Portable High-Energy Semiconductor Diode Lasers for Interior Ship Coating Removal

(N03-105 Technology for Shipbuilding Affordability)

ONR Small Business Innovation Research Program

Update June 14, 2006 NSRP SP-3

Norfolk, VA

Presented by:

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LANCORP ASI

Phase II Participants

LANCORP Advanced Systems Inc

Penn State Applied Research Lab

General Dynamics Marine Systems

Northrop Grumman Shipbuilding

Dawson-MacDonald Co

The Sherwin-Williams Company

Indirect – Providing additional testing input: NNSY, PNSY & NSRP members

ONR Phase II SBIR - Portable Solid State Diode Laser Systems for Surface Preparation

Challenge: To create an affordable portable high power laser system to remove coatings from all types of surfaces for spot stripping: must be user friendly, efficient, and easy to maintain.

SOLUTION: Our approach has been to focus on solid state diode laser technology, which allows for versatility of surface preparation and surface enhancement, and fiber fed at 1000 Watts.

System Description

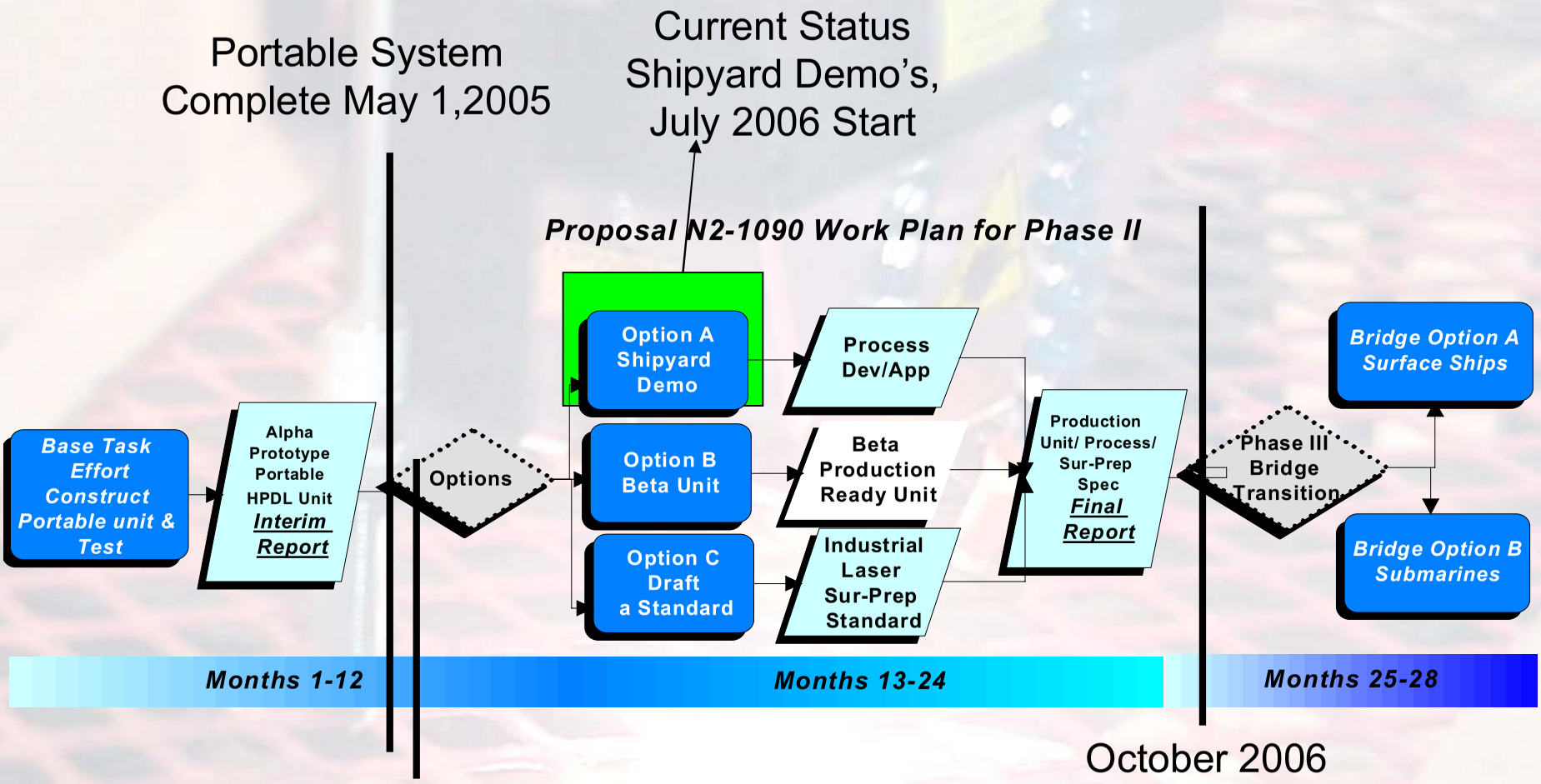
- Weight Laser unit est. 400 lbs
  - Chiller 300 lbs
  - Workhead – 7lbs
- Power 208V-3 Phase (also 480V 3 phase)
- Dimensions 55”lx55h”x28”w
- Reach – 100 Feet from unit
- Mobility :Casters, 4 Lifting Eyes, 4 Retractable handles
- Rate: 100-200 sqft/hr/mil
- Integral vacuum

