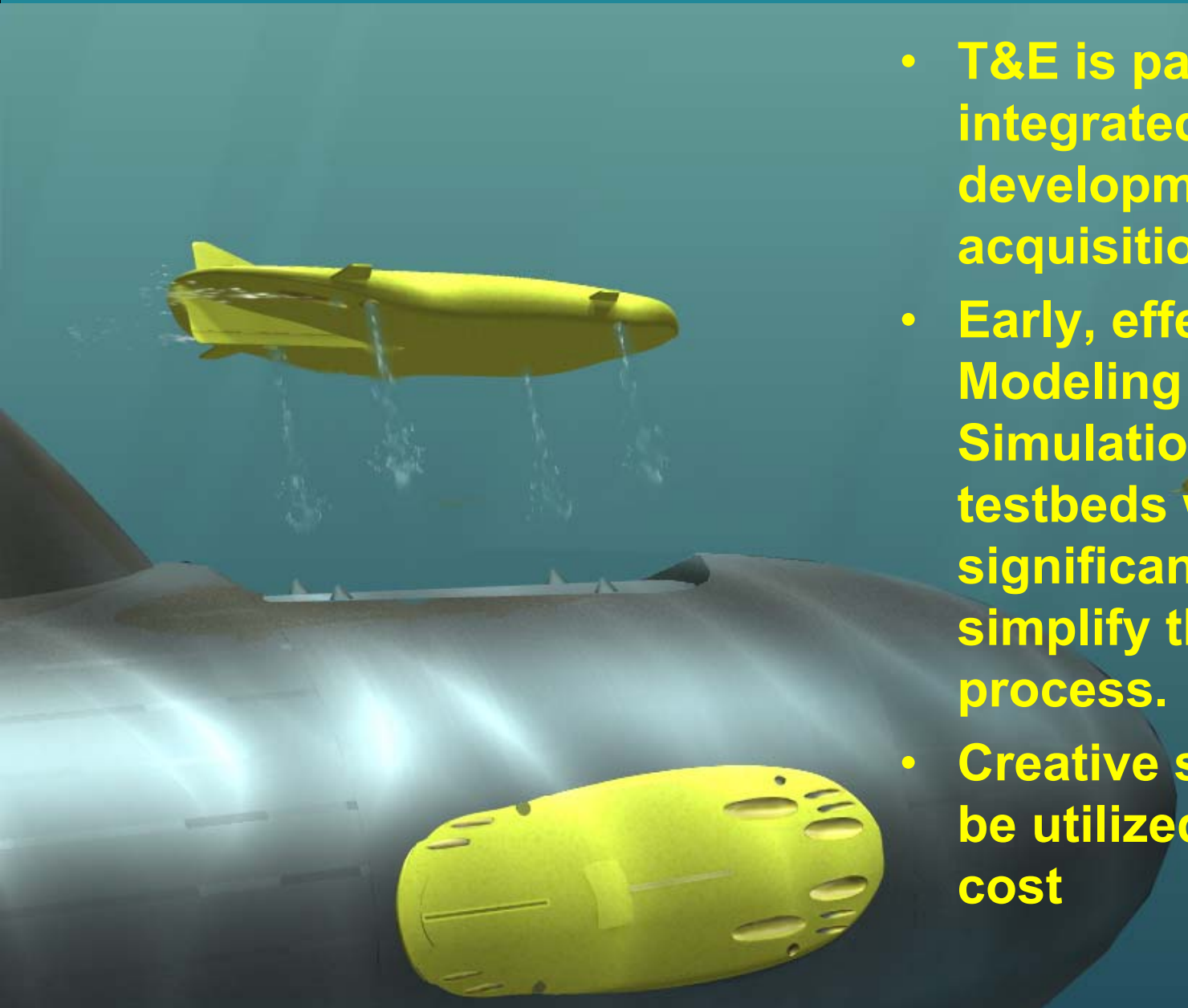
Unmanned Maritime Vehicle (UMV) Test & Evaluation Conference

Future Technology Development and Assessment for UUV Acquisition

James Griffin
NUWCDIVNPT
Autonomous Systems and Technology Department



- T&E is part of an integrated technology development and acquisition strategy
- Early, effective use of Modeling and Simulation and HIL testbeds will add significant “value” and simplify the T&E process.
- Creative solutions can be utilized to reduce cost

