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BENEFITS OF COMMERCIAL SPACE LAUNCH FOR FOREIGN ICBM AND SATELLITE PROGRAMS

HEARING

BEFORE THE

SUBCOMMITTEE ON INTERNATIONAL SECURITY, PROLIFERATION, AND FEDERAL SERVICES

OF THE

COMMITTEE ON GOVERNMENTAL AFFAIRS
UNITED STATES SENATE

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BENEFITS OF COMMERCIAL SPACE LAUNCH FOR FOREIGN ICBM AND SATELLITE PROGRAMS

THURSDAY, MAY 21, 1998

U.S. SENATE,
SUBCOMMITTEE ON INTERNATIONAL SECURITY,
PROLIFERATION, AND FEDERAL SERVICES,
OF THE COMMITTEE ON GOVERNMENTAL AFFAIRS,
Washington, DC.

The Subcommittee met, pursuant to notice, at 10 a.m. in room SD–342, Senate Dirksen Building, Hon. Thad Cochran, Chairman of the Subcommittee, presiding.

Present: Senators Cochran, Collins, Levin, and Thompson [ex officio].

OPENING STATEMENT OF SENATOR COCHRAN

Senator COCHRAN. The Subcommittee will please come to order.

I would like to welcome everyone to today's hearing of the Governmental Affairs Subcommittee on International Security, Proliferation, and Federal Services.

This morning we will examine the question of how a foreign country's satellite and intercontinental ballistic missile programs could benefit from launching commercial satellites that are built in the United States, and whether the administration's export control policy for satellites is adequate to prevent technology transfers that could endanger our country.

We will hear from witnesses who will explain the evolution of our commercial satellite export policies and discuss specifically whether military benefits are derived by China when it launches U.S.-built satellites.

In 1996, President Clinton ordered export-licensing jurisdiction for all commercial satellites on the U.S. Munitions List moved from the State Department to the Department of Commerce. This policy change was accompanied by an announcement that the Commerce Department would conduct "enhanced" reviews of satellite export license requests in order to safeguard American technology and national security; that export licensing decisions for commercial satellites would still be based primarily on the national security implications of the transfer; and that an individual validated license would continue to be required throughout the export process.

The end of the Cold War, of course, did not signal the end of threats to America's security. In numerous hearings last year, this

Subcommittee took testimony from experts who provided many facts on one of the most substantial post-Cold War threats to the United States, the proliferation of weapons of mass destruction and missile delivery systems. And while Russia and China were identified as the world's major proliferators, we learned last year that the United States itself is implicated in proliferation through increasingly lax controls on the export of so-called ''dual-use products,'' such as supercomputers, that have both civilian and military uses.

This morning we will explore the effect on American national security of the relaxation of U.S. export controls on missile and satellite technology. Although there is a lot of interest in the reasons for the administration's commercial satellite export policy changes, and particularly in the questions that have been raised about the license issued to Loral Space and Communications, those issues will be examined later, after a thorough review of the facts.

A senior official of one of America's major aerospace firms recently told my staff that, ''whenever you connect a launch vehicle to a satellite, there has to be some technology transferred.'' The question is whether the United States faces enhanced national security risks as a result of this kind of technology transfer, and if so, what should be done about it.

The witnesses who will testify this morning are: Dr. William Graham, former Deputy Administrator of NASA and Science Advisor to Presidents Reagan and Bush, and currently President of National Security Research, Incorporated; John Pike, Director of the Space Policy Project at the Federation of American Scientists; and Dr. William Schneider, Under Secretary of State for Security Assistance, Science, and Technology from 1982 through 1986, and now a fellow at the Hudson Institute.

It is the intention of the Chair to ask each witness to make a statement. We have written statements which have been supplied to the Subcommittee which will be printed in the record, and then we will have an opportunity, after all the statements have been made, to question the witnesses.

Senator Levin.

OPENING STATEMENT OF SENATOR LEVIN

Senator LEVIN. Thank you, Mr. Chairman.

The question that we're asking today is whether using other countries' rockets to launch U.S. commercial satellites could jeopardize our national security. Specifically, the focus will no doubt be on whether the United States should permit U.S.-built civilian satellites to be sent to China or other similarly situated countries for launching.

Apparently our country does not have enough capacity to accommodate the needs of our own commercial companies, and launches in the United States are considerably more expensive than launches in China. These factors drove U.S. businesses to seek approval for their satellites to be launched in China, starting in the late 1980's, when President Reagan first approved the use of Chinese rockets in China to launch U.S.-made commercial satellites.

In order to send a sensitive item like a satellite to a foreign country like China, the owner must obtain an export license. As of

March 1996, the owner is required to submit an application to the Commerce Department which convenes an interagency process to review it. The Department of Defense, Department of State, Energy Department, and Arms Control and Disarmament Agency all participate in reviewing the license application.

For countries other than China, that's the end of the process. The Commerce Department can either approve or reject the application. Prior to March 1996 and depending upon the type of satellite or satellite equipment, the licensing agency was the Department of State, which maintains the so-called "munitions list," which included many commercial satellites and satellite equipment. The Department of State limits licensing considerations to those of national security and foreign policy, without consideration of economic or trade concerns.

When the licensing authority was transferred to the Commerce Department, consideration of national security and foreign policy concerns continued, but consideration of U.S. economic interests was added.

Relative to China, however, the licensing process doesn't reach a conclusion until the President agrees to a waiver, unless, of course, there is a decision not to proceed. Since the 1989 Tiananmen Square incident, the law prohibits any commercial satellite shipment to China unless the President, on a case-by-case basis, determines that the shipment would be in the national interest. This waiver, like the export license, involves an interagency process in determining whether a waiver would be appropriate.

The State Department is a major player in this decision. If the agencies agree, they send a recommendation to the National Security Council which then conducts its own review and makes a recommendation to the President. No license to ship a satellite to China may be issued by the Commerce Department—nor could it have been issued by the State Department when it had the jurisdiction—without that Presidential waiver.

So in the case of China, the licensing process is really determined by the requirement of a Presidential waiver, since no license can be issued without it and obviously once a waiver is granted, the license would follow.

Recent news stories have focused on the procedures that our government follows in granting licenses to send satellites to China, namely the issue of which Department should be in charge of approving the licensing and whether the grant of waivers by President Clinton has been appropriate. But in looking at the last 9 years in which American-made satellites have been sent to China for launching, we can see that both the choice of which Department will be doing the licensing and the identity of the President granting the waivers has been immaterial to the outcome.

As you can see from the list which has been prepared by my Subcommittee staff,[1] using data provided by the Congressional Research Service, of the 20 waivers granted for satellites sent to China for launching in the last 9 years, 9 were approved by President Bush over 3 years, and 11 were approved by President Clinton

[1] The chart entitled "Waivers for Exports of Satellites Launched By China," provided by the Subcommittee staff, appears in the Appendix on page 59.

over 4½ years. And, in all but the last 3 waivers—so in 17 of the 20 waivers—the licensing agency was the State Department, which is the licensing agency if the exported item is on the munitions list.

These facts strongly suggest that it has made no difference relative to China whether satellites were on the munitions list and therefore licensed by the State Department, or whether the satellites are not on the munitions list and therefore licensed by the Commerce Department. Either way, the use of Chinese launch rockets require a Presidential waiver, and it made no difference whether the President was named Bush or Clinton. Those waivers have been approved.

In answering the question of whether we should simply eliminate the opportunity for a waiver and bar the shipment of civilian satellites or their parts to China, period, we need to look at the risks involved in continuing the current practice initiated by President Reagan. First, does the act of using China's rockets to launch U.S. satellites involve the transfer of technology that will enhance China's ability to launch missiles? At least one witness today thinks there is such a possibility.

Second, there is the possibility that the failure of a launch—the explosion of a rocket—will allow pieces of U.S.-made satellites to fall into the hands of the Chinese. I would like to explore that question and the question of other possible risks with today's witnesses, as I know each of us will.

Mr. Chairman, the United States is a technological giant in the world of commerce. This hearing raises important questions about how we carry out that role. I am glad we are holding this hearing, and I thank you for bringing us together.

Senator COCHRAN. Thank you, Senator Levin.

Senator Thompson.

OPENING STATEMENT OF SENATOR THOMPSON

Senator THOMPSON. Thank you very much, Mr. Chairman.

I appreciate the fact that you are holding these hearings to examine our process of export approval of commercial communications satellites, and whether or not we are risking the transfer of technology that might assist the Chinese with their ICBM missiles.

I think that we will have to conclude at the outset that no one—no one here, anyway—can possibly know whether or not technology has been transferred in any particular instance that might compromise our interests. I think it's clear that with regard to the way these things work, the extensive communications between our commercial vendors here and the Chinese concerning the operations of the missiles, no one knows exactly what conversations take place or what information might be passed on.

We do know that it's very much in the interest of our commercial enterprises for these missiles carrying their satellites to work. It's very much in the commercial interest of our domestic companies to have the Chinese, for example, carry these satellites. It's the difference between hundreds of millions of dollars per launch and somewhere between $25 million and $85 million.

So going in, we know that our commercial interests—while totally patriotic—have a commercial interest in not only having the Chinese do this, and others, but that they work and that they not

explode, as happens on occasion. And if there are problems with regard to the missiles carrying these satellites, I am sure there is a tendency to want to transfer enough information—to the Chinese, in this instance—to make sure those missiles don't explode again, that they don't shake so much that they damage sensitive technology, and that they have the capability of getting the job done.

We can't know about all of what transpires. We can guess; we can think in terms of probabilities, or we can think in terms of possibilities. We can think in terms of the risks that are there, and we certainly need to think in terms of safeguards and what kind of process and procedure we need to have in place to minimize those risks.

Of course, the underlying problem is that these commercial communications satellites contain militarily-sensitive characteristics cross-link capabilities where satellites talk to one another without having to go through the ground, integration technology that could improve ballistic missile capabilities to make sure that the missiles are stable.

Many think the intangible know-how that might be derived from learning more and more about how to make their missiles operable and accurate is more important to the Chinese than the actual hardware. Satellite dispensing technology—the same technology that allows multiple satellites to be launched on one launcher—is the same kind of technology that is needed for multiple warhead missiles.

There is no question that the standards have been relaxed with regard to the transfer of this technology and export licensing. The State and Commerce Departments simply approach things differently, as they are supposed to do. The Commerce Department has more than one interest; the Commerce Department has the commercial interest in addition to the national security interest.

I'm not sure how much we can determine by the fact that there have been sanctions waivers in various administrations and that some licenses are granted by the State Department and some by the Commerce Department. I'm not sure without examining each one, how much we can determine about that, or what the result might have been had decisions been with another agency. But we do know that the shift that this administration made in 1996 of the responsibility in this area from the State Department to the Commerce Department was contrary to the determinations that had previously been made by interagency groups, both in the Bush and the Clinton Administrations.

I think it's important to point out that in the Bush Administration, the interagency group established criteria with regard to militarily-sensitive characteristics pertaining to these satellites and they determined that satellites that did not contain these militarily-sensitive characteristics could be transferred to the jurisdiction of the Commerce Department. About two dozen items were so transferred, and about half of the satellites which had no such characterizations. That was following the recommendation of a 2-year study by this interagency group.

What happened in 1996 was that the interagency group at that time determined that that situation should stay the way it was; that is, if these satellites did not contain militarily-sensitive infor-

mation, it was OK for them to be under the Commerce Department jurisdiction, but if they did, they should remain at the State Department.

Secretary of State Christopher agreed with that. However, the President overruled his own interagency group and the Secretary of State—his own Secretary of State at the time—and transferred licensing authority to the Commerce Department. So the difference between administrations is, first, in the nature of the technology or the nature of the satellites that were being transferred, and second, the fact that one President followed the recommendations of his interagency group while another President overruled it. It was overruled when Secretary of Commerce Ron Brown appealed the decision of Secretary of State Warren Christopher to President Clinton. And that's the way that that came about.

The GAO looked at all of this, and they say that the implications of transferring to the Commerce Department authority over satellites with militarily-sensitive characteristics are uncertain.

I not think that we can consider this matter without the underlying consideration of who we're dealing with. We know the Chinese have sent missiles to Pakistan; they've sent technology to Iran; they've sent nuclear equipment to both; they've conducted missile tests off the coast of Taiwan; and apparently, according to reports, the CIA has determined that 13 of their 18 long-range ballistic missiles have nuclear warheads aimed at American cities. They have been caught in violation of their solemn agreements with regard to these matters. They are apparently aggressively trying to improve their missile program as a part of a military buildup.

This is what we're dealing with here. So I appreciate the fact that you're having this hearing, Mr. Chairman. I look forward to exploring this, and saving other matters for other times. Later we will have a chance to look into several of what have been called "coincidences," such as the fact that the Chinese arms dealer, Wang Jun, visited Mr. Brown at the Commerce Department and attended a White House coffee on the very day that President Clinton approved the launch of four satellites by the Chinese on February 6, 1996. Of course, Wang Jun had millions of dollars at stake in a Hong Kong satellite company.

Another coincidence that we will inquire into later is the fact that between November 1995 and June 1996, the Loral folks contributed $275,000 to the Clinton reelection.

The last coincidence we will look into later on is one concerning Ms. Liu. Apparently after the President announced this shift to the Commerce Department, she facilitate the transfer of a little under $100,000 to the Democratic National Committee. Ms. Liu, of course, is reported to be a Lieutenant Colonel in the Chinese military; her father was the highest-ranking member in the military and in the leadership of the Communist Party.

Incidentally, the parent company of Ms. Liu's company tests and provides equipment for the Chinese nuclear arsenal, and the Great Wall Industries Company. That company also launches private satellites; and that company, incidentally, is the one that was sanctioned by this country back in 1993 for transferring satellites to Pakistan.

So those are all matters that we will save for another time. But I look forward to that also. Thank you very much.

Senator COCHRAN. Thank you, Senator Thompson.

Senator Collins.

OPENING STATEMENT OF SENATOR COLLINS

Senator COLLINS. Thank you very much, Mr. Chairman.

I want to start by commending you, Mr. Chairman, for your long leadership in the area of technology transfer. I know this is an issue that has been of great concern to you for many years, and you've been a real leader in Congress in this area.

Certainly, recent events have conspired to give the subject of our hearing this morning even more relevance than usual. On February 15, 1996, a so-called Long March booster rocket lifted off its launch pad in the People's Republic of China, only to explode spectacularly some moments later. Because this explosion destroyed a $200 million satellite owned by Loral Space and Communications, and Hughes Electronics, February 15 was a grim day for these American companies.

This launch failure, however, was perhaps not entirely unwelcome from the perspective of United States national security interests. It has recently been reported that at least 13 of China's 18 intercontinental ballistic missiles are targeted on American cities. Significantly, if ever launched, the nuclear warheads on these missiles would be carried to their American targets by rocket boosters similar to the Long March system that exploded on that day in February 1996.

Significantly, the faults that the two American companies subsequently found in the exploding Long March booster were reportedly symptomatic of more general engineering or design flaws in Chinese rockets. If the Long March blew up upon launching, in other words, we could hope that if Chinese missiles were ever released against Washington, Chicago, New York, Denver, Dallas, or San Francisco, they, too, might well blow up.

Ordinarily, one might think that a previously undiscovered defect in Chinese ballistic missiles would be good news for all Americans. Loral and Hughes, however—and with them it appears, the White House itself—did not think so. The details of how these companies and the administration cooperated to facilitate improvements in Chinese missile reliability now seems likely to be the subject of considerable investigation by Congress.

The reports of this missile episode, however, highlight the importance of the export control matters that we are considering today. They suggest that there are some very real problems in the way that U.S. policy attempts simultaneously to promote American business interests and to protect American national security.

Security policy making in a democracy often requires enormously difficult trade-offs. Among these many balancing acts is the tension between free trade and export controls. No matter what the economic benefits from free trade, however, arming potential adversaries with weapons they cannot otherwise obtain is surely foolhardy.

It is on the strength of this insight that we have built our system of national security export controls. Today they revolve around

such things as ICBM launch control systems, supercomputers, and multiple warhead delivery systems.

With regard to ICBMs, we should make no mistake. The technologies used in military and civilian space launch systems have always been inextricably intertwined. The space programs and the ICBM programs of both the United States and the Soviet Union, for example, shared a common origin in Hitler's V–2 rocket program. The V–2 mastermind, Werner von Braun, in fact, went on to help us build our earliest ICBMs and to develop our civilian satellite program.

Space launch technologies have, therefore, always been dual-use technologies.

Now, I do not mean to suggest that we can never insulate civilian technology transfers from military ones. My point simply is that it takes great care and diligence to do this correctly. It requires constant attention from real security professionals. And it requires that the White House not interfere with the decisions of those professionals.

There is considerable reason to believe that our government has failed to follow these requirements.

I look forward to hearing the expert witnesses that we have before us today. And again, I commend the Chairman for his longstanding leadership in this area.

Senator COCHRAN. Thank you very much, Senator.

If we now can move to the statements of our witnesses, we'll call on Dr. Graham first, then Mr. Pike and Dr. Schneider will follow in that order.

Dr. Graham, welcome.

