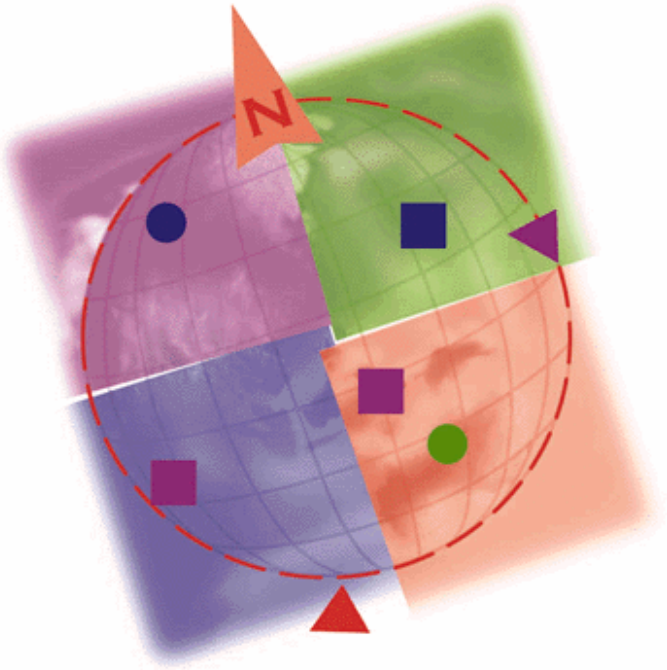
Pilot/Aircrew Cockpit Management System (PACMAN)

** Public Briefing **



Position Integrity

Situational Awareness

No military endorsement is expressed or implied in this presentation.

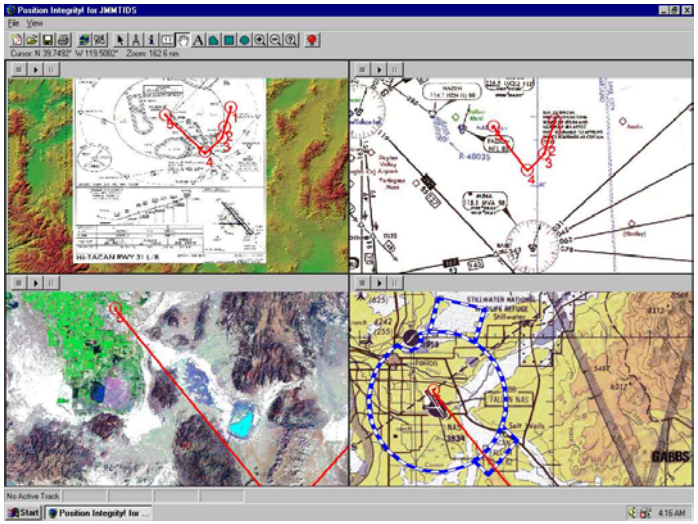
Who is Position Integrity?

- **Emphasizing 10 years expertise in the aviation industry**
- **An aviation technology company**
  - » Transportation safety technology to save lives
  - » Software applications to maintain situational awareness
  - » Data processing and provisioning services
- **A heritage of defense contracting**
  - » Technology from $5M of government funding
  - » Current Sponsor is U.S. Military and avionics industry
  - » Applying government research achievements to industry and commerce

Proven Technology

Winner of Microsoft Windows World Open

- Laptop used by co-pilot in Navy E-2C Hawkeye
- Multi-window application included terminal procedures, airport diagrams, enroute charts, DAFIF, CADRG, DTED, CIB, LANDSAT,and JTIDS traffic/intel.
- Flight tested at Fallon NAS, NV and then deployed globally.
- Endorsed and funded by Admiral Archie Clemins, CINCPACFLT
- Award presented to Navy sponsor by Bill Gates



US SOCOM uses PI software for its wearable computer display

- We demonstrated System with aircraft at Hurlburt AFB, Florida.
- System used digital data messaging without the errors common in voice communication.

PI Services to Industry

- ARINC-424 Aeronautical Data
- Flight Management System format utilities
- Graphic Rendering Engines
- End User Applications
- Data Warehousing
- Web Distribution
- Commercial Customers include Honeywell, BAE, Litton and NASA.

PACMAN Initiative

- **18-month development under Air Expeditionary Force and Air Mobility Command Battlelabs.**
- **The Battlelab is a unique organization focused on rapidly introducing high payoff initiatives that:**
  - » Reduce mobility response time.
  - » Reduce deployment support structure.
  - » Increase deployed combat capability and effectiveness.

Seymour Johnson F-15E Deployment Mar 02

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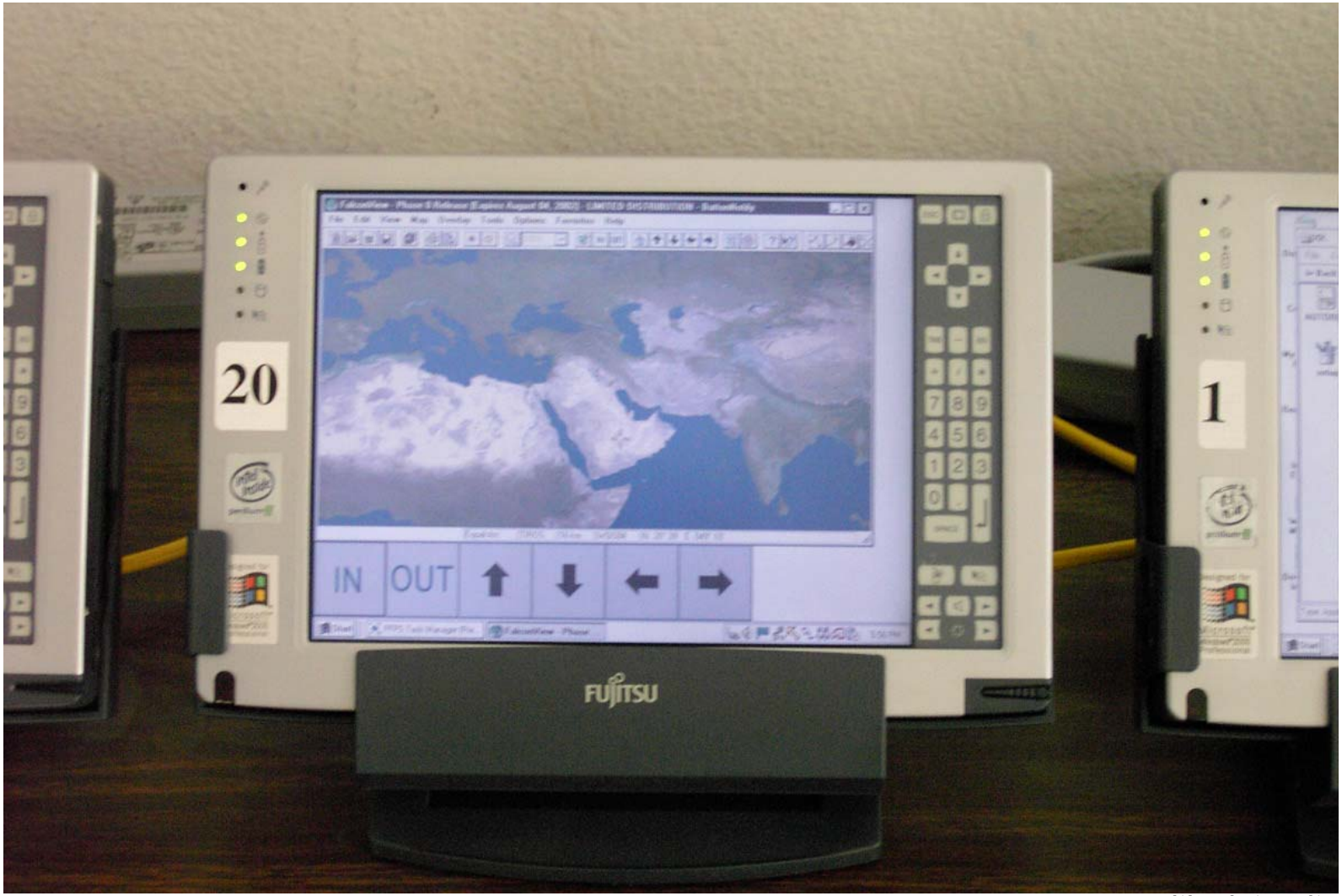
Ongoing PACMAN Flight Tests Scheduled

