

Marine Diesel Engine Market, Emissions, Needs and Opportunities

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Naval Sea Systems Command



Propulsion and Electrical Service Applications





Topics

- Marine Diesel Market
- Navy Applications and Needs
- Navy/DOD R&D funding opportunities
- The EPA voluntary retrofit program and Navy Marine Vessels

"Our marine transportation system is the lifeline that links American producers, farmers and manufacturers to global markets"

Secretary Slater, Department of Transportation.



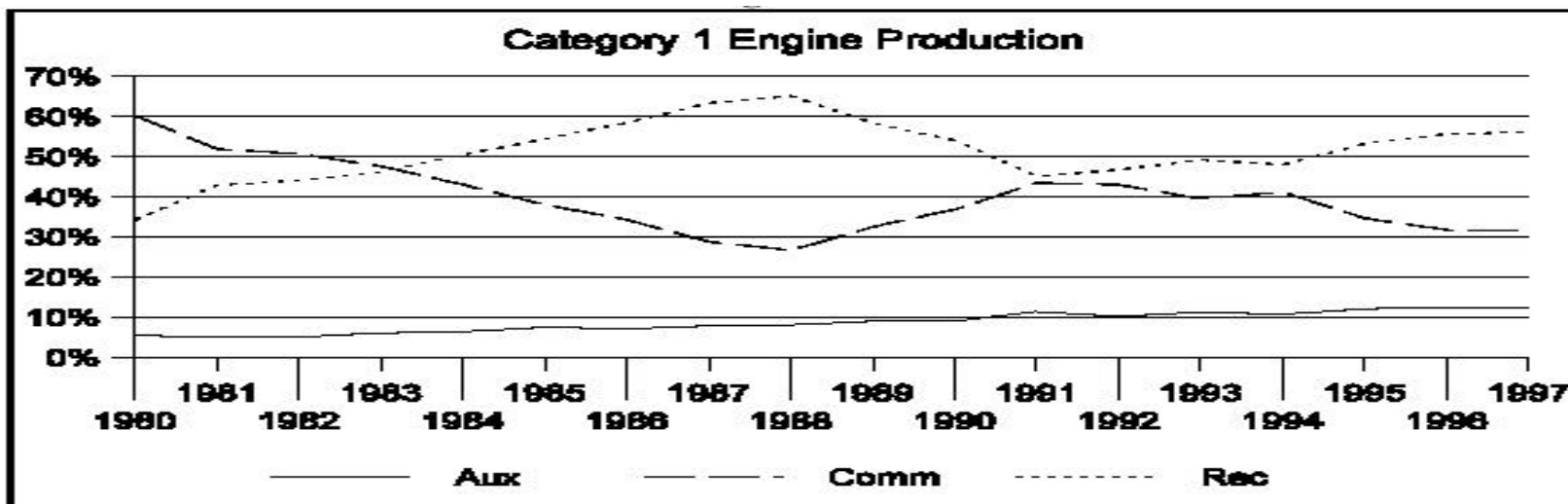
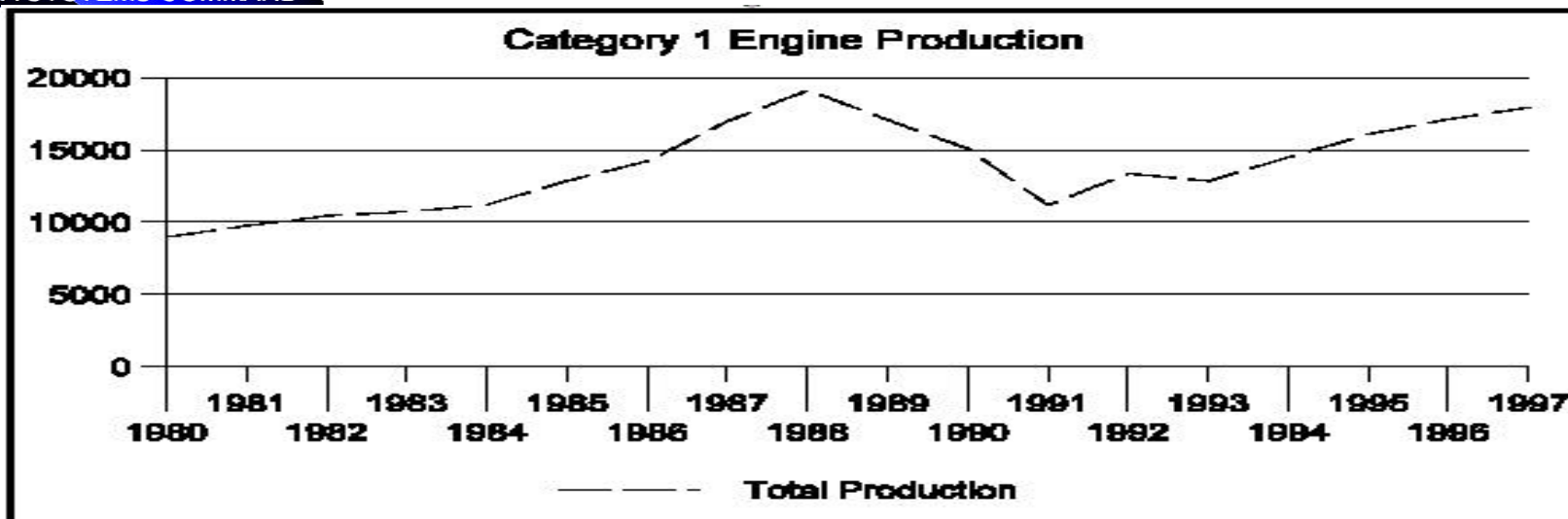
"Large ships contribute at least 14 percent of all nitrogen emissions in the world"