TESTIMONY OF WILLIAM GRAHAM,[1] PRESIDENT, NATIONAL SECURITY RESEARCH, INC., FORMER DEPUTY ADMINISTRATOR, NASA, SCIENCE ADVISOR TO PRESIDENTS REAGAN AND BUSH

Mr. GRAHAM. Thank you, Mr. Chairman, and Senators.

I'd like to briefly address the benefits of commercial space launch assistance and use for foreign intercontinental ballistic missile programs this morning.

The design, engineering, testing and operation of ballistic missiles and space launch vehicles, sometimes called SLVs, have a great deal in common. This is particularly true for intercontinental ballistic missiles. The maximum velocities of ICBMs can be slightly less than that of SLVs, but from an orbital mechanics point of view, ICBM's can be considered space launch vehicles whose orbits intersect the Earth at the target.

There's a misperception in some circles that ICBMs are more sophisticated and complex than space launch vehicles. In reality, the opposite is true. The preponderance of SLVs are ICBMs with additional elements. Put another way, if you have a space launch vehicle, you also can have an ICBM by removing those additional elements—the satellite in particular—and adding a re-entry vehicle containing a nuclear or other type of warhead.

[1] The prepared statement of Mr. Graham appears in the Appendix on page 43.

Most of the current U.S. unmanned space launch vehicles are derived from ICBM systems and are closely related to them. This is true for foreign countries as well.

In the case of China, the Long March–3 was derived from DF–5 ballistic missile technology, and India's Agni Medium Range Ballistic Missile is based on the design of its first space launch vehicle, the SLV–3, which in turn is a copy of a U.S. space launch vehicle.

Space launch vehicles produced in non-market economies have been offered to the United States and other satellite manufacturers at attractive prices for launching high altitude geosynchronous communications satellites, which support the demand for long distance telephony, data transmission, pagers, radio feeds, and television feeds, as we've seen this week with the Galaxy IV satellite failure. And in the coming years, lower altitude satellites will provide infrastructure for commercial remote sensing, cell phones, and pagers.

Because these commercial satellites are expensive and time-consuming to build, and are instrumental in generating profits for the communications industry, American satellite manufacturers have strong incentives to enlist in ensuring that foreign SLVs transport their satellites to the intended orbits reliably and deploy the satellites in good working order. This assistance, however, can equally aid in the development and the reliability of foreign ICBMs.

Essential elements of a space launch vehicle are its propulsion, structure, staging, guidance and control, ground support and launch equipment and procedures, overall systems integration, payload, the satellite or re-entry vehicle with warhead, the payload deployment, and the development testing, engineering, and facilities of the space launch vehicle.

These essential elements of an ICBM are the same, with the exception of the payload, which for an ICBM, as I mentioned, is a reentry vehicle containing some type of warhead rather than a satellite. I will briefly discuss each of these elements.

Propulsion. There are basically two types of propulsion systems used in rockets: liquid fuel propulsion systems and solid fuel propulsion systems. The liquid fuel systems are all derivatives and extensions of the V–2 technology developed during World War II. That applies all the way from the V–2 itself to the space shuttle main engines that are used today.

These liquid propulsion systems are very efficient. At the same time, they require some care in handling and preparation for launching. The propellants themselves are very, very energetic chemicals and have to be managed and handled by experts.

Solid propellants, on the other hand, are much more inert materials until they're ignited. And they are much more appropriate for a ballistic missile force that has to stay on a high state of alert for long times—years—and still launch on very short notice—minutes. This is an advanced ballistic missile force, and in fact similar to the technology the United States and, by and large, Russia uses today.

Both of these technologies can be used for space launch vehicles, and both have been used for space launch vehicles. In general, developing countries tend to prefer the greater efficiency of the liquid systems for their first space launch vehicles.

The structure of ICBMs and space launch vehicles must both be very light, since they're being accelerated against the force of gravity to velocities in the range of 24,000 feet per second—about 10 times the speed of a typical rifle bullet—but still must be very strong.

The acceleration of launch produces several Gs of load on the structure during the ascent phase, and the aerodynamic loads are large during portions of the trajectory when the vehicle is high in the atmosphere.

The structural requirements place a premium on materials design and fabrication for both ICBM and SLVs. These structures are very highly integrated in order to save weight. That integration goes through the payload itself, either the warhead for an ICBM or the satellite for an SLV.

Staging is a common procedure designed to throw away part of the mass of the space launch vehicle, or the ICBM, before it reaches orbit or its target. You've heard of one, two, and three stage rocket systems, in which stages are sequentially discarded after the fuel has been expended.

Stage separation, which is commanded by the vehicle's control system immediately after the propulsion of the stage is terminated, is used to minimize the amount of structure carried along after it is no longer needed. Staging is a very delicate process that has to be done quite precisely so that it doesn't disorient or otherwise damage the stages remaining to go to orbit, or for that matter, disrupt the satellite or the warhead.

Guidance and control subsystems of both space launch vehicles and ICBMs keep track of where the vehicle is and where it's supposed to go. Where it's supposed to go is a combination of velocity and location in orbit for a space launch vehicle, or a point on the surface of the Earth for an ICBM.

The guidance and control system calculates the direction and duration of the rocket thrust that must be commanded for the rocket to reach the target, and then controls the direction of thrust, so that it satisfies that calculation. This process occurs several times each second during powered flight.

In the past, the location of the vehicle during ascent was determined by inertial measuring units, comprised of gyroscopes and accelerometers. But the opportunity exists today to use U.S. global positioning satellite systems and the Russian GLONAST system to establish the rocket's location with high accuracy by reference to precision satellite beacons.

While high precision inertial measuring units are expensive and difficult to produce, GPS and GLONAST—assisted navigation units are potentially more accurate and less expensive, and the basic elements are widely available today.

ICBMs designed to destroy targets specifically hardened to nuclear attack require more accurate guidance than space launch vehicles. However, for attacking all other targets, including cities, space launch vehicle guidance systems have sufficient accuracy for ICBM use as well.

Ground support and launch equipment and procedures are also an important part of both ICBMs and space launch vehicles. In fact, they're the same for the propulsion and guidance elements of

both of these types of systems. From a personnel standpoint, space launch vehicle crews are automatically capable of being ICBM launch crews.

The ground support for preparation, monitoring and checkout of the specific payloads for space launch vehicles and ICBMs is different, since the payloads are different. Satellite payloads for SLVs tend to be more complex and require more advanced ground support than do ICBM warheads.

A very important area that's sometimes overlooked is the *overall system integration*, which in general is a field in which the United States has world leadership. Even after the individual components and subsystems of a space launch vehicle or ICBM are functioning properly, they must still be integrated into a complete system that can work together.

Instabilities in propulsion, control, or other subsystems often depend on the coupling of two or more subsystems in unanticipated ways. Incipient instabilities can lead to a rough ride to orbit, placing additional mechanical stresses on the payload. An extreme manifestation of these instabilities can, and unfortunately has, caused the breakup and destruction of the entire vehicle in powered flight.

The integration of the propulsion, guidance, control, structure and aerodynamics is the same for space launch vehicles and ICBMs, while the integration of the payload is unique to the specific design. However, the analytical tools, such as the structural dynamics analysis software, are the same for both and are used widely.

The integration of the payload, like other aspects of system integration, require an intimate knowledge of both the payload and the launch vehicle. In the case of a space launch vehicle, a great deal of detailed technical information must be exchanged between the satellite designers, the satellite attachment and aerodynamic shroud designers, and the vehicle designers, to integrate the payload into the system.

And there must be a close working relationship between the space launch vehicle engineers and satellite engineers and technicians to assure a successful launch mission.

Mr. Chairman, integrating a satellite with an SLV is not like putting a load in the back of a pickup truck. This is a very highly integrated system.

The more that can be done to improve the ride to orbit by reducing the mechanical stresses on the satellite, and the more that can be done throughout the SLV system to increase its overall reliability, the more likely that a successful launch and orbital insertion will be achieved. Measures taken to increase the performance and reliability of space launch vehicles translate directly into performance and reliability improvements in ICBMs.

United States and Russian ICBM development programs have used more test flights than have their space launch vehicle counterparts. This is a result of United States and Russian efforts to achieve both high reliability and high accuracy—goals that may not be as important to other countries.

Payloads for space launch vehicles and ICBMs are different. That has been noted in the opening statements, and is certainly worth repeating.

On the other hand, the integration problems, as I mentioned, are the same. And all the ascent problems are very similar.

Payload deployment is another area of common technology. The release of a single satellite payload and a single warhead payload are similar operations. Both require the proper deployment, positioning, and orientation of the payload. The deployment of multiple satellites from a space launch vehicle and multiple warheads from an ICBM are also similar operations.

The Iridium program, for example, which has used Chinese space launch vehicles, among others, deploys several satellites during one launch mission, and requires a deployment platform to do that. This, of course, is very, similar to the technology for multiple reentry vehicles such as we have on our Minuteman III system, and for that matter, on Peacekeeper. Information and experience gained from one of these payload deployment activities can be applied directly to the other.

Development, testing, engineering and facilities is another area of common technology. The requirements for space launch vehicle and for ICBM vehicle development are very similar. These include engine test stands and testing, guidance and navigation test laboratories and facilities, test flight ranges, and vehicle diagnostics and telemetry systems.

Perhaps the most critical technology that can be transferred is the engineering skill and experience required for interpreting and rectifying design problems that occur during system development and are reflected in the telemetry of system performance during testing.

In addition to advancing the ICBM capabilities of other countries, U.S. assistance in supporting and developing space launch vehicle capabilities assists these countries in being able to use space more effectively for military purposes. These purposes include reconnaissance, communications, and meteorology, and others.

Such capabilities can then be provided in turn to other countries in exchange for military, political, or financial support. Transferring space launch technology to the developing world provides space access to many potential adversaries of the United States, and is a serious matter that carries substantial risk to the United States and its allies around the world.

Thank you, Mr. Chairman.

Senator COCHRAN. Thank you very much, Dr. Graham, for your statement.

Mr. Pike, we will now hear from you.

TESTIMONY OF JOHN PIKE,[1] DIRECTOR, SPACE POLICY PROJECT, FEDERATION OF AMERICAN SCIENTISTS

Mr. PIKE. Mr. Chairman, Members of the Subcommittee, I appreciate the opportunity to testify before you this morning, a morning in which the world is a more dangerous place than it was a month

[1] The prepared statement of Mr. Pike appears in the Appendix on page 48.

ago or a year ago. And a morning on which I think it's going to be a more dangerous place a month and a year from now.

We're witnessing the birth pangs of an arms race on the Indian subcontinent, rumors of war in Kashmir, ratification of the comprehensive test ban in the United States, or the START –2 agreement in Russia seem less likely than even a few weeks ago.

This Subcommittee in particular has been instrumental in alerting the Nation to these and other dangers, many of which transcend the traditional Cold War litany. Fortunately, however, the subject of today's hearing does not rank very high on this list. And I welcome this opportunity to inject some much-needed balance to the increasingly controversial questions of the relationship between missile and space launch technology, and the adequacy of existing export control mechanisms to maintain this distinction.

You may recall that Werner von Braun "aimed for the Moon and hit London." Since the dawn of the space age and the missile era, the primary distinction between space launch vehicles and missiles has been attitude, and only secondarily, altitude. The first American and Soviet satellites were launched on converted military missiles and derivatives of these missiles continue to be used by both countries.

It remains trivially true that many of the major technical arts applicable to the challenges of missilery are equally applicable to space launch operation. A more challenging question is to unravel the actual military significance of specific technologies.

Concerns have been raised as to whether the interactions with American commercial satellite operators have led to the transfer of technical information that would be useful to the Chinese in improving the liability or capability of their missiles. Given the ongoing investigations of these matters, and the consequent limited public availability of detailed technical information, it's difficult to form a definitive view on this matter, and several general observations are possible and necessary at this juncture.

For nearly three decades, the Chinese have maintained a small arsenal of ICBMs capable of targeting American cities. It is the fact of the existence of this force, rather than the fine grained details of their technical characteristics, that has defined their existential deterrent posture relative to the United States.

The space launch industry is extremely sensitive to questions of launcher reliability, with launchers exhibiting reliability lower than the prevailing 90 to 95 percent liability rates, facing potentially prohibitive insurance premiums. Unlike space launch vehicles, the difference between 75 percent and 90 percent reliability of the Chinese missile force would have no material bearing on the quality of the existential deterrents in terms of American or Chinese calculation.

High confidence and high reliability of missiles has been an abiding concern of the United States. But we face a very different operational requirement of achieving target kill against a large number of Russian ICBM silos.

I am concerned that in the absence of rampant and significant reductions in American and Russian nuclear arsenals, China may, over the coming decades, build up to current American force levels

if we choose not to build down to theirs, and develop an appetite for high confidence and reliability.

Hopefully we can forestall this development, but should we fail, we will not confront the Chinese arsenal of liquid fueled DF–5s, such as they have today, but rather a more numerous arsenal of their new solid fuel DF–31 and DF–41 missiles.

And any insight, however marginal, into the reliability of the DF–5 gained in the 1990's would surely be of vanishing or little relevance to the reliability of the utterly unrelated DR–31s and DF–41s deployed decades hence.

While accuracy is also of interest in the missile and launch fields, divergent considerations apply. Satellite operators generally set standards for launch vehicles, placing their satellites into some proximity of the destination orbit.

But the margin for error in the real world is normally many miles. And since satellites always carry their own maneuvering propellant it's left to the satellite rather than the launcher to reach the ultimate destination. And in the case of deploying multiple satellites, this deployment can take place over a period of hours or days, rather than the minutes found in the case of a multiple warhead missile.

The warheads carried on missiles have no such supplementary guidance or propulsion capability, and rely entirely on the missile and the quality of the re-entry vehicle body to reach their terrestrial destination. The accuracy of existing Chinese missiles is not well characterized in -the open literature, but is surely denominated in miles rather than the hundreds of yards characteristic of American missiles. Such accuracy is consistent with the deterrent role of the existing Chinese missile force.

Close does count in horseshoes, hand grenades and global thermonuclear war. It matters little to China or America precisely which part of Los Angeles is the actual ground zero. It should be recalled that the atomic bomb dropped on Nagasaki actually missed by a wide margin, a fact lost on the citizens of that unfortunate city.

Again, over time, this may change, and we may a few decades hence confront the Chinese nuclear arsenal that is both as numerous and as accurate as that deployed by the United States today. While this would represent a profound policy failure on the part of the United States to the extent that it was within our control, the potential transfer of technical data related to current Chinese launch vehicles would not materially contribute to this failure.

And given the ongoing investigation of allegations, it's also difficult at this point and in this forum to provide a definitive answer to the adequacy of current export control regulations. But the course taken over this decade with respect to the Chinese launch vehicles has had diverse benefits and on balance, manageable risks.

This set of policies has strengthened the American satellite industry, enhancing our global dominance of this strategic sector, and in the process, increasing the diversity and capability of communications available to our military forces worldwide.

It's engaged the energies of the Chinese aerospace industry and perhaps moved them towards seeing space development rather

than missiles as a central focus of their emerging role in the world. It's given us leverage in discouraging their transfer of special weapons technologies to other countries, notably Pakistan. While these efforts have clearly not been as successful as we would have wished, armed proliferation sticks would have been even less effective in the absence of the carrots of space proliferation.

We should not allow current controversies to obscure the fundamental soundness of this approach. But even more critically, we should not allow the current controversy to distract us from the more pressing and significant challenges American security faces today.

Senator COCHRAN. Thank you, Mr. Pike.

Dr. Schneider, we will hear from you now.

TESTIMONY OF WILLIAM SCHNEIDER, JR.,[1] ADJUNCT FELLOW, HUDSON INSTITUTE

Mr. SCHNEIDER. Thank you very much, Mr. Chairman, and I appreciate the privilege of testifying before this Subcommittee, and also appreciate your leadership on this particularly important subject.

I'll just summarize a few remarks concerning the regulatory aspects of this problem. The U.S. Government has historically regulated communications satellites, even when they were having strictly commercial applications, because of the close association of space launch and space satellites with national defense purposes.

Over time, the enabling technologies for the civil and military applications began to converge, and there were relatively few differences between them for either civil or military applications for communications satellites.

The primary differences between the commercial communications satellites and military communications satellites focused on measures to assure the survivability of those satellites. Those measures were generally developed through the Department of Defense, and hence justified the regulation of the communications satellites, even for commercial purposes, under munitions list auspices.

Due to the growth in space and launch services reliability, as Dr. Graham and Mr. Pike referred, especially in Russia and China, it created the possibility of establishing a worldwide commercial launch industry. This coincided with the U.S. Government's policy change seeking to de-nationalize the space launch industry and convert it into a commercial industry.

However, for national security as well as commercial considerations, the U.S. Government chose in the 1980's to limit the use of Russian and Chinese space launch services. This was done through continuing munitions list licensing of communications satellites and a system of launch quotas because of the fact that China and Russia at the time were non-market countries.

A policy change undertaken referred to in 1996 is an important philosophical change, and I think it should be noted, because of the difference between the concept of munitions license regulation and commercial or Department of Commerce regulation. The philosophy under munitions licensing is that the matter to be exported is ap-

[1] The prepared statement of Mr. Schneider appears in the Appendix on page 55.

proved to achieve the national security purposes of the United States. Nothing is permitted to be exported that addresses those purposes, unless specifically authorized.

