



Satellite Detection of AIS-SART-EPIRB Sea Trials

2010 Beacon Manufacturers Workshop

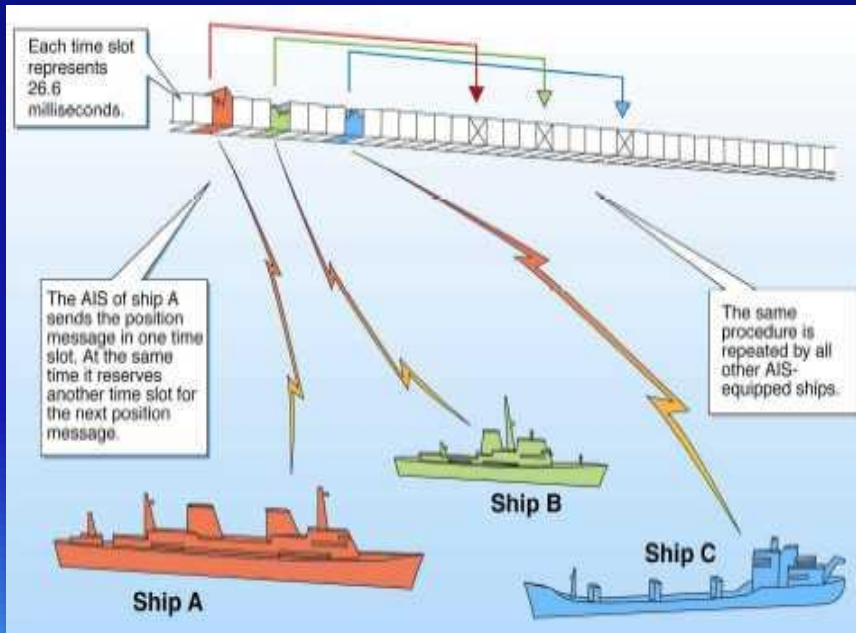
San Diego, 21 May 2010

Jim King



Automatic Identification System (AIS)

- Collision Avoidance and Traffic Management System
- Installed on more than 70,000 vessels
- AIS carriage requirements increasing



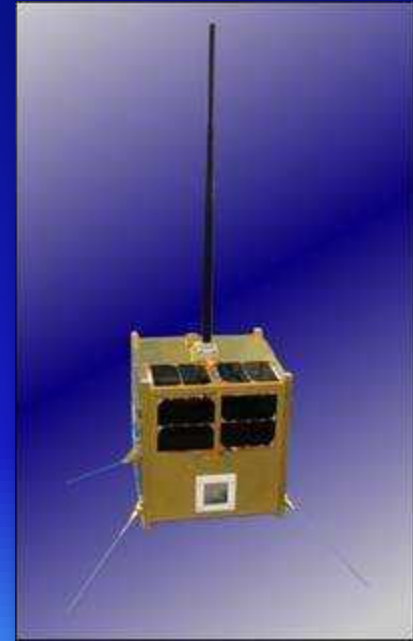
Source: USCG Navigation Center

- AIS Transponders emit VHF signal
 - Automated
 - Dynamic
 - Short range (50 nm)
- Standard message content includes:
 - Vessel Identification
 - GPS Position
 - Course and Speed

Satellite AIS shifts detection of signals into space, extending range of the system and creates new applications

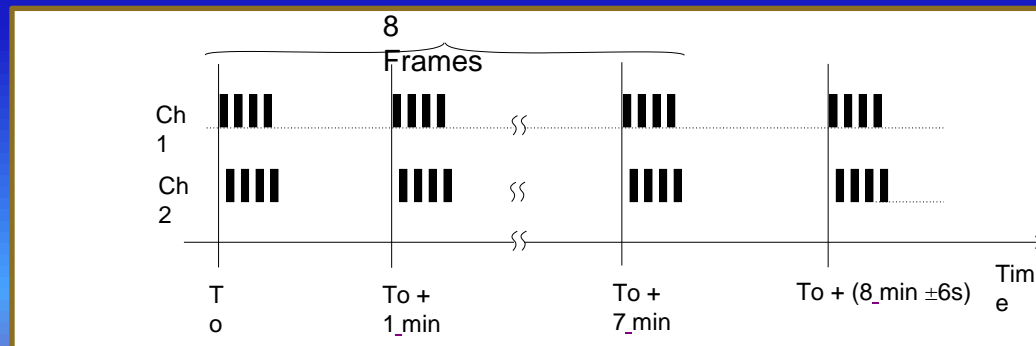
AIS Search & Rescue Sea Trials

- COM DEV has:
 - been developing and building a global Satellite-AIS system to detect these devices
 - set up new data services company: exactEarth Ltd
- We were invited to participate in AIS Search and Rescue Sea Trials organized by:
 - USCG - U.S. Coast Guard ; and
 - IALA - International Association of Marine Aids to Navigation and Lighthouse Authorities
- Our NTS (nano-satellite for Tracking of Ships) was used to detect AIS signals from new types of SAR devices
- Sea Trials conducted in Hawaii on 20-21 Jan 2010

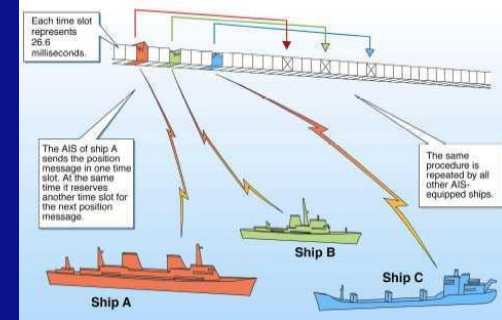


AIS-SART Transmissions

- For 20 years, SARTs were SAR “Radar Transponders” for use in life rafts
- AIS Search and Rescue Transmitters : AIS-SARTs :
 - new devices authorized by IMO from 1 Jan 2010
 - Low-power, battery operated devices
 - designed for use in life raft or in water by users in distress
 - Intended for detection by nearby vessels to assist in rescue
- Only 1/10 as strong as regular Class A AIS on a vessel (1 Watt vs 12.5 Watts)
- AIS-SART antenna usually near the water, and bobbing in the waves
- Adding AIS transmitter in a 406 MHz EPIRB could facilitate homing
- Transmits a special message defined by ITU: 8 quick bursts each minute, alternating on channels AIS 1 & AIS 2:



