

Public Interest Report

The Real Terrorist Missile Threat and What Can Be Done About It

By Robert Sherman

The past year has seen intense speculation on why early signs of the World Trade Center attack were not detected. Historians will forever dispute whether the FBI was negligent in failing to recognize that something consequential was in the offing as Arab students with poor flying skills asked to learn how to fly jumbo jets without learning how to take off or land.

But today the civilized world faces a threat many times more serious than 9-11. The evidence of the threat is not subtle or



Photo courtesy of the Government of Columbia

SA-18 Iгла (needle) man-portable surface-to-air missile

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Science-Based Workshop for Leaders of Environmental NGOs and GONGOs in China

By Walter E. Parham, Ph.D.

Over the past few years, the highest levels of China's government have talked candidly about the serious environmental/natural resource problems plaguing China today. They've been clear that many of the problems were caused by human activities and are not merely "natural disasters." China's current Five-Year Plan states

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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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The Real Terrorist Missile — Continued from page 1

ambiguous. It sits right in front of us in plain sight.

Suppose that, within the space of one month, terrorists using shoulder-fired missiles shoot down two 747s and two regional passenger aircraft. Examination of such a scenario leads inexorably to six conclusions:

1. The socioeconomic cost would be immense.
2. Terrorist intent to use missiles against commercial aircraft is clear.
3. Weapons now widely dispersed around the world are capable of such an attack.
4. A variety of countermeasures can be implemented to significantly reduce the probability of a successful attack. While these countermeasures are not cheap, their cost is trivial compared to the cost of allowing terrorist counter-airliner attacks to succeed. Yet in most cases they are being pursued half-heartedly or not at all.
5. Major policy changes are imperative.

COST

One successful large-airliner shoot-down would be viewed as a freakish tragedy. But two successful attacks spread over a few days or weeks would be viewed as a pattern, an indicator of things to come. Statistically, one might argue that air travel remained safer than automobile travel regardless of whether there had been zero, one, two, or five successful attacks. But the psychological impact of

serial shoot-downs would likely be extreme.

Immediately, the flying public would conclude that commercial aviation is unsafe.

Insurers would sharply increase their projections of the risk of commercial flight. Hull and liability insurance could become unavailable or prohibitively expensive. Passenger ticket sales could fall catastrophically because of fear and a sharp increase in ticket prices. Consider, for example, a world in which the cheapest coach seats are priced higher than today's unrestricted first-class seats.

The very survival of all air carriers, aircraft manufacturers, and their supporting industries would be endangered, as would those industries whose operations depend on air transportation. Civilization's ability to move people and goods rapidly over long distances could be lost.

Direct casualties from downing a handful of passenger jets would be in the hundreds, well under those of 9-11. But the socioeconomic cost would be far greater, deep in the hundreds of billions of dollars at least, depriving the world of rapid transportation, and probably triggering a worldwide recession or depression from which recovery cannot be predicted.

It is true that although the total number of civilians killed by terrorist use of shoulder-fired missiles against smaller aircraft to date approximates the passenger load of a large airliner, the socioeconomic

impact of these attacks has been minimal. Similarly, many more people died in previous shipwrecks than in the sinking of the Titanic, but it was the latter that stimulated such obvious steps as requiring liners to carry enough lifeboats to hold all the passengers. The difference is psychological. Small numbers of large airliners carry a psychological and political salience that larger numbers of smaller aircraft do not.

TERRORIST INTENT TO ATTACK AIRLINERS

Recent history finds ample evidence of accelerating terrorist attempts to attack passenger aircraft with shoulder-fired missiles. The most notable incidents include:

- 1994 — A Falcon-50 executive jet carrying the Presidents of Rwanda and Burundi is shot down, igniting massive ethnic violence.
- 1997 — Rebels shoot down a Yugoslav government transport, killing five.
- 1998 — A Congo Airlines 727 airliner is shot down by rebels, killing all 40 aboard
- 1999 — Rebels in Angola shoot down a United Nations C-130 transport, killing 14.
- 2001 — Rebels in Angola hit, but fail to destroy, a United Nations 727 cargo aircraft.
- 2002 — An expended surface-to-air missile launch tube is found near Prince Sultan Air Base in Saudi Arabia.
- 2002 — Two missiles are fired at an Israeli chartered 757 with 271 on board as it takes off from Mombasa, Kenya. The

- missiles are seen by the pilot as they fly by and miss.
- 2002 — A young man openly carrying a fully functional late-model Russian shoulder-fired anti-aircraft missile is arrested on a street in St. Petersburg. He had found the missile on a shooting range and was taking it home to show his friends.
- 2003 — At least two missiles are fired at US Air Force aircraft landing at Baghdad airport, but miss.
- 2003 — Three arms dealers are arrested in a sting in New Jersey for attempting to sell the first of 200 Russian SA-18 missiles to an apparent Sudanese terrorist explicitly for use against American airliners. Fortunately, the apparent supplier of the missile was a Russian counter-terrorist agent; the missile was intentionally inoperable; the apparent Sudanese terrorist buyer was an FBI agent; and the arms dealers are now in custody and awaiting trial.

THE WEAPONS

An accurate count of shoulder-fired anti-aircraft weapons is impossible, but worldwide they appear to number in the mid to high hundreds of thousands with most, of course, in the hands of national militaries. The number of terrorist organizations known to possess them appears to number in the low teens.

Fire and forget missiles

Shoulder-fired anti-aircraft weapons typically use fire-and-forget infra-red

guidance, homing at supersonic speed on the heat signature of the target aircraft. All are capable of being carried and fired by one man, although operation usually consists of a two-man crew with two missiles. Typical system weight is about 35 pounds. All are about the size of a trombone. All can be readily concealed and fired with preparation time of a few seconds. Generally they are “wooden rounds,” requiring no maintenance.

Because of their lightweight warheads, a direct hit is required to do significant damage, and fusing is by contact with the target. Probability of kill per hit should be assumed to be high, but is a subject of considerable debate. C-17 advocates, for example, claim that a direct hit on one of the four C-17 engines would cause that engine to break away, leaving the aircraft crippled but flyable. This should be taken with a grain of salt; the location and precise effect of a missile hit is unpredictable.

Fire and forget missiles of concern here include, in order of increasing capability:

- SA-7a Strela 2
- SA-7b Strela 2M
- SA-14 Strela 3
- SA-16 Igla 9K-31-0
- Stinger Basic
- SA-18 Igla 9K-38
- Stinger POST
- Stinger RMP

(SA-XX is the NATO designator for surface-to-air missiles of the former Soviet Union. Stingers are US missiles.)

The most widely-deployed of these missiles is the SA-7b, which was

probably the weapon used in all the attacks listed above. Using Vietnam-era technology, its nominal range is about 3 miles and nominal altitude about 10,000 feet, but its effective footprint is somewhat less than that. Its speed is about Mach 1.6, its maneuverability about 6G, and its maximum flight duration before self-destruct is about 15 seconds. Its seeker technology generally limits it to operating in tail-chase mode.

Moving down the list, the missiles progressively increase in range, altitude, speed, and maneuverability. A step increase in effectiveness begins with the Stinger Basic, which has a superior seeker capable of detecting and tracking aircraft engine heat from any aspect, thus radically increasing its attack opportunities.

Another step increase is found beginning with SA-18, which uses a two-color seeker. This enables the missile to distinguish and respond to the spectral differences between the emissions of an engine and those of a conventional pyrotechnic flare.

Several thousand Stinger Basics were given to the mujaheddin to help resist the Soviet occupation of Afghanistan. It appears that two or three hundred of these Stingers remain unused and are in the hands of Al Qaida remnants, or of similar sub-national entities that bear no love for Western civilization. These missiles are old, more than twice their rated storage life of eleven years. While their reliability is uncertain, they must be considered a highly significant threat to commercial aviation — as are the several thousand SA-18s and the

much larger number of their earlier brothers dispersed around the world.

Laser-guided shoulder-fired anti-tank missiles

Some commentators have suggested that laser-guided missiles such as the British Blowpipe are particularly dangerous because they are relatively immune to countermeasures. But they require the operator to hold a laser spot on the target throughout the flight of the missile. This is a highly demanding task and would probably deter or defeat terrorist use of laser-guided anti-aircraft missiles.

Anti-tank missiles used against aircraft

Because of the use of RPG light anti-tank missiles against hovering helicopters in Somalia, dramatized in the motion picture “Blackhawk Down”, there is some public concern about possible RPG attack against airliners. While freak events can happen, basically this concern is misplaced. The RPG is an unguided,

rifle-sighted missile with range limited to a few hundred meters. Its short range denies it a useful tail-chase or head-on opportunity, and its unguided nature renders a shot from the side almost certain to miss.

On the other hand, although this has not been demonstrated, a very smart anti-tank missile such as the US Javelin might be effective in a head-on shot.

