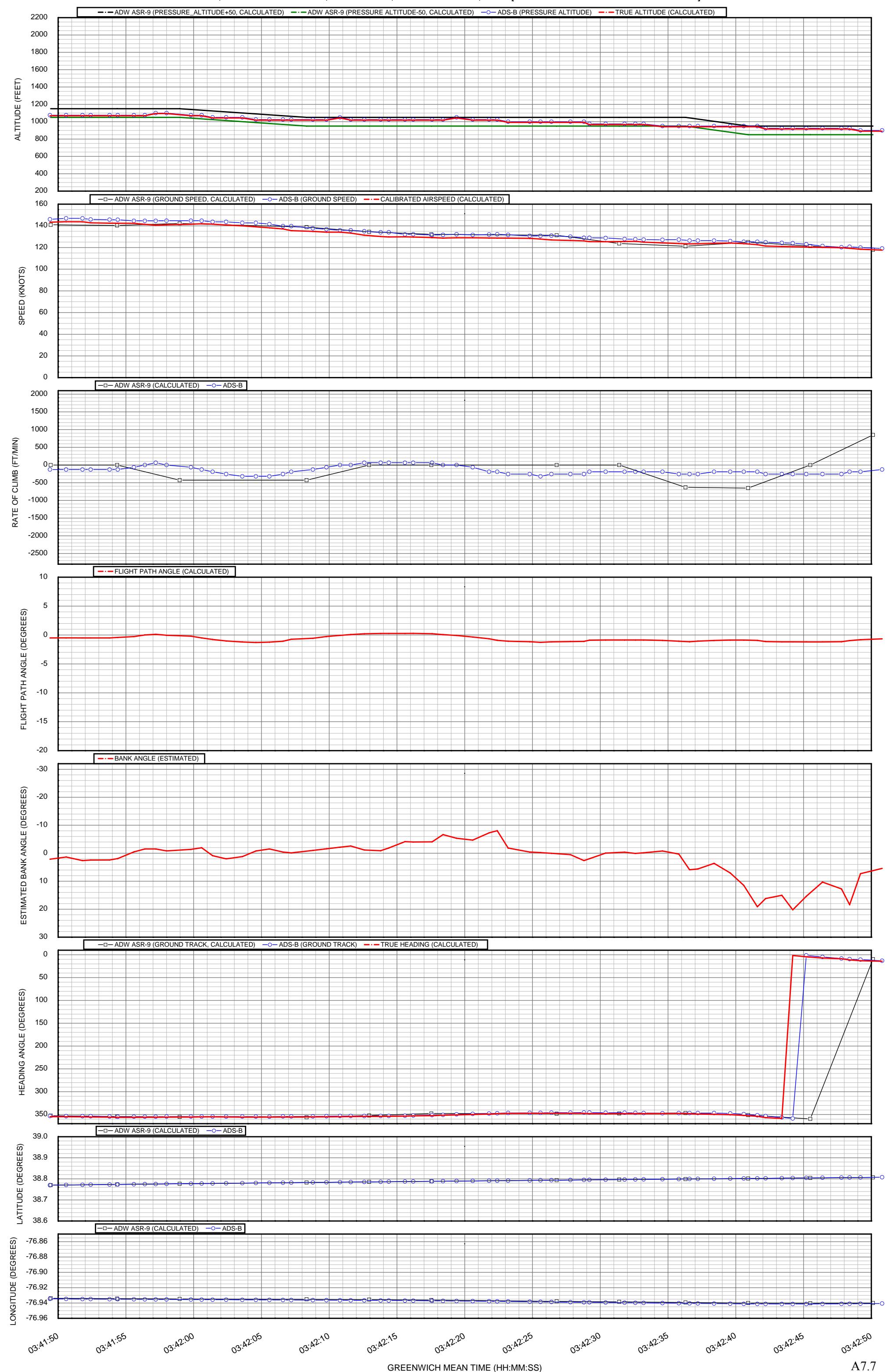
MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]

NATIONAL TRANSPORTATION SAFETY BOARD

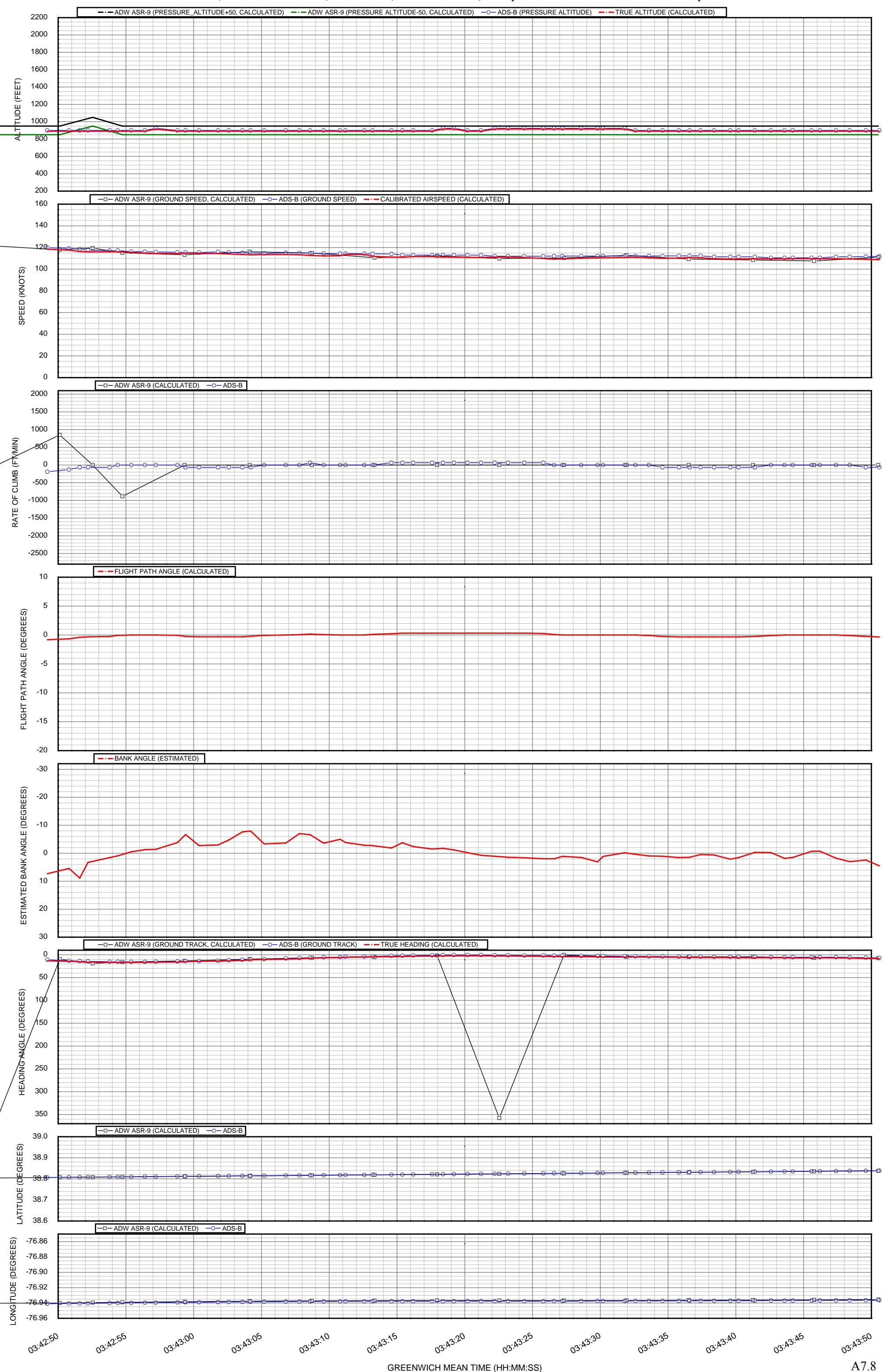


MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]