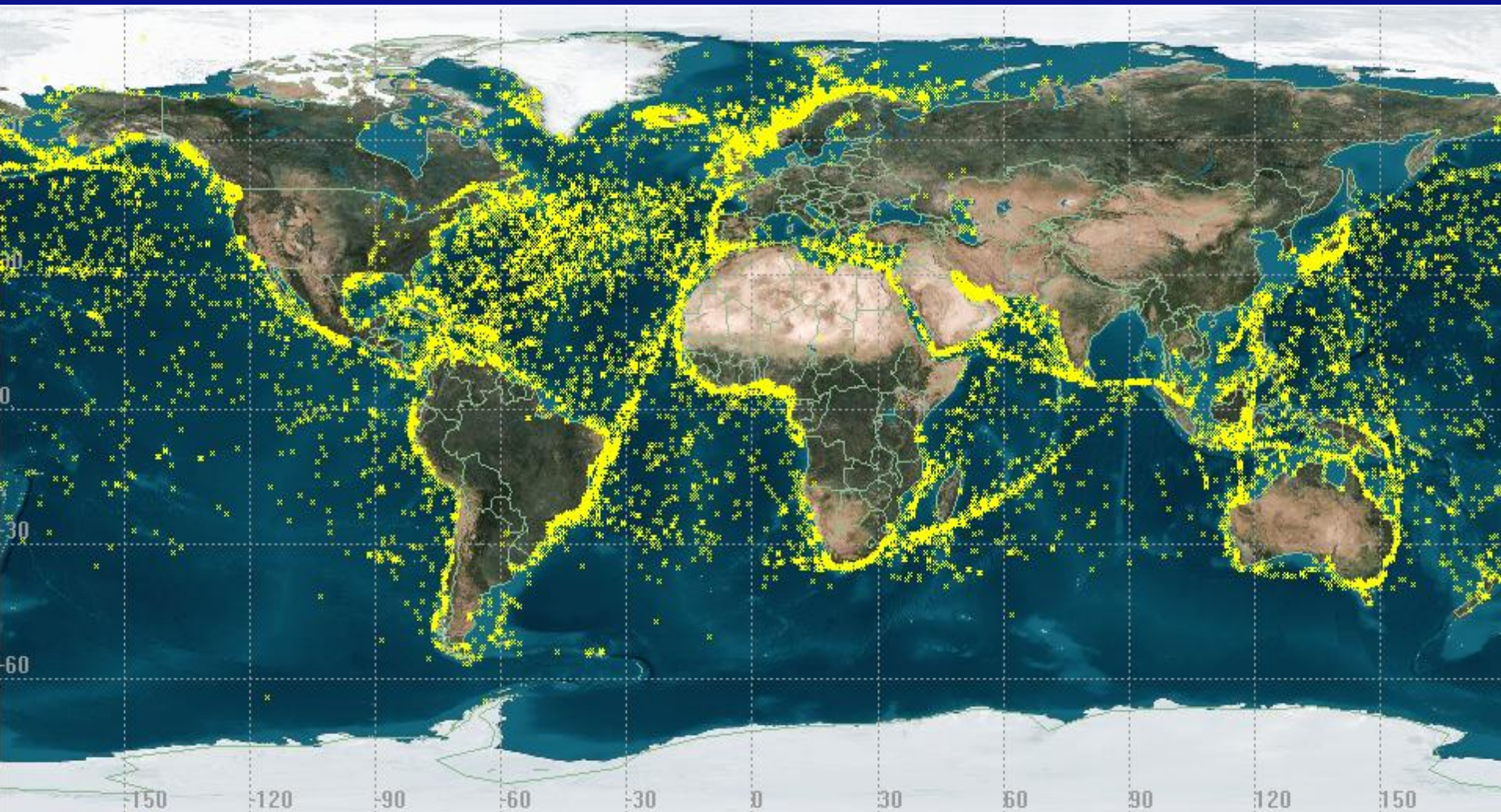
Taking AIS to the next level



- AIS today – globally deployed, locally used
 - ~70,000+ transponders, many years of successful operation
 - >\$1B invested in coastal AIS monitoring systems
- •Satellite AIS detection ‘takes AIS global’
 - Enables a range of new capabilities for AIS
 - Does NOT require any change to the ship’s equipment
- Advanced Satellite detection technology is a must
 - Satellite may see up to 8,000 ships at once, must be able to resolve these overlapping signals



