



3D Visualization Support for Aviation Mission Planning

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About ProLogic



- Small 8(a)-certified software development firm
- Offices in Fairmont, WV and Washington DC area
- Mixed Model Business - *Products and Services*
- Customers include Air Force, Army, NASA
- STK Business Partner - Solution Provider
- ESRI Business Partner, SEDRIS Associate
- Core Competencies
 - Geospatial Technologies
 - GIS, Visualization, Modeling & Simulation
 - Knowledge Management
 - Testing, IV&V



Overview



- USAF uses Portable Flight Planning System (PFPS) to support a broad range of aviation mission planning needs
- ProLogic developed a demo system for mission planning program office (AFMSS) that integrated with PFPS and added 3D Visualization capabilities
- STK is used to provide 3D visualization of
 - PFPS data elements (aircraft routes, annotations, threats)
 - Raster products (terrain, imagery, maps)
 - NIMA DAFIF data (airspace, airways, nav aids, airports)
 - NIMA DVOF data (towers, buildings)
- The system also takes advantage of STK strengths to provide advanced situational awareness



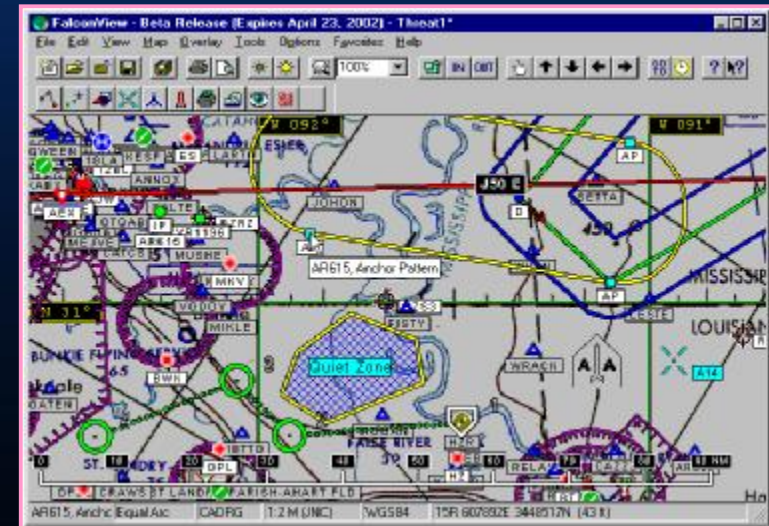
PFPS System



Combat Flight Planning Software - [hans_clark_01.rtc]

Turn Pt	Type	Fix/Point	Latitude	Elev	Aspd	Altitude	Temp	MR	Leg Time	Leg Dist	Leg Fuel
1	ST	NEED 29 29 3	N 42 26.17	124 FT	124M	+19C	294	00:00:00	0.0	500	
		LAURENCE G HA	N 42 16.40	15.7W			294	03:00:00	0.0	19600	
2		IBSD 11 11 1	N 42 30.21	130 FT	330T	193M	+15C	233	00:00:14	1.2	25
		LAURENCE O HA	N 42 18.02	15.6W			653T	233	12:00:14	1.2	19475
		Javel Off	N 42 30.40	14N	N/A	19000M	-5C	295	00:01:53	13.0	541
			N 42 35.43	15.5W			17190	295	12:02:07	14.2	10034
3		ALBIR	N 42 44.69	275 FT	325T	19000M	-5C	295	00:10:17	89.1	1605
		ALBANY	N 42 34.10	14.3W			5264	295	12:30:24	113.3	17323
4		HANCE	N 42 03.78	207 FT	325T	19000M	-5C	253	00:14:33	78.8	1253
		HAMCOCK	N 42 18.98	13.0W			5167	253	12:34:57	152.0	10076
5		PSBUR	N 40 54.96	244 FT	325T	19000M	-5C	254	00:25:39	138.9	2160
		PHILIPSBURG	N 42 59.58	10.7W			5254	254	13:03:26	320.5	13018
6		JSTAR	N 40 19.00	228 FT	325T	19000M	-5C	239	00:10:43	52.6	803
		JOHNSTOWN	N 42 50.25	9.9W			4925	239	13:10:19	363.6	13113
7		INDR	N 39 50.45	202 FT	325T	19000M	-5C	240	00:05:49	31.7	479
		INDIAN HEAD	N 40 21.60	9.9W			4914	240	13:16:10	415.3	12634
		descent pt	N 39 35.61	102 FT	325T	19000M	-5C	233	00:05:45	31.1	468
			N 40 43.66	9.9W			4885	232	13:21:55	446.4	12196
8		NGAWM	N 39 33.40	204 FT	N/A	13398M	-3C	233	00:00:44	3.0	22
		MORGANTOWN	N 40 51.82	9.9W			1795	232	13:22:38	448.4	12144
9			N 39 30.32	14N	N/A	3731M	+10C	235	00:04:26	18.0	133

