AUV Fest 2005: Highlights

W[M] Schopfel
ONR Test Director

AUV Fest: History

- 6 events beginning in 1997
- Gulfport Mississippi & Keyport Washington
- Purpose remains the same
  - S&T community
  - Collaborative & challenging environment
  - Test emerging technologies

Push the envelope

AUV Fest 2005: Statistics

6 -17	June 2005
6	Sponsors
18	Organizations
210+	Participants
30+	Technologies
7	Range Areas

AUV Fest 2005: Advancements

Vehicle Technology

Sensor Development

Navigation

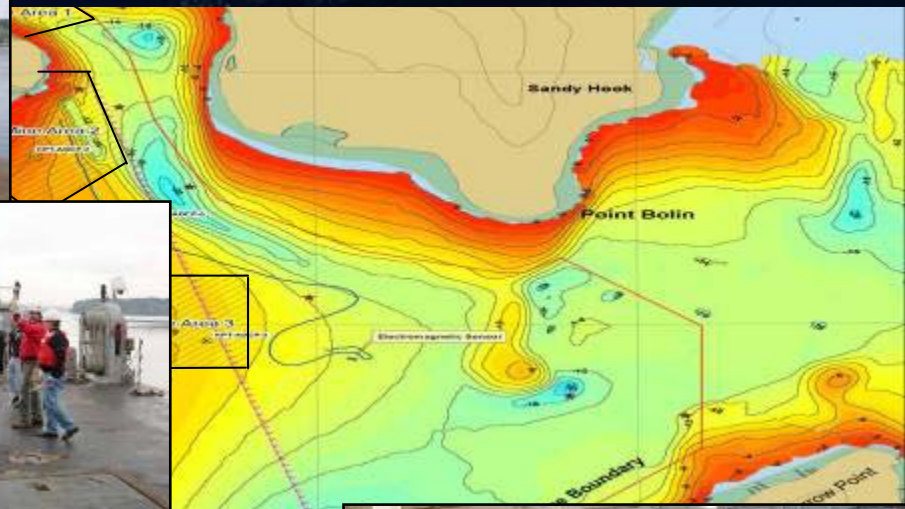
Communications

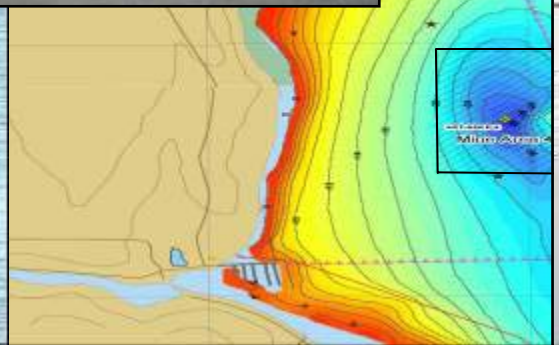
Collaborative Operations

Environmental Characterization

T2E2

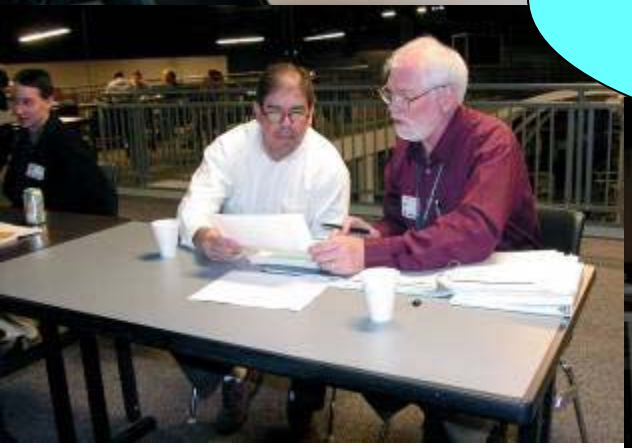
AUV Fest 2005: Support





AUV Fest: Support

PEOPLE



NSCT-ONE

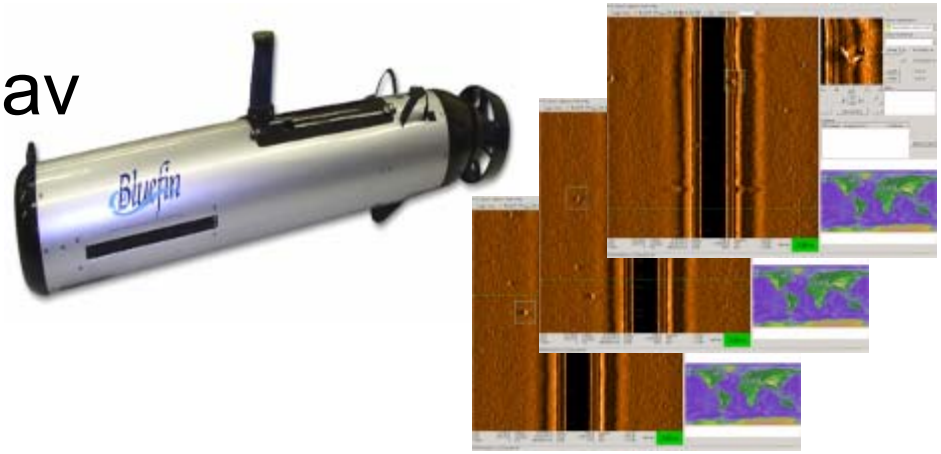
- Fleet operations – Reason for AUV Fest
- Integrator of new equipment, procedures, doctrine with current TTPs and legacy equipment
- Beyond “Demonstration” – T2E2
  - Unit Training
  - Testing (Equip / Procedures / Tactics)
  - Experimentation -- UOES
  - Evaluation – Foreign Comparative Test (FTC) Program

AUV Fest 2005

NSCT-ONE

- GAVIA (Iceland)
  - Foreign Comparative Test Program
  - Dual Frequency SSS
  - Modular payloads

- Sea Lion (Bluefin 9”)
  - “Transponder less” Nav
  - UOES
  - SSS
  - Video

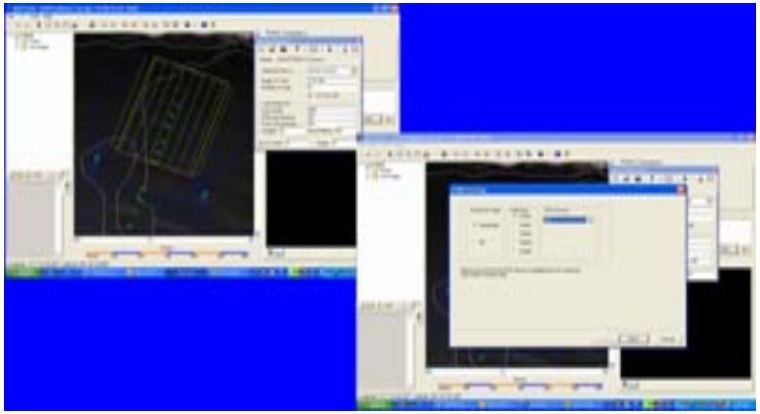


AUV Fest 2005

NSCT-ONE

- R & I Vehicle
  - SCM & RAI Missions
  - Dual Frequency SSS
  - UOES

- Common Operator Interface (COIN)
  - Msn Planning, Execution, and Reporting Tool
  - Common system interface

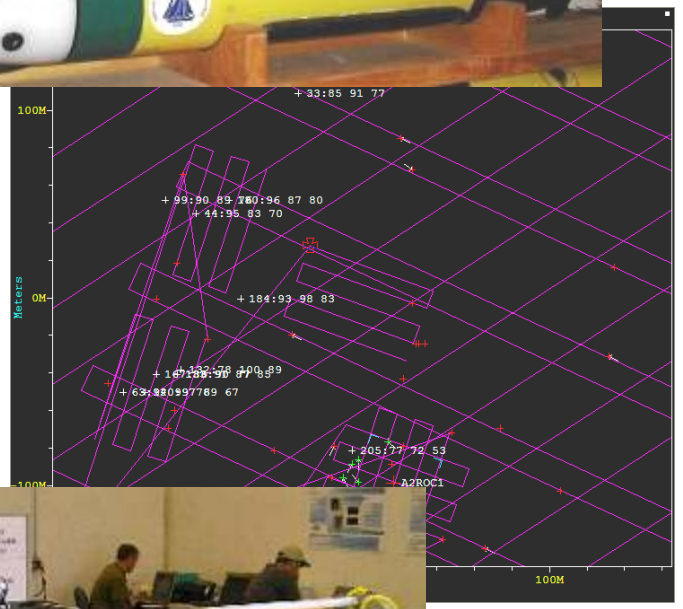


* Ask about UAVs

AUV Fest 2005

REMUS VSW

- Collaborative Operations
  - CRAWLERS
  - CETUS II
  - NEKTON
- Submarine Dry Dock Launch
  - Underwater Release
  - Surface & GPS Lock
  - Transit-Mission-Return
- UW Docking



