The Open Group Guide

FACE™ Business Guide: Guidance in the Value Proposition and Business Case for the FACE Approach, Version 3.0

Prepared by The Open Group FACE™ Consortium Business Working Group.

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FACE™ Business Guide: Guidance in the Value Proposition and Business Case for the FACE Approach, Version 3.0

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Preface

The Open Group

The Open Group is a global consortium that enables the achievement of business objectives through technology standards. Our diverse membership of more than 750 organizations includes customers, systems and solutions suppliers, tools vendors, integrators, academics, and consultants across multiple industries.

The mission of The Open Group is to drive the creation of Boundaryless Information Flow™ achieved by:

- Working with customers to capture, understand, and address current and emerging requirements, establish policies, and share best practices
- Working with suppliers, consortia, and standards bodies to develop consensus and facilitate interoperability, to evolve and integrate specifications and Open Source technologies
- Offering a comprehensive set of services to enhance the operational efficiency of consortia
- Developing and operating the industry's premier certification service and encouraging procurement of certified products

Further information on The Open Group is available at www.opengroup.org.

The Open Group publishes a wide range of technical documentation, most of which is focused on development of Standards and Guides, but which also includes white papers, technical studies, certification and testing documentation, and business titles. Full details and a catalog are available at www.opengroup.org/library.

This Document

This document is the Future Airborne Capability Environment (FACE) Business Guide, Version 3.0. It serves as a reference to better understand the benefits to both the Government and industry of utilizing the FACE Approach. This Guide is developed and maintained by The Open Group FACE Consortium.

Background

Today's military aviation airborne systems typically entail a unique set of requirements and a single vendor. This form of development has served the military aviation community well; however, this stovepipe development process has had some undesired side-effects including long lead times, cumbersome improvement processes, and lack of hardware and software reuse between various aircraft platforms resulting in platform-unique designs.

The advent of complex mission equipment and electronics systems has caused an increase in the cost and schedule to integrate new hardware and software into aircraft systems. This – combined

with the extensive testing and airworthiness qualification requirements – has begun to affect the ability of the military aviation community to deploy new capabilities across the military aviation fleet.

The current military aviation community procurement system does not promote the processes of hardware and software reuse across different programs. In addition, the current aviation development community has not created sufficient standards to facilitate the reuse of software components across the military aviation fleet. Part of the reason for this is the small military aviation market. Another part is the difficulty in developing qualified software for aviation. An additional problem is the inability to adopt current commercial software to Common Operating Environment (COE) standards because they do not adhere to the stringent safety requirements developed to reduce risk and likelihood of loss of aircraft, reduced mission capability, and ultimately loss of life.

To counter these trends, the U.S. Naval Aviation Air Combat Electronics program office (PMA-209), U.S. Army Program Executive Office (PEO) Aviation, the U.S. Army Combat Capabilities Development Command Aviation & Missile Center (CCDC AvMC), and U.S. Air Force Life Cycle Management Center (AFLCMC), enabled by the expertise and experience of the military aviation community's industrial base, are adopting a new approach.

Approach

The FACE Approach addresses the affordability initiatives of today's military aviation domain. The FACE Approach is to develop a Technical Standard for a software COE designed to promote portability and create software product lines across the military aviation domain. Several components comprise the FACE Approach to software portability and reuse:

- Business processes to adjust procurement and incentivize industry
- Technical practices to promote development of reusable software components
- A software standard to promote the development of portable components between differing avionics architectures

The FACE Approach allows software-based "capabilities" to be developed as software components that are exposed to other software components through defined interfaces. These "capabilities" are composed of one or more software units referred to as a FACE Unit of Conformance (UoC). A FACE UoC is a software component or Domain-Specific Data Model (DSDM) designed to meet the requirements within an individual FACE Segment. A DSDM is a data model designed to the FACE Data Architecture Requirements that captures domain-specific semantics. UoCs must be verified as conformant to the FACE Technical Standard to be certified.

The key business goals of the FACE Approach are to:

- Improve the affordability of capabilities
- Improve time-to-field, delivering new capabilities to the warfighter faster

To address the goals listed above and to help ensure competition of the capability throughout the lifecycle of the gaining platform, acquisitions specifying FACE requirements need to meet the following three key tenets:

- Conformance to the FACE Technical Standard

- Delivery of appropriate deliverables and artifacts
- Acquisition of appropriate rights in deliverables and artifacts

To promote adoption, the FACE Technical Standard is an open, non-proprietary technical specification that is publicly available without restrictive contracts, licensing terms, or royalties.

FACE Artifacts

The following published documents and artifacts provide definition and support of the FACE technical and business practices:

- FACE Technical Standard
- FACE Reference Implementation Guide
- FACE Software Supplier Getting Started Guide
- Open Universal Domain Description Language (Open UDDL)
- FACE Shared Data Model Governance Plan
- FACE Shared Data Model
- FACE Conformance Verification Matrix
- FACE Matrix User's Guide
- FACE Business Guide
- FACE Contract Guide
- FACE Conformance Policy
- FACE Library Policy
- FACE Problem Report (PR)/Change Request (CR) Process
- FACE AV-2: Glossary of Terms and Definitions

Additional information can be found at www.opengroup.org/face/docsandtools.

Trademarks

Acknowledgements

The Open Group FACE Consortium gratefully acknowledges the contribution of the following people in the development of this document:

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- Jeffry Howington, Collins Aerospace
- Deborah Mooradian, CCDC AvMC/CRL Technologies, Inc.
- Dennis Stevens, Lockheed Martin
- Corwyn Tiede, U.S. Army PEO Aviation/Quantum

Referenced Documents

The following referenced documents are included for the application of this Guide. For dated references, only the edition cited applies.

(Please note that the links below are good at the time of writing but cannot be guaranteed for the future.)

- ARINC Specification 653: Avionics Application Software Standard Interface
- AV-2: FACE™ Glossary of Terms and Definitions, Edition 3.0.1, The Open Group Guide (G194), published by The Open Group, August 2019; refer to: www.opengroup.org/library/g194
- Developer's Requirements Guide for Airworthy, Reusable FACE Units of Conformance, Carter, et al. April 25, 2014
- DoD Open Systems Architecture (OSA) Contract Guidebook for Program Managers, Version 1.1, June 2013
- FACE™ Contract Guide: Guidance in Writing Solicitations and Proposals with FACE Requirements, Version 3.0, The Open Group Guide (G20A), published by The Open Group, June 2020; refer to: www.opengroup.org/library/g20a
- ISO/IEC 12207:2008: Systems and Software Engineering – Software Life Cycle Processes; refer to: https://www.iso.org/standard/43447.html
- ISO/IEC/IEEE 24765:2017: Systems and Software Engineering – Vocabulary; refer to: https://www.iso.org/standard/71952.html
- ISO/IEC/IEEE 42010:2011: Systems and Software Engineering – Architecture Description; refer to: https://www.iso.org/standard/50508.html

1 Introduction

1.1 Document Scope

This document serves as a reference for executives, military executive officers, and senior leadership from both the Government and industry to understand the value proposition of the FACE Approach. The goals are to:

- Enable Government leadership to understand the value and benefits of including FACE requirements in programs
- Enable industry leadership to understand the value and benefits of having FACE requirements in programs
- Understand the impacts the FACE Approach has on the drivers of developing a business case
- Describe the applicability of the FACE Approach
- Describe the FACE business goals that apply to both Government and industry

Users at all organization levels are encouraged to reference this document for their own benefit, and any potential briefs or discussions they may have with their respective leadership, teams, and colleagues.

This Version 3.0 updates the FACE Business Guide to:

- Align the Glossary with FACE AV-2, Edition 3.0.1
- Include recent Department of Defense (DoD), Army, Navy, and Air Force guidance
- Add the list of acronyms, glossary, and index
- Enhance by incorporating user feedback from the FACE Business Guide, Version 2.0

This document is a product of the FACE Consortium Business Working Group and has been approved by The Open Group FACE Consortium.

1.2 FACE Vision

Historically, embedded avionics software systems have been developed, procured, and implemented with platform-specific designs. This results in tightly-coupled systems with unique and closed interfaces that inhibit cross-platform reuse and adversely affect interoperability between systems. To maintain global leadership in highly capable, innovative systems, both the Government and industry have recognized that it is unsustainable to continue current practices. Various software systems range from closed interfaces to fully open interfaces. As shown in Figure 1, the FACE Approach enables greater Open Systems Architecture (OSA) benefits with open interfaces.