The Results – from NTS Demo Sat

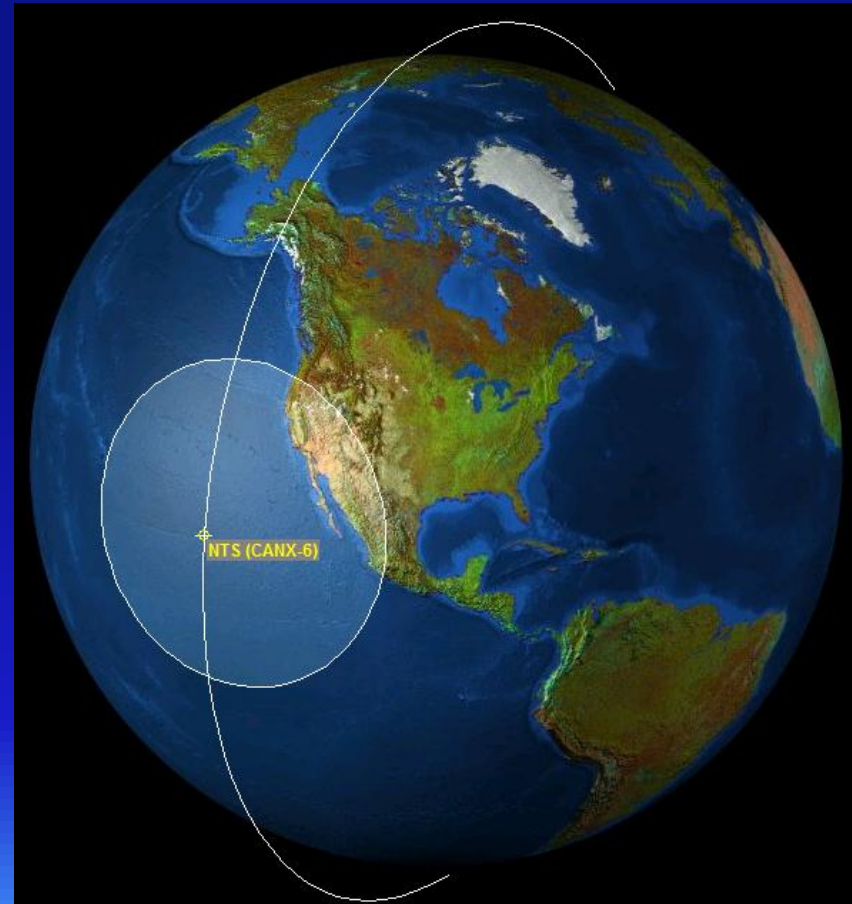


Northern Australia



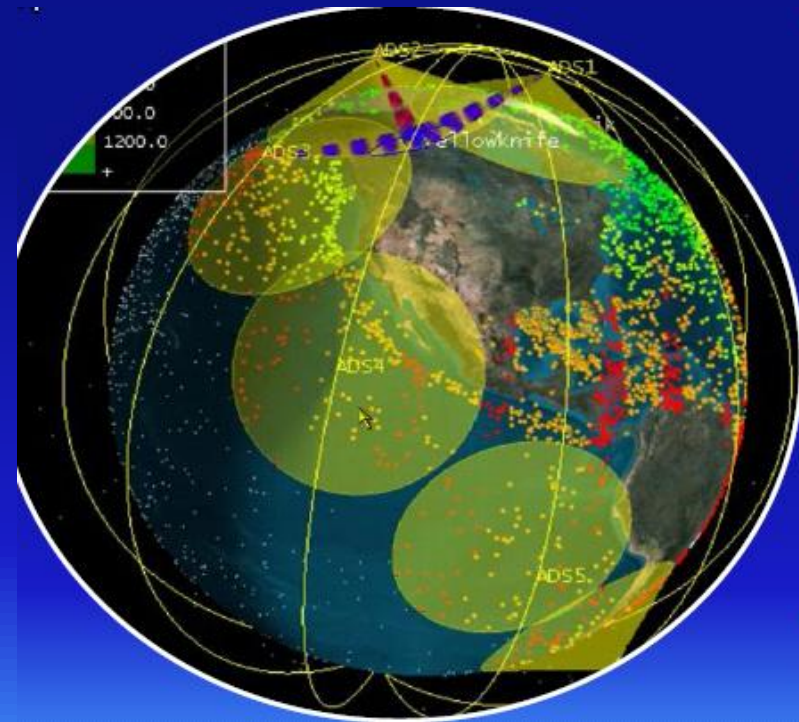
Our Satellites for AIS

- Satellites pass over North and South Poles, like C-S LEOSAR system
- at 850 km altitude, satellite circles the globe in 100 minutes
- Moving satellite “footprint” is about the size of a continent (~5,000 km dia)
- From Earth, satellite moves across the sky in about 10 minutes
- Satellite remains in one orbital plane and the Earth rotates beneath it
- Therefore, one satellite scans the entire globe in less than half a day
- More satellites coming soon...

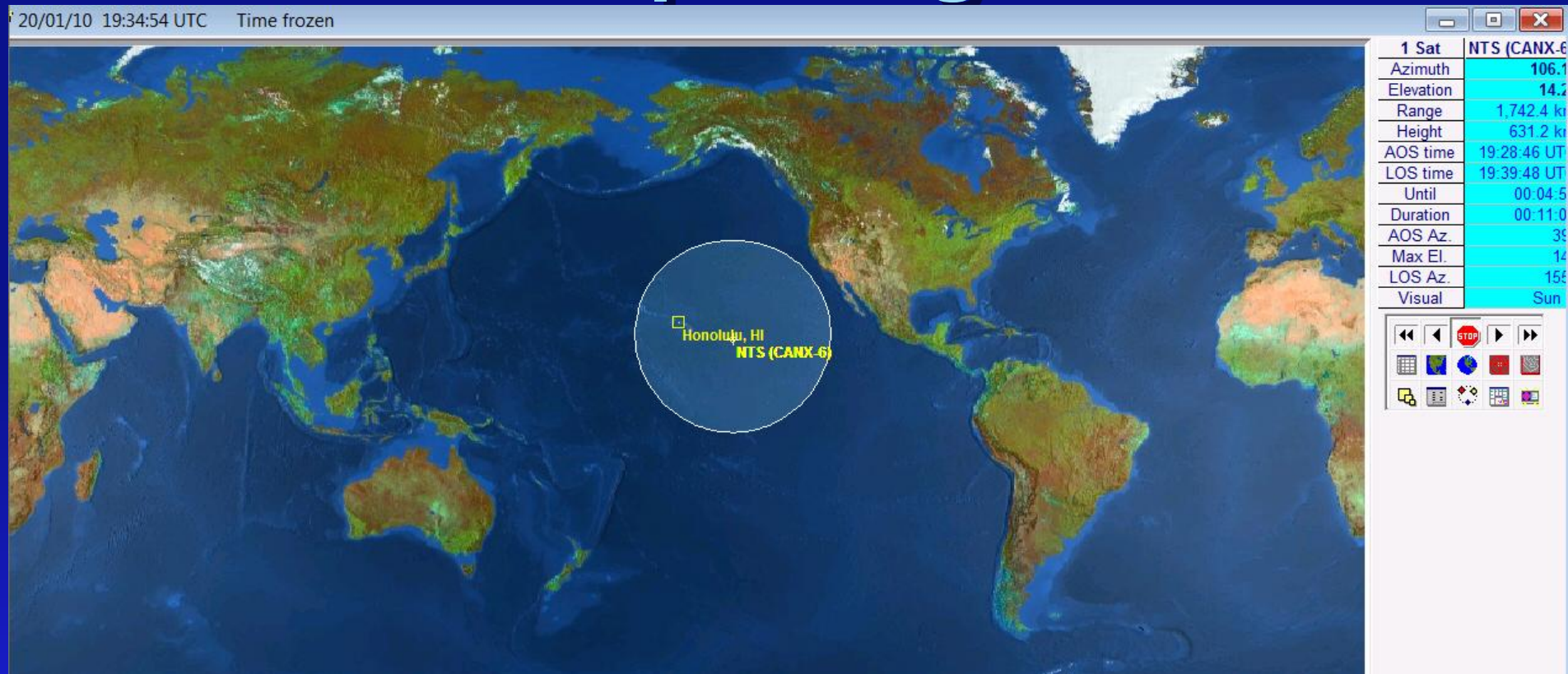


Our S-AIS Principle of Operation

- Each satellites continually receives AIS signals from all ships in its footprint (1000's of ships !)
- Signals stored in satellite memory
- Memory data is encrypted & replayed as satellite passes over next ground receiving station
- Encrypted data is fed to the Data Processing Centre where AIS signals are extracted and forwarded to authorized users
- Soon will have multiple satellites for faster coverage (3 plus 3 more)



