

DART™ and Tsunami R&D

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NOAA

PMEL Director of Engineering

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Topics:

- DART™ & forecast system evolution
 - Forecast example
- DART™ research and development



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DART™ system evolution

1. 20 years of tsunami research *(early 80's)*
2. Internally recording instruments *(mid-80's)*
3. One-direction realtime reporting (DART™ I) *(mid-90's)*
 - *Transitioned to operations*
4. Bi-directional, global reporting (DART™ II) *(2003)*
 - *Patent pending & transitioned to operations*
 - *Concept copied/adopted by commercial vendors* *(2006)*
5. Bi-directional, global, easy to deploy (DART™-ETD) *(2007)*
 - *Trademark filed/License applications*

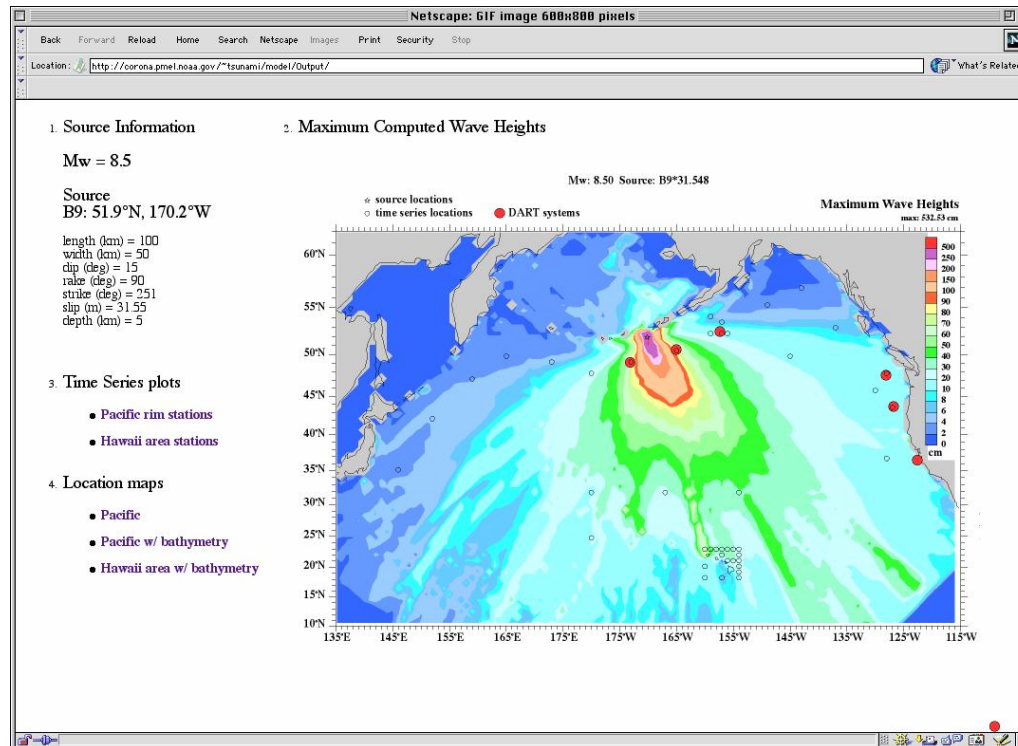


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Tsunami Forecasting

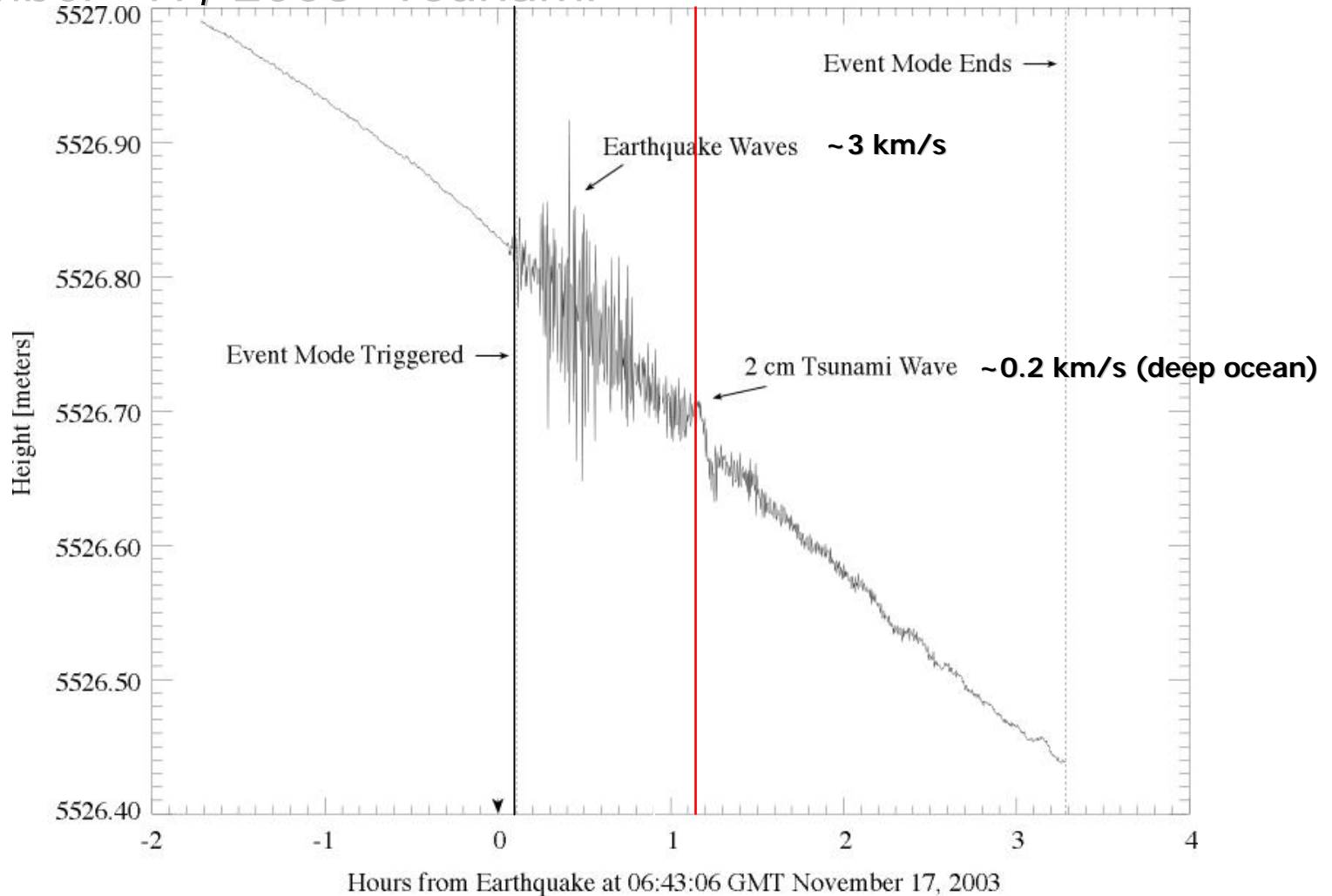
Goal: Faster, more reliable forecasts-



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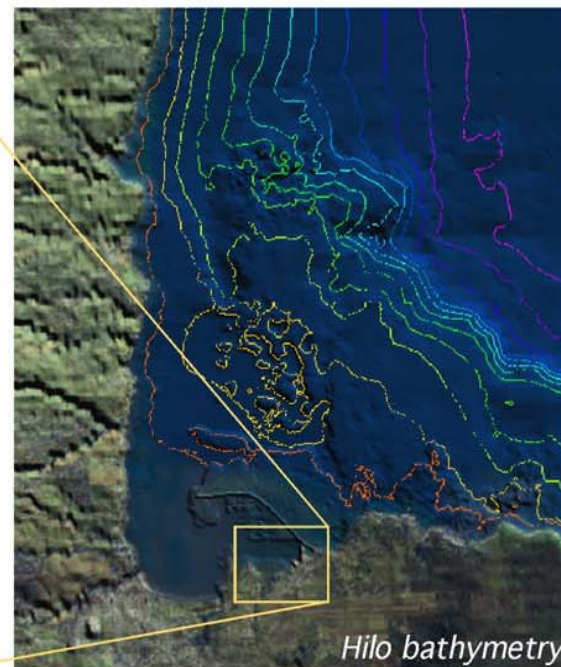
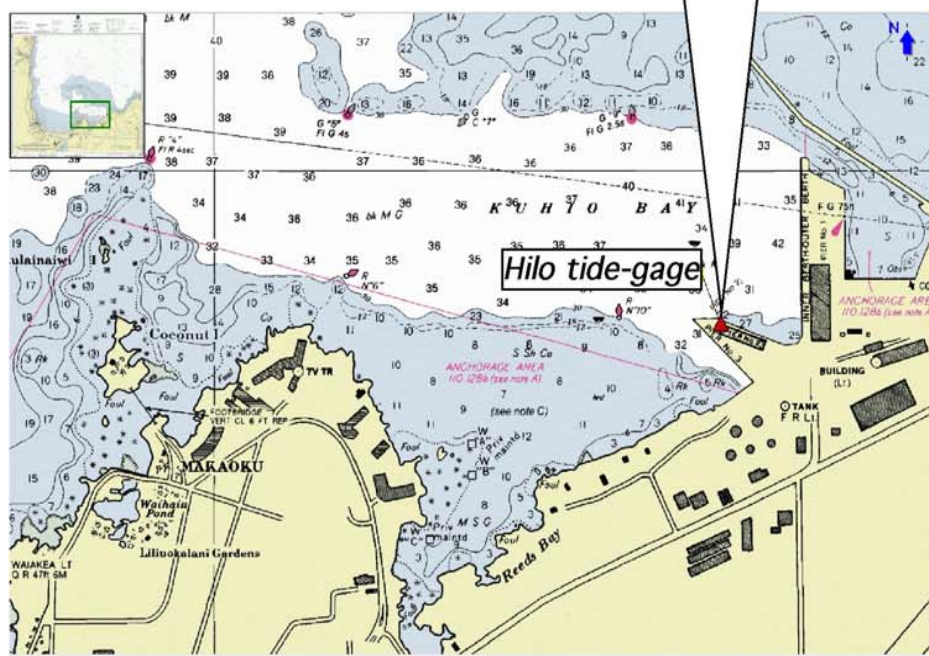
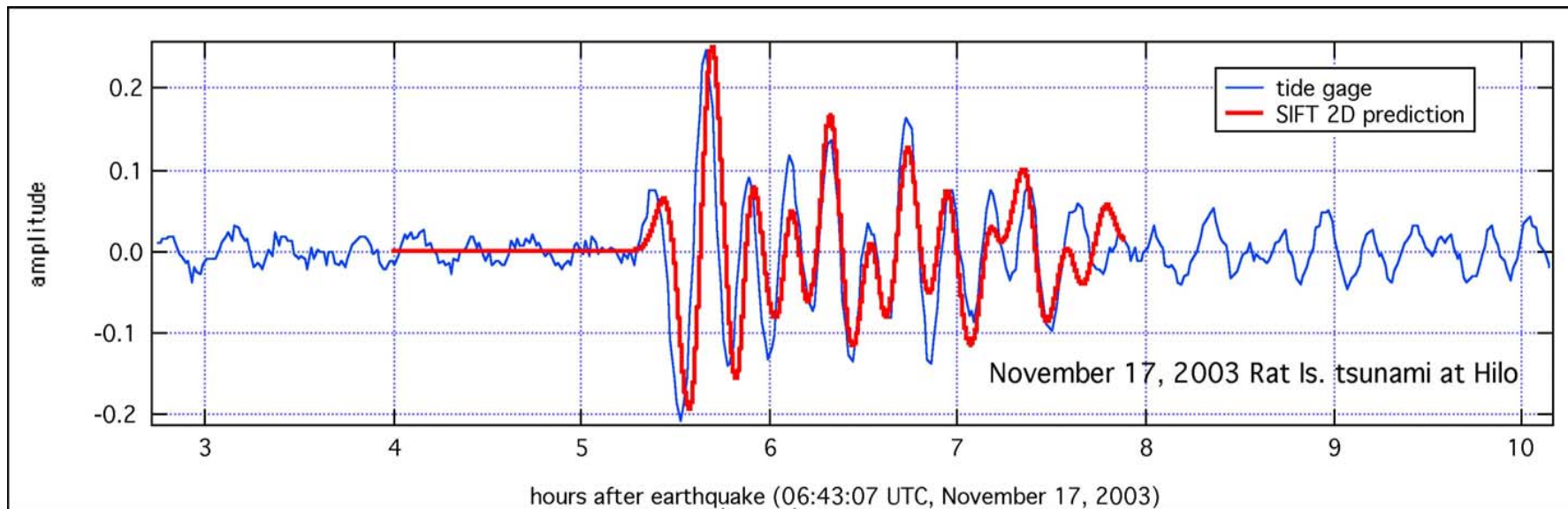
Real Time Detection of November 17, 2003 Tsunami