- KC-135
- C-130
- B-2
- A-10
- Ground Users
- Others

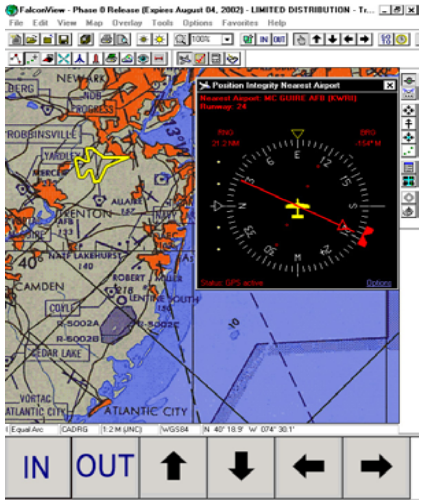
PACMAN Display Device is a modified Pen Computer

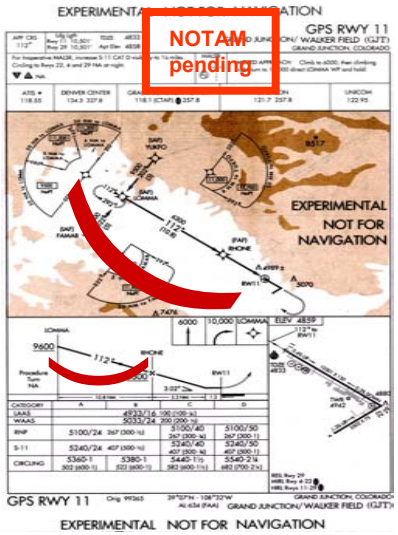


The Complete Hardware Suite

- PACMAN Pen Computer
- GPS Receiver (or interface to A/C nav)
- Multiple 2 ½-hour Batteries (or A/C power)
- Custom kneeboard case
- Data Modem
- Cabling to A/C Radio
- Custom cable bundles
- Map Server for Squadron
- Firewall/Router/Network Switch

Overview of PACMAN's 3 Initial Software Functions





LEFT/RIGHT HYDRAULIC SYSTEM FAILURE

If left system fails:
1a. FLAP EMER RETR – EMER RETR
1b. If landing gear is down, LAND GEAR circuit breaker – Pull.

If right system fails:
1. SPD BK EMER RETR – EMER RETR

If pressure decreases:
2. SAS/Anti-Skid – Paddle OFF.
3. Pitch SAS – Leave OFF.
4. Yaw SAS switch (operable channel only) – Engage (if desired).
5. Anti-Skid switch – ANTI-SKID (if left hydraulic system is operable).
6. Monitor hydraulic pressure of operable hydraulic system, and land as soon as practical; if damage is confirmed or suspected, accomplish CONTROLLABILITY/STRUCTURAL DAMAGE (EF-19).

Prior to landing:
7. Speedbrakes – As required.
8. Landing Gear Handle – DOWN.

If left hydraulic system has failed or LAND GEAR circuit breaker was pulled:
a. AUX LG EXT handle – Pull.
b. AUX LG EXT handle – PUSH in (when landing gear indicates safe).
c. Emergency brake handle – Pull.

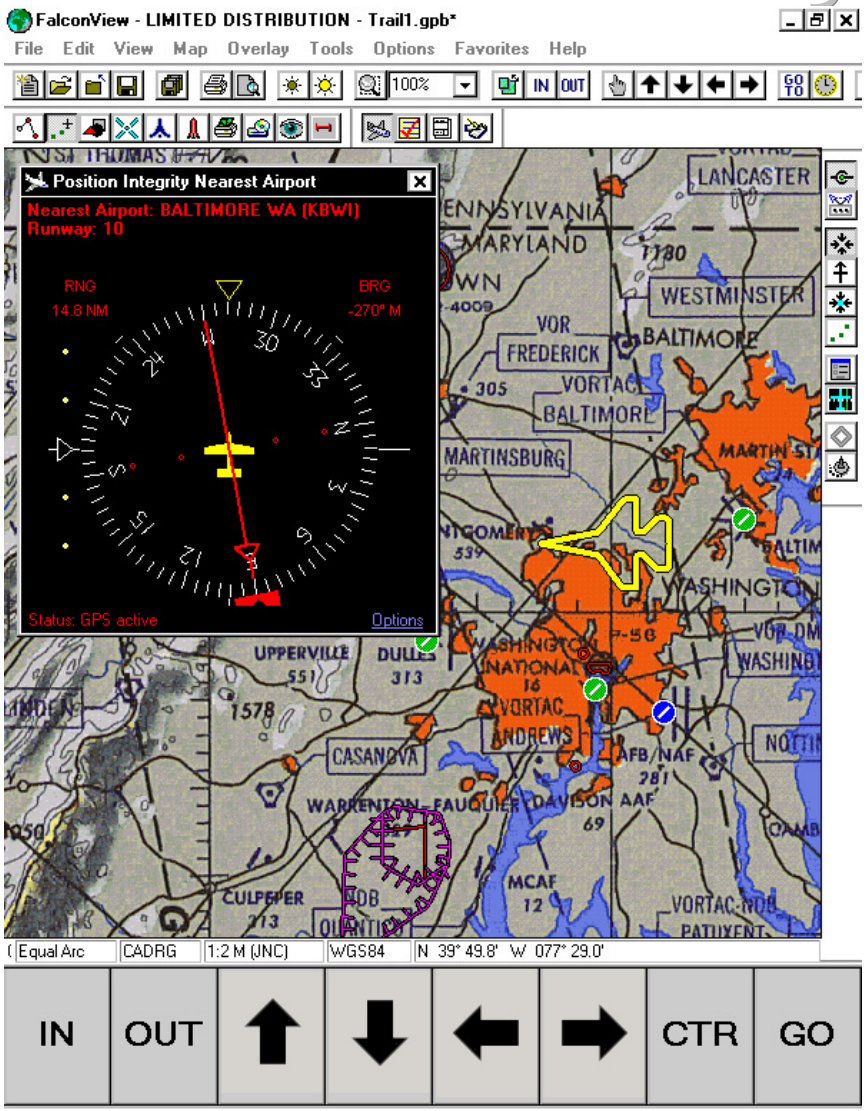
9. Flaps – As required.

If both hydraulic systems fail: refer to DUAL HYDRAULIC SYSTEM FAILURE (EA-5).

