A FUTURE NAVAL CAPABILITY

Total Ownership Cost Reduction

The most capable and elegant systems imaginable do us no good if we can't afford to purchase and operate them. But the cost of buying and maintaining them continues to rise. We must reduce life-cycle costs while preserving—and improving—capabilities and performance.

Why is this Future Naval Capability important? Our goal is to reduce—significantly—the cost of acquisition, operation, and support by accurately identifying and predicting those costs and mitigating them at the source.

What's our investment strategy? In developing our core investment program, the Total Ownership Cost Reduction FNC IPT focused on identifying and filling capability gaps, making commitments to funded acquisition programs, and designing a strategy that would provide the wherewithal to execute the program. Three enabling capabilities will get us there:

- ***First priority.*** We need to reduce maintenance and cost of ownership.
- ***Second priority.*** We need advanced materials, designs, and manufacturing processes that will reduce acquisition and lifecycle costs.
- ***Third priority.*** We need better cost estimating tools: predictive models that will help us determine how we can insert new technologies and processes that will lower costs.

How are we filling the gaps in those enabling capabilities? Each enabling capability has milestones and transition opportunities.

First priority: Reduce maintenance and cost of ownership.

- ***In FY 2002-2004:*** Long-life modular hybrid pier.
- ***In FY 2002-2003:*** Total Oil Monitoring System (TOMS) and supporting wireless data transfer capability for continuous, *in-situ* assessment of lubricant health and contamination.
- ***In FY 2002-2005:*** Wireless, distributed sensor and processor system to diagnose and predict mission-critical mechanical faults onboard complex weapons systems.
- ***In FY 2002-2004:*** Smart aircraft wiring systems for fault diagnosis and isolation.
- ***In FY 2002-2006:*** Circuit breakers resistant to electrical malfunctions to prevent fires caused by arcing faults.
- ***In FY 2002-2006:*** Edge-wrapping , corrosion-resistant coatings for various holding ship tanks.
- ***In FY 2002-2007:*** Enhanced performance rotor blades with individual shape memory actuator systems for increased aircraft payload, range and fuel efficiency.
- ***In FY 2002-2007:*** Airframe life assessment models—arresting shank, LEF hinge, dorsal longeron, secondary components, and Y488 bulkhead.
- ***In FY 2002-2005:*** Corrosion-avoiding wash-down systems for USMC vehicles.
- ***In FY 2004-2006:*** Non-destructive evaluation for concrete airfields, bollards, and pier decks. High-strength, low-density concrete and high fly ash concrete for naval facilities and structures.
- ***In FY 2002-2007:*** Understanding corrosion resistance of alloys for USMC vehicles. Advanced performance coatings for airframes. Corrosion prevention compounds for aircraft. Electro-chemical and resistance sensors for airframe corrosion monitoring. Pulse thermography, ultrasonic imaging, laser-pumped fluorescence, and sonic thermography for airframe corrosion detection.
- ***In FY 2006-2007:*** Sea-born ship and submarine propulsion shaft NDE based on ultrasonic guided wave technology

that will significantly reduce the incidence of dry-docking.

Transition opportunities:

· Specifications and maintenance manual changes for airframe corrosion resistance—transition to OPNAV N881 and NAVAIR 4.1D in FY 04-FY 07.

· Smart wires-first transition platform: P-3 in FY 04.

· Diagnostics and prognostics- first transition platform: Advanced Amphibious Assault Vehicle (AAAV) in FY 04 and FY 06.

· Diagnostic capabilities and specifications for facilities and structures—transition to NAVFAC Codes 15C/D in FY 05-FY 07.

· Arc fault circuit breakers-first transition platforms: F/A-18 and EA-6B in FY 06.

· Corrosion-resistant ship holding tanks—transition to NAVSEA 05M from FY 04 through FY07.

· Corrosion-resistant washdown, coating system and road test method—transition to MARCOMSYSCOM Combat Support and Logistics Equipment from FY 05 through FY 07.

· Rotor blades with embedded shape memory actuator technology-first transition platform: V-22 in FY 07.

· Propulsion shaft NDE- transition to NAVSEA 05M in FY 07.

Second Priority: Develop advanced materials, designs, and manufacturing processes to reduce acquisition costs.

· ***In FY 2002-2007:***

· Advanced compression systems for turbine engines—two-stage fan, moderate aspect ratio fan, reduced cost rotors, high-cycle fatigue reduction, and advanced materials (for operability, foreign object damage tolerance, stage-loading, and fatigue tolerance).

· Advanced combustion systems for turbine engines—light weight high temperature rise, high fuel/air ratio, low emissions, ceramic matrix composite (high temperature, low pattern factor, durability, operability).

"We need to find means of making advanced technology work better in the dirt and wet and knocking about that are a part of duty in the field and at sea and in the air. Similarly, because our equipment and weapon systems are high tech and required to be precise in their performance, we have to ensure that our maintenance efforts are equally high tech and precise."
—General James L. Jones, Commandant of the Marine Corps

· Advanced turbine systems—advanced damping, ceramic matrix vanes, ceramic matrix barrier, tilted airfoils, high cycle fatigue reduction, next generation disk (high temperature, cooling effectiveness, affordability, and aerothermal response).

· Control systems and engine health management—integrated health management, life-extending control, reduced sensor load diagnostics, disk crack detection, smart control, light weight heat exchanger (prognostics, diagnostics, cost, weight, and operability).

· Mechanical systems for advanced turbine engines—film riding seal, high DN bearings, robust bearings, advanced design concepts, metal matrix composite reinforced thrust, robust seals (long-life corrosion resistant materials, wear, stability, and high temperature).

Transition opportunities:

· Turbine engine compression, combustion, turbine, control and health management , and mechanical systems for future and legacy aircraft—transitioned to F/A-18, H-60 and Joint Strike Fighter following successful engine demonstrations in FY 02, FY 03, FY 05 and FY 07.

Third priority: develop better cost estimating tools.

In FY 2004-2007: Cost Predictive Tools—generic cost analysis methods that address manufacturing processes and system-level cost models to support design-cost trade-offs for airframes, airframe subsystems, and propulsion.

Transition opportunities:

· Validated cost predictive models—transition to F/A-18E/F, V-22, Joint Strike Fighter, in FY 05-FY 07.

What's some of the sustaining discovery and invention science and technology? Exploitation and delivery depend upon discovery and invention. In ONR's vertically integrated program, we will continue to exploit basic work that proves relevant to total ownership cost reduction.

· ***Sustainment*** investigations into corrosion control, diagnostics and prognostics, automated decision-making tools, and expert agents will help reduce total ownership costs.

· ***Materials and structures*** comprise a research area that yields cost-effective materials and processes for affordable, robust, reliable components.

· ***Electronic materials and devices*** will be relevant to the advanced sensors required for diagnostics and prognostics.

· ***Industrial programs*** play an important role in developing manufacturing processes for increased affordability.