



The Essential Engineering Partner

From Serendipitous Development to Strategic Growth

By Joseph Sifer, Executive Vice President
sifer_joseph@bah.com

Booz | Allen | Hamilton

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The stakes could not have been higher. American warfighters on the ground in Iraq and Afghanistan were facing a new and deadly threat: enemy combatants using improvised explosive devices, or IEDs. A favored weapon in the arsenal of insurgents, IEDs were killing or injuring scores of American forces every month. What's more, the enemy's use of clever and adaptive means to trigger IEDs made it challenging to mitigate the threat.

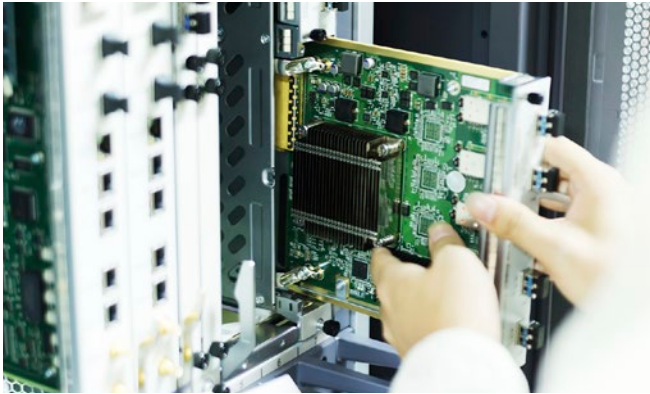
In the early days of these conflicts, Booz Allen Hamilton engineers supported the Department of Defense and Federal Bureau of Investigation by providing technical and forensic analysis of recovered IEDs to map electronic components and triggering mechanisms. The firm developed a reliable and rapid integration and insertion process for advanced-technology IED electronic countermeasures to aid Army units in protecting the warfighter. As a result, while the enemies of the U.S. attempted to overcome these countermeasures, Booz Allen, in partnership with the DoD, helped pave the way for the mitigation and defeat of IEDs in the field—saving the lives of those who protect our own.

As with so many of the world's—and our clients'—challenges, such engineering expertise is an integral part of the solution. Over the past several decades, Booz Allen has been quietly building its engineering business and capabilities. How that expertise developed has resulted in a distinctive approach for delivering high-quality engineering services, solutions, and products tailored to client missions and business imperatives.



The Engineer-Consultant Era

Throughout most of its 101-year history, Booz Allen has worked on engagements with an important engineering element, though initially more as consultants than as hands-on engineers. For instance, in 1949, the firm was called on to help with a guided-missile development project. Consultants reviewed every missile-research project in existence and estimated what would be required in plant space, production staff, materials, and cost to produce them. Beginning in the 1960s, Booz Allen consulted for NASA on the theoretical strategy for the Apollo 11 moon launch. Booz Allen also conducted a study that correctly predicted the challenges experienced by the Orbiting Astronomical Observatory (it failed after a day in orbit after NASA had rejected the study and launched the satellite anyway), and contributed to the design of the Hubble Space Telescope. In the mid- and late-1970s, Booz Allen helped the Navy merge shipboard computer and communications technologies, and was also involved in helping clients with communications security, including cryptographic devices, network protection, and other ways of ensuring government telecommunications.



The technology and digital revolutions of the 1980s and 1990s largely set the stage for the engineering business Booz Allen has today. Technology was quickly becoming increasingly critical to our clients' success. Computers were becoming essential to business and government operations. Telecommunications systems were rapidly moving from analog to digital. Digital systems were becoming progressively interdependent and interconnected.

With these phenomena and other technologies pervading deeply into client operations, Booz Allen needed specialized expertise to complete the types of studies and assessments the firm was conducting to solve client challenges. For example, as the nation's telecommunications network was moving from analog to digital, support the firm was providing clients required deep understanding of digital networks and the underlying technology, along with an understanding of how to embed the necessary capabilities within that network.

This was not the kind of knowledge traditional management consultants could learn as needed for each engagement. Engineers, scientists, information technologists, and software developers joined the firm to do the kind of analytical work that required their specialized capabilities.

