

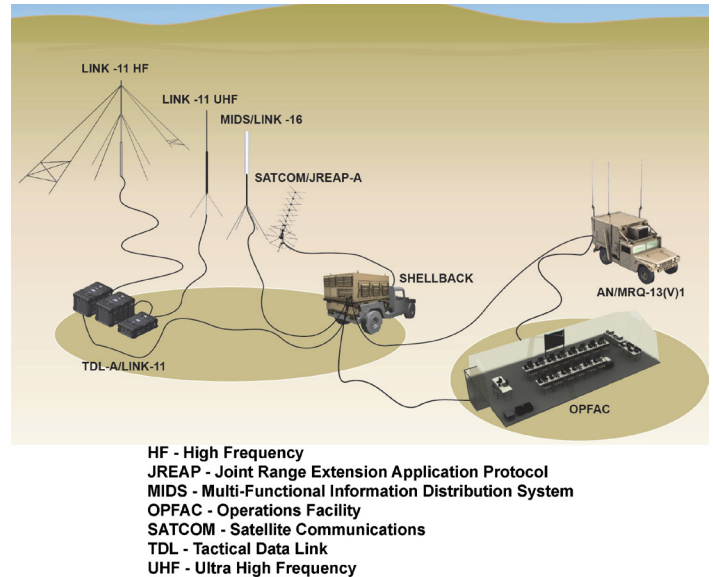
Common Aviation Command and Control System (CAC2S)

Executive Summary

- In 2QFY15, the Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN(RD&A)), as the Milestone Decision Authority, conducted a Milestone C review for the Common Aviation Command and Control (C2) System (CAC2S), which resulted in an approval to enter the Production and Deployment Phase of its life cycle and to procure low-rate initial production items to support IOT&E.
- During 3QFY15 and 4QFY15, the Marine Corps conducted additional data fusion testing using updated operational scenarios, and integrated/interoperability testing with the Composite Tracking Network. The Marine Corps continued risk reduction efforts by conducting a full Tactical Air Command Center (TACC) functionality demonstration during a 1QFY16 Weapons and Tactics Instructors' (WTI) exercise at Marine Corps Air Station (MCAS) Yuma, Arizona, as well as conducted datalink testing and an integration demonstration with the Ground/Air Task Oriented Radar (G/ATOR).
- During the 1QFY16 WTI exercise, the Marine Corps continued operational testing of CAC2S using effectiveness and suitability data collected to support the 3QFY16 CAC2S IOT&E.
- In 3QFY16, the Marine Corps Operational Test and Evaluation Activity (MCOTEA) completed the IOT&E for the CAC2S Increment I Phase 2 during the WTI exercise at MCAS Yuma. The IOT&E was conducted in accordance with a DOT&E-approved test plan.
- During the IOT&E, CAC2S demonstrated that it was operationally effective and operationally suitable to support mission accomplishment of the three Marine Corps aviation command and control agencies. Additionally, CAC2S demonstrated the ability to provide data fusion of real-time, near real-time, and non real-time information onto a single tactical display.
- Cybersecurity testing of CAC2S during IOT&E identified significant system vulnerabilities that make it susceptible to compromise in a contested network environment.
- In 4QFY16, Program Executive Officer Land Systems conducted the Fielding Decision Review.

System

- CAC2S consists of tactical shelters, software, and common hardware. The hardware components are expeditionary, common, modular, and scalable. Components may be assembled in a number of configurations to include transportable shelters (via the High Mobility Multi-purpose Wheeled Vehicle), tactical shelters, general-purpose tents, and available military or civilian facilities.



- CAC2S Increment I is being delivered in two phases. Phase I previously delivered hardware and software to fully support the Direct Air Support Center (DASC) mission requirements and partially support Tactical Air Operations Center (TAOC) mission requirements. Phase 2 combines the three legacy Phase 1 systems into two functional subsystems and fully supports the requirements of the DASC, TACC, and TAOC.
 - The Communication Subsystem provides the capability to interface with internal and external communication assets and the means to control their operation.
 - The Aviation Command and Control System provides:
 - The operational command post and functionality to support mission planning, decision making, and execution tools to support all functions of Marine Aviation
 - An open architecture interface capable of integrating emerging active and passive sensor technology for organic and non-organic sensors to the Marine Air Command and Control System
 - The capability to display real-time, near real-time, and non real-time sensor data to support C2 of Marine Air Ground Task Force (MAGTF) aviation assets

Mission

- The MAGTF Commander will employ Marine Corps aviation C2 assets, including the DASC, TAOC, and TACC equipped with CAC2S, to integrate Marine Corps aviation into joint and combined air/ground operations in support of Operational

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Maneuver from the Sea, Sustained Operations Ashore, and other expeditionary operations.

- The MAGTF Commander will execute C2 of assigned assets afloat and ashore in a joint, allied, or coalition operational environment by using CAC2S capabilities to:
 - Share mission-critical voice, video, sensor, and C2 data and information to integrate aviation and ground combat planning and operations
 - Display a common, real-time, and near real-time integrated tactical picture with the timeliness and accuracy necessary to facilitate the control of friendly assets and the engagement of threat aircraft and missiles
 - Provide fusion of real-time, near real-time, and non real-time information to support the MAGTF
 - Access theater and national intelligence sources from a multi-function C2 node

- Standardize Air Tasking Order and Airspace Control Order generation, parsing, interchange, and dissemination throughout the MAGTF and theater forces by using the joint standard for Air Tasking Order interoperability

Major Contractors

- Phase 1
 - Government Integrator: Naval Surface Warfare Center – Crane, Indiana
 - Component Contractor: Raytheon-Solipsys – Fulton, Maryland
- Phase 2
 - Prime Contractor (no Government Integrator): General Dynamics – Scottsdale, Arizona

Activity

- In 2QFY15, the ASN(RD&A), as the Milestone Decision Authority, conducted a Milestone C review for CAC2S, which resulted in an approval to procure low-rate initial production items to support IOT&E.
- In 2015, the Marine Corps conducted data fusion testing using an updated and operationally realistic scenario that more adequately stressed the system.
- During the 1QFY16 WTI course, the Program Office and MCOTEA conducted integrated testing of CAC2S for all operations cells within the TACC and also conducted operational endurance testing as risk reduction for the upcoming IOT&E. During this test period, they also conducted an integration demonstration of CAC2S with G/ATOR as a risk reduction effort since the G/ATOR system is still in development. Data collected during the 1QFY16 WTI exercise were used to support the CAC2S IOT&E in accordance with a DOT&E-approved test plan.
- In 2QFY16, MCOTEA conducted cybersecurity testing of CAC2S with a Cooperative Vulnerability and Penetration Assessment at Marine Corps Base Camp Pendleton, California.
- In 3QFY16, MCOTEA conducted an IOT&E of CAC2S during the 3QFY16 WTI exercise at MCAS Yuma, Arizona