WHAT CAN BE DONE

There is no silver bullet. No single countermeasure can shield all airliners from all shoulder-fired missiles under all conditions. But there are a variety of countermeasures that, in combination, can provide significant risk reduction.

Controllable enabling

It is now possible to retain use control of shoulder-fired missiles even if physical possession is lost. Missiles can be designed with a chip-level feature that requires enabling by an electronic password before the missile will activate.

This does not mean that a soldier with a hostile aircraft or tank bearing down on him will have to look up a password in a code book and type it in before he can defend himself. On the contrary, the password can be entered by radio signal or various other automated means, and the missile can remain enabled for whatever duration the command chooses, be it two minutes or two years. But after the password expires, the missile will

No single countermeasure can shield all airliners from all shoulder-fired missiles under all conditions.

never again enable unless the password is re-entered.

This solution would not be a *disabler* such as a trigger lock. A disabler could be removed, leaving the missile operable. Rather, it would be a *controllable enabler*, built in as part of the missile's highest-tech circuitry. Removal of the enabler circuitry could only be done by removing key components without which the missile could not operate.

Similar features, called Permissive Action Links, have been used in more elaborate form in US nuclear weapons for many decades. A low-cost consumer version has long been used in some automobile radios. If the radio is removed from the car, it goes dead and will never again operate unless it receives a code held by the manufacturer. So these radios have no value if stolen.

Since controllable enabling would be built in at the chip level, it would add no weight and no measurable production cost for new missiles. There would be design cost but this would be small.

Irreversible retrofit of existing missiles would be technically challenging and much more expensive. The key problem would be to prevent non-controlled components from being re-installed as retrofits, replacing the controllable enabler. But tamper-proofing and other safeguards can probably render this beyond terrorists' capabilities.

That being said, of course controllable enabling can't be applied to missiles already in hostile hands.

WHAT IS BEING DONE

For a decade and a half, some agencies of Government have pressed hard for controllable enabling of shoulder-fired missiles. Regrettably, the US Army was not among them.

Controllable enabling was mandated by Congress in the 1988 Defense Appropriation Bill. The Appropriations Committee report specifies that "\$4 million....only may be used to develop without delay a device to neutralize any diverted Stinger missiles. The Committee is concerned that the Army has not assigned sufficient priority to this effort in the past."

The following year, the Appropriations Committee made a similar recommendation with respect to the Javelin anti-tank missile, reflecting concern that it could present a severe threat against any ground target including a Presidential limousine. And in 1995, the Arms Control and Disarmament Agency sought to interest the Army in building controllable enabling devices into all of its shoulder-fired missiles.

In all cases the Army's response was, in essence, "We could do this but we won't. It's not our job."

While the Army's recalcitrance was in a sense irresponsible, in another sense it was understandable. Both Stinger and Javelin were pushing the limits of technology. Their designers' task was to give American soldiers missiles to do what no soldiers had ever done before. The last thing the

designers wanted was an additional requirement not part of their core mission.

9-11 was a wake-up call in this, as in many other respects. The Department of Defense now understands the need to safeguard shoulder-fired missiles. But no program for controllable enabling has yet emerged.

Airport monitoring and patrolling

Intense surveillance of the airport area, including the use of helicopter patrols, requires no new technology and has the advantage of being able to be ramped up relatively quickly. For airports surrounded by water or barren terrain, this can be quite effective, particularly against short-range missiles such as the SA-7. But Stinger and SA-18 footprints can be larger than 150 square miles and typically include large highly built-up areas that cannot be policed.

Active defense of commercial aircraft

Since the infra-red guidance systems on shoulder-fired missiles are passive, emitting no radiation of their own, detecting and tracking an incoming missile is inherently difficult.

The traditional military defense against heat-seeking missiles has been the use of pyrotechnic flares, released preemptively when the aircraft is in a threat area. A flare's strong point-source of light causes the missile to go for the flares rather than the airplane. But the penalties of dropping incendiary flares on

populated areas near airports are prohibitive. Two active defense systems, using sharply differing technologies, are now in wide use.

The Northrop Grumman Large-Aircraft Infrared Countermeasure (LAIRCM) detects and tracks the missile by a staring ultra-violet device which has full-circle coverage in the downward hemisphere. It then attacks the missile's seeker with an infrared laser, modulated to distort the flight path of the missile. It is internally installed in about 150 US and UK military aircraft of 20 different types including the C-17, MC-130 and MH-53. According to press reports, it is also in Air Force One and Air Force Two. For commercial airliners it would be retrofitted in a small pod added to the rear lower fuselage.

The Israeli Aircraft Industries Flight Guard uses a pulse Doppler radar to detect and track an incoming missile by its motion. The system then automatically dispenses "safe flares" which are charges of hot gas rather than burning solids, and are claimed to leave no residue falling to the ground. Six antennas give all-aspect coverage. The system is installed on about 150 aircraft, and is claimed to have successfully defended against an SA-18 attack. This implies that, unlike conventional pyrotechnic flares, the gas flares simulate jet engines well enough to deceive a two-color seeker. The system has been certificated for use in airliners by the Israeli government, but in the US the explosive flare canisters appear to be creating a safety concern.

Passive defense

Modifications can reduce the infrared signature of commercial aircraft. For example, non-reflective paint could help significantly. Flat paint adds aerodynamic drag and looks dirty. But according to a recent Congressional Research Service report, the airlines' primary aversion to flat paint is that it would openly acknowledge the threat and thereby upset passengers. This attitude is inexcusable. Failing to take countermeasures, in a futile attempt to pretend the threat is not there, will needlessly increase the risk to passengers.

Flight tactics

Abandoning noise-abatement requirements and using maximum-climb departures would significantly reduce the footprint of shoulder-fired missiles, at the expense of greatly increased noise in the area close under the takeoff path. In some cases, presently pleasant neighborhoods could become unsuited for residential use.

Similarly, missile footprints could be further reduced by altering the landing approach. Military transports flying into known threat areas such as that now around Baghdad airport maintain altitude above missile reach until they are close to the airport, and then execute a sharp spiral descent. Adapting this for commercial airliners would create safety issues, would require upgrading the landing systems at most airports, and would reduce the number of landings that could be accommodated per unit time. A

more moderate solution would be simply to stay higher longer and then descend more sharply, to the extent that this can be done without creating excessive airspeed.

One commentatorⁱ has argued that "Successful evasion is a low-cost, near-term solution to the threat. A trained pilot can be very effective in evading missiles." This is nonsense and should not be pursued. An airline pilot has zero vision to his rear hemisphere; the first he would know of a missile attack would be when he felt the impact. If he were to be warned by an external source, it would still not be credible to attempt to outmaneuver a missile. Even the SA-7 is capable of 6G maneuvers, while an airliner on takeoff would be in severe distress at 3Gs. Transient maneuverability (the ability to quickly roll, pitch, or add Gs) of airliners is weak. An airliner is not intended to be an F-16, which can flick into a vertical-bank hard turn in the blink of an eye. And even an F-16 would not win many maneuverability contests against a Stinger.

Export controls

The traditional method of controlling such weapons is to restrict sales and to require end-use agreements. We only transfer them to our friends, we ask that they be rigorously guarded, etc. Certainly this is essential; otherwise Al Qaida could simply buy Stinger RMPs over the counter. But export controls are a partial solution, porous even under the best of circumstances. Weapons are not

always perfectly guarded in peacetime. In wartime they can be dropped on the battlefield, picked up by the other side, and used or sold without restriction.

Cooperative Destruction

Many governments realize that they have more shoulder-fired weapons than they need. They are willing to destroy them, but are concerned about cost and other issues. The State Department is currently working with these governments to develop plans under which the United States will give technical and financial help with destroying the missiles.

weapons pose a threat, but there is no specific credible evidence that they are in the hands of terrorists in the United States or that they plan to use them to shoot down airliners.”

For US policy-making purposes, whether these weapons are now in the United States doesn't matter. Nor does it matter if at this moment terrorists do not have plans to shoot down airliners. Terrorists have the weapons, and can bring them into the United States within days. The terrorist motivation exists, and plans can change in minutes. But most of the solutions will take months or years to implement. If we wait until the threat stares us in the face and then reach for solutions, the most effective ones won't be there. We will have let our adversaries operate inside our decision loop, very far inside. Civilization will likely lose, and lose badly.

In absolute terms, an urgent drive for solutions costing billions or tens of billions of dollars will not be cheap. But relative to the cost of failure, it will be very cheap.

2. Recognize the breadth of the shoulder-fired missile problem.

It is not confined to anti-aircraft missiles. It includes advanced anti-tank missiles. Thus, the common term MANPADS (Man-Portable Air Defense Systems) is too narrow.

