



LSU Timing Update (State of LDC and TWSTFT)

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Agenda

- State of LDC
 - LDC installations
 - Differential corrections
 - LDC Description Document update
 - Next steps for LDC
- State of TWSTFT
 - Requirements development
 - System design

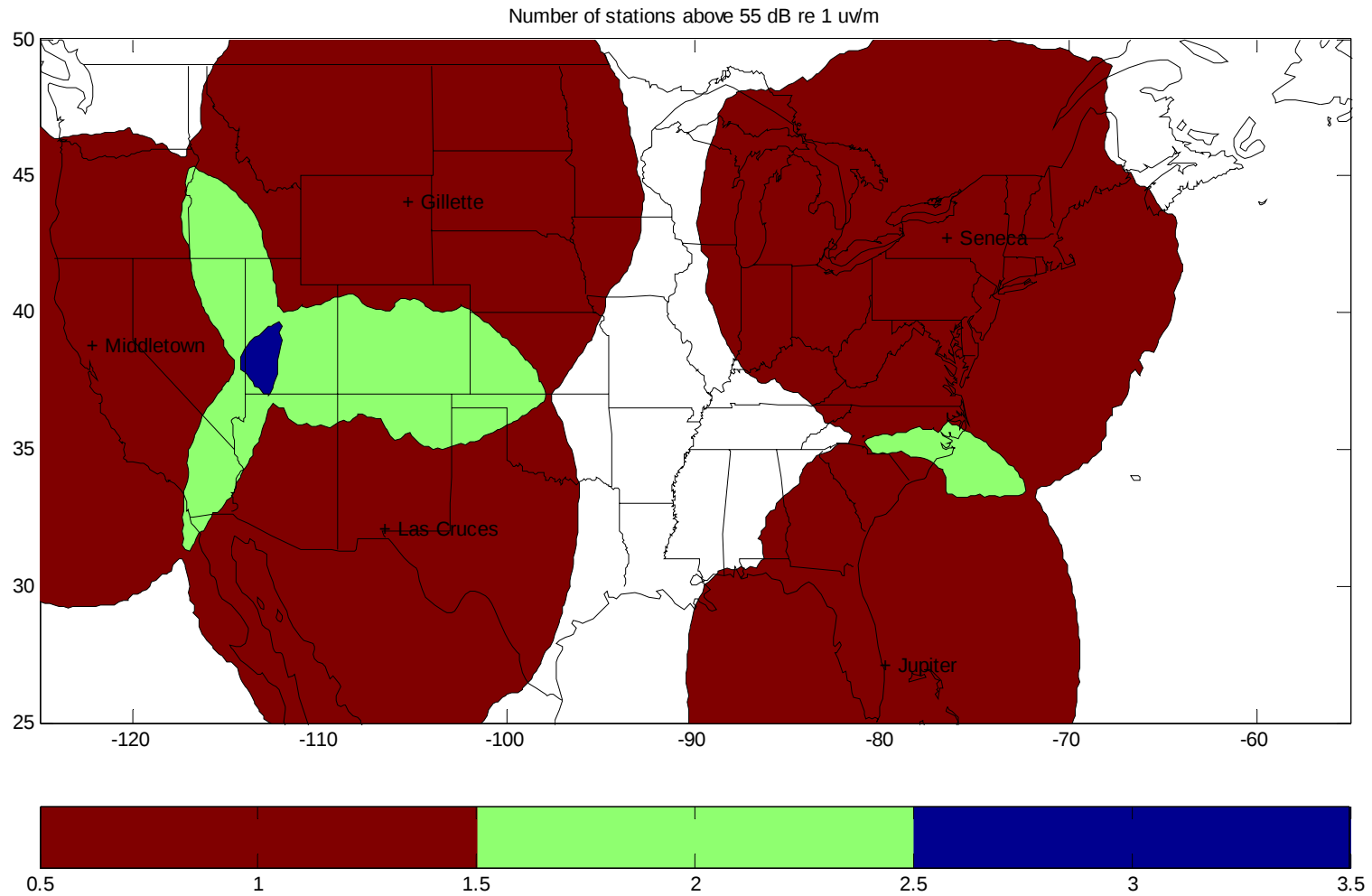


LDC Installations

- LorSta Jupiter OCT 2005
- LorSta Seneca DEC 2005
- LorSta Las Cruces APR 2006
- LorSta Middletown OCT 2006
- LorSta Gillette OCT 2006
- Future Additions:
 - LorSta Dana TBD
 - LorSta Grangeville TBD
 - LorSta George TBD