These pockets of consultant engineers and technologists, working especially in the defense and intelligence markets, used their expertise to help a variety of clients develop and manage complex systems. For instance, Booz Allen helped the National Communications System, which at the time was within

the Department of Defense, create the Government Emergency Telecommunications Service. And following the 1991 Gulf War, Booz Allen helped Pentagon planners tackle the challenge of creating a communications and information system that would allow data sharing and interoperability across branches of the military.

From Consulting to Practicing Engineers

The terrorist events of September 11, 2001, and the subsequent wars in Iraq and Afghanistan brought new challenges to Booz Allen's defense and intelligence clients. Many of their programs and systems failed to function as needed or, like the IED problem, were not matched to the asymmetric threats of enemy combatants.

The challenges were many and varied, spanning platform modernization, systems engineering and integration, C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance), and more. Soldiers on the ground and their vehicles had insufficient armor. Complex systems lacked interoperability and needed to be acquired, upgraded, or adapted under short timeframes. Communication technologies couldn't provide troops and analysts with real-time access to data, video, and imagery.

Facing these and many other pressing challenges that were putting mission success at risk, defense and intelligence agencies significantly accelerated the acquisition process in order to quickly field needed solutions.

Booz Allen was ready to help these clients rapidly address their dramatically changing needs. The firm's relatively small cadre of engineers, technologists, and scientists not only expanded, but also started doing more and more hands-on engineering work, of which the counter-IED solution is just one example.

In 2005, warfighters in Iraq and Afghanistan expressed an urgent need for a new two-way satellite-based communications infrastructure that would provide real-time access to data, full-motion video, and geospatial imagery to support their mission. Working with the Defense Information Services Agency, a Booz Allen team

engineered a standards-based, scalable architecture. Then, within six months, it deployed a fully accredited operational network over commercial and Department of Defense satellite and wireless networks.

In another high-priority acquisition, U.S. Central Command tasked PM Night Vision/Reconnaissance, Surveillance, and Target Acquisition (PM NV/RSTA) with developing an integrated system of state-of-the-art sensors, networks, and information technologies. To protect the warfighter, critical forward operations needed such a system to be able to detect, locate, identify, and track adversarial threats. Booz Allen partnered with PM NV/RSTA and worked with industry to design, develop, procure, and field an integrated family of sensor systems. These systems provided the Base Expeditionary Targeting and Surveillance System-Combined (BETSS-C) with a sensor common tactical picture based on full-motion video, acoustic, magnetic, seismic, laser, and radar sensor data.

The Wolfhound radio direction finder system provides soldiers with critical information to detect enemy communications and trace the signal path from command and control nodes. Booz Allen, in partnership with the U.S. Army and a key subcontractor, helped design, test, produce, field, and sustain the versatile system. It has proved a reliable, cost-effective, and life-saving device, and it earned an Army Greatest Invention of the Year award.

Booz Allen also supported the Army's Intelligence and Information Warfare Directorate and Distributed Common Ground System-Army (DCGS-A) program for more than a decade. In one effort, a Booz Allen team helped develop the DCGS-A Standard Cloud, a revolutionary cloud-based system that brings together data sets from different sources so analysts can rapidly gather, process, and share intelligence data to shape ongoing operations. Booz Allen defined the infrastructure, acquired the hardware, integrated commercial and custom-developed software, produced test scenarios and training materials, and facilitated deployment and support in-theater.