Demonstration UUV's

T&E of Payloads on UUV Testbeds

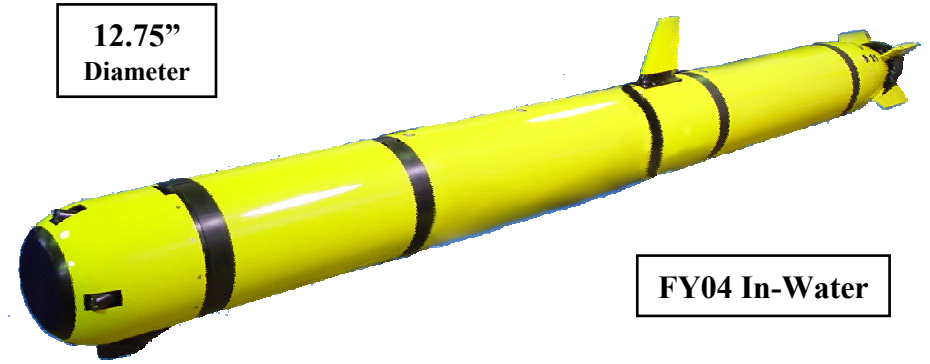
- •Early Awareness of Fleet Integration Issues
- •Common Interfaces and Modular Payloads
- •Applicable UUV Standards

21" Diameter

21UUV

- ~ 200 In-Water Runs
- Acquisition Program Risk Mitigation
- Vision Based Navigation, Camera Suites, Photo Mosaic's
- Side Scan Sonar Imagery
- "Electric Torpedo" Testbed and Weapon Launch from MTV
- Autonomous Controller Experiments

12.75" Diameter



FY04 In-Water

MARV - Mid-sized Autonomous Research Vehicle

- Technology Demonstrations for Various S&T Programs
- Low Speed Control and Hover Payload (Thruster Based) Demonstrations
  - Imaging Sensor Evaluation
  - Homing and Docking Demonstrations

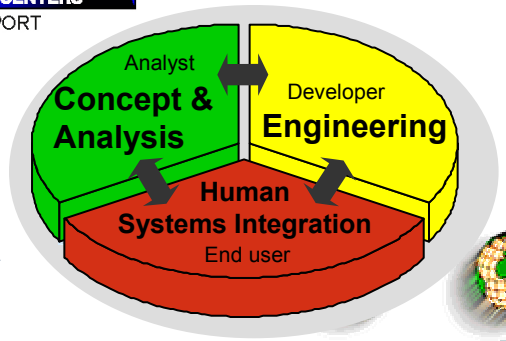
8 Ton Displacement

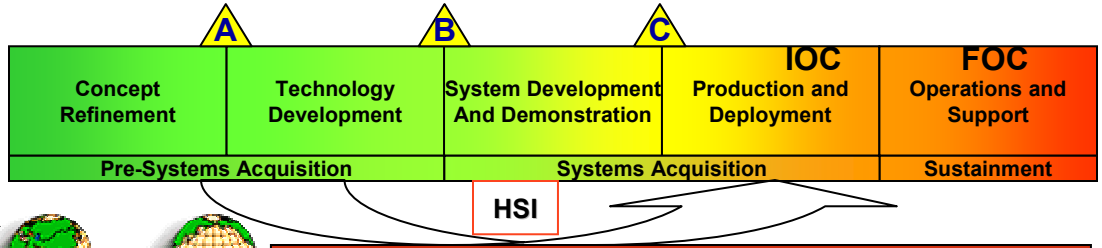
MTV - Manta Test Vehicle

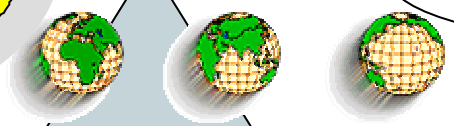
- **~100 In-Water Runs**
- **Multiple UUV and Weapon Launch**
- **Advanced ISR Suites – RADINT, SIGINT, Optics, IR**
- **Deployed ASW Systems**
- **Advanced Networked Communications**
- **Advanced Autonomy**