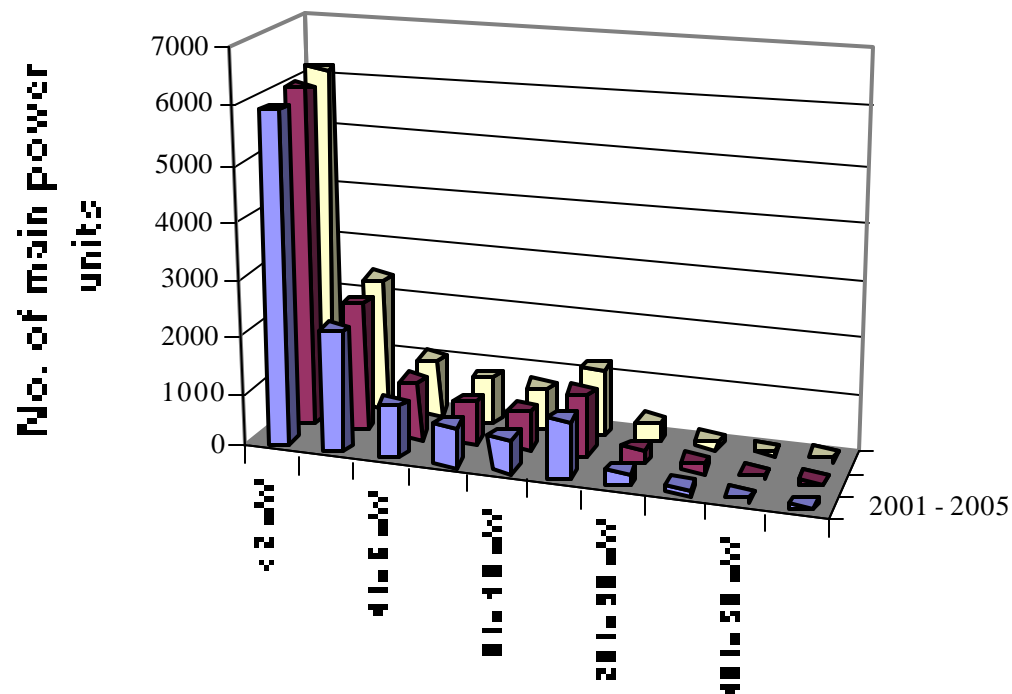


"One large ocean vessel, such as this cargo ship in San Francisco Bay, spews more pollutants than 2,000 diesel trucks according [to] a Bluewater Network report"