Booz Allen's Leading Specialty Facilities

Biometrics/Forensics Lab
 C4ISR Lab
 Custom Electronics & Devices Lab
 Cyber Security Engineering and Assessment
 Directed Energy Test Facility
 Electromagnetic Programs Lab
 Hardware/Software Production Lab
 Modeling, Analysis, Visualization, Robotics, and Integration Center (MAVRIC)
 Mixed-Use Prototyping & Development Facility
 Platform Integration Virtual Lab
 Position, Navigation, and Timing Center of Excellence
 Radio Frequency Systems Lab
 Robotic Systems and Simulation
 Satellite Navigation Engineering Lab
 Signal Intelligence Lab
 Systems Development and Integration Lab
 Systems Engineering and Integration Facility
 System Integration & Flight Simulation Lab

As Booz Allen was increasingly called upon to support military, intelligence, and homeland security missions during the post-9/11 period, the firm rapidly grew capabilities in C4ISR, unmanned systems, robotics, radio-frequency electronics, and other areas. This was an entrepreneurial era within the firm, characterized by pockets of engineers and technologists building lines of business to field solutions in support of clients' operational needs and missions. Their success in rapidly engineering, producing, and deploying capability sets provided the foundation for further expansion of the firm's engineering business. In fact, from these and other long-term engineering engagements (e.g., over 25 years supporting the Air Force in developing military satellite communications systems), Booz Allen has built its cadre of engineering leaders who are driving the business today.

Acquisitions Complement Capabilities

After a long period of growing its engineering expertise organically, Booz Allen made two strategic acquisitions that broadened and deepened its capabilities and brought new clients.

On November 30, 2012, Booz Allen closed its purchase of the Defense Systems Engineering and Support division of ARINC Incorporated. Renamed Booz Allen Hamilton Engineering Services and operated as a wholly owned subsidiary, the division added approximately 1,000 staff to the existing 2,000+ engineering business. The acquisition added depth and scale particularly in C4ISR; sustainment engineering; aviation and naval shipboard systems; and positioning, navigation, and timing. It also brought a new client set, especially in sustainment engineering for Air Force and Navy platforms.

Booz Allen Engineering by the Numbers

3,200 Engineers and Applied Scientists

130+ INCOSE-Certified Systems Engineers

27 Specialized Facilities Across the U.S.

2 Manufacturing Facilities

Also on December 31, 2012, Booz Allen acquired SDI Technologies Corporation, a small company with approximately 30 employees based in Durham, North Carolina. This added important rapid-prototyping, manufacturing, and production capabilities along with expertise in customized electronics and radio frequency communications.

The strengths of these acquisitions combined with the expertise long resident in pockets across the firm not only enabled its current, robust engineering business, but also set the stage for future growth to better serve clients.