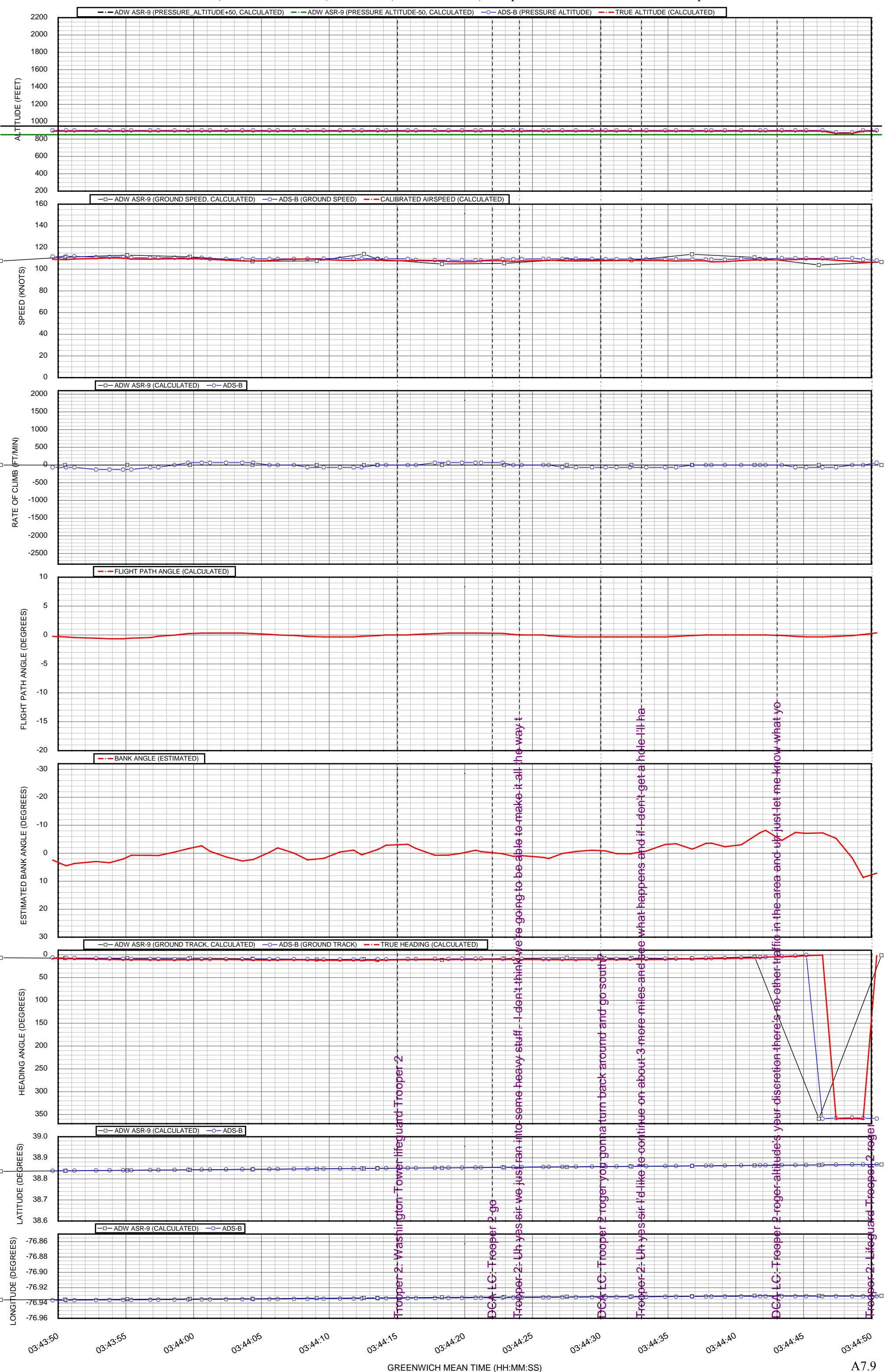
NATIONAL TRANSPORTATION SAFETY BOARD



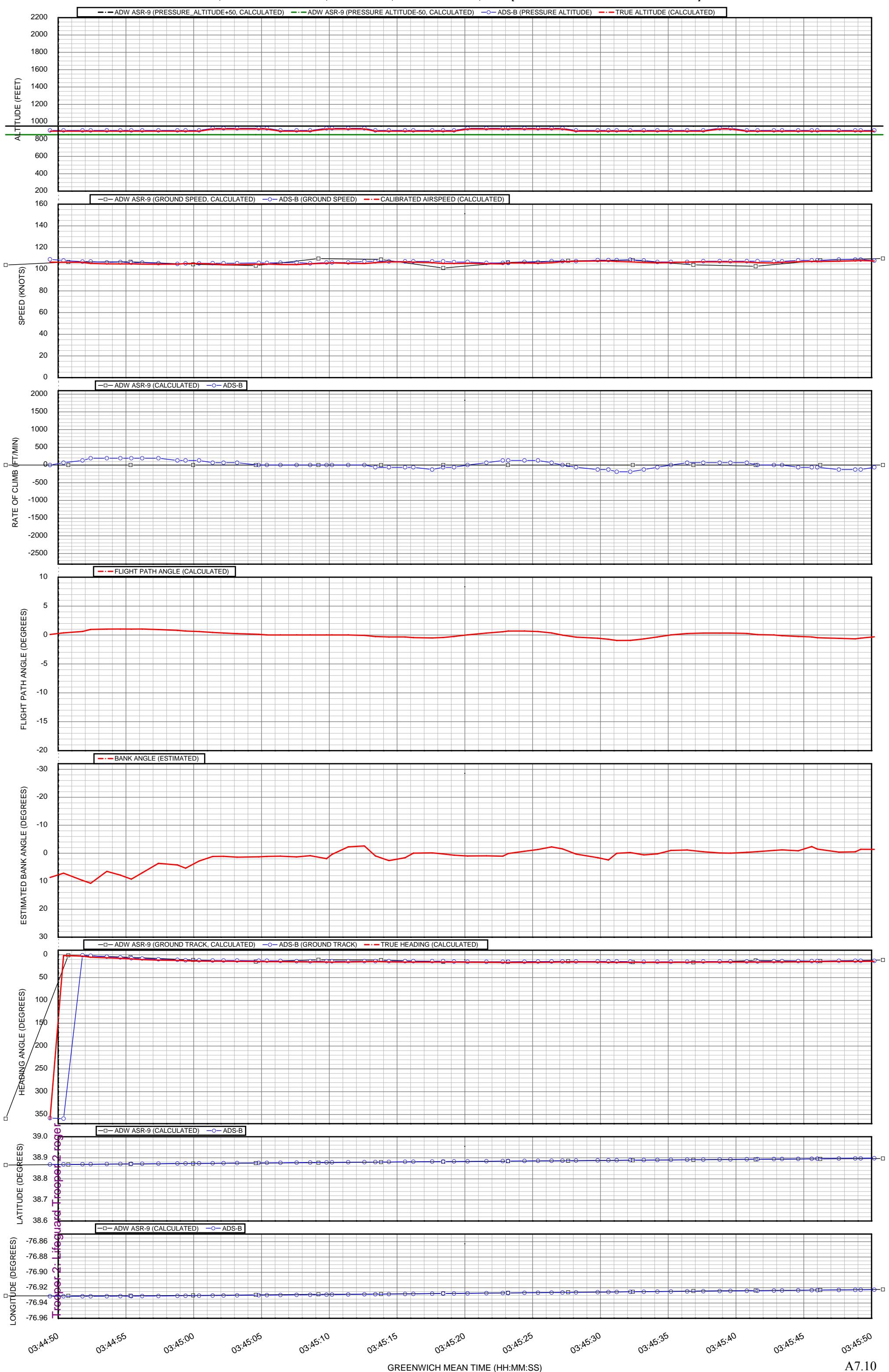
MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



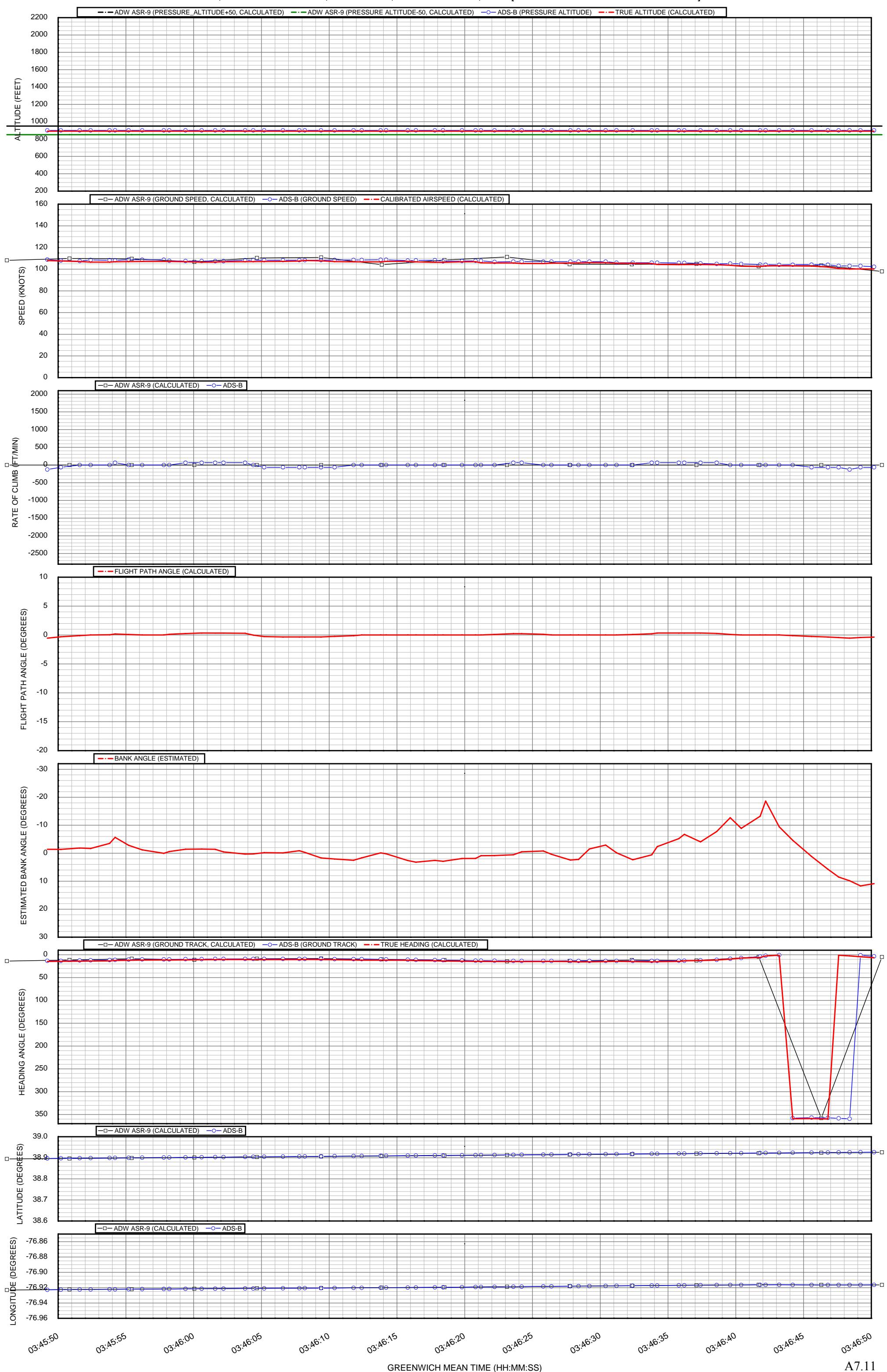
MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



