Accuracy Scenario Refresh Analysis

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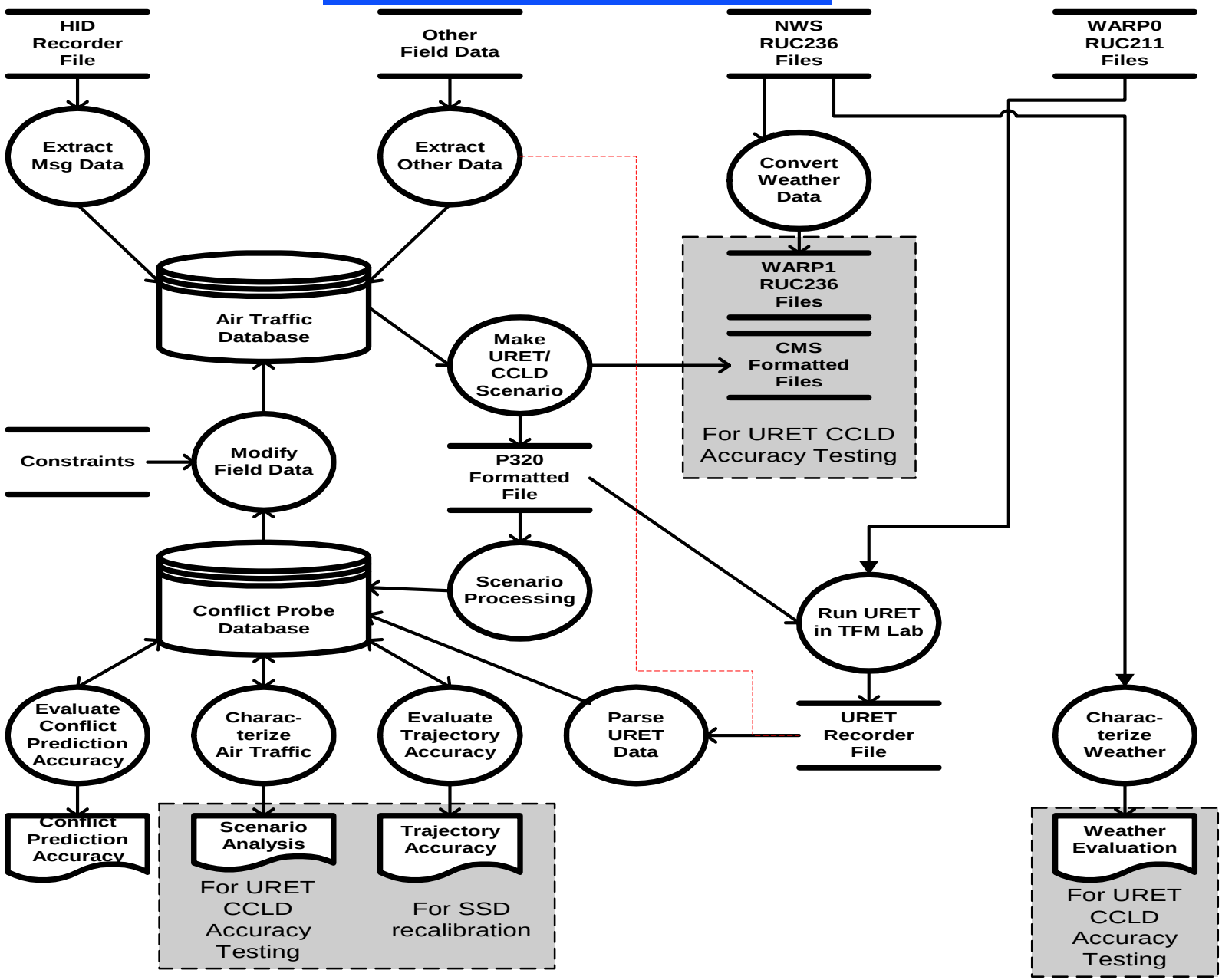
ACT-250 Conflict Probe Assessment Team

May 16, 2001

Overview of Briefing

- Overall Process -- All the Tools
- Scenario / URET Data Processing
- Trajectory Accuracy Measurement
- Conflict Analysis
- Altitude Modeling
- Flight Sample (Ryan)
- Scenario Characteristics (Summerill)

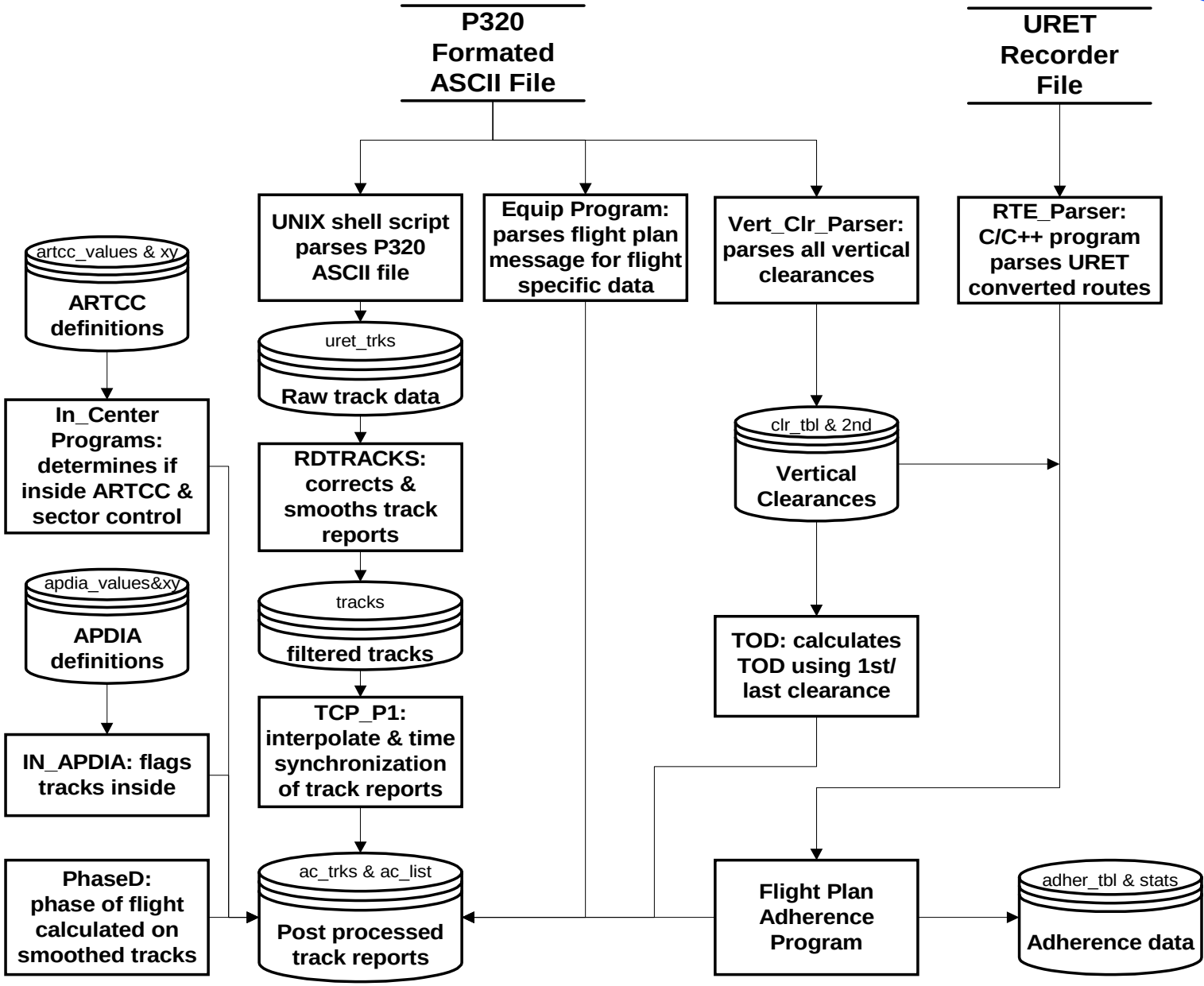
Methodology



Summary of Software Types

- UNIX Shell Scripts (Bourne and C Shells)
- ANSI C/C++ Programs (using GNU g/g++ compilers)
- Oracle PL/SQL Programs (using Oracle Version 8.1.5), Oracle Applications:
  - SQL PLUS
  - SQL Loader
  - SQL Import/Export
- C/C++ and Oracle Hybrid using Oracle PreCompiler

Scenario/URET Data Processing

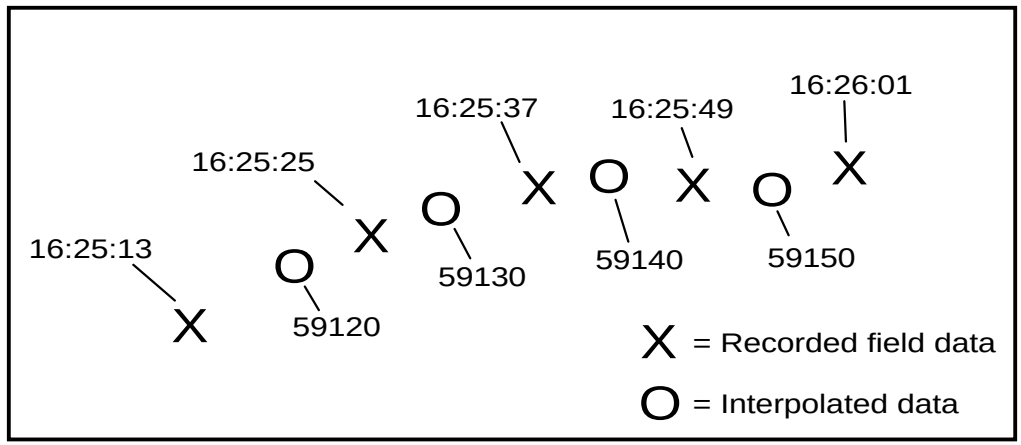


Track Processing - Problems

- Missing track reports
- Stationary track reports
- Inconsistent track reports
- *Jitter (not filtered)*

Interpolate Filtered Track Reports

- "track data was interpolated using a uniform 10 second interval and synchronized to the hour"*



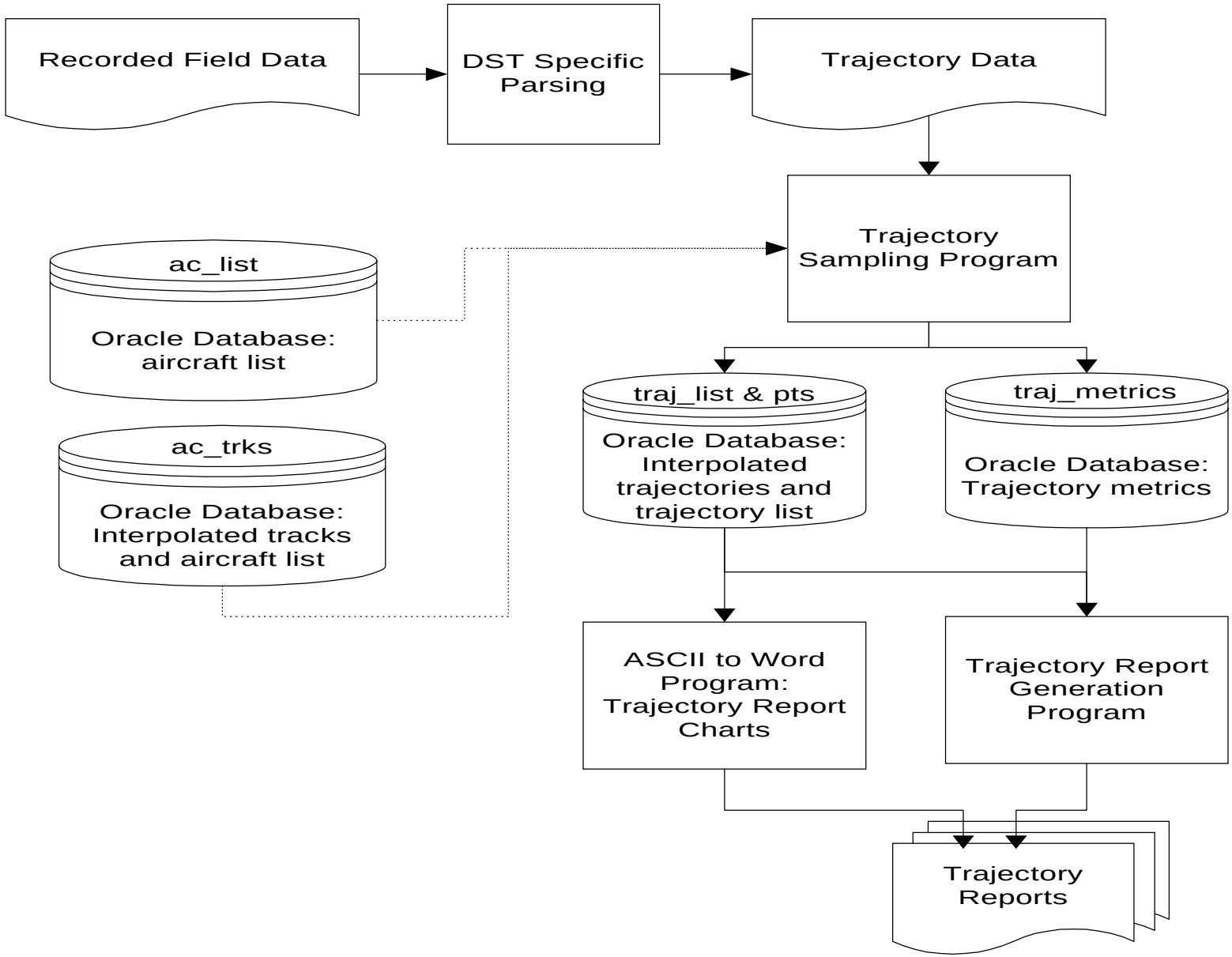
- Consists of Oracle Standard Query Language Program (SQL / Plus)
- Track Conflict Probe Part 1 (TCP_P1)
  - Developed in 1998 URET Conflict Prediction Acc. Study

*Source: *Trajectory Prediction Accuracy Report: URET/CTAS*, DOT/FAA/CT-TN 99/10, May 1999, Section 2.4.4 , page 12.