3. Rapidly develop and begin production of controllable enabling devices for Stinger and Javelin.

4. Immediately stop work on all final assembly and upgrade of

shoulder-fired missiles, and on all sub-assemblies (usually the seekers) on which controllable enabling should be installed.

Resume production when controllable enablers can be included. This will be disruptive and costly. But that very fact will send a persuasive message to other governments that we are very serious about preventing terrorist use of shoulder-fired missiles.

5. Immediately negotiate with other producer nations about installing controllable enablers in their shoulder-fired missiles.

Consider sharing the technology wherever possible. Controlling shoulder-fired missiles is in the self-evident interest of every non-terrorist government.

6. Significantly augment airport patrols.

Sen. Boxer recently described walking up on the roof of an airport building and standing unobserved within easy SA-7 range of departing airliners. This is an experiment most of us could probably repeat, in many variations and with little difficulty. Augmented patrols are one step that doesn't take new technology and can be done rapidly.

7. Establish a government program of aircraft hull and liability insurance.

Rates should be higher than present commercial rates, so the program would not be used unless and until there were a successful attack. But it would be immediately

If we wait until the threat stares us in the face and then reach for solutions, the most effective ones won't be there.

RECOMMENDATIONS FOR THE US GOVERNMENT

1. Recognize the urgency of the problem and respond with Manhattan-project priority

We have heard many government statements such as that by Brian Roehrkasse of the Department of Homeland Security that “These

Controlling shoulder-fired missiles is in the self-evident interest of every non-terrorist government.

available if commercial rates were to zoom, or coverage to vanish, after an attack. The purpose of the program would not be per se to compensate victims of future attacks. It would be to enable commercial air operations to continue and thereby avoid economic disaster. More fundamentally, it would send a message to terrorists that shooting down airliners would not cause economic collapse. The very act of sending this message could remove much of the motivation for an attack.

Establishment of such a program will require many months as the Administration develops its plan, the House and Senate each modify, debate, and pass their separate versions, and the differences are resolved in conference. Therefore it needs to be done preemptively, in the near term, so it can be on the shelf ready for immediate use if the occasion arises.

8. Fund the accelerated production and installation of

both active and passive airliner defense equipment.

A bill by Sen. Barbara Boxer (D-CA) and Rep. Steve Israel (D-NY) provides for government funding to install active defenses in the 6800 existing jet airliners on scheduled service. This should be done, beginning with the largest widebodies. Large freight and charter aircraft should also be included. The Boxer-Israel bill also provides for installation to begin in December of this year. That is too quick; the goal is good but the engineering can't be done that soon. The Administration's program, in contrast, would probably lead to first deployment in 2006. That is unnecessarily slow, in light of the fact that two systems are already operating successfully in military aircraft. This schedule should be substantially accelerated. Passive measures including nonreflective paint can be installed within months at low cost.

9. Evaluate the cost and benefit of more rapid climb and descent for airliners in light of the shoulder-fired missile threat.

10. Vigorously pursue negotiations, many of which are now ongoing, with foreign governments on controlling proliferation of shoulder-fired weapons and on destroying surplus missiles.

11. Sting, sting, and sting again.

The recent spectacular success of the US and Russian governments in catching an arms dealer hoping to sell SA-18s for fun and profit should be the first of many such operations. Critics have accused it of merely proving that if somebody wants to sell missiles, he can always find a buyer. This misses the point. On the contrary, it proves that if somebody tries to buy missiles illegally, he can expect to spend the rest of his life in prison. If this is demonstrated repeatedly, the number and enthusiasm of buyers can be significantly impacted.

12. This above all things: In making any decision on shoulder-fired missile policy, fully contemplate the price of failure.

Author's note: Robert Sherman, a principal in the consulting firm of Carr Sherman Minjack, was formerly the Director of the Advanced Projects Office at the Arms Control and Disarmament Agency and Director of the Strategic Security Project at the Federation of American Scientists.

ⁱ "Facts About the Shoulder-Fired Missile Threat", James Jay Carafano, and Jack Spencer, Heritage Foundation WebMemo #328

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Meeting Natural Gas Demand: Infrastructure is Important, Technology is Key

By John Riordan

When the Chairman of the Federal Reserve testified before Congress, we got a realistic assessment of the natural gas dilemma this country faces. Last June's message from Chairman Greenspan on Capitol Hill was loud and clear: the nation has to increase its supplies of natural gas or face the economic consequences.

Let me first point out that, warnings aside, the US is *not* running out of natural gas. In fact, we have abundant gas reserves. At today's consumption rates, our 1400 trillion cubic feet of technically recoverable reserves would translate into almost 60 years of supply. The problem: We have essentially "cherry-picked" the inexpensive gas and need new ways to affordably meet gas demand.

There are three key ingredients to increasing gas supply. First, we need an expanded infrastructure, specifically to move Alaska's gas to the lower 48 via pipeline, as well as to enable increased imports of liquefied natural gas. Second, we need to re-visit federal policies and Congressional moratoria that have placed much of our potential gas supply off limits to production. Finally — and too often undervalued — we need to promote the research that will help us develop our abundant domestic natural gas reserves.



Photos courtesy of the Gas Technology Institute

Technology was not, however, undervalued by Chairman Greenspan. It was, in fact, a key subtext of his testimony. He noted the value of technology to gas supply in observing that "dramatic changes in technology are making existing energy reserves stretch further while keeping long-term energy costs lower than they otherwise would have been." New techniques allow far deeper drilling of promising fields, especially offshore. He went on to highlight some of those technologies, along with their specific natural gas supply impacts. He noted that in the Rocky Mountain region, "technologies are facilitating production of tight sands and coalbed methane. Marketed production in Wyoming, for example, has risen from 3.4 percent of total US output, in 1996 to 7.1 percent last year."



The development of technologies to produce gas from unconventional resources— tight gas sands, coalbed methane, gas shales – was not serendipitous. Rather, it was a result of government and industry collaboration: a focused research effort, combined with critical production incentives, to enable the affordable production of resources that now represent over 20% of our domestic gas supply.

Unfortunately, trends in both government and industry are working against this need. Government funding for gas supply R&D has not exceeded \$15 million a year for a decade. Also, federal funding for oil and gas supply research is often viewed as corporate welfare. The problem

with this view is that there is nothing in deregulated energy markets that either incentivizes or compels private R&D investment, in spite of the significant public policy ramifications associated with supply shortages and price spikes.

On the industry side, one of the unintended victims of deregulation of the production sector of the natural gas industry has been R&D. Company research budgets, found almost exclusively in the supermajors or in large service companies, have been declining for the last ten years. Also, major integrated oil and gas producers have largely moved offshore or overseas. This has left onshore production increasingly in the hands of small independent producers who lack the resources to conduct R&D.

Finally, collaborative industry research and development funding, paid for through a pipeline surcharge for the last 25 years, is slated for extinction in 2005. This fee funded a significant portion of the research that has enabled us to turn coalbed methane from a safety hazard into over 7% of our domestic production, or tight gas sands from a known but inaccessible resource, into 17% of our supply.

Significant – but expensive – gas reserves are found on federal lands in ultra-deepwater provinces offshore and in unconventional basins onshore. Congress should consider investing a portion of the federal oil and gas royalty monies

currently going into the general fund into the research programs necessary to affordably produce these vast reserves. Analysis conducted by the Bureau of Economic Geology at the University of Texas, indicates that such an investment would result substantial new gas supply, as well as a significant overall increase in revenues to the Treasury in the form of royalties on new, technology-enabled production.

Chairman Greenspan is correct in noting that, in addition to technology, we need additional infrastructure. We need responsible access to public lands currently open for production. But the political will may not be there to exploit these options. Infrastructure additions always encounter local resistance. Opening up offshore California, Florida or East Coast may — or may not — ever materialize. Also, the imports of natural gas in the form of LNG raise serious geopolitical issues, similar to those we currently have with oil.

Investing in developing the technologies we need to affordably produce our domestic gas resources in environmentally sound ways is critical, it is possible, and has been proven effective time and time again. We should heed Chairman Greenspan's entreaty on the need for gas supply and invest in the technologies we need to respond to this wake-up call.

Author's Note: John Riordan is President and CEO of the Gas Technology Institute.



Photos courtesy of the Gas Technology Institute



that they now have a target of “halting the deteriorating trend of environmental degradation” and a series of concrete actions are underway to address the challenges that environmental problems have created for China’s economy and its people. FAS has been working for several years to forge better links between scientists in China working on this problem and to strengthen relationships with scholars in the US. A workshop in Guangzhou represents a significant new step in this work.