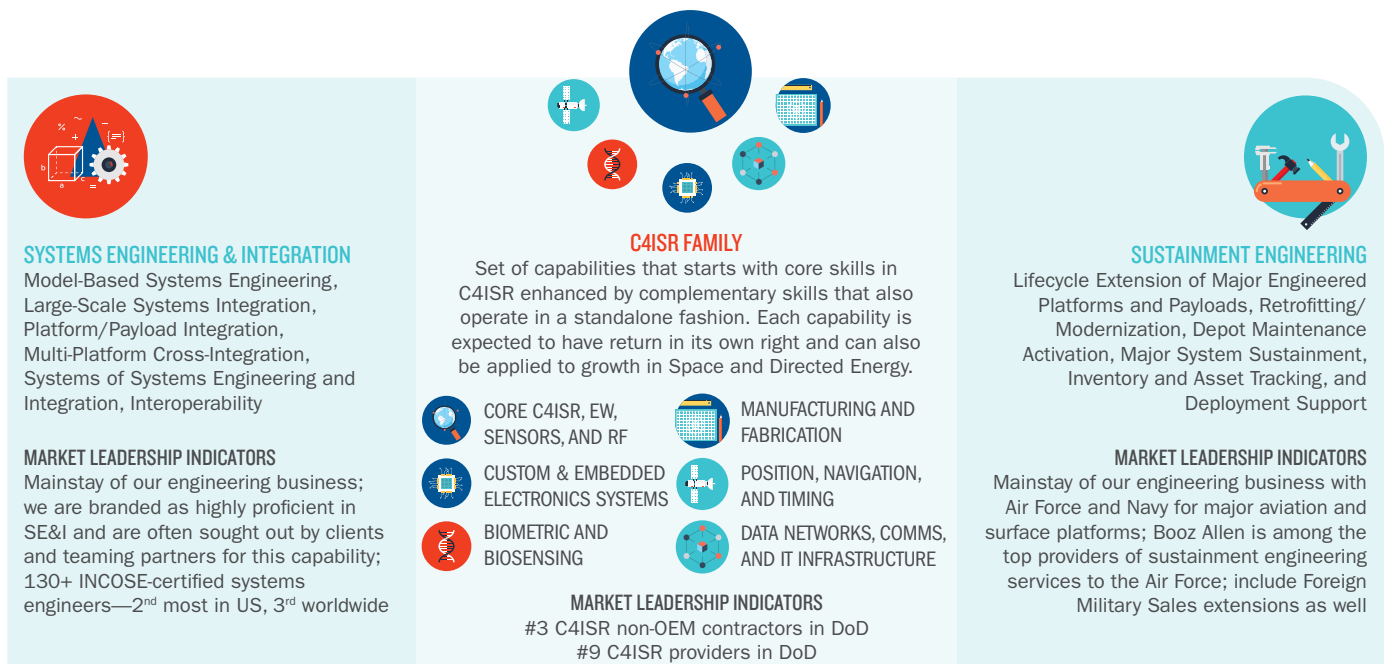
Present Prowess, Future Vision

As Booz Allen enters its second century in business in 2015, technology and engineered systems of all kinds are increasingly central and essential to client success, and thus an important growth platform and strategic driver for the entire firm.

Today, the firm employs more than 3,200 engineers and applied scientists and has 27 labs and specialized facilities across the U.S. These engineering and scientific professionals work in concert with technical staff on clients' hardest engineering and applied science problems, especially in the core areas of C4ISR, systems engineering and integration, and sustainment engineering (see Exhibit 1).

These professionals are collaborating with experts at the Naval Surface Warfare Center, Dahlgren Division, to develop prototypes of directed energy weapon systems. They invented a custom low-power wireless mesh network protocol with the U.S. Army Logistics Innovation Agency that greatly improves the richness and timeliness of data used to locate and maintain assets. And in support of United States Air Forces Central Command, they developed and fielded a new joint radio relay system that overcomes terrain and other obstructions and handles both encrypted and unencrypted communications without onsite cryptographic equipment.

With each of these examples and myriad other engineering-centric engagements, three factors set Booz Allen apart: mission alignment, purpose-fit solutions, and well-rounded professionals. By focusing first on understanding the client's required mission outcomes and the engineered capabilities needed to achieve them, Booz Allen's solutions—whether for new capabilities or service life extension of existing systems—are mission-oriented. Moreover, rather than relying on clients' technical requirements, the firm's engineers seek a deep understanding of the desired performance and outcomes, and then iterate at the front end of the engineering process—during concept definition, research and development, design, modeling

Exhibit 1 | Booz Allen Excels in Three Core Areas of Engineering

Source: Booz Allen Hamilton

and simulation, and prototyping—to quickly arrive at a solution that when built, delivers as required. Finally, many Booz Allen engineers and scientists are not only accomplished in their fields, they also possess strong skills in other disciplines, including policy, business, management, and leadership, and are passionate about the social good at the core of client missions.

Together these three distinguishing attributes manifest in a deep commitment of service to clients, and that commitment in turn is driving an evolution in the firm's engineering business to ensure readiness to meet clients' future mission and operational challenges.

Booz Allen's comprehensive plan for the future—its Vision 2020 strategy—includes five growth platforms of which the Engineering Growth Platform is one. Launched on April 1, 2015, the Engineering Growth Platform is moving the business from the somewhat serendipitous way the firm has acquired and deployed engineering capabilities in the past to a more holistic, strategic

approach to bring the power of engineering and applied science to solving client problems across all markets—government, commercial, and international.