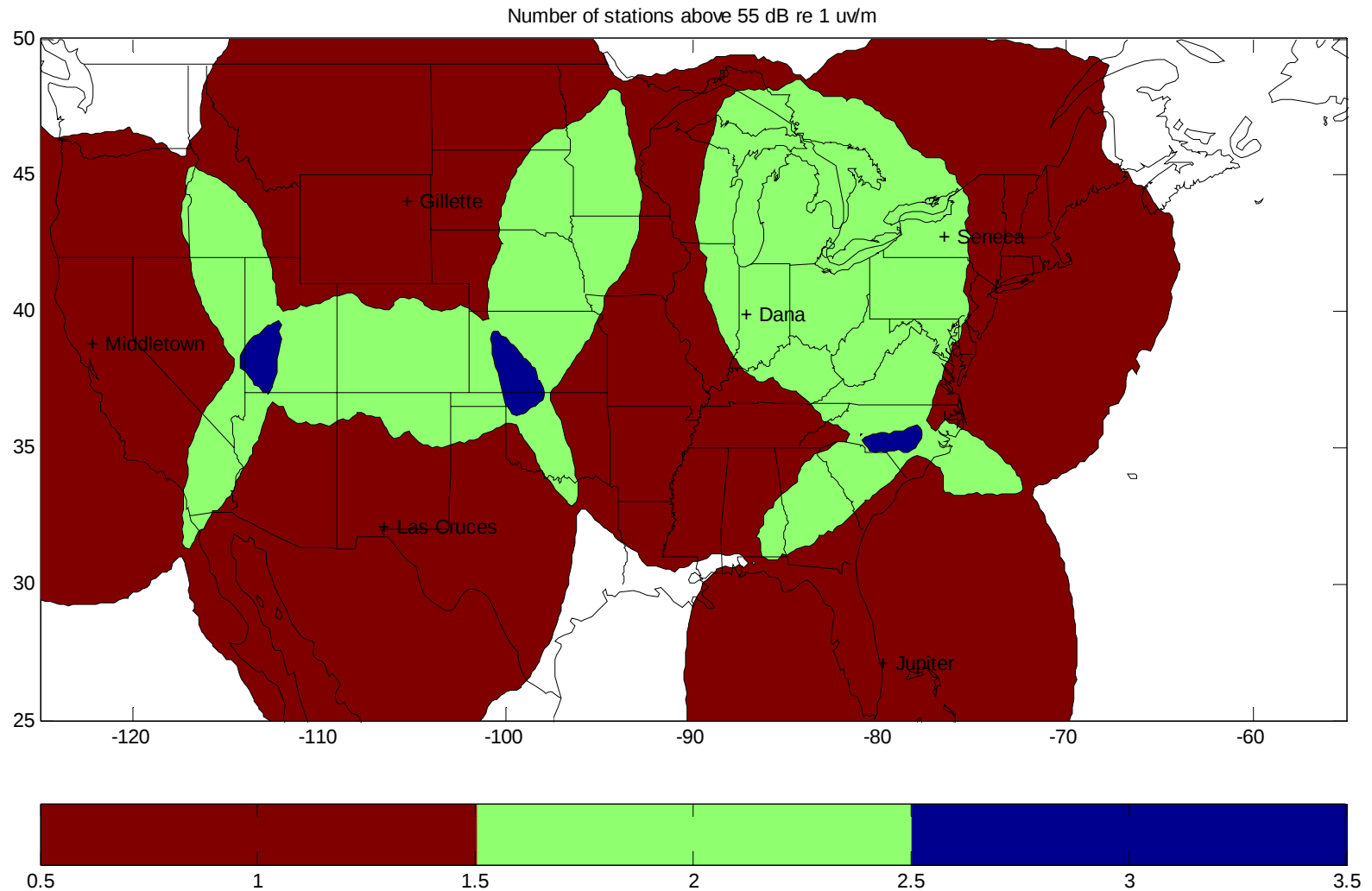


LDC Coverage Diagram – OCT 2006



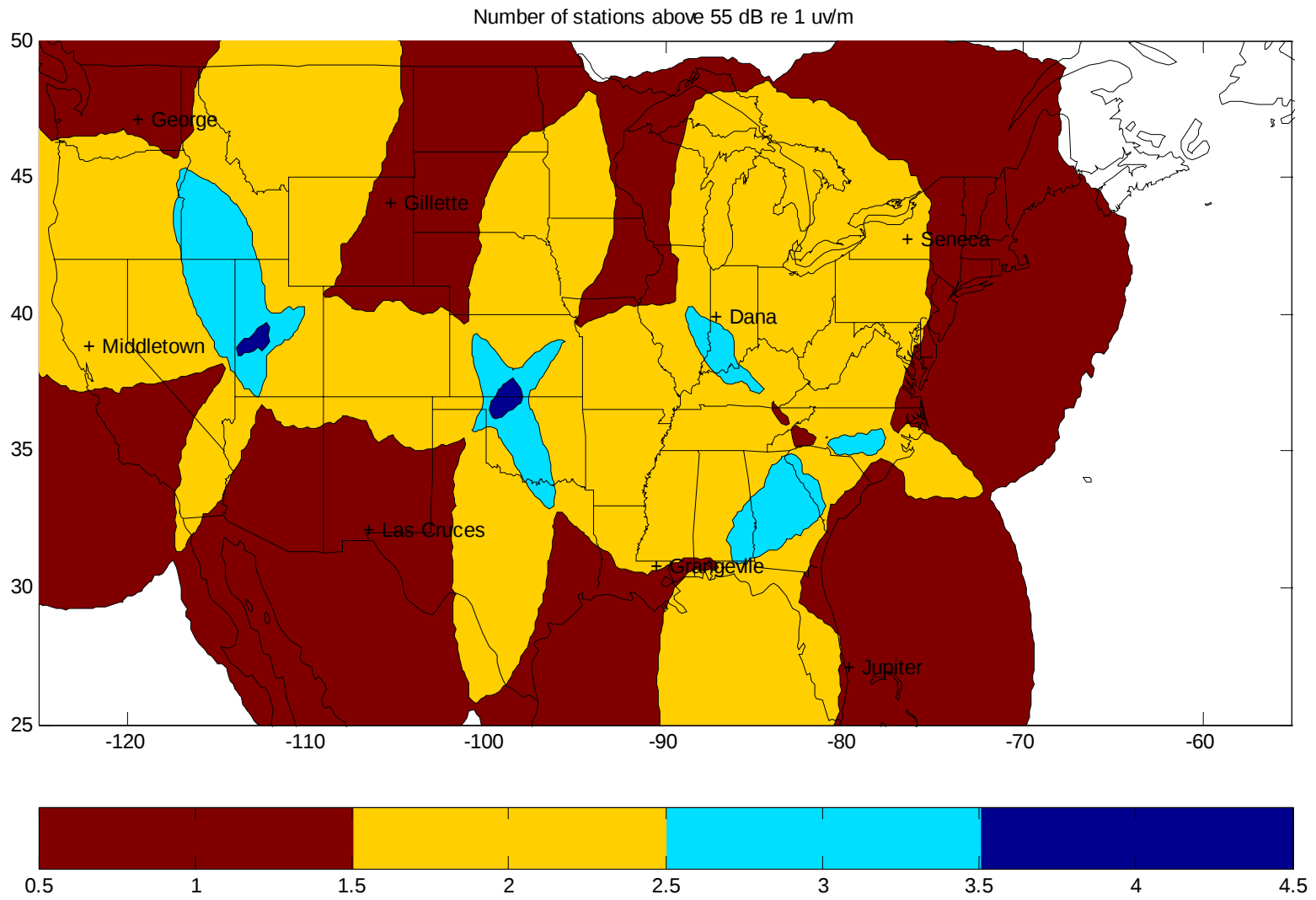


Existing 5 + LorSta Dana





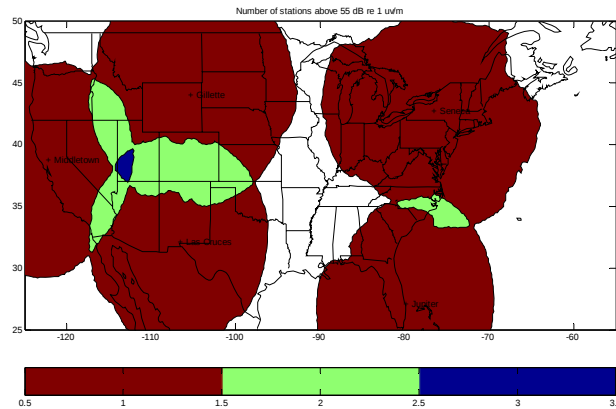
Existing 5 + Dana, Grangeville and George



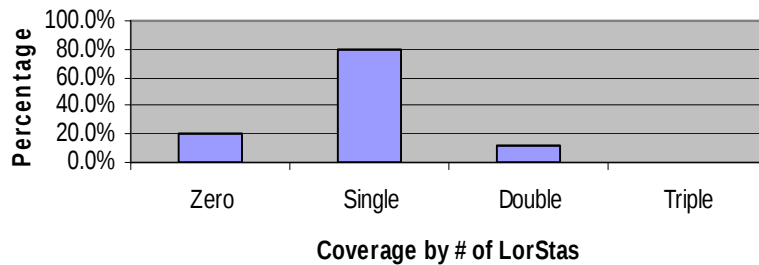
Coverage Percentage



Current Configuration (5 LorStas)

