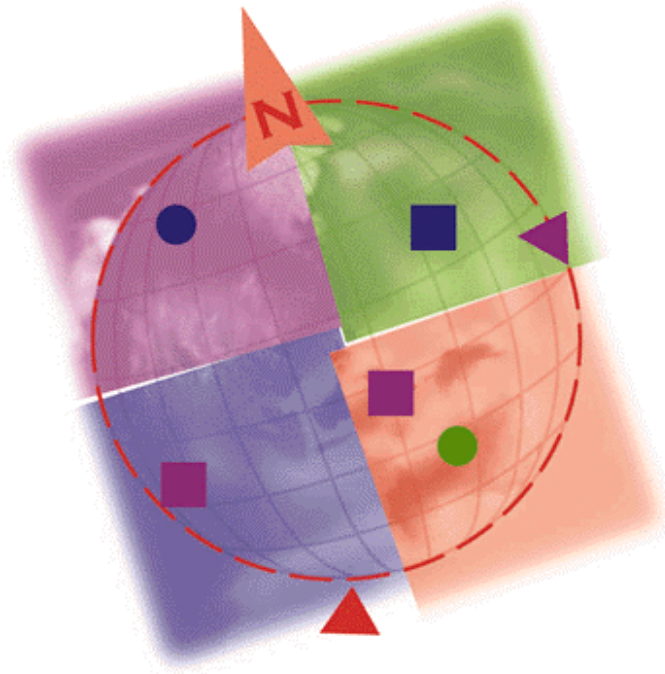


***Pilot/Aircrew Cockpit Management System  
PACMAN***



***Position Integrity***

***Situational Awareness***

# PACMAN Initiative

- The Pilot Aircrew Cockpit Management (PACMAN) initiative incorporates advanced portable computing and avionics software into DOD aircraft.
- Functions include moving map and route display, imagery and terrain analysis, FLIP, technical publications, weather products, emergency navigational aids, and network data messaging.
- The first deployment of 20 PACMAN devices supported Air Force F-15E crews at Seymour Johnson AFB under Operation Enduring Freedom. Dozens more are being tested and procured at bases throughout the military.

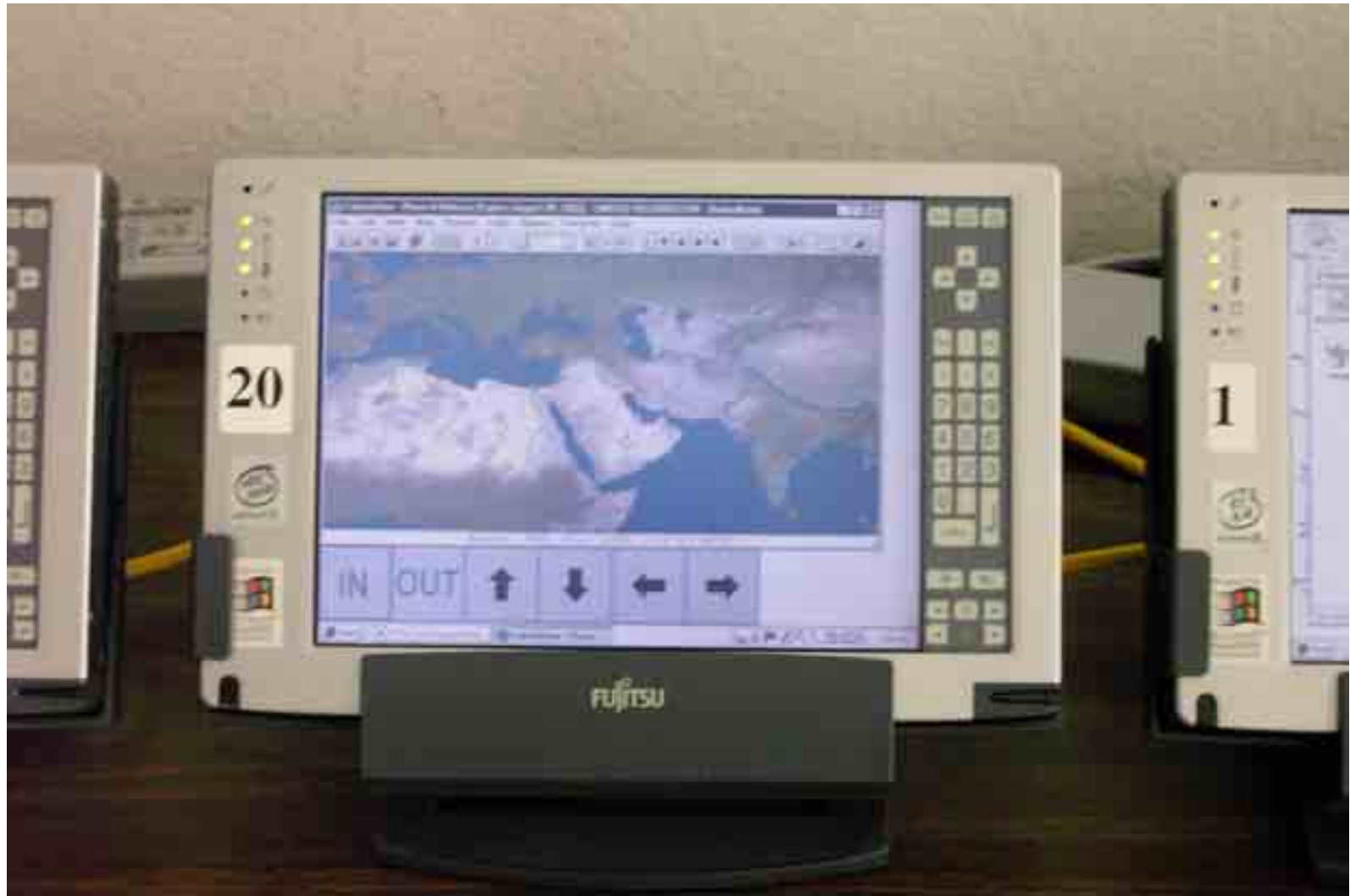
# Seymour Johnson F-15E Deployment Mar 02