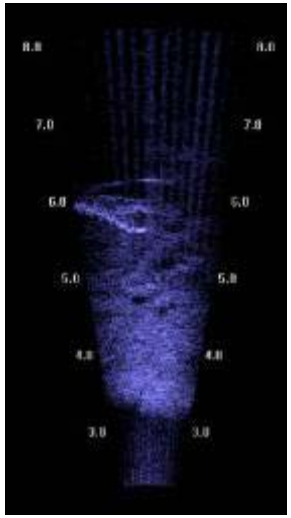
WHOI

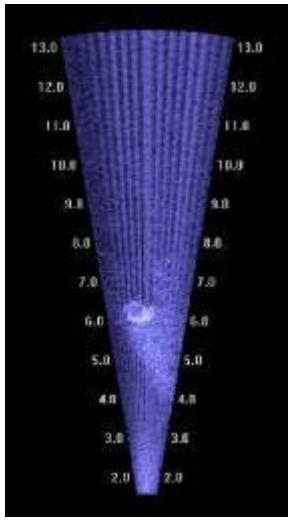
AUV Fest 2005

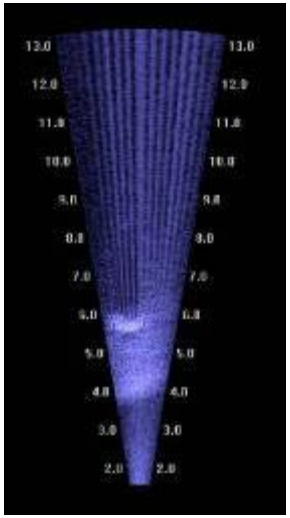
CETUS II--RAI

- Hover Capable UUV
- R & I Vehicle
  - MIRIS Forward Looking Sonar
  - Collaborative Ops with REMUS and/or CRAWLERS

* Ask about other CETUS variants





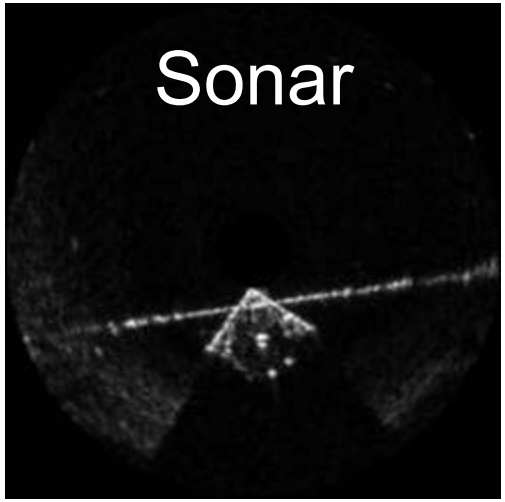


LOCKHEED MARTIN PERRY

AUV Fest 2005

CRAWLERS

- Conducted Collaborative Ops w/REMUS & CETUS
- Multi-Mission Capable
  - R & I
  - Neutralization
  - SCM in the Surf Zone



NSWC-PC

NEKTON RANGER & TRANSPHIBIAN

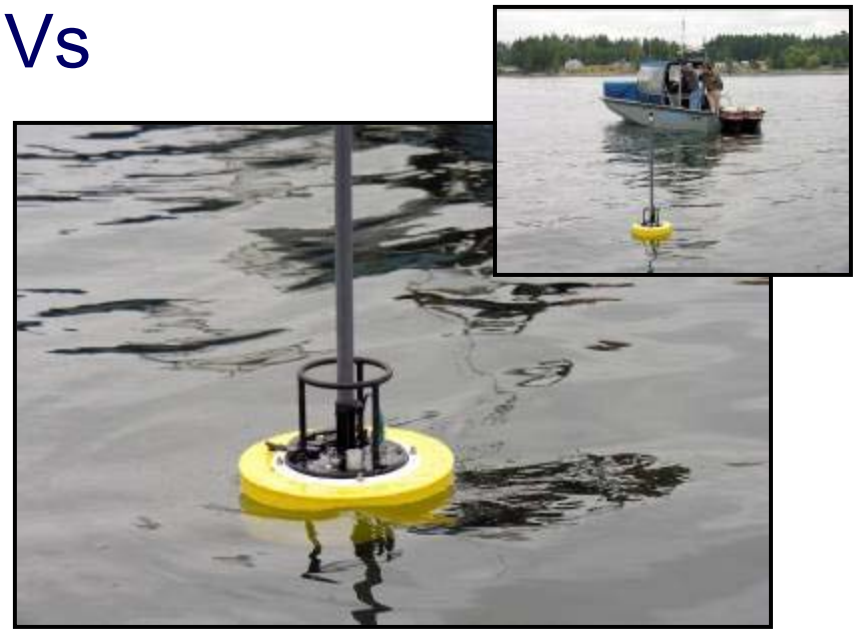
- Small Hand Held UUV
  - Reacquire and Neutralize Volume Mines
  - Blazed Array Sonar

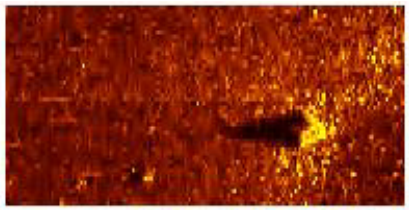
- Mine Hunter/Neutralizer
  - Restricted Areas
  - Swims & Crawls
  - Rotating Head Sonar

NEKTON Research

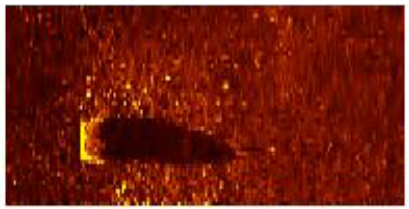
Acoustic Communications

- Acoustic Networking of UUVs
  - REMUS
  - Sea Lion
  - CETUS
  - CRAWLERS
- Real-Time Tracking
  - Standard Message Formats
  - Operators Ashore
- High Speed Modem
  - CAD/CAC SSS Images
- WHOI/Benthos Modem Interoperability





0. Target ID 1061
File:REMUS336.MST, Ping:91% X:-46%
Received:Mon Jun 13 14:41:16 2005
Position: 47N41.654 122W36.826
Score: 94.5 (94.5, 97.1, 91.9)



4. Target ID 1440
File:REMUS193.MST, Ping:35% X:43%
Received:Tue Jun 14 14:46:42 2005
Position: 47N41.589 122W36.881
Score: 87.8 (95.3, 99.9, 68.1)

