1. Curriculum Number: 570
2. Curriculum taught at NPS
3. Students are Fully Funded
4. Curriculum Length in Months: 24
5. Months the program starts: January, June
6. APC Required: 323
7. Community Managers have agreed to allow billets to be coded for Naval Mechanical Engineering 570 and Officers to be educated for this curriculum.

<table>
<thead>
<tr>
<th>Designator</th>
<th>Officer Community Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 1110</td>
<td>Surface</td>
</tr>
<tr>
<td>b. 1120</td>
<td>Submarine</td>
</tr>
<tr>
<td>c. 1440</td>
<td>Engineering Duty</td>
</tr>
</tbody>
</table>

8. The Officer must understand the fundamental concepts and be familiar with the basic functional areas of Mechanical Engineering within the Department of the Navy and the Department of Defense including:

a. THERMODYNAMICS AND HEAT TRANSFER: Fundamentals of thermodynamics and heat transfer with applications to all marine engineering power cycles as well as propulsion and auxiliary system cycle analysis and design.

<table>
<thead>
<tr>
<th>Required Course #</th>
<th>Description</th>
<th>Alternate Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME2101</td>
<td>Thermodynamics (4-1)</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>ME3150</td>
<td>Heat Transfer (4-1)</td>
<td>NU3159</td>
</tr>
<tr>
<td>ME3240</td>
<td>Marine Power and Propulsion (4-2)</td>
<td></td>
</tr>
</tbody>
</table>

b. FLUID MECHANICS: Compressible and incompressible flow, both viscous and inviscid, with emphasis on propellers, cavitation, and design of shipboard fluid systems (e.g., fluid machinery, pumps, turbo machinery).

Enclosure (3)
<table>
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<th>Description</th>
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<tbody>
<tr>
<td>ME2101</td>
<td>Introduction to Fluid Dynamics (3-2)</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>ME3201</td>
<td>Intermediate Fluid Dynamics (3-2)</td>
<td></td>
</tr>
</tbody>
</table>

c. DYNAMICS, CONTROL, NAVIGATION, AND AUTONOMOUS SYSTEMS:
Kinematics and dynamics of particle, rigid-body and multi-body mechanical systems. Modeling and simulation of engineering systems with mechanical, electrical and hydraulic components. Feedback control concepts, both frequency response and time domain, with applications to the design of component, platform, and weapon systems. Control of systems with continuous, discrete and combined logic states. Navigation and control for single and network-centric systems. Design of intelligent systems for machinery monitoring and automation, as well as autonomous vehicle operations.

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<tbody>
<tr>
<td>ME2502</td>
<td>Dynamics (4-1)</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>ME2801</td>
<td>Introduction to Engineering System Dynamics (3-2)</td>
<td></td>
</tr>
<tr>
<td>ME3801</td>
<td>Linear Automatic Controls (3-2)</td>
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<tr>
<td>ME2501</td>
<td>Statics (3-0)</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>ME2601</td>
<td>Solid Mechanics I (3-2)</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>ME3521</td>
<td>Mechanical Vibrations (3-2)</td>
<td></td>
</tr>
<tr>
<td>ME3611</td>
<td>Solid Mechanics II (4-1)</td>
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</tr>
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d. STRUCTURAL MECHANICS AND VIBRATION: Statically determinant and indeterminate structural analysis, stress/strain analysis, buckling and fatigue. Shock and vibration response of marine structures, including surface ships and submarines.

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<tr>
<td>ME3611</td>
<td>Solid Mechanics II (4-1)</td>
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e. MATERIALS AND FABRICATION: Metallurgical processes and transformations; analytical approach to failure of materials in Naval Engineering use and a basic understanding of the materials technology associated with welding or marine
corrosion; an introduction to the developing fields of composites and superconducting materials.

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<tbody>
<tr>
<td>MS2201</td>
<td>Engineering Materials (3-2)</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>MS3202</td>
<td>Failure Analysis and Prevention (3-2)</td>
<td></td>
</tr>
<tr>
<td>MS3304</td>
<td>Corrosion and Marine Environment Degradation (3-2)</td>
<td>MS3606</td>
</tr>
</tbody>
</table>

f. COMPUTERS: A basic understanding of computer system architecture, operating systems, networking and introduction to engineering software design. Practical experience of structured programming languages and the use of integrated design tools for computational and symbolic manipulation. Use and application of mainframe, workstation and personal computers for the solution of Naval engineering design and analysis tasks. Exposure to finite element and finite difference tools and techniques, with application to the thermo-fluid and structural mechanics/dynamics areas, including experience with representative software packages.