NTS Satellite passing over Hawaii



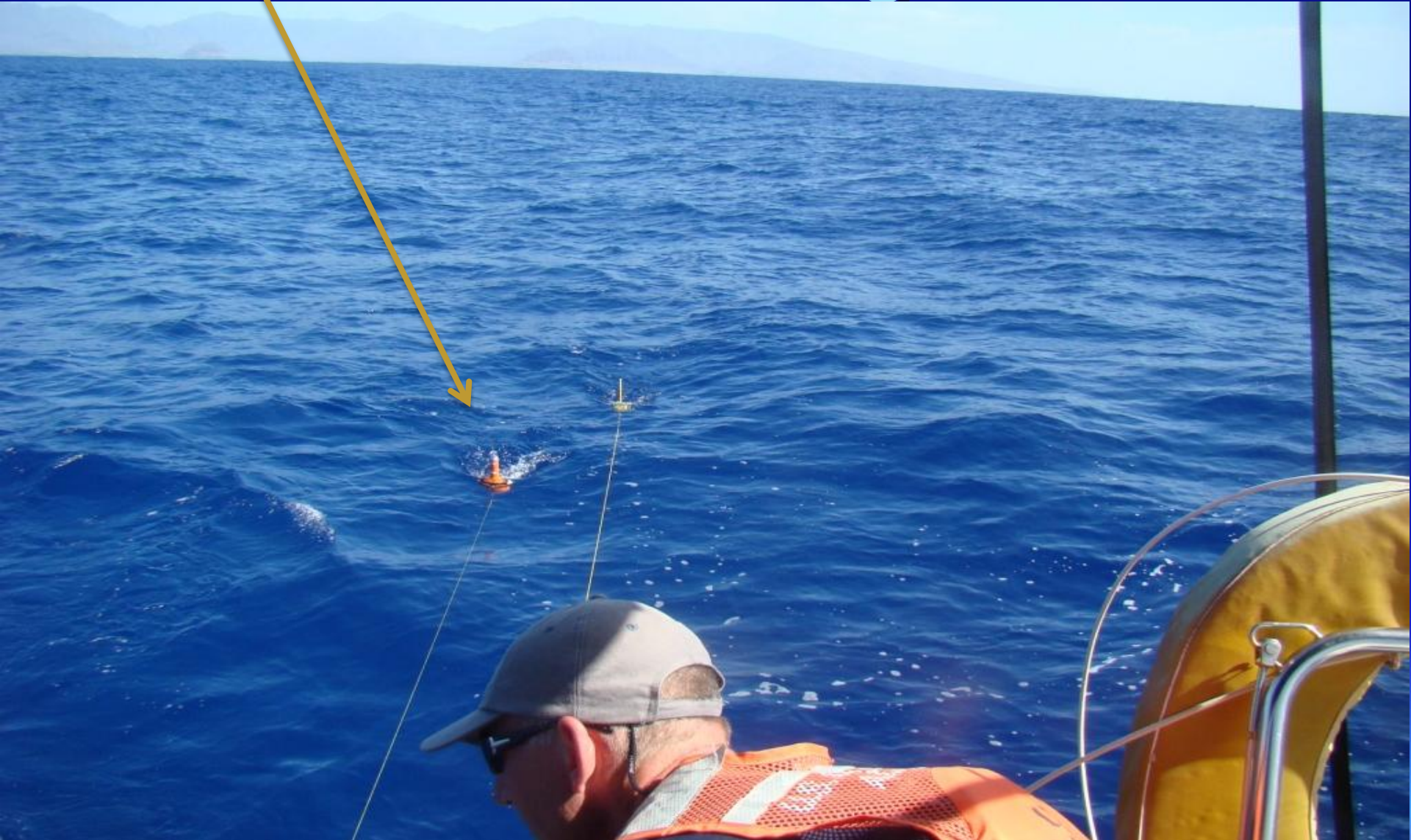
- Data collected from the AIS transmitters as satellite passed over Hawaii
- Data collected for about 1 to 1.5 minutes and stored in NTS satellite memory
- Data downloaded to ground station / processing centre in Canada

AIS Test Signals

- 5 different test units activated for sea trials near Hawaii:
 - 1 AIS-EPIRB at 1 Watt
 - 3 AIS-SARTs at 1 Watt
 - 1 AIS Class A at 12.5 Watt (*that incremented its MMSI number every 2 sec*)
- AIS devices deployed in water, above water, on floating lifejacket or on vessel
- In addition, many ships in the Pacific Ocean were transmitting regular AIS signals