AUV Fest 2005

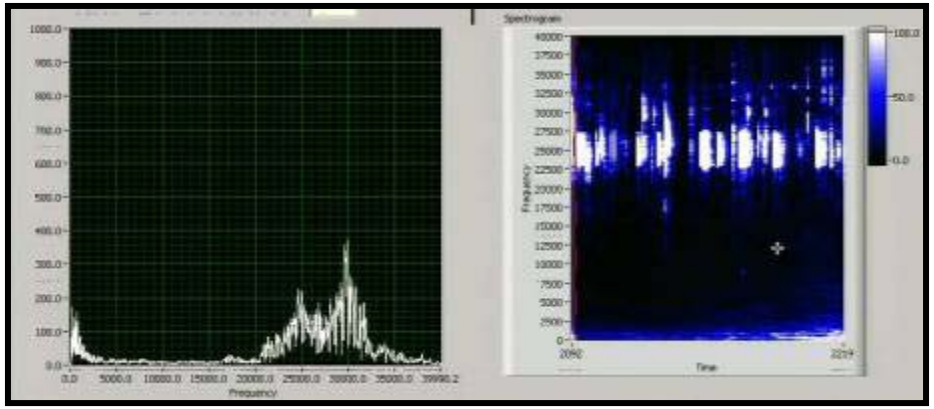
GATEWAY BUOY

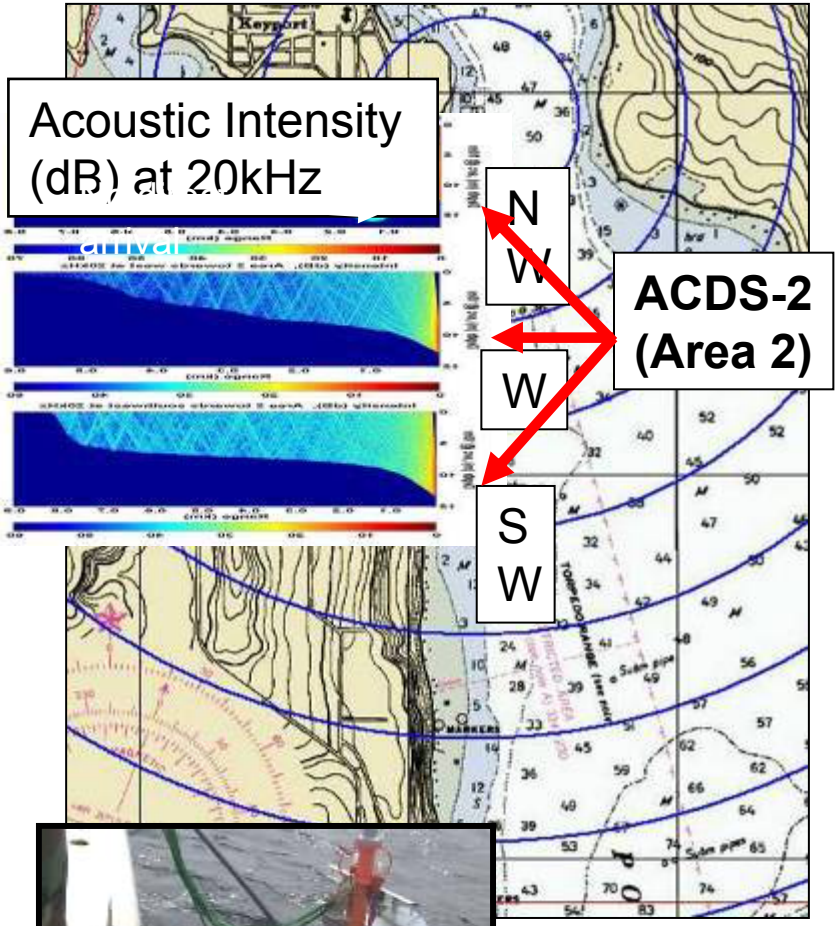
- Deployable Gateway Buoys
  - Helicopter
  - Fast Boat
  - Self Locating
  - Self Mooring
- Integrated into C2 Architecture
  - Collaborative Ops with REMUS and CRAWLERS

FAU

Acoustic Communication & Data Storage (ACDS)

- Characterization of the Acoustic Environment
- Deployed 3 Acoustic Communication and Data Storage Buoys
- Monitor and Record Acoustic Communications



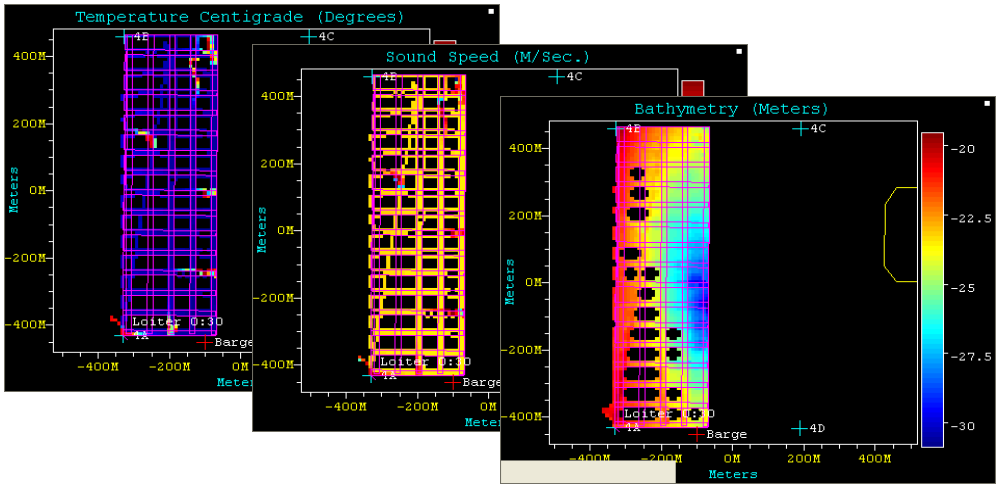


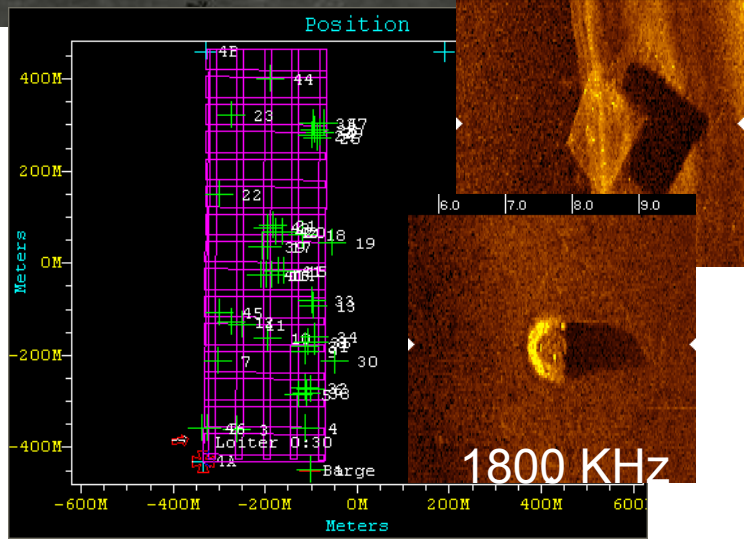
NRL

AUV Fest 2005

REMUS SW

- Improves on REMUS VSW Moves MCM into SW
  - Dual Frequency SSS for SCM and R&I
  - DIDSON
  - GPS/INU Navigation
  - OTH Iridium C2



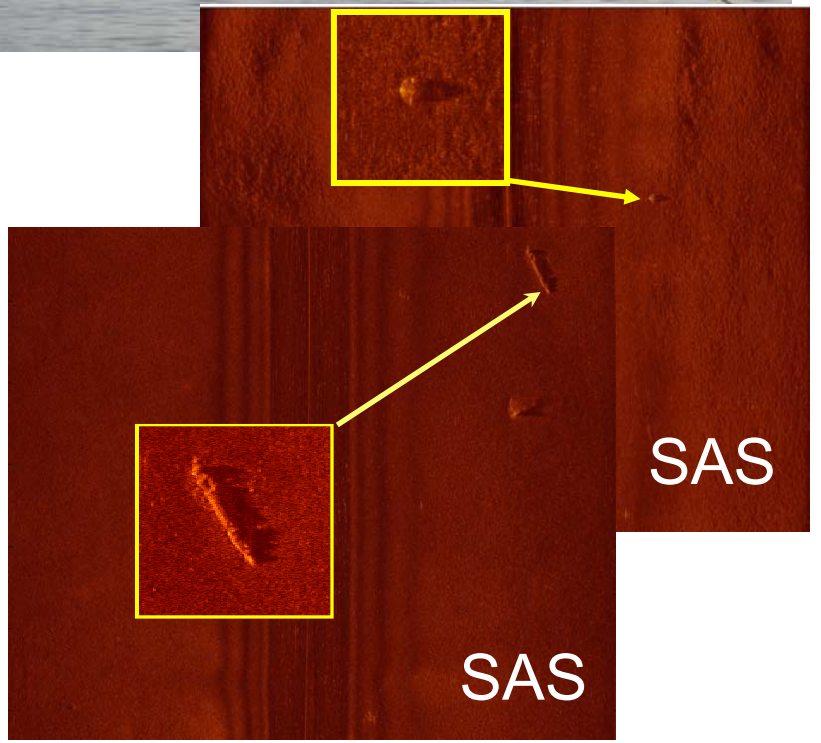


REMUS SW
"Two Man Transportable"

