Concept of Operations for Scientists and Engineers

IN THE UNITED STATES AIR FORCE

U.S. AIR FORCE

FOREWORD

The Air Force will meet 21st century challenges by continued reliance on overwhelming technological leadership and an intrinsic ability to respond quickly to the demands of a rapidly changing world. To clearly articulate our commitment to maintaining a dominant edge in technology and provide a clear path for our members, we set forth this vision for our Air Force Scientists and Engineers:

> *"Air Force Scientists and Engineers... guiding, producing and sustaining concepts, technologies and systems that are key to aerospace operations."*

The Scientists and Engineer CONOPS that follows provides the foundation of how we will employ this vital element of our workforce. It reflects the invaluable contributions our Scientists and Engineers make in conducting our Air Force mission. The CONOPS also outlines our objective to evolve our aerospace force to ensure we sustain our technological dominance. Finally, it underlines our conviction that a strong in-house Scientist and Engineer capability is essential to meet our national security demands of the future.

MICHAEL E. RYAN
General, USAF
Chief of Staff

JAMES G. ROCHE
Secretary of the Air Force

OUR VISION

Air Force Scientists and Engineers... Guiding, Producing and Sustaining Concepts, Technologies and Systems that are Key to Aerospace Operations

Technological superiority plays a key role in realizing Air Force Core Competencies. To sustain full spectrum dominance, the Air Force must achieve faster, more lethal, and more precise military capabilities.[1] In the past, our USAF Scientist and Engineer (S&E) workforce has produced, sustained, and operated leading-edge technologies to provide such capabilities for the warfighter. This Concept of Operations (CONOPS) describes our vision of a future of sustained technological dominance—it provides for the employment of the S&E workforce through the year 2020 and beyond.

Air Force CONOPS 2020 identifies people as a "foundation" enabler that is equal to the enablers of communications, command and control, infrastructure, expeditionary culture, and modernization. The S&E CONOPS identifies the S&E military, civilians, and contractors[2] that are part of the "people foundation." It is these people who will enable a continuing world-class technology dominance, providing a steady infusion of new technology to our warfighters.

The S&E CONOPS broadly describes the basic building blocks (S&E functions) of technology dominance and groups these blocks to show effects and outcomes. It provides a conceptual tie between technological dominance and innovative operational tactics resulting in battlefield superiority.

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1 *Air Force Vision 2020* and the *Air Force Strategic Plan.*
2 For the purpose of this CONOPS the term 'contractors' refers only to support contractors (not prime). Although Federally Funded Research & Development Centers (FFRDC) have attributes similar to organic personnel, the S&E Functional Manager will not be responsible for their recruitment, development, and retention.

BACKGROUND

Since the dawn of flight, the partnership of the science, engineering, and warfighting communities has been critical to the success of American aerospace power. The partnership pioneered flight, all-metal flight structures, pressurized cabins, jet engines for military aircraft, and cruise missiles. The partnership developed the first supersonic research airplanes and the first practical supersonic military fighters and bombers. It pioneered the first intercontinental ballistic missiles, the first space launch systems, and the first manned voyages beyond the atmosphere. The partnership established revolutions in composite structural materials, electronic flight controls, directed energy systems and stealth technology. These are but a few of the better-known examples. Air Force S&Es, both military and civilian, are at the core of the partnership and are a resource of great potential to continued United States global aerospace power. In the aerospace age of today and tomorrow, this resource will be of even greater and more urgent importance.

The career path of Air Force S&Es has been one of a constantly growing connection to service; an ever-increasing understanding of its mission, purpose, capabilities, and needs; and an ever-stronger dedication to the promulgation of global aerospace power for the defense of America and her interests.

ASSUMPTIONS

STATEMENT OF WORK

The Air Force will continue to recruit, develop, and retain military and civilian S&Es and partner with contractor S&Es to enable our vision of continued technical dominance on the battlefield. This workforce is essential to achieve an unrivaled degree of innovation founded on effective integration and testing of new concepts, non-material innovations, advanced technologies, and synergistic experimentation. We shall employ proactive management practices to ensure the right quality and mix of military, civilian, and contractor scientists and engineers needed to achieve *Air Force Vision 2020*.

Our ability to sustain technological dominance is inextricably linked to Air Force Vision 2020. This document presents a vast range of challenges that the Air Force will face over the next two decades. The following assumptions, together with the challenges in *Air Force Vision 2020*, will shape the USAF S&E workforce of the 21st century.