Trajectory Sampling Program (TJS)

- Implements a generic (time based) trajectory sampling approach
- Calculates trajectory prediction accuracy metrics
- C / C++ program using Oracle Pre-Compiler
- Populates Oracle database tables

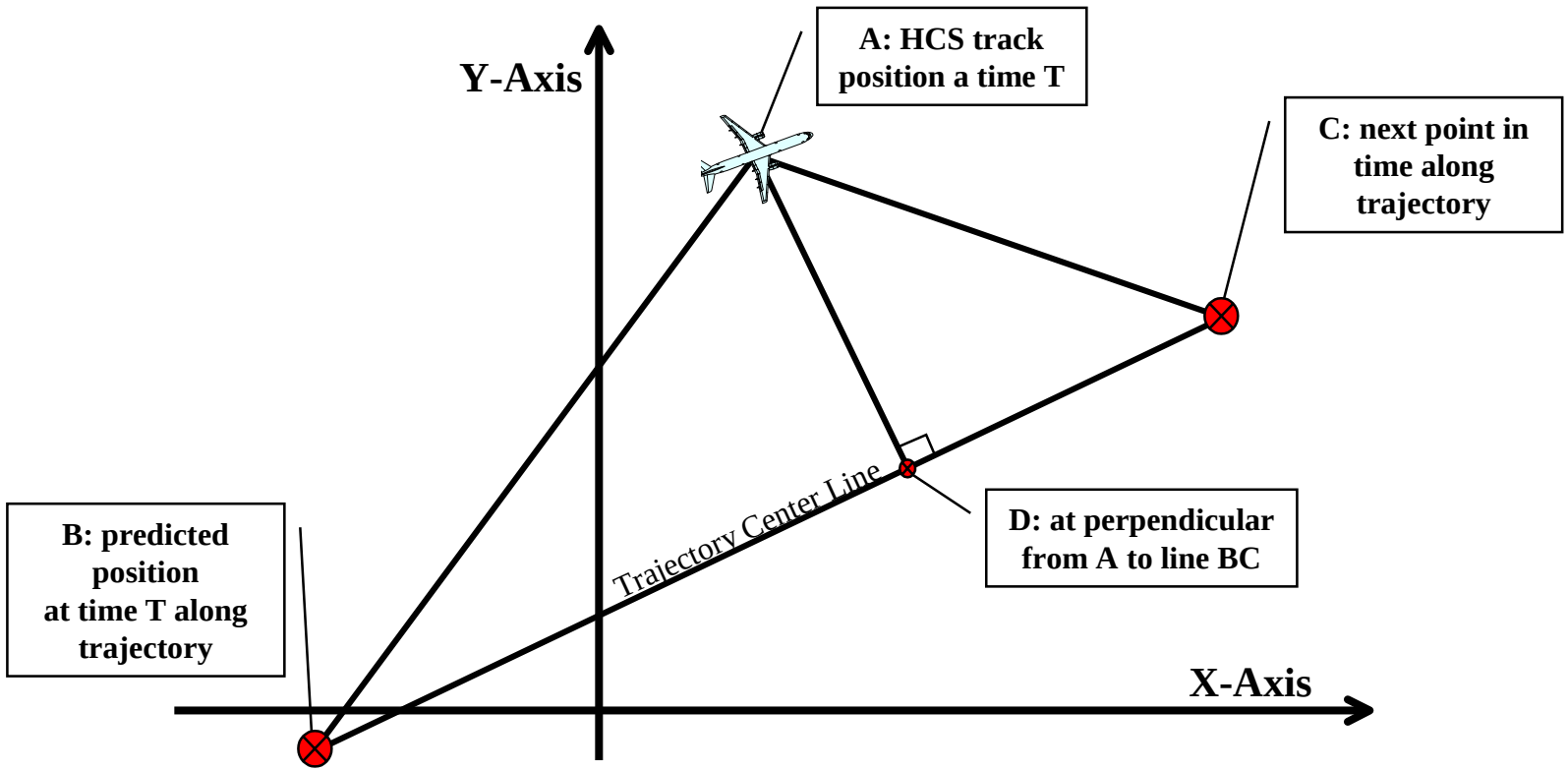
Trajectory Processing



Trajectory Accuracy Metrics

- **Spatial Error**
  - **Horizontal Error - difference in horizontal distance between time-coincident track and trajectory points**
    - ✓ **Longitudinal Error (along trajectory vector length)**
    - ✓ **Lateral Error (cross trajectory vector length)**
  - **Vertical Error - difference between altitudes associated with time-coincident track and trajectory points**
- **Time Error - difference between time tags associated with closest spatially-coincident track and trajectory points**

Horizontal Spatial Error



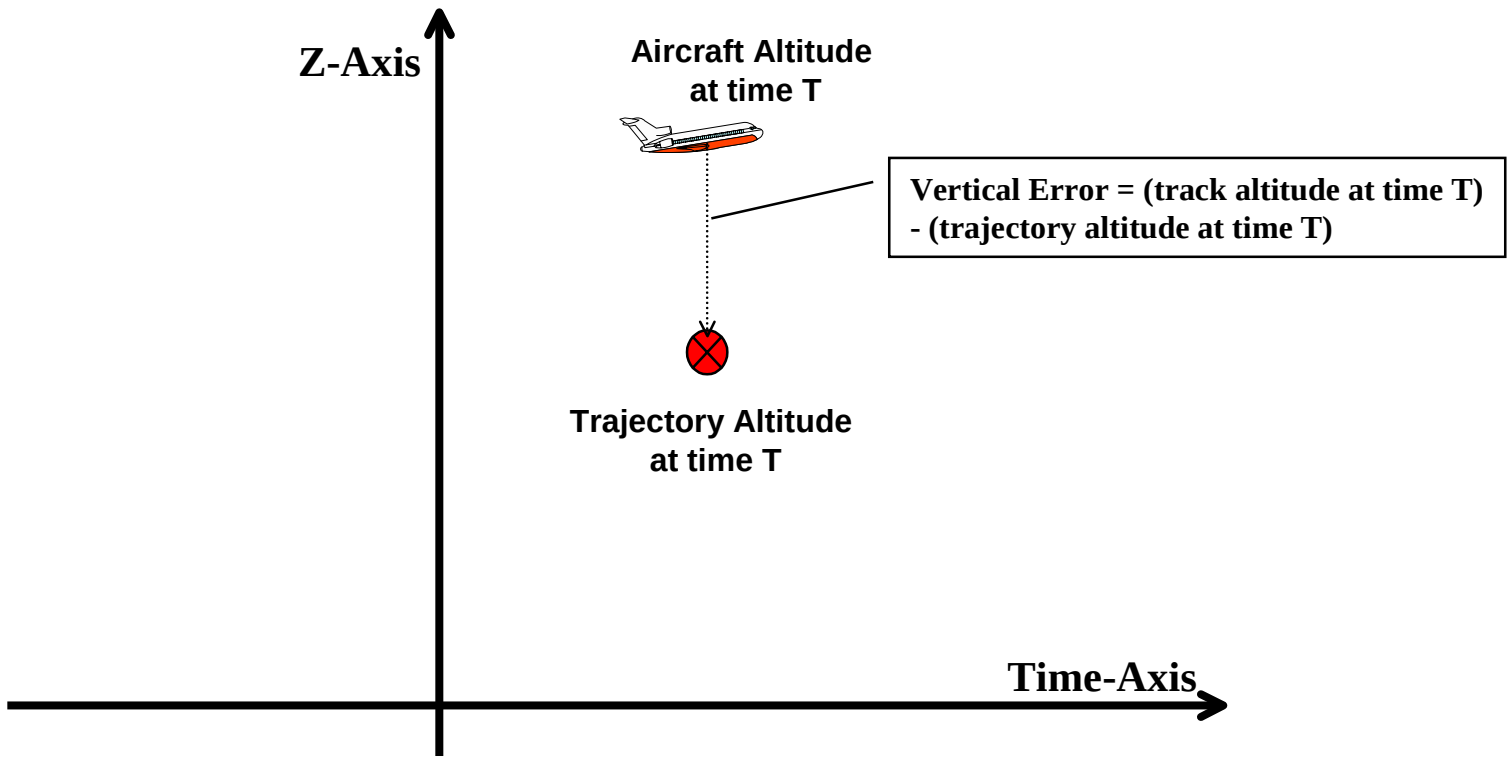
Horizontal prediction error = AB

Longitudinal prediction error = BD

Lateral prediction error = AD

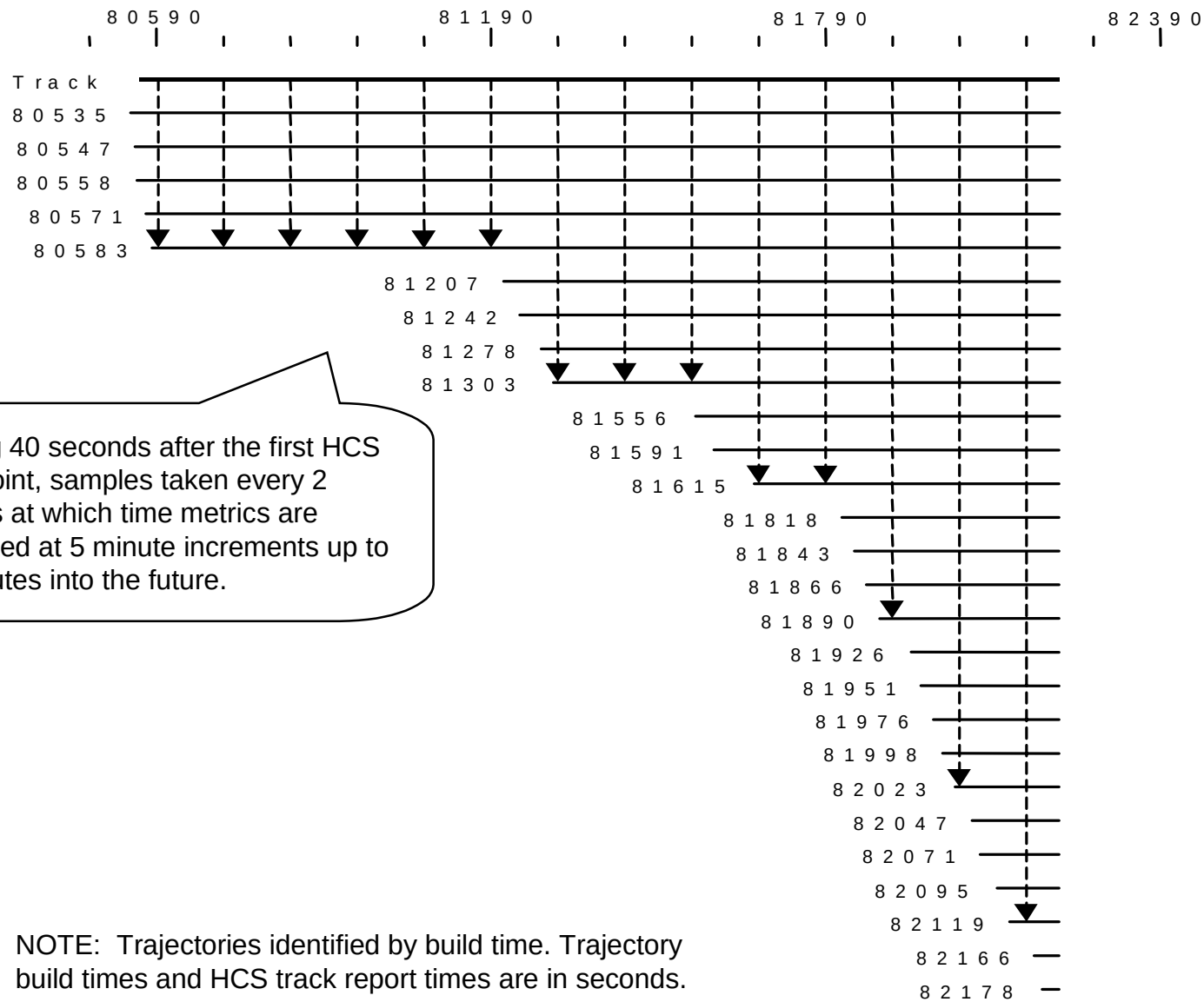
Note: This diagram illustrates positive longitudinal error and negative lateral.

Vertical Spatial Error



Note: This diagram illustrates positive vertical error.

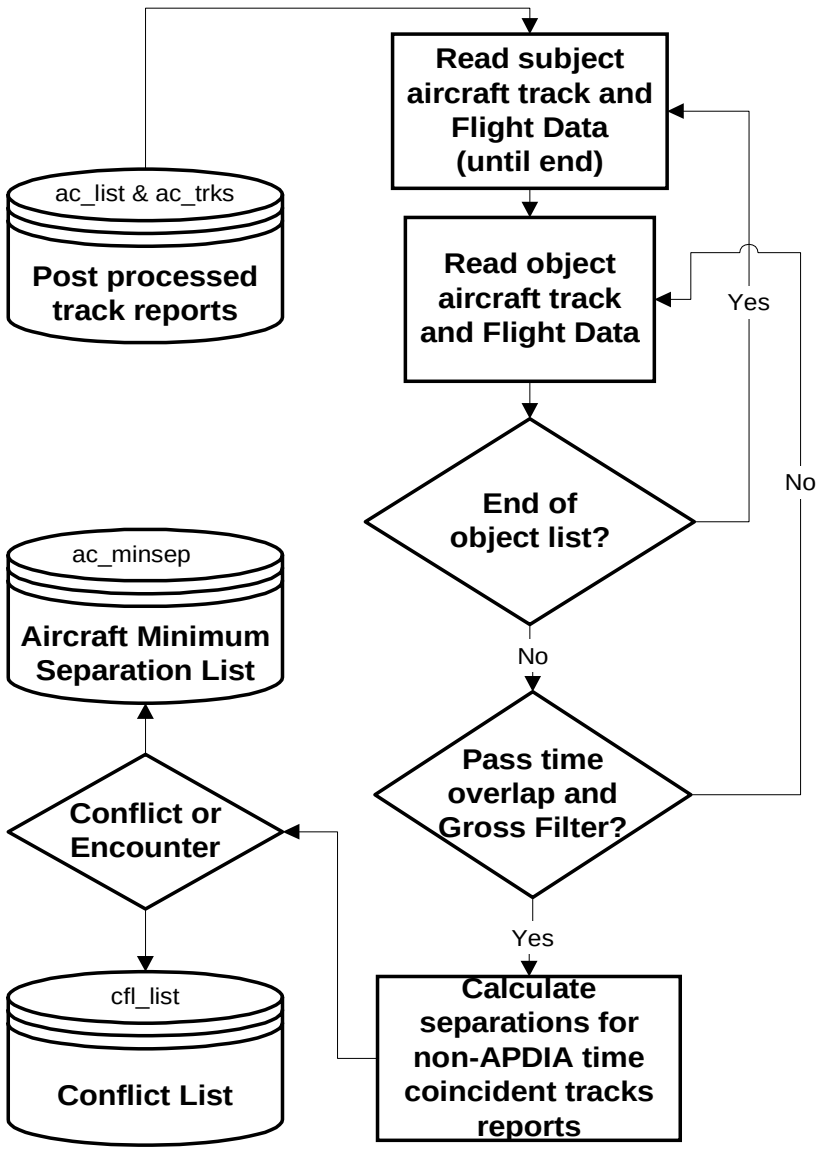
Trajectory Sampling Process



Starting 40 seconds after the first HCS track point, samples taken every 2 minutes at which time metrics are calculated at 5 minute increments up to 20 minutes into the future.

NOTE: Trajectories identified by build time. Trajectory build times and HCS track report times are in seconds.