Land degradation is central to many of these problems. Widespread soil erosion, destruction of agricultural land, loss of the natural vegetative cover, destruction of biological diversity, damage of wildlife habitats and extinction of wildlife species, contamination of water resources and food crops, careless development are widespread (see www.fas.org/china_lands for South China examples). Reversing the effects of land degradation and reversing the effects of existing damage will help create new jobs, prevent flooding, protect key habitats, and sequester large amounts of carbon dioxide as soils are rebuilt.

FAS and the South China Agricultural University (SCAU) in

Guangzhou will conduct a one-week field workshop (November 8-16, 2003) in Guangdong Province for leaders of 25 to 30 environmental Non-Governmental Organizations (NGOs) and environmental Government Organized Non-Governmental Organizations (GONGOs). Support for the field workshop is provided by The International Foundation (US), and the Guangdong Natural Science Foundation.

Chinese NGOs function much as NGOs in the west. GONGOs, on the other hand, are initiated by the government to function more as research centers for government agencies. Some are evolving to look more like NGOs and some of the GONGOs and NGOs cooperate in environmental activities. About two-thirds of the organizations attending will be environmental NGOs and the remaining one-third will be environmental GONGOs.

These Chinese environmental organizations can provide a key educational link to the general population by explaining the nature of the problems, their causes and adverse effects, and solutions to the problems. In addition, they can provide the needed “grass roots” source of valuable information to

help assure that well-intended, remedial actions taken by the government or others to address the environmental/natural resource problems do not themselves lead to additional problems. Lastly, NGOs, through their fund-raising activities, can provide a small but critical resource to complement the Chinese government efforts.

The field-workshop approach will introduce environmental leaders from all over China to some of South China’s important environmental/natural resource problems, help them identify causes, and illustrate some workable solutions. It is intended to provide new environmental leaders, who may be in the formative stages of developing their environmental agendas, with a unique educational opportunity to interact directly with natural resource/environmental scientists in field settings where development is progressing rapidly.

Guangdong Province provides an excellent field setting where environmental leaders can learn first hand about environmental/natural resource problems that are common to South China and other parts of China as well. Many common environmental/natural resource problems have their roots in social and economic issues as

These Chinese environmental organizations can provide a key educational link to the general population by explaining the nature of the problems, their causes and adverse effects, and solutions to the problems.



Map courtesy of www.chinapage.com

well as in the biological, chemical, and physical world. Discussions will focus on how interdisciplinary solutions were developed in this province, and how other interdisciplinary solutions could be developed to deal with China's

emerging environmental/natural resource problems here and elsewhere in China. On the workshop's completion, the environmental leaders should be able to transfer and adapt this learning approach to other

parts of China by cooperating with concerned scientists in their home regions.

Below are representative examples of field sites the workshop participants will visit. Ample time will

be available at each site for questions and discussion. In the evening, a leader from each of the environmental organizations will present background on his or her environmental organization and describe how the organization deals with degraded land issues at home.

Qi'ao Mangroves

Qi'ao Island, in the Pearl River near Zhuhai, once was an island surrounded by mangrove forests but became severely damaged by fire-wood cutters. Originally, a large population of white egrets inhabited the mangroves. However, firewood cutting damaged their habitat and the egret population declined. In addition, local people received payments from Chinese from Taiwan and Hong Kong by encouraging them to come to Qi'ao to shoot the egrets for sport.

More recently, restoration of the mangrove forests from 20 hectares to 180 hectares slowed shore-line erosion, improved habitats for fish breeding, and increased the number of the local egret population. Today, hunting is prohibited here but many tourists come to the island to watch the beautiful, large flights of egrets come and go in the evening and morning. Ecotourism has increased the local income.

Now, however, authorities are planning to connect Zhuhai to Hong Kong by bridges that will cross the Pearl River. Bridge and highway construction will destroy Qi'ao's mangroves and wetland environment. Only a small patch of endangered mangrove in Zhuhai

just west of Macau may survive. Local fishing in the Pearl River will be adversely affected once again.

Dinghushan Biosphere Reserve

The last remnant of South China's tropical, broad-leaf monsoon forest occupies a few square kilometers in the hills about 50 km west of Guangzhou. The site is one recognized by the United Nations Man and the Biosphere program for its uniqueness. Scientists conduct research here to learn how the forest functions ecologically and also to learn how this kind of forest might someday be reestablished widely in South China.

The rapid growth of tourism threatens the remaining Dinghushan forest. Each year, more people flock to the cool forest and mountain streams and ponds of Dinghushan bringing the harmful effects of automobile pollution. Without meaning to, crowds of people also damage the native plant life. Visitors will see evidence of and hear about the growing adverse effects of uncontrolled tourism on such important sites.

Using City Wastes for Orchard Fertilizer

Some lychee/longan growers use city wastes as fertilizer when planting fruit trees. The waste generally consists of a mixture of organic matter, coal ash, plastic, glass, and metal. Low-cost city waste, hauled to tree-planting sites, is deposited in the holes for tree planting in amounts of 5 to 10 kg and then covered with soil. Many orchard farmers keep the

soil surface clear of vegetation beneath the fruit trees to avoid the competition of underlying vegetation's use of nutrients and water that farmers want reserved for their fruit trees. Because most orchards are on hillsides, water erosion removes the soil, thus uncovering the city waste. Some of the city waste is carried down slope by running water and some is scattered across the land by the wind.

In some cases, the city waste is in fact medical waste. Nevertheless, it is used as fertilizer. Handling medical wastes could be hazardous to orchard workers during planting and the scattering of the medical wastes by wind and water can widen the potential for serious health problems. These once-damaged hill slopes need fertilizer to grow fruit trees but the current practice of using "low cost" medical-waste fertilizer may lead to unintended, serious health problems in the countryside.

Zhuhai Reservoir Erosion

Severe erosion existed all around Zhuhai's water reservoir in 1989. A graduate geography student experimented with four different systems of vegetation restoration on four hectares of land adjacent to the reservoir. The researcher planted many exotic, fast-growing tree species and various nitrogen-fixing grasses.

Within one year after planting, springs flowed again and erosion nearly stopped. Rainfall run-off slowed, thus replenishing the groundwater. After ten years, a

mature vegetative cover blankets the test sites, a well developed litter cover exists on the floor of the woods, and groundwater is 1.5 to 2 meters higher during the dry season than at the start of the work. However, few wildlife species have returned to live in the wooded site. Native birds do not like the berries and seeds produced by the exotic plants and go elsewhere. Small animals, other than occasional rats, mice and cobras, avoid the site. The experiment demonstrates that rapid land repair is possible but also shows the need for using native plant species to encourage wildlife to live there. Birds are responsible for about 80 percent of seed dispersal in tropical Guangdong Province. Native wildlife can help expand the forest cover at little cost to local citizens if a variety of native plants exist in the restoration site.

Guanming Farm

This is a large, modern dairy farm reclaimed from severely degraded land. The farm now produces about 75 percent of the milk sold in Hong Kong. The liquid cattle waste goes back to the fields to provide fertilizer to help grow cattle feed. The solid animal waste produces biogas that, in turn, is used to generate all of the farm's electrical power. The solid residual waste after gas production becomes a valuable organic fertilizer. Soil erosion essentially stopped on the

farm; now the hills support a blanket of lychee trees and fast-growing, exotic, nitrogen-fixing, typhoon-resistant trees. No commercial pesticides are used on the farm; pest control is achieved through biological control agents. The farm illustrates that degraded lands can be improved using environmentally friendly methods and that the economic benefits can be large.

Golf, hunting, and game farm on degraded lands

Tourism activities are expanding in South China. One of these, the private Pine Valley Sports and Country Club, situated on 290 hectares of degraded lands in Zhuhai, has country-club, golf-course, gun-club, boating and fishing, and game-farm facilities for its members. The land once was covered by a moist tropical forest but became degraded by past damaging agricultural practices so that the land only supported scrub vegetation and scattered trees. The natural wildlife had been severely depleted as well.

The owners' aim was to design the facilities carefully and thoughtfully to protect the environment. They believe that the environmental operations will benefit the Club and the environment over the long run. They have constructed a lake, and introduced water treatment, waste treatment, and the repopulation

of native game birds to the greater area of the local township where such knowledge and understanding was lacking. The workers at the Club's facilities, hired from the local population, receive classroom training on environmental management. Native game-bird species such as wild pheasants and partridge are continually raised on site for release to the countryside. The bird population is intended to move freely from the Club into the surrounding countryside.

Author's note: Dr. Parham has conducted research on degraded lands in Hong Kong since 1967 and in South China since 1986. In addition to his affiliation with the Federation of American Scientists, Dr. Parham is an Honorary Professor of the South China Agricultural University in Guangzhou, an Honorary Research Fellow of the Kadoorie Agricultural Research Centre of the University of Hong Kong, a Research Fellow of Duke University's Center for Tropical Conservation, and a Research Associate with the Botanical Research Institute of Texas and with the Bishop Museum in Honolulu. He received his Ph.D. in geology/clay mineralogy from the University of Illinois, was an Associate Professor of Geology and Geophysics at the University of Minnesota, a Physical Science Officer who worked on developing country environmental issues with the Agency for International Development/US Department of State, and directed studies for the US Congress on agriculture and renewable resources at the Congressional Office of Technology Assessment.

