



LORAN Modernization

Loran Data Channel

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Orlando, FL

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Introduction



- Loran Today
- Loran Modernization – Achievements
 - Lorsta & Consta Electronics Recapitalization
 - Time Of Transmission (TOT) Control
 - Loran Data Channel (LDC) – Differential Loran
- Loran Modernization – Expectations
 - Remaining Recapitalization
 - eLoran: LDC Coverage Expansion
 - eLoran: Differential Loran Trials



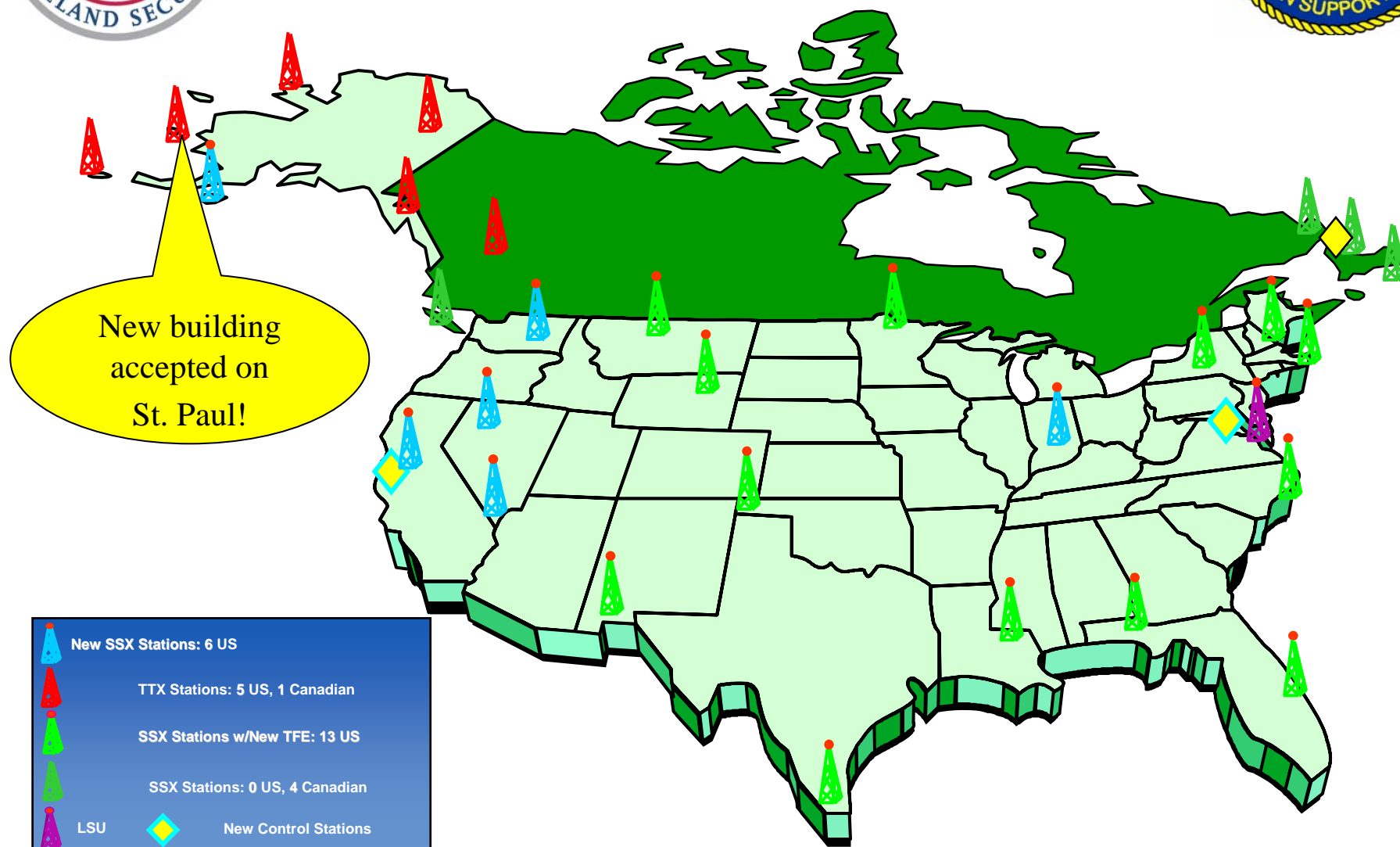
LORAN-C Today



- 100 kHz, ground wave, high-power (400-1600 kW)
- Delivers timing info & 2-D position
- Affected by propagation path and weather
- Manual steering to 100-ns of UTC
- Not yet “All that it can be”
 - Discontinuities (time steps)
 - Chains & SAM control (does not enable all-in-view receivers)
 - Transitioning to TOT Control
 - 500-meter horizontal system
 - No Gov’t statement = industry reluctance