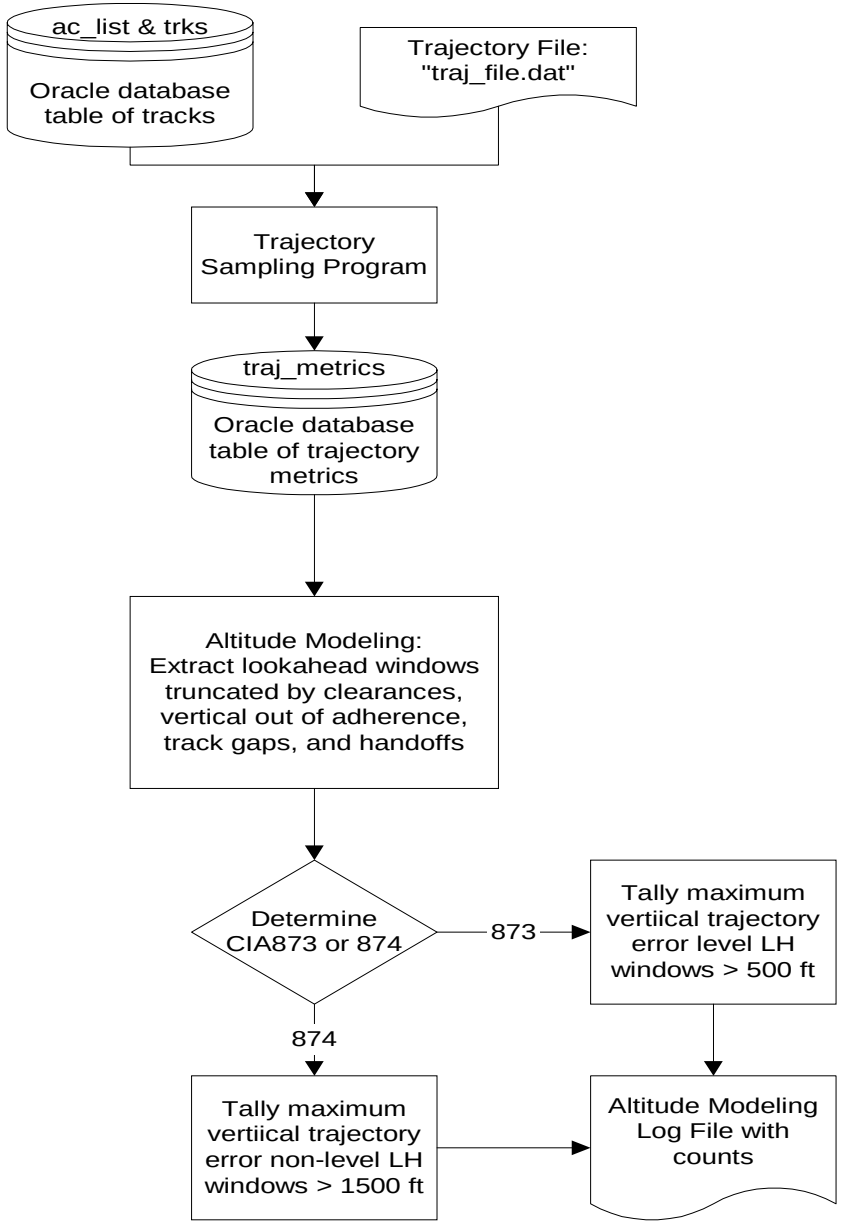
Aircraft Conflict Processing



Design Considerations:

- Beyond center control
- Exclude in APDIA
- Short duration cfl
- Multiple merge cfl
- Track gap during cfl
- <300 ft of cleared alt.
- Conflict attributes
  - adherence age
  - popup codes
  - min. separations
  - vertical phase of flight
  - encounter angle

Altitude Modeling



Sample Flight Analysis

Prepared by

ACT-250

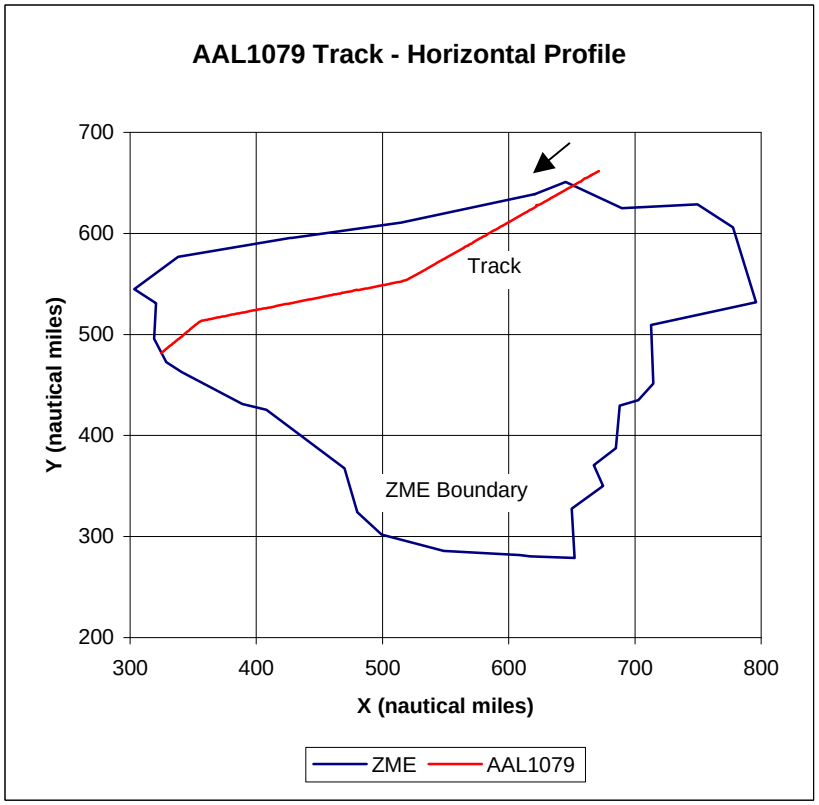
Conflict Probe Assessment Team

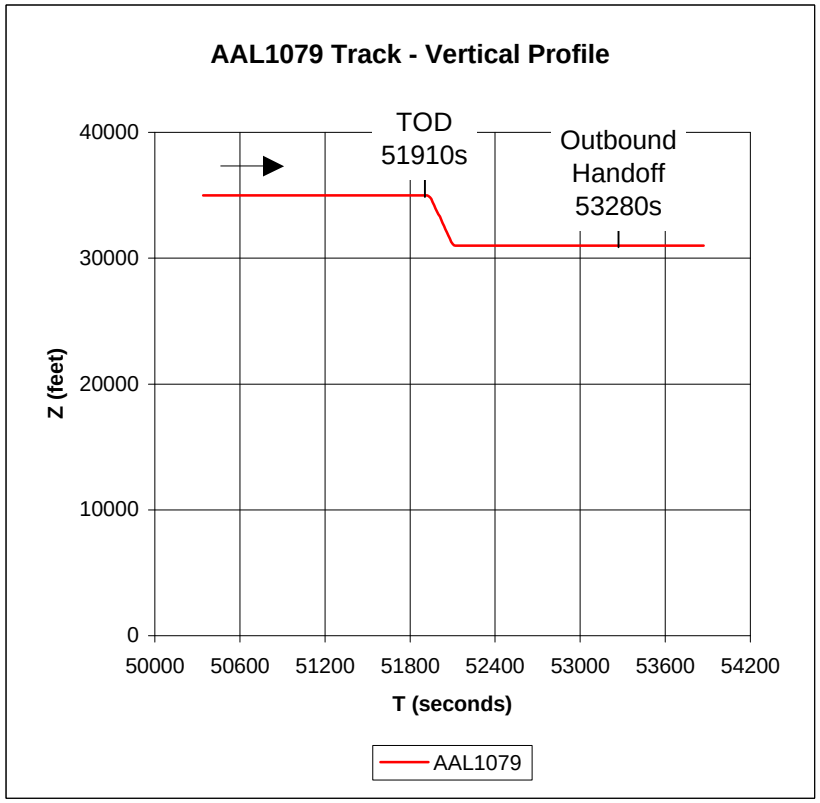
Presented by

Dr. Hollis F. Ryan

Signal Corporation

May 16, 2001





Scenario: Final 11:00-16:00 Interfacility (November 2000)
Flight Acid: AAL1079 **Flight CID:** 004
Route: Newark to Dallas **Type:** Overflight
First Track Point: 50340 seconds **Last Track Point:** 53870 seconds
Handoffs: ZID to ZME to ZFW
Outbound Handoff Time: 53280 seconds
TOD: 51910 seconds

Air Traffic Control Directives:

48642 133042 FP AAL1079 004 B752 1 E 470 PXV 1356 E 350 'EWR./.PXV..ARG..FSM.BYP3 + .FSM.BYP3.+ .DFW ' " L 2717
50266 135746 FP AAL1079 004 B752 1 E 470 PXV068007 1357 E 350 'EWR./.PXV067007..ARG..FSM.BYP3 + .FSM.BYP3.+ .DFW ' " L 2717
51657 142057 FP AAL1079 004 B752 1 E 470 PXV068007 1357 E 310 'EWR./.PXV067007..ARG..FSM.BYP3 + .FSM.BYP3.+ .DFW ' " L 2717
51660 142100 QQ AAL1079 004 350
51903 142503 FP AAL1079 004 B752 1 E 470 PXV068007 1357 E 310 'EWR./.PXV067007..ARG..FSM.BYP3 + .FSM.BYP3.+ .DFW ' " L 2717
51905 142505 QQ AAL1079 004

Track Data Processing for AAL1079 (RDTRACKS)

- Number of track reports
  - total = 296
  - adjusted = 3
  - zero altitude = 3
  - duplicate coordinates = 0
  - 12-second step size = 279
  - 11-second step size = 8
  - 13-second step size = 8
- Maximum adjustment horizontally = 0.79 nm
- Maximum adjustment vertically = 0 ft

Summary of AAL1079 Post-Processed Track Data from AC_LIST

AC_NUM	ACID	TRACK_ CNT	ST_TIME	END_ TIME	ORIG_ TRACK_ CNT	ORIG_ST_ TIME
8	AAL1079_004	354	50340	53870	296	50338

ORIG_ END_ TIME	TRACK_ QSTAT	MAX_X	MIN_X	MAX_Y	MIN_Y	MAX_Z
53878	0.010135	671.342	324.626	661.699	481.506	35000

MIN_Z	AC_ EQUIP	AC_TYPE	DEST_FIX	FLIGHT_ TYPE	ORIGIN_ FIX	PRM_ID
31000	E	B752	DFW	OVR	EWR	35

GAP_ VALUE	MAX_X_ SMO	MIN_X_ SMO	MAX_Y_ SMO	MIN_Y_ SMO	MAX_Z_ SMO	MIN_Z_ SMO
0	671.342	324.626	661.699	481.506	35000	31000

TOD_ TIME	END_ CENTER	START_ CENTER	END_CENTER_ TIME	START_ CENTER_ TIME
51910	OTHR	ZID	53280	50350

Sample Track Reports for AAL1079 from AC_TRKS

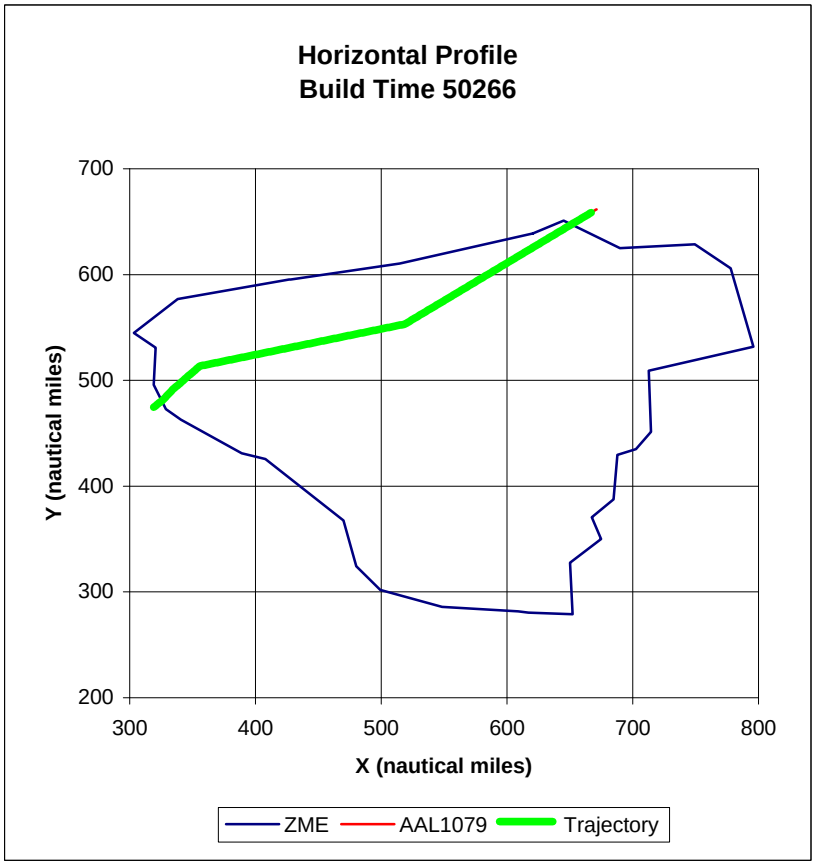
AC_NUM	ELAP_ TIME	X_VALUE	Y_VALUE	Z_VALUE	SECTOR_ VALUE	GROUND_ SPEED
8	50340	671.342	661.699	35000	-1	394
8	50350	670.500	661.190	35000	61	397
8	50360	669.358	660.348	35000	61	397
8	50370	669.043	660.100	35000	61	397
8	50380	668.100	659.436	35000	61	401

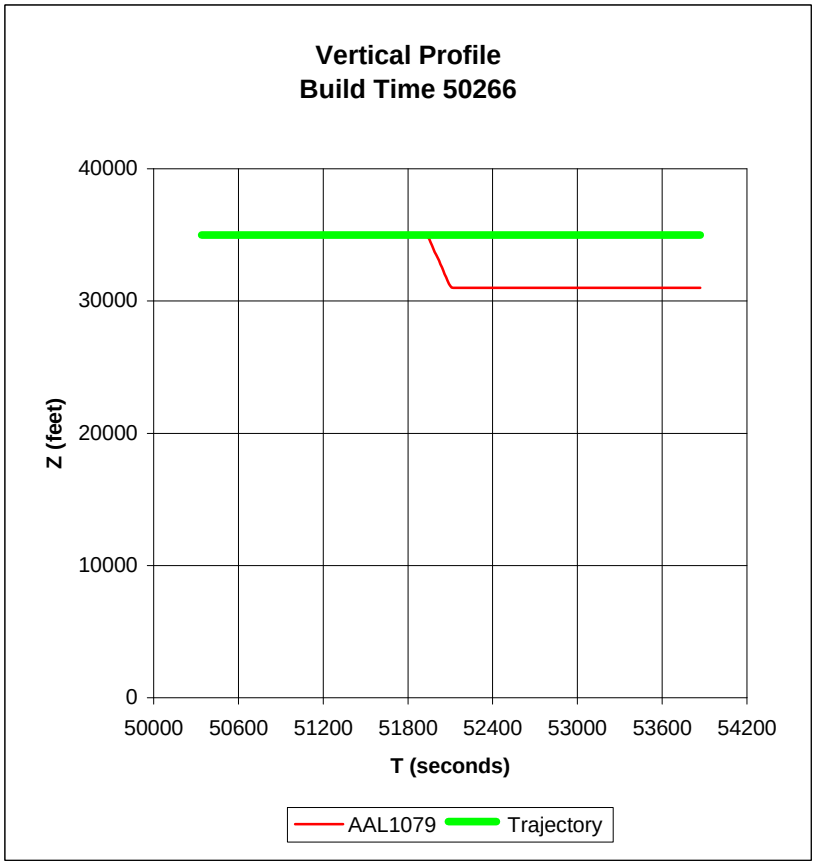
HEADING	IN_APDIA	PHASE_ HORZ	PHASE_ VERT	LAT_OUT	VERT_ OUT	ADHER_AGE
239	0	STR	LEV	0	0	999999
234	0	LFT	LEV	0	0	999999
232	0	STR	LEV	0	0	999999
235	0	RGH	LEV	0	0	999999
235	0	STR	LEV	0	0	999999

