FACE™ Master Class

April 28, 2016

IOA 2016
London, England

-Presenters-

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Chair: FACE Business Working Group

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Vice Chair: Steering Committee

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Vice Chair: Business Working Group

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Lockheed Martin Corporation
Chair: Technical Working Group Steering Committee
FACE™ Master Class Agenda

- Introduction
- FACE Coordination With Other Open Architecture Initiatives
- Conformance & Library Overview and Processes
- Break
- Technical Overview
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Future Airborne Capability Environment

• The FACE Concept is a government-industry software standard and business strategy:

• The FACE Technical Standard:
  − An open avionics standard of standards to facilitate robust, interoperable, portable and secure avionics capability

• The FACE Business Strategy:
  − Designed to facilitate the acquisition of affordable software systems
FACE Consortium

• Member Composition:
  – Industrial Supply Chain

• Voluntary Consensus Based Standards Development Activity:
  – Industrial Supply Chain
# FACE Consortium Members

## Sponsor Level Member Organizations
- Air Force Research Laboratory
- Boeing
- Lockheed Martin
- Rockwell Collins
- US Army PEO Aviation
- US Navy NAVAIR

## Principal Level Member Organizations
- AeroVironment, Inc.
- BAE Systems
- Elbit Systems of America
- GE Aviation Systems
- General Dynamics
- Green Hills Software
- Harris Corporation
- Honeywell Aerospace
- IBM
- Northrop Grumman
- Raytheon
- Sierra Nevada Corp.
- Sikorsky Aircraft
- Textron Systems
- US Army AMRDEC
- UTC Aerospace Systems
- Wind River

## Associate Level Member Organizations
- Abaco Systems
- AdaCore
- Alliant Techsystems Operations, LLC
- Astronautics Corporation of America
- Avalex Technologies
- Avionics Interface Technologies
- Brockwell Technologies
- CALCULEX
- Carnegie Mellon Univ. – Software Engineering Institute
- CERTON Software, Inc.
- CMC Electronics
- Cobham Aerospace Communications
- Concurrent Computer Corporation
- Core Avionics & Industrial Inc.
- Creative Electronic Systems North America
- CTSi
- Curtiss-Wright Defense Solutions
- DDC-I
- DornerWorks
- Draper Laboratory
- Enea Software & Services
- ENSCO Avionics
- Esterel Technologies
- Esterline AVISTA
- Exelis Inc.
- GECO Inc.
- General Atomics Aeronautical Systems, Inc.
- GrammaTech, Inc.
- Howell Instruments, Inc.
- Intrepid, LLC
- Johns Hopkins Univ. - APL
- Joint Tactical Networking Center
- Kaman Precision Products
- KEYW Corp.
- KIHOMAC
- Kutta Technologies
- L-3 Communications
- LDRA Technology
- Leidos Inc.
- Lynx Software Technologies
- Mercury Systems
- OAR Corporation
- Performance Software
- Physical Optics Corp.
- Presagis USA, Inc.
- PrismTech Corp.
- Pyrrhus Software
- Real-Time Innovations
- Richland Technologies
- SAIC
- Selex Galileo Inc.
- SimVentions
- Southwest Research Institute
- Stauder Technologies
- Support Systems Associates
- Symetrics Industries
- Technology Service Corporation
- TES-SAVI
- Thales USA, Inc.
- Thomas Production Company
- Trideum
- TTTech North America, Inc.
- ULTRAX Aerospace, Inc.
- US Army Electronic Proving Ground
- University of Dayton Research Institute
- Vencore, Inc.
- Verocel
- Vector Software, Inc.
- Zodiac Data Systems
FACE Progress

- Technical Standard 2.1
- Supporting reference documentation
- Business Practices:
  - Library Administrator Selected
  - Conformance Program Work Flow Tool Initiated
  - Change Management Program Operational
- International Participation:
  - Basis for existing process
  - Methods available today:
    - The Open Group Company Review
    - Open Availability to Documents
    - CR/PR Process
International Participation:

- Rationale for Existing Practice
- Methods Available today:
  - The Open Group Company Review
  - Open Availability to Documents
  - CR/PR Process
- Future Outlook
US DoD – Using FACE Approach as Enabler for MOSA Implementations

April 28, 2016

Jeffry A Howington, Rockwell Collins Steering Committee Vice-Chair
Enabling MOSA

- FACE Standard Intent
  - Fulfill MOSA tenets
  - Meet Better Buying Power MOSA goal

- Deliver Key Benefits
  - Reduce life cycle costs
  - Manage obsolescence
  - Speed integration of new capabilities
  - Attract innovation
  - Reduce time to field

Better Buying Power 3.0
- Use Modular Open Systems Architecture to stimulate innovation
Open Architecture Definitions

- **Architecture**
  - The fundamental organization of a system embodied in its components, their relationships, to each other, and to the environment, and the principles guiding its design and evolution