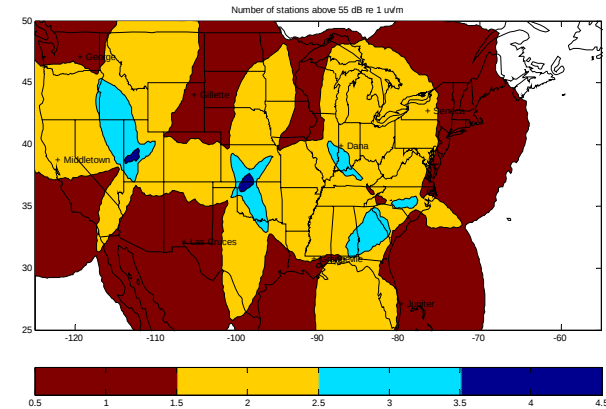


Percentage of CONUS LDC Coverage - 5 LorStas

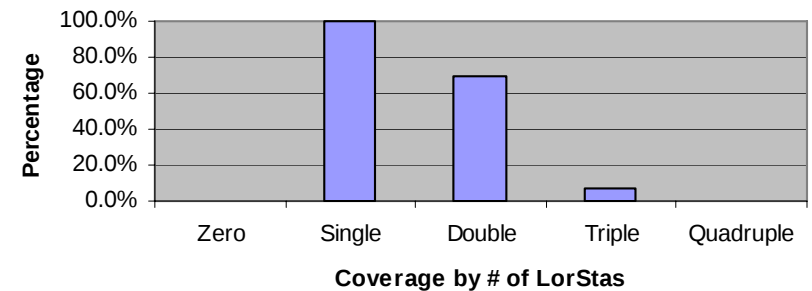


~79.4% single coverage

Future Configuration (8 LorStas)



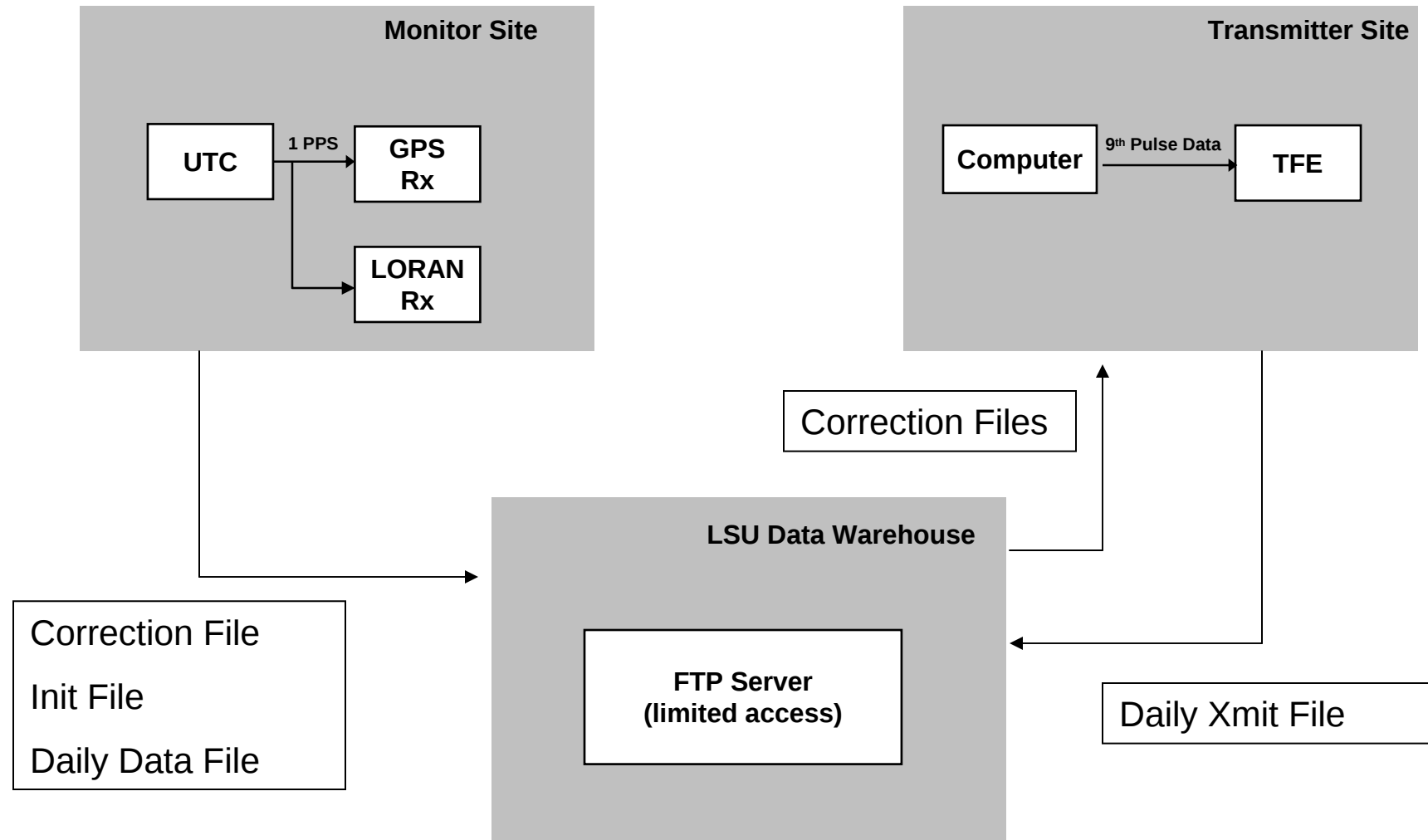
Percentage of CONUS LDC Coverage - 8 LorStas



~99.7% single / ~69.3% double



LDC - Differential Corrections





LDC Data

- All LSU monitor sites continue to be added on FAA website
- LSU FTP Server also being setup to store everything related to on-air broadcast of 9th pulse
 - Monitor Site
 - Corrections, Init File and Daily Data File
 - Transmitter Site
 - Daily Transmitted Data File
- Data is available upon request



LDC Monitor Sites

- 9th Pulse on-air status:
 - New scheme will bring together all Loran team monitor sites in northeast US in real-time status:

LSU/PIG Monitor Sites

- Sandy Hook
- USNO
- NRL
- LSU

CGA Monitor Sites

- Staten Island
- CGA
- Volpe
- URI
- FAA Tech Center
- Ohio University

LDC Comms Manual - Update



- V1.3 (mod1)
 - What and How
 - Continued changes planned
 - Excel spreadsheet: easier document for engineers to work with
 - Working document

Loran Data Channel Communications
using 9th Pulse Modulation

Version 1.3 (mod1)

Prepared By:
Dr. Benjamin Peterson, Mr. Ken Dykstra, Peterson Integrated Geopositioning, LLC
LT Dave Lown, LT Kevin Shmihluk, USCG Loran Support Unit

Last Modified: 20061020



Next Steps for LDC

- Continued Modernization
 - ELRR continued development
 - 9th Pulse integration into TFE
 - TFE correction of existing trouble reports with system
 - Two-way satellite time and frequency transfer (TWSTFT)



GPS Outage: PRN-30 02 June 2006

Data from LT Montgomery

GPS Outage cont.

