

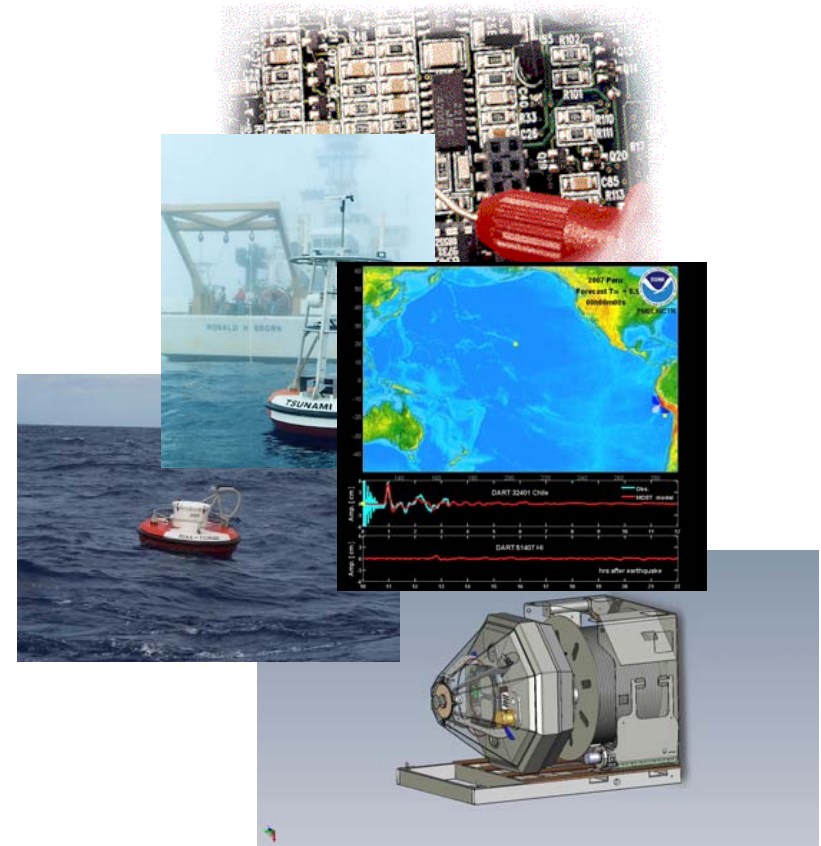
# Recent Developments in Tsunami R&D and Forecast Systems

*Christian Meinig*

*NOAA/PMEL*

*Director of Engineering*

*Oct 15, 2007*



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# Outline

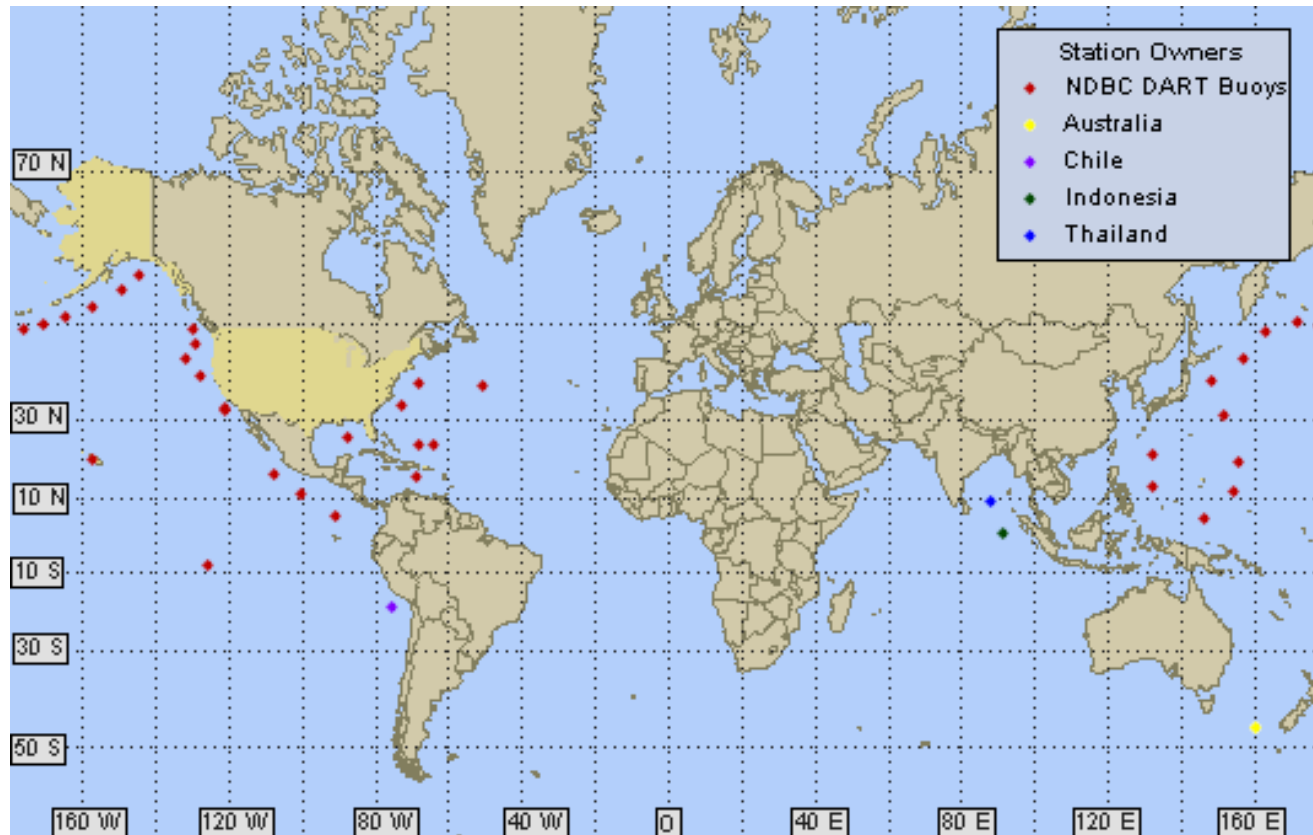
- DART array update
- Forecast System update-examples
- Deployment Results
- Tsunami R&D



