

Public Interest Report

FAS PLANS LEARNING GAME TO TRAIN FIRST RESPONDERS

As the Boston and New York areas tighten security for the Democratic and Republican conventions this summer, many people are asking how enough emergency responders can possibly be trained in all the scenarios now feared – a radiological (“dirty bomb”) attack, detonations of chemical or biological weapons, or even high explosive bombs like those that killed 191 people in Madrid. Shouldn’t our firemen and medical workers stay at their firehouses and ERs? How can they possibly drill and practice so that they can save more



Photo: Associated Press

lives when one of these events or a natural disaster occurs? In its report *Training Technology Against Terror*, FAS outlined a coherent national approach to this urgent problem and highlighted the fact that only with new information technologies can we meet the need.

FAS recently received funding from the Centers for Disease Control to design an instructional game, or distributed simulation, called **Mass Casualty Incident Responder Training**, to demonstrate how technology-enabled instruction can meet this need.

Continued on page 8

DIESEL HYBRIDS: BACK TO THE FUTURE?

Henry Kelly

Inherently more efficient than the Otto cycle engines that power most U.S. cars, diesel engines dominate markets for trucking, construction equipment, pipeline pumps and many other applications. But they have a well-deserved reputation for being foul smelling polluters—not something that you’d want to invite home. Their reputation in U.S. markets was further sullied during the 1980s when General Motors introduced a diesel car that has become a legendary disaster on the scale of Ford’s Edsel fiasco. Today diesels are less than 1 per cent of the U.S. personal vehicle fleet.

In Europe, diesel’s market share of car sales jumped from 20 per cent to 40 per cent in the past decade because of its fuel efficiency and superior performance, particularly high torque at low RPM. The major barrier to expanding markets for diesels is their reputation for being polluters. Few of the models sold in Europe meet present U.S. emission standards and they are even farther from meeting our stricter standards just coming into force.

Continued on page 4

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In This Issue

- 1 FAS Plans Learning Game to Train First Responders
Diesel Hybrids: Back to the Future?
- 2 FAS in the News
- 3 Congress Cools on New Nukes
Inaction on Crucial Small Arms Treaty
- 5 Digital Human Steps Ahead
Carnegie Supports Biosecurity Education
- 7 Hype About Hydrogen
- 9 Opinion: Private Sector Must Invest in Learning R&D
- 10 New FAS Report on Firearms in Western Hemisphere
- 11 Protecting Space Assets
- 12 Playboy Honors FAS
Secrecy Project
- 13 Opening Up the Abu Ghraib Prison Scandal
Secrecy News Highlights
- 15 FAS Wins Top Charity Rating
Shapley Joins FAS
Giving to FAS
Members’ Mailbox

About FAS

The Federation of American Scientists (FAS), founded October 31, 1945 as the Federation of Atomic Scientists by Manhattan Project scientists, works to ensure that advances in science are used to build a secure, rewarding, environmentally sustainable future for all people by conducting research and advocacy on science public policy issues. Current weapons nonproliferation issues range from nuclear disarmament to biological and chemical weapons control to monitoring conventional arms sales and space policy. FAS also promotes learning technologies and limits on government secrecy. FAS is a tax-exempt, tax-deductible 501(c)3 organization.

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FAS IN THE NEWS

The Federation continued to be in the news this spring. FAS' Government Secrecy Project was cited almost daily; its unique expertise in intelligence, classification, and the Freedom of Information Act was in high demand. News about the Secrecy Project is on pages 11 and 12. Sample coverage of other FAS projects is below.

CNN and **New Scientist** were among the media featuring FAS' calls for tighter control of nuclear materials. In July when the Department of Energy announced it had carried out of Iraq 1.77 metric tons of low enriched uranium and "1,000 highly radioactive sources" to a secure location in the United States, FAS Strategic Studies Director Ivan Oelrich praised the move on **CNN**, **Fox Newswire** and other media. The International Atomic Energy Agency, which favors stronger controls over uranium and plutonium, had urged that Iraq's stash of uranium be secured. The system of tracking and controlling other radioactive materials used in industry and medicine is "incredibly loose" FAS President Henry Kelly said in a June 5 **New Scientist** article.

In the online edition of **Technology Review**, FAS Biology Issues Director Stephanie Loranger warned about the amount of money and effort going for new biosecure laboratories in the aftermath of 9-11 and the anthrax attacks. TR quoted her as saying "It's hard to say that this is a bad thing," but "it's difficult to know how many labs are enough or how many are too many." There is concern that basic biomedical research may suffer, she and others explained in the article. Besides advancing health and basic knowledge, such basic research is the only way to find yet-unknown pathogens. The larger issue which FAS is posing in its project work is this: How to spend the enormous sums the government is allocating for biodefense research, so those doing the research grasp the new ethical and policy issues they face. (See article page 5.)

The need for the United States to ratify the OAS Firearms Convention was a principal theme of an FAS report released in June. (See article page 10.) **La Prensa**, the big Panama City daily, wrote up the report June 20, citing its examples of how the black market in small arms aids international crime, the drug trade, and terrorism. In the report, the Panamanian police force was named in one bogus transaction.

The **Christian Science Monitor** in a July 15 feature about armaments fueling conflict in Venezuela, quoted the author of this FAS report, Matthew Schroeder, as dismayed by the U.S. Senate's failure to pursue ratification of the Convention this session. The Convention "so clearly ties in to the war on terrorism" that failure to proceed with ratification is "baffling," Schroeder said. (See article starting page 3.)

Forbes magazine featured FAS' project for safe, energy-efficient housing in an article titled "Foam Home" in the June 21 issue. Traditional flat-roofed mud huts, used by Afghans for thousands of years, become "death traps" during the earthquakes that regularly plague the war-torn country. "We decided to try to do something about it," said FAS President Henry Kelly in the article. **Forbes** recounted how FAS challenged a nationwide group of housing experts from the Lawrence Berkeley National Laboratory, MIT and elsewhere to find a better way to build houses in Afghanistan—while keeping construction techniques simple and using a sustainable, wood-free design. The answer appeared in the form of structural insulated panels, a simple composite of cement and expanded polystyrene, which is best known as Styrofoam. **Forbes** reported on FAS' plans to demonstrate construction techniques and materials to builders in Afghanistan as well as the United States.

CONGRESS COOLS ON NEW NUKES

Benn Tannenbaum

The administration's drive for new nuclear weapons funding got considerable national press attention last year, when both houses ultimately gave approval. Curiously, there was less media coverage of this year's battles over the fiscal year 2005 requests for new nukes—and yet almost offstage, the political ground shifted somewhat against the request.

This year, the Bush Administration's push for new nuclear weapons met resistance from a surprising source: Rep. David Hobson (R-Ohio), Chairman of the Energy and Water Development Subcommittee of the House Appropriations Committee. Hobson previously supported the administration's nuclear programs, but June 9 he refused to approve its request of \$95 million for new nukes research, including support for the Robust Nuclear Earth Penetrator (RNEP or "bunker buster"), the Modern Pit Facility, advanced concepts nuclear weapons, and decreasing the time needed to prepare for a nuclear weapon test.

When Hobson opened the subcommittee session that refused the funds, he said: "Much of the DOE weapons complex is still sized to support a Cold War stockpile. The NNSA [National Nuclear Security Administration] needs to take a 'time-out' on new initiatives until it completes a review of its weapons complex in relation to security needs, budget constraints, and this new stockpile plan." The subcommittee approved the cut; the full committee ratified it June 18.