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Curbing the Illicit Trade in Small Arms and Light Weapons in Latin American

By Matthew Schroeder

Over the past year, fitful but intense coverage of the threat posed by shoulder-fired missiles to civilian aircraft has awakened the industrialized nations to a security threat that the rest of the world was already painfully aware of — the global scourge of illicit small arms and light weapons. Numbering in the hundreds of millions, these weapons take the lives of an estimated 500,000 lives per year, stunt economic growth, and perpetuate the lawlessness upon which terrorists and other criminals thrive.

Nowhere are the ill-effects of this scourge more apparent than in Latin America. Weak export controls, porous borders and an overabundance of small arms and light weapons have transformed Central and parts of South America into a giant arms bazaar that fuels instability and criminality. The four-decade civil war in Colombia, for

example, is sustained by the thousands of illicit weapons and millions of rounds of ammunition that seep into the country through its porous borders. The weapons are used by the guerrilla groups — the Revolutionary Armed Forces of Colombia and the National Liberation Army — and the Self-Defense Forces of Colombia (AUC) to wage war on the government, protect coca operations, commit human rights abuses and engage in kidnapping and murder. Money generated via kidnapping and narco-trafficking conducted from rebel and AUC-controlled territories is then used to purchase (or is bartered for) more weapons and supplies which, in turn, sustain offensive operations against the government and deny it control over much of the countryside.

The Colombians undoubtedly suffer the most from this self-perpetuating cycle of violence and lawlessness.

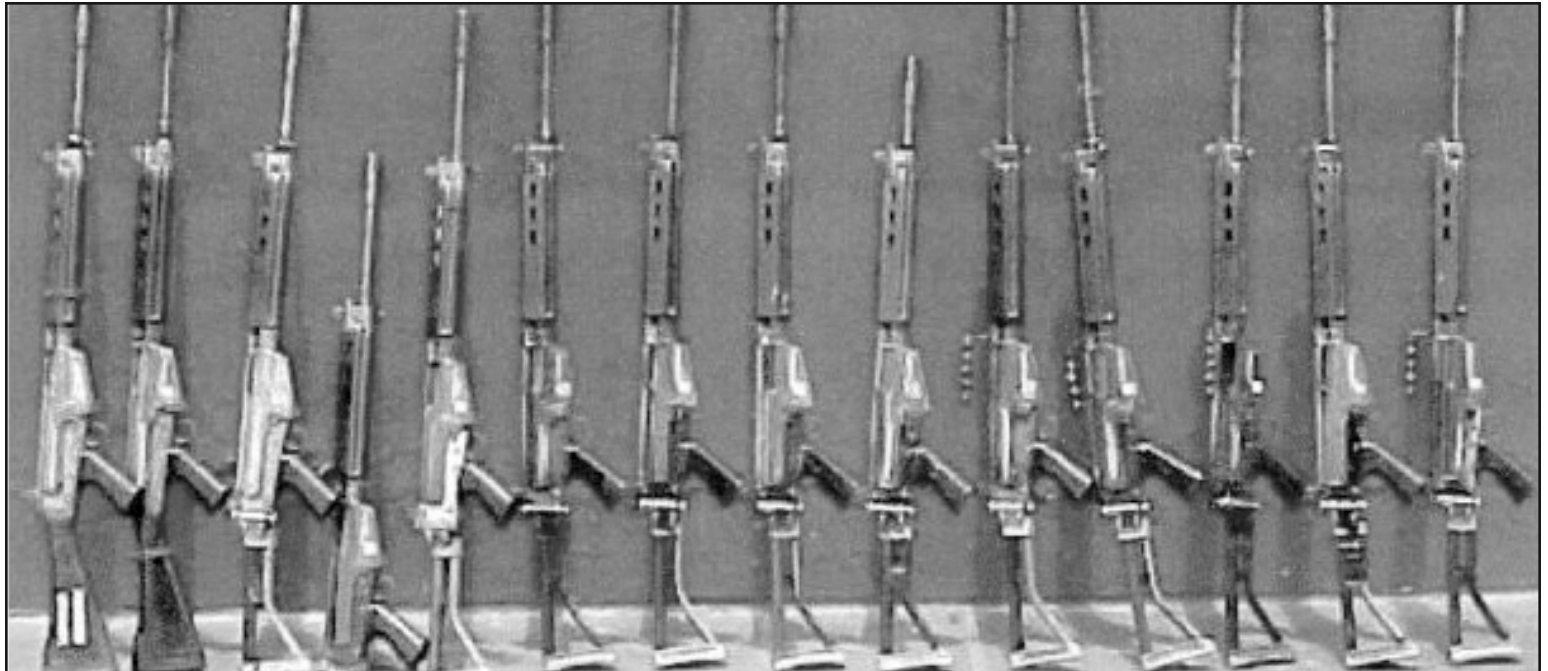
Nonetheless, its impact is felt throughout the Hemisphere, including the United States. Over the past decade, more than 50 American journalists, aid workers and civilian military contractors have been kidnapped and/or murdered by the guerrillas while working and traveling in Colombia and the neighboring states.ⁱ Equally pernicious are the thousands of tons of Colombian narcotics that flood the United States each year. These drugs sap the US economy of hundreds of billions of dollars and wreak havoc in the lives of the nation's 4.7 million cocaine and heroin users.ⁱⁱ

Transoceanic shipment of these weapons is another security threat that deserves more attention. While the terrorists and insurgents that stock their arsenals with loose weapons from Latin America are primarily homegrown, there is anecdotal evidence that arms traffickers from other continents, including some with ties to Islamic terrorist organizations, procure weapons from Latin America. The most unnerving of these cases is also the one that best illustrates the transcontinental nature of the trade in illicit weapons. In January 2001, Aziz Nassour, a Sierra Leonean arms and diamonds trafficker of Lebanese decent, emailed a list of weapons that he hoped to obtain for his "friends in Africa" to Shimon



Photo courtesy of the Government of Columbia

Various assault rifles seized from the Columbian guerrillas



FAL assault rifles seized from the Colombian government

Photo courtesy of the Government of Columbia

Yelenick, an Israeli arms dealer operating out of Panama. Nassour had many “friends in Africa” who were responsible for untold suffering, including Charles Taylor’s corrupt and brutal regime; the Revolutionary United Front in Sierra Leone, which gained notoriety in the late 1990’s for hacking the limbs off civilians; and even Osama bin Laden’s network, whom Nassour had helped to convert millions of dollars stashed in vulnerable bank accounts into conflict diamonds.

Nassour’s list — sniper rifles, man-portable surface-to-air missiles, anti-tank weapons, etc. — constituted a veritable arsenal of terrorist tools. The list ultimately reached the Nicaraguan army but, according to Nassour, the weapons were never delivered. If that is indeed the case, it is not because Nicaraguan export controls are air tight. Less than a year later, Yelenick duped the Nicaraguan army into selling him 3000 AK-47s which he claimed were for the Panamanian

National Police but ultimately were shipped to Turbo, Colombia, where the AUC took possession of them.ⁱⁱⁱ

Regardless of whether the weapons were ever shipped to Africa, the attempt itself is significant. The fact that an arms dealer operating out of West Africa - which is awash in small arms and light weapons — chose to shop in Central America attests to the region’s potential as a source of

weaponry for brutal dictators, blood-thirsty insurgent groups and global terrorist organizations.

Like many of today’s most pressing security threats, the small arms and light weapons problem defies quick and easy solutions. The durability, ease of use and versatility of these weapons ensure that the market for them will remain large and lucrative. As they are relatively small and nonperishable, they are easy to smuggle across national borders. Finally, they are ubiquitous. According to the Geneva-based Small Arms Survey, there are 600 million small arms and light weapons in existence today.^{iv}

Nonetheless, there are many ways in which the international community can begin to rein in the illicit trade in small arms and light weapons. Strengthening and harmonizing arms export controls and procedures; increasing cooperation, information-sharing, and the provision of technical and legal assistance

**... rein in the
illicit trade in
small arms and
light weapons.**

between national law enforcement agencies; and destroying excess stockpiles of weapons top the list. In Latin America, a framework for achieving all of the above except stockpile destruction is provided in the form of the Inter-American Convention Against the Illicit Manufacture of and Trafficking in Firearms, Ammunition, Explosive and Related Materials, otherwise known as the OAS Firearms Convention.

