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## Plan Text

### The United States Federal Government should fully fund the Constellation program.

## 1ac – Space Leadership Adv

### Cancellation of the Constellation shuttle replacement sent an international signal that the U.S. is abandoning leadership in space --- this will lock the U.S. out of cooperative ventures

Elizabeth K. Newton, Professor of Physics – University of Alabama, Huntsville and Michael D. Griffin, Former Administrator – NASA and Eminent Scholar and Professor – University of Alabama, Huntsxville, February 2011, “United States Space Policy and International Partnership”, Space Policy, 27(1), p. 8-9

3. Will the USA have more influence on the world stage? *3.1. Perceptions of style* President Obama’s 2010 policy is notable for the shift over the 2006 version, which most agree to be more a stylistic change of tone, rather than one of substance. The messages conveying the need for multilateral action are likely to be welcome to external audiences’ ears and suggest a more consultative approach. That said, the cancellation of the Constellation program was done without prior notice or consultation with international partners, and much of the debate on the subject has centered on the domestic repercussions of the decision, not the impact on the partners. There is evidently a mismatch between intent and such unilateralist actions. *3.2. Perceptions of reliability as a partner* The president’s request and congressional authorization for continued funding of the ISS’s operations delivers on commitments made to international partners beginning in the mid-1980s when the program was conceived. However, without a successor system to the Shuttle, the USA has abrogated intergovernmental agreements to provide crew and cargo transportation, and crew rescue, as partial compensation for partner investments in the ISS’s infrastructure and operations. Reliance on the Russian Soyuz for limited down-mass cargo transport seriously inhibits the value that can be realized from ISS utilization until a commercial solution is available. In addition, the USA’s unilateral abandonment of the Moon as a near-term destination shakes partners’ political support for their exploration plans, some of which were carefully premised on US intentions, and more than five years of collaborative development of lunar base plans. *3.3. Leadership* The USA is a majority funder for many space programs and is a technology leader, two features which have provided sufﬁcient motivation for partners to accept US leadership, even when unfortunately high-handed. It is a stunning failure of political will to lack a successor system to the retiring Space Shuttle, and so the US cedes leadership in human spaceﬂight with its inability to access the ISS independently, for itself or for its partners, until a new commercial capability has been demonstrated. The USA further relinquishes leadership when abandoning years of work on strategic planning and guidance, the evaluation of alternatives, and orchestration of diverse but important contributions that were manifested in the Global Exploration Strategy. Sudden redirections without consultation are not hallmarks of leadership and will no doubt motivate partners to do more unilateral planning and execution, at least for a while. Finally, leadership in the future is at risk: how can the USA hope to inﬂuence outcomes and protect interests---strategic, commercial, and cultural---on the Moon if it is not present? *4. Conclusion* Is the USA better off with the new (emerging) space policy? In some areas, yes, in some, no; and in some, it is too early to tell. In human spaceﬂight chronic under-funding and a political failure to persist toward goals have engendered a repetitive and distasteful cycle of churn that in the long haul is more expensive than if a plan had been committed to and executed. Policy changes on some fronts will be celebrated by international partners and rued on other fronts, where continued interdependence will be approached cautiously. We should be diligent in monitoring whether the risks and time-delays created by policy change are proven to be worth the beneﬁts, that is, we need to create a ‘closed loop’ on the system, to gauge regularly and systematically whether we are achieving what we want. A vision of American excellence and leadership in security, political economy, and inﬂuence provides a framework for this evaluation and for the goals that we set for ourselves. While accountability and data are not beloved in the political process, we will not be able to move beyond debates that the majority of Americans view as arcane, unless we zero in on data-driven evaluations of policy’s performance. Magical thinking might make for good politics, but it makes poor policy.

## 1ac – Space Leadership Adv

### Constellation’s replacements will be practically ineffective, and if not, will spark internal dissention within NASA that erodes morale necessary for its success

Taylor Dinerman, Consultant – Department of Defense and Reporter – Space Review, 6-9-2010, “The Collapse of NASA?”, Hudson New York, http://www.hudson-ny.org/1366/the-collapse-of-nasa

The attempt to kill George W. Bush's Constellation Program has thrown NASA and the US space industry into chaos. If the next human to set foot on the Moon is not a US astronaut, that change will be seen by the rest of the world as a major humiliation for this country. Those who say, "Been there, done that" will be answered with, "Can't go there, can't do that." In his testimony at the May 12th hearing, former astronaut Neil Armstrong said, "If the leadership we have acquired through our investment is allowed to simply fade away, other nations will surely step in where we have faltered. I do not believe that this would be in our best interest." Although the Constellation Program may have been modestly underfunded, it was based on technological and political reality. The new "Obama Program," however, currently proposed as a substitute for the Constellation, recommend a "flexible path" to human space exploration, yet provides no solid goals or timelines, and only a few vague promises that, with "game changing technology," NASA will someday be able to visit an asteroid or, in the very long term, send people to the moons of Mars. It is, as Apollo Astronaut Gene Cernan before a US Senate Committee on May 12th put it, "a travesty which flows against the grain of over 200 years of our history." The proposal is also based on the idea that the US cannot be the world's leader in space technology. It must now seek to subordinate its space ambitions to the international community. Even to the extent of killing off large segments of the space industry. The Constellation Program emerged in the aftermath of the Colombia disaster of February 2003; and was called the Vision for Space Exploration. It was at first hailed as the answer to NASA's prayers -- just the sort of clear direction that many of the agency's longstanding critics had demanded. Unlike George H.W. Bush's similar Space Exploration Initiative, which was eviscerated by Congress in 1991 and 1992, the Vision was carefully planned to be acceptable to a large bipartisan majority in Congress. To achieve that, this program, renamed Constellation, had to be technologically conservative; it also had to make full use of the existing workforce and infrastructure. The resistance to Obama's program on Capitol Hill and elsewhere is fierce. NASA Administrator Bolden has literally had to beg his own employees for support. Meanwhile, supporters and skeptics are at each others throats. The damage this is doing to personal and professional relationships inside the space industry is real and lasting. Ever since it was created by President Eisenhower in 1958, NASA has had a powerful grip on the American imagination. As Tom Wolfe put it: " The 'space race' became a fateful test and presage of the entire Cold War conflict between the 'superpowers' the Soviet Union and the United Startes. Surveys showed that people throughout the world looked upon the competition… as a preliminary contest proving final and irresistible power to destroy." After a rough start, the Apollo Moon landing in 1969 ended the first phase of the space race with a decisive American victory. The pictures of astronauts standing next to the flag became a permanent part of America's global image. So much so, in fact, that US enemies almost always subscribe to the belief that the Moon landings were faked. After Apollo, it became commonplace to say that NASA lost its way. On the contrary, the agency has, with remarkable tenacity, pursued an human space exploration agenda that has provided the framework for almost everything it does. First, they pursued a low-cost, safe, reliable Earth to Orbit transportation system, The Shuttle, which was supposed to provide; but due to cost-cutting by the Nixon administration and Congressional Democrats, led by Edward Kennedy and Walter Mondale in the early 1970s, it failed to live up to its potential. The agency also wanted a Space Station as a stepping stone to the Solar System. The existing International Space Station (ISS) may not be in the ideal orbit for interplanetary exploration, but it does exist and this alone is a tribute to NASA's powerful institutional will. A permanent base on the Moon, and eventually a manned landing on Mars, were the ultimate goals of the US space agency. President George W. Bush's Science Advisor, John Marbuger, explained what the end result would be during a speech in March 2006: "As I see it, questions about the the (NASA) Vision boil down to whether we want to incorporate the Solar System in our economic sphere or not." The proposal to replace the shuttle with a commercial taxi service has gotten a lot of attention. The concept is not new. During the Bush administration, NASA set up the Commercial Orbital Transportation Services (COTS) contracts, the of which were to provide cargo services to the Space Station. It was hoped that later ones would be able to carry astronauts. Sadly, the firms involved have found that they needed a lot more time and money than originally planned. Whether Bolden said it or not, there is a better than even chance that at some point they will need to be bailed out. At one time, the US-manned space program was something that the overwhelming majority of Americans could be proud of; with a few exceptions, it enjoyed strong bipartisan and popular support. It has so much visibility that many people believe it gets as much as 20 percent of the federal budget, instead of the the real number which is a little more than one-half of one percent. Now it is the object of a nasty political squabble -- mostly between the White House and Congress as a whole, rather than between Republicans and Democrats. While a few leaders in Washington are seeking a compromise, the fight over Constellation has been getting nasty. Senator Richard Shelby (R Al.), the most eager supporter of the Moon Mission, may attach an amendment forbidding NASA to cancel the Constellation to a "must pass" military appropriations bill. This would insure the programs survival at least until 2012. The turmoil inside the agency is costing time and money. Worse, it is biting into the necessary trust that is essential to all involved in the program. As long as people inside both NASA and its contractors are worried about the future of their jobs, and the possibility that they may be wasting their efforts either by working on the President's program or by working on Constellation, the situation is ripe for trouble.

## 1ac – Space Leadership Adv

### Declining space launch leadership spills over, collapsing broader U.S. dominance in space

Mark Stout, Researcher and Analyst – National Space Studies Center, Air University, 10-29-2009, “U.S. Space Leadership: Reverting to the Mean?”, The Wright Stuff – Publication of Air University, <http://www.au.af.mil/au/awc/awcgate/nssc/op-ed/american_spacepower_reverting_to_the_mean.pdf>

For some time, U.S. space programs have been reverting towards the mean. Ok, while there really isn’t a real mean for space programs, the general idea is relative to the U.S., others are catching up, and relative to these others, the United States is not nearly as dominant as it has been. This seems to be especially true regarding the United States as a space launching nation. Need proof? Let’s see--China now has a serious commercial space program and a robust manned space flight effort as well. When they get their heavy lift Long March 5 on line in 2014, they’ll be capable of launching a wide variety of very heavy payloads including up to 55000 pounds to a low earth orbit, as well as to geosynchronous orbit and beyond. Russia? They possess the know-how behind the amazing RD-180 engines and some exceedingly mature space launch systems. Besides the space shuttle, the Russian Soyuz and Proton systems provide rides to the International Space Station. Arianespace? That French-led endeavor, along with its nine other European partners, are probably pretty happy with the Ariane 5’s 32 consecutive successful launches. How about some other space launching nations that few seldom think of like India, Japan, and Iran? So far, indigenous South and North Korean space programs have only been suborbital…so far. Reverting to the mean for U.S. human space flight isn’t too bothersome--unless you’re NASA-- as the value of manned space flight is basically a spectacular stunt, kind of like a grizzly bear dunking a basketball. First you say “Wow!” Then you say “Weird.” Next, it’s “Are you going to eat the rest of that hot dog?” Finally you say “Why is that bear dunking a basketball anyway?” From a military perspective however, a loss of U.S. space launch leadership is more problematic: space launch is that necessary first enabler for all other operations in the space domain, such as the traditional unmanned space missions of providing ISR, communications, weather, and GPS that not only enable the U.S. military but are also thoroughly intertwined with our economy. Just as the United States has a national security requirement to be capable of performing military missions in the air, on the ground, and on and under the sea, we similarly have a need to be able to get to space and to operate our space systems. If we lose the ability to get to space, we put our capacity to operate in the space domain at serious risk. Because of the decision made to get military payloads off the space shuttle following the 1986 Challenger disaster and because we were then in the Cold War, a number of already developed space launch systems came quickly into great prominence.