END

- 1. GPS-Moving Map
- 2. Interactive aircraft checklists
- 3. Airport Terminal Procedures

GPS-Based Moving Map enhances safety



- NIMA Raster Charts for background
- DAFIF vector overlays (airports, SUAS, etc.)
- Own position updated in real time
- North up or track up
- Find Nearest Airport Function based on Aircraft's runway length requirement

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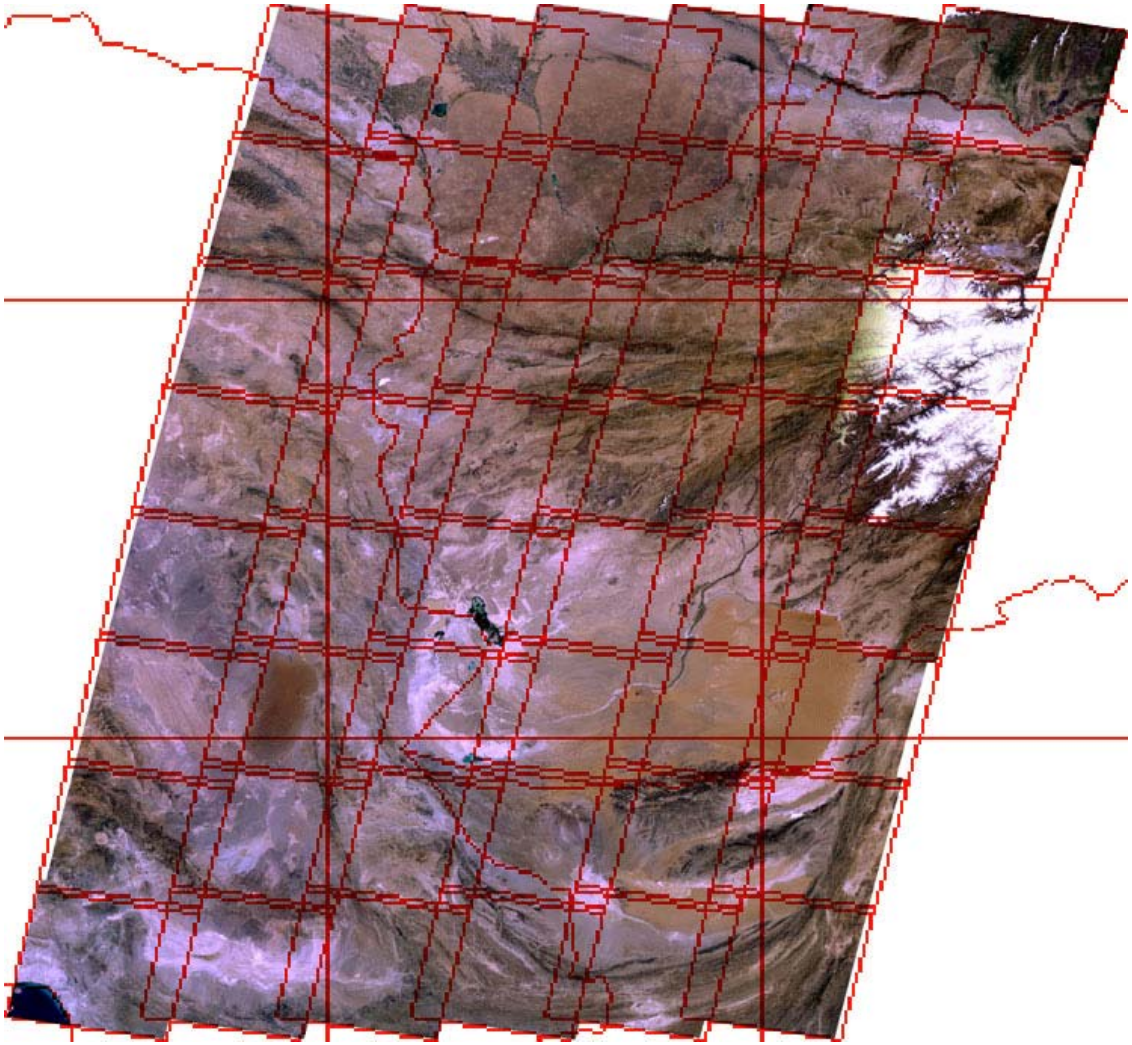
PACMAN Data Loads

Data Type	NIMA Source	Other Source
1. Maps	CADRG	PI GeoTIFF
2. Imagery	CIB	JPL, USGS GeoTIFF
3. Terrain	DTED	
4. Aeronautical	DAFIF	(SHP), NOTAMS
5. FLIP Text	PDF, { new }	
6. FLIP Enroute	{new}	PI GeoTIFF
7. FLIP TPs	{new}	PI PDF, GeoTIFF
8. Tech Pubs		PDF, SGML, XML
9. Weather		AF GeoTIFF
10. E-mail		PACMAN Network
11. Flight Plans		PFPS/JMPS
12. Pilot Custom		Scratchpad files

Large Area Mosaic of Middle East from Position Integrity and JPL for PACMAN



NASA
Jet Propulsion Laboratory
California Institute of Technology

Position Integrity™

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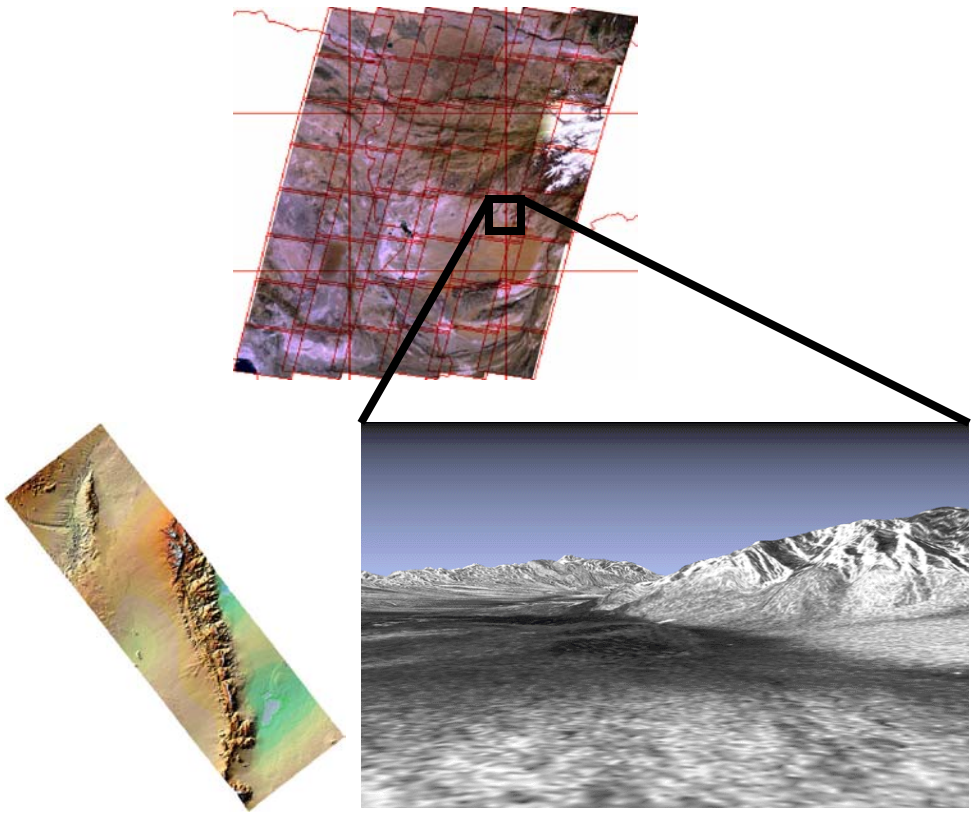
PACMAN relies on GeoTIFF standards to promote interoperability