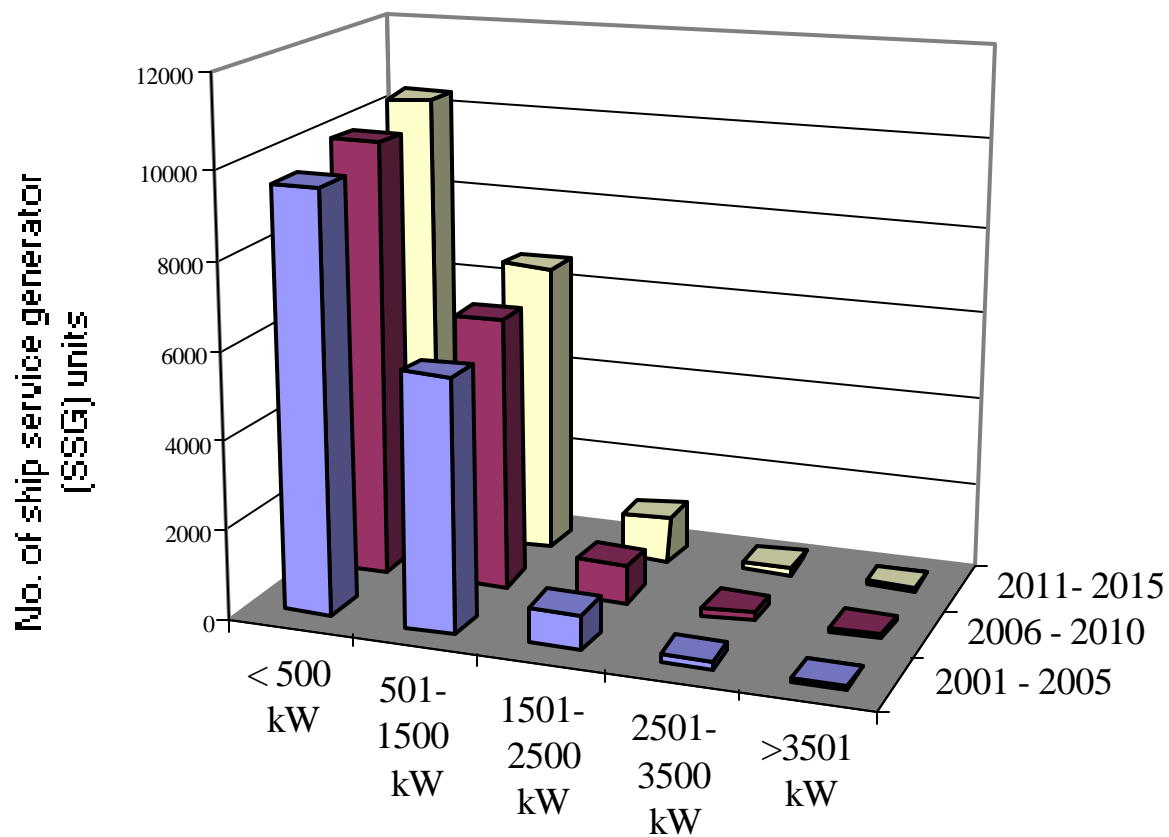
US Marine Diesel Engine Production

(Ref EPA Regulatory Impact Analyses)

