

purpose finite element behavior. Also, modeling and run times are significantly less than that required for general purpose finite element programs.

CableCAD® is a design tool that can be used to quickly evaluate many construction concepts for cables, wire rope and some types of flexible pipes. The program gives the designer the confidence to consider alternatives outside of historical design rules so that nontraditional cable constructions can be explored. This will help lead to innovative new cable constructions that meet the challenging operational requirements of today. Although CableCAD® is a powerful cable development tool, SSI is quick to point out the importance of physical testing of cables before being placed in service. Both cable modeling and cable testing are important steps in developing a new cable design and should be regarded as complementary.

SSI was established in 1980 by Dr. Ronald Knapp in Aiea, HI. Dr. Knapp is a professor of Mechanical Engineering at the University of Hawaii at Manoa. Currently, SSI has six employees with the possibility of expansion. SSI provides structural engineering design and finite element analysis services, cable design and sales of CableCAD® software to manufacturers and users. Some CableCAD® licensees include major manufacturers such as British Telecom, Global Marine, LG Cable, Nexans Norway, Pirelli, Rochester Cable and Vector Cable. The Aerospace Corporation uses SSI software in the design of cables in space.

Since 1993, CEROS has funded SSI for various projects. SSI has received five contracts from CEROS to design, model and test cables - FY96 & FY97, *3-D Finite Element Design of Cables*; FY00, *Modeling of Cable Fatigue*; FY01, *Experimental Investigation of Cable Fatigue*; FY02, *Structural Modeling of Synthetic Fiber Ropes*. For more information on SSI and CableCAD®, consult www.cablecad.com.

Portions of this article were reprinted with permission from *Sea Technology* who published an article in their July 2002 issue.

CEROS ANNOUNCEMENTS...

Dr. Yonover, **SEE/RESCUE® Corporation**, was an invited speaker at the Air Force World Wide Life Support Workshop in Utah. He briefed the Air Force on the Self-Deploying Infra-Red SEE/RESCUE® for ejection seat pilots. Dr. Yonover was also an invited speaker at the Army Aviation Life Support Equipment meeting in Alabama. He briefed the Army on the Infra-Red and Retro-reflective SEE/RESCUE® technology and performed a water demonstration. For more information, consult www.seerescue.com.

In an upcoming publication of **Science**, scientists describe the use of a novel instrument developed by NanoRaman Instruments, a division of **Concurrent Analytical, Inc.** formerly **Detection Limit** (Waimanalo, HI). The article entitled, "*Nanoparticle Probes with Raman Spectroscopic Fingerprints for Biodetection*", describes the detection of RNA targets with single nucleotide polymorphisms using Surface Enhanced Raman Spectroscopy. This is a revolutionary new paper involving the use of Concurrent Analytical Inc. technology in proteomics and genomics applications. This work has been funded entirely by CEROS. For more information, consult www.concana.com.

Sea Engineering, Inc., a Hawaii based company with offices at the Makai Pier in Waimanalo and Pier 21 in Honolulu Harbor, recently opened a new office in Santa Cruz, California. Five new staff members complement the existing staff of twenty-five. With this new office, Sea Engineering now offers marine sediment and contaminated sediment transport and other aquatic environmental analysis services to its clients. The company's core expertise in coastal engineering, marine construction and diving will, in turn, be available in California and the West Coast. For more information, consult www.seaengineering.com.



The National Defense Center of Excellence for Research in Ocean Sciences (CEROS)

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CABLECAD® SOFTWARE - AN INNOVATIVE ALTERNATIVE TO HISTORICAL DESIGN

Today, numerous cable applications require sophisticated designs that satisfy various strength, communication and power transmission functions. These cables often have highly complex constructions that require structural analysis beyond simple, idealized mathematical models. Other manufacturing industries have realized tremendous productivity and product gains through the successful implementations of general purpose, computer-aided design (CAD) tools

into their development process over the past 30 years. The cable industry has not benefited from these

tools to the same extent, however, because it is difficult to model the helical wire geometries found in cables.

In response to this need, Structural Solutions, Inc. (SSI) developed the CableCAD® software for geometric and finite element modeling of cables. This tool simplifies model creation to facilitate rapid parametric design studies and it takes advantage of known geometrical properties of the cable so that creation of finite element models is transparent to the designer. CableCAD® allows the cable designer to quickly evaluate many design

concepts prior to expensive prototyping and testing.

For example, the geometric modeler simplifies the process of positioning helical components using intuitive "drag and drop" operations where the developing cable geometry can be viewed in real time. Also, the program can find the optimal arrangement of helical components that minimizes cable diameter. All geometric plots are to scale and realism is added by using accurate material colors and viewing the design in 3-D as depicted in the ROV cable model. As the ROV model reveals, both symmetrical and asymmetrical, axial and compound helical geometries can be represented.