As a consequence, when a communications satellite or space launch services or anything else that is identified on the munitions list is proposed for export, the technology is very thoroughly disaggregated to the point where perhaps two dozen offices in the national security community, the Department of Defense, Department of State, intelligence community and other agencies depending on the details of the technology, will review it very carefully, based upon very detailed documentation required to be submitted by the applicant.

This differs from the philosophy of products that are licensed under the Department of Commerce licensing, which is mainly done to promote the economic interests of the United States. And the aim is to facilitate the passage of this technology or services or hardware into international commerce for the benefit of U.S. industry.

Typically, the technology associated with it is focused primarily on the functionality of the system, that is, what purpose would it be used for, rather than the disaggregated review of the technology, as is the case in munitions licensing. These philosophical differences are important, because to the degree to which technology is transferred under a commodity jurisdiction change, from the munitions list to the Department of Commerce list, the technology is more likely to go into the public domain and indeed, to be done in a way that is generally not subject to U.S. monitoring.

I think the trends in this can be underscored by the degree to which liberalization has taken place. When I served in the Department of State in the mid-1980's, the Department of Commerce issued nearly 150,000 validated export licenses for dual-use equipment. In fiscal year 1997, that figure dropped to about 11,000, underscoring the dramatic degree to which the advanced technology has been liberalized.

Indeed, the most common items licensed on the Department of Commerce list are shotguns. So the degree of liberalization is indeed very substantial.

If added to that, there is a Commodity Jurisdiction change, based on the philosophical differences between the two licensing systems, it reflects a change in underlying public policy. The circumstances that we face with communications satellites is that it is at the nexus of the problem of balancing between these commercial aspirations of the United States which are extremely important, as our society and economy are information-driven, and our national security concerns.

I appreciate the work of this Subcommittee in trying to understand the issue and achieve appropriate balance in them.

Thank you Mr. Chairman.

Senator COCHRAN. Thank you, Dr. Schneider, for your assistance to the Subcommittee and for your statement.

Dr. Graham, you have pointed out how there are a lot of similarities between space launch activities and intercontinental ballistic missile activities in terms of the testing, building, and launching of these types of vehicles.

We happen to have a chart here that was prepared for the Subcommittee by the Central Intelligence Agency, although it is unclassified. It's available there, and it compares different parts of the missile system with a space launch vehicle.[1]

Does this in your view, based on your experience and knowledge of these systems, describe in a helpful way or an accurate way how interchangeable so many of the parts of these systems are?

Mr. GRAHAM. Yes, Mr. Chairman, I think this is a good representation of it. I would only add that for third world countries that are developing longer range rockets, they can also take the strap-on boosters you see on the space launch vehicle and apply them to the ballistic missile as well. So there is in fact a little more commonality than that chart shows.

But it's basically correct.

Senator COCHRAN. In 1993, on the question of whether the State Department would continue to license technical data sharing for the commercial satellites already moved to the Commerce Department's licensing jurisdiction, a Defense Department memorandum to the Department of State said, "While all of the USML," meaning U.S. Munitions List, "controlled technical data is of concern, that technical data which covers launch vehicle integration services is of the utmost importance to DOD and the missile tech community. Because any technical data on the launch vehicle, other than electrical and mechanical integration data, directly relates to ballistic missile proliferation concerns."

Do you think the Department of Defense memorandum in 1993 is still a valid expression of concern?

Mr. GRAHAM. Yes, Mr. Chairman. If anything, I think it was a understatement of the concern. It excludes the mechanical integration information, but in fact, the mechanical integration of the payload with the booster is very important.

For example, both ballistic missiles and space launch vehicles tend to bend while they're flying upwards, sort of like this. The control system has to be able to take that out by dynamic control.

The weight of the satellite or the payload on top is also moving back and forth. You can't let that body, in an oscillation called a body mode, either damage the satellite or its mount, or somehow have that mass at the top of the missile adversely affect the dynamical response of the rest of the vehicle.

So I think if anything, the concerns are a little more extensive than they are voiced there. But they're basically correct.

Senator COCHRAN. In the next year, January 1994, there was a *Washington Times* article which reported that licenses had been approved for the launch of two Martin Marietta satellites, Echo Star and AsiaSat II in China. The Commerce Department export licenses reportedly permitted Martin Marietta to assist the Chinese with integration analysis of the satellites to the space launch vehicle.

According to the article, "A Martin Marietta spokesman confirmed that his company's sale would include an integration analysis package," my question to you is, what is this integration anal-

[1] The chart provided by the Central Intelligence Agency appears in the Appendix on page 60.

ysis that is being discussed there, and how could it be helpful to Chinese missile programs?

Mr. GRAHAM. The integration analysis is the analysis of the overall performance of the space launch vehicle with the satellite on board. It's a very important part of space launch activities, because if in fact the missile or the booster is not well suited to the satellite launch, if it provides a rough ride or high acceleration to the satellite, one of two things will happen. Either you will have to put more structure in the satellite, which means you have less useful payload, or you will experience a failure in the satellite, either from the mechanical stresses on it or on the attachment it has to the space launch vehicle.

Similarly, if the satellite isn't the right mass and balance, it can affect adversely the rocket launcher itself. So there is not a way to separate the integration of the satellite with the integration of the space booster. They have to be done as one single unit. And you have to understand the performance of that whole system to have a successful launch to orbit.

There's technically not a divide between what the booster design people need to know and what the satellite people need to know. They both need to know almost everything about the mechanical and electrical characteristics of the system.

Senator COCHRAN. Your statement is in essence a conclusion based on your experience and knowledge of these systems that by allowing China to launch U.S. commercial satellites, we're actually helping improve China's missile and satellite launch capabilities and their infrastructure.

Does this also relate to providing a higher state of readiness for those involved in China in these programs? We hear a lot about China being unable to immediately respond in cases of emergencies. Does launching U.S. satellites also help keep China's launch time in a higher state of readiness than it otherwise would be?

Mr. GRAHAM. It certainly provides strong economic support to the cadres of rocket scientists and engineers that China has. We essentially pay for part of their training and their infrastructure. That gives China an overall more capable ballistic missile as well as satellite launch capability.

It also keeps those cadres active in preparing and launching rockets. That, again, helps their readiness to launch whatever China dictates that they launch.

Finally, in the longer run, the next step in guidance systems, for example, is going to be to global positioning satellite assisted guidance, both for space launch vehicles and for ICBMs. And that will make both of these much more accurate in their performance and improve their ICBMs' ability to hit targets.

Senator COCHRAN. Dr. Schneider, in your discussion of the regulatory regime and its evolution and the changes that have taken place over the last several years, you mentioned the impact of the change of philosophy as well as regulation that occurred in 1996. I have a copy of a letter that was written to the Chairman of the Senate Foreign Relations Committee from the Department of State, signed by Barbara Larkin, who was Assistant Secretary for Legislative Affairs.

It's dated September 20, 1996. And it's notifying the U.S. Senate, specifically the Chairman of the Foreign Relations Committee, of these changes that had taken place under the Export Administration Act. I'm going to give you a copy of this, so you can have it available to you.[1]

One thing that is mentioned in this letter is that, not only is there a removal from State Department to the Commerce Department, from the munitions list to the so-called Commerce Department control list, of militarily sensitive components of commercial satellites. But it noted that additional controls would be placed on these items by the Commerce Department to bolster its export control regime.

The letter says this: "These satellites would not be eligible for a Commerce Department general license."

My question is, what is meant by the term "general license"? Is this some kind of jargon for saying a formal export license from the government is not necessary to export the item? And how is this different from an individual validated license?

Mr. SCHNEIDER. Thank you, Mr. Chairman.

A general destination license is essentially equivalent to not requiring an export license. The technology that is so identified, or the product that's so identified, can be exported by the exporter without need for additional authority from the U.S. Government.

The individual validated license, which is, that is the category I mentioned that has been a beneficiary of substantial liberalization from about 150,000 now down to about 11,000 in fiscal year 1997. Individual validated license means that the applicant has to provide information on what he wishes to export and who the end user is, and other bits of information relating to it.

That is assessed by the Department of Commerce and in some cases referred to other agencies. If the agencies agree, then the Department of Commerce will issue a license of the intended purpose. And that is an individual validated license.

Senator COCHRAN. Thank you. For the purpose of our record, I'm going to ask that a copy of the letter dated September 20, 1996, be included in the record.

Senator COCHRAN. Senator Levin.

Senator LEVIN. Thank you, Mr. Chairman.

First I'd like to go back to 1988, when President Reagan decided to allow for the transfer of satellites for Chinese launch. It was apparently a highly controversial decision, opposed by many members of Congress. This is what a *Washington Post* article says on September 10, 1988, which I would ask be made part of the record, Mr. Chairman.[2]

It said that, "President Reagan, in a move designed to expand trade between the United States and China, has given conditional approval to plans to launch three American-made communications satellites on China's Long March rocket boosters, the State Department announced yesterday. If the decision is not blocked by Congress, or by a special Western Bloc commission that monitors technology transfers to communist nations, it will mark the first time

[1] The letter, dated September 20, 1996, appears in the Appendix on page 63.
[2] The *Washington Post* article referred to appears in the Appendix on page 61.

U.S. satellites have been launched from a non-western or communist country.''

''The administration's approval of export licenses,'' and I'm shortening this, that's why I want the whole article in the record, ''the administration's approval of export licenses for the satellites was condemned by several members of Congress as threatening national security by giving the Chinese an opportunity to see American satellite technology.''

''China's promised it will not examine the satellites, which will be shipped for launch in sealed containers. But some U.S. officials have said there is no way to ensure the security of the satellites once they're in China awaiting launch.''

So apparently this decision, it says here by the way, ''this is a victory,'' says the *Washington Post*, ''for the Chinese government.''

Apparently it was a highly controversial decision at the time, because of some of the concerns, Dr. Graham, which I heard from you this morning, the very launch of an American satellite from a Chinese rocket contributes to the advance of rocket science in China. Is that fair?

Mr. GRAHAM. Yes, Senator, that's fair.

Senator LEVIN. Since that time, since Tiananmen Square, there's been a requirement for a Presidential waiver for a transfer of a satellite for Chinese launch. Those waivers have been forthcoming under both President Bush and President Clinton.

There must be a national security review, as I understand it, before those waivers, so that the waiver in effect supersedes the licensing requirement. Because the agency, whether it's the State Department or the Commerce Department, is going to license something where there's been a Presidential waiver. Once it's gone through that waiver process, I doubt there's very much left for the agency to decide.

The waiver process kind of supersedes the licensing process. If a President waives a transfer, it's kind of hard to imagine the Commerce Department or the State Department is not going to issue the license following that.

Do you know, Dr. Schneider, whether or not the number of agencies involved in that presidential review are fewer than they are for a munitions list review, when there's a State Department licensing? Do you know if the number of agencies is fewer?

Mr. SCHNEIDER. I'm not intimately acquainted with the process that's being used. But my expectation would be that the same agencies at the cabinet level would be involved. The issue that is not known to me is the degree to which the technology is in fact disaggregated and sent to the special offices that have the particular knowledge of the technology. That might make a difference in how the review would come out.

Senator LEVIN. So you're not sure whether or not, inside each agency, it goes to the same sub-agency groups for review, but it might.

Mr. SCHNEIDER. It might, yes. I hope it would.

Senator LEVIN. Now, yesterday, the House passed an amendment which reverses this policy and says, no more satellites can be transferred to China-basically reverses the decision—there's also a

couple of other amendments, too, which change the munitions list issue.

But the fundamental amendment adopted yesterday by the House said, no more satellites can go to China for launch, regardless of what President Reagan's done, what President Bush has done, what President Clinton has done, in terms of permitting this with waivers or with scrutiny. The fundamental issue here seems to me is the one that Dr. Graham has raised, and you others have commented on: Should the satellites be permitted to go to China for launch?

By a vote yesterday of 417 to 4, following I believe a 10-minute debate on the amendment but a much longer debate on the whole issue, the House of Representatives said that there will be a prohibition, here it is: "No satellite of the United States in origin, including commercial satellites and satellite components, may be exported or re-exported to the People's Republic of China."

Do you agree with that decision, Dr. Graham?

Mr. GRAHAM. Senator Levin. I would like to preface my response with a brief word of background. I first worked on ballistic missiles in 1964, when I was an officer in the Air Force. I have worked on several ballistic missiles since then, and also helped, when I was at NASA, resurrect the U.S. unmanned space launch vehicle program. So I have considerable familiarity with both ballistic missiles and space launch vehicles.

I was the director of the Office of Science and Technology Policy, as well as science advisor to the President, when the issue of the use of Chinese SLVs came forward in 1988. Based on my experience, at that time I opposed sending those first three satellites to China for launch. I still think that was an unsound policy, and therefore think the measures the House has taken yesterday are in fact correct.

Senator LEVIN. In 1988, you opposed President Reagan's action?

Mr. GRAHAM. No, Senator, there was an interagency review of the prospect of allowing those satellites to be transferred to China for launch. During that interagency review process, I opposed their being transferred.

Senator LEVIN. That's what I mean. During that process, it was your opinion that those satellites should not have been transferred, we should not have started down that road?

Mr. GRAHAM. That's correct, Senator.

Senator LEVIN. That's still your opinion?

Mr. GRAHAM. Yes, Senator.

Senator LEVIN. Mr. Pike, yesterday's vote, do you think it is wise or unwise? It's the fundamental issue.

Mr. PIKE. I think it was certainly very poorly premised, and that's one of the reasons I'm hoping that this hearing today is going to be able to put this matter in a slightly better perspective. If one examines the statements that have been made on the Floor of the House, Floor of the Senate over the last several weeks regrading the situation with respect to the Chinese strategic forces, it seems to me that the House was making a decision that was at best extremely poorly informed.

We've heard charges that there are now hundreds of Chinese nuclear missiles aimed at the United States, although I think we've

had probably a more realistic assessment of that here this morning. The suggestion that there were no Chinese missiles capable of reaching the United States until last year and that this change and all kinds of other horrific changes have been solely due to the events that I take it are going to be subject to further investigation here and elsewhere, I think is obviously and fundamentally at variance with the facts.

So if the House is basing its decision with respect to launching Chinese satellites, American satellites on Chinese rockets, under the notion that this policy has somehow resulted in some profound, immediate, obvious, irrefutable degradation in American security due to the ability of the Chinese to fire hundreds of nuclear missiles at the United States today, whereas they were utterly incapable of doing so a year ago, I think that it's astonishing that the House could be making a decision on the basis of such erroneous information.

Senator LEVIN. I take it, then, you don't agree with the House's decision?

Mr. PIKE. I think it was very poorly premised, and I'm hopeful that the Senate will be able to set matters straight, hopefully on the basis of the record we're making in this hearing today.

Senator LEVIN. Dr. Schneider, was the House doing the right thing yesterday in prohibiting the transfer or export of satellites or components to China?

Mr. SCHNEIDER. I know any President wishes to have discretion in the ability to manage foreign policy. Restrictions imposed by the Congress are often resisted for that reason. But because of the risks of proliferation, I think it was the right choice.

Senator LEVIN. Simply, no more commercial satellites for launch in China?

Mr. SCHNEIDER. Unless we can come up with a technique that isolates China's access to the technology transfer that we've been discussing here.

Senator LEVIN. Doesn't the very launch of those satellites contribute somewhat to their knowledge, for the reasons that Dr. Graham went into and you went into somewhat?

Mr. SCHNEIDER. Yes. Hypothetically, the only way I can imagine doing it is if they export the satellites to an offshore user acceptable to the United States, where all the launch integration services would be performed by people outside of China.

Senator LEVIN. My understanding of the waiver provision following Tiananmen Square, which has been used by President Bush and by President Clinton, is that Congress has an opportunity to overturn the waivers. We're on that chart that I put up, those 20 waivers. Is that your understanding? Does anyone know if that is correct?

Excuse me, the license, technically, which follows the waiver. Do you know if that's technically correct, anybody, that Congress has, I think, 30 days after the license is issued following the waiver to China, to overturn that license?

Mr. SCHNEIDER. That's not my understanding. That process, to the best of my knowledge, applies only to exports under the Arms Export Control Act where there's a Congressional——

Senator LEVIN. All right, but 17 of those 20 were munitions list items.

Mr. SCHNEIDER. Munitions List items, yes.

Senator LEVIN. So in those 17 cases, when the State Department had the licensing responsibility following the waiver, in those cases Congress had 30 days to object. Is that correct?

Mr. SCHNEIDER. Yes, under the Section 36 notification process, that's correct.

Senator LEVIN. All right. Now, do you know whether in any of those 20 cases, where those launches occurred in China, that Congress even attempted to file an objection? Does anybody know that?

Mr. SCHNEIDER. It's not known to me, Senator.

Senator LEVIN. Do you know? Anybody know?

Mr. PIME. There has certainly been, at least early in the process, a fair amount of specifying. But I don't think there was any concerted effort.

Senator LEVIN. So as far as you know, Congress has never exercised the power it has to stop a satellite from going to China in order to be launched in China, is that correct? Never attempted to exercise that power?

