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OAK RIDGE Y-12 PLANT

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Martin Marietta, Y-12 Plant
Laboratory Partnership
Program Plan

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Martin Marietta, Y-12 Plant **Laboratory Partnership** **Program Plan**

I. Background

The Oak Ridge Y-12 Plant is one of three installations in Oak Ridge, Tennessee, managed by Martin Marietta Energy Systems, Inc. (MMES), for the United States Department of Energy (DOE)*. The other installations are the Oak Ridge National Laboratory and the K-25 Site. The Y-12 Plant was constructed as part of the World War II Manhattan Project in 1943. Missions of the Y-12 Plant over the years have evolved and changed with the easing of international military tensions and the resulting drastic reduction of the Y-12 Plant's weapon component production mission in 1992 (now limited to stockpile evaluation and maintenance activities).

Today, our national security requirements extend beyond the basic need for military defense. The United States has been confronted by challenges ranging from foreign manipulation of our energy supplies to the erosion of our strategic industrial base, including our domestic sources of essential defense components. The competition between nations is now increasingly being decided by the ability of each nation to create and apply technological leverage to secure and sustain a competitive advantage. These factors are having a tremendous affect on this nation's balance of trade and debt.

I.a. DOE/Defense Programs Benefits

The Y-12 Plant currently embraces three mission areas; stockpile surveillance, maintaining production capability, and storage of special nuclear materials. The Y-12 Plant also contributes to our nations' economic strength by partnering with industry in deploying technology. This partnering has been supported to a great extent through the Technology Transfer Initiative (TTI) directed by DOE/Defense Programs (DP-14). The Oak Ridge Centers for Manufacturing Technology (ORCMT) was established to draw upon the manufacturing and fabrication capabilities at the Y-12 Plant to coordinate and support collaborative efforts, between DP and the domestic industrial sector, toward the development of technologies which offer mutual benefit to both DOE/DP programs and the private sector. Most of the needed technologies for the "Factory of the Future" (FOF) are being pursued as core areas at the Y-12 Plant. As a result, 85 percent of DP-14 projects already support the FOF. The unique capabilities of ORCMT can be applied to a wide range of manufacturing problems to enhance the capabilities of the U.S. industrial base and its economic outcome. The ORCMT has an important role to play in DOE's Technology Transfer initiative because its capabilities are focused on applied manufacturing and technology deployment which has a more near-term impact on private sector competitiveness. The Y-12 Plant uses the ORCMT to help maintain its own core competencies for the FOF by challenging its engineers and capabilities with technical problems from industry.

I.b. Core Areas

The all-inclusive expertise found in Y-12 Plant/ORCMT personnel covers concept, through detailed design and specification, to building prototypes and configuring integrated manufacturing process. The ORCMT currently focuses on seven major core technology areas at the Y-12 Plant/ORCMT.

1. Manufacturing Technology Deployment
2. Manufacturing Technology Development
3. Industry-Specific Technology

*Under Contract DE-AC05-84OR21400.

4. Manufacturing Technology Demonstration
5. Manufacturing Quality and Process Assurance
6. Energy and Environmentally Conscious Manufacturing
7. Special Material Processing

Each core area reports vertically into ORCMT and performs its mission through one or more centers of expertise. These centers of expertise reside within the functional divisions of MMES and serve the individual core areas through a matrix relationship. Thus the technical talent and operating tools of each center will rapidly change and reorient to meet changing industrial needs or national program direction.

The Y-12 Plant has established nine key processes necessary for the performance of its stockpile support mission as well as the maintenance of its production capability. These areas all need to be exercised to keep expertise trained in the state of the art as well as applying new scientific developments to stockpile support and production. These key processes include:

1. Assembly and Welding
2. Casting and Melting
3. Machining and Machine Tools
4. Physical Testing and Dimensional Inspection
5. Plating and Cleaning
6. Business Systems
7. Virtual Manufacturing
8. Quality Assurance Certification and Calibration
9. Rolling & Forming

The FOF is a new way of carrying out the business of creating and delivering new products and will require changes in the approach to design, development, and production. The components of the FOF are Knowledge Engineering, Virtual Manufacturing, Modeling and Simulation of Components and Processes, Advanced Materials and Processes, Information and Communication Systems, and sound Business Practices. The Y-12 Plant can contribute in all of these areas since many of the concepts are being used in our manufacturing processes today.

The nine key processes are still necessary to make product. However, in many cases, the complex will utilize entirely different methods within the process. Our laboratory partnership funds will be used to ally with industry in areas that will enhance the use of FOF-type processes.