The Appropriations Committee action followed several close votes on new nuclear weapons in the House and Senate. On May 20 for example, the House voted narrowly, by 214-204, to defeat an amendment offered by Representatives Ellen Tauscher (D-Calif.), Edward J. Markey (D-Mass.), Ike Skelton (D-Mo.), John Spratt (D-S.C.), Norman Dicks (D-Wash.) and Tom Allen (D-Me.). This amendment to the defense authorization bill was intended to move funding

for the nuclear bunker buster and advanced concepts nuclear weapons over to fund more intelligence on locating underground bunkers and enemy strongholds.

The vote was the closest the House has come in years to actually stopping new nuclear weapons. Supporters say the chances of success are good in the next Congress. By contrast, a similar amendment was defeated last year 199-226. In 2002 the vote was 172-243. The appropriations process has seen similar progress: last year Hobson cut the FY 2004 request by only \$15.5 million.

However, the outlook in the Senate is still strongly favorable to these programs. Sen. Pete Domenici (R-N.M.), chair of the Senate Energy and Water Development Appropriations subcommittee, is a supporter of bunker buster research and similar efforts. Further, an amendment to the defense authorization bill offered by Senators Dianne Feinstein (D-Calif.) and Edward Kennedy (D-Mass.) to remove funding for the bunker buster failed on a vote of 55-42. This is only a slight change from last year's vote of 53-41. In their respective authorizing legislation, the House and Senate have agreed to fully fund the President's request for new nuclear weapons.

What remains to be seen is how the political winds blow this summer, when the \$95 million differences in the two appropriations bills will be resolved in House-Senate conference. Hobson is quite convinced that the NNSA is unprepared to build new nuclear weapons and that no real need for these weapons has been demonstrated. Mr. Domenici feels precisely the opposite. At least, after the House cut the program, the press began taking notice.

Benn Tannenbaum is Senior Research Associate, FAS Strategic Security Project

SENATE COMMITTEE FORGOES ACTION ON CRUCIAL SMALL ARMS TREATY

Matthew Schroeder

Despite earlier signs that the U.S. government was finally ready to pursue ratification of the Organization of American States Firearms Convention, the Senate Foreign Relations committee recently confirmed that it plans no action on the Convention this year.

The OAS Firearms Convention—an unprecedented regional agreement aimed at curbing illicit arms trafficking—has been stuck in the Senate for six years. Hopes for action on it were raised in March, when the head of the U.S. delegation to the treaty's 5-year review conference declared that the Bush administration had "recently concluded a further review of the Convention and [would] seek Senate advice and consent to ratification of this Convention during the current

congressional cycle." The delegation head also announced that the Senate Foreign Relations Committee would hold a hearing on it and several other law enforcement treaties on April 1.

The committee postponed the hearing a few days later. Then it announced a new hearing date June 17 and posted the list of treaties that would be addressed. The Firearms Convention was not on the list. Despite emergency interventions by the FAS and other advocates the committee did not add it. While action is theoretically still possible, prospects for ratification this year are grim.

The OAS Firearms Convention requires member states to enact basic, common sense controls on small arms imports

Continued on page 10

But this situation has been transformed by dramatic changes in technology and regulations that have gone almost unnoticed. Given the right incentives, new generations of highly efficient diesel engines, diesel hybrids, and dramatically cleaner diesel fuels can provide a practical, affordable way to provide Americans the transportation they want while slashing pollution and fuel use. And these changes could be made in the next few years, since diesels require comparatively modest changes in US vehicle manufacturing and fuel infrastructures.

While it is possible that fuel cells may eventually be less expensive and more efficient than diesels, the research challenges remain enormous and the risks high. Indeed it may take a decade or more to develop a commercial fuel cell system that even matches today's diesel performance – let alone cost. The main risk with today's diesels is not whether they can achieve efficiency and emission goals but whether the cost of meeting these goals will be acceptable to markets in the next few years. At the very least, diesel vehicles will set a high standard for any other new technology to meet. It makes no sense to miss the benefits of a proven technology to wait and hope for fuel cell breakthroughs.

Exact comparisons between different fuel and power systems are difficult since it is important not just to compare peak efficiencies but the average efficiency of an engine in a realistic driving cycle. Mile per gallon comparisons must also be adjusted to reflect the different energy content of fuels—diesel fuel contains about 13 per cent more energy per gallon than gasoline. Also, different amounts of energy are required to manufacture the fuel itself.

The accompanying chart compares the energy efficiency of different fuel/vehicle systems. The top pair of bars shows gasoline engines today; the next pair represent today's diesel systems. The middle pair of bars show results for a diesel/hybrid prototype. The three lower pairs of bars show

fuel cell vehicles planned for the future, including targets DOE has set for a hypothetical fuel cell vehicle in 2010. The performance ratings of the diesel/hydraulic hybrid prototype vehicle clearly steal the show, delivering a huge gain in overall energy that actually propels the vehicle – 28 per cent compared to today's gasoline engines, which direct just 14 per cent of the energy used “from well to wheels”—to turning the wheels. That's a 100 per cent improvement.

It's important to recognize that hydrogen fuel cell manufacturers face a nasty series of engineering challenges even to produce the near-term fuel cell systems shown on the chart that meet U.S. consumer expectations for price, reliability, range and lifetimes.

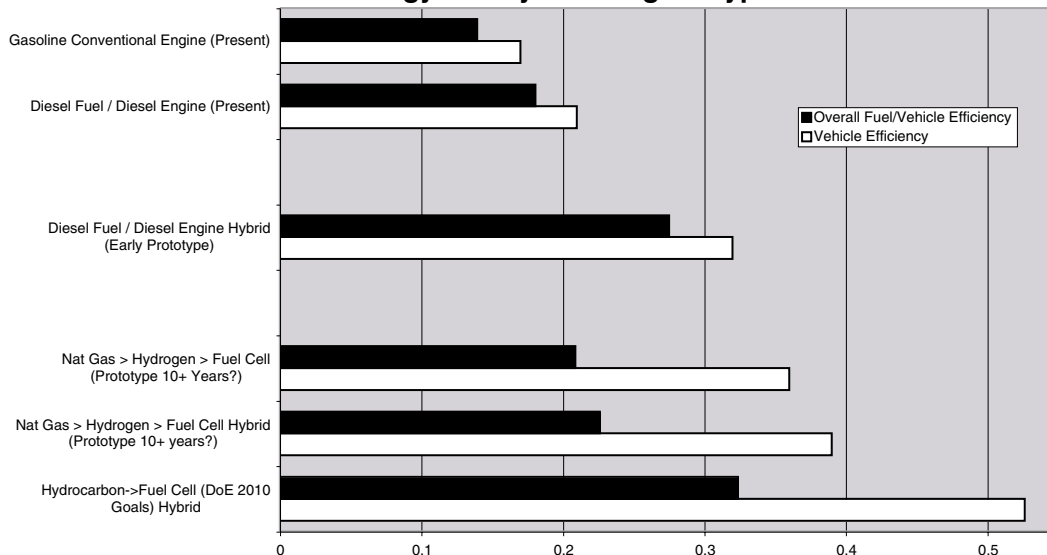
The final pair of bars reflects the DOE 2010 goal of a fuel cell capable of using a hydrocarbon fuel.¹ There is no theoretical reason why these goals can not be achieved and research to pursue them should clearly continue. But the goals are astonishingly bold given the current state of the art in fuel cell and fuel reforming cost and performance. What is striking, however, is that even if the ambitious, high-risk goals are met, the systems would achieve fuel efficiencies that are only 18 percent higher than the diesel hybrid system already in prototype.

Three Transforming Changes

Three critical factors in the United States are transforming the diesel as we know it: fuel standards, incoming “Tier 2” EPA vehicle emissions standards, and engine technology.

