Wave Front

the Directed Energy Technical Newsletter - Winter 2002

Director's Forum

I am pleased to be able to share some of my thoughts on Directed Energy and the activities of DEPS. Membership and interest in DEPS continues to increase as it plays the pivotal role in fostering directed energy communications amongst academia, industry and government. The major information forum remains the annual directed energy symposium, but DEPS has expanded to sponsor the Solid State and Diode Laser Review and co-sponsor the Directed Energy Test and Evaluation Conference. The best way to stay abreast of directed energy activities is through our web site at www.deps.org.

A survey of DEPS members showed a need and desire for a Directed Energy Journal. A call for papers for the first issue of this journal should be sent out soon. DEPS is working with the University of Florida Graduate Engineering Research Center to publish the Directed Energy Journal. Initial volumes will be openly published with refereed papers. The survey also showed a strong interest in a classified journal. DEPS is exploring possible government support for an additional classified journal.

Past DEPS activities have focused mostly on lasers with minimal high power microwave representation. I believe that this was principally because of the greater funds being spent on lasers and the greater information release restrictions on high power microwaves. Future DEPS activities should provide a more balanced view of directed energy. The last issue of this newsletter featured the very popular high power microwave active denial system. It is currently the only HPM application that can be discussed publicly, but many other HPM applications can be discussed within the DEPS classified forums. The DEPS symposium this year should contain a substantially greater number of HPM presentations with the inclusion of papers which in the past would have been presented at the National High Power Microwave Conference.

Lasers and high power microwaves will bring unique and complimentary speed of light capabilities to the future battlefield. Both will have to earn their place through competition with conventional kinetic capabilities and with each other. It is important

that the directed energy community understands and advocates for the development and use of the appropriate portion of the electromagnetic spectrum for a given mission need. This requires laser people to know about high power microwaves and vice versa. It is directed energy as a whole will dramatically transform future war fighting through an unprecedented range of effects based capabilities. DEPS is supporting many activities to help achieve this vision.

DEPS is a volunteer organization and we need your help to serve the directed energy community. Please volunteer for either leadership or support roles on our committees or as a potential elected director. Refer to our web page frequently for the latest directed energy news and send us your comments and suggestions.

William L. Baker
Member of the Board

Featured Technology

Solid State Lasers

Jacqueline Gish and John Waypa
TRW Space & Electronics

Solid-state lasers represent both the oldest and some of the newest types of laser systems. The first laser, demonstrated by Maiman at Hughes in 1960, was a solid-state laser using ruby. Some of today's most promising high power *lasers for military and commercial applications are also solid-state lasers, utilizing crystalline or glass media as hosts for the lasing species. Solid-state lasers offer the advantages of (typically) requiring only electrical power for their operation and have a reduced logistics trail. They have enjoyed widespread use in materials processing, range-finding, and in illumination and sensing applications. On the other hand, they have not demonstrated high total efficiency (when* thermal management *is considered), and truly high powers – 10s to 100s of kW – are still only a goal.*

Considerable effort is underway today to expand the performance capabilities of solid-state lasers. At TRW, investigations are ongoing in advanced Nd:YAG slab lasers and single and coupled fiber lasers for commercial and military applications. Real progress is being made, and the prospects of realizing high power, high beam quality solid-state lasers are good. This technology has the potential to simplify current applications and create a number of new ones.

Introduction

Solid-state lasers (SSLs) use a crystalline or glass material doped with an ion, which is the lasing species. These lasers use flashlamps or light producing diodes to pump the ions to excited levels, which then emit radiation. Low-power SSLs have been around for a long time (the first laser, a ruby laser, is an SSL). Recently, SSLs have been scaled to higher powers for a variety of Government and commercial applications. The most common SSL is based on neodymium (Nd) doped into crystals such as yttrium aluminum garnet (YAG). Nd:YAG lasers emit radiation at 1.06 mm, an excellent wavelength for transmission through the atmosphere.

TRW has emphasized high power/high beam quality lasers which produce high brightness in its solid-state laser development activities. The results of this work have yielded diode-pumped SSLs from the 30 W level to multi-kW levels in a variety of pulse formats, ranging from continuous wave (cw) to very short pulses at repetition frequencies from 100 Hz to tens of kHz and beyond. TRW has demonstrated pulse energies up to 10 J. By a variety of nonlinear processes such as harmonic conversion, Raman shifting, and optical parametric oscillation, record powers have been demonstrated at shifted wavelengths from the mid-IR to the ultraviolet.

For the future, the military is interested in very high power (100 kW or more) solid-state lasers for applications such as missile defense, aircraft and ship self-protection, and attack against ground targets. TRW and others are investigating the use of high-power, coherently-coupled fiber arrays for this mission. Fiber lasers are really just long, skinny, flexible solid-state lasers, but have the advantage of higher efficiency, excellent beam quality, and a large surface area for heat removal. The current state-of-the-art (SDL result) is 100 W from a single fiber, with a number of groups working to increase this level. Scaling of bulk ("slab") SSLs is also underway at various places including Lawrence Livermore National Laboratory and TRW. These lasers offer the possibility of nearer term high power, with lower efficiency than fiber lasers may offer.

Government Solid-State Laser Applications

Some of the important applications for the Government include illumination, infrared countermeasures (IRCM), remote sensing, and ordnance destruction. TRW developed and delivered the 500-W, 2500-Hz Active Tracker Laser (ATLAS) to the Air Force's Starfire Optical Range. ATLAS, pictured in Figure 1, is being used by the Air Force for active illumination.