North American Loran System - 2007





New Loran-Station Electronics



New Solid State Transmitter
(NSSX)



New Timing & Frequency
Equipment (NTFE)



Facilities Installation



Building HVAC



Exterior fuel tank/GENSET



Canadian Control Upgrade



New LORSTA Comms
Equipment, Receivers and
RAIL Computers



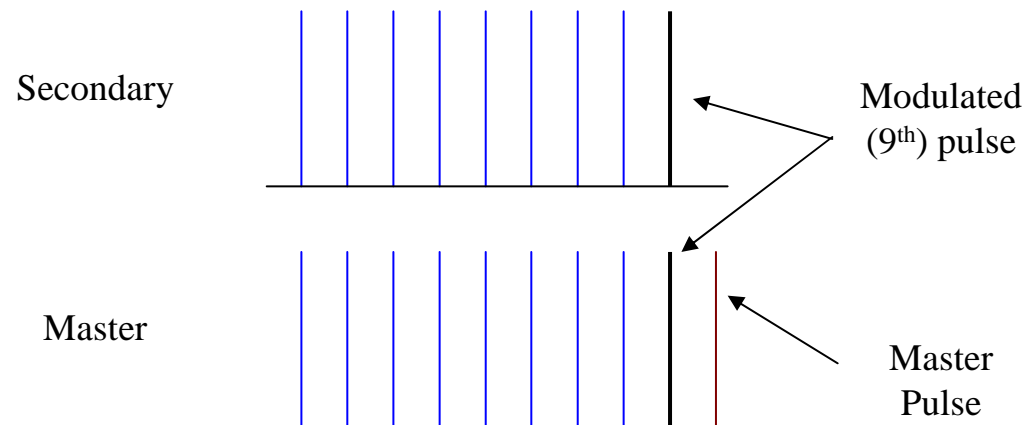
New Consolidated Control
System (NLCCS)



Loran Data Channel

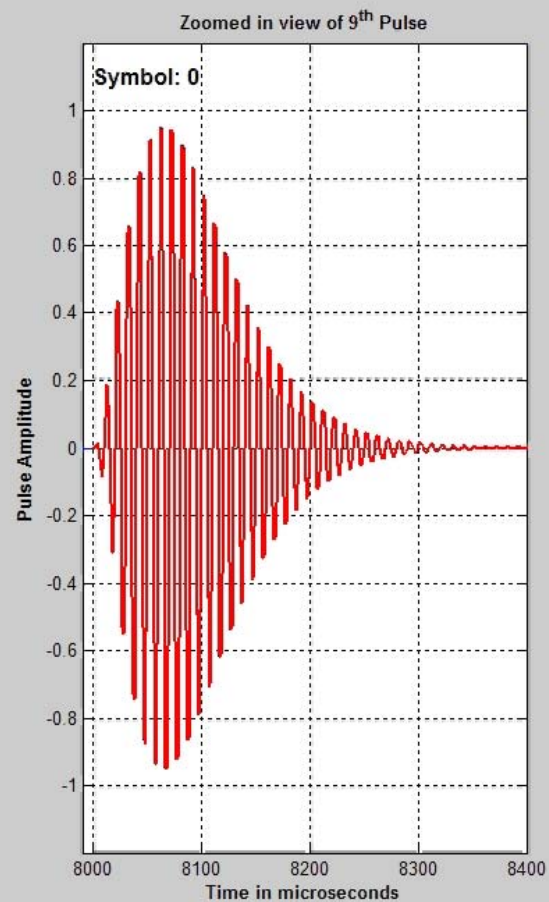
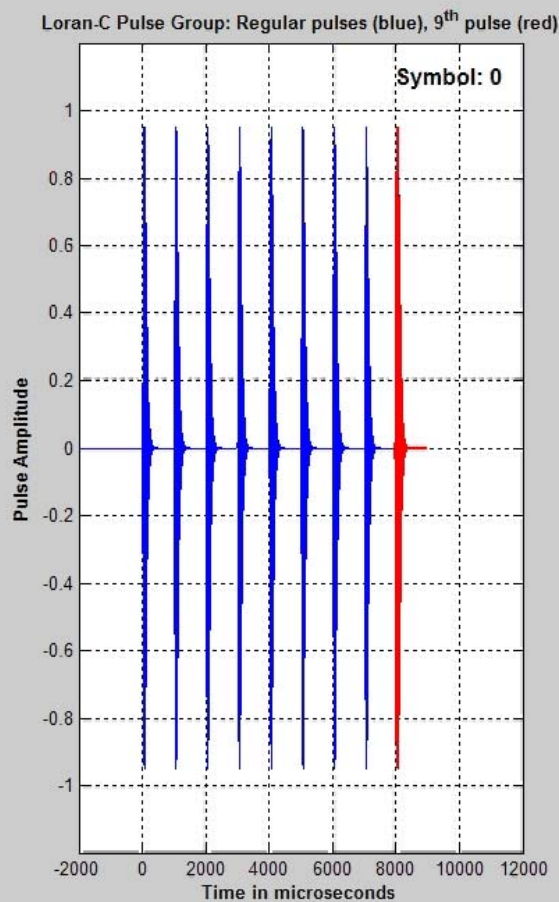