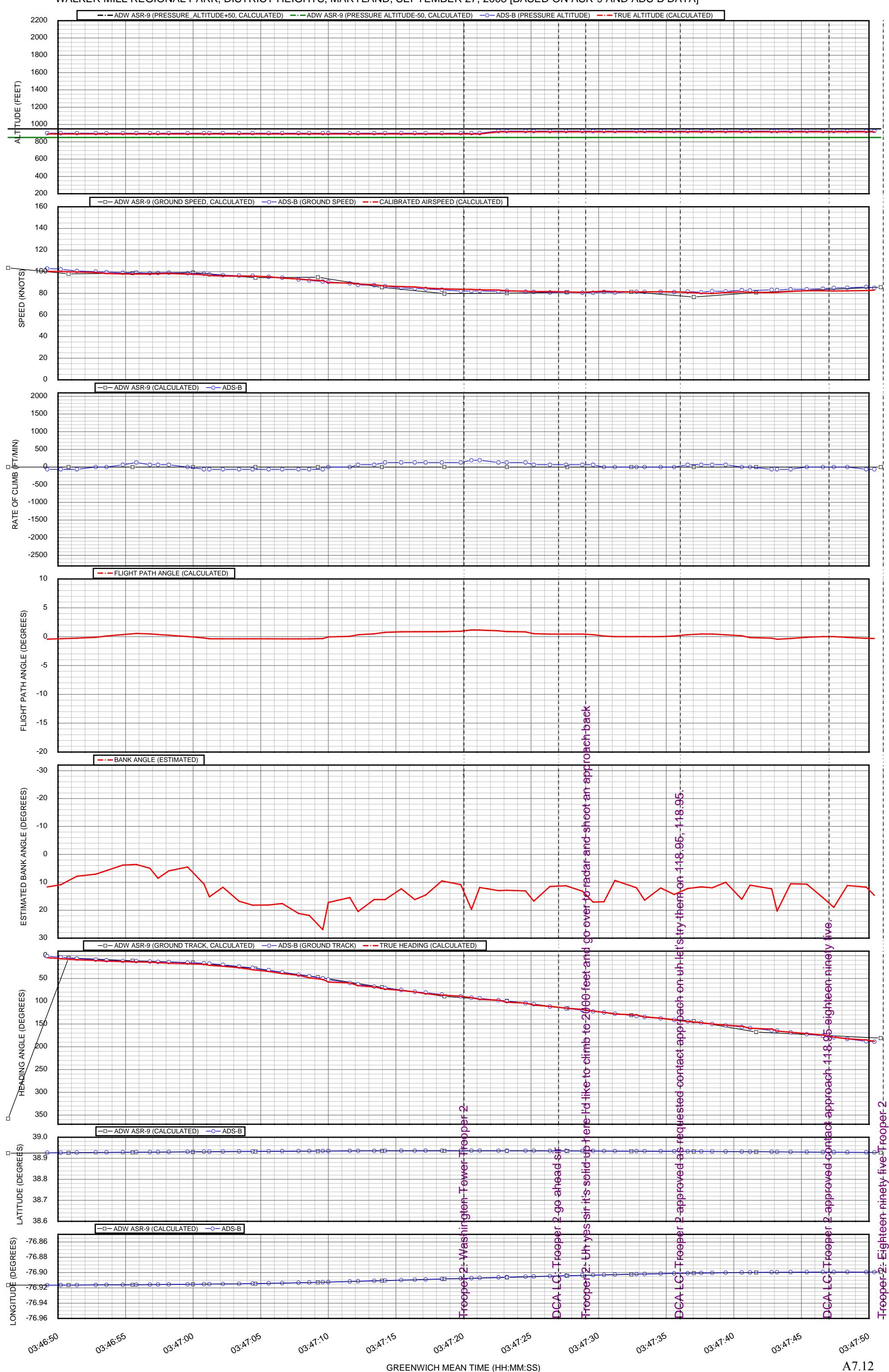
MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
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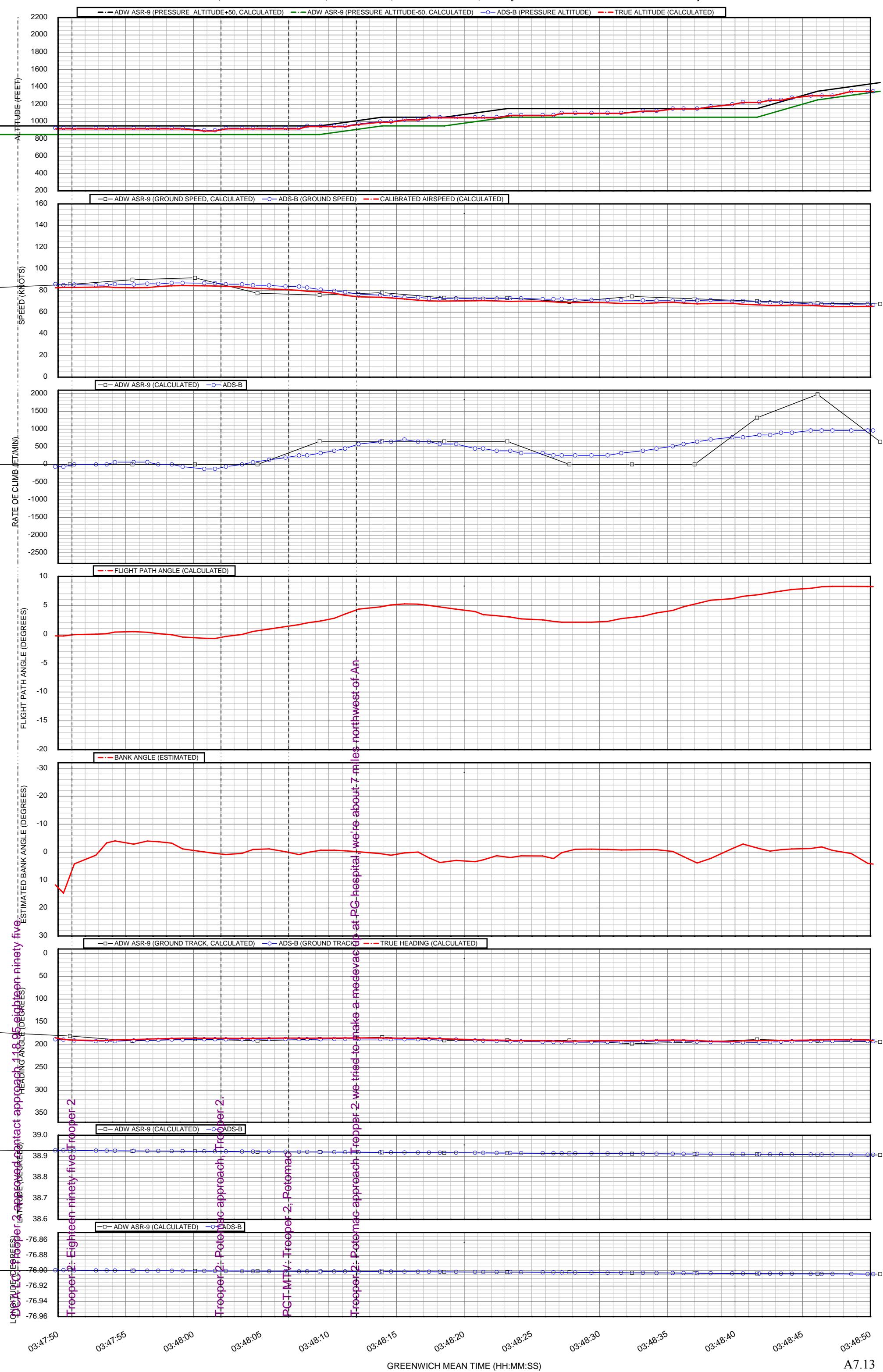
MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



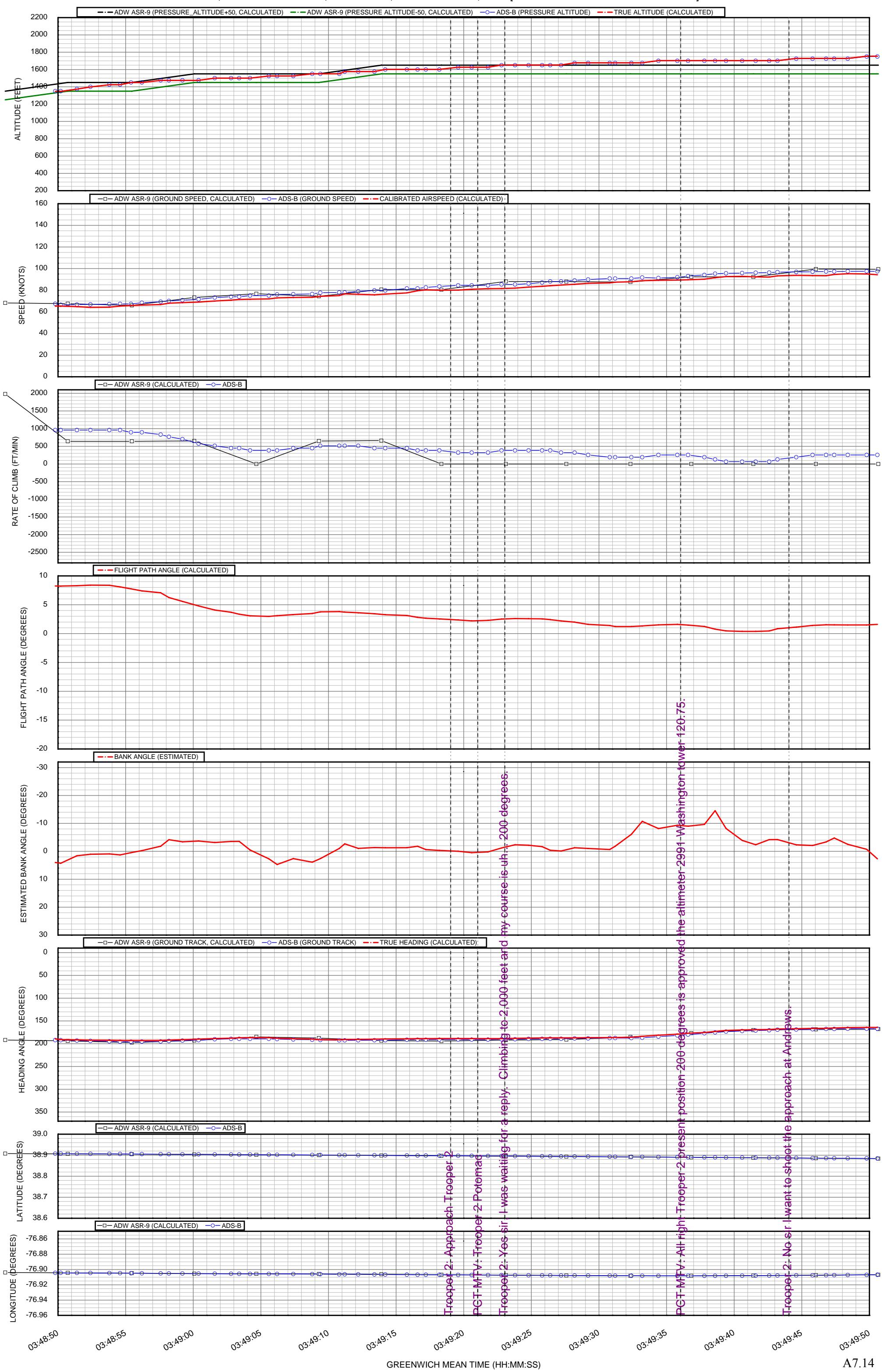
MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