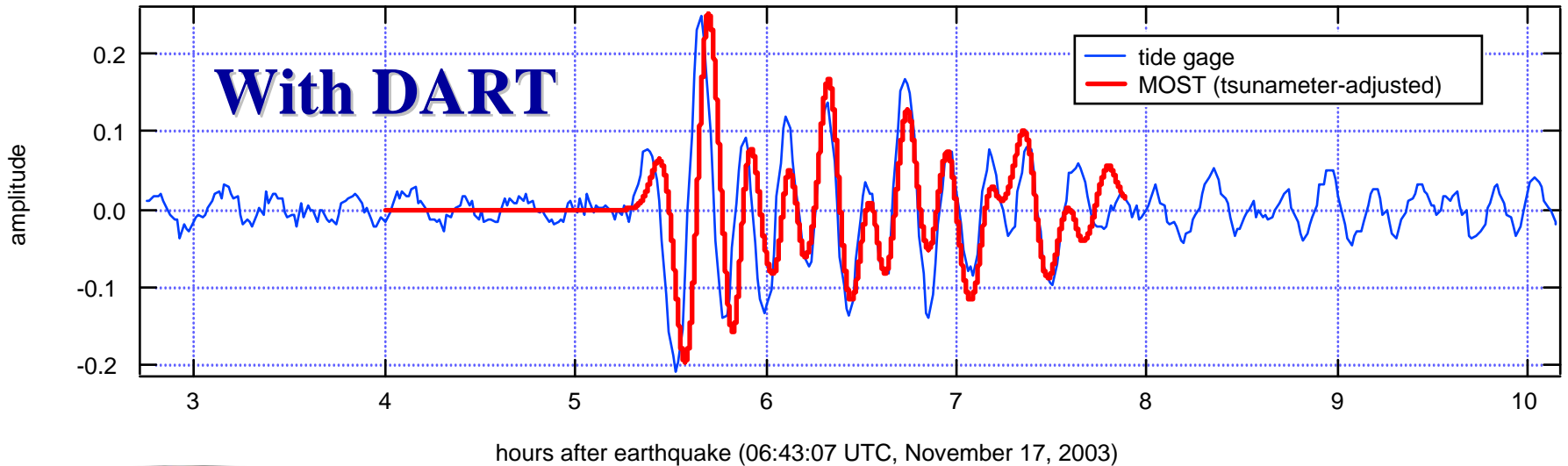
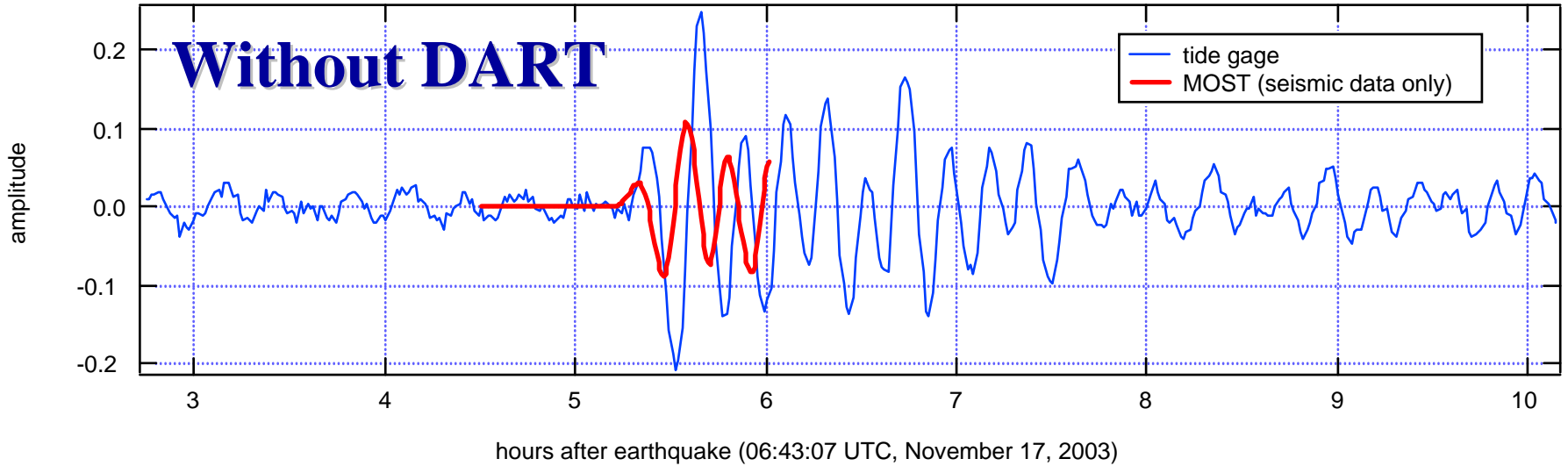
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First Tsunami Forecast Using Real Time Tsunameter Data



DART Data Greatly Improves Forecast

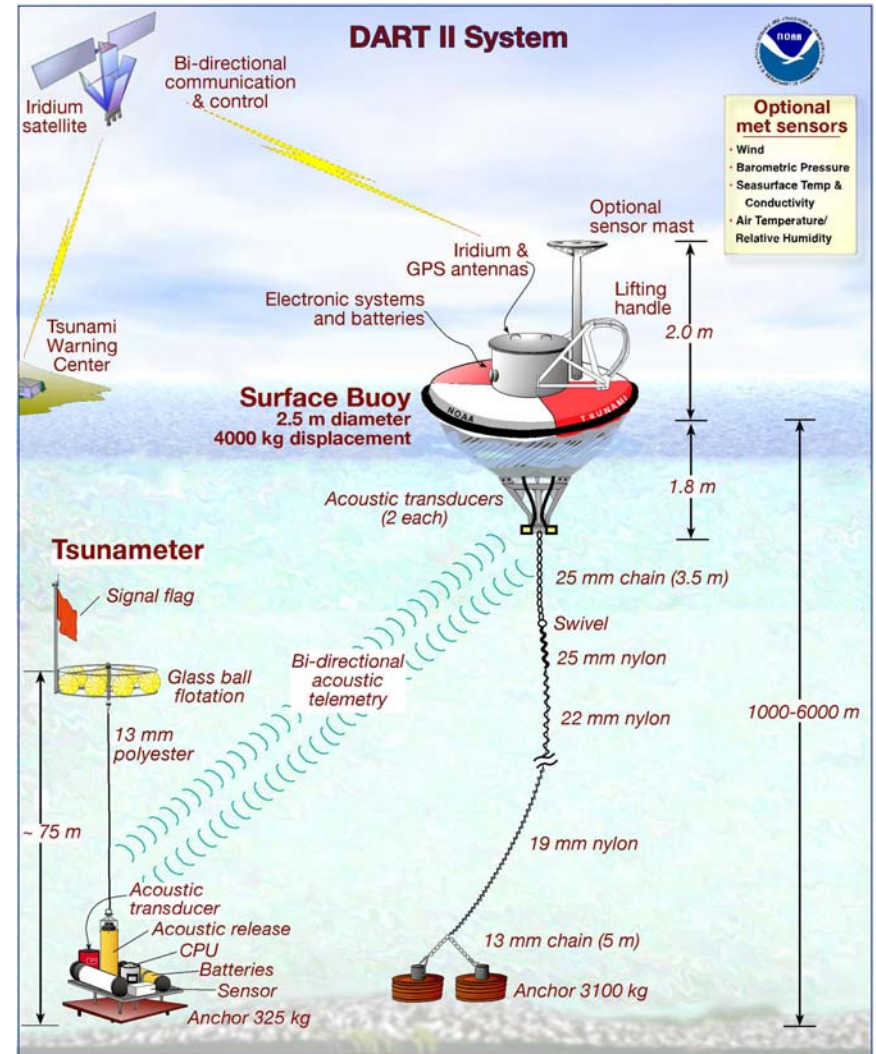


DART™ II system

The Tsunameter measures small changes in pressure at the seafloor. Data are sent acoustically to the surface buoy, then via satellite to the warning centers.