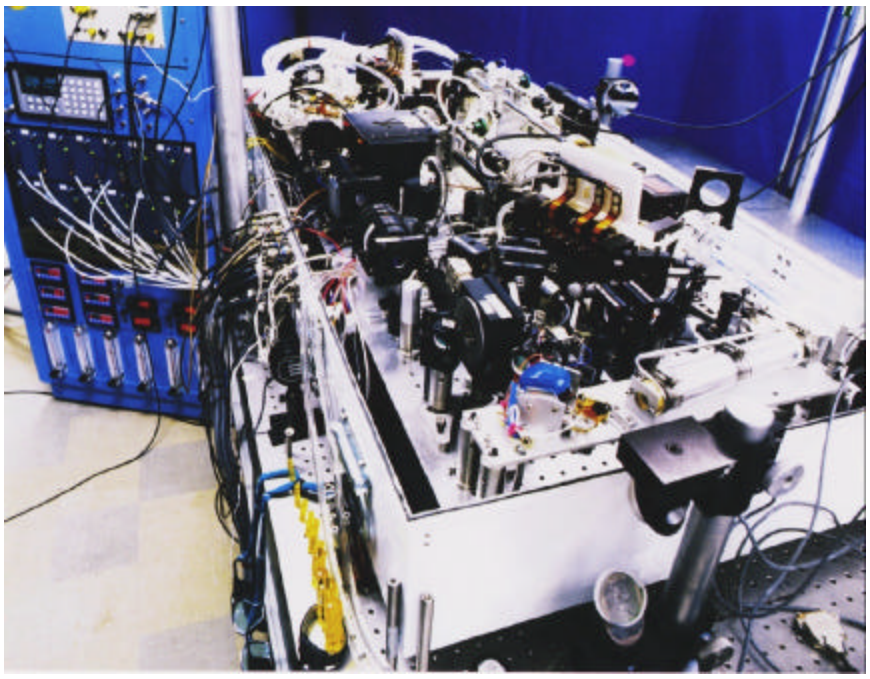


Figure 1. High Brightness ATLAS Illuminator Laser (500 W, 2500 Hz).

Figure 2 shows a 900-W scaled version of this laser (called Infrared Experimental Source or IRES). TRW is also scaling this technology for use as an illuminator on the Airborne Laser Program. Under contract from the Navy and funded by DARPA, TRW developed a 20-W mid-IR laser for IRCM. The laser was delivered to the Navy's Chesapeake Bay Facility for testing.

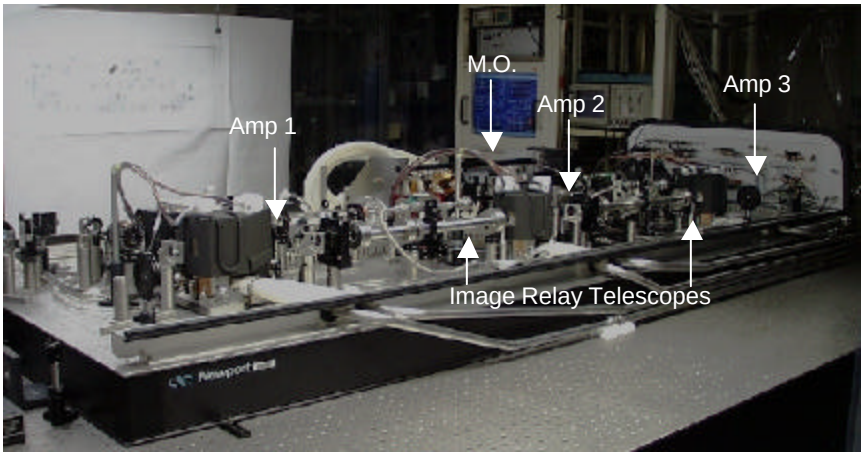


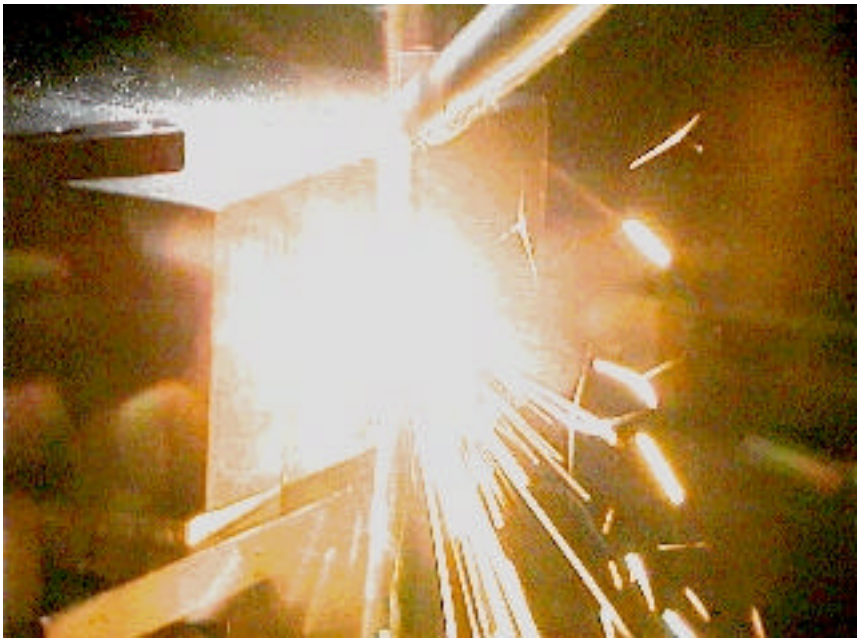
Figure 2. IRES Testbed Showing the Master Oscillator (MO) and Three Amplifiers (900 W)

Figure 3 shows the 500 W-laser delivered to Sparta, Inc. for use on the Zeus program for ordnance destruction. Also shown in Figure 3 is the Zeus system mounted on a vehicle.

Figure 3. 500-W Laser Delivered to Sparta, Inc. for Ordnance Destruction and the Sparta Zeus System Mounted on a Humvee.