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# Global DARTs



~38 systems, 5 countries



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# Tsunami Forecasts

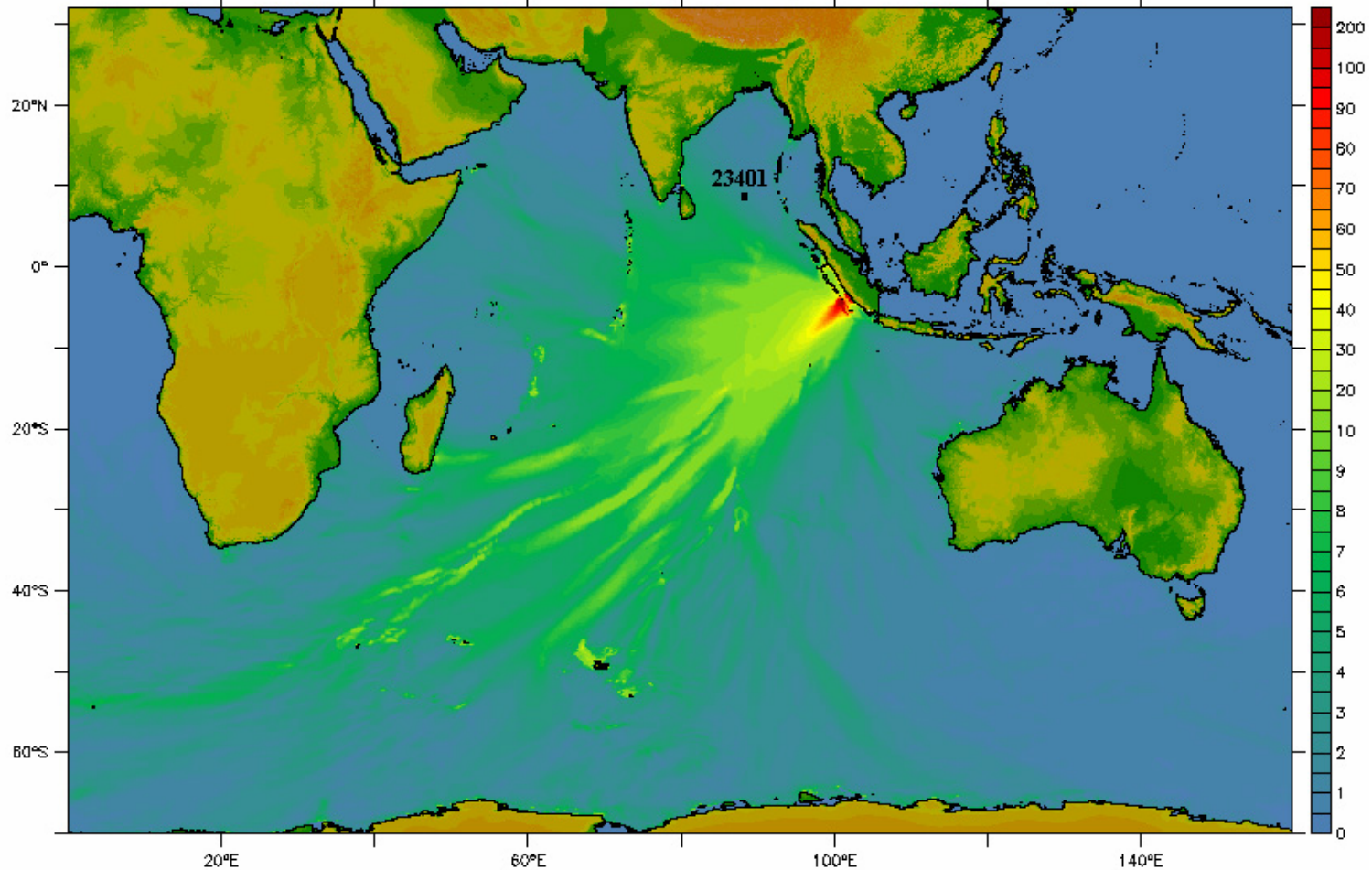
- Pre-operational stage
- Four successful realtime forecast over the past 18 months
- Testing and UI evaluations at warning centers



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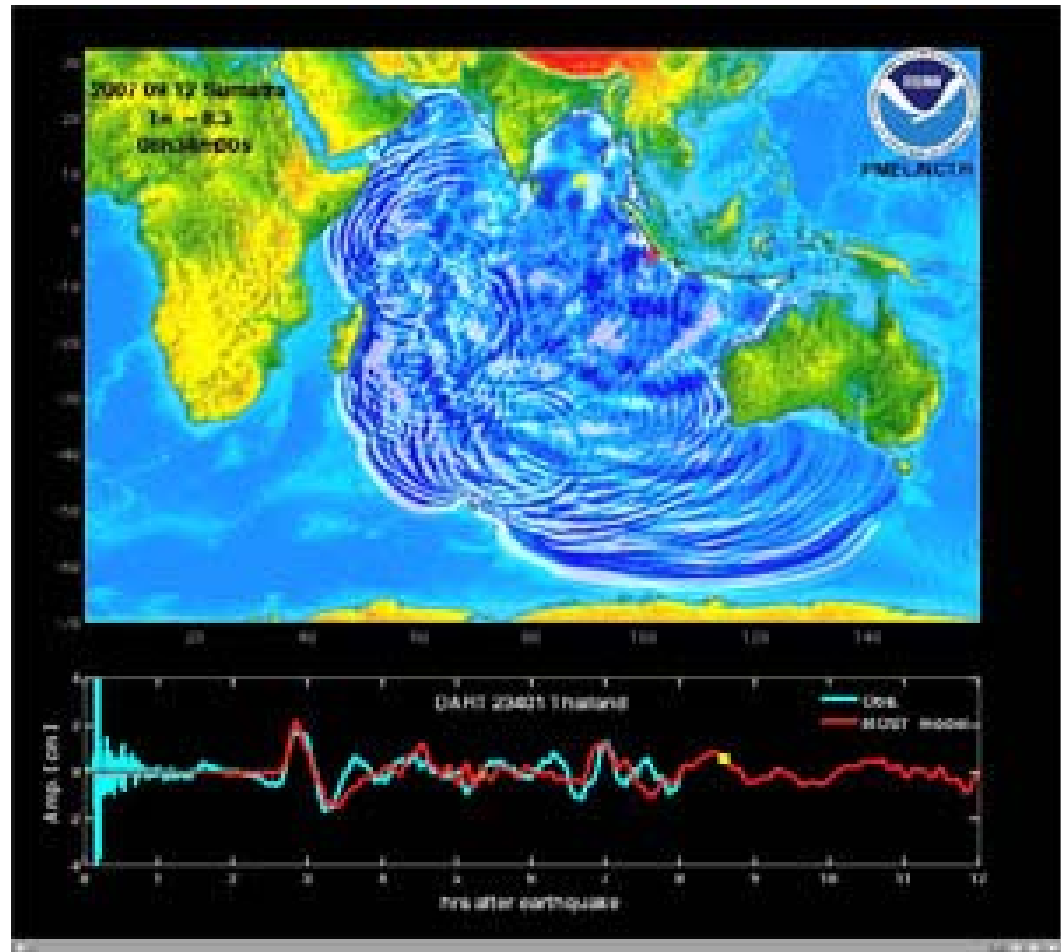
## Southern Sumatra 12-Sep-2007 11:10:26