CFPS (Combat Flight Planning Software)



FalconView

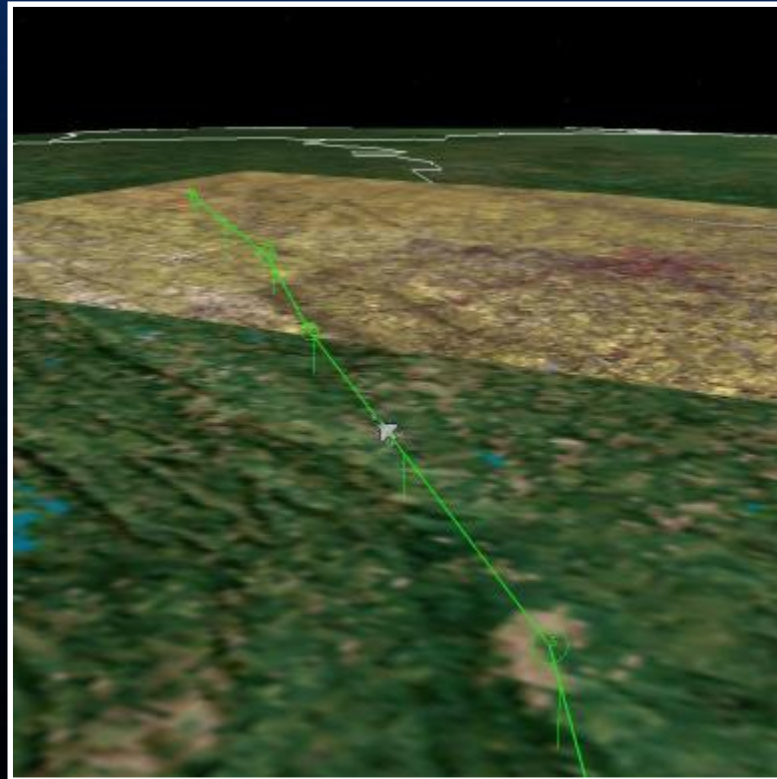
RATSuite, TOLD, ARTOOL, CARDWIN,
CWDS, TaskView, NOTAM, Weather, etc.