Mr. SCHNEIDER. Yes, that's correct, Senator.

Senator LEVIN. Is there also a power that Congress has when something is removed from the munitions list to object, do you know?

Mr. SCHNEIDER. I don't recall, sir.

Senator LEVIN. I think the letter that was read earlier is a notice to Congress under Section 38(f) that the President report to the Congress at least 30 days before any item is removed from the U.S. Munitions List. So there is a notice requirement, is that correct?

Mr. SCHNEIDER. Notification, right.

Senator LEVIN. And as far as you know, did Congress, when it received notice of the shift of these items from the munitions list to the Commerce Department list, was there an effort to override that shift? Do any of you know?

Mr. SCHNEIDER. I don't believe there is a statutory process where they have a resolution of disapproval, as in the case of AECA transfers.

Senator LEVIN. But a bill could be introduced?

Mr. SCHNEIDER. Yes, of course.

Senator LEVIN. Do you know whether or not a bill was introduced?

Mr. SCHNEIDER. Not me, Senator.

Senator LEVIN. Any of you know?

Mr. GRAHAM. No.

Mr. PIME. No.

Senator LEVIN. Thank you, Mr. Chairman.

Senator COCHRAN. Thank you, Senator Levin.

Senator Thompson.

Senator THOMPSON. On the license issue, is my understanding correct that if something's on the munitions list at the State Department, then the administration's got to give Congress 30 days notice?

Mr. SCHNEIDER. Correct.

Senator THOMPSON. That does not mean that Congress has special power over these sales. Congressmen can object or make a speech, but the only power that we have is the power we have anyway, and that is to pass a law prohibiting it. There's no special override on the part of Congress, is that right?

Mr. SCHNEIDER. On these transactions, Senator, the Congress can submit a resolution of disapproval. And if that is passed by the Congress, then the sale cannot be consummated.

Senator THOMPSON. That's legislation.

Mr. SCHNEIDER. Yes, its a specific form described in the law.

Senator THOMPSON. Is one of the consequences now of transferring this authority from the State Department to the Commerce Department that there no longer is that 30-day notice requirement?

Mr. SCHNEIDER. That's correct. There are two different statutes involved.

Senator THOMPSON. When it was under the State Department, you had to give Congress 30 days notice, so they could at least voice an objection.

Mr. SCHNEIDER. That's correct.

Senator THOMPSON. Now, that it's been changed to the Commerce Department, Congress does not even get that 30 day notice, is that correct?

Mr. SCHNEIDER. That's correct.

Senator THOMPSON. All right. Also with regard to the waiver issue, I don't think the fact that there have been waivers under various administrations, is an issue. I mean, it's not a waiver is a waiver is a waiver, or a transfer is a transfer is a transfer. I think that the issue is what is being waived, what is being transferred. There is a difference between a transfer that contains militarily sensitive material and a transfer that does not.

Also, I would assume that whether or not there was a viable USSR might have something to do with decisions as to what one would transfer in these circumstances. Also, the process by which these decisions were made would be relevant.

I think when we acknowledge that there are several waivers at several different times, we have to go a little further than that and determine exactly what was waived and under what circumstances and what were the processes.

Now, you've mentioned some of the different standards between the Commerce Department and the State Department. As I understand it, there's one license required at the Commerce Department, two licenses at the State Department.

Mr. SCHNEIDER. Yes, there are different types of licenses. For example, to market products that are licensed by the State Department, you need one type of license. And to transfer technical data, you need another type of license. To actually transfer the hardware, you need yet a different type of license.

So the aim is to protect as best as can be done through the regulatory process, access to defense-related technology.

Senator THOMPSON. Well, for a matter under the State Department on the munitions list, don't you have to have a license even to begin to enter into discussions with the Chinese, for example?

Mr. SCHNEIDER. Yes.

Senator THOMPSON. That's not true with the Commerce Department, is it?

Mr. SCHNEIDER. That's correct.

Senator THOMPSON. As I understand it, according to this GAO report, the Bush interagency group and subsequently the Clinton interagency group all agreed that if these satellites contain militarily sensitive characteristics integrated in them, they should remain at the State Department, right?

Mr. SCHNEIDER. Correct.

Senator THOMPSON. Are you familiar with these nine sensitive characteristics, anti-jam capability, antenna cross-links, encryption devices, pointing accuracy, and all of that? Are you generally familiar with those?

Mr. SCHNEIDER. Yes, I am.

Senator THOMPSON. Do you agree with the interagency determinations that if those sensitive military matters are present within these satellites, they should remain under the stricter standards of the State Department? Do you agree with that?

Mr. SCHNEIDER. Yes, I do, sir.

Senator THOMPSON. Is it not also true that now, since 1996, when the shift was taken, that even if a satellite contains any or all of these characteristics, pointing accuracy, propulsion system, the others that I mentioned, that that still rests with the Commerce Department now?

Mr. SCHNEIDER. That's correct.

Senator THOMPSON. All right. There's been some writing in the professional journals concerning intangible know-how. Dr. Graham, you might respond to this, or all of you. Hardware is one thing, but one of the matters we need to be most concerned about is the transfer of intangible know-how. We should take special care regarding conversations that might go on, the information that might be transferred pursuant to U.S. companies trying to make sure that these rockets work.

Do you share that concern?

Mr. GRAHAM. Yes, Senator. I'm an engineer speaking with this criticism, but we engineers are trained our whole lives to look at equipment capabilities, analyze them, look for flaws, errors, and anything else that would cause failure or trouble, and try to solve the problem.

That's what engineers do. It's almost impossible to stop them from doing that, and almost no matter where you put them, that's what they're going to do. Experienced U.S. engineers have intangible knowledge that can very easily be transferred to foreign engineers, if you put them together.

Senator THOMPSON. Well, I understand that the statement is made sometimes in response that monitoring does occur. But my information is that there's no absolute requirement that the Department of Defense monitor and be present at all times with regard to discussions, the mating of rocket to satellite, the launching and all of that. That in fact, with regard to the May 19 Lockheed Martin Marietta launch, that they went to the Department of Commerce and asked them to provide monitors. Are you familiar with that point?

Mr. GRAHAM. I'm generally familiar with the fact that Martin initiated the request for monitoring, not the U.S. Government, Senator.

Senator THOMPSON. Do you know whether or not in practice there's an absolute requirement that Department of Defense monitor and be present at all stages?

Mr. GRAHAM. I would defer to Dr. Schneider.

Mr. SCHNEIDER. My understanding is that no, that is not the case. This illustrates the difference between a commercial license and a State Department license. The State Department license limits what technology can be transferred. And there are procedures that a vendor is required to follow that restrict even the amount of informal knowledge he is allowed to transmit. He is told exactly what he can transmit, the vendor is required to submit a technology transfer control plan, in most cases, so that they know exactly how the information will be transferred, under what procedures and so forth.

But with a Commerce Department license, the idea is to transfer the asset and its functionality. And there is not a procedure in ordinary Commerce Department licenses for the control of this informal transmission of information. And the idea of a monitor would probably be of some help, but it would still be difficult to control the transfer of information if there was not otherwise a requirement in the license to do so.

Senator THOMPSON. All right. Let me ask you one more question. Are any of you gentlemen familiar with the Coordinating Committee for Multilateral Export Controls, which the United States was a member of?

Mr. SCHNEIDER. Yes, I'm familiar with it.

Senator THOMPSON. Dr. Schneider, what was the function of that entity? And why did we get out of it?

Mr. SCHNEIDER. It was established in 19149 among the United States and our European allies, to restrict the flow of initially arms to the Warsaw Pact, but later, to control the flow of technology that would enhance the military performance of the Warsaw Pact. It was a non-treaty based organization, headquartered in Paris, that coordinated the export control activities of the member states.

At the end of the Cold War, the U.S. Government was unable to persuade allied governments to continue the existence of the COCOM organization. So a new entity was established in 1994 called the WASSANAAR arrangement, after the river in the Netherlands where the meeting was held. This arrangement does not control the transfer of technology, but only limits the flow of, let's say, it requires notification after sale of military equipment to essentially pariah states.

Senator THOMPSON. Did the United States remove itself from the original organization?

Mr. SCHNEIDER. No, the United States agreed not to continue COCOM and to seek a new——

Senator THOMPSON. When did that happen?

Mr. SCHNEIDER. In 1993.

Senator THOMPSON. Did the COCOM, as you've referred to it, would that have placed stricter requirements on the exports of these commercial satellites than what we have today?

Mr. SCHNEIDER. Yes.

Senator THOMPSON. That's all.

Senator COCHRAN. Senator Collins.

Senator COLLINS. Thank you, Mr. Chairman.

I want to follow up on some questions that Senator Thompson posed to you about the differences between the procedures used by the Department of State and the Department of Commerce. It seems to me one basic difference also lies in the mission of the two departments. And indeed, when you look at the people who are appointed to be the Commerce Department Secretary, they often have highly political backgrounds. But I can't think of any in recent history who had national security expertise.

And this area, of course, is very technical and does obviously involve complex aspects of national security.

I'd like to ask each of you which department or agency you believe should have primarily responsibility in the area of export control of space technology. Dr. Graham, let's start with you.

Mr. GRAHAM. It's my personal view that the greatest expertise in that area resides in the Department of Defense, since they are the agency that develops, or at least used to develop, ballistic missiles for the United States, and also is an extensive user of space launch technology.

So from a national security and generally national benefit point of view, I would feel most comfortable if the primary responsibility in the area of export control of space technology resided ultimately with the Department of Defense.

Senator COLLINS. Mr. Pike.

Mr. PIKE. I think that the current arrangement where the Bureau of Export Administration at the Department of Commerce has primary responsibility for dual-use technologies is the correct arrangement. The challenge, of course, that we have is, unlike the situation in the Cold War where we were mainly concerned with primarily military exports, the concern today is primarily with dual-use technologies like supercomputers, like space launch components.

I think that the Bureau of Export Administration, their proper place is trying to strike the balance with American competitiveness and other interests.

Senator COLLINS. Dr. Schneider.

Mr. SCHNEIDER. The two export control regimes—the Department of Commerce regime and the Arms Export Control regime—have their origin in different statutes with different purposes. The State Department export controls over the U.S. Munitions List is derived from the Arms Export Control Act. The purposes of that act are to assure the congruence of exports with the foreign policy and national security interests of the United States.

The export control regime managed by the Department of Commerce is derived from the Export Administration Act. And the purpose of that is to promote the commerce of the United States, and for that reason, I believe that the licensing apparatus should be managed by the national security apparatus, because of the coupling of this technology to U.S. national security interests.

I think the arrangement that the Department of State manages with interagency consultation, where the office with the most ex-

pertise, whether it's the Department of Defense or the Department of Energy, whatever, is the one that dominates licensing decision. I think that is an acceptable way of managing and should be continued.

Senator COLLINS. So Dr. Schneider, you would disagree with the decision that the Clinton Administration made to transfer the primary responsibility from the State Department to the Commerce Department?

Mr. SCHNEIDER. Correct.

Senator COLLINS. Thank you.

Dr. Graham, I'm interested in the issue of the technology transfers that can happen in the event of a launch failure. It's been reported that a so-called black box containing decryption hardware is missing from one of the satellites launched unsuccessfully by China, one of the ones that presumably blew up.

The *New York Times* has reported that similar devices are used to communicate with American spy satellites, and that the Pentagon and intelligence agencies were concerned that anyone who could crack the code could take control of the satellites themselves.

Now, the National Security Advisor, Sandy Berger, has dismissed technology transfer concerns on the grounds that China had no access to the technology in U.S. satellites, because such devices are sealed into a container that's not opened until the satellite actually leaves the booster in space. But isn't there a danger in the event of a failure that there will be unexpected access to technology, to very sensitive technology?

Mr. GRAHAM. Yes, there is, Senator Collins. I am not familiar with the details of this particular satellite and its encoding devices. But it's common to provide some degree of encryption in what is called the telemetry command and control, or housekeeping system for the satellite, so that unauthorized users can't come in by radio link and disorient or otherwise cause the satellite to malfunction once it's on orbit. You basically protect yourself against rogue data streams coming into the satellite with encryption.

That is in part embedded in the hardware in the satellite, and in part in the software. That hardware will be placed inside black boxes in the satellite, and should the satellite and booster fail on the way to orbit, those black boxes will be scattered over the landscape, or the seascape, depending where it comes down, and are available for whoever finds them first.

While they will tend to be rather damaged-looking from the outside, my experience with such failures is that you can learn a great deal by taking them apart.

Senator COLLINS. Mr. Pike, do you share the concerns expressed by the Pentagon and intelligence agencies and Dr. Graham about the access that could occur in the event a satellite blows up?

Mr. PIKE. This is obviously dependent on technical details that can't be discussed in an unclassified forum. I think that it's certainly safe to say that, for instance, in the immediate aftermath of the Challenger accident, one of the very highest priorities the U.S. Government had was not recovering the bodies of the astronauts, but rather recovering the cryptographic support materials that were on the communications satellite carried by the shuttle.

The cryptologic systems used by American military satellites are obviously of a different type and a different standard than those used on commercial satellites. However, obviously, commercial satellite operators have an interest in making sure that backyard enthusiasts can't commandeer the satellite to have their own pirate television station, as was done before these cryptographic systems were implemented in the early 1980's.

But at the same time, normally these systems are embedded in chips that have been hardened to make it extremely difficult to open the packaging of the chip without completely destroying the underlying chip. And even having access to the cryptosystems electronics hardware might enable you to replicate that type of hardware, but it is not going to give you the keys to getting access to enable you to commandeer a commercial satellite. And certainly not a military satellite.

And of course, the United States has been trying to get other countries to implement these type chip-based cryptologic systems, to make it easier for the National Security Agency to read their communications. So the notion that the Chinese are going to be trying to replicate a cryptographic system whose chief virtue is that it's certified to be readable by the National Security Agency is not something I'm terribly worried about.

Senator COLLINS. Dr. Schneider, do you have a concern in this area?

Mr. SCHNEIDER. Yes, I think it logically follows, if the public policy was to protect the access to the content of the satellite before it went on then it follows that if the satellite should be destroyed, and the contents inaccessible to unauthorized parties, that it would be a concern of the United States.

Senator COLLINS. It seems that it would be a concern to me, also.

Thank you, Mr. Chairman.

Senator COCHRAN. Thank you, Senator Collins.

Dr. Schneider, in your capacity as Under Secretary of State, you had a responsibility for supervising this munitions list that we've talked about. You served in that capacity for how long?

Mr. SCHNEIDER. Four years, sir.

Senator COCHRAN. And now I understand you are chairman of the State Department's Defense Trade Advisory Group, is that correct?

Mr. SCHNEIDER. That's correct, Mr. Chairman.

Senator COCHRAN. Can you tell us, based on your experience in these positions, if there is a substantial difference between a technical assistance agreement that was required when a munitions list item was to be sold or transferred, and the current policy in this administration? And if there is a difference, what is that difference, and what was the reason for the technical assistance agreement?

Mr. SCHNEIDER. Do you mean the difference between a TAA in the State Department and the Commerce Department?

Senator COCHRAN. Yes, the current license or——

Mr. SCHNEIDER. OK. A technical assistance agreement is required under a munitions license any time you transfer technical data that is not in the public domain. This can be classified or unclassified. It requires this review.

The review is extremely thorough, and very few licenses are issued without what are called provisos, which are further restrictions on how the technical data can be transferred. It has a high order of rigor, because the technical data is often the key to understanding the performance of the system.

Because of the differing philosophies between the two export control regimes, the Commerce Department normally doesn't license technical data. In some cases they do, but it's not a primary feature of Commerce Department licenses, because of the philosophy of the export control. They are mainly transferring the functionality of the system, and don't seek, in most cases, to control the transfers of the technical data, per se.

Senator COCHRAN. There is a list that I have been given of 14 categories of technical data. I'm advised that these relate to missile launch activities or characteristics or components. I'm giving a copy, asking the staff to give a copy to each witness and each Senator. I will also ask that a copy be made a part of the record.

[The information supplied follows:]

1. Form, fit, and function
2. Mass
3. Electrical
4. Mechanical
5. Dynamic/environmental
6. Telemetry
7. Safety
8. Facility
9. Launch pad access
10. Launch pad parameters
11. Telemetry, tracking and control maintenance data
12. Satellite system data such as power, weight, and fuel budgets
13. Observance of satellite test
14. Operational training for customer personnel

Senator COCHRAN. I'm wondering if you can tell us if these technical data categories would have been included in a required technical assistance agreement as part of the license, if the transfer of commercial satellites were still a munitions list item?

Mr. SCHNEIDER. Yes, they would, and there would be additional ones to that.

Senator COCHRAN. Can you tell us what the significance of these technical data items would be in terms of technology transfers that could be harmful to the United States, in the hands of the wrong country?

Mr. SCHNEIDER. Each of the items on this list pertains to matters relating to the integration of the payload to the booster. That's why they would be considered categories that the applicant would have to provide, if it was a Department of State munitions license. They would have to, in addition to providing the information, the license would specify exactly what form, fit and function data could be transferred. Frequently they will say in addition what cannot be transferred.