- For decades, diesel fuels were allowed to be dirtier than gasoline, but this is changing. Refiners were allowed to sell diesel fuel having up to 500 parts per million (ppm) of sulfur; sulfur at these levels effectively destroys catalytic converters used to lower other emissions. But the new fuel standards, issued at the beginning of the current administration, require the allowed maximum sulfur content

Energy Use by Fuel/Engine Type



The white bars show the efficiency of the vehicle; the black bars show overall efficiency of the fuel and its vehicle for various fuel/vehicle types. The overall efficiency of the diesel/hybrid system (third black bar from top) is greater than hydrogen fuel cell systems because it is far more efficient to produce diesel fuel from oil than it is to produce hydrogen fuel from natural gas, the most likely source. Even the highly efficient fuel cell vehicle proposed by the DOE for 2010 (white bar at bottom) ends up being just 18 percent more efficient (black bar at bottom) overall than current diesel/hybrid prototype. Sources: Industry, academic and government studies.

DIGITAL HUMAN STEPS AHEAD

"The ultimate goal of the Digital Human project is construction of a complete, functioning, accessible simulation of the human body," Chris Johnson of the University of Utah told a packed lunch meeting on Capitol Hill June 24.

Johnson characterized the task of modeling the body's processes from DNA molecules and proteins to cells, tissues and gross anatomy a "grand challenge." Grand challenges are overarching problems that arise due to breakthroughs in knowledge and technology and across fields. Biomedical science is producing such a quantity of data, he said, that researchers and medical practitioners find it harder and harder to use each others' data. They need a single shared computational framework in order to make use of each other's research and to properly collaborate, he said.

The FAS' Digital Human consortium is bringing together researchers who have begun linking data by developing a unified ontology and geometry. Imaging is a key element of biomedical computation. "The availability of imaging across a range of scales will spur spectacular discovery," Johnson said.

The ideas for Digital Human were brought together by the Federation of American Scientists several years ago. The project is supported by the National Science Foundation and the Defense Advanced Research Projects Agency.

The lunch was the best attended in the series, drawing about 80, said a spokesman for the Joint Steering Committee on Public Policy (<http://www.jscpp.org/>). The JSCPP organizes them for the Congressional Biomedical Research Caucus. They draw staff, business, non-profits and members of Congress. Rep. Rush Holt (D-N.J.) also attended and spoke, calling on Congress to support the Digital Human initiative.

Johnson is a well known investigator in the field of biomedical computing. He is also Director of the School of Computing, and Director of the Scientific Computing and Imaging Institute at the University of Utah.



Chris Johnson, Distinguished Professor of Computer Science at the University of Utah, greets Stephanie Loranger of FAS, at a June Capitol Hill lunch meeting, where Johnson briefed Congress members and staff on FAS Digital Human project and called it one of the "grand challenges" of research.

Photo: Charles Votaw, JSCPP

CARNEGIE SUPPORTS BIOSECURITY EDUCATION PROJECT

In April the Carnegie Corporation of New York announced it would support FAS' Biosecurity Project with a grant of \$500,000 over two years. This will enable the project, directed by Stephanie Loranger, to produce a plan to establish centers for biosecurity policy at universities and other institutions that engage in biosecurity-related research. In FY 2005 for example, Congress appropriated \$1.3 billion for biodefense research, including establishment of at least ten university centers dedicated to such work. The FAS project will consult with working scientists and lab officials to come up with a plan for guiding research and information dissemination – without hindering scientific freedom.

It is hoped to have at least one center adopt this plan on a test basis. Universities around the country are welcome to participate.

FAS seeks participation in the second aspect of the project, which is to raise awareness among bioscientists of their responsibility to stop the potential misapplication of biotechnology.

The project will develop course modules drawing on experience from around the nation. To this end, we placed this ad in *Biosecurity and Bioterrorism*, a journal edited at the Center for Biosecurity of the University of Pittsburgh Medical Center.

We welcome information on case examples that could be included in the course. See the ad below.



Rep. Rush Holt (D-N.J.) at the Capitol Hill meeting said Congress should support the Digital Human project.

Photo: Charles Votaw, JSCPP

Biosecurity Education for Biology Researchers

The Federation of American Scientists is currently developing an interactive teaching module to promote awareness of biosecurity issues among bioscience researchers.

At this time, we are soliciting the bioscience community for examples of case studies that are illustrative of the security issues confronting researchers.

To submit a case, or if you have questions, please contact Stephanie Loranger, PhD 202-454-4686 or sloranger@fas.org

in diesel fuel to drop by a whopping 97 per cent to 15 ppm, by 2009. Refiners expect average fuel to contain less than 15 ppm sulfur and several are selling low sulfur fuels now in preparation for the final phase-in which begins in 2006.² (By that year the sulfur content of gasoline fuel will also change, going from about 200 ppm today to an average of 30 ppm by 2006.³)

- This striking reduction in the sulfur content of diesel fuels made it possible for EPA to set extremely strict limits on other diesel emissions. So under Tier 2 standards, diesel vehicle emissions will finally catch up—that is, go down to—the standards for NOx and particulates of gasoline-fueled cars and light trucks. These must average 0.07 grams per mile (gpm) of NOx by 2009—an 80 per cent reduction from the 0.3 gpm allowed earlier. Diesels, playing catch up, will have to reduce NOx by 93 per cent by 2009 from the 1gpm previously allowed for the larger personal vehicles. The new emissions standards also drop particulate levels to roughly 0.01 gpm. Vehicle manufacturers will be allowed to average diesel and gasoline vehicles to meet standards. There is no ironclad guarantee that diesel vehicles won't be slightly above the average but no vehicle in mass production could stray far from the average.

As for heavy trucks, which are mostly diesel-fueled, the new standards require them to emit no more than 0.2 grams per horsepower-hour of NOx and 0.01 gram of particulate per horsepower-hour by 2010, with phase-in beginning in 2007. EPA argues that new technology will allow the standards to be met with little or no fuel economy penalty.

- Besides fuels and emissions, there is technology. Thirty manufacturers surveyed by EPA confirmed they can meet the new standards by advances in particulate traps, emission controls, and other devices. (There is some question whether the efficiency of diesel engines might be somewhat reduced.) On the other hand, powerful, low-cost computers can now control how fuel and air are injected into diesel cylinders so that temperatures inside stay below the 2100 degrees K where NOx is formed—almost eliminating NOx emissions.

Diesel Hybrids

The new diesel engines are well suited for use with hybrids, such as a hydraulic/diesel setup being explored by International, Ford and others. Hydraulic hybrids use compressed nitrogen instead of batteries to store energy. When the brakes are pressed, a much higher fraction of the energy captured is returned to the wheels. If a hydraulic motor could power the vehicle, it would be possible to integrate the engine and pump in a free-piston system that could be simple and inexpensive.

The point is that these technologies are available now or within the next five years—in sharp contrast to more fuel cell technology that faces large technical uncertainties.

But what would diesels cost and where would we get more diesel fuel?

Advanced diesel technology could increase the fuel efficiency of a large 4-wheel drive SUV from 17.2 mpg in a baseline vehicle to 23.6 mpg, for an incremental cost of about \$1,600. Use of a hydraulic hybrid could achieve 32 mpg for an incremental cost of \$2,200. Including improved tires and aerodynamic designs, the vehicles could achieve 38.2 mpg for an incremental cost of \$2,500. These estimates are not in the distant yonder, but come from a detailed study published by EPA in January 2004, which assumed high volume production.⁴

One of the benefits of hydrogen is that it can be produced from many sources. But diesel fuels also can be produced from a variety of fuel resources. Since diesel is a liquid fuel, expanding diesel's use does not require replacing current filling stations and adding new infrastructure, as expanded use of hydrogen would require.