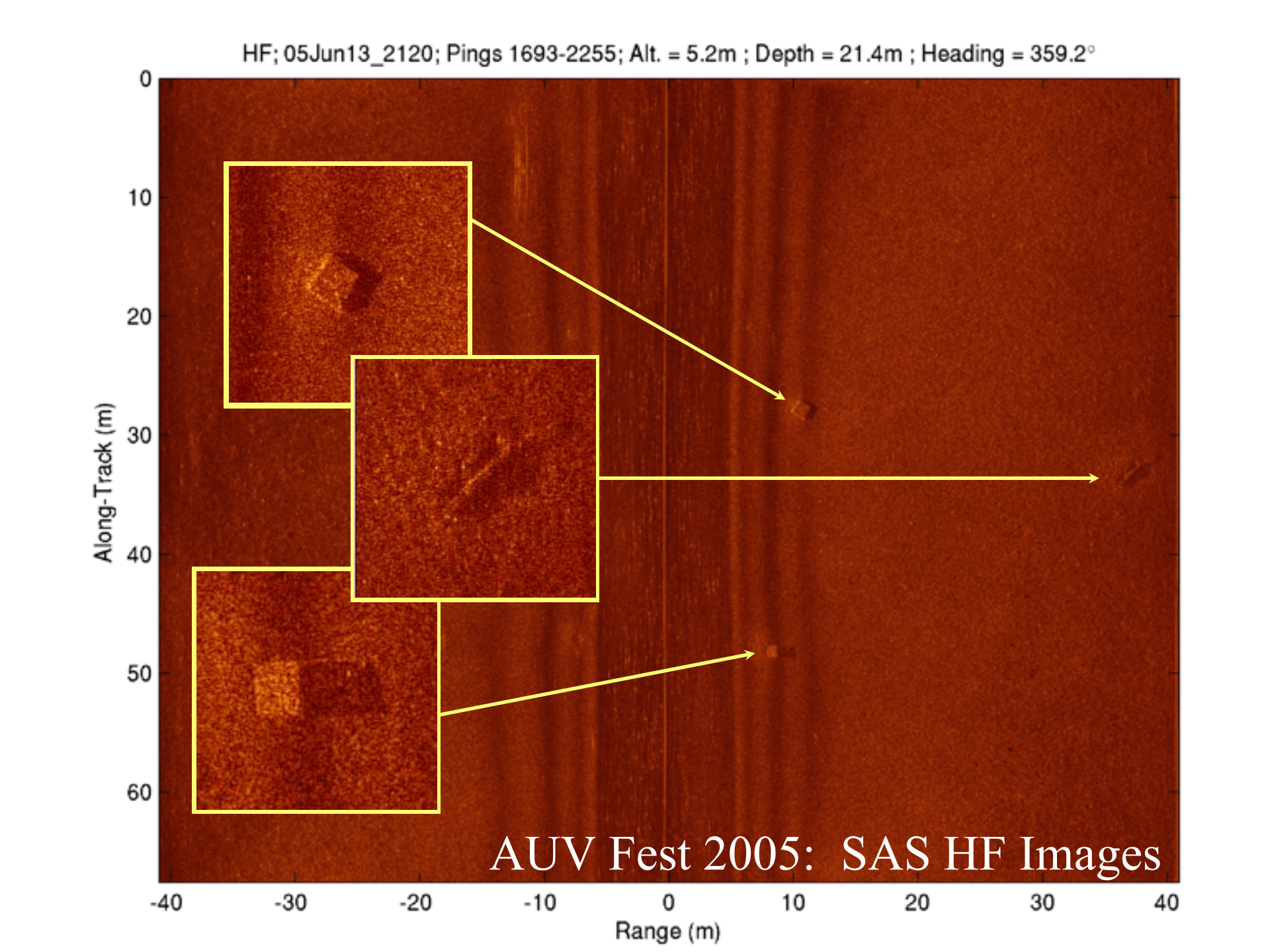
AUV Fest 2005

Small Synthetic Aperture Minehunter (SSAM)

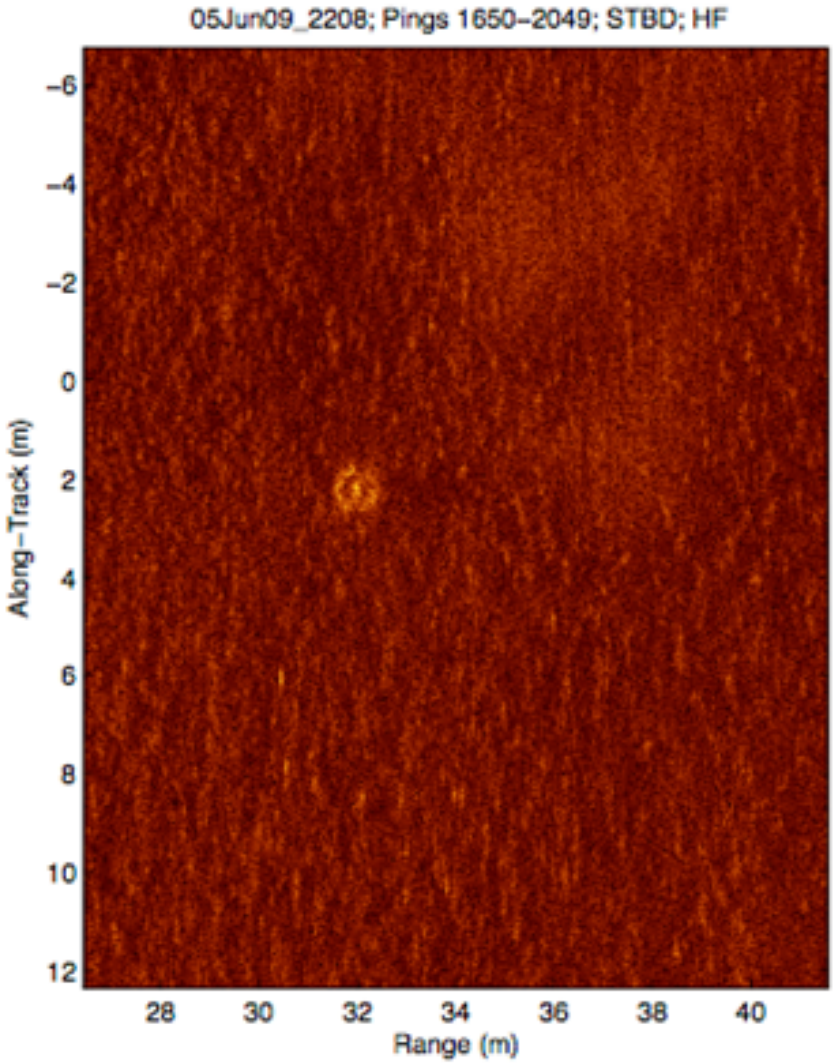
- REMUS – 600 UUV
- 12 ¾" Diameter
- Synthetic Aperture Sonar (SAS)
  - HF Imaging for High Resolution (ID Quality?)
  - LF Imaging for Buried / Partially Buried Mines
- Challenging Environment
  - Motion Sensitivity