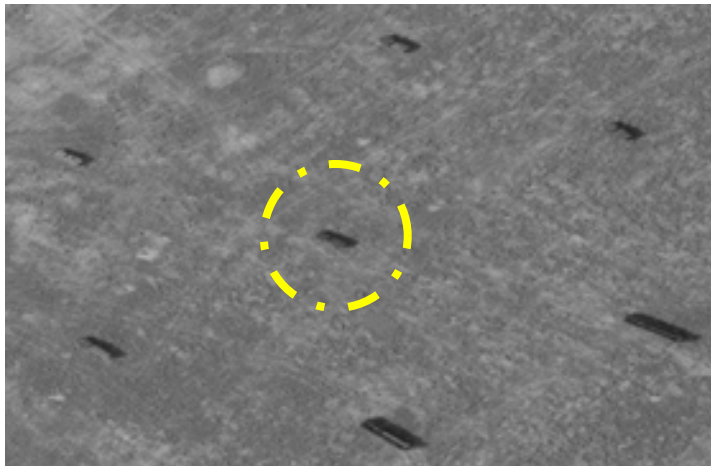
# Next PACMAN Flight Tests Scheduled

<u>Platforms</u>	<u>Locations/Dates</u>	<u>Objectives</u>
UH-60L Black Hawk CH-47D Chinook AH-64A Apache	Ft. Campbell, KY (Jun-Jul 02)	Fly-off for Army's Electronic Data Manager ORD
B-1	Mt. Home AFB, ID (Jul-Aug 02)	Integration with Busy JDAM/Dynamic Precision Engagement (DPE)
B-2	Whiteman AFB, KS (ongoing)	Special Projects
F-15E	Seymour Johnson AFB, NC (Jul-Sep 02))	CMNS Spiral 2 Demo, Imagery Server, OEF Combat Assessment
A-10	Mt. Home AFB, ID (Jul-Sep 02)	Alternate Controls
A-10 or F-16	Mt. Home AFB, ID (Sep-Dec 02)	CAS 9-Line, Data Network
C-130, KC-135, CF-27	McGuire AFB, NJ (Sep-Dec 02)	AMWC Integrated Solutions
Emergency Vehicles and Medivac	NASA/JPL, CA (Fall 02)	Homeland Defense