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DART & MOST  
forecast  
Model comparison  
from  
Sumatra Sept 12  
EQ



Liujuan Tang  
NCTR, NOAA/PMEL

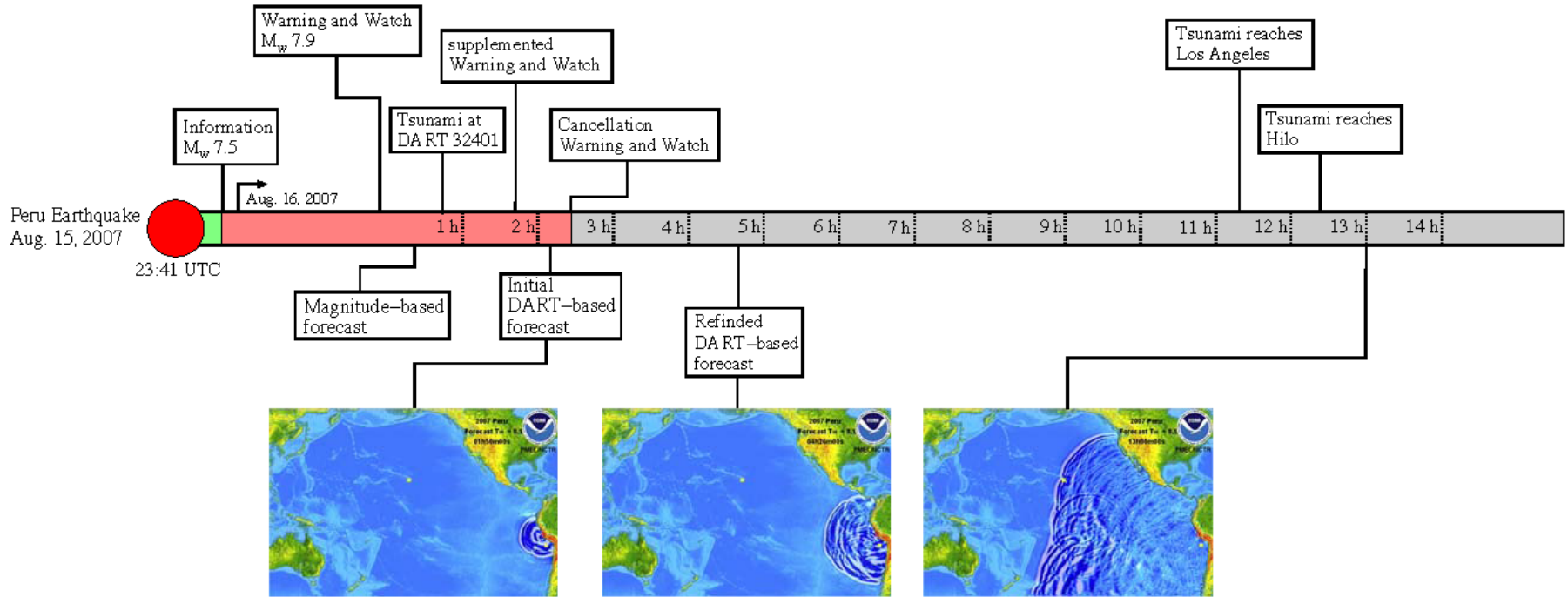


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# Example: Timeline of a Tsunami Event