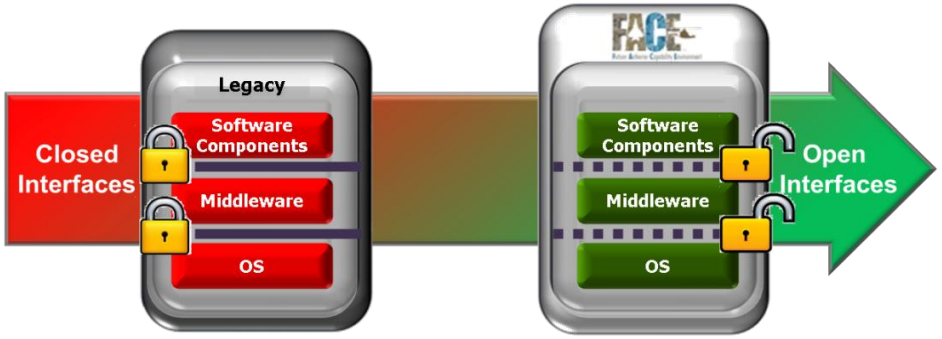


Figure 1: Progressing to Open Interfaces

Open standards are utilized in commercial software such as ARINC 653 in aircraft and POSIX™ in communications. Accordingly, the FACE Consortium envisioned an approach for avionics capabilities to be developed, acquired, and deployed using open standards. This approach incorporates modularity, resulting in an open architecture with:

- A segmented design for grouping software components
- Highly cohesive, loosely-coupled, and severable modules that can be separately competed and deployed throughout the lifecycle

The FACE Approach addresses all five of the Modular Open Systems Approach (MOSA) Principles and helps overcome the following challenges with the modern defense avionics market:

- The lack of common and compatible architectures and standards limits portability and reuse of capabilities across aircraft platforms and limits competition
- Immature acquisition processes and mechanisms inhibit the procurement of independent, modular capabilities
- Guidelines regarding MOSA and Open Systems are generic and difficult to enforce and therefore have unrealized value

As shown in Figure 2, the FACE Approach addresses many of the challenges associated with the traditional approach to obtaining military capabilities.

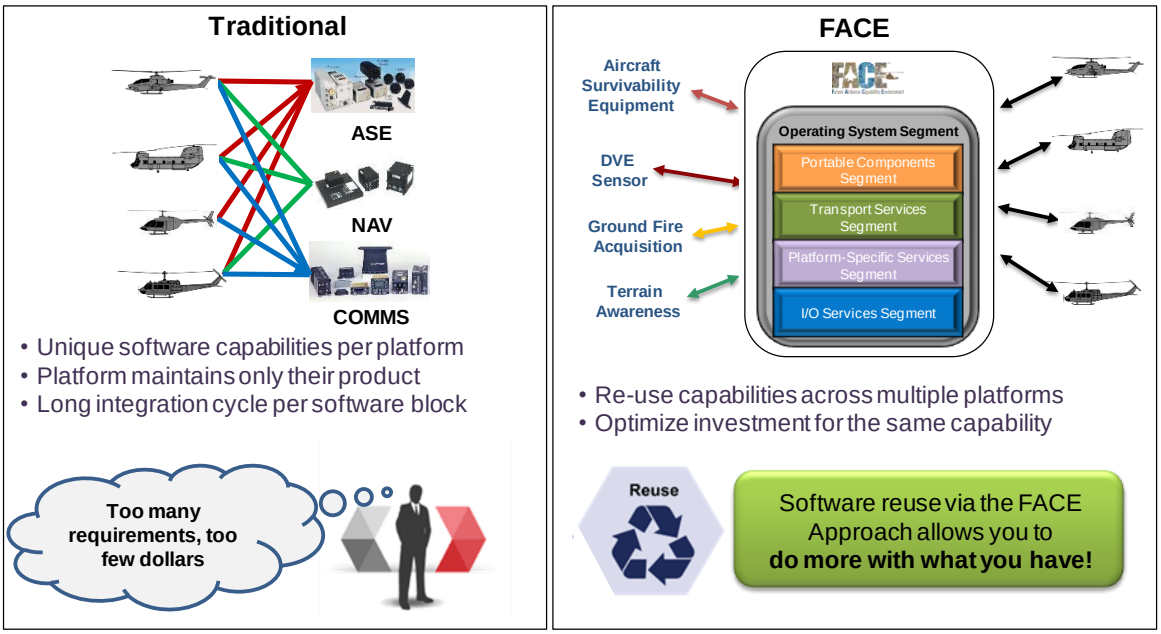


Figure 2: Traditional Approach *versus* FACE Approach

1.3 FACE Consortium Overview

The Open Group FACE Consortium was formed as a Government, industry, and academia collaboration to define an open avionics environment for all military airborne platform types. Today, it is an aviation-focused professional group made up of Government, industry suppliers, academia, and users. The FACE Consortium provides a vendor-neutral forum for Government and industry to work together to develop and consolidate the open standards, best practices, guidance documents, and business models.

The FACE Consortium is formed under the auspices of The Open Group as a "Voluntary Consensus Standards Body" as defined by the National Technology Transfer Act and the Office of Management and Budget (OMB) Circular A-119 with the following attributes:

- Openness
- Balance of interest
- Enabler for consortium participation by U.S. agencies
- Foundation of consortium status under the National Cooperative Research and Production Act (NCRPA)
- Consensus
- Due Process
- An appeals process

Figure 3 depicts the current high-level organization of the FACE Consortium.

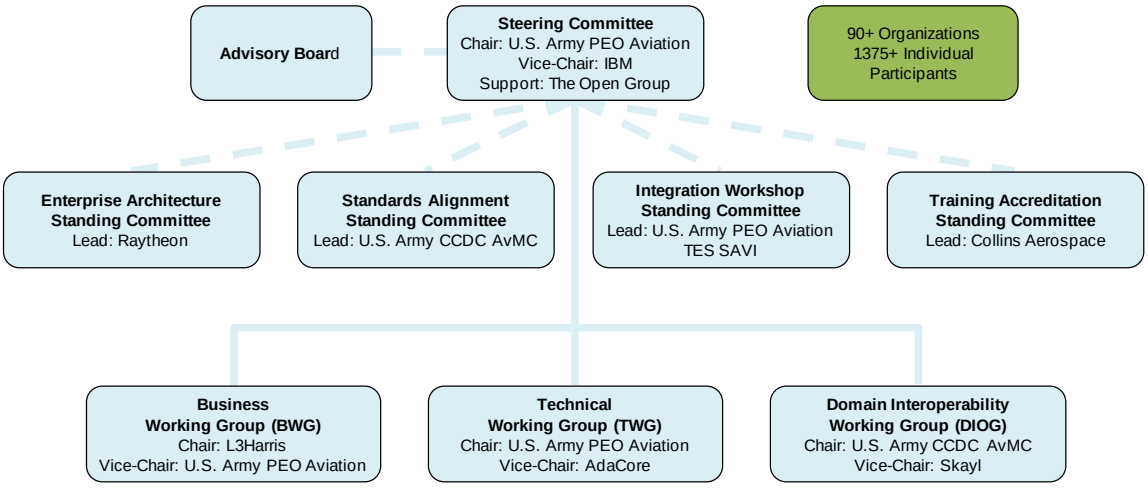


Figure 3: FACE Consortium Organization

2 FACE Approach and Common Misconceptions

2.1 FACE Approach

The key business goals of the FACE Approach are to:

- Increase the affordability of capabilities
- Improve time-to-field, delivering new capabilities to the warfighter faster

The supporting attributes to achieve these goals include:

- Accelerate innovation and new technology insertion
- Enable cross-platform software modularity, portability, and reuse
- Create an Off-the-Shelf (OTS) software marketplace
- Align with other open architecture initiatives and industry standards

The FACE Approach addresses all five of the MOSA Principles and integrates both the technical and business practices that establish a standard COE to support portable capabilities across avionics systems.

The five MOSA Principles and aspects of the FACE Approach that satisfy them include:

1. Establish an enabling environment

   — FACE documents, tools, infrastructure, capabilities available

2. Employ modular design

   — FACE Reference Architecture & Data Architecture

3. Designate key interfaces

   — FACE Interfaces

4. Use open standards

   — FACE Technical Standard leverages ARINC 653, 661, POSIX, OpenGL, etc.

5. Certify conformance

   — FACE Conformance Program

The FACE Technical Standard defines the requirements for architectural segments and key interfaces that link the segments together. This enables the reuse of capability-based software components across different hardware computing environments. The idea is to avoid "reinventing the wheel" for every new platform system. When programs reuse more, they save more. It also enables rapid replacement of older software and insertion with new and improved software throughout the system lifecycle.

The FACE Consortium also recognized the need to build and promote the business processes and rationale that complement the FACE Technical Standard – this is one of the primary characteristics which set this initiative apart from others. Some of the practical business concerns the FACE Approach addresses include conformance (FACE Conformance Program), contracting (FACE Contract Guide), value proposition and business drivers (FACE Business Guide), and product registry (FACE Library Infrastructure documents).

Developing portable and reusable software capabilities is a focus of the FACE Technical Standard. The FACE Consortium determined that portability and reuse could be achieved through the standardization of interfaces and the development of a Reference Architecture comprised of modular layers separating the business logic of mission capability from the platform-specific characteristics. Analogous to the screw-socket interface of the light bulb shown in Figure 4, the FACE Reference Architecture enables a wide range of unique and competitive designs by using an open, common interface for avionics software.