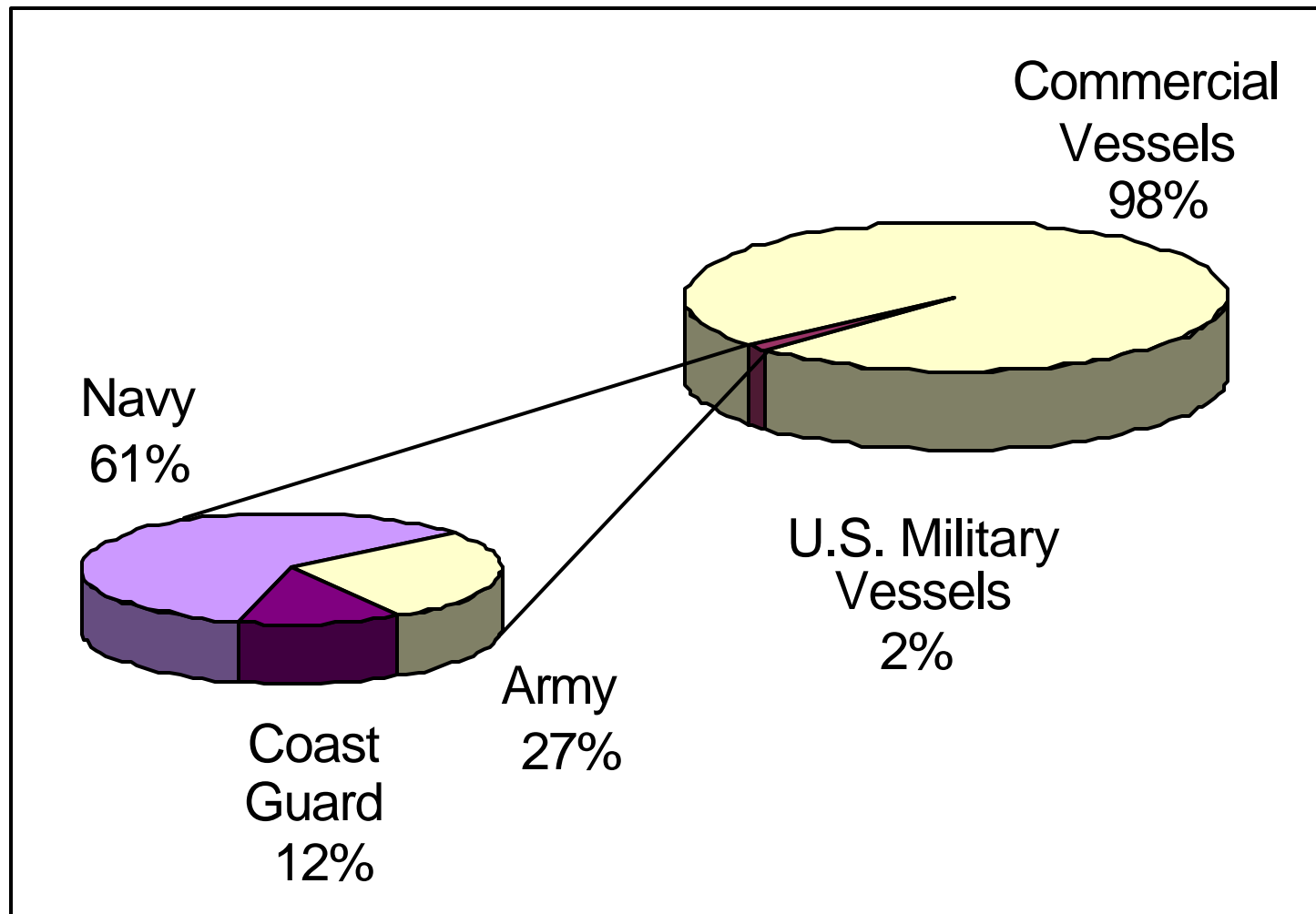




Main Power Unit Forecast -- ALL VESSEL TYPES



SSG Forecast -- ALL VESSEL TYPES



World Commercial Fleet Compared To U.S. Military Vessels

Low Power Density &
Specific Power



High Manning and Operating Cost

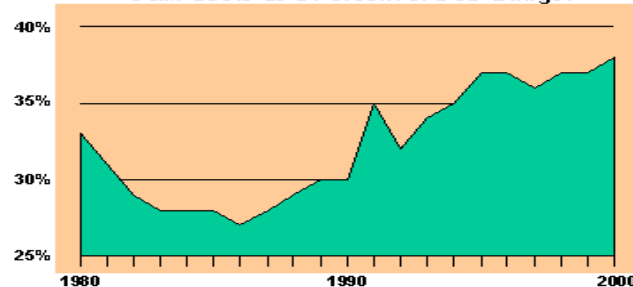


Poor Fuel Economy

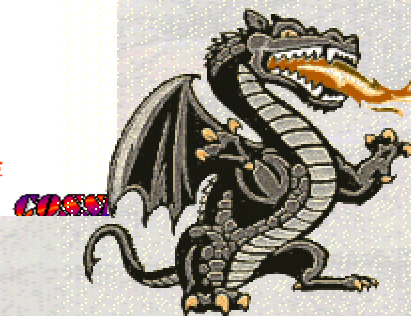


O&M COSTS

O&M Costs as a Percent of DoD Budget



USD(AT&L) Goal: Reduce logistics support costs by 20% by 2005



Pollution



Declining R&D Budgets

Shock and Vibration

NEAR TERM SHIP PERFORMANCE SPECS

- Nominal 30 Knot transit speed
- Chemical Projectiles
- DFM, F76, MGO Fuels
- Crew with less than 100 men
- Integrated Power System
- Intelligent Controls and Sensors
- Limited Stealth
- Low Life Cycle Cost

POSSIBLE FUTURE SHIP PERFORMANCE SPECS

- Greater than 30 Knot transit speeds
- Laser and Particle Beam Weapons
- Smart Missiles
- Multi-fuel capability
- Integrated Power System
- Autonomous Controls & Robotics
- Air Independent
- Unmanned
- Stealth (emissions, signatures,etc)
- Extended time on station
- Low Life Cycle Cost

NEAR TERM POWER TECHNOLOGIES

- Advance Gas Turbines
- Advance Diesels
- Fuel Cell
- Hybrid Fuel Cell & Turbines
- Hybrid Fuel Cell & Thermoelectrics

FAR TERM POWER TECHNOLOGIES

- Closed Cycle Gas Turbines
- Nuclear Turbines
- Fusion Plasma Generators

Technologies on the Round Table



Why Sponsor Commercial R&D!