# PACMAN hardware host is a Pen Computer



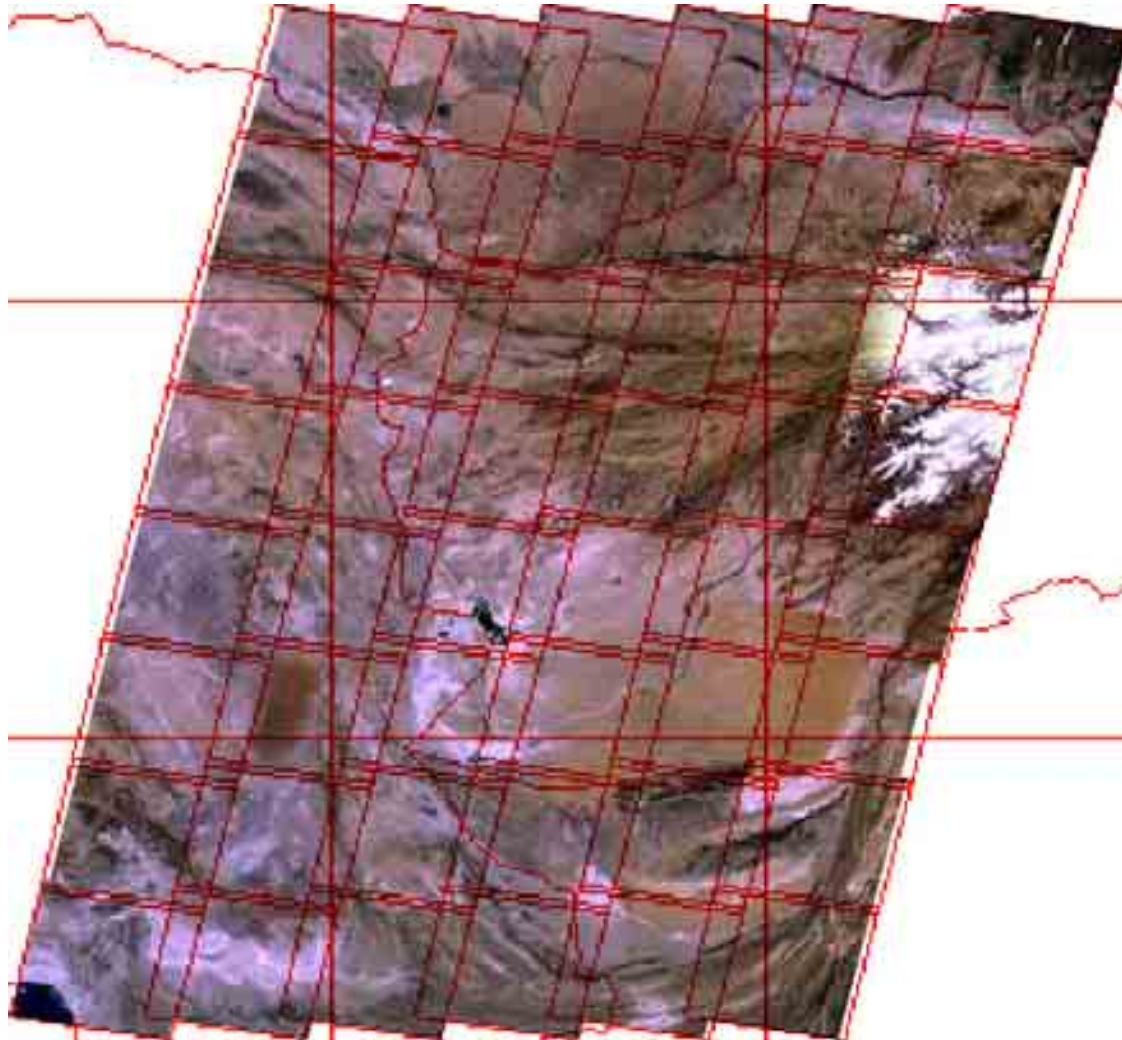
# Overview of PACMAN's 3 Initial Software Functions



- 1. Time-Critical-Targeting with high-resolution imagery
- 2. Interactive aircraft checklists
- 3. Airport Terminal Procedures (IAPs, DP, STARs)



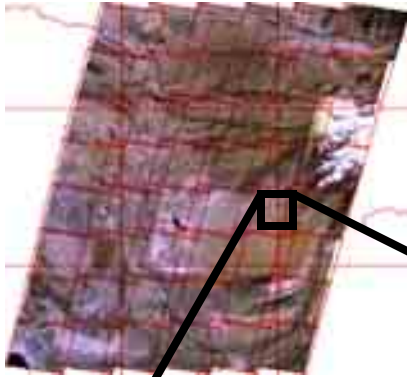
# Large Area Mosaic of West Afghanistan from Position Integrity and JPL for PACMAN



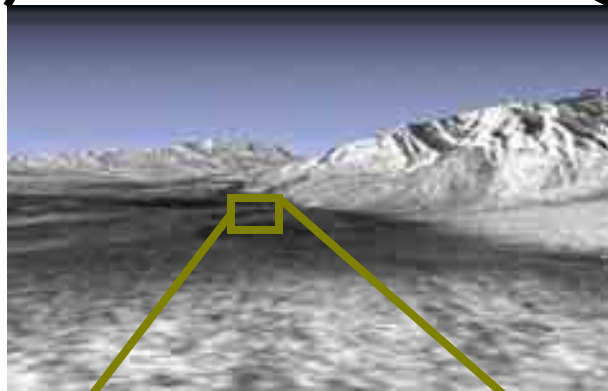
**Position Integrity<sup>™</sup>**

[www.positionintegrity.com](http://www.positionintegrity.com)

