VA/AR Systems In Shipbuilding

**ARgos** Project Proposal

“And set a watcher upon her, great and strong Argos, who with four eyes looks every way.”

*From the Greek Poem: Aegimius by Hesiod*

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On a Submarine or Ship there are 1000’s of cable runs, that are done toward the end of manufacturing.

Complexity of the Cable Runs Provides a Huge Challenge:
- Reachability
- Visibility
- Cable Travel
- Structural Changes

Labor Intensive = Expensive
Solution = ARgos

• Provide a collaborative environment of Augment Reality On The Shop Floor, and...

• Provide a connection to a Virtual Environment for Engineering
CAD Agnostic: Can read major CAD systems directly from the Shipyards

Provide A Distributed Environment To Promote Collaboration

Minimize Work and Rework.

Efficiently train workforce.
  - Manufacturing
  - Engineers
ARgos – Goals

- Reduce the cost to install cables aboard ships
  - Using proven VR/AR software advances w/existing hardware
  - Interactive Physics-based simulation of cable pulling
  - Immersive display, large scale and small scale
  - Generate a first-time quality build plan
ARgos – Goals

• Improve the cable installation process
  – AR tools for the installer to see Virtual CAD embedded in Real-World
  – Documented and pre-tested build plan
  – Optimized process and realistic training
• Mitigate the knowledge retention problem
  – Simulated, realistic hands-on cable installation
  – Improve training for new installers
  – Improve design and planning expertise
  – Capture process, principles, and practice
• Test/Demonstrate the tools and methodology
  – Full-scale prototype using a submarine module
  – End to end exercise of capabilities
    • Designers develop initial build plan in VR
    • Train new installers in VR
    • Enhance installation process with AR
    • Capture lessons learned, improve process
    • Collaboration between installers and designers, AR/VR
ARgos – Project Schedule/Milestones

**Phase 1**

- **Task 1:** VR Design For Production Scenario
  - Demonstration of ESI Integration Into Shipyard’s Product Model

- **Task 2:** Knowledge Retention & VR Training
  - Demonstrate Optimized Cable Routing Visualization via HDM’s
  - Disseminate Results to Industry via Panel Meetings

- **Task 3:** Hands On AR Cable Installation
  - Demonstrate Enhanced AR Capabilities & Phase 1 Final Report

- **Task 4:** Demonstration, Proof Of Concept – AR/VR
  - Demonstrate Enhanced AR/VR Capabilities & Phase 2 Final Report

**Phase 2**

- **Task 1:** VR Design For Production Scenario
  - Demonstration of ESI Integration Into Shipyard’s Product Model

- **Task 2:** Knowledge Retention & VR Training
  - Demonstrate Optimized Cable Routing Visualization via HDM’s
  - Disseminate Results to Industry via Panel Meetings

- **Task 3:** Hands On AR Cable Installation
  - Demonstrate Enhanced AR Capabilities & Phase 1 Final Report

- **Task 4:** Demonstration, Proof Of Concept – AR/VR
  - Demonstrate Enhanced AR/VR Capabilities & Phase 2 Final Report

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ARgos – Business Case

Business Case #1 (Tasks 1 a Cable Lay Build Plan

Business Case #2 (Tasks 3 a Location via AR

Projected savings for OR from ARgos:
- VA (Block I-III) learning curve costs: (160K hours)
- X OR size factor (1.4)
- X 35% reduction $5.9M

Projected E_ROM savings for OR from ARgos AR:
- Location of electrical hangers by name: $450K

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<thead>
<tr>
<th>Project Cost</th>
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<tbody>
<tr>
<td>Program Funding</td>
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<td>Cost Share</td>
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<td>Total Project Cost</td>
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Implementation Cost Estimate (Labor, material, training, etc.)
- Project Team Shipyard $75,000
- Other shipyards $100,000

E_ROM Reduction Forecast
- Cost Category
  - 35% reduction installation reduction/ship $16,800,000 $5,900,000
  - 1% reduction hanger installation reduction/ship $45,000,000 $450,000
- Total cost reduction $6,350,000
ESI VIRTUAL PRODUCT ENGINEERING

COLLABORATE

- virtual integration platform
- multiphysics
- electromagnetics
- fluid dynamics
- vibro-acoustics
- crash impact & safety
- biomechanics
- comfort
- virtual reality

VIRTUAL REALITY

CONTROL

- systems modeling
- welding & assembly
- NVH & dynamics

EXPERIENCE

casting
sheet metal forming
composites