- Information modulated on a 9th Pulse
- Preserves navigation information on pulses 1-8
- Prototyped with solid-state transmitters
- Differential corrections from monitors
- Other possible techniques (Eurofix, “10th” Pulse)



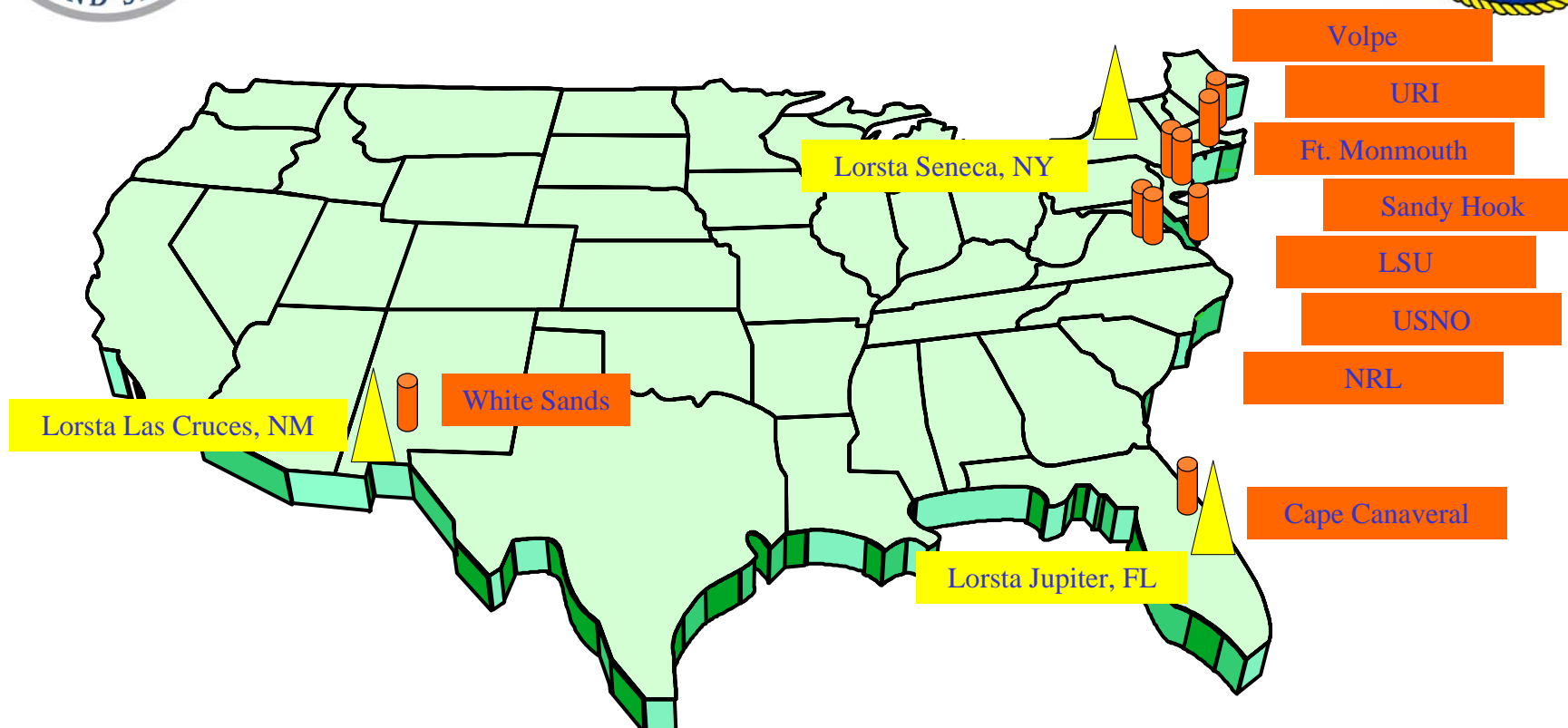


“9th Pulse” Loran Data Channel





Enhanced Loran Timing Test Beds



Volpe

URI

Ft. Monmouth

Sandy Hook

LSU

USNO

NRL

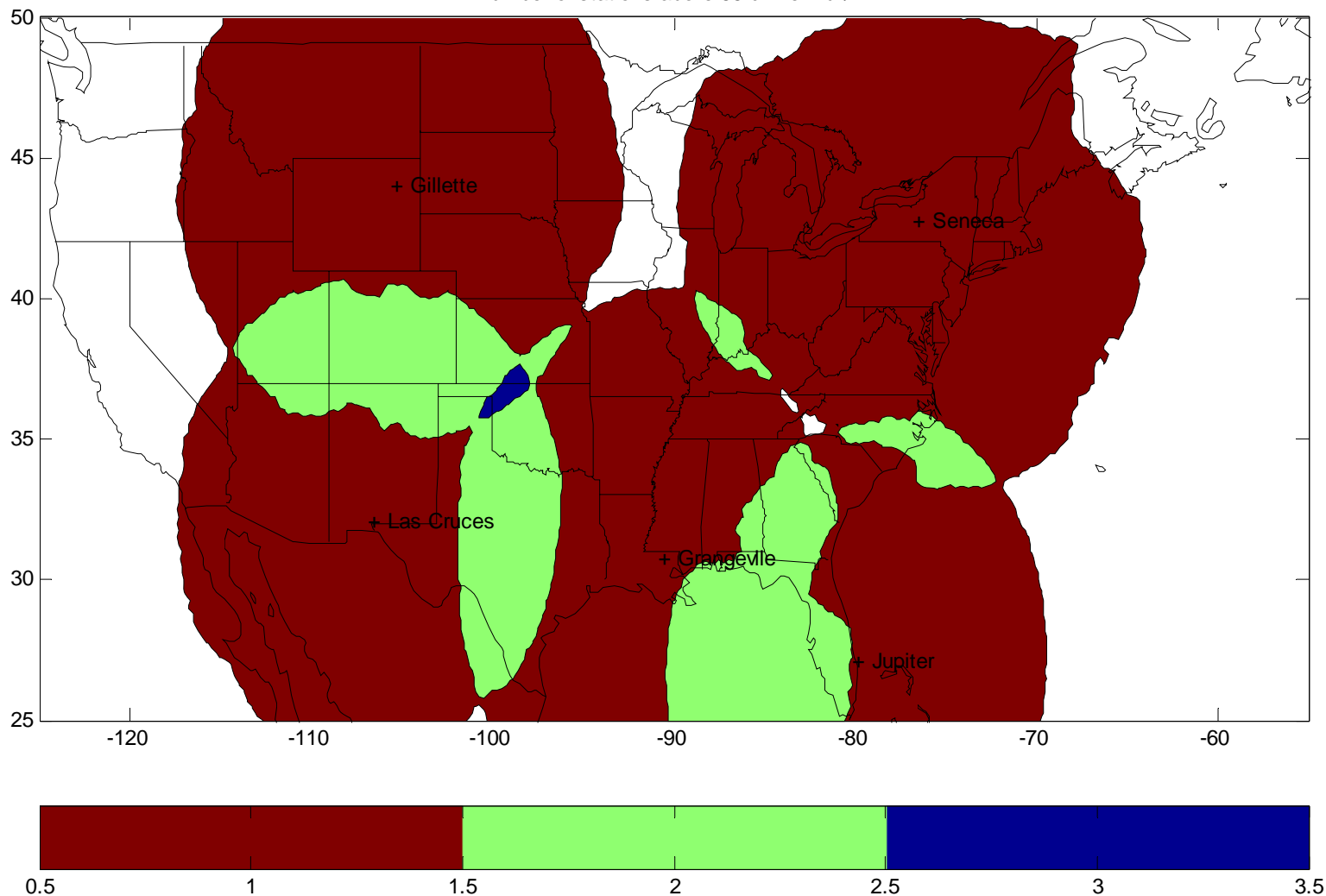
Cape Canaveral



Coverage of Loran Data Channel Testing

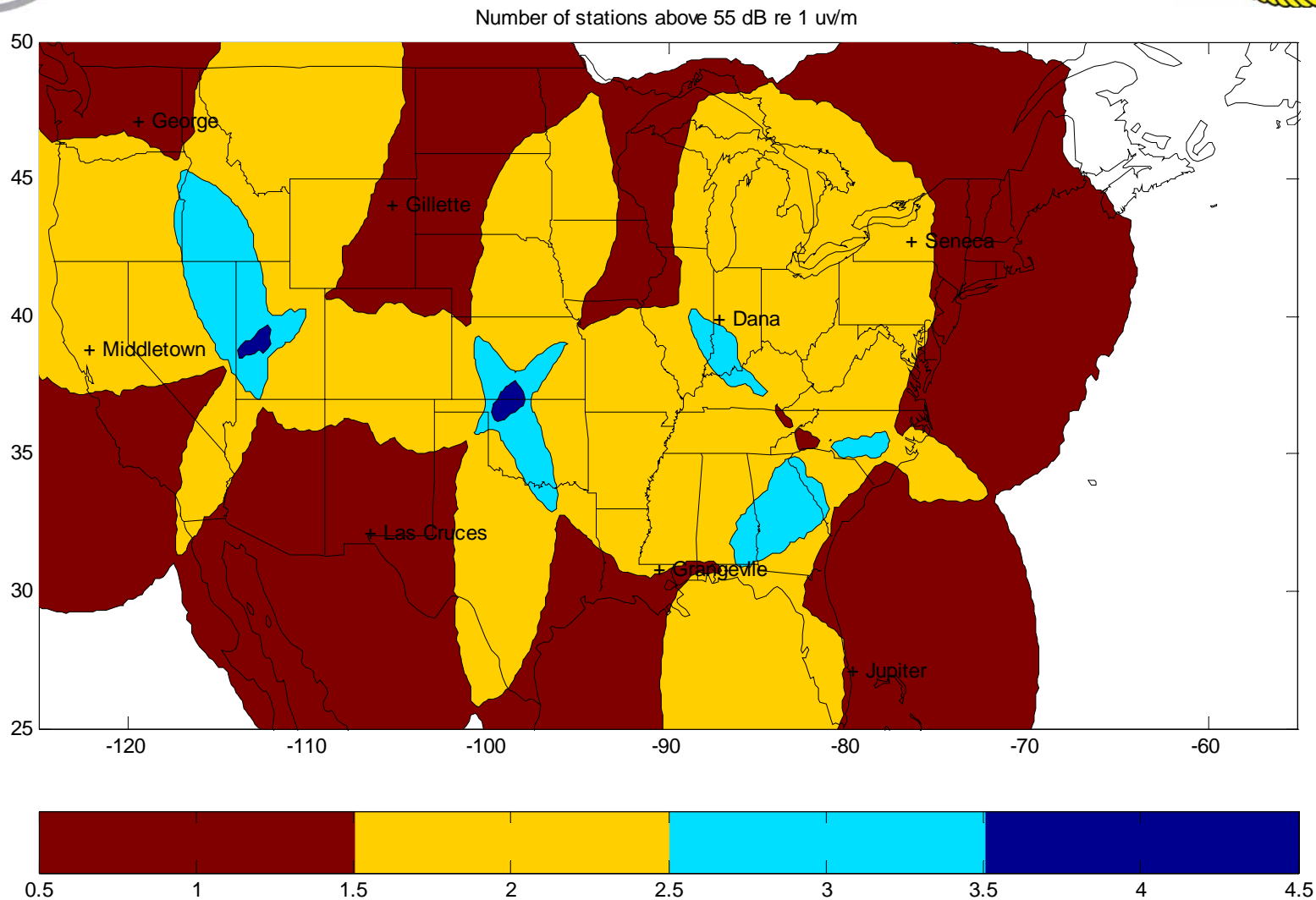


