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Space Security or Anti-satellite Weapons?

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Satellites save lives, strengthen our economy, and support national security. Without the assured use of satellites, police, fire fighters and first responders would be hampered, financial transactions would be disrupted, and US troops in harm's way would be less able to defend themselves.

Satellites are vulnerable as well as invaluable because nations that depend heavily on satellites also have the means to damage them. No nation benefits more from space or has more to lose if space becomes a shooting gallery than the United States. What, then, is the most appropriate strategy to ensure that essential satellites will be available for use when needed?

Because of America's great dependency on satellites, some have advocated the testing of anti-satellite (ASAT) weapons and their use during crises or warfare. In this view, the United States needs to dominate space to deter the use of space weapons by potential foes and to win wars decisively on the ground. Advocates of space dominance believe in two underlying assumptions: that warfare in the heavens is inevitable and that the United States can succeed in dominating space with ASAT weapons.

The desire by some to "seize the high ground of space" by testing and deploying weapons in space has outlasted the Cold War. But conditions have changed radically since the Soviet Union dissolved. Old-fashioned arms races have been replaced by asymmetric warfare. Washington's space budgets will continue to dwarf those of Beijing and Moscow, but China and Russia do not have to be America's equal to nullify US attempts to dominate space. Even a few ASAT weapons can do great damage to essential satellites, as was evident when China tested an ASAT weapon in January 2007. This irresponsible test created a large, lethal debris field that will last for perhaps a century in low earth orbit, placing manned spaceflight and hundreds of satellites at risk — including those belonging to China.

An alternative approach to space security holds that the uniquely hostile and fragile nature of outer space makes cooperation not only possible, but mandatory. This view rests on the assumptions that attempts to dominate space will backfire, and that a war in space between major powers cannot be won and must not be fought. Presidents Ronald Reagan and Mikhail Gorbachev reached exactly the same conclusion about nuclear warfare, and then reached path-breaking threat reduction agreements. Throughout the Cold War, the United States and the Soviet Union reached tacit agreements and treaties protective of satellites. This track record of restraint can be extended because satellites are more essential than ever before and because major powers have less to fight about than in previous decades.

US advantages in space and global security can best be enhanced by seeking to stop debris-producing ASAT tests and, more broadly, by establishing stronger protections against acts of purposeful, harmful interference against satellites. The most clear cut way to establish agreed protections of satellites is by means of a treaty — and the most verifiable treaty is one that bans the testing and use of destructive methods against space objects. But treaties can entail lengthy and difficult negotiations. In addition, the consent of two-thirds of the United States Senate is required for treaty ratification, which means that the Pentagon must strongly advocate a ban of destructive ASAT tests.

Another approach to increase space security would be for the United States to join with its European allies and other countries to negotiate a Code of Conduct for responsible space-faring nations. “Rules of the road” exist for ships, planes, and military activities. A Code of Conduct could also be negotiated for activities in space, clarifying irresponsible actions and facilitating appropriate responses against rule breakers. One key element in a Code of Conduct would be a pledge not to engage in harmful interference against satellites.

The George W. Bush administration refused to engage in any negotiation that would curtail US military options in space — including the testing and use of debris-producing ASATs. And yet every space-faring nation loses freedom of action in space as the debris population in low earth orbit grows. The three worst man-made debris-creating events in the history of the Space Age have occurred since 2007: the Chinese ASAT test, a collision between US and Russian satellites, and the break-up of a Russian rocket stage.

Because of the growth of debris and ASAT capabilities, the absence of space diplomacy during the Bush administration had the practical effect of diminishing US freedom of action in space. The timing is right for Washington, Beijing, and Moscow to reconsider their approaches to ASAT tests and space security. The United States has more agenda-setting powers than any other country, but no single nation can create conditions for successful space diplomacy. Space security requires wise choices by the United States, China, Russia, and other major space-faring nations.

The Stimson Center hopes that readers will find this booklet helpful. For more on Stimson's work in this field, please visit our website, www.stimson.org, and our Space Security Project page, http://www.stimson.org/space. Stimson's Space Security Project is made possible by support from the John D. and Catherine T. MacArthur Foundation, the Ploughshares Fund, the New-Land Foundation, the Secure World Foundation, and the One Earth Future Foundation.

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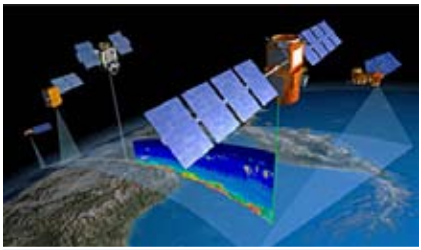
Introduction to Outer Space

What is outer space?

Outer space is the region beyond the earth's atmosphere, where satellites in orbit monitor the weather, assist in military and humanitarian operations, and help first responders provide emergency assistance. Satellites save many lives every day. They have become indispensable tools for personal, national, and international security. Outer space is a global commons. It is also a hostile environment that mandates international cooperation. Building and launching satellites can be very expensive, which also encourages collaboration and burden-sharing. For example, over 15 countries have a stake in the International Space Station. At least 10 nations can launch satellites into orbit and more than 40 nations now operate satellites.



CALIPSO: Gathers data for weather and climate forecasts (Photo: NASA).

Has there ever been warfare in space?

Space has long been "militarized," but has not yet become "weaponized." This means that many satellites are used to support military operations, but no weapons have ever been used in or from space in combat or during crises. The sanctuary of space was maintained during the Cold War, even though the United States and the Soviet Union tested anti-satellite weapons a total of 54 times. (By comparison, the United States and the Soviet Union tested nuclear weapons 1,769 times.) Both superpowers deployed crude ground-based ASATs for brief periods during the Cold War, after which they were mothballed. The last ASAT test during the Cold War was carried out by the Reagan administration in 1985. A 22-year test moratorium on destructive tests against satellites followed, which was broken by China in 2007, and then by the Bush administration in 2008.

Defense Support Program: Provides early warning of missile launches (Photo: US Air Force).