The applicants are required to do a substantial amount of record keeping and reporting and so forth relating to the implementation of that license.

Senator COCHRAN. And as I understand it, the Commerce Department's control list and its licensing requirements and rules

don't include any such technical data categories or specific authority to discuss technical data, is that correct?

Mr. SCHNEIDER. In the case of the arrangements that were made during the transfer of the commodity jurisdiction, the Department of Commerce has undertaken a higher order of review, then it is the case normally in Department of Commerce licenses with respect to the transfer of satellite systems.

As Senator Levin mentioned, the Commerce Department leads an interagency process that undertakes reviews that can cover this particular material. As I mentioned, I'm not intimate with the details of how the interagency process is being conducted. So I can't really comment as to whether they take each of these items in detail. But the fact that they have an expanded review would certainly give the agencies the authority to comment on these issues if they chose to do so.

Senator COCHRAN. I understand that some companies, despite the absence of a requirement to do so, are continuing to go to the State Department to obtain what amounts to a technical assistance agreement, or TAA license. Is that your understanding?

Mr. SCHNEIDER. Yes, I have heard that. That may be for applicants who have previously had export licenses issued by the Department of State, and are following up on that. I don't have any specific knowledge of why they've chosen to do that.

Senator COCHRAN. Based on all of these facts that you have given us, is it fair to conclude that export control requirements on commercial satellites have become less stringent since being moved from the munitions list to the Commerce control list?

Mr. SCHNEIDER. I believe that's the case.

Senator COCHRAN. On October 8 last year, the manager for export compliance at the Hughes Space and Communications Company wrote a letter to the Commerce Department, seeking guidance on whether the technical data I mentioned, these 14 categories of technical data, requires an export license.

And I understand the Commerce Department has not replied to that letter of 7½ months ago, even though for the first 10 categories, the official with Hughes wrote, "We believe that this data is classified as EAR99, exportable under the Commerce Department license exception NLR."

And I'll ask that this letter be made part of the record, and a copy provided.[1]

I'll also note that the Commerce Department license exception NLR stands for, I think, "no license required."

Mr. SCHNEIDER. Correct.

Senator COCHRAN. For the last four categories, the Hughes official wrote, "Since there is some difference of opinion as to what event triggers the ability to utilize a Commerce Department license exception, please clarify conditions under which the exception is applicable."

What is your reaction to that in terms of the Defense Department memorandum that we earlier talked about that mentioned transferring jurisdiction of this data, these 14 categories to the Commerce Department, and the Commerce Department handling

[1] The letter, dated October 8, 1997, appears in the Appendix on page 65.

it? How important do you consider the licensing oversight of technical information transfer under these circumstances to be?

Mr. SCHNEIDER. I think it's very important if the technology is pertinent to matters relating to national defense. I think for items that are not so required, that it would constitute a burden on the Commerce Department.

Senator COCHRAN. Dr. Graham, you have in front of you that list that I refer to that was included in the Hughes letter. What is your opinion about whether we should be concerned that one of the major aerospace companies is operating on the impression that 10 of these 14 categories requires no technical assistance license? Or for that matter, any license? And for the last four categories, clarification of administration's policy is necessary?

Mr. GRAHAM. Well, Mr. Chairman, these are just categories, of course. But in looking at them, I would be very concerned that if there were an unconstrained dialogue or cooperative engineering work that was performed, even seemingly simple ones like mass involve far more than just how heavy the satellite is.

The distribution of the mass, the concentricity of the mass, the moments of inertia that it provides to the missile are all very important in not just the weight, but also how it affects the dynamic response of the missile, or rather the space launch vehicle satellite system. That is picked up in item five again, dynamic environmental, when you get into a dynamic analysis of the space launch vehicle, and its satellite.

Here again, I believe it would be virtually impossible for an American engineer to look at a space launch vehicle satellite combination, observe some kind of a serious problem, or perhaps even critical flaw in the space launch vehicle, and go ahead and let the satellite be launched with a high degree of knowledge that it might not reach orbit, without saying something about it.

Of course correcting flaws in either the structural, electrical or other elements of the system are also directly applicable to both liquid and solid ICBM systems. Telemetry is another category; it tells you how well the SLV system is working on its way to orbit and tells you what problems it's having, if any.

So I think each of the categories on this list warrant further exploration. But some of them are clear areas of potential technology transfer that would be adverse to the United States.

Senator COCHRAN. And it seems, if I'm concluding correctly from the Hughes letter, that they believe this data is exportable under the Commerce Department license rules. And according to what I understand from you and Dr. Schneider, these are items, technical data items, that could very well be employed by the recipient country in a militarily useful way that could endanger our national security, is that correct?

Mr. SCHNEIDER. Yes, if these items transferred are applied for military purposes, yes, they could be.

Senator COCHRAN. And how does that compare with the State Department notice about the transfer of these munitions list items to a Commerce Department licensing regime and then the statement that enhanced regulations have been developed and agreed upon, an individual validation license will be required for all des-

tinations, etc. Obviously, Hughes and others had copies of these regulations.

And then for them to be able to conclude that no license was required for 10 of these items. Doesn't seem to me that these are enhanced regulations, these are much more relaxed regulations. Is that the conclusion that you come to as well?

Mr. SCHNEIDER. The process that was set up under the Department of State notification so that it could produce the same results. And I haven't audited this process to see how it's actually working.

But if the situation spins out as you describe it, it could produce unintended transfers of technology that's pertinent for military purposes.

Mr. PIKE. That's not self evident from this list, though.

Senator COCHRAN. Mr. Pike, I didn't ask you. I'll ask you a question later.

Mr. PIKE. All right.

Senator COCHRAN. Senator Levin.

Senator LEVIN. Thank you.

Relative to the shift from the State Department to the Commerce Department, this occurred after 17 licenses were issued for a launch in China, is that correct?

Mr. SCHNEIDER. That's correct.

Senator LEVIN. So the vast majority, including the one that blew up, was on the munitions list?

Mr. SCHNEIDER. Correct.

Senator LEVIN. Then when the transfer was made, at the last three, Congress had an opportunity for 30 days for someone to file a bill or someone to object. I don't know of any effort on the part of Congress or anyone in Congress to object to that transfer. None of our witnesses seem to know of any effort at that point, either.

But there's another point. And that is that when we come to China, it is the same process in terms of a Presidential waiver, whether or not you had a State Department or a Commerce Department issuing the license. Now, again, with the vast majority since 1988, since President Reagan started down this road, the vast majority, 17 out of 20, it was a State Department license, that means a munitions list issue. And they all got approved.

But in all 20 of the 20, there was a Presidential waiver, which involved a National Security Council recommendation to the President.

Now, do any of you know, relative to that National Security Council recommendation that occurred with all 20 of these—which gets us a little closer to your point, Dr. Graham, about getting the Department of Defense involved in this, because I think that is a critical issue—relative to that National Security Council recommendation to a president, be it President Bush or President Clinton, was that process in those 20 instances any different whether or not the State Department started down the licensing road in 17 of the 20, or the Commerce Department started down the road? Do you know of any differences in that waiver review, which involved the National Security Council, do you know of any differences, Dr. Schneider, in that review process?

Mr. SCHNEIDER. No, the waiver is a separate process from the analysis of the transfer itself.

Senator LEVIN. And do you know, are you familiar with that process?

Mr. SCHNEIDER. Not in detail. Only in the structure you describe, I have heard of before.

Senator LEVIN. Do you know of any difference in the National Security Council involvement in this waiver process, be it under the first 17, whether it was the State Department, or the last three under the Commerce Department?

Mr. PIKE. There were certainly important differences in terms of the policy objectives that were sought and granting the waivers. Because we had not been granting these waivers simply because American satellite companies wanted to fly on Chinese launch vehicles. This has been part of our non-proliferation policy with respect to China.

On several occasions, we have withheld these pending resolution of non-proliferation concerns with the Chinese. And they were only brought forward once the Chinese had made representations that were satisfactory to the concerns we then raised.

But apart from that very important policy difference, which I think highlights a lot of why we had been doing this, procedurally, I think they were approximately the same.

Senator LEVIN. As far as the procedures used with a Presidential wavier?

Mr. PIKE. Essentially.

Senator LEVIN. The same whether it was the State Department or the Commerce Department? Do you know, Dr. Graham?

Mr. GRAHAM. Senator, I haven't followed this process since I left government, so I don't know.

Senator LEVIN. There are some differences between State Department and Commerce Department licenses. There's no doubt about it. And items are shifted, by the way, from one list to another, with notice to Congress. There are differences.

But in the case of China, when we're talking about satellites, you have a totally different track, whether it starts up here at the State Department, which it did 17 out of 20, or up here, the last 3, with the Commerce Department. It then gets into a single track which goes through an interagency process, and then a recommendation from the National Security Council to the President.

DOD is deeply involved, as it should be, in that track, by the way. But I think it's important that we know the difference between the Commerce Department and the State Department. I think that's a very relevant issue. But it's not nearly as relevant, and indeed may be totally irrelevant relative to those particular transfers.

Because in the case of China, with the satellites, they all go through this Presidential review process involving the National Security Council. And I think, Mr. Chairman, it would be very useful for us to have somebody either answer for the record or somehow or another tell us whether or not there was any difference in that National Security Council process, depending on whether or not it started off on the State Department track or on the Commerce Department track.

I don't believe there is. And if there isn't, it seems to me relative at least to the satellite issue that this distinction between the State

Department and the Commerce Departments is not relevant. It is a relevant distinction for a whole lot of other issues. But when it comes to the issue of export or transfer to China of satellites, it's not relevant, if the key issue is a Presidential waiver, made on the recommendation of the National Security Council, no matter whether or not the initial review started in the State Department with that munitions list, or started in the Commerce Department with its own list.

So Mr. Chairman, I would like to ask for the record, from the National Security Council, whether or not their process of review for Presidential wavier purposes is any different, dependent on whether the licensing process began with the State Department or with the Commerce Department. If we could do that for the record.

Senator COCHRAN. I suggest we draft a letter, you and I sign it, send it to them, and ask for a response for our record.

Senator LEVIN. One last question. A number of other countries apparently, allegedly do not treat civilian satellites as munitions. Is that correct, Dr. Schneider?

Mr. SCHNEIDER. Yes, that's correct, Mr. Chairman, and I think that's been one of the frustrations that has led to the change in commodity jurisdiction. The United States, I believe, is the only producer of satellites that had maintained satellites on a munitions list.

Senator LEVIN. We were the only producer of commercial satellites which at one point had them on a munitions list?

Mr. SCHNEIDER. That's correct.

Senator LEVIN. And the other countries that produce satellites did not?

Mr. SCHNEIDER. Did not. Yes. And as I said, that's one of the things that stimulated the effort to move it from the munitions list to the Commerce Department list.

Senator LEVIN. Thank you so much.

Senator COCHRAN. Thank you.

Senator Thompson.

Senator THOMPSON. Thank you very much.

I think we still have a bit to understand about the distinctions between the waiver process and the license process. By the time a wavier gets down to the Department, I would assume they would know what their boss, the President of the United States, would want. I think that some might assume that the review process would be just as rigorous under those circumstances as if they were on the munitions list, for example. I question that.

But let me ask you about the explosion that happened in February 1996 which destroyed a $200 million Loral satellite. There was an investigation conducted in the cause of that accident which has since caused some controversy as to whether or not sensitive information was given to the Chinese pursuant to that investigation.

Gentlemen, are you generally familiar with that situation, and what can you do to enlighten us with regard to what happened and what the potential problems are there? Let me tell you what my understanding is, then you can correct me or fill in, to the extent that you can.

I understand that after that explosion, Hughes-Loral did an investigation and prepared a report. They determined that it was the guidance system that was essentially the problem. There was a question raised as to whether or not that information should have been given to the Chinese. I think even the Hughes-Loral people voluntarily—I think the phrase was used—turned themselves in. Whether that's a correct phrase or not, I don't know.

I've also read where the Department of Defense has determined that national security was harmed by releasing this report to the Chinese. What do you know about the instance, and what is the significance? Dr. Graham.

Mr. GRAHAM. Senator Thompson, let me address what I've seen in the press about it. I've seen statements that the Defense Department, as you said, has judged that as a part of the review of the launch failure, information was transferred by Loral to the Chinese that would benefit Chinese construction and operation of both space launch vehicles and ballistic missiles. I have not seen any statements in the press by the Defense Department or any other government agency, that contradicts that conclusion. I'm afraid I have to leave it there in this particular forum.

Senator THOMPSON. As far as the facts, Dr. Schneider, can you elaborate on that in any way?

Mr. SCHNEIDER. I read the same material, and that's my understanding of what took place. From a regulatory perspective, my presumption is that transferring information about the guidance section would require a separate license. If that is indeed what happened, then that activity would of course need to be licensed for authorization.

Senator THOMPSON. Is this one of the kinds of problems that just arise in these sorts of things? I mean, it stands to reason that if you put up a $200 million satellite and it's destroyed, you want to tell the people who are going to put the next one up, maybe, what went wrong. And therein lies the inherent problem, I suppose.

What about the May launch of the Motorola satellites? My understanding is they were using dispensing technology. Can you describe dispensing technology and how that is used commercially? What purpose is serves?

Mr. GRAHAM. Yes. The Motorola launch, I believe, was for one of the sets of Iridium satellites that will form a low orbit constellation of cellular telephone base stations. Each of these satellites is relatively small, smaller than the payload of the Long March or most other space launch vehicles. Therefore, it's economical to put several of these satellites on the same space launch vehicle and take them to orbit simultaneously.

But of course, you don't want to put them in exactly the same orbit. You want to at least disperse them enough so they won't interfere with each other while they finish the maneuvers necessary to get them to final desired orbits. Therefore, you have to be able to release them carefully to allow them to reach their preplanned orbits.

Senator THOMPSON. It's been written that this is the same thing as MIRV technology. Is that essentially correct, in your opinion?

Mr. GRAHAM. This is very similar to MIRV technology.

Senator THOMPSON. Mr. Pike can speak for himself, but I understand, Mr. Pike, your point was that with regard to commercial satellites, they dispense the satellites more slowly than in a military situation?

Mr. PIKE. That's correct.

Senator THOMPSON. A military application would be more rapidly dispensed?

Mr. PIKE. An ICBM basically has about half an hour from launch to impact. The MIRV busing phase, typically you're only looking at about 10 minutes or so.

I'm not familiar with the precise deployment sequence in the case of Motorola Iridium, but in the case of U.S. intelligence community satellites, where you have multiple deployments, those typically take place over a period of several days.

I think if the Motorola people were able to go to the Chinese with some confidence that they would succeed in this regard, because the Chinese had demonstrated a multiple launch capability off a single launch vehicle, the ability to deploy several satellites on a single launch vehicle, about two decades ago. So there was nothing particularly novel or in my view, immediately militarily significant in the Iridium launch.

Senator THOMPSON. Well, doing something and knowing how you do it are two different things. Perfecting it, I think, would be also.

But I assume that leads you to the conclusion that it's not a big problem if we can enhance the Chinese capability to use this dispensing technology. Because that transfer from the commercial to the military is, I assume in your opinion, not as significant as a lot of other people think it might be.

Dr. Graham, what's your response to that?

Mr. GRAHAM. I think it can be quite significant. In the first place, we need to look at the time lines on the Iridium deployment. In fact, with ICBMs, we do some final maneuvering, much as we do with satellites, when we insert independently targeted re-entry vehicles.

The device on an ICBM that deploys multiple independently targeted warheads is called a bus. It moves the satellites around in space and velocity until it has each on the right line to the target, and then releases it. A similar process conducted is done with multiple satellites. The time lines for the space launch can be longer, or can be the same as for the ICBM without damage to the space launch. It just depends on how you want to go about it.

Senator THOMPSON. So you don't think that difference in timing is that significant?

Mr. GRAHAM. No, Senator.

Senator THOMPSON. That's all I have, Mr. Chairman. Thank you very much.

Senator COCHRAN. One other characteristic of the policy that you administer, Dr. Schneider, at the Department of State, was that a Department of Defense monitor, a person who would observe discussions and transfer of data, was required as a part of the process and procedure. What is, in your view, the importance of having that monitor involved in the process and does the absence of such a monitor now under current policy present any particular problems for our national security?

Mr. SCHNEIDER. The incorporation of provisions for a Department of Defense monitor occurred subsequent to my departure from the government. But during my own service on China exports, there were several cases where there was a requirement for a U.S. monitor. The general purpose of this is to assure compliance with the terms of the license, that the license was implemented by the specific end user identified in the license, and for the purposes identified in the license.

The procedure was designed to monitor efforts to divert the product transferred to an end use that was not specified in the license. The absence of a monitor then creates a compliance issue as to whether or not compliance can be monitored by other means.

Senator COCHRAN. Do you think the lack of a requirement under current regulations for the presence of Department of Defense monitors to be a weakness in the current policy?

Mr. SCHNEIDER. If they don't have any other means of monitoring compliance, then there could be some difficulty. I haven't seen the details of the license as to whether they have perhaps other U.S. Government officials, other than the Department of Defense, doing the monitoring, or some other means to sustain compliance. But if they have no one monitoring, then there presumably is no other way to assure compliance.