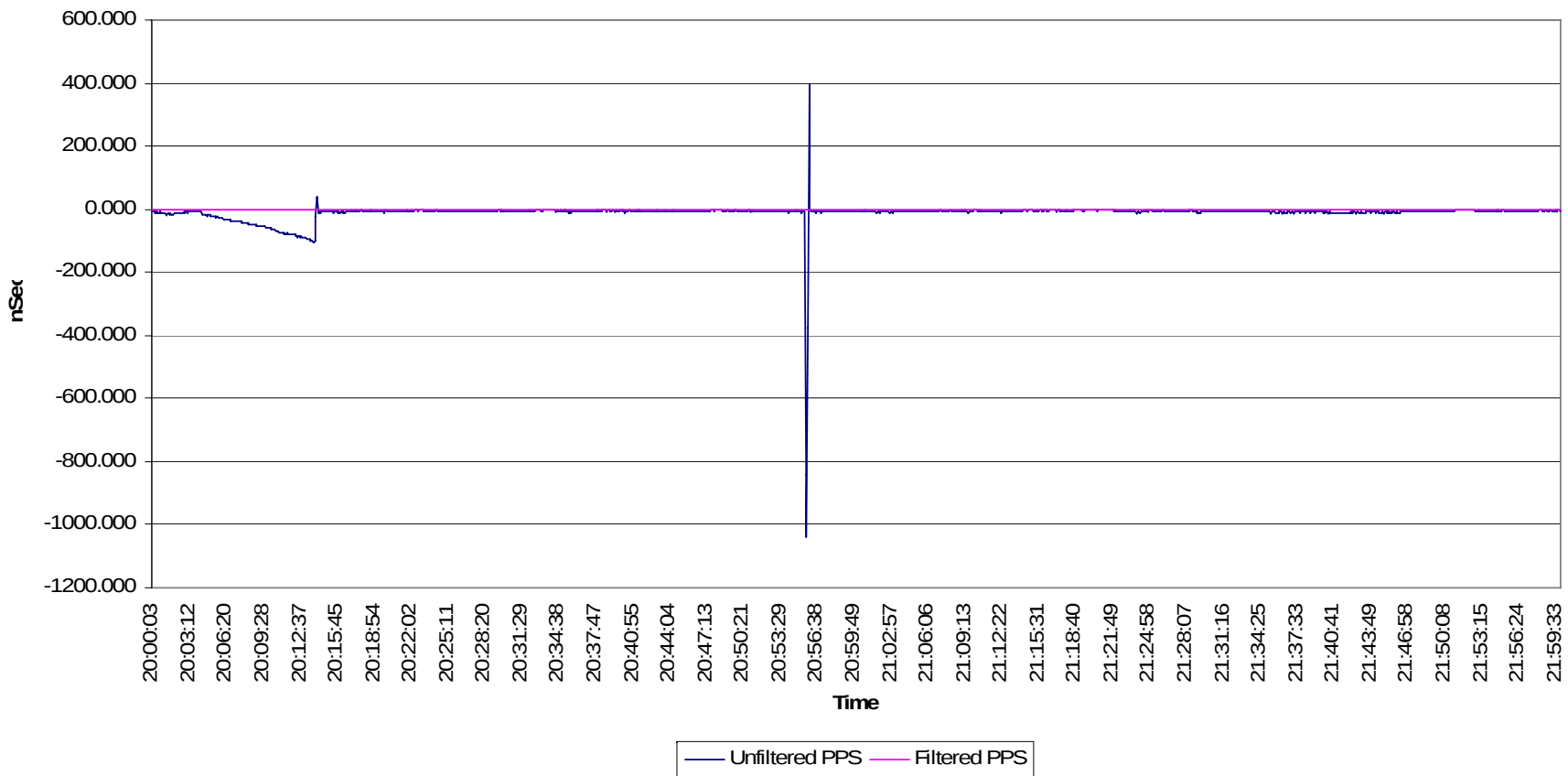


- Timeframe notes:
 - 2005 to 2014 PRN-30 went bad
 - 2014 PRN-30 changed to a different code
 - 2055 to 2056 renamed PRN-30 back to its original code
 - Unhealthy bit set
 - Causes approx. 30 seconds of bad data to be downloaded to know that SV is unhealthy
 - This is when TFE had problems



Baudette (8290W TFE 1)

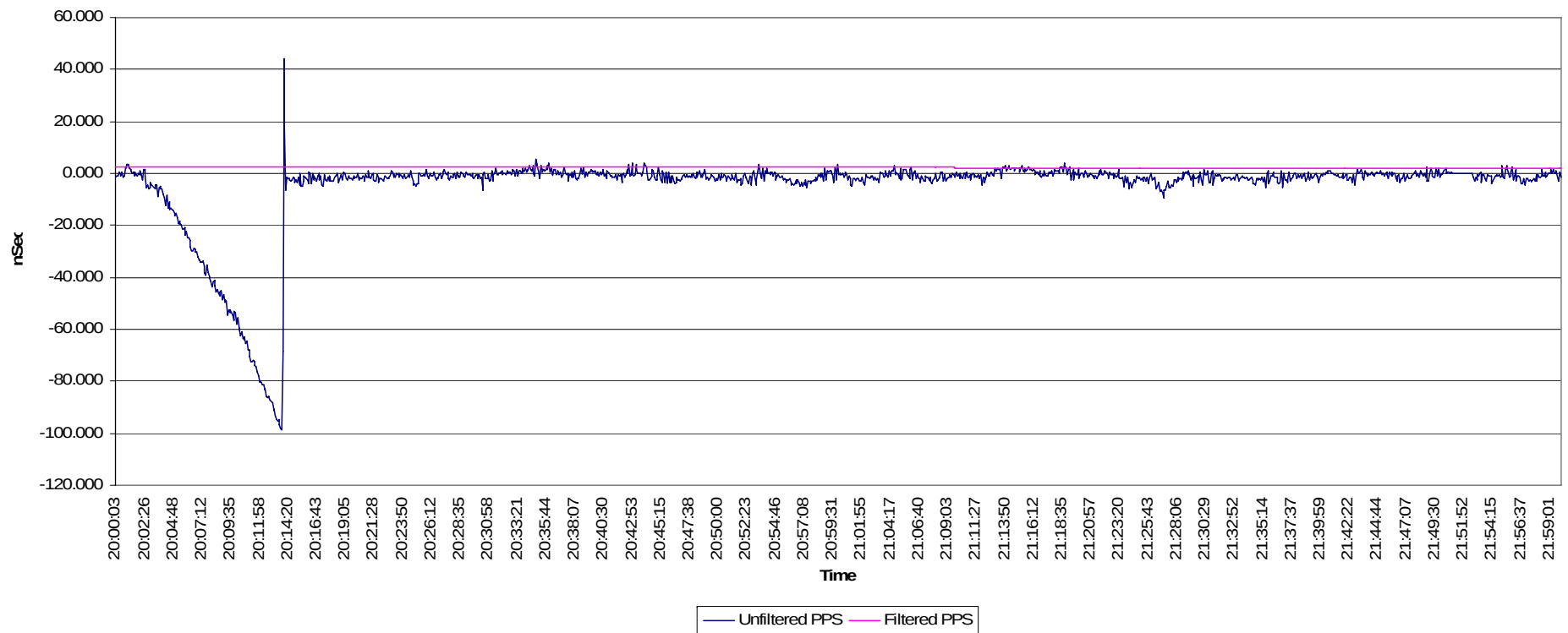
8290W TFE #1 1PPS 02 Jun 2006



Baudette (8290W TFE 2)