## 1ac – Space Leadership Adv

### U.S. space leadership is on the brink --- we’ll be passed by Russia and China and locked out for decades

Frank Wolf, United States Representative and Ranking Member – House Appropriations Committee, 4-25-2010, “Don’t Forsake US Leadership in Space”, Space News, http://spacenews.com/commentaries/100425-dont-forsake-leadership-space.html

Space exploration has been the guiding star of American innovation. The Mercury, Gemini, Apollo and shuttle programs have rallied generations of Americans to devote their careers to science and engineering, and NASA’s achievements in exploration and manned spaceflight have rallied our nation in a way that no other federal program — aside from our armed services — can. Yet today our country stands at a crossroad in the future of U.S. leadership in space. President Barack Obama’s 2011 budget proposal not only scraps the Constellation program but radically scales back U.S. ambition, access, control and exploration in space. Once we forsake these opportunities, it will be very hard to win them back. As Apollo astronauts Neil Armstrong, Jim Lovell and Gene Cernan noted on the eve of the president’s recent speech at Kennedy Space Center, Fla.: “For The United States, the leading space faring nation for nearly half a century, to be without carriage to low Earth orbit and with no human exploration capability to go beyond Earth orbit for an indeterminate time into the future, destines our nation to become one of second or even third rate stature.” In terms of national security and global leadership, the White House’s budget plan all but abdicates U.S. leadership in exploration and manned spaceflight at a time when other countries, such as China and Russia, are turning to space programs to drive innovation and promote economic growth. Last month, China Daily reported that China is accelerating its manned spaceflight development while the U.S. cuts back. According to Bao Weimin with the Chinese Academy of Sciences, “A moon landing program is very necessary, because it could drive the country’s scientific and technological development.” In a recent special advertising section in The Washington Post, the Russian government boasted of its renewed commitment to human spaceflight and exploration. Noting the White House’s recent budget proposal, the piece said, “NASA has long spent more money on more programs than Russia’s space agency. But President Barack Obama has slashed NASA’s dreams of going to the moon again. … At the same time, the Russian space industry is feeling the warm glow of state backing once again. There has been concerted investment in recent years, an investment that fits in well with the [Vladimir] Putin doctrine of trying to restore Russian pride through capacity.” Manned spaceflight and exploration are one of the last remaining fields in which the United States maintains an undeniable competitive advantage over other nations. To walk away is shortsighted and irresponsible. Our global competitors have no intention of scaling back their ambitions in space. James A. Lewis with the Center for Strategic and International Studies recently said that the Obama administration’s proposal is “a confirmation of America’s decline.” The 2011 budget proposal guarantees that the United States will be grounded for the next decade while gambling all of our exploration money on unproven research-and-development experiments. Although I am an ardent supporter of federal R&D investments, I believe it is unacceptable that the administration would gamble our entire space exploration program for the next five years on research. The dirty little secret of this budget proposal is that it all but ensures that the United States will not have an exploration system for at least two decades. That is a fundamental abdication of U.S. leadership in space — no matter how much the administration tries to dress it up. Our international competitors are not slowing down, and neither should we.

## 1ac – Space Leadership Adv

### Robust U.S. leadership is essential to protect and replace critical space assets --- otherwise, short-term failure is likely due to accidents, attacks, or expiring life spans

AIAA, Aerospace Industries Association of America, April 2010, “Aerospace and Defense: The Strength to Lift America”, April, http://www.nationalaerospaceweek.org/wp-content/uploads/2010/04/whitepaper.pdf

*Space Technology is an Investment in U.S. Global Leadership, Competitiveness and Innovation*

Space systems drive our nation’s competitiveness, economic growth and innovation. U.S. soldiers in the mountains of Afghanistan, farmers, bankers and emergency responders here at home all have a common reliance on a space infrastructure in orbit above the Earth. Everyday activities, taken for granted by many Americans, are supported or even driven by space systems. These systems are hidden to us and rarely noticed unless the services they provide are interrupted. However, the lack of visibility of space systems doesn’t diminish their importance — both our nation’s economy and national security are tied directly to this critical infrastructure. Communications drive today’s commerce, and space systems are a chief global conduit of our nation’s commercial and national security communications. The Internet, e-mail and wireless devices have all become the standard for businesses and recreation. Direct-to-home television and satellite radio have become standard in many American homes and automobiles. These all depend on our satellite communications systems. Similarly, the Global Positioning System, originally designed for military use, is now relied on for banking transactions, ATMs, improved agriculture, air traffic and ground transportation systems and by emergency responders. All of these applications add up to substantial economic activity. Of $214 billion in aerospace industry sales in 2007, direct space system industry sales topped $40 billion.14 Total direct and indirect global space activity for 2008 was $257 billion.15 Even harder to quantify — but no less valuable — is the impact that technology spinoffs from space activities bring to our economy. In 2009 alone, NASA entered into more than 250 agreements with private and other external entities for development of dual-use technologies.16 Space is certainly becoming more contested, congested and competitive. More than 60 nations are engaged in space efforts and tens of thousands of man-made objects orbit the Earth. In January 2007, the Chinese used a ballistic missile to destroy an aging weather satellite. This anti-satellite test demonstrated the very real ability of a foreign power to attack and destroy space assets and resulted in a dangerous debris cloud. In addition, the February 2009 collision of a commercial U.S. satellite and Russian satellite showed that space systems not only face disruption from intentional attack, but are also at risk from unintentional events in an increasingly crowded environment. Using systems developed by America’s aerospace industry, the Defense Department currently tracks more than 21,000 man-made objects in the Earth’s orbit — many of which could threaten civil and national security space systems, as well as our nation’s efforts to increase the commercial use of space.17 In such an environment, investments in rapid reconstitution, sensors, tracking, threat assessment and other space protection and situational awareness capabilities are needed to mitigate the impacts of an unexpected catastrophic space system failure. The cost and difficulty involved in developing and deploying space systems as well as the severe consequences of their loss necessitates that our nation’s space infrastructure be adequately protected. Part of ensuring robust space capabilities means that America must routinely replace and update its space infrastructure. It is highly problematic — if not infeasible — to perform maintenance or even refuel them. Space systems have limited life spans and, at today’s pace of technology, can quickly become obsolete. Critical space systems that provide missile warning, global communications, positioning, navigation and timing and weather are in need of upgrade at a time when other nations are rapidly modernizing their own space infrastructure. The United States must remain a leader in human and robotic space — a position that is perishable if not properly supported. Research aboard the International Space Station and human and robotic exploration beyond low Earth orbit must remain national priorities. These activities demonstrate global leadership, sharpen our expertise for future long-range space travel, add to our scientific knowledge and inspire our youth to pursue engineering and science disciplines. Space systems often go unnoticed in our daily lives, but their impact is very real. It is imperative that we as a nation have the right plans, strategies and budgets in place to keep our space industry competitive and our space systems, and their supporting Earth-based infrastructure, operating when we need them. It is increasingly important that the United States develop and maintain a cohesive national approach to our efforts in space — one that crosses civil agencies, the Defense Department and the intelligence community.

## 1ac – Space Leadership Adv

### Disruption of space assets shatters the global economy

Clay Dillow, Researcher – Popular Science Magazine, 5-27-2010, “Pentagon: A Space Junk Collision Could Set Off Catastrophic Chain Reaction, Disable Earth Communications”, Popsci, [http://www.popsci.com/technology/ article/2010-05/dod-space-junk-tipping-point-collision-could-set-catastrophic-chain-reaction](http://www.popsci.com/technology/article/2010-05/dod-space-junk-tipping-point-collision-could-set-catastrophic-chain-reaction)

Our reliance on satellites goes beyond the obvious. We depend on them for television signals, the evening weather report, and to find our houses on Google Earth when we're bored at work. But behind the scenes, they also inform our warfighting capabilities, keep track of the global shipping networks that keep our economies humming, and help us get to the places we need to get to via GPS. According to the DoD's interim Space Posture Review, that could all come crashing down. Literally. Our satellites are sorely outnumbered by space debris, to the tune of 370,000 pieces of junk up there versus 1,100 satellites. That junk ranges from nuts and bolts lost during spacewalks to pieces of older satellites to whole satellites that no longer function, and it's all whipping around the Earth at a rate of about 4.8 miles per second. The fear is that with so much junk already up there, a collision is numerically probable at some point. Two large pieces of junk colliding could theoretically send thousands more potential satellite killers into orbit, and those could in turn collide with other pieces of junk or with satellites, unleashing another swarm of debris. You get the idea. To give an idea of how quickly a chain reaction could get out hand consider this: in February of last year a defunct Russian satellite collided with a communications satellite, turning 2 orbiting craft into 1,500 pieces of junk. The Chinese missile test that obliterated a satellite in 2007 spawned 100 times more than that, scattering 150,000 pieces of debris. If a chain reaction got out of control up there, it could very quickly sever our communications, our GPS system (upon which the U.S. military heavily relies), and cripple the global economy (not to mention destroy the $250 billion space services industry), and whole orbits could be rendered unusable, potentially making some places on Earth technological dead zones.

### Economic collapse causes global nuclear war

Michael Auslin, Resident Scholar – American Enterprise Institute, and Desmond Lachman – Resident Fellow – American Enterprise Institute, 3-6-2009, “The Global Economy Unravels”, Forbes, http://www.aei.org/article/100187

What do these trends mean in the short and medium term? The Great Depression showed how social and global chaos followed hard on economic collapse. The mere fact that parliaments across the globe, from America to Japan, are unable to make responsible, economically sound recovery plans suggests that they do not know what to do and are simply hoping for the least disruption. Equally worrisome is the adoption of more statist economic programs around the globe, and the concurrent decline of trust in free-market systems. The threat of instability is a pressing concern. China, until last year the world's fastest growing economy, just reported that 20 million migrant laborers lost their jobs. Even in the flush times of recent years, China faced upward of 70,000 labor uprisings a year. A sustained downturn poses grave and possibly immediate threats to Chinese internal stability. The regime in Beijing may be faced with a choice of repressing its own people or diverting their energies outward, leading to conflict with China's neighbors. Russia, an oil state completely dependent on energy sales, has had to put down riots in its Far East as well as in downtown Moscow. Vladimir Putin's rule has been predicated on squeezing civil liberties while providing economic largesse. If that devil's bargain falls apart, then wide-scale repression inside Russia, along with a continuing threatening posture toward Russia's neighbors, is likely. Even apparently stable societies face increasing risk and the threat of internal or possibly external conflict. As Japan's exports have plummeted by nearly 50%, one-third of the country's prefectures have passed emergency economic stabilization plans. Hundreds of thousands of temporary employees hired during the first part of this decade are being laid off. Spain's unemployment rate is expected to climb to nearly 20% by the end of 2010; Spanish unions are already protesting the lack of jobs, and the specter of violence, as occurred in the 1980s, is haunting the country. Meanwhile, in Greece, workers have already taken to the streets. Europe as a whole will face dangerously increasing tensions between native citizens and immigrants, largely from poorer Muslim nations, who have increased the labor pool in the past several decades. Spain has absorbed five million immigrants since 1999, while nearly 9% of Germany's residents have foreign citizenship, including almost 2 million Turks. The xenophobic labor strikes in the U.K. do not bode well for the rest of Europe. A prolonged global downturn, let alone a collapse, would dramatically raise tensions inside these countries. Couple that with possible protectionist legislation in the United States, unresolved ethnic and territorial disputes in all regions of the globe and a loss of confidence that world leaders actually know what they are doing. The result may be a series of small explosions that coalesce into a big bang.

## 1ac – Space Leadership Adv

### Restoring funding to Constellation re-establishes U.S. space leadership

Eugene A. Cernan, Commander – Apollo XVII and Retired Captain – United States Navy, 5-26-2010, Testimony before the House Committee on Science and Technology, [http://www.marklarson.com/genecernan/House\_Hearing\_ Statement.pdf](http://www.marklarson.com/genecernan/House_Hearing_Statement.pdf)

With the submission of FY2011 budget, The Administration and the originators of this proposal were either misinformed or showing extreme naivete, or I can only conclude, are willing to take accountability for a calculated plan to dismantle America’s leadership in the world of Human Space Exploration resulting in NASA becoming nothing more than a research facility. In either case, I believe this proposal is a travesty which flows against the grain of over 200 years of our history and, today, against the will of the majority of Americans. The space program has never been an entitlement, it’s an investment in the future – an investment in technology, jobs, international respect and geo-political leadership, and perhaps most importantly in the inspiration and education of our youth. Those best and brightest minds at NASA and throughout the multitudes of private contractors, large and small, did not join the team to design windmills or redesign gas pedals, but to live their dreams of once again taking us where no man has gone before. If this budget proposal becomes the law of the land, these technicians, engineers, scientists, a generation removed from Apollo, yet re-inspired by the prospect of going back to the moon and on to Mars, will be gone – where I don’t know – but gone. America’s human space flight program has for a half century risen above partisan differences from Eisenhower to Kennedy to the present day. The challenges and accomplishments of the past were those of a nation – never of a political party or of any individual agenda. Those flags that fly on the moon today are neither blue flags nor are they red flags – they are American Flags. We are at a cross road. If we 6 abdicate our leadership in space today, not only is human spaceflight and space exploration at risk, but I believe the future of this country and thus the future of our children and grandchildren as well. Now is the time for wiser heads in the Congress of the United States to prevail. Now is the time to overrule this Administration’s pledge to mediocrity. Now is the time to be bold, innovative and wise in how we invest in the future of America. Now is the time to re-establish our nation’s commitment to excellence.

