

FROM DAVE'S DESK

Our friends and clients may recall that, on 1 May 1998, Band, Lavis & Associates, Inc. was acquired by the CDI Marine Company of Jacksonville, Florida and we began to operate as Band, Lavis & Associates, Inc., a subsidiary of CDI Marine Company. Now, after 26 years, the name Band, Lavis and Associates has served us well, but, henceforth, our group, headquartered in Severna Park, Maryland, will be known as the Systems Development Division of the CDI Marine Company.

Thus, our name has changed, but we have not. We have the same dedicated and talented people, and our internal organization has not changed. We, in fact, have been functioning for nearly five years as one of three divisions of what is now called the CDI Engineering Solutions Government Services Group, headquartered in Jacksonville, Florida. This group of some 700 personnel consists of (i) the original CDI Marine Company, which primarily provides support for the detail design of large ships, (ii) the M&T Company, which provides engineering and logistics support to military aviation, and (iii) ourselves.

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SPOTLIGHT ON OUR ACQUISITION MANAGEMENT CAPABILITY

By Drew Eisele, Naval Architect

The central objective in any vessel acquisition, regardless of size or type, is ensuring that maximum value is achieved for each dollar spent. In the case of many small, limited budget acquisition projects, this concern for value-added accounting of expenditures can easily lead an owner or operator away from an investment in up-front naval architecture in favor of recycling an existing "off-the-shelf" design. While this low risk approach may guarantee the delivery of a proven vessel at a known cost, very rarely will the resulting design be completely optimized for the intended application. Compromises regarding vessel speed, range, working area, payload capacity, and seakeeping performance are often required.

This necessity for compromise leads to a series of questions. What is the optimum vessel? How much will it cost? How does the optimum design compare to other

available options? Is it necessary to re-evaluate some performance requirements? If so, what are the costs associated with specific performance parameters? Only with answers to these questions can the owners be certain they have achieved the best value for their money.

We remain ideally suited to provide cost-effective solutions to these questions through the utilization of advanced design synthesis models, comparative naval architecture techniques, and expert technical analysis, as described in our recent presentation entitled "Workboat Acquisition – A Process Driven Approach" delivered at December's International Workboat Show 2002 in New Orleans, Louisiana.

The presentation documented our highly respected and proven track record in providing owners and acquisition managers with critical up-front technical support in the form of requirements definition, analysis of alternatives, trade-off studies, evaluation criteria, specifications, and concept design development. We are involved throughout the detail design, construction and testing process through source-selection support, construction oversight, quality assurance inspections and management of acceptance trials as an owner's representative.

Several recent acquisition projects have benefited from our "concept-to-acceptance" approach to acquisition management over the past few years, including the highly successful State of Delaware Fisheries Research Vessel "R/V FIRST STATE", delivered in June 2002 (pictured below).



R/V FIRST STATE

FROM DAVE'S DESK

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As a result of the now nearly five years with CDI Marine, we have become extremely well integrated technically and administratively, and, accordingly, we have reaped the serious benefits of shared resources. This is even more significant when it is realized that the Government Services Group is, in turn, a division of the large CDI Engineering Solutions business unit headquartered in Philadelphia, PA. This business unit has three other engineering divisions: (i) Chemical & Industrial, headquartered in Philadelphia, PA, which covers principally the design of chemical, petrochemical and industrial plants, (ii) Biotech & Pharmaceutical, also headquartered in Philadelphia, PA, which covers principally the design of pharmaceutical plants, and (iii) Aerospace Technologies, headquartered in Phoenix, AZ, which covers principally support to the Aerospace Industry. Together, the four divisions employ over 3300 professional engineers and technicians in more than 50 offices throughout North America, receiving a total of close to \$300M in annual revenues. The ability to cross-share engineering resources in the form of talent, software and equipment, linked by an extensive international wide-area network has prepared us well to meet the challenges of the 21st Century.

We look forward to our continued association with each and every one of you.

Warm regards,

David and the staff in Severna Park, Maryland

WORLD LEADERS IN HOVERCRAFT DESIGN

Our reputation for being the world leader in the design of Air Cushion Vehicles (ACVs), or hovercraft, took another major step forward in March this year with the award of another large six-figure contract from an overseas client. This marks the second major ACV design contract in four years that we have won in the face of stiff worldwide competition. Four years ago, we started the successful design of the Finnish Navy's T-2000 Fast Surface Combatant ACV for Aker Finnyards. This ACV was launched in late 2001, and we are continuing to support its test and trials in the Baltic.

Other ACV-related work we have accomplished in recent years has included:

- (1) Design of the extremely successful LCAC Deep Skirt, which is now the de facto standard skirt for all U.S. Navy LCACs.
- (2) Design and testing of new lift fans for the Norwegian OKSOY-class MCM SES and SKJOLD Fast Combatant SES.