Why hasn't space become a shooting gallery?

Every US President since Dwight D. Eisenhower has recognized the value of satellites and has championed the peaceful uses of space. Consequently, ASAT tests have been rare. Another reason for restraint is that satellites serve as the eyes and ears of nations that have nuclear weapons. An attack on satellites could therefore trigger a nuclear war. Third, major powers that start a war in space would have great difficulty protecting their own satellites. Fourth, space warfare could cause massive amounts of debris, which would indiscriminately endanger essential satellite operations and manned spaceflight. Fifth, major space powers have interlinked economies. A war in space could do great harm to their financial transactions and international commerce. Sixth, space is widely viewed as a global commons that should remain a sanctuary blessedly free from the disputes that plague us on Earth. Because all major powers could be seriously disadvantaged by a war in space, none have wished to open this Pandora's Box.

How can we best preserve our space sanctuary?

One way would be a verifiable treaty banning destructive ASAT tests. Pending the negotiation of this treaty, space-faring nations could, at a minimum, pledge not to carry out such tests. Another approach would be for space-faring nations to agree to a Code of Conduct to promote the peaceful uses of outer space and to prevent purposeful, harmful interference against satellites.

Banning Weapons In Space

Some Weapons are Already Banned

Above-ground nuclear tests created radiation hazards to humanity. They also interfered with fledgling satellite operations and threatened the health of astronauts and cosmonauts. A single high-yield US nuclear test in 1962 damaged or destroyed four American, one British, and one Russian satellite. The 1963 Limited Test Ban Treaty bans nuclear testing in space and in the atmosphere. The 1967 Outer Space Treaty bans all weapons of mass destruction in space. The 1972 Anti-Ballistic Missile Treaty banned space-based weapons of all kinds used for missile defenses. The Bush administration withdrew from this treaty in 2001.

Q What kind of weapons can be used to disrupt or destroy satellites?

A Many weapons designed for other purposes can be adapted for use against satellites, such as ballistic missiles and the missiles designed to intercept them. China used a ballistic missile to launch a satellite-killer in 2007, and the United States used a ballistic missile defense interceptor for an ASAT test in 2008. Lasers and jammers that can disrupt electronic transmissions can also interfere with satellite operations. Alternatively, states can design weapons specifically for the purpose of harming satellites, as the Soviet Union and United States did during the Cold War.

Q What weapons are not banned for use in space?

A The weapons that are most likely to be used — those that don't rely on nuclear detonations or other weapons of mass destruction — including ASAT weapons designed to collide into satellites.

Q Is it possible to ban all space weapons?

A For all practical purposes, no. Many military capabilities can be directed against satellites. In addition, many peaceful uses of technology would also have to be banned because they could be used as ASAT weapons.

Q Now that China and the United States have tested ASAT weapons and blown up satellites, can the weaponization of space be stopped?

A Yes, because all of the old reasons against space weapons remain valid. Every space-faring nation will be worse off if weapons are deployed or used in space. As the unquestioned leader in space, the United States not only has more to lose, but also has more leverage than any other state to call for a moratorium on further ASAT testing.

Q Are other ASAT tests likely?

A Yes — unless the United States champions new diplomatic initiatives to prevent further testing.

Satellites Save Lives

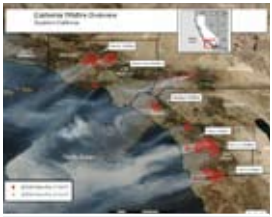
Satellites save uncounted lives every day. They provide directions and road maps for police, fire-fighters, and first responders during emergencies. Satellites track hurricanes and provide early warning of landfall. They pinpoint areas for disaster relief. Military satellites provide early warning of threatening troop build-ups and missile launches. Intelligence satellites help prevent surprise attacks and support US military operations.

Satellites Protect US Armed Forces

Satellites save the lives of US soldiers in harm's way. They help troops to travel safely through trackless deserts and dangerous neighborhoods. Satellites are essential for communication, navigation, intelligence-gathering, and targeting. They help US forces win quickly, decisively, and with a minimum of casualties. No nation gains more military benefit from the use of satellites than the United States.

GRAB: collected electronic intelligence data during Cold War (Photo: Smithsonian).

Everyone Relies On Satellites



Satellites provided images of wildfires in California in 2007 (Photo: National Geospatial-Intelligence Agency).

Illustration of a Global Positioning System satellite (Photo: Wikipedia).

Satellites provide these life-saving services:

- Police/Fire/Emergency Management Navigation
- Search and Rescue Operations
- Natural Disaster Damage Assessment
- Disease Tracking
- Hurricane, Cyclone, and Tornado Prediction
- Parolee Monitoring
- Remote Diagnosis and Surgery Assistance
- Earthquake and Volcano Monitoring
- Emergency Communication
- Airplane Navigation
- Precise Marine Vessel Navigation
- Train Control and Collision Avoidance

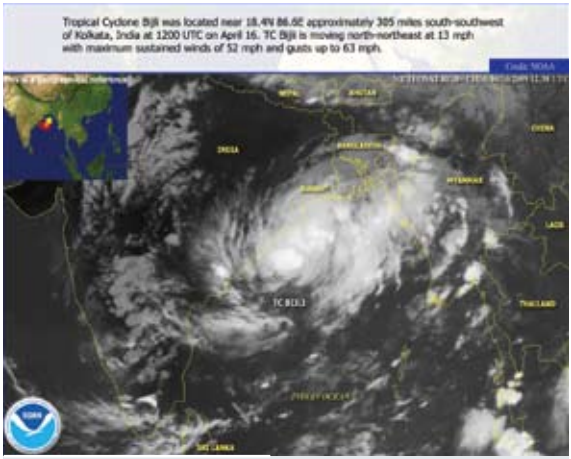
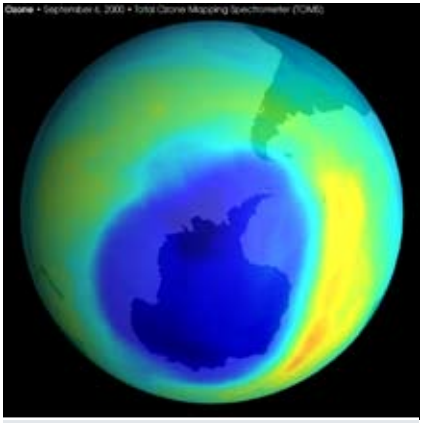