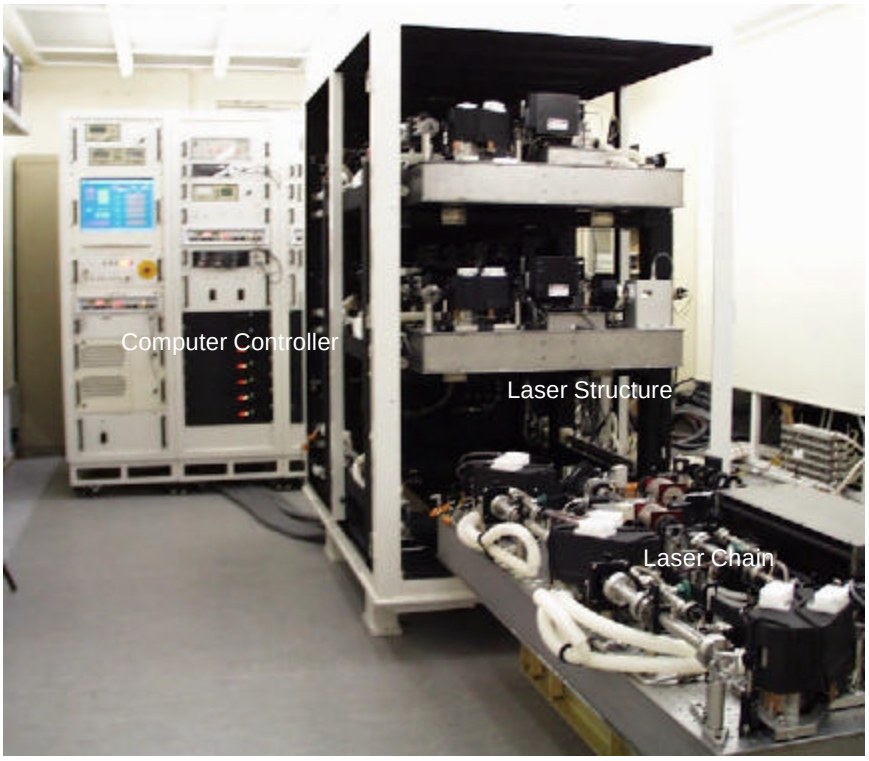
Commercial Solid-State Lasers Applications

TRW has been actively working on two commercial applications of high-power SSLs: precision laser machining and extreme ultraviolet (EUV) lithography. The laser delivered to Sparta (and shown above in Figure 3,) is a 500 -W laser developed for commercial machining applications. TRW and the Government jointly funded this work, under a Technology Reinvestment Program (TRP). This laser has been used for cutting, welding, and drilling a wide array of materials. Because of the excellent beam quality, small, reproducible holes can be drilled and precise cuts and welds can be made as shown in Figure 4. In addition to the 500-W laser, the program has demonstrated lasers with powers of greater than 5 kW. The higher-power laser has been used for deep penetration welding of steel and aluminum and for deep cutting in materials such as titanium.



Under joint funding by TRW and the EUV Limited Liability Company (EUV LLC), TRW is developing a laser-based Integrated Light Source (ILS) for use in an Extreme Ultraviolet Lithography (EUVL) process necessary for the next-generation fabrication of semiconductors. The short uv wavelength permits smaller feature size than what is currently possible, allowing greater circuit integration. This EUV source employs a diode-pumped solid-state laser to illuminate a xenon gas jet thereby creating a high-temperature plasma which radiates efficiently in the EUV (11 to 13 nm) spectral region. The ILS will be integrated into a semiconductor fabrication system known as a “stepper,” which in turn will be sold to semiconductor chip makers for installation into their fabrication facilities.

The 1.7-kW, 6-kHz laser TRW has developed for the EUV LLC is shown in Figure 5. This laser was delivered to Sandia National Laboratories and is being tested with a supersonic xenon jet to generate the EUV radiation. The laser builds upon the ATLAS technology. TRW is actively working to reduce the cost and increase the reliability of the laser.



Summary
Although solid state lasers have not demonstrated the weapon-class powers of their flowing gas chemical laser counterparts, they are currently the preferred choice for many applications due to their ease of use. They have reached performance levels where they are show high potential utility for a number of military and commercial applications. If sufficient funding is provided, both bulk and fiber SSLs will yield significant advances in overall brightness compared to current SSLs. . Solid-state lasers may then offer the ideal weapon application laser.

The Directed Energy Professional Society thanks the following authors of this article for their contribution:

Jacqueline Gish is currently the manager of Directed Energy and Kinetic Energy Technology at TRW Space and Electronics, with responsibilities for the identification and development of advanced laser technology. Dr. Gish has more than 20 years of experience with laser development. Dr. Gish received her Bachelor's degree in Physical Chemistry from the University of California, Los Angeles, and her PhD in Chemical Physics from the California Institute of Technology.
E-mail: jackie.gish@trw.com

John Waypa is currently the manager of Laser Weapons at TRW Space & Electronics, with responsibilities for advanced laser applications. Mr. Waypa has more than 30 years of experience with high power laser systems. He holds Bachelor and Masters of Science degrees in Mechanical Engineering, from the Stevens Institute of Technology, and a Master of Science degree in Systems Management from the University of Southern California.
E-mail: john.waypa@trw.com

Laser Safety: Are You Protected?

by Kris Sweet
Kris Sweet is the communications specialist for the Laser Institute of America in Orlando, Fla.
Reprinted in part from *Photonics Spectra Magazine*, Dec 2001

The increasingly widespread use of lasers in a variety of applications and fields will require more people to become familiar with this valuable tool - and with its potential hazards.

The basic approach of virtually all laser safety standards has been to classify lasers by their hazard potential. The (ANSI) 2136.1 (2000) Safe Use of Lasers standard from the American National Standards Institute, for example, places lasers into four classes, with class 4 being the most dangerous. Laser manufacturers must label all laser systems sold in the US accordingly.