- **Open Standard**
  - An Open Standard is a publically available standard, designed and developed with adherence to the key characteristics of due process, consensus, transparency, and balance

- **Open Architecture**
  - Open Architecture is a type of computer or software architecture designed using open standards and ease the effort associated with adding, modifying, removing, and interchanging components
Key Open Architecture Characteristics

• Provides standardization of key interfaces
• Supports layered architecture principles
• Facilitates abstraction
• Supplies key attributes of:
  – Adaptability (Configurability to meet different requirements)
  – Modularity (Ability to be separated from system)
  – Portability (Transportability between systems)
  – Scalability (Ability to scale with needs)
  – Interoperability (Effective information exchange)
• Other key system attributes desirable in an Open Architecture environment
  – Security
  – Safety
Enabling Cost Reduction

- Implementation underway
  - US Army
  - US Navy
  - US Air Force
  - Industry
Importance of Coordination

- Software expense drives avionics cost
  - Similar trend in other technologies
  - Makes up 80%+ of capability
- The FACE technical approach for cost reduction
  - Layered abstracted architecture and data model
  - Enable software reuse across multiple aircraft
- Other software architecture standards available
  - Can burden software developers (which standard should they use?)
  - Risks undoing the beneficial intent
Coordination Activities

- Actively seeking coordination and alignment
  - UAS Control Segment (SAE AS-4UCS)
  - Joint Tactical Networking Center (JTNC)
  - Sensor Open Systems Architecture (SOSA)

- Alignment Scope
  - Interface Definitions
  - Data Models
  - Conformance Process (including Repositories)
  - Solution Domain Scope
FACE/SOSA Aligned Architecture

- Operating System Segment
- Portable Components Segment
  - Common Services
  - FACE Application
- Transport Services Segment
  - Core Interface
  - DDR
  - Web Services
  - Other
- Platform-Specific Services Segment
- Platform-Specific Device Services
  - GPS, EGI
- Platform-Specific Graphics Services
- I/O Services Segment
  - Adapter
  - Device Driver

SOSA
- ISR Sensor Hardware
- ISR Sensor Software
- Electrical Interface
- Mechanical Interface
Data Architecture Framework Concept

Core Standard

Library of data architecture elements

Conformant data architectures
Conformance and Library Process

David Boyett
US Army AMRDEC
Vice Chair: FACE Business Working Group
April 28, 2016
FACE Building Blocks

- A Unit of Portability (UoP) is ...
  - Items that fit completely within one of the top three FACE Architecture segments
    - Portable Component Segment (PCS)
    - Transport Services Segment (TSS)
    - Platform Specific Services Segment (PSSS)

- A Unit of Conformance (UoC) is
  - Items that fit completely within one of the five FACE Architecture segments
    - PCS (also a UoP)
    - TSS (also a UoP)
    - PSSS (also a UoP)
    - I/O Services Segment (IOS) (not UoP)
    - Operating System Segment (OSS) (not UoP)
What is FACE Conformance?

• FACE Conformance
  – An assessment of a Software Item, known as a Unit of Conformance (UoC), to the applicable Conformance Requirements contained in the FACE Technical Standard

• Applicable Requirements
  – are determined based on the segment and profile selected in the design of the particular UoC

• Verification of Conformance
  – is conducted utilizing automated test tools and inspection of design and test documents

• Conformance Verification Matrix (CVM)
  – The specific requirements, method of verification, and associated verification evidence is detailed in the CVM
What can be Certified as FACE Conformant?

- Certification is for Units of Conformance (UoC) or UoC Packages
- There is
  - No “compliance”
    - Software is either “certified conformant” or not
  - No FACE certification for entire systems
    - Systems can be comprised completely of Certified UoCs or a mix of Certified UoCs and other software
  - No FACE certification for independent libraries, runtimes, frameworks
    - These can be included in a certification of a larger set
Driving Factors

• Certification is for UoCs or UoC Packages
  – An assessment of a Software item, known as a Unit of Conformance (UoC), to the applicable Conformance Requirements contained in the specified FACE Technical Standard Edition
  – Determined based on the Technical Standard Edition, segment and profile selected in the design of the particular UoC
  – Recompiling to a different target does not cause a loss of FACE Certification
Driving Factors

• No Functional or Performance Testing
  – Interfaces are tested
  – Other Verification Evidence is inspected (evaluated)
  – Functional Testing is assumed as part of other development processes and is not required for FACE Conformance

• Not Plug-n-Play
  – Various levels of integration will likely be required for porting (reuse of software)
Conformance Program and Processes

Software Supplier

- Initiate Verification
- Initiate Certification
- Initiate Registration

FACE Verification
FACE Certification
FACE Registration

FACE Verification Authority (VA)
FACE Certification Authority (CA)
FACE Library Administrator (LA)
Conformance Processes

• **FACE Verification**
  - The process of determining the conformance of an implementation to specification requirements. Verification is handled through an entity known as a Verification Authority (VA), a technical expert on the FACE Technical Standard and Verification process and approved by the FACE Consortium Steering Committee.