Diesel fuels do not require the high quality petroleum or extensive refining required to make gasoline. Fuels that work in diesel engines can be made from otherwise undesirable heavy oils available in many parts of the world including the U.S. and Canada. Diesel systems can run on dimethyl ether or methanol made from natural gas. Given the right economics it's also possible to make diesel fuel from coal. All of these resources, of course, are carbon-based. The way diesel systems would help reduce greenhouse gas emissions is due to their much higher efficiency.

Even greater reductions in greenhouse emissions can be achieved given technologies to make diesel fuels from organic waste or biomass crops.

The bottom line is that diesel technology has been advancing steadily for the past decade—even while the public debate about the future of cars has gotten sidetracked on a possibly quixotic quest for fuel cells. Yet humble diesel could increase the fuel economy of new vehicles entering the U.S. fleet by 25 to 100 per cent (in hybrids) and at affordable prices. If the whole fleet were diesel, it could use one fourth less of the total fuel used today—the equivalent of cutting all the oil we get now from Saudi Arabia.

Where is the public debate going? Environmentalists are paranoid that the new emission standards will be rolled back, and some lobbyists are trying to do just that. For instance Rep. Mac Collins (R-Ga.), who owns a family trucking business,⁵ asked the GAO for a study of the standards' impact—probably expecting the answer to be dire. But the GAO found no such thing; in fact it found reassurance from industry, no less, that the standards can be met. The report said:

“Representatives of the association of emissions control technology manufacturers and the five engine manufacturers we contacted said that the technologies to control diesel

emissions have advanced. While they acknowledged that several technical problems remain, all of the engine manufacturers reported that they expect to have engines ready by 2007 and plan to have prototype engines ready for trucking companies to test by mid- to late 2005.”⁶ In other words, they confirm the conclusions of the recent EPA review, namely that makers of diesel heavy-duty trucks are ready to meet the standards.

Demand for diesel would grow if Congress required fuel economy of at least 36 mpg, or if it passed a fuel tax that

reflected the real costs of the gasoline fleet’s dependence on high-grade foreign oil. But such sensible policies are unlikely, to say the least. Meanwhile, modest tax credits to consumers and to manufacturers, coupled with strict adherence to the present standards, could start getting diesels on track for a bigger role. It is an opportunity too great to ignore.

Henry Kelly is the President of the Federation of American Scientists.

1 http://www.eere.energy.gov/hydrogenandfuelcells/mypp/pdfs/3.4_fuelcells.pdf

2 <http://www.epa.gov/otaq/regs/hd2007/frm/final-pr.pdf>, EPA Feb, 2001.

3 <http://www.epa.gov/otaq/regs/ld-hwy/tier-2/420f04002.pdf> EPA, January 2004.

4 Progress Report on Clean and Efficient Automotive Technologies Under Development at EPA, EPA420-R-04-002, January 2004.

5 Diesel Fuel News, March 15, 2004.

6 <http://www.gao.gov/new.items/d04313.pdf>

THE HYPE ABOUT HYDROGEN

Joseph J. Romm

Hydrogen cars are being hyped today as few technologies have ever been. In his January 2003 State of the Union address, President George W. Bush announced a \$1.2 billion research initiative, “so that the first car driven by a child born today could be powered by hydrogen, and pollution-free.” Since then, the U.S. Department of Energy has made hydrogen and fuel cells the central focus of its transportation R&D funding. Governor Arnold Schwarzenegger has said California will build a “hydrogen highway” of 200 fueling stations up and down the state.

Yet, for all this effort, hydrogen cars are very unlikely to actually be good for the environment through at least 2035, and they may well *increase* pollution. Also, absent multiple major scientific breakthroughs, hydrogen cars will remain inferior to the best clean cars available today, gasoline-electric hybrids such as the Toyota Prius, in cost, range, annual fueling bill, convenience, and safety.

Don’t get me wrong. I am a strong proponent of keeping the hydrogen option open. I helped oversee the Department of Energy’s program for clean energy and alternative fuels, including hydrogen, for much of the 1990s—during which time we increased funding for hydrogen technologies tenfold. I believe continued research into hydrogen remains important because it is one of several fuels that might plausibly provide a pollution-free substitute for oil post-2035.

But going beyond R&D at this point to actually build regional or national hydrogen infrastructure and to deploy hydrogen cars is both unjustified and unwise. Let’s see why.

First, hydrogen cars make sense *only as a long-term strategy*, as most independent studies have shown. Even two well-known California hydrogen advocates, Joan Ogden and Dan Sperling of U.C. Davis, acknowledge in a new

article: “Hydrogen is neither the easiest nor the cheapest way to gain large near- and medium-term air pollution, greenhouse gas, or oil reduction benefits.” In that sense, focusing on hydrogen is a misdirection of resources away from strategies that can achieve greater environmental and energy benefits, at less cost, in the next few decades.

Hydrogen cars can actually be *more* polluting than the gasoline cars they replace. Hydrogen is not a primary fuel, like oil, which we can drill for. It’s bound tightly in molecules of water, or in hydrocarbons like natural gas. Much energy must be used to unbind it. Making that energy causes pollution.

Two Bad Bait-and-Switch Moves

Officialdom must avoid two bait-and-switch moves whereby they promise cleaner vehicles but deliver dirtier ones.

The first dangles the hope of an affordable fuel cell vehicle — supposedly using a combustion-free process that might have higher efficiency than internal combustion engines, plus zero tailpipe emissions—but then subsidize inefficient, polluting hydrogen-burning cars. California’s South Coast Air Quality Management District (AQMD) is doing this; it is spending millions to turn clean, efficient gasoline-burning hybrid cars into dirty, inefficient hydrogen-burning hybrids.

The other bait-and-switch move is when politicians talk up hydrogen from clean sources of energy, like solar and wind, but then subsidize polluting hydrogen filling stations. Note: Renewable hydrogen generated at a fueling station is likely to cost more than \$10 per gallon of gasoline equivalent. Delivering renewable hydrogen to a fueling station might cost less; but, note again: Virtually all hydrogen deliveries today are by diesel truck; when the added

“Without technology, we can’t hope to train enough responders in time,” said Michelle Roper, Project Director. “The project’s collaborators in the New York City Fire Department have indicated they see technology as key to their ability to efficiently deliver the essential training their members need to make informed, split-second decisions under life-threatening conditions,” says Roper.

Mass Casualty Incident Responder Training is just one of three “games” projects FAS is developing to show the use of distributed simulations and games to improve learning. (See PIR Vol. 57, No. 2 page 10.) “Studies show people learn by doing” says Kay Howell, who heads FAS’ information technologies programs. “Many decades of learning research have shown that trainees must have frequent practice with exposure to the requisite information and cues. With simulations it is possible to present essentially the same learning scenario and cues again and again. Our goal is to combine the motivational techniques of computer and video games, while presenting the learner with practice environments that provide real-world cues and automatic instruction and feedback.”

“We want to make the mass casualty game a platinum in the first responder training world,” Howell says. “we want to build a game that is so absorbing that firemen and others will play it in their down times at the station, or even on their days off.

“Simulations of how police, firefighters, medics and others should respond are far more cost-effective than staging real-world exercises and disrupting the life of a city—not to mention taking emergency workers away from their posts for long periods. With our game, players in remote locations, including some with older computer terminals, will be able to repeat the rehearsals and vary the kind of emergency from a fire to a chemical attack.”

Another game under development is **Immune Attack**. In this game, players interact with the human immune system to learn how disease and resistance to disease works. The target audience is high school and college biology students. The National Institutes of Health has provided preliminary funding.

Distributed game-playing as a medical teaching tool is the subject of a conference FAS will co-sponsor in September at the University of Wisconsin, Madison.

