Bright Horizons

...the AF STEM Workforce Strategic Roadmap
"Reaffirming and strengthening America’s role as the world’s engine of scientific discovery and technological innovation is essential to meeting the challenges of this century."

President Obama, 23 November 2009
A Message from SECAF

Bright Horizons shapes the way the Air Force will manage our mission-critical science, technology, engineering, and mathematics (STEM) workforce. These individuals provide the core capabilities for developing and applying technology which must be outcome oriented and whose impact is ultimately measured by warfighter success on the battlefield. At the end of the day, we must dominate the air, space and cyber domains, while preserving life and protecting the freedoms we enjoy. To maintain a world-class STEM workforce, a substantial portion of that workforce must be engaged in the actual application of science and engineering principles, processes and techniques. Those who are not practicing such skills should be teamed with those who are. Through optimal integration of these skills with life-cycle management, we can create the winning edge. Today’s Airmen – our most important resource – define our character, our capability to perform, and the foundation of our intellectual capacity. Effective strategic management of our Airmen is the cornerstone of our future, and STEM Airmen will play an ever-increasing role in our success.

Michael B. Donley
Secretary of the Air Force

A Message from CSAF

From the birth of our great Air Force in 1947, the application of technology has achieved and assured our warfighting edge. We owe a deep debt of gratitude to the scientists and engineers who have gone before us, and we are in awe of their achievements. We did not become the world’s greatest Air Force by accident or good fortune. We are ‘who we are’ as the result of working hard, employing the world’s best talent, and winning the support of the American people we defend. Never before in our history have we depended more heavily on the application of technology – whether in air, space, or cyber domains.

Bright Horizons is our inaugural effort to get our arms around, with a singular focus, the STEM challenges we face – today and tomorrow. The operational communities of the Air Force recognize the critical importance of technological superiority generated by the Air Force STEM community and therefore all communities must work in continued partnership to ensure our future. Unquestionably, our need for the world’s best scientists, technologists, engineers, and mathematicians will continue to accelerate at the very time our country’s supply of this talent is in jeopardy and foreign competition in science and technology is on the rise. We must continue to evolve and embrace the culture of technological innovation that has been our hallmark.

Norton A. Schwartz
General, USAF
Chief of Staff
Foreword

“Any air force which does not keep its doctrines ahead of its equipment, and its vision far into the future, can only delude the nation into a false sense of security.”

(General Henry “Hap” Arnold, 1945)

The United States Air Force has enjoyed global preeminence in the air since our founding in 1947. The compelling argument to establish a separate Service from the United States Army was our need to discover and translate technology into operational capability. As we mature our space domain and create the new domain of cyberspace, while rapidly responding to today’s challenges, it is essential we truly understand how we got to where we are today and where we need to be tomorrow. STEM professionals multiply our forces through creative research, development, test and fielding of innovations in air, space and cyber as well as in enabling areas such as training and education, energy, healthcare and logistics.

(F-35, depiction of technology integration)

Key to our efforts is the relationship between the operational user and the science and technology community. This relationship needs to be close, continuing, and genuine. Dr Theodore Von Karman, a founding father of today’s Air Force, said it best:

“Scientific results cannot be used effectively by soldiers who have no understanding of them, and scientists cannot produce results useful for warfare without an understanding of the operation.”
The threat we face today, and as far ahead as we can see, is changing. The threat is as different as it is diffused. It may be traditional, irregular, disruptive, catastrophic, or any combination. Our laboratories, product centers, test ranges, and logistics facilities will need the kinds of talent whose breadth of understanding of our challenges matches the depth of expertise they bring to their respective specialties. Ours is increasingly a world characterized by the “death of distance.” No longer does physical proximity between two people/organizations present the challenges it once did. We will also need people who fully understand and appreciate the nature of complex organizations that may be virtual and who have the capacity to span and integrate across multiple disciplines. The threat will challenge our ability to integrate our capabilities on many different levels.

The shifting supply of qualified STEM resources has been written about over the last several years and has been identified as a significant problem. Can America produce enough high-caliber STEM talent in future years to meet our growing needs in national defense? The changing demographics are significant and warrant the attention of every leader in today's Air Force.

Mr. Norman Augustine (Chair of three National Academy studies; ‘Rising Above the Gathering Storm” (2006), and “Rising Above the Gathering Storm: Two Years Later” (2009), “Rising Above the Gathering Storm, Revisited” (2010)) said

“"A variety of studies have concluded that between 50 and 85 percent of the growth in America’s Gross Domestic Product over the past half-century has its root in advancements in science and engineering. Correspondingly, it has been estimated that two-thirds of the increase in productivity in America in recent decades is also attributable to advancements in science and engineering. Only four percent of America’s workforce is comprised of scientists and engineers, but this four percent contributes disproportionately to the creation of jobs for the other ninety-six percent. One cannot sustain an economy simply by trying to make money with money...at some point workers have to produce food, manufacture medicine and build houses.” (January 7, 2009, Statement before the Democratic Steering and Policy Committee, U.S. House of Representatives)