## Constellation Solves – Co-Op Internal

### International cooperation is critical to U.S. space leadership

Elizabeth K. Newton, Professor of Physics – University of Alabama, Huntsville and Michael D. Griffin, Former Administrator – NASA and Eminent Scholar and Professor – University of Alabama, Huntsville, February 2011, “United States Space Policy and International Partnership”, Space Policy, 27(1), p. 8

*1. Will the USA be more secure?* As stated in the White House’s space policy and Lynn’s preview of the National Security Space Strategy, US security hinges on fostering a cooperative, predictable space environment where countries can operate in a stable, sustainable way. Planned debris tracking standards, considerations of international ‘rules of the road’, and shared data sets for collision avoidance and debris mitigation are measures that undoubtedly will contribute to the security of space as a shared venue for national activities. The stated desire to develop a Combined Space Operations Center for coalition operations could expand access to information, awareness, and services. Leveraging partner capabilities, integrating them into system architectures, and increasing the interoperability of systems are important planned steps as well. These new strategies do not diminish the USA’s current strengths in the national security space realm and quite likely stand to capitalize on international interest in multilateral solutions. Further information will doubtless be forthcoming in the Space Posture Review. One might also mention, under the theme of security, the USA’s ability to access its strategic assets in space. On the civil space side, the ‘gap’ in the government’s ability to access the International Space Station (ISS), a >$70 billion asset, after the Shuttle’s retirement is certainly detrimental from a strategic point of view. The USA will be dependent on the goodwill of international partners until an as-yet-unrealized commercial capability becomes available. However even then, the policy’s lack of support for having an independent federal capability is worrying, for it is tantamount to relying on FedEx without the back-up of a US postal service; or on commercial airlines without alternative military air transport; or on commercial weather forecasting without a National Oceanographic and Atmospheric Agency (NOAA).

## Constellation Solves – Capabilities Internal

### Constellation is critical to space leadership --- cancellation has crippled U.S. capabilities

Rob Bishop, Five Term United States Representative, 2-25-2010, “Space Cuts Short-Sighted”, Deseret News, http://www.deseretnews.com/article/700011837/Space-cuts-short-sighted.html

Roughly 40 years later, President Barack Obama has proposed a NASA budget that would end our efforts to get back to the moon, cancel the replacement for the space shuttle, cripple our capabilities in space and hurt our national security. This "one small budget step" would be a giant leap backward for American leadership in space and security. For years, we've known the space shuttle would be phased out. The replacement, which has already been through extensive research, development and testing, is the Ares rocket, part of the Constellation program. The Ares, named by Time magazine as the No. 1 invention of 2009, was successfully test-launched less than four months ago. NASA itself called it a "spectacular launch." Everything seemed on-course for America to retain a safe and reliable vehicle for space travel and maintain leadership in space — until Obama released his proposed budget this month. The Obama budget would cancel the Constellation program, cancel the Ares I rocket for manned space travel, cancel the Ares V rocket for cargo and cancel the Orion manned space capsule. The only apparent replacement for all of this is some nebulous funding for grants to commercialize our space exploration with no tested or proven alternative. It would be one thing if gutting the space program was an attempt to save money. But it isn't. In fact, the Obama plan does not eliminate wasteful spending. It actually adds an additional $1.5 billion to the NASA budget, but spends it in the wrong places. The president's proposals for NASA will, however, destroy U.S. leadership in space exploration. Russia and China will control space. Instead of sending 40 or so American astronauts to space each year, we will end up sending four or five. And they will essentially be trying to hitch a ride on a Russian or Chinese rocket. The Obama plan will also destroy 20,000 private sector jobs, if not more. By my estimation, we stand to lose around 2,000 jobs right here in Utah — a complete contradiction to an administration that say jobs are the priority. And these aren't minimum wage jobs. They are high-skilled jobs in science, math and engineering. This seems hypocritical from an administration that says it wants to encourage kids to take science, math and engineering classes.

## Constellation Solves – Morale Internal

### Constellation funding is critical to NASA’s morale

Neil Armstrong, First Man on the Moon and Former NASA Astronaut, Jim Lovell and Gene Cernan, Former Apollo Mission Commanders, 5-24-2011, “Is Obama Grounding JFK’s Space Legacy?”, USA Today, http://www.usatoday.com/news/opinion/forum/2011-05-24-Obama-grounding-JFK-space-legacy\_n.htm

President Obama's proposed 2011 budget did not include funds for Constellation, therefore essentially canceling the program. It sent shock waves throughout NASA, the Congress and the American people. Nearly $10 billion had been invested in design and development of the program. Many respected experts and members of Congress voiced concern about the president's proposal. Some supported the president's plan,but most were critical. The supporters' biases were often evident, particularly when there was a vested or economic interest in the outcome. Obama's advisers, in searching for a new and different NASA strategy with which the president could be favorably identified, ignored NASA's operational mandate and strayed widely from [President Kennedy's vision](http://www.americanrhetoric.com/speeches/jfkriceuniversity.htm) and the will of the American people. "We intend to be first. In short, our leadership in science and in industry, our hopes for peace and security, our obligations to ourselves as well as others, all require us to make this effort, to solve these mysteries, to solve them for the good of all men, and to become the world's leading space-faring nation." — President Kennedy Congress, realizing the devastating effects to the plans, program and morale of those trying to keep America in the forefront of exploring the universe and expanding the human frontier, worked diligently to steer NASA's program back toward Kennedy's goals. Congress passed an authorization bill directing NASA to begin development of a large rocket capable of carrying humans toward the moon and beyond and to continue development of a multipurpose spacecraft based on the configuration that was being developed in the Constellation program. However, the president's 2012 budget reduced funding significantly below the authorized amount for both the big rocket and the multipurpose crew vehicle. On the other hand, the president's budget had significantly increased funding over the congressional direction in the area of space technology research programs and the development of rockets and spacecraft by the commercial entrepreneurs. Congress stated that rather than depending on NASA subsidies, the development of commercial sources to supply cargo and crew to the International Space Station should be a partnership between government and industry. Entrepreneurs in the space transportation business assert that they can offer such service at a very attractive price — conveniently not factoring in the NASA-funded development costs. These expenditures, including funds to insure safety and reliability, can be expected to be substantially larger and more time consuming than the entrepreneurs predict. The response to Kennedy's bold challenge a half-century ago has led to America's unchallenged leadership in space. We take enormous pride in all that has been accomplished in the past 50 years. And we have the people, the skills and the wherewithal to continue to excel and reach challenging goals in space exploration. But today, America's leadership in space is slipping. NASA's human spaceflight program is in substantial disarray with no clear-cut mission in the offing. We will have no rockets to carry humans to low-Earth orbit and beyond for an indeterminate number of years. Congress has mandated the development of rocket launchers and spacecraft to explore the near-solar system beyond Earth orbit. But NASA has not yet announced a convincing strategy for their use. After a half-century of remarkable progress, a coherent plan for maintaining America's leadership in space exploration is no longer apparent.

## A2: Russia Solves

### Russia will cut off U.S. access to space

Charles Krauthammer, MD and Pulitzer Prize-Winning Columnist, 2-12-2010, “Closing the New Frontier”, <http://culberson.house.gov/preserving-americas-leadership-in-space/>

The Russians may be new at capitalism, but they know how it works. When you have a monopoly, you charge monopoly prices. Within months, Russia will have a monopoly on rides into space. By the end of this year, there will be no shuttle, no U.S. manned space program, no way for us to get into space. We’re not talking about Mars or the moon here. We’re talking about low-Earth orbit, which the United States has dominated for nearly half a century and from which it is now retiring with nary a whimper. Our absence from low-Earth orbit was meant to last a few years, the interval between the retirement of the fatally fragile space shuttle and its replacement with the Constellation program (Ares booster, Orion capsule, Altair lunar lander) to take astronauts more cheaply and safely back to space. But the Obama 2011 budget kills Constellation. Instead, we shall have nothing. For the first time since John Glenn flew in 1962, the United States will have no access of its own for humans into space — and no prospect of getting there in the foreseeable future.

## A2: Private Sector Solves

The private sector can’t fill in – not enough market demand

Newton and Griffin ’11– \*director for Space Policy in the Center for System Studies at the University of Alabama in Huntsville, former strategist at NASA Marshall Space Flight Center, AND \*\*physicist & space engineer, former Administrator of NASA, eminent scholar and professor of mechanical and aerospace engineering at the University of Alabama in Huntsville (Elizabeth and Michael, Space Policy, “United States space policy and international partnership” ScienceDirect)

2.4. Market creation

The president’s new policy endeavors to jump-start a private sector-led space transportation market by canceling plans for a government transportation system to deliver cargo and crew to low-Earth orbit and redirecting the funds toward procuring a yettobe developed commercial solution which proponents purport will be more cost-efficient. This decision has its curious origins in a juncture of circumstances: first, the Office of Management and Budget’s drive to downsize the agency; second, ascendant special interests over-anxious for market conditions that do not yet exist and frustrated with a status quo manifested in a mature bureaucracy’s methodical execution. Commercial demand for cargo and crew transport to low-Earth orbit is currently non-existent, and will be so for the foreseeable future, so it is specious to characterize the government’s paying for system development to meet limited government demand as ‘market creation’. Historically, market creation has occurred when the government’s long-term needs guaranteed a predictable and relatively high-volume of purchases, or when the government served as an anchor tenant, establishing a long-term need for service, rather than serving as an ‘investor of last resort’ to underwrite the entirety of system development because private capital markets will not. Space will only truly be brought into the USA’s economic sphere when some commercially viable enterprise is invented that either serves a stable user-base in space or that uses the resources of low-Earth orbit, the lunar surface, or other destinations. It is worth noting that an international, government lunar base would have constituted one such stable market for logistics and supplies that could have spawned a commercial market. ISS utilization, in contrast, will not require a comparable magnitude or frequency of service.

Government launch programs provide political cover for private sector problems – key to commercialization

Faith, 10 - independent technology consultant and Adjunct Fellow for Space Initiatives at the Center for Strategic and International Studies, (April 26, G. Ryan, “President Obama’s Vision for Space Exploration (part 2)”, “The Space Review”, http://www.thespacereview.com/article/1616/1)

For commercial crew transportation to be a strong and resilient element of the US civil space exploration, it will be important for the commercial providers themselves to diversify their income streams to move beyond reliance on NASA contracts alone. One obvious route would be for the United States to meet its crew transportation obligations to the international partners by purchasing seats on a commercial launch system. But for commercial transportation to further strengthen its political position, commercial providers must stimulate demand for transportation to LEO destinations other than the ISS. If commercial transportation services are able to respond to the inevitable questions about prices, risks, and delays by demonstrating that the prices and services being offered to the government are comparable to offers found in a free transportation market, this will provide valuable political cover. This could prove particular critical in the event of a Challenger- or Columbia-like disaster involving loss of crew and vehicle. In previous years, the response to such disasters involved extended periods of time when the transportation fleet was grounded, and the idea of continuing a human spaceflight program was called into question. In the event of such a disaster involving commercial spacecraft, if the commercial provider must rely solely on NASA contracts, being grounded for extended periods might jeopardize the existence of the company. Beyond that, since commercial providers would probably lack the political staying power of a program like the Space Shuttle or the ability to keep Congressional funds flowing while flights are halted, the odds of complete NASA withdrawal from a contract could be much higher.

NASA technology development is a prerequisite for private sector acceptance of risk

Aubrecht 9 - Vice Chairman, Vice President of Strategy and Technology at Moog, Inc, former aerospace engineer for Moog, Inc (Dr. Richard,. written testimony before a hearing on “Decisions on the Future Direction and Funding for Nasa: What Will They Mean for the U.S. Aerospace Workforce and Industrial Base?” by the Committee on Science and Technology, House of Representatives December 10, 2009. pgs 37-39. http://www.gpo.gov/fdsys/pkg/CHRG-111hhrg54449/pdf/CHRG-111hhrg54449.pdf ps)

In addition, Moog has developed a variety of other control components and systems with NASA for other launch vehicles, and various deep space and orbiting satellites such as Mars Science Laboratory and DAWN. As with the rocket engine steering controls, these NASA programs have always been the most challenging and pushed the envelope. Moog’s NASA experience on all these applications has enabled us to also provide the world’s best technologies for similar applications on DOD and commercial launch vehicles, all types of satellites and various missile interceptors. NASA has a history of setting very ambitious goals that drive the need for new technologies, designs and capabilities that are beyond what the Commercial space projects are willing or able to undertake. Once the capability and reliability of the components are demonstrated on NASA projects, the Commercial space suppliers are then confident in using these components on their vehicles. Not only Moog’s technologies benefit from these NASA projects. Our products incorporate technologies and components from several hundred companies. While some of these components are relatively standard, our innovative solutions for NASA require the majority of our vendors to push their designs to a higher level as well. So the benefit of the NASA programs becomes very widely spread. While I do not profess to be familiar with all aspects of the NASA vehicles, I am familiar with the technologies and components adjacent to our components. I can see the companies supplying these adjacent components have also similarly benefited from their NASA work.