Warning center



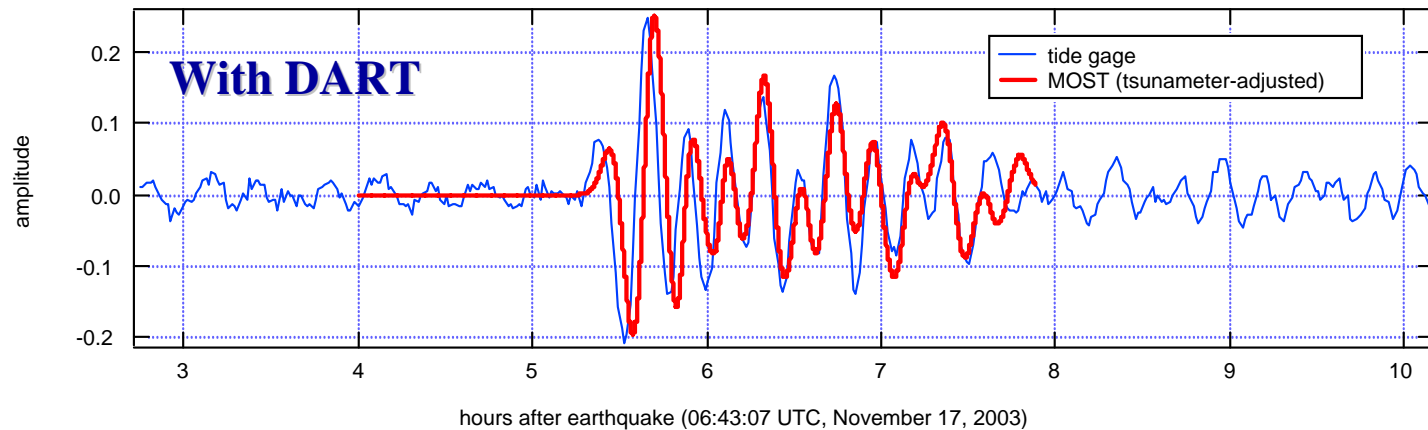
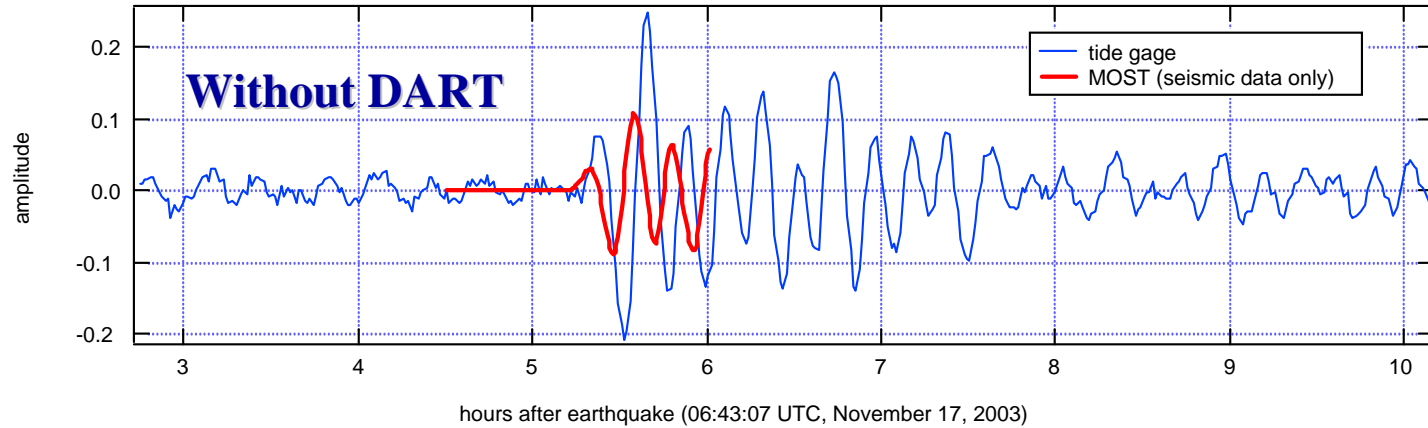
From Y. Wei, et al., 2007



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# DART Data Greatly Improves Forecast



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# Next Generation DART™ Technology

Desired improvements from DART™ II

- Eliminate need for large ship & skilled crew
- Deployment sea state limitations
- Large buoys
- Vandalism protection
- Flexibility to array operations
- Cheaper lifecycle costs



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# DART™ system evolution

- 20 years of tsunami research *(early 80's)*
- Internally recording instruments *(mid-80's)*
- One-direction realtime reporting (DART™ I) *(mid-90's)*
  - *Transitioned to operations*
- Bi-directional, global reporting (DART™ II) *(2003)*
  - *Patent pending & transitioned to operations*
  - *Concept copied/adopted by commercial vendors* *(2006)*
  - *Trademark filed/License applications*
- Bi-directional, global, easy to deploy R&D (DART™-ETD) *(2007)*
  - *SAIC licenses DART II technology*
  - *ETD Pre-operational prototypes deployed*



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# DART™ II & DART™ ETD

*Common core components-different packaging  
i.e. desktop and laptop*

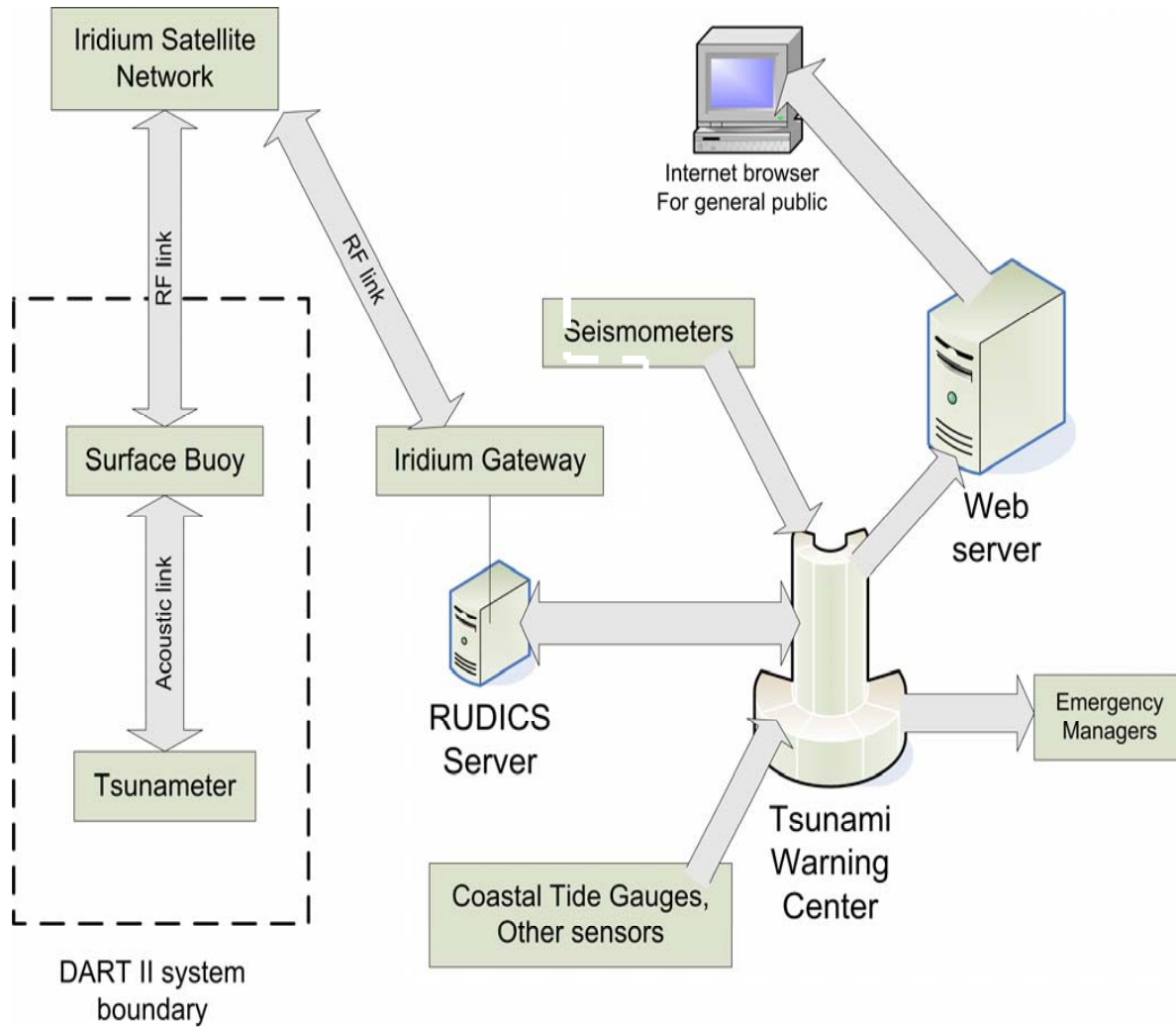
- *No Changes:*
  - *Data logger CPU, Acoustic Modem PCB, BPR, Paros, Iridium Modem and transmission protocol, system modes and tsunami detection scheme.*
- *Minor Changes:*
  - *Acoustic modem transducer and pre-amp, system software and GPS & ground plane.*