300-Meter Imagery for Situational Awareness

30-Meter Imagery Draped over 30-Meter SRTM Terrain

Visit www.geotiff.net for a on-line demonstration of NASA imagery

Big Buttons for Entering Locations

N _ _ º _ _ '. _ _ _

W _ _ _ º _ _ '. _ _ _

1	2	3
4	5	6
7	8	9
←	0	ENTER

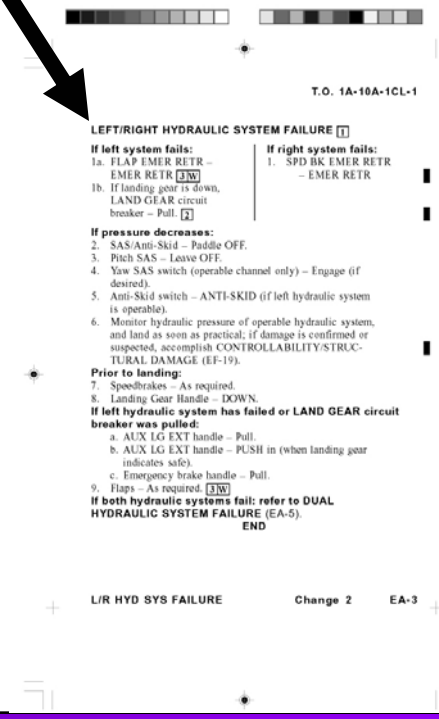
IN	OUT	↑	↓	←	→	CENTER	GO TO

Functional Separation Between Technical Manual Format and Content

PACMAN
Rendering

XSL
"Look and Feel"

(titles)
(fonts in Unicode)
(hyperlinks)



XML
Content

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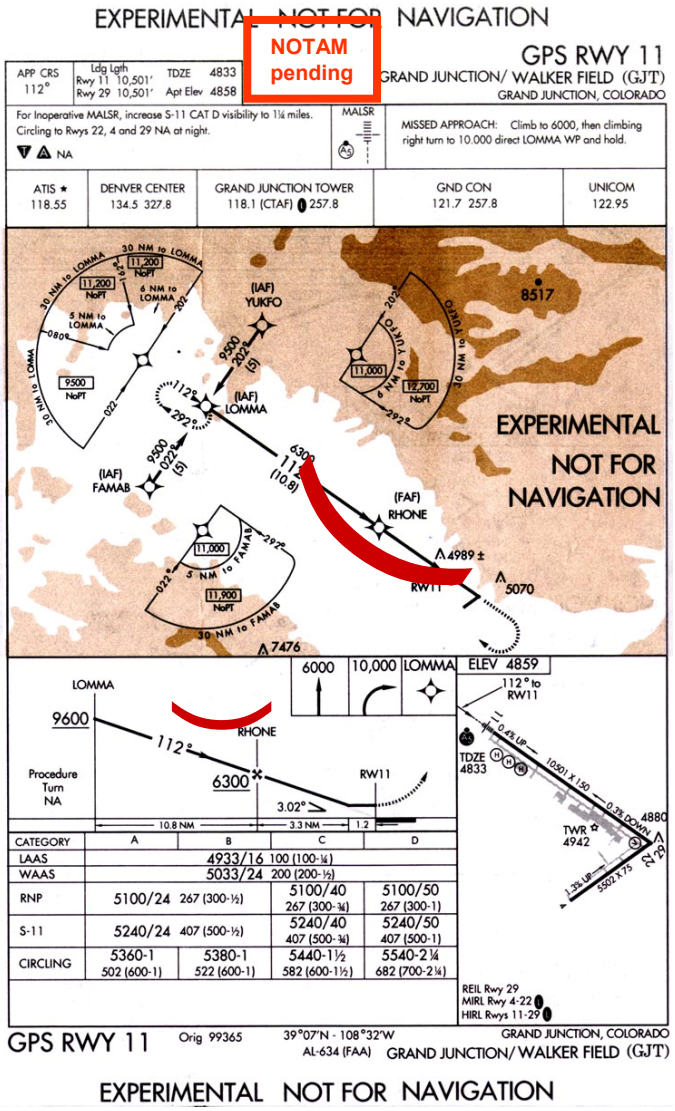
Three-Dimensional Terminal Guidance

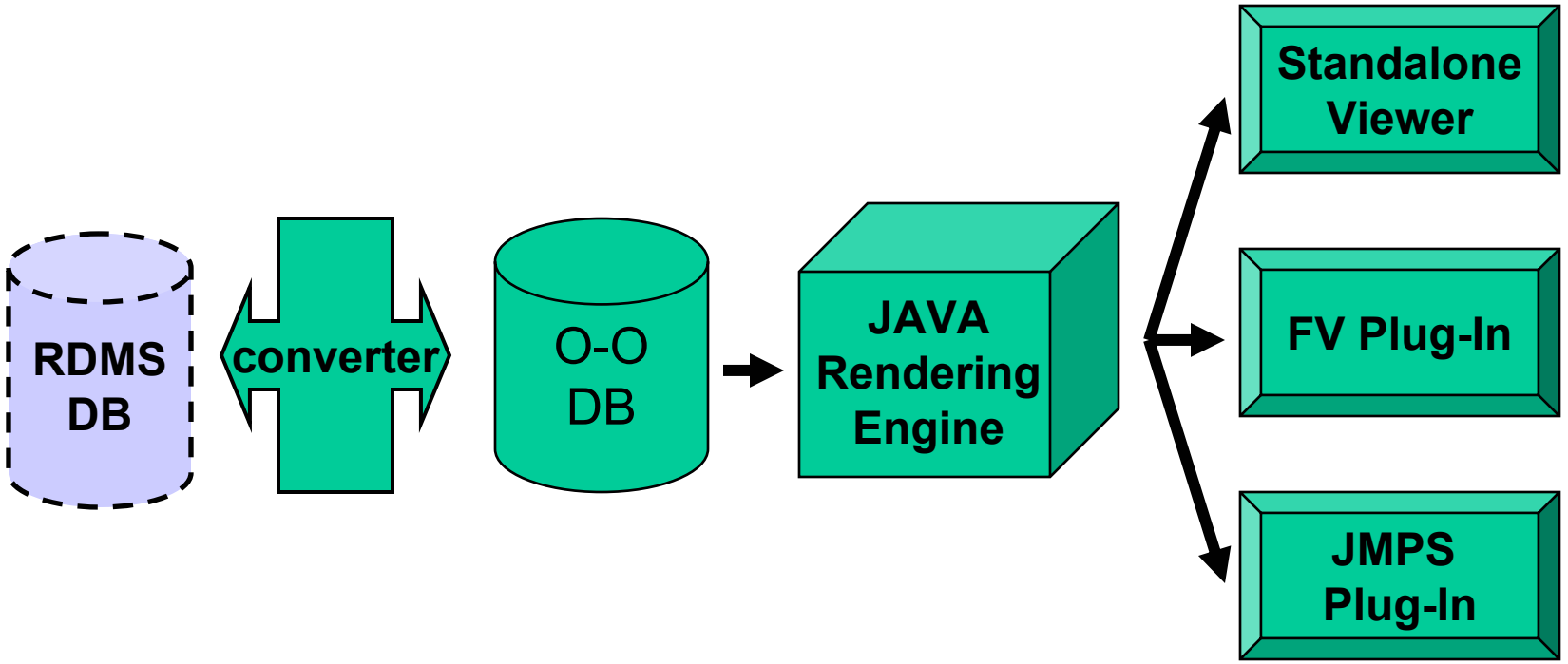


- We currently process 11,000 terminal charts per update in raster for General Aviation.
- Provide HTML hypertext linking of airports to procedures.
- PACMAN needs to accommodate new multicolor format.
- Must include NOTAM distribution mid-cycle.
- Vector Procedures planned by FLIP DWG for DAFIF Ed 8 (Summer 04) is not soon enough.
- Conducted TEM #1 with NIMA to accelerate.