• **FACE Certification**
  - The process of applying for a FACE Conformance Certificate once verification has successfully been completed. Certification is processed through the FACE Certification Authority (CA).

• **FACE Registration**
  - The process of listing FACE Certified UoCs in a public listing of FACE Certified UoCs known as the FACE Registry. The FACE Registry is accessed from the FACE Landing Page.

*The FACE Landing Page can be accessed at [http://opengroup.org/face](http://opengroup.org/face)*
Roles

• **Software Supplier**
  – Anyone providing software (UoC) to be certified. This may include the original software developer, an integrator, or another entity wishing to certify software developed from another party.

• **FACE Verification Authority (VA)**
  – One of several organizations approved by the FACE Consortium to evaluate software against the FACE Technical Standard. The VA is an expert on the FACE technical standard and verification process. The VA conducts or witnesses conduct of the For-the-Record Test, utilizing an approved Conformance Test Tool, and inspects the Verification Evidence.
Roles

- **FACE Certification Authority (CA)**
  - The FACE Certification Authority is the singular organization approved by the FACE Consortium that can provide a FACE Conformance Certificate

- **FACE Library Administrator (LA)**
  - The FACE Library Administrator manages a listing of FACE Certified UoCs known as the FACE Registry

- **FACE Trademark Licensor**
  - The FACE Trademark Licensor issues the FACE Conformance Certification Trademark for Certified Units of Conformance and Certified Unit of Conformance Packages
FACE Library

- Provides the infrastructure to enable the development and discovery of FACE UoCs
- The FACE Library is the primary source of information on:
  - FACE Consortium activities
  - Developing to the FACE Technical Standard
  - How to get a FACE UoC verified and certified
  - Searching for existing FACE certified UoCs
  - Advice on how to acquire FACE certified UoCs
  - Reporting problems with FACE products
Conformance Preparation

Supplier Obtains References and Tools
- FACE Technical Standard
- Reference Implementation Guide (RIG)
- Automated Tools, SDK, ITK
- Conformance Certification Users Guide
- Conformance Policy
- Verification Matrix
- Matrix Users Guide (MUG)
- Conformance Test Suite
Conformance Preparation

• Supplier Selects a Verification Authority (VA)
  - List of Approved VAs from the Landing Page
  - Meets supplier needs
    ▪ Not limited to Internal Verification
    ▪ Willing to perform verification for the UoC’s applicable FACE Architecture segment, e.g., Operating System

• Current Approved VAs
  • Army VA at AMRDEC (SED ASIF Lab)
  • NAVAIR 5.4.3.7 V & V Branch
  • Tucson Embedded Systems (TES SAVi)
  • More to come in the future…
Conformance Preparation

- Supplier provides Verification Evidence
  - A trace of the FACE requirements to specific documents supporting the requirements
  - Required for all items in the Tech Standard identified as needing inspection in the Conformance Verification Matrix (CVM) including applicable conditional requirements

<table>
<thead>
<tr>
<th>Verification Needed (Y or N)</th>
<th>FACE Segment</th>
<th>Technical Standard for the FACE Reference Architecture Edition 1.0</th>
<th>Verification Method</th>
<th>Conformance Artifacts (DID or equivalent)</th>
<th>SW Supplier Artifact Cross-Reference</th>
<th>Verification Notes</th>
<th>Conditional Reqs</th>
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</thead>
<tbody>
<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>PSSS</td>
<td>3.5.6 PSS Segment Requirements</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PSSS</td>
<td>9. All communication with the IOSS shall go through the I/O Services Interface.</td>
<td>Test</td>
<td>Test Suite</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PSSS</td>
<td>10. Messages communicated through the I/O Services Interface shall be in the format defined in Section D.11.</td>
<td>Inspection</td>
<td>SDD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PSSS</td>
<td>11. All components of the PSSS shall use the interface defined in Section 3.11, Section 3.12, or Section 3.13 to access the functions provided by the OSS.</td>
<td>Test Inspection</td>
<td>Test Suite SAD SDD</td>
<td>Inspection is only of Java frameworks or Ada run-times.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Conformance Preparation

Supplier Establishes Legal Agreements

1. Conformance Certification Trademark License Agreement with TM Licensor
2. Verification Agreement with Selected VA
3. Certification Agreement with CA
Conformance Workflow Tool

- Provides the infrastructure to support the centralized FACE certification and registration process
- Login required
- Individual or Organizational accounts available
- Manage progress of UoCs through Conformance program
- Browse and search the FACE registry

https://www.facesoftware.org
Conformance Workflow Tool Dashboard

Registry Search

The FACE Registry is the single source for listing all UoCs that have received FACE certification. Only UoCs that have completed the Certification and Registration processes are listed here.

| Search | All | Search the FACE Registry... | Go |

UoC Management

Below is a list of the UoCs for which you have a defined role in the workflow. As a supplier, you may create a new UoC which allows you to list your UoC in the FACE Registry. Click the button to begin.

