CCDoTT Program Overview
Agile Port and High Speed Ship Technologies / Strategic Mobility 21

1.0 INTRODUCTION

CCDoTT is a partnership of academic and commercial research partners working together to focus on and develop related critical enabling technology. We use a team of research partners to complement our in-house University capabilities and bring commercial operational experience to bear on selected Navy/military and commercial needs. Our years of experience organizing, planning, executing, and coordinating projects with partners who are acknowledged leaders in their respective fields brings credibility to the team and high probability of success to the projects.

1.1 Agile Port and High Speed Ship Technologies:

This document outlines the Fiscal 2006 program of effort for our Agile Port and High Speed Ship Technologies program with the Office of Naval Research. Over the years ONR and CCDoTT have developed and demonstrated an excellent working relationship, one which has served to align CCDoTT capabilities to the requirements and needs of ONR.

In the FY 2006 program several projects relate to Future Naval Concepts requirements. From a military view, the same technologies that support commercial cargo flow improvements and competition also have the potential to support the rapid deployment expeditionary logistics requirements of the military to move combat units into theater quickly (Force Closure surge) and to sustain those forces. The program focuses on the continuity of existing and evolving projects and relates projects to the evolving Future Naval Concepts of Seabasing while including POLA/LB related projects of Port Disruption, Short Sea Shipping, Maglev and the Pacific Northwest Agile Port Demonstration.

The projects selected are all focused on transportation issues with an emphasis on High Speed Ship Systems and Agile Ports and Terminal Systems. Several of the High Speed Ship options recently under development by CCDoTT could directly effect the long distance force closure times and the in-theater movement of forces and logistics in support of military operations. For example, High Speed Ship requirements for Force Closure, in-theater movement, logistics support, and Seabasing concepts require the combined technology advances provided by efficient design tools, development of Multihull vessels (such as the Trimaran) and a waterjet propulsor that can meet the unique compact propulsion requirements as well as adapt to the constrained slender hull requirements of high speed ship designs. The Agile Port System Demonstration and the deployment of Magnetic Levitation technology for container movement could revolutionize land side cargo movement. Together, both might support a new end-to-end system supporting Seabasing.

The emerging High Speed Ship systems and the Agile Ports and Terminals that support them represent an area of maritime technology development that has exceptional potential in advancing the national military and commercial transportation capability. High-speed movement of commercial cargo improves the national competitive edge in a highly competitive domestic and international industry. Agile Ports sustain that increased speed of movement by reducing the port flow-through time (and therefore cost) while impacting almost every aspect of port operations including intermodal transfer, land requirements, traffic, pollution, labor, security, and information technology requirements. While Agile Ports and Terminals technologies is inclusive of military logistics operations, we have categorized some projects that are purely focused on a military requirement as Rapid Deployment Technologies.

1.2 Strategic Mobility 21:

Strategic Mobility 21 is presented in this overview as it represents a project that has evolved and matured to the point of spinning off from CCDoTT to become its own program. SM21 has developed out of several years of projects relating to integrated cargo movement systems, primarily commercial, to apply these lessons to military logistics systems in combination with evolving DoD systems. A high level of cooperation is maintained between the two programs where there are many common threads allowing for significant synergy to be achieved. CCDoTT's Seabase Logistics Optimization and Pacific Northwest Agile Port Demonstration projects provide mutual support when in collaboration with SM21.

2.0 FY 2006 AP/HSS PROGRAM (Period of Performance 02/07 – 03/08)

2.1 CCDoTT:

The CCDoTT portion includes two projects that support the total program providing critical multi-project coordination and technology transition functions.

- ***Technical Coordination and Planning*** insures integration and coordination of projects on the single, multiyear, and inter-project level to provide continuity of program and sponsor objectives.

- ***Technology Transition and Outreach*** provides the critical effort to align essential stakeholders to support projects and find end users to exploit the technology capabilities developed by the projects.

2.2 High Speed Ship (HSS) Technologies:

Past CCDoTT projects have contributed to the development of multi-hull ships, and specifically the Trimaran, as viable high speed hull forms. High speed ships require new and innovative hull designs and powering systems. The FY06 program includes six (6) projects that allow us to press forward in this area. We focus our High Speed Ship development in ways that directly impact mid-term high speed ship capabilities and take full advantage of the experience we have gained in this area.