- To better leverage commercial products and research and development and thus drive down system costs without compromising capability.
- To maintain advanced capabilities, control costs, reduce cycle time, and implement mechanisms to mitigate technological obsolescence.
- Commercial industry, particularly small and mid-sized companies, will have an opportunity to tap into the Naval R&D marketplace.



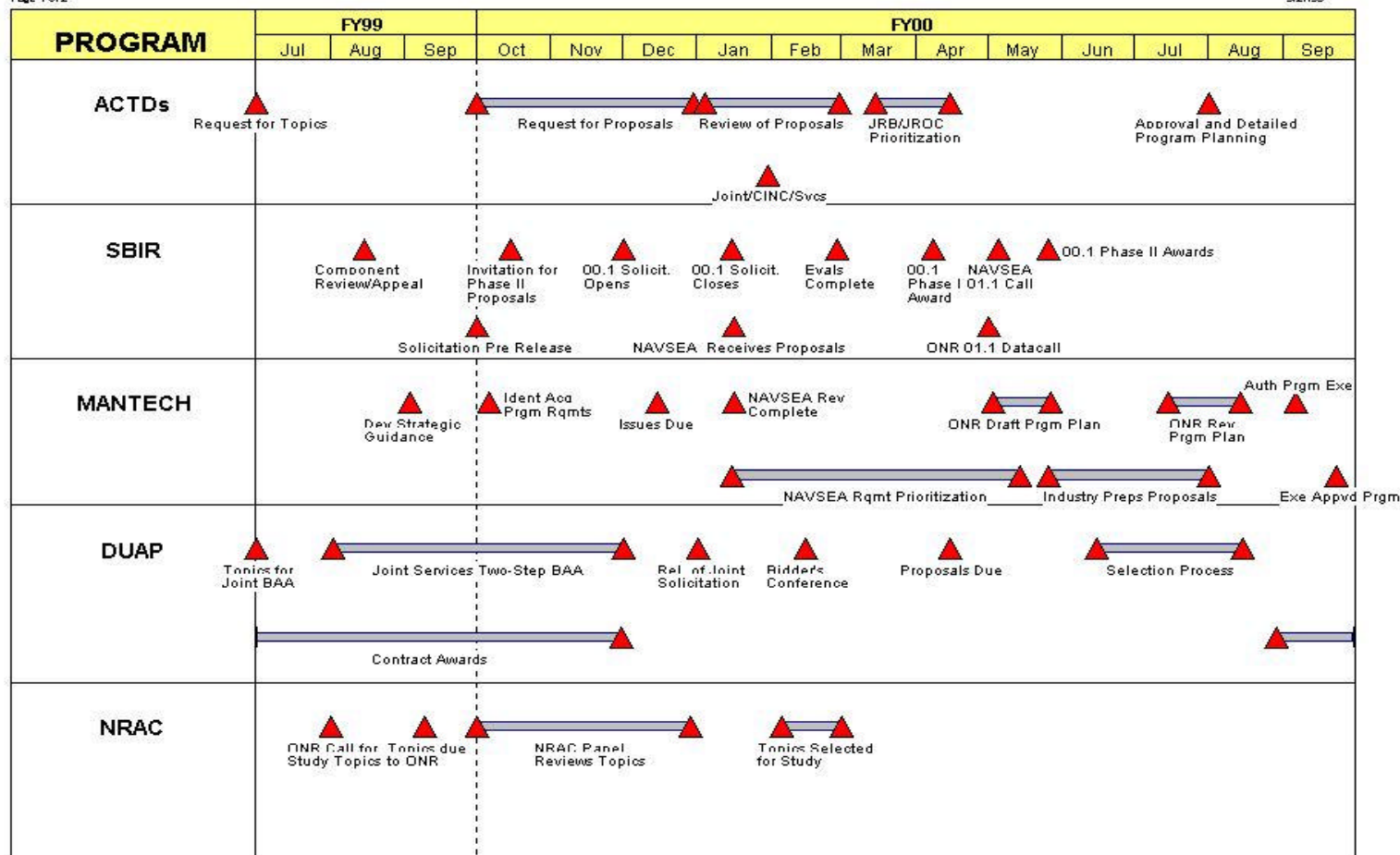
KEYS TO LEVERAGING

- Early communication between the developer of technology and customers in Acquisition Program
- Establish connectivity between Topics and Acquisition Program Needs
- Plan and Execute Program