<table>
<thead>
<tr>
<th>Supplier UoC Name</th>
<th>Version</th>
<th>Origination Date</th>
<th>Status</th>
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<tbody>
<tr>
<td>F2FTest</td>
<td>1.0</td>
<td>2016-04-06</td>
<td></td>
</tr>
<tr>
<td>F2FOrgAdminTest</td>
<td>2.1</td>
<td>2016-04-06</td>
<td></td>
</tr>
<tr>
<td>testadmin</td>
<td>1.1</td>
<td>2016-04-07</td>
<td></td>
</tr>
<tr>
<td>ssupplierUoC</td>
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<td>2016-04-07</td>
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</tr>
<tr>
<td>SupplierUoC2</td>
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</tbody>
</table>

Archived UoC Name

<table>
<thead>
<tr>
<th>Version</th>
<th>Origination Date</th>
<th>Status</th>
</tr>
</thead>
</table>
Conformance Verification Process

Initiate Verification

Software Supplier

- Select and Establish Contractual Relationship with VA
- Develop Software Verification Package
  1. Verification Agreement
  2. Verification Evidence
  3. Conformance Statement
  4. Software Product Set

FACE Verification Authority (VA)
Software Verification Package

- **Verification Agreement**
  - Defines the conformance verification services to be provided by the VA
  - Defines acceptance by the Software Supplier to provide the required verification evidence and Software Product Set

- **Verification Evidence**
  - Supporting verification documentation submitted by the Software Supplier to provide evidence of FACE Conformance to the applicable conformance requirements of the Technical Standard that are not directly tested by the Test Suite.
  - The verification evidence is organized to correlate with the specific conformance requirements and verification approach contained in the applicable segment of the Conformance Verification Matrix
Conformance Statement

• Software Supplier’s response to a standard questionnaire, tailored to the appropriate Segment of the Technical Standard, structured to obtain precise identification of the software product and conformance evidence.
• The Conformance Statement includes:
  - Software product description documentation to uniquely identify and configuration manage the Software product through the conformance process.
  - The Conformance Statement identifies:
    1. The specific edition of the Technical Standard
    2. The applicable set of conformance requirements
    3. The Conformance Verification Matrix version
    4. The version of Conformance Test Suite used for verification
Software Verification Package (cont.)

- **Software Product Set**
  - Contains the software deliverables that are required for executing the software product using the FACE Conformance Test Suite.
  - The Software Product Set includes:
    1. The software product
    2. Associated information for set-up of interfacing segments
    3. Minimum computer operating environment requirements
Conformance Verification by VA

- Inspect Software Verification Package
- Evaluate the Verification Evidence
- Conduct/Witness For The Record (FTR) test using Approved Conformance Test Suite
- Issue Verification Statement
- Archive Data
UoC Verification Metadata

Welcome back, Supplier

UoC: F2F Test

Contact Info | Suppliers: steve@steve.com

Verification
Take Action

Certification
Certify

Registration
Register

Submit for Verification
Submit for Certification
Save

Product Information | Verification Statement | Certification Information

General Information

UoC Name: F2FTest

UoC Version: 1.0

Short Title / Acronym: Test

UoC Description: This is a test UoC

Previous versions: Text: URL:
Conformance Verification Process

Software Supplier

Initiate Verification

FACE Verification

Verification Results Package

Verification Results Pkg and Software Verification Pkg

Verification Retention Repository

FACE Verification Authority (VA)
Conformance Certification Process

Software Supplier

Initiate Certification

• Establish Contractual Relationship with CA
• Submit Legal Agreements
  o Certification Agreement
  o Trademark License Agreement
• CA Requests Verification Results Package from VA
# UoC Certification metadata

## General Information

<table>
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<th>Field</th>
<th>Value</th>
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<tbody>
<tr>
<td>UoC Name:</td>
<td>F2FTest2</td>
</tr>
<tr>
<td>UoC Version:</td>
<td>2.0</td>
</tr>
<tr>
<td>Short Title / Acronym:</td>
<td></td>
</tr>
<tr>
<td>UoC Description:</td>
<td></td>
</tr>
<tr>
<td>Company Name:</td>
<td>SVCD</td>
</tr>
</tbody>
</table>

**Description:**
- **UoC Name:** F2FTest2
- **UoC Version:** 2.0
- **Short Title / Acronym:** 
- **UoC Description:** Free text description of the FACE product
- **Company Name:** SVCD

**Previous versions:**
- **Text:**
- **URL:**
Conformance Certification

Software Supplier

Initiate Certification

FACE Certification

FACE Certification Authority (CA)

- Ensure legal agreements are in place (Certification Agreement and Trade Mark License Agreement (TMLA))
- Review Conformance and Verification Statements for completeness and correctness
Conformance Certification

Software Supplier

Initiate Certification

FACE Certification

Conformance Certificate, Conformance Statement, Verification Statement, TMLA

FACE Certification Authority (CA)