This standard identifies three types of measures to help prevent exposure to laser radiation at hazardous levels: administrative and procedural controls, personal protective equipment controls and engineering controls.

Administrative and procedural controls consist of posting up-to-date standard operating procedures, emergency contacts and laser safety guidelines, and providing a laser safety policy manual. Other administrative measures may include an eye exam requirement, the availability of proper eye and skin protection and laser safety training for all personnel. Priority is given to engineering controls. Every facility that uses lasers is different, but some general engineering control concerns addressed by any safety program include:

• Is the laser secured to the table?
• Are the laser optics secured to prevent stray beams?
• Is the laser at eye level? (Beam height should be at a level other than that for a sitting/standing operator.)
• Is the beam enclosed?
• Are beam barriers or stops in place?
• Can the beam be viewed remotely?
• Is the beam condensed or enlarged?
• Is the beam focused?
• Is the beam intensity reduced through filtration?
• Are fiber optics used?
• Are windows in the room covered?
• Are reflective materials kept out of the beam's path?
• Is the beam management documented?
• Is there physical evidence of stray beams?
• Is there a Class 4 diffuse reflection hazard?

Some fundamental rules apply to all laser classes but become more specific or stringent as hazard potential increases. Class 2 and 3a lasers that do not exceed maximum permissible exposure require posting of a "CAUTION" sign, whereas some Class 3a and all Class 3b and 4 lasers require operators to post a "DANGER" sign.

Another administrative issue is training. Laser safety and training programs are recommended for Class 2 and 3a users and are required for individuals using Class 3b and 4 lasers. Class 1 lasers are incapable of producing damaging radiation levels and are therefore exempt from training mandates.

Safe Environment

The environment in which a laser is used helps determine the safety program. Protocols must be adapted for indoor or outdoor use if Class 3b or 4 beams are present; if there is potential exposure to direct, reflected and/or scattered radiation; or if the laser is in a controlled area.

In an indoor controlled area, for instance, the use of Class 3b lasers is restricted to authorized and trained personnel and requires constraint of the beam path if it might extend beyond the nominal hazard zone.

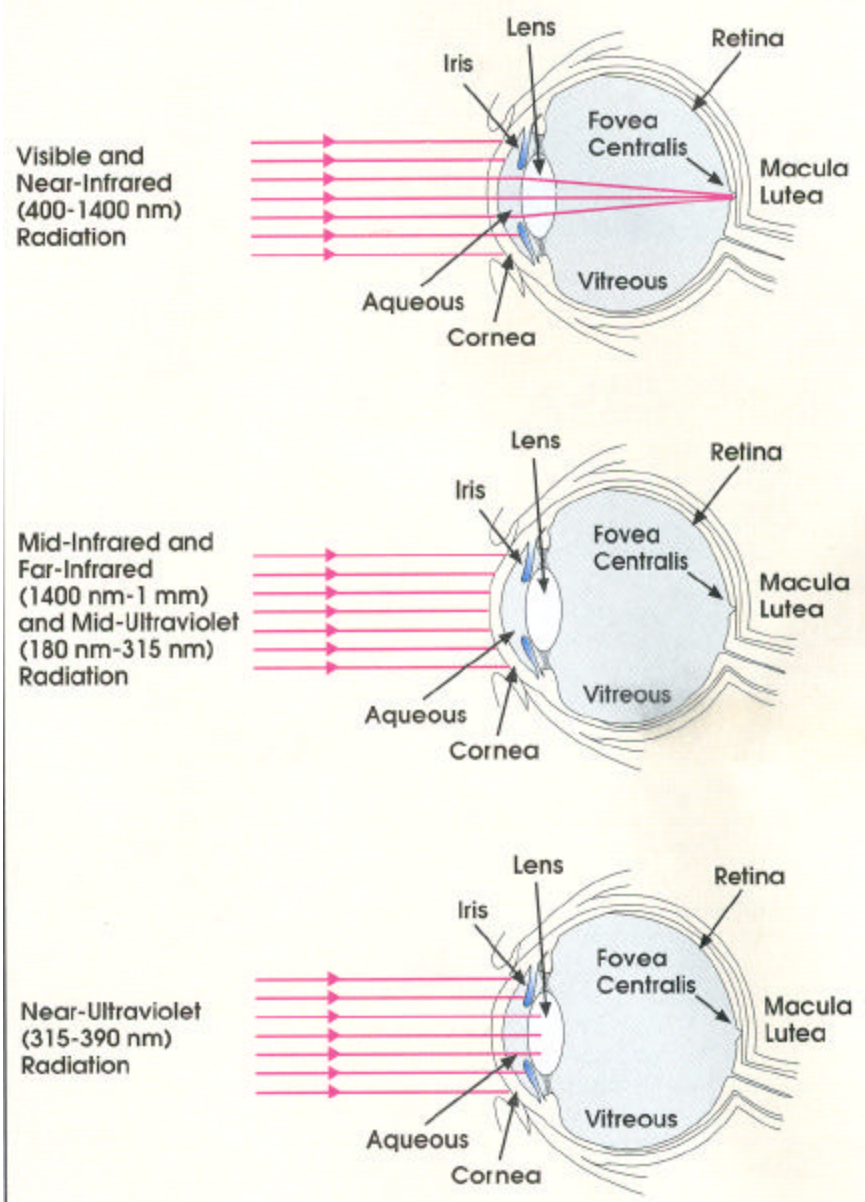
The ANSI 2136.1 (2000) standard lists a number of additional recommendations, such as controlling access to the laser's location, providing appropriate protective equipment, terminating potentially hazardous beams with a beam stop and using diffusely reflecting materials in or near the beam path.

A Class-4-laser workplace introduces additional control measures, including a clearly marked "panic button" to deactivate the laser and entryway controls that encompass:

• Nondefeatable methods that use hardware to deactivate the laser or reduce levels of maximum permissible exposure.
• Defeatable methods that allow override of interlocks.
• Procedural practices, which entail trained individuals with personal protective equipment, attenuation of laser radiation at entry and visible or audible signals that indicate that the laser is operating.