- ***Multi Disciplinary Design Optimization (MDO) Tools for Large Multihull Ships*:** The MDO project supports efficient multi-hull design processes. There is currently a lack of available design tools in this area. We propose to build upon FY05 efforts in developing a prototype, and provide useful optimization tools for multi-hull design. These evolving tools are currently being used and validated in ongoing design projects to include the HALSS project discussed below.

- ***Workshop on Numerical Tools for Innovative Ship Design*:** An effective process in the development of complex design tools is to bring together the experts in the field(s) and the anticipated end users to discuss the "state of the art." The optimization process being developed by CSULB has progressed to the point where it is considered timely to conduct a workshop focused on high performance ships and further limited to the four specific topics of CFD, motions and loads, MDO and integrated tools, and available resources (vendors).

- ***Waterjet Inlet Design and Hull Integration Optimization for Improved Performance Efficiency of an Advanced Waterjet*:** The proposed effort is to analyze the waterjet inlet system design in a basically parametric approach using advanced CFD tools. The CFD approach will allow a broad range of waterjet inlet variables and arrangements to be evaluated and analyzed for favorable trends and installations in a fraction of the time and at less cost than physical testing would require. Good waterjet inlet design knowledge and increased understanding of the inlet-hull interactions will help optimize the overall waterjet inlet system design approach and will benefit the overall propulsive performance of both military and commercial applications.

- ***HALSS – Heavy Air Lift Seabasing Ship – Advanced Technology Development and Concept Design Study*:** This project builds on a series of CCDoTT sponsored studies that assess High Speed Trimaran (HST) technologies and ship concepts for various commercial and military applications. The Heavy Air Lift Seabase Ship (HALSS) is an HST that exploits the characteristics of the heavy lift, fixed wing C-130J aircraft to provide a complementary logistic solution for Seabasing. At the current moment the Navy's Joint High Speed Sealift (JHSS) program is under development. The JHSS program is mostly focused on a conventional high speed monohull concept without fixed wing aircraft capability. Complementary to the program, HALSS would add C-130J logistic and deployment capabilities to the basic Seabasing requirements. The proposed study addresses hydrodynamic performance, sea motions and structural loads of the innovative hull forms, diesel machinery and combined propeller – waterjet propulsion. This work will specifically expand the FY04 and FY05 studies on HST design tools, CFD applications, system engineering solutions and buildability of the HALSS initial concept.

- ***Route/Mission Dependent Prediction Program for Rational Structural Dynamic Loads for High Speed Sealift Applications, Phase II-B*:** This effort will complete a multi-year project to create a ship motion and dynamic load calculation program that would be suitable for use by Designers, Classification Societies and the U.S. Navy to predict the structural loads of high-speed ships. The program will be suitable for both advanced

monohulls and multihulls such as catamarans and trimarans. This effort will complete the ultimate load model and the reliability design methodology developed in earlier work by including the prediction of slamming and impact loads for the practical design of structure for advanced high-speed vessels.

- ***Alternative Shipboard Powering Systems for Naval and Regulatory Review, Part II*:** The purpose of this effort is to further prove the viability of alternate methods of propulsion by taking the results of the prior study and discussing the nuclear option with various governmental, political and commercial groups. This project will develop discussions and presentations from the previous work designed to familiarize key decision makers with the benefits, both environmental and economic, of nuclear propulsion while at the same time acknowledging the fact that security and safety are paramount. We believe this is the best use of the previous work and is consistent with recent Navy studies on the economic break point for nuclear versus oil fuels for certain ships. We believe that the time is right to bring the alternately fueled ship option to the forefront.

2.3 Agile Port (AP) Technologies:

Agile Port technology exploits technological innovation, information technology and the restructuring of infrastructure and processes to increase cargo throughput and overall terminal productivity at our ports. The definition includes all cargo movement facilities and means at the port. Concepts now include supporting operations such as intermodal facilities, inland intermodal and transshipment facilities, and inland port concepts. CCDoTT has been at the forefront of Agile Ports since developing the *High Speed Sealift/Agile Port Operational Concept Document* for the United States Transportation Command in 1995.