Areas of strength at the Y-12 Plant that could impact the FOF include modeling of processes and advanced materials; intelligent inspection systems with standardized operator interfaces, analysis software, and part programming language; electronic transfer of designs and features; existing computer-based concurrent engineering; and knowledge-based forming process.

II. Scope of Activity

Laboratory Partnership Program (LPP) projects will be technology driven and strategically aligned with the core/critical technologies required to maintain the nuclear defense mission. These partnerships with industry will be block funded by DOE and managed by the Y-12 Plant under the direction of the Oak Ridge Operations Office through its Y-12 Site Office. As a primary objectives the partnerships will strategically partner with individual companies, or groups of companies, to maintain, strengthen and advance the nuclear defense required core competencies, critical technologies, and key capabilities while simultaneously assisting U.S. economic outcome. The Appendix lists legacy projects and new projects that could be funded under the Laboratory Partnership Program.

II.a. Project Selection

The Y-12 Plant will select projects subject to approval by the DOE Y-12 Site Office which support the core areas. Upon notification that funding is available, the Y-12 Technology Services Technology Transfer Programs Manager will issue a call for proposals in specific focus areas accompanied by the list of criteria that will be used in the selection process analogous to the current Small Business Project procedure.

Project selection will be made by the Oak Ridge DP Technology Transfer Committee. This committee is appointed by the Y-12 Plant Manager and is composed of senior level managers from the Y-12 Plant (including the MMES Laboratory Coordinating Board member), the Oak Ridge DOE Offices dealing with technology transfer and the Y-12 Plant site operations, and the MMES Office of Technology Transfer.

Approved projects will have limited scopes and durations such that the project will be funded for the full duration from the budget available during the approval year. Projects may be augmented subject to full approval process. Clear funding limits and augmentation limits will be in place to avoid oversubscription and undue industry expectations.

Three types of project will be selected: 1) Mortgages on existing projects which have not been assigned to an Office of Economic Competitiveness Major Programs. Any remaining funds will be distributed among 2) industrial partnership projects and 3) initiation or augmentation of the Y-12 Plant initiatives which fall within the Defense Programs Technology Transfer Division Program Source Book 1994 edition.

III. Funding

Based on the available funds, the Y-12 Plant will activate projects in strategic thrust areas, advertise for prospective industrial partners, and conduct an internal project selection process.

The Y-12 Plant has focused on major partnerships and has only a small percentage of its total DOE DP Economic Competitiveness funding identified as laboratory partnerships. The long-term funding objective for Y-12 Laboratory Partnerships is to build the program to a level of \$20 million (in FY95 dollars) of DOE DP Economic Competitiveness.

A written plan describing the selection criteria and funding requirements for direct assistance augmentation of existing projects, or other projects such as technology maturation, will be provided to DOE Y-12 Site Office for approval.

The four labs meet early in the fiscal year to review focus areas and core competencies. Mutual areas are identified for interlab cooperation and coordination of projects. Martin Marietta Energy Systems, Inc. will work with the local DOE Operations Office concerning core areas and selection criteria of projects. The number of projects to be executed will be based on the available Lab Partnership funding at the lab site for the fiscal year.

IV. Laboratory Partnership Management Structure

The success of the program depends principally upon quality and timely accomplishments of the technical contributors, i.e., the people directly involved in the scientific and technical work coupled with the performance of the industrial partner. The responsible organizations and individuals managing the Defense Program Technology Transfer work in Oak Ridge, Tennessee, are as follows:

The DOE Y-12 Site Manager has overall responsibility for implementation and oversight of the DOE-DP LPP in Oak Ridge.

The MMES Vice President for Defense and Manufacturing has overall responsibility for the DOE-DP Technology Transfer Program within MMES. He has signature authority by contractual language to execute DP Cooperative Research and Development Agreements at Oak Ridge.

The Director of Technology Services at the Y-12 Plant reports to the above and is delegated the overall responsibility for the technical performance, milestones, and cost control of the DOE-DP TT Program in MMES. He and members of the Technology Services organization maintain an oversight of DOE-DP contracts and conduct selections and reviews of project progress. The Director is the MMES agent for receiving funds from DOE for approval.

The MMES Defense Programs Technology Transfer Committee, appointed by the Vice President for Defense and Manufacturing, reviews proposed projects and ranks the proposals according to criteria for Lab Partnership Projects and importance to MMES.

V. Performance Metrics

The ORCMT will use the same industrial partner survey developed to assess the level of satisfaction with the project, provide a vehicle for self-assessment, and identify aspects of the process that need improvement as used with all industrial partnerships. The survey assesses three parts; negotiation and execution of the contract with the partners, technical performance of the project, and close-out/retrospective of the project's economic impact on the partners. The prime objective of the survey is to provide specific feedback for continuous process improvement.

