Written Testimony of Lieutenant General Daniel P. Leaf
Vice Commander, Air Force Space Command
Before the President's Commission on Moon, Mars and Beyond
On
Partnerships Between the Air Force and NASA

We set sail on this new sea because there is new knowledge to be gained, and new rights to be won, and they must be won and used for the progress of all people. For space science, like nuclear science and all technology, has no conscience of its own. Whether it will become a force for good or ill depends on man, and only if the United States occupies a position of preeminence can we help decide whether this new ocean will be a sea of peace or a new, terrifying theater of war.

– President John Kennedy, 12 September 1962

Inspired by all that has come before, and guided by clear objectives, today we set a new course for America's space program. We will give NASA a new focus and vision for future exploration. We will build new ships to carry man forward into the universe, to gain a new foothold on the moon and to prepare for new journeys to worlds beyond our own. – President George W. Bush, 14 January 2004

Introduction

It is my distinct honor to appear before the Committee today, on behalf of Secretary James Roche, Undersecretary Peter Teets, and the Air Force Chief of Staff, General John Jumper. My boss, General Lance Lord, regrets he could not be today due to a situation with his family. In his place, I represent the world's finest Air and Space Force,

specifically, the 39,000 Space Professionals of Air Force Space Command. I am joined today by the Commander of Air Force Materiel Command, General Gregory Martin, and Major General Paul Nielson who commands true leaders in science and technology – the Air Force Research Laboratory. I will focus my comments today around 1) The historic partnership between the Air Force and NASA; 2) Operational partnership efforts that exist today; and 3) Working together for our bright future in space.

Historic Partnership

This year marks the 50th Anniversary of U.S. Air Force leadership in both space and missiles, celebrating achievements that revolutionized life here on earth. We now view events around the globe as they occur; we have advance warning of adverse weather as it develops; we can communicate with people ten miles away or ten thousand miles away with equal ease; a small receiver tells us where we are and guides us to any point on or above the earth; new technologies move large amounts of data around the world at the speed of light; and worldwide commerce has changed forever, with territorial boundaries virtually eliminated. What was once science fiction has quietly become expected norms of a transformed society, thanks to the freedom to operate in the medium of space. Over the last 50 years, Air Force missiles deterred the most violent weapons the world has ever known and helped us reach the high ground of space to truly transform both our society and our military.

In late 1953, Assistant Secretary of the Air Force for Research and Development, Trevor Gardner, convened a group of experts in the field of long-range missiles that

became known as the Teapot Committee. Their report urged acceleration of the Intercontinental Ballistic Missile (ICBM) program and the implementation of a new agency to develop it. As a result, Air Research and Development Command established the Western Development Division (WDD) in the summer of 1954, under the command of then Brigadier General Bernard "Bennie" Schriever. WDD's work on the Atlas and Titan ICBMs and the Thor Intermediate Range Ballistic Missile (IRBM) became the cornerstone of deterrence during the Cold War and became the basis for America's access to space for the next four decades.

While the Atlas was being conceived, engineered, produced and developed, General Schriever simultaneously supervised creation of the Thor IRBM, which went from contract award in December 1955 to Initial Operational Capability (IOC) in June 1959 – less than four years. The far more sophisticated Titan ICBM reached its IOC in April 1962. Most amazing of all, an entirely new concept in ICBMs, the solid-fuel Minuteman, achieved its IOC in December 1962, rendering obsolete all but Titan II missiles for nuclear deterrence. In just eight years, General Schriever and his brilliant organization created a missile industry able to provide the US Air Force with four complete missile systems of almost unimaginable complexity and capability. Today, 40+ years after the Minuteman was first deployed, advanced models of the missile still safeguard our nation.