Certification Retention Repository

50
# UoC Registration Metadata

## UoC: TestUoC

**Contact Info**
- Suppliers: Joe@test.com
- Verification Authority: Brendan’s VA

**General Information**

<table>
<thead>
<tr>
<th>Field</th>
<th>Details</th>
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<tr>
<td><strong>UoC Name:</strong></td>
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<td><strong>UoC Description:</strong></td>
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<td>URL:</td>
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<td></td>
<td></td>
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<tr>
<td><strong>Company Name:</strong></td>
<td>Supplier Org</td>
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</tbody>
</table>

**Submit for Review**
FACE Registration Process

Software Supplier

- Submit Product Description and Conformance Certificate ID to Library Administrator

FACE Library Administrator (LA)
FACE Registration Process

- Request and Receive Conformance Certificate from CA
- Populates FACE Registry with Product Description and Conformance Certificate
Conformance Program and Processes

Software Supplier

- Initiate Verification
  - FACE Verification
    - FACE Verification Authority (VA)
- Initiate Certification
  - FACE Certification
    - FACE Certification Authority (CA)
- Initiate Registration
  - FACE Registration
    - FACE Library Administrator (LA)
UoC in the FACE Registry

Search

Sort By: UoC No.

Refine By
FACE Segment
FACE Edition
Licensing Categories
Safety Certifications
Profile
OS API Type

F2F Test2

Company: SVCG
Version: 2.0

FACE Segment: Operating System
Key FACE Conformance References

- Technical Standard
  - Requirements for the FACE Architecture
- Conformance Verification Matrix
  - Guidance and Verification Methods
- Conformance Policy
  - Policy for Certification of UoCs
- Conformance Certification Guide
  - Guidance on the Policy and Program

*Please visit [http://opengroup.org/face/information](http://opengroup.org/face/information) for the most recent published documentation*
Problem Reporting and Change Request

David Boyett
US Army AMRDEC
Vice Chair: FACE Business Working Group
April 28, 2016
Problem Reporting and Change Requests

- The FACE Consortium has developed a comprehensive PR/CR process
- Problems can be communicated via the FACE Landing Page
- FAQs are available on the FACE Landing Page
- Focus is on users who are not members of the FACE Consortium, including international users
- A tool has been developed to capture and track PRs/CRs to resolution

https://ticketing.facesoftware.org
PR/CR Process
Create an account / login
# User Dashboard

**Search Existing PR/CR Tickets**

Enter a New PR/CR Ticket

<table>
<thead>
<tr>
<th>Category</th>
<th>Tickets</th>
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<tbody>
<tr>
<td>Triage</td>
<td>(1)</td>
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<tr>
<td>Administrator</td>
<td>(2)</td>
</tr>
<tr>
<td>FACE CCB</td>
<td>(1)</td>
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<td>BWG CCB Tickets</td>
<td>(9)</td>
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<td>TWG CCB Tickets</td>
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<td>Conformance Tools CCB Tickets</td>
<td>(7)</td>
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<tr>
<td>Shared Data Model CCB Tickets</td>
<td>(26)</td>
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</table>
View all PR/CR tickets

<table>
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<tr>
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<tr>
<td>14</td>
<td>Library Requirements</td>
<td>2.0</td>
<td>Remove Digital Signature</td>
<td>Closed</td>
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<tr>
<td>15</td>
<td>Library Requirements</td>
<td>2.0</td>
<td>Product Repository - Only FACE Certified Products</td>
<td>Closed</td>
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<td>16</td>
<td>Conformance Authorities Plan</td>
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<td>Assign VA ID on Verification Statements</td>
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<td>Low</td>
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<tr>
<td>17</td>
<td>FACE Technical Standard</td>
<td>2.0</td>
<td>TSS API message_size parameter “in out”</td>
<td>Investigate</td>
<td>Low</td>
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<td>FACE Technical Standard</td>
<td>2.1</td>
<td>Duplicate of 20</td>
<td>Rejected</td>
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<td>19</td>
<td>FACE Technical Standard</td>
<td>2.1</td>
<td>How MessagePorts would be used from a UoP to create connections revealed discrepancies</td>
<td>Assigned</td>
<td>Low</td>
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<td>20</td>
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<td>Add Software Communications Architecture (SCA) as a framework</td>
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<td>23</td>
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<td>Coordinate conversions are missing, or hidden in Frames of Reference</td>
<td>Investigate</td>
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<td>24</td>
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<td>Figure 27 should be consistent with figure 46</td>
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<td>26</td>
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<td>Clarify Platform-Specific Graphics Services restriction for Security Profile</td>
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</table>
Filter all tickets by state
Submit a Problem Report / Change Request

Create a FACE PR/CR Ticket

| Information entered in Issues within this system is visible to the general public. Intellectual Property, confidential, or classified information should not be posted here. The FACE Consortium and the manager of this tool accepts no liability over the release of information through this system. |