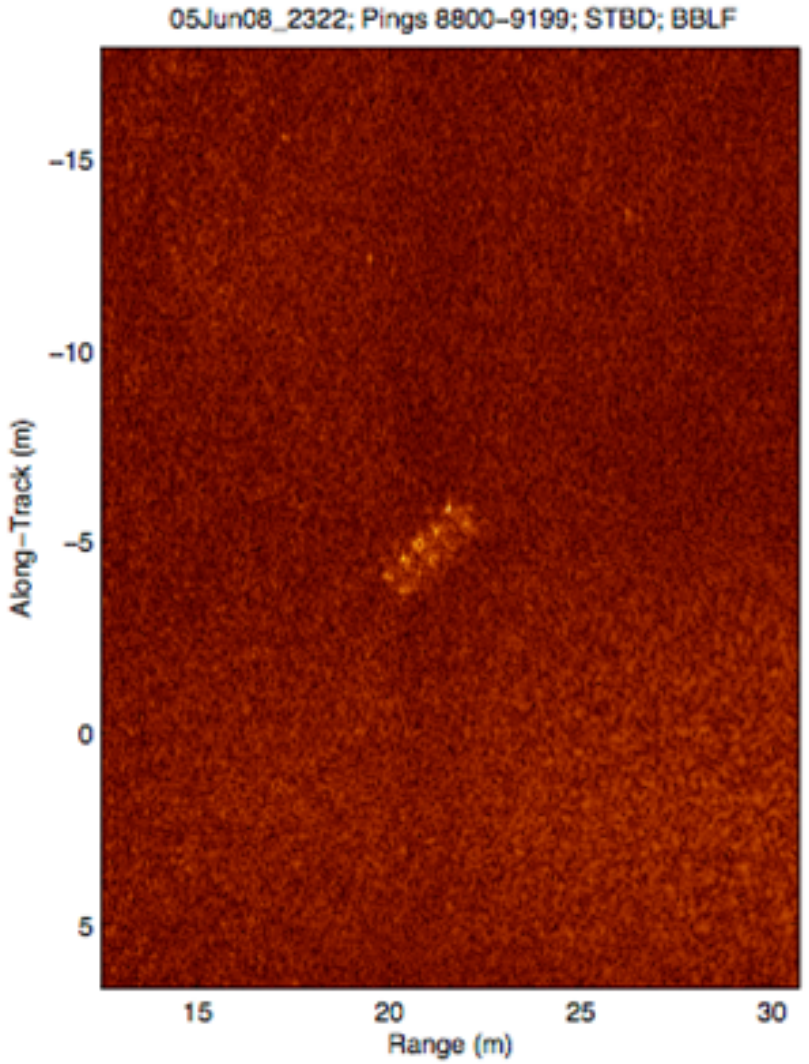


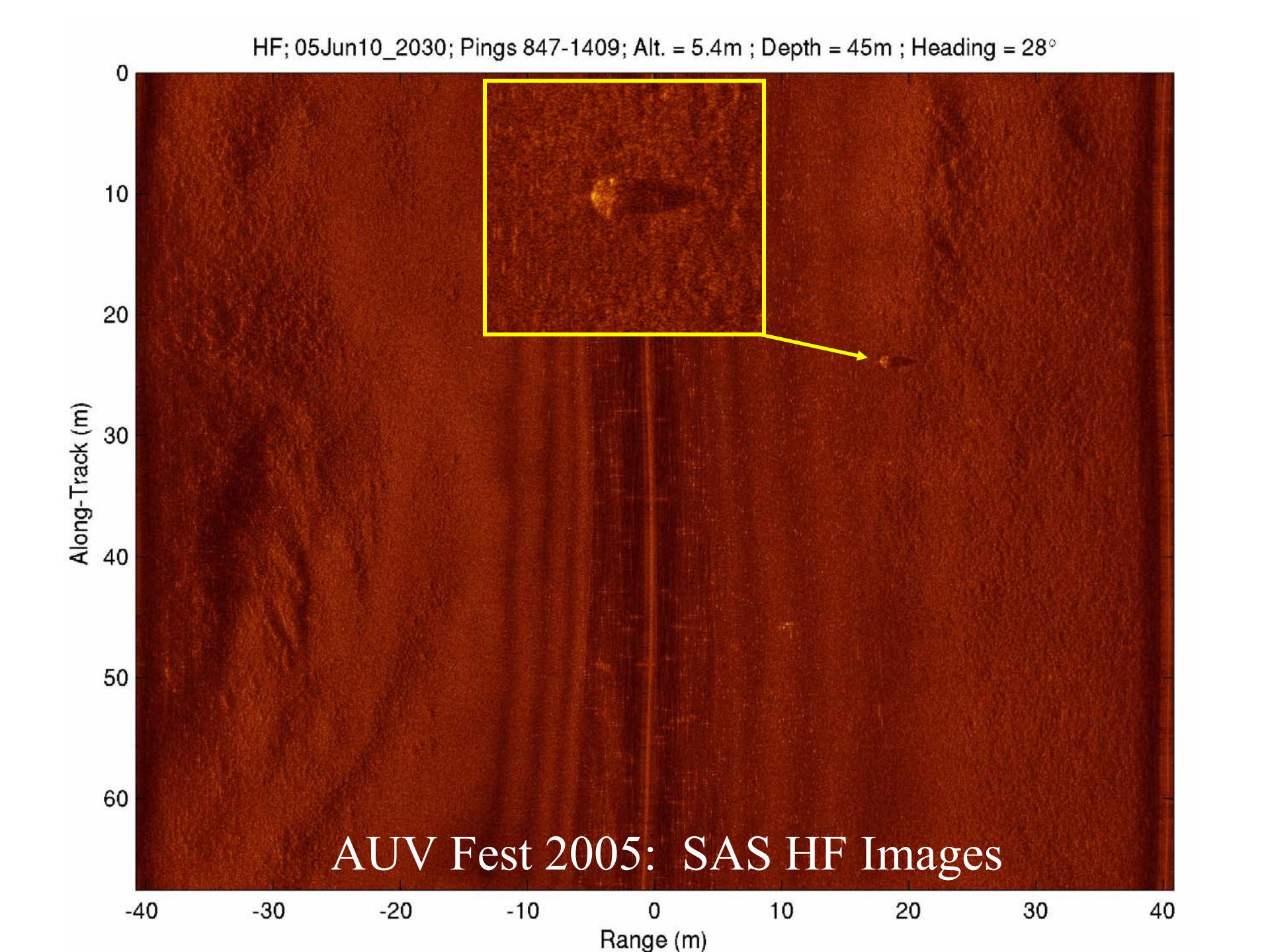
NSWC-PC & WHOI

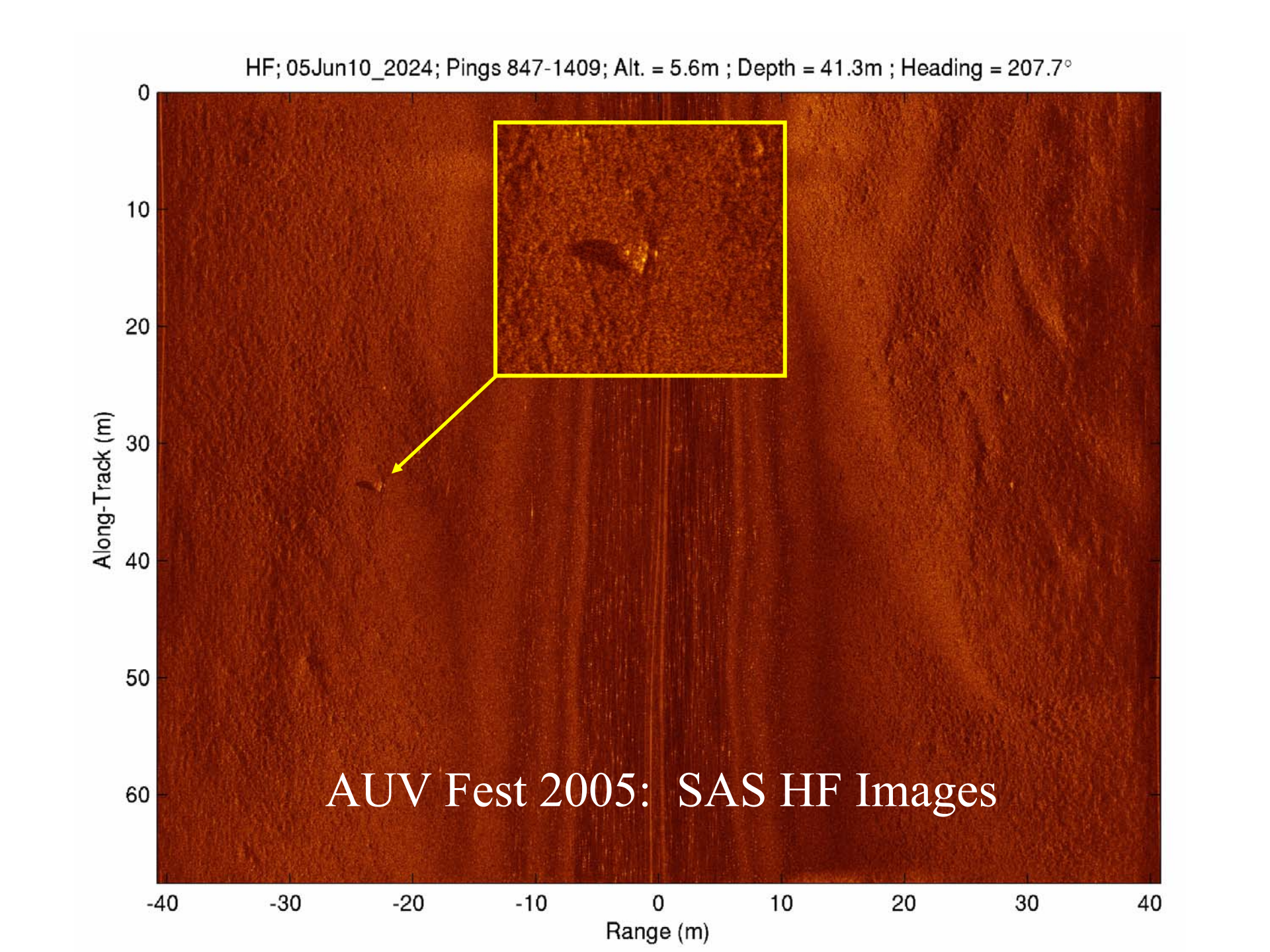

HF; 05Jun13_2120; Pings 1693-2255; Alt. = 5.2m ; Depth = 21.4m ; Heading = 359.2°
Along-Track (m)
0
10
20
30
40
50
60
-40
-30
-20
-10
0
10
20
30
40
Range (m)
AUV Fest 2005: SAS HF Images

