Flight Testing the ARDS Service Life Extension

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Advanced Range Data System

Full Battlespace Test

- A brief history of GPS on the Test Range
- Challenges faced with aging technology and the acquisition process
- Challenges met through Government engineering and teamwork

ADVANCED RANGE DATA SYSTEM (ARDS)

- **GPS/INS based TSPI system used on fighter aircraft and other platforms**
- **Provides data in real-time back to a control display center through ground stations and relays**
- **Common system used by DoD for DT&E**

HISTORY

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- **Army/Air Force/ Navy joint program late 1980's**
- **Development flowed from**
  - **Full Scale Early Development (FSED)**
  - **Low Rate Production (LRP)**
  - **Full Rate Production (FRP) with several upgrades done afterwards**
- **Anticipated life span of 8-10 years from FRP**
- **Follow on Tri-Service upgrades to the system failed to materialize and ARDS reached critical mass by 2006**
- **ARDS Service Life Extension (SLEP) effort started in 2006 with funding in 2007-2010**

SUSTAINMENT PROBLEM & GOALS

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- **Sustainment problems**
  - **Non-repairable items**
    - **GPS receiver**
    - **Processor**
    - **Data recorder memory media**
  - **Lack of documentation to re-procure**
- **Goals of the Sustainment effort**
  - Develop form-fit-function replacements components where possible and develop multiple sources for hardware
  - Maintain current performance capabilities as a minimum.
  - **Eliminate proprietary hardware and software wherever possible**

IN-HOUSE GOVERNMENT EFFORTS

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- **Tri-Service Team Effort**
- **Eglin's form-fit-function replacement development efforts**
  - **Capable government engineering base and empirical knowledge of ARDS**
  - **Good working relationship with Services and industry**
  - **Dynamic partnership with the ARDS Sustainment Management Office (SMO)**

The ARDS Pod

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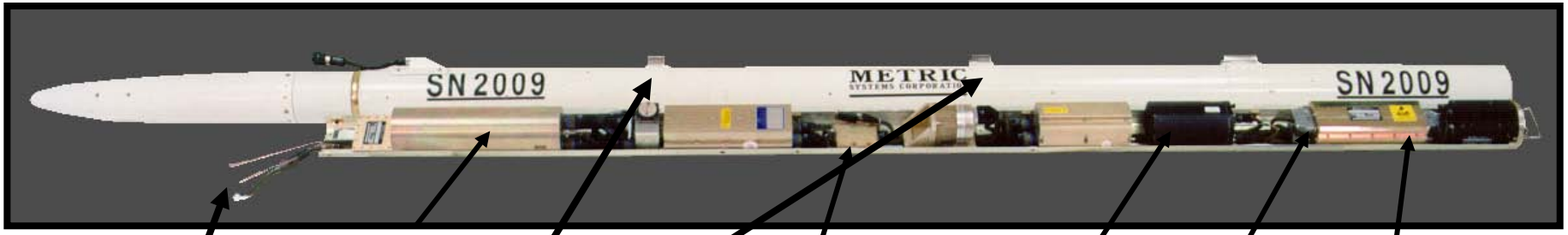

Data Link Transceiver

Hangers

Encryption

GPS Receiver

Advanced Digital Interface Unit

Cable Harness

Intelligent Flash Solid State Recorder

Components Old and New

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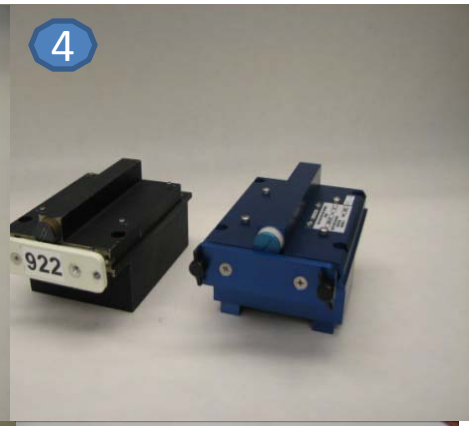