Ocular hazards represent injury potential for several structures of the eye. Retinal damage is possible from exposure to laser wavelengths in the visible and near-infrared spectral regions between 400 and 1400 nm. The incidental corneal irradiance, or radiant exposure, increases approximately 100,000 times at the retina because of the focusing effects of the cornea and lens.

Laser emissions in the ultraviolet and far-infrared spectral regions, below 400 nm and above 1400 nm, respectively, produce ocular effects primarily at the cornea. However, laser radiation at certain wavelengths may reach the lens and cause damage there as well.



Laser beams present the potential for eye injury. Certain wavelengths pose a serious hazard to the retina (top), cornea (middle) and lens (bottom).

Some lasers are eye-safe

Not all lasers pose a serious hazard to the eye. There is no known ocular hazard from a Class 1 laser or laser product, and these instruments are considered to be eye-safe. Class 2 lasers are low-power lasers that emit only visible laser radiation between 400 and 700 nm and are incapable of causing eye injury within the normal aversion response to bright light, which occurs within 0.25 s.

Class 3 and especially Class 3b laser beams present serious potential for eye injury resulting from intrabeam viewing. Hence, control measures for these lasers concentrate on eliminating that possibility: Enclose as much of the beam path as possible; use low power settings, beam shutters and laser output filters to reduce the beam power when full output power is not required; and operate the laser only in a well-controlled area. All operators of Class 3b lasers should be trained in laser safety.

High-power or Class 4 lasers, which present serious eye and skin hazards, necessitate all of the above control measures and more. Additional precautions include interlocked entrances to ensure that the laser cannot emit when the door is open, mandatory appropriate eye protection on all personnel and the placement of a shield between the laser beam and those present. Remote firing and video monitoring or remote viewing through a laser safety shield should be used where feasible.

Any laser powerful enough to be used for cutting could harm a worker exposed to the beam. Most laser accidents involving the eye have resulted from workers not using eyewear, but some have been attributed to design flaws. Most laser eyewear available today is designed to prevent slippage and/or offers wrap-around lenses. Other lenses are frameless to provide maximum field of vision or are designed specifically to block the beam from ultrafast lasers.

Eye protection is available for most wavelengths. It is important that eyewear be clearly marked with optical density and specific wavelength information to ensure that it is not used against laser wavelengths and/or power levels for which it is not intended.

There may be instances where eye protection should not be relied upon --for example, when using very high power laser systems where direct exposure is possible. In these cases, engineering controls that preclude direct exposure may be the only option. Eye protection should never be used for intrabeam viewing.

Protecting the skin

From a safety standpoint, skin hazards are usually considered to be secondary in importance compared with ocular hazards. While a severe burn of the cornea may produce permanent scarring with resultant loss of vision, a skin burn will generally heal. However, with the more widespread use of ultraviolet and higher-power lasers, skin injuries have assumed greater importance. Class 1, 2 and 3a lasers do not pose skin hazards.

Arguably, the most dangerous nonbeam hazard is electric shock. Since 1960, at least eight people have died from contact with high-voltage laser related components. Generally such accidents occur during maintenance or installation, when protective barriers are removed.

Explosion hazards

Laser-related fires and explosions can happen if a laser comes into contact with flammable liquids or plastic tubing that is used to transport dyes or solvents. Or, the beam can heat up nearby materials beyond their combustion temperature.

This article was reprinted in part with the express permission of the group publisher of the Photonics Spectra *publication, Dec 2001 issue. For the full article and more information on this topic please refer to their website at* http://www.photonics.com/Spectra/Features/dec01/repPointers.asp.

Programmatic Update

The HEL Joint Technology Office (JTO):

As our readers may remember, on 3 January 2001, in accordance with the Floyd D. Spence National Defense Authorization Act for fiscal year 2001, the Under Secretary of Defense (AT&L) signed a memorandum designating the Deputy USD(S&T) as the senior civilian official for High Energy Laser (HEL) programs.

The USD(AT&L) also designated Albuquerque, New Mexico as the site for the HEL Joint Technology Office (JTO), to commence in the summer of 2001.

The JTO is now fully operational in Albuquerque and had their ribbon-cutting ceremony on 1 Feb 02. Mr. Ed Pogue, the JTO Director officiated the ceremony. In attendance were Mr. Al Shaffer, Director of Plans and Programs within OSD as well as U.S. Senators Pete Domenici and Jeff Bingaman.

Navy setting up a DE shop:

The Navy has reactivated its High Energy Laser Program Office (NAVSEA PMS 405). The organization is headed by Commander Roger McGinnis.

Space Based Laser (SBL) Update

(1) It appears there will be no Joint Venture Team (JVT) as soon as the Missile Defense Agency (MDA) can make that happen.

(2) The funding profile is $50M-$35M for FY02-03, with an assumption that it would remain flat thereafter, unless it is possible to argue for more for specific experiments. The community recognizes that you cannot, in general, do space experiments for that kind of money.

(3) As of right now, there are no milestones defined. The SBL is purely a technology program for FY02-03, and the study that Dr. Charles Infosino, MDA Chief Scientist, is conducting is to come up with some milestones. He has been very clear that they need to have a near-term and long-term vision.