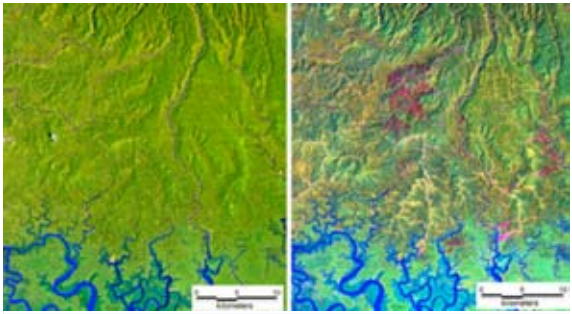
Image taken by a weather satellite of a cyclone in the Indian Ocean, April 16, 2009 (Photo: NOAA).

Satellites And Planetary Health

Satellites alert us to planetary threats such as ozone depletion, rising temperatures, receding glaciers and polar ice caps, soil erosion, and deforestation. The Nimbus satellites track ozone depletion. Radar satellite images revealed the connection between climate change and rising sea levels. Satellite images of environments predict famines and help with disaster relief. In developing countries, satellites help manage agricultural production and increase crop yields. India and other countries use satellites for long-distance education and for medical treatment in remote areas. Malaysia uses satellites to help detect and prevent illegal logging.



NASA's Nimbus 7 satellite tracked ozone depletion over the South Pole (Photo: NASA).



Satellite images show the effects of logging operations in Papua New Guinea between 1988 and 2002 (Photo: University of Papua New Guinea).

Satellites Help Relief Operations

After natural disasters, relief teams rely on picture-taking and global positioning satellites to plan supply, airlift, rescue, and medical operations. Satellite images were essential life-saving tools for the massive earthquakes that struck China in May 2008 and Pakistan in October 2005, as well as the December 2004 tsunami that battered India, Indonesia, Malaysia, Sri Lanka, and Thailand.

Satellite photos of Aceh, Indonesia before and after the 2004 tsunami (Photo: National University of Singapore).

Satellite Reliance: Quick Facts	
Number of emergency GPS beacons in the United States	300,000
Estimated value of property and personal damage averted by hurricane warnings	$3 billion
US households reliant on satellite-based weather forecasting	105 million
Average number of lives saved by search and rescue satellites annually	900

Space and Economic Security

The US economy and international commerce rely on satellites that enable financial markets and investors to make transactions quickly and securely. Credit card users at gas pumps sometimes use satellites. War in space could disrupt financial markets and create havoc in stock exchanges. Businesses such as delivery services that use satellite communication and tracking devices could be badly disrupted. The use of weapons in space could place these and other services, the revenues they generate, stock markets, and thousands of jobs at risk.

ASATs are bad for business.

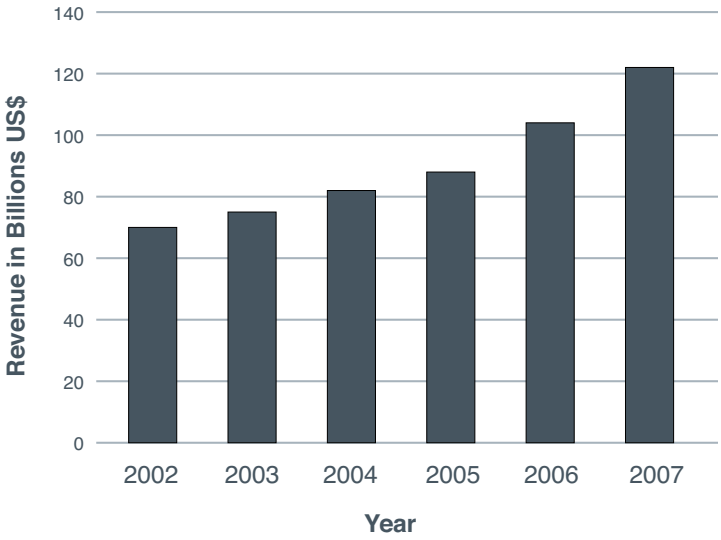
Investments in Space

From 1959 to 2007, US taxpayers invested over one and a half trillion dollars in space. These sunk costs could be nullified if the use of weapons in space trashes the orbits used by essential satellites.

Investments in Space: A Sampler	
Global Positioning System	~ $45 Million per Satellite ~ $26 Billion through 2016
Weather Satellite	~ $450 Million
US Spy Satellites	$1—$10 Billion
Space Shuttle	$1.7 Billion
International Space Station	NASA: ~ $25 Billion Total: ~ $100 Billion
Satellite Launch Costs	$10—$150 Million per Satellite
Apollo Program	$125 Billion

Space By The Numbers	
Space Industry Revenue (2007)	$123 Billion
Revenue From GPS Equipment (2007)	$56 Billion
Number of US Jobs Supported by Space Industry	729,000
GPS-related Patents Issued in 2006	800+
US Satellite Radio Subscribers	13.65 Million

World Space Industry Revenues



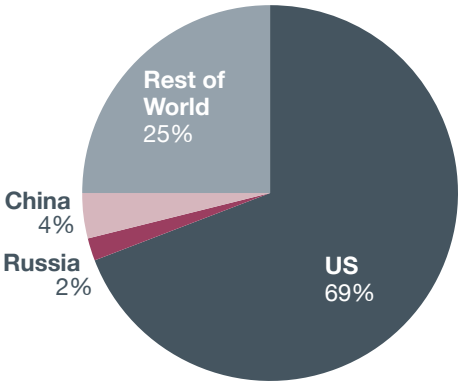
US Preeminence Without Weapons in Space

US advantages in outer space cannot be questioned. Today, the United States spends approximately $40 billion a year for activities in outer space — more than two-thirds of all global space expenditures. The US share of global military space expenditures is even greater.