VI. Review Schedule

The Y-12 Plant's Technology Services Organization will be responsible for the internal management of the LPP and the individual projects within the program. Projects under this program will be managed locally as part of the same management structure that MMES uses for all of its DOE/DP Technology Transfer projects. Periodic internal reviews of the progress of the projects will be conducted by plant personnel and DOE Y-12 Site Office staff members to evaluate the status of the work. Monthly/quarterly reports will be prepared and distributed.

APPENDIX

Y-12 Laboratory Partnership Plan

Strategic Focus Area

The Y-12 Plant has established nine key processes necessary for the performance of its stockpile support mission as well as the maintenance of its production capability. These areas all need work to keep expertise trained in the state of the art as well as applying new scientific developments to stockpile support and production. These key processes include:

1. Assembly and Welding
2. Casting and Melting
3. Machining and Machine Tools
4. Physical Testing and Dimensional Inspection
5. Plating and Cleaning
6. Business Systems
7. Virtual Manufacturing
8. QA Certification and Calibration
9. Rolling and Forming

Legacy Projects

Title:	Environmentally Compliant Manufacturing
Description:	Develop and apply machine tool coolants with reduced environmental impact.
DP Benefit:	Supports processes 3 and 4
Partners:	Cincinnati Milacron
Funding:	FY95 \$200K FY96 \$200K

Title:	Advanced Metalization Technology
Description:	Develop and apply advanced metalization technology for multichip modules.
DP Benefit:	Supports processes 5 and 8
Partners:	IBM
Funding:	FY95 \$500K FY96 \$250K

Title:	Materials by Computational Design
Description:	Develop capability to model material properties based upon molecular structure of constituents.
DP Benefit:	Supports process 1,2,6 and 9
Partners:	Marlow, Concurrent Technology, Hoechst Celanese
Funding:	FY95 \$350K

Title:	Semiconductor Yield Improvement
Description:	Develop methods to improve yield of semiconductor fabrication by automatic defect classification.
DP Benefit:	Supports processes 4 and 8
Partners:	KLA
Funding:	FY95 \$100K

Title:	High-performance Storage Systems
Description:	Develop and deploy improved mass storage systems for computer systems.
DP Benefit:	Supports processes using computers heavily, 3, 4, 5, and 8
Partners:	IBM
Funding:	FY95 \$300K

Title:	Advanced Information Technology
Description:	Develop and apply advanced techniques to large database activities.
DP Benefit:	Supports processes 4, 5, and 8
Partners:	IBM
Funding:	FY95 \$400K FY96 \$400K

Legacy Projects (Cont.)

Title:	Electron Beam Curing
Description:	Develop materials and processes need to cure epoxy composite structure using e-beam radiation.
DP Benefit:	Supports processes 1 and 9
Partners:	Consortium of 10 companies
Funding:	FY95 \$1150K
	FY96 \$1142K
	FY97 \$ 420K

Title:	Moldable Transient Suppression Polymer Composite
Description:	Develop high dielectric constant materials from moldable polymers.
DP Benefit:	Supports process involving high voltages
Partners:	GE
Funding:	FY95 \$300K
	FY96 \$600K

Title:	Bio-Remediation
Description:	Work with NCMS members in the development of bio-remediation methods of cleaning industrial waste sites.
DP Benefit:	Supports processes 1, 2, 3, 4, 8, and 9
Partners:	NCMS
Funding:	FY95 \$500K
	FY96 \$500K
	FY97 \$250K