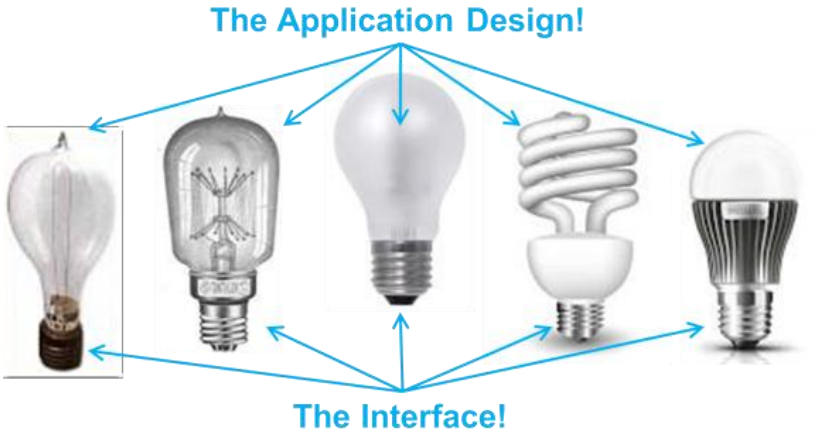


Figure 4: Interface Analogy

The FACE Technical Standard utilizes current industry standards for distributed communications, programming languages, graphics, and operating systems that support OSAs to enable qualified third parties to add, replace, remove, or provide support for a component of a system, based on open standards and published interfaces. By making the FACE Technical Standard a requirement for the software computing environment of system architectures, programs can satisfy the following OSA attributes:

1. Modular designs, with loose coupling and high cohesion, that are based on standards and allow for independent acquisition of system components
2. Enterprise investment strategies, based on collaboration and trust, that maximize reuse of proven hardware and software system designs and ensure we spend the least to get the best
3. Transformation of the lifecycle sustainment strategies for software-intensive systems through proven technology insertion and software product upgrade techniques
4. Dramatically lower development risk through transparency of system designs, continuous design disclosure, and Government, academia, and industry peer reviews
5. Strategic use of data rights to ensure a level competitive playing field and access to alternative solutions and sources, across the lifecycle

2.1.1 FACE Conformance

Conformance to the FACE Technical Standard helps ensure FACE UoCs are open, modular, and reusable to the maximum extent possible. There are no varying levels of compliance with the FACE Technical Standard; a FACE UoC is either conformant or not. The Program Manager (PM) should note that FACE Conformance Certification is only available through the FACE Conformance Program.[1]

Conformance to the FACE Technical Standard is based on proper adherence to the FACE Reference Architecture. FACE Conformance and conformance testing are at the FACE UoC level, as opposed to the system level. The FACE Conformance Program utilizes test tools to ensure conformance to the FACE Data Architecture and defined interfaces, as well as verification processes to ensure conformance to the FACE Technical Standard. The program uses the FACE Conformance Verification Matrix (CVM), which assigns verification methods, describes conformance artifacts for each requirement, and provides additional information for some of the requirements for FACE UoCs in specific FACE Segments. Verification includes a FACE Conformance Test Suite (CTS) to check FACE UoCs for proper adherence to the FACE Interfaces.

FACE Conformance Certification occurs at the end of the software development process. Therefore, FACE Conformance Certification does not have to be complete to bid unless otherwise specified in the solicitation. If the PM desires a warranty from the Contractor to correct any conformance-related deficiencies at the Contractor's cost, the language suggested in the FACE Contract Guide, Chapter 5, Clause H2 provides guidance.

FACE Conformance Certification provides formal recognition of certified conformance to the FACE Technical Standard, which allows:

- Buyers to specify and procure products from vendors providing solutions that are conformant to the FACE Technical Standard
- The FACE Certification Authority (CA) to issue a Conformance Certificate to the software supplier
- Suppliers and practitioners to make and substantiate clear claims of conformance to the FACE Technical Standard, evidenced by possession of a FACE Conformance Certificate

2.1.2 FACE Registry

The FACE Registry enables the discovery and acquisition of FACE UoCs through a centrally located and managed gateway to promote cost-effective reuse of products that have already been developed. Although the FACE Registry does provide the metadata for certified FACE Conformant UoCs, it is not an "app store" from which a FACE UoC is simply "downloaded". After discovery of a FACE UoC, organizations must contact the supplier and enter into applicable agreements for product access and usage.

2.1.3 FACE Contract Guide

The FACE Contract Guide serves as a reference for including FACE requirements into a solicitation or proposal and supplements the DoD Open Systems Architecture (OSA) Contract Guidebook for Program Managers (DoD OSA Guidebook) and, as such, only addresses FACE

[1] See the FACE Conformance Policy, available at: www.opengroup.org/library/x1608.

requirements for an acquisition. PMs are encouraged to reference the DoD OSA Guidebook and include additional OSA language as appropriate.

To promote the adoption and use of the FACE business objectives and technical standards, all FACE documents and Consortium approved tools are open and available without data rights restrictions at the FACE website (www.opengroup.org/face/docsandtools).

2.1.4 Improves Affordability through Software Reuse

As more functions of an aircraft (and other platforms) transition to software implementation, complexity and cost are projected to increase exponentially. Figure 5 illustrates the software complexity and cost growth associated with the development of advanced aircraft avionics for both the commercial and military industry.

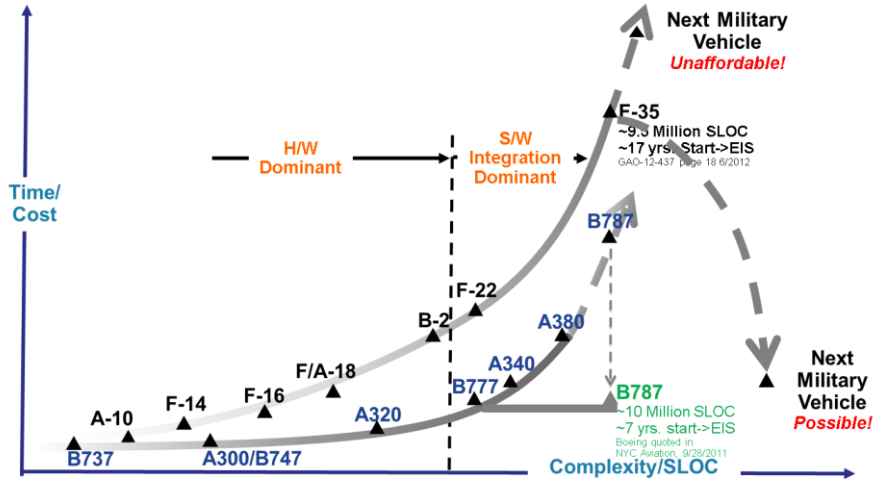


Figure 5: Avionics Cost and Complexity[2]

The lower curve represents the growth of software on commercial aircraft. Commercial aircraft in the era of the B737 through the A320 had modest growth in software as the cockpit instrumentation and systems primarily relied on hardware – proven electro-hydraulic systems that were predominantly analog in nature. As reliability and trust grew in the use of digitization and networking on newer aircraft (like the B777 through A380), avionics functions transitioned to more complex algorithms implemented in software. The savings in weight and improvements in reliability were rapidly being offset by the software cost. The commercial world realized that standardization was required to reduce software cost through the use of proven reusable software modules designed to a common standard known as the Integrated Modular Avionics (IMA) Standard ARINC 653. Through the use of this standard, the cost and complexity of the B787 was reduced to levels approaching the previous generation of avionics software.

Military avionics followed a similar trajectory as shown in Figure 5 upper plot. The era of A-10 through F/A-18 aircraft avionics relied predominantly on hardware – including electro-hydraulic systems and federated analog sensing and actuation systems. As the evolution of military avionics progressed with the advent of modern high-speed computing and associated digitization, the complexity and cost of modern military avionics started to increase

[2] Figure provided by GE Aviation with their permission to use.

exponentially. This culminates in today's F-35 aircraft being dependent upon advanced processors with highly sophisticated software to handle the majority of sensing and actuation. For the next generation of military aircraft, the forward projection of complexity and cost raises serious concerns of the ability to afford new capability to the warfighter in a timely manner.

The FACE Consortium considered these fundamental parallels in both markets and concluded, similar to the commercial market, a common standard is required to enable the affordability of new capabilities to the warfighter.

Figure 6 shows a notional example of how software reuse will result in beneficial cost avoidance. By avoiding "re-developing capabilities" for every new platform system, the Government can increase the Return on Investment (ROI) from any investment in a particular capability or technology as the number of platforms using it increases.