Nearly ten years ago another publication said it this way: “The harsh fact is that the U.S. need for the highest quality capital in science, mathematics and engineering is not being met....Second only to a weapon of mass destruction detonating in an American city, we can
think of nothing more dangerous than a failure to manage properly science, technology, and education for the common good ...” (United States Commission on the National Security in the Twenty-first Century, “Road Map for National Security: Imperative for Change,” 2001)

Thinking ahead, the CSAF and SECAF directed the Air Force Chief Scientist to look out ten to twenty years and determine what technologies the Air Force will require to maintain a winning edge against a variety of threats which are broadly described above. The results can be found in the 2010 Technology Horizons study. Bright Horizons is the strategic plan that addresses the “people” dimension of delivering and operating the required technology by having the right STEM qualified people in the right place, at the right time, with the right skills.

“Alignment”

Solving the STEM workforce challenges requires careful integration of Air Force STEM policy and practices with existing higher level guidance and direction. Bright Horizons is designed to maintain alignment with Air Force doctrine; the Air Force Strategic Plan; Air Force S&T Strategy; Acquisition Workforce Strategic Plan; and the Manpower, Personnel & Services Transformation Roadmap. In addition, Bright Horizons aligns with Defense directives to include Defense Planning Guidance; Quadrennial Defense Review; Unified Legislative Budgeting; Acquisition, Technology, and Logistics Human Capital Strategic Plan; DOD’s Research and Development Imperatives; and OSD’s Civilian Human Capital Strategic Plan.
**Bright Horizons** also is mindful of the Air Force’s stated priorities when addressing such challenges as strengthening the nuclear enterprise, hardware modernization, and acquisition excellence. It is imperative that we recognize how integral managing our STEM workforce is to our overall success and plan accordingly.

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**Air Force Priorities**

- Continue to Strengthen the Air Force Nuclear Enterprise
- Partner with the Joint and Coalition Team to Win Today’s Fight
- Develop and Care for Airmen and their Families
- Modernize our Air and Space Inventories, Organizations, and Training
- Recapture Acquisition Excellence

*CSAF Vector 2010, 4 July 2010*

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**Bright Horizons Vision Statement**

Considerable thought was given to developing an Air Force **Bright Horizons** vision statement. A vision needs to be clear, it needs to be understood, and it needs to be output oriented. It is...

**“Leveraging the fight, creating the edge.”**

This statement reflects that capabilities developed, sustained, and enabled by our STEM workforce provide tremendous leverage for the warfighter and create the edge necessary to Fly, Fight, and Win. Never before in our history has technology brought more capability to the fight with a single sortie, manned or remotely piloted. Our capacity to maintain the winning edge is forever woven into the STEM fabric of our Air Force.
Bright Horizons – The Air Force STEM Workforce Strategic Roadmap

March 16, 2011

Bright Horizons Mission Statement

The mission of the United States Air Force is to fly, fight and win….in air, space, and cyberspace. The mission statement of Bright Horizons is to...

“Foster an Air Force culture that embraces Science, Technology, Engineering, and Mathematics (STEM) and its enduring ability to translate technology into operational capability.”

STEM Workforce Terminology

**AF Workforce** – The total organic military and civilian personnel assigned.

**STEM Competent** – Air Force personnel lacking a specific degree in science, technology, engineering, or mathematics, but having undergraduate course work in these subjects, training, or experience and being conversant in these areas. This is a broad definition to be expanded upon and applied by individual functional communities based on their respective mission needs.

**STEM Workforce** – Air Force professionals having degrees in science, technology, engineering, or mathematics.

**STEM Degreed** - The total assigned military/civilian personnel with a qualifying STEM degree at the undergraduate/graduate level to include those who are not presently serving in a technical degree required position, such as a program manager or a pilot.

**STEM Assigned** – The Air Force professionals having degrees in Science, Technology, Engineering or Mathematics and are presently serving in a technical degree required position.

Interpretive Note: We typically find STEM assigned Airmen in organizations that perform analysis, research, test, sustainment, and program management to include nuclear, cyber, or space related missions. STEM degreed Airmen are also found in higher headquarters, the Reserves, and Air Force support functions such as communications/computer, civil engineering, and weather. It is not meant, at this time, to address medical personnel, civilian technicians, enlisted personnel, or contractors. This definition can be expanded when we further mature the idea of AF STEM.
Air Force STEM Workforce – The Challenge

The STEM Challenge for the Air Force is to provide a highly qualified fighting and support force which possesses the right STEM education, training, and workplace skills. The men and women of the Air Force need to be provided the right tools, facilities, equipment, and resources to meet and overcome a myriad of future operational and technology challenges to enable the Air Force to Fly, Fight, and Win in Air, Space, and Cyberspace.

Simply put, the STEM challenge facing the Air Force is a problem of supply and demand. Yet many factors and many unknowns make balancing supply and demand a constant and potentially growing challenge.