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# Infrastructure-*unchanged*



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Anchor

Reel with 5000 meters  
of mooring line

SST

Acoustic Modem  
Transducer

Tsunameter

DART

EXPLORATION

Barometric  
Pressure

Wind Sensor

NOAA  
PMEL



PMEL -Engineering Development Division Seattle, WA

# Packaging & Logistics



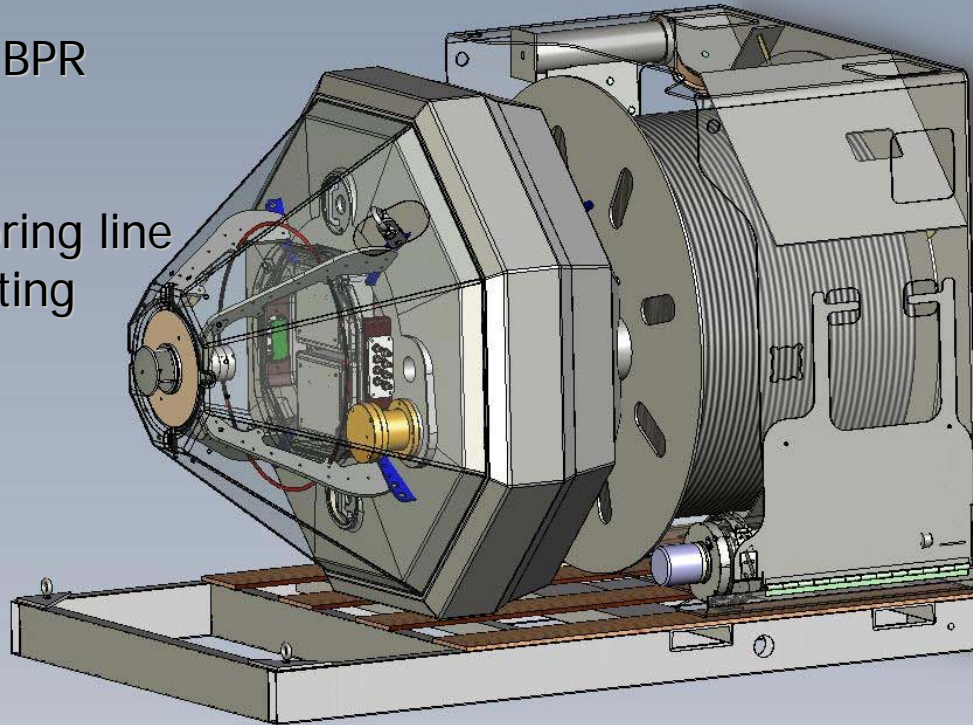
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# DART II-ETD

## New Features:

- 4-5 year expendable BPR
- Conex packaging
- MET sensors
- Improved upper mooring line
- Ongoing rigorous testing



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# DART-ETDs (Low Latitude)



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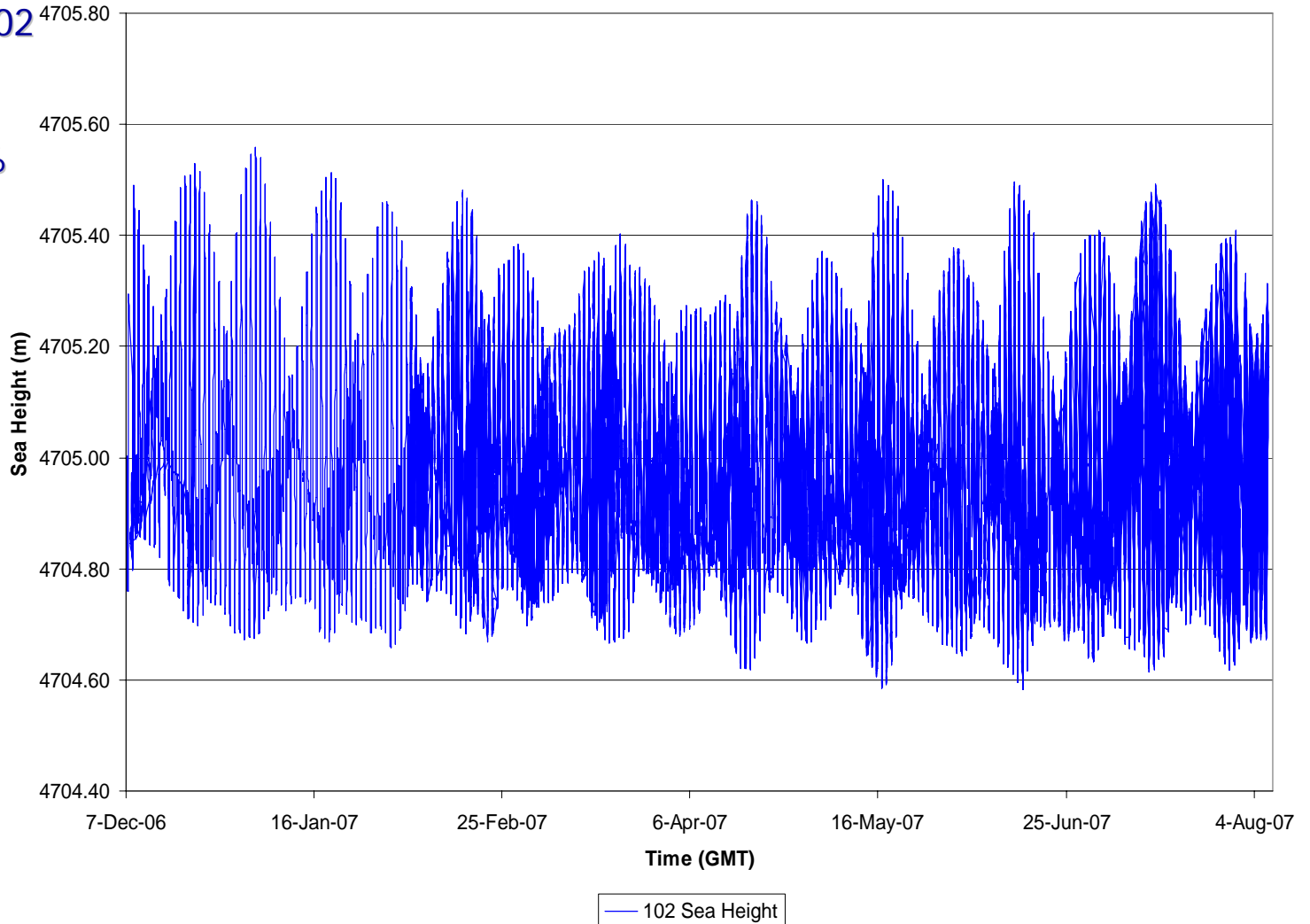