Senator COCHRAN. Dr. Graham, when we were preparing for the hearing, we learned that there was an impending Chinese launch scheduled of a Lockheed Martin ChinaStar–1 satellite. The ChinaStar–1 license was granted in 1996. And according to Lockheed Martin officials, the license required no Department of Defense monitor for any phase of the export.

We were told that Lockheed Martin requested the monitors, despite the absence of a licensing requirement. My question is, by not having Department of Defense monitors present at these meetings between the satellite builder or vendor and the Chinese launch team officials, does this increase the risk, in your opinion, of technology transfer and intangible know-how transfer that could be militarily useful to the Chinese?

Mr. GRAHAM. I believe it does, Senator Cochran. As you know, I'm not in favor of this process in any of its forms. This would be an effort to mitigate the damage done to the United States by adverse technical transfer to the Chinese. It could have some of that effect if there were a set of clear terms of reference, guidelines, and constraints imposed on the contractor before the discussions began, and if the government monitors, or chaperons, were competent to know when those terms were being observed and when they were being violated. It would also provide the opportunity for the contractor to hold discussions on issues before material was presented to the Chinese. Once you have said something or given some material, it doesn't come back, so it's a very irrevocable act.

While I would not encourage any of this type of technological interchange or transfer, if it's going to be done, I think having the strongest possible chaperons present would be in the U.S. interest.

Senator COCHRAN. Dr. Graham, would it surprise you if an engineer or scientist were to identify a problem and suggest how it could be fixed, in the case of a launch vehicle, given the financial situation and the risk of a loss of an expensive satellite? Is it your

view that these kinds of temptations under the current situation are too great to overcome and stand and remain silent while a launch is about to take place that might very well be risky or destined to fail, and not point out some deficiency?

Mr. GRAHAM. Well, the economic issues certainly drive the process towards tech transfer. But even beyond that, engineers are trained and practice all their lives to find problems, point them out, and fix them. So it would surprise me only if the engineer did not do something to try to rectify the problem once he saw it.

Senator COCHRAN. There are many low-Earth orbit communication satellite constellations deployed or planned for the future, and they are driving the demand by U.S. satellite manufacturers for foreign launch services.

What needs to be done, in your opinion, to keep these launches, or at least more of them, within the United States? Do we not have the launch capability here to handle the volume of launches that are in demand now by the communication companies? And if we don't, what should we consider doing about it?

Mr. GRAHAM. Senator Cochran, in the early 1960's, we built a thousand Minuteman missiles in something on the order of 6 years. It is inconceivable that the industrial bases of the United States couldn't provide adequate launch systems for all the satellites that the United States builds.

I believe this is basically an economic issue, where satellite owners and builders are attempting to take advantage of the prices that these non-market economies, such as China, are willing to provide and receive in turn the recognition of their ballistic missile and satellite capabilities, the technologies they will get from it, and the western hard currency to sustain their rocket infrastructure.

But the United States could certainly build the needed SLVs.

Senator COCHRAN. Dr. Schneider, one aerospace executive told us as we were preparing the hearing, that he views the DOD monitors that you and I were talking about as important because companies tend to view their foreign launch service providers as customers. Hence when the customer wants something, you want to try to help him out. And U.S. companies try to respond in a way that establishes a good relationship for future business dealings.

Do you think this attitude is prevalent, or a problem among American satellite manufacturers? And what if anything can be done to prevent it from making technology transfer commonplace?

Mr. SCHNEIDER. Well, I don't think this is necessarily a conflict. Because in the case of munitions list transfers of, say, conventional munitions to convention arms to allies abroad, the ally abroad is, of course, a customer as well.

But the terms of the license restrict the U.S. vendor from transferring information. My own experience in the Department of State is that the vendor community was very familiar with these restrictions and would inform the customer that they cannot give them information of a specific type, because it was proscribed by the terms of the license.

So I think because this practice generally works pretty well, there is not a normal requirement for a Department of Defense monitor to be associated with all munitions list transfers. The li-

censees enforce the transfers themselves, because there are indeed draconian penalties for failure to do so.

Senator COCHRAN. Thank you very much, Dr. Schneider.

Senator Levin.

Senator LEVIN. I'll withhold any additional questions for the record. Thank you very much, and thanks to these witnesses.

Senator COCHRAN. Senator Thompson.

Senator THOMPSON. Just one more observation. The question still remains, and I certainly want to understand more about this process myself, in a situation where a waiver must first be obtained for these satellites, does that waiver create a national security review process that's the same, regardless of which control list the export item is on?

We saw the administration's national security process at work. Secretary Christopher convened an interagency group consisting of the Department of Defense, the State Department, Arms Control and Disarmament Agency, the Commerce Department, CIA, NSA and the entire intelligence community. It's decision about licensing authority was overridden on the recommendation of Ron Brown.

So that's the process that we saw work in one instance. And I wonder, too, if the waiver process for an item that is not on the munitions list is as stringent as it would be if the item were on the munitions list. If it is, why take it off the munitions list to start with?

Mr. SCHNEIDER. I think it applies less to China than perhaps other markets. The munitions list treatment of any item imposes a greater burden on the exporter than does the Commerce Department license. And I think that has been what has driven people to seek the commodity jurisdiction transfer to the Department of Commerce.

But because of the special circumstances of China, there has been this process of approving a waiver after the licensing activity has been undertaken by the interagency process. That is the device that's intended to assure compliance with the U.S. national security objectives. If the administration has set up a system where the President gets to make the final call, that's all that can be done, I believe.

Senator THOMPSON. Thank you. That's all I have.

Senator LEVIN. Mr. Chairman, can I just briefly comment on that?

Senator COCHRAN. Certainly, Senator Levin.

Senator LEVIN. My understanding is that the Ron Brown reference was not to a waiver situation, but the transfer from the munitions list issue. And that the State Department approved every single one of the waivers.

But that's the kind of factual determination we can make when that answer comes for the record. But I don't believe that the Ron Brown position related to a waiver at all. It related to a transfer from the munitions list to the Commerce Department list, which he, of course, was fighting for. I'll repeat that I believe that every single one of those waivers was approved by the State Department.

Senator COCHRAN. I should have done this at the beginning of the hearing, I hope you will forgive me for omitting this. But for

the record, could you state your professional training and education and qualifications—Dr. Graham, and Mr. Pike and Dr. Schneider?

Mr. GRAHAM. Mr. Chairman, I have a bachelor's degree in physics and a Ph.D. in electrical engineering. I've served as an Air Force project officer, working at the Air Force Weapons Lab, and working on, among other things, the Minuteman II and III missile systems, and in subsequent work after I left the Air Force, the Polaris and the Poseidon sea launch ballistic missile systems.

I have generally been involved with ballistic missile programs for about 35 years. I have also served as the Deputy Administrator of NASA, was involved in resurrecting the unmanned space launch vehicle capability of the United States. Those are my primary activities in this area.

Senator COCHRAN. Thank you. Mr. Pike.

Mr. PIKE. Mr. Chairman, my involvement is slightly less illustrious than my colleague here. I've been Director of the Space Policy Project at the Federation of American Scientists for the last 15 years. I've done consulting work with NASA, the United Nations and I'm a fellow of the British Interplanetary Society.

Senator COCHRAN. What is your educational experience?

Mr. PIKE. I attended Vanderbilt in Nashville, Tennessee, as an undergraduate.

Senator COCHRAN. Dr. Schneider.

Mr. SCHNEIDER. Mr. Chairman, I'm an economist, Ph.D. from New York University. I have worked for 16 years in the Federal Government, including 4 years in the Department of State, dealing with matters pertaining to export control. Subsequent to my departure from the Department of State, I served as Chairman of the General Advisory Committee on Arms Control and Disarmament, and have monitored the export control system throughout my career.

Senator THOMPSON. Mr. Chairman, if I may comment just very briefly.

Senator COCHRAN. Senator Thompson.

Senator THOMPSON. While it is true the instance I mentioned was not a waiver, it had to do with something much more significant than a waiver. It had to do with the entire transfer of the entire process. And it had to do with a national security process, which I think is instructive when we consider the process they may be going through with regard to any individual waiver.

Thank you very much.

Senator COCHRAN. This has been a very interesting, and I think productive, hearing for our Subcommittee. I appreciate very much the attendance of the witnesses and the Senators for participating.

I think we've learned first, that there can't be any question about the potential military utility of commercial satellite launches for ballistic missile and satellite programs. And second, when commercial satellites received export licenses from the State Department Munitions List, a license was necessary for technical data that was shared with China and others. And DOD monitors were required to be present in all meetings and launch activities.

Third, since commercial satellites were moved to the Commerce control list, the requirement for a license to share technical information is at best ambiguous, with some companies proceeding with

them, and some without them. Furthermore, the requirements for a DOD technical monitor is also ambiguous, with some companies requesting monitors on their own volition and other companies proceeding without them.

This sounds to me like a situation where militarily significant technology transfer can occur and probably has occurred. It's a situation at odds with the administration's September 1996 representation to the Congress that enhanced regulations have been developed and agreed upon by the interested departments that will provide for both national security and foreign policy controls under the Export Administration Act for commercial satellites.

It's hard to understand why the administration has failed to respond to a request 7½ months ago from the Hughes Corporation for clarification of the current regulations. I think it's clear the administration's export control policy for commercial satellites isn't doing a good enough job of reducing risks to American security.

We will continue to explore this issue. Our Subcommittee will have another hearing on this subject in June, at a date that we will announce later. We will invite the Commerce Department to testify and explain why it worked so hard to gain control of export licensing for commercial satellites, but has done little to control their exports since gaining the authority to do so.

We will likely invite some of the aerospace companies as well to send representatives to discuss the licensing process. Until then, the Subcommittee will stand in recess.

[Whereupon, at 12:34 p.m., the Subcommittee was recessed, to reconvene at the call of the Chair.]

APPENDIX

TESTIMONY

before the

Senate Committee on Governmental Affairs

Subcommittee on International Security, Proliferation, and Federal Services

on

BENEFITS OF COMMERCIAL SPACE LAUNCH ASSISTANCE AND USE FOR FOREIGN INTERCONTINENTAL BALLISTIC MISSILE PROGRAMS

by

William R. Graham, Ph.D.

May 21, 1998

BENEFITS OF COMMERCIAL SPACE LAUNCH ASSISTANCE AND USE FOR FOREIGN INTERCONTINENTAL BALLISTIC MISSILE PROGRAMS

The design, engineering, testing, and operation of ballistic missiles and space launch vehicles (SLVs) have a great deal in common. This is particularly true for intercontinental ballistic missiles (ICBMs). The maximum velocities of ICBMs are less than SLVs: from an orbital mechanics point of view, ICBMs can be considered SLVs whose orbits intersect the earth at the target.

There is a misperception that ICBMs are more sophisticated and complex than space launch vehicles (SLVs). In reality, the opposite is true. The preponderance of SLVs are ICBMs with additional elements. Put another way, if you have an SLV, you also have an ICBM by removing those elements and adding a reentry vehicle containing a nuclear or other type of warhead.

Most of the current U.S. unmanned SLVs are derived from ICBM systems. While this relationship could have occurred in the reverse order, in the era when they were developed the U.S. gave highest priority to ICBM programs, with space launch applications coming shortly thereafter. Thus today, the preponderance of U.S. commercial and military SLVs are derived from current and previous ballistic missiles such as Thor, Atlas, Titan, Minuteman and Peacekeeper. Russian ballistic missiles, including the SS-19 and SS-25 also have derivatives that serve this role. In the case of China, the Long March 3 was derived from DF-5 ballistic missile technology, and India's Agni Medium Range Ballistic Missile (MRBM) is based on the design for its first space launch vehicle called the SLV-3, which is a copy of a U.S. space launch vehicle.

Space launch vehicles produced in non-market economies have been offered to U.S. and other satellite manufacturers at attractive prices for launching high altitude communications satellites to support the demand for long distance telephony, data transmission, television feeds and direct broadcasts; and lower altitude satellites to provide infrastructure for commercial remote sensing, cell phones and pagers. Because these commercial satellites are expensive and time-consuming to build and are instrumental in generating profits for the communications industry, American satellite manufacturers have strong incentives to ensure that foreign SLVs transport their satellites to the intended orbits reliably and deploy the satellites in good working order. This assistance, however, can equally aid the development and reliability of foreign ICBMs.

The essential elements of an SLV are its propulsion, structure, staging, guidance and control, ground support and launch equipment and procedures, overall system integration, payload (the satellite), and payload deployment. The essential elements of an ICBM are the same with the exception of the payload, which for an ICBM is a reentry vehicle containing some type of a warhead, rather than a satellite. I will briefly discuss each of these elements.

- **PROPULSION**: The ICBMs that the U.S. developed in the 1950s used highly energetic liquid fuels that were fed by high speed turbopumps to a combustion chamber, where they reacted, and then exhausted at high speed and temperature through the rocket nozzle. This general approach has been used by every liquid-fueled rocket from the V-2 to the space shuttle main engines. The liquid propellants used are highly reactive chemicals that are readily available on the world market, along with their production equipment. They range from red fuming nitric acid to various hydrazine compounds to liquid oxygen.

  Storing, loading, and handling these propellants requires the careful attention of skilled technicians. Therefore, in the early 1960s, the U.S. developed ICBMs that used solid propellants. The Soviet Union/Russia has deployed both solid and liquid fueled ICBMs since that time. The solid propellant rockets are not as efficient as liquid propellant ones, but they make up for that deficiency by being easier to maintain on alert and to launch on short notice. The greater efficiency of liquid propulsion systems has kept them the dominant propulsion for SLVs, and can provide very effective propulsion for ICBMs when sustaining a high state of alert for long times (years) and launching on short notice (minutes) are not primary concerns. All foreign space launch vehicles other than a few Russian systems use liquid fuel propulsion, and I anticipate that the developing world will first produce liquid propulsion ICBMs before moving to solid propulsion.

- **STRUCTURE:** The structure of both SLVs and ICBMs must be very light, since it is being accelerated against the force of gravity to velocities in the range of 24,000 feet per second – about ten times the speed of a typical rifle bullet – and still be very strong. The acceleration of launch produces several Gs of load on the structure during the ascent and the aerodynamic loads are large during portions of the trajectory when the vehicle is still within the atmosphere. The structural requirements place the same premium on the materials, design, and fabrication for both ICBMs and SLVs.

- **STAGING:** Most SLVs and ICBMs are constructed of three or more stages, or rocket propulsion sections, that can be sequentially detached from the rest of the vehicle after the stage's propulsion has been expended. Stage separation, which is commanded by the vehicle's control system immediately after the propulsion of a stage has terminated, is used to minimize the amount of structure that must be accelerated to the final velocity of the payload.

  Staging is a precise process. Separation must be accomplished without damaging or deflecting the portion of the vehicle that will continue in powered flight, and must be followed immediately by the start of the next stage's propulsion system. Staging can produce transient mechanical stresses on the vehicle and its payload that must be considered in the design and integration into the overall system. Since staging occurs during the powered flight part of ascent, it is identical for SLVs and ICBMs.

- **GUIDANCE AND CONTROL:** The guidance and control sub-system of both SLVs and ICBMs keeps track of where the vehicle is and where it is supposed to go (its

target: a combination of velocity and location in orbit for an SLV or a location on the surface of the earth for an ICBM), calculates the direction and duration of the rocket thrust that must be commanded to reach that target, and then controls the direction and duration of the thrust to satisfy the calculation. This process occurs several times each second during powered flight. In the past, the location of the vehicle was determined by inertial measuring units comprised of gyroscopes and accelerometers, but the opportunity exists today to use the U.S.Global Positioning Satellite (GPS) system and the Russian GLONAST system to establish the rocket's location with high accuracy by reference to precision satellite beacons. While high precision inertial measuring units are expensive and difficult to make, GPS and GLONAST assisted navigation units are potentially more accurate and less expensive.

ICBMs designed to destroy targets specifically hardened to nuclear attack require more accurate guidance systems than do SLVs; however, for attacking all other targets, such as cities, SLV guidance systems are sufficiently accurate for ICBM use. For example, the accuracies of current space launch vehicles such as the Delta II and improved Conestoga are sufficient to attack a city or other large area target.

- **GROUND SUPPORT AND LAUNCH EQUIPMENT AND PROCEDURES:** Ground support and launch procedures are the same for the propulsion and guidance elements of equivalent SLV and ICBM systems. From a personnel standpoint, SLV launch crews are automatically capable of being ICBM launch crews. The ground support for preparation, monitoring, and checkout of the specific payloads of SLVs and ICBMs is different, since the payloads are different. Satellite payloads of SLVs tend to be more complex and require more advanced ground support than do ICBM warheads.

- **OVERALL SYSTEM INTEGRATION:** Even after the individual components and sub-systems of an SLV or ICBM system are functioning properly, they must still be integrated into a complete system that can work together properly. Instabilities in propulsion, control, or other subsystems often depend upon the coupling of two or more subsystems in unanticipated ways. Incipient instabilities can lead to a "rough ride" – additional mechanical stresses placed upon the payload – and the extreme manifestation of the instabilities can (and has) caused the breakup and destruction of the entire vehicle in powered flight.

