



KC-46A AFOTEC Adaptive Relevant Testing (ART) Strategies to Enable Incremental Evaluation



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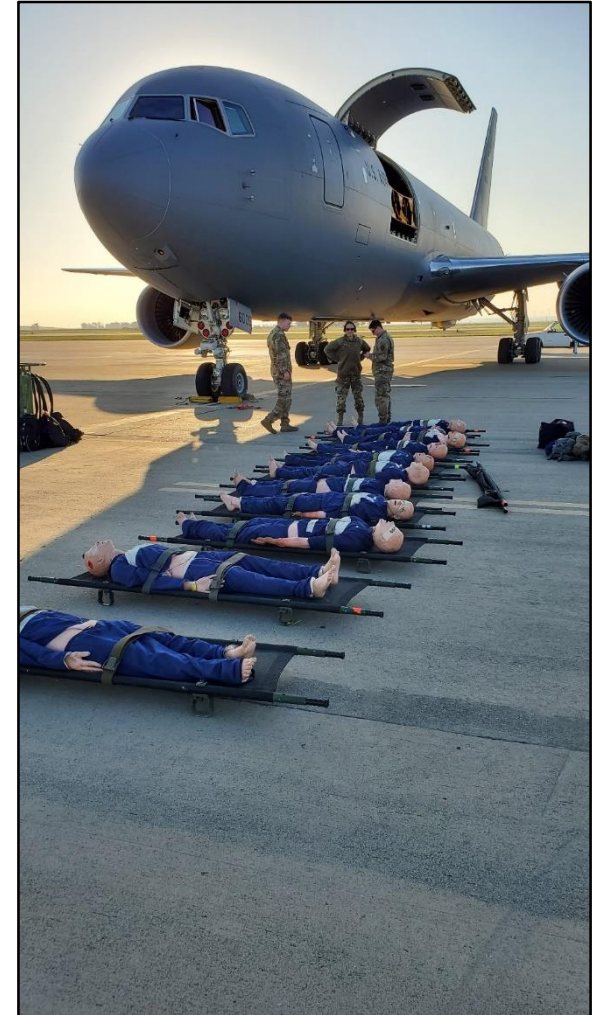
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Overview



- Adaptive Relevant Testing Overview
- KC-46A Overview
- ART Applications to KC-46A
 - Schedule
 - Performance
 - Cost
- Operational Examples





Purpose



- **How KC-46A Operational Test and Evaluation implemented Adaptive Relevant Testing (ART) principles to enable test team discovery, reporting, and correction to major system deficiencies much earlier than traditional methods**





Developmental Test vs. Operational Test



- **Developmental Test (DT)**
 - Focused on **Contract Specification Compliance**
 - “Was it built right?” (Verification)

- **Operational Test (OT)**
 - Focused on **MAJCOM Requirements and Operational Capability**
 - “Did we build the right thing?” (Validation)