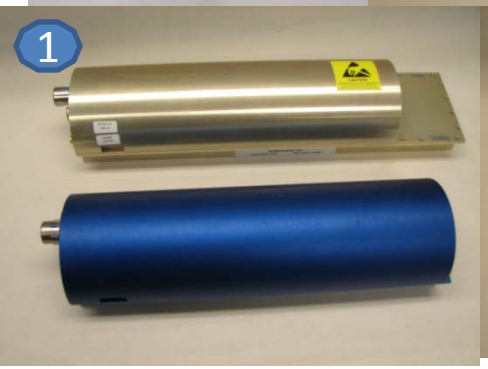

1. Data Link (MODEM + Power Amp)
2. EDIU – Digital Interface Unit
3. GPS Receiver
4. EFSSR – USB Data Recorder
5. AC/DC power Supply
6. Isolation Box (Aircraft interface)
7. Pod hanger

New Technology Provides Benefits

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- **GPS Accuracy**
  - Carrier Phase processing with very low cost software
- **Processing Speed**
  - On board processing provides for upgrades to performance as required
- **Data Recording Capacity**
  - The ubiquitous USB provides hours and hours of high rate data collection
- **Power Amplifier Efficiency**
  - Cleaner cooler power

Our Test Jet

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MK-82s and TSPI PODs