Totals	FY95 \$3800K
	FY96 \$3092K
	FY97 \$670K

New Projects

Title:	Concurrent Engineering Development
Description:	This project will make computer-integrated manufacturing technologies available to industry in projects that support all stages of manufacturing from product and process design through product and process application. The "concurrent engineering" approach improves quality and decreases the design duration for a new product or facility. Technologies addressed are advanced numerical control, certification part programming, information engineering technology, distributed numerical control, product data exchange, computer analysis, shop floor control, product modeling, and automated manufacturing systems.
DP Benefit:	Supports 2, 3, 4, 5, and 7
Potential Partners:	Software and hardware vendors, machine tool makers, metal working companies
Funding:	\$1M /year
Title:	Ultraprecision Manufacturing Technology
Description:	Develop manufacturing capabilities that include single point diamond turning, ductile grinding, ion beam milling, optical characterization, and system design and analysis as applied to product fabrication.
DP Benefit:	Supports 3, 4, and 5
Potential Partners:	High precision and surface finish industries including: optics, tool and die, medical
Funding:	\$1.6M/year
Title:	Manufacturing Prototyping and Demonstration
Description:	This project will bring together personnel with high level capabilities to enhance design concepts and build manufacturability into designs and processes during prototyping. Based in Y-12's world class job shop these projects will push the limits of machining tolerances while maintaining the capabilities, equipment and technology to perform other required work.
DP Benefit:	Supports 1, 2, 3, 4, 5, 6, 7, 8, and 9
Potential Partners:	Companies needing high quality prototypes in metal, composites, ceramics, and plastics.
Funding:	\$2M/year
Title:	Material Joining Development
Description:	This project will exercise Y-12's capabilities in manufacturing joining processes for metals, ceramics, plastics, and composite products, including traditional arc welding, resistance welding, brazing processes, laser beam welding, and electron beam welding. Special emphasis will be placed on process evaluation, process development, process selection, and optimization of joining and assembly processes.
DP Benefit:	Supports 1 and 9
Potential Partners:	Any company needing improved joining technology for their product.
Funding:	\$400K/year

New Projects (Cont.)

Title:	Material Forming and Processing
Description:	This project will seek opportunities for joint R&D with a goal of optimum part quality and processing demonstrated by hands-on experience with emerging technologies such as near-net-shaping, casting, forming, and rolling, semisolid processing, powder metallurgy, metal matrix composites forming, computer modeling, and recovering and recycling of materials from waste streams.
DP Benefit:	Supports processes 1, 6, and 9
Potential Partners:	Companies involved in tool & die, piece part fabrication, sheet-metal forming, etc.
Funding:	\$2M/year
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Title:	Plating and Cleaning
Description:	Project will enhance conventional coating and finishing services and develop unique coatings for materials or shapes that are complex, hazardous, radioactive, extremely valuable, or involve new manufacturing methods.
DP Benefit:	Supports processes 1, 3, 4, 8, and 9
Potential Partners:	Companies involved in optics, tribology, bonding, abrasion resistance, radiation protection, corrosion protection and high temperature survivability
Funding:	\$1M/year
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Title:	Composites Manufacturing Technology
Description:	Develop prototype and deploy in industry technologies dealing with composite material characterization, design and analysis, processing technology, prototype development, testing, and evaluation, technology commercialization.
DP Benefit:	Supports processes 3, 4, 5, 7, and 8
Potential Partners:	Companies with products that will benefit from materials with tailored properties, i.e. medical, transportation, machine tool.
Funding:	\$1M/year
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Title:	Pollution Prevention Technologies
Description:	Y-12 will partner with industrial partners to develop a better understanding of technologies that minimize the generation of pollution and reduce the cost of compliance with environmental regulations. Areas of particular interest include advanced cleaning and decontamination technologies, advanced coating technologies, and minimize waste generation.
DP Benefit:	Supports processes 2, 3, 4, and 9
Potential Partners:	All piece part manufacturers producing a waste stream
Funding:	\$600K/year

New Projects (Cont.)

Title: Description: DP Benefit: Potential Partners: Funding:	Metrology Technology Development and Deployment Develop with industrial partners standards and calibration programs to support stringent tolerance requirements including the full range of physical, electrical, radiological, optical, and dimensional measurements. Supports processes 4, 5, and 8 NIST, metrology equipment vendors, metrology users \$3M/year
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Title: Description: DP Benefit: Potential Partners: Funding:	Testing and Evaluation Development Development, application, and deployment of leading-edge capabilities for nondestructive evaluation, material property determinations, surface analysis, weld quality determination, and chemical analysis. Supports processes 4 and 5 Non-destructive evaluation equipment makers and users \$2M/year
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Title: Description: DP Benefit: Potential Partners: Funding:	Advanced Photonics The extensive DOE capabilities in Oak Ridge in the combined field of optics and electronics will be applied jointly with industrial partners to broad applications. Areas of particular interest include lasers and laser diagnostics, fiber optics and fiber-optic sensors, spectroscopy, image processing, environmental sensing and measurement, holography, electro-optics, and optical materials. Supports processes all vital processes Sensor makers and users \$1M/year
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Title: Description: DP Benefit: Potential Partners: Funding:	Advanced Ceramics This project will support development that will reduce the high cost of using ceramics as the material of choice. Targets will be machining and certifying structural ceramics. Supports processes 3 and 4 Ceramic producers, users, and developers \$2M/year
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Title: Description: DP Benefit: Potential Partners: Funding:	Direct Assistance This project will support providing short-term direct assistance and small cooperative projects with industrial partners needing rapid response from Y-12's technical experts. Supports all processes All \$4M/year
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Future Funding Needs	\$21.6M/year
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