Key technologies:

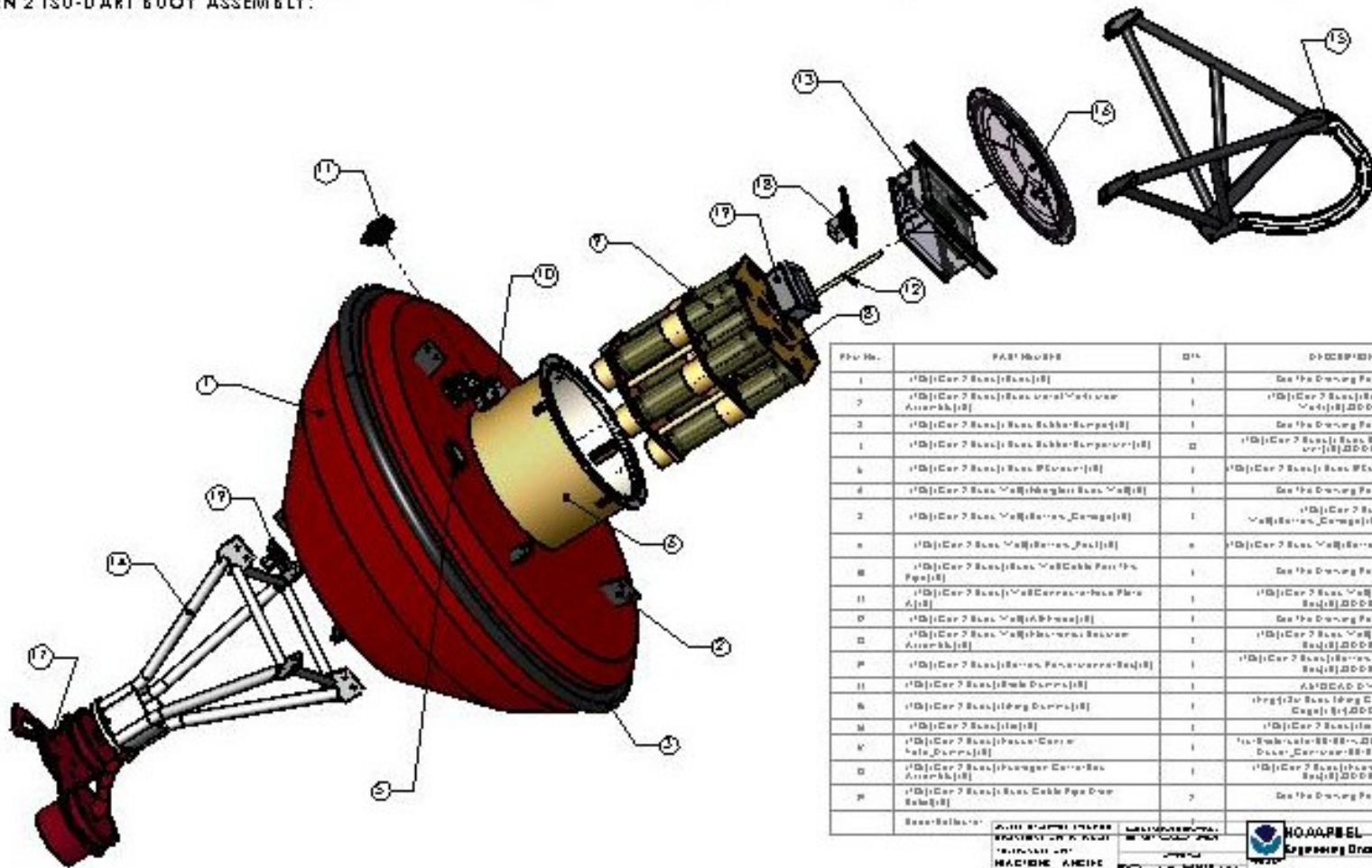
- Bi-directional coms
- Tsunami Detection Algorithm
- Backup systems
- Worldwide deployable
- Plug-in to existing warning center infrastructure
- Optional MET sensor



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GEN 2 TSU-DART BUOY ASSEMBLY:



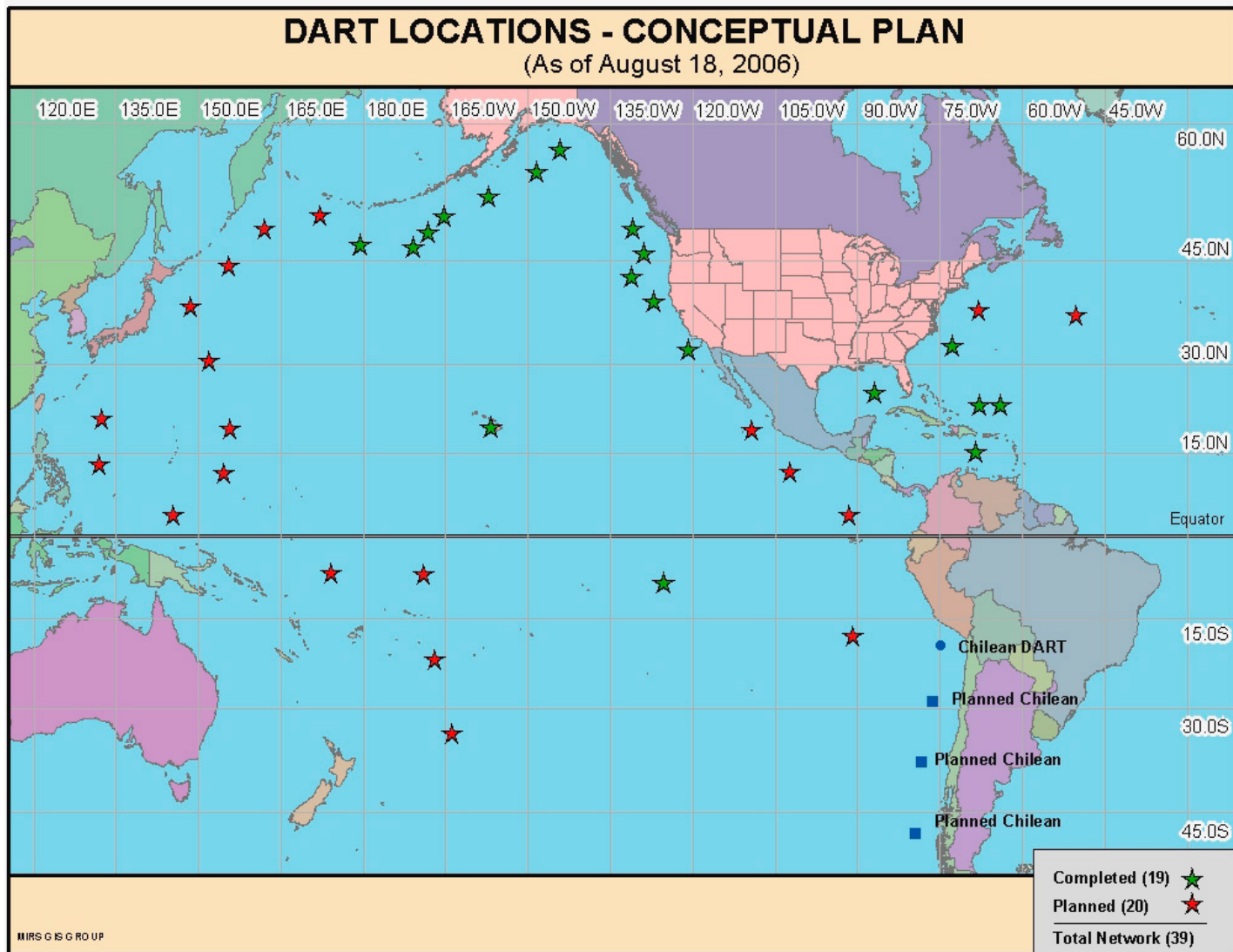
Part No.	PART NUMBER	QTY	DESCRIPTION
1	'(D)Car 2 Buoy(Buoy)(8)	1	See The Drawing Package
2	'(D)Car 2 Buoy(Buoy)Panel'Weldment Assembly(8)	1	'(D)Car 2 Buoy(Buoy)Panel'Weldment(8)DDDSV
3	'(D)Car 2 Buoy(Buoy)Submergence(8)	1	See The Drawing Package
4	'(D)Car 2 Buoy(Buoy)Submergence(8)	2	'(D)Car 2 Buoy(Buoy)Submergence(8)DDDSV
5	'(D)Car 2 Buoy(Buoy)Flange(8)	1	'(D)Car 2 Buoy(Buoy)Flange(8)DDDSV
6	'(D)Car 2 Buoy(Buoy)Flange(8)	1	See The Drawing Package
7	'(D)Car 2 Buoy(Buoy)Flange(8)	1	'(D)Car 2 Buoy(Buoy)Flange(8)DDDSV
8	'(D)Car 2 Buoy(Buoy)Flange(8)	8	'(D)Car 2 Buoy(Buoy)Flange(8)Jaws
9	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	See The Drawing Package
10	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	'(D)Car 2 Buoy(Buoy)Cable Port(8)DDDSV
11	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	See The Drawing Package
12	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	'(D)Car 2 Buoy(Buoy)Cable Port(8)DDDSV
13	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	See The Drawing Package
14	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	'(D)Car 2 Buoy(Buoy)Cable Port(8)DDDSV
15	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	See The Drawing Package
16	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	'(D)Car 2 Buoy(Buoy)Cable Port(8)DDDSV
17	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	See The Drawing Package
18	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	'(D)Car 2 Buoy(Buoy)Cable Port(8)DDDSV
19	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	See The Drawing Package
20	'(D)Car 2 Buoy(Buoy)Cable Port(8)	1	'(D)Car 2 Buoy(Buoy)Cable Port(8)DDDSV

DATE: 01/11/2011 TIME: 10:00 AM NAME: ANNE JOB: 311 DRAWING: X-10.5 XXX-10.2 XXXX-10.2	NIS DS/DS 1/13/11 Gen 2 Buoy(DART Buoy)(8)	NOAA/REL Engineering Office Gen 2 Buoy 1/13/11 Gen 2 Buoy(DART Buoy)(8)
Exploded Buoy Assembly	1/13/11	1/13/11



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19ea systems presently deployed

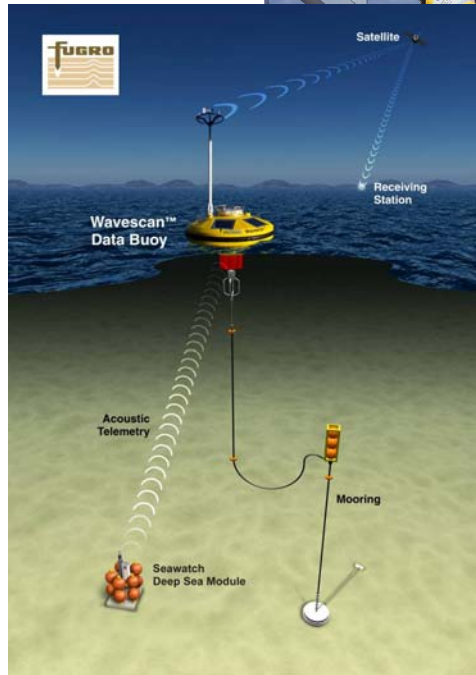
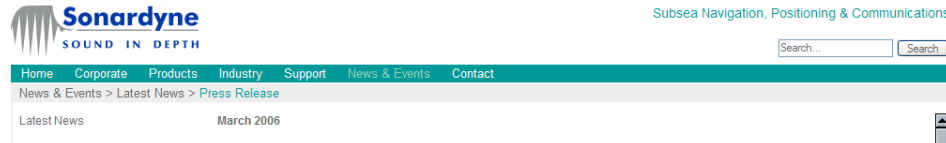


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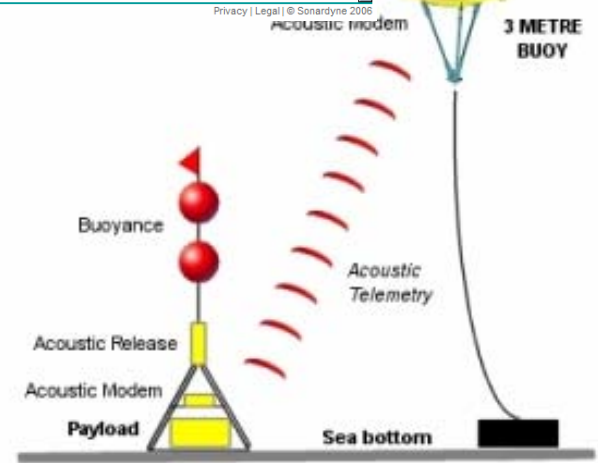
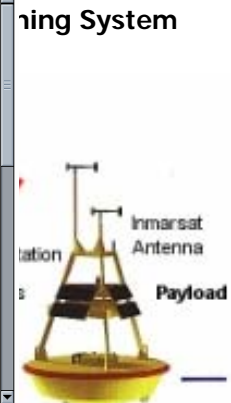
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Commercial Systems

1. Fugro
2. Sonardyne
3. Envirtech
4. SAIC



Warning of tsunami waves has been developed by Sonardyne International Ltd of Yateley, UK. The system uses acoustic communications technology and the new system was first presented on Sonardynes exhibition, London.