FAS is currently seeking to develop **Discover Babylon**, an instructional math game targeted at 8 to 16 year old players. It will use sophisticated video gaming and realistic environments to teach math and science through a series of mysteries set in ancient Iraq, so the game also will teach players about Mesopotamian society, business, and trade.

The games projects are but demonstrations of broad cognitive and technological principles of a national project FAS is leading, the Learning Federation project. It aims to ensure that technology-based solutions for learning are developed systematically, with scientifically validated principles.

In its first phase, the Learning Federation Project identified instructional design for game- and simulation-based learning as one of five priorities the research community must address. The project completed its two-year first phase by publishing research and development “road maps” for each of the five focus areas. They are:

- Instructional Design: Using Simulations and Games in Learning
- Question Generation and Answering Systems
- Learner Modeling and Assessment
- Building Simulations and Virtual Environments
- Integration Tools for Building and Maintaining Advanced Learning Systems

In the second phase, the Learning Federation project will develop the prototype games and work with national policymakers, industry leaders, and the education community to implement a national research program. We are encouraged by our progress to date.

The project is supported in part by Members which include Microsoft and Hewlett Packard.

FAS Resources

Training Technology Against Terror report is at <http://www.fas.org/main/content.jsp?formAction=325&projectId=15>

Learning Federation home page <http://www.thelearningfederation.org/>



Kay Howell, director of FAS’ information technologies programs.

Photo: Amanda Costantino FAS

KELLY CALLS FOR PRIVATE SECTOR INVESTMENT IN IT LEARNING R & D

Henry Kelly

OPINION

The United States spends about a trillion dollars a year on education and training. As a service sector, it is second in size only to health care. But it has remained almost completely innocent of the computer and connectivity-driven revolution that has revolutionized service quality and increased efficiency almost everywhere else.

This is the single greatest failure of the American economic and political system in this century. It's a national scandal and there's plenty of blame to go around.

It's not because we're failing to invest. Schools, universities, and training institutions are spending about \$5 billion a year on information technology. Things start falling apart when you ask how schools are using this stuff.

Any CEO knows that just laying IT on top of what you're already doing simply adds cost to the bottom line. Instead, you have to answer fundamental questions about the needs of your customers and identify new services and effective business processes to meet those needs. This means having the guts to make fundamental changes in operations, products, and job descriptions. Today's workplace looks nothing like it did 100 years ago—why is it that our schools and training classrooms do?

There is overwhelming evidence that there are better ways to teach people than lecturing at them. Learning by doing, instruction tailored to individualized needs, question asking, frequent feedback – these teaching methods dramatically increase how quickly and well students learn. Students taught by even mediocre tutors perform much better than students in 30-person classrooms and with a much lower range of outcomes – and virtually no one is left behind.

Technology can make many of these ideas affordable. In the private sector, companies invest billions to create detailed profiles of individual customers so that they can shape messages and offer products precisely tailored to their revealed knowledge, needs, interests, and desires.

The cookies on your kid's computer probably know more about her than her teacher. Help-desk service centers spend billions to understand customer and employee questions and craft answers for the person asking (check the cookie) and the context of the question. Well-designed systems are smart enough to know when the automated system is failing and get a real person on the line.

Computer and video game designers are creating compelling challenges in beautifully rendered artificial worlds that worry endlessly about keeping players on the edge of anxiety. These services and products are routine parts of our lives, yet walking into a classroom is like entering a time warp to a world that would be familiar to Millard Fillmore.

To fix this problem, government has to use its limited leverage where it matters most, in R & D and demonstration. The private sector can't pick up the tab for all education research any more than it can foot the entire bill for health research. The nation needs a tightly managed program of basic and applied research, built around a well-designed plan that embraces all needed disciplines and encourages public/private partnerships.

Ironically the US military leads the world in using sophisticated training technology. It's the only way they can have millions of service people and contractors prepared to use advanced equipment to deal with the unexpected anywhere on the globe. Why are these ideas trapped in the Pentagon?

What about the nation's diverse workforce of emergency responders – firemen, police, doctors, nurses, Army medics, and the like? Why do we allow their training, retraining, and updating of knowledge to stay stuck in Millard Fillmore's age?

Education managers have to stop raising the bogeyman of faceless corporate management; they should accept how much business can contribute to a revolution in learning in the classroom and beyond. But I throw my largest stone at the business community for its "soft bigotry of low expectations" for the entire education enterprise – including their own training operations. Business has the most at stake – for starters, a decline in the skills of the workforce. Business leaders have a unique vantage on what can be done improve service delivery to a diverse customer base. And they know how to manage innovation.

The FAS' Learning Federation project has benefited from government, non-profit, and private sector support. To carry out our next phase, in which our mission is to see that research, development and demonstration goes forward, the support of business will be critical.

Henry Kelly is the President of the Federation of American Scientists.

Senate Committee Forgoes Action on Crucial Small Arms Treaty

Continued from page 3

and exports, and encourages cooperation and information sharing among national law enforcement agencies. To date, 33 OAS member states have signed the Convention and 24 have ratified it. The United States was an early and important supporter. It helped to draft the Convention's text and was one of its first signatories. This early momentum fizzled after it was transmitted to the Senate Foreign Relations Committee, where it has languished since 1998.

Welcome Progress on Shoulder-fired Missile Threat

This spring saw progress on the shoulder-fired missile (MANPADS) threat on several fronts. In March, Representatives John Mica (R-Fl.), Peter Defazio (D-Or.) and Steve Israel (D-N.Y.) introduced the Commercial Aviation MANPADS Defense Act (CAMDA). It was reported out of the House Transportation Committee on June 23rd.

CAMDA expands upon last year's bill which focused primarily on technical countermeasures by strong international agreements on export controls and surplus stockpile destruction. The new bill requires the Federal Aviation Administration to set up a process for expediting certification of such systems. The bill also addresses information sharing between U.S. intelligence and law enforcement agencies, contingency planning for threats of MANPADS attacks and airport vulnerability assessments.

US to Help Nicaragua Destroy its Surplus MANPADS

In May, the State Department announced that the Nicaraguan government had agreed to destroy its entire stockpile of 2,200 shoulder-fired missiles. The agreement is the culmination of months of negotiations between the State Department and the Nicaraguans, who had insisted on holding on to hundreds of these missiles as a hedge against possible military threats from neighboring countries.

The destruction of the Nicaraguan missiles will be funded through the State Department's Small Arms/Light Weapons (SA/LW) Destruction Program, a little-known but essential part of the U.S. strategy to rein in illicit trading in small arms. Dollar for dollar, this program provides more security for Americans than any other defense or foreign aid initiative. Yet it receives a fraction of the funding lavished upon many Pentagon programs. Last year, the SA/LW Destruction Program was appropriated a mere \$3 million—2 per cent of the cost of an F-22 fighter aircraft. The President has requested \$9 million for the program in FY2005, a three-fold increase over FY2003. While significant, the increase is hardly proportional to the growing threat posed by surplus small arms and light weapons.

GAO Criticizes Defense Department's End-Use Monitoring Program

The General Accounting Office capped off this spring's nonproliferation activities with the release of its eagerly anticipated report on U.S. efforts to stop proliferation of MANPADS (the principal US MANPAD is the Stinger). The report provides an overview of existing multilateral non-proliferation agreements, critiques the Defense Department's

end-use monitoring program for MANPADS exports, and summarizes recent developments in the Department of Homeland Security's program to outfit commercial airliners with missile defense systems.

Particularly important is the GAO's analysis of the Defense Department's end-use monitoring (EUM) program. The GAO found that vague DOD EUM requirements have resulted in inconsistent inspections of U.S. MANPADS and incomplete inspection records. The report also summarizes U.S.-led multilateral agreements on all use, transfer and storage of MANPADS. These codify norms and practices that are essential to help prevent additional MANPADS from entering the black market. Nonetheless, the GAO report notes that the absence of adequate U.S. mechanisms for monitoring compliance makes it difficult to be ensure that member states are complying.