The structural modeler features two analysis ap-

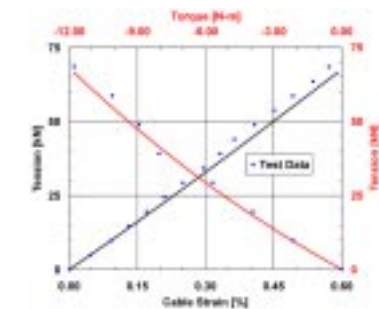
proaches including a layer element modeler (each layer is an element) and a finite element modeler (each component is an element). The former provides rapid initial assessment of cable performance and the latter provides a highly detailed structural evaluation includ-

ing stress contour plots for all cable components. To avoid the difficulties associated with general purpose finite element codes when assembling numerous contacting helical wires, CableCAD® automatically generates a finite element mesh. In practice, this means that the user does not have to

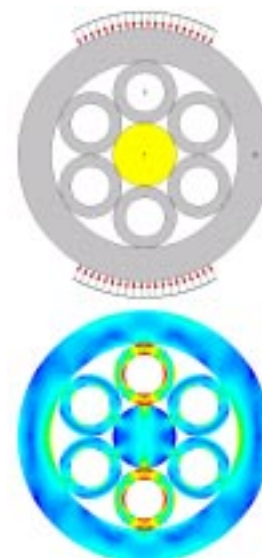
be trained in the use of finite elements and that design time is reduced substantially. Both structural modelers provide plots of cable strain, torque or rotation, and deformations. CableCAD® also can handle important nonlinear effects such as nonlinear material behavior, layer locking and round wire indentation into adjacent soft layers.

Comparisons with actual cable test data and other general purpose finite element software show that the CableCAD® code provides reasonable estimates of cable behavior. Also, modeling and run times are significantly less than that required for general

(Continued on Page 4)



ROV Strain and Torque Plot



Finite Element Results - Pinched Cable and Stress



ROV Tether Cable Model

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The 2002 CEROS Broad Agency Announcement will be posted on the CEROS web page (www.ceros.org) on October 1, 2002.

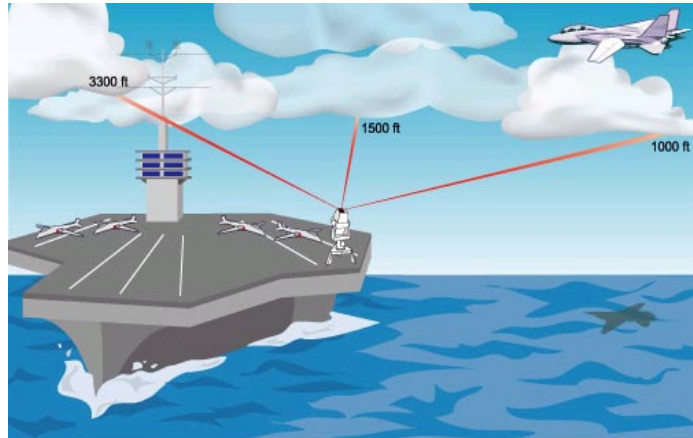


HAWAII'S OCEANIT BUILDS 3D CEILOMETER

Worldwide, eighty airline carriers take off and land 8.8 million times per year. That's 24,100 flights every day. During takeoffs and landings, having accurate real-time weather data can save lives – knowing when the ground will appear through clouds is of vital importance to aircraft safety. Ceilometers located on the ground provide this information. However, current ceilometers use fixed mounted lasers that measure only a

six-inch area in the sky. Such systems are of limited value during rapid cloud movement and weather changes. In FY01, CEROS funded Oceanit for a *Three Dimensional Cloud Height Indicator for Marine Application (3D-CHIMA)*. Oceanit's 3D Ceilometer scans a ten-mile-diameter area in the sky to create 3D images of clouds to significantly improve ceiling and visibility measurements. The 3D Ceilometer makes aircraft takeoffs and landings safer by providing more accurate real-time weather

- Continuous 3D laser scanning operations
- Comprehensive 3D information for decision making
- **Simplicity**
- Clouds appear as 3D animation
- Easy to setup and maintain
- Portable (2 people can move)



3D Ceilometer scans the sky to give pilots and controllers real-time 3-D picture of cloud coverage to make takeoffs and landings safer.

data to pilots and air traffic controllers. In FY02, Oceanit received additional CEROS funding for Phase II of the project for system marine testing. Oceanit's ceilometer has the following characteristics:

Reduce Flight Risks

- Wide ten-mile scanning range
- Variable scanning mode captures rapid cloud and weather changes
- Easy-to-view 3D cloud animations

Increase Air Traffic Productivity

- Improved cloud and weather accuracy gets planes in the air faster

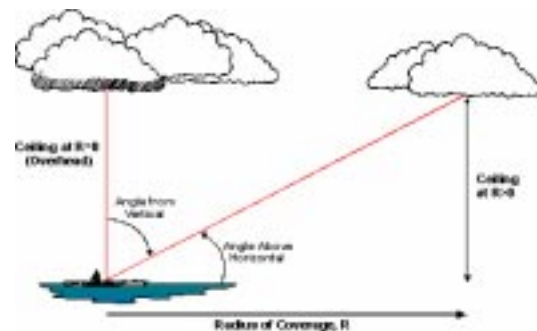


Illustration of 3D-CHIMA Cloud Height Measurement

Established in 1985, Oceanit is a Hawaii-based engineering, science, and research company. Oceanit's staff of nearly 100 occupies offices and laboratories throughout Hawaii and parts of the mainland. Oceanit's main office is located in downtown Honolulu with branch offices on Kauai and Maui and numerous operational project sites throughout the State of Hawaii and the Pacific.

