Current and foreseeable Loran system capabilities

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Overview

Current eLoran performance Recent updates Ninth pulse capability New antenna concepts Novel processing – revisiting data New acquisition algorithms Improving update rates Timing: using multiple references Future ?

Current performance tracking accuracy



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Niijima – 120 km





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Antenna concepts



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E-field

E-field antenna

- Miniature E-field antenna (actual antenna is 6 cm long)
- Size Length 85mm, width 55mm, height 125mm
- High dynamic range
- Very low noise level
- Can be operated with all Loradd receivers
- Specs can be fine tuned for special applications
- Available now!

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New receiver developments

9th pulse demodulation/decoding

- Implementation completed
- Now available as an option on all Loradd receivers

Upcoming:

- Chain acquisition
 - Massive parallel search for quick acquisition anywhere in the world
- Multi-station receiver clock slaving
 Improved tracking update rates



Multi-station receiver clock slaving

Algorithm monitors n Loran stations

Automatically detects and drops outliers

Works for n ≥ 1; outlier detection works from n ≥ 2 (!)



Steering the oscillator to a ramped TOA



6731M 6731Y 6731Z 7499M 7499X



Steering the oscillator to a ramped TOA





Clock steering Single source w/ induced TOA ramp



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Clock steering Dual source w/ induced TOA ramps



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Tracking Update rates

Moving away from Integrate and Dump
 Increasing Loran update rate
 Removing Loran lag



0.2 Hz and 1 Hz update rates



Recorded data was re-processed with kind permission of the General Lighthouse Authorities

What can we expect?

- Resilience to transmitter outages (for timing). Less downtime ?
- 5 Hz update rates can be achieved
- Approx. 10 meters accuracy w/ ASF maps and dLoran
- More ASF maps to become available
- dLoran to become more available
- Faster RX start-up time
- Equipment price reductions
- Equipment size reductions
- Integration of low-frequency receiving equipment (eLoran, Radiobeacons, TOR, ...) for lower cost to the user

Conclusions

► Efforts over the last decade have resulted in user accuracy improvement more than an order of magnitude (450m→≈10m) over 'traditional' Loran !
 ► Receiving positioning/tracking performance not expected to make further spectacular leaps in the near future; however 'normal' development will still continue

Need to identify which applications can be serviced based on the current or foreseeable system performance. This task should be of concern to the eLoran community as a whole.

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