The supply side of the equation is easier to assess; yet much of the supply side of the equation is outside Air Force control. The Air Force can expect to have only a small influence on encouraging the nation’s youth and educational institutions to provide the nation’s STEM talent pool. All national and international indicators point toward the United States slipping in U.S. citizen STEM output. Projections of future supply are therefore troubling. Domestic competition for this valuable resource is intensifying, while competition from the international science and technology community is also simultaneously increasing. The ability to find STEM talent capable of attaining higher level security clearances is also of concern. The retention of STEM talent will be influenced by factors such as outside opportunities and the degree to which the Air Force is able to provide a mission focused yet stimulating environment for operational and support force.

The demand side of the equation is within Air Force control yet is much more difficult to forecast since technology and Air Force missions continue to evolve. For example, the rapid increase in cyber capabilities and vulnerabilities is driving Air Force-wide mission evolution...
and therefore changes in personnel requirements including STEM. Rapid technological changes in cyberspace are difficult to forecast more than a few years in advance, obscuring our ability to forecast cyber related STEM requirements in the development and operational fields. Another difficulty is STEM requirements are not presently managed at the corporate Air Force level. Units control their requirements and their tactical-level decision making sometimes leads to strategic-level changes in STEM workforce composition with unintended negative consequences. For example, *Technology Horizons* calls for increased use of Human Augmentation and many scientists forecast fundamental technological breakthroughs in biology which will alter our fighting environment; yet the number of Air Force officer biologist positions has dwindled to a mere handful. This situation was not attained by strategic-level decision making but rather tactical-level adjustments made at the unit level.

Although the very challenging problem of ensuring future requirements are met can seem insurmountable, progress can be made by examining a more manageable set of sub-problems which can each be addressed with a higher degree of confidence. First, the driving forces behind Air Force STEM requirements can be examined and projected into the future based on visions such as *Technology Horizons*, our current Air Force Research Laboratory technology roadmaps, our acquisition program needs, and the technical environment in which we expect our warfighters to operate in the future. Second, we must examine the ‘pipeline’ for STEM professional accessions. Can the Air Force compete successfully with academia and industry to induct and hire high quality personnel to fill key positions in required technical areas? Third, we must understand whether the Air Force properly manages the STEM workforce. Are STEM personnel utilized correctly and are they given adequate career advancement opportunities, training, and advanced education incentives? Are research facilities, test and evaluation facilities, and the operational environment sufficient to attract and retain top talent?

By addressing these questions we can develop an executable strategy to meet Air Force STEM needs long-term.

> "People are the only sustainable competitive advantage in any enterprise."

Dr. Michael A. Kuliasha, former Air Force Research Laboratory Chief Technologist
The chart reflects the inventory we have today of STEM educated officers and civilians, by years of service, in the Air Force. The orange line is the officer sustainment line and the red is the civilian optimum line. Clearly the civilian profile is not the desired profile and reflects, in a dramatic manner, the challenges we face in creating a more desirable inventory profile.


What is Strategic STEM Workforce Management?

In its simplest terms, strategic STEM workforce management is getting the right people with the right competencies in the right jobs at the right time. It requires a strong partnership with Air Force operational and functional leaders to ensure workforce projections and human capital are aligned with organizational missions and goals. Many organizations, both public and private, have developed models for workforce management. Putting aside variations in terminology, these models are fundamentally alike. All rely on an identification of workforce competencies needed for the future; an analysis of the present workforce (demographics, retirement projections, competencies, etc); a comparison of the present workforce to future needs to identify gaps and surpluses; development of strategies for building the workforce needed in the future; and an evaluation process to ensure that the workforce plan remains valid and that objectives are being met. In short, you plan based on the demand and the available supply, then synchronize in terms of numbers and kinds, and
identify the strategies to fill the gaps. Finally, the outcome is accomplished through execution within the personnel life cycle (see chart below).

Workforce Management Framework

Why Strategic STEM Workforce Management Now?

As discussed earlier, the escalating pace of competing demands for shrinking resources (e.g., STEM qualified people), make purposeful and smart workforce management absolutely critical to meeting Air Force requirements. We must maintain a competitive edge in recruiting and retaining STEM qualified personnel to meet Air Force’s future technological needs, both developmental and operational. Corporate strategies are designed to enhance value to the customer, and workforce strategies are integral to business strategies.
Strategic workforce management provides a deliberate, transparent, and analytical basis for addressing unique human capital needs consistent with short- and long-term organizational productivity. A mature strategy is indicated when workforce planning is central to effectively accomplishing the organization’s mission, is flexible to changes that occur in the marketplace, and personnel understand the strategy. Key benefits of a common framework are:

1. Effective personnel utilization through accurate, efficient alignment of the workforce (military, civilian) with strategic objectives and priorities.
2. Skilled and experienced replacements are available to fill the most crucial vacancies – especially critical with increased turnover projections, coupled with labor market shortages and limited compensation levels.
3. Adaptability of existing STEM personnel
4. Realistic staffing projections for budgeting purposes.
5. Recruitment resources are more efficiently and effectively used.
7. Transparent, participative process across mission areas.