During the Cold War, the Soviet Union was a significant competitor in outer space, typically launching over 70 space missions annually. The Russian space program has contracted greatly, launching 28 space missions in 2008.

The Chinese space program is making significant gains, but it still lags significantly behind the United States. Beijing has launched 100 satellites since 1970, compared to 850 for the United States. Beijing's first manned space mission was in 2003, and since then it has successfully conducted two other manned space missions. The United States has conducted 150 manned spaceflights with 784 astronauts since 1961.

Space Budgets of Major World Powers



Global Space Expenditures

US: $39.5 billion

China: $2.2 billion (upper estimate)

Russia: $1.32 billion

Other International Expenditures: $14.7 billion

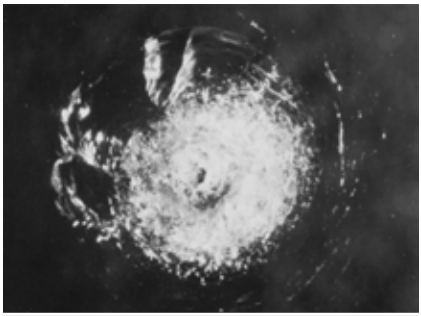
China Is Far Behind the United States		
	US	**China**
First Satellite	1958	1970
First Astronaut	1961	2003
First Anti-Satellite Weapon Test	1959	2007
Number of Satellites Launched	1,141	100
Launch Sites	8	3

Russia's Space Program Has Shrunk			
	USSR 1962-1982	USSR/Russia 1983-2003	Russia 2004-2008
Average Launches Per Year	73	55	25
Military Launches Per Year	48	31	7
Total Anti-Satellite Tests	20	0	0

Reducing Vulnerabilities In Space

Crude ASAT weapons are far less expensive to build than sophisticated and vulnerable satellites that usually travel in predictable paths and that are hard to hide. Consequently, major space-faring nations that rely on satellites also have the means to target them. Improved armor can help protect US troops operating in harm's way, but heavily-armored satellites are impractical, and armor still cannot protect against high-speed collisions in space.

Space Debris Kills



The front window of the Space Shuttle after a collision with a small paint chip (Photo: NASA).

Space debris is deadly. Space debris travels at ten times the speed of a rifle bullet in low earth orbit, where a piece of debris the size of a marble could strike a satellite with approximately the same energy as a one-ton safe dropped from a five-story building. The worst debris fields in space can be caused by ASAT tests that pulverize satellites. The Reagan administration carried out a destructive ASAT test in 1985 that generated 300 pieces of trackable debris, one of which came within one mile of the newly launched International Space Station — 14 years later. It took 19 years for the debris from the 1985 ASAT test to burn out of the earth's atmosphere. China created the worst-ever man-made debris field in space by testing an ASAT in 2007. This test generated approximately 40,000 pieces of lethal debris, and an estimated two million debris fragments overall. Because the Chinese ASAT test was conducted at such a high altitude, its lethal, mutating debris field is likely to remain in low earth orbit for over a century. Even small pieces of debris can be worrisome because they can't be tracked but can still penetrate the thin outer skin that protects satellites. The windows on the US Space Shuttle have needed to be changed more than 70 times because of tiny debris hits. The United States now tracks more than 18,000 pieces of space debris.

Size of Debris	Object of Similar Size	Amount of Debris	Is it Detectable?	Is it Trackable?	Damage Potential
< 1 cm	Staple	Tens of millions	No	No	Minor Degradation
1 cm – 10 cm	Tennis ball (mid-range)	200,000 – 300,000	Yes	No	Possible Impairment
>10 cm	Grapefruit	18,000 – 19,000	Yes	Yes	Assured Destruction

Debris Mitigation

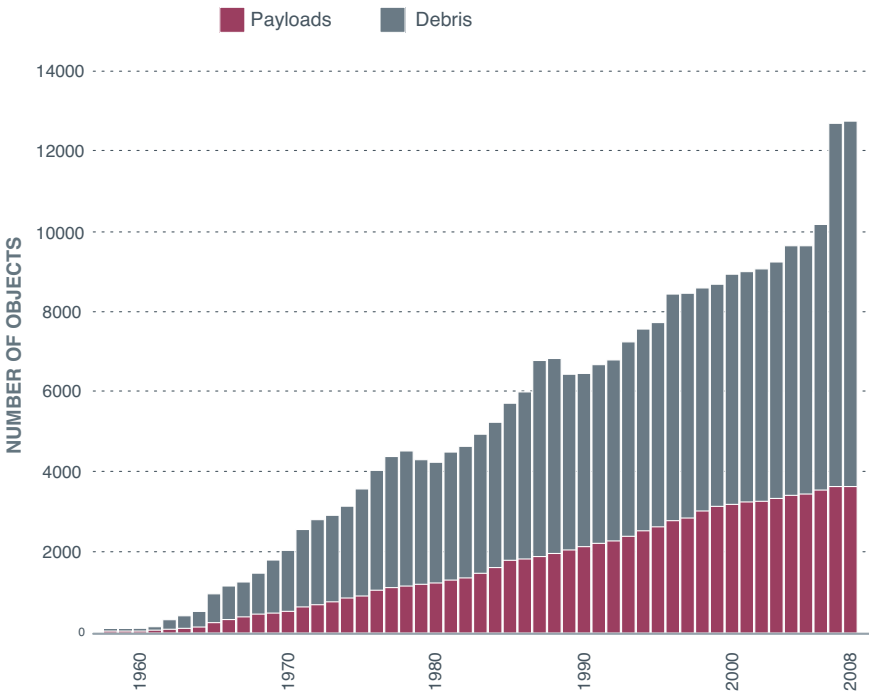
Space debris doesn't recognize US preeminence in space. Because the United States carries out the most space flights and operates as many satellites as the rest of the world combined, it is most likely to be victimized by space debris. Major space-faring nations have belatedly recognized that debris threatens this global commons. A consortium of space-faring nations began discussing voluntary guidelines for debris mitigation in 1992. Voluntary guidelines for debris mitigation were finally endorsed by the United Nations in December 2007. Additional ASAT tests that create debris fields would make a mockery of these guidelines.