Preeminent S&E Workforce and Infrastructure The Air Force will build on its history of providing aerospace superiority by maintaining a strong in-house scientific and engineering capability to develop, test, field, maintain, and operate superior weapon systems. The key to achieving technological dominance lies in obtaining the most efficient mix of military, civilian, and contractor components with supporting infrastructure, with people being the most crucial component of readiness.

The S&E infrastructure consists of the laboratories, tools, facilities, and ranges needed to explore, develop, and evaluate new technologies, concepts, and ideas. AF S&Es will pursue the most efficient and effective infrastructure, whether organic or commercial, to attain specified goals and objectives.

Qualitative Technological Advantage The Air Force uses superior weapons system capability, enabled by leading-edge technology, to provide a force-multiplying effect. While striving to leverage existing technology available in the industrial base, we must actively push the technical state-of-the-art to maintain our capability advantage. A strategic thinking S&E workforce contributes significantly to maintaining a time-phased modernization

strategy—a strategy that recognizes the need to balance today's readiness with modernization goals.

Weapon System Longevity The Air Force mission is broad; its resources, limited. This situation causes us to retain weapon systems such as aircraft for extraordinarily long times. Accordingly, we are vulnerable to problems associated with the aging of these systems. To maintain a qualitative edge, the Air Force must provide for intensive and innovative efforts to sustain and upgrade them. The S&E workforce will play a pivotal role in achieving this objective by helping to identify and develop timely, innovative solutions to include technology insertion and replacement. Building strong links between the technologist and operators will help us achieve greater effectiveness in sustaining technology dominance.

Weapon System Complexity The Air Force was born of the need to institutionally envision, encourage, protect, and develop aerospace technological innovation. Today, technology remains the hallmark of Air Force culture. To meet emerging threats, the Air Force will continue to develop, procure, and use new weapon systems requiring complex design and integration efforts. These systems will require a technologically knowledgeable developer, buyer, maintainer, and operator, capable of developing, applying, and transitioning new and improved technologies.

Fusion of Technology and Operations Air Force Operations rely on high-technology weaponry, faster decision-making, intelligence, surveillance, reconnaissance, and information technology. The operational commanders need a pool of S&Es to provide rapid technology support.

ENABLERS

People are the foundation of our aerospace force. To accomplish the mission, we must have the right number of motivated, trained people with the right skills. The aerospace force of today and tomorrow requires that we recruit, retain, and develop highly skilled and knowledgeable technical professionals. The S&E workforce must also remain flexible to meet the demands dictated by rapidly changing technology. The following enablers are fundamental to achieving aerospace technical dominance.

Workforce Size and Mix The Air Force must recruit, retain, and sustain organic S&Es as well as partner with contractor S&Es. Maintaining an appropriate workforce size and mix, in today's highly dynamic environment, presents a significant challenge. To meet this challenge, we will establish effective management structures, policies, and processes that provide an efficient means to administer, review, and adjust workforce demographics as required to accomplish Air Force goals and objectives. To preserve a vibrant and highly motivated S&E workforce, we will provide S&E career paths that offer opportunities to gain breadth, depth, flexibility, and operational experience. Each of the three components of the S&E workforce has unique attributes:

Military: Military S&Es, including Reservists and National Guardsmen, are critical to maintaining the link between the warfighter and the larger S&E community by combining operational and technical insight. Military S&Es bring organizations fresh thinking through breadth of experience, multiple assignments, and perspective across organizations, product lines,

and mission areas. They are easily deployable and are a readily accepted broker of technology to the warfighter.

Civilians: Civilian S&Es provide continuity of technical expertise. They are an important source of corporate knowledge, which allows them to draw from lessons learned. S&E civilians bring breadth and depth of experience to a product line or discipline. Just as military S&Es provide our primary bridge to the warfighter, we rely on civilian S&Es as our bridge to technology in U.S. industry and academia.

Contractors: Contractors offer flexibility by allowing rapid response to changing requirements and technology. They enable us to infuse critical technical skills, and provide access to important pools of talent in high-cost geographic locations.

WORKFORCE MANAGEMENT

Education, Training, and Development The USAF needs to create the best S&E workforce possible. However, S&E technological prowess is highly perishable. Therefore, we must continue to ensure that S&Es maintain their technological prowess through graduate education, S&E continuing education, seminars, exchanges, and training. Just as we need to develop S&Es through education and training, we must supplement their training with well-planned assignments. Such assignments provide developers with insight into the operational aspects of a fielded system. As technology continues to grow, we need to shape and sustain a superior S&E workforce and to present them with significant challenges and career opportunities.