It is no accident that the USA aerospace prime contractors and the hundreds of subcontractors have developed leadership positions on the vast majority of the relevant technologies. The NASA programs have clearly enabled USA companies to develop and maintain these leadership positions. A leadership position can be measured as a combination of performance, reliability, weight and cost. It is also clear that the Chinese, having watched NASA’s successes, have embarked on a very ambitious manned space program. Their expectation is for their space program to provide Chinese aerospace companies with the experience to challenge the USA’s leadership in commercial space and commercial aircraft.

## A2: Private Sector Solves

### Private sector launches fail --- and crush short-term space dominance

Charles Krauthammer, MD and Pulitzer Prize-Winning Columnist, 2-12-2010, “Closing the New Frontier”, <http://culberson.house.gov/preserving-americas-leadership-in-space/>

But the Obama 2011 budget kills Constellation. Instead, we shall have nothing. For the first time since John Glenn flew in 1962, the United States will have no access of its own for humans into space — and no prospect of getting there in the foreseeable future. Of course, the administration presents the abdication as a great leap forward: Launching humans will be turned over to the private sector, while NASA’s efforts will be directed toward landing on Mars. This is nonsense. It would be swell for private companies to take over launching astronauts. But they cannot do it. It’s too expensive. It’s too experimental. And the safety standards for getting people up and down reliably are just unreachably high. Sure, decades from now there will be a robust private space-travel industry. But that is a long time. In the interim, space will be owned by Russia and then China. The president waxes seriously nationalist at the thought of China or India surpassing us in speculative “clean energy.” Yet he is quite prepared to gratuitously give up our spectacular lead in human space exploration.

## A2: Mars Replacement Solves

### Mars isn’t a sustainable replacement --- its infeasible and will be axed in the medium-term

Charles Krauthammer, MD and Pulitzer Prize-Winning Columnist, 2-12-2010, “Closing the New Frontier”, <http://culberson.house.gov/preserving-americas-leadership-in-space/>

As for Mars, more nonsense. Mars is just too far away. And how do you get there without the stepping stones of Ares and Orion? If we can’t afford an Ares rocket to get us into orbit and to the moon, how long will it take to develop a revolutionary new propulsion system that will take us not a quarter-million miles but 35 million miles?

To say nothing of the effects of long-term weightlessness, of long-term cosmic ray exposure, and of the intolerable risk to astronaut safety involved in any Mars trip — six months of contingencies vs. three days for a moon trip.

Of course, the whole Mars project as substitute for the moon is simply a ruse. It’s like the classic bait-and-switch for high-tech military spending: Kill the doable in the name of some distant sophisticated alternative, which either never gets developed or is simply killed later in the name of yet another, even more sophisticated alternative of the further future. A classic example is the B-1 bomber, which was canceled in the 1970s in favor of the over-the-horizon B-2 stealth bomber, which was then killed in the 1990s after a production run of only 21 (instead of 132) in the name of post-Cold War obsolescence.

## Space Leadership Key to Hegemony

### Space leadership is key to intel and warfighting capabilities

A. Thomas Young, Chair – Institute for Defense Analyses Research Group, et al., July 2008, “Leadership, Management, and Organization for National Security Space”, [http://www.armyspace.army.mil/ASJ/Images/National\_Security\_S pace\_Study\_Final\_Sept\_16.pdf](http://www.armyspace.army.mil/ASJ/Images/National_Security_Space_Study_Final_Sept_16.pdf)

Today, U.S. leadership in space provides a vital national advantage across the scientific, commercial, and national security realms. In particular, space is of critical importance to our national intelligence and warfighting capabilities. The panel members nevertheless are unanimous in our conviction that, without significant improvements in the leadership and management of NSS programs, U.S. space preeminence will erode to the extent that space ceases to provide a competitive national security advantage. Space technology is rapidly proliferating across the globe, and many of our most important capabilities and successes were developed and fielded with a government technical workforce and a management structure that no longer exist.

### That’s key to overall U.S. hegemony

A. Thomas Young, Chair – Institute for Defense Analyses Research Group, et al., July 2008, “Leadership, Management, and Organization for National Security Space”, [http://www.armyspace.army.mil/ASJ/Images/National\_Security\_S pace\_Study\_Final\_Sept\_16.pdf](http://www.armyspace.army.mil/ASJ/Images/National_Security_Space_Study_Final_Sept_16.pdf)

*U.S. Leadership in Space is a Vital National Advantage*  Space capabilities underpin U.S. economic, scientific, and military leadership. The space enterprise is embedded in the fabric of our nation’s economy, providing technological leadership and sustainment of the industrial base. To cite but one example, the Global Positioning System (GPS) is the world standard for precision navigation and timing. Global awareness provided from space provides the ability to effectively plan for and respond to such critical national security requirements as intelligence on the military capabilities of potential adversaries, intelligence on Weapons of Mass Destruction (WMD) program proliferation, homeland security, and missile warning and defense. Military strategy, operations, and tactics are predicated upon the availability of space capabilities. The military use of space-based capabilities is becoming increasingly sophisticated, and their use in Operation Enduring Freedom and Operation Iraqi Freedom is pervasive.

## Space Leadership Key to Heg

### Space leadership is critical to all areas of effective warfighting --- multiple examples prove

Larry J. Schaefer, Lieutenant Colonel – United States Air Force, August 2002, “Sustained Space Superiority: A National Strategy for the United States”, Air War College Occasional Paper No. 30

*Importance of Space Superiority* The United States is very dependent on space for multiple aspects of its national security. The following section addresses how the United States depends on space for commerce and military activities. It describes how the dependence on space is growing at an extraordinary rate, which is likely to continue for many years. During the 1990s, the United States and the world gravitated towards an interconnected global economy. This condition was termed globalization and is described by Thomas Friedman in his book, The Lexus and the Olive Tree. The significant increases in communication capabilities and the proliferation of computer power changed the face of the world. The Tofflers identified this era as a new wave in the way commerce is conducted and wealth created. Tremendous changes have occurred in the past decade and the United States is trying to adjust to and leverage these changes. *Military Pressures* Military pressures to move away from the space as sanctuary mindset are likely to mount as U.S. national security is reshaped to fit a newly globalized world. The Bush and Clinton administrations adopted policies that made computer and communication capabilities available to the American population. These administrations also included the need to leverage information technologies in their National Security Strategies. Since the U.S. National Security Strategy depends on worldwide knowledge and access, the United States relies heavily on commercial and military space systems. The United States Department of Defense addressed its strategy for supporting these elements in Joint Vision 2020 and the National Military Strategy, both of which depend on information dominance and knowledge management to improve U.S. decision-making capabilities in war. To achieve this, the U.S. military will require robust sensors that can generate and process enormous amounts of data as well as communication capabilities for getting that data to processing centers where it can be transformed into militarily useful information and knowledge. Since we do not know when or where the next conflict will occur, sensors will require immediate access to all parts of the world, and similarly, global communications systems will be required to support these sensors. For these reasons, placing sensors and communications systems on satellites clearly supports these requirements. Just as the military will rely on space for these capabilities, the same will be true for commerce. Accordingly, the United States will need to protect its space platforms that support commerce and national security. There are many recent examples that demonstrate the growing U.S. dependence on space assets, including the Persian Gulf War and the use of space assets in the Balkans and Kosovo. The Persian Gulf War was the first space and information war in terms of the U.S. reliance on space assets and information technology for reconnaissance, weather, communications, and precision navigation. In fact, the U.S. Air Force continues to update its doctrine and theory of air power based on these efforts and military operations conducted in Kosovo. While NATO efforts in Kosovo were limited to air power, the emphasis on air power highlighted the advantages associated with space capabilities and that space was critical to NATO and U.S. efforts. The demand for near real time information puts pressure on the United States to shift from the space as sanctuary mindset to one of sustained space superiority. The pressures of a globalized world will increase the dependence of theater combatant commanders on information and communications to support military operations. Since U.S. national strategy depends on space systems, the United States is likely to need space control if it is to protect critical information and deny that information to adversaries. Other states have noted that the U.S. dependence on space systems is increasing. For example, Chinese officials have described space as a critical U.S. vulnerability and have identified striking at space systems as being a preferred approach for countries that cannot defeat the United States with conventional weapons. A paper supporting the Commission to Assess United States National Security Space Management documents additional threats that are forcing the United States to shift from a space sanctuary mindset. *Commercial Pressures* While the military's dependence on space is growing, the commercial sector is increasing so rapidly that there will be additional pressures to move toward space superiority. For example, the International Space Business Council identifies the space industry as a $96 billion business that could grow to roughly $170 billion by 2005. In addition, a number of U.S. companies achieved more than 100 percent growth in stock price during 1999 when the Iridium satellite communication system declared bankruptcy and was rejuvenated as a commercial venture. The first company to orbit a one-meter resolution imaging satellite was Space Imaging on September 24, 1999. It plans to capture thirty to forty percent of the commercial imagery market, which is estimated to be more than $6 billion per year by 2007 and growing at an annual rate of thirty-four percent. Recent decisions by the U.S. government to allow commercial firms to sell one-half meter resolution satellite imagery are generating a commercial sector that has extraordinary potential for growth. The International Space Station creates possibilities for other potential revenue producing space applications, such as medicine and biological processing. However, the growing dependence on space for commerce and national security means that the United States should prepare soon to protect its assets in space. For example, communications satellites have already been deliberately disrupted--Tongasat was jammed because of disagreements over possession of a geosynchronous orbit slot. Germany and China have developed "inspector" satellites. Germany developed its satellite in a partnership with Russia to inspect the MIR space station for damage. While the satellite failed to complete its mission, most of the technology necessary for performing operations near other satellites was demonstrated, and these same technologies can now be used to disrupt U.S. satellites. One satellite constellation that is susceptible to disruption is the Global Positioning System (GPS), which provides precise time and location information for global commercial, civil, and military users. For the military, these satellites supported precision bombing and navigation in the Persian Gulf War and Kosovo. The civilian community is highly dependent on GPS signals for aircraft and maritime navigation, and commercial applications range from navigation for recreational boating to electronic map functions in rental cars to establishing the timing signal that is necessary for worldwide telephone networks. The combined revenue for these commercial applications was estimated at $7.3 billion in the year 2000, and is expected to exceed $16 billion per year by 2005. In view of the importance of GPS satellites to U.S. national security, and the fact that that satellite signals are susceptible to jamming explains, in part, the U.S. Air Force's GPS modernization program that seeks to reduce the vulnerability to jamming. For these reasons, the GPS system is an important example of the difficulties associated with shifting from the ‘space is a sanctuary’ mindset. The GPS program is moving into the commercial sector, as a result of President Clinton's decision to provide the more precise military GPS signal to all users, which was motivated by commercial and civil pressures. At the same time, there have been discussions about shifting the management of GPS from the U.S. Air Force to the civil sector. Thus, the pressures of globalization are changing the relevance of the space as sanctuary mindset that dominates U.S. policy. The following section examines a framework for evolving a national strategy for space superiority.