  The integration of the propulsion, guidance, control, structure, and aerodynamics is the same for SLVs and ICBMs, while the integration of the payload is unique to its specific design. The analytical tools – such as structural dynamics analysis software – are the same for both and widely available.

  The integration of the payload, like other aspects of the system integration, requires an intimate knowledge of both the payload and the launch vehicle. In the case of an SLV, a great deal of detailed technical information must be exchanged between the satellite designers, the satellite attachment and aerodynamic shroud designers, and the vehicle designers to integrate the payload into the system, and there must be a close

working relationship between SLV and satellite engineers and technicians to assure a successful launch mission.

The more that can be done to improve the ride to orbit by reducing the mechanical stresses, and the more that can be done throughout the SLV system to increase its overall reliability, the more likely that a successful launch and orbital insertion will be achieved. Measures taken to increase the performance and reliability of SLVs translate directly into performance and reliability improvements for ICBMs.

U.S. and Russian ICBM development programs have used more test flights than have their SLV programs. This is the result of their effort to achieve both high reliability and accuracy – goals that may not be as important to other countries.

- **PAYLOAD:** The payloads for SLVs and ICBMs are different: satellites in the first case, and warheads in the second. ICBM warheads have the additional requirement that they must reenter the atmosphere at very high speed, and maintain their structural, thermal, and aerodynamic integrity while traversing to the target. However, satellite electronics are considerably more delicate than reentry vehicles and their warheads. Although not essential, SLV technology that ensures the reliable delivery of satellite payloads can be used to improve ICBM reliability as well.

- **PAYLOAD DEPLOYMENT:** The release of a single satellite payload and a single warhead payload are similar operations. Both require the proper deployment, positioning, and orientation of the payload. The deployment of multiple satellites from an SLV and multiple warheads from an ICBM are also similar operations. Information and experience gained from one of these activities can be applied to the other.

- **DEVELOPMENT TESTING, ENGINEERING, AND FACILITIES:** The testing, engineering, and facilities required for SLV development are the same as those required for ICBM vehicle development. These include engine test stands and testing, guidance and navigation test facilities, test flight ranges, and vehicle diagnostics and telemetry systems. One of the most critical technologies that can be transferred is the engineering skill and experience required for interpreting and rectifying design problems that occur during system development.

In addition to advancing the ICBM capability of other countries, U.S. assistance in supporting and developing SLVs capabilities assists these countries in being able to use space for military purposes, including reconnaissance, communications, and meteorology. Such capabilities can also be provided in turn by these countries to their allies in exchange for military, political, or financial support. Transferring space launch technology to the developing world provides space access to many potential adversaries of the U.S., and is a serious matter that carries substantial risk to the U.S. and its allies around the world.

Missile and Space Launch Vehicle Technology and Export Controls

Prepared Testimony of

John Pike
Director
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This morning the world is a more dangerous place than it was a month or a year ago, and I fear that it will be an even more dangerous place a month and a year from now. We are witnessing the birth pangs of an arms race on the Indian subcontinent, the hazards of which are now at best dimly perceived. Ratification of the Comprehensive Test Ban Treaty seems unlikely in the Senate this year, and the prospects for ratification of the START-2 agreement by the Russian Duma appear equally dim.

This Committee has been instrumental in alerting the nation to these and other dangers, many of which transcend the traditional Cold War litany. Fortunately, however, the subject of today's hearing does not rank high on this list, and I welcome this opportunity to hopefully inject some much-needed balance to the increasingly controversial questions of the relationship between missile and space launch technology, and the adequacy of existing export control mechanisms to police the proliferation of this technology.

TECHNOLOGY TRANSFER FROM LAUNCHERS TO MISSILES

Werner von Braun "aimed for the Moon and hit London." Since the dawn of the space age and the missile era, the primary distinction between space launch vehicles and missiles has been attitude, and only secondarily altitude. The first American and Soviet satellites were launched on converted military missiles, and derivatives of missiles have remained the mainstay of our respective space programs. Over time, new space launch vehicles have been developed whose missile pedigree is far more attenuated, and whose applicability as engines of war is rather difficult to envision.

But it remains trivially true that many of the major technical arts applicable to the challenges of missilery are equally applicable to space launch operations. The more challenging question is to unravel the actual military significance of specific technologies.

As with so many other technologies, China was the birthplace of rocketry. With initial assistance from the Soviet Union, China has in recent decades developed a diverse inventory of military missiles and derivative space launch vehicles.

China has between 10 and 20 CSS-3 / DF-4 (Dong Feng or East Wind) IRBMs with a range of 4,750 km. (3,000 miles). While these are capable of placing targets in Russia at risk, the continental United States is beyond their reach, at a distance of over 6,000 miles from China [even Honolulu is nearly 5,000 miles away].

The DF-5A [CSS-4] is a liquid-fueled silo-based ICBM with a range of 13,000 km. (8,125 miles) carrying a single 5 MT nuclear warhead. The missile has also reportedly been tested with multiple warheads [MIRV]. With an initial operational capability in 1981, for many years thereafter the DF-5A was deployed in small numbers, with open source estimates ranging from four to ten operational missiles. Other sources have more recently estimated that currently this number may be as high as 20 missiles. The Long March CZ-2 space launch vehicle derivative of this missile has, with various modifications, been used by China to launch both its own satellites and those of other countries.

The DF-31 is a three-stage solid-fuel missile with a estimated range of 8000 km carrying a single one-megaton warhead. This missile, which may become operational as soon as this year, could be used to strike targets in the northwest corner of the United States from launch sites in Manchuria

The DF-41 three-stage solid-fuel missile, which will have a range of some 12,000 km, is projected to replace existing CSS-4/DF-5 ICBMs after the year 2000.

Concerns have been raised as to whether interactions with American commercial satellite operators have led to the transfer of technical information that would be useful to the Chinese in improving the reliability or capability of these missiles. Given the ongoing investigations of these matters, and the consequent limited public availability of detailed technical information, it is difficult to form a definitive view on this matter. But several general observations are certainly possible, and necessary, at this juncture.

The nature and volume of the technical data alleged to have been transferred by American companies is surely trivial compared to the extensive Soviet aid that facilitated initial Chinese efforts in this field. But even with that assistance, China faced a steep road into space, and has developed a robust domestic design and manufacturing capability. While technical insights from colleagues in other design communities are always of interest, there is no "secret ingredient" to American rocketry that could produce startling breakthroughs for the Chinese.

I would stipulate that recent exchanges between American and Chinese companies may have resulted in the transfer of technical information of some military significance. Certainly, I am not prepared to dispute published reports that the Defense Department has raised concerns that sucn transfers have or could have resulted in a harm to US national security interests. Indeed, if one

contemplates the mountains of trivial information that the Defense Department classifies as SECRET, it is difficult to imagine how it could be otherwise. It was not until a few years ago that the government finally got around to declassifying military plans dating back to World War I, so I can easily imagine how the Defense Department would be inclined to err on the side of caution in the present matter.

At present, however, there is no indication in the public record of an actual identifiable harm to American security interests. Irresponsible public claims to the contrary, China today has no capabilities to attack to the United States that it did not have a year ago, or a decade ago.

Concerns have been raised about the potential for American technical information to be used by the Chinese to improve the accuracy or reliability of their ICBM force. There is no indication that this has in fact happened, there is little reason to anticipate that it will happen, and even less reason for American concern should it happen.

For nearly three decades the Chinese have maintained a small arsenal of ICBMs capable of targeting American cities. It is the fact of the existence of this force, rather than the fine-grained details of its technical characteristics, that has defined their "existential deterrence" posture, their ability to "tear off an arm and a leg."

The space launch industry is extremely sensitive to questions of launcher reliability, with launchers exhibiting reliability lower than the prevailing 90%-95% rates facing potentially prohibitive insurance premiums. Unlike space launch vehicles, the difference between 75% reliability and 90% reliability of the Chinese missile force would have no material bearing on the quality of the existential deterrent, in either Chinese or American calculations. High confidence in high reliability of missiles has been an abiding concern of the United States, but we face very different operational requirements of achieving prompt hard-target kills against Russian ICBM silos. I am concerned that, in the absence of rapid and significant reductions in American and Russian nuclear arsenals, China may over the coming decades built up to current American force levels, and develop an appetite for high confidence in high reliability. Hopefully we can forestall this development, but should we fail, we will not confront a Chinese arsenal of liquid-fueled DF-5s, but rather a more numerous arsenal of new solid-fueled DF-31s and DF-41s. Any insights into the reliability of the DF-5A gained in the 1990s would surely be of vanishingly little relevance to the reliability of the utterly unrelated DF-31

deployed in the year 2015.

While accuracy is also of interest in both the missile and launch fields, divergent considerations apply. Satellite operators generally set standards for launch vehicles placing their satellites into some proximity of the ultimate destination orbit. But the margin for error in the real world is normally many miles, and since satellites always carry maneuvering propellant, it is left to the satellite rather than the launcher to reach the ultimate destination. The warheads carried on missiles have no such supplementary guidance or propulsion capability, and rely entirely on the missile [and the quality of the reentry vehicle] to reach their terrestrial destination. The accuracy of existing Chinese missiles is not well characterized in the open literature, but is surely denominated in miles rather than the hundreds of yards characteristic of their American counterparts. Such accuracy is consistent with the city-busting role of the existing Chinese missile force. Close does count in horse-shoes, hand-grenades, and global thermonuclear war. It matter little to the China [or America] precisely which part of Los Angeles is the actual ground zero. It should be recalled that the atomic bomb dropped on Nagasaki actually missed by a wide margin, a fact lost on the citizens of that unfortunate city. Again, over time this may change, and we may a few decades hence confront a Chinese nuclear arsenal that is both as numerous and as accurate as that deployed by the United States today. While this would represent a profound policy failure on the part of the United States, to the extent that it is within our control, the potential transfer of technical data related to current Chinese launch vehicles would not materially contribute to this failure.

ADEQUACY OF CURRENT EXPORT CONTROLS

Given the ongoing investigation of allegations of unauthorized transfers of technical information China, it is impossible at this point and in this forum to provide a definitive answer as to the adequacy of current export control regulations and their implementation.

The Bush Administration inaugurated the policy of allowing American content commercial satellites to be launched on Chinese launch vehicles, with the understanding that in the process there must be no contribution to China's capability to design, develop, operate, maintain, modify or repair a launch vehicle. Over time licenses issued under this policy have been modified to eliminate any uncertainty on this point. If in fact these policies have been violated or circumvented, appropriate penalties should be imposed,

and consideration given to further measures to reduce the risk of future infractions.

However, as we have seen in other situations ranging from export control administration to domestic law enforcement, no regulatory regime can assuredly preclude inadvertent or unscrupulous infraction. The question is not whether we should or can modify the existing regulatory environment to confidently preclude the possibility of the transfer of any and all technical information with potential military applications to China. Rather the much more challenging question is whether the existing regime strikes the proper balance between overall American national and security interests, and the risks that are inherent in transactions with a state such as China, with which we have both common and divergent interests.

The judgement of the present and previous Administrations is that the current approach strikes this proper balance. If anything, general trends in the nature of the relationship between technology and national security increasingly appear to reinforce this judgement, recent doubts notwithstanding.

Technological innovation and superiority have been at the core of the American way of war since the birth of the American Republic. The production of mass-produced muskets with inter-changeable parts is part of the folklore of the early years of the American army, and the War Between the States was marked by introduction of a variety of new engines of war that came to dominate subsequently conflicts. Throughout the 20th Century American operational culture consistently sought to substitute treasure for blood, seeking means of replacing, or at least augmenting, men with machines on the battlefield. The contest for technological superiority was at the heart of the Cold War arms race, and unchallenged American technological supremacy is the hallmark of the sole remaining superpower.

But the traditional Cold War models and institutions have proven poorly suited to the new security environment and the emerging information economy.
The Defense Department is no longer the central engine of technological innovation. In the Colonial era the War Department was responsible for a wide variety of scientific and technological innovations that subsequently found commercial application. And in the early years of the Cold War the Department of Defense sponsored the development of many of the technologies that form the basis of today's economy, ranging from the jet engine to radar and space systems. By the late 1970s and early 1980s it had become increasingly clear that highly specialized military technologies

such as thermonuclear weapons and stealth had little relevance for the commercial sector. And by the early 1990s it was increasingly apparent that the defense sector's relationship to the commercial sector was more appropriately cast in the role of pupil rather than tutor.

The transformation of the relationship between military and commercial technological innovation has been accelerated by the changing face of warfare. For many the 1991 Gulf War was the watershed event in which silicon trumped steel, in which the dominant battlespace awareness afforded by sophisticated information systems over-awed a less sophisticated military preoccupied with the weapons of a bygone era. Even less exuberant observers of the contemporary scene acknowledge the increasingly decisive role played by information systems in the modern military. And the fundamental lessons of the new information economy have not been entirely lost on the Defense acquisition establishment: open systems leverage the power of the marketplace to provide the most powerful capabilities at the lowest cost.

During the Cold War the race for technological superiority was waged by contending military research and development establishments that sought to be the first to develop and field uniquely military weapons systems. In the new information era technological supremacy lies in the art of rapidly mastering and incorporating commercially developed information systems and learning to apply them to military problems. This model requires a radically different mindset and culture than has prevailed in the past and remains too prevalent today.

During the Cold War the Soviet Union sought to impose absolute control over information relating to not only militarily unique technologies, but also information pertaining to virtually every other aspect of their economy. The judgement of history is surely that this simple-minded model was perhaps less successful than its authors might have hoped.

Throughout the Cold War the United States was prepared to take greater risks with technical information. While not blind to the dangers of the promiscuous dissemination of hard-won technical insights, these Cold War policies were also very much alive to the essential contribution of the flow of technical data in building a vibrant economy.

With the fundamental shifts currently underway in both the emerging global information economy, and the ongoing revolution in military affairs, once again prudential risk taking is essential if we are to avoid the pitfalls of the Soviet model, which in seeking to

control everything was in the end unable to control anything.

CONCLUSION

We live in a real world in which the art of decision making lies not in choosing obvious and easy courses which are certainly beneficial and without costs, but rather in the more challenging act of choosing among alternatives which have risks and uncertainties, and costs as well as benefits. On balance the course taken in this decade with respect to the Chinese launch vehicle has had diverse benefits, and manageable risks. This set of policies has strengthened the American satellite industry, enhancing our global dominance of this strategic sector and in the process increasing the diversity and capability of communications available to our military forces world wide. It has engaged the energies of the Chinese aerospace industry, and perhaps moved them towards seeing space development rather than missiles as the central focus of their growing role in the world. It has given us leverage in discouraging their transfer of special weapons technologies to other countries, notably Pakistan. While these efforts have clearly not been as successful as we would have wished, our non-proliferation sticks would have been even less effective in the absence of the carrots of space cooperation.

We should not allow current controversies to obscure the fundamental soundness of this approach, but even more critically, we should not allow this current controversy to distract us from the more pressing and significant challenges to US security interests.

STATEMENT BEFORE THE
SUBCOMMITTEE ON INTERNATIONAL SECURITY,
PROLIFERATION, AND THE FEDERAL SERVICES
COMMITTEE ON GOVERNMENTAL AFFAIRS
UNITED STATES SENATE

POLICY ISSUES IN THE MANAGEMENT OF EXPORT CONTROLS FOR COMMUNICATION SATELLITES

William Schneider, Jr.

Adjunct Fellow
Hudson Institute
Washington, D.C.

May 21, 1998

Policy Issues in the Management of Export Controls for Communication Satellites

Mr. Chairman and Members of the Subcommittee:

I am William Schneider, Jr. Currently, I serve as an Adjunct Fellow at the policy research organization, Hudson Institute, and operate an international trade and finance service business From 1982-86, I served as Under Secretary of State for Security Assistance, Science and Technology. Among the responsibilities of the office at the time were those associated with the export control process. These duties included direct responsibilities with respect to the Department of State's munitions list export controls (the International Traffic in Arms Regulations) under the Arms Export Control Act. In addition, I served as Chairman of the Senior Interagency Group on Strategic Trade. This interagency organization coordinated the export control activities of the US government including "dual use" exports to permit the Federal government to have a coordinated and consistent approach to export controls. I subsequently served (1987-93) as Chairman of the General Advisory Committee on Arms Control and Disarmament. In this capacity, the issue of the proliferation of militarily significant technology, especially technologies pertinent to weapons of mass destruction and their means of delivery and its link to export controls was a major concern.

Thank you for the opportunity to testify before this subcommittee today. You are addressing some of the most difficult and contentious public policy issues in the export control field. The issues involved are at the vortex of conflicting objectives including the advancement of international commerce, US technological leadership in the international telecommunications sector, and the problem of the proliferation of sensitive technology with high military utility. My remarks will address some of the major issues associated with the management of export controls relating to communications satellites.

Background information

The US government historically regulated the transfer of communications satellites and their associated technology. Communications satellites and associated technologies were regulated as a munitions list item because their sensitivity and association with national defense applications. Over time, the enabling technologies in civil and military applications of advanced electronics in space came to converge. The enabling technologies of both military and civil communications satellites began to have relatively few differences. The primary residual differences (apart from the application of the communications satellites) was in survivability enhancements imbedded in all military communication satellites and virtually all civil satellites.