## 102 Sea Height

DART II-ETD 102

Primary 98%  
Secondary 98%

8 month test  
deployment



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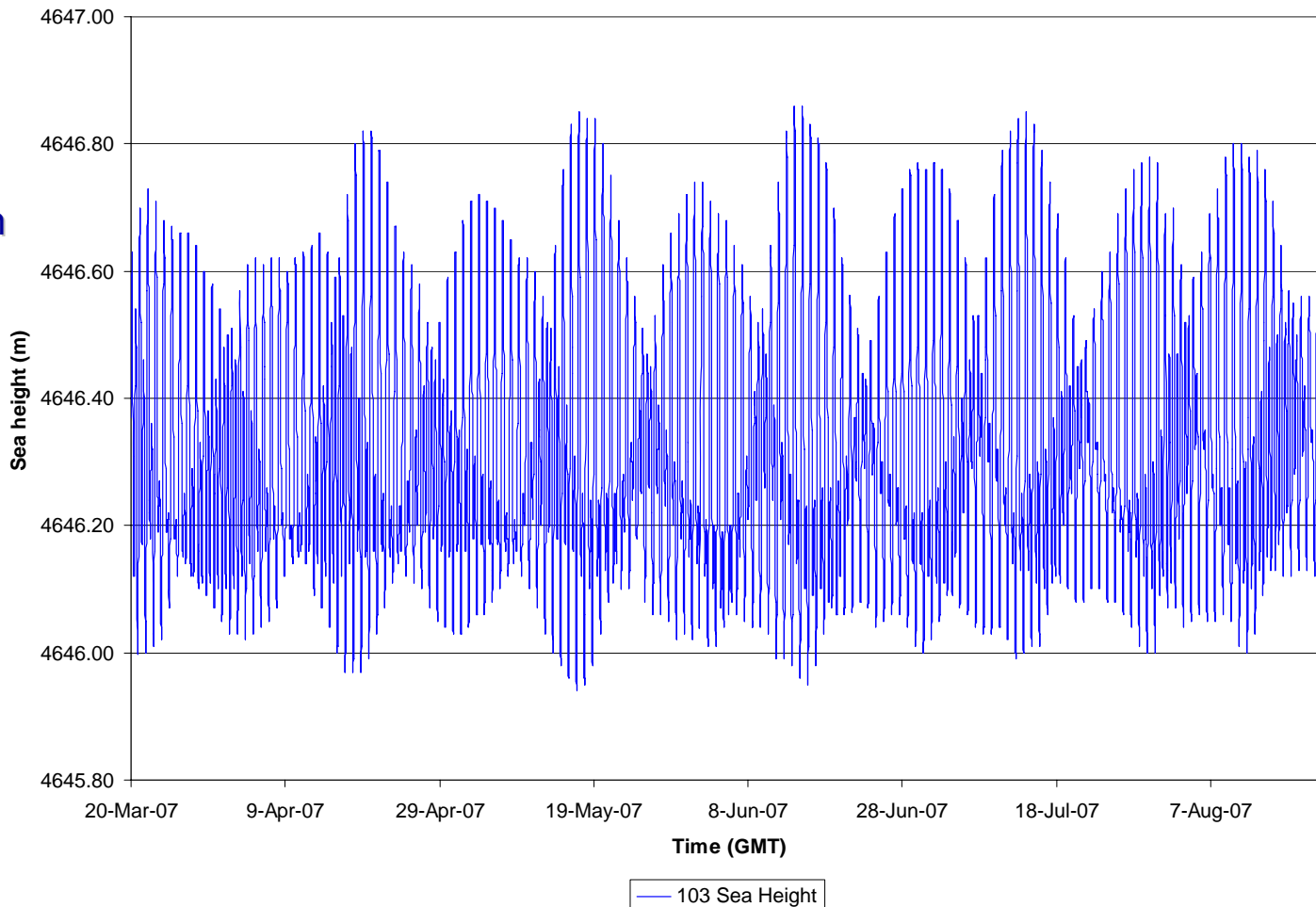
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# DART II-ETD 103