Cooperation Highlights

BMDO Changes Name:
DoD Establishes Missile Defense Agency

http://www.acq-ref.navy.mil/longnews.cfm?newsitem=83 ; January 11, 2002

On 2 Jan 02 Secretary of Defense Donald H. Rumsfeld announced the redesignation of the Ballistic Missile Defense Organization (BMDO) as the Missile Defense Agency (MDA). Consistent with the president's emphasis on missile defense, the secretary also provided direction necessary to meet the top four priorities for the United States in this important mission area. These are:

- To defend the United States, deployed forces, allies and friends from ballistic missile attack.
- To employ a Ballistic Missile Defense System (BMDS) that layers defenses to intercept missiles in all phases of their flight (i.e. boost, midcourse, and terminal) against all ranges of threats.
- To enable the Services to field elements of the overall BMDS as soon as practicable.
- To develop and test technologies, use prototype and test assets to provide early capability, if necessary, and improve the effectiveness of deployed capability by inserting new technologies as they become available or when the threat warrants an accelerated capability.

Elevating BMDO to agency status recognizes the national priority and mission emphasis on missile defense. The current director of BMDO, Air Force Lt. Gen. Ronald T. Kadish, will assume the title of director, Missile Defense Agency. He will continue to report directly to Edward C. "Pete" Aldridge Jr., undersecretary of Defense for Acquisition, Technology, and Logistics. The secretary has tasked Aldridge with the responsibility of implementing his direction and will look to the Senior Executive Council for oversight of missile defense activities. Also, the full and cooperative efforts of the military Services, Joint Staff and defense agencies are essential.

The overall objectives for missile defense include: establishing a single program to develop an integrated missile defense system; assigning the best and brightest people to this work and applying a capability-based requirements process for missile defense. The MDA is charged with developing the missile defense system and baselining the capability and configuration of its elements. The military departments will procure and provide for missile defense operations and support.

News media points of contact are Cheryl Irwin, Office of the Secretary of Defense, Public Affairs, at (703) 697-5331, and Lt. Col. Rick Lehner, MDA External Affairs, at (703) 697-8997

TRW Reorganizes Laser Business Development

TRW Space & Electronics (S&E) has restructured, subsuming all laser business development under its Business Development organization. The shift enhances customer focus and ensures use of common processes enterprise-wide.

Patrick P. Caruana, vice president for Missile Defense, now leads business development of laser systems. TRW's Tactical High Energy Laser and Space-Based Laser programs fall under Caruana's direction, as do business development efforts for the Airborne Laser. John Waypa serves as manager for development of new laser systems, reporting to Caruana.

Laser technology development now falls under Tom Romesser, vice president for Technology Development. Romesser leads the identification, development and acquisition of all S&E's strategic technologies, including lasers. He also serves as executive contact for the commercial laser operations of Cutting Edge Optronics, a TRW subsidiary. Jackie Gish supports Romesser as manager of directed energy and kinetic energy technology.

For more information on TRW's laser activities, visit TRW.com. Click on Laser Systems, under the Aerospace & Information Systems tab.

Education Update:

DEPS Middle School Education Outreach Project Set to Wow Students

This school year, middle school students in the Air Force Research Laboratory's Providing Engineering and Technology Experiences for Students (AFRL PETES) are preparing to put some new laser coursework and materials to the test. The coursework and materials have been developed by two teachers in the AFRL PETES project through a grant from DEPS. These teachers set out to create a course of study, to include laser equipment and lesson plans, for use with middle school students, which would enhance education and stimulate interest in laser-based career fields. The teachers showcased their prototype at the recent DEPS Educational Workshop. Six laser kits are being assembled based on this prototype, and will be distributed to other teachers participating in AFRL PETES as part of the testing phase. The lesson plans are not yet ready to distribute widely until the testing phase is completed and DEPS formally accepts the lesson plans. AFRL PETES students spend the school year studying a focus area in math, science or engineering and display their results at the AFRL Students Planning And Conducting Engineering Symposium held in the Spring. The laser coursework is intended ultimately to be made available to middle school teachers worldwide via the Internet.

Wave Packets

Since the events of September 2001, everyone in the United States has had to adapt. The Directed Energy community is no different in that program emphasis and technology development have all been reevaluated in the light of events. The following articles have been arranged to give some insight on Homeland Defense and the thoughts that might affect directed energy development.

Homeland Defense: Assumptions First, Strategy Second

Col. Randall J. Larsen, USAF-Ret. and Dr. Ruth A. David

October 2000

http://www.homelandsecurity.org/journal/Articles/article.cfm?article=1Homeland defense is a new concept for America, requiring new ideas, new partnerships, and vigorous debate. …. The first step in the action phase should be a Presidential White Paper on homeland defense. It should contain five key assumptions:

1. The threat of asymmetric attacks on the American homeland, either by nation-states or terrorist organizations, is real and will increase during the next decade.

2. The federal government will play the leading role in deterrence, prevention, preemption, attribution, and retaliation.

3. State assets (which include the National Guard) and local governments will play the lead role in first response and consequence management.

4. The private sector will play a critical operational role, particularly in defending against and responding to cyber and biological attacks.

5. An integrated warning/information/coordination system is required to ensure effective use of resources to mitigate effects during and after large-scale attacks or campaigns.

Defending America

John R. Brinkerhoff

August 2001

http://www.homelandsecurity.org/journal/Articles/article.cfm?article=19

Preventing Delivery and Activation of a Munition Despite our best efforts to prevent a decision to attack, someone will try. When this occurs it is necessary to identify the attackers, intercept the delivery of the munition, and prevent its activation. The two feasible methods of delivering a munition to a target in the United States are by covert delivery and by missile. Each of these methods requires different defensive measures.

Preventing covert delivery depends on knowing in advance when, where, and how the munition will be brought into or manufactured in the United States. It is the job of the Intelligence Community to obtain and disseminate this knowledge and the job of the Justice Department to intercept and neutralize the munition. The Coast Guard, Border Patrol, Immigration and Naturalization Service, Federal Bureau of Investigation, and other agencies involved in this effort should be strengthened, equipped with the best technology available, and transformed as necessary to allow them to prevent the covert entry of munitions or their manufacture inside our borders.