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<tbody>
<tr>
<td>EC1010</td>
<td>Matlab (1-1)</td>
<td></td>
</tr>
<tr>
<td>ME3450</td>
<td>Computational Methods in Mechanical Engineering (3-2)</td>
<td></td>
</tr>
<tr>
<td>MA3232</td>
<td>Numerical Methods for PDE (3-2)</td>
<td></td>
</tr>
</tbody>
</table>

g. MATHEMATICS: A basic understanding of statistics, multi-variable and vector calculus, matrix and linear algebra, differential equations, partial differential equations, and numerical methods and their applications in mechanical engineering fields of study.

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<tbody>
<tr>
<td>MA1115</td>
<td>Multi-variable Calculus (4-0)</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>MA1116</td>
<td>Vector Calculus (4-0)</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>MA2043</td>
<td>Introduction to Linear and Matrix Algebra (4-0)</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>MA2121</td>
<td>Differential Equations (4-0)</td>
<td>Undergraduate</td>
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<tr>
<td>MA3132</td>
<td>Partial Differential Equations (4-0)</td>
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<tr>
<td>MA3232</td>
<td>Numerical Methods for PDE (3-2)</td>
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</tr>
<tr>
<td>OS3104</td>
<td>Statistics for Science and Engineering (4-0)</td>
<td>Undergraduate</td>
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</table>

h. **DESIGN/SYNTHESIS:** Design synthesis and introduction to optimization techniques, with emphasis on the design of mechanical subsystems and their integration into the ship system.

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<tbody>
<tr>
<td>MB3711</td>
<td>Design of Machine Elements (4-1)</td>
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</tr>
<tr>
<td>MB3712</td>
<td>Capstone Design Project (1-6)</td>
<td>Undergraduate Design Project</td>
</tr>
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</table>

i. **ELECTRICAL ENGINEERING:** Electromagnetic and circuit theories, dc circuits, steady-state ac circuits, methods of circuit analysis, including Laplace transforms. Exposure to the construction and operating characteristics of rotating machinery, static converters, and power distribution systems and multi-phased circuits.

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<tbody>
<tr>
<td>EC2102</td>
<td>Introduction to Circuit and Power System Analysis (4-2)</td>
<td>Undergraduate TS3000 NU3009</td>
</tr>
</tbody>
</table>

j. **NAVAL ARCHITECTURE:** Fundamentals of naval architecture including the geometry, hydrostatics and hydrodynamics of monohull floating and submerged structures. Wave and skin friction analysis, power requirements of particular designs. Longitudinal and transverse stability of floating and submerged bodies, hull girder strength requirements. Introduction to sea keeping and survivability principles.

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<tbody>
<tr>
<td>TS3001</td>
<td>Fundamental Principles in Naval Architecture (3-2)</td>
<td>Undergraduate</td>
</tr>
</tbody>
</table>
k. **SPECIALIZATION**: Each officer will also acquire technical competence in one or more of the following areas: THERMAL/FLUID SCIENCES, SOLID AND STRUCTURAL MECHANICS, DYNAMICS AND CONTROLS, MATERIAL SCIENCE, OR TOTAL SHIP SYSTEMS ENGINEERING through additional graduate level courses and their associated prerequisites.

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<tr>
<td>ME4XXX</td>
<td>Specialization</td>
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<td></td>
<td>Elective</td>
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<td>ME4XXX</td>
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<tr>
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<td>Elective</td>
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</table>

l. **JOINT AND MARITIME STRATEGIC PLANNING**: American and world military history and joint and maritime planning including the origins and evolution of national and allied strategy; current American and allied military strategies which address the entire spectrum of conflict; the U.S. maritime component of national military strategy; the organizational structure of the U.S. defense establishment; the role of the commanders of unified and specified commands in strategic planning, the process of strategic planning; joint and service doctrine, and the roles and missions of each in meeting national strategy.

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<tr>
<td>NW3230</td>
<td>Strategy and Policy: The American Experience (4-2)</td>
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m. **THESIS**: The graduate will demonstrate the ability to conduct independent analysis, in the area of Naval/Mechanical Engineering and proficiency in presenting the results in writing and orally by means of a thesis and command-oriented briefing appropriate to this curriculum.

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<tbody>
<tr>
<td>ME0810</td>
<td>Thesis Research</td>
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</tbody>
</table>
Approved:

T. J. Eccles

17 May 2012

Date

RADM Thomas J. Eccles,
Chief Engineer and Deputy Commander, Naval Sea Systems Command

Daniel T. Oliver
President, Naval Postgraduate School

Date

Director, Total Force Programming and Manpower Management
OPNAV N15

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