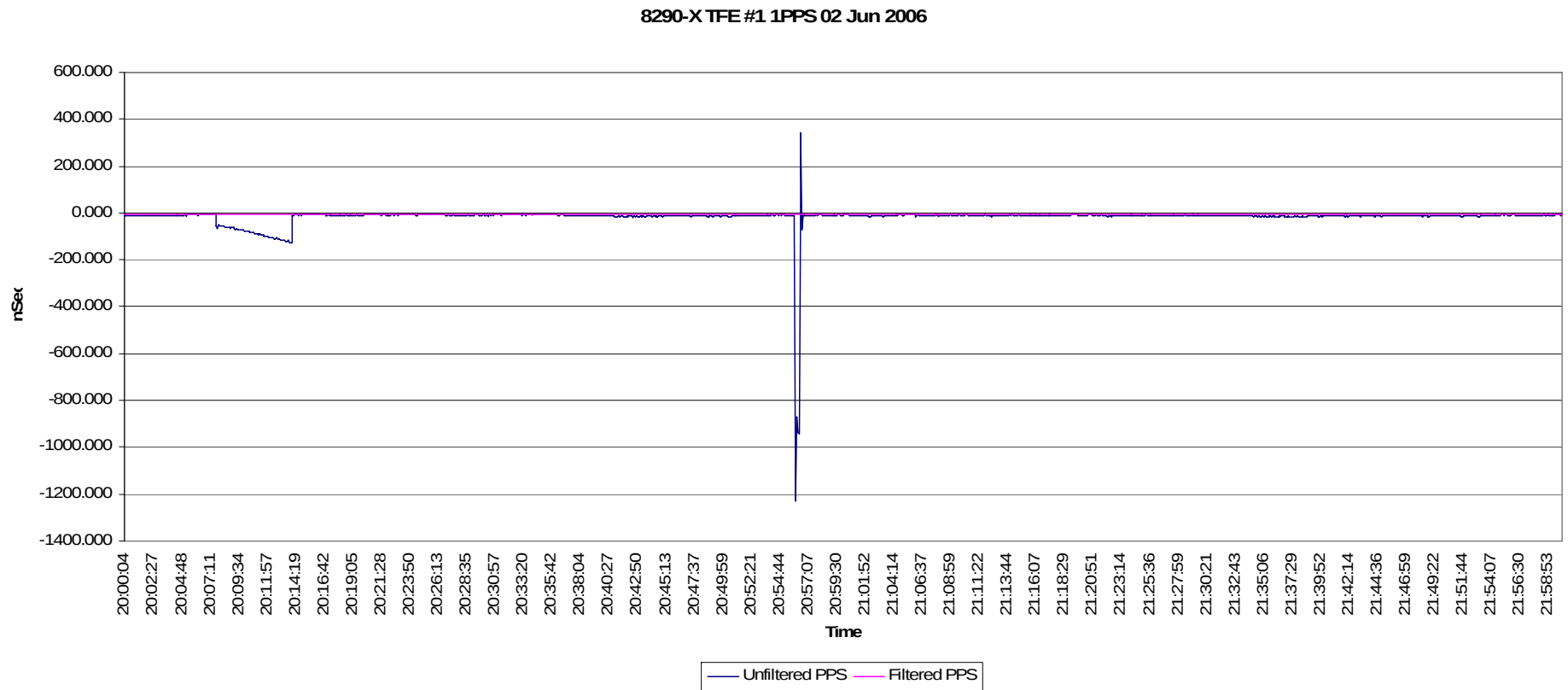


8290W TFE #2 1PPS 02 Jun 2006





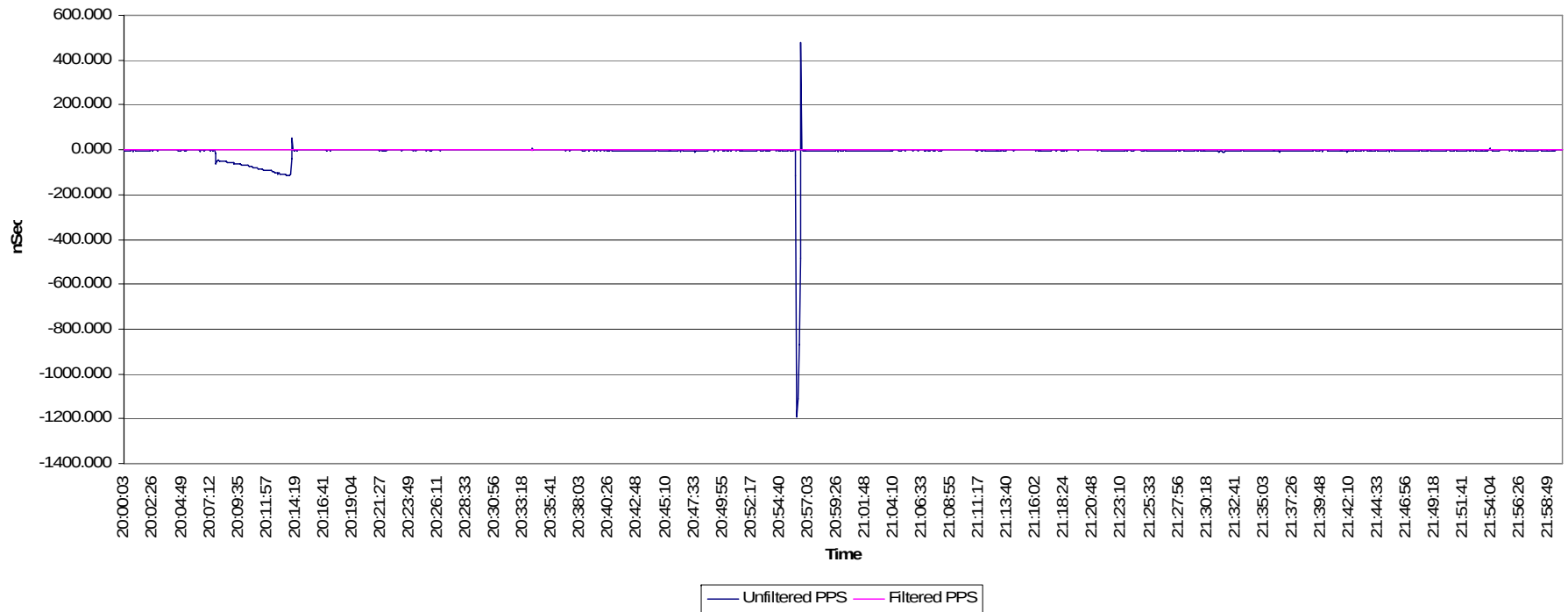
Gillette (8290X TFE 1)