The OAS Firearms Convention is the only legally binding international instrument that focuses solely on controlling small arms and light weapons. It requires member states to, *inter alia*, criminalize offenses associated with firearms smuggling, establish a system of licensing firearms transfers, exchange information that will aid in the investigation and prosecution of arms traffickers, and improve border controls. The Convention enjoys broad support among the OAS member states, 20 out of 34 of which have ratified it, and has prompted several changes to their laws and practices.

The United States was an active supporter of the OAS Convention during its drafting, and continues to participate in the meetings of the Convention's Consultative Committee. Nonetheless, the Convention has languished in the Senate Foreign Relations Committee for years despite the fact that the US is largely in compliance with its requirements.

US ratification is important not because of the changes to US policies it would require — which are

minimal — but because of the United States' diplomatic influence in the hemisphere. Diplomats interviewed for a forthcoming report on the US and the Convention commented several times that US ratification would provide a discernable boost in the Convention's credibility. Conversely, continued refusal by the US to ratify the Convention will erode its influence and subsequently undermine efforts to achieve full and universal implementation of its provisions.

Ratification of the Convention would also allow the US to use it as leverage when dealing with countries in the region that have not taken all the steps necessary to control illicit arms trafficking. A good example of how the Convention can be used in this manner is the impact of a report on the November 2001 diversion of 3000 Nicaraguan AK-47s to the Colombian paramilitaries. The report, compiled by an OAS investigative team, provided a detailed summary of how the states involved in the diversion failed to adhere to the Convention. Immediately following the publication of the report, a Nicaraguan government official submitted to the head of the investigative team an outline of the steps his government would take to prevent similar transfers.^v The fact that the OAS investigative team found no evidence that national laws were broken suggests that the Nicaraguan government was responding directly to the stigma associated with failing to comply with their obligations under the Convention. Combined with the United States' unparalleled diplomatic influence, this stigma

could be used with great effect by the United States but only if it becomes a full party to the Convention.

Halting the trade in illicit small arms and light weapons in the Western Hemisphere requires a multi-faceted, multilateral strategy implemented by all the states in the region. The OAS Firearms Convention is a good vehicle for developing and implementing such a strategy, and as such deserves the full support of all OAS members, including the United States.

Author's Note: Matthew Schroeder is a Research Associate with the Arms Sales Monitoring Project at the Federation of American Scientists.

ⁱ Assistant Secretary of State for Western Hemisphere Affairs Otto Reich testifying before the Subcommittee on the Western Hemisphere, International Relations Committee, U.S. House of Representatives, 107th Congress, 2nd Session, <http://fas.org/terrorism/at/docs/2002/Reich-ColombiaTerrorism.htm>.

ⁱⁱ Office of National Drug Control Policy, Executive Office of the President of the United States, "Drug Facts: Cocaine," 5 September 2003, <http://www.whitehousedrugpolicy.gov/drugfact/cocaine/index.html> and Office of National Drug Control Policy, Executive Office of the President of the United States, "Drug Facts: Heroin," 5 September 2003, <http://www.whitehousedrugpolicy.gov/drugfact/heroin/index.html>.

ⁱⁱⁱ For more information, see Ambassador Morris D. Busby, *Report of the General Secretariat of the Organization of American States on the Diversion of Nicaraguan Arms to the United Self Defense Forces of Colombia*, OEA/Ser.G, CP/doc. 3687/03, (Washington, DC: OAS, January 2003), http://www.fas.org/asmp/campaigns/smallarms/OAS_Otterloo.htm.

^{iv} Graduate Institute of International Studies, *Small Arms Survey 2003: Development Denied*, (Oxford: Oxford University Press, 2003), 57.

^v "Nicaragua: Loopholes Foment Arms Smuggling," *EFE News Services*, 28 January 2003, <http://www.web.lexis-nexis.com>.

Hiroshima Survivors Visit the Federation

By Sharon Gleason and Ivan Oelrich

The Federation of American Scientists was founded by Manhattan Project scientists who had helped develop and build the first atomic bombs. It was appropriate and moving then, when survivors of the Hiroshima bombing visited the FAS offices on the 58th anniversary of the atomic bombings. Every year on the anniversary of the first, and thankfully so far only, use of atomic weapons in war, survivors come to Washington. To raise awareness of the realities and horrors of nuclear war, they visit the offices of members of Congress, make public appearances, and talk to the press.

Nuclear war is so horrifying in its reality that talk of it often flees to a vocabulary that is abstract, even mathematical, technical, and sterile. We are left with PSI, CEPs, and

“overkill.” During the Cold War, a small industry grew up creating computer models that calculated the optimal allocation of nuclear weapons against military targets and against “value” targets. “Value” targets was the name given to those things that a society values and threatening them will, so the theory goes, deter them from using nuclear weapons themselves. Ultimately these value targets are the people of the society, the homes they live in, the industry that provides their livelihood and keeps them warm and clothed and fed. It is all too easy to forget the human face of these targets when calculating a “laydown.”

So what a shock to meet a real flesh and blood person who, on the morning of August 6, 1945, was asleep on a cot less than two

kilometers from the epicenter of the Hiroshima atomic bomb blast. Masakazu Saito is the president of one of the local groups of *hibakusha* or atom bomb survivors. He was nineteen at the time, and described how his arms, back, and head were burned. He was able to escape the wooden barracks where he had been sleeping before it was engulfed in flames. In the chaos after the bombing, cleanup activities took place. Soldiers quickly piled up corpses to be burned, afraid that the radiation would somehow spread from these bodies. Assumed to be dead, Mr. Saito managed to crawl away from those slated to be burned. He saw sights that were too horrific for words.

Today, although near 80, he is in remarkable, vigorous good health. He has produced a series of shocking yet eerily beautiful watercolors of his experience. Even through a translator, his experience made real to all of us the horrors of actual use of a nuclear weapon.

An estimated 280,000 people survived the atomic bomb. Groups, like Mr. Saito's, have been organized to represent the interests of the survivors, who find themselves in a peculiar position in Japan. Not only did they suffer in the bombing, but even later they were ostracized as sick, damaged and prone to producing genetically deformed babies. The survivors were not seen as desirable mates, partners or workers in a society that believed creating a family and working hard were the key to



Ivan Oelrich with two survivors of the atom bomb

FAS member photo

rebuilding Japanese society. Even now, decades later, they meet with various forms of discrimination. They are often denied health insurance, and employers are sometimes hesitant to take them on. Many survivors keep their experience secret to avoid the stigma of having been exposed to atomic radiation.

The *hibakusha* also, of course, have a very personal involvement in nuclear disarmament. They

understand the reality that is often masked by analytical discussions of “mini-nukes” and “bunker busters.” Their visit reminded us all why the Federation of American Scientists was founded, and what our mission is, and why we work so hard for what remains one of mankind’s most important goals: to make certain that those two bombs, dropped decades ago, are the last. The *hibakusha* are welcomed back each anniversary because we cannot be reminded too often.

Nuclear war is so horrifying in its reality that talk of it often flees to a vocabulary that is abstract, even mathematical, technical, and sterile.

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The Learning Federation: Progress Report

By Kendra Bodnar

The explosive growth in information and the growing complexity of scientific and technology problems that need to be addressed require a dramatically new approach to how we teach, learn, and conduct research. Our Information Technologies project is working with national experts in academia, industry and government to articulate a national research plan and form communities of researchers to build the tools and infrastructure needed to enable radically improved approaches to teaching, learning, and sharing research. We’ve made measurable progress in a number of key areas.

ROADMAPS FOR LEARNING SCIENCE AND TECHNOLOGY RESEARCH AND DEVELOPMENT

After eighteen months of hard work, FAS staff have completed

development of a Learning Science & Technology R&D roadmap, or research plan. A series of five roadmaps was developed. Each roadmap details how specific learning technologies could be designed and implemented into our teaching systems and forecasts what could be accomplished in the near future with appropriate funding. These roadmaps will facilitate efficient and effective use of the research funds by strategically prioritizing attention to gaps in the knowledge-base, encouraging interdisciplinary research that might otherwise be overlooked and coordinating research projects. Each component roadmap addresses a critical learning science and technology R&D focus area:

Instructional Design for New Technology-Enabled Approaches to Learning

Understanding how people learn, how experts organize information, and the skills of effective learners

Learner Modeling and Assessment

What to measure, when to measure and how to use the information

Question Generation and Answering Systems

How to take advantage of the benefits offered by emerging technologies to facilitate inquiry

Building Simulations and Virtual Environments

How to build complex virtual environments that accurately reflect current understanding of physics, chemistry, biology, and mathematics that permit exploration-based pedagogy

Integration Tools for Building and Maintaining Advanced Learning Systems

Engineering strategies for using learning system tools to build learning systems

The component roadmaps were presented in a July *Roadmap Integration Workshop* conducted by the FAS at the Institute for Defense Analyses in Virginia. The workshop brought together many of the key authors and consultants who have worked on the roadmaps to discuss integration of the component roadmaps into a final research plan. These discussions led to beneficial feedback and ideas. Leaders in the fields of cognitive science, and information technology were in attendance, each having dedicated significant time and effort to develop these roadmaps.