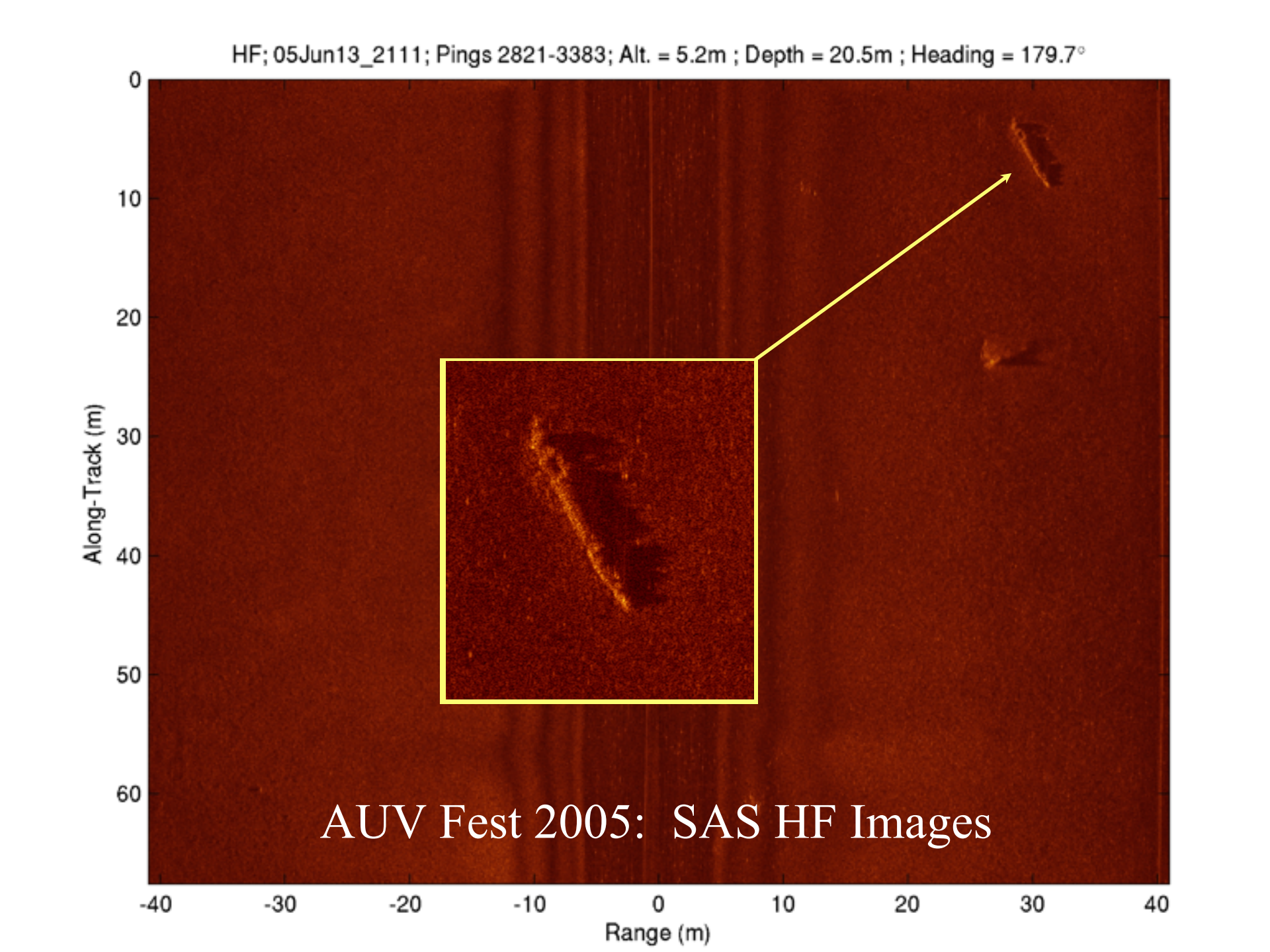
AUV Fest 2005: SAS HF Images

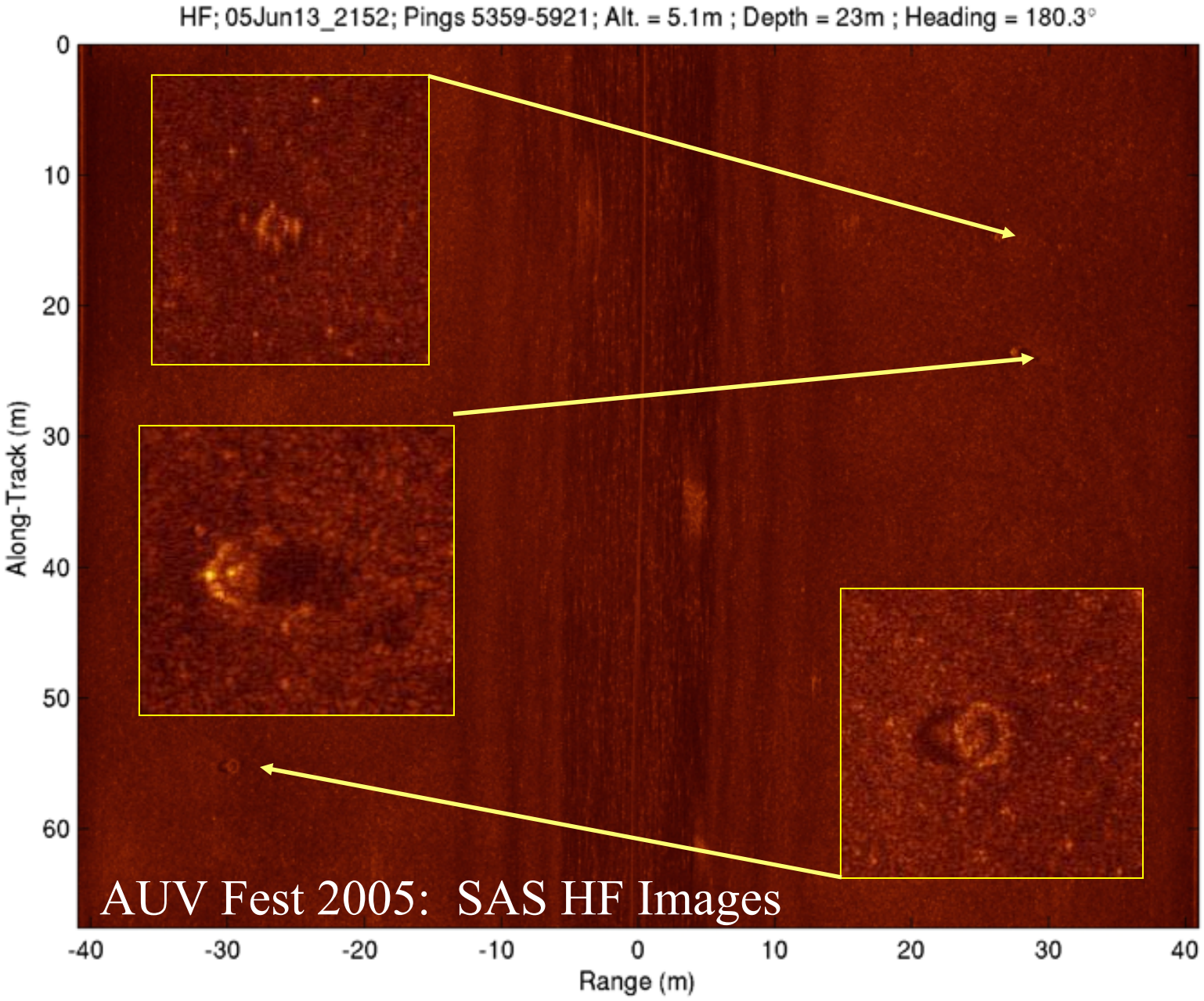





HF; 05Jun10_2030; Pings 847-1409; Alt. = 5.4m ; Depth = 45m ; Heading = 28°
Along-Track (m)
0
10
20
30
40
50
60
-40
-30
-20
-10
0
10
20
30
40
Range (m)
AUV Fest 2005: SAS HF Images

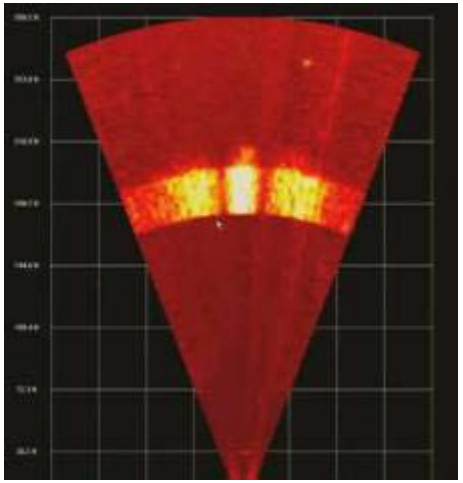

HF; 05Jun10_2024; Pings 847-1409; Alt. = 5.6m ; Depth = 41.3m ; Heading = 207.7°
0
10
20
30
40
50
60
Along-Track (m)
-40
-30
-20
-10
0
10
20
30
40
Range (m)
AUV Fest 2005: SAS HF Images


HF; 05Jun13_2111; Pings 2821-3383; Alt. = 5.2m ; Depth = 20.5m ; Heading = 179.7°
Along-Track (m)
0
10
20
30
40
50
60
-40
-30
-20
-10
0
10
20
30
40
Range (m)
AUV Fest 2005: SAS HF Images


HF; 05Jun13_2152; Pings 5359-5921; Alt. = 5.1m ; Depth = 23m ; Heading = 180.3°
Along-Track (m)
0
10
20
30
40
50
60
-40
-30
-20
-10
0
10
20
30
40
Range (m)
AUV Fest 2005: SAS HF Images

Acoustic Radio Interactive Exploratory Server (ARIES)

- ARIES UUV -- Navigation