Gillette (8290X TFE 2)



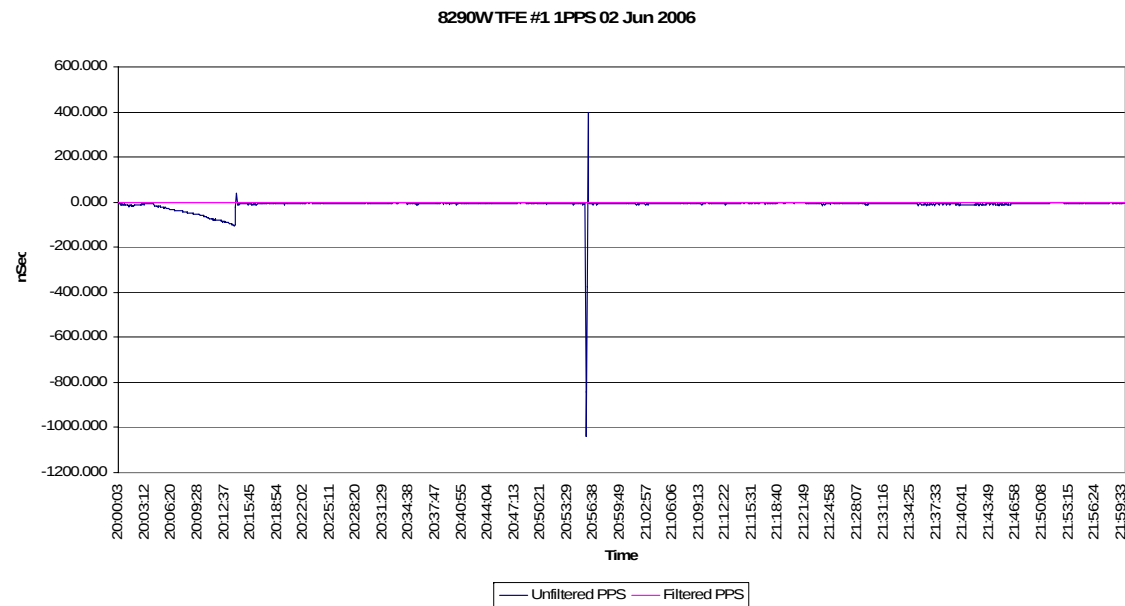
8290X TFE #2 1PPS 2 Jun 2006





GPS Outage cont.

- TFE Impact
 - TFE's GPS rcvr downloaded 30 seconds of bad data before it downloaded unhealthy bit
 - GPS rcvr's rejection filter was overwhelmed
 - Bad data then added to entire GPS time



GPS Outage cont.



- Solution
 1. Immediate: LSU testing alteration of GPS averaging (inc from 10 to 60 sec)
 2. Long Term A: TFE code change to increase integrity checking between sources of time
 3. Long Term B: TWSTFT implementation



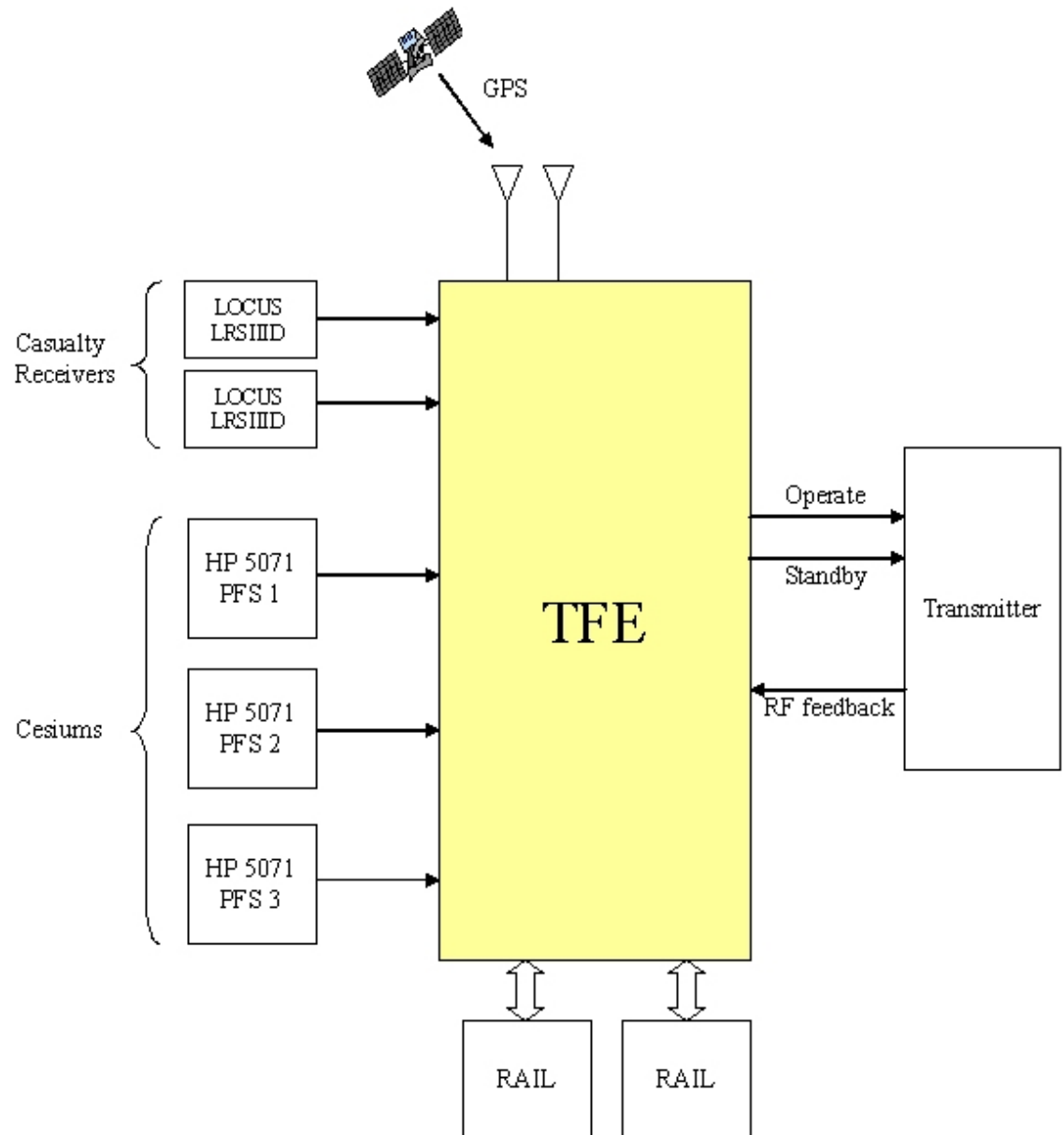
Two-Way Satellite Time and Frequency Transfer (TWSTFT)