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Next Generation DART™ Technology

Desired improvements from DART™ II

- Eliminate need for large ship & skilled crew
- Sea state limitations
- Large buoys
- Limited subsea capabilities
- Vandalism protection



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DART™ II & DART™ ETD

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

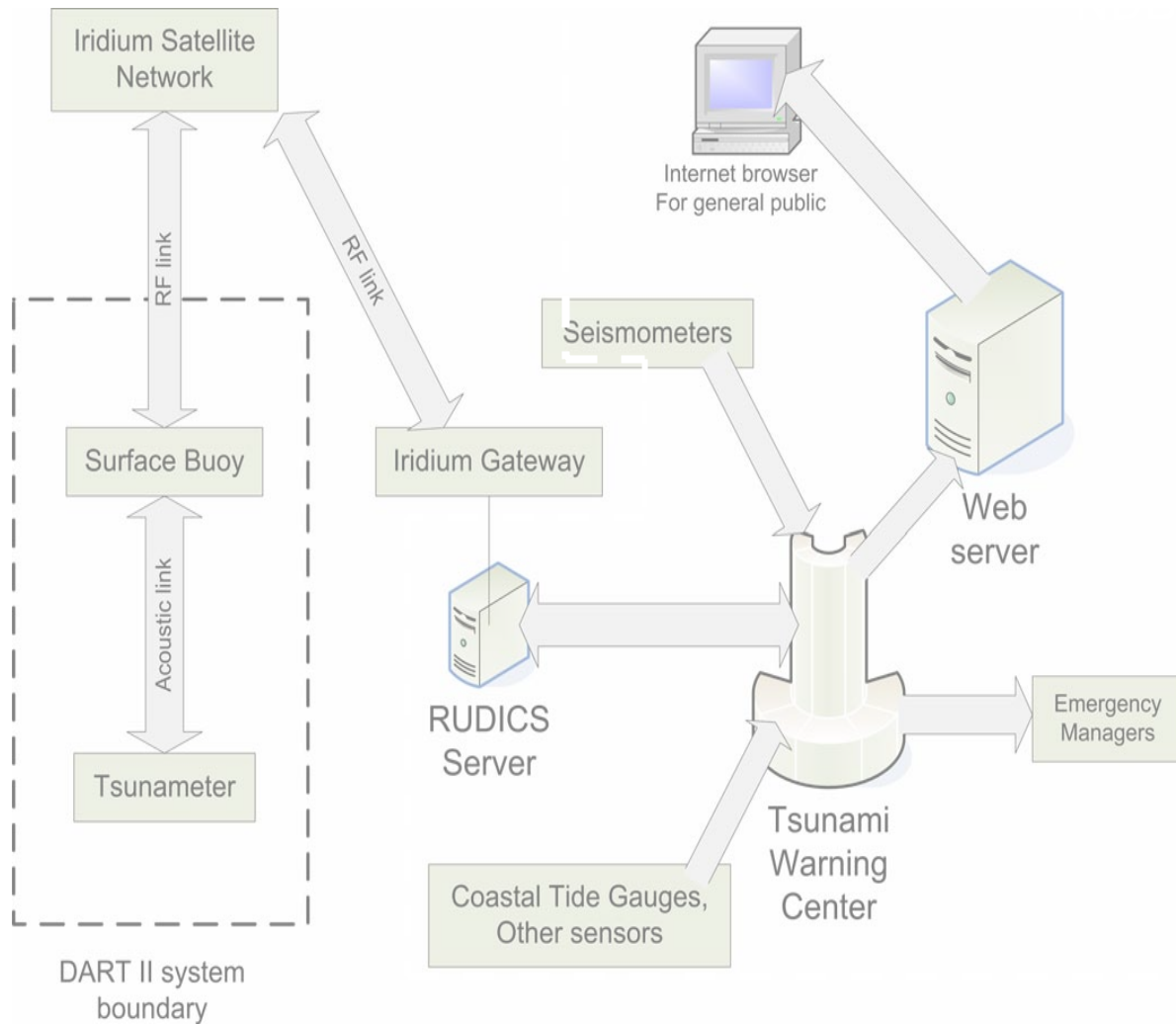
- *No Changes:*
 - *Data logger CPU, Acoustic Modem PCB, BPR, Paros, Iridium Modem and transmission protocol, system modes and tsunami detection scheme.*
- *Minor Changes:*
 - *Acoustic modem transducer and pre-amp, system software and GPS & ground plane.*



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Infrastructure



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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



Packaging & Logistics



Which would you rather have?



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F/V Sea Falcon-example



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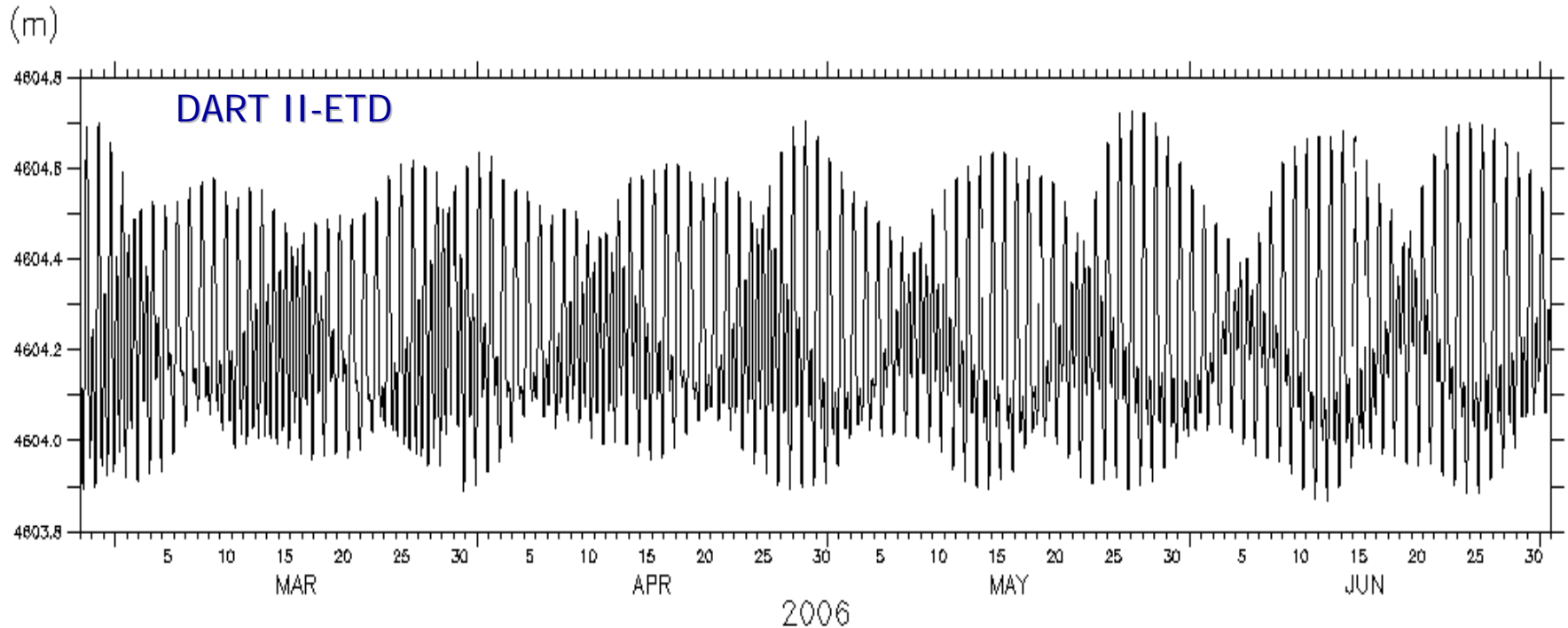