  - Obstacle Avoidance – “Up and Over”
  - Forward Looking Blazed Array Sonar
  - Onboard Dynamic Image Processing
  - Small to Mid-sized UUVS



* Ask about Broadband Communications thru UAV

Naval Postgraduate School (NPS)

Mid-sized Autonomous RV (MARV)

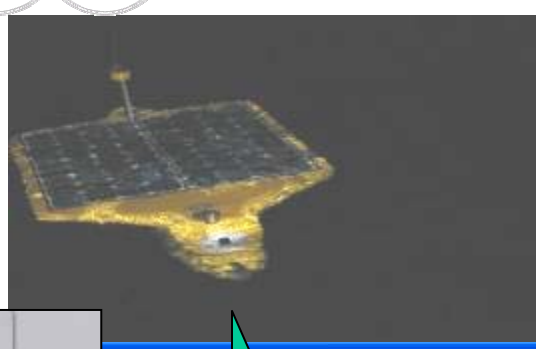
- Research Platform
- Multiple Payloads
  - Chemical Sensing
  - Color Video
- Operated in Hood Canal

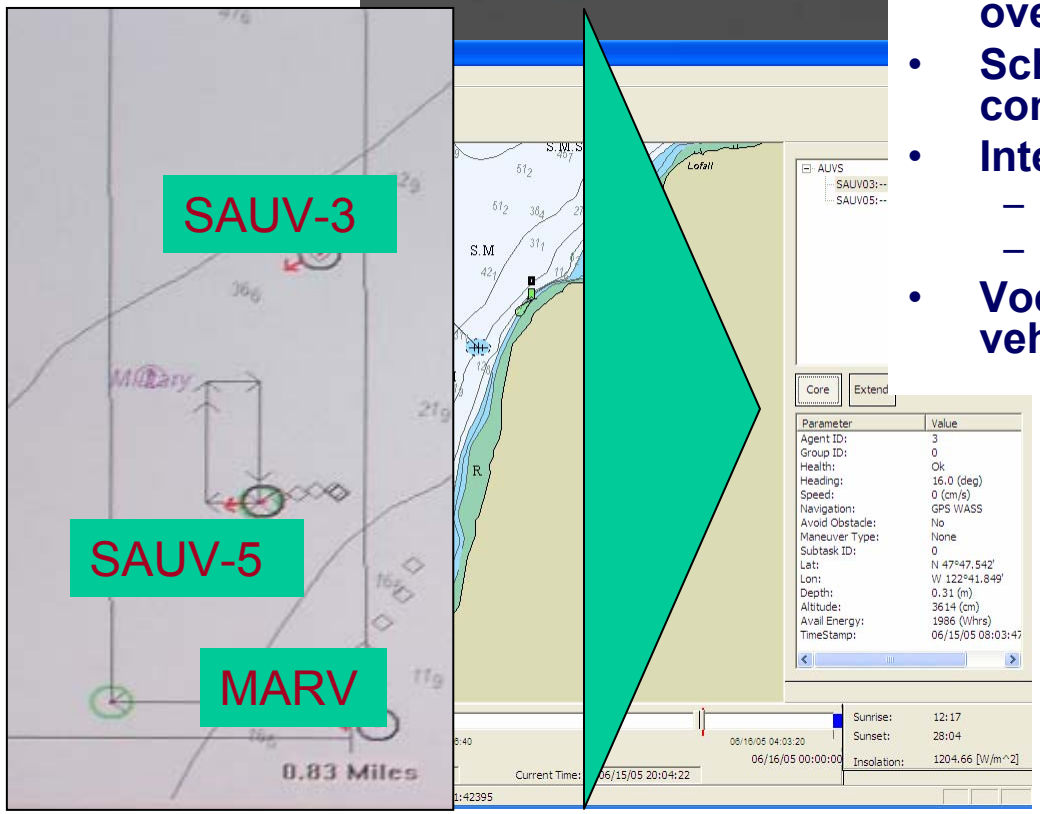
* Ask about “Hover” capability

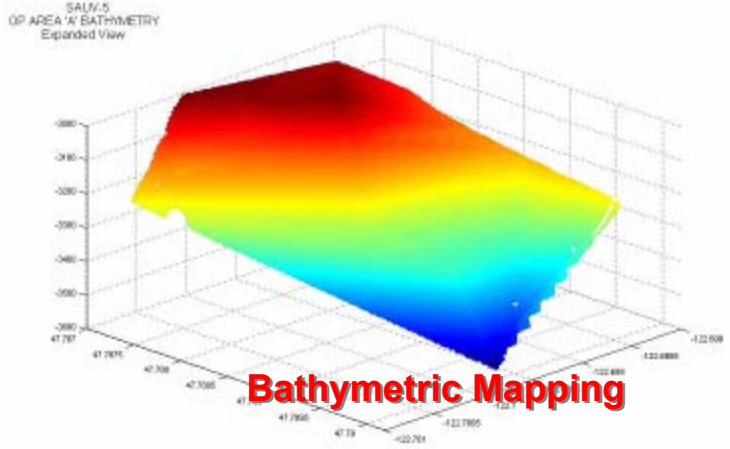
NUWC Newport

Solar AUV

- Long Endurance-Multiple Vehicle Cooperation
- Acoustic Communication Networks
  - COFSNet few nodes
  - AUSNET many nodes
- Shore-based Multi-Vehicle Mission Planner
- SAUVs were 24 hour operationally-ready over 3 day scheduled mission
- Scheduled and unscheduled mission re-configuration
- Interoperability between mixed modem
  - SAUV with Benthos modem
  - SAUV with the micro modem
- Vocabulary and Grammar for multiple vehicle cooperation