<table>
<thead>
<tr>
<th>FACE Consortium Product</th>
<th>FACE Business Guide</th>
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</thead>
<tbody>
<tr>
<td>Product Version</td>
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<tr>
<td>Comment Type</td>
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<td>Submitter Priority</td>
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<td>Location</td>
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<td>Submitter Title</td>
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<tr>
<td>Submitter Description</td>
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<td>Submitter Proposed Resolution</td>
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<tr>
<td>Certification Need</td>
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</tr>
<tr>
<td>ITAR Data Exists</td>
<td>No</td>
</tr>
<tr>
<td>Add Attachment</td>
<td>Choose File, No file chosen</td>
</tr>
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</table>

Enter New Ticket
View all submitted tickets in user dashboard
### View details of submitted ticket

**Ticket #138**
Change ABC to XYZ

**Current Status:** Initiated  
This ticket is in the **INITIATED** state. The ticket has been recently created or modified by the submitter.

**Next Action:** FACE Triage Group  
If the ticket is clear and applicable, the FACE TRIAGE GROUP should assign this ticket to a Product CCB for action.

#### Submitter Input

<table>
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<tr>
<th>ID</th>
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<tr>
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<td>FACE Business Guide</td>
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<td>ITAR Data Exists</td>
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<td>Location</td>
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<tr>
<td>Submitter Description</td>
<td>ABC has been changed to XYZ</td>
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<td>Replace all instances of ABC with XYZ</td>
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<tr>
<td>Submitter Attachments</td>
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Add Attachment Browse... No file selected Attach File
View consortium response to submitted ticket

Ticket #138
Change ABC to XYZ

Current Status: Initiated
This ticket is in the INITIATED state. The ticket has been recently created or modified by the submitter.

Next Action: FACE Triage Group
If the ticket is clear and applicable, the FACE TRIAGE GROUP should assign this ticket to a Product CCB for action.

<table>
<thead>
<tr>
<th>Consortium Response</th>
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<tr>
<td>Consortium Description</td>
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<td>Consortium PR/CR Criticality</td>
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<td>Consortium PR/CR Priority</td>
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<td>Proposal Subcommittee</td>
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<td>Local Impact Only</td>
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<tr>
<td>Proposed Correction</td>
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<td>Proposed Correction Approved</td>
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<tr>
<td>Proposed Correction Approved Date</td>
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</table>
Communicate with FACE Consortium about PR/CR
The FACE Technical Standard

Kirk Avery
Technical Working Group Chair
Lockheed Martin Fellow
Lockheed Martin Mission Systems and Training Ship and Aviation Systems

Distribution Statement A
"Approved for public release distribution is unlimited"
Master Class Overview

- **FACE Technical Standard**
  - An in-depth description of the technical reference architecture defined in the FACE Technical Standard
  - Planned enhancements for the FACE Technical Standard

- Future plans for the Data Model Architecture and Shared Data Model
FACE TWG Organization Chart

**TECHNICAL WORKING GROUP**
Chair: Kirk Avery (Lockheed Martin)
Vice Chair: Chris Kimmel (NAVAIR)

- **Standards Subcommittee**
  - Kirk Avery, David Bowes, Chris Kimmel
  - Edition 1.0 Revisions
  - Edition 2.1 Revisions
  - Edition 3.0 Revisions
  - FACE Introduction

- **EA Support**
  - Kirk Avery, Chris Kimmel

- **BWG Support**
  - Kirk Avery, Dr. Bubba Davis, Marcell Padilla, Chris Kimmel
  - Conformance
  - Library

- **Configuration**
  - Joe Dusio, Joel Sherrill

- **Data Model**
  - Dr. Bubba Davis, Bill Kinahan

- **Reference Implementation Guide**
  - Kirk Avery, David Bowes

- **Conformance Verification Matrix**
  - Dr. Bubba Davis, Marcell Padilla

- **Graphics**
  - Marc Moody, Levi Van Oort

- **Safety**
  - Glenn Carter, George Romanski

- **General Enhancement**
  - Chris Kimmel, Don Akers

- **Transport**
  - Stephanie Burns, Bill Antypas

- **Security**
  - Joe Neal, Scott Wigginton

- **Operating System**
  - Patrick Huyck, Joel Sherrill
The FACE strategy is to create a software environment on the installed computing hardware of DoD aircraft (a.k.a. platforms) that enables FACE applications to be deployed on different platforms with minimal to no impact to the FACE application.
Eliminates Barriers to Portability

- Truly portable applications require common open standards at multiple layers in the architectures
- Prevents lock-in and improves competition throughout supply chain

Uniform application of common open standards across DoD aviation needed to break “Cylinders of Excellence”
What is the FACE Architecture?