Primary 99%  
Secondary 98%

On-going ~7 month  
test deployment

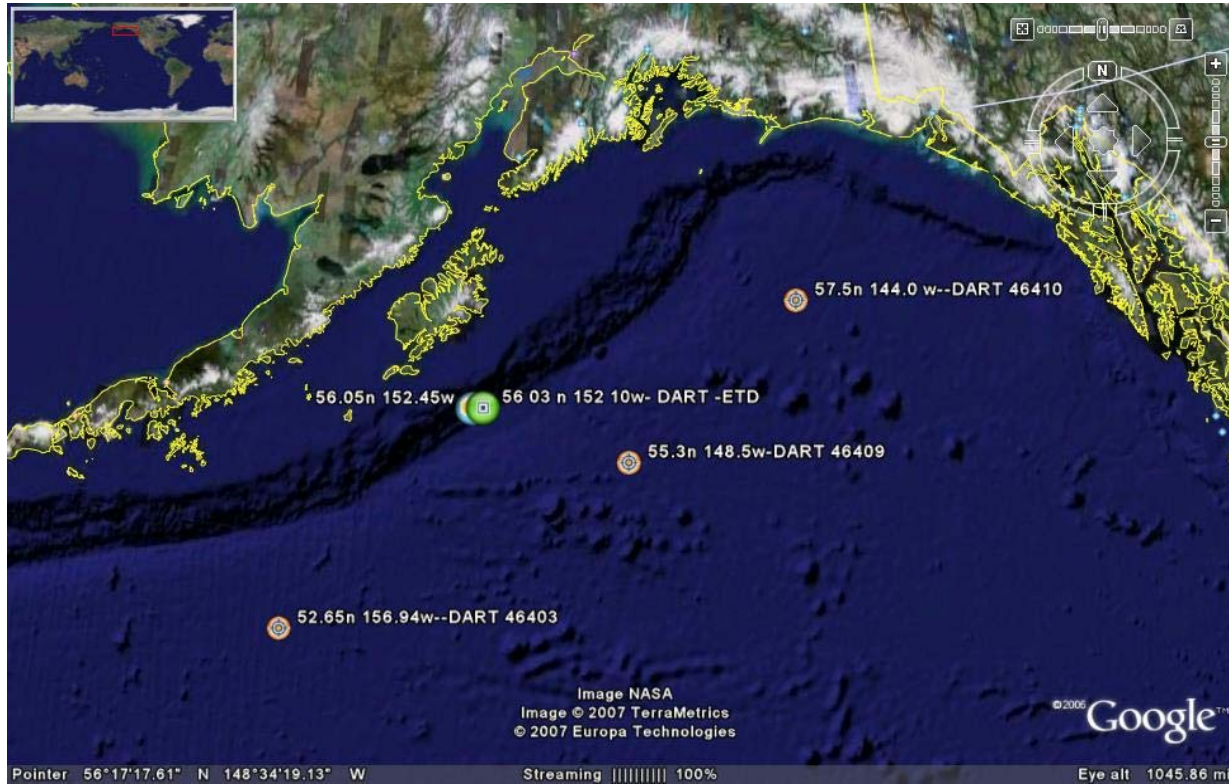
### 103 Sea Height



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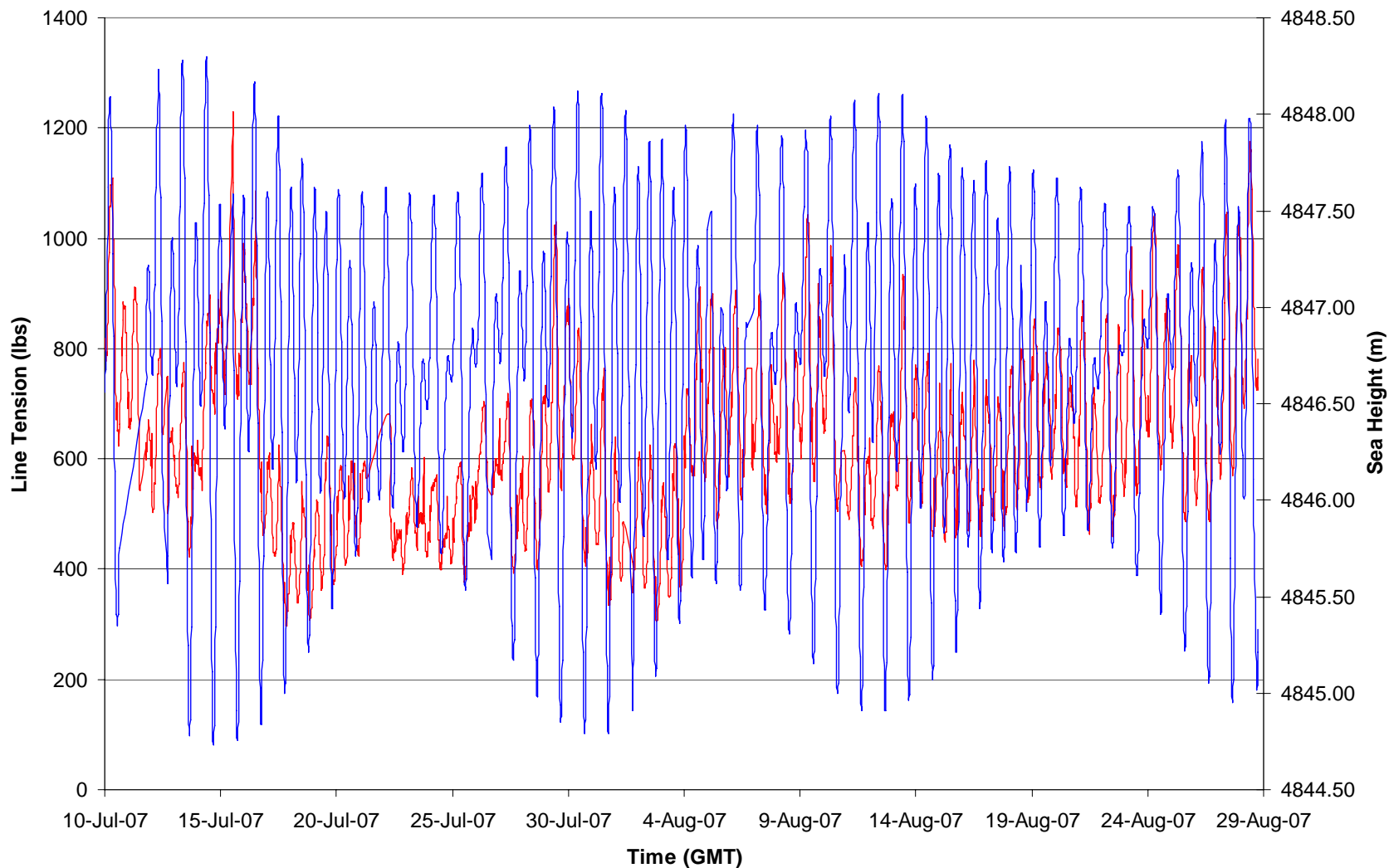
# DART-ETD (High Latitude)