Technology Description

The operator controls the laser power and traverse speed as the work-head is manually manipulated across surfaces to vaporize coatings.

A variety of work-heads allow for the beam to be contained and the effluent captured while giving the operator maximum reach for getting behind objects or covering flat areas.

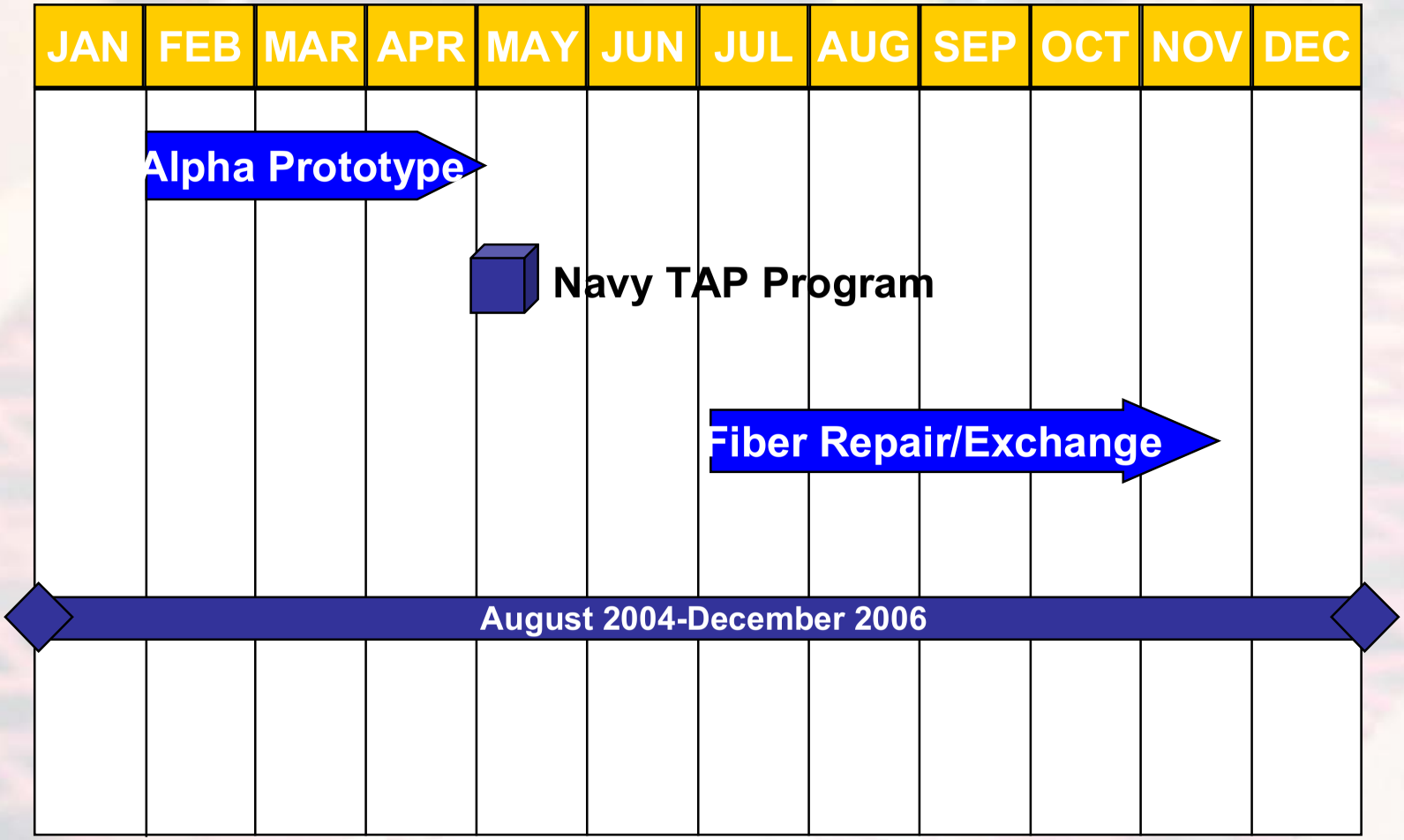
Phase II Development Timeline



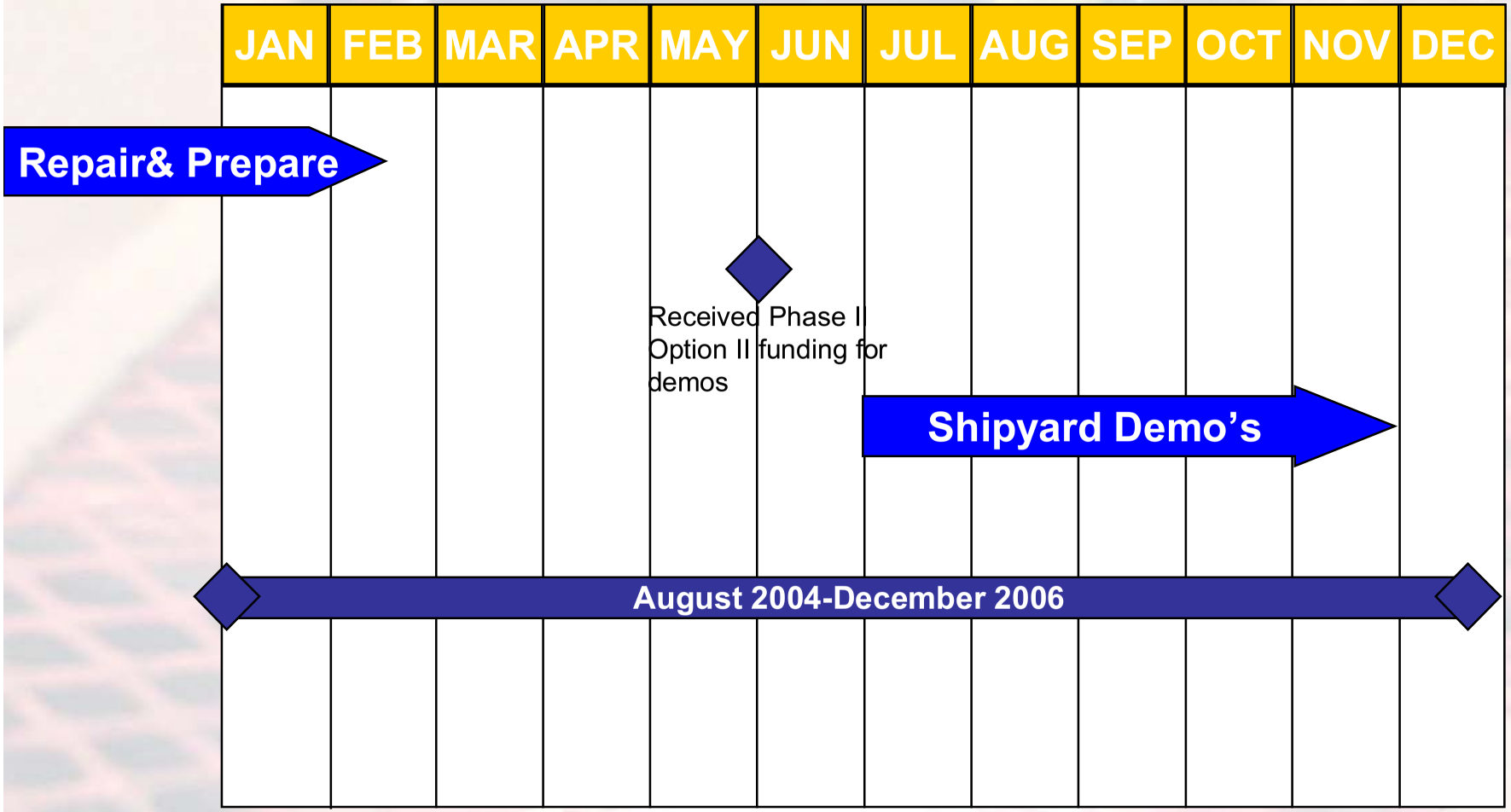
June, Fiber damaged (warranty issue) *Fiber sent back for repair after evaluation* ***Delays field testing***