- A software computing environment to enable product lines for military Aviation
- The FACE architecture is comprised of a set of “places” where variance occurs
  - Points of variance are called “Segments”
  - The structure created by connecting these segments together is the beginning of the FACE architecture
- Horizontal and vertical interfaces defined as part of FACE architecture
FACE Architectural Segments

- **FACE Portable Components Segment**
  - Portable Applications
  - Portable Common Services
- **Transport Services Segment**
- **Platform Specific Services Segment**
  - Platform Device Services
  - Platform Common Services
  - Graphics Services
- **I/O Services Segment**
- **Drivers**
- **Operating System Segment**
Standardization and Constraint on UoP Interfaces

FACE components (a.k.a. FACE Units-of-Portability) are easily integrated with (i.e. “plugged into”) the FACE Portable Component Segment, Transport Services Segment, and Platform Specific Services Segment due to their exclusive use of the FACE defined Interfaces.
Operating System Segment

- Governed by:
  - POSIX
  - ARINC 653
- Profiles:
  - General Purpose
  - Safety
  - Security
  - Language Runtimes
  - Application Frameworks
IO Services Segment

- The PDS packs data and sends over the IO API
- Data is sent between I/O Libraries over the OS API using the IOMM
- The I/O Service reads and writes data to the device drivers
- The I/O Service sends received data to the I/O library
- Data is sent between I/O Libraries over the OS API using the IOMM
- The PDS extracts the data from the message payload received over the IO API

Note: For more information on this and other example Implementations, refer to FACE Reference Implementation Guide
Platform Specific Services Segment

- PSSS components can use the I/O Interface to communicate with the IOSS
- PSSS components may communicate directly with the GPU driver
- PSSS components use the TS Interface to communicate with the TSS
  - The TS Interface provides communication between PSSS and PCS components
  - PSSS components can act as software abstractions by converting I/O Interface data to the FACE Data Model for use in the TSS

Note: For more information on this and other example Implementations, refer to FACE Reference Implementation Guide
The TSS Central Distributor creates, manages, and uses all connections necessary to perform message distribution.

Each TS Library only communicates with the TS Library associated with the TSS Central Distributor.

Note: For more information on this and other example Implementations, refer to FACE Reference Implementation Guide.
Transport Services Segment
Distributed Protocol Translation

Example of a distributed implementation between PCS 1, PCS 2, and PCS 3 TS Libraries where PCS 3 exchanges data to/from both PCS 1 and PCS 2

Note: For more information on this and other example Implementations, refer to FACE Reference Implementation Guide
Portable Components Segment

- The PCS is not a deliverable container for software
- The PCS is a logical container for UoPs
- PCS components are entirely independent from other FACE segments
- A PCS UoP contains the business logic decoupled from a specific implementations
- A PCS UoP must use the TS Interface for all communication
- Any data sent over the TS Interface must use the FACE Data Model.
FACE Data Model Architecture

- Three levels to the primary data and message models aligned with ideas from the Object Management Group’s (OMG) Model Driven Architecture™
- The addition of the Unit of Portability Model (UM) allows components to be tied to the messages and data elements in the Platform Model
- Supports definition and potentially generation of code and other artifacts
FACE Data Architecture

- Defines basis elements enforced across all UoP data models.
- Baseline established by Data Model Subcommittee
- Managed by Data Model CCB according to Data Model Governance Plan
  - Defines basis elements to be managed
  - Will grow as UoP developers add to it.
  - Stored in an XMI file
- Built by UoP Developers
- Must align with SDM
- New basis element items must be added to SDM before conformance can be achieved
- Stored in an XMI file
- Built by System Integrators
- Defines interconnectivity between UoPs in a system
- Stored in XMI file

Meta-Model defines rules for data model construction
OCL Constraints added for semantic checks

Shared Data Model (FACE XMI)
UoP Supplied Model (FACE XMI)
Integration Model (FACE 3.0)

SDM Gov Plan

Tech Standard

Meta Model
# Overview of Model Levels

## Conceptual Model
Defines basic ideas and establishes an abstract definition of entities.

- Coordinate System
- Coordinate System Axis
- Measurement System
- Measurement System Axis
- Landmarks
- Reference Point
- Reference Point Part

## Logical Model
Refines entity concepts and describes how observable properties will be measured.

- Observables
- Measurement
- Units
- Value Type

## Platform Model
Refines logical entities and describes how measurements will be mapped into IDL data types. Adds views to map data into messages.

- Platform Specific Component
- Portable Component
- IDLPrimitiveTypes
- IDLTypes
- Views

## UoP Model
Defines FACE Component and ports for data exchange.

- Entities
- Associations
- Port

---

Note: Not complete list of meta-model elements. For introduction only! See meta model for complete list.
Data Model Example

Define conceptual entities and relationships of importance to UoP

Refine entities by specifying how values are measured (frames of reference, units, etc.)