Motivation The Air Force provides a tremendous opportunity to participate in developing, sustaining and operating advanced technology. To motivate the workforce, we must provide a culture with technically challenging and rewarding work, along with competitive compensation and rewards that are based on technical merit and contribution. We need to build a shared understanding within the S&E community and across the Air Force of S&E roles, values, and expectations. Our end state goals are technologists who understand operations and operators who understand technology. The synergy created by building strong links between technologists and operators will help us achieve greater effectiveness in sustaining technology dominance.

The Air Force S&E Functional Manager and support staff within Headquarters Air Force will create an Air Force Strategic Plan and develop policy and guidance for organic S&E workforce issues including recruitment, assignments, career development, compensation, education and training, and retention. The S&E Functional Manager will establish processes using advice from the Major Commands (MAJCOMs). In conjunction with HQ USAF and MAJCOM XPMs, the S&E Functional Manager will determine the best size and mix for the S&E workforce; will identify the resources and legislative initiatives to support the workforce; and will be its principal advocate.

Air Force Institute of Technology

MISSION AREAS

There are five S&E mission areas, none of which can be maintained in isolation:

1. Contribute to timely fielding of capabilities in response to current and future threats
2. Ensure weapon systems are sustainable
3. Respond rapidly to time-critical requirements
4. Avoid technological surprise
5. Create opportunities for Revolutions in Military Affairs enabled by new technologies

These five mission areas represent the highest level of S&E involvement within the USAF mission. Figure 1 shows four S&E workforce functions that, singly or combined, enable the mission areas to provide technological dominance.

Figure 1 S&E Workforce Functions

Knowledge and Technology Generation and Analysis The Air Force is committed to innovation. We are continually examining and investing in short- and long-term improvements to sustain our nation's aerospace power advantage. S&Es can provide leadership with cutting-edge technical vision and expertise—the vision and expertise required to discover, analyze, develop, integrate, and deliver affordable technologies for improved warfighting capabilities. S&Es are actively involved in research and development, requirements assessment and analysis, operational requirements development, studies and analysis, concept development, and intelligence.

Material and Non-material Solution Development[3] S&E innovation results in either a material or a non-material solution to meet the evolving need of our warfighters. S&Es are actively involved in modeling and simulation, source selection, modernization, applied research, battle laboratories and demonstrations, technical assessment and interpretation, technical insertion, test and evaluation, analysis of alternatives, and systems engineering.

Operations and Support S&Es provide agile field support and independent mishap investigation. They have a key role in technology insertion, direct operations support, technical insight, training, and innovation for sustainment of systems. S&Es provide an in-house operations research, simulation, combat plans, and systems evaluation capability for the operators' specific needs. S&Es are actively involved in weapon system employment, analysis and sustainment, war gaming and computer aided exercises, operational assessment, aircraft battle damage repair, and technical operations/analysis. To maintain currency with the warfighter, a

scientist or engineer must then transfer operational experience and apply it to the other three functions.

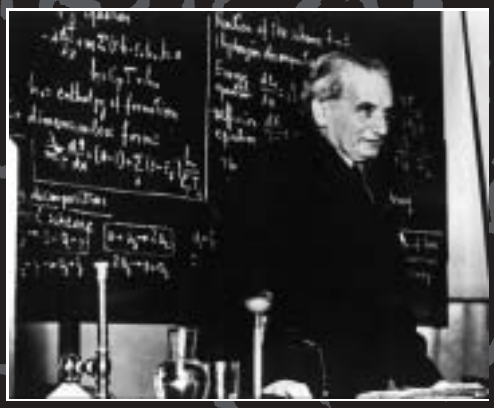
Infrastructure and Support Activities

S&E support is a major workforce function that involves management, development, dissemination of technical policy, and technical advice to support executive decisions. S&Es develop and support the infrastructure required to maintain the four S&E functional categories. S&Es are actively involved in teaching/mentoring, career management, technical policy, technical interface with external agencies, and facility operations and development.

3 The application of knowledge and technology to produce a warfighter solution.

CONCLUSION

The themes addressed in this CONOPS parallel the challenges found in implementing Global Vigilance, Global Reach, and Global Power. The S&E workforce is a prime enabler in attaining technology. Historically, S&Es are intertwined with our nation's success at enabling technology. Therefore, S&Es will continue to play a key role in Air Force technological dominance and mission success.



“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 operations”

Dr. Theodore Von Karman
Scientific Advisory Group, Chairman
Appointed by Gen “Hap” Arnold (1944)

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