# PACMAN Targeting Imagery CONOPS



**300-Meter Imagery for  
Situational Awareness**



**30-Meter Imagery  
Draped over  
30-Meter SRTM Terrain**



**1-Meter Imagery in 2D and 3D  
For Targeting Rehearsal**



# Sample A-10 Checklist + Markups

## 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.

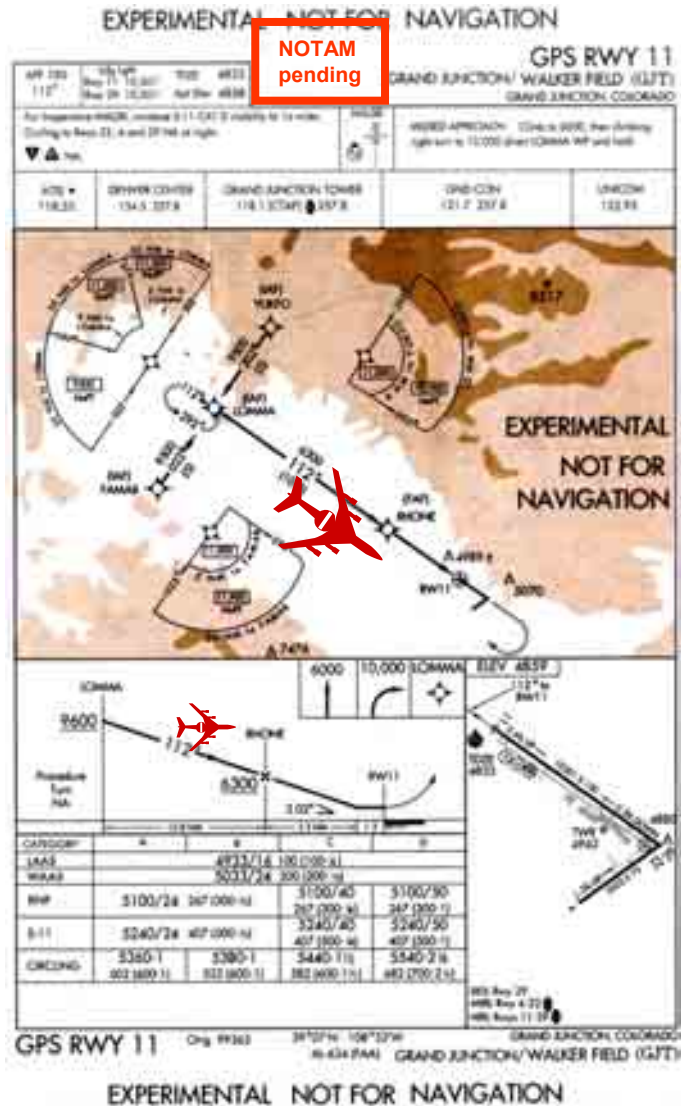
### If left hydraulic system has failed or LAND GEAR circuit breaker was pulled:

- 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

# 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 can accommodate new multicolor format.
- NOTAM distribution mid-cycle.
- Vector Procedures planned for DAFIF Ed 8. (Summer 04)

# Advantages of Vector FLIP over scanned Raster charts

<u>Feature</u>	<u>Raster FLIP</u>	<u>Vector Flip</u>
Size	~300Kb	~3Kb
Quantity per 1Gb	3 volumes (i.e. NorthEast U.S.)	36 Volumes (all 20,000 procedures)
Intelligence	unsophisticated electronic page turner	Smart: can query all fields
GPS Moving Map	Only partial, not fully to scale	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

# PACMAN Device is supported by web-centric architecture

PACMAN System Architecture, Rev2



- PACMAN device is designed to operate autonomously in aircraft.
- Central servers provide replenishment of current databases.
- Remote servers overcome bandwidth limitations at forward deployed bases.

# The next PACMAN Phases

1. Large Numeric Keyboard buttons
2. Squadron-level Imagery Server
3. Busy-JDAM LAR graphics
4. New 3D
5. GPS integration
6. Message Network using Iridium
7. CAS Utilities
8. Battlefield Track Management