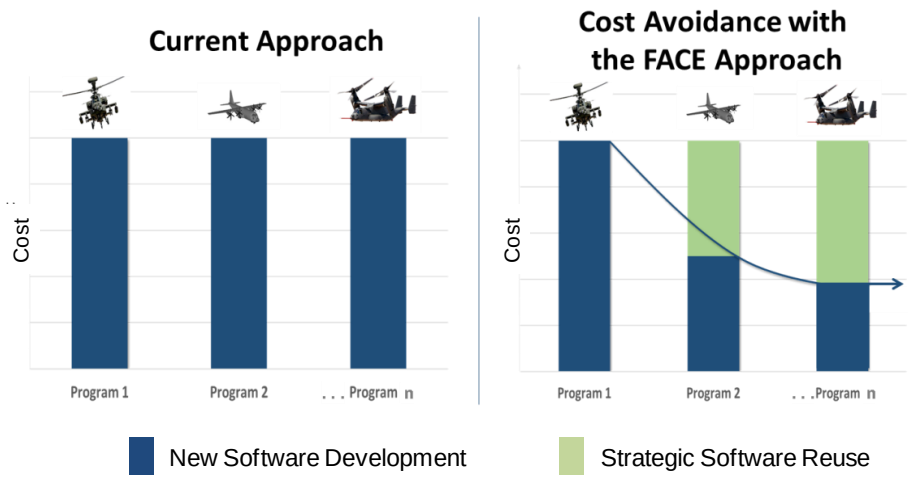


Figure 6: Cost Avoidance with the FACE Approach

The initial cost to develop a capability enabled by FACE Conformant UoCs should not be significantly different from typical development costs without FACE Conformance. However, the real value is in the resulting cost reduction by:

- Reducing duplicate development (through portability and reuse)
- Reducing testing effort, particularly when porting existing FACE Conformant UoCs
- Simplifying integration
- Sustainability savings (tech refresh, upgrades, obsolescence, life extensions)

2.1.5 Reduces Software Lifecycle Timelines

The FACE Approach can reduce the software lifecycle timeline especially in the areas of integration and technology refresh. For first-time development, there may be no schedule improvement, especially when transitioning from an enduring federated system architecture to a modern, partitioned IMA architecture. But once an IMA architecture with robust partitioning is deployed, subsequent insertions of new capabilities should see significant reductions in insertion and testing times.

Getting new and improved capabilities to the warfighter faster is a critical need. The FACE Approach facilitates this by reducing development, integration, and testing timelines, primarily through software reuse, software artifact reuse, and software test artifact reuse. Once the FACE Computing Environment is in place, the addition of new capabilities can be independent of existing hardware and software upgrade cycles.

2.2 Misconceptions about the FACE Approach

Figure 7 lists the common misconceptions of the FACE Approach.

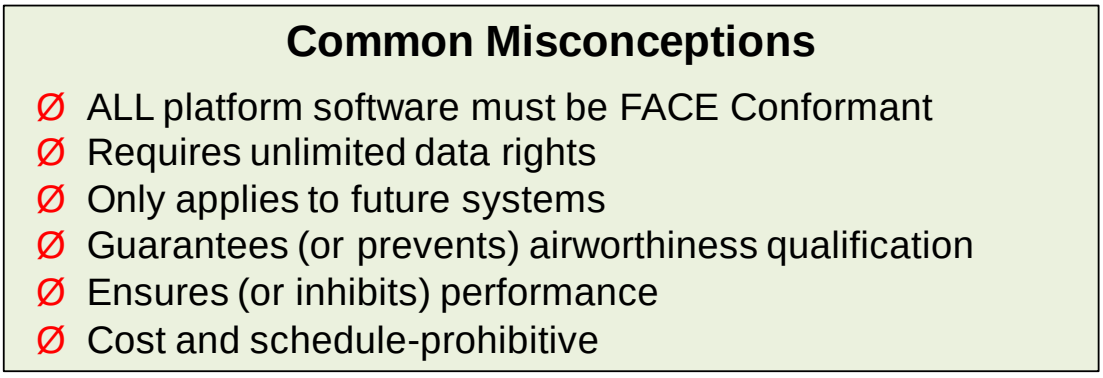


Figure 7: Common Misconceptions of the FACE Approach

2.2.1 All Platform Software must be FACE Conformant

The FACE Approach promotes portability and software reuse. Therefore, only the software intended for reuse on other platforms or systems should be FACE Conformant. A capability enabled by software can comprise any combination of FACE Conformant UoCs and non-conformant software.

2.2.2 Requires Unlimited Data Rights

The FACE Approach does not require a specific data rights strategy. It recommends focusing on utilizing open interfaces and employing a modular design to prevent vendor lock and promote competition and innovation. Moreover, the FACE Approach does not require a software supplier to relinquish data rights within the software application or the software computing environment.

2.2.3 Only Applies to Future Systems

The FACE Approach is intended for both the enduring fleet and future platforms with the benefit that FACE Conformant UoCs can be shared and reused across platforms.

2.2.4 Guarantees (or Prevents) Airworthiness Qualification

The FACE Technical Standard does not specify or guarantee compliance with safety certification standards. Efforts have been made to ensure FACE Conformant UoCs and artifacts do not preclude the ability to meet airworthiness requirements. An optional document developed by the CCDC AvMC may be referenced for airworthiness: Developer's Requirements Guide for Airworthy, Reusable FACE Units of Conformance (see Referenced Documents). This document addresses Army-specific airworthiness requirements for developing reusable FACE UoCs.

2.2.5 Ensures (or Inhibits) Performance

The FACE Technical Standard does not specify or guarantee functionality or performance. The FACE Approach does not eliminate the need for robust system engineering and integration/test processes to ensure functionality and performance.

2.2.6 Cost and Schedule-Prohibitive

The FACE Technical Standard is an open, non-proprietary technical specification that is publicly available without restrictive contracts, licensing terms, or royalties. One of the many benefits of using the FACE Approach is that integrators will develop efficiency in performing the systems engineering and integration/test effort based upon the standardization of interfaces allowing for rapid insertion of capabilities and scaling of these technologies to new environments.

3 Value of the FACE Approach to Stakeholders

The stakeholders involved in the FACE Approach are defined as Government and industry entities that are responsible for the successful completion or deployment of systems and subsystems incorporating FACE requirements. The sections below describe the value of the FACE Approach. Figure 8 shows how these stakeholders may interact on a program with FACE requirements. Some of the key impacts with the FACE Approach include the addition of the FACE Conformance Program, FACE Library, and the flow of FACE requirements, FACE UoCs, and related artifacts.

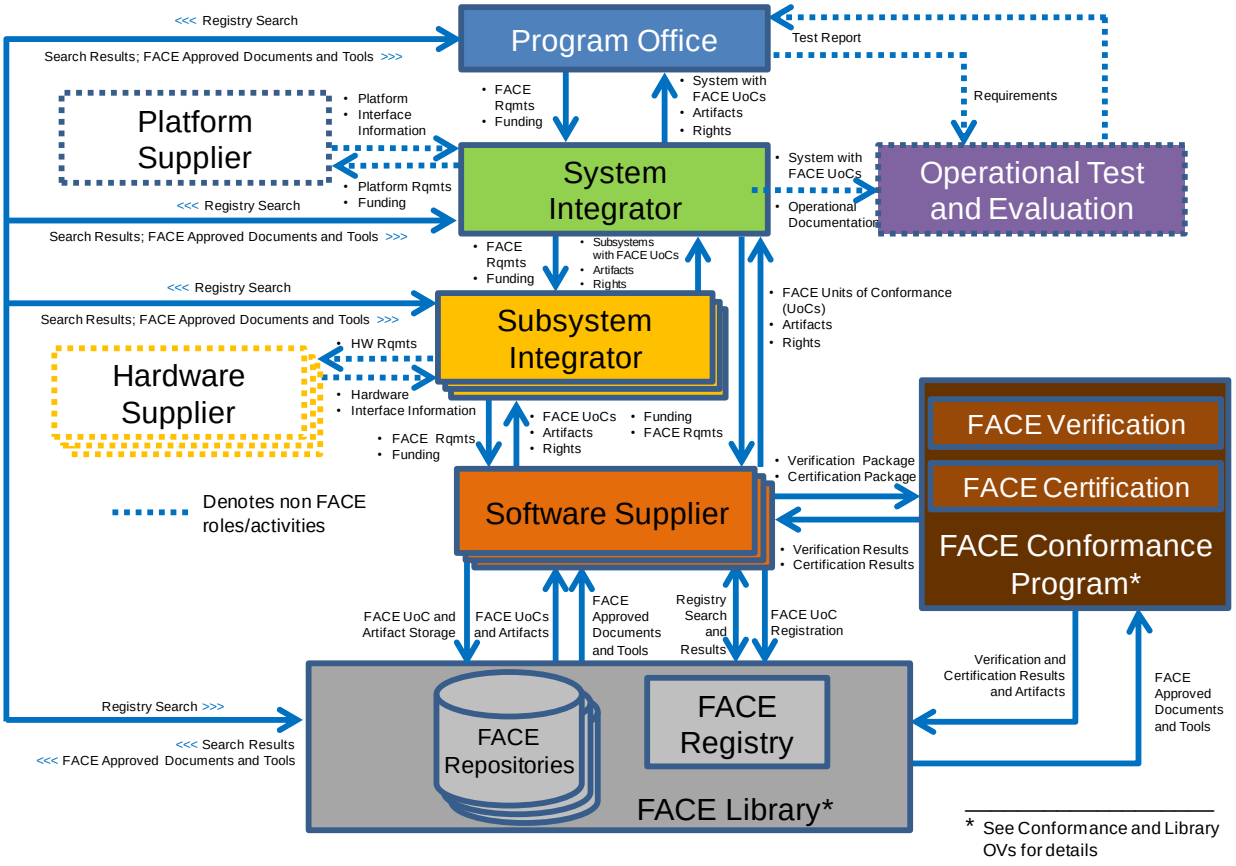


Figure 8: DoD Contracting Roles with the FACE Approach

3.1 Value to the Government

3.1.1 Government Stakeholders

Government stakeholders are those program offices and personnel who will be managing a procurement or program with FACE requirements for a new or existing platform or system.