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Pass 1 Setup Mission 6861

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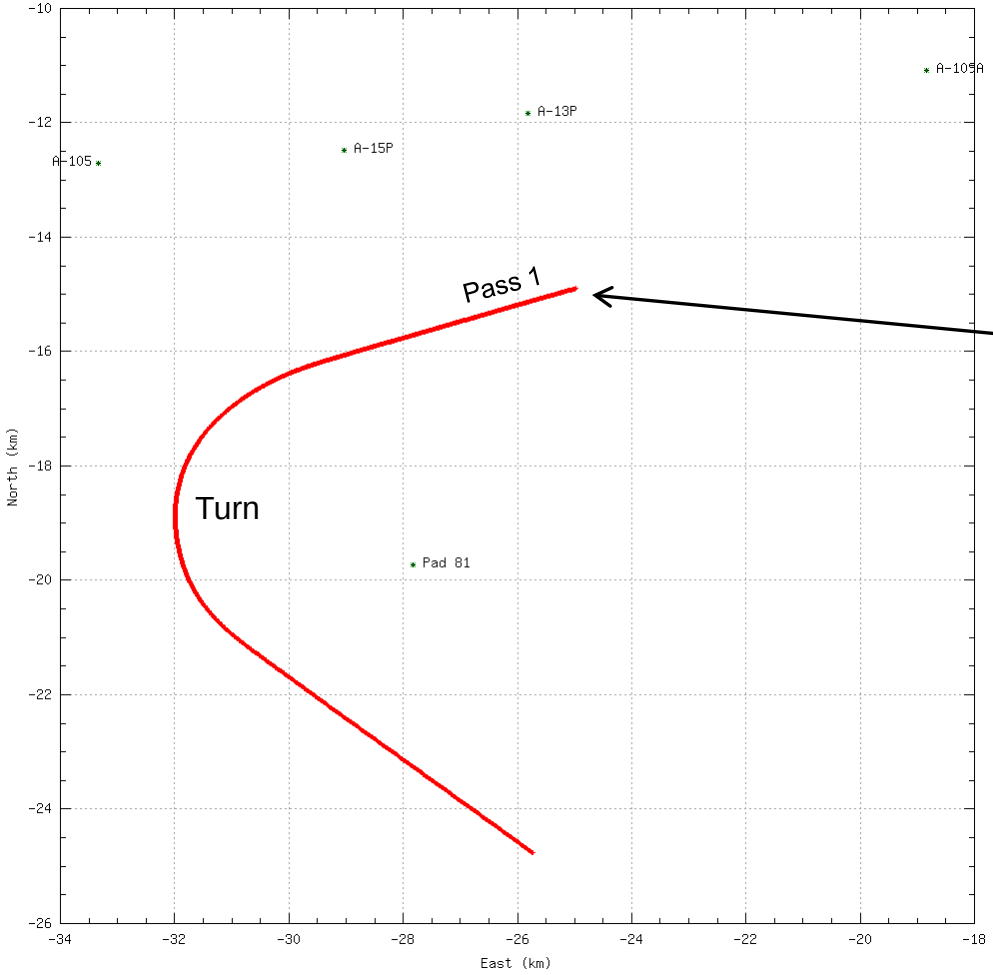
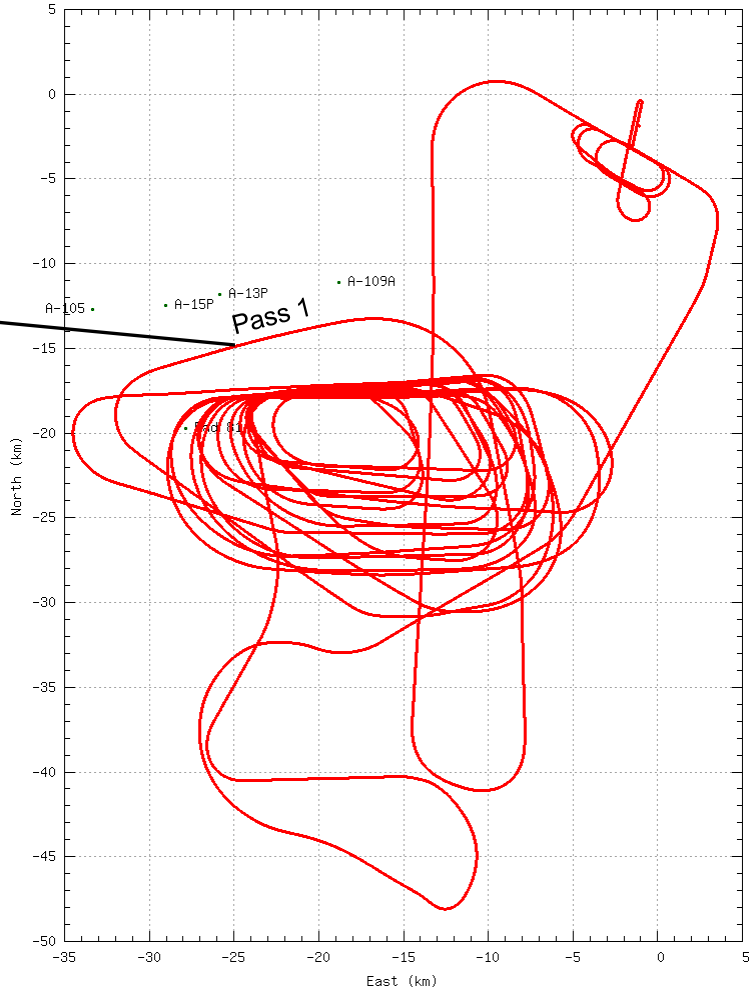
- F16 with 6 MK82 Inert Bombs and 3 GPS Pods
  - Pod 906: ARDS GNP 10 on F16 Station 2, Pitch -3 deg
  - Pod 909: ARDS II DIGS on F16 Station 9, Pitch -3 deg, Roll -90 deg
  - Pod 922: ARDS II ENGR on F16 Station 8, Pitch -3 deg
- Pass 1 executed at ~9000 ft altitude 1.5 nm south of beach Cine-T sites.
  - A-105 MSL 42.659 ft
  - A-109A MSL 33.992 ft
  - A-13P MSL 15.335 ft
  - A-15P MSL 19.253 ft
  - Gulf Range Armament Test Vessel (GRATV), Pad 81
- All data mapped into CCF STD file format, dumped, and plotted