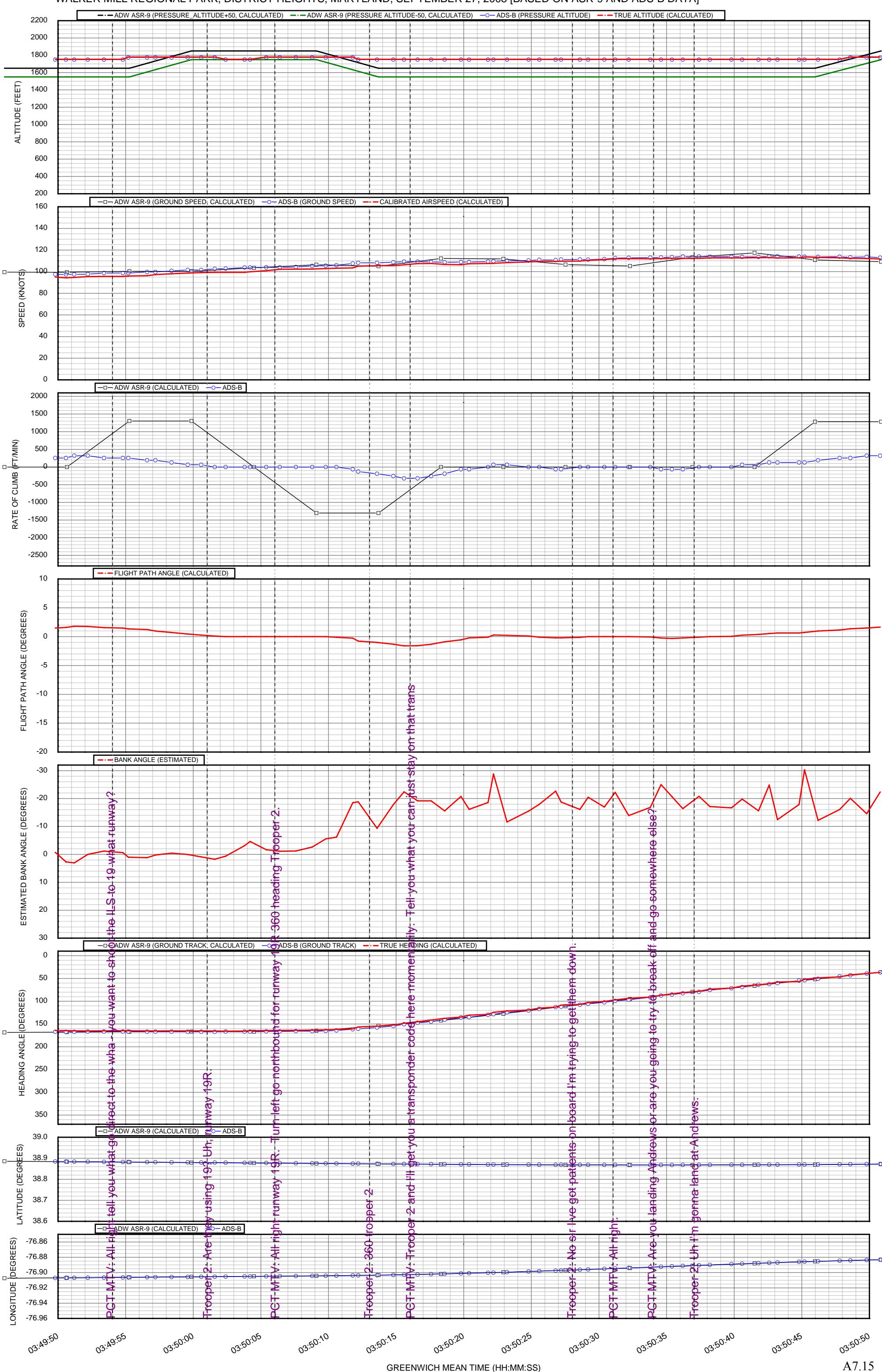
MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