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DART™-ETD

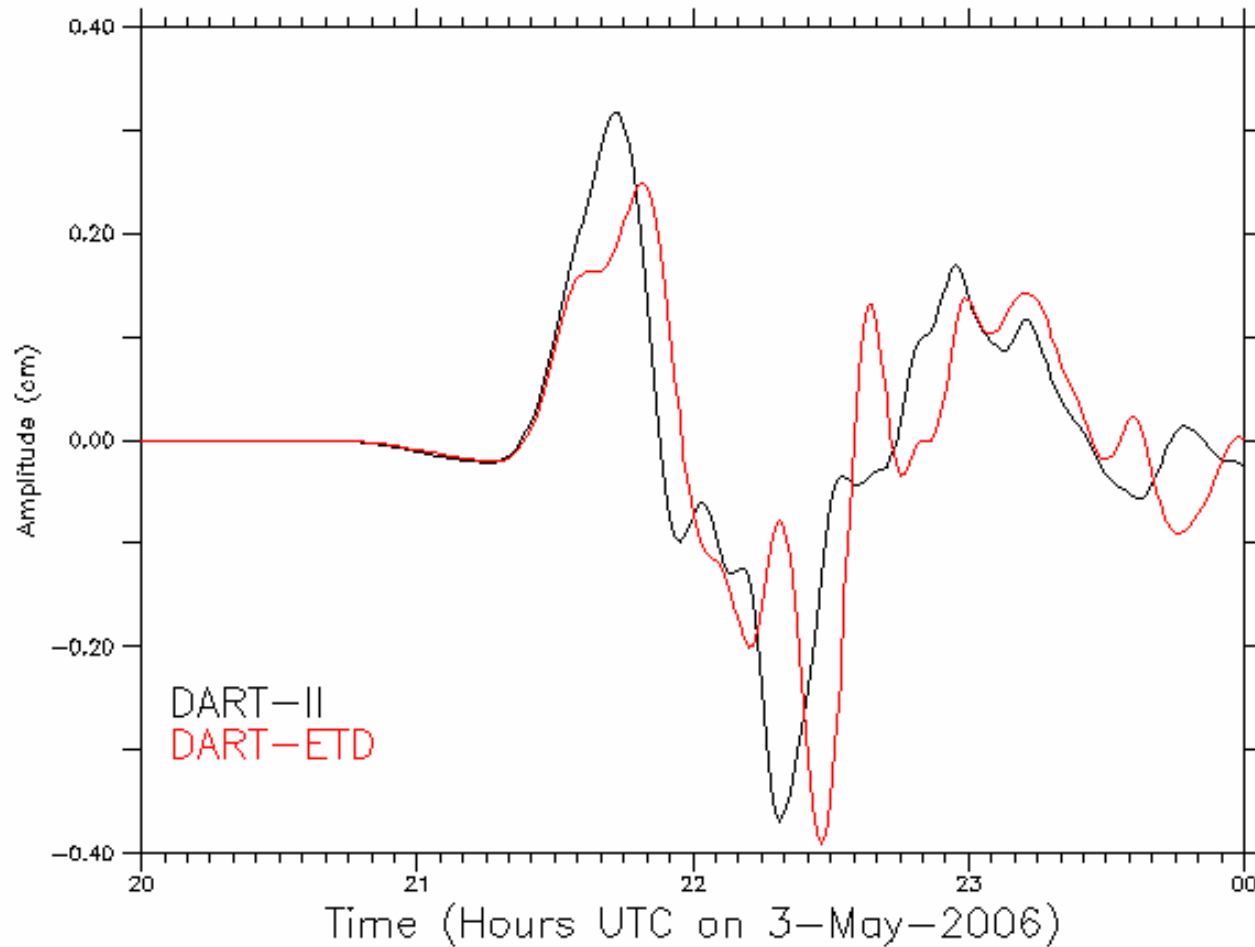
Current test off Hawaii indicates
99.1% data return
for March-July 2006



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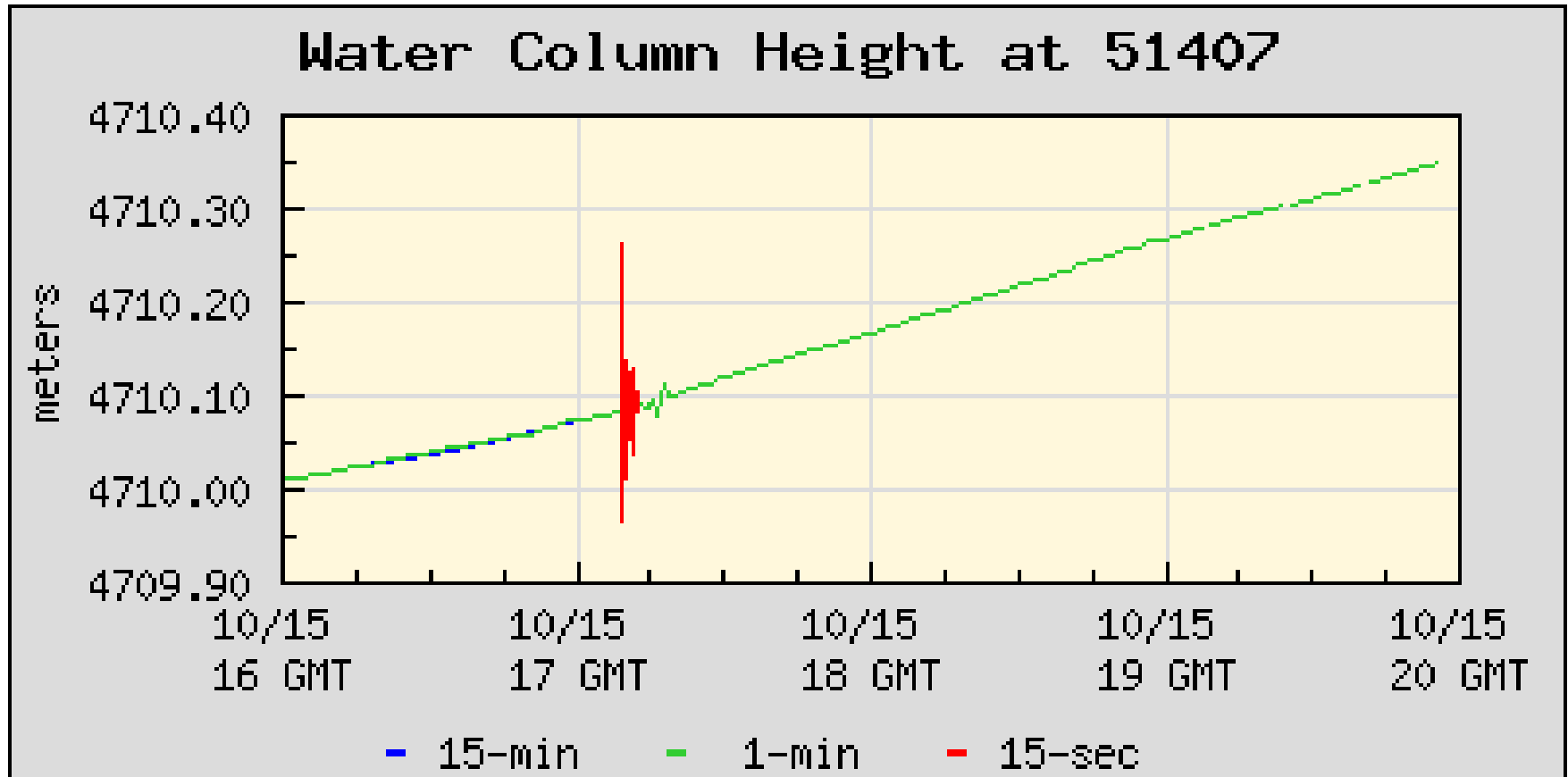
Tonga Tsunami estimated from Propagation Database