3.1.2 FACE Approach Supports Government Business Drivers

Adopting the FACE Approach satisfies the policies and guidance for MOSA by addressing all five MOSA Principles. Better Buying Power (BBP) 3.0 is the DoD's mandate to do more without more through a set of fundamental acquisition principles. Government PMs must provide advanced capabilities to the warfighter in a timely manner to maintain battlefield superiority. BBP 3.0 recommends an implementation of best practices to increase buying power through improving industry productivity. In addition to BBP 3.0, the National Defense Authorization Acts (NDAAs) of FY15 and FY17 strengthen the OSA requirements for new Major Defense Acquisition Programs (MDAPs). Section 801 of the NDAA of FY15 introduces a requirement for an open systems approach for major defense acquisition programs in order to improve affordability and increase innovation. Section 1701 of the NDAA of FY17 strengthens, expands, and provides greater detail on the requirement for MDAPs to be designed and developed with a MOSA.

The 2018 National Defense Strategy identifies deepening interoperability as a priority to enable speed of delivery, continuous adaptation, and frequent modular upgrades. In response to the 2018 National Defense Strategy and the NDAA of FY17, the DoD Office of the Under Secretary of Defense for Research and Engineering (OUSD(R&E)) is working with the defense community to develop guidance, such as the MOSA Reference Frameworks in Defense Acquisition Programs from May 2020, for implementing modular open systems approaches in defense acquisition programs.

The Tri-Services Memo from January 7, 2019: MOSAs for our Weapon Systems is a Warfighting Imperative[3] cites the following open standards:

- FACE Technical Standard
- SOSA Technical Standard
- Open Mission Systems Universal Command and Control Interface (OMS/UCI)
- Vehicle Integration for C4ISR/EW Interoperability (VICTORY)

stating that "continued implementation of these standards … is vital to our success" and "should be included in all requirements, programming, and development activities".

Soon after signing the Tri-Services Memo, the Secretary of the Navy (SECNAV) issued Defense Acquisition System and Joint Capabilities Integration and Development Systems Implementation (SECNAV Instruction 5000.2F) on March 26, 2019 that requires the following:

- For all acquisition programs, the PM shall follow MOSA Principles
- ACAT I programs[4] that receive Milestone A or B approval after January 1, 2019 shall be designed and developed, to the maximum extent practicable, with a MOSA that meets the requirements of reference (al)(10 U.S.C. §2446a-2446c)[5]

In a follow-up to the Tri-Services Memo, the Army Acquisition Executive issued a memo on March 20, 2020: Policy Guidance on Implementing MOSA in Army Acquisition Programs and Middle Tier of Acquisition Efforts containing the following requirements:

[3] Refer to: https://www.dsp.dla.mil/Portals/26/Documents/PolicyAndGuidance/Memo-Modular_Open_Systems_Approach.pdf.
[4] Refer to: https://www.dau.edu/glossary/Pages/GlossaryContent.aspx?itemid=26756.
[5] Refer to: https://www.law.cornell.edu/uscode/text/10/2446a.

- PEOs shall develop guidance for implementing MOSA across portfolios by March 2021 and collaborate with the Office of the Chief Systems Engineer (OCSE) for ASA(ALT) approval
- PMs shall develop acquisition, data rights, and product support strategies that implement the MOSA Principles

With the Air Force Instruction 63-101/20-101 Integrated Life Cycle Management dated June 30, 2020, the Secretary of the Air Force ordered the following related to MOSA:

- The PM utilizes Digital Engineering (to include model-based systems engineering), MOSA, software-defined capabilities, and commercial standards and interfaces to the maximum extent practicable; the PM documents their justifications for not utilizing any of these new, rapid tools in the Acquisition Strategy in order to obtain MDA approval or redirection
- The PM applies the MOSA and Open Technology Development to the system architecture design wherever feasible
- The PM applies the MOSA and Open Technology Development wherever feasible; the Chief Engineer uses the technical architecture and market research of potential technologies and sources of supply to craft an open system approach that maximizes technology reuse and system interoperability, and that reduces dependency on proprietary data and total lifecycle costs

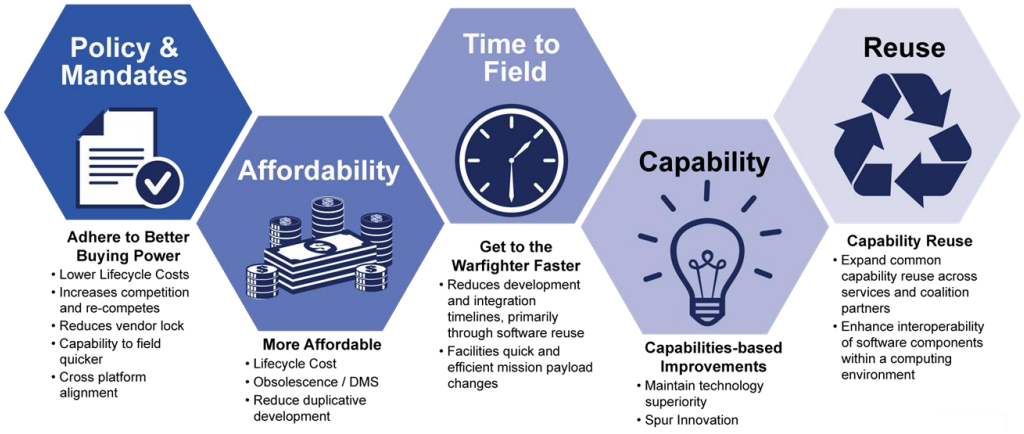


Figure 9: Key Business Drivers for the Government

Furthermore, as the Government moves towards joint programs and multi-role platforms, with the intent to share capabilities and functionality across multiple aircraft types, the FACE Technical Standard can help the Government achieve the following goals, which also align with key business drivers shown in Figure 9:

1. Reduced lifecycle costs and time-to-field:
    a. Reduced vendor lock
    b. Increased competition throughout the lifecycle
    c. Reduced obsolescence redesign costs

d. Reduced technology refresh costs

2. Increased Government and industry collaboration
3. Increased competition in the market for software capabilities (e.g., avionics)
4. Increased opportunities to leverage previously developed capabilities across multiple aircraft platforms
5. Expansion of common capability reuse across services and coalition partners
6. Conformance to the FACE Technical Standard addresses MOSA Principles
7. Consolidation of contract actions to reduce redundant capability efforts
8. Ability to integrate emerging capabilities more affordably

These benefits are key to sustaining warfighting dominance of the U.S. and its allies. In the present fiscal environment, the acquisition community must make a cultural shift away from sole-source, platform-unique solutions and adopt a holistic open architecture approach to cost-effectively deliver the most capability across the DoD and preserve the relevance of enduring systems.

The FACE Computing Environment and resulting hardware and software abstraction will also help mitigate the impact of hardware and software obsolescence. Lengthy development cycles have historically forced expensive redesigns to accommodate obsolete hardware and software components. The FACE Computing Environment will enable evolutionary design and faster development when specifications are updated or changed.

By shifting away from traditional practices to the FACE Approach, the Government can realize numerous benefits, as described in Table 1.

Table 1: Benefits to the Government

More of this	Less of that
• Commonality, reuse, leveraging • Government-defined and managed Technical Reference Frameworks (TRFs) • Software product lines • Functional decomposition down to core building blocks • Flexibility to add, remove, and replace components as the mission capabilities change • Competition • Shared risk between programs and platforms • Leverage products from the commercial market (e.g., COTS)	• Single platform, stovepipe solutions • Platform or vendor-specific open architectures • Point-to-point integrations, duplicative development • Large, complex, tightly-coupled, monolithic systems • Non-competitive upgrades to obsolete capabilities or underperforming systems • Vendor-locked systems • Risk aversion towards shared programs and initiatives • Military-unique development

Use of the FACE Technical Standard and modular software computing environment will allow the Government or the integrator to unbundle new capabilities into distinct hardware and software components and bid them separately. Increased competition for both hardware and

software will open the market to additional suppliers, allowing the Government to procure from a wider supplier base to ensure the warfighter is getting best-in-class systems.

The advantages of adopting and implementing the FACE Reference Architecture and basing procurement on preference for certified conformant products, provides the Government with a wider range of choices and expanded usage of available Commercial Off-the-Shelf (COTS) products. Increased utilization of COTS will drive the Government to adopt commercial practices in its dealings with the commercial marketplace. Considering creative and cost-efficient solutions from commercial practices, such as licensing, to meet the Government's needs may ensure the viability and future economic reuse of FACE UoCs and result in cost savings.

The FACE Approach may result in a shift towards acquiring more capabilities through common component offices (e.g., the Army's PM Aviation Mission Systems & Architecture and the U.S. Naval Aviation Air Combat Electronics program office (PMA-209) and may culminate in an open DoD product line approach to capabilities. This is a result of the FACE Approach enabling a computing environment for software reuse and porting of common components. Integration risks and unknowns will be minimized through conformance to the interfaces and open architecture defined in the FACE Technical Standard. For certain upgrades, the FACE Approach may also open up the integrator role to contractors who have not traditionally been integrators or to organic support by the Government.