What was developed to loft weapons became instrumental to all our achievements in space, resulting in very safe, effective and reliable launch vehicles. The first Atlas

space launch was in 1958, and the Atlas booster was used for all Mercury manned orbital launches. We continue to launch the successful Atlas II today while transitioning to the Atlas V Evolved Expendable Launch Vehicle (EELV). Military and commercial versions of Atlas have launched interplanetary exploration missions to the moon (Surveyor), Mars (Mariner) and beyond (Pioneer). Atlas also lofted critical communication satellites, including the Defense Satellite Communications System (DSCS), Navy Fleet Satellite Communication (FLTSATCOM), International Telecommunications Satellites (Intelsat), NASA Tracking and Data Relay Satellite System (TDRSS) and continual use broadcast systems like DirecTV.

A second generation of Titan ICBM, the Titan II, was used for all of NASA's Gemini missions. Last October, the final refurbished Titan II ICBM launched a Defense Meteorological (weather) Satellite on a perfect mission. This 25th launch for the Titan II booster capped an overall success record of an *amazing* 100%. Its big brothers, Titan III and IV, carried our most capable national security satellites to orbit – including the Military Strategic Tactical Relay (MILSTAR) communications satellites and the Defense Support Program (DSP) missile warning satellites. Titan III also lofted the Voyager interplanetary probes *(Voyager 1 is now over 8.4 billion miles from earth and still operating)* and Viking 1 and 2, the first Mars landers.

The Thor IRBM had its first successful flight in 1957. Just two years later, Thor launched Discoverer 1, the world's first polar orbiting satellite. From Thor, we built the Delta launch vehicle that took our GPS constellation to orbit and launched prized NASA

missions – most notably the two Mars rovers, Spirit and Opportunity. Delta IV now forms a key part of our future access to space.

WDD's development of Air Force spacecraft began with Weapon System 117L, a reconnaissance satellite program. It took 12 failures before the first CORONA satellite made it to orbit and worked correctly, but because of the dedication of WDD and its industry partners, we could take 30-foot resolution pictures of Soviet missile fields in 1960. Not many Americans know the true leadership behind the trail-blazing paths that led to all of our high tech missile and space capabilities – in missile early warning, satellite communication, global navigation, weather forecasting, and imaging – and that's why we're going to tell their story in this, the 50th Anniversary Year of Air Force Space and Missiles. We are truly standing on their shoulders.

We honor a select number of past space and missile leaders every summer at Air Force Space Command as winners of the Air Force Space and Missile Pioneer Award. Air Force Space Command began presenting this official Air Force award in 1997 on the 50th anniversary of the Air Force. Each year since then, we have selected additional Space and Missile Pioneers to highlight our heritage and honor those truly deserving individuals. They continue to inspire us to always push forward and develop innovative solutions for our most pressing problems.

Space and Missile Systems Center (SMC) is now Air Force Space Command's Center of Excellence for space and missile acquisition. Under the leadership of Lieutenant

General Brian Arnold, our “stuff getters” continue to live up to the legacy of WDD and the space and missile pioneers. I think it’s important to remember our history – our roots – and the space and missile pioneers who gathered around the chalkboard, the design table, the factories and the launch pads. They crafted the systems that evolved into the capabilities we have today – improving the life of our citizens and transforming our military.

Operational Partnerships

When our missions are common, when our technology requirements are similar, and when we can make the best use of our nation’s limited space infrastructure, both NASA and the DoD benefit from cooperative efforts. Whether maneuvering in space, experimenting in space or communicating in space, there is shared workspace that leads to the best possible equipment, processes and procedures to ensure success, whether the mission is military or civil in nature. In developing basic technologies for launch systems, materials for use in space activities, or developing infrastructure to command and communicate with our spacecraft, DoD and NASA cooperation is key to making the most of our efforts. Specific examples include:

National Polar-orbiting Operational Environment Satellite System (NPOESS) – One of the most important joint collaborative efforts currently underway between NASA and the Air Force is the tri-agency (NASA, DoD, and the Department of Commerce (DoC)) NPOESS polar-orbiting weather satellite program. NASA, working with the NPOESS Integrated Program Office, is providing pre-operational risk-reduction demonstration and

validation tests for four critical NPOESS sensors that will fly on the NPOESS Preparatory Project (NPP). NPP is primarily a NASA mission that serves as a "bridge" between the Earth Observation Satellite (EOS) mission and NPOESS.