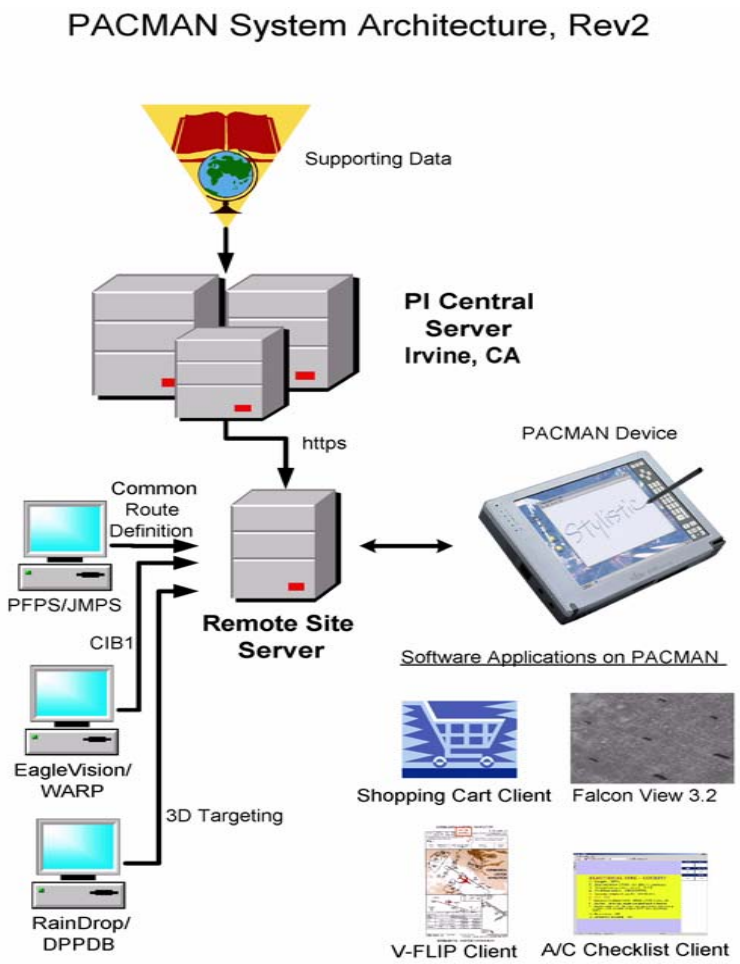
Advantages of Vector FLIP over scanned Raster charts

Feature	Raster FLIP	Vector Flip
Size	~300Kb	~3Kb
Quantity per 1Gb	3 volumes (i.e. NorthEast U.S.)	36 Volumes (all 20,000 procedures)
Intelligence	Dumb electronic page turner	Smart: can query all fields
GPS Moving Map	Plan View only within 5 NM range ring	Entire Plan View + Profile View
Features	All or nothing	Can toggle field on/off for selectable content
Rendering	Fixed Presentation	Variable for integration into many applications

New Aeronautical Information Architecture



PACMAN Device is supported by web-centric architecture



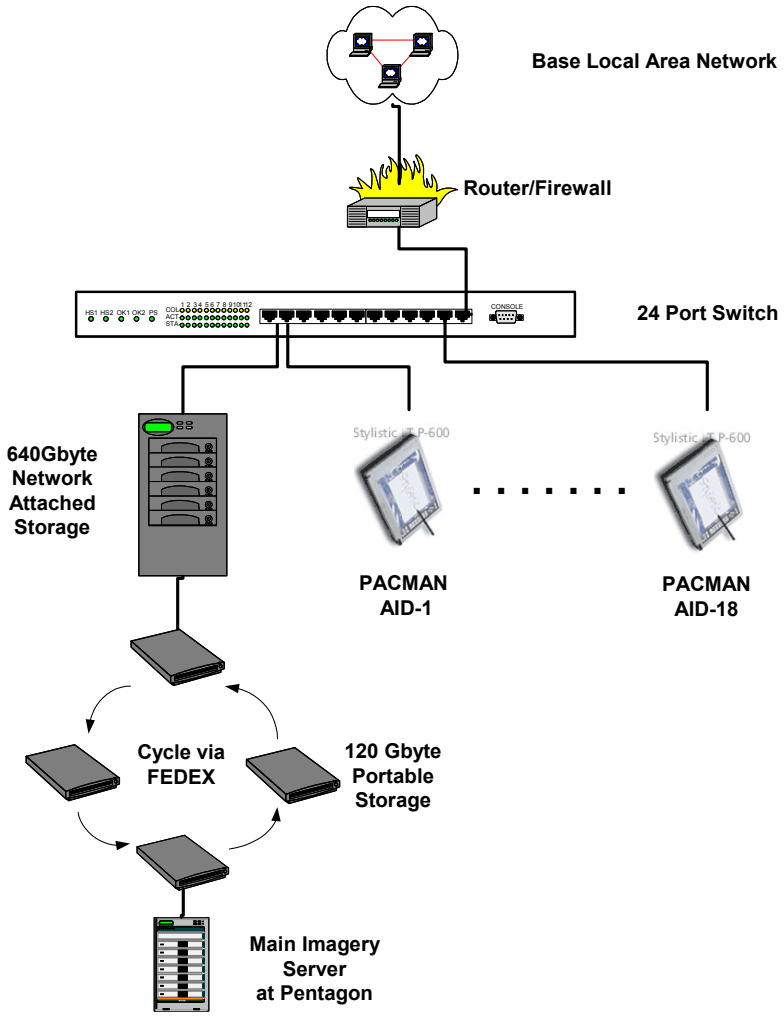
- PACMAN device is designed to operate autonomously in aircraft.
- Irvine- and Pentagon-based Central servers provide replenishment of current databases.
- Remote servers overcome bandwidth limitations at decentralized sites.
- PACMAN team installing the first prototype server.

The next PACMAN Phases

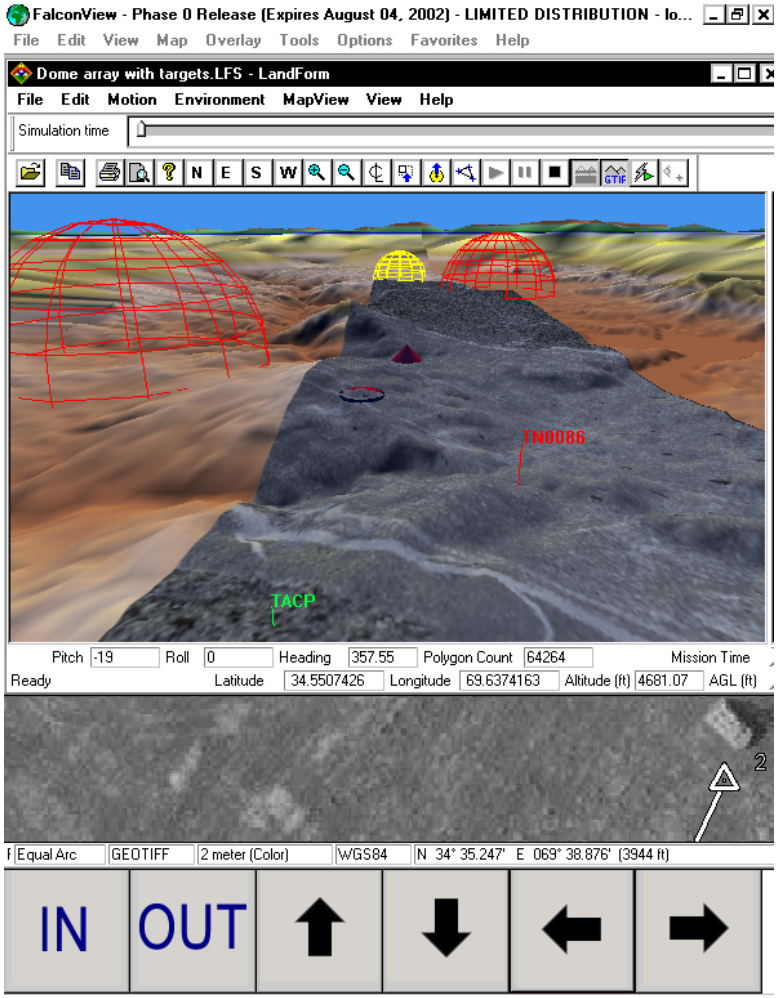
1. Squadron-level Map Server
2. New 3D
3. Weather
4. Messaging Network
5. Traffic