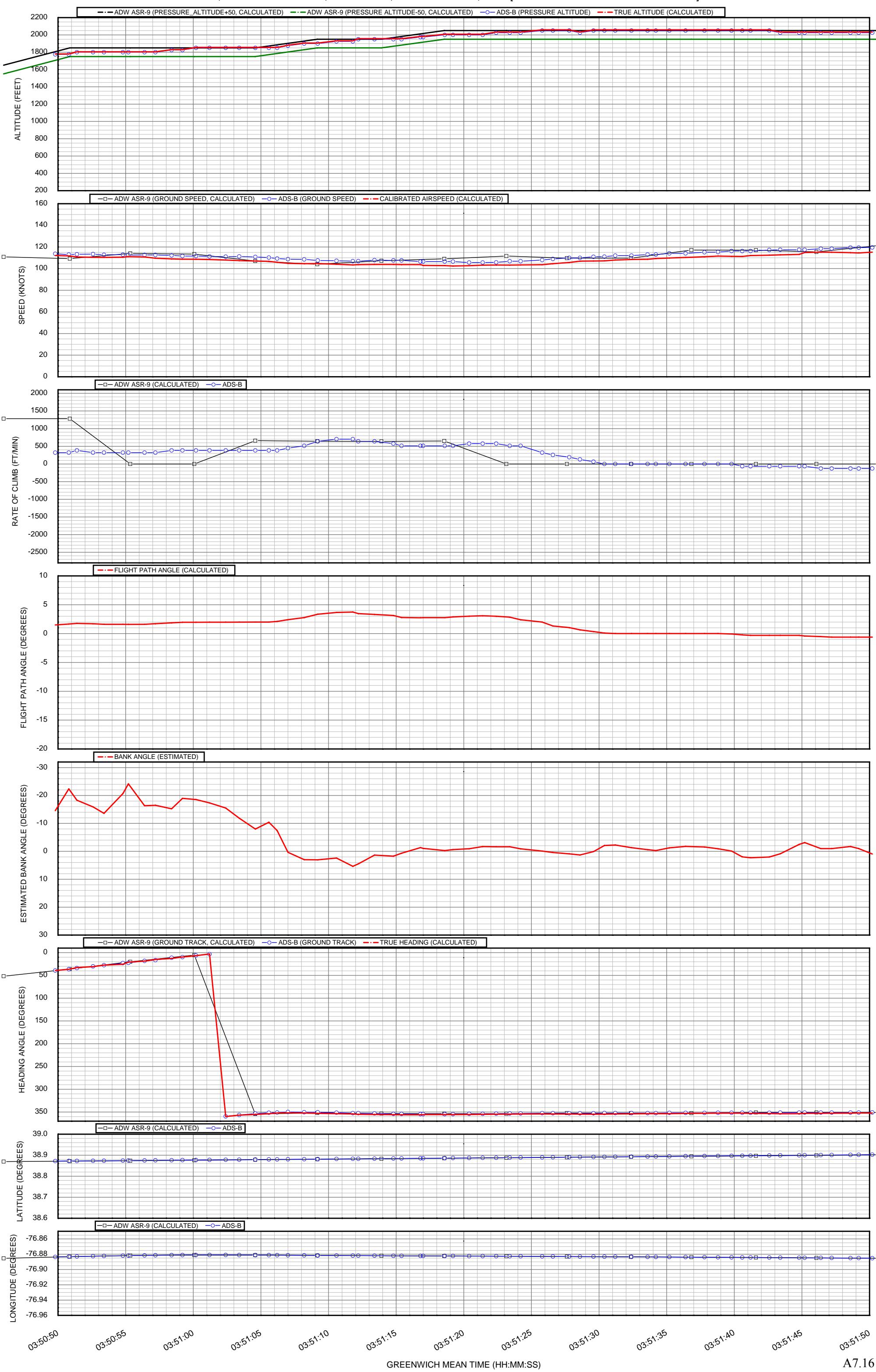
MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
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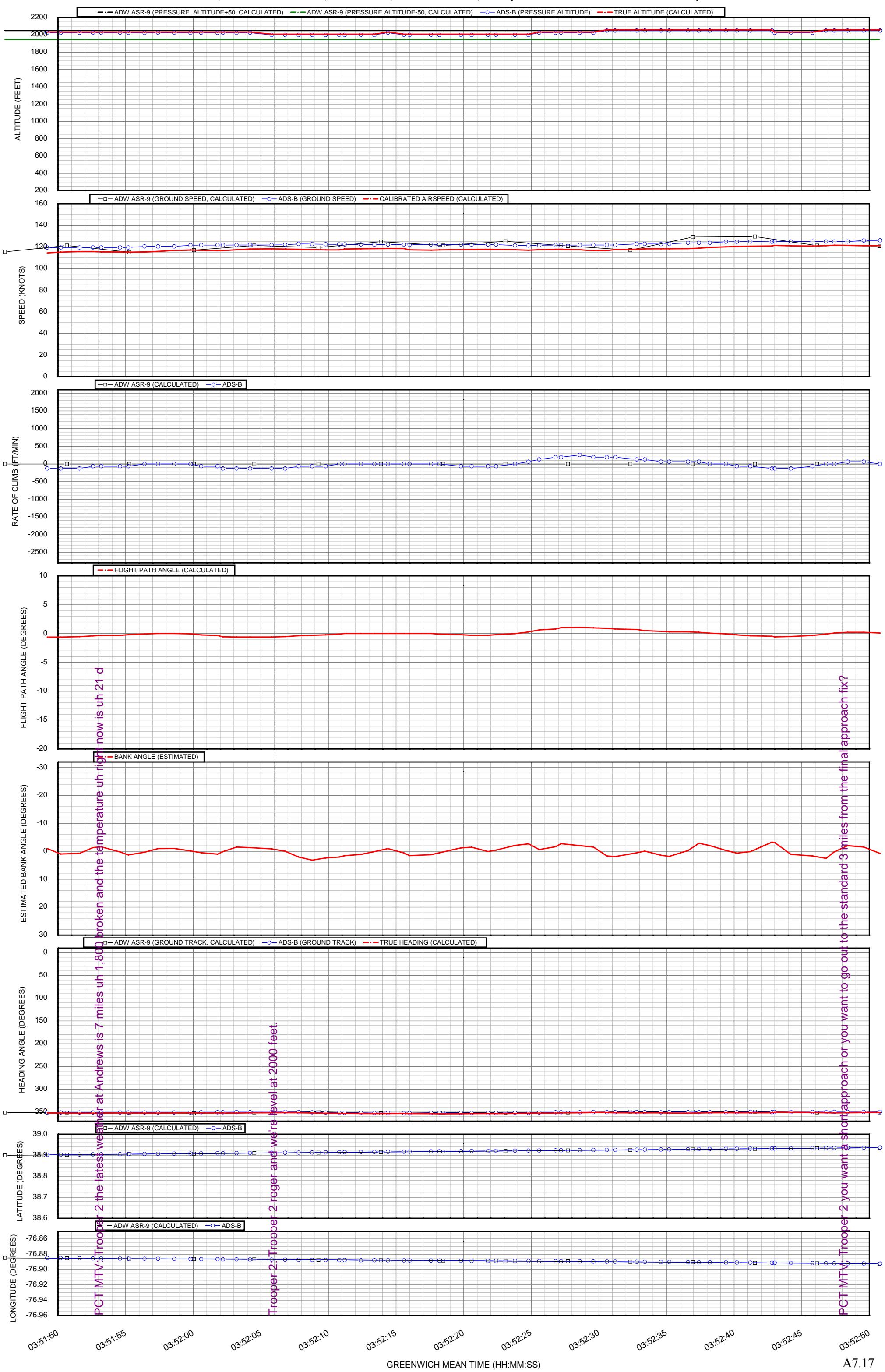
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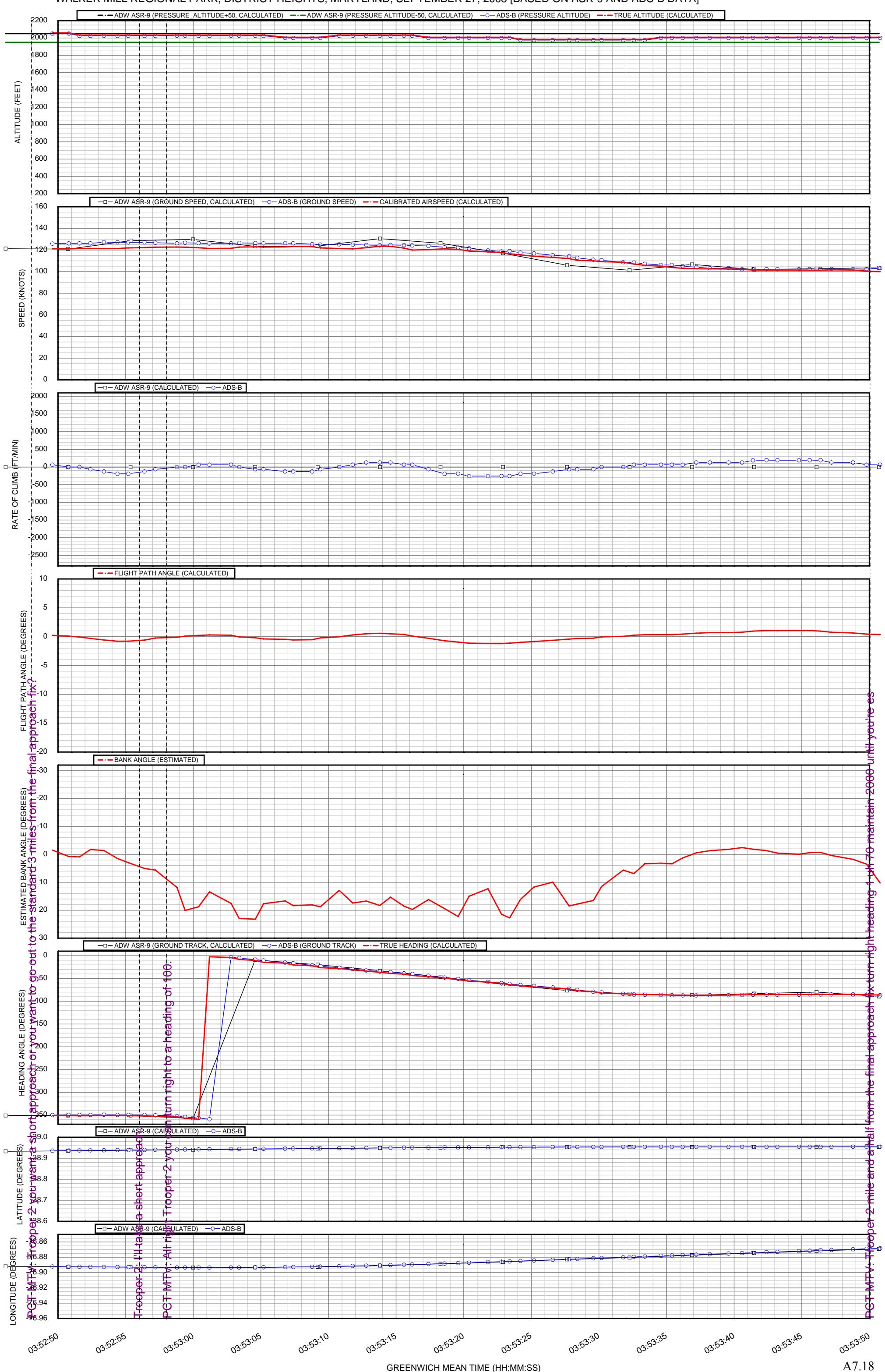
MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
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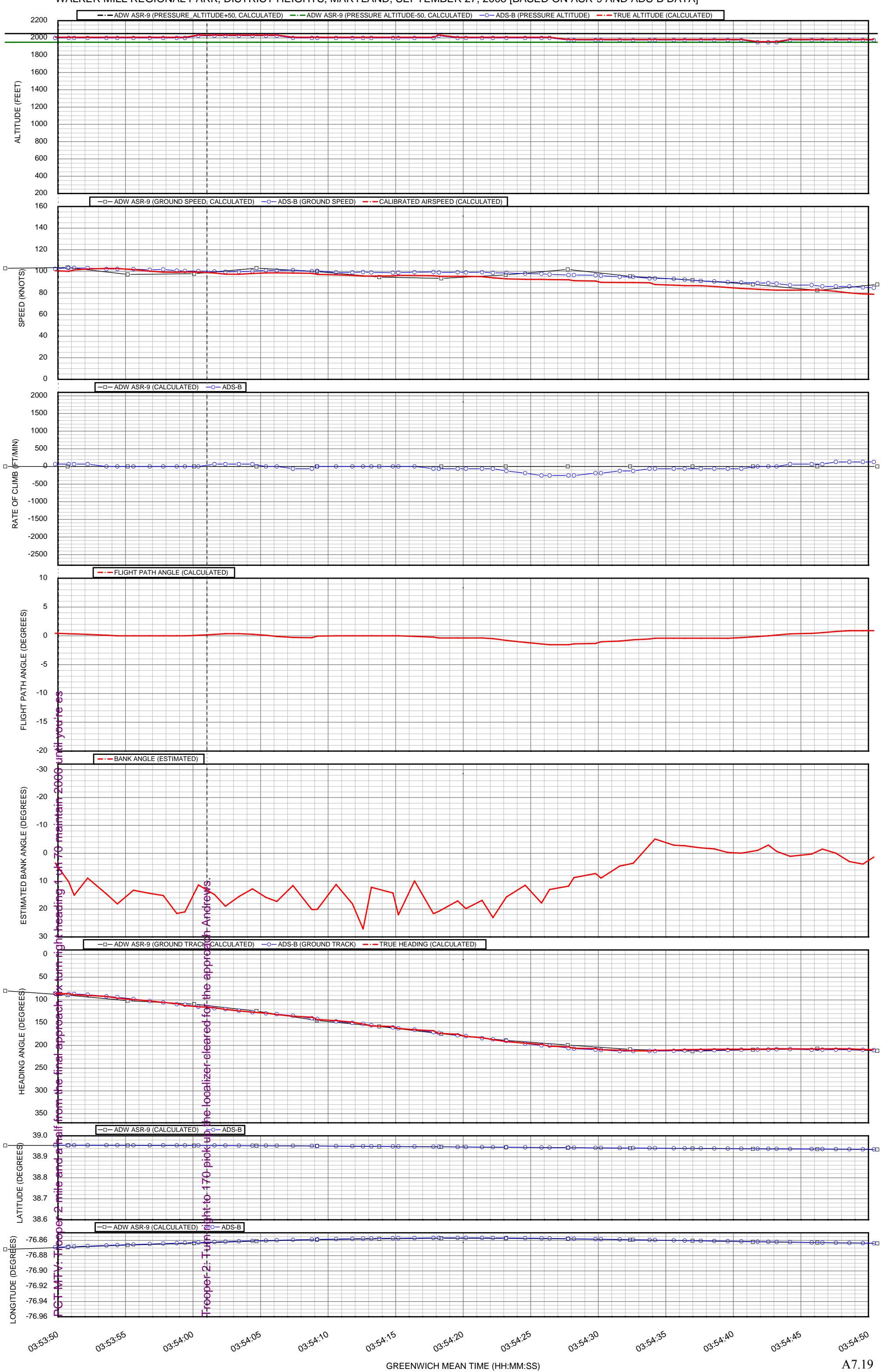
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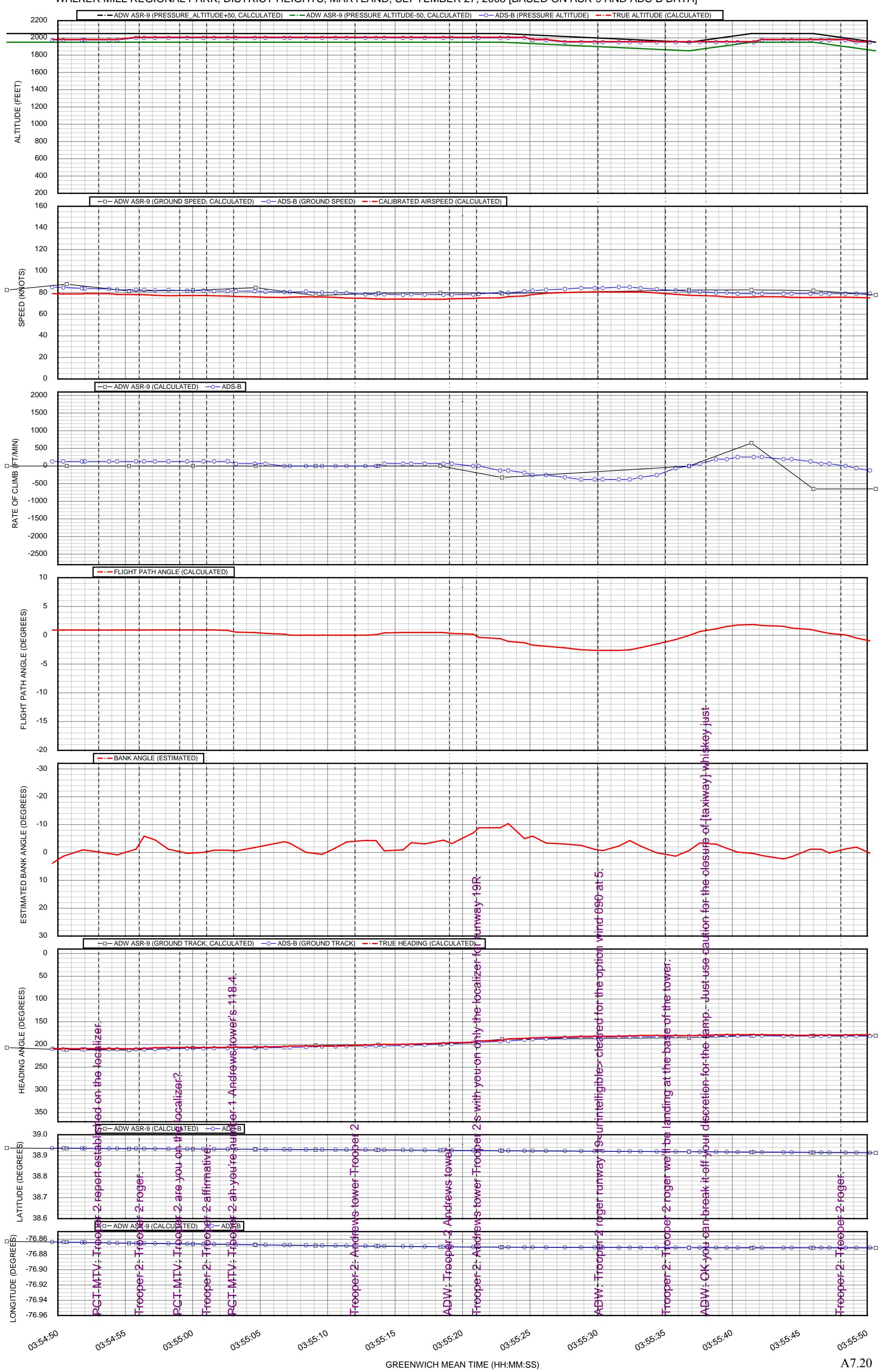
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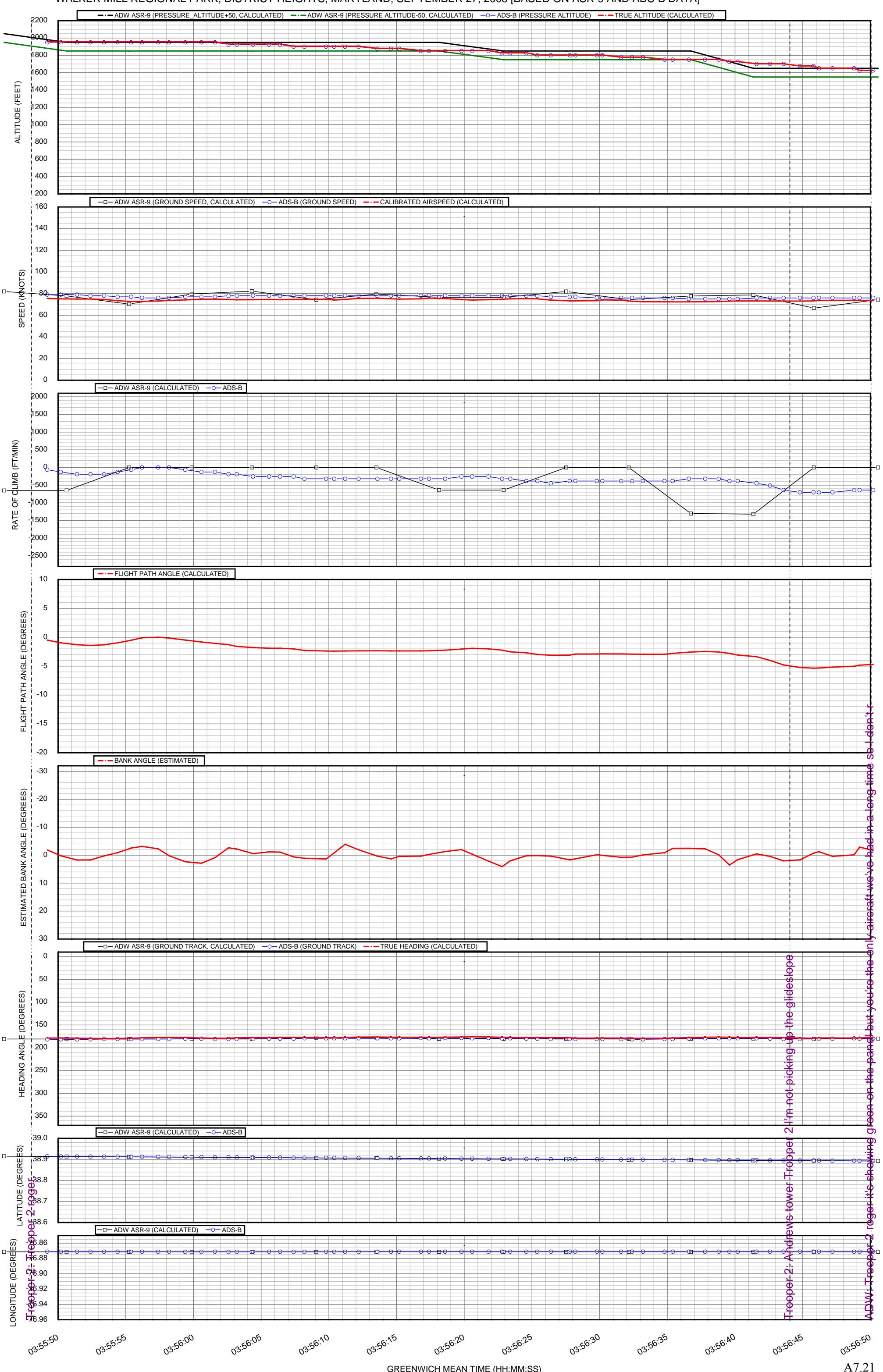
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WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