- (3) The start of the development of a new ducted air-screw-propulsion system and lift-air-supply fans for the next generation Heavy-Lift LCAC, which is being accomplished using the very latest advanced turbo machinery CFD software available from U.K. and U.S. sources to supplement our own in-house CFD codes. (See article by Alan Becnel on page 4.)

The design and technology development of ACVs has been the cornerstone of our expertise since we commenced business in 1977, while some of us have been continuously involved in the technology for more than 43 years, beginning with the trials of the SRN1, the first manned but skirtless ACV, in the U.K. in 1959.

Over the ensuing years, we have been involved with, and have made major contributions to, numerous successful ACV and SES acquisition and test programs throughout the world including the U.S. Navy's AALC, LCAC, SES 100A&B and 3KSES programs, the Army PACK and LACV-30 programs, plus numerous SES and ACV programs overseas in Sweden, Norway, Spain, Germany, Italy, Korea, Canada, Japan and Singapore. Most of these involved the use of our own unique ACV/SES design and analysis software, combined with both model testing and full-scale trials, which have generated a huge proprietary database of technology information that we have maintained within our 12,000-document, computer-cataloged library in Severna Park, Maryland.

The successful design of weight-sensitive vessels, such as hovercraft, requires a special blend of marine and aerospace practices, with the need to pay particular detailed attention to accurately predicting vessel performance and subsystem weights. This attention to detail has served us particularly well over the years when we have been called upon to develop design tools for other types of high-performance ships and craft.

It has been the development of these unique tools, combined with our extensive experience, that have continued to set us apart from the competition.

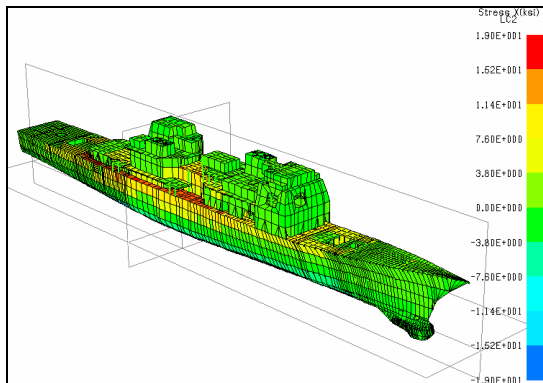
RECENT RECOGNITIONS FOR EXCELLENCE

Already this year we have received a lot of great praise for the good work that we have done. This includes our accomplishments for: (i) Northrop Grumman Ship Systems (NGSS) on the Littoral Combatant Ship (LCS) program, (ii) the USCG on the Homeland Security fast-patrol boat program, (iii) Honeywell and General Dynamics (GD) for the marine waterjet propulsion design work we have accomplished for the Marine Corps high-speed Advanced Amphibious Assault Vehicle (AAAV), (iv) NAVSEA PMS 377 on LCAC, and (v) the U.S. House of Representatives on Homeland Security systems.

DESIGN OF SHIP STRUCTURES USING FEA *By Manish Gupta, Sr. Naval Architect*

Over the past several years, we have been involved in several high-profile structural design and analysis projects for the DoD and commercial clients. In the process, our engineers have used several state-of-the-art Finite Element Analysis (FEA) software packages, such as ALGOR, COSMOS/M, MAESTRO, MSC-NASTRAN, and SAFEHULL to name a few. However, the key to most efficiently and effectively designing the ship's structure using FEA tools is not in choosing the most expensive or most powerful FEA software, but in formulating the right design and analysis strategy and then complementing it with the right FEA tool.

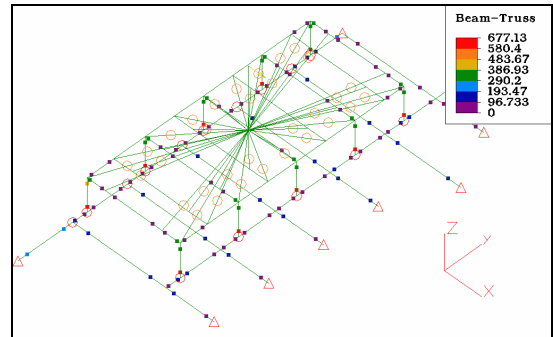
For example, one may be tempted to use a top-of-the-line general-purpose FEA software package, such as ANSYS or NASTRAN, when designing the whole structure of the ship. However, at the whole-ship structure level, most of the scantling designs are somewhat fluid, even until the detail design stage. Thus, adopting a general-purpose FEA software package may provide all the versatility in terms of solving and graphics output, but no capability in terms of rapid modification and quick analysis of the models. That becomes even more important when designing a class of ships, where they can structurally vary from one another due to different mission requirements. Therefore, from a whole ship design perspective, parametric FEA software such as MAESTRO or SAFEHULL makes more sense, since their parametric modeling capabilities allow rapid modifications and analysis.