**STEM Workforce**

“Greatness has to be earned and continually re-earned,”
Norm Augustine, “Is America Falling Off the Flat Earth”

Having the greatest Air Force in the world is not a birthright. We are confronted with four arenas of challenge – an aging STEM workforce, declining “homegrown” talent from our educational system, worldwide competition for STEM talent, and attraction to STEM careers. (“Rising Above the Gathering Storm,” The National Academies, 2005, 2009, 2010)

Overcoming these challenges is essential to ensuring the continued success of our Air Force and security for our Nation.

As we move forward from an industrial-based economy to a knowledge-based, service-oriented economy, we must begin to embrace and appreciate the idea of intellectual property (IP) and what that can mean to the Air Force. IP is the currency of the new emerging “creative economy” from which economic growth is leveraged and funds our society. The STEM ‘intellect’ we need as we look forward is a one that is knowledge-based intellect, analytically driven, decision focused, and outcome oriented. (“Academic Entrepreneurship and the Creative Economy,” Peters and Besley, Thesis Eleven, August, 2008)
Executing *Bright Horizons* and realizing the vision is a shared responsibility of the entire Air Force community. Realizing the *Bright Horizons* vision cannot be achieved without the active support of the many stakeholders at all levels including the operational commands and the warfighter. However, key individuals and organizations will be specifically tasked to further develop and implement *Bright Horizons* for the benefit of the Air Force while monitoring progress of the goals and initiatives designed to support the strategic and operational needs of the Air Force, today and tomorrow.

If the Air Force is to maintain a world-class STEM workforce, a significant number of the STEM personnel must be engaged in the actual practice of science and engineering in close coordination with the larger scientific and technical community. Furthermore, the entire STEM community must actively participate in lifelong learning, both as students and teachers.

STEM students, who are otherwise qualified to enter the national defense sector but choose not to, cite three primary factors – poor physical work facilities, shortage of opportunities for professional development and growth, and a lack of exciting and meaningful tasks. (“The Brown Journal of World Affairs,” Fall/Winter, 2006.)

The Air Force recognizes its STEM personnel:
- Enjoy defining and solving problems that are technically challenging
- Thrive on lifelong learning and growth in responsibility
- Want accountability
- Need the opportunity to collaborate
- Thrive on challenging ideas in a nurturing environment
- Desire appreciation from leadership

The Air Force expectations of STEM personnel are to:
- Hone technical skills through advanced degrees and continuing education
- Attend professional conferences and continue networking with colleagues
- Seek challenging tasks
- Broaden their career experiences at the appropriate times

We are proud of the Air Force STEM personnel we have today and need to focus attention on our STEM workforce of tomorrow.
Bright Horizons Focus Areas

1. Ensure STEM governance is an Air Force “team sport.”
2. Develop accurate and timely STEM-related manpower requirements across the Air Force.
3. Establish adequate and predictable funding levels in terms of funded military and civilian authorizations, and career field management programs.
4. Aggressively use force management practices to build and maintain a highly competent, diverse, and agile force at the right grade levels, at the right time, and the appropriate locations.
5. Actively use the Air Force’s Continuum of Learning to promote a world class STEM workforce.
6. Aggressively pursue strategic partnerships and outreach activities with schools, universities, sister services, professional associations, other Federal agencies, and international partners to grow the STEM workforce of the future.
7. Develop and apply measurements that drive business behaviors across the Air Force that are consistent with the vision and goals of Bright Horizons.

Desired End State

The overall desired outcome is to ensure the STEM workforce is affordable, scalable, agile, and seamlessly aligned to Air Force missions and strategies. To achieve this desired end state three elements are necessary. First, we require a STEM workforce populated with talented professionals with the technical education, training, and experience to continue their unparalleled capability to provide the technology that keeps the US Air Force unrivaled in the world today and into the foreseeable future. Second, we require STEM personnel in the right proportions to develop, operate, and sustain the highly technological Air Force of the future. Third, we require strategically-guided workforce management processes to ensure the STEM workforce is adequately sustained at all levels throughout the Air Force. This will include a full understanding of the motivations of the STEM populations to ensure adequate recruiting and retention, career paths that lead to the development of scientific and technological leaders, and mentoring to shape individuals into the STEM workforce required to sustain the Air Force heritage of technological superiority in an increasingly STEM contested world.
Bright Horizons is the first step in strategically managing the STEM force. Actions taken under the overarching guidance of Bright Horizons will seek to understand and establish proper STEM requirements for the STEM workforce. Other activities flowing from Bright Horizons will be to understand and improve processes for accessing and sustaining STEM personnel. Adoption of an ‘inventory management’ process for STEM resources similar to that used for rated personnel will be examined.

We recognize that across the Air Force, we must take an integrated approach in management of the STEM workforce that cuts across multiple career fields and communities from operations, to support, to acquisition. We cannot be successful without recognizing STEM workforce requirements and resourcing must be carefully managed as a strategic asset. The governance structure recommended herein provides the proper mechanisms to manage these critical resources at the strategic level while maintaining the flexibility necessary at the unit level to accomplish our diverse Air Force mission set.