There are four (4) separate projects that comprise the AP effort for FY06. These include:

- ***Electrodynamic Container Conveyor – ECCO System Definition and Implementation Plan*:** While the general technical and economic feasibility of Maglev has been demonstrated in previous work, specific issues need to be addressed to further demonstrate that Maglev is the most capable and socially acceptable means of moving containers through the Los Angeles area. Switching and load/unload components of a general ECCO transport system will be developed and modeled. Those elements will be integrated with existing models to produce cost/performance models for a short and a long-haul ECCO system. Results of the cost/performance models can then be used to structure a number of possible funding approaches for ECCO consistent with the project's findings. The project's capacity to significantly increase port throughput and connect remote port transshipment, rail terminus and the Power Projection Platform flowing from the training areas and depots of high desert should significantly increase military rapid deployment and sustainment capabilities.

- ***Pacific Northwest Agile Port System Demonstration Analysis*:** This is a continuing project to demonstrate a proof of concept by using real infrastructure, cargo and deployment operations. This program will prove the concept of a viable commercial and military Agile Port System that will enable the military to load out cargo with higher efficiency, lower cost, and more flexibility while minimizing disruption to commercial operations. This effort will focus on development of Pacific Northwest regional Agile Port System simulations using post demonstration data to support financial and environmental impact analysis, demonstration analysis, and tradeoff analysis. The incorporation of the demonstration data into the simulation model is key to the analysis of concept options to follow.

- ***Operational Development of Short Sea Shipping to Serve the Pacific Coast*:** This Study builds on the FY05 efforts to extend the feasibility analysis of domestic and feeder markets for a transportation and logistics system based on a generic short sea vessel. The project will be broad-based, not constrained by niche focus, and cover the entire West Coast for both domestic and international traffic. The maintenance of a door-to-door supply chain perspective is a critical element of the study, reflecting shipper practice and requirements. The results of the prior FY05 work will be extended to a detailed review of ship and logistics options, deployments and port selection, and impact on gaining revenue to support the enterprise. The dual use of Short Sea Shipping to meet military requirements will continue to be identified and evaluated.

- ***Port Disruption Model – Program Definition*:** Port disruption has been defined from many perspectives such as port closure, economic impacts, ship diversion, labor disputes, terrorism, natural disaster and so forth to name a few. The multiplicity of definitions has resulted in a similar number of modeling attempts that are limited to a particular perspective. This project will seek to outline a comprehensive model requirement that includes the impact of any event on the logistics system as a whole vice piecemeal. We will produce a detailed program outlining all aspects required to create and maintain a Port Disruption Model (PDM). This project will result in a PDM conceptual model architecture and a program plan to develop a comprehensive and much needed PDM.

2.4 Rapid Deployment:

The Rapid Deployment Sector is focused on the projects that are primarily military cargo movement first, even if there are significant portions of the logistical systems or processes that are commercial. Integrated systems such as those required to support Seabasing often blur the sector lines as they involve factory to Power Projection Platform to Port of Embarkation to Seabase to Warrior transitions that move between commercial and military logistics. Additionally, the development of seabase concepts may well involve the development of specialized ships and even include high-speed ships in the developmental and functional mix. There are two (2) projects in this category. One is a very comprehensive look at seabasing. The other meets a critical requirement to simulate the accessibility of critical ports in the theater of operations to train crews, select the best ship to go there and influence ship design to support accessibility.

- ***Seabase Logistics Optimization*:** The purpose of this effort is to identify improvements in concepts and processes planned or used by military and commercial enterprises that will support and improve seabasing operations. The principal objective is to provide both military and commercial seabasing communities with independent and objective recommendations that improve seabasing operational capabilities and efficiency. Specific objectives include development of conclusions and recommendations for days of supply (DOS) requirements, T-AKE employment options for MPF (F) sustainment, and advance base throughput and cargo handling requirements. These analyses will require an end-to-end process model that begins at the advance base and ends at delivery to the war fighter. (Based on recommendations from OP-42.)