With the goal of serving clients even better and achieving a market-leading position, the Engineering Growth Platform is harnessing the power of the firm's engineering ecosystem within a common framework. This means the businesses, leaders, and staff, which have been distributed in pockets across the firm, are being united in an enterprise model to increase cohesion and collaboration in service delivery. Now all engineering and scientific professionals—whether someone is an applied scientist working with Navy clients, an expert in rapid prototyping aligned to the Advanced Engineering Services team, an engineer with Booz Allen Hamilton Engineering Services, or a sustainment engineer extending the life cycle of major platforms—are integrated under the larger Engineering Growth Platform umbrella. What's more, to strengthen employee affiliation and facilitate development and

collaboration, a new Engineering & Technology career track was introduced in 2013, as were functional communities for engineering, sciences, and network and IT infrastructure where subject matter experts can share best practices and learn from each other.

Another way the Engineering Growth Platform is prosecuting its goal is by being continually responsive to client demand. This may include venturing with other companies that have particular needed offerings, developing specialized products that support services and solutions, offering licensing or managed services, and remaining open to acquiring new capabilities.

As has been the case during the many decades that Booz Allen has been quietly building its engineering capabilities, the engineering business will largely be integrated within engagements addressing client challenges that are core to mission success. This type of work depends on the application and delivery of expertise in core engineering disciplines (e.g., electrical, chemical, mechanical, civil, aerospace, marine), specialized disciplines (e.g., systems engineering, power, RF engineering, etc.), and scientific areas (e.g., physics, chemistry, biology, environment).

And the work may take the form of services, solutions, or products. Services encompass discrete engineering artifacts and deliverables that are analytical in nature and involve the application of specialized expertise to conceptualizing, planning, researching, designing, investigating, testing, reconfiguring, and evaluating proposed or existing end items, systems, or systems of systems. The solutions meet client requirements through the delivery of discrete engineering solutions (e.g., specifications, drawings, build-to packages, engineered end items, end-to-end systems, systems of systems, prototypes, and distinct components or subsystems). Products are Booz Allen–proprietary items or systems, which may be tailored to better fit client needs.

The evolution of Booz Allen’s engineering business—from engineers-as-consultants, to hands-on practitioners, to entrepreneurial business-building engineers and expansion to providing holistic solutions—has today given birth to an enterprise of engineers, scientists, and technologists unified in their commitment to applying their expertise to help clients achieve their missions and objectives. The Engineering Growth Platform continues to drive this trajectory with the ultimate vision of bringing to bear all of the firm’s resources to be an essential partner to clients.

About the Author

Joseph F. Sifer is a Booz Allen Hamilton Executive Vice President with 30 years of experience in engineering and technology solutions that meet the mission and business needs of the U.S. Government and global commercial clients. He currently leads the firm's engineering business, which is one of five firm-wide growth platforms articulated in Booz Allen's Vision 2020 strategy. His prior roles were in the firm's Army business, including leading its C4ISR and technology portfolios. Most recently as a Senior Vice President he served as the overall account lead and general manager for the firm's Army business.

Mr. Sifer has extensive experience in engineering, technology, and consulting for projects in telecommunications, C4ISR, and networking; IT infrastructure, computing, and operations; wireless and advanced RF systems; communications and remote sensing satellites; sensors and sensor platforms; avionics for aircraft, unmanned aerial vehicles, launch vehicles, and spacecraft; attitude determination and control systems for ground, air, and space systems; and advanced concepts such as hybrid networks, specialized gateways, and interoperability.

Contact Information:

Joseph F. Sifer
Executive Vice President
sifer_joseph@bah.com
+1-703-377-4900

About Booz Allen

Booz Allen Hamilton has been at the forefront of strategy and technology for more than 100 years. Today, the firm provides management and technology consulting and engineering services to leading Fortune 500 corporations, governments, and not-for-profits across the globe. Booz Allen partners with public and private sector clients to solve their most difficult challenges through a combination of consulting, analytics, mission operations, technology, systems delivery, cybersecurity, engineering, and innovation expertise.

With international headquarters in McLean, Virginia, the firm employs more than 22,500 people globally, and had revenue of \$5.27 billion for the 12 months ended March 31, 2015. To learn more, visit www.boozallen.com. (NYSE: BAH)

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