UUV M&S Full Spectrum Capability
End-to-End Modeling & Simulation Framework

NAVSEA WARFARE CENTERS
NEWPORT

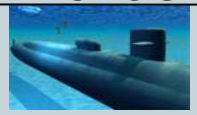




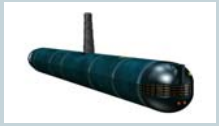


Theater

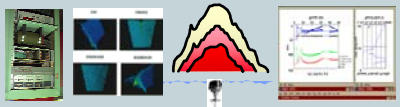
Force



Platform



System



Engineering

Interoperable
Variable Fidelity

Model re-use

Engineering Level M&S

- Future links to Fleet synthetic training environments
- Enable experimentation and exercise collaboration, distributed networked environments
- Socialization of new technology
- Test & Evaluation in support of Sea Trial.

Capabilitie

- Assess new concepts and technologies
- Naval & joint CONOPS development
- Provide advanced (TT&Ps)
- Requirements study, analysis of alternatives (AoA)
- Performance prediction, “what-if”, Monte Carlo
- Investment decisions on UUVs.
- Reliability modeling
- Analyze design change impact on program

- Risk Reduction,
- Engineering trade studies
- ICD development & validation
- Contractor system validation
- HWIL/sub-system/end-to-end system simulation

Fleet	Government labs	Warfare Centers	Academia	Industry
Cost-effective	Distributive	Collaborative	Re-usable	Extensible	Composable	Persistent

HWIL Testbed – *Supports Mission Planning, Diagnostics, and Effective Testing*

Propulsion/ Effector Module

Vehicle Control, Autonomy, Navigation Module

Energy Module

Payload/Sensor/ Comms Module

Network bus

Switch

Switch

Switch

Switch

Power Bus

Power Distribution & Conditioning

Power Distribution & Conditioning

Power Distribution & Conditioning

Power Distribution & Conditioning

Module Controller

Module Controller

Module Controller

Module Controller

Propulsion Subsystem Sim

Effectors Subsystem Sim (e.g., VB, Fins, thrusters)

Support subsystems

Mission & Vehicle Control Computer

Navigation

Wireless Ethernet Comms

Energy Subsystem Sim

External
Test & Support Equipment, External Vehicle Sim, Comms, Mission Planning

Payload (1)

Payload (2) Sim

Sensor/Comms

Sensor Sim

Note: Minimal interfaces between sections will facilitate hardware modularity

Key:

- Discrete I/O, Serial, analog, digital
- Vehicle Component
- Simulated Subsystem (hardware or software)
- 100 base T Data Network
- Main Power Bus
- Conditioned Power lines, specific voltages needed for subsystems, payloads

Note: Support subsystems will be in each section, but will vary between modules. Examples are leak detectors, pressure sensors, pingers, etc.

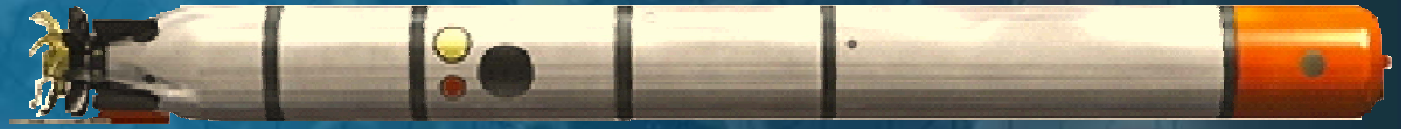
NAVSEA
WARFARE CENTERS
NEWPORT

Creative use of Existing Navy Assets: ASW Targets

Partners: EMATT -Sippican Inc.
Mk 30 Mod 2-TBD
Sponsor: PMS404

- Provided 1073 training events with Mk 39 EMATT for FY 04

- Provided 314 training events in support of 446 customers with Mk 30 Mod 1 for FY 04



- Received IOC approval letter for Mk 30 Mod 2

  -Production Contract Awarded (FY05)

Targets as UUV Mission Enablers?

NAVSEA WARFARE CENTERS NEWPORT

*Expendable Mobile ASW Training Target (*EMATT)

- State of the Art Electronic Suite
- Dynamics
  - Submarine Realistic Turn Rates
  -Run Speeds: 3-8 Knots
- Autonomous Evasion(AE)
  - AE Cued by Torpedoes, Sonobuoys, Dipper, & Surface Ship
- Range Tracking Pinger Function
  - Addition of Mk 84 Long Ping Format for Shallow Water