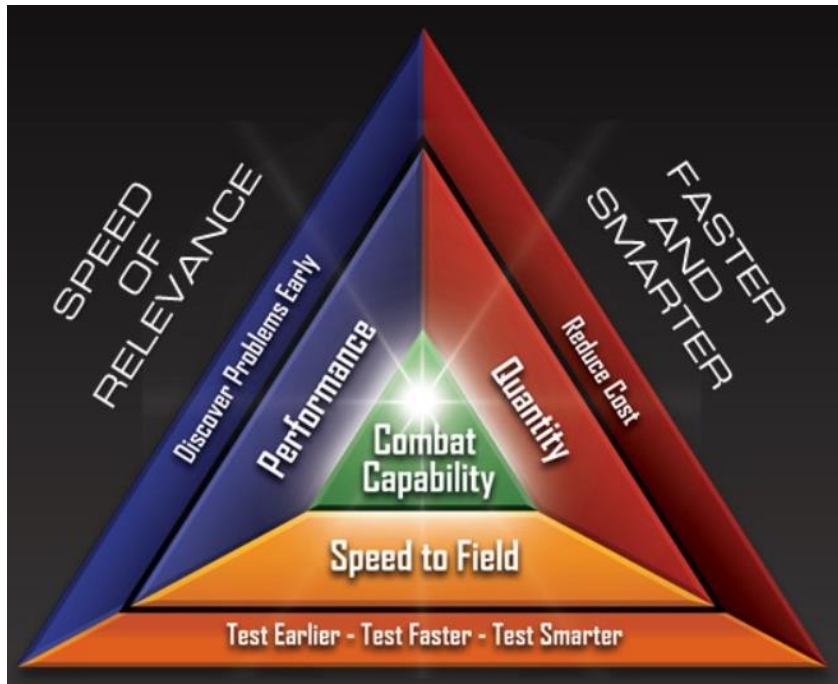


AFOTEC Adaptive Relevant Testing Overview



Challenge

AFOTEC Response



Key Principles

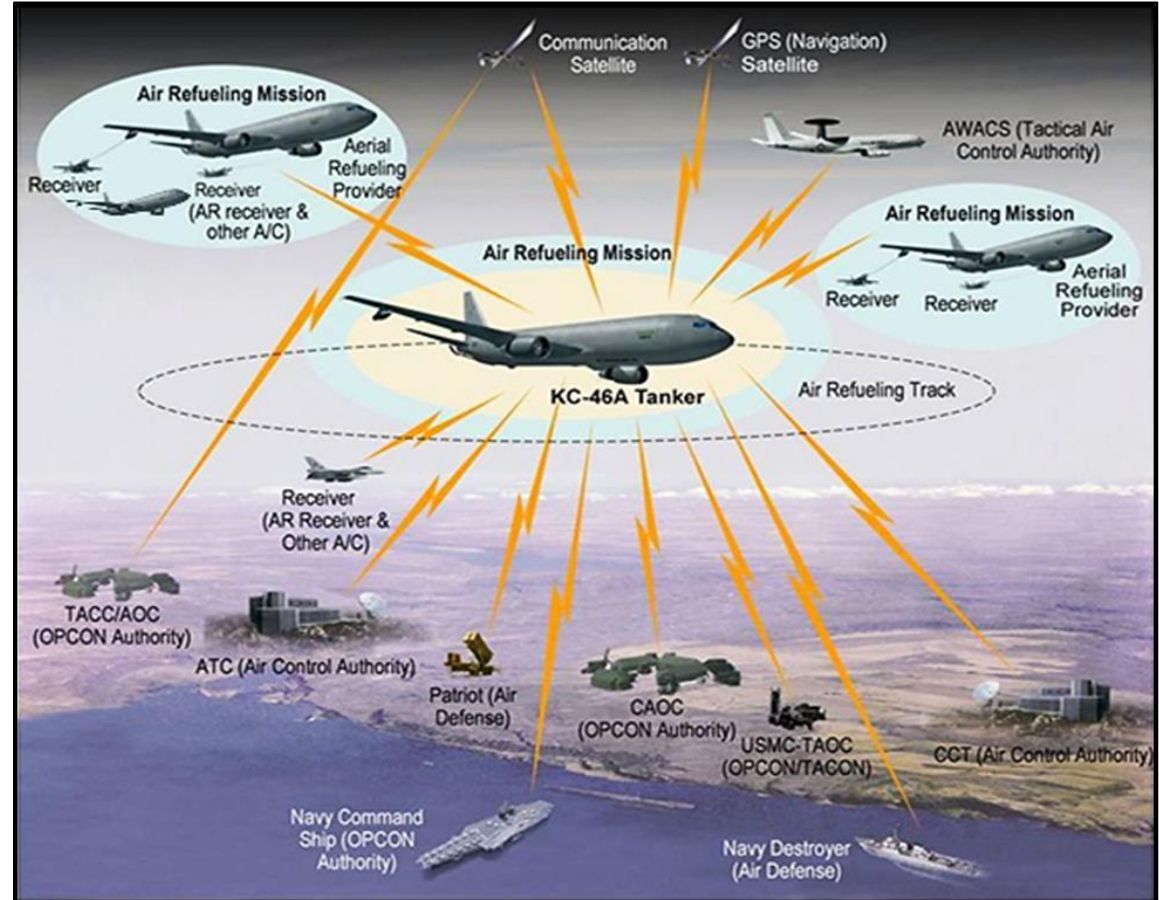
1. Early OT Involvement
2. Tailor to Situation
3. Continuous Feedback
4. Streamline Processes & Products
5. Integrate & Combine Test
6. Adaptive



Employment Concepts



- Aerial Refueling
- Airlift to Support
 - Cargo
 - Passengers
- Aeromedical Evacuation (AE)



Enhanced KC-135 mission (Per JP 3-17, Air Mobility Operations)



KC-46A OT Test Design



- **Design of Experiment (DOE) Methodology**
 - Test design provides 80% power level with signal-to-noise ratio (SNR) of 1.5
- **4,500+ data points across 700 test events**
 - Flight test is primary methodology for gathering data
- **AFOTEC HQ approves Test Plan; DOT&E approves Test Design technical adequacy**



Test Methodology (Effectiveness)



Three Critical Operational Issues:

1. Can the KC-46A perform refueling operations?
2. Can the KC-46A perform airlift operations?
3. Can the KC-46A perform aeromedical evacuation operations?



- **Ground test**
 - Alert launch
 - Cargo load demonstrations
 - Forward Area Refueling Point (FARP)
 - Cyber
- **Flight test**
 - In-contact aerial refueling
 - Effectiveness of supporting systems
 - Command and Control
 - Lavatory, galley, etc.
 - Cargo and passenger operations
 - Aeromedical evacuation operations



Test Methodology (Suitability)



Two Critical Operational Issues:

1. Can the KC-46A be generated to meet mission taskings?
2. Is the KC-46A logistically supportable in the worldwide environment?