Orbital debris does not recognize US preeminence in space.

A Near Miss

On March 12, 2009 three astronauts aboard the International Space Station quickly scrambled into their escape module. The reason: a five inch piece of debris from a GPS satellite launch in 1993 came perilously close to striking the station. More close calls can be expected.

Large Objects in Orbit



Source: European Space Agency

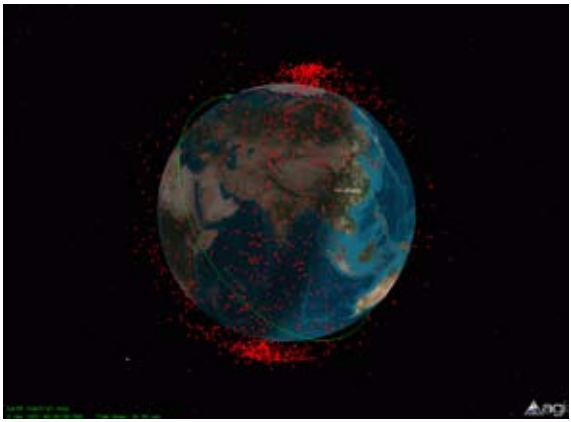
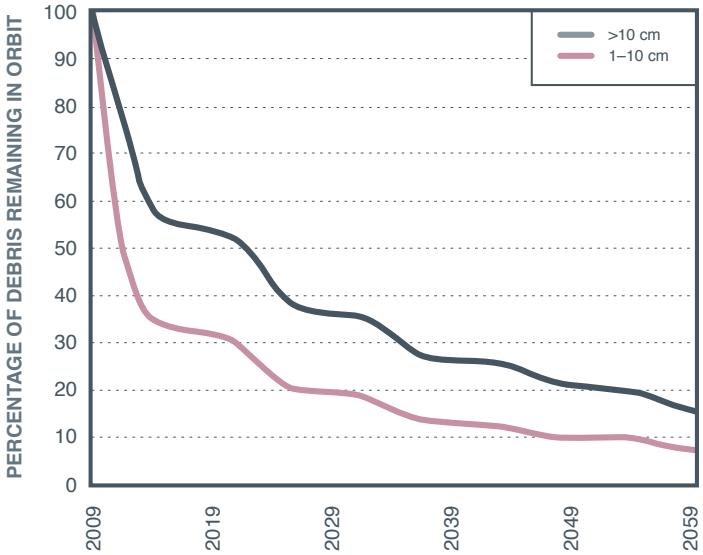


Illustration of the debris from China's ASAT test (red) and the orbit of the International Space Station (green) (Image: Dr. T.S. Kelso, Celestrak.com).

Heads Up: Collision in Space

On February 10, 2009, a communications satellite operated by Iridium, an American corporation, collided with a satellite launched by Russia in 1993 that ceased functioning two years later. The collision produced more than 800 pieces of debris larger than 10 cm in diameter. As shown by the graph below, most of these debris fragments will be in orbit for decades, endangering more than 200 satellites. This collision serves as a wake-up call for two important rules of the road for space: providing timely warning of likely satellite collisions, and refraining from debris-producing ASAT weapon tests.



The fraction of debris from the satellite collision that is expected to remain in orbit as a function of time (Graph: Union of Concerned Scientists).

Maintaining US Advantages in Space

The military and intelligence advantages the United States enjoys in space would be threatened by the use of weapons in space. Washington's most serious potential competitors, Beijing and Moscow, say they oppose weapons in space and call for a treaty to prevent them. At the same time, they have tested ASAT weapons in the past and are presumably improving their capabilities to impair and destroy satellites. Maintaining US advantages in space requires improved satellite survivability.

Q Is there a solution to the satellite vulnerability problem?

A There is no simple or complete solution to the satellite vulnerability problem. A combination of initiatives, however, can greatly reduce the likelihood that satellites will be attacked.

Q What role can diplomacy play?

A The absence of diplomacy detracts from space security, as has been evident from ASAT tests in recent years. Effective diplomacy can establish treaty obligations or rules of the road that clarify responsible and irresponsible activities in space. But diplomacy alone can't solve the satellite vulnerability problem. Diplomatic agreements can be broken, and besides, satellites will remain vulnerable to man-made debris as well as to other environmental hazards in space, such as solar flares, radiation, and corrosion.

Q Is deterrence part of the answer to the satellite vulnerability problem?

A Because satellites are so vulnerable and because so many existing weapons can be adapted for use as ASAT weapons, deterrence helps explain why no satellites have been attacked in crises or warfare. But deterrence based on mutual vulnerability is, at best, a partial solution.

Q Won't international agreements limit US freedom of action is space?

A Actually, the absence of international agreements can greatly limit US freedom of action is space. Debris-producing events can greatly constrain US freedom of action in space, and debris-producing events can be reduced by international agreements.

Q Besides diplomacy and deterrence, what else can be done to address the vulnerability problem?

A Protection against some man-made and natural hazards can be marginally improved when projected benefits exceed costs. In addition, the United States can choose to deploy larger numbers of less capable intelligence-gathering satellites, rather than investing in a small number of hugely expensive satellites. Wise, diversified investments in space can make surprise attacks against US satellites — a "space Pearl Harbor" — less likely. Maintaining the world's strongest military can also help dissuade other countries from attacking US satellites.