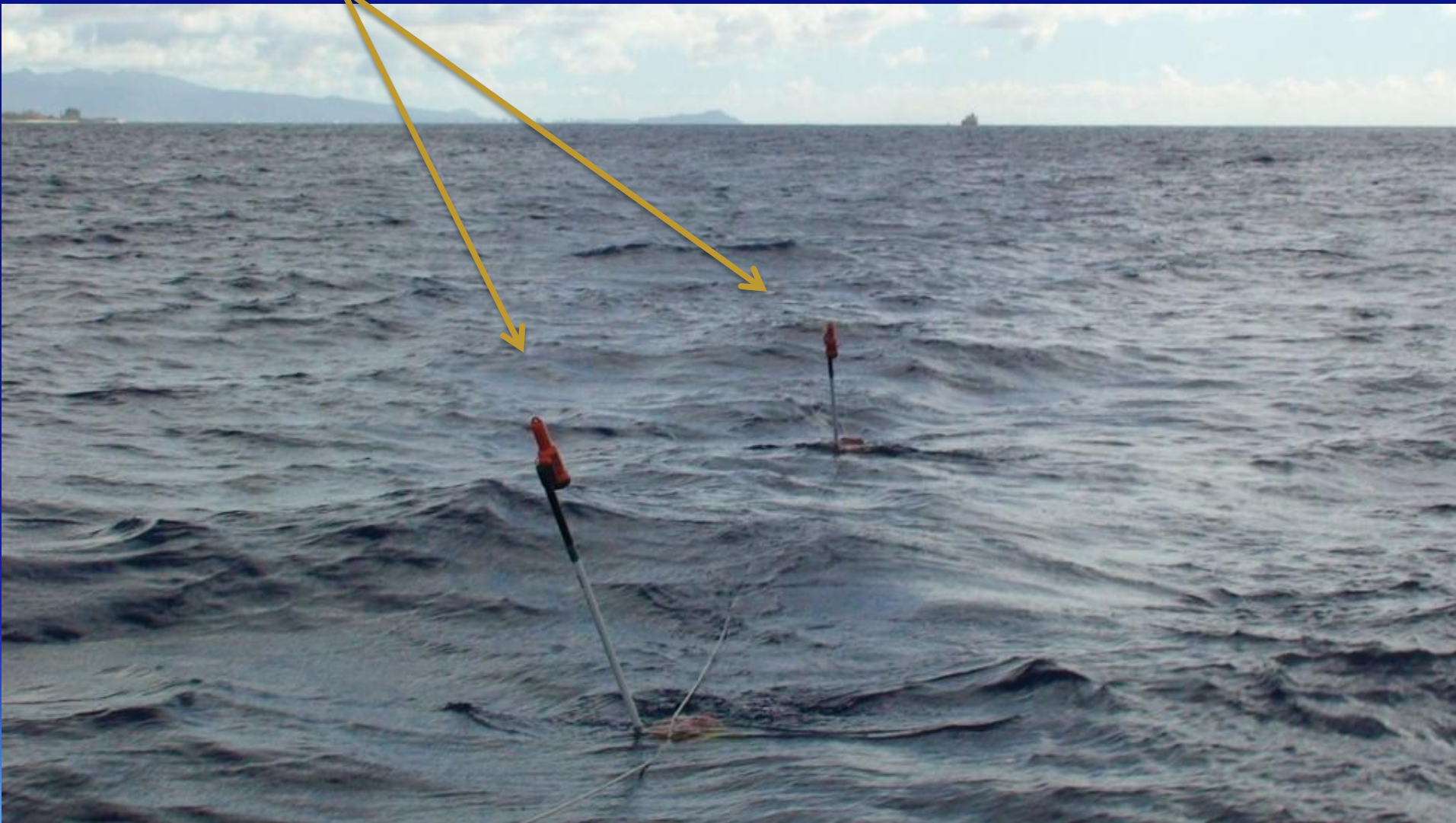
AIS-EPIRB Floating in water



AIS-SART- On life jacket in water



AIS-SARTs- Floating 1m above water



AIS-SARTs- on vessel railing



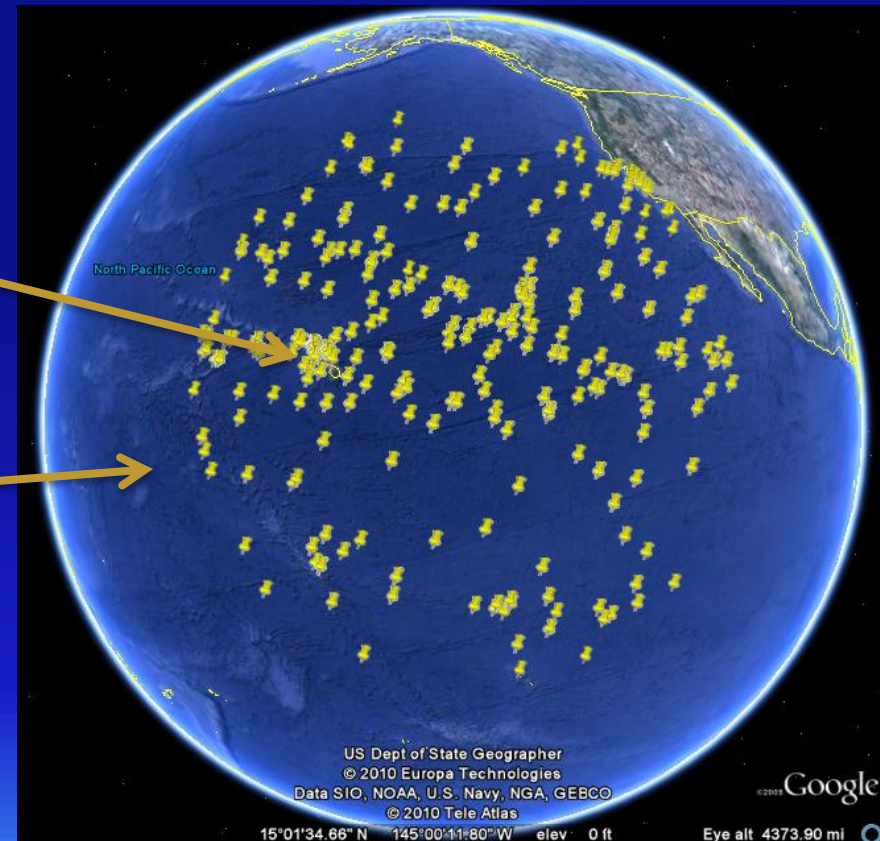
AIS-SARTs- on vessel railing



Satellite Detection of AIS Signals

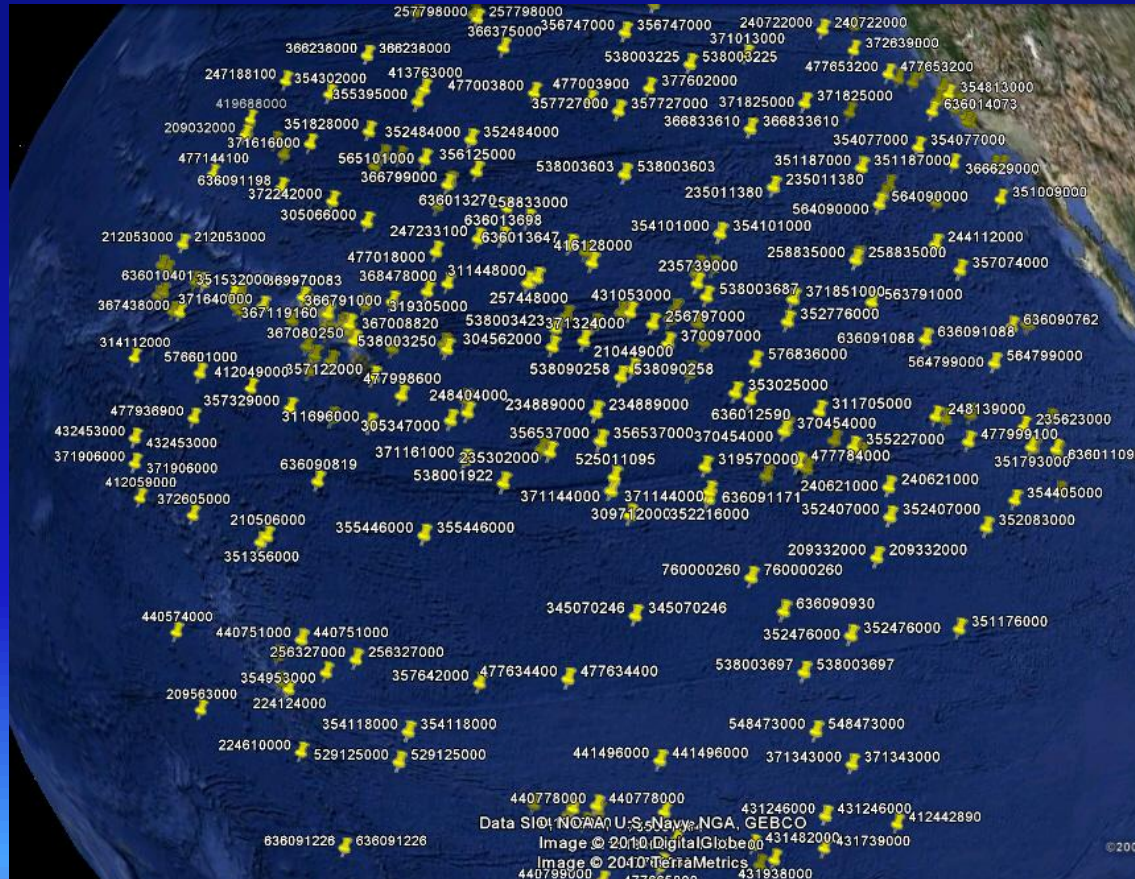
- All 5 AIS Test Units were detected by the COM DEV NTS satellite

- In addition, about 270 ships in satellite footprint were also detected



Satellite Detection of AIS Signals

Zooming in shows the unique MMSI number of each ship's AIS transmitter:

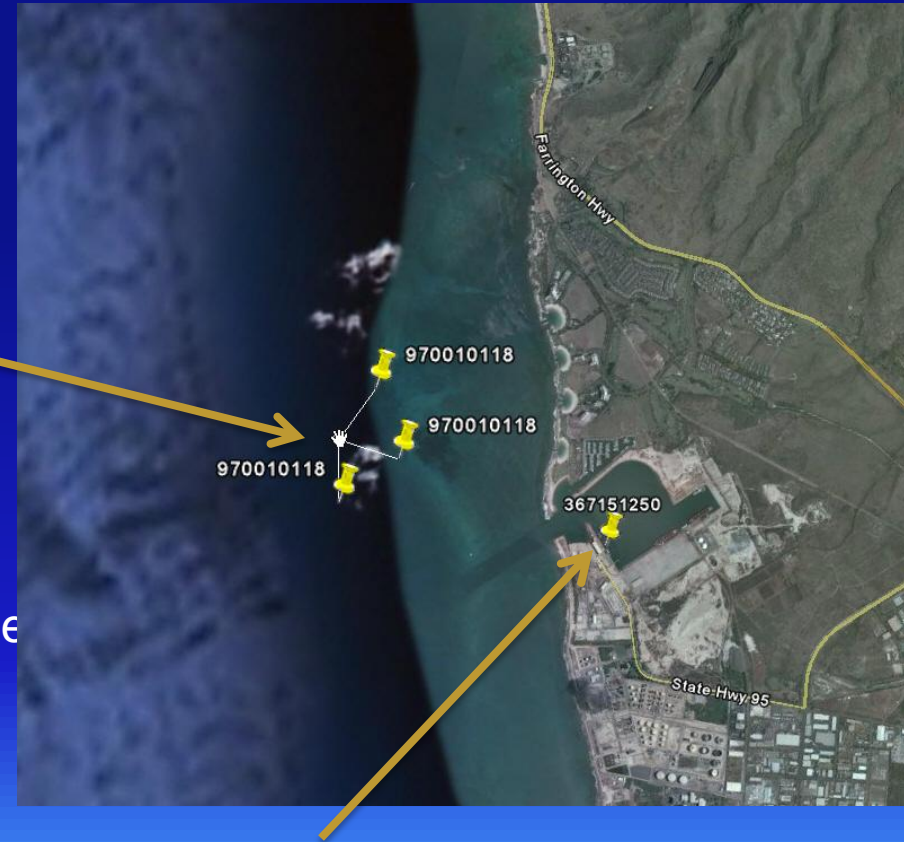


NTS Satellite Passes

- NTS satellite passes during test period:
 - Day 1: 20 Jan 2010 at 19:34:54 UTC (= 09:34:54 Hawaii time)
 - Satellite collected AIS data for 90 seconds
 - Elevation angle to the satellite = 14 degrees
 - Distance to the satellite = 1,800 km
 - Day 2, 21 Jan 2010 at 19:53:54 UTC (=09:53:54 Hawaii time)
 - Satellite collected AIS data for 60 seconds
 - Elevation angle to the satellite = 25 degrees
 - Distance to the satellite = 1,300 km
- Multiple AIS bursts received from each Test Unit, approx equal number on each AIS channel (AIS 1 & AIS 2)
- GPS position encoded in each message was plotted on map

Satellite Detection – Day 1

- 2 AIS-SART Test Units were deployed on day 1
- Floating in water, about 1nm off the coast of Hawaii
- COM DEV satellite collected AIS data for 90 sec
- AIS-SART MMSI 970010118 detected several times
- AIS-SART MMSI 970010119 was also detected by the satellite, but it had only default location data in its message, (due to faulty test unit) so its location could not be plotted on the map as it had default lat/long)



Regular AIS on a vessel in port (not a test unit)

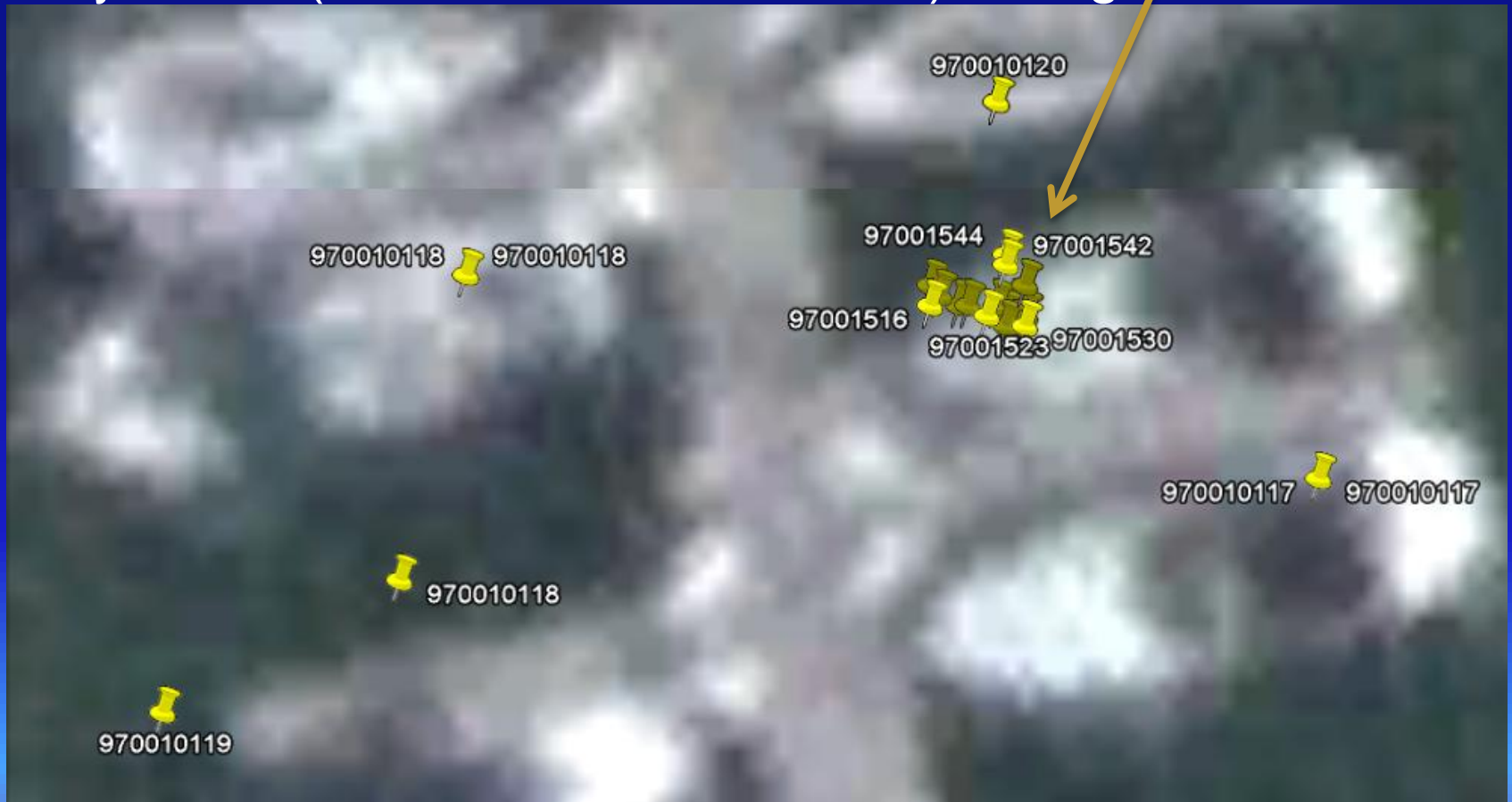
Satellite Detection – Day 2

- 5 AIS-SART Test Units were activated on day 2 while vessel in marina
- COM DEV satellite collected AIS data for 60 sec
- All 4 low-power AIS-SARTs detected:
 - 1 W in EPIRB- 970010117 and
 - 1 W in SARTs- 970010118, 19 & 20
- Also detected 12.5 W Class A onboard vessel