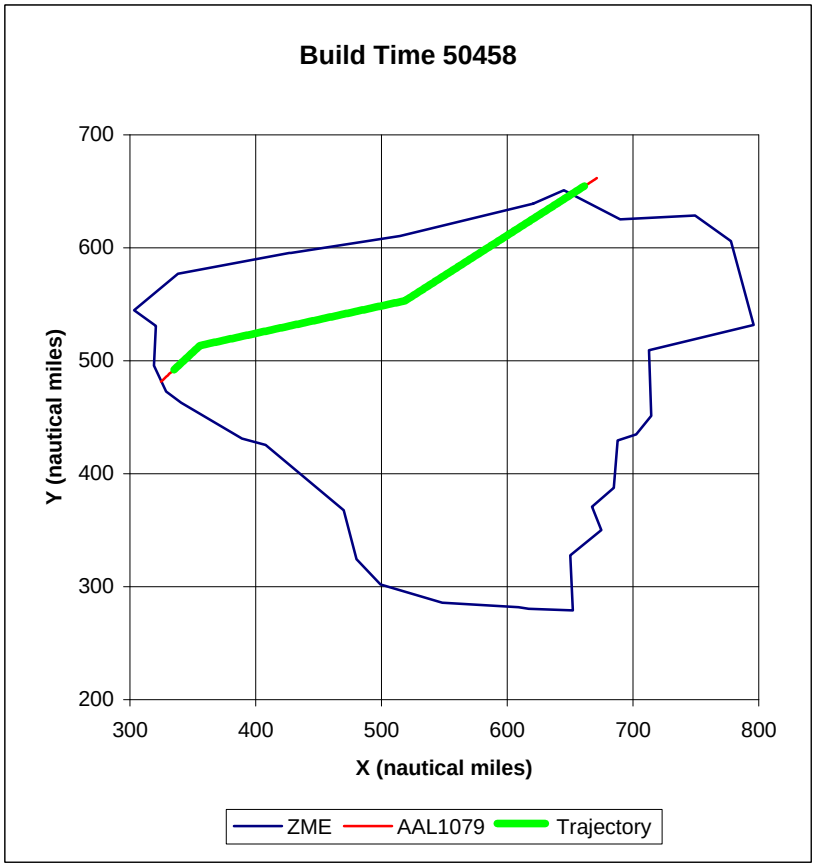
X_VALUE_ SMO	Y_VALUE_ SMO	Z_VALUE_ SMO	GROUND_ SPEED_SMO	IN_ CENTER_ END	IN_ CENTER_ START
671.342	661.699	35000	394	1	2
670.500	661.190	35000	397	1	2
669.358	660.348	35000	397	1	2
669.043	660.100	35000	397	1	2
668.100	659.436	35000	401	1	2

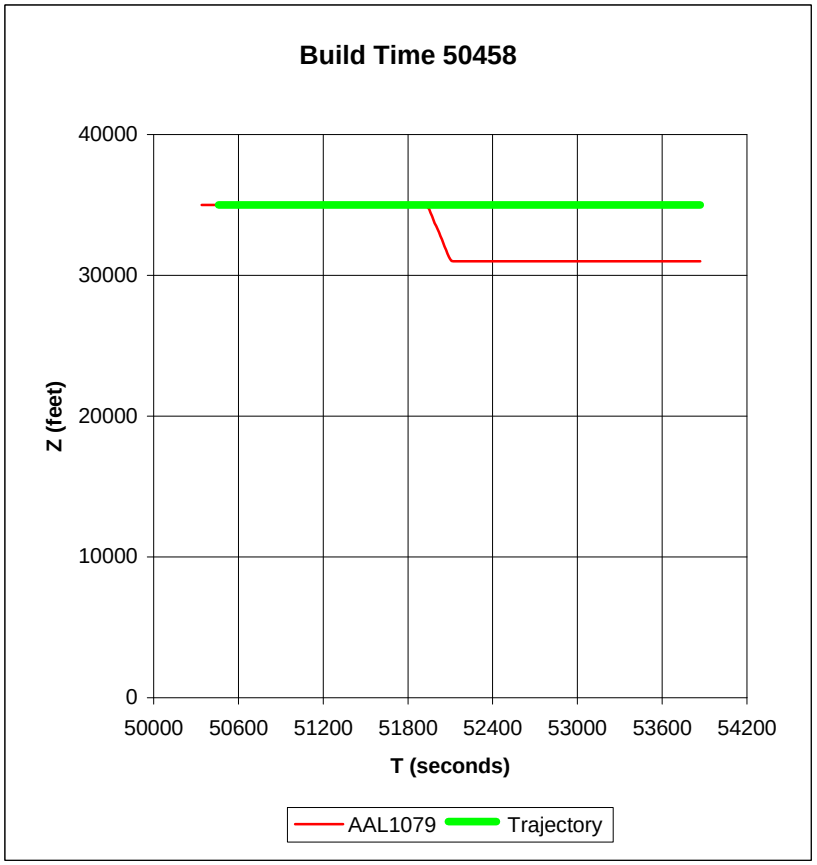
Flight Prediction - Trajectories

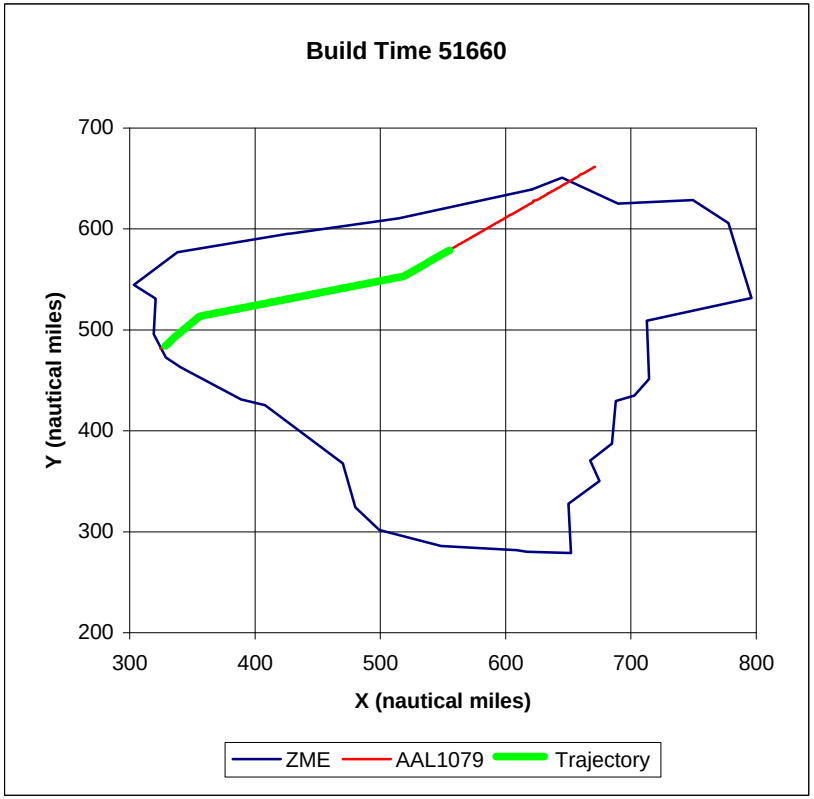
- Generated by baseline URET Daily Use
- 11 trajectories generated- 6 sampled for accuracy measurements
- Cross track errors small
- Along track errors up to
  - 11.7 nm without CCLD rules applied
    - on trajectory age of 18 min and look ahead of 20 min
  - 10.2 nm with CCLD rules applied
    - on trajectory age of 74 sec and look ahead of 20 min
- Descent not predicted by first 3 trajectories
  - creates large vertical errors

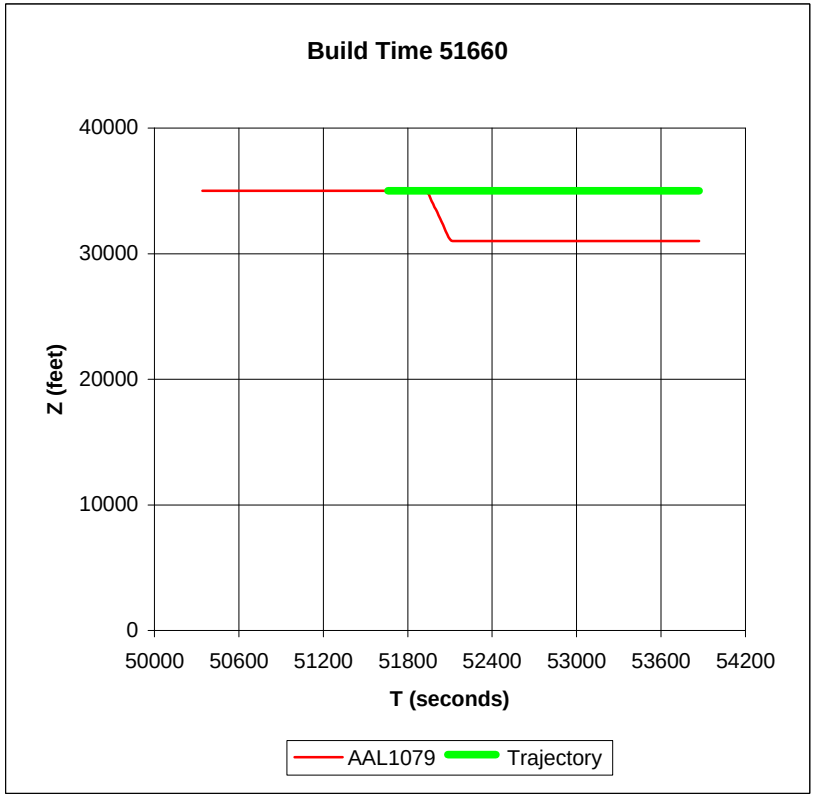

Horizontal Profile
Build Time 50266
700
600
500
400
300
200
Y (nautical miles)
300
400
500
600
700
800
X (nautical miles)
ZME
AAL1079
Trajectory

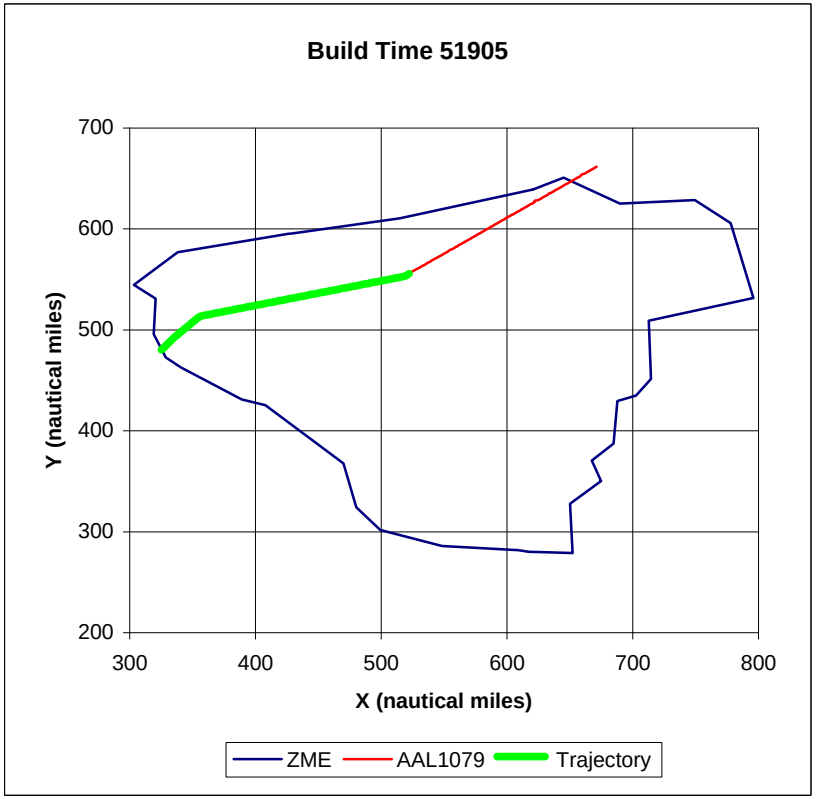

Vertical Profile
Build Time 50266
40000
30000
20000
10000
0
Z (feet)
50000
50600
51200
51800
52400
53000
53600
54200
T (seconds)
AAL1079
Trajectory

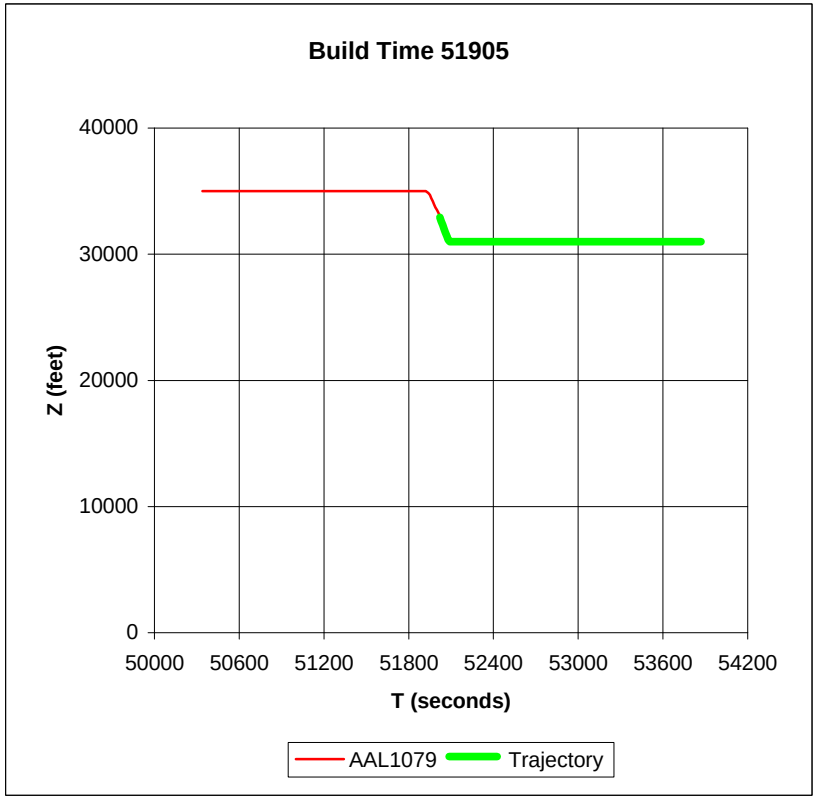

Build Time 50458
700
600
500
400
300
200
300
400
500
600
700
800
Y (nautical miles)
X (nautical miles)
ZME
AAL1079
Trajectory