Governance

As the AF strategic roadmap for management of the STEM workforce, Bright Horizons establishes the governance structure. Across the Air Force, we will take an integrated approach in management of the STEM workforce that cuts across multiple career fields and functional communities. To be successful, we must recognize that STEM workforce requirements and resourcing must be carefully managed as a strategic asset.

Roles & Responsibilities

Realizing the vision and executing this roadmap are shared, Total Force responsibilities. They can be achieved only with active support of all stakeholders at all levels. Key
stakeholders and organizations have the responsibilities outlined below to further develop and implement this plan while monitoring progress of the supporting goals and initiatives.

**Science, Technology, Engineering, and Mathematics Advisory Council (STEMAC)**

The STEMAC is the Air Force’s senior STEM matters advisory group chartered by the Force Management and Development Council (FMDC). The STEMAC is chaired by the Assistant Secretary of the Air Force for Acquisition (SAF/AQ) and composed of representatives from key STEM functional areas and communities. Members will be initially appointed by the Air Force Vice Chief of Staff (AF/CV) following FMDC procedures. In addition to the STEMAC objectives listed in the charter, members perform three key roles:

1. Prepare the Air Force STEM roadmap (*Bright Horizons*), to include all initiatives and goals, for SAF/AQ, CSAF, and SECAF approval.
2. Ensure their organizations are executing the Air Force STEM vision, goals, and strategy. Oversee performance of all STEM activities and assume lead responsibility for goals and initiatives assigned to them.
3. Continue to keep abreast of issues affecting the AF STEM community and ensure those issues are addressed in the appropriate forum.

At least semi-annually the STEMAC reviews progress on goals, initiatives, related metrics, and associated milestones supporting *Bright Horizons*. The STEMAC provides feedback to the Goal Champions and Initiative Owners.

**SAF/AQ**

SAF/AQ has overall Air Force responsibility for *Bright Horizons* to include developing and implementing processes and procedures to achieve the goals and roadmap’s initiatives. SAF/AQ establishes strategic partnerships with other STEM functional leaders to establish appropriate goals and initiatives. For those issues not being presented to the Air Force board structure or the FMDC for approval, SAF/AQ is the final Air Force decision authority. SAF/AQ advocates for resources, policy changes, and legislative initiatives in support of the plan’s strategic themes and objectives. SAF/AQ introduces public and private sector best practices to increase Air Force capabilities and improve efficiencies, and in partnership with STEM functional managers, develops the STEM agenda. SAF/AQ is the Air Force lead to sponsor and advocate strategic partnerships with OSD, other Services, interested federal agencies such as the National Science Foundation, and private industry.
SAF/AQR

SAF/AQR is the designated office for the day-to-day management of Bright Horizons. SAF/AQR is responsible for developing STEM strategic concepts, principles, plans, integrating elements of the roadmap, facilitating implementation, and executing specific programs to support STEM themes and objectives. These efforts will be worked in partnership with the corresponding STEM Career Field Managers and Development Teams. SAF/AQR organizes meetings and presentations supporting STEM workforce issues. SAF/AQR monitors and administers processes for reviewing, updating, and changing the roadmap and prepares for meetings with STEM governing bodies. SAF/AQR also leads the continued development of the AF STEM roadmap, which is aligned with the Air Force’s strategic plan and is driven by information and knowledge gaps identified during roadmap development and program reviews.

Deputy Chief of Staff, Manpower, Personnel & Services (AF/A1)

AF/A1 is responsible for providing assistance and guidance to SAF/AQ in managing AF STEM resources and ensuring this effort is consistent with broader Air Force plans, policies, directives, and processes concerning AF human capital management. AF/A1 will have a senior level STEMAC representative.

Goal Champions

Each Bright Horizon’s strategic goal is assigned a General Officer or Senior Executive Service champion. Goal Champions:

1. Establish initiatives, with STEMAC review and approval, to achieve strategic goals.
2. Ensure strategic measures for their objectives and initiatives are SMART (Specific, Measurable, Achievable, Realistic, and Timely).
3. Ensure all measures are either outcome or output focused.
4. Designate initiative owners.
5. Coordinate with cross-functional OPRs to ensure objectives and initiatives represent a broad-spectrum, enterprise context.
6. Provide updates on objectives and initiatives as requested by SAF/AQ.

Initiative Owners

Typically a colonel or civilian equivalent level, initiative owners manage efforts with shorter duration than strategic goals, and serve to further the overall positive achievement of the goal to which they’re assigned. Goal Champions can choose Initiative Owners from outside
their own organization. In many cases initiatives will cross-cut organizations. Initiative owners will:

1. Develop, maintain, track and project key milestones associated with initiative completion.
2. Designate a POC as required to serve as action officer.
3. Coordinate with their respective goal champions to provide periodic updates.
4. Recommend changes (updates, closure, additions, alterations, etc.) to goal champions in keeping with the vision of Bright Horizons.