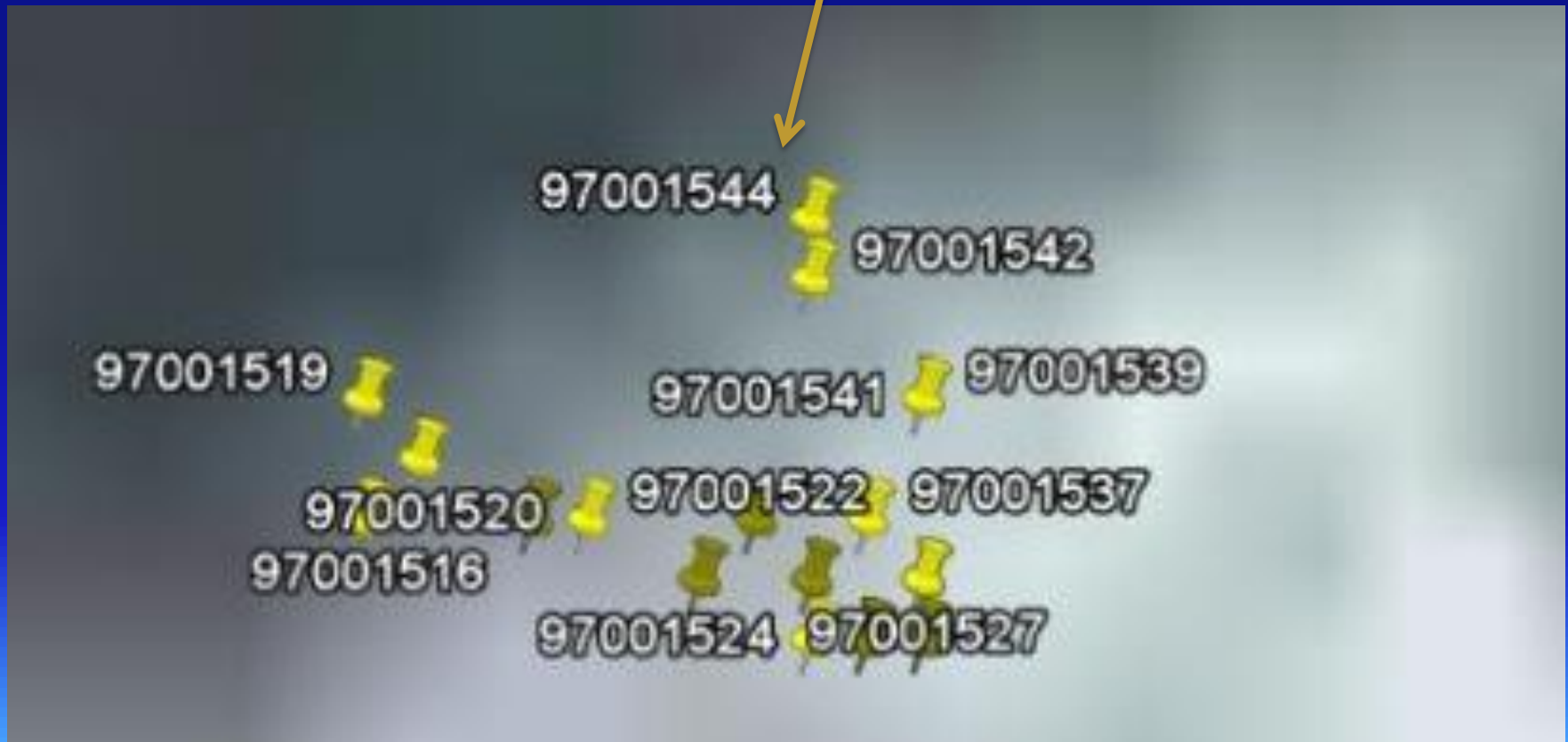
Satellite Detection – Day 2 (con't)

Zooming in shows EPIRB & SARTs and cluster of multiple bursts from Class A onboard vessel , with ID number changing every 2 sec (...1515, 1516.... to 1544) during satellite's 60 sec