FAS Report Shows Need to Curb Illicit Small Arms in Western Hemisphere

In June the FAS released a report on the OAS Firearms Convention.* While there are other reports on the global traffic in small arms and light weapons, the 38-page FAS study was unique in explaining how this 1997 Convention helps curb illicit arms transfers. It makes cogent arguments that this trade would be better curbed if the United States ratified the Convention.

The report also documents how illicit arms stoke the "witch's brew" of criminal activity and drug trading centered in violence-torn Columbia. "For arms traffickers, the world is a very small place," says report author Matthew Schroeder, manager of the Arms Sales Monitoring Project at FAS.

The report was delivered to every U.S. senator and to all the representatives to the OAS in Washington. Ambassador Luigi R. Einaudi, Assistant Secretary General of the OAS, welcomed the FAS report as a helpful tool to shed light on this important problem and the little known but crucial Convention.

"The OAS Convention is essential to curbing the illicit trade in small arms, and U.S. ratification is essential to making it happen," Einaudi said.

The report was released in early June to persuade the Senate to finally spring the Convention out of committee and get it to the Senate floor for a vote. But without explanation the Senate Foreign Relations Committee declined to hear it. (See story starting page 3.)

*Formal title: Inter-American Convention Against the Illicit Manufacturing of and Trafficking in Firearms, Explosives, Ammunition and other Related Materials.

The report is FAS Occasional Paper No. 1, Small Arms, Terrorism and the OAS Firearms Convention. To order call 202.454.4693. Or visit "http://fas.org/asmp/campaigns/smallarms/OAS_Firearms_Convention.html"

Battle Set Over Licensing Exemptions

The Senate version of the 2005 Defense Authorization bill includes a controversial amendment to U.S. law that waives conditions on arms export licensing exemption agreements for the UK and Australia. Currently, U.S. law restricts license-free arms transfers to countries with export control regimes that are comparable to those of the United States. The UK and Australia are either unwilling or unable to fully comply with license exemption requirements. Their resistance prompted the State Department to seek “legislative relief” from these requirements.

The amendment will face stiff opposition from opponents in the House, who will have a chance to kill it during conference committee negotiations. In May, the House International Relations Committee (HIRC) released a scathing report on the UK and Australia exemptions. The report highlights possible security threats, including the elimination of pre-shipment

checks on shippers and freight forwarders, because middlemen are in a position to divert the shipments to unauthorized recipients.

In the cover letter of the HIRC report, Chairman Rep. Henry Hyde (R-Ill.) underscores the incompatibility of the licensing exemption agreements with U.S. counter-terrorism efforts:

“...This is a moment in our Nation’s history to strengthen, not relax, export controls over all weapons technology—not only weapons of mass destruction... but also conventional weapons and munitions, which our enemies are already using against our civilians and U.S. servicemen and servicewomen.

“Indeed, a policy to relax weapons exports controls seems unhinged from U.S. counterterrorism and non-proliferation policy.”

Matthew Schroeder is the Manager of the Arms Sales Monitoring Project at FAS.

SPACE ASSETS CAN BE PROTECTED WITHOUT SPACE WEAPONS, SAYS NEW FAS REPORT

Satellites have become an absolutely critical component of U.S. military operations. They are used to guide munitions, provide intelligence, relay communications, and enable live video links from battlefields. Because of the central role of space, it is possible that potential adversaries will seek to destroy or disrupt U.S. space assets in a future conflict. The 2001 Commission to Assess United States National Security Space Management and Organization, also known as the Rumsfeld Commission on Space, argued that countering threats to U.S. space assets would require “superior space capabilities.” This statement has been taken by some advocates of space weaponization as a recommendation to place weapons in space, in order to defend critical U.S. systems.

In December of 2002, the Federation of American Scientists assembled a panel of scientists and engineers, including academics and former high-level government officials, to assess the threats to U.S. military and civilian space assets over the next five to ten years and to determine the best method to counter these threats. The final report of the panel’s findings is scheduled to be released to the public this summer.

The chief findings and recommendations follow.

- Space weapons do not constitute the best mitigating strategy to any of the perceived threats to space assets: ground-based anti-satellite weapons, jamming, space mines, orbital debris, or a high-altitude nuclear explosion.
- No space weapons should be deployed by the United States in the next five years, although R&D should continue at an appropriate level so that the United States is not caught by surprise.
- The U.S. should ensure that critical space systems are redundant and placed in multiple orbital planes to reduce the damage caused by losing an individual satellite.
- Critical military infrastructure in low earth orbit should be hardened against radiation to increase survivability in the event of a high-altitude nuclear explosion.

- Quick launch capabilities should be developed in order to replace critical space infrastructure.
- The U.S. should take the initiative to secure verifiable international agreements, including “rules of the road” that make clearer what is considered threatening activity in space.
- The U.S. should continue to improve its space monitoring capabilities and space situational awareness to prevent stealthy hostile actions and further reduce the threat posed by background orbital debris.
- The threat posed by small satellites is not well understood. A thorough technical study should be undertaken to assess the magnitude of this threat over the next ten years. In particular, the study should investigate the minimum requirements in fuel and mass for various orbital maneuvers, how much support from ground stations they would require, and the homing and stealth capabilities of small satellites.
- The panel developed a rigorous analytical model of the hazard posed by orbital debris. Based on this model the panel determined that suborbital and low earth orbit explosions will not generate debris fields that are significant hazards to space infrastructure. Such debris fields could result from the interception of ballistic missiles in space or from the direct destruction of satellites. Assets in geostationary orbit, however, are much more closely packed and explosions at or near this orbit could potentially cause debris fields that would be extremely dangerous to military and commercial assets.
- To improve confidence in models of the debris problem, the panel recommends that the appropriate government agencies undertake or commission studies to better correlate the current fragmentation models with more precise measurements.
- The panel recommends that a similar study be commissioned in five years to assess how changes in the political and technological landscape may have altered the arguments for and against space weaponization.

Josh Kellar is an FAS Research Assistant who has worked extensively on the Space Weaponization Project.

PLAYBOY FOUNDATION HONORS FAS SECRECY PROJECT AT DINNER WITH THE STARS



Shining with Stars At a dinner at New York's Pier Sixty Restaurant, Christie Hefner, Chairman and CEO of Playboy Enterprises Inc., (center) celebrates with Bill Maher (left) host of HBO's "Real Time" and actress Martha Plimpton. Maher was one of eight honored for his contribution to the defense of First Amendment values, along with Steven Aftergood, Director of the FAS Project on Government Secrecy.

Photo: David Allocca StarPix

Steven Aftergood, who has directed the FAS Secrecy Project and single-handedly has put out hundreds of issues of the popular online newsletter *Secrecy News* since 2000, was selected as one of eight winners of this year's Hugh M. Hefner First Amendment Award. Aftergood was honored at a dinner at New York's Pier Sixty – complete with movie and television stars. The ceremony was hosted by Christie Hefner, the Chairman and CEO of Playboy Enterprises Inc. and daughter of Playboy founder Hugh Hefner.

The prize "honors individuals who have made a significant contribution to protect and enhance the First Amendment rights of Americans," according to the Playboy Foundation.

Among other winners this year were Bill Maher, controversial host of HBO's "Real Time," Molly Ivins, syndicated columnist, and David Cole, a professor of law at Georgetown University. The judges this year were Margaret Carlson of CNN's *The Capital Gang*, Ann Richards, former governor of Texas and John Siegenthaler, founder of Vanderbilt University's First Amendment Center. The proceeds from the benefit dinner go to The Creative Coalition, a nonprofit advocacy group for the arts and entertainment industry.