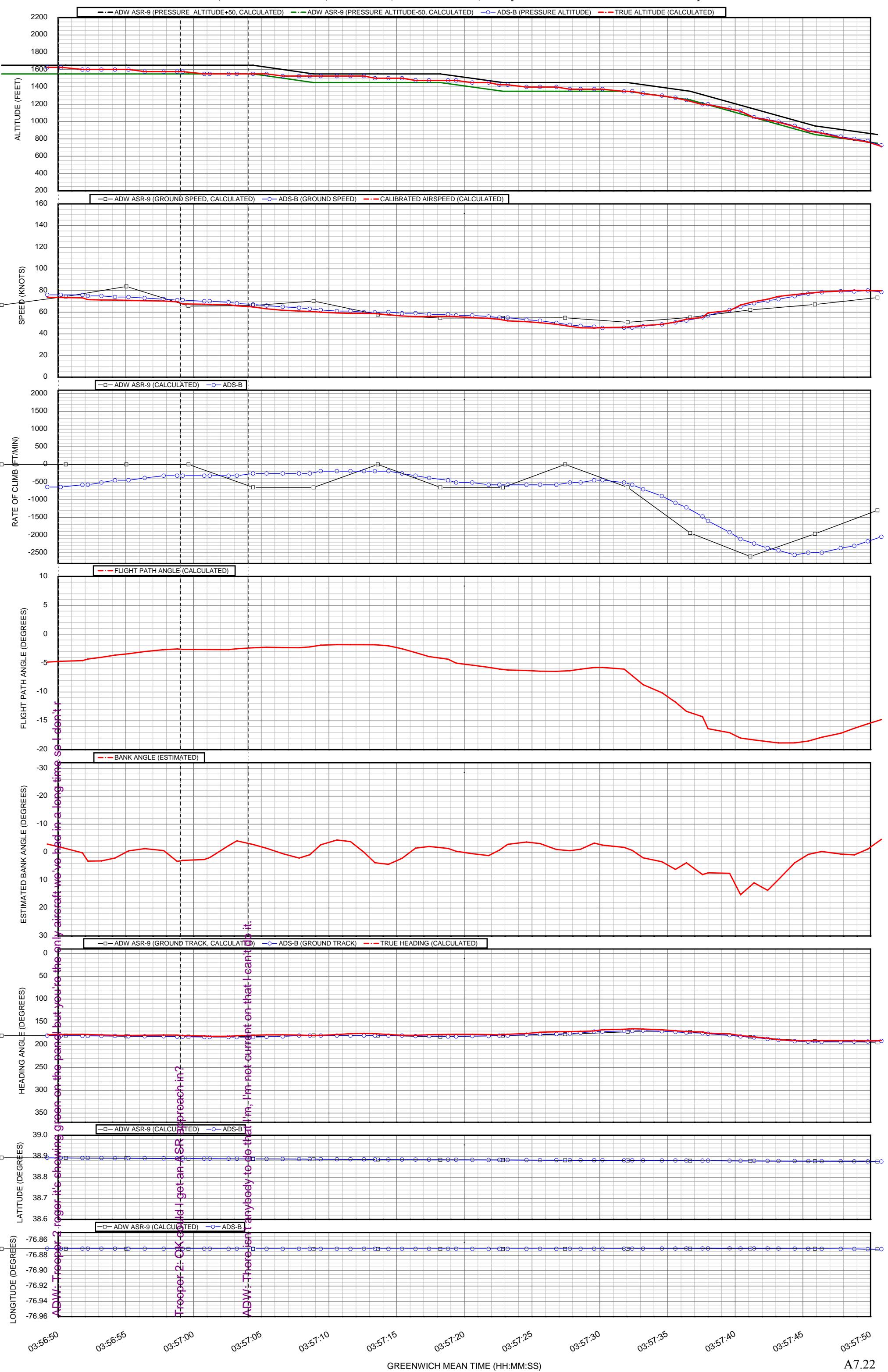
MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