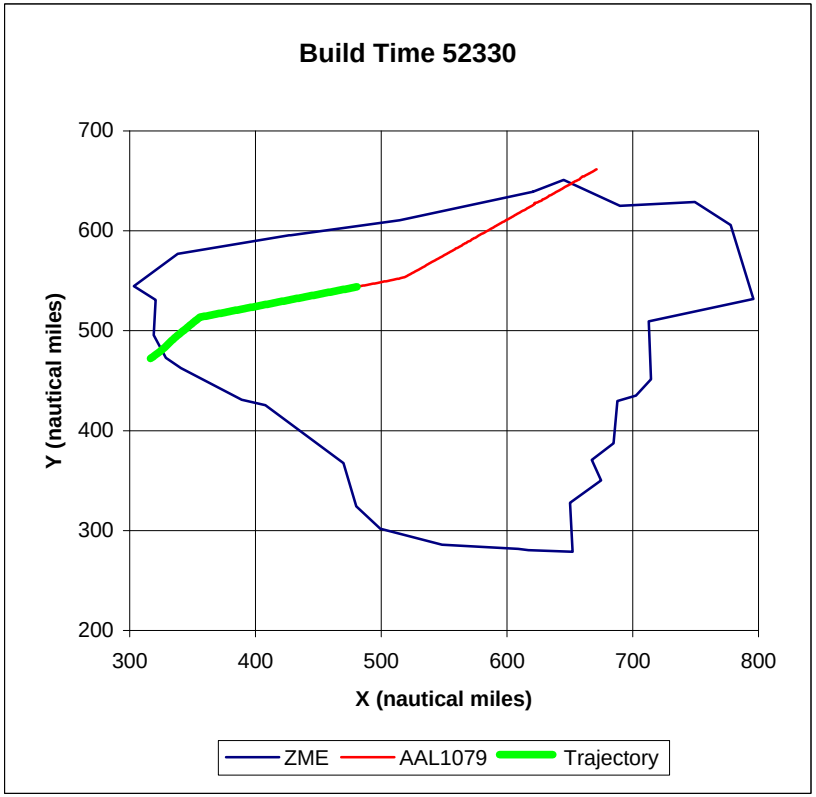

Build Time 50458
40000
30000
20000
10000
0
50000
50600
51200
51800
52400
53000
53600
54200
Z (feet)
T (seconds)
AAL1079
Trajectory

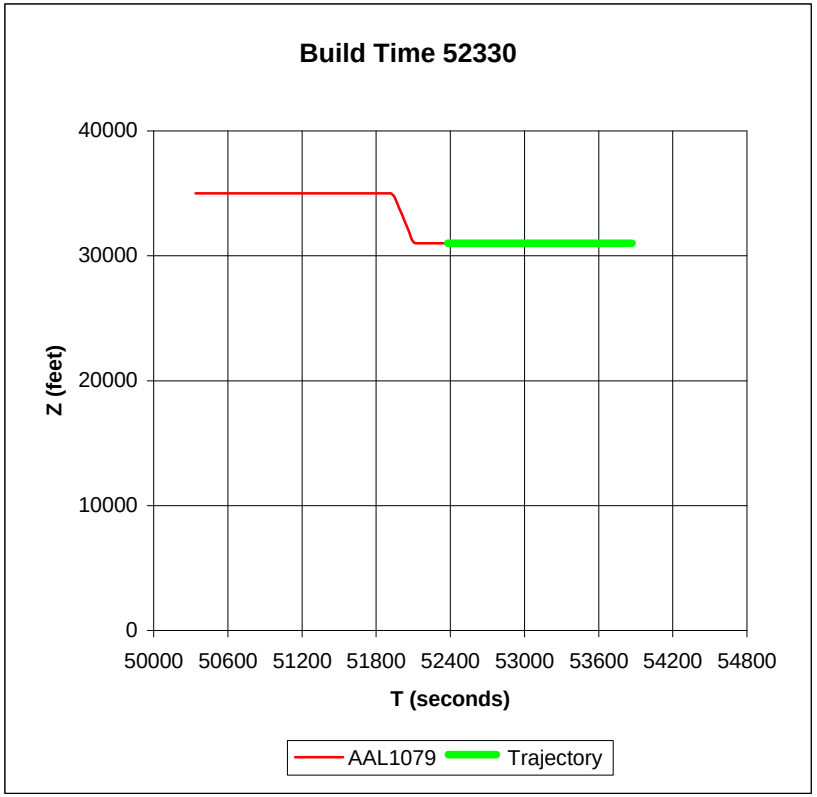

Build Time 51660
700
600
500
400
300
200
Y (nautical miles)
300
400
500
600
700
800
X (nautical miles)
ZME
AAL1079
Trajectory

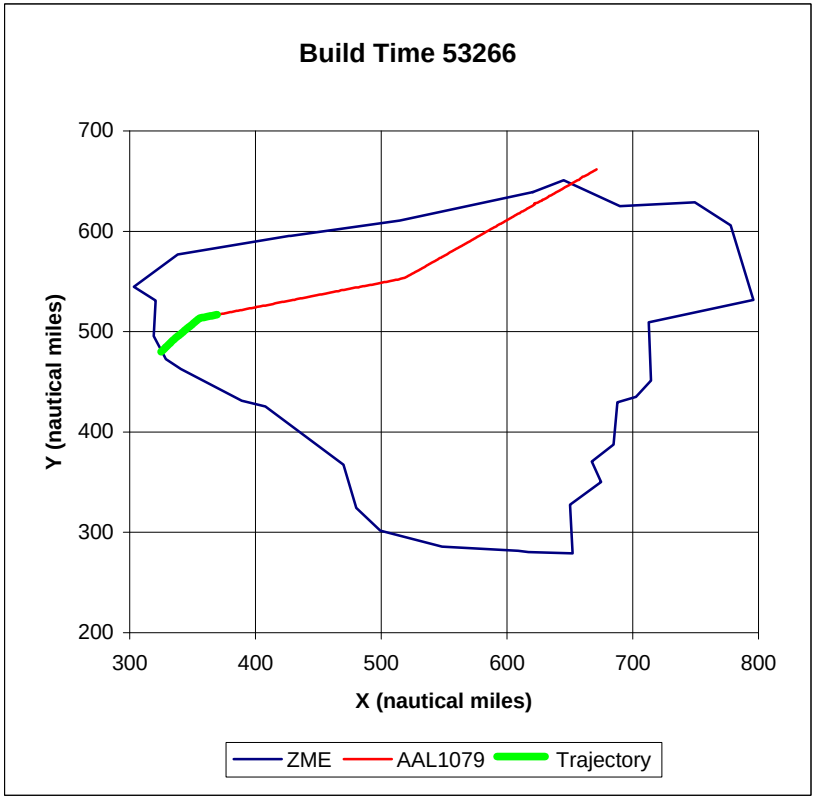

Build Time 51660
40000
30000
20000
10000
0
Z (feet)
50000
50600
51200
51800
52400
53000
53600
54200
T (seconds)
AAL1079
Trajectory

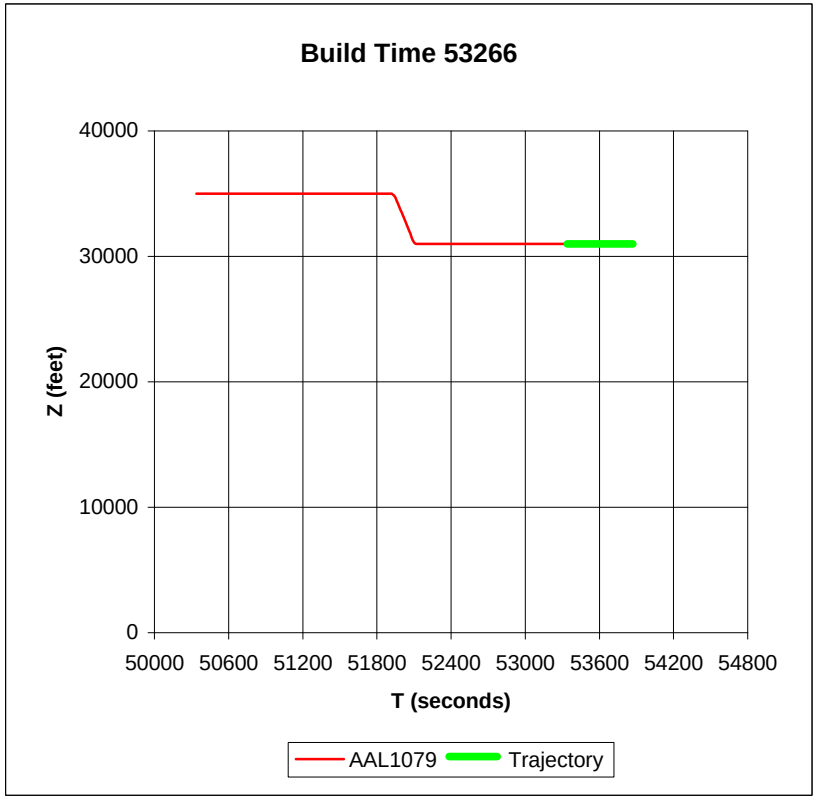

Build Time 51905
700
600
500
400
300
200
300
400
500
600
700
800
Y (nautical miles)
X (nautical miles)
ZME
AAL1079
Trajectory


Build Time 51905
40000
30000
20000
10000
0
50000
50600
51200
51800
52400
53000
53600
54200
Z (feet)
T (seconds)
AAL1079
Trajectory


Build Time 52330
700
600
500
400
300
200
Y (nautical miles)
300
400
500
600
700
800
X (nautical miles)
ZME
AAL1079
Trajectory


Build Time 52330
40000
30000
20000
10000
0
Z (feet)
50000
50600
51200
51800
52400
53000
53600
54200
54800
T (seconds)
AAL1079
Trajectory


Build Time 53266
700
600
500
400
300
200
Y (nautical miles)
300
400
500
600
700
800
X (nautical miles)
ZME
AAL1079
Trajectory


Build Time 53266
40000
30000
20000
10000
0
Z (feet)
50000
50600
51200
51800
52400
53000
53600
54200
54800
T (seconds)
AAL1079
Trajectory

Trajectory Summaries for AAL1079 from TRAJ_LIST

TRAJ_ NUM	ACID_CID	TRAJ_ BUILD_TM	CP_NAME	ST_TIME	END_TIME	TRAJ_CNT	ORIG_ST_ TIME
6608	AAL1079_004	50266	URET	50340	53870	354	50220
6758	AAL1079_004	50458	URET	50460	53870	342	50458
7652	AAL1079_004	51660	URET	51660	53870	222	51660
7824	AAL1079_004	51905	URET	52020	53870	186	51905
8662	AAL1079_004	53266	URET	53340	53870	54	53266
8105	AAL1079_004	52330	URET	52380	53870	150	52330
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:

ORIG_END_ TIME	ORIG_ TRAJ_CNT	MAX_X	MAX_Y	MIN_X	MIN_Y	MAX_Z	MIN_Z	PRM_ID
55367	26	666.823	658.49	319.056	474.534	35000	35000	0
55575	26	661.353	654.715	335.055	492.172	35000	35000	0
55474	25	555.007	578.971	328.3	483.94	35000	35000	0
55432	29	522.208	555.61	325.154	480.371	32911	31000	0
55468	22	480.692	543.906	316.585	472.169	31000	31000	0
55320	22	369.372	516.832	324.831	480.062	31000	31000	0
:	:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:	:

Trajectory Reports for AAL1079 from TRAJ_PTS

TRAJ_NUM	TIME	X_VALUE	Y_VALUE	Z_VALUE	GROUND_ SPEED
6608	50340	666.823	658.490	35000	402
6608	50350	665.913	657.842	35000	402
6608	50360	665.002	657.195	35000	402
6608	50370	664.092	656.547	35000	402
6608	50380	663.181	655.899	35000	402
6608	50390	662.270	655.251	35000	402
6608	50400	661.360	654.603	35000	402
6608	50410	660.449	653.955	35000	402
6608	50420	659.539	653.308	35000	402
6608	50430	658.628	652.660	35000	402
:	:	:	:	:	:
:	:	:	:	:	:

Error Measurements

- Compare track to trajectory
  - cross track (lateral) error
  - along track (longitudinal) error
  - vertical error
- Sample track every 2 minutes
- For each sample time, measure errors at look ahead times of 0, 60, 300, 600, 900, and 1200 seconds
- 30 sample times for AAL1079 and 153 measurements

Measurement Exclusions

- Flag trajectory measurements past
  - a Top of Descent
  - a gap in the track data
  - the handoff to the next non-CP equipped Center
  - a track report out of adherence
  - an ATC clearance
  - a track report at or near an interim altitude
- CCLD rules exclude these flagged measurements
- Remaining errors averaged for specification refresh

Trajectory Metrics for AAL1079_004 from TRAJ_METRICS

Sample Time	Traj Build Time	Look Ahead Time	Measure Time	Horz Err	Lat Err	Long Err	Vert Err	TOD Flag	Gap Flag	Out Bound Flag	Adher Flag	Clear Flag	QQ Flag
50340	50266	0	50340	5.5420	-0.0047	-5.5420	0.00	0	0	0	0	0	0
		60	50400	4.9436	0.0481	-4.9434	0.00	0	0	0	0	0	0
		300	50640	7.1498	-0.0036	-7.1498	0.00	0	0	0	0	0	0
		600	50940	8.1862	0.0754	-8.1859	0.00	0	0	0	0	0	0
		900	51240	9.3603	0.2260	-9.3576	0.00	0	0	0	0	0	0
		1200	51540	10.2433	0.1440	-10.2423	0.00	0	0	0	0	0	0
50460	50458	0	50460	0.0729	-0.0716	0.0135	0.00	0	0	0	0	0	0
		60	50520	0.1796	-0.1326	0.1212	0.00	0	0	0	0	0	0
		300	50760	0.6183	-0.0003	0.6183	0.00	0	0	0	0	0	0
		600	51060	0.8265	0.1583	0.8112	0.00	0	0	0	0	0	0
		900	51360	1.0830	0.0811	1.0799	0.00	0	0	0	0	0	0
		1200	51660	2.0230	0.1881	2.0142	0.00	0	0	0	0	1	1
50580	50458	0	50580	0.2988	-0.2634	0.1412	0.00	0	0	0	0	0	0
		60	50640	0.4417	-0.0878	0.4329	0.00	0	0	0	0	0	0
		300	50880	0.9544	0.2587	0.9187	0.00	0	0	0	0	0	0
		600	51180	0.9092	0.0593	0.9073	0.00	0	0	0	0	0	0
		900	51480	1.2833	0.0409	1.2827	0.00	0	0	0	0	0	0
		1200	51780	2.6203	0.2500	2.6084	0.00	0	0	0	0	1	1
50700	50458	0	50700	0.4780	-0.0720	0.4725	0.00	0	0	0	0	0	0
		60	50760	0.6183	-0.0003	0.6183	0.00	0	0	0	0	0	0
		300	51000	0.7657	0.0008	0.7657	0.00	0	0	0	0	0	0
		600	51300	1.0007	0.1823	0.9840	0.00	0	0	0	0	0	0
		900	51600	1.7837	0.0627	1.7826	0.00	0	0	0	0	0	0
		1200	51900	3.5355	0.2364	3.5275	0.00	0	0	0	0	1	1
50820	50458	0	50820	0.7854	-0.0444	0.7841	0.00	0	0	0	0	0	0
		60	50880	0.9544	0.2587	0.9187	0.00	0	0	0	0	0	0
		300	51120	0.8355	0.1465	0.8226	0.00	0	0	0	0	0	0
		600	51420	1.2139	0.1477	1.2049	0.00	0	0	0	0	0	0
		900	51720	2.3608	0.1184	2.3578	0.00	0	0	0	0	1	1
		1200	52020	4.3060	0.3180	4.2942	-1950.00	1	0	0	0	1	1
50940	50458	0	50940	0.7595	0.0089	0.7595	0.00	0	0	0	0	0	0
		60	51000	0.7657	0.0008	0.7657	0.00	0	0	0	0	0	0
		300	51240	0.9668	0.1770	0.9504	0.00	0	0	0	0	0	0
		600	51540	1.4329	0.1127	1.4285	0.00	0	0	0	0	0	0
		900	51840	3.0669	0.2407	3.0575	0.00	0	0	0	0	1	1
		1200	52140	5.3311	0.0863	5.3304	-4000.00	1	0	0	0	1	1