Aftergood and FAS were honored for work that keeps "Americans apprised of the inner workings of government secrecy and promotes reform of its secret processes."

Since the prize was founded 25 years ago, the award has gone to over 100 people. The Playboy Foundation reports that since it was founded in 1965, it has awarded nearly \$16 million in grants and in-kind contributions to organizations concerned with First Amendment freedoms. At this year's dinner, each winner received a prize check of \$5,000.

FAS Honored Steven Aftergood holds the Playboy Foundation's First Amendment Award at the May dinner in New York.

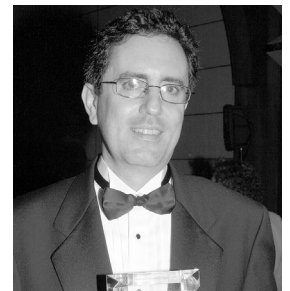


Photo: David Allocca StarPix

Hydrogen For The Fleet? Don't Hold Your Breath

Continued from page 7

diesel emissions are factored in, they cancel out most of the air quality benefits of hydrogen.

The vast majority of hydrogen fueling stations built through 2035 are unlikely to be green. Today approximately 95 per cent of hydrogen in the United States is made from natural gas, a fossil fuel. Making large quantities of hydrogen from natural gas is so impractical that a National Academy of Sciences panel concluded last March that it "is highly likely that fossil fuels will be the principal sources of hydrogen for several decades."

So why don't we use renewables such as solar and wind as our main future source of hydrogen? Even if the costs of renewables dropped sharply, it is bad policy to rely on them to make hydrogen for the transportation sector. We would achieve far greater reduction in pollution by using renewables to displace coal or natural gas power plants. By using renewables for power generation directly, we achieve benefits without massive new investment in hydrogen infrastructure. A 2004 analysis by Jae Edmonds

et al. of Pacific Northwest National Laboratory concluded that even "in the advanced technology case with a carbon constraint ... hydrogen doesn't penetrate the transportation sector in a major way until after 2035."

H2 for the Fleet?

Hydrogen cars are probably technological dead-ends, like Betamax or gas turbine cars, absent at least two major scientific breakthroughs. A major review of research, chaired by MIT's Mildred Dresselhaus, for DOE's Basic Energy Sciences program, noted that the cost of transportation fuel cells is currently 100 times that of internal combustion engines.

As for DOE's research on high-pressure tanks and cryogenic liquid storage, the National Academy panel which reported last March concluded: "The DOE should halt efforts on [these]... They have little promise of long-term practicality for light-duty vehicles." The same month a report by the

Continued on page 14

SECRECY PROJECT AND THE ABU GHRAIB PRISON SCANDAL

The FAS Secrecy Project continued to push for greater openness where disclosure is legitimate. In early May when shocking images of U.S. personnel at Baghdad's Abu Ghraib prison abusing Iraqi prisoners burst into public view, the Secrecy Project was among those pressing for full disclosure of the internal Army report on the matter. The March 2004 report is known as the "Taguba report" after its author, Maj. Gen. Antonio M. Taguba.

The report soon leaked into the public domain (and can also be found on the FAS web site) even though it nominally remains classified. On May 6 the Secrecy Project filed a complaint with the government's Information Security Oversight Office challenging the classification of the report.

The FAS complaint noted that it is official policy that "in no case shall information be classified in order to conceal violations of law." Yet the Taguba report contained passages describing instances of "sadistic, blatant and wanton criminal abuses" which were marked as "classified," in apparent violation of classification policy.

The ISOO agreed to undertake an investigation in response to the FAS complaint.

The next week Secretary of Defense Donald Rumsfeld testified most of the day under the glare of TV lights and the questioning by Republicans and Democrats on the Senate Armed Services Committee. Secretary Rumsfeld said the DOD had at least three compact disks containing yet more images of the abuse of prisoners in Iraq. FAS and Aftergood urged the Pentagon to release, or at least declassify, all additional images in its possession.

Disclosure of all relevant images is "a prerequisite to achieving full accountability for the abuses documented," said the FAS request. Classifying them could violate the same official policy, noted above, which bars classification to "conceal violations of the law." The FAS request also said: "We would not object if the images were modified prior to release so as to protect the privacy of individual victims."

See also FAS In The News on page 2.

HIGHLIGHTS FROM THE PROJECT NEWSLETTER SECRECY NEWS

July 4 A book-length Army study of the war in Iraq, entitled "On Point," contains "a revealing and fairly critical account of lessons learned from the war." But when the Center for Army Lessons Learned posted the study, the web version was coded so it could not be downloaded or copied or printed by readers.

"This may be unprecedented for a government web site" wrote SN. "If the Axis powers had won World War II, the whole internet might look like this."

A Center spokesman said that the restriction on downloading was temporary due to copyright permissions not yet obtained at the time of posting and was designed to protect against "unscrupulous individuals" selling "our products." A copy of the report was independently made available in downloadable form on the GlobalSecurity.org web site.

July 7 The British Parliament disclosed in an annual report the total amount the U.K. government spends for intelligence. In 2003-2004 the total budget for the nation's three major intelligence agencies – GCHQ, the Security Service (better known as MI5) and the SIS (MI 6) – was \$1,130.9 million pounds, a 20% increase over the prior year. Meanwhile, SN noted, the CIA continues to fight an FAS lawsuit asking that the intelligence budgets from 1947 through 1970 be disclosed. The total U.S. intelligence budget was revealed for the first time in 1997 (\$26.6 billion at that time) in response to a previous FAS lawsuit.

April 23 SN reported a study by the Association of American Universities showing that universities report "a significant increase of situations where a [research] sponsor

has included language that either restricts the dissemination of research results or the use of foreign nationals without prior approval." Of 138 cases cited, most restrictions were imposed by the Department of Defense. Not to be outdone, the DOD Inspector General released a report showing that "one university granted foreign nationals access to unclassified export-controlled technology without proper authorization." In April SN also posted two Congressional Research Service reports on balancing national security with open publication of scientific data.

April 9 The nuclear power plant accident at Three Mile Island took place 25 years ago, but all the records concerning the March 28, 1979 incident have still not been released. SN reported on a request by Rep. Edward J. Markey (D-Mass.) to three federal agencies to finally release these, to help communities that may have been affected.

March 26 SN reported the challenge from two members of Congress to the DOD's decision to retroactively classify "50 specific recommendations" made by independent evaluators of DOD missile defense tests. Henry Waxman (D-Calif.) and John F. Tierney (D-Mass.) wrote that the decision "appears to be an attempt to stymie public debate."

March 10 The Dalai Lama's speech called for greater freedom of information in China to drive peaceful political change. To effect change smoothly, "We should seek truth from facts—facts that are not falsified," he said. The occasion for the speech was the forty-fifth anniversary of the 1959 Tibetan People's Uprising.

American Physical Society said “a new material must be discovered” to make onboard hydrogen storage practical.

Generally, the gap between current hydrogen production, storage, and fuel cell technology and what is needed for hydrogen vehicles to be competitive “cannot be bridged by incremental advances of the present state of the art. Bridging the gap requires not only creative engineering, but also *revolutionary conceptual breakthroughs*,” concluded the Dresselhaus panel reviewing DOE research.

An analysis in the May 2004 issue of Scientific American stated, “Fuel-cell cars, in contrast [to hybrids], are expected on about the same schedule as NASA’s manned trip to Mars and have about the same level of likelihood.” So we will have a long time to wait before hydrogen cars are practical or before we deploy significant infrastructure.