PFPS Routes



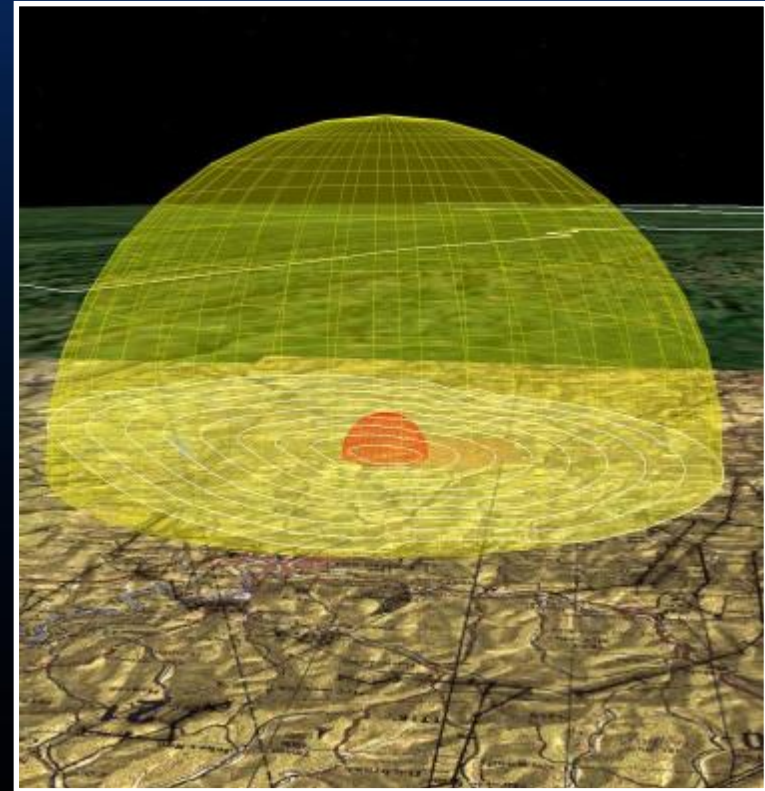
- Route data
 - Planned date
 - Turnpoints
 - Positions
 - Leg Speed/Time
 - Aircraft type
 - Additional data (fuel, etc.)
- STK Implementation
 - Aircraft for model & track
 - Turnpoint markers



PFPS Threats



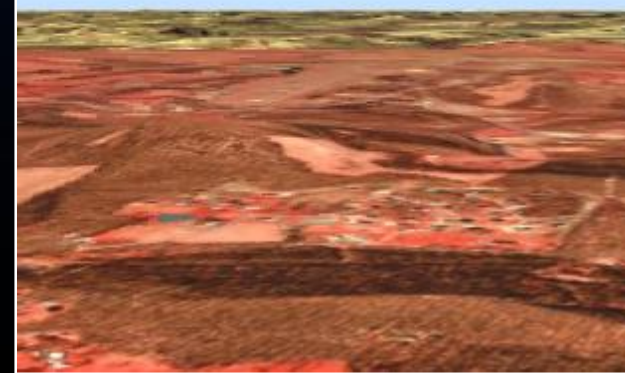
- PFPS (FalconView) Threats
 - Location
 - Engage Radar (outer)
 - Detect Radar (inner)
 - Visualization of Terrain Mask
- STK Implementation
 - Threat Object
 - Two sensors
 - AzEIMask