LTP Ground Track (Pass 1 + Turn)

Full Battlespace Test





LTP Height (Pass 1 + Turn)

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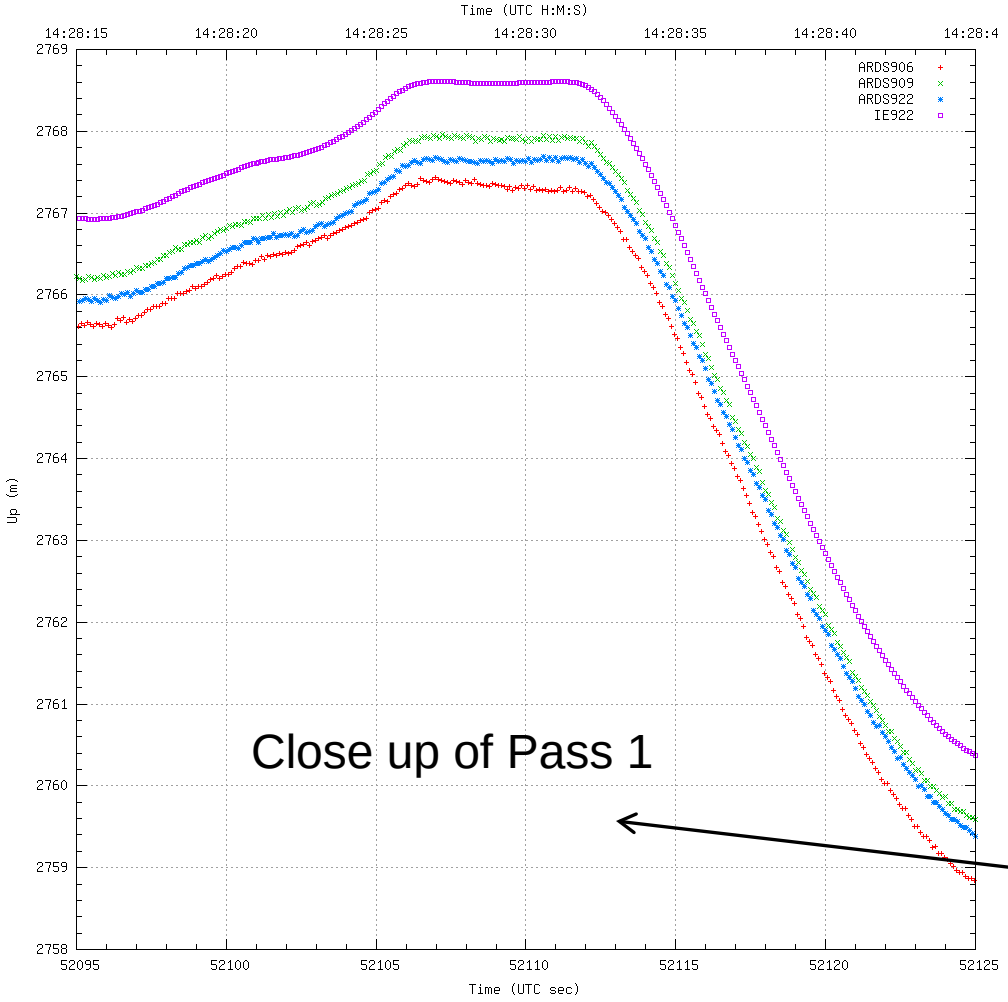
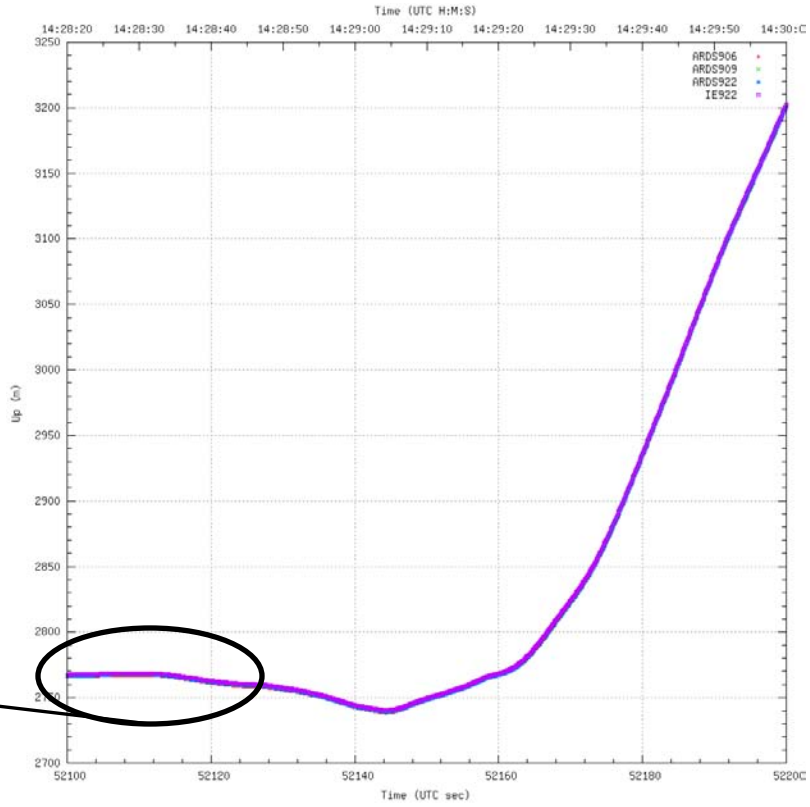