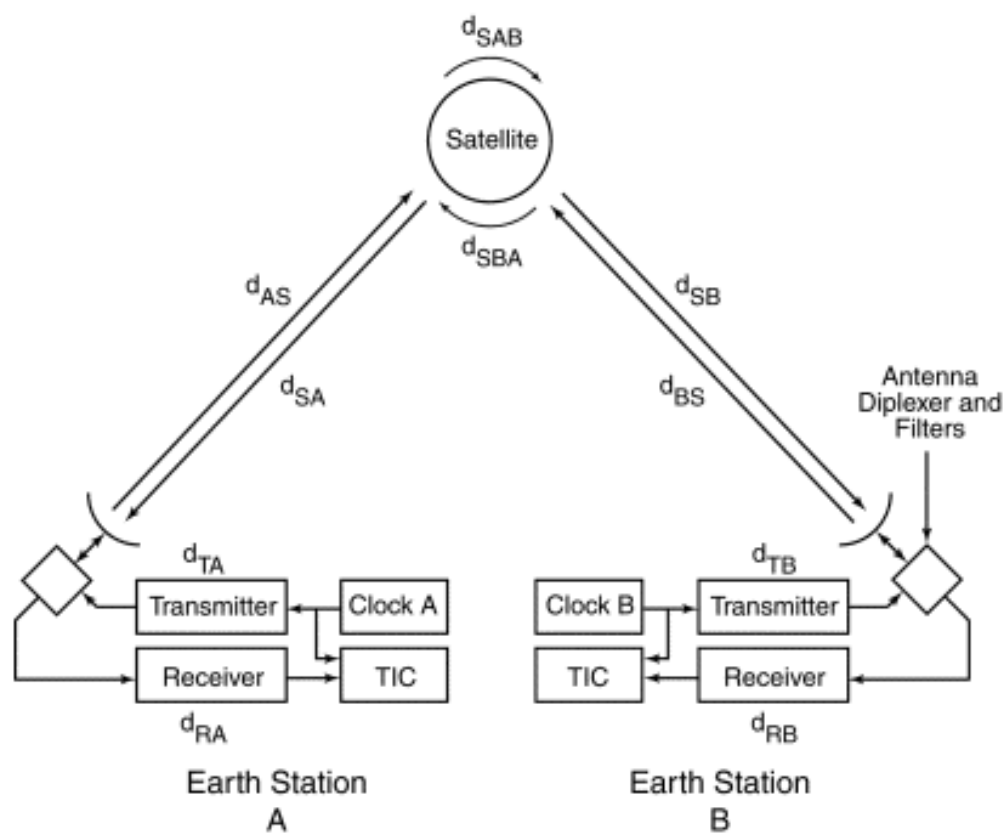


Why TWSTFT?

- Current Timing suite is GPS dependent
 - GPS is TFE's only source of UTC(USNO)
 - Need to break link to be true GPS backup



Two-Way Satellite Time and Frequency Transfer TWSTFT



Two-way time and frequency transfer using a geostationary communications satellite

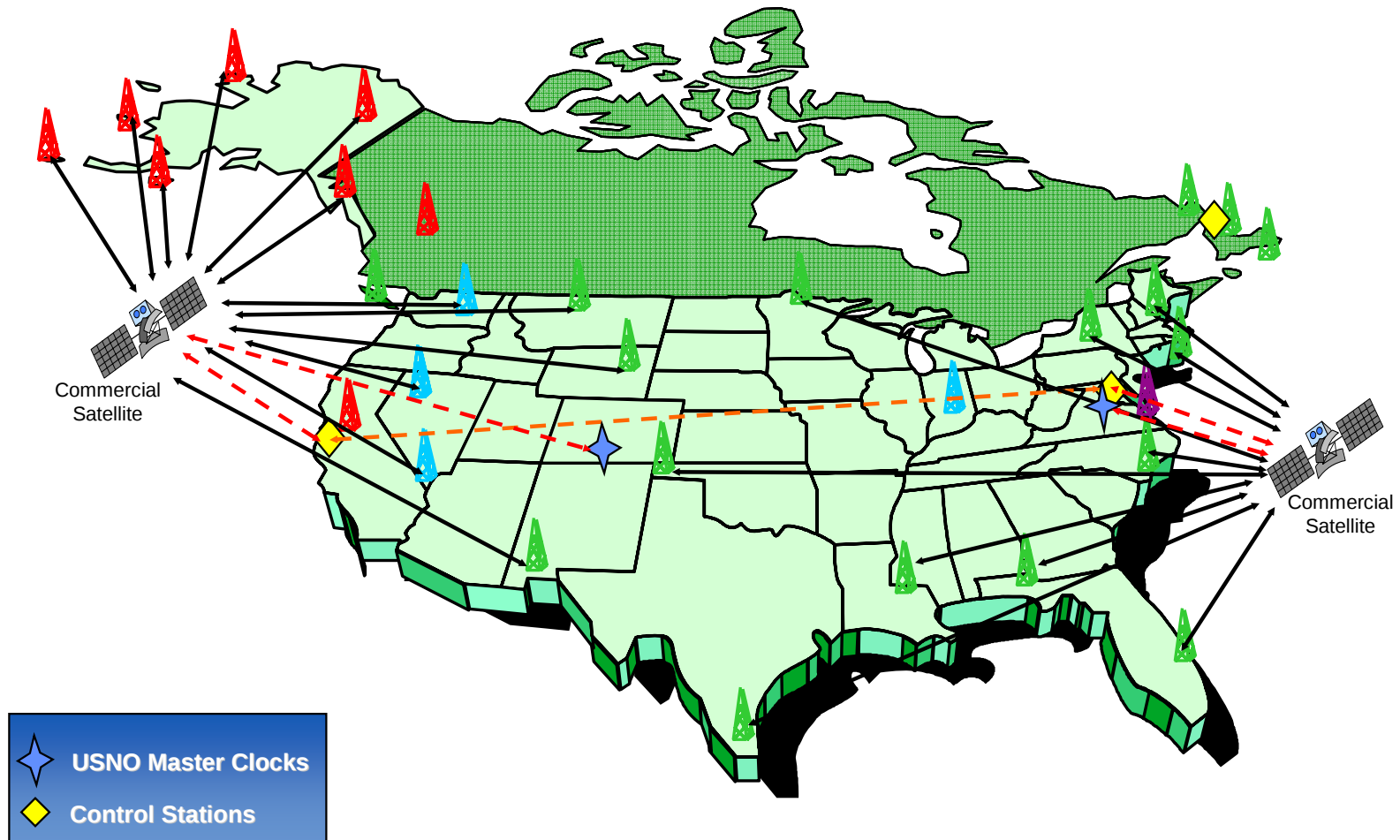


Hardware

- High Power/Low Noise Transceiver
 - Transmit Frequencies
 - 14.0 – 14.5 GHz
 - Receive Frequencies
 - 10.95 – 12.75 GHz
 - 4 watt Ku-Band
- Antenna
 - 1 m VSAT (Direct TV) – 4.6 m Steer able Dish
 - Roof Mountable (non-penetrating)