Anti-Satellite Weapons

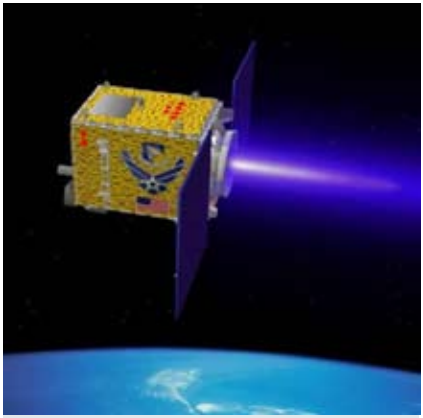
The United States

During the Cold War, the United States tested ASAT weapons 34 times. After the Cuban missile crisis, President John F. Kennedy approved of the deployment of one Nike Zeus and three Thor missiles designed for use as ASAT weapons. These missiles took many hours to prepare for launch and carried nuclear warheads that, if used, would have damaged US satellites, as well. These ASATs were mothballed because they were impractical. During the Reagan administration, the Pentagon favored a "hit to kill" ASAT carried under the wing of an F-15 fighter aircraft. This ASAT was used to destroy an aging US weather satellite in 1985. Now the Pentagon has shifted its interest away from ASATs that cause debris fields to those that employ "temporary and reversible" effects, such as jammers and lasers. It has not, however, foreclosed destructive ASAT testing. In February 2008, the Pentagon used a sea-based missile defense interceptor to destroy a dead intelligence-gathering satellite, ostensibly to avoid a potential public health hazard posed by the satellite's unused fuel. This ASAT test was designed to minimize space debris.

The ASM-135, the missile used by the United States for its 1985 ASAT test (Photo: Wikipedia).

Despite the 2008 ASAT test, the Bush administration was unable or unwilling to implement the Air Force's ambitious plans for fielding "offensive counterspace" capabilities. These programs have not ranked high on the Pentagon's budget priorities, and they have been strongly opposed on Capitol Hill. During the Bush administration, the Pentagon focused instead on demonstrations in space of multi-purpose technologies that could eventually be used to harm satellites, but that also could be used for peaceful purposes. One such program is the Experimental Satellite Series (XSS), which makes close approaches to satellites and other space objects. Such "proximity operations" in the future could be used to inspect and repair friendly satellites or to interfere with hostile ones. The Air Force also operates the Starfire Optical Range in New Mexico, which is home to a number of directed-energy research programs. In addition, the Missile Defense Agency is developing an airborne laser in a 747 aircraft. Lasers can be used for satellite inspections and station keeping, as well as for war-fighting purposes.

Laser testing conducted at the Starfire Optical Range (Photo: Wikipedia).



Illusration of an XSS satellite (Photo: U.S. Air Force).

China

In 2007, China succeeded in destroying one of its own satellites using a modified ballistic missile, after having carried out two previous tests. China also has lasers that could be used for peaceful or war-fighting purposes in space. China's 2008 manned space mission also deployed a small satellite, the BX-1, which was used for proximity operations, like those performed by the XSS.

China's DF-21 ballistic missile was likely modified for use in its 2007 ASAT test (Photo: 'KT-1' at Encyclopedia Astronautica, © Mark Wade, 1997 – 2007).

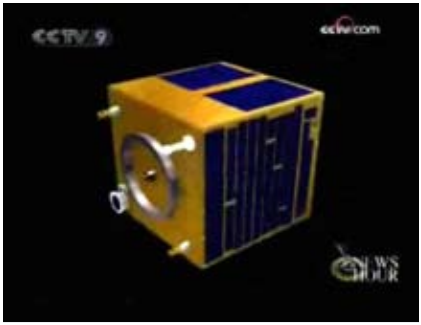


Illustration of China's BX-1 satellite (Photo: Union of Concerned Scientists).

Russia

The Soviet Union tested ASATs 20 times up until 1982. During the 1970s, Moscow favored a "co-orbital" ASAT that sidled up to the target satellite and exploded. This weapon was unreliable and took over an hour to approach its target, which greatly reduced the element of surprise. The Soviet Union also maintained ground-based lasers that could be used against satellites. Moscow still possesses the capability and technology to test ASATs by using lasers, jammers, ballistic missiles, and air defense interceptors.

Illustration of the Soviet Union's co-orbital ASAT (Photo: Defense Intelligence Agency).

Q Given Russian and Chinese ASAT capabilities, why shouldn't the United States protect its investments in space with firepower? If not, won't US military superiority be impaired?

A ASATs can be ruinous to satellite operations, but they won't change the outcome of a war: the United States will still win. But the costs of war will be greater for everyone. The burdens on US ground forces, which are already very severe, would become much heavier. Without the assured use of satellites, US casualties would mount. Since US attacks will be less precise without satellites, civilians will suffer more too. Everybody loses if ASAT weapons are used.

Q Doesn't the United States need ASATs to punish states that interfere with American satellites?

A The United States has many ways to punish wrongdoers where they live. If absolutely necessary, the United States can retaliate against satellite attacks by punishing bad actors in space, using weapons designed for other purposes.

Q If weapons designed for other purposes can be used to attack satellites, why not go ahead with new anti-satellite weapons?

A Weapons designed for other purposes that can be used against satellites serve as a deterrent as well as an insurance policy. This insurance policy makes the testing and deployment of new ASAT weapons unwise and unnecessary.

Space Dominance or Space Diplomacy?

The United States is the world's most powerful standard setter. Unwise US initiatives are therefore likely to result in bad choices elsewhere. If Washington seeks space dominance, others can be expected to take blocking action, including the tests of ASAT weapons. Immediately before becoming Secretary of Defense, Donald H. Rumsfeld chaired a commission that called on the Pentagon to "project power through and from space." The Bush administration refused to engage in negotiations that might limit ASATs of any kind. In 2001, it withdrew from the Anti-Ballistic Missile Treaty which banned space weapons used for missile defenses and which provided protections against interfering with intelligence-gathering satellites. A new US Air Force doctrine was published in 2004 that endorsed a strategy to "dominate" space. The Bush administration found little support for its military space policies. In December 2008, 171 nations voted "Yes" on a UN resolution to prevent an arms race in outer space. One country, Israel, abstained. Only the United States registered a "No." The absence of diplomacy, plans for space dominance, and the testing of ASATs during the Bush administration resulted in less space security and more satellite vulnerability.