## Heg Collapse Causes Nuclear War

### Global nuclear war

Alexei Arbatov, Member – Russian Academy of Sciences and Editor – Russia in Global Affairs, July/Sept 2007, “Is a New Cold War Imminent?”, Russia in Global Affairs, 5(3), <http://eng.globalaffairs.ru/numbers/20/1130.html>

However, the low probability of a new Cold War and the collapse of American unipolarity (as a political doctrine, if not in reality) cannot be a cause for complacency. Multipolarity, existing objectively at various levels and interdependently, holds many difficulties and threats. For example, if the Russia-NATO confrontation persists, it can do much damage to both parties and international security. Or, alternatively, if Kosovo secedes from Serbia, this may provoke similar processes in Abkhazia, South Ossetia and Transdniestria, and involve Russia in armed conflicts with Georgia and Moldova, two countries that are supported by NATO. Another flash point involves Ukraine. In the event of Kiev’s sudden admission into the North Atlantic Alliance (recently sanctioned by the U.S. Congress), such a move may divide Ukraine and provoke mass disorders there, thus making it difficult for Russia and the West to refrain from interfering. Meanwhile, U.S. plans to build a missile defense system in Central and Eastern Europe may cause Russia to withdraw from the INF Treaty and resume programs for producing intermediate-range missiles. Washington may respond by deploying similar missiles in Europe, which would dramatically increase the vulnerability of Russia’s strategic forces and their control and warning systems. This could make the stage for nuclear confrontation even tenser. Other “centers of power” would immediately derive benefit from the growing Russia-West standoff, using it in their own interests. China would receive an opportunity to occupy even more advantageous positions in its economic and political relations with Russia, the U.S. and Japan, and would consolidate its influence in Central and South Asia and the Persian Gulf region. India, Pakistan, member countries of the Association of Southeast Asian Nations and some exalted regimes in Latin America would hardly miss their chance, either. A multipolar world that is not moving toward nuclear disarmament is a world of an expanding Nuclear Club. While Russia and the West continue to argue with each other, states that are capable of developing nuclear weapons of their own will jump at the opportunity. The probability of nuclear weapons being used in a regional conflict will increase significantly. International Islamic extremism and terrorism will increase dramatically; this threat represents the reverse side of globalization. The situation in Afghanistan, Central Asia, the Middle East, and North and East Africa will further destabilize. The wave of militant separatism, trans-border crime and terrorism will also infiltrate Western Europe, Russia, the U.S., and other countries. The surviving disarmament treaties (the Non-Proliferation Treaty, the Conventional Armed Forces in Europe Treaty, and the Comprehensive Nuclear Test Ban Treaty) will collapse. In a worst-case scenario, there is the chance that an adventuresome regime will initiate a missile launch against territories or space satellites of one or several great powers with a view to triggering an exchange of nuclear strikes between them. Another high probability is the threat of a terrorist act with the use of a nuclear device in one or several major capitals of the world.

## Space Leadership Key to Competitiveness

### Space leadership is slipping --- risks undercutting key drivers of U.S. economic competitiveness

J.P. Stevens, Vice President for Space Systems – Aerospace Industries Association, 2011, “Maintain U.S. Global Leadership in Space”, http://www.aia-aerospace.org/issues\_policies/space/maintain/

U.S. space efforts — civil, commercial and national security — drive our nation’s competitiveness, economic growth and innovation. To maintain U.S. preeminence in this sector and to allow space to act as a technological driver for current and future industries, our leadership must recognize space as a national priority and robustly fund its programs. Space technologies and applications are essential in our everyday lives. Banking transactions, business and personal communications as well as emergency responders, airliners and automobiles depend on communications and GPS satellites. Weather and remote sensing satellites provide lifesaving warnings and recurring global measurements of our changing Earth. National security and military operations are deeply dependent upon space assets. The key to continuing U.S. preeminence is a cohesive coordination body and a national space strategy. Absent this, the myriad government agencies overseeing these critical systems may make decisions based upon narrow agency requirements. The U.S. space industrial base consists of unique workforce skills and production techniques. The ability of industry to meet the needs of U.S. space programs depends on a healthy industrial base. U.S. leadership in space cannot be taken for granted. Other nations are learning the value of space systems; the arena is increasingly contested, congested and competitive. Strong government leadership at the highest level is critical to maintaining our lead in space and must be supported by a healthy and innovative industrial sector.

## Economy Impact – Royal 2010

### Economic decline causes global war

Jedediah Royal, Director of Cooperative Threat Reduction – U.S. Department of Defense, 2010, “Economic Integration, Economic Signaling and the Problem of Economic Crises”, Economics of War and Peace: Economic, Legal and Political Perspectives, Ed. Goldsmith and Brauer, p. 213-215

Less intuitive is how periods of economic decline may increase the likelihood of external conflict. Political science literature has contributed a moderate degree of attention to the impact of economic decline and the security and defence behaviour of interdependent states. Research in this vein has been considered at systemic, dyadic and national levels. Several notable contributions follow. First, on the systemic level, Pollins (2008) advances Modelski and Thompson's (1996) work on leadership cycle theory, finding that rhythms in the global economy are associated with the rise and fall of a pre-eminent power and the often bloody transition from one pre-eminent leader to the next. As such, exogenous shocks such as economic crises could usher in a redistribution of relative power (see also Gilpin. 1981) that leads to uncertainty about power balances, increasing the risk of miscalculation (Feaver, 1995). Alternatively, even a relatively certain redistribution of power could lead to a permissive environment for conflict as a rising power may seek to challenge a declining power (Werner. 1999). Separately, Pollins (1996) also shows that global economic cycles combined with parallel leadership cycles impact the likelihood of conflict among major, medium and small powers, although he suggests that the causes and connections between global economic conditions and security conditions remain unknown. Second, on a dyadic level, Copeland's (1996, 2000) theory of trade expectations suggests that 'future expectation of trade' is a significant variable in understanding economic conditions and security behaviour of states. He argues that interdependent states are likely to gain pacific benefits from trade so long as they have an optimistic view of future trade relations. However, if the expectations of future trade decline, particularly for difficult to replace items such as energy resources, the likelihood for conflict increases, as states will be inclined to use force to gain access to those resources. Crises could potentially be the trigger for decreased trade expectations either on its own or because it triggers protectionist moves by interdependent states.4 Third, others have considered the link between economic decline and external armed conflict at a national level. Blomberg and Hess (2002) find a strong correlation between internal conflict and external conflict, particularly during periods of economic downturn. They write: The linkages between internal and external conflict and prosperity are strong and mutually reinforcing. Economic conflict tends to spawn internal conflict, which in turn returns the favour. Moreover, the presence of a recession tends to amplify the extent to which international and external conflicts self-reinforce each other. (Blomberg & Hess, 2002. p. 89) Economic decline has also been linked with an increase in the likelihood of terrorism (Blomberg, Hess, & Weerapana, 2004), which has the capacity to spill across borders and lead to external tensions. Furthermore, crises generally reduce the popularity of a sitting government. "Diversionary theory" suggests that, when facing unpopularity arising from economic decline, sitting governments have increased incentives to fabricate external military conflicts to create a 'rally around the flag' effect. Wang (1996), DeRouen (1995). and Blomberg, Hess, and Thacker (2006) find supporting evidence showing that economic decline and use of force are at least indirectly correlated. Gelpi (1997), Miller (1999), and Kisangani and Pickering (2009) suggest that the tendency towards diversionary tactics are greater for democratic states than autocratic states, due to the fact that democratic leaders are generally more susceptible to being removed from office due to lack of domestic support. DeRouen (2000) has provided evidence showing that periods of weak economic performance in the United States, and thus weak Presidential popularity, are statistically linked to an increase in the use of force. In summary, recent economic scholarship positively correlates economic integration with an increase in the frequency of economic crises, whereas political science scholarship links economic decline with external conflict at systemic, dyadic and national levels.5 This implied connection between integration, crises and armed conflict has not featured prominently in the economic-security debate and deserves more attention.

## Ext – Global Econ Internal

### Satellite disruption destroys the global economy

Michael Kraig, and Michael Roston, “Nuclear-Tipped Foolishness”, Foreign Policy in Focus, 5-1-2002, <http://www.fpif.org/articles/nuclear-tipped_foolishness>

Most commercial communications satellites are in low earth orbit. In their role as conduits for rapid information exchange, they form the backbone of the global economy, and their destruction would chaotically disrupt international markets. Furthermore, the diplomatic consequences of destroying all other countries' LEO satellites in such a strike (including those of our allies) would be almost unimaginable. And the effects would go well beyond economic and diplomatic. Weather prediction and monitoring satellites would also be badly degraded, undermining everything from U.S. military operations to worldwide shipping and transportation to disaster prevention. In addition, crucial military imaging systems such as the Lacrosse, KH-11, and KH-12 photo-reconnaissance satellites would eventually be disabled as well.

## 1ac – Industrial Base Adv

### Cancelling Constellation has a negative impact across the domestic industrial base --- interlinked supply means NASA’s decision will turn aerospace workers away from the DoD

Jim Hillhouse, Former Space Shuttle Technician and Columnist – AmericaSpace, 2-14-2010, “Obamas Move To End Constellation Prompts Industrial Base Questions”, AmericaSpace, <http://www.americaspace.org/?p=1034>

According to the article, people from Rep. Bob Bishop, whose Utah Congressional district includes ATK, the maker of the Constellation first stage, to Marion Blakey of the Aerospace Industries Association, have expressed concerns that canceling Constellation could have a long-term, negative impact on the nation’s ability in solid motors, launch and range infrastructure, and aerospace workers. Once [lost aerospace workers are] out the door and in the unemployment lines, they’re not coming back. Representative Bishop stated in the interview with Space News that, It’s not a spigot you can turn on and off, Bishop said in a Feb. 9 interview. Once they’re out the door and in the unemployment lines, they’re not coming back. Aerospace Industries Association president Blakey, in a February 3rd statement, Although investment in commercial space will create new opportunities, we are concerned that the cancellation of the Constellation program may have a lasting impact on our workforce and the unique skills they bring to our industrial base. According to Gary Payton, a retired military astronaut and currently DoD’s Undersecretary for Space Programs, We share an industrial base with NASA — on solids, liquids, range infrastructure and a work force, he said during a media roundtable here organized by the Space Foundation. So, with the cancellation of the Constellation program … we have got a lot of work to do with NASA to figure out how to maintain a minimum industrial base on liquid-rocket engines and solid-rocket motors. Of some interest is the statement on February 12 by NASA senior management that Administrator Charles Bolden consulted senior Pentagon officials, including Deputy Defense Secretary William Lynn and Pentagon acquisition chief Ashton Carter, about the industrial base ramifications of canceling Constellation. According to NASA’s Deputy Administrator Garver, Very senior discussions were held over the last six months between NASA and [the Defense Department] on this topic, so it is not something that was not discussed. I feel industrial base issues are completely legitimate because having the best defense industrial and technology base in the world is not a birthright. Last year, Undersecretary Carter stated that [industrial base issues need to have a higher priority](http://www.defensenews.com/story.php?i=4266169) in future decisions by those in government when making decisions about whether or not to cancel advanced technology programs. Carter said on September 9, 2009, I feel industrial base issues are completely legitimate because having the best defense industrial and technology base in the world is not a birthright.

### *Uncertain* space policy causes short-term price spikes that ripple through the defense budget

Jim Maser, Chair of the Corporate Membership Committee – American Institute of Aeronautics and Astronautics and President – Pratt & Whitney Rocketdyne, 3-30-2011, “A Review of NASA’s Exploration Program in Transition: Issues for Congress and Industry”, U.S. House Science, Space, and Technology Committee Hearing, <http://www.prattwhitney.com/media_center/executive_speeches/jim_maser_03-30-2011.asp>

Access to space plays a significant part in the Department of Defense’s ability to secure our nation. The lack of a unified national strategy brings uncertainty in volume, meaning that fixed costs will go up in the short term across all customers until actual demand levels are understood. Furthermore, the lack of space policy will have ripple effects in the defense budget and elsewhere, raising costs when it is in everyone’s interests to contain costs. Now, it is of course true that there are uncertainties about the best way to move forward. This was true in the early days of space exploration and in the Apollo and Shuttle eras. Unfortunately, we do not have the luxury of waiting until we have all the answers. We must not “let the best be the enemy of the good.” In other words, selecting a configuration that we are absolutely certain is the optimum configuration is not as important as expeditiously selecting one of the many workable configurations, so that we can move forward. This industry has smart people with excellent judgment, and we will figure the details out, but not if we don’t get moving soon. NASA must initiate SLS and MPCV efforts without gapping the program efforts already in place intended to support Constellation. The time for industry and government to work together to define future space policy is now. We must establish an overarching policy that recognizes the synergy among all government space launch customers to determine the right sustainable industry size, and plan on funding it accordingly. The need to move with clear velocity is imperative if we are to sustain our endangered U.S. space industrial base, to protect our national security, and to retain our position as the world leader in human spaceflight and space exploration. I believe that if we work together we can achieve these goals. We are ready to help in any way that we can. But the clock is ticking.