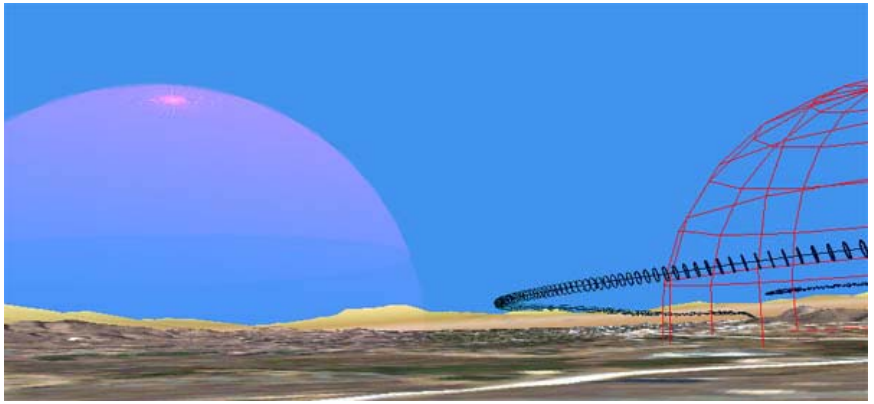
Squadron-level Geospatial Product Library (GPL) Server

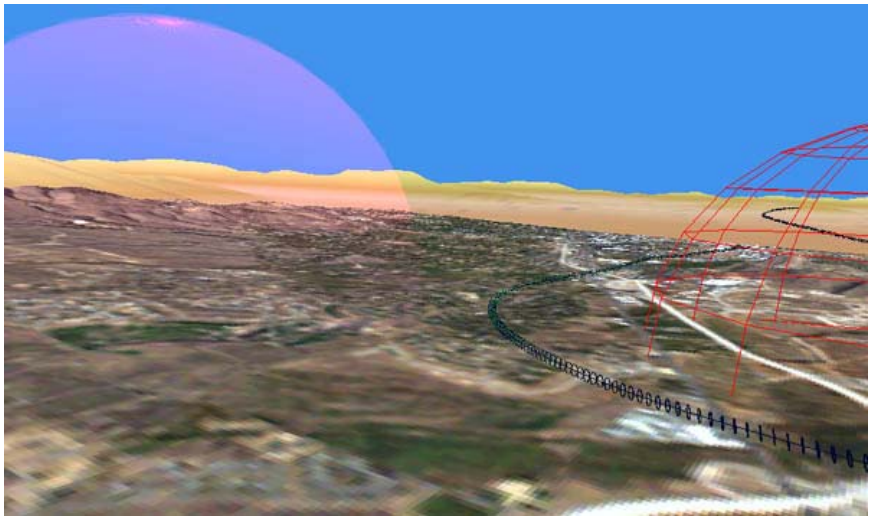
Squadron Imagery Server Architecture v1



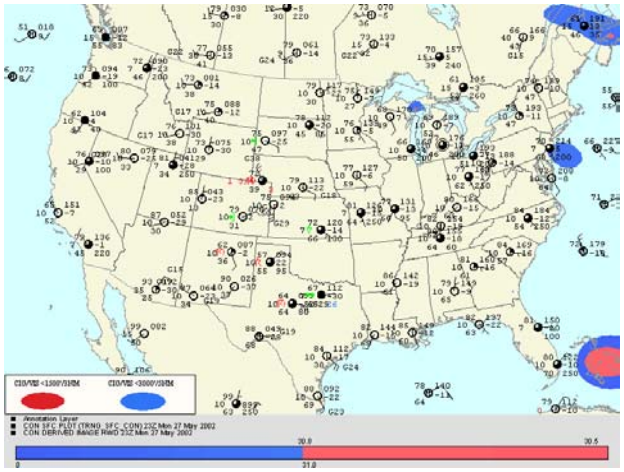
LandForm C3 scenes on PACMAN enhance 3D Perspective