Raster Data



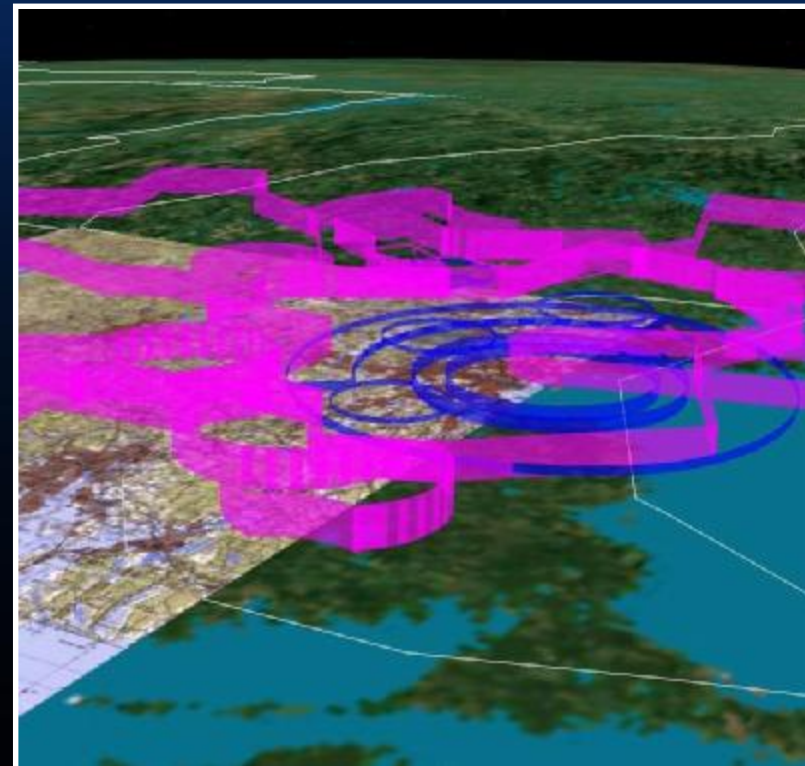
- Raster Types
 - NIMA
 - CADRG, ADRG
 - CIB
 - DTED
 - Other
 - DEM
 - HREI FOTE Product
 - Local Aerial Imagery (DOQ)
- STK Implementation
 - Image import
 - Terrain import
 - Globe files



DAFIF Airspaces



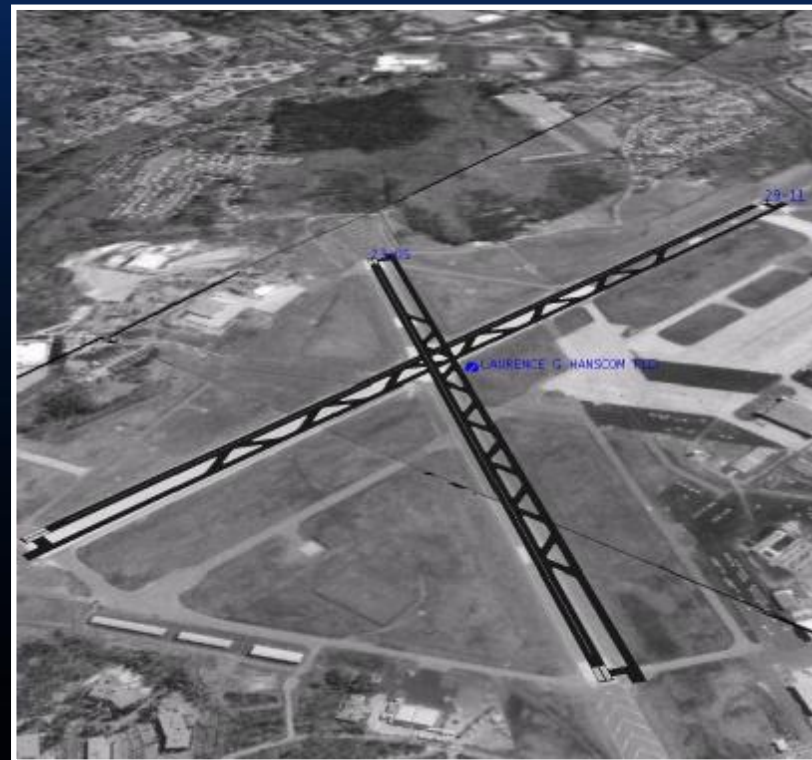
- Airspace data
 - Large volumes
 - Closed polygons
 - Min/Max altitude
 - Stacked
 - “inverted wedding cake”
- STK Implementation
 - Extruded polygons
 - Translucent coloring