3.1.3 Government Commitments to the FACE Approach and Potential Future Business

The Government has demonstrated its commitment to the success of the FACE Approach through its policies, commitment of financial resources, and other initiatives. Government participants in the FACE Consortium (Army, Navy, and Air Force) hold key leadership roles, coordinating/leveraging existing DoD Open Architecture efforts, and aligning activities to ensure the continued interest and participation of the industrial base.

The Assistant Secretary of the Army for Acquisition, Logistics, and Technology (ASA(ALT)) has designated the FACE Technical Standard as one of the technical standards needed to show compliance with the Army's COE initiative. Programs within the Army's Real-Time Safety-Critical Computing Environment (RTSCE CE) have been pursuing FACE Conformance in weapons systems upgrades, modifications, and spiral developments, as well as in design and development of the Future Vertical Lift (FVL) family of systems.

Naval Air Systems Command (NAVAIR) has evaluated the FACE Technical Standard as an enabler for DoD acquisition improvement, with the goals of increasing readiness, reducing cost, and increasing speed of capabilities to the fleet. In addition, the Naval Aviation Open Architecture charter has identified the FACE Reference Architecture as one of the recommended TRFs in a limited set of TRFs.

To support these efforts, Systems Integration Labs (SILs) have been set up by PEO Aviation, NAVAIR, and CCDC AvMC to support development of FACE UoCs. Software suppliers and system integrators will be able to use these labs to aid in development and testing of FACE UoCs within a FACE Computing Environment.

NAVAIR and CCDC AvMC are recognized and operating as FACE Verification Authorities (VAs). These Government funded VAs are operating and working closely with commercial VAs to share lessons learned and improve the ability of industry to develop software that can pass FACE verification testing.

The Air Force Life Cycle Management Center (AFLCMC) has demonstrated the utility of the FACE Reference Architecture in the A-10C Rapid Modular Software Integration (RMSI) demonstration. RMSI replaced the obsolete safety-critical, analog computing capability with a digital system using the FACE Reference Architecture.

The Army, Navy, and Air Force are also working to align existing architectural standards and the FACE Technical Standard.

The benefits of the FACE Approach extend beyond the U.S. DoD. There has been much interest in expanding the benefits of the FACE Approach to U.S. coalition partners. Significant outreach efforts have occurred to educate NATO partners and other allies about how to align with efforts supporting the FACE Approach. FACE Consortium Government members are funding science and technology projects to exercise the FACE Technical Standard including some efforts with international partners.

For information on U.S. Government solicitations with FACE requirements, visit the FACE Procurements page at www.opengroup.org/face/procurements.

3.2 Value to Industry

3.2.1 Industry Stakeholders

Industry stakeholders are those industry entities that supply systems, subsystems, components, or services that adhere to the FACE Technical Standard. This document divides stakeholders into three distinct roles:

- System integrator
- Subsystem integrator
- Software supplier

While a single entity may perform one or more of these roles, this document describes these roles as distinct activities. These stakeholder roles interact with each other in the course of delivering capability enabled by FACE Conformant software, as depicted in Figure 8.

The industry stakeholders described below may build systems with FACE Conformant UoCs using commercial designs, military designs, or a combination. Therefore, the industry stakeholders may include commercial as well as military suppliers. These suppliers may also re-use existing components, new components, or a blended solution.

System Integrator

A system integrator is responsible for integrating the capability within a system and ensuring the system performance meets the customer requirements, technical specifications, and contractual statement of work.

Responsibilities also include generating all system requirements derived from Government-supplied specifications and allocating appropriate ones to the subsystem and its software components, including FACE Conformance.

Subsystem Integrator

A subsystem integrator designs, develops, and delivers avionic subsystems. Subsystem integrators primarily perform avionics hardware and software integration and testing. The requirements allocated to the avionics supplier from the system integrator will call for the avionics to incorporate a FACE Computing Environment, which can support the hosting of FACE Conformant UoCs. These requirements may call for certification of avionics (at the subsystem level) to the safety and security standards imposed by a military authority, a civilian authority, or both.

Software Supplier

A software supplier produces software products (operating systems and associated software business logic, math functions, Real-Time Operating Systems (RTOS), middleware, and so on) for both civilian and defense avionics markets, and other commercial markets. The role of software suppliers in the FACE Approach is to supply FACE Conformant UoCs and a FACE infrastructure. These suppliers work from the requirements provided by the system integrators and avionics suppliers as the software is developed.

3.2.2 FACE Approach Supports Industry Business Drivers

Adopting the FACE Approach provides industry with the opportunity to help satisfy the customer's requirements for addressing the five MOSA Principles, implementing OSAs and reducing lifecycle costs. Additional industry business drivers are shown in Figure 10 and described further in this section.

Figure 10: Key Business Drivers for Industry

The FACE Approach also helps provide opportunities to grow the business. The impact of not winning a major system acquisition in the future is likely to be felt more acutely for individual companies. The result of these intense competitions can often be characterized as a "winner

takes all". The selected system is likely to have a platform-unique architecture, which creates a very high cost of entry for competitors to get future work on the system during maintenance and upgrades and results in vendor lock. Adoption of the FACE Technical Standard helps create more competition by specifying a common, open architecture and facilitates breaking up a single large procurement into smaller, capabilities-based procurements lowering cost of entry barriers. With programs using the FACE Approach, there can be more opportunities to compete for separate components. Even if a technology supplier is not selected as the primary winner on a contract, there can be more opportunities to compete as a supplier as platform upgrades and tech refreshes are scheduled. Companies that take advantage of these new competitive opportunities can grow their business.

It is important to note that the integration role does not disappear with the FACE Approach. Instead, it enables integrators to optimize platform integration efficiency, because the standardization of software interfaces allows for more rapid insertion of capabilities and scaling of these technologies into new environments. Technology suppliers that utilize this benefit may find more opportunities to use their integration services.

The FACE Approach also provides an opportunity to improve shareholder value. Instead of limiting the use of a single software capability to a single program, the FACE Approach facilitates a capability to be incorporated across multiple platforms. This can potentially expand sales from software product reuse on more platforms and increase the ROI from any investment in a particular capability. Technology suppliers can potentially offset development costs of a capability or technology over a greater number of platforms than is possible today. For companies using a product line approach to software development, there will be greater opportunities for those product lines to be efficiently used across platforms. The benefits of a software product line approach (productivity gains, improved time-to-market, increased market agility, increased customer satisfaction, improved use of resources) are derived from the reuse of the core components in a strategic and prescribed way. Once the core components base for the software product line is established, there is a direct savings each time a software product is integrated. The FACE Technical Standard provides the technical framework that will allow for maximum reuse of these components by minimizing the use of unique architectures that would necessitate altering the software product.

The modularity derived from the FACE Technical Standard enables an agile environment for technology suppliers to respond to market and warfighter demands for capability changes and upgrades. Those technology suppliers that employ this agility for rapid technology insertion and accelerated time-to-market will create benefits for both the warfighter as well as the bottom line.

4 Applicability of the FACE Approach

The FACE Approach enables the bidirectional transition of software between the enduring fleet and future platforms.

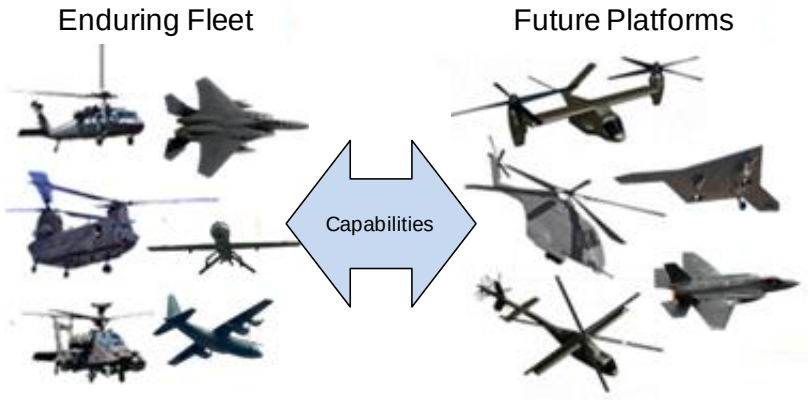


Figure 11: FACE Applicability

4.1 Future Platforms

For future platforms, leveraging the FACE Approach will enable all of the benefits described in this document:

- **New designs:** because the FACE Technical Standard will be included in the system design, the benefits of the FACE Approach will be realized to the highest degree possible on new future systems; systems will have defined interfaces and a partitioned architecture that will enable capability to be fielded faster, at reduced integration costs
- **System-level upgrades:** system-level upgrades to the future fleet will leverage the existing FACE Computing Environment incorporated into the platform design; incorporating new functionality into the FACE Computing Environment will have lower risk and lower cost than the current approach to aircraft upgrades
- **Component upgrades:** future systems containing FACE UoCs will also enable functionality to be improved incrementally at much closer intervals than currently possible; individual FACE UoCs can be replaced with minimum effort

Adherence to the FACE Technical Standard will enable the increase of the delivery cadence of capabilities to the warfighter while reducing cost and complexity, thereby keeping pace with the rapid changes of technology advancement and adversarial threats.