Preventing missile delivery of munitions depends on having a capability to detect, intercept, and destroy missiles launched toward targets in the United States. An assured capability to identify an attacker also strengthens deterrence of such attacks, because the attacker can count on retaliation. This is a job for the Department of Defense.

… The most likely lethal agent used by terrorists is still conventional explosives, including those that can be manufactured out of easily available raw materials. The goal of terrorists is to draw attention to their cause and/or confuse their enemies; these goals can be attained without having to deal with the more difficult and risky chemical and biological agents and nuclear weapons. However, it is likely that these special lethal agents will be used against targets in the United States in the near future. Certainly, the cyber war is already in full tilt. Thus, it is essential to provide in the national emergency management system a capability for dealing with the consequences of attacks that use chemical agents, biological agents, radiation, electromagnetic pulse, nuclear detonations, and cyber attacks.

Having a reasonable capability to deal with the consequences of special lethal agents increases the deterrence against their use and reinforces measures taken to defend against their use. This applies in particular to missile defense. Opponents of missile defense systems assert that it makes no sense to put up a system than cannot prevent all missiles from striking the United States—they demand perfection or nothing at all. However, it is better to destroy four of five incoming missiles than allow all five to hit their targets unimpeded. If the emergency management system can deal effectively with the consequences of the few that get through, the case for deterrence and defense is strengthened. The American people will forgive imperfection, but they will not forgive unpreparedness.

THE HART-RUDMAN COMMISSION AND THE HOMELAND DEFENSE

Ian Roxborough

September 2001

http://carlisle-www.army.mil/usassi/ssipubs/pubs2001/hartrud/hartrud.pdf

The Hart-Rudman Commission calls for a “culture of coordinated strategic planning,” and notes that America’s “challenges are no longer defined for us by a single prominent threat.” The commission argues that the United States needs five kinds of military capabilities: nuclear capabilities to deter and protect the United States and its allies from attack; homeland security capabilities; conventional capabilities necessary to win major wars; rapidly employable expeditionary capabilities; and humanitarian relief and constabulary capabilities.

Pentagon official emphasizes 'creative approach' to defense

By Molly M. Peterson, National Journal's Technology Daily

The U.S. military must embrace a "more entrepreneurial, more creative approach" to acquiring the tools necessary to combat enemies abroad and to protect the homeland, the Defense Department's director of force transformation told reporters Tuesday.
Retired Adm. Arthur Cebrowski, who was appointed to the newly created office last October, explained that the rapid proliferation of information technology has made the future of warfare much harder to predict.

"It is ubiquitous," Cebrowski said of information technology during a media breakfast hosted by *Defense Week* and General Dynamics. "It is low-cost, and the cost is falling. As a result, smaller groups of people--non-state groups--can have access to high-quality technology ... and this poses profound challenges for us."
President Bush issued a broad mandate last year to transform the nation's military capabilities in a manner that reflects society's transition from the industrial age to the information age.

… Sensor-based technologies such as space imaging are a key example of how the military is moving into the information age. "We're seeing the emergence of sensor-based warfare," Cebrowski said. "In some areas of warfare, [sensors] have always been important, but now, they're universally important."

But rapid advancement in the U.S. military's sensor-based capabilities is prompting attempts by enemies of the United States to foil those sensors with advanced technology of their own.

"The world knows that if we can sense it, we can kill it," Cebrowski said. "Consequently, there is a great deal of work going on ... to reduce firing opportunities--for example, with mobility or with deception."

In response to those counter measures, the military must constantly improve, expand and network its sensor technology while connecting it "more closely and more robustly" to weapons systems, Cebrowski said. "This is an enormous growth area in defense," he said. "I would be surprised if, over the next several years, we didn't see a considerable reallocation of resources in that direction."

Cebrowski added that the U.S. military's transformation must continue indefinitely. "No one can run for very long on the logic that says, 'We've transformed, so we needn't do anymore," he warned. "Transformation is a continuing process, not a destination."

Oversight of missile defense agency reduced

From Global Security Newswire
February 19, 2002

Bush administration officials are drastically reducing oversight at the U.S. Missile Defense Agency, which is responsible for developing a missile defense system, the *Washington Post* reported Saturday.

Defense Secretary Donald Rumsfeld outlined oversight exemptions in a memo last month that elevated the Ballistic Missile Organization to the MDA. The agency will be exempted from Pentagon regulations that force military commanders to detail requirements for new weapons systems, according to the memo. In addition, the MDA will not be required to report on program schedules and costs, and many of its testing programs will not be overseen by the Defense Department's test evaluation office.

The exemptions are to help streamline oversight programs that have often imposed intrusive paperwork, overlapping information requests and other unnecessary demands on missile defense authorities, said Pete Aldridge, undersecretary of defense for acquisition.

"We needed to give them a process by which they could put all these things together without all the encumbrances of having so much oversight and so many briefings that have to be done at multiple levels," Aldridge said.

MDA Director Lt. Gen. Ronald Kadish will be responsible for missile defense programs while they are in their experimental phases, according to Rumsfeld's memo. Once the systems are ready for procurement, they will be turned over to the Army, Navy, or Air Force, at which point they will be subject to traditional oversight procedures, according to the *Post*.

Military transformation opens up new IT market

By William New, National Journal's Technology Daily
http://www.govexec.com/dailyfed/0202/022502td1.htm

The Defense Department is seeking to return to its Reagan-era budgetary might, but the spending of the future will look different. While the department still will build big ships and airplanes, top Defense officials are pushing a "transformation" of the military toward more efficient internal systems and weapons driven by information technology.

Such a transformation spells opportunity for the nation's IT sector, which is looking for ways to contribute to the nation's security and for products to help it recover economically, industry sources say.

"What we're seeing is a whole array of companies stepping forward with technology solutions," said David Colton, vice president for strategic initiatives at the Information Technology Association of America (ITAA). "Companies are looking at both homeland defense and the Department of Defense as opportunities. Since Sept. 11, the tempo has picked up."