The LS&T R&D Roadmap can play a critical role in shaping the national debate on the need for expanded learning technology research. It should be particularly valuable to Executive Agencies, Congress, and research institutions. The roadmaps are available on the website at <http://www.learningfederation.org/>.

Major funding support for the roadmap developed was made possible through a Federal appropriation to the Federation of American Scientists for the Digital Opportunity Investment Trust. We also gratefully acknowledge the funding support of the organizations that helped sponsor this work and made possible the roadmap: Microsoft Research, National Science Foundation, Hewlett

Packard, Department of Defense, DDR&E, Carnegie Corporation of New York, and Hewlett Foundation.

SPECIAL EDITION OF THE ASSESSMENT JOURNAL FOR EDUCATION

The Learning Federation has been invited to co-edit a special issue of *Education Assessment*, an Erlbaum journal. Several presenters from the Learning Federation workshop on Learning Modeling and Assessment will be writing articles that discuss the research presented at the workshop, including: Student Modeling; Linking Cognitive Psychology and Assessment; Learnome — a framework that can be used to standardize and automate task analysis, assessment design and use; Assessment for Feedback; Technology Supported Assessment Design; Assessment practices to encourage transfer; and Affective Measurement in Technology Environments. Henry Kelly, President of FAS, and Randy Hinrichs, Group Research Manager for Learning Science and Technology group at Microsoft Research, will write the preface for these articles. The edition will make an important contribution to the field of educational technology and we are thankful to all the contributors. The date of publication will be posted on our website.

A REPORT TO CONGRESS

The Federation of American Scientists and the Digital Opportunity Investment Trust (DO IT) are partnered together to revamp

learning technologies in the humanities and sciences. DO IT and FAS have made great progress in being granted a hearing on 'Digital Dividends and Other Proposals to Leverage Investment in Technology' which will be held in the House of Representative's Energy and Commerce Subcommittee on Telecommunications and the Internet in this Congress. The hearing had originally been scheduled for September 3rd but has been postponed temporarily. Witnesses from a variety of fields utilizing digitalization and technology for educational purposes will testify. Please keep on eye on our website or the Digital Promise website <http://www.digitalpromise.org/> for more details.

The FAS also worked with the Digital Promise Project to write a report to Congress entitled "The Digital Opportunity Investment Trust: Transforming Rural and Urban Education, Learning and Training." It outlines the essential need for changing our traditional education system by integrating technologies designed for learning. The report will inform our legislators about what learning technologies are and their potential to make learning more engaging, more productive and more accessible to all Americans. This report shows the necessity for the digitization of our Nation's resources in museums and libraries. FAS, the Learning Federation and the Digital Promise Project have brought together a wealth of information pertaining to how learning technologies could revitalize learning in a variety of fields such as humanities, science, medicine, and manufacturing.

Exemplars of our latest learning and digitized systems are reported. The report addresses every age group-K-12, higher education, workforce training, and lifetime learning. It is a useful and timely report for so many difficult fields and seeks to have enormous ramifications on education policy in our nation. We expect the report to be published later this autumn.

NEW WEBSITE- A TECHNOLOGY AT ITS BEST

To coincide with the publication of the Learning Federation's LS&T R&D Roadmap, FAS has launched a new Learning Federation website! The website

will provide easier access to information on previous and upcoming events and important timely news and reports about educational technology. The 'updates' section will alert you to future events that The Learning Federation is participating in; our 'news' section will help to keep you up to speed on the events of the Ed Tech field and policies or politics related to this field; in addition the 'what you can do' section will tell you about relevant events or legislation and how you can take action. The special report section will archive all of the critical reports from The Learning Federation, our workshops, other documents that are important to learning

technologies, and our other projects. One of the most exciting and eagerly awaited features is the 'discussion boards'. This part of our website will provide an electronic forum for communication between anyone who is interesting in our project. Participants may interact with some of the major players in this field and can watch hotly debated topics be played out electronically. Please log on and voice your opinion and expertise at <http://www.thelearningfederation.org/>.

Author's note: Kendra Bodnar is the new manager of the Learning Technologies Project at FAS.

FAS has launched

a new

Learning Federation website

www.thelearningfederaton.org

FAS Holds Board Meeting

By Sarah J. Mason

On Friday, August 8, the Federation of American Scientists held its final FY03 Board of Directors meeting at its office in Washington, DC. The 2003, 2004 and 2005 classes of Directors gathered together for the second time this year to review the state of the organization and share their visions of its future.

Informal morning sessions gave Board members an opportunity to meet with FAS Project Directors in small groups and to discuss the issues most relevant to their work and personal interests. Chairman Frank von Hippel led the formal meeting in the afternoon. The Board reviewed FAS' progress during the past six months and focused on plans for the future outlined in FAS' final Strategic Plan (www.fas.org/stratplan). During this meeting they focused on reviewing FAS work in nuclear and biological weapons areas in the Strategic Security program (Ivan Oelrich led the discussion helped by staff

members Stephanie Loranger and Matthew Schroeder), and on the Learning Federation and Digital Opportunity Investment Trust projects (Kay Howell led the discussion).

Dr. Richard Sprott, of the Larry Ellison Medical Institute, spoke about his perspective on successful NGO boards with an insightful, and occasionally hilarious, description of successful and unsuccessful boards he's watched in action (and inaction). It set up an energetic discussion on how to make the FAS Board as productive as possible.

The meeting concluded with a tribute and thanks to Frank von Hippel, whose second term as Board Chair came to a close in 2003. The Board and staff recognized his spectacular contributions to FAS over many years, including service on the Board. (See tribute on page 23.)

Later that evening, the FAS Board of Directors and Staff reconvened for a dinner hosted by Secretary-Treasurer Jonathan Silver and his family at their house in Georgetown. The group was honored to hear from guest speaker Dan Singer, who served as FAS General Counsel from 1960-1970. Dan and his wife Maxine helped define the ways civilian scientists can play a constructive, and powerful role in shaping national policy that continues to guide FAS today.

The next Board of Directors meeting will take place in December 2003, and will be the first to include the class of 2006. We thank all the Directors and other guests who helped to make the August 2003 meeting a success, and we look forward to working with them throughout the year.

Author's note: Sarah Mason is FAS' Organization Manager.

Next Board Meeting

December 2003

FAS Staff News



FAS member photo

Former Board Chairman, Frank von Hippel

FAS BOARD CHAIRMAN, FRANK VON HIPPEL STEPS DOWN

FAS would like to acknowledge how immensely grateful we are to Frank von Hippel for his unparalleled contribution to FAS over many decades.

In addition to serving as Chairman of the FAS Board from 1979-1984 and again from 2000-2003, Frank provided the intellectual foundation for what the organization has done in many areas, particularly in our core work to control the continuing — and increasing — danger of nuclear weapons and nuclear materials. He has helped provide vision, energy, and courage in the face

of political debacles — both external and internal — and steadfastly guided the organization through some of its greatest triumphs and its most difficult times.

Von Hippel has inspired generations of young scholars by defining what a “public interest scientist” can achieve through careful analysis of challenging problems, through creative and practical policy proposals, and persistence. As Professor of Public and International Affairs and Co-Director of the Program on Science and Global Security at the Woodrow Wilson School at Princeton University and formerly as assistant director for national security in the White House Office of Science

and Technology, he has made significant contributions to policy research in nuclear arms control and nonproliferation, energy, and checks and balances in policymaking for technology.

Frank’s work, and ours, is far from finished. But his unwavering commitment to bringing truth to the public process, and his astonishing record of success in the face of terrible odds, continues to give us an important measure of hope. We’ve gained enormously from Frank’s leadership and we hope that he’ll continue to be a close advisor and counselor to our organization for many years to come.

Election results for the FAS Board of Directors will be reported in our December 2003 PIR issue.

FAS BIDS FAREWELL TO MARIANNE BAKIA, DIRECTOR OF THE LEARNING TECHNOLOGIES PROJECT

Marianne Bakia served as the Learning Technologies Project Director for two and a half years, during which time she played a vital leadership role that advanced the aims of both the Learning Federation and the Digital Promise Project. Marianne’s expertise, skills, energy and enthusiasm contributed greatly to our research plan to stimulate research and development in learning science

and technology. Working with national experts, she helped to produce several of the carefully designed component research roadmaps that we hope will lead to a national initiative to realize vastly improved training and education for all Americans. Her persistence and gentle coaching resulted in the quality documents we have today.