DoD Space Test Program – A key part of our Command continues to make excellent use of the Space Shuttle and other boosters for cutting edge research and testing. When necessary, NASA and DoD have worked to develop new integration methods and hardware to make the most use of every ounce of available spacelift. To date, the Space Test Program (now under SMC Detachment 12) has launched over 200 experiments on over seventy Shuttle missions, including some of the first science experiments that were carried out on the International Space Station. As part of the effort to provide risk reduction to the NPOESS system, the DoD Space Test Program launched the Coriolis Mission in January 2003.

Range Modernization – The Air Force's Spacelift Ranges support all launch operations for NASA manned and unmanned launches from the Kennedy Space Center (KSC) or from Vandenberg AFB. Range missions include spacelift (DoD, civil, commercial), Test and Evaluation (ballistic missiles, missile defense, aeronautical), and space surveillance. Modernization and sustainment is ongoing to replace obsolete equipment and improve operations and flight safety. Our current modernization program, to be complete by FY08, includes improving range safety, responsiveness, flexibility, reliability and availability, reducing O&M costs, and standardizing and automating where practical. The Air Force and NASA have existing memoranda of agreement

establishing partnerships to support NASA launches with Spacelift Range assets and to pursue advanced launch and test new Range technologies. At the recommendation of the Interagency Working Group on Future Management and Use of US Space Launch Bases and Ranges, the Air Force and NASA established the Advanced Range Technology Working Group (ARTWG), co-chaired by Air Force Space Command and NASA-KSC. The ARTWG charter focuses on improving safety, increasing flexibility and capacity, and lowering range costs in support of future generations of reusable and expendable launch vehicles. The Joint Base Operating Support Contract (JBOSC) is a joint procurement effort between KSC NASA and our 45th Space Wing (45 SW) to provide unified base support services for KSC, Cape Canaveral AFS, and Patrick AFB.

Human Spaceflight – Air Force astronauts are administratively assigned to Air Force Space Command. We are working to integrate them better in our leadership structure once their NASA tours are complete. Colonel Susan Helms is a prime example – she now heads our Space Superiority Division in our Directorate of Requirements. Her technical and operational leadership is essential to ensuring positive results throughout the Command in one of our most critical mission areas. We also provided support to NASA on the Columbia accident response and subsequent investigation. Brigadier General Duane Deal, our 21st Space Wing Commander, served on the Columbia Accident Investigation Board (CAIB) and also heads the wing responsible for operating the space surveillance network, which assisted in the Columbia investigation. Additionally, Air Force Space Command provided additional investigation support by

leading the DoD Columbia Investigation Support Team.

Space Superiority – As we look to the future, it is our duty and fundamental responsibility to gain and maintain space superiority, and ensure the freedom to operate in space for all mankind. At Air Force Space Command, “space superiority” rolls off our tongues as easily as air superiority does throughout the Air Force – it is the first thought in all we do. Our coalition forces on the ground, on the sea, under the sea and in the air are crucially depending on spacepower, and we will not let them down. Robust Space Situation Awareness (SSA) is absolutely essential to this mandate. SSA includes space intelligence, space surveillance, space reconnaissance and monitoring the space environment. We currently track 1,150 satellites in space today – over 300 of those are US spacecraft, about 60 of which are military. There are also over 13,500 objects in space that we catalog for collision avoidance based on more than 180,000 observations each day – down to about 10 cm (softball) size which could do extensive damage to any manned or unmanned spacecraft. We continue to work closely with NASA and others in the international community through working groups chartered to research and minimize space debris and develop debris mitigation guidelines for space launches. We know and track what’s up there and we’re expanding our capabilities to discern between environmental, unintentional and adversarial actions that could disrupt our use of space by developing new ways and means of detecting, characterizing, reporting and responding to attacks in the medium of space.