S&T Program Participation / Influence

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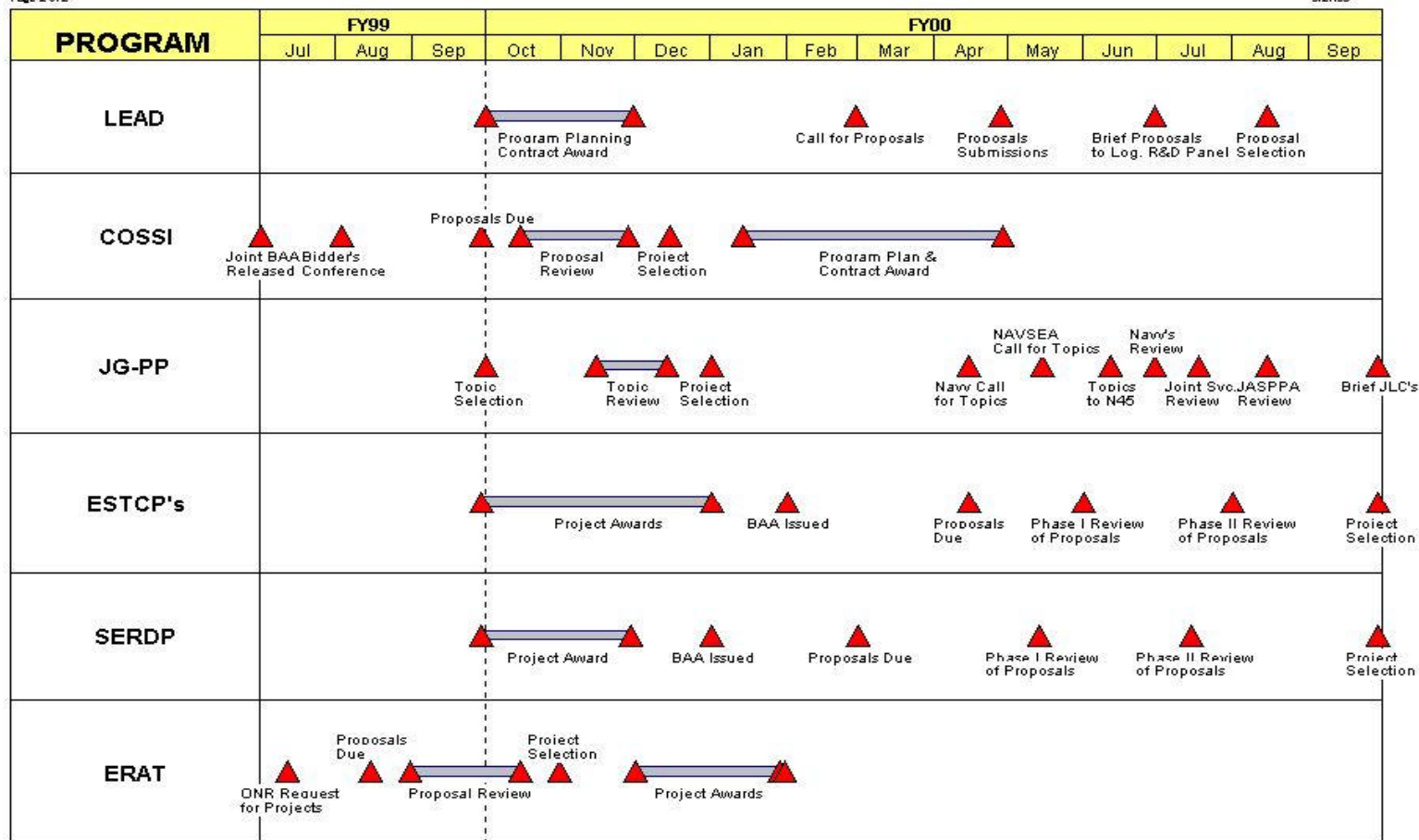
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S&T Program Participation / Influence

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Small Business Innovative Research (SBIR)

Purpose: The Federal SBIR Program is mandated by Public Laws PL 97-219, PL 99-443, and PL 102-564.

Objective:

- stimulating technological innovation, strengthening the role of small business in meeting DoD R&D needs,
- fostering and encouraging participation by minority and disadvantaged persons in technological innovation, and
- increasing the commercial application of DoD-supported research and R&D results.

Typical Project Funding: Up to \$100K.

Selection Criteria: 500 Employees, No Revenue Limit



Small Business Technology Transfer

Purpose: The purpose of STTR is to create, for the first time, an effective vehicle for moving ideas from our nation's research institutions to the market, where they can benefit both private sector and military customers.