USS Lake Erie – Full Ship FEA using MAESTRO

As the right FEA tool is important, so is the right strategy. As an example, we have been extensively involved in design and analysis of equipment foundations for several Navy ships. Since equipment foundations are governed by system installations, which are constantly changing through the detail design phase, it is only prudent to adopt a modeling and analysis approach that lends itself to easy modification. Thus, we model most of the foundation and support structures in the FEA tools with beam elements, and only use plate elements where absolutely necessary. This strategy allows the models to be rapidly updated and analyzed with

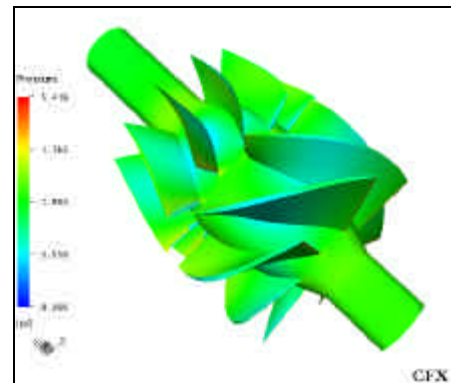
any changes in the foundation configuration. Again, both the Cadillac and the Chevy Cavalier have their place in this world.



Foundation Analysis using Beam Elements in ALGOR

ADVANCED MARINE WATERJET PROPULSION SYSTEM DEVELOPMENT *University of New Orleans Waterjet Research Program* *By Alan Becnel, Senior Engineer*

We have concluded a three-year, \$1M, effort (with support from NSWC-CD and others) to develop performance prediction methods for marine waterjet propulsion systems. One task on this project was to obtain an experimental database and to validate the waterjet propulsion pump performance. To achieve this goal, a model test was performed in the 24-inch cavitation tunnel at CDNSWC using a 7.5-inch model of the ATHENA waterjet. The cavitation tunnel test section was modified from the standard propeller arrangement to a waterjet system with the drive shaft from the aft. CFD calculations were also performed using ANSYS-CFX 5.5 Navier-Stokes flow solver. The Figure below shows the surface pressure distribution on the rotor and stator blades for one design condition. Excellent agreement was achieved between the measured and calculated torque at three different flowrates. Good agreement was also obtained for the pump headrise and efficiency.



**Surface Pressure Distribution on Model ATHENA
Waterjet Pump**

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THE QUARTERLY DIGEST

CDI Marine Company
Systems Development Division
(formerly Band, Lavis & Associates)

DEVELOPMENT OF LIFT FANS AND SHROUDED AIR PROPELLERS FOR AIR CUSHION VEHICLES USING COMPUTATIONAL FLUID DYNAMICS SOFTWARE

By Alan Becnel, Senior Engineer

We have been tasked by the Coastal Systems Station to develop advanced lift fans and propellers for the Heavy-lift Landing Craft Air Cushion (HLCAC). To accomplish these tasks, we are using state-of-the-art methods for both the design and analysis of these systems. TURBOdesign¹, developed by Advanced Design Technology, Inc., is being used for the design of

both the lift fan and propeller. ANSYS CFX is used for the analysis of these systems. Figure 1 shows the velocity contours on one axial plane in a centrifugal lift fan impeller, and Figure 2 shows the velocity contours on one radial plane in a shrouded air propeller.

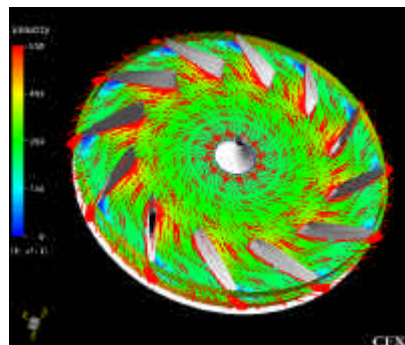


Figure 1. Velocity Contours in a Centrifugal Lift Fan Impeller

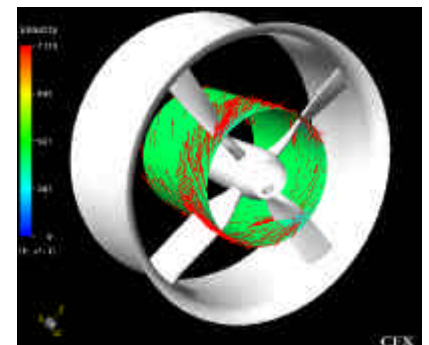


Figure 2. Velocity Contours in a Shrouded Air Propeller

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