The ease with which communications satellites could be destroyed at thousands of miles by a burst of high-energy radiation from a single nuclear detonation at thousands of miles distance was illustrated by the destruction of one of the first experimental

communications satellites, *Telstar*. Radiation from a single high altitude US nuclear test over the Central Pacific in 1962 (the *Starfish* event) destroyed the electronic circuits in *Telstar*. The vulnerability of all communications satellites to high energy radiation in space produced a civil as well as military requirement for radiation-hardened components. As such components were developed for military missions, systems using them became munitions list items.

As the major industrial nations gained more experience with space launch vehicles, their use became increasingly reliable. The possibility of a truly commercial space industry began to emerge in the 1970s, and became unavoidable in the 1980s. The former Soviet Union had a lead in the development of reliable space launch systems. Unlike the United States which emphasized small numbers large payloads efficiently deployed from optimized space launch rockets, the Soviet Union focused on the use of large numbers of single-purpose space payloads using rockets propelled by a variant of World War II German V-2 technology. Moreover, because the former Soviet Union did not have a market pricing system, it could undercut any Western commercial space launch system.

The US government resisted Soviet (and Chinese) offers in the mid-1980s to provide space launch services for payloads of multinational communications agencies. This resistance was based on the need to protect the technology associated with both the satellites themselves as well as the space vehicle integration technology – a subtle, but crucial dimension of export control policy at the time. This policy of resistance to Soviet and Chinese efforts to provide space launch services for Western space payloads was abandoned in the late 1980s, in favor of a quota system for "non-market economies." Recognizing that no rational pricing system was possible from a non-market state, a quota-approach was seen as one which diminished the risk to the embryonic US space launch services sector.

The attenuated threat posed by both the Soviet Union in 1990 (when the policy was promulgated) and China allowed security related concerns to slip from view. The collapse of the former Soviet Union in 1991, and China's apparent pre-occupation with economic development reinforced the trade-focused US policy perspective.

The US government was unique in its policy of regulating commercial communications satellites as a munitions-list item. This fact intensified pressure to relocate the regulatory responsibility for communications satellites from the Department of State to the Department of Commerce. Such a change is consistent with the deregulation of dual-use technology in international trade.

Only eleven thousand dual-use validated export licenses were issued in FY 97 – compared to more than ten times that number in the mid-1980s. Following the promulgation of Tiananmen Square sanctions against China, the remaining munitions-list components in communications satellites were replaced by commercial-specification types facilitating a policy decision to transfer regulatory responsibility for communications satellites to the Department of Commerce. The controversy surrounding

this decision is likely to emerge frequently in the future as the enabling subsystems in military equipment become dominated by commercial rather than military-unique technologies.

Export licensing policy issues in the regulation of communications satellites

Communications satellites pose a difficult regulatory problem because of the importance of the satellite and associated technologies to both the civil and defense sectors. Communications satellites cannot be readily justified as munitions-list items based on the usual metric – dependence on technologies developed for or normally used for military purposes. Communications satellites take on a security-related dimension in connection with the end-user, or intermediaries providing space-launch services who gain access to technology and processes associated with the integration and deployment of space-segment payloads such as communications satellites, and application of the satellite to a military end-use (e.g. military command-control-and-communications).

Successive administrations have found that trade related interests outweighed security related interests, especially after the collapse of Soviet military power. The likelihood that nations of proliferation concern to the United States will eventually acquire a civil space launch sector based on low-cost launch technology makes it likely that the contemporary dilemma concerning communications satellite export licensing policy will recur. Space launch services for the civil sector can provide a useful cross-subsidy to sustain a military missile program. Because there is a financial incentive to do so, it can be expected that the early years of the next century will witness very attractive pricing for space launch services by a number of nations of proliferation concern to deploy communication satellites on behalf of a commercial end-user.

The problem is a vexing one today when proliferation concerns confront other foreign policy equities of the US government. As munitions list licensing adds another dimension to export licensing decisions, it is often seen as an obstacle within then Federal government to the use of unimpeded bilateral trade as an instrument of foreign policy. To concerned exporters, articles and services requiring munitions licensing tightens the linkage between commerce and foreign policy, rendering the former too often dominated by the latter.

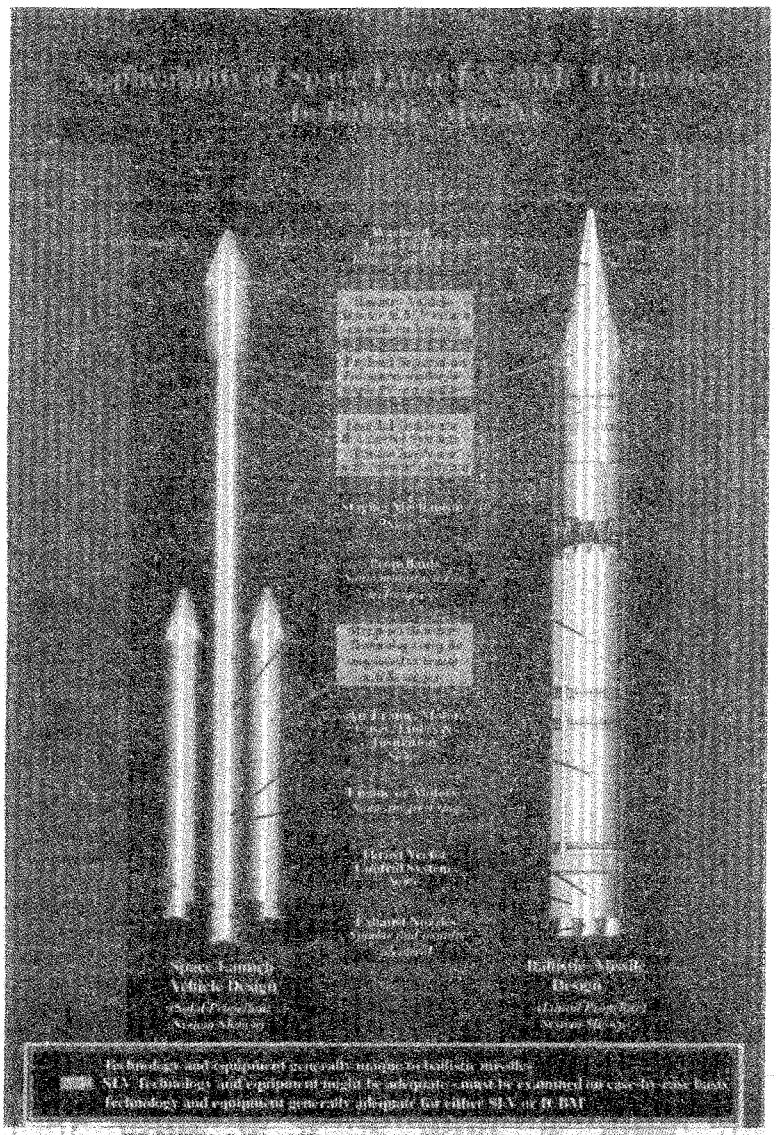
The policy dilemma is clear, and cannot be resolved by an analysis of the underlying technologies of communications satellites themselves. A comprehensive and integrated understanding of the implications of authorizing the use of offshore space launch services for communications satellites and other commercial payloads needs to be reflected in the policy the Federal government ultimately selects. Over the past two decades, alternative emphasis on trade and security have altered the manner in which communications satellite exports are managed. A new, and perhaps more enduring and balanced approach may now be appropriate.

Waivers for Exports of Satellites Launched By China

Satellite	Date of Waiver	Licensing Agency	Manufacturer	End-User
Asiasat-1	12/19/89	State	Hughes	Asia Satellite
Aussat (Optus-B1 & -B2)	4/30/91	State	Hughes	Australia
Freja	4/30/91	State	N/A	Sweden
Asiasat-2	9/11/92	State	Martin Marietta	Asia Satellite
Apsat (or Apstar)	9/11/92	State	Hughes	APT Satellite
Intelsat-7A	9/11/92	State	Martin Marietta	Intelsat
Starsat	9/11/92	State	N/A	N/A
Afrisat	9/11/92	State	N/A	Afrispace
Dongfanghong-3	9/11/92	State	China	China
Iridium	7/2/93	State	Lockheed	Iridium
Intelsat-8	7/2/93	State	Loral	Intelsat
Echostar-1 & -2	7/13/94	State	Martin Marietta	Echostar
Mabuhay	2/6/96	State	Loral	Phillipines
Cosat-1 and -2	2/6/96	State	Lockheed Martin	China
Chinasat-7	2/6/96	State	Hughes	China
Asia Pacific Mobile Telecommunications	6/23/96	State	Hughes	APT Satellite
Globalstar	7/9/96	State	Loral	Globalstar
Fengyun-1	11/19/96	Commerce	China	China
SinoSat-1	11/23/96	Commerce	Aerospatiale	China
Chinasat-8	2/18/98	Commerce	Loral	China

N/A = not available

Source: CRS
Prepared by Subcommittee on International Security, Proliferation, and Federal Services, Minority Staff (5/21/98)



151ST STORY of Level 1 printed in FULL format.

The Washington Post

September 10, 1988, Saturday, Final Edition

SECTION: FINANCIAL; PAGE D12

LENGTH: 842 words

HEADLINE: Reagan Backs Plan to Launch Satellites From China Rockets

BYLINE: Jeffrey Goldberg, Washington Post Staff Writer

BODY:

President Reagan, in a move that is designed to expand trade between the U.S. and China but may hurt the nascent U.S. commercial rocket industry, has given conditional approval to plans to launch three American-made communications satellites on China's Long March rocket boosters, the State Department announced yesterday.

If the decision is not blocked by Congress or by a special Western bloc commission that monitors technology transfers to Communist nations, it will mark the first time U.S. satellites have been launched from a non-Western or Communist country.

The administration's approval of export licenses for the satellites was condemned by several members of Congress and private American launch companies, who see China's entry into the market undercutting U.S. business and threatening national security by giving the Chinese an opportunity to see American satellite technology.

"This is an inconsistent administration policy," said Rep. Bill Nelson (D-Fla.), whose district includes the U.S. space facility at Cape Canaveral. "On the one hand, the president has ... wanted to build up commercial space ventures, and on the other hand, he is cutting off the commercial space ventures at the knees with these export licenses."

China has promised it will not examine the satellites, which will be shipped for launch in sealed containers, but some U.S. officials have said that there is no way to ensure the security of the satellites once they are in China awaiting launch. In any event, State Department officials said, the satellites will not contain leading-edge technology.

A spokesman at the Chinese embassy declined to comment on yesterday's announcement.

The decision is a victory for the Chinese government and for AsiaSat, a British-Chinese consortium, and AUSSAT, an Australian satellite group, who have booked space on Chinese rockets to launch their American-made telecommunications satellites. AsiaSat is scheduled to launch its satellite -- a retooled version of the Westar 6 satellite brought back from orbit by the space shuttle four years ago -- in late 1989. AUSSAT's two satellites, made by Hughes Aircraft Co. are booked for dates in 1991 and 1992.

The Washington Post, September 10, 1988

Private commercial launch companies have opposed China's entry into the market because the country's state-run, government-subsidized rocket program does not have to make a profit and can charge half of what American commercial carriers must charge for equivalent launches.

The American commercial space launch market has been flourishing in the wake of the 1986 Challenger tragedy. After that disaster, President Reagan ordered that the space shuttle be used only for military and scientific payloads, forcing commercial satellite makers to seek rides to orbit from private rocket companies.

Martin Marietta Corp. of Bethesda, General Dynamics Corp. and McDonnell Douglas Corp. are considered the leading American makers of commercial rockets. They have been competing with Europe's Arianespace program for lucrative satellite launching business, with Soviet and Chinese efforts waiting in the wings.

The American rocket companies fear that their prices will be undercut by the foreign launchers. "We're disappointed by the decision," said Richard Brackeen, president of Martin Marietta's commercial rocket division. "Free enterprise firms, independent of their product, cannot compete in a market target by foreign governments willing to commit considerable financial strength."

AsiaSat reportedly is paying the Chinese $ 30 million for launch on the Long March rocket. Launching the same satellite on an American commercial rocket could cost as much as $ 50 million, analysts said. A State Department official who spoke on condition of anonymity said the Chinese are expected to make their prices comparable to American prices after several "promotional" launches.

John Logsdon, the director of George Washington University's Space Policy Institute, said that American launchers are fairly safe if the Chinese do not undercut the market.

"If indeed they have to play by the same set of market rules and pricing rules as the U.S. and Europe have agreed to, then by our principles of the market, a level playing field has been established," Logsdon said.

State Department spokesman Charles Redman said the department believes the decision will not subvert U.S. commercial launch interests.

"In reaching this decision, the administration is determined to protect legitimate U.S. national security interests, and assure the ability of the U.S. commercial launch industry to compete on an equal footing with launches from a nonmarket economy," Redman said.

Redman said that all future applications for export licenses to China will be considered on a case-by-case basis and that the launch decision is contingent on Chinese adherence to a strict set of guidelines, including promises not to study the satellites' technology.

The Chinese must also agree to accept responsibility for any accidents and price the launches competitively, Redman said.

LANGUAGE: ENGLISH

United States Department of State

Washington, D.C. 20520

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SENATE
FOREIGN RELATIONS

SEP 20 1996

Dear Mr. Chairman:

Section 38(f) of the Arms Export Control Act requires the President to report to the Congress at least 30 days before any item is removed from the United States Munitions List (USML) and to describe the nature of any controls to be imposed on that item under the Export Administration Act of 1979, as amended (EAA). (Although the EAA has expired, the President has invoked his authority under the International Emergency Economic Powers Act to continue the system of export controls in effect under the EAA.)

Pursuant to these requirements, I am writing to report that the President has approved a proposal developed by the Departments of State, Commerce and Defense to remove commercial jet engine hot section technologies and commercial communications satellites from the USML. Henceforth, commercial hot section technologies will be controlled on the Commerce Control List of dual-use items, which are licensed by the Department of Commerce. Commercial communications satellites also will be controlled on the Commerce Control List, even if they include individual USML components or technologies; in all other cases, however, those components and technologies will continue to be controlled on the USML, subject to State Department licensing.

Enhanced regulations have been developed and agreed upon by the interested departments that will provide for both national security and foreign policy controls under the EAA, permitting the Department of Commerce to control these items to all destinations and end users worldwide. An individual validated license will be required for all destinations except Canada for export and re-export of these items. Each license application will be reviewed on a case-by-case basis through an inter-agency process involving the Departments of State, Commerce and Defense to determine whether the export or re-export is consistent with U.S. national security and foreign policy interest.

The Honorable
Jesse Helms, Chairman,
Committee on Foreign Relations,
United States Senate.

Further, these items will not be eligible for general licenses, will be exempted from de minimis provisions, and Commerce shall not be required to issue licenses in particular cases where foreign availability exists, under new interim final regulations that will be published in the Federal Register by the Department of Commerce. Those regulations will be promulgated coincident with publication by the Department of State of an amendment to the International Traffic in Arms Regulations (ITAR) that will effect the removal of these items from the USML. I am enclosing for your information a copy of the proposed ITAR amendment. OMB has reviewed this regulation and does not object to its publication.

I understand the Department of Commerce is providing to you directly a copy of its proposed regulations.

Sincerely,

Barbara Larkin
Assistant Secretary
Legislative Affairs

Enclosure:
As stated.

October 8, 1997

HUGHES
SPACE & COMMUNICATIONS
A HUGHES ELECTRONICS COMPANY

Export Classification Request

U.S. Department of Commerce
14th St. and Pennsylvania Ave. NW
Room H1099D
Washington, DC 20230

SUBJECT: Commerce Dept. Jurisdiction Technical Data
Delivered Under Notes 2 & 6 to ECCN 9A004

To Whom It May Concern:

In accordance with EAR Part 748.3, Hughes Space and Communications Company requests the ECCN and License Exception for the following technical data which is provided to the launch service provider for the launch of commercial communications satellites controlled by ECCN 9A004:

form, fit and function
mass
electrical
mechanical
dynamic/environmental
telemetry
safety
facility
launch pad access
launch pad parameters

All of this data generated by Hughes (the spacecraft manufacturer) describes the interface requirements for the mating of the satellite to the launch vehicle and parameters for the launch. We believe that this data is classified as EAR99, exportable under Commerce License Exception NLR.

In addition, Hughes Space and Communications Company requests the ECCN and License or License Exception for the technical data which is normally delivered to customers/operators of commercial communication satellites, described in CCATS #33173 dated 1/25/93(copy attached). Per the technical data description attached to the CCATS this data includes Telemetry, Tracking and Control(TT&C) Maintenance Data, Satellite System data such as power, weight and fuel budgets, observance of satellite test, operational training for customer personnel.

Since there is some difference of opinion as to what event triggers the ability to utilize a Commerce Dept. License Exception, please clarify conditions under which the exception is applicable.

If you have any questions, please feel free to contact me at (310)364-6868.

Sincerely,

M. E. Mersch

M.E. Mersch
Manager, Export Compliance
Hughes Space and Communications Company

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