Objective: STTR is similar in structure to SBIR but funds cooperative R&D projects involving a small business and a research institution (i.e., university, federally-funded R&D center, or nonprofit research institution)

Typical Project Funding: The STTR Program provides up to \$600,000 in early-stage R&D funding directly to small companies. DoD's STTR program, funded at \$31 million in fiscal year 2000, is part of a larger (\$62 million) federal STTR program administered by five federal agencies.

Selection Criteria: (DoD's next STTR solicitation will be publicly released on January 2, 2001)



Fast Track

Purpose: Provides a significantly higher chance of SBIR/STTR award, and continuous funding, to small companies that can attract outside investors.

Objective: Process for SBIR/STTR projects that attract outside investors who will match phase II funding, in cash, contingent on the project's selection for phase II award.

Typical Project Funding: Receive interim funding of \$30,000 to \$50,000 between phases I and II; Offers an opportunity to obtain a match of between \$1 and \$4 in DoD SBIR/STTR funds for every \$1 the investor puts in.

Selection Criteria: Be evaluated for phase II award under a separate, expedited process; and Be selected for phase II award provided they meet or exceed a threshold of "technically sufficient" and have substantially met their phase I technical goals.



COMMERCIAL OPERATIONS AND SUPPORT SAVINGS INITIATIVE (COSSI) PROGRAM

Purpose: To leverage private sector research and development by inserting leading edge commercial technologies into fielded military systems to reduce operations and support costs.

COSSI is a two stage process. In Stage I COSSI funds the non recurring engineering, testing and qualification that is typically needed to adapt a commercial item for use in a military system. If Stage I is successful, the military customer can buy production quantities of the prototype in Stage II using procurement or operations and maintenance funds.

Typical Project Funding: The funding available for COSSI projects depends on Congressional appropriations. \$52 million has been requested for FY 2001.

Selection Criteria: Military customer support letter and cost sharing.



Manufacturing Technology (MANTECH)

Purpose: to significantly improve the affordability of Navy systems by engaging in manufacturing initiatives that address the entire weapon system life cycle.

Objective:

- (1) Reduce the risk and cycle time associated with the transition from R&D to full scale production by developing and implementing advanced manufacturing processes and equipment.
- (2) Extend the life of current Navy systems by providing manufacturing technologies to support the maintenance, repair and overhaul of these systems.
- (3) Strengthen the industrial base by providing maximum dissemination of the results of all MANTECH projects and the best manufacturing practices of government and commercial facilities.



Advance Concept Technolgoey Demonstrations

*ACTD MUST MEET URGENT MILITARY NEEDS

*TECHNOLOGY SHOULD BE SUFFICIENTLY MATURE

*PROGRAM SHOULD SIGNIFICANTLY INCREASE MILITARY
CAPABILITY

*PROGRAM SHOULD BE AFFORDABLE

*USER SHOULD BE INTIMATELY INVOLVED

*TIME FRAME: TYPICALLY 2-4 YEARS FROM APPROVAL TO
COMPLETION

*PROGRAM PLAN SHOULD ADDRESS ALL ESSENTIAL ASPECTS

*RISH SHOULD BE IDENTIFIED, UNDERSTOOD AND ACCEPTED

*ADEQUATE FUNDING SHOULD BE BUDGETED TO COMPLETE
DEMO

*COST EFFECTIVE DEMOS SHOULD FOCUS ON PRINCIPLE
ISSUES

*FUNDING SHOULD SUPPORT 2-YEARS IN THE FIELD

*LEAVE BEHIND/RESIDUAL ASSETS



Department Research Initiatives (DRIs)

Department Research Initiatives (DRIs) are vehicles for logical, visible introduction of new ideas responding to emerging S&T opportunities within and across the Navy. DRIs are nominally five years in duration, based on proposals from within the Office of Naval Research.



Dual-Use S&T

Purpose: Enable the Services to leverage commercial Research and Development (R&D) to improve the cost and performance of military systems and to insert commercial products and processes into fielded military systems to decrease operations and support (O&S) costs. The DUAP, is a Joint Service and industry program to prototype and demonstrate new approaches for leveraging commercial research, technology, products, and processes into military systems.