## 1ac – Industrial Base Adv

### The plan’s key to send a signal that reassures business and allows clear planning --- averts high costs and workforce shortages that will collapse aerospace

Jim Maser, Chair of the Corporate Membership Committee – American Institute of Aeronautics and Astronautics and President – Pratt & Whitney Rocketdyne, 3-30-2011, “A Review of NASA’s Exploration Program in Transition: Issues for Congress and Industry”, U.S. House Science, Space, and Technology Committee Hearing, <http://www.prattwhitney.com/media_center/executive_speeches/jim_maser_03-30-2011.asp>

It is true that we face many other significant challenges and that our country is going through a period of transition. However, we must not lose sight of the fact that the aerospace industry directly employs more than 800,000 people across the country, and supports more than two million middle class jobs and 30,000 suppliers from all 50 states, with total industry sales in 2010 exceeding $216B. As a result, the health of the aerospace engineering and manufacturing base in America is a crucial element of our continued economic recovery and employment growth. But in addition to that, the aerospace industry is unique in its contribution to national security. And if the highly skilled aerospace workforce in the United States is allowed to atrophy, it will have widespread consequences for our future wellbeing and success as a nation. The U.S. space community is at a crossroads and facing an uncertain future that is unlike any we have seen in decades. This uncertainty significantly impacts our nation’s ability to continue exploring space without being dependent on foreign providers. It also has implications for our national security and the U.S. industrial base. Thirteen months ago, NASA administrator Charlie Bolden called me, as well as several other aerospace manufacturers, to tell us that the Constellation program had been cancelled. \In the 13 months since that call, NASA has yet to identify a strategy to replace the Space Shuttle.  There does not appear to be consensus within the Administration regarding the need for the Space Launch System (SLS) and Multi-Purpose Crew Vehicle (MPCV), and clearly there is not a consensus between Congress and the Administration on NASA’s priorities. This uncertainly has our industry partners and suppliers very concerned about how we can position our businesses to meet NASA’s needs, while retaining our critical engineering and manufacturing talent. It is creating a gap which our industry will not be able to fill. When the Apollo program ended in 1975, there was a gap of about six years prior to the first flight of the Space Shuttle program. However, the Shuttle program had been formally announced in January 1972. So, although there was a gap in U.S. human spaceflight, there was not a gap in work on the next generation system. Clearly this transition was difficult for industry. NASA budgets were reduced but the industry adapted to this new reality. During the Space Shuttle era, we saw NASA budgets flattening, declining to less than one percent of the federal budget. And although the space industry would have liked to have seen overall increases, we knew how to plan our business, how to invest, how to meet our customers’ needs, and how to compete. But the situation now is much worse. It poses a much greater risk to the U.S. space community, to the engineering workforce, and to U.S. leadership in space. The difference between the Apollo-Shuttle transition and the Shuttle-next generation space exploration system transition is the perilous unknown. We simply do not know what is next. Congress passed an authorization bill that directs NASA how to move to the next generation program. But NASA has said that due to the Constellation contractual obligations they are limited in moving forward with the Authorization bill. This situation is creating a host of problems, and it urgently needs to change. If NASA is going to be relieved of Constellation obligations, we need to know how the workforce will be transitioned and how the many financial investments will be utilized for future exploration efforts. Whereas the Apollo-Shuttle transition created a gap in U.S. human access to space, this next transition is creating a gap in direction, purpose, and in future capabilities. In order to adequately plan for the future and intelligently deploy resources, the space community needs to have clear goals. Up until two years ago, we had a goal. We had a national space strategy and the plan to support it. Unfortunately, at this point, that plan no longer exists. This lack of a unified strategy coupled with the fact that the NASA transition is being planned without any coordination with industry leaders, makes it impossible for businesses like mine to adequately plan for the future. How can we right-size our businesses and work towards achieving greatest efficiency if we can’t define the future need? This is an impossible task. So, faced with this uncertainty, companies like mine continue fulfilling Constellation requirements pursuant to the Congressional mandate to capitalize on our investment in this program, but we are doing so at significantly reduced contractual baseline levels, forcing reductions in force at both the prime contractor and subcontractor levels. This reality reflects the fact that the space industrial base is not FACING a crisis; we are IN a crisis. And we are losing a National Perishable Asset ... our unique workforce. The entire space industrial base is currently being downsized with no net gain of jobs. At the same time we are totally unclear as to what might be the correct levels needed to support the government. Designing, developing, testing, and manufacturing the hardware and software to explore space requires highly skilled people with unique knowledge and technical expertise which takes decades to develop. These technical experts cannot be grown overnight, and once they leave the industry, they rarely return. If the U.S. develops a tremendous vision for space exploration five years from now, but the people with these critical skills have not been preserved and developed, that vision will disappear. We need that vision, that commitment, that certainty right now, not five or ten years from now, if we are going to have a credible chance of bringing it to fruition. In addition to difficulties in retaining our current workforce, the uncertainty facing the U.S. space program is already having a negative impact on our industry’s ability to attract new talent from critical science, technology, engineering and mathematics. Young graduates who may have been inspired to follow STEM education plans because of their interest in space and space exploration look at the industry now and see no clear future. This will have implications on the space industrial base for years to come.

## 1ac – Industrial Base Adv

### Aerospace decline spills over, collapsing U.S. air power

David Thompson, President – American Institute of Aeronautics and Astronautics, 12-10-2009, “The Aerospace Workforce”, Federal News Service, Lexis

Aerospace systems are of considerable importance to U.S. national security, economic prosperity, technological vitality, and global leadership. Aeronautical and space systems protect our citizens, armed forces, and allies abroad. They connect the farthest corners of the world with safe and efficient air transportation and satellite communications, and they monitor the Earth, explore the solar system, and study the wider universe. The U.S. aerospace sector also contributes in major ways to America's economic output and high- technology employment. Aerospace research and development and manufacturing companies generated approximately $240 billion in sales in 2008, or nearly 1.75 percent of our country's gross national product. They currently employ about 650,000 people throughout our country. U.S. government agencies and departments engaged in aerospace research and operations add another 125,000 employees to the sector's workforce, bringing the total to over 775,000 people. Included in this number are more than 200,000 engineers and scientists -- one of the largest concentrations of technical brainpower on Earth. However, the U.S. aerospace workforce is now facing the most serious demographic challenge in his 100-year history. Simply put, today, many more older, experienced professionals are retiring from or otherwise leaving our industrial and governmental aerospace workforce than early career professionals are entering it. This imbalance is expected to become even more severe over the next five years as the final members of the Apollo-era generation of engineers and scientists complete 40- or 45-year careers and transition to well-deserved retirements. In fact, around 50 percent of the current aerospace workforce will be eligible for retirement within just the next five years. Meanwhile, the supply of younger aerospace engineers and scientists entering the industry is woefully insufficient to replace the mounting wave of retirements and other departures that we see in the near future. In part, this is the result of broader technical career trends as engineering and science graduates from our country's universities continue a multi-decade decline, even as the demand for their knowledge and skills in aerospace and other industries keeps increasing. Today, only about 15 percent of U.S. students earn their first college degree in engineering or science, well behind the 40 or 50 percent levels seen in many European and Asian countries. Due to the dual-use nature of aerospace technology and the limited supply of visas available to highly-qualified non-U.S. citizens, our industry's ability to hire the best and brightest graduates from overseas is also severely constrained. As a result, unless effective action is taken to reverse current trends, the U.S. aerospace sector is expected to experience a dramatic decrease in its technical workforce over the next decade. Your second question concerns the implications of a cutback in human spaceflight programs. AIAA's view on this is as follows. While U.S. human spaceflight programs directly employ somewhat less than 10 percent of our country's aerospace workers, its influence on attracting and motivating tomorrow's aerospace professionals is much greater than its immediate employment contribution. For nearly 50 years the excitement and challenge of human spaceflight have been tremendously important factors in the decisions of generations of young people to prepare for and to pursue careers in the aerospace sector. This remains true today, as indicated by hundreds of testimonies AIAA members have recorded over the past two years, a few of which I'll show in brief video interviews at the end of my statement. Further evidence of the catalytic role of human space missions is found in a recent study conducted earlier this year by MIT which found that 40 percent of current aerospace engineering undergraduates cited human space programs as the main reason they chose this field of study. Therefore, I think it can be predicted with high confidence that a major cutback in U.S. human space programs would be substantially detrimental to the future of the aerospace workforce. Such a cutback would put even greater stress on an already weakened strategic sector of our domestic high-technology workforce. Your final question centers on other issues that should be considered as decisions are made on the funding and direction for NASA, particularly in the human spaceflight area. In conclusion, AIAA offers the following suggestions in this regard. Beyond the previously noted critical influence on the future supply of aerospace professionals, administration and congressional leaders should also consider the collateral damage to the space industrial base if human space programs were substantially curtailed. Due to low annual production rates and highly-specialized product requirements, the domestic supply chain for space systems is relatively fragile. Many second- and third-tier suppliers in particular operate at marginal volumes today, so even a small reduction in their business could force some critical suppliers to exit this sector. Human space programs represent around 20 percent of the $47 billion in total U.S. space and missile systems sales from 2008. Accordingly, a major cutback in human space spending could have large and highly adverse ripple effects throughout commercial, defense, and scientific space programs as well, potentially triggering a series of disruptive changes in the common industrial supply base that our entire space sector relies on.

## 1ac – Industrial Base Adv

### That sparks global WMD conflict

Ashley Tellis, Senior Political Scientist – RAND, 1998, “Sources of Conflict in the 21st Century”, http://www.rand. org/publications/MR/MR897/MR897.chap3.pdf

This subsection attempts to synthesize some of the key operational implications distilled from the analyses relating to the rise of Asia and the potential for conflict in each of its constituent regions. The first key implication derived from the analysis of trends in Asia suggests that American air and space power will continue to remain critical for conventional and unconventional deterrence in Asia. This argument is justified by the fact that several subregions of the continent still harbor the potential for full-scale conventional war. This potential is most conspicuous on the Korean peninsula and, to a lesser degree, in South Asia, the Persian Gulf, and the South China Sea. In some of these areas, such as Korea and the Persian Gulf, the United States has clear treaty obligations and, therefore, has preplanned the use of air power should contingencies arise. U.S. Air Force assets could also be called upon for operations in some of these other areas. In almost all these cases, U.S. air power would be at the forefront of an American politico-military response because (a) of the vast distances on the Asian continent; (b) the diverse range of operational platforms available to the U.S. Air Force, a capability unmatched by any other country or service; (c) the possible unavailability of naval assets in close proximity, particularly in the context of surprise contingencies; and (d) the heavy payload that can be carried by U.S. Air Force platforms. These platforms can exploit speed, reach, and high operating tempos to sustain continual operations until the political objectives are secured. The entire range of warfighting capability—fighters, bombers, electronic warfare (EW), suppression of enemy air defense (SEAD), combat support platforms such as AWACS and J-STARS, and tankers—are relevant in the Asia-Pacific region, because many of the regional contingencies will involve armed operations against large, fairly modern, conventional forces, most of which are built around large land armies, as is the case in Korea, China-Taiwan, India-Pakistan, and the Persian Gulf. In addition to conventional combat, the demands of unconventional deterrence will increasingly confront the U.S. Air Force in Asia. The Korean peninsula, China, and the Indian subcontinent are already arenas of WMD proliferation. While emergent nuclear capabilities continue to receive the most public attention, chemical and biological warfare threats will progressively become future problems. The delivery systems in the region are increasing in range and diversity. China already targets the continental United States with ballistic missiles. North Korea can threaten northeast Asia with existing Scud-class theater ballistic missiles. India will acquire the capability to produce ICBM-class delivery vehicles, and both China and India will acquire long-range cruise missiles during the time frames examined in this report.

## 1ac – Industrial Base Adv – Missile Defense Module

### Funding Constellation is critical to successful missile defense --- cuts will leave the U.S. vulnerable to attacks by North Korea and Iran

Rob Bishop, Five Term United States Representative, 2-25-2010, “Space Cuts Short-Sighted”, Deseret News, http://www.deseretnews.com/article/700011837/Space-cuts-short-sighted.html?pg=2

Finally, and perhaps most importantly, canceling the Constellation program and the Ares rocket will harm U.S. missile defense efforts and our national security. The same kinds of jobs and technology needed to send men to the moon are the same set of skills needed to build defensive missiles. Whether it's lifting man or missiles into space, the skilled work force and solid rocket motors come from the same industrial base. When you cut one, you hurt the other. Last year, the administration cut our U.S. missile defense system and some jobs were lost. The cancellation of Constellation would essentially wipe out the rest. This would destroy the U.S. industrial base and make us militarily vulnerable to countries like North Korea and Iran. A report to Congress last year pointed out that delays in the NASA Ares program could have "significant negative impact" on the industrial base for missile production. If delays are "significant" an outright cancellation would be overwhelming. We will lose not just our capabilities for space exploration, but our capability to protect our homeland. Our nation will be less secure. Maintaining leadership in space and creating jobs is important, but fulfilling our constitutional duty to provide for the common defense is an absolute must.

### North Korea will use bioweapons --- including smallpox

Sung-Ki Jung, “N. Korea Has 13 Types of Biological Weapons”, Korea Times, 10-5-2009, http://www.koreatimes.co.kr/www/news/nation/2009/10/113\_52961.html

North Korea is believed to possess 13 types of viruses and germs that it can readily use in the event of a conflict, a ruling party lawmaker said Monday, citing a defense ministry report. The North is believed to be one of the world's largest possessors of chemical and biological weapons. South Korea suspects the communist neighbor has up to 5,000 tons of chemical agents. During a National Assembly audit of the Ministry of National Defense, Rep. Kim Ock-lee of the Grand National Party said diseases that could be caused by North Korean biological weapons include cholera, pest, yellow fever, smallpox, eruptive typhus, typhoid fever and dysentery.