4.2 Enduring Fleet

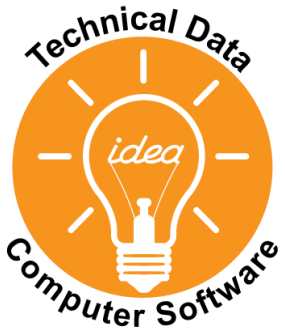
For enduring fleet to take advantage of the benefits of the FACE Approach, some investment will be needed to accommodate the update of a system to host a FACE infrastructure. The amount of investment required in enduring systems to transition wholly or partly to the FACE Computing Environment will vary from platform to platform. Once an investment is made in an enduring platform, however, the platform will be able to leverage the full benefits of the FACE Approach. These benefits include:

- Cost avoidance from using FACE Conformant UoCs
- Cost avoidance from transitioning legacy software onto the existing platform with a FACE Computing Environment
- Cost avoidance for migrating existing FACE Conformant UoCs onto future systems using the FACE Approach
- Speed of integrating new FACE Conformant UoCs

It is important to note that FACE Conformant UoCs can potentially be deployed without the full instantiation of the FACE Computing Environment as long as their dependencies are satisfied. For enduring platforms, desired FACE Conformant UoCs can be incrementally added as the legacy computing environment can support them. The program would need to understand the impact and limitations of the applicable enduring systems, as well as the associated management to achieve an incremental migration that is feasible with respect to the technical and business requirements. Enduring system upgrade/modification programs in a constrained budget environment, aggressive schedule, or limited scope stand to benefit from this potential of the FACE Approach. The bottom line is that the FACE Approach supports incremental deployment to meet short-term/quick reaction needs and long-term goals.

5 Rights in Technical Data and Computer Software (Data Rights)

Neither the FACE Technical Standard nor the FACE Conformance Certification process require or prohibit a software supplier to relinquish rights to Technical Data (TD) or Computer Software (CS)[6] (herein referred to as data rights) within the software, the business logic, the presentation logic, or any other logic whether in the application or the software computing environment.



The FACE Technical Standard is agnostic to the software supplier's business model and allows the use of Intellectual Property (IP) ranging from Open Source to royalty-bearing code.

The FACE Technical Standard also does not require nor prohibit purchasing organizations from requesting or acquiring data rights. The FACE Technical Standard does not conflict with laws, regulations, or policies governing how such data rights are acquired.

The FACE Approach is designed to enable the flexibility and balance of Government and industry interests regarding data rights. This neutral stance regarding data rights is intended to promote the adoption of the FACE Technical Standard among the widest possible audience of supplier and purchaser parties, to enable those parties to negotiate according to their own needs for data rights, and to permit parties to consult their own experts for navigating the data rights and legal rules in place within their Government's jurisdiction.

The following sections discuss data rights considerations from a U.S. Government and industry perspective.

5.1 Data Rights Strategy Considerations

It is important for the Government to assess the requirements of their program and create a data rights strategy for each procurement as required by Defense Federal Acquisition Regulation Supplement (DFARS) 207.106 and specified in guidance documents such as the FACE Contract Guide,[7] the DoD OSA Guidebook,[8] DoD Navigating Commercial Waters,[9] DoD Directive 5000.01,[10] Defense Acquisition Guidebook, Chapter 4: Systems Engineering,[11] and DoD

[6] Refer to the definitions of TD and CS in the DFARS: 252.227-7013(a) and 252.227-7014(a).
[7] FACE™ Contract Guide, Version 3.0 (see Referenced Documents).
[8] DoD OSA Guidebook, Appendix 7: Assessing a Program's Intellectual Property Rights Needs and Developing a Technical Data Rights Strategy (TDRS).
[9] Navigating Through Commercial Waters: Issues and Solutions when Negotiating Intellectual Property with Commercial Companies (Version 1.1), Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, October 2001; refer to: www.acq.osd.mil/dpap/Docs/intelprop.pdf.
[10] DoD Directive 5000.01; refer to: www.dtic.mil/whs/directives/corres/pdf/500001p.pdf.
[11] Defense Acquisition Guidebook, Chapter 3: Systems Engineering: https://www.dau.edu/tools/dag.

Instruction 5000.2.[12] The Government should clearly communicate its intended use and thus desired need for rights in the resulting deliverables (commercial and non-commercial) in a solicitation and contract. The Government encourages contractors to offer innovative and cost-efficient solutions to meet the Government's needs.

In determining which data deliverables and associated rights are sufficient to support the principles of OSA and the planned technology development, acquisition and logistics support strategies as well as reuse, portability, interchangeability/replaceability, and open competition throughout the lifecycle of the product for a system with FACE requirements, the Government should consider:

- The type of TD and CD to be delivered (technical data, software code, Interface Control Documents (ICDs), other documents, etc.)
- The appropriate license rights in TD, CS, and documentation required to integrate and replace the UoCs and other software units, software items, and related documentation in the future (such as interface data/documentation) and the need for, and timing of, delivery of such data and software; refer to DFARS and Legal Counsel with regard to obtaining these appropriate license rights
- The development and delivery of Unit of Portability (UoP) Supplied Models (USMs) necessary to integrate software internally within the FACE Computing Environment
- The development and delivery of ICDs necessary to integrate software externally and to identify physically and functionally interchangeable items

5.2 U.S. Government Perspectives on Data Rights and IP

The benefits of the open architecture and the FACE Approach can be realized within the full spectrum of possible data rights licenses. PMs are being encouraged to conduct Business Case Analyses (BCAs) to carefully weigh the cost benefits of the different types of license rights and where in a system those rights are necessary, including but not limited to unlimited rights, Government Purpose Rights (GPR), limited rights, restricted rights, and specially negotiated license rights. In the future, there could be a potential shift towards licensing software if industry starts to incorporate the FACE Technical Standard in commercial products that can be transitioned to military use. A data rights strategy will allow PMs to promote competition and fairly compensate industry for innovation.

Here are some key data rights considerations for the Government PM:

- Which components, systems, interfaces, or modules are expected to experience the most frequent changes?
- What are the near-term and future design documentation and TD needs?
- How do the TD needs compare to what the Government is entitled to per the DFARS considering source of funding and Form, Fit, and Function (FFF)?
- What type of data needs to be delivered and the appropriate level of documentation (such as system level, segment level, UoC level)?

[12] DoD Instruction 5000.2; refer to: https://www.esd.whs.mil/dd/.

- What TD or rights are required to integrate and/or replace the UoCs being acquired in the future (such as interface data/documentation)?

The FACE Contract Guide provides guidance on the recommended Contract Data Requirements Lists (CDRLs) and documentation for UoCs to enable reuse, tech refresh, and replacement.

5.3 Industry Perspectives on Data Rights and IP

IP forms the basis of a company's core competencies and can enable differentiation of their products and services from competitors. Companies often invest their own funds to develop new technologies or capabilities prior to being put on U.S. Government contract. Protecting the rights to these developments and being able to receive an economic benefit is essential for companies to continue to make such investments.

With the inherent flexibility of data rights approaches supported by the FACE Approach, a balance of interests can be realized. This is the best way for industry to provide innovation that pushes the frontier of technology to serve warfighter needs in a balanced, symbiotic market environment, which results in "win-win" outcomes for both Government and industry.

A Acronyms

Acronym	Definition
ACAT	Acquisition Category
AFLCMC	Air Force Life Cycle Management Center
ARINC	Aeronautical Radio, Incorporated
ASA(ALT)	Assistant Secretary of the Army for Acquisition, Logistics, and Technology
BBP	Better Buying Power
BCA	Business Case Analysis
CA	Certification Authority
CCDC	Combat Capabilities Development Command
CCDC AvMC	CCDC Aviation & Missile Center
CDRL	Contract Data Requirements List
CI	Configuration Item
COE	Common Operating Environment
COTS	Commercial Off-the-Shelf
CS	Computer Software
CTS	Conformance Test Suite
CVM	Conformance Verification Matrix
DFARS	Defense Federal Acquisition Regulations Supplement
DoD	Department of Defense
DoD OSA Guidebook	DoD Open Systems Architecture (OSA) Contract Guidebook for Program Managers
DSDM	Domain-Specific Data Model
FFF	Form, Fit, and Function
FVL	Future Vertical Lift

Acronym	Definition
GPR	Government Purpose Rights
I/O	Input/Output
ICD	Interface Control Document
IMA	Integrated Modular Avionics
IOSS	I/O Services Segment
IP	Intellectual Property
ISO	International Organization for Standardization
MDAP	Major Defense Acquisition Program
MOSA	Modular Open Systems Approach
NAVAIR	Naval Air Systems Command
NCRPA	National Cooperative Research and Production Act
NDAA	National Defense Authorization Act
OCSE	Office of the Chief Systems Engineer
OMB	Office of Management and Budget
OMS/UCI	Open Mission Systems Universal Command and Control Interface
Open UDDL	Open Universal Domain Description Language
OSA	Open Systems Architecture
OSS	Operating System Segment
OTS	Off-the-Shelf
OUSD(R&E)	Office of the Under Secretary of Defense for Research and Engineering
PCS	Portable Components Segment
PEO	Program Executive Office
PM	Program Manager
POSIX	Portable Operating System Interface
PSSS	Platform-Specific Services Segment
RIG	Reference Implementation Guide

Acronym	Definition
RMSI	Rapid Modular Software Integration
ROI	Return on Investment
RTOS	Real-Time Operating System
RTSCE	Real-Time Safety-Critical Computing Environment
SECNAV	Secretary of the Navy
SIL	Systems Integration Lab
TD	Technical Data
TDRS	Technical Data Rights Strategy
TRF	Technical Reference Framework
TSS	Transport Services Segment
UoC	Unit of Conformance
UoP	Unit of Portability
USM	UoP Supplied Model
VA	Verification Authority
VICTORY	Vehicle Integration for C4ISR/EW Interoperability

B Glossary

Aircraft Platform

Represents an airframe that hosts mechanical, computing, and other resources necessary to perform a particular mission within the aviation domain.