Note: After system checked-out, fiber sent to Optoskand in Sweden, July-August they were on vacation – received fiber back end of November.

Project Update-Timeline 2005



Project Update-Timeline 2006



Technology Development Milestones

Milestones	TRL (more)1 to 9(lesss)	Risk-Test	Measure of Success	Date
Feasibility testing (removal @1000 W)	3	Remove Standard Navy Coatings	Rates of 100 ft2/mil achieved	Phase I Nov 2003
Environmental Testing (gas/solid)	4	Effluent tests Off gas, Solids	No apparent hazard detected	Phase I Oct-Dec 2003
Construct Prototype 1KW fiber coupled laser, portable and manual operation	5	Phase II Alpha Prototype	Rates improved over Phase I, Portable system. Functional for field tests	May 2005
Shipyard Tests	7	Functionality	Meets shipyard criteria for production	July 2006 -Oct 2006
Navy Transition	8	Safety, ease of use & production rates	Shipyard worker & sailor acceptance	Oct-2006 – >>>>

Tentative Demonstration Sites

- Norfolk Naval Shipyard
  - Preservation Shop
- Bath Iron Works
  - Test Shop
- Dawson-MacDonald Company
  - Wilmington MA, central to NE shipyards
- Tentative- SE shipyards TBD
- Additional sites
  - Lockheed Martin, Cape Canaveral FL for Navy Strategic Systems program

Costs

- Estimated System Cost
  - 1000 Watt ~ $300,000 - 350,000
  - 500 Watt ~ $150,000 – 160,000
- Operating Costs ~ estimated <$5/hr
- Annual Operating Expenses ~ $3-$4,000
  - SCUBA Air: used to purge laser diode cavity, provide a dry atmosphere est $1,500
  - Vacuum Filters est $2,000

Benefits

- **Minimal waste – Reduced >90%**
- **No abrasives, chemicals, solvents, or masking**
- **Multi-Surface Compatible**
- **Fast Removal – and Quiet <80dB**
- **Leaves the Surface Clean,**
  - **No Chlorides**
  - **Converts corrosion**
- **Surface Profile is Left in Tact**
- **Labor saving over present methods**
  - **No prep/no cleanup**

Removes:

- Polyurethanes
- Epoxies
- Enamels
- Alkyds
- Powdercoats
- Urethanes

From:

- Composites
- Fiberglass
- Metals
- Stone
- Wood

EH&S

- The filtered effluent from the vaporized coating is clean (vaporized coating captured at surface)
- Beam Wavelength 808nm
  - Requires eye protection for everyone in the work area.
- Noise- Below 80db
- Heat – minimal, beam spread out and pulsed for surface prep.
- Will be addressed in site testing

Applicable Surface Prep Standards

- Currently a standard does not exist
- Phase II Option 3 is for PSU-ARL to work on establishing a surface cleanliness standard for laser surface prep.
  - Initially for steel and aluminum
  - Composites & fiberglass would require physical testing
    - Eg, Fatigue testing (edgewise tension)

Contact Information

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