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## 105/6 Line Tension and Sea Height



— 105/6 Line Tension — 105/6 Sea Height

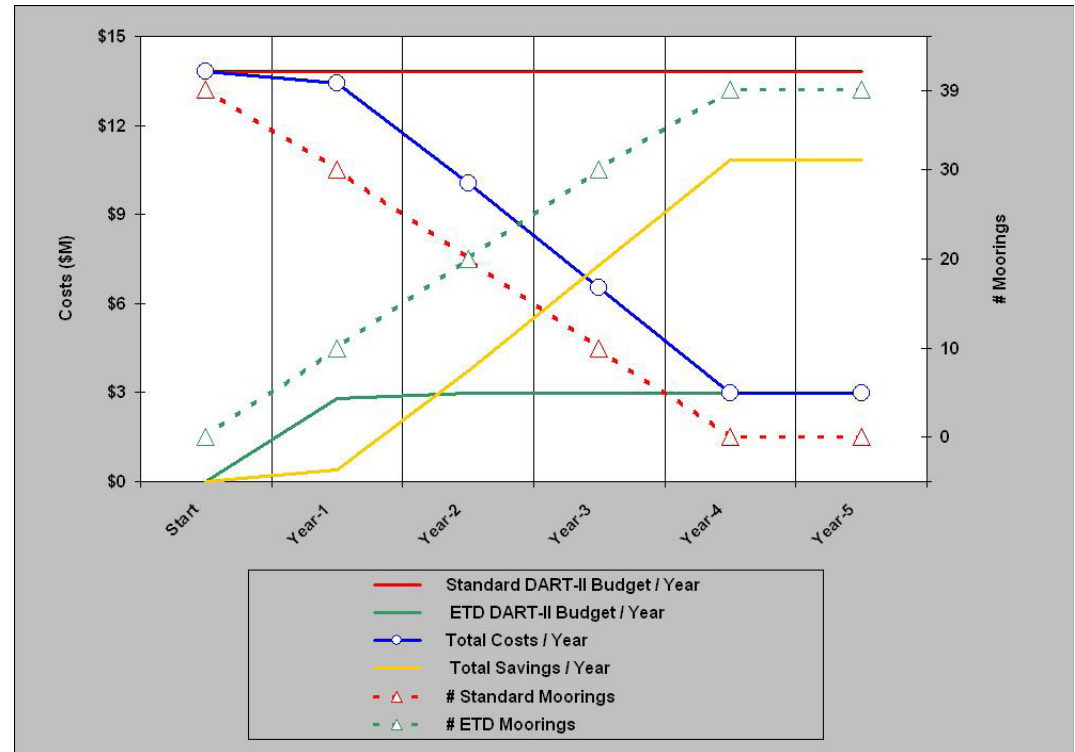


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# PMEL Cost Study Analysis

...."The findings (largely based on the cost differentials in unit production, unit service life, and the mode of deployment and type of vessels utilized) indicate that a fully deployed array of 39 ETD DART-II sites could be accomplished on sufficient service cycle for an annual budget of approximately \$2.97M, or less than 22% of the projected budget for comparable array maintenance with Standard DART-II moorings." .....



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# 4<sup>th</sup> Generation DART?:

A system with the power of human intelligence, vision capabilities, integrated audible alarm and very low battery requirements



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# Acknowledgements

- Vasily Titov, Scott Stalin, Dirk Tagawa, Michael Strick, Michael Spillane, Marie Eble, Rachel Tang, Angie Venturato, Yong Wei



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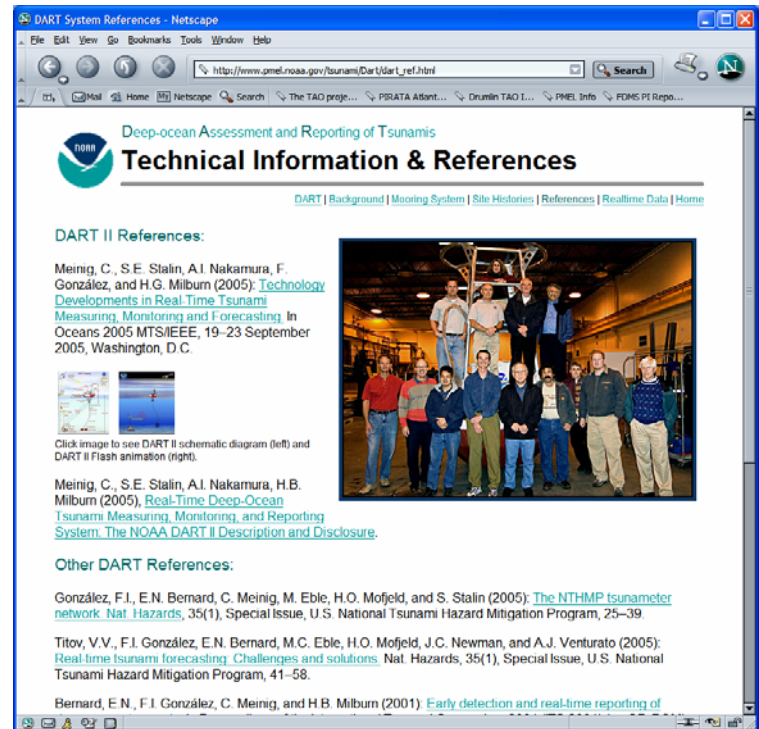
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# Thank you.....For more information

[www.pmel.noaa.gov/tsunami/Dart/dart\\_ref.html](http://www.pmel.noaa.gov/tsunami/Dart/dart_ref.html)



[www.tsunami.noaa.gov](http://www.tsunami.noaa.gov)



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