Spacelift – We are in a critical period of transition from legacy boosters, which served us so well, to the Evolved Expendable Launch Vehicle. Our pillar of assured access is ensuring we have two expendable launch vehicle providers. If one system is grounded due to processing, test or launch anomalies, we need to ensure at least another provider is ready to respond to critical national security spacelift needs. The commercial spacecraft industry is recovering, but orders still remain below expectations when EELV was originally conceived. We will add funding in the near term to cover increases caused by the downturn in the commercial market in the late 1990s to enable continuing infrastructure sustainment, crucial engine production and tooling (such as the RL-10) and critical component engineering. We are proud of the success of both families of Evolved Expendable Launch Vehicles. With six successful launches in a row, three from each provider, these are the best launch vehicles we've ever produced. Simultaneously, we are investigating entirely new, operationally responsive space activities. Long-term, we are pursuing vehicle concepts that can be launched on demand – in hours and days, rather than weeks and months – with the vision of fulfilling time-critical warfighter requirements. Air Force Space Command is currently engaged in an Operationally Responsive Spacelift (ORS) Analysis of Alternatives (AoA) that is due for completion this summer. NASA remains an engaged participant. We will develop the "way ahead" for the ORS program based on emerging AoA results leading to beginning the ORS program in FY07 for proposed FY18 operational capability. We fully support assisting in NASA's next generation launch capabilities to support the President's vision, just as the Space Pioneers helped NASA take its critical first steps

into orbit.

Communications – The Transformational Communications Office (TCO) put together a Transformational Communications Architecture (TCA) to include all systems required to develop "next generation," fully networked communications systems for the military, DoD, other government agencies and the Intelligence Community. The architecture includes the Transformational Satellite system (TSAT), Advanced Polar satellites and linkages to TDRSS. Interoperability is critical to our future communications capabilities.

Working Together for Our Bright Future

Since 1958, the White House has created several organizational mechanisms to coordinate civil and military space programs and activities, ranging from President Eisenhower's Civilian-Military Liaison Committee, which was designed to coordinate NASA and DoD activities, to the Kennedy-Johnson-era National Space Council and Aeronautics and Astronautics Coordinating Board, to President Reagan's National Security Council-led interagency group, and then to President Clinton's decision to separate Space Council functions under the Office of Science and Technology Policy and the National Security Council.

Partnership Council – This council is our current mechanism for coordination between NASA and DoD. Initially started in 1997, the memorandum of agreement among the agency heads of the Partnership Council reflects the need to address the many lessons learned from past efforts to coordinate NASA and DoD space activities. Among the

lessons learned by these past collaborative efforts are the need to: streamline operations costs; cross-utilize facility capabilities; consolidate redundant facilities; share support services; and leverage science and technology investments. General Lord remains an engaged participant in this council, along with the Commander of Strategic Command, Admiral Jim Ellis, the Honorable Sean O'Keefe, Undersecretary of the Air Force Peter B. Teets and Director of Defense Research and Engineering, Doctor Ron Sega. .

Key Leadership Meetings – Our National Security Space leadership meets monthly. The Deputy for Military Space, Office of the Under Secretary of the Air Force; Director, National Security Space Integration; Director, National Security Space Architect; and NASA Space Architect meet regularly, and as needed, to improve the intermediate planning process and products, and implement opportunities identified by the Partnership Council.

Schriever Wargame Series – NASA was a full partner in both the design and execution of the Schriever II Wargame – producing numerous significant insights on how both NASA and DoD should be structured to ensure the freedom of space well into the future. This wargame involved over 800 people who explored space warfare issues in detail, examined mission partner equities as Executive Agent for Space, generated insights for Air Force, Air Force Space Command, DoD and NASA transformational architectures and provided cadre building by bringing together the best strategic & operational minds to focus on the future of space power.