"There's a certain patriotism that's being felt and seen," said Rhett Dawson, president of the Information Technology Industry Council (ITI). "In addition, it is obviously a growing market at a time when the IT market has been flat. It's a combination of enlightened self-interest and trying to do the right thing for your country."

Super Power, Superior Weapons

….The detailed Defense budget breakout on information technology is due for release in March.

Examples of transformation in the budget proposal include $3 billion for intelligence and communications, more than $100 million for unmanned aerial vehicles (UAVs) and about $500 million for sensor-based combat systems, with remote artillery firing for the Army, according to Dan Heinemeier, president of the Government Electronics and Information Technology Association (GEIA)….

In the much-regarded Quadrennial Defense Review Report (QDR), Defense Secretary Donald Rumsfeld said the transformation process would "require a longstanding commitment" but at the same time "must be embraced in earnest today" because the nation is under immediate threat. The report was issued weeks after the September 11 terrorist attacks, and it shows the intent of the department to transform itself has intensified since that tragedy.

The transformation is necessary to keep the U.S. military ahead of its adversaries, officials say. "For the United States, the [technological] revolution in military affairs holds the potential to confer enormous advantages and to extend the current period of U.S. military superiority," the QDR said.

Defense officials such as Vice Adm. Arthur Cebrowski, the director of force transformation, say that transforming the military largely involves changing its "state of mind" to one that is more like a business. It also involves using advanced technologies to gather intelligence, manage information and develop more effective, less soldier-intensive weapons.

Edward "Pete" Aldridge, the Defense undersecretary for acquisition, technology and logistics, said last week that a secure, global information backbone of "unlimited depth and global reach" will be essential.

Ripe IT Harvest

A strong emphasis is being placed on the interoperability of technology systems. ….. Aldridge said interoperability "has to be checked off now as a criterion."

Another area of focus is reducing the cycle times for developing and deploying defense technology. "When our acquisition cycle is several times greater than industry's, there is something wrong," Cebrowski said last week.

Heinemeier cited several defense-related growth areas for the IT industry in the post-Sept. 11 environment. One is information assurance, or providing security to the military services for the obtaining and transmitting of information. Another is biometrics, which allows testing, for example, for certain substances in the air or water.

Intrusion-detection systems present another opportunity. The services are becoming more aggressive in protecting critical infrastructure so that it is available to war-fighters and not hacked, Heinemeier said.

An example of a new information system is the Navy-Marine Corps Intranet, a secure global intranet for internal communications that is wholly outsourced to EDS to act as the systems integrator. Other services are looking at the concept, which was funded by Congress and mostly is expected to be online by June 2003. "Information assurance and protecting the intranet are all aspects of transforming the military to allow it to be more Internet-enabled," Heinemeier said.

A GEIA five-year forecast of the information assurance market for Defense, civil agencies and the commercial sector showed growth from $17.6 billion in 2001 to $61.8 billion in 2006. Ninety percent is from the commercial sector, but GEIA predicted that the government sector's share would increase from $2.6 billion to $9.2 billion in 2006.

"We're very encouraged by the increased investment," Heinemeier said. "IT and related systems are going to be way up."

Dogfight of the Future

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"Transformation is not just about weapons platforms, but the unification of what were once isolated components into unified battlefield management," said Colton.

For example, in Tora Bora, Afghanistan, an unmanned plane with an IT link synchronized with a gunship had a sensor that could feed data about the target instantaneously into the gunship. "It was the first time in human warfare there was almost zero delay between the sensor and shooter," Colton said. Some envision the day when unmanned aircraft will fight each other.

"There's no question that we see this as a shotgun opportunity for deployment of new technologies," Colton said. "Since Sept. 11, I think there is a huge desire [in the IT industry] to contribute."

"In a tight budget environment ... force transformation becomes a necessity," he said. "It's our belief that technology is a 'force multiplier' because you will have fewer platforms and they will need to be more lethal, and the way to do that is through 'Net-centric' warfare."….

Calendar

** 23 May, Directed Energy Workshop, Washington DC

The hotel arrangements for this event have been confirmed with the Hyatt Regency on Capitol Hill, just a few blocks from the Capitol in DC. The agenda continues to develop and registration should be available on the DEPS web site later this month. This is the second of a series that began in 2000. Attendance will be limited.

** 3-6 June, Solid State and Diode Laser Technology Review, Albuquerque, NM

Opportunities to participate in poster and demonstration sessions remain open until 25 March 2002. Information about these opportunities and commercial exhibit space as well as the registration and agenda information are available on the DEPS web site. Attendance is limited to US citizens.

** 13-15 August, Directed Energy Test & Evaluation Conference, Albuquerque, NM

The conference hotel for this joint DEPS/ITEA meeting has been changed to the Crown Plaza Pyramid in Albuquerque. The hotel identified in the mailer sent in the fall of 2001 has been replaced, although other mailer information such as the 1 May deadline for abstract submissions remains correct. Some sessions at this meeting will be classified. Much more information is mounted on DEPS the web site.

** 12-15 November. The 5th Annual Directed Energy Symposium will be held in Monterey, CA. The theme this year is *Directed Energy: Transforming America's Defense for the 21st Century*.

The deadline for abstracts for contributed papers,1 April 2002, is rapidly approaching! Dr. Robert Peterkin of AFRL has been appointed the Co-Chair for this year's symposium and will subsequently serve as the Chair of the 2003 Symposium.

Be sure to check out the deps.org web page for more detail on each of these events.

Our **Thanks** and **Appreciation** go out to all the contributors to this publication. All of the content contained herein came from volunteers and supporters of the DEPS, or from open literature. If you would like to be a future contributor, and bring your ideas and work before your fellow directed-energy colleagues, please contact me to make arrangements.

Terry A. Franks
Communications Chairman
tfranks@deps.org