Refine entities by specifying platform data types to be used to hold values

<<conceptual entity>>
RelevantOperatingPicture

- ID
- position
- extents
- Track tracks [0..*]

<<logical entity>>
RelevantOperatingPicture

- ID (UUID)
- position (WGS84, deg, deg, m)
- extents (Width km, Length km)
- Track tracks [0..*]

<<platform entity>>
RelevantOperatingPicture

- ID (UUID)
- kind (Air, Ground, Sea)
- position (ECEF km, km, km)
- Track tracks [0..*]

<<platform entity>>
Track tracks [0..*]

- ID (string)
- kind (enum Air, Ground, Sea)
- position (double, double, double)

<<PortableComponent>>
TacticalDataMgrUoP

- <<Port>>
  - TracksPort
- <<Port>>
  - ROPPort

<<platform view>>
TracksView

- tracks

<<platform view>>
ROPView

- ropPosition
- ropSize

Refine entities by specifying how values are measured (frames of reference, units, etc.)

Refine entities by specifying platform data types to be used to hold values

Define conceptual entities and relationships of importance to UoP
Data Model Tools and Flow

- Model Editing Tools
  - UoP Tools
  - Proprietary Tools

- Shared Data Model (FACE XMI)

- UoP Supplied Model (FACE XMI)

- UoP Tools
  - Modeling Tools for FACE Software Development*
  - FACE Conformance Test Suite*
  - Proprietary Tools

- FACE::DM (Data Types)
- FACE::TS (Transport APIs prototypes)
- Other Generated Artifacts (optional)

* Available from http://www.opengroup.org/face
FACE Technical Standard Planned Enhancements

• FACE Edition 3.0
  – Refinements from FACE Technical Standard, Edition 2.x
  – OS API Set enhancements
  – Extensions for Multi-Core and Hypervisor
  – Component Framework/Language Runtime integration
  – I/O Service message types enhancements
  – Configuration Services enhancements
  – Data Architecture enhancements
  – System Lifecycle Model definition
  – TSS Interoperability enhancements
  – Graphics Enhancements
The FACE Technical Standard 3.0 has been architectured for separation of the FACE Data Architecture sections:

- Allowing for independent governance
- Facilitate Data Architecture and Shared Data Model evolution
- Prepare for multi-domain adoption
- Enable expanded contribution
- Currently planned for Technical Standard, Edition 3.1
Publicly Available FACE Documentation

- FACE Technical Standard Edition 1.0
  - http://www.opengroup.org/bookstore/catalog/c122.htm
- FACE Technical Standard Edition 1.1
  - https://www2.opengroup.org/ogsys/catalog/C13J
- FACE Technical Standard Edition 2.0
  - www.opengroup.org/bookstore/catalog/c137.htm
- FACE Technical Standard Edition 2.1
  - https://www2.opengroup.org/ogsys/catalog/c145
- FACE Reference Implementation Guide Edition 2.0
  - https://www2.opengroup.org/ogsys/catalog/g142
- FACE Reference Implementation Guide Edition 2.1
  - https://www2.opengroup.org/ogsys/catalog/g162
- FACE Data Model Governance Plan Edition 2.1
  - https://www2.opengroup.us/face/documents.php?action=show&dcat=&gdid=16916
- FACE Shared Data Model Edition 2.0
  - https://www2.opengroup.us/face/documents.php?action=show&dcat=&gdid=16917
- FACE Shared Data Model Edition 2.1
  - https://www2.opengroup.us/face/documents.php?action=show&dcat=31&gdid=17240
- FACE Conformance Policy 1.1
  - https://www2.opengroup.org/ogsys/catalog/X1406
- FACE Conformance Authorities Plan 1.0
  - https://www2.opengroup.org/ogsys/catalog/X1302
- FACE Conformance Statement
- FACE Verification Statement
- FACE Conformance Verification Matrix User's Guide 2.0
  - www.opengroup.org/bookstore/catalog/x1318.htm
- FACE Conformance Verification Matrix Edition 1.1
  - www.opengroup.org/bookstore/catalog/x1318a.htm
- FACE Conformance Verification Matrix Edition 2.0
  - www.opengroup.org/bookstore/catalog/x1318b.htm
- FACE Conformance Verification Matrix Edition 2.1
  - https://www2.opengroup.org/ogsys/catalog/X1412A
- FACE Business Guide, Version 1.1
  - http://www.opengroup.org/ogsys/catalog/g115.htm
- FACE Library Requirements Document Edition 2.2
  - https://www2.opengroup.us/face/documents.php?action=show&dcat=&gdid=17212
- FACE Library Implementation Plan 1.0
  - https://www2.opengroup.us/face/documents.php?action=show&dcat=&gdid=16438
- FACE Library Administration Plan 1.0
- FACE Conformance Test Suites
- FACE Contract Guide Version 1.0
  - https://www2.opengroup.org/ogsys/catalog/G145

For Change Requests / Problem Reports please use the following link:
https://mantis-fp.gtri.gatech.edu/
Summary

- FACE is addressing the business concerns that have hampered other OA initiatives
- FACE documentation is being designed through industry and government collaboration
- FACE enables getting capabilities to the Warfighter with reduced schedule and at a lower cost
- FACE Technical Standard requirements are being required by Customers today
- The FACE Technical Standard is being used today across industry product lines