# Big Buttons for Entering Locations

N \_\_\_ ° \_\_\_ ' \_\_\_

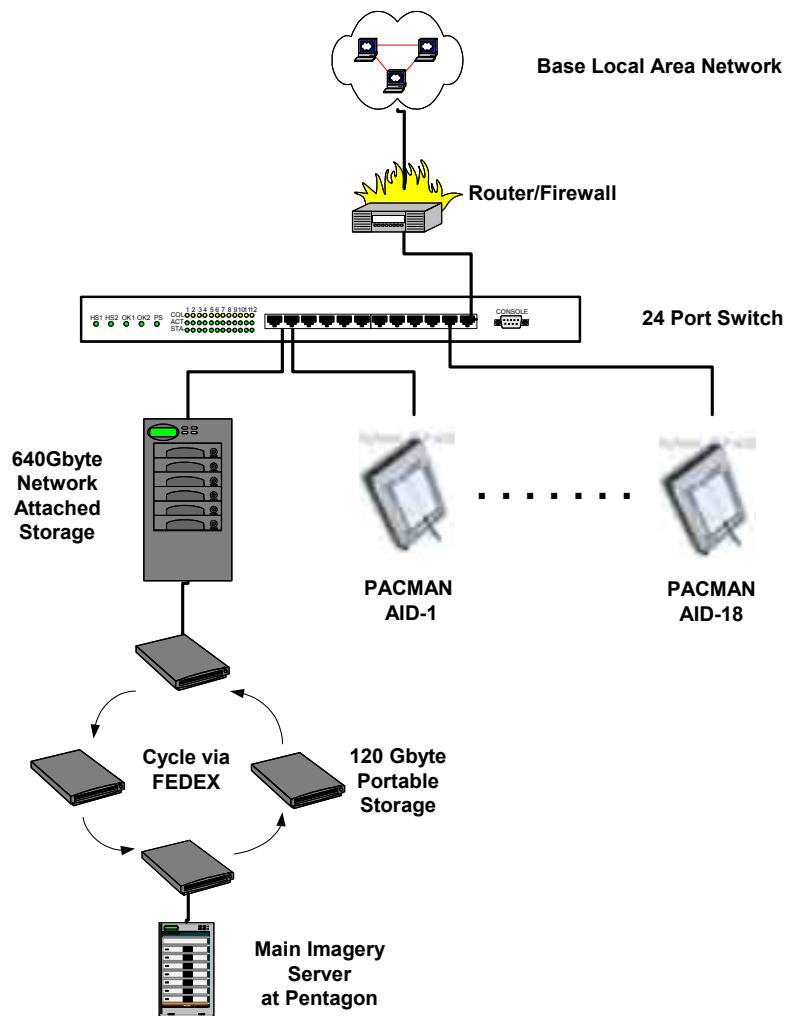
W \_\_\_ ° \_\_\_ ' \_\_\_

1	2	3
4	5	6
7	8	9
←	0	ENTER

IN	OUT	↑	↓	←	→	CENTER	GO TO
----	-----	---	---	---	---	--------	-------

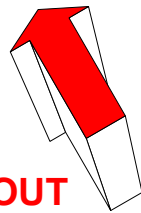
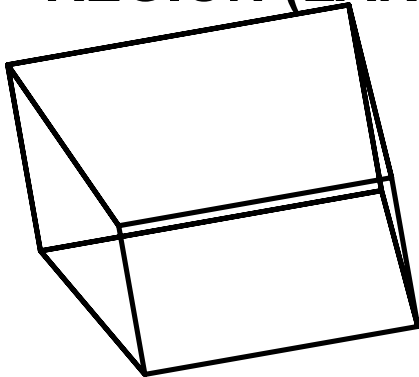
# Squadron-level Imagery Server