In general, Oceanit focuses on the following four areas of business:

Biotechnology, Information Technology, Environmental and Industrial Technology, and Solutions, including engineering, scientific and technical consulting services.

Oceanit's service customers include most agencies of the Department of Defense, other federal agencies, municipal and state governments, as well as private companies and landowners. Oceanit has also formed a non-profit organization to enhance innovation in and applications of science and engineering. Oceanit Research Foundation is a research, development and educational institution. It promotes scientific, engineering, educational and literary pursuits in environmental and high technology areas. For more information about Oceanit, consult – www.oceanit.com.



TECHNICAL DIRECTOR'S CORNER - DARPATECH HIGHLIGHTS

In late July, I attended DARPATech 2002 in Anaheim, California. Defense Advanced Research Projects Agency (DARPA) hosts these meetings at roughly 18 month intervals to provide potential DARPA contractors with insight into DARPA's organizational and technical focus. The venue provides for a stimulating mixture of technical briefings from DARPA program managers and informal social functions for individual interactions. DARPATech 2002 began with a welcoming address from DARPA Director Tether. The meeting's Keynote address was delivered by the Honorable E. C. Aldridge, Under Secretary of Defense for Acquisition, Technology and Logistics (AT&L). Speakers at subsequent sessions included the Honorable Ronald M. Sega, Director of Defense Research and Engineering; General Richard B. Meyers, USAF, Chairman, Joint



Chiefs of Staff; the Honorable Gordon England, Secretary of the Navy; former DARPA Director Larry Lynn; the Honorable William Perry, Former Secretary of Defense; and Vinton Cerf, (a former high school classmate) one of the acknowledged "fathers of the Internet". I believe my interactions with the DARPA managers and featured speakers will benefit the CEROS technical program through increased awareness of DARPA requirements and processes.

The theme for this meeting was *Transforming Fantasy* and the Office Directors used take-off themes from various Disney endeavors as points of departure for their presentations. Programs in information management, augmented human physical and cognitive capabilities and space were emphasized. The principal military programs served by DARPA technological developments seem to be covered by the rubric C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance). Maritime programs were not directly featured, though the mobile land-based target problem that was discussed in several presentations seems analogous to the littoral ASW problem and some of the techniques under development may have application in the maritime environment if the differences in data rates can be managed.

Clearly, DARPA Director Tether has committed the organization to a course with principal focus on providing practical technical tools to combat asymmetric threats to the United States (i.e. the War on Terrorism) and take advantage of unprecedented advances in computers,

materials, and neurobiological and cognitive sciences. Major topics include the typical "hard DARPA problems" with an emphasis on speed, stealth, precision, control, connectivity, sustainability, anticipation, deception and surprise to produce decisive action, the edge in combat and overwhelming control of the "battlesphere", regardless of the threat or terms of engagement. Furthermore, the "biorevolution" at DARPA continues, with an emphasis on the brain-machine interface, enhancing human performance, exploiting complex systems, cognition, robust tactical networks, and fuzzy decision aids. To meet the current and future threats, Director Tether has redefined the mission of the Information Processing Technology Office to emphasize the importance of programs in augmented cognition and high performance computing. Furthermore, Director Tether has formed the Information Exploitation Office (IXO) to develop technology to better exploit and control information. Also, DARPA has

reinvigorated advanced development projects in defense-oriented Space Activities.

From a practical standpoint for CEROS, DARPATech 2002 provided two instructions for the technology companies in Hawaii that are interested in doing business with DARPA:

I believe the maritime technology sector in Hawaii has much to offer to a variety of DARPA programs.

(1) become familiar with the "sense" of DARPA technology and identify a fit for company capabilities and interests and (2) make contact with the appropriate DARPA program managers early and often to get and remain "in the loop" as programs are formulated, constructed and executed. The DARPA website (www.darpa.mil) is the principal tool for access to information about the DARPA programs. I believe the maritime technology sector in Hawaii has much to offer to a variety of DARPA programs. I urge all ambitious technology based companies with bright ideas and leading edge capabilities to seize the opportunity afforded by the emerging and dynamic programs at DARPA

Bill Friedl
CEROS Technical Director

REMINDER



If you are submitting a proposal abstract, the abstracts are due on **November 13th** at **12:00 PM Noon** at the Project Office in Kailua-Kona. CEROS strongly encourages submission of abstracts electronically at the website www.ceros.org/baa_abstract.html.



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