Trajectory Metrics for AAL1079_004 from TRAJ_METRICS

Sample Time	Traj Build Time	Look Ahead Time	Measure Time	Horz Err	Lat Err	Long Err	Vert Err	TOD Flag	Gap Flag	Out Bound Flag	Adher Flag	Clear Flag	QQ Flag
51060	50458	0	51060	0.8265	0.1583	0.8112	0.00	0	0	0	0	0	0
		60	51120	0.8355	0.1465	0.8226	0.00	0	0	0	0	0	0
		300	51360	1.0830	0.0811	1.0799	0.00	0	0	0	0	0	0
		600	51660	2.0230	0.1881	2.0142	0.00	0	0	0	0	1	1
		900	51960	3.8555	0.2902	3.8446	-550.00	1	0	0	0	1	1
		1200	52260	6.2949	-0.0605	6.2946	-4000.00	1	0	0	0	1	1
51180	50458	0	51180	0.9092	0.0593	0.9073	0.00	0	0	0	0	0	0
		60	51240	0.9668	0.1770	0.9504	0.00	0	0	0	0	0	0
		300	51480	1.2833	0.0409	1.2827	0.00	0	0	0	0	0	0
		600	51780	2.6203	0.2500	2.6084	0.00	0	0	0	0	1	1
		900	52080	4.9528	1.6386	4.6739	-3450.00	1	0	0	0	1	1
		1200	52380	7.3781	0.0008	7.3781	-4000.00	1	0	0	0	1	1
51300	50458	0	51300	1.0007	0.1823	0.9840	0.00	0	0	0	0	0	0
		60	51360	1.0830	0.0811	1.0799	0.00	0	0	0	0	0	0
		300	51600	1.7837	0.0627	1.7826	0.00	0	0	0	0	0	0
		600	51900	3.5355	0.2364	3.5275	0.00	0	0	0	0	1	1
		900	52200	5.8689	0.1230	5.8676	-4000.00	1	0	0	0	1	1
		1200	52500	8.6733	-0.0048	8.6733	-4000.00	1	0	0	0	1	1
51420	50458	0	51420	1.2139	0.1477	1.2049	0.00	0	0	0	0	0	0
		60	51480	1.2833	0.0409	1.2827	0.00	0	0	0	0	0	0
		300	51720	2.3608	0.1184	2.3578	0.00	0	0	0	0	1	1
		600	52020	4.3060	0.3180	4.2942	-1950.00	1	0	0	0	1	1
		900	52320	6.8795	0.0002	6.8795	-4000.00	1	0	0	0	1	1
		1200	52620	10.1165	0.0811	10.1162	-4000.00	1	0	0	0	1	1
51540	50458	0	51540	1.4329	0.1127	1.4285	0.00	0	0	0	0	0	0
		60	51600	1.7837	0.0627	1.7826	0.00	0	0	0	0	0	0
		300	51840	3.0669	0.2407	3.0575	0.00	0	0	0	0	1	1
		600	52140	5.3311	0.0863	5.3304	-4000.00	1	0	0	0	1	1
		900	52440	8.0413	0.1604	8.0397	-4000.00	1	0	0	0	1	1
		1200	52740	11.7050	0.0492	11.7049	-4000.00	1	0	0	0	1	1
51660	51660	0	51660	0.2154	0.1881	0.1050	0.00	0	0	0	0	0	1
		60	51720	0.2245	0.1183	0.1908	0.00	0	0	0	0	0	1
		300	51960	0.7081	0.2901	0.6459	-550.00	1	0	0	0	1	1
		600	52260	1.8960	-0.0605	1.8950	-4000.00	1	0	0	0	1	1
		900	52560	3.9364	0.0959	3.9353	-4000.00	1	0	0	0	1	1
		1200	52860	6.8149	0.0560	6.8146	-4000.00	1	0	0	0	1	1

Trajectory Metrics for AAL1079_004 from TRAJ_METRICS

Sample Time	Traj Build Time	Look Ahead Time	Measure Time	Horz Err	Lat Err	Long Err	Vert Err	TOD Flag	Gap Flag	Out Bound Flag	Adher Flag	Clear Flag	QQ Flag
51780	51660	0	51780	0.3100	0.2499	0.1834	0.00	0	0	0	0	0	1
		60	51840	0.4452	0.2406	0.3746	0.00	0	0	0	0	0	1
		300	52080	1.3243	0.2999	1.2899	-3450.00	1	0	0	0	1	1
		600	52380	2.5603	0.0008	2.5603	-4000.00	1	0	0	0	1	1
		900	52680	5.0082	0.0391	5.0080	-4000.00	1	0	0	0	1	1
		1200	52980	8.5015	-0.1109	8.5008	-4000.00	1	0	0	0	1	1
51900	51660	0	51900	0.6326	0.2364	0.5868	0.00	0	0	0	0	0	1
		60	51960	0.7081	0.2901	0.6459	-550.00	1	0	0	0	1	1
		300	52200	1.6815	0.1230	1.6770	-4000.00	1	0	0	0	1	1
		600	52500	3.4375	-0.0048	3.4375	-4000.00	1	0	0	0	1	1
		900	52800	6.1825	-0.0661	6.1821	-4000.00	1	0	0	0	1	1
		1200	53100	9.7732	0.0660	9.7730	-4000.00	1	0	0	0	1	1
52020	51905	0	52020	0.7811	0.3180	0.7134	138.76	0	0	0	0	0	0
		60	52080	1.1571	0.2999	1.1175	404.88	0	0	0	0	0	0
		300	52320	1.5242	0.0002	1.5242	0.00	0	0	0	0	0	0
		600	52620	2.9575	0.0812	2.9564	0.00	0	0	0	0	0	0
		900	52920	5.3028	0.0878	5.3020	0.00	0	0	0	0	0	0
		1200	53220	6.0154	-0.1009	6.0146	0.00	0	0	0	0	0	0
52140	51905	0	52140	1.0613	0.0863	1.0578	0.00	0	0	0	0	0	0
		60	52200	1.2402	0.1231	1.2341	0.00	0	0	0	0	0	0
		300	52440	1.9692	0.1604	1.9627	0.00	0	0	0	0	0	0
		600	52740	3.8238	0.0492	3.8234	0.00	0	0	0	0	0	0
		900	53040	7.6857	0.2764	7.6808	0.00	0	0	0	0	0	0
		1200	53340	4.8867	0.0169	4.8867	0.00	0	0	1	0	0	0
52260	51905	0	52260	1.3017	-0.0605	1.3003	0.00	0	0	0	0	0	0
		60	52320	1.5242	0.0002	1.5242	0.00	0	0	0	0	0	0
		300	52560	2.5831	0.0959	2.5814	0.00	0	0	0	0	0	0
		600	52860	4.7019	0.0560	4.7016	0.00	0	0	0	0	0	0
		900	53160	6.7427	0.0287	6.7426	0.00	0	0	0	0	0	0
		1200	53460	3.7251	-0.0103	3.7251	0.00	0	0	1	0	0	0
52380	52330	0	52380	0.1830	0.0008	-0.1830	0.00	0	0	0	0	0	0
		60	52440	0.3075	0.1605	-0.2623	0.00	0	0	0	0	0	0
		300	52680	0.3966	0.0391	-0.3947	0.00	0	0	0	0	0	0
		600	52980	0.4526	-0.1109	0.4388	0.00	0	0	0	0	0	0
		900	53280	2.0987	-0.0995	-2.0964	0.00	0	0	0	0	0	0
		1200	53580	6.9936	-0.1093	-6.9927	0.00	0	0	1	0	0	0

Trajectory Metrics for AAL1079_004 from TRAJ_METRICS

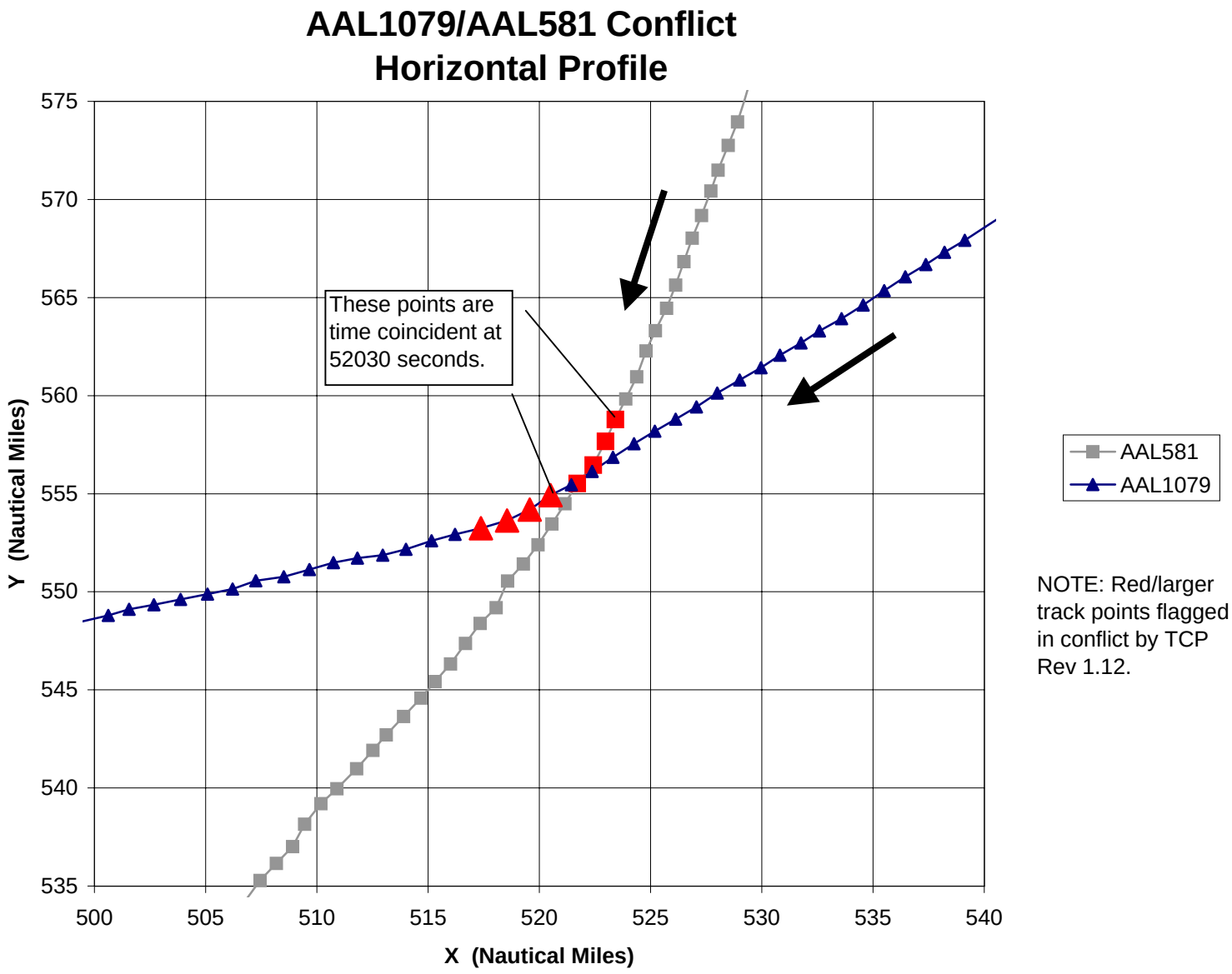
Sample Time	Traj Build Time	Look Ahead Time	Measure Time	Horz Err	Lat Err	Long Err	Vert Err	TOD Flag	Gap Flag	Out Bound Flag	Adher Flag	Clear Flag	QQ Flag
52500	52330	0	52500	0.3697	-0.0047	-0.3696	0.00	0	0	0	0	0	0
		60	52560	0.4149	0.0959	-0.4037	0.00	0	0	0	0	0	0
		300	52800	0.2919	-0.0661	-0.2843	0.00	0	0	0	0	0	0
		600	53100	0.6506	0.0660	0.6472	0.00	0	0	0	0	0	0
		900	53400	3.8990	-0.1934	-3.8942	0.00	0	0	1	0	0	0
		1200	53700	9.1649	-0.3949	-9.1564	0.00	0	0	1	0	0	0
52620	52330	0	52620	0.4167	0.0812	-0.4087	0.00	0	0	0	0	0	0
		60	52680	0.3966	0.0391	-0.3947	0.00	0	0	0	0	0	0
		300	52920	0.0952	0.0878	0.0367	0.00	0	0	0	0	0	0
		600	53220	1.1553	-0.1009	-1.1509	0.00	0	0	0	0	0	0
		900	53520	5.8589	-0.0805	-5.8583	0.00	0	0	1	0	0	0
		1200	53820	11.0644	1.4139	-10.9737	0.00	0	0	1	0	0	0
52740	52330	0	52740	0.3058	0.0492	-0.3018	0.00	0	0	0	0	0	0
		60	52800	0.2919	-0.0661	-0.2843	0.00	0	0	0	0	0	0
		300	53040	1.6783	0.2764	1.6554	0.00	0	0	0	0	0	0
		600	53340	3.0390	0.0169	-3.0389	0.00	0	0	1	0	0	0
		900	53640	8.0920	0.0061	-8.0920	0.00	0	0	1	0	0	0
52860	52330	0	52860	0.1920	0.0560	-0.1837	0.00	0	0	0	0	0	0
		60	52920	0.0952	0.0878	0.0367	0.00	0	0	0	0	0	0
		300	53160	0.0516	0.0288	-0.0429	0.00	0	0	0	0	0	0
		600	53460	4.9191	-0.7516	-4.8613	0.00	0	0	1	0	0	0
		900	53760	10.5699	0.4119	-10.5619	0.00	0	0	1	0	0	0
52980	52330	0	52980	0.4526	-0.1109	0.4388	0.00	0	0	0	0	0	0
		60	53040	1.6783	0.2764	1.6554	0.00	0	0	0	0	0	0
		300	53280	2.0987	-0.0995	-2.0964	0.00	0	0	0	0	0	0
		600	53580	6.9936	-0.1093	-6.9927	0.00	0	0	1	0	0	0
53100	52330	0	53100	0.6506	0.0660	0.6472	0.00	0	0	0	0	0	0
		60	53160	0.0516	0.0288	-0.0429	0.00	0	0	0	0	0	0
		300	53400	3.8990	-0.1934	-3.8942	0.00	0	0	1	0	0	0
		600	53700	9.1649	-0.3949	-9.1564	0.00	0	0	1	0	0	0