Squadron Imagery Server Architecture v1



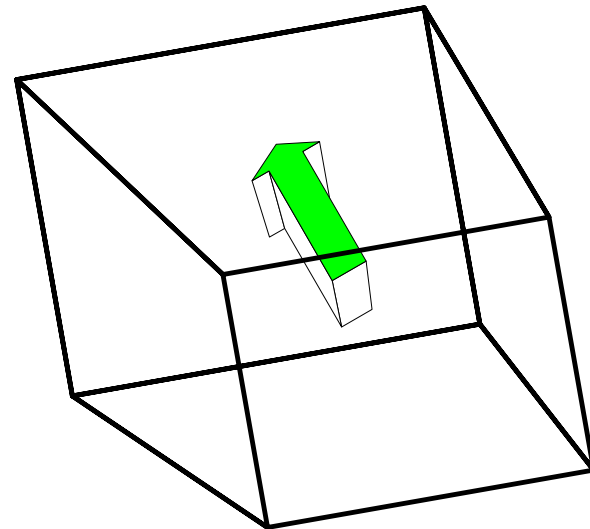
# Sample Busy-JDAM LAR Graphics

## LAUNCH ACCEPTABILITY REGION (LAR) STATUS



LAR STATUS: **OUT**  
TURN LEFT: 13 DEGREES  
CLIMB UP: 34 DEGREES  
FOR: 12 MILES  
ETA: 70 SECONDS

## LAUNCH ACCEPTABILITY REGION (LAR) STATUS



LAR STATUS: **IN**  
ETA TO LIMIT: 10 SEC



# PACMAN curtails Friendly Fire

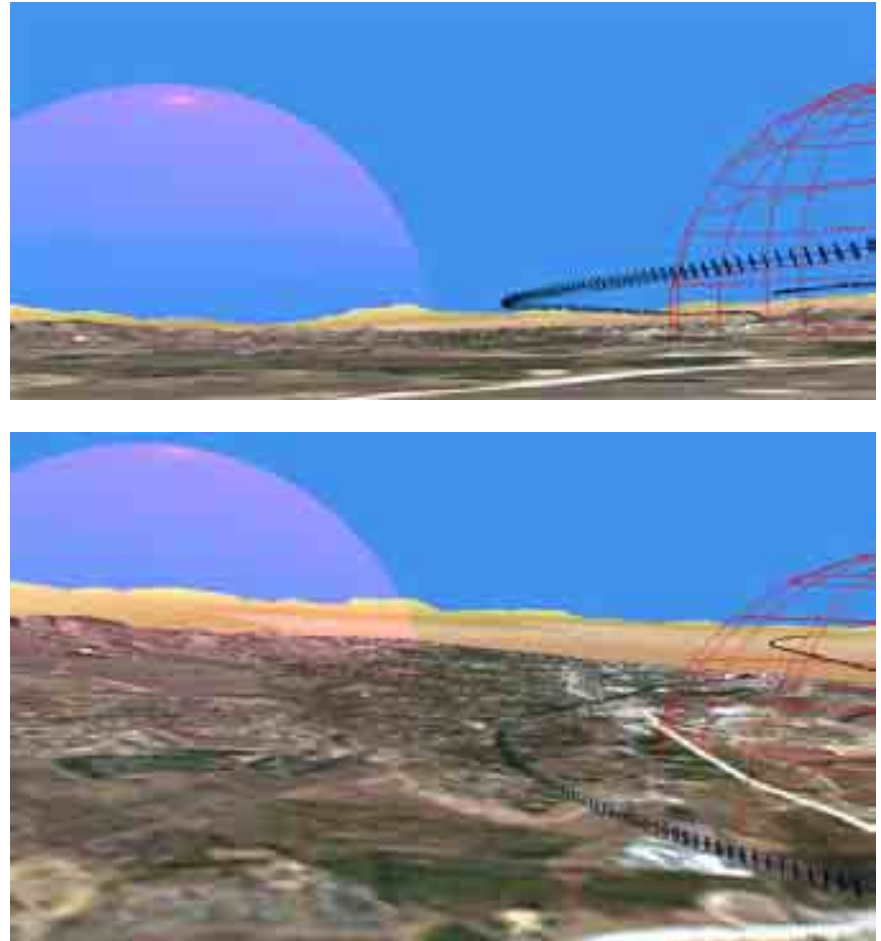
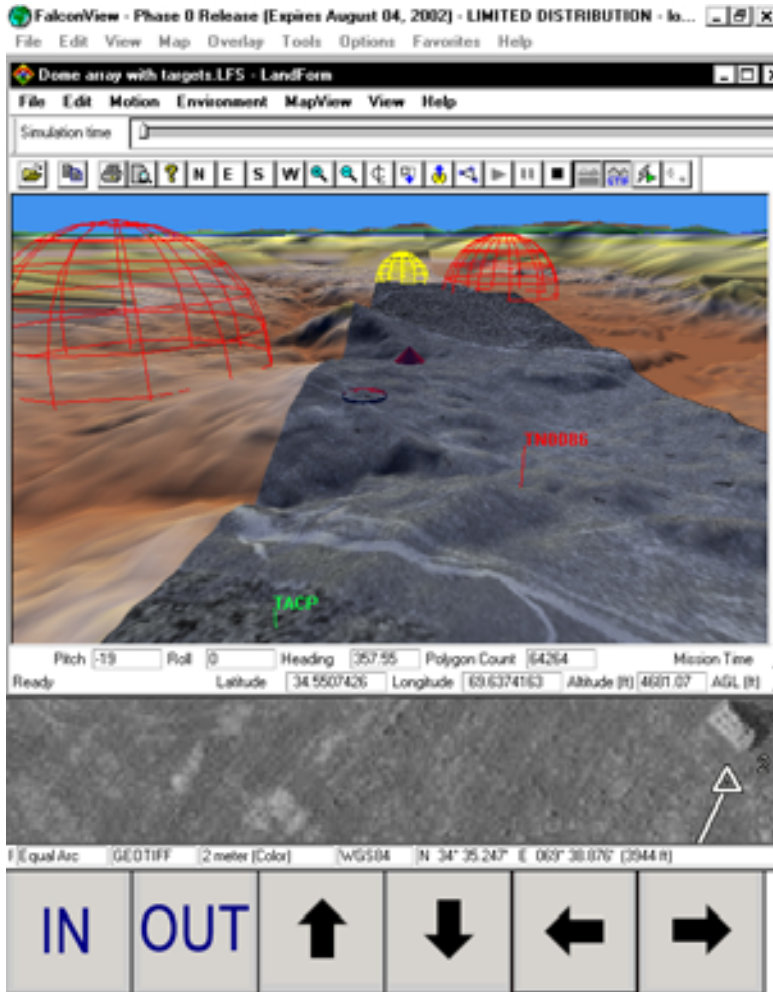
- In Operation Desert Storm 24% (35/148) of casualties were killed by Friendly Fire
- This high rate is still being experienced during Operation Enduring Freedom (example: Dec 5, 2001 accident)
- PACMAN's graphically depicts green "friendly" versus red target positions, thereby avoiding deadly mixups.