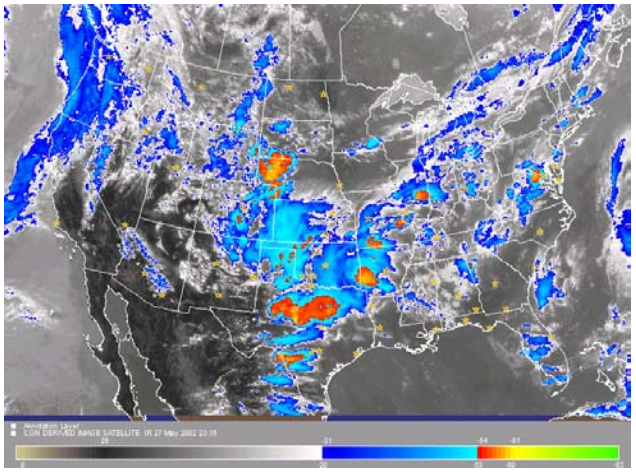


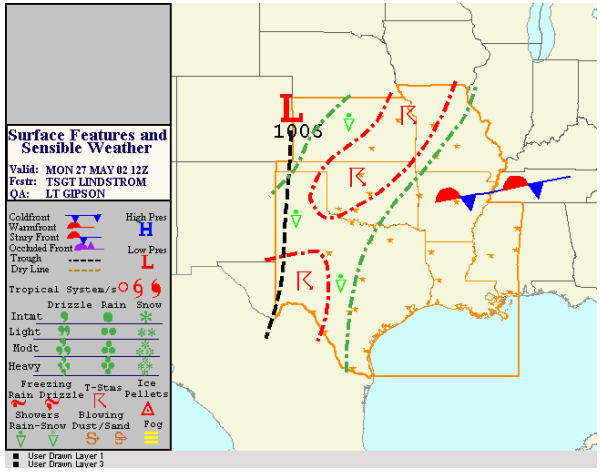


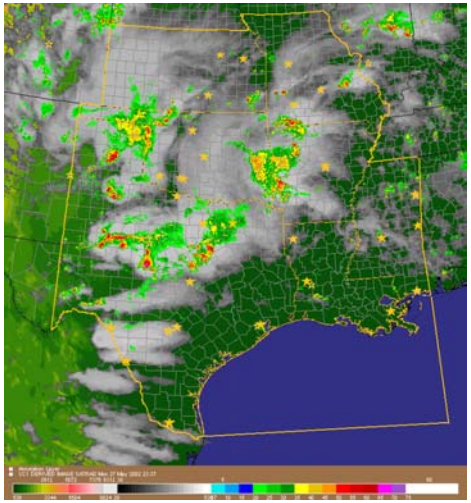


Pre-flight and Real-Time Weather Integration





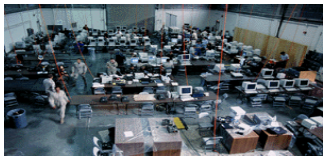




PACMAN Message Network allows Email messages with attachments

Assist

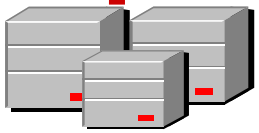
Assist



Ground

Gateway

Message Server



Observer

Area of interest

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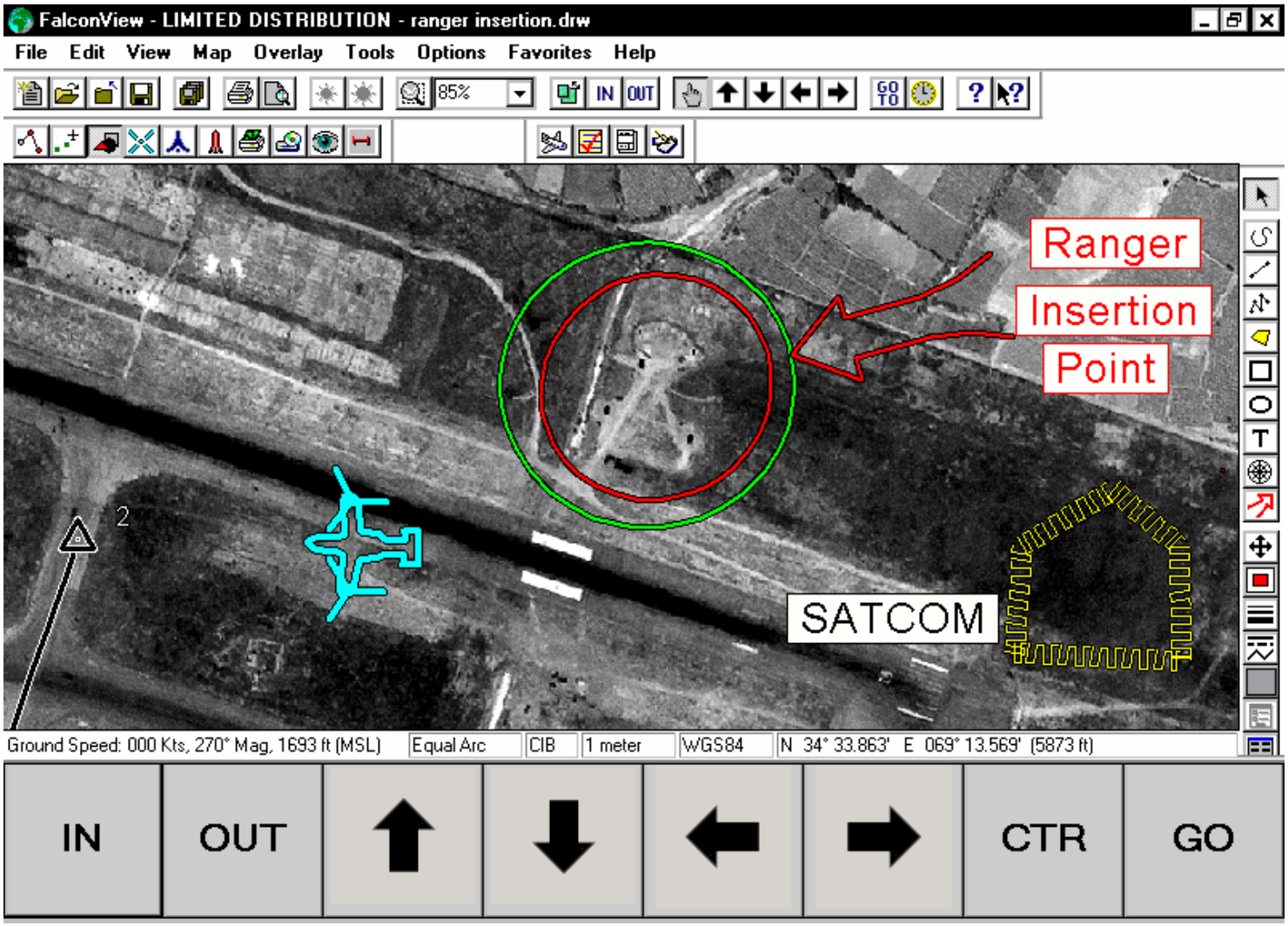
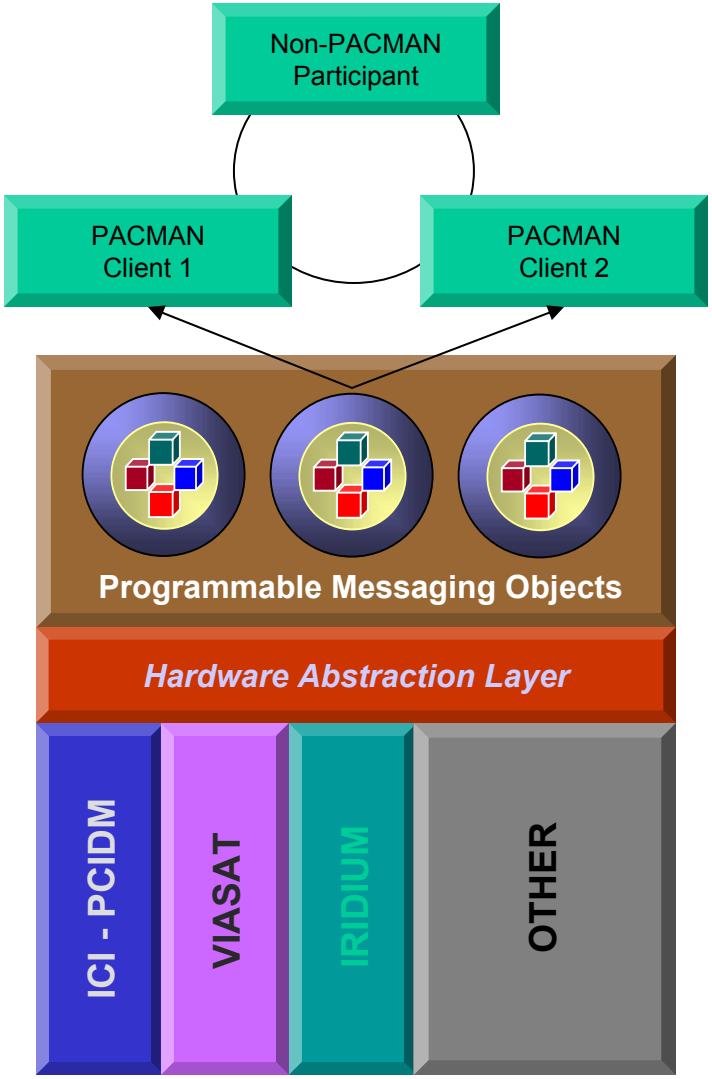
PACMAN Network Utilities

- 1: Email with Attachments
- 2: Own Position Reports
- 3: “John Madden” graphics
- 4: Update of real-time GeoTIFFs
- 5: Weather updates