The Bush Administration and Space Diplomacy

"We are paving the road of 21st century warfare now. And others will soon follow."
—Peter B. Teets, Undersecretary, US Air Force, 2002

"Space superiority provides freedom to attack."
—*Counterspace Operations*, Air Force Doctrine Document 2-2.1, 2004

"Our vision calls for prompt global strike space systems with the capability to directly apply force from or through space against terrestrial targets."
—Strategic Master Plan, Air Force Space Command, 2003

"Additional binding arms control agreements are simply not a viable tool for enhancing the long-term space security interests of the United States."
—Ambassador Donald Mahley, US State Department, 2008

New Opportunities for Diplomacy

The personal security of US citizens, as well as their economic and national security, requires that essential satellites be available when needed. Foreign citizens and their governments have similar requirements. The challenge facing space-faring nations is how to align space diplomacy with these common interests, despite mistrust over motives and the capabilities major powers possess to damage satellites. One way to serve common interests is through a verifiable treaty that bans the testing and use of destructive methods against satellites. Another approach is a Code of Conduct that sets norms for responsible space-faring nations and clarifies irresponsible acts, such as debris-creating ASAT tests. Either way, if Washington seeks to rule out testing ASATs, there are no guarantees of good behavior by others. Therefore, US restraint would best be accompanied by a hedging strategy to encourage others to practice similar restraint.

A Treaty Banning Destructive ASAT Testing

Since many military capabilities designed for other purposes — including ballistic missiles, missile defense interceptors, lasers and jammers — can be used against satellites, and since these technologies serve many essential purposes, it is not possible or wise to ban them all. But a complete ban on weapons capable of serving as ASATs is not required to prevent space from becoming a shooting gallery. Paradoxically, the existence of so many potential ASAT weapons helps to explain why so few actual ASAT tests have occurred during peacetime, and why no ASATs have been used to date in crises or combat between space-faring nations. Nonetheless, complacency about ASATs is unwise. As China demonstrated in 2007, only a few ASAT tests can create massive debris fields. The collision of US and Russian satellites in February 2009 should serve as a wake-up call. Large debris fields have been created in low earth orbit, increasing the risk of more collisions and dangerous chain reactions in space.

Destructive ASAT tests are the hardest to hide and the easiest to verify by national space authorities as well as by private citizens who keep track of satellites. Since verifiable, destructive tests against satellites pose a hazard to all space-faring nations, these irresponsible and verifiable acts might usefully be banned by a treaty. Pending this treaty's successful negotiation and entry into force, responsible space-faring nations could pledge not to carry out destructive ASAT tests, or more broadly, not to be the first to carry out ASAT tests of any kind.

A Code Of Conduct For Responsible Space-Faring Nations

The peaceful uses of outer space can also be advanced by a Code of Conduct that clarifies "rules of the road" for responsible space-faring nations. Codes of conduct were negotiated during the Cold War to prevent dangerous military practices and accidents by the superpowers on the ground, in the air, and at sea. The Bush administration endorsed some codes of conduct, including the 2003 Proliferation Security Initiative. This initiative began as a political compact among eleven like-minded states that sought improved international cooperation to help interdict shipments of dangerous weapons and materials. An additional 80 countries have subsequently signed on to the core principles of this code of conduct. The Proliferation Security Initiative has helped to intercept illicit commerce destined for Iran, Libya, and Syria.

The United States has been wise to set standards to prevent dangerous military practices on the sea, ground, and in the air. Space also deserves "rules of the road" to help prevent incidents and dangerous military activities. With the help of nongovernmental partners from Canada, China, France, Japan, and Russia, the Stimson Center has drafted a model Code of Conduct for Responsible Space-Faring Nations, borrowing from other codes of conduct. Stimson's model Code spells out the rights and responsibilities of space-faring nations.

Key Elements of Stimson's Space Code of Conduct

Rights of Space-Faring States

1. The right of access to space for exploration or other peaceful purposes.
2. The right of safe and interference-free space operations, including military support functions.
3. The right of self-defense as enumerated in the Charter of the United Nations.
4. The right to be informed on matters pertaining to the objectives and purposes of this Code of Conduct.
5. The right of consultation on matters of concern and the proper implementation of this Code of Conduct.

Responsibilities of Space-Faring States

1. The responsibility to respect the rights of other space-faring states and legitimate stakeholders.

2. The responsibility to regulate stakeholders on national territory or that use national space launch services in conformity with the objectives and purposes of this Code of Conduct.

3. The responsibility to regulate the behavior of nationals in conformity with the objectives and purposes of this Code of Conduct, wherever those actions occur.

4. The responsibility to develop and abide by rules of safe space operation and traffic management.

5. The responsibility to share information related to safe space operations and traffic management and to enhance cooperation on space situational awareness.

6. The responsibility to mitigate and minimize space debris in accordance with the best practices established by the international community.

7. The responsibility to refrain from harmful interference against space objects.

8. The responsibility to consult with other space-faring states regarding activities of concern in space and to enhance cooperation to advance the objectives and purposes of this Code of Conduct.

9. The responsibility to establish consultative procedures to address and resolve questions relating to compliance, and to agree upon additional measures to improve the Code's viability and effectiveness.

The European Union's Draft Code of Conduct

In December 2007, The European Union issued a draft Code of Conduct for Outer Space Activities. The EU's draft Code strongly affirms the principle of no harmful interference against space objects, including

- the freedom of access to, exploration and use of outer space for peaceful purposes without interference, fully respecting the security, safety and integrity of space objects in orbit;
- the responsibility of States to take all the appropriate measures and cooperate in good faith to prevent harmful interference in outer space activities;
- the responsibility to establish and implement national policies and procedures to minimize the possibility of accidents in space, collisions between space objects or any form of harmful interference with other States' right to the peaceful exploration and use of outer space;
- the responsibility to refrain from any intentional action that will or might bring about, directly or indirectly, the damage or destruction of outer space objects.