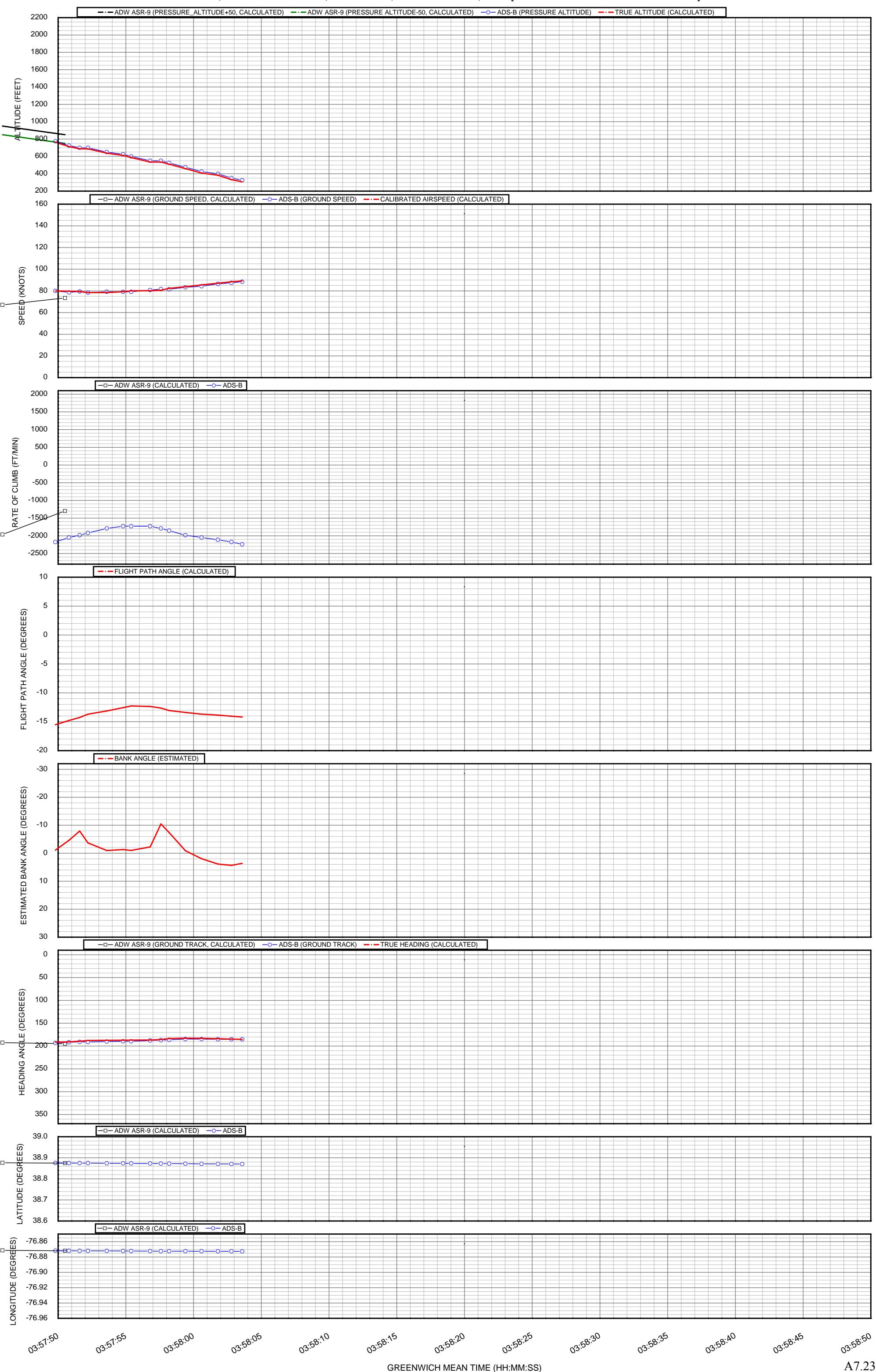
MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



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WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



MARYLAND STATE POLICE AEROSPATIALE (EUROCOPTER) AS365 N1 COLLISION WITH TERRAIN (N92MD)
WALKER MILL REGIONAL PARK, DISTRICT HEIGHTS, MARYLAND, SEPTEMBER 27, 2008 [BASED ON ASR-9 AND ADS-B DATA]



Attachment 8: Honeywell EGPWS Simulation Data

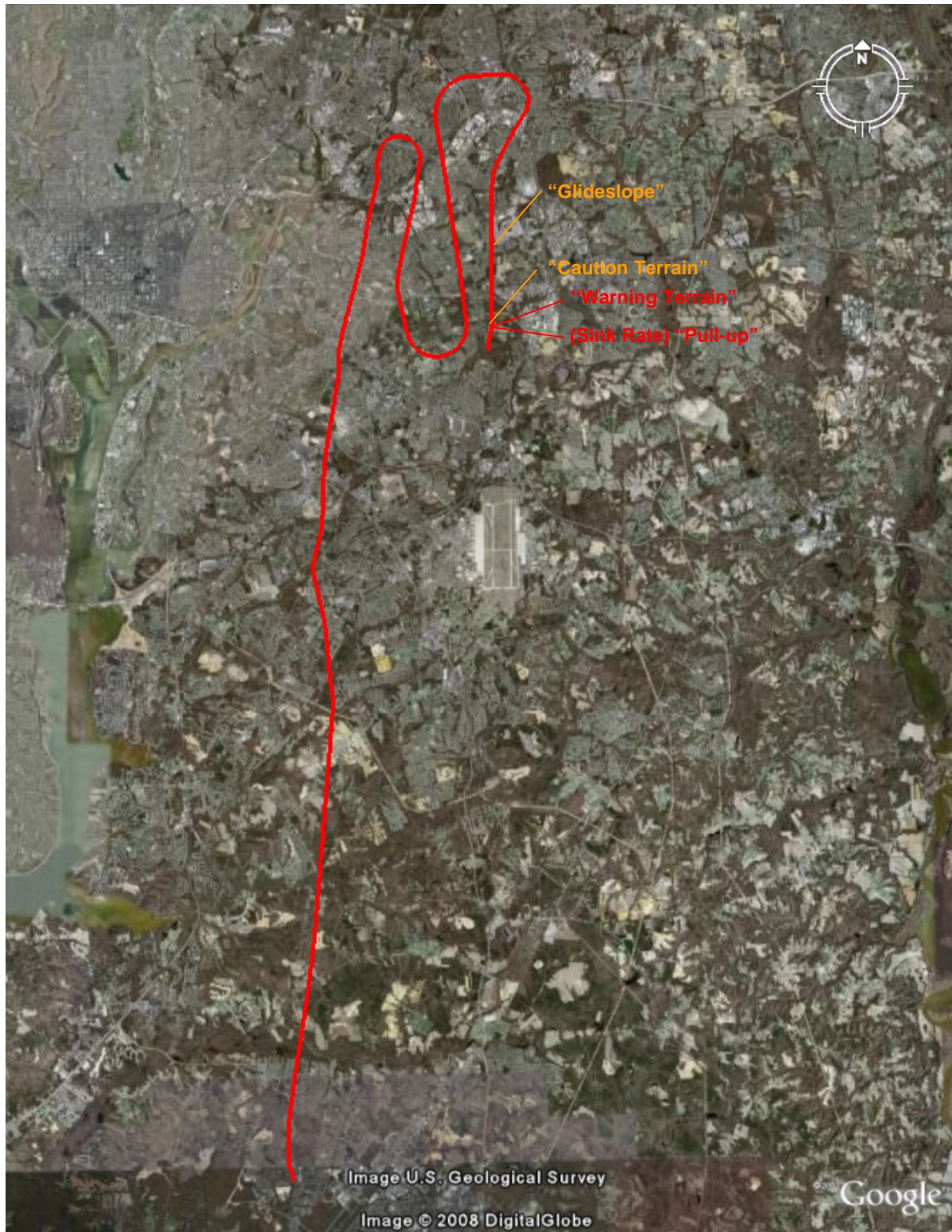
EMS Helicopter Accident in District Heights, MD

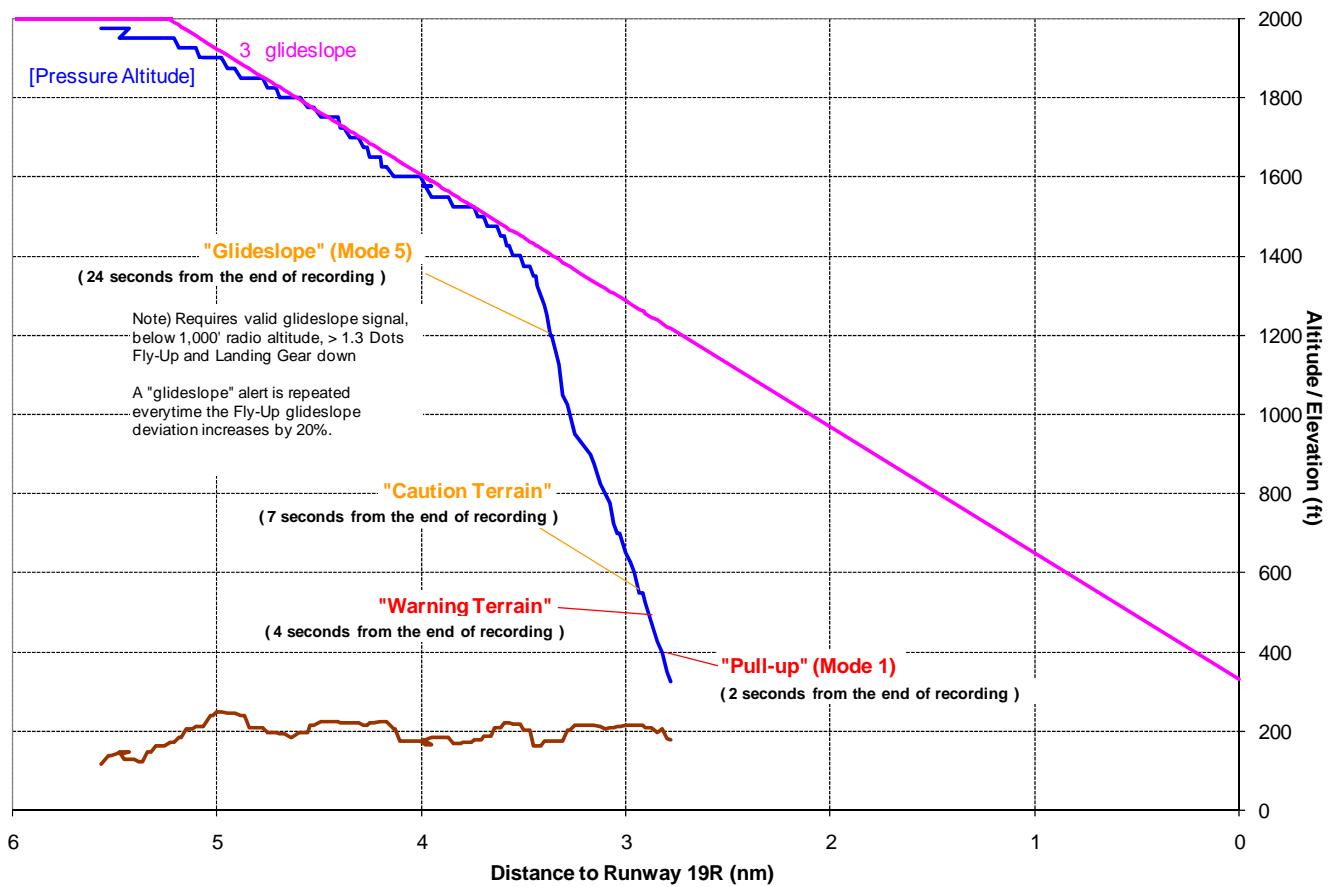
Date: September 27, 2008

Aircraft Type: AS365 N1 (Dauphine)