Goal One: Requirements and Inventory - Develop accurate and timely STEM related manpower requirements across the Air Force. Goal Champion: AF/A1D, SAF/AQH

Transforming the Air Force to counter future threats and meet emerging challenges requires an appropriately educated and skilled STEM workforce. In 2000, the Science & Engineer (S&E) Summit I (11 Dec 2000, hosted by SAF/AQ) identified a critical shortfall in STEM Manning. This shortfall was validated in the S&E Requirements Review of 2001, and briefed to the SECAF at the S&E Summit II on 6 Dec 2001, also hosted by SAF/AQ. Understanding the manpower requirements is the keystone to a successful Air Force STEM program. Knowing what these requirements are today and tomorrow, is an essential first step in human capital life cycle. Mission requirements suggest a more technology intensive and adaptive STEM workforce is required. This will involve sizing a right mix of military, civilian, and contractor personnel. The conversion of contractor positions is an example of adjustments to the mix. The magnitude of these in-sourcing requirements is ambitious, and will require close collaboration on the part of leadership and experts across multiple communities at installation, MAJCOM, and HAF levels. As we transition mission performance back from a contractor role, it is important we team together to minimize potential gaps in mission execution.

Initiatives:

Goal 1, Initiative 1 – Determine what academic degrees constitute STEM, establish STEM definition and requirements baseline, identify future mission requirements, and ensure all inherently governmental tasks are performed by AF personnel. Establish a process for identifying the “true” STEM requirements of the Air Force through coding of non-technical Air Force Specialty Code’s/Occupational Series. The focus of this effort is those career fields that are non-technical, but have a partial need for STEM qualified people, such as pilots and program management. Upon completion, conduct a thorough STEM-related manpower requirements review through the functionals across the AF domains to include space and cyber.
Goal 1, Initiative 2 – Define “STEM competence” in a generic manner consistent with the recommendation from the NRC report and data system capabilities recognizing the application may vary by community. Establish an inventory baseline.

Goal 1, Initiative 3 - Explore STEM competence as an institutional competency (e.g. computer literacy).

Goal 1, Initiative 4 – Enhance usage of Reserve & Guard STEM resources, beginning with cyber talent.

Goal Two: Funding & Resources - Establish adequate and predictable funding levels in terms of funded military billets, civilian pay, and career field management. Goal Champion: AFMC/CA, AF/A8P

The life blood of human capital capability is a reliable, predictable, and adequate funding level. Within the Air Force our STEM resources are funded in significantly different ways. Military personnel are budgeted and funded differently from civilians and within the civilian population we fund across many ‘colors of money.’ These wide variations of funding generate unintended perturbations in our workforce, especially on the civilian side.

Initiatives:

Goal 2, Initiative 1 – Standardize and stabilize the funding for the management of civilian STEM positions working in RDT&E by moving operations and maintenance (3400) funded positions to RDT&E (3600).

Goal 2, Initiative 2 – Establish a viable process across participating functional communities to adequately advocate for STEM related education, training, and outreach activities to the Air Force Corporate Structure and other Air Force Corporate Processes

Goal Three: Force Management – Appropriately apply force management practices to build and maintain a highly competent, diversified, and agile force at the right grade levels, at the right time, and the appropriate locations. Goal Champion: AF/A1P
Across the Air Force, we have more than 25,000 STEM assigned personnel, split roughly 40/60 military to civilian. The life cycle management (from accession to separation) of this highly talented group of men and women is a dynamic and challenging process. On the military side, we have 39 career families. On the civilian dimension, we have 59 occupational series. We access our people from a number of sources across the country to include our colleges and universities. Our civilians come to us at the entry, intermediate, and journeyman levels to include leadership positions. The recruiting tools and process used are equally varied.

Initiatives:

**Goal 3, Initiative 1** – Review and refine the processes used to manage AF STEM personnel with the goal of cutting across Air Force functional domains so STEM can be viewed as an Air Force capability. Explore the feasibility of using rated management or other mission management principles/processes for application to the broader AF STEM community. This is to be done in such a way that functional communities will continue to manage the resources within their communities while being sensitized to the STEM needs of the Air Force via various functional Development Teams.

**Goal 3, Initiative 2** – Investigate incentives for people to pursue STEM degrees and look into related policy implications (e.g. civilians going to AFIT). Document what we have now, what we can use, and what we can afford.

**Goal 3, Initiative 3** – Review existing policies and legislative authorities regarding recruiting and retention incentives/bonuses to determine appropriate and effective usage. Where changes are warranted implement appropriate policy changes or advocate legislative changes that may be needed. This review will include Section 852 incentives and various DOD initiatives such as SMART.

**Goal 3, Initiative 4** – Establish yearly military AF STEM accession goals, with prioritization, for recruiting sources to include USAFA and the other commissioning sources.

**Goal 3, Initiative 5** – Review whether AF should establish a goal for the minimum percentage of USAFA and other commissioning source graduates with a STEM major.
Goal 3, Initiative 6 – Establish STEM competence as a minimum requirement for program management certification and establish a data element identifier.

Goal 3, Initiative 7 – Establish/revise policies and processes to improve the time it takes to recruit STEM-degreed civilians.

Goal 3, Initiative 8 - Periodically and systematically assess the utilization of the STEM workforce (officer and civilian) to include outcomes of the appropriate STEM-related DTs.

