

ACC FEDERAL LABORATORY—BEALE: EMBEDDED WITH THE WARFIGHTER

OPEN SOFTWARE ARCHITECTURE AND PROCESSING AT THE EDGE

OBJECTIVE/TECHNOLOGY DESCRIPTION

To integrate an Automatic Targeting Algorithm (ATR) on the U-2 to enable onboard processing of imagery, thus prototyping the ability to process information in a disconnected environment. The Air Combat Command (ACC) Federal Lab—Beale created a government-owned, Open Application Program Interface (API) Architecture that can host a wide array of containerized software services. This architecture removes proprietary reliance from the API while protecting intellectual property via containerization to promote collaboration. First line of code to first test flight onboard an operational U-2 was less than 6 months.

Initial demonstrations used an Electro-Optical/Infra-Red (EO/IR) ATR developed by Sandia National Labs. Since then, additional ATRs for different object/sensor pairings have been integrated along with In-Flight Simulations to generate data from sources not currently available to the architecture: Data Fusion algorithms to increase confidence by merging multiple sensor modalities and Georectification Improvement Services to combine sensor parametrics and terrain models to improve target localizations.



Open Architecture Enabling Disconnected Intelligence, Surveillance, and Reconnaissance (ISR) in a Contested Environment

THE “SO WHAT”?

Open API and microservice mentality validated a “drop-in” interoperability with properly designed and containerized software services. This allows the integration of multiple ATRs from disparate sources and plug-and-play integration with new or existing capabilities.

Designed to be compatible with additional systems and legacy formats via message adapter services, this architecture can be interoperable with Open Mission Systems/ Universal Command and Control Interface (OMS/UCI) such as future capabilities targeted for the U-2 technical refresh.

TECHNICAL APPROACH

Leverage industry-standard best practices, software tools, and open standards to create a lightweight, edge-capable, open system for easier integration of new capabilities. This Reference Implementation suite of containerized microservices, containing EO and Synthetic Aperture Radar (SAR) ATRs, managers, Entity-Based Data Fusion, In-flight electronic warfare (EW)/imagery intelligence (IMINT) Collection Simulation, Georectification Improvement Services and UCI adapters was demonstrated on legacy hardware onboard the U-2 by leveraging local training sorties and non-test pilots.

The incorporation of cloud-based technologies (e.g., Docker, Kubernetes) increases system reliability and cybersecurity while enabling processing distribution across multiple legacy computers, securing mid-flight software updates, and starting to build the underlying infrastructure required of a Cloud-to-Edge future.

Enabling Advanced Battle Management System (ABMS) Capabilities with Ties to

FUTURE GROWTH FOR SOFTWARE ARCHITECTURE

As a developmental system, the robustness of this Open Software Architecture implementation can be improved. Additional cybersecurity protections to onboard computing hardware and an improved continuous integration and continuous delivery (CI/CD) pipeline to include (vHIL & HIL) testing of flight authorized hardware will improve secure delivery.

The ACC Federal Lab—Beale is currently exploring exporting this architecture to additional USAF and Joint platforms within the next 12 months (e.g., F-16, F-22, A-10, F/A-18, EP-3, P-8, MQ-4C, and even the Tomahawk missile).

Booz Allen Hamilton is exploring other edge deployments, such as space-based applications (e.g., CubeSats).



Developer Integration at the Operator Level

Confluence of Developers and Warfighters to Deliver Weapon-System-Specific Solutions at the Speed of Relevance

The ACC Federal Laboratory—Beale was established to meet 2018 National Defense Strategy (NDS) intent to fast-field (technology transfer)—or fast fail—advanced technologies. Prior to a technology exit, the lab increases maturity and decreases risk by bringing developers, acquirers, and operators together under one operational roof.

Backed by the National Institute of Standards and Technology's (NIST's) National Voluntary Laboratory Accreditation Program, the lab is part of a future whereby all federal weapon systems are individually supported by a bespoke laboratory.



Demonstrating the Feasibility of an Artificial Intelligence (AI) Copilot

Responded to a Challenge from Assistant Secretary of the Air Force (Acquisition, Technology, and Logistics) (SAF/AQ) in Less than 6 Weeks, Paving the Way for Significant Advances in Deploying AI to Platforms

Expand upon academic developments in the field of reinforcement learning to demonstrate the emulation of an AI-based copilot, capable of handling critical mission tasks and reducing the workload of pilots, in addition to demonstrating Pilot-AI interaction/teaming with a shared resource. Intentionally provocative, the AI algorithm was designated as “mission commander” and given final say as to sensor disposition.

The ACC Federal Laboratory demonstrated an AI algorithm on a local sortie in less than 6 weeks, from concept to first flight.

Enabling Cloud to Edge

Responded to a Challenge from SAF/AQ in Less than 6 Weeks, Paving the Way for Significant Advances in Deploying AI to Platforms



The ACC Federal Laboratory was tasked with integrating the Air Force's PlatformONE DevSecOps Platform onboard the U-2. While much of PlatformONE's “BigBang” supplies significant cyber, cluster, and container security, many assumptions were identified that relied on heavy compute and network connectivity, which made it inappropriate for legacy flight hardware.

The lab, in collaboration with PlatformONE and their “BigBang” team was able to strip out the most relevant tools and remove network dependencies in order to fly a slimmed-down offering affectionally referred to as “BigCrunch” onboard an operational U-2. Based on the same technologies the Air Force is pushing for software development, this begins to tie edge processing back to the cloud, enabling a more integrated and connected Air Force.

Booz Allen Points of Contact

Mike Tallent
Principal/Director
tallent_michael@bah.com
(757) 561-7916

Brian Ark
Senior Associate
ark_brian@bah.com
(619) 813-2032

Jesse Angle
Lead Associate
angle_jesse@bah.com
(352) 359-2016