Other Codes of Conduct

- Incidents at Sea Agreement (1972)
- Prevention of Dangerous Military Activities (1989)
- International Code of Conduct Against Ballistic Missile Proliferation (2002)
- Proliferation Security Initiative (2003)

Rules For Space Security

The United States and other countries have traffic rules and penal codes. People still speed and break laws, but the rules that most people honor continue to be essential and are necessary to prosecute rule breakers. We expect rules to govern financial transactions and help stop nuclear proliferation. Military forces abide by codes of conduct in peacetime. There are even rules of warfare. Rules prevent anarchy and save lives. Some rules of the road exist to protect life-saving satellites from harm — but not enough of them.

Agreed Rules of the Road For Outer Space

- **No Nuclear Weapon Tests in Outer Space**
  Limited Test Ban Treaty, 1963
  (118 Nations)
- **No Weapons of Mass Destruction in Orbit**
  Outer Space Treaty, 1967
  (125 Nations)
- **No National Appropriation of Space by Any Means**
  Outer Space Treaty, 1967
  (125 Nations)
- **Cooperate on Search and Rescue Operations In Space**
  Agreement on Rescue of Astronauts, 1968
  (115 Nations)
- **States Are Liable For Damage Caused By Their Space Objects**
  Liability Convention, 1972
  (113 Nations)

What Else is Needed?

- Minimize debris in space.
- Avoid and reduce the risk of collisions in space.
- Avoid or announce in advance dangerous maneuvers in space.
- Create special caution areas around satellites.
- Refrain from simulating attacks in space.
- Refrain from using lasers to damage or blind satellites.
- Cooperate on space traffic management.
- Refrain from flight-testing or using destructive ASAT weapons.

Q **Why is a Code of Conduct for space-faring nations needed?**

A Having agreed rules that define responsible behavior promotes national security and global commerce.

Q **But won't bad actors break the rules?**

A Laws are broken. That doesn't make the laws irrelevant, or unimportant. Rules still matter. Agreed rules also make it easier to identify and build coalitions against rule breakers.

Without rules in space, there are no rule breakers.

Q Since others can't be trusted, why not launch space weapons first and demand that others play by US rules?

A By launching space weapons first, the United States sets a precedent that others will follow. This approach would ensure widespread testing and deployment of ASAT weapons and would make warfare in space and on the ground more likely.

Q But if the United States exercises restraint, will other countries play by these rules?

A The United States doesn't depend on the good faith of others, which is why a hedging strategy is also required. America enjoys the world's best space monitoring capabilities and armed forces. If others insist on testing ASATs, the United States could, too. But it is not in the economic and national security interest for the United States to open this Pandora's box.

Q Doesn't hedging send the wrong signal, prompting ASAT tests by others?

A Not hedging against the use of ASATs by others could also send the wrong signal, inviting use without consequences. But if the US hedges too much — such as by initiating a resumption of ASAT testing — others will surely follow. So a hedging strategy requires balance, such as by flight testing multi-purpose technologies.

The Diplomacy of Space Assurance

Space assurance means that the satellites essential for personal, economic, and national security will be available when needed. How can the United States provide for space assurance? First, by maintaining conventional US military superiority. The United States can thereby clarify that states interfering with satellites can suffer severe consequences. Second, by improving US intelligence capabilities, so that threats to US satellites can be detected and perpetrators can be identified. Increased "situational awareness" in space can also help deter potential adversaries. Third, by seeking to stop tests of ASAT weapons which make satellites more vulnerable and space operations more dangerous. Fourth, by hedging with research and development of technologies that have multiple end uses — but without testing them as ASAT weapons. These hedges help clarify to potential adversaries that the United States can and will respond effectively if they initiate ASAT attacks. Fifth, by championing diplomatic initiatives to promote the peaceful uses of outer space.

Key Elements of Space Assurance

- Maintain the Best Armed Forces in the World
- Increase Situational Awareness in Space
- Promote a Ban on Testing ASATs
- Adopt Prudent Research & Development Hedges
- Champion Diplomatic Initiatives for the Peaceful Uses of Space

The Choice for Space With Rules of the Road

- International Cooperation
- Economic Growth
- Public Safety
- Stronger US Military

Without Rules Of the Road

- Anti-Satellite Weapons
- Satellites at Greater Risk
- Less International Cooperation
- Greater Likelihood of Conflict

Space Security Resources

Foundations & Non-Governmental Organizations

Center for Defense Information
www.cdi.org

Center for International and Security Studies at Maryland
www.cissm.umd.edu

Heritage Foundation
www.heritage.org

Marshall Institute
www.marshall.org

One Earth Future Foundation
www.oneearthfuture.org

Secure World Foundation
www.swfound.org

Space Policy Institute George Washington University
www.gwu.edu/~spi/

Space Security Index
www.spacesecurity.org

Stimson Center
www.stimson.org

Union of Concerned Scientists
www.ucsusa.org

Commercial Groups

Futron Corporation
www.futron.com

Satellite Industry Association
www.sia.org

Government & Inter-Government Bodies

Inter-Agency Space Debris Coordination Committee
www.iadc-online.org

National Aeronautics and Space Administration (NASA)
www.nasa.gov

NASA Orbital Debris Program Office
http://orbitaldebris.jsc.nasa.gov

United Nations Office for Outer Space Affairs
www.oosa.unvienna.org

United Nations Institute for Disarmament Research
www.unidir.org

U.S. Air Force Space Command
www.afspc.af.mil

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www.airforce-magazine.com/Almanacs/Pages/default.aspx

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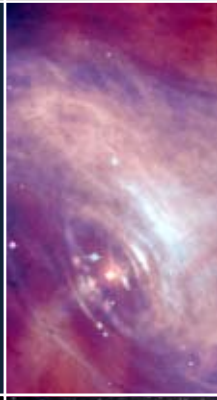

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