Goal Four: Continuum of Learning (COL) - Actively use the Air Force’s Continuum of Learning to promote a STEM workforce that is scientifically, technologically, and mathematically strong. Goal Champion: AF/A1D

The ability to predict in a timely manner the educational needs of our workforce can be challenging. What is easier, though, is to be sure we produce individuals who are clever and agile enough to be able to incorporate new concepts and ideas into their thinking. The COL will include formal and informal training, short and long term coursework, advanced degrees, and sabbaticals. We will develop a world class STEM workforce to evolve existing systems, seek revolutionary capabilities to change the nature of warfare, and educate both the operators who employ the systems and the future scientists and engineers who develop them. The focus of COL is to keep our STEM workforce on the leading edge of technology.

Initiatives

Goal 4, Initiative 1 – Review on a scheduled basis curricula at AFIT and USAFA to ensure STEM curricula are consistent with the mission needs of the Air Force. This will include assuring graduates of non-STEM degree programs have an adequate appreciation of the impact of science and technology on the Air Force. A similar process should take place at educational institutions with AFROTC programs. This will include civilians as appropriate.

Goal 4, Initiative 2 – For officers and civilians identify and baseline, for each STEM career field, the required skills training, professional continuing education, and career broadening opportunities. Identify what new or additional developmental events are needed.

Goal 4, Initiative 3 – Review AFERB process and determine whether change is appropriate to better emphasize STEM.

Goal 4, Initiative 4 – Strengthen opportunities for STEM degreed personnel who are likely candidates for Program Management positions to develop their technical skills during the first five years of their AF career.

Goal 4, Initiative 5 – Develop modules of instruction at AFIT to help increase STEM competence of AF officers and civilians.
Goal 4, Initiative 6 - Pursue use of scholarships and other incentives based on Air Force requirements to encourage ROTC production of STEM degrees to include non-STEM students to acquire STEM competence.

Goal Five: Outreach - Aggressively pursue strategic partnerships and outreach activities with our schools, universities, sister services, professional associations, and other Federal agencies. Goal Champion: SAF/AQR, AFRL/CA

“Our schools continue to trail. Our students are outperformed in math and science by their peers in Singapore, Japan, England, the Netherlands, Hong Kong, and Korea, among others. ... I am committed to making the improvement of STEM education over the next decade a national priority.” President Obama, Nov 2009

A basic science and mathematics education is considered necessary not only for those who seek STEM related degrees, but for those who need to better understand how science and technology issues affect their lives. The National Science Foundation (House Science and Technology Committee testimony, 26 Feb 2009) has stated with the rapid changes in technology a workforce trained in the sciences and engineering is necessary for continued economic growth. Precollege (K-12) science and mathematics instruction has an important relationship to the future supply of U.S. scientific and technological personnel. Less than one-third of US 8th-grade students performed at or above a level called “proficient” in mathematics; “proficiency” was considered the ability to exhibit competence with challenging subject matter. Alarmingly, about one-fifth of the 4th graders and one-third of the 8th graders lacked the competence to perform even basic mathematical computations (National Center for Education Statistics, 2006. “The Nation’s Report Card: Mathematics 2005”).

Quoting from the “Report to the President, Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) for America’s Future,” page vi, September, 2010.

It is important to note that the problem is not just a lack of proficiency among American students; there is also a lack of interest in STEM fields among many students. Recent evidence suggests that many of the most proficient students, including minority students and women, have been gravitating away from science and engineering toward other professions. Even as the United States focuses on low-performing students, we must devote considerable attention and resources to all of our most high-achieving students from across all groups.
These trends in the U.S. and abroad suggest that global competition for college-educated workers will intensify as a result of forecasted changes in demographics. For those of us in the Federal government, this will hinder our “supply side” sourcing efforts.

**Initiatives:**

**Goal 5, Initiative 1** – Establish AF level STEM outreach office to coordinate and further develop an AF outreach capability.

**Goal 5, Initiative 2** - Inventory existing AF outreach efforts with goal of providing centralized theme and resources.

**Goal 5, Initiative 3** – Investigate STEM management and outreach by other services. Leverage OSD STEM outreach program. Establish, maintain, and leverage strong connections with other military and government outreach programs.

**Goal 5, Initiative 4** – From initiative 2 and 3, perform gap analysis. Close gap by pursuing outreach agreements with outside agencies, industry, and schools that have STEM programs. Establish formal outreach agreements at all Air Force locations that have a significant S&T related mission.

**Goal 5, Initiative 5** – Establish a working relationship with diversity operations office to emphasize STEM accessions and education.

**Goal 5, Initiative 6** - Air Force, in partnership with research lab/logistics facilities, commissioning sources, educational institutions (public and private), and museums, such as the National Museum of the US Air Force, will form and conduct efforts to expand the awareness of STEM opportunities available within the AF and to improve the flow of STEM qualified individuals into the USAF's military and civilian workforce.