Program Benefits

- Leveraging of scarce Science and Technology (S&T) funding
- Beneficial partnerships between the Services, Industry, Defense Laboratories and universities
- Access to Advanced Technology through these partnerships
- Potential for Transition of technologies into defense systems

Program Requirements: Cost Sharing



WEB Pages

- <http://www.acq.osd.mil/sadbu/sbir/>
- <http://www.navysbir.brtrc.com/onr.html>
- <http://www.navysbir.brtrc.com/navsea.htm>
- <http://sbir.navair.navy.mil/>
- <http://www.marcorsyscom.usmc.mil>
- [http://agena.spawar.navy.mil/PubInfo.nsf/\\$defaultview/ADC509530ABB8A46882567A10077CD1C/\\$File/spawar_00k_info.htm#sbir](http://agena.spawar.navy.mil/PubInfo.nsf/$defaultview/ADC509530ABB8A46882567A10077CD1C/$File/spawar_00k_info.htm#sbir)
- <http://mantech.bmpcoe.org/>
- <http://mantech.iitri.com/>
- <http://mtiac.iitri.com/>
- <http://www.bmpcoe.org/>
- <http://mantech.bmpcoe.org/centers/>
- <http://www.acq.osd.mil/es/dut/>



EPA Voluntary Retrofit Impacts

Program Description

FUNDAMENTALS

- **Announcement:** 22 Mar 00
- **Goal:** secure commitments in 2000 to improve emissions from 10,000 existing engines by end of 2001
- **Focus:** 3 - 4 urban areas (population \geq 750,000)
- **Compelling rationale:** existing engines with life spans of 20 - 30 years will continue to emit greatest portion of diesel exhaust constituents of concern well beyond 2004 -- deadline for next set of regulations incorporating most significant proportional reductions in diesel emissions



EPA Voluntary Retrofit Impacts

Program Description

JUSTIFICATION

- **Primary need:** more rapid reduction of emissions in large urban populations where air is most polluted
- **Diesel exhaust produces:** >20% of NO_x, >15% of PM in U.S.
- **Growing concern:** health effects of diesel exhaust exposure
- **Potential emissions reduction:** 20 - 80%, dependant on retrofit technology
- **Projected benefit:** 700 TPY NO_x, 100 TPY PM, 500 TPY HC
- **Urban bus retrofit program success:** 15,000 buses retrofitted



EPA Voluntary Retrofit Impacts Program Description

RETROFIT TECHNOLOGY CERTIFICATION

- **Review panel:** reps. from industry, academia, and Government
- **Material reviewed:** design specs., operating mechanism, test results, and field results
- **Preferred material:** Federal test cycle results from testing conducted at one or more certified laboratories
- **Affirmative certification:** listed on EPA web site as such and available for selection -- approved engine models only-- on EPA's emissions calculator



EPA Voluntary Retrofit Impacts Program Description

Proportional Navy Involvement in Voluntary Retrofits

- **Number of engines to consider:** 10 engines (0.1% of 10,000)
- **Potential urban area with large Navy presence:**
 - West coast: San Diego and Seattle
 - East coast: Norfolk and Mayport
- **Rate and down-select potential technologies:**
 - Cost-effectiveness
 - Reliability, availability, maintainability, durability (RAMD)



EPA Voluntary Retrofit Impacts

Specific Impacts

- **Opportunity for Navy participation:**
 - Incentive for Navy facility/activity to investigate involvement in program as part of emissions reduction strategy
 - Potential to increase emissions margin within established caps if located near a polluted and/or non-attainment zoned urban area
 - Cooperative effort with local/state governments and industry to reduce regional emissions -- public relations benefits



EPA Voluntary Retrofit Impacts

Applicable Technologies

- **PM, HC, and CO control:**
 - Diesel oxidation catalyst (DOC)
 - Diesel particulate filters (DPF)
 - Enhanced combustion modifications
 - Low sulfur diesel fuel or alternative fuels (e.g. fuel-water emulsion)
 - Fuel borne catalysts
- **NO_x control:**
 - Selective catalytic reduction (SCR)
 - Engine modifications after PM control application



EPA Voluntary Retrofit Impacts Installation Considerations

- **Investigate applicable factors of other retrofit programs:**
 - Technologies utilized (specifics of technology [OEM, model], integration/ interface requirements, engine model, and application)
 - Cost
 - Performance and RAMD effects
 - Maintenance
 - Disposal issues
 - Emissions reductions (measurement technique and time since installation)



EPA Voluntary Retrofit Impacts Funding

- **Pilot installation/s:** EPA willingness to fund; details being discussed
 - Controlled laboratory emissions and performance tests
 - Shipboard test
- **Follow-on installations:** Shore activity/user funded; interest/commitment being solicited
 - Monitoring engine emissions, performance, and RAMD
 - Identification of retrofit technology maintenance and disposal issues



ADVANCE NOTICE:

Marine Vessel & Air Quality Conference

January 2001 Timeframe

San Francisco Bay Area

Sponsored by Maritime Industry and EPA



Marine Engine Exhaust Emissions POCs

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