### Extinction

Clifford E. Singer, Professor of Nuclear Engineering and Director of the Program in Arms Control, Disarmament, and International Security – University of Illinois at Urbana-Champaign, 2001, “Will Mankind Survive the Millennium?”, http://www.acdis.uiuc.edu/research/S&Ps/2001-Sp/S&P\_XIII/Singer.htm

There are, however, two technologies currently under development that may pose a more serious threat to human survival. The first and most immediate is biological warfare combined with genetic engineering. Smallpox is the most fearsome of natural biological warfare agents in existence. By the end of the next decade, global immunity to smallpox will likely be at a low unprecedented since the emergence of this disease in the distant past, while the opportunity for it to spread rapidly across the globe will be at an all time high. In the absence of other complications such as nuclear war near the peak of an epidemic, developed countries may respond with quarantine and vaccination to limit the damage. Otherwise mortality there may match the rate of 30 percent or more expected in unprepared developing countries. With respect to genetic engineering using currently available knowledge and technology, the simple expedient of spreading an ample mixture of coat protein variants could render a vaccination response largely ineffective, but this would otherwise not be expected to substantially increase overall mortality rates. With development of new biological technology, however, there is a possibility that a variety of infectious agents may be engineered for combinations of greater than natural virulence and mortality, rather than just to overwhelm currently available antibiotics or vaccines. There is no a priori known upper limit to the power of this type of technology base, and thus the survival of a globally connected human family may be in question when and if this is achieved.

## Industrial Base Declining Now

### Defense industrial base is being eroded --- there are already shortfalls

Steven Capozzola, Media Director – Alliance for American Manufacturing, 4-14-2011, “What Remains of the U.S. Defense Industrial Base?”, American Manufacturing Blog, <http://www.americanmanufacturing.org/blog/what-remains-us-defense-industrial-base>

[A new report](http://www.aflcio.org/issues/jobseconomy/manufacturing/upload/manufsumm_092010.pdf)commissioned by the AFL-CIO Industrial Union Council and authored by Dr. Joel Yudken finds that the ongoing erosion of the U.S. manufacturing base has left critical holes in the America's national security.  Yudken's report, [Manufacturing Insecurity](http://www.aflcio.org/issues/jobseconomy/manufacturing/upload/manufsumm_092010.pdf), reports that "there are advanced technologies critical to military systems—armor plate steel, defense-specific integrated circuits, night vision goggles—for which domestic sources are inadequate." Yudken says that significant numbers of items once supplied by U.S. manufacturers are now obtained from foreign suppliers because they are "not readily available from U.S. producers."  He cites Col. Michael Cole, of the U.S. Joint Forces Command, who observes: the problem is not just a matter of a handful of highly specialized items designed to meet narrow defense requirements, but the “eradication of U.S. industry capability.” He also warns that current strategies to deal with an industrial base that increasingly is unable to supply the military with manufactured parts and electronic components are not working. [Manufacturing Insecurity](http://www.aflcio.org/issues/jobseconomy/manufacturing/upload/manufsumm_092010.pdf)examines how much of U.S. industrial defense capability has been eroded and looks at the potential weakening of America’s defense industrial base in the coming decades.

### Aerospace sector is weak

Ian Goold, Staff – Aviation News, 7-25-2010, “Turbulent ride awaits aerospace and defense, says business study”, AIN Online, http://www.ainonline.com/news/single-news-page/article/turbulent-ride-awaits-aerospace-and-defense-says-business-study-25609/

Economic Forecast for Aerospace: Headwinds Ahead AlixPartners’ 2010 Global Aerospace & Defense Review cites several factors that could cause the economic recovery to be slow over the next two years: \* Global aircraft deliveries were down 9 percent in January-March 2010, while aircraft orders (which dropped 70 percent in 2009) have only partially recovered. \* Airline passenger traffic was down 7.5 percent and cargo down 22 percent in the 12 months prior to April 2010. \* Signs point to big cuts in defense spending ahead, as the U.S. and other countries’ defense departments face fallout from the world financial crisis. \*Continued weak demand for business jets will continue, due to still fragile corporate profits and a “politically incorrect” image. \* Consumer disposable income will be cut further by government deficit-reduction efforts, as reinforced in recent G20 meetings.

## Air Power Declining Now

### Air power is declining --- boosting the industrial base is critical to reverse the trend

Kent Hughes, Director – Program on America and the Global Economy, 1-4-2011, “The Defense Industrial Base at Risk”, America and the Global Economy, <http://americaandtheglobaleconomy.wordpress.com/2011/01/04/the-defense-industrial-base-at-risk/>

For decades America has remained at the forefront of both industrial innovation and national defense. These twin pillars of American strength now exist in a challenging climate beset by uncertain economic and political realities. On December 6th, the Reserve Officers Association and the Woodrow Wilson Center’s Program on America and the Global Economy hosted a half day event that included Members of Congress and policy and industry experts to discuss these and other issues as they relate to the state of America’s defense industrial base. The speakers provided a number of unique perspectives and touched on a number of key elements affecting the defense industrial base that ranged from the defense budget and the push to reduce the country’s fiscal deficit to technological developments and the future U.S. international power. Following welcoming remarks by Bob Feidler of the Reserve Officers Association, Lt. Gen. Michael Dunn (Ret.), President of the Air Force Association, provided a war-fighter’s perspective on the declining defense industrial base. “The bottom line,” he began, “is yes, the industrial base is in trouble.” Emphasizing the preeminent supremacy of American airpower throughout his speech, he noted the antiquated state of the air fleet today, citing a number of planes that are aging. Dunn argued that while the U.S. Air Force has long been America’s “asymmetric advantage,” the balance is no longer as one sided as it has been in the past as nations like Russia and China continue to build up their respective air fleets. Dunn reiterated the drastic need for greater plane procurement, insisting that the U.S. is not buying enough planes to sustain its military strength.

### Key aerospace suppliers are extremely marginal --- NASA-driven demand is critical to prevent catastrophic closures that erode military access to technology

Air Force Association, 2010, “Cancellation of NASA’s Constellation Program”, <http://www.afa.org/edop/2010/nasas_constellation_program.asp>

There is no question that the cancellation of the Constellation program will result in the elimination of tens of thousands of jobs around the country. Not only will major suppliers feel the impact, but so will second and third tier suppliers, not to mention other collateral business fallout. The magnitude of the job loss is catastrophic enough, particularly when the nation is experiencing an unemployment rate of nearly 10%, but compounding the effect is the fact that jobs being lost are exactly the types we would like to retain if we are serious about remaining in a position of world leadership…highly technical design, engineering, and manufacturing jobs, most of which are fairly high paying. There is also a significant negative impact on the United States aerospace industrial base. As an example, we currently have but one or two companies in this country that can reliably produce large scale solid rocket boosters. The elimination of Constellation eliminates the need to produce those boosters, and as a result, the capability to do so will likely wither away. There is money in the NASA budget for research on large rockets, but there is a huge difference between R&D capability and production capability. Let us also not forget that our Armed Forces depend on these same companies to produce large missiles and boosters for our national defense. The DOD is not currently procuring enough large missile or booster systems to keep these companies afloat, either. In fact, it was the combination of military and NASA business that enabled a booster production capability to be maintained in this country. Since the NASA aerospace industrial base and the DOD aerospace industrial base are inherently intertwined, a significant negative impact on one has the same impact on the other.

## A2: Industrial Base Resilient

### Industrial base is dynamic and prone to rapid collapse --- strong demand is critical to build-in resilience

Steven A. Melnyk, Ph.D., Professor of Operations and Supply Chain Management – Michigan State University, et al., April 2011, “Recovering the Domestic Aerospace and Defense Industrial Base”, [http://www.ndia.org/Divisions/ Divisions/Manufacturing/Documents/White%20Papers%202011/NDIA%20White%20Paper-Recovering%20A-D%20Industrial%20Base\_FINAL.pdf](http://www.ndia.org/Divisions/Divisions/Manufacturing/Documents/White%20Papers%202011/NDIA%20White%20Paper-Recovering%20A-D%20Industrial%20Base_FINAL.pdf)

The supply chain and its associated supplier base significantly influence the ability of the firm or industry to achieve the desired outcomes of cost, quality, responsiveness, resilience, security, sustainability, and innovation (Melnyk, Davis, Spekman, & Sandor, 2010b). With this recognition of the importance of the supply chain also comes the awareness that, for the supply chain and the supplier base to support and meet the objectives and needs of its customer, the supply chain should be healthy, dynamic, and vibrant (Melnyk, Cooper, Griffis, Macdonald & Phillips, 2010a). Key to this requirement is the ability of the industry to be able to attract and retain qualified suppliers at all tiers—first, second, third and beyond. This ability is critical because supply chains are inherently dynamic, with existing suppliers leaving for such reasons as bankruptcy, acquisition, or changes in strategic direction. The domestic suppliers who have left the A&D industry must be replaced by new suppliers who can quickly fill in the gap. Attracting and retaining the “right” qualified suppliers is not an easy task. It involves more than simply discovering these suppliers (Melnyk et al., 2010a); it involves the challenge of “attractiveness.” For the A&D industry, this means assessing how attractive this industry is to these potential suppliers. This is especially critical when dealing with domestic SMEs. In today’s environment, it is important to remember that the A&D industry is not the only industry seeking out qualified SMEs; this industry is in competition with other industries (e.g., medical, energy, automotive) for the same firms. The NDIA survey yields significant implications of the lack of attractiveness of the A&D industry and its inability to attract and retain qualified domestic suppliers. These results are best understood in the context of today’s A&D supply chains. Of particular note is the growing importance of small- to medium-sized manufacturers in the supply chain as the large “primes” and first-tier suppliers shift more to being integrators.

## Airpower Impacts – Hegemony

### Air power sustains U.S. leadership and makes power projection credible

Richard Hazdra, Major – USAF, August 2001, Air Mobility: The Key to United States National Security Strategy, Fairchild Paper, http://aupress.au.af.mil/fairchild\_papers/Hazdra/Hazdra.pdf

In shaping the international environment, the United States must possess a credible military force where military activities include overseas presence and peacetime engagement and the will to use military force.2 According to the NDP, overseas presence is the key to a stable international environment.3 Peacetime engagement includes rotational deployments that help sustain regional stability by deterring aggression and exercises with foreign nations that solidify relations with those nations.4 Deployments and exercises both require air mobility in the form of both airlift and air refueling in order to transport the necessary troops and equipment. Peacetime engagement also includes other programs such as the Nunn–Lugar Cooperative Threat Reduction Program where the United States assists members of the Commonwealth of Independent States in dismantling and storing WMD.5 Here, air mobility is the lead component by transporting nuclear weapons to the United States from compliant nations. Airlift also plays a crucial role in responding to threats and crises by enhancing our war-fighting capability.6 The United States may move some forces nearer to a theater in crisis and rapidly deploy other forces into that theater. Depending on the crisis, forces from the Army, Navy, Air Force, Marines, or any combination of military personnel and equipment could comprise the force structure required. Consequently, the United States must airlift these forces along with the needed logistics support. In addition, the focused logistics concept of Joint Vision 2010 requires the transportation of supplies and materials to support these forces within hours or days rather than weeks, a mission solely suited to air mobility. In responding to crises, forces may deploy in support of smaller-scale contingencies which include humanitarian assistance, peace operations, enforcing NFZs, evacuating US citizens, reinforcing key allies, limited strikes, and interventions. 7 Today, US forces find themselves globally engaged in responding to these contingencies more frequently and maintain longer-term commitments to support these contingencies. In these situations, many deployments occur in the absence of forward basing.8 The loss of forward basing has reduced AMC’s worldwide infrastructure from 39 locations in 1992 to 12 in 1999.9 Thus, the United States must again use air mobility to deploy forces overseas in a minimum amount of time for an operation to be successful.