“America risks jeopardizing its prosperity, security and indeed its very way of life if we do not improve the math and science literacy of our students. Mathematics is a critical gateway subject for college success and business and technical careers at all levels, and it is the foundation of higher order thinking. The sciences provide both a method of approach to problem solving and basic knowledge needed in our complex society. It should be unacceptable to each of us that we spend more per pupil than nearly any other nation, yet the performance of American students in math and science continues to compare poorly relative to their peers overseas.” Carnegie Corporation of New York and Institute for Advanced Study, Joint Commission on Math and Science Education, 2007, President, Vartan Gregorian
Goal Six: Evaluation/Metrics – Measurements will be developed and applied that drive business behaviors across the Air Force that are consistent with the vision and goals of Bright Horizons. Goal Champion: AF/A9

Metrics is a key element to meaningful and effective management of programs. Good measurements and effective modeling drive organizations to create output that is aligned with the goals and visions of the Air Force.

Initiatives:

Goal 6, Initiative 1 – Develop metrics to measure progress towards the vision and goals of Bright Horizons.

Goal 6, Initiative 2 – Assess 2000-2001 S&E Summit recommendations to determine if they were acted upon. Review/compare analysis of current NRC recommendations with prior efforts that have occurred in the last 10 years.

Goal 6, Initiative 3 – Review/analyze the root causes of STEM workforce fluctuations.

Goal 6, Initiative 4 – Determine the feasibility of developing and implementing a STEM Management Decision Support Process Model analogous to the Rated Management Decision Support System. Identify necessary model inputs, and how a centralized management model would drive changes to the current, decentralized STEM personnel management process. Provide recommendations as to which organization should own, operate, and maintain such a model.

At-Large Initiative - Air Force will develop appropriate language in the forthcoming Air Force Strategic Plan & Guidance to facilitate development of STEM workforce needs and highlight their importance to the Air Force mission.

“Almost every failure is a dissociation of thinking from acting. Success, like two feet walking, is the convergence of thinking and acting into a viable pattern of behavior.” Author unknown
Final Thought

The Air Force STEM workforce has proven its value countless times by providing and employing a continuous stream of technical capabilities that propelled the US Air Force to the forefront of air power globally. The pace and breadth of technical development worldwide continues to increase. Therefore, we must continue to acquire and develop STEM talent necessary to meet our future challenges. Much has been done; much still remains. In answer to President Obama’s STEM goals and with the support of Department of Defense leadership, we will actively engage with our partners across government to support STEM workforce development. We will actively engage with Congress to fulfill the workforce planning requirements established in the 2010 National Defense Authorization Act. President Kennedy said in his 1961 inaugural address “…the torch has been passed to a new generation of Americans…” Nearly 50 years later, the torch is being passed once again. We accept the challenge and confidently lift off towards our “Bright Horizons.”

“Science is more essential for our prosperity, our security, our health, our environment, and our quality of life than it has ever been. And if there was ever a that reminded us of our shared stake in science and research, it’s today.”

President Barack Obama       27 April, 2009
Appendix A

Key References:

Air Force Basic Doctrine Document 1, “Air Force Basic Doctrine”


2008 Air Force Strategic Plan


Air Force AFI 36-2640, “Executing Total Force Development”

“Technology Horizons,” United States Air Force, 2010

Air Force AFI 36-2302, “Professional Development (Advanced Academic Degrees and Professional Continuing Education”

Appendix B  Selected Readings:


“Rising Above the Gathering Storm - Two Years Later,” National Academies, 2009

“Rising Above the Gathering Storm, Revisited - Rapidly Approaching Category 5,” National Academies, 2010

“Report to the President, Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) for America’s Future,” President’s Council of Advisors on Science and Technology, September 2010


Air Force Science & Technology Strategy 2010, United States Air Force, SAF/AQR

“Engineering in K-12 Education,” 2010 National Academy of Engineering

“Key Science and Engineering Indicators,” 2010 Digest, National Science Board, NSB 10-02, January 2010

“Building the S&E Workforce for 2040” NDU, July, 2008

CRS Report to Congress, Science, Technology, Engineering, and Mathematics (STEM), March, 2008

Education: Background, Federal Policy, and Legislative Action, March 21, 2008


ITIF, “Refueling the U.S. Innovation Economy: Fresh Approaches to Science, Technology, Engineering, and Mathematics (STEM) education.” 2010

“avoiding technology surprise for tomorrow’s war fighter-symposium 2010,” National Academies, 2010


GAO, “Contractors’ Strategies to Recruit and Retain a Critically Skilled Workforce Are Generally Effective,’ February 2005


NASA, “Building the Foundation for the Next 50 Years of Exploration,” 2008


RAND, National Defense Research Institute, “Perspectives on U.S. Competitiveness In Science and Technology,” 2007
Appendix C. The current Goal Champions, Initiative Owners, and a detailed listing of the current initiatives that underpin each of the Goal Areas in *Bright Horizons* are maintained by SAF/AQR and are distributed separately. Copies can be obtained by contacting SAF/AQR, 1060 Air Force Pentagon, Washington D.C. 20330-1060, phone 571-256-0294