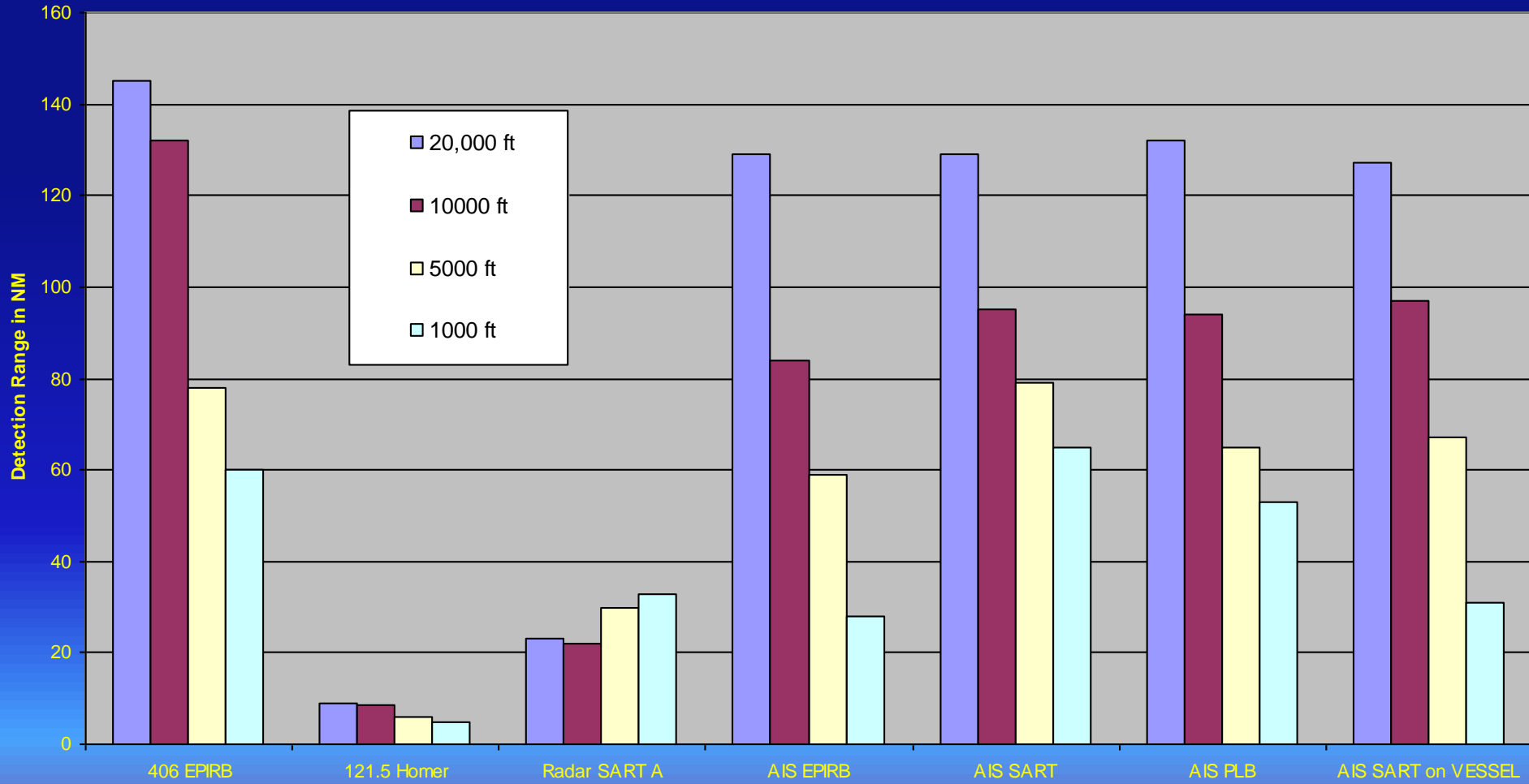


Satellite Detection – Day 2 (con't)

Further zooming on ID number changing every 2 sec (...1515, 1516.... to 1544) during satellite's 60 sec data collection



SAR Aircraft 'Homing' Trials (from previous year sea trials-Florida -2009)



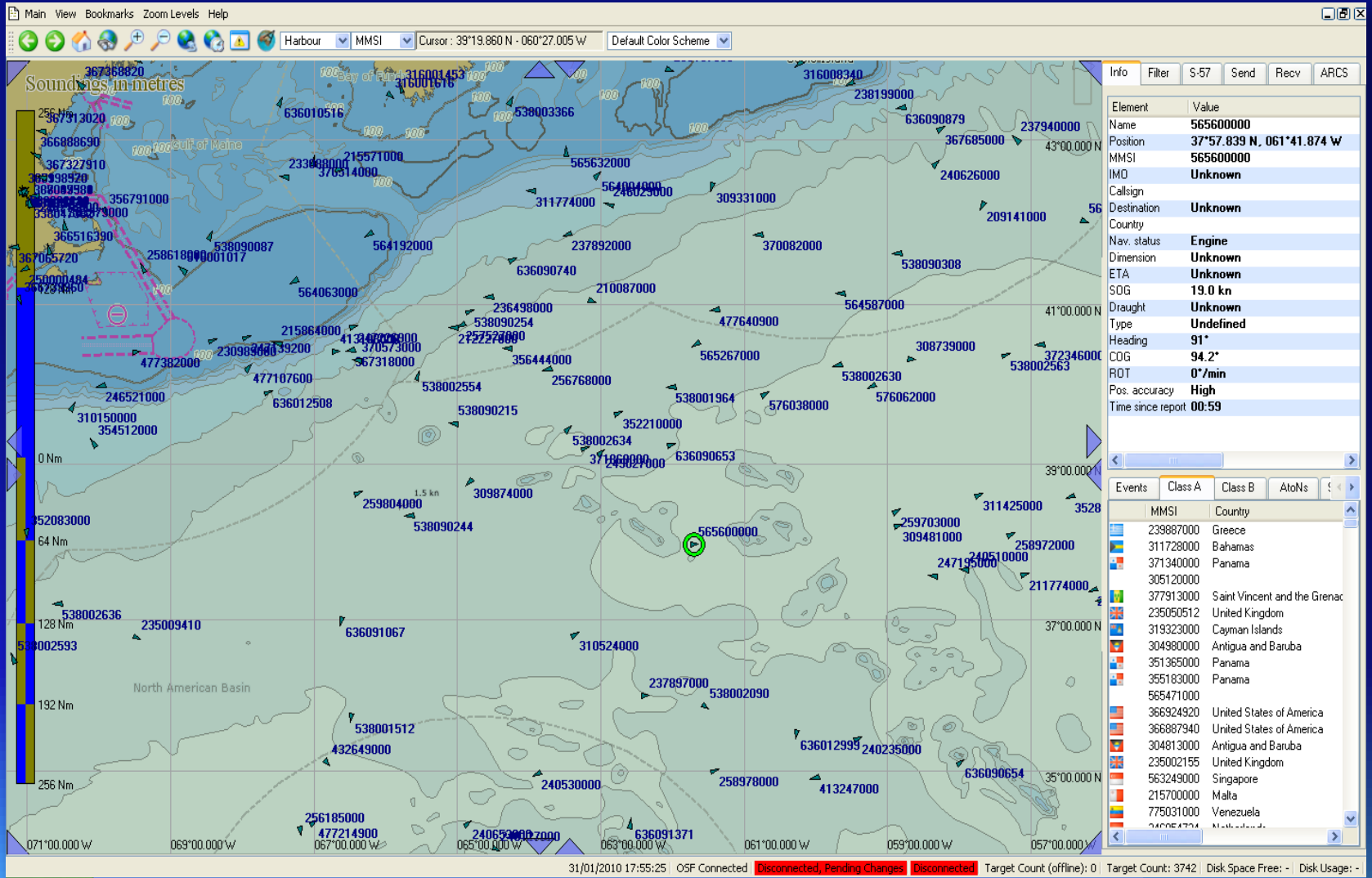
S-AIS for Search and Rescue

New Capabilities for Search and Rescue Needs



- ✓ Satellites can detect AIS-SARTs
- ✓ Can also identify ships within proximity of distress as first responders
- ✓ Tracking of drifting life raft from distress call location
- ✓ Proactive notice to SAR coordinator of ship entering remote coverage zones
- ✓ Identify projected track based on last known position

Satellite-AIS sees Vessels in Vicinity



Summary

- AIS-SART Sea Trials were a challenging environment:
 - Low power transmitter (1/10 power of Class A)
 - Device bobbing in waves and antenna near water
- Sea Trials demonstrated that AIS-SART signals are detected by SAR a/c & vessels, ships in vicinity & satellites
- ‘Homing’ distance far more than 121.5 MHz or Radar SART
- Satellite-AIS can also provide local and global coverage of maritime traffic
- S-AIS data can be valuable tool for SAR forces
- exactEarth Ltd is pleased to be building this new tool and to working with SAR forces

“Every Ship, Every Time”

Thank you

Need more information?

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“Every Ship, Every Time”

The logo for exactEarth, featuring the word "exactEarth" in a lowercase, sans-serif font. A thin, curved line arches over the "x" and "a" of "exact".