Close up of Pass 1



Pass 1: Position Comparison

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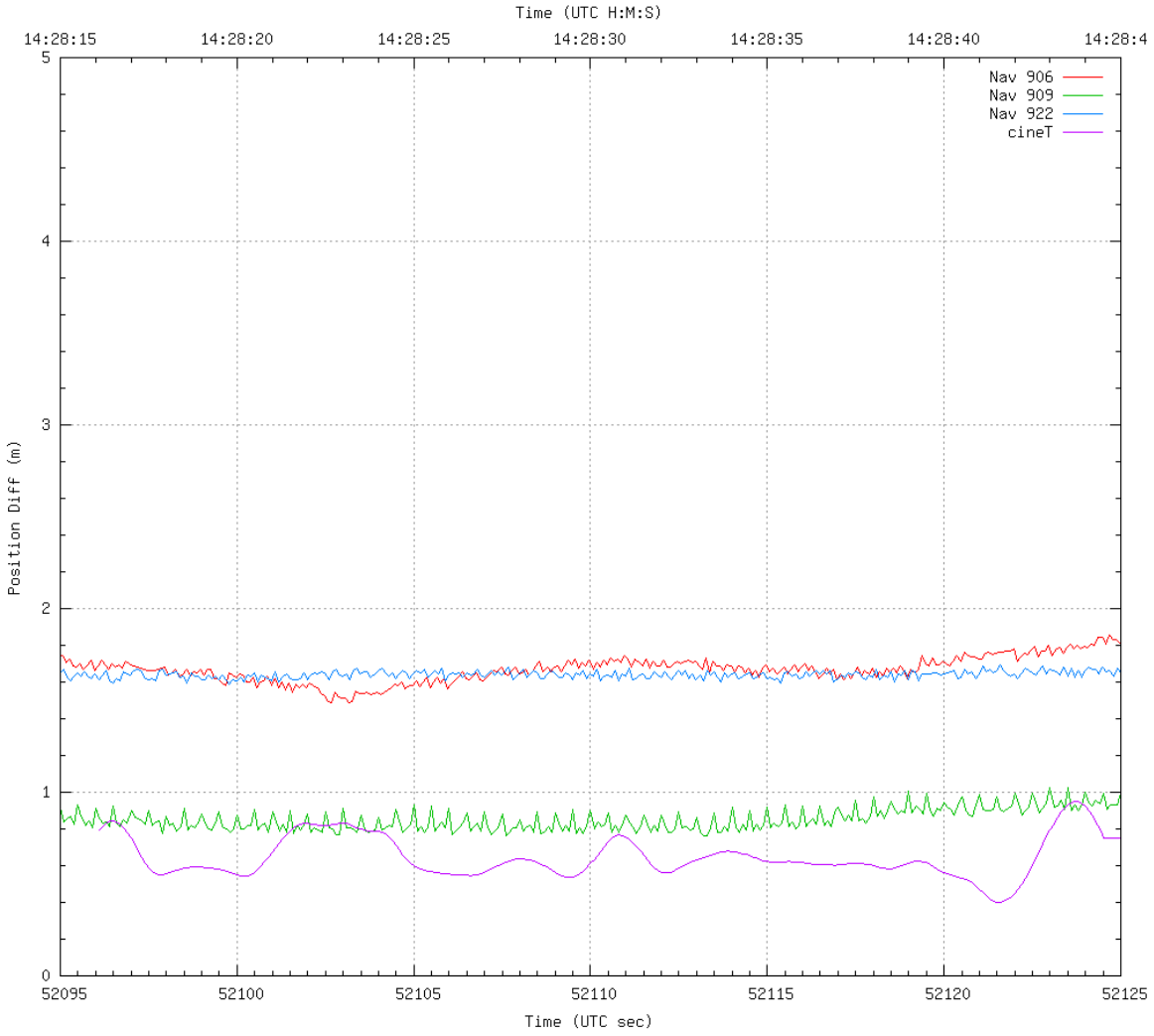
- Mission date 9-29-2011.
- The ARDS Nav message for pods: 906, 909, 922 are compared to post-processed Waypoint Inertial Explorer (IE) 922 solution (GPS Ref. Ant. at A-13B) are lever armed to the CG
- The TDOP CineT solution is compared to the IE 922 solution lever armed to the nose.
- CineT data was processed for the F-16 noise for Pass 1, which was a flyby at 9000 ft altitude and 1.5 mi. south of the CineT array.
- Estimated CineT position uncertainty is .5 to 1 m Std.Dev
- The IE Novatel SPAN solution for Pod 922 is about 0.6 m from the CineT solution.