Number of stations above 55 dB re 1 $\mu\text{V/m}$





Coverage of Loran Data Channel Testing





Differential Loran



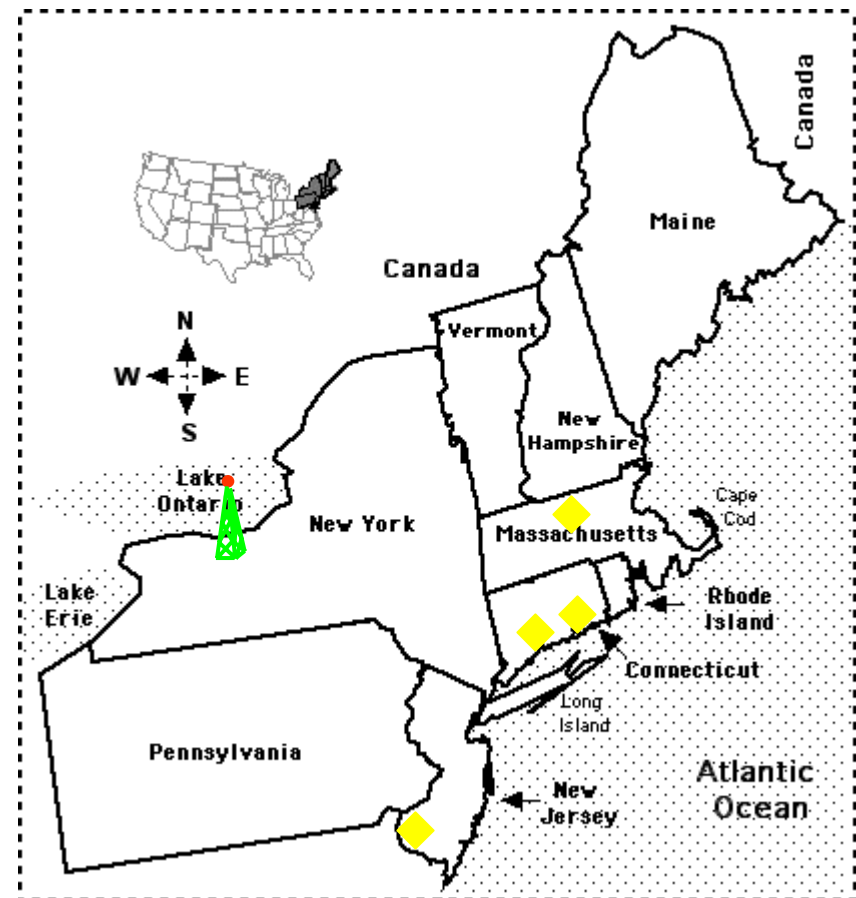
- Land-path signal delays (spatial)
 - Land propagation path introduces signal delays called “additional secondary factors (ASF)”
 - Provider needs to survey each waterway for ASFs beforehand
 - User receiver stores waterway’s spatial ASFs beforehand
- Weather-path signal delays (temporal)
 - Provider’s shore-side monitor calculates corrections in real-time
- Loran Data Channel “9th Pulse Comms”
 - Provider modulates monitor info onto Loran signal & sends to user
- Differential-Loran user receiver
 - User’s receiver applies spatial ASFs
 - User’s receiver demodulates & applies temporal corrections
 - Differential-Loran improves position accuracy significantly
- It works!



Differential Loran (cont'd)



- Differential Corrections
 - LORSTA Seneca, NY
 - 8 monitor sites (USCGA, Volpe, URI, FAA Tech Center, Ohio U, CGSta Pt. Allerton, LSU, USNO)
- LDC Format
 - Comms Ver 1.3 mod 1
- New London Demo's
 - Dec '06 and Apr '07





Summary



- Achievements
 - All CONUS Lorstas and Control Centers modernized
 - New Timing & Frequency Equipment at 11 Lorstas
 - 1st AK recap accomplished & 2nd nearing completion
 - NEUS and GLKS transitioned to TOT Control
 - Differential Loran & 9th Pulse demonstrated in real time
- Next Steps
 - Continue AK modernizations (funding dependent)
 - LDC research and broadcasts continue
 - Automation / unstaffing



The views expressed in this briefing are those of the author 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.

Questions?

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