## Airpower Impacts – Terrorism

### Air power is critical to an effective war on terrorism

RAND, Project Air Force Annual Report, 2003, http://www.rand.org/pubs/annual\_reports/2005/AR7089.pdf

Counterterrorism Will Require a Mix of Air Force Capabilities and Long-Term, Sustained Effort The war on terrorism is more likely to be a long-term effort in which the use of force, at least by U.S. military personnel, is only sporadic and successful military operations will resemble counterinsurgency operations. The primary role of U.S. military forces will often be indirect and supportive. U.S. forces will be called upon to train, equip, advise, and assist host-country forces in rooting out terrorist groups; forge strong relationships with host-country personnel; show great discretion in their conduct of operations; and maintain a low profile in the host country. They will be able to react swiftly and effectively when promising targets arise. The Air Force, then, should expect sustained heavy demand to provide important capabilities, assets, and skill sets to support counterterrorism operations abroad. Chief contributions will include surveillance platforms, operators, and analysts; language-qualified personnel to help train and advise host-country forces and to analyze human intelligence; security police and other force protection assets; base operating support personnel and equipment to provide communications, housing, and transportation; heliborne insertion and extraction capabilities; and humanitarian relief assets. In some cases, U.S. airpower may be called upon to strike terrorists in base camps, hideouts, vehicles, and other locations.

### Extinction

Yonah Alexander, Prof, Dir – Inter-University for Terrorism Studies, 8-28-2003, Washington Times, Lexis

Unlike their historical counterparts, contemporary terrorists have introduced a new scale of violence in terms of conventional and unconventional threats and impact. The internationalization and brutalization of current and future terrorism make it clear we have entered an Age of Super Terrorism [e.g. biological, chemical, radiological, nuclear and cyber] with its serious implications concerning national, regional and global security concerns. Two myths in particular must be debunked immediately if an effective counterterrorism "best practices" strategy can be developed [e.g., strengthening international cooperation]. The first illusion is that terrorism can be greatly reduced, if not eliminated completely, provided the root causes of conflicts - political, social and economic - are addressed. The conventional illusion is that terrorism must be justified by oppressed people seeking to achieve their goals and consequently the argument advanced by "freedom fighters" anywhere, "give me liberty and I will give you death," should be tolerated if not glorified. This traditional rationalization of "sacred" violence often conceals that the real purpose of terrorist groups is to gain political power through the barrel of the gun, in violation of fundamental human rights of the noncombatant segment of societies. For instance, Palestinians religious movements [e.g., Hamas, Islamic Jihad] and secular entities [such as Fatah's Tanzim and Aqsa Martyr Brigades]] wish not only to resolve national grievances [such as Jewish settlements, right of return, Jerusalem] but primarily to destroy the Jewish state. Similarly, Osama bin Laden's international network not only opposes the presence of American military in the Arabian Peninsula and Iraq, but its stated objective is to "unite all Muslims and establish a government that follows the rule of the Caliphs." The second myth is that strong action against terrorist infrastructure [leaders, recruitment, funding, propaganda, training, weapons, operational command and control] will only increase terrorism. The argument here is that law-enforcement efforts and military retaliation inevitably will fuel more brutal acts of violent revenge. Clearly, if this perception continues to prevail, particularly in democratic societies, there is the danger it will paralyze governments and thereby encourage further terrorist attacks. In sum, past experience provides useful lessons for a realistic future strategy. The prudent application of force has been demonstrated to be an effective tool for short- and long-term deterrence of terrorism. For example, Israel's targeted killing of Mohammed Sider, the Hebron commander of the Islamic Jihad, defused a "ticking bomb." The assassination of Ismail Abu Shanab - a top Hamas leader in the Gaza Strip who was directly responsible for several suicide bombings including the latest bus attack in Jerusalem - disrupted potential terrorist operations. Similarly, the U.S. military operation in Iraq eliminated Saddam Hussein's regime as a state sponsor of terror. Thus, it behooves those countries victimized by terrorism to understand a cardinal message communicated by Winston Churchill to the House of Commons on May 13, 1940: "Victory at all costs, victory in spite of terror, victory however long and hard the road may be: For without victory, there is no survival."

## Industrial Base Impact – Heg/Economy

### Industrial base is eroding --- will collapse heg and the economy

Sheila Ronis, Ph.D. and President – University Group, Inc., 8-1-2003, “Erosion of U.S. Industrial Base is Troubling; Growing Dependence on Foreign Suppliers Should Concern Policy Makers”, National Defense, Lexis

The U.S. industrial base is eroding, and this situation has enormous national security implications. It has made the United States so dependent on foreign countries for critical components and systems that it may have lost its ability to control its supply chains. The United States is becoming dependent on countries such as China, India, Russia, France and Germany for critical weapons technology. It's conceivable that one of these governments could tell its local suppliers not to sell critical components to the United States because they do not agree with U.S. foreign policy. The federal government, and in particular, the Department of Defense, does not manage the country's industrial base as a "system." U.S. government agencies are fiefdoms that rarely compare notes tosee how their collective policies might affect a company or an industry. Interagency cooperation is an essential element of what needs tochange in the future. A Defense Department report entitled "Transforming the Defense Industrial Base: A Roadmap," recommended the department consider "viewing the industrial base as being composed of operational effects-based sectors that support transformational war-fighting. ... Organizing its decision processes to optimize operational effects--not programs, platforms or weapons systems." This report makes sensible arguments, but more needs to be done. U.S. corporations increasingly act as large social systems with a global focus. But ask the CEOs of the Fortune 500 to describe the issues on their minds and, more than likely, national security or the disintegration of the U.S. industrial base would not be among them. Many global corporations do not believe they owe allegiance to any stakeholder except their stockholders, and sometimes, their customers. This attitude has not changed since the end of the Cold War--not even since 9/11. A new vision of national security is needed that includes cooperation between government and industry. National security requires a healthy market-based economy, with a strong industrial base of globally competitive industries continuously improving quality and productivity. The United States cannot sustain the kind of growth it has enjoyed for the last several decades if the industrial base steadily erodes. Increasingly, a number of U.S. companies in specific industries find it impossible to compete in world markets. This is of particular concern for the industrial base that supplies the U.S. military.

### Strong defense base is key to U.S. leadership and economic growth

Nydia M. Velázquez, Ranking Member – House Small Business Committee, 10-16-2003, http://www.house.gov/smbiz/democrats/Statements/st101603.htm

However, from January 2002 to December 2002, nearly half a million jobs were lost in the technology sector. One critical concern for our nation's small tech firms is that the environment must be conducive to foster a strong domestic defense industry base. Readiness and access to cutting-edge technology are necessities in regard to the U.S. defense industry and our national security. As we recently found in the war with Iraq, many times Americans do have to turn to foreign countries for assistance. And as we experienced with France, it is not always easy. That is why the U.S. should not have to depend on countries overseas for military assistance - we need to have a secure base right here. A strong defense base is crucial for U.S. economic and military security, yet we are hearing contradictory statements about its viability. During a hearing this summer, the Department of Defense (DOD) stated that its current policies do not have a negative effect on our economy or threaten our national security. However, a recent report by the DOD Advisory Group on Electron Devices (AGED) found the opposite. They reported that the outsourcing of the U.S. technology sector has had a negative impact on our ability to research and produce the best products for our nation. The report said that DOD now has to obtain a majority of cutting-edge technologies from overseas - giving those countries a political and military advantage. The AGED report also claims that the Department of Defense must take immediate action to preserve our position as a leader in technological advancement, and to counter the decline of the U.S. electronics and technology sector. To compliment the AGED report, the President's Council of Advisors on Science and Technology (PCAST) Subcommittee on Information Technology Manufacturing and Competitiveness recently warned that by outsourcing the tech sector abroad, our country would risk losing its innovation strength for design, research, development and creation of new products. Much of this outsourcing has been in the semiconductor industry. This industry is key to the U.S. manufacturing sector's vitality and strength. In 1999, it posted $102 billion in sales, and accounted for half of the world market. In addition, it is the cornerstone of the $425 billion U.S. electronics sector. Continued outsourcing and decline in the semiconductor industry would create a ripple effect. It would eventually leave small high-tech firms struggling for business and our nation's domestic defense base weak. By shifting semiconductor manufacturing overseas, we are hindering our nation's role as a leader in technological research and development. Today's hearing will allow us to examine how outsourcing these vital sectors are affecting U.S. competitiveness. The weakening of our technology industry can have detrimental effects on both national and economic security. Policies need to be in place that will allow not only the manufacturing and technology sector to flourish, but also our nation's small high-tech firms, so that we can remain a leader in the world market.

## Exploration Add-On

### Lunar mining is key to access rare earth elements --- prevents Chinese cut-off

Leonard David, Space Insider Columnist – Space.com, 10-4-2010, “Is Mining Rare Minerals on the Moon Vital to National Security?”, NASA Lunar Science Institute, <http://lunarscience.arc.nasa.gov/articles/is-mining-rare-minerals-on-the-moon-vital-to-national-security>

The seemingly barren moon may actually be a treasure-trove of priceless resources: a potentially bountiful, mineral-rich – yet untapped – cosmic quarry. Still, few see the moon as an alluring mining site, ripe for the picking of rare elements of strategic and national security importance. Here on Earth, China recently blocked the export of rare earth elements to Japan for use in an array of products; from wind turbines and glass for solar panels to use in hybrid cars, and even guided missiles and other defense-oriented creations. China is increasingly putting the pinch on quotas of such elements out of their country. And as the scarcity of these valuable minerals grows, so too does the concern in other nations regarding the availability of this limited resource. For instance, a recent report from the Congressional Research Service – a study arm of the U.S. Congress – reviewed the worldly use of rare earth elements for national defense. The report looked at the production of elements such as europium and tantalum, among others, outside the United States and flagged the important issue of supply vulnerability. The study pointed out that rare earth elements are used for new energy technologies and national security applications and asked: Is the United States vulnerable to supply disruptions of these elements? Are they essential to U.S. national security and economic well-being? Among the policy options flagged in the Congressional Research Service assessment is establishing a government-run economic stockpile and/or private-sector stockpiles. Doing so “may be a prudent investment,” the study noted, and would contain supplies of specific rare earth elements broadly needed for “green initiatives” and defense applications. Local concentrations Given all the mineral mischief here on Earth, the moon could become a wellspring of essential resources – but at what quality, quantity and outlay to extract?

### Chinese cut-off collapses civilization

Mike Adams, Editor – NaturalNews, 1-26-2010, “Global Supply of Rare Earth Elements Could Be Wiped Out by 2012”, <http://www.naturalnews.com/028028_rare_earth_elements_mining.html>)

It's the bubble you've probably never heard of: The rare earth bubble. And it's due to pop in 2012, potentially devastating the industries of western nations that depend on these rare elements. What industries are those? The automobile industry uses tens of thousands of tons of rare earth elements each year, and advanced military technology depends on these elements, too. Lots of "green" technologies depend on them, including wind turbines, low-energy light bulbs and hybrid [car](http://www.naturalnews.com/car.html) batteries. In fact, much of western civilization depends on rare earth elements such as terbium, lanthanum and neodymium. So what's the problem with these rare elements? 97 percent of the world's supply comes from mines in China, and China is prepared to simply stop exporting these strategic elements to the rest of the world by [2012](http://www.naturalnews.com/2012.html). If that happens, the western world will be crippled by the collapse of available rare earth elements. Manufacturing of everything from computers and [electronics](http://www.naturalnews.com/electronics.html) to farm machinery will grind to a halt. Electronics will disappear from the shelves and [prices](http://www.naturalnews.com/prices.html) for manufactured goods that depend on these rare elements will skyrocket. These 17 rare earth elements (REE) -- all of which are metals -- are strategic resources upon which entire nations are built. In many ways, they are similar to rubber -- a resource so valuable and important to the world that many experts call it the "fourth most important [natural](http://www.naturalnews.com/natural.html) resource in the world," right after [water](http://www.naturalnews.com/water.html), steel and oil. Without rubber, you couldn't drive your car to work or water your lawn. Many medical technologies would cease to work and virtually all commercial construction would grind to a halt. Many of the strategic battles fought in World War II were fought, in fact, over control of rubber, most of which now comes through Singapore and its surrounding regions (Malaysia and Indonesia). Global shortage of Rare Earth Elements coming... Now, by threatening to cut off the world's supply of rare earth elements, China appears to be attempting to monopolize this extremely important strategic resource. According to information received by The Independent, by 2012 China may cease all exports of rare earth elements, reserving them for its own economic expansion. An article in that paper quotes REE expert Jack Lifton as saying, "A real crunch is coming. In [America](http://www.naturalnews.com/America.html), Britain and elsewhere we have not yet woken up to the fact that there is an urgent need to secure the supply of rare earths from sources outside China." And yet virtually no one has heard of this problem! People are familiar with peak [oil](http://www.naturalnews.com/oil.html), global warming, ocean acidification, the national debt and the depletion of fossil water, but very few are aware of the looming crisis in rare metals... upon which much of western civilization rests.