# PACMAN Network Reduces Friendly Fire

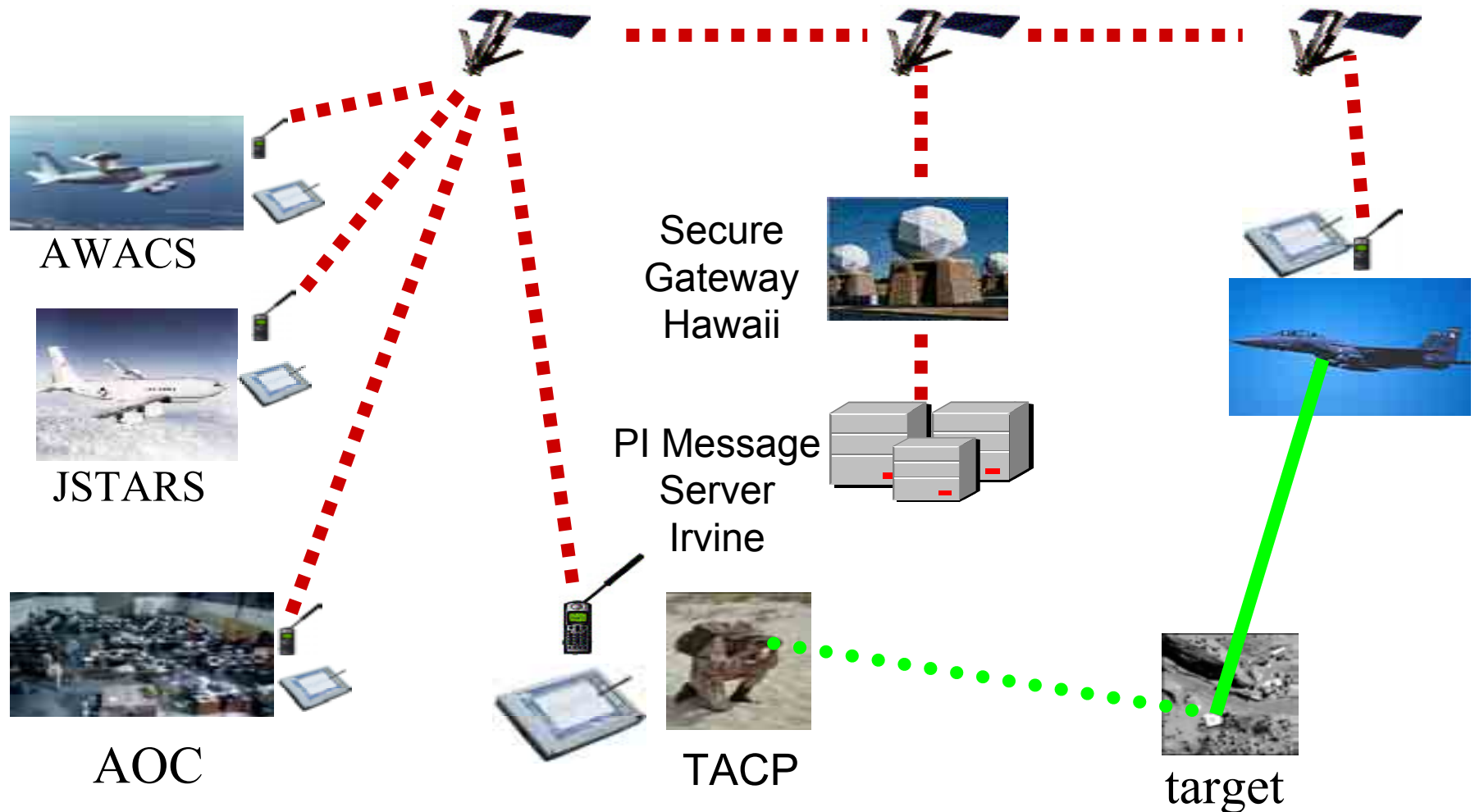


- TACP has GPS-enabled PACMAN device which auto distributes his position as “friendly.”
- TACP graphically identifies target and transmits message via AOC.
- Shooter receives graphical situation overlay and can display on an identical imagery screen.
- Result is reduced possibility of transposing locations as happened in December 5th Friendly Fire Accident.

# LandForm C3 scenes of Afghanistan on PACMAN enhance 3D Perspective



# PACMAN Message Network Leverages Iridium Satellites



# PACMAN 4 CAS Utilities

- **1) Close Air Support (CAS)  
9-Line Brief**
- **2) Immediate CAS Request**
- **3) CAS Check-in Briefing  
(Aircraft transitions to controller)**
- **4) Bomb Damage  
Assessment (BDA)**

# CAS 9-Line Brief (1 of 4 functions)

## CAS BRIEFING FORMAT (9-LINE)



Terminal controller: " \_\_\_\_\_ this is \_\_\_\_\_ "  
(Aircraft Call Sign) (Terminal Controller)

1. IP/BP: " \_\_\_\_\_ "  
(IP / BP to Target)

2. Heading: " \_\_\_\_\_ " (Magnetic)  
Offset: " \_\_\_\_\_ " (Left/Right)

3. Distance: " \_\_\_\_\_ "  
(IP -to-Target in Nautical Miles / BP-to-Target in Meters)

4. Target Elevation: " \_\_\_\_\_ "

5. Target Description: " \_\_\_\_\_ "

6. Target Location: " \_\_\_\_\_ "  
(Latitude/Longitude or Grid Coordinates or Offset or Visual)

7. Type Mark: " \_\_\_\_\_ " Code: " \_\_\_\_\_ "  
(WP, Laser, IR, Beacon) (Actual Code)

Laser to Target Line: " \_\_\_\_\_ " Degrees

8. Location of Friendlies: " \_\_\_\_\_ "  
Position Marked by: " \_\_\_\_\_ "

9. Egress: " \_\_\_\_\_ "  
Remarks (as appropriate): " \_\_\_\_\_ "  
(Threats, Restrictions, Danger Close, Attack, Clearance, SEAD, Abort Codes, Hazards)