- ***Simulated Seabase Ship System Selective Port Access and Operational Performance Assessment*:** Expeditionary operations may require the use of ports that have constrained accessibility. The use of a ship simulator to model a variety of harbors, including specific ports for which contingency plans are prepared or being considered could support both planning and operational requirements. This effort will demonstrate the application of ship maneuvering and hydrodynamic simulation to define operational envelopes and limits for various seabased ship systems. These parameters can then be used for contingency planning of optional ports for military support and emergency relief and humanitarian operations. This project will use the latest simulation technology products (full-bridge simulator, USN ship models, realistic environmental conditions, etc.) and USN experienced mariners to navigate the ship to test the concept on a selected harbor and a single seabasing ship. Simulation scenarios will be developed to test the ability of the ship to be brought into the port, and dock/undock under a variety of environmental conditions. The result will provide a proof of concept and establish simulation parameters.

2.5 CCDoTT FY06 Project List

The projects have been selected for the FY06 program. All projects cover a 12 month time period.

Subcontractor	Title
CSULBF/CCDoTT	Technical Coordination and Planning
CSULBF/CCDoTT	Technology Transition and Outreach
CSULB/COE – James	ECCO System Definition and Implementation Plan
CSULB/COE – Hefazi	Multi-Disciplinary Design and Optimization Tools for Large Multihull Ships
CSULB/COE – Hefazi	Workshop on Numerical Tools for Innovative Ship Design
CDI Marine Company	Waterjet Inlet Design and Hull Integration Optimization for Improved Performance Efficiency of an Advanced Waterjet
CSC	HALSS Advanced Technology Development and Concept Design Study
TranSystems Corp.	Pacific Northwest Agile Port System Demonstration Analysis
CDI Marine Company	Route/Mission Dependent Prediction Program for Rational Structural Dynamic Loads for High-Speed Sealift Applications, Phase II-B
GMP, LLC	Alternative Shipboard Powering Systems Part II
Manalytics	Operational Devt. of Short Sea Shipping to Serve the Pacific Coast
LMI	Seabase Logistics Optimization
MITAGS	Simulated Seabase Ship System Selective Port Access and Operational Performance Assessment
TranSystems Corp.	Port Disruption Model – Program Definition

3.0 FY 2005 SM21 PROGRAM (Period of Performance 02/06 – 04/07)

Strategic Mobility 21 is a multi-year CCDoTT sponsored advanced logistics technology demonstration. It builds upon eight years of applied research into the use of information technology to manage freight movement more efficiently and safely. CCDoTT researchers have mastered the ability to map a logistics network of disparate players and their business processes and apply technology (e.g. electronic data interchange message traffic monitoring and radio frequency identification tag monitoring), to track containers and equipment moving through global logistics networks. They are applying intelligent agents embedded in computer networks to monitor thousands such movements to better mange traffic flow, identify potential bottlenecks, and avoid disruptions.

CCDoTT has focused research on goods movement issues by studying the Southern California regional freight distribution network. This distribution network is critical to the health of the regional and national economy and to the strategic defense of the United States. Southern California is the home to major military training facilities, the US Pacific Fleet, and three DoD designated Strategic Ports. The focus of that effort will now shift to real time experimentation and demonstration involving tagging and tracing of actual movement of commercial and military goods movement using a twenty first century high speed short haul rail network to be based in Victorville, California at the former George Air Force Base site

3.1 Strategic Mobility 21 Advanced Logistics Technology Demonstration

The objective of the Strategic Mobility 21 Advanced Logistics Technology Demonstration is to demonstrate the components of the Agile Port System (APS) into integrated operational concepts supporting both commercial and military requirements. Based on the foundation of prior APS research, the current FY05 Office of Naval Research sponsored project will demonstrate the advanced logistics concepts set forth in the Concept of Operations (CONOPS), developed under CCDoTT's FY04 High Speed Ship/Agile Port program, for the operation of an inland multi-modal transfer facility functioning as an agile port in the Southern California region. The CONOPS incorporates the Victorville facility being designed as an integrated component of the Southern California freight network and the DoD Power Projection Support Platform and sustainment distribution networks and, as such, serves as the basis for future logistics experiments to identify capability gaps in the end-to-end deployment and distribution process.