Remote Messaging for “John Madden” Overlay graphics

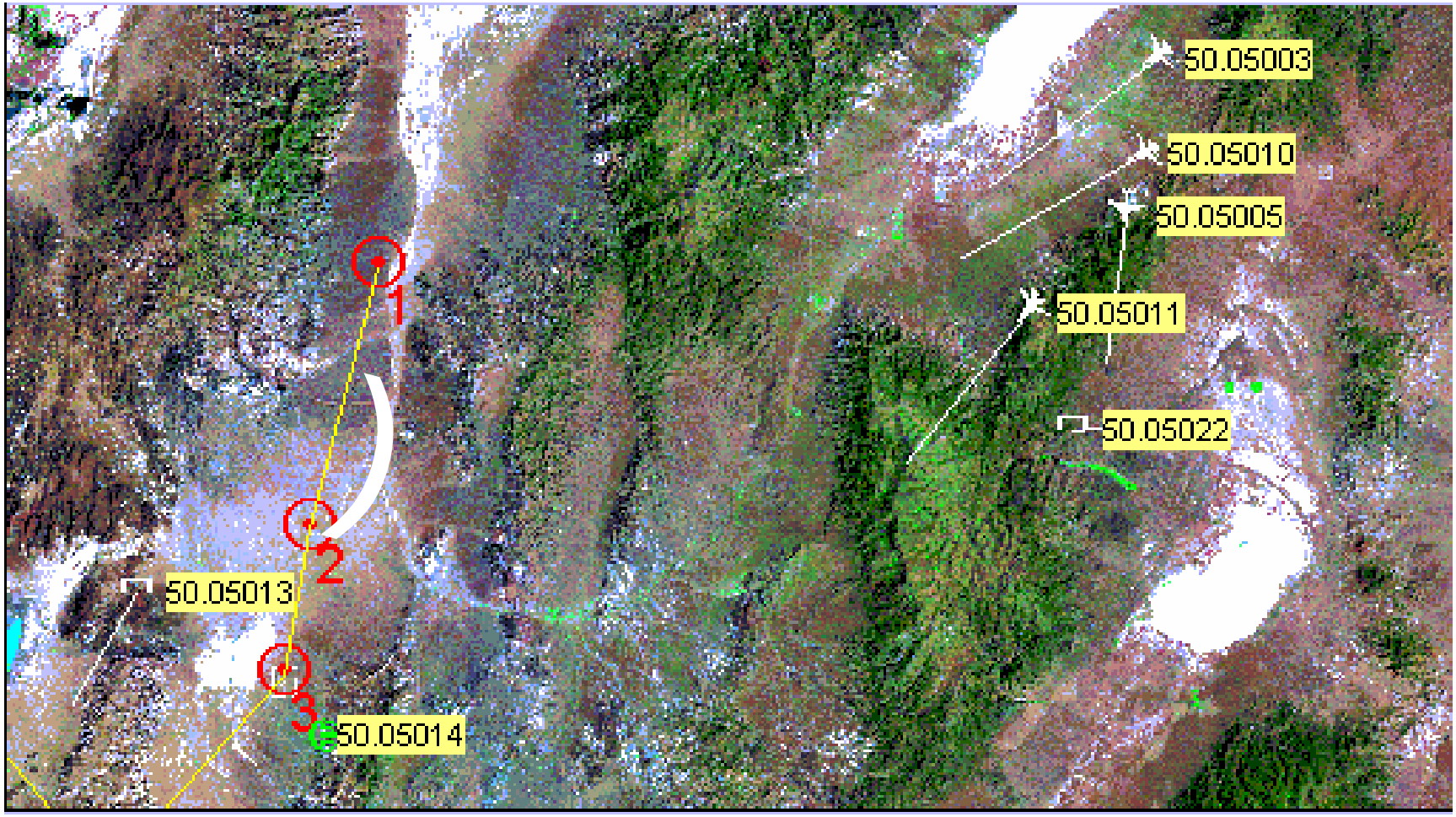


PACMAN Communications and Messaging Module

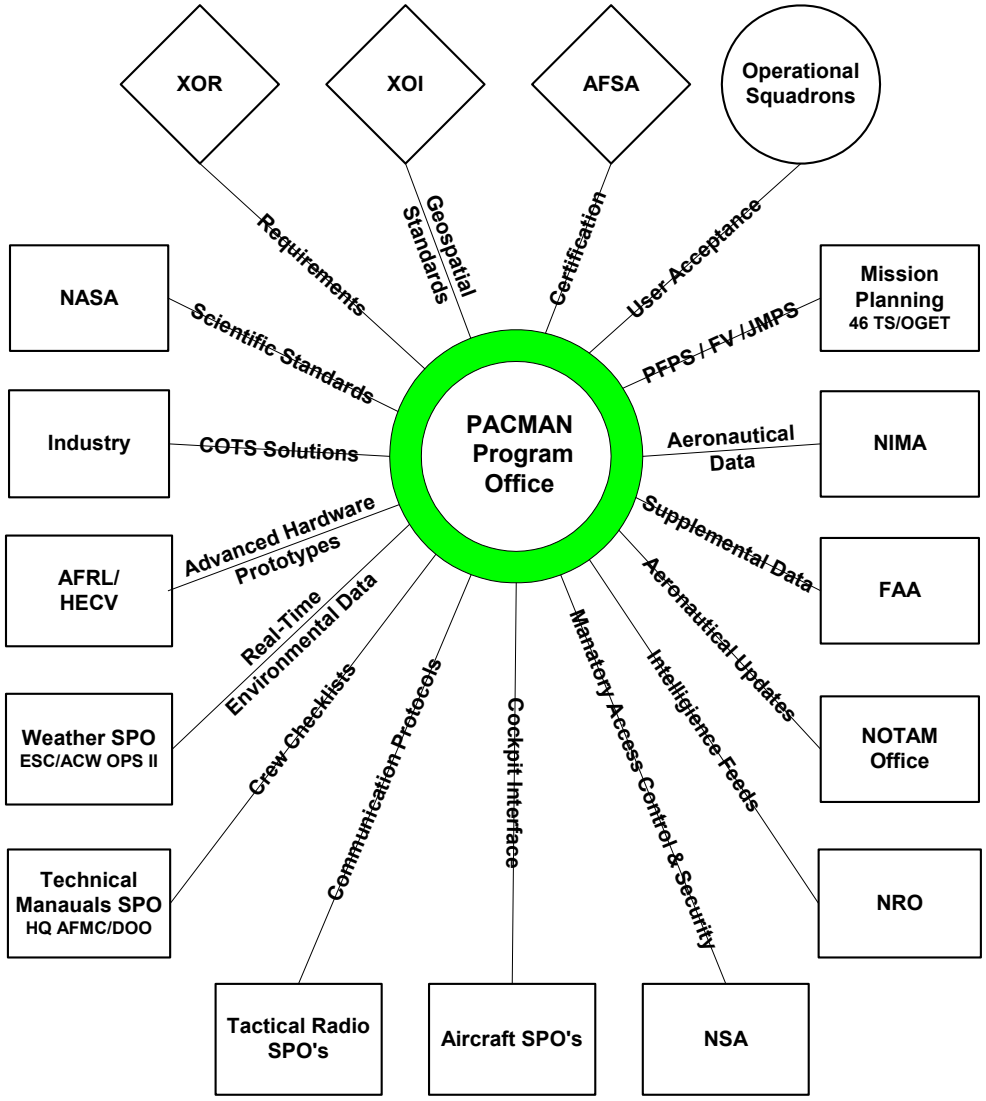


- Transparent to user
- Asynchronous
- Bandwidth independent
- Point-to-Point or Multi-cast
- SATCOMs supported.
- Extensive list of radios and protocols.

Traffic Management from central feeds helps to manage busy skies



The richness & complexity of the PACMAN Stakeholders



PACMAN Demonstration

- Thank you!
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