Finally, questions of public safety must be addressed. Russell Moy, a chemical engineer who oversaw hydrogen storage and refueling facilities at Ford Motors, wrote last November, “it is difficult to imagine how hydrogen risks can be managed acceptably by the general public when wide-scale deployment of the safety precautions would be costly and public compliance impossible to ensure.”

Hybrids and Plug-ins

We must keep exploring other alternatives to gasoline for the period after 2035. These include advanced hybrids, biofuels, and clean diesels running on zero-carbon fuel. Government programs have helped introduce ultra low-emission hybrid vehicles, like the Toyota Prius and Ford Escape. Hybrids are almost certainly the platform from which all future clean vehicles will evolve. For instance, if fuel cells ever prove practical, they will be inserted into hybrids.

As battery technology continues to improve, we will see hybrids that can be plugged into the electric grid, allowing the car to run as a pure “zero emission vehicle” in cities. Since most vehicle use is for relatively short trips, such as commuting, which are followed by an extended period of time during which the vehicle is not being driven and could be charged, even a relatively modest all-electric range of 20 or 30 miles could allow these vehicles to replace a substantial portion of gasoline consumption and tailpipe emissions.

The potential greenhouse gas benefits of plug-ins are significant, if a source of zero-carbon electricity can be utilized for recharging. Plug-ins have an enormous advantage over hydrogen fuel cell vehicles in utilizing zero-carbon electricity. That is because of the inherent inefficiency of generating hydrogen from electricity, transporting hydrogen, storing it on board the vehicle, and then running it through the fuel cell. The total well-to-wheels efficiency with which a hydrogen fuel cell vehicle might utilize renewable electricity is roughly 20 per cent. (That number could rise to 30 per cent or possibly a little higher with the multiple technology breakthroughs required for a U.S. hydrogen economy.) The well-to-wheels efficiency of charging an onboard battery and then discharging it to run an electric motor in a plug-in, however, is 80 per cent (and could be more efficient in the

future)—four times more efficient than current hydrogen fuel cell vehicle pathways.

As Dr. Alec Brooks, who led the development of the Impact electric vehicle has shown: “Fuel cell vehicles that operate on hydrogen made with electrolysis consume four times as much electricity per mile as similarly-sized battery electric vehicles.”

Hydrogen and Climate Change

A central focus of our energy and transportation policy must be global warming. And that means addressing emissions from coal and natural gas power plants. The U.S. Energy Information Administration (EIA) forecasts that in the electricity sector “112 gigawatts of new coal-fired generating capacity will be constructed between 2003 in 2025” in part because rising natural gas prices improve the cost competitiveness of coal-fired technologies.

At the same time, utilization of existing coal plants is projected to rise, so that by 2025, U.S. coal consumption by electric generators will be 50 per cent higher than today.

These EIA projections underscore the need for increasing production of power from other sources, rather than increasing coal use for making alternative fuels such as hydrogen, for at least the next two decades.

Domestic policy must consider the global implications. The EIA projects that more of this country’s growing demand for natural gas will be met from imported liquefied natural gas, rather than increased domestic in production. Thus, we should start thinking of natural gas as a global resource, when we contemplate using it for purposes other than displacing coal. A basic reason is that projected growth in worldwide coal consumption poses an even bigger greenhouse gas problem than projected U.S. growth in coal use. The International Energy Agency projects that coal generation will double between 2000 and 2030. Over their lifetimes, new coal plants will raise global anthropogenic carbon dioxide emissions by some 500 billion metric tons, an amount roughly half again the total emissions of all fossil fuel plants during the past 250 years. Thus, added coal plants would dramatically increase the chances of catastrophic climate change.

Our optimum climate strategy through 2030 is straightforward. In transportation, push hard for efficiency, especially hybrid vehicles. In other end-use sectors like buildings and industry, we should also push hard for efficiency. In the power sector, we must aggressively pursue low-carbon sources, especially renewables. Until the electric grid is virtually carbon-free, we should not divert substantial amounts of natural gas or renewables to make hydrogen for vehicles.

At this point, hydrogen is the most technically challenging of all alternative fuels and the least likely to be cost-effective as a climate change solution. Other strategies deserve at least as much attention and funding.

Joseph J. Romm is former Acting Assistant Secretary of Energy and author of “The Hype about Hydrogen: Fact and Fiction in the Race to Save the Climate.” Island Press, 2004. He is at the Global Energy Technology Foundation.

FAS gets 4-Star Rating from Charity Navigator

For the second consecutive year the FAS received a 4-star rating from Charity Navigator, a group that ranks nonprofit organizations. It compares the financial management of about 3,000 nonprofits per year as a service to potential donors.

"Receiving four out of a possible four stars indicates that your organization excels, as compared to other charities in America, in the area of strong fiscal management. This consistency in your rating is an exceptional feat, especially given the economic challenges all charities have had to face in the last year," Veronica Marshall of CN said June 1.

Other nonprofits in the sciences awarded 4-stars were the Rand Corporation, the American Museum of Natural History in New York City, and the American Association for the Advancement of Science.

Charity Navigator is America's largest independent evaluator of charities, said Marshall.

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You don't have to give up income to make a gift. You can make a financial commitment from your will, living trust, or other estate plans including:

- Bequests: Make a gift to FAS in your will or living will.
- Retirement Plan Assets: Use your tax-deferred retirement plan assets to benefit FAS.
- Life Income Gifts: Transfer assets to FAS and you and your chosen beneficiary receive income for a term of years or for life. When the term expires, the remainder of the life income gift is distributed to FAS.

Contact Christine Palumbo at 202.546.3300 or email membership@fas.org

Shapley New FAS Director of Communications Our Site. Our Fan Mail.

Deborah Shapley has joined FAS as its first Director of Communications. Shapley is a journalist who has written extensively on defense, arms control, science policy and information technology. Her articles have appeared in The New York Times, Technology Review, Time, The Financial Times, The Washington Post, The Washington Times, The Bulletin of the Atomic Scientists, Daedalus and other publications. She makes frequent public speeches and has appeared on CBS, CNN and CSPAN.

Her grandfather, Harvard astronomer Harlow Shapley, was one of the founders of the Federation in 1945. Alan Shapley, who was associated with the Federation for several years, is her uncle.

She is the author of three books. The most noted is a biography of former defense secretary Robert McNamara. *Promise and Power: The Life and Times of Robert McNamara*



Photo: Chad Evans Wyatt

was published by Little, Brown in 1993. Earlier books were on U.S. science policy and on Antarctica. Shapley's journalistic career includes 9 years spent as a weekly reporter for Science Magazine and then as Washington Bureau Chief for Nature. Her books were supported by leading foundations. She will edit the Public Interest Report and coordinate FAS' outreach to the public, policy makers and the media.

In the second quarter of 2004 www.fas.org continued to be one of the most heavily used sites on the entire Web. In June the tracking service Alexa ranked it around 10,000th higher than the sites of many nonprofits and most other defense-related organizations. (The first through third most trafficked sites belong to Yahoo, MSN and Google respectively.) Generally FAS consistently ranks in or near the top 10% most popular web sites.

We continue to get good reviews for the site—though we apologize that the sleek, blue pages visitors see first are skin deep; the older pages below get the most traffic. We are still forging links to the old version, which has possibly 100,000 pages.

Webmaster Peter Voth notes that the visitors to our site every day download an average of 25 gigabytes of data. "If that information were on paper, it would fill about 25 pickup trucks," he says. User tip: If you don't find what you're looking for with a "Website Content" search, choose the "Google" search button instead.

From the mailbag:

A fan wrote that he "enjoyed your web site for several years as a valuable source of information and encouraged others to do the same, [so] it's about time I once again send you some support. Enclosed is \$50 for the purpose."

A graduate student at California State University who joined wrote, "Keep up the good work!"

We appreciate your kudos and will work hard for you.