We also appreciate the skill and energy she brought to help forward the Digital Promise coalition. Her ability to balance the demands of the Digital Promise project with the Learning Federation tasks allowed both projects to move forward at a remarkable pace. Throughout her time at FAS, we've benefited from her calm in the most vexing fire drills, her strength of purpose, creative thinking and willingness to face difficult challenges. While it is hard to say good-bye to such a valuable team member, we wish her much success in her new endeavors and look forward to working with her in the future in her new position at SRI.

FAS WELCOMES KENDRA BODNAR

Kendra Bodnar joined the FAS team in August 2003 as the Manager for the Learning Technologies Project. At FAS, she will work to raise awareness of the opportunities emerging technologies create for education and training and promote a national plan for a focused R&D program in learning sciences and information technology.

Kendra received her B.S. in biology at Duquesne University and was awarded the Richard King Mellon grant to work on a research project studying evolutionary genetics. She received her M.Sc. from Boston College where she examined immune cell development and she received her Ph.D. from the University of Pittsburgh School of Medicine with a concentration in Molecular Virology and Microbiology. Her work has been published in *Infection and Immunity*, *Tuberculosis*, and was highlighted in the American Society for Microbiology's *News*. During

graduate school Kendra was involved in many aspects of teaching. She was a teaching assistant and lecturer for various classes and laboratories. In addition, she participated in organizing scientific workshops, lectures, and laboratories at the University of Pittsburgh, Carlow College, and the Carnegie Science Center that were designed to interest young children and women in science and to pursue related careers.

Kendra's research and teaching experiences in graduate school fueled her interest in science policy. After graduate school, Kendra received the American Society for Microbiology Science and Technology Congressional Fellowship and worked on Capitol Hill in the office of Representative Edward Markey (D-MA), a senior member of the House Energy and Commerce Committee. During the year-long fellowship, she worked on a variety of healthcare, biosecurity, and science and technology issues.

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WIIS-FAS NUCLEAR NON-PROLIFERATION PANEL

The Federation of American Scientists and Women in International Security are co-sponsoring a colloquium on nuclear non-proliferation and counter-proliferation. An expert panel will examine the differences between these approaches and will debate their effectiveness as means of controlling the spread of nuclear weapons.

Monday, November 17, 5:30 pm
The Elliott School of International Affairs
George Washington University
1957 E Street, NW, Room 602

We will provide additional information about the panel when the list of speakers is finalized. Check our website www.fas.org for updates or direct inquiries to Jaime Yassif at 202.454.4688, jyassif@fas.org.

PILLEDGE and show your support

Leaving a Legacy of Peace

FAS counts on members like you to support our efforts to advance sound science in public policy for generations to come. You can help by encouraging others to join FAS as members. Tell your friends, co-workers, family members about our work and urge them to become FAS members. New members can join using our website www.fas.org, or by writing to the FAS office.

We also encourage you to consider a gift donation. There are many ways to make a gift, including outright donations, gifts of securities or other personal assets, and planned gifts. FAS is a tax-exempt, tax-deductible, 501(c)3 organization. Every gift, no matter the amount, counts as vital support

for FAS programs. The amount that you give is the amount that's right for you.

As we move to the end of 2003, you, like many others, may be reviewing your long-term estate and financial plan. Please remember that your will, life insurance policies, retirement accounts and other planned giving vehicles may offer exceptional opportunities for leaving the lasting legacy of peace.

With your support, FAS will continue its work to secure a safe, healthy and rewarding future for all people. Donate now using our secure online contribution form or please contact Sharon Gleason at sgleason@fas.org or 202.454.4680.

BioSecurity 2003 Conference

The emergence of global terrorists potentially armed with biological weapons necessitates a dramatic shift in how the biological research community views its role and involvement with national security policy and decision-making. Furthermore, the lack of awareness of biosecurity requirements and concerns among bioscientists in the academic research community is a national security vulnerability that must be addressed to avoid misuse or misappropriation of dual use biological research knowledge for bioweapons development. The policy challenge requires balancing science and security without compromising national security or scientific progress.

With that goal in mind FAS is pleased to be a Founding Supporter of BioSecurity 2003, a conference dedicated to practical problem solving for global biosecurity.

OCTOBER 21 - 22, 2003
Washington, DC

FAS members receive a registration.

REGISTER NOW

To ensure your spot at this important event, please register now at www.biosecuritysummit.com/registration using priority code **FASBIO1** to receive a **\$300 discount** on an All Access or All Access Plus pass.

For more information, visit <http://www.biosecuritysummit.com> or contact Ben Sullivan at 323.954.6078.

HARVARD, RAND, JANE'S TEAM AGAINST BIOTERRORISM **Research community joins law enforcement, defense for critical summit**

WASHINGTON, D.C. – Researchers who must prepare for and respond to biological and chemical threats are encouraged to attend BioSecurity 2003 (<http://www.biosecuritysummit.com>), organized by Harvard Medical International, Harvard Medical School and Harvard School of Public Health, in conjunction with the RAND Center for Domestic and International Health Security and Jane's Information Group.

Attendees will learn from leading experts how to best protect their communities from, and respond to biological or chemical events involving anthrax, smallpox, SARS and more. In addition, the latest advances from the lab will be presented in conference and abstracts sessions.

The three-day summit, October 20-22 in Washington D.C., will bring together leaders in research, medicine, public health, law enforcement, first response, defense and policy to share intelligence, techniques and lessons learned from the biosecurity trenches. Interested parties should Register now at (<http://www.biosecuritysummit.com/registration>) to ensure their place at this important gathering. FAS members, please use priority code

FASBIO1 when registering to receive a \$300 discount on an All Access or All Access Plus pass.

RECEIVE CONTINUING MEDICAL EDUCATION CREDIT

The Harvard Medical School is accredited by the Accreditation Council for Continuing Medical Education (AACME) to sponsor continuing medical education for physicians. Harvard Medical School designates this educational activity for up to 24.75 hours in category 1 toward the AMA/Physician's Recognition Award. Each physician should claim only those hours of credit that he or she actually spent in the educational activity.

Application has been made for nursing contact hours.

TOOLS AND TECHNOLOGY

In addition to three days of intensive, hands-on conference sessions and workshops, BioSecurity 2003 will feature an exhibit of the latest tools, technology and services available to biosecurity professionals. A partial list of past exhibitors includes: Agilent, Batelle, Citigate GIS, FDA, Jane's, NACCHO, NIAID, PAHO, Pfizer, Quidel, SAIC and others. Organizations interested in exhibiting their products should contact: Curtis Chiu at curtis.chiu@medialiveintl.com or David Baron david.baron@medialiveintl.com for more information.

BIOSECURITY 2003 SPEAKERS AND ADVISORY BOARD MEMBERS INCLUDE:

- Anthony Fauci — *Director, National Institute for Allergy and Infectious Disease*
- Barry Bloom — *Dean, Harvard School of Public Health*
- David Heyman — *Exec. Director, Communicable Diseases, World Health Organization*
- Dennis O'Leary — *President, Joint Commission on Accreditation of Healthcare Organizations*
- Georges Benjamin — *Director, American Public Health Association*
- James Kvatch — *Chief Scientist, Defense Intelligence Agency, Armed Forces Medical Intelligence Center*
- John Marburger — *White House Office of Science and Technology Policy*
- Joseph Martin — *Dean, Harvard Medical School*
- Lawrence Kerr — *Director of Bioterrorism Research and Development, U.S. Dept. of Homeland Security*
- Lester Crawford — *Deputy Director, U.S. Food and Drug Administration*
- Lt. Martin Ryczek — *Chicago Police Department*
- Sylvie Beaudoin — *Montreal EMS, Urgences-santé*
- Zarnaaz Rauf — *National Association of County and City Health Organizations*

BIOSECURITY 2003 TRACKS AND SESSIONS INCLUDE:

- Changing Priorities of Disaster Response
- Food and Agro Terrorism
- Global Health
- Lessons Learned from Anthrax Attacks
- Living and Working With SARS
- Management Analysis of a Catastrophic Event
- Operational, Prototype and Next Generational Biosecurity Science and Technology
- Public Health Preparedness Today, Tomorrow
- Public Mental Health
- Smallpox: A Case Study
- Stress, Terror and Communications
- Syndromic Surveillance: Outbreak Detection & Disease Monitoring
- The Hospital Emergency Evaluation Tool

FAS

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Special Projects Coordinator

Attention FAS Members!

In our continuing effort to provide FAS members with lively and timely articles in national security policy and other areas of science and technology policy, we are inviting members to submit proposals for articles in areas of interest to FAS members (maximum 1000 words). Selection of the articles is at the discretion of the Editor. Completed articles will be peer reviewed.

Proposals should be sent to the Editor, PIR, Federation of American Scientists, 1717 K St. NW, Suite 209, Washington, DC 20036, or to fas@fas.org. Please provide us with your full address including email in all correspondence.