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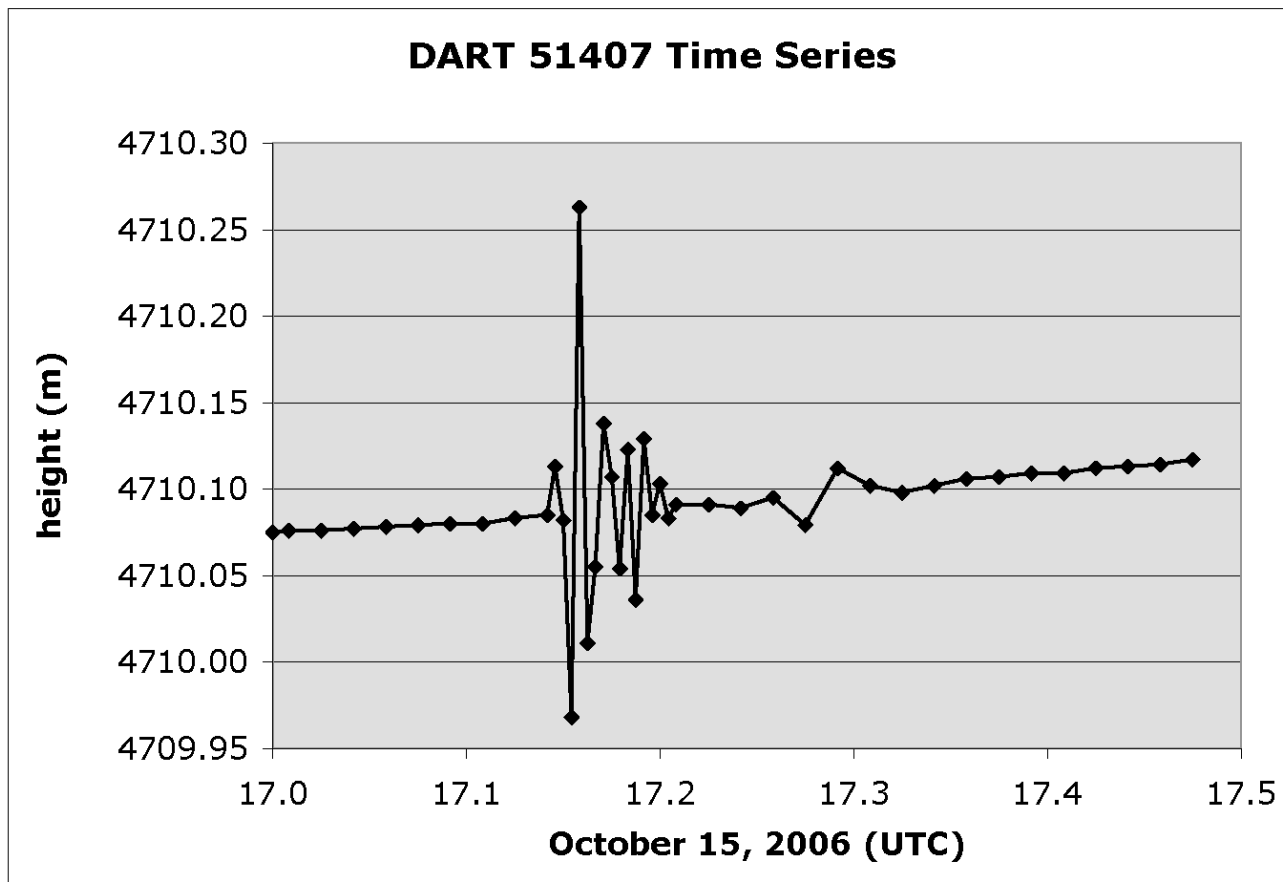
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Yesterday...Hawaii-Kona 6.3 Eq



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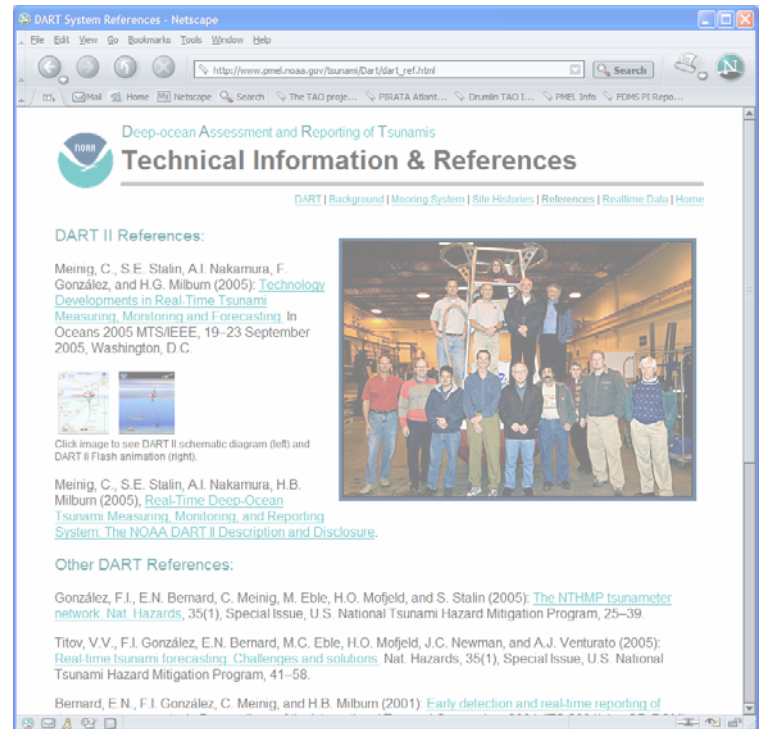
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Thank you.....For more information

www.pmel.noaa.gov/tsunami/Dart/dart_ref.html



www.tsunami.noaa.gov



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