Architecture

Fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution (ISO/IEC/IEEE 42010).

Certification Authority (CA)

The entity officially sanctioned to manage the day-to-day operations of the FACE Conformance Program in accordance with the policies defined in the FACE Conformance Policy.

Cohesion

A measure of the strength of association of elements within a Software Unit. It is a way of describing the degree to which a module achieves the objective of carrying out a single, well-defined purpose.

Commercial Software

Software developed or regularly used for non-Government purposes which has been or offered for sale, lease, or license to the public. See DFARS 252.227-7014(a)(1).

Computing Platform

The combination of hardware and operating system, network, and device drivers supporting software components. Typically refers to a processing hardware within a Weapons Replaceable Assembly, or Line Replaceable Unit, along with its associated software infrastructure.

Configuration

The selection of values or features of a component or system such that the intended operational characteristics are achieved.

Configuration Item (CI)

An aggregation of hardware, software, or both that satisfies an end-use function and is designated for separate configuration management by the acquirer.

Conformant

See FACE Conformant.

Coupling

A measure of the degree to which each module relies on each one of the other modules.

Data Architecture

A set of related models, specifications, and governance policies with the primary purpose of providing an unambiguous description of exchanged data and an interoperable means of data exchange.

Data Model

An abstraction that describes real-world elements, their properties, and their relationships in order to establish a common understanding for communication between components.

Domain-Specific Data Model (DSDM)

A Data Model designed to the FACE Data Architecture Requirements. It captures domain-specific semantics.

FACE Computing Environment

A generic concept instantiated for a particular system under development. It includes all elements of the FACE Reference Architecture necessary to deploy FACE Conformant components. The FACE Computing Environment is composed of the software infrastructure (Transport Services, Operating System, and I/O Services Segments), the Platform-Specific Services Segment required by the FACE components.

FACE Conformance Certificate

A document issued to a Software Supplier formally declaring that a Unit of Conformance, any associated conformant variants, and/or Unit of Conformance Package has successfully met the requirements for certification.

FACE Conformance Certification

Provides formal recognition of conformance to the FACE Technical Standard.

FACE Conformance Policy

The document that defines the processes and policies that govern the FACE Conformance Program including the conformance verification and certification processes.

FACE Conformance Test Suite (CTS)

A test suite that will accept the Unit of Conformance and produce a pass/fail with respect to all Conformance Requirements covered by the test suite plus a detailed report of the test results.

FACE Conformant

Unit(s) of Conformance that have been certified as adhering to the requirements of a specific edition of the FACE Technical Standard, for the applicable FACE Profile(s) and FACE Segment.

FACE Contract Guide

The document that serves as a reference guide for including FACE specific content into a solicitation or proposal.

FACE Infrastructure

An implementation of a FACE Operating System Segment, I/O Services Segment, and Transport Services Segment that is capable of hosting PCS and PSSS software components that are aligned to the FACE Technical Standard.

Note: PCS and PSSS components are not required to have a FACE Conformant "stamp" in order to be integrated.

FACE Interfaces

Standardized interfaces providing connections between software components of the FACE Segments.

FACE Library

The infrastructure developed to enable the discovery and acquisition of FACE Certified Units of Conformance.

FACE Reference Architecture

A reference architecture that guides and constrains the development of FACE Units of Conformance based on the architectural segments, key interfaces between the architectural segments, programming language mappings, and the operating system profiles as specified in the FACE Technical Standard.

FACE Registry

The single online reference point for listing and managing all FACE Certified Units of Conformance. As the gateway to discovering certified products, it will include descriptions and locations of available FACE Conformant products and the publishable standard licensing terms for each product.

FACE Technical Standard

An open, royalty-free standard that addresses the software technical requirements of the FACE infrastructure, interfaces, and software.

I/O Service

A collection of software components that provides a unified view of an IO Interface to all Platform-Specific Services Segment software components using that interface.

License

The grant by the owner of intangible or intellectual property, such as a trademark or software program, of the rights to make certain uses of the property.

Models

A description or specification of a system and its environment for some certain purpose, often presented as a combination of drawings and text using a modeling language or a natural language.

Modularity

The degree to which a system or software is composed of discrete software such that a change to a Software Unit has minimal impact on other software.

Non-Commercial Software

Software that does not qualify as commercial software (see Commercial Software). See DFARS 252.227-7014(a)(14).

Open Source

Pertaining to or denoting software whose source code is available free-of-charge to the public to use, copy, modify, sublicense, or distribute.

Open Standards

Widely accepted and supported standards set by recognized standards organizations. These standards support interoperability, portability, and scalability and are equally available to the public at no cost or with a moderate license fee, and are maintained by standards bodies that meet the requirements of OMB-A119.

Platform

Refers to one of three related things with respect to the FACE Technical Standard: Device (comprised of sensors, Weapon Replaceable Assembly, and Line Replaceable Unit), Aircraft (to include one or more computing platforms), and Computing (comprised of electronic circuitry and software).

Portable

The ability to move existing software elements from one environment (physical or computing) to another. More specifically, the ease with which Unit of Conformance source code can be transferred and reused from one instance of a Software Computing Environment to another.

Proprietary Software

Non-commercial software "developed exclusively at private expense" in accordance with DFARS 252.227-7014. Although commercial software and non-commercial software that was not developed exclusively at private expense may be proprietary, it is excluded from the definition of "Proprietary Software" as used herein.

Reference Implementation Guide (RIG) for the FACE Technical Standard

The FACE Reference Implementation Guide is to be used in conjunction with the FACE Technical Standard. The RIG guides the developer through the thought process in determining how FACE Conformant products may be instantiated in a manner that is conformant to the FACE Technical Standard.

Reuse

The ability for source code, components, or modules to be used again to add new functionalities with slight or no modification.

Segment

A logical grouping of components and/or services within a boundary whereby elements within are allowed to vary based on system needs and the interface to elements outside the Segment boundary adheres to the FACE Reference Architecture.

Service

A software utility providing capability to software components or other services.

Software Artifact

Any piece of software or reference to software or software documentation (e.g., models, descriptions, reports, analyses) developed and used during software development and maintenance. Examples are requirements specifications, architecture and design models, source and executable code (programs), configuration directives, test data, test scripts, process models, project plans, various documentation, etc.

Software Capability

A set of software deliverables that provides one or more mission-level facilities to the existing functionality of the current software suite.

Software Computing Environment

From a deployment perspective, a layer above the computing and networking hardware that encompasses a collection of configured instances of Operating System Segment Units of Conformance, Transport Services Segment Units of Conformance, I/O Services Segment Units of Conformance, and Platform-Specific Services Segment Common Service Units of Conformance required to support a specific collection of configured instances of Portable Components Segment Units of Conformance and Platform-Specific Services Segment Units of Conformance in the layer above it.

Software Configuration Item

An aggregation of software designated for configuration management and treated as a single entity in the configuration management process (ISO/IEC/IEEE 24765). This entity satisfies an end-use function and can be uniquely identified at a given reference point (ISO/IEC 12207:2008 §4.7).

Software Supplier

A vendor who is interested in, is applying for certification in, or has certified a Unit of Conformance in the FACE Conformance Program.

Software Unit

An element in the design of a Computer Software Configuration Item; for example, a major subdivision of a Computer Software Configuration Item, a component of that subdivision, a class, object, module, function, routine, or database. Software Units may occur at different levels of a hierarchy and may consist of other Software Units (MIL-STD-498). From a FACE standpoint, one or more Software Units can make up a Unit of Conformance, which can be combined with one or more Units of Conformance, and/or conventional (not adhering to the FACE Technical Standard) Software Units, to create a Computer Software Configuration Item.

Unit of Conformance (UoC)

A software component or Domain-Specific Data Model (DSDM) designed to meet the applicable requirements defined in the FACE Technical Standard. It is referenced as a FACE UoC at any point in its development, and becomes a FACE Certified UoC upon completion of the FACE Conformance Process.

Unit of Conformance Package

A collection of Units of Conformance combined to create a singular software logical entity, which may be placed in the Registry. The Units of Conformance that make up a Unit of Conformance Package may be from different FACE Segments.

Verification Authority

An entity officially sanctioned by the Steering Committee to conduct or witness For-the-Record Verification testing using an approved version of the Conformance Test Suite and assess the Verification Evidence provided by the Software Supplier in support of the FACE Conformance Program. The Verification Authority may be an independent third-party entity or a designated internal, independent entity of the Software Supplier.

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