DAFIF Airports & Runways



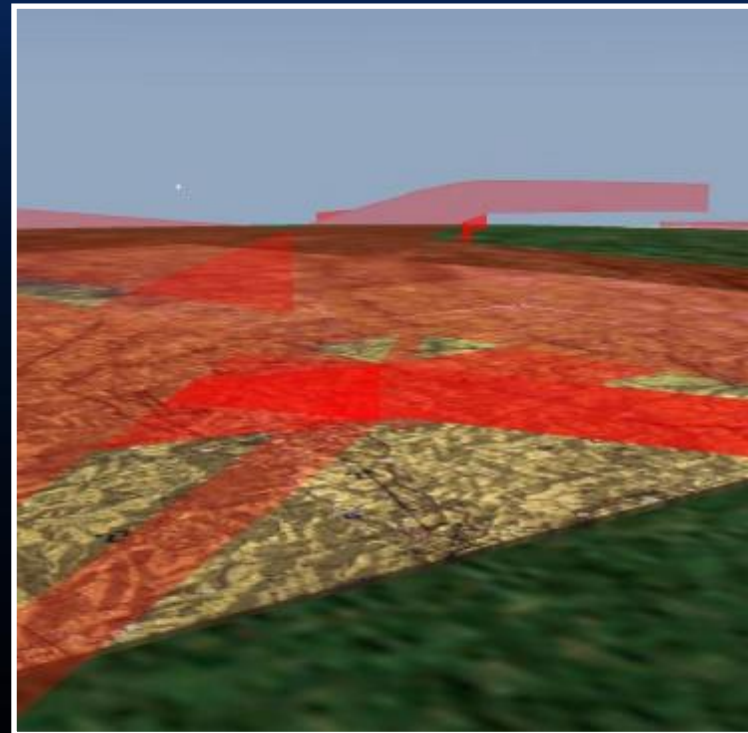
- DAFIF Data
 - Airport
 - Position
 - Type
 - Runways
 - End points
 - Length
 - Width
- STK Implementation
 - Airport markers
 - Runway models



DAFIF Airways

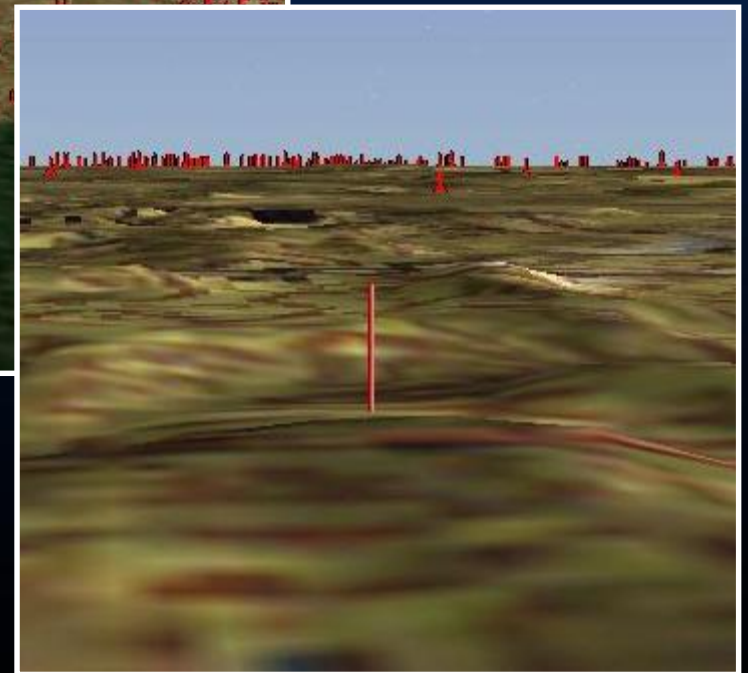
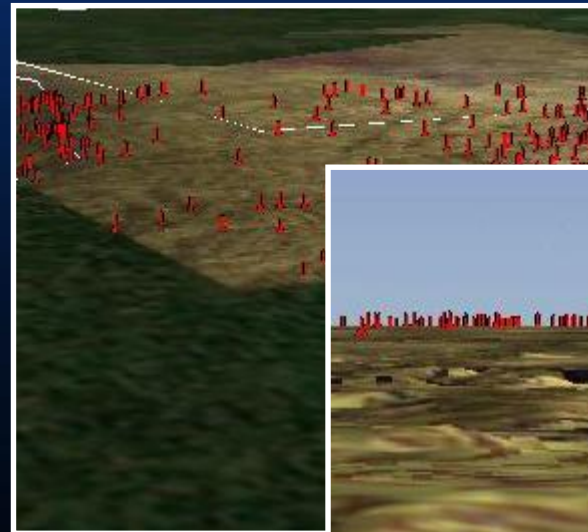