Aircraft Registration: N92MD

Fatality: 4

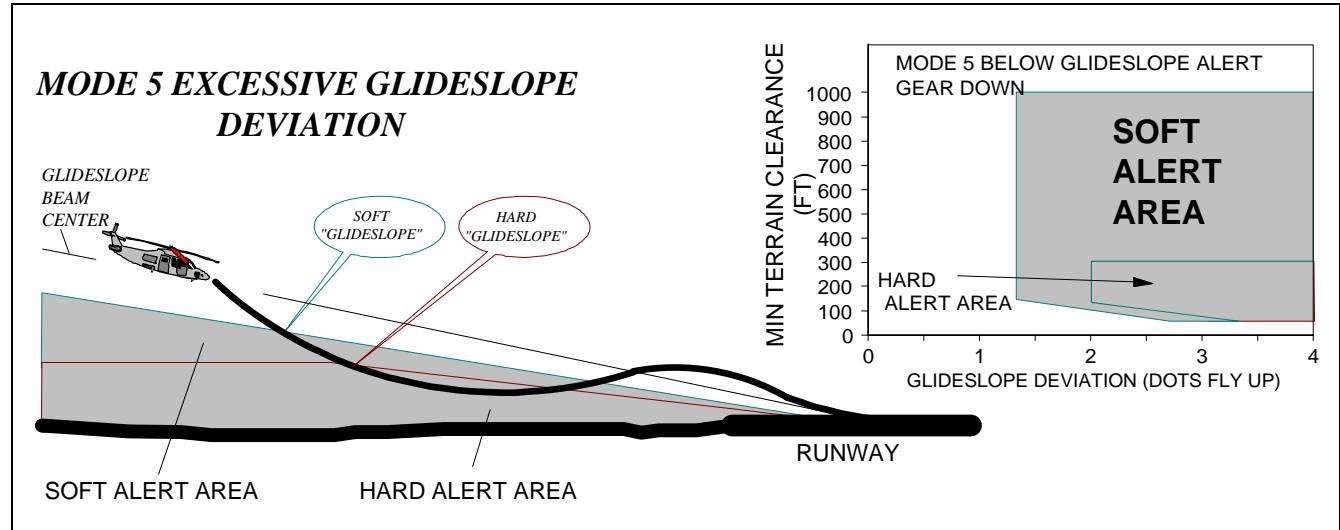




Note) The terrain elevation was generated from USGS National Elevation Dataset (NED).

Mode 5 - Below Glideslope

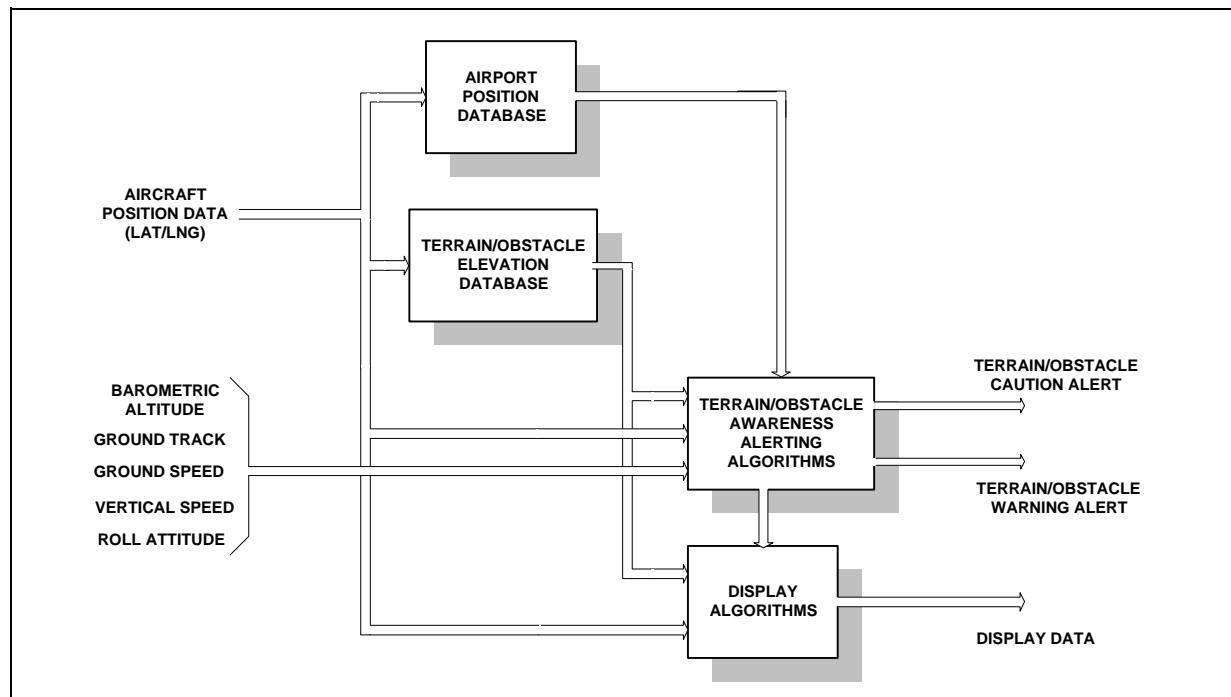
Mode 5 provides two levels of alerting when the aircraft flight path descends below the Glideslope beam on front course ILS approaches. The first alert activation occurs whenever the aircraft is more than 1.3 dots below the beam and is called a "soft" Glideslope alert. That is because the volume level of the "Glideslope" alert is approximately one half (-6 dB) that of the other alerts. A second alert boundary occurs below 300 feet Radio Altitude with greater than 2 dots deviation and is called "loud" or "hard" Glideslope alert because the volume level is increased to that of the other alerts. Mode 5 is illustrated in figure below.



MODE 5 - EXCESSIVE GLIDESLOPE DEVIATION

Terrain and Obstacle Awareness

These functions use aircraft geographic position, aircraft altitude and a terrain and obstacle database to predict potential conflicts between the aircraft flight path and the terrain, and to provide graphic displays of the conflicting terrain or obstacle, as illustrated by the block diagram below.



TERRAIN & OBSTACLE AWARENESS FUNCTIONS

Terrain Alerting

The terrain awareness alerting algorithms continuously compute terrain clearance envelopes ahead of the aircraft. If the boundaries of these envelopes conflict with terrain elevation data in the terrain database, then alerts are issued. Two envelopes are computed, one corresponding to a Terrain Caution Alert level and the other to a Terrain Warning Alert level. The algorithms are designed to meet the following criteria:

- Operational Compatibility - Minimal unwanted alerts during normal flight operations and approach procedures
- Improved Terrain Awareness Warning Times - Provide adequate alert times for all flight phases and conditions
- Robustness - Tolerant of aircraft position errors, altitude signal errors and database errors

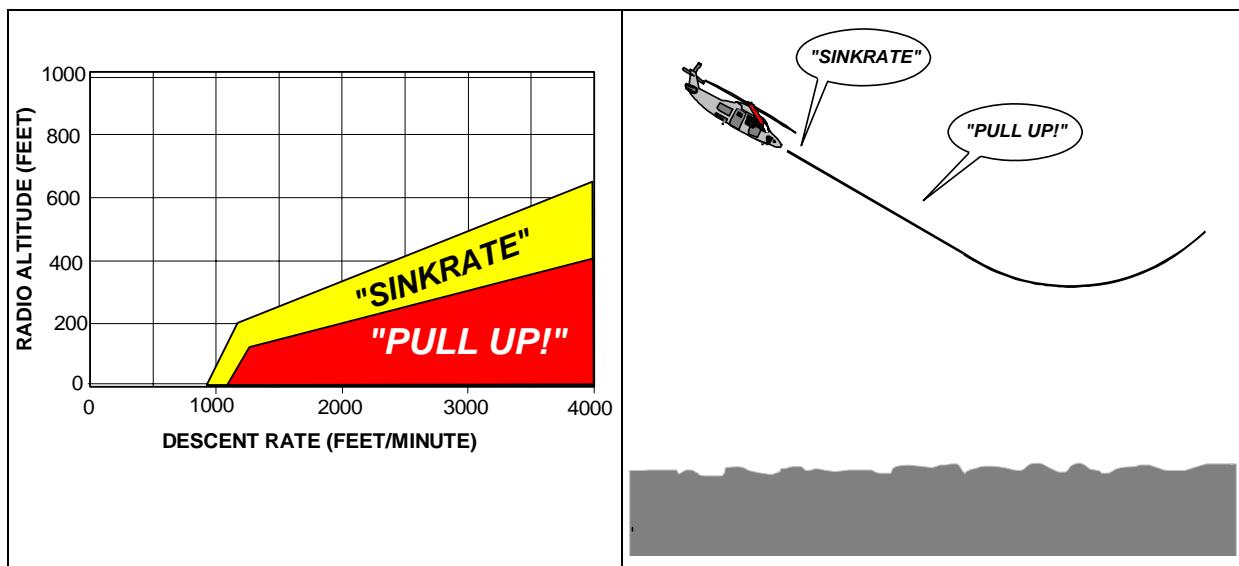
The Caution and Warning envelopes use a terrain floor as a baseline, and “look ahead” of the aircraft in a volume which is calculated as a function of airspeed and flight path angle.

If the aircraft penetrates the Caution envelope boundary, the aural message “*Caution Terrain, Caution Terrain*” is generated, and alert discretes are provided for activation of visual annunciators. Simultaneously, terrain areas which conflict with the Caution criteria are shown in solid yellow color on the Terrain Display.

If the aircraft penetrates the Warning envelope boundary, the aural message “*Warning Terrain*” is generated, and alert discretes are provided for activation of visual annunciators. Simultaneously, terrain areas which conflict with the Warning criteria are shown in solid red color on the Terrain Display.

Mode 1 - Excessive Descent Rate

Mode 1 provides alerts when the aircraft has excessive descent rate close to the terrain.



MODE 1 - EXCESSIVE DESCENT RATE

If the aircraft penetrates the “outer” alert boundary, the aural message “*Sinkrate*” is generated, and alert discretes are output by the computer for driving visual annunciators. If the aircraft penetrates the “inner” alert boundary, the aural message “*Pull Up!*” is generated and visual alert discretes are also output. The alert boundaries are defined in terms of aircraft Vertical Speed (Barometric Altitude Rate) and Radio Altitude. Aircraft configurations with a torque input will detect an autorotation and during that time inhibit Mode 1.

Alert Priority:

The following table provides the alert priority. First entry, top of the table, is highest priority with each follow-on condition specifying the order. Note that all warning modes stated below are actively computed during this phase of flight and allowed to alert if the aircraft conditions violate the given envelope. The priority table only dictates what alert would be spoken first if multiple voices were being requested simultaneously.

ALERT/WARNING CONDITION	AUDIO MESSAGE
MODE 1 PULL UP	PULL UP (continuous while in the warning envelope)
TERRAIN AWARENESS WARNING	WARNING! TERRAIN (continuous while in the warning envelope)
TERRAIN AWARENESS CAUTION	CAUTION TERRAIN (PAUSE) CAUTION TERRAIN
MODE 1 SINKRATE	SINKRATE Note: The basic warning is “SINKRATE (PAUSE) SINKRATE”. However, if the Mode 1 Pullup curve is violated only a single “Sinkrate” may occur prior to the pull up voice.
MODE 5 GLIDESLOPE	GLIDESLOPE