Trajectory Metrics for AAL1079_004 from TRAJ_METRICS

Sample Time	Traj Build Time	Look Ahead Time	Measure Time	Horz Err	Lat Err	Long Err	Vert Err	TOD Flag	Gap Flag	Out Bound Flag	Adher Flag	Clear Flag	QQ Flag
53220	**52330**	**0**	**53220**	**1.1553**	**-0.1009**	**-1.1509**	**0.00**	**0**	**0**	**0**	**0**	**0**	**0**
		60	**53280**	**2.0987**	**-0.0995**	**-2.0964**	**0.00**	**0**	**0**	**0**	**0**	**0**	**0**
		300	*53520*	*5.8589*	*-0.0805*	*-5.8583*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
		600	*53820*	*11.0644*	*1.4139*	*-10.9737*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
53340	**53266**	*0*	*53340*	*0.0804*	*0.0169*	*-0.0786*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
		60	*53400*	*0.2498*	*-0.1934*	*-0.1581*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
		300	*53640*	*0.4281*	*0.0061*	*-0.4281*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
53460	**53266**	*0*	*53460*	*0.4128*	*-0.0331*	*-0.4115*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
		60	*53520*	*0.1848*	*-0.0805*	*-0.1663*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
		300	*53760*	*0.8682*	*0.0246*	*-0.8678*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
53580	**53266**	*0*	*53580*	*0.3332*	*-0.1093*	*-0.3147*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
		60	*53640*	*0.4281*	*0.0061*	*-0.4281*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
53700	**53266**	*0*	*53700*	*0.5015*	*-0.0278*	*-0.5008*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
		60	*53760*	*0.8682*	*0.0246*	*-0.8678*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*
53820	**53266**	*0*	*53820*	*1.0158*	*0.9000*	*-0.4709*	*0.00*	*0*	*0*	*1*	*0*	*0*	*0*

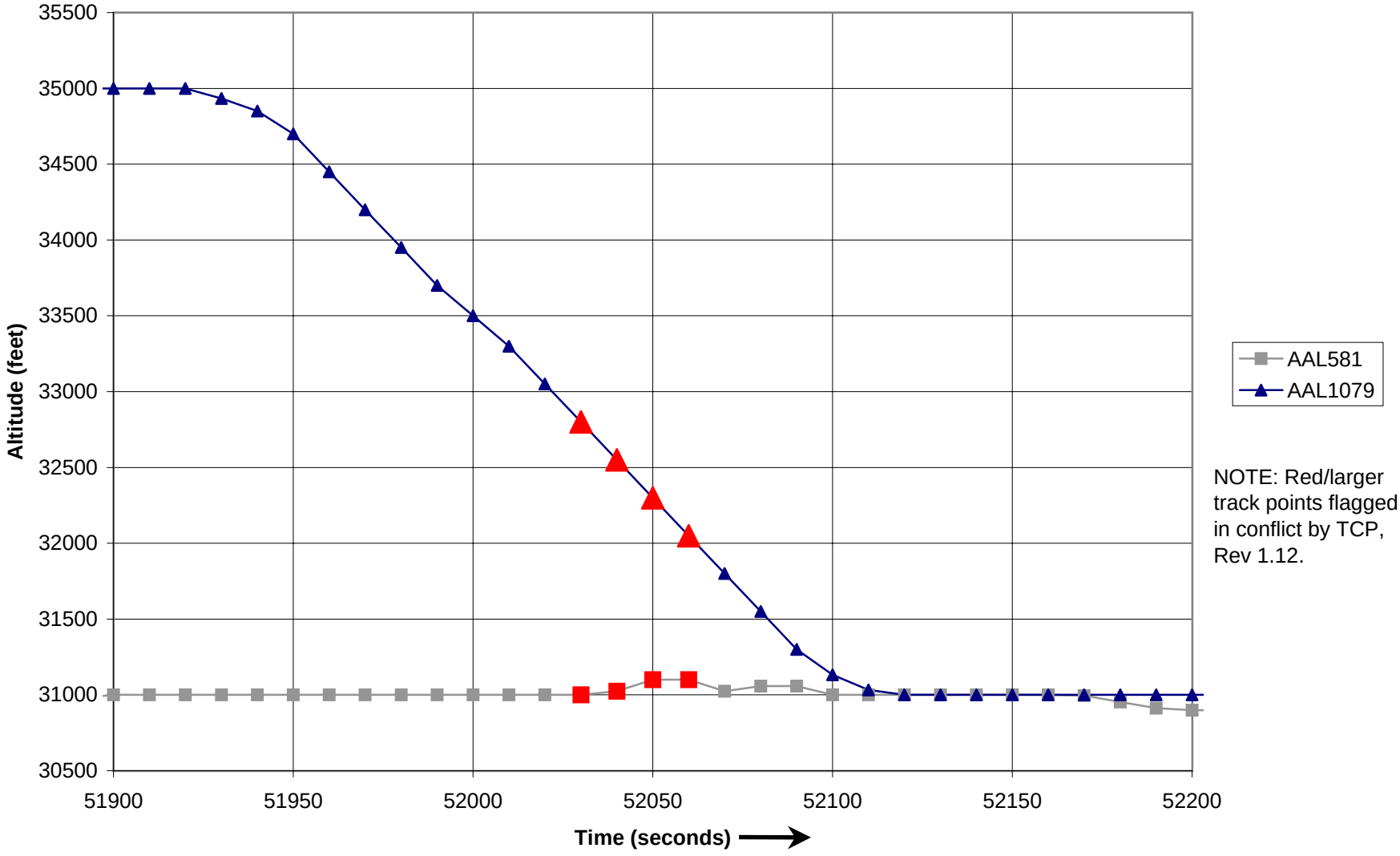
Conflict: AAL1079 & AAL581

- Crossing courses - intersect at 38 degrees
- AAL581 descends from FL350 to FL310 & continues at FL310
- AAL1079 cruising at FL350, descends to FL310
- At CPA:
  - AAL581 in level cruise at FL310
  - AAL1079 descending to FL310
  - aircraft diverging horizontally
- Vertical separation is lost before horizontal separation increases to 5 nm



NOTE: Red/larger track points flagged in conflict by TCP Rev 1.12.

AAL1079/AAL581 Conflict
Vertical Profile



NOTE: Red/larger track points flagged in conflict by TCP, Rev 1.12.

SAMPLE AIRCRAFT-AIRCRAFT CONFLICT FROM FINAL ACCURACY SCENARIO 1100_1600i

TCP detected conflict (in file name => "cfl_enc_cnts26_1100_1600.txt" on Refresh CD):

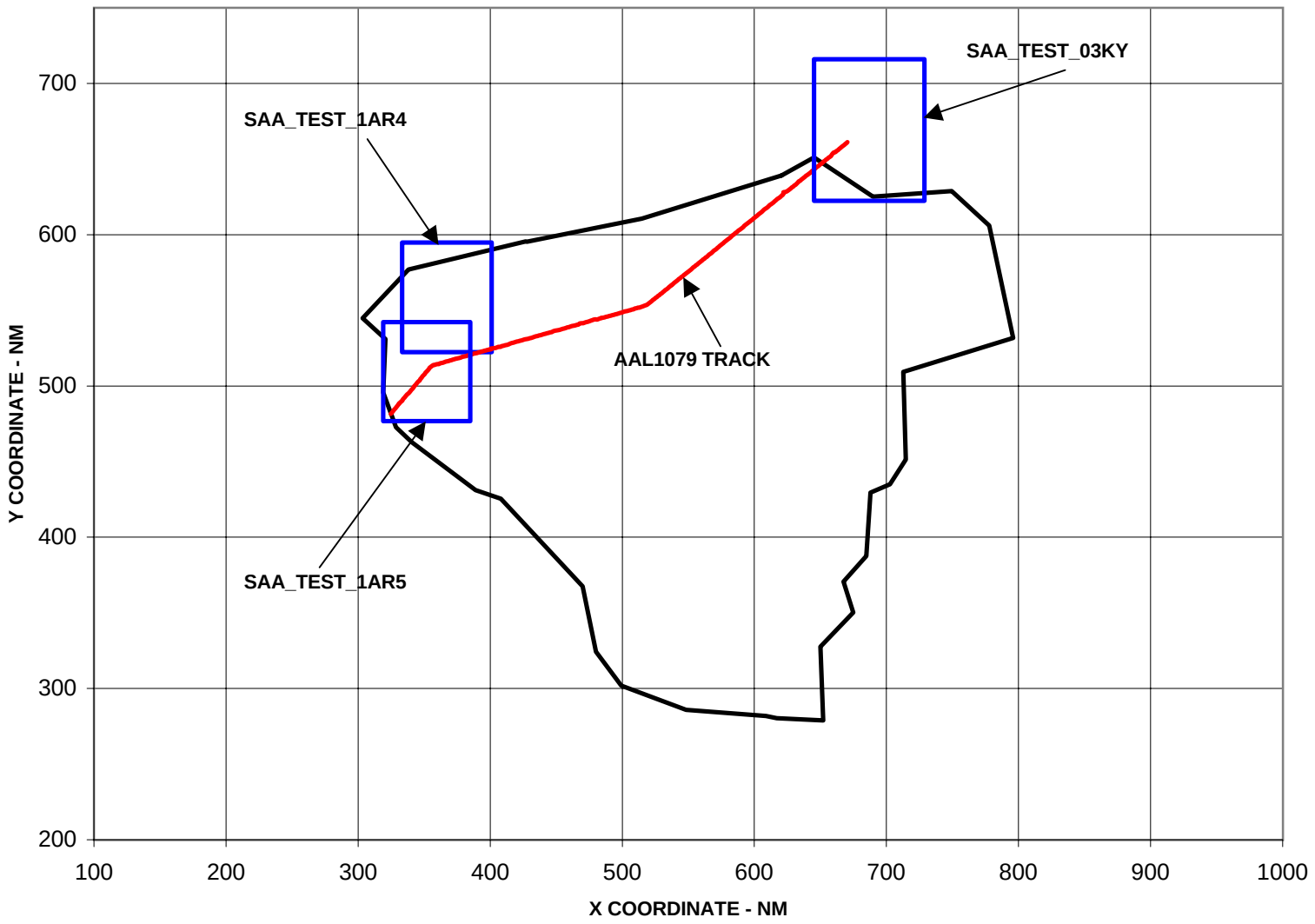
ACID_1	ACID_2	Start Tm	End Tm	Alt_St_1	Alt_St_2	Min_Hsep	Tm Mhsep	Min_Vsep	Tm Mvsep
AAL1079_004	AAL581_058	52030	52060	32800	31000	4.797	52050	1050	52060

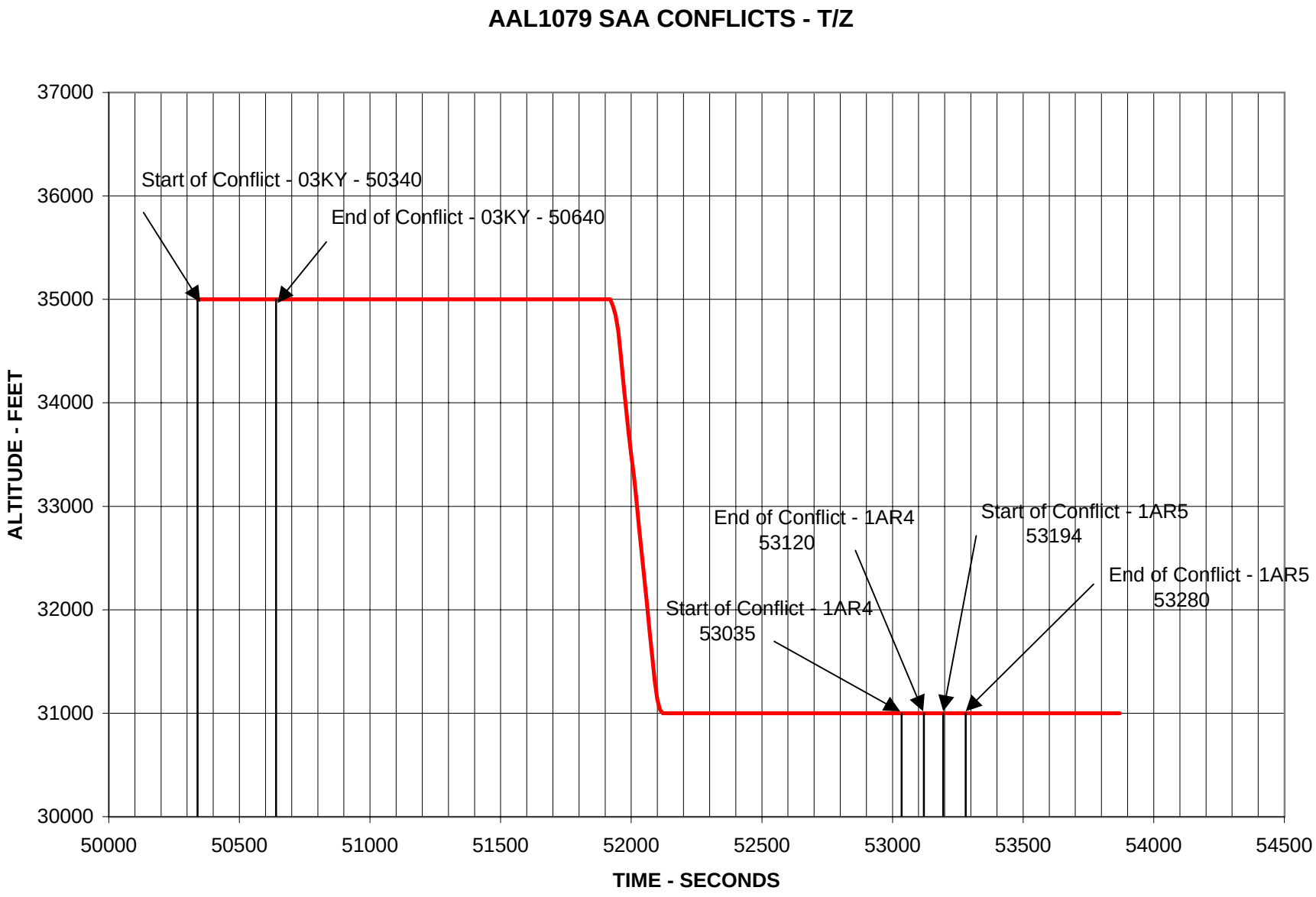
Min-MaxR	Time Min-MaxR	Encountr Angle	Phase Vertical ACID_1	Phase Vertical ACID_2	Current Plan Adher Age	Current Plan Adher Hsep	Trial Plan Adher Age	Trial Plan Adher Hsep	Popup Flag
0.959	52050	38	DESCENT	CRUISE	999999	4.832	999999	4.832	2

POST PROCESSED TRACK:

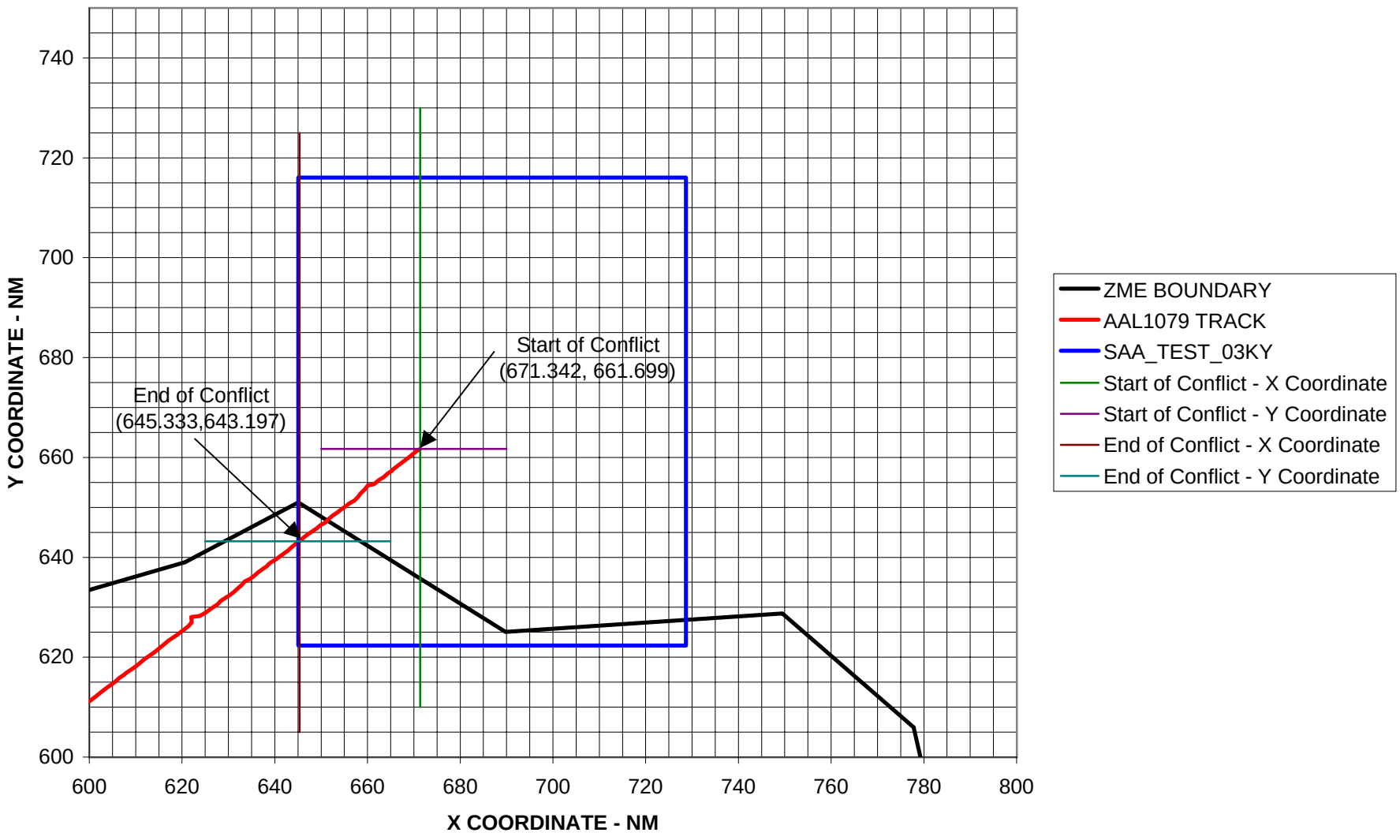
AAL1079_004						AAL581_058								
TIME (sec)	X (nm)	Y (nm)	Z (ft)	Sector	Phase_V	TIME (sec)	X (nm)	Y (nm)	Z (ft)	Sector	Phase_V	Horz_Sep	Vert_Sep	
51030	610.953	618.847	35000	24	LEV	51030	565.999	669.887	34991	-1	DES	68.01429	9	
51040	610.06	618.185	35000	24	LEV	51040	565.891	669.362	34908	-1	LEV	67.60167	92	
51050	609.123	617.6	35000	24	LEV	51050	565.22	668.463	34900	-1	LEV	67.19016	100	
…	…	…	…	…	…	…	…	…	…	…	…	…	…	(vsep
51990	524.253	557.553	33700	25	DES	51990	525.217	563.316	31000	25	LEV	5.84307	2700	based
52000	523.315	556.86	33500	25	DES	52000	524.792	562.274	31000	25	LEV	5.611856	2500	on
52010	522.377	556.133	33300	25	DES	52010	524.375	560.964	31000	25	LEV	5.227864	2300	clr alt
52020	521.442	555.455	33050	25	DES	52020	523.889	559.826	31000	25	LEV	5.009336	2050	rule)
52030	**520.5**	**554.93**	**32800**	**25**	**DES**	**52030**	**523.422**	**558.779**	**31000**	**25**	**LEV**	**4.832482**	**1800**	**1800**
52040	**519.567**	**554.197**	**32550**	**25**	**DES**	**52040**	**522.973**	**557.676**	**31025**	**25**	**LEV**	**4.868704**	**1525**	**1550**
52050	**518.547**	**553.637**	**32300**	**25**	**DES**	**52050**	**522.428**	**556.457**	**31100**	**25**	**LEV**	**4.797349**	**1200**	**1300**
52060	**517.38**	**553.245**	**32050**	**25**	**DES**	**52060**	**521.703**	**555.523**	**31100**	**25**	**LEV**	**4.886472**	**950**	**1050**
52070	516.213	552.933	31800	25	DES	52070	521.157	554.492	31025	25	LEV	5.183977	775	
52080	515.15	552.595	31550	25	DES	52080	520.563	553.451	31058	25	LEV	5.480265	492	
52090	514	552.17	31300	25	DES	52090	519.937	552.404	31058	25	LEV	5.94161	242	
52100	512.958	551.862	31133	25	DES	52100	519.282	551.422	31000	25	LEV	6.339288	133	
…	…	…	…	…	…	…	…	…	…	…	…	…	…	

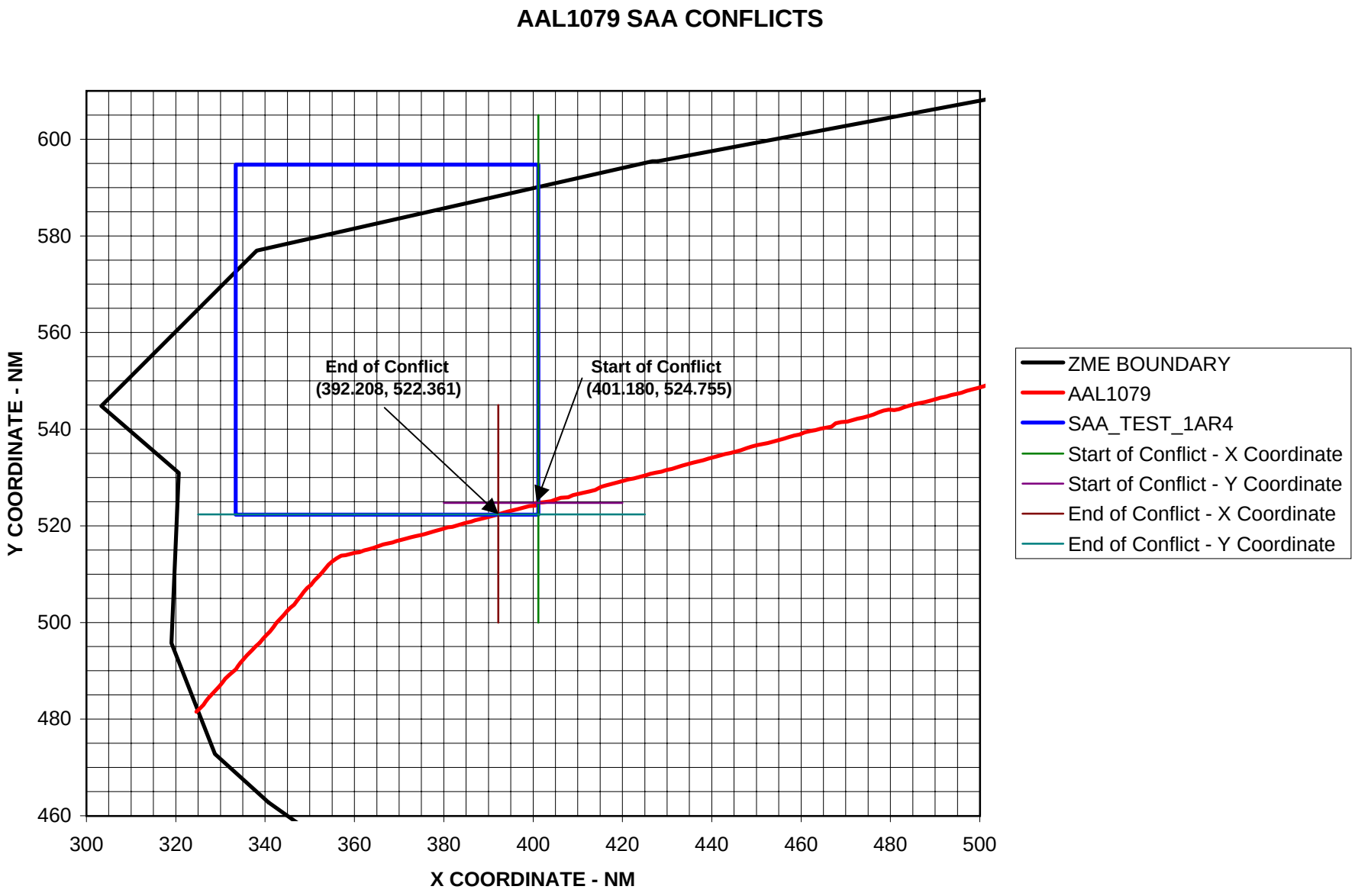
AAL1079 SAA CONFLICTS

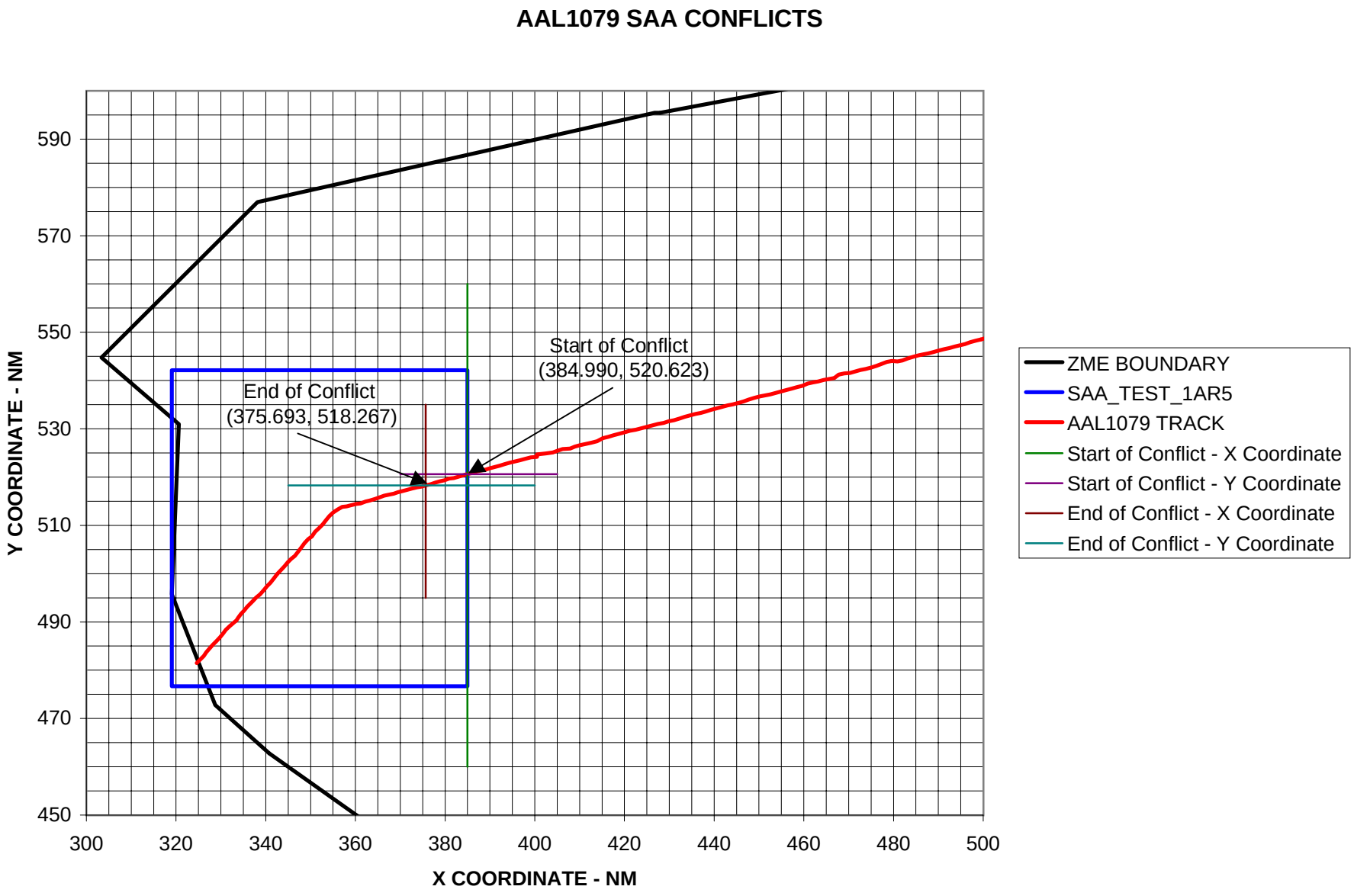



AAL1079 SAA CONFLICTS - T/Z
ALTITUDE - FEET
TIME - SECONDS
37000
36000
35000
34000
33000
32000
31000
30000
50000
50500
51000
51500
52000
52500
53000
53500
54000
54500
Start of Conflict - 03KY - 50340
End of Conflict - 03KY - 50640
End of Conflict - 1AR4
53120
Start of Conflict - 1AR5
53194
End of Conflict - 1AR5
53280
Start of Conflict - 1AR4
53035

AAL1079 SAA_TEST_03KY CONFLICT




AAL1079 SAA CONFLICTS
End of Conflict
(392.208, 522.361)
Start of Conflict
(401.180, 524.755)
Y COORDINATE - NM
X COORDINATE - NM
600
580
560
540
520
500
480
460
300
320
340
360
380
400
420
440
460
480
500
ZME BOUNDARY
AAL1079
SAA_TEST_1AR4
Start of Conflict - X Coordinate
Start of Conflict - Y Coordinate
End of Conflict - X Coordinate
End of Conflict - Y Coordinate


AAL1079 SAA CONFLICTS
Y COORDINATE - NM
X COORDINATE - NM
590
570
550
530
510
490
470
450
300
320
340
360
380
400
420
440
460
480
500
Start of Conflict
(384.990, 520.623)
End of Conflict
(375.693, 518.267)
ZME BOUNDARY
SAA_TEST_1AR5
AAL1079 TRACK
Start of Conflict - X Coordinate
Start of Conflict - Y Coordinate
End of Conflict - X Coordinate
End of Conflict - Y Coordinate

AAL1079 AIRCRAFT - AIRSPACE CONFLICTS

ACID_CID	SAA MODULE NUMBER	SAA MODULE NAME	VERT PHASE	HORZ PHASE	START CODE	CONFLICT COUNT	CONFLICT START X COORD	CONFLICT START Y COORD	CONFLICT START Z COORD	CONFLICT START TIME	CONFLICT START ANGLE
AAL1079_004	43	SAA_TEST_03KY	STR	LEV	4	1	671.342	661.699	35000	50340	-1
AAL1079_004	50	SAA_TEST_1AR4	STR	LEV	1	1	401.180	524.755	31000	53035	84.359
AAL1079_004	52	SAA_TEST_1AR5	STR	LEV	1	1	384.990	520.623	31000	53194	76.244

CONFLICT END X COORD	CONFLICT END Y COORD	CONFLICT END Z COORD	CONFLICT END TIME	CURRENT PLAN ADHERENCE AGE	TRIAL PLAN ADHERENCE AGE	POPUP FLAG
645.333	643.197	35000	50640	999999	999999	1
392.208	522.361	31000	53120	999999	999999	0
375.693	518.267	31000	53280	999999	999999	0