- Airways
 - “Highways in the sky”
 - Floating ribbons
 - Multisegment lines
 - Min/max altitudes
 - Segments connect waypoints
- STK Implementation
 - Extruded airways
 - Translucent coloring



Vertical Obstructions

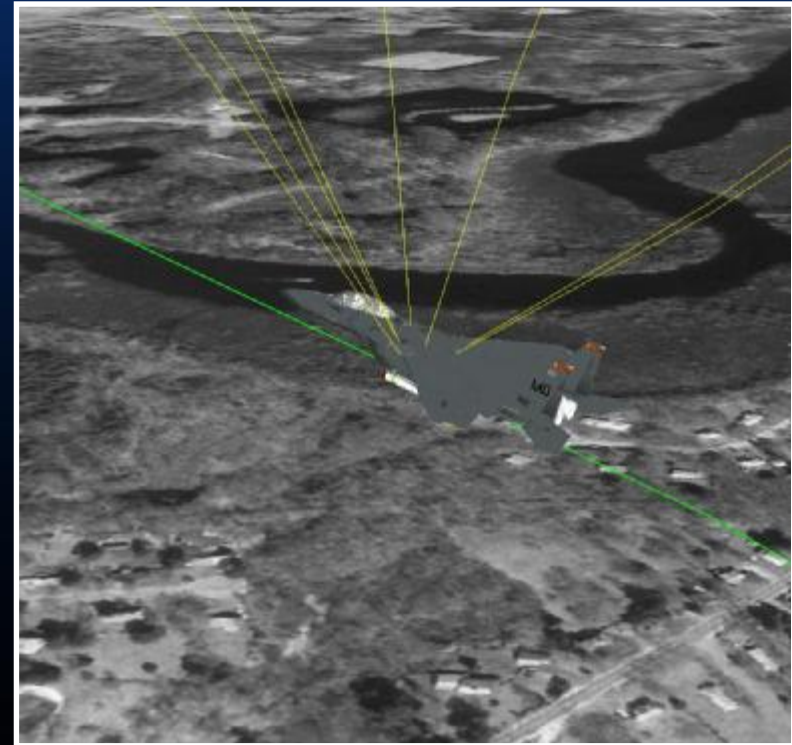
- FCC Data
 - Antenna Structures
 - Lat, Lon, Elev, Height
- DVOF Data
 - Various Types
 - Lat, Lon, Elev, Height
- STK Implementation
 - Markers at a distance
 - Scaled models up close