• Ground Evaluations

- Maintenance tasks / demonstrations and support equipment
- Interactive Electronic Technical Manuals
- Cyber

• Analysis

- Training plans and curriculum
- Historical maintenance metrics
 - Reliability, Maintainability, Availability
- Sustainability
 - Logistics/Supply



Test Systems When They Are Ready (Schedule)



- **Formal OT officially started in Oct 19**
 - 22% of test points completed before official OT start
 - **Advantages**
 - Left leaning schedule delivers capability faster to the warfighter
 - ID early, Increase maturity, reduce delivery time of combat capability
-
- **Limitations**
 - Little/No control on contractor testing due to FFP Contract Type
 - Some systems were not ready when test began
 - May require re-testing completed test points
 - Can lead to increased demand on OT personnel requirements



Identify Issues Early (Performance)



- **Advantages**

- Provides capability incrementally to the warfighter to allow training and familiarization
 - Integrated Testing (IT) with DT provides early insights and system knowledge
 - Able to find and fix problems earlier than a historical IOT&E
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- **Limitations**

- Can be “re-discovery” of DT data due to lack of time to resolve known problems (mitigated by effective IT)
- Training and support may not be representative of an operational unit (mitigated by effective IT)



Reduce Cost Through Optimized Testing (Cost)



- **Advantages**

- Integrated Testing decreases the total number of test points required
 - Decreases Long Term Cost
-

- **Limitations**

- Teams may be in place longer to coordinate and execute
- Harder to maintain statistical power and confidence
- Re-testing of previously completed test points can reduce efficiency



ART Principles in Action



**Problem
much k**

Breaking News

US Air Force restricts KC-46 from carrying cargo and passengers

By: [Valerie Insinna](#) September 11, 2019

Christopher Woody Jan





ART Principles in Action



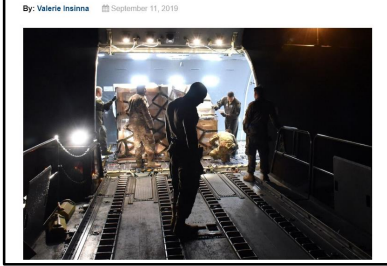
Another setback: Air Force restricts cargo, passengers on KC-46 tanker flights



Problems with Boeing's new refueling tanker could cause a much bigger headache for the Pentagon



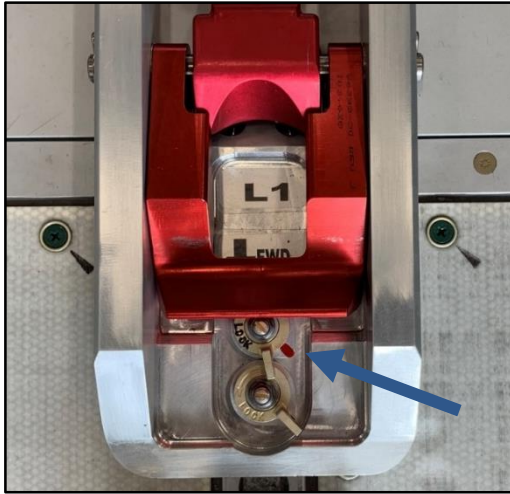
Breaking News
US Air Force restricts KC-46 from carrying cargo and passengers



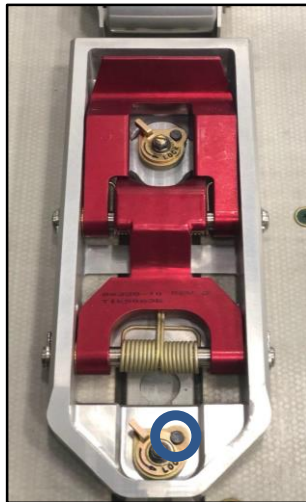
- **Cargo Latch Background**
 - Cargo floor locks restrain pallets to the aircraft floor
 - Equipped with a “quick release” mechanism for ease of install/removal
 - Quick release has a tactile indication of LOCK provided to the user via a “click”
- **Cargo Latch Problems**
 - Locks became unlocked during flight
 - AFOTEC Test Boom discovered discrepancies on a cargo trip prior to dedicated OT



Old vs New Locks



Old



New





Aircraft Performance Tool (APT)



- **Operational Assessment 2**
 - Until May 16, TOLD provided using Boeing FAA-certified dispatchers
 - OT Team Members identified missing on-board TOLD calculation as a critical deficiency
- **Take Off and Landing Data (TOLD)**
 - TOLD required prior to taxi
 - TOLD used to determine liftoff speed and Go/No-Go speeds
 - Go/No-Go Speeds – determine if you can stop or must takeoff (affected by several factors)
- **APT Fix**
 - Early ID gave Boeing time to develop, test, & implement fix
 - In Jan 19, the first KC-46 was delivered from Boeing Field with TOLD calculated by APT



Lessons Learned



- **Integrated testing is critical**
 - Remove OT vs. DT mindset: **Simply Test**
- **No system is 100% “ready”**
 - When delays occur, test what is available
 - Cargo issues would have historically delayed tests by roughly 3 months while KC-46 continued testing
- **Contract type can be severely limiting to test (FFP)**
- **Communicate timely results at actionable levels**
 - Daily SITREPs and Periodic Reports delivered every 3 months



Questions