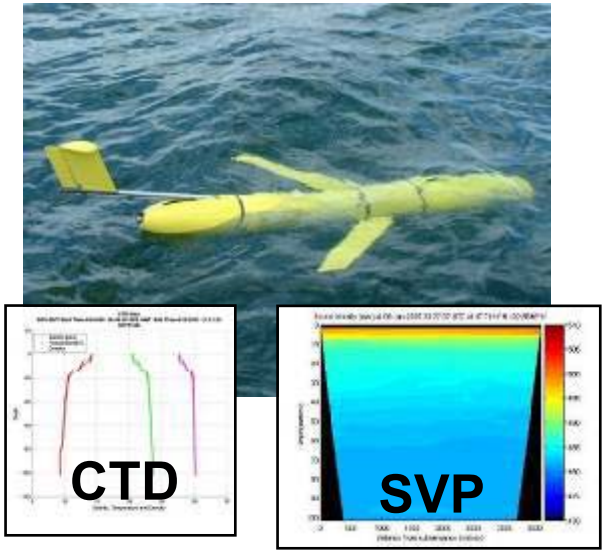






AUV Fest 2005

GLIDERS



- Noise Mapping Glider
  - Alaskan Native Technologies
  - Slocum Shallow Water Glider
- Collects Ambient Noise & Environmental (SVP) Data
  - IRIDIUM & Free Wave C2

- Sea Glider
  - APL, University of Washington
  - Deep Water (0 –1000m) Long Duration Ops (190+ days)
- Environmental Data Collection
  - IRIDIUM Communications
  - Data to User - 45 minutes from call

AUV Fest 2005

SCOUT

- Cooperative Behavior between Vehicles
  - Precision Maneuvers
  - Collision Avoidance
  - Autonomous Ops
- Low Cost/COTS
- Bottom Mapping w/SSS

MIT

Hydrographic Unmanned Survey Craft (HUSCy)

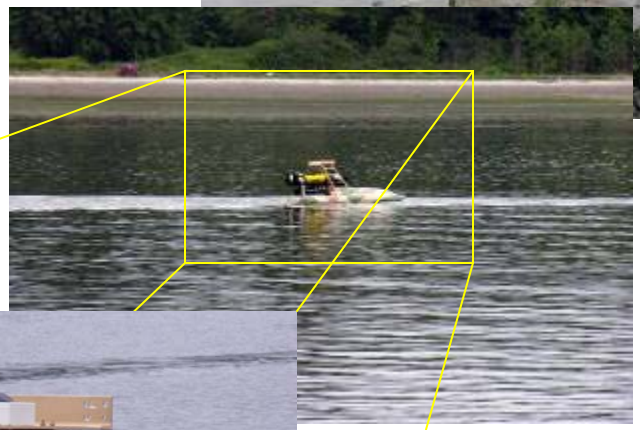
- Tactical Data Collection in SW and VSW (<100')
  - Hydrographic
  - Oceanographic
- Low Visibility
- Free Wave Data Link
- GPS Navigation
- SSS

Naval Oceanographic Office

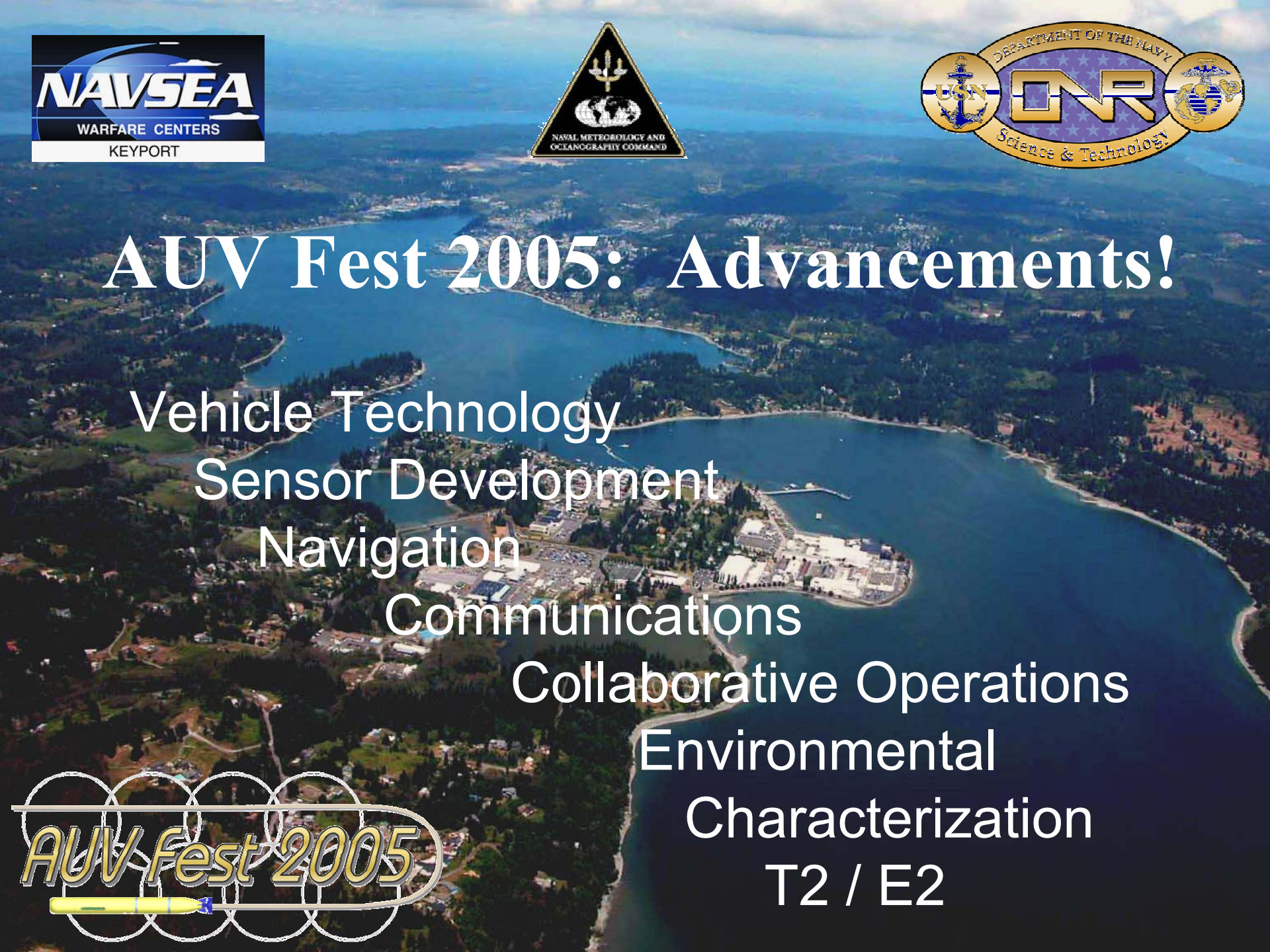
AUV Fest 2005

Remote Delivery of Unmanned Technologies (RDUST)

- Rapid Delivery of UUV
  - Autonomous Positioning
  - Beyond10 Miles
- Functions as Gateway Buoy
- Surface Awareness
  - IR
  - Video



NSWC-PC


NAVSEA
WARFARE CENTERS
KEYPORT
NAVAL METEOROLOGY AND OCEANOGRAPHY COMMAND
DEPARTMENT OF THE NAVY
ONR
Science & Technology
AUV Fest 2005: Advancements!
Vehicle Technology
Sensor Development
Navigation
Communications
Collaborative Operations
Environmental
Characterization
T2 / E2
AUV Fest 2005