GPS Availability



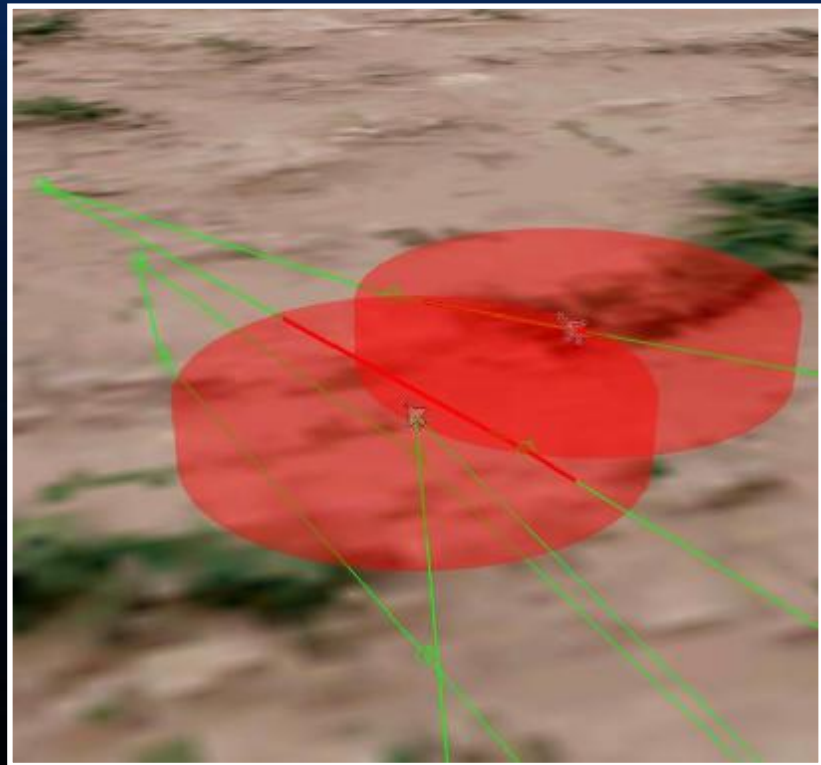
- Goal
 - Visualize GPS availability for each route during flight
- STK Implementation
 - GPS Constellation
 - Chain access to aircraft



Route Conflicts



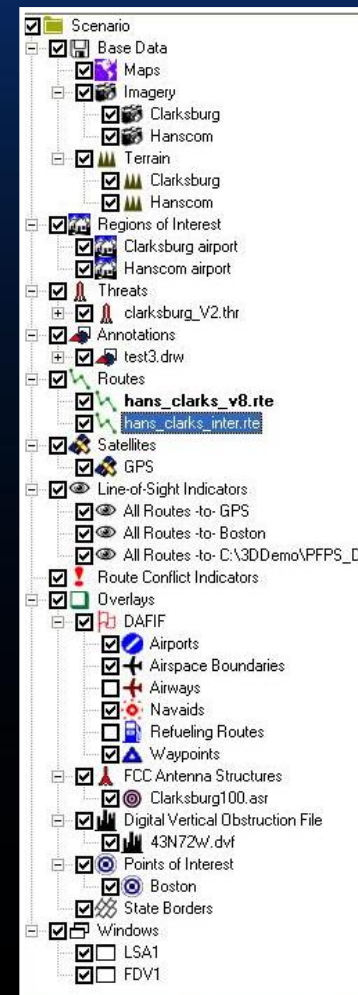
- Conflict Detection
 - Route conflict: when vertical or horizontal separation is not maintained
 - Each has a start/end time
 - Conflicts usually symmetric
- STK Implementation
 - Custom constraints for access calculations
 - Cylindrical “buffer” model displayed during access



Mission Planning GUI



- Central user interface for Mission Planning tasks
 - Data management
 - Overlay controls
 - toggle visibility
 - filters
 - Analysis (Line-of-sight, route conflicts)
 - Eyepoint control
- Shared simulation clock
- Loads scenarios from XML



Summary



- Leveraged STK/AVO via STK/Connect
- Seamlessly integrated with PFPS to provide a new 3D Visualization window
- Used STK's "access" calculations to implement GPS prediction, route conflict, threat avoidance, etc.
- Addition of advanced 3D Visualization and analytical capabilities well received by USAF
- Demonstration system could help identify user requirements for 3D Visualization in JMPS (next generation mission planning system)



Acknowledgements



- Support from ESC/DIJ Project Management
 - Lt Peter Buikema, Maj James Raulerson
 - Bill Berthelotte , Kevin Miller
- Guidance from AFMSS Program Office
 - Nancy Markuson
 - Ron Nadreau
- Assistance from AGI Staff
 - Joe Murphy, Mike Shepard
 - Deron Ohlarik, Jimmy Tucholski