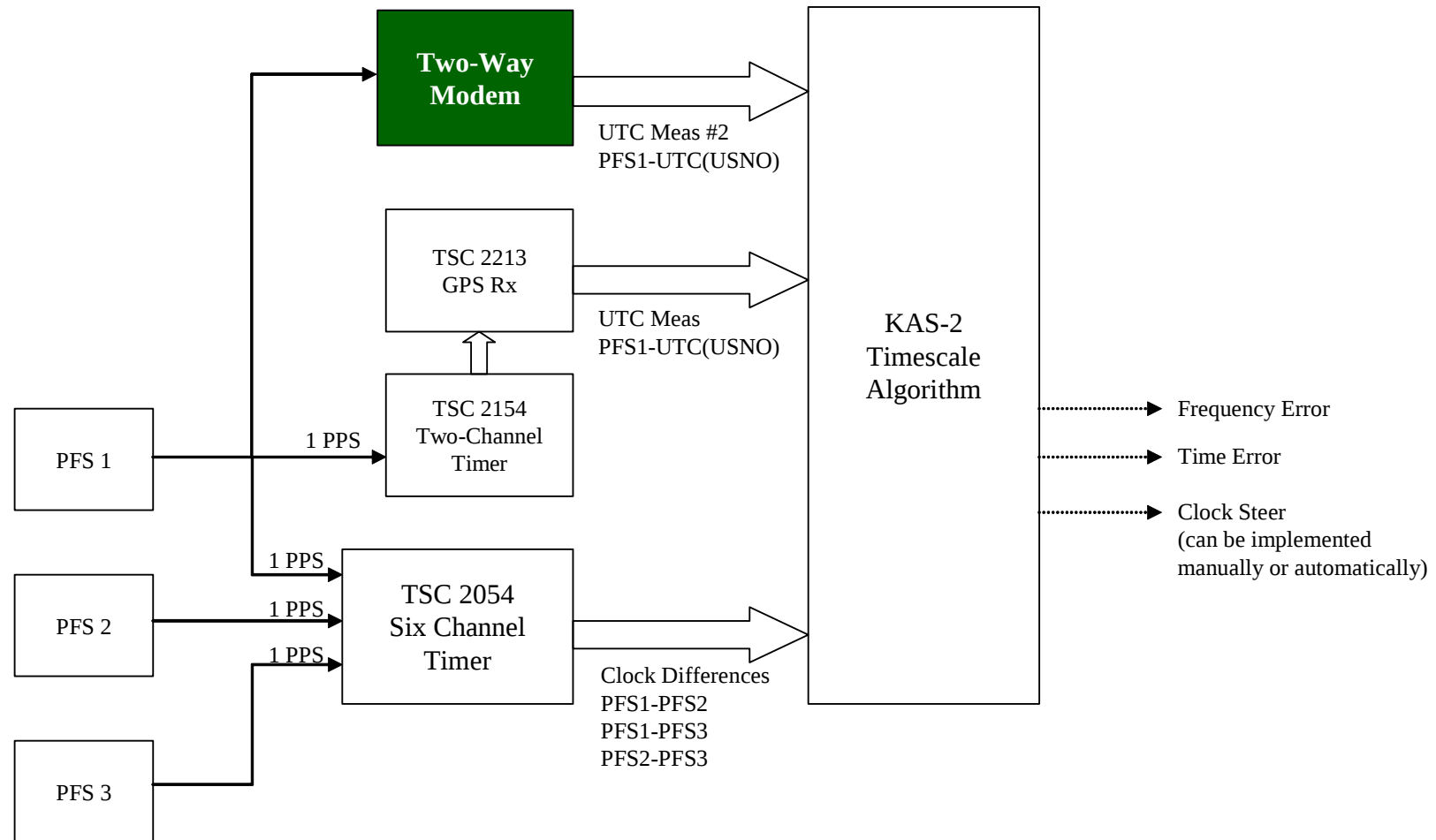


Conceptual View





Timing Aspect





Goals of TWSTFT

- GPS Independence
- Joining approx 100 geographically dispersed Cs clocks, to create a Loran Timescale
- Setup diagnostic tools for timing at control centers (NavCen and NavCen Det) to collect and log clock data from all LorStas

Requirements Development

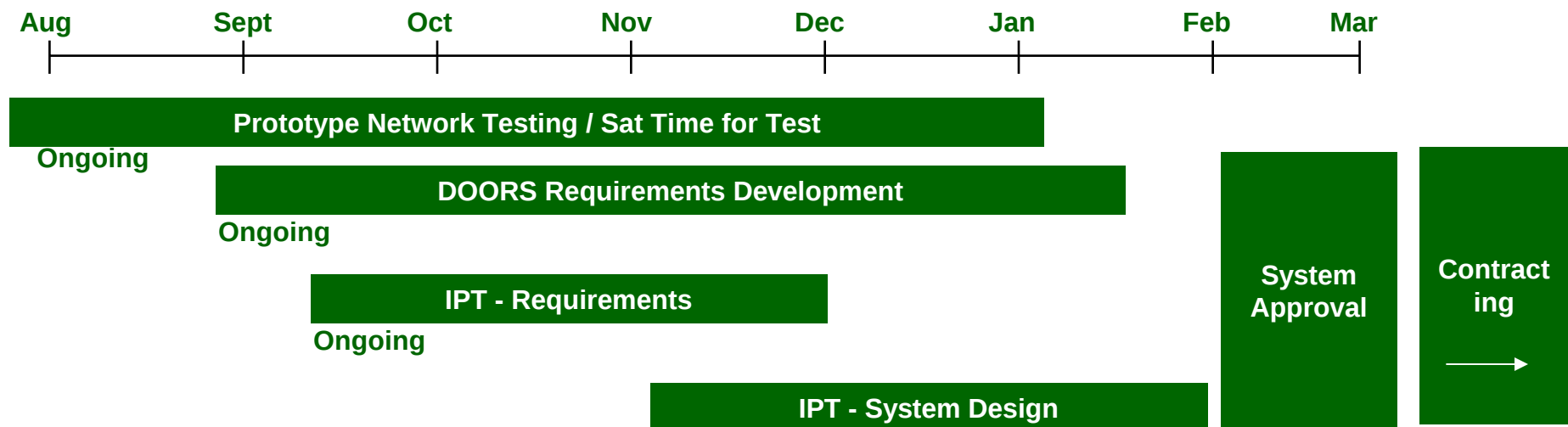


- DOORS
 - Requirements development and tracking software
 - In support of USCG SDLC (System Development Life-Cycle) initiative
 - In use with new LICOS/LEMS requirements development contract with BAH (Tom Gunther and Ron Davis)



TWSTFT Planning

- LSU is collaborating with US Gov't agencies to develop requirements for system and also to assist in system design
 - USNO, NAVCEN, NIST, VOLPE, CGA
- Goal is to get quick rollout of system while being sure that system development life-cycle steps are followed
 - Allows for requirements tracking
 - Will filter into future projects being planned (LEMS and LICOS)





The views expressed in this briefing are those of the authors and are not to be construed as official or reflecting the views of the U. S. Coast Guard, the Department of Homeland Security, or the U. S. Government.



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