3D – Position Plot

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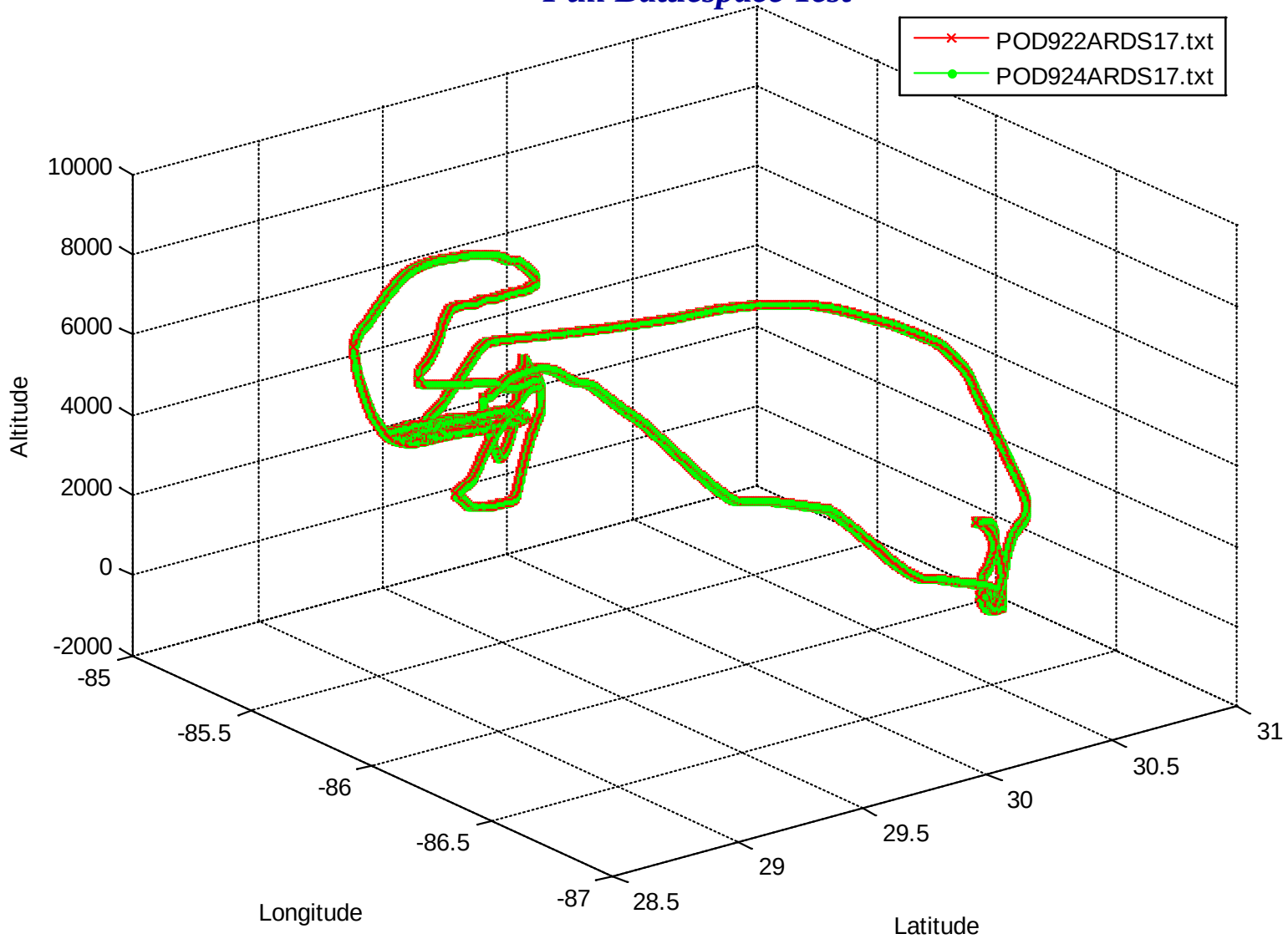

LESSONS LEARNED

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- Pay me now, or pay me later, with interest and penalties
  - Very early in the ARDS program the expense of documentation and software code were adopted as trade space
  - Proprietary engineering needed for sustainment of this system became a strangle hold the services could no longer afford

- TSPI accuracies claimed and those that can be demonstrated are all subject to lots of interpretation
  - Our newest Carrier Phase solutions provided the new ‘truth’ but even this can and is challenged
  - Comparative results met our “at least as good as” requirement

- Preserve the centers of excellence in engineering and technical design
  - This one factor saved the ARDS mission from certain death or at least a much more expensive existence

Contact Information

Full Battlespace Test

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