Other Planning Activities – NASA participates with us in conducting National Security Space (NSS) Program assessment that, among other things, identifies interagency Science and Technology cooperation opportunities. NASA also participates in the annual update of the NSS Plan that provides implementation guidance to the NSS community on desired capabilities, including S&T. In addition, NASA is participating with the DoD and the Intelligence Community in developing the Congressionally-directed DoD Space S&T Strategy, which will be complete in the summer of 2004.

Young Panel – We continue to benefit from the recommendations of the joint Defense Science Board and Air Force Scientific Advisory Board task force on Acquisition of National Security Space Programs, led by Mr. A. Thomas Young. Mr. Young is a past Director of the Goddard Space Flight Center, and headed the 1999 NASA-chartered review of the Mars Polar Lander loss. Just as in the DoD, during the 1990s, NASA experienced declining budgets, increased acceptance of risk (for example – Faster, Better, Cheaper), unrealized growth of a commercial space market, increased dependence on space by an expanding user base, and consolidation of the space industrial base.

The Young Panel identified 5 “basic reasons” for cost growth and schedule delays in National Security Space programs:

1. Cost has replaced mission success as the primary driver in managing space development programs…resulting in excessive technical and schedule risk.

2. Unrealistically low cost estimates lead to unrealistic budgets and unexecutable programs.
3. Undisciplined definition and uncontrolled growth in system requirements.
4. Government capabilities to lead and manage the acquisition process have seriously eroded.
5. Industry has failed to implement proven practices on some programs. The space industrial base is adequate to support current programs, although long-term concerns exist.

Within the DoD, we have taken the Young Panel findings and recommendations very seriously, and are continuing to implement policy and process changes in response to the Young Panel recommendations. Many of these findings likely have some applicability to NASA since we share much of the same industrial base and have experienced similar budget pressures. We have shared the Panel's results and our lessons learned with senior NASA leadership during the Partnership Council and lower level interaction.

Developing Space Professionals - In order to preserve our advantage as the leading space faring nation, we must ensure we have a strategy to guarantee availability of the most crucial element of space power - our space cadre. People remain central to our success in space, and meeting the serious challenges of today, and the future, requires a Total Force approach. We will continue to develop well-educated, motivated, and competent people who are skilled in the demands of the space medium. Operationally,

they must understand the tactical environment they support, as well as the space-unique tactics, techniques, and procedures needed. Technically, they must be schooled in the development and acquisition of space systems, the requirements of the vehicles that operate in space, and the development of space-related research, science, and technology.

Our space cadre must be sensitive to the needs of the many and varied end-users of space capabilities, and be able to formulate and articulate new space doctrine to fully control and exploit the medium of space in support of our nation's security objectives. They must be able to develop new technologies, systems, training methods, concepts of operations, tactics and organizations that will continue to sustain the U.S. as a world leader in space. The new systems they develop must be able to achieve desirable effects at all levels of conflict. Furthermore, they must ensure these systems are interoperable with and integrated into architectures that support the creation of lethal and non-lethal effects. The backbone of our joint and interagency space operations capabilities will continue to be individuals of exceptional dedication and ability.

We developed, and are implementing, the Secretary of the Air Force-approved Space Professional Strategy. This strategy describes a professional development construct that is comprehensive and recognizes the unique roles that officers, enlisted personnel, and government civilians play in National Security Space. Our objective is to ensure our professional space cadre possesses the necessary education, skills and experiences, at all levels, to meet National Security Space needs. We are currently in

the process of identifying the people and skill base we have today and developing a comprehensive education plan to enhance the performance of our current, and future, Space Professionals throughout their careers.

Conclusion

Air Force Space Command will be ready for whatever the future brings by continuing to innovate, develop, design, launch and operate leading-edge space and missile systems. With the help of the Air Force Research Laboratory, through Air Force Materiel Command, and our industry partners, we are continuing to transform Air Force Space Command to ensure the medium of space remains a sea of peace to explore for the benefit of all mankind. We look back on our space and missile heritage with pride and anxiously anticipate the bright future that awaits us all. We stand ready to support the President's vision of the Moon, Mars and Beyond.