Time on Target (TOT): " \_\_\_\_\_ " or Time to Target (TTI): \_\_\_\_\_

"Stand by \_\_\_\_\_ plus \_\_\_\_\_ Hack"

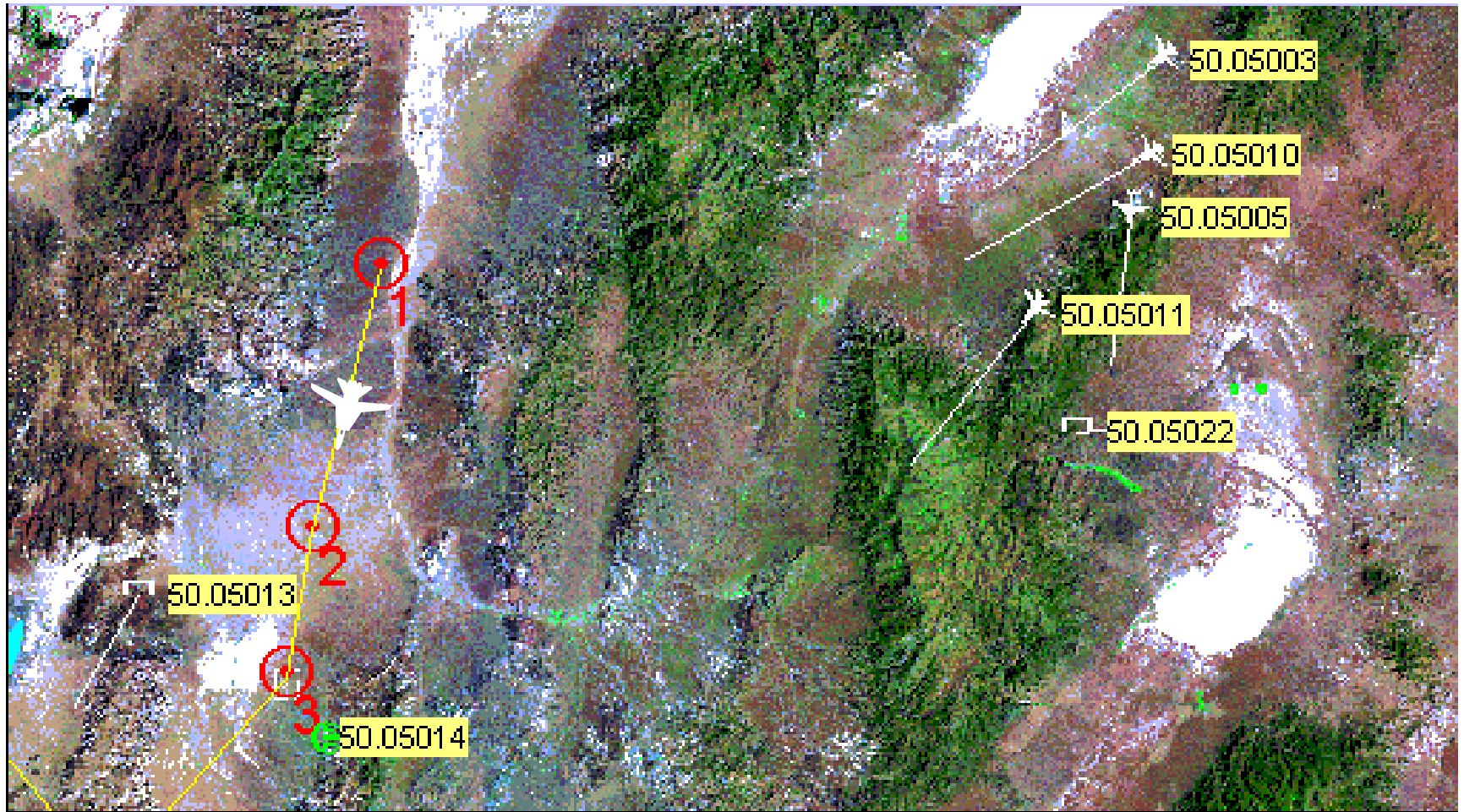
- Identifies targeting information for shooter
- Includes IP and egress information
- All data stored in relational database within PACMAN computer.
- Conforms to FM 90-20 (J-FIRE Manual) and TF 1-160 Fire Support SOP.

# Typical Message Sequence



- **CAS 9-Line** →
- **Immediate CAS Request** →
- ← • **Accept/Modify**
- **Accept/Reject/Resubmit** →
- ← • **CAS Check-In**
- **(Weapon release)**
- **BDA** →

# Battlefield Management from C2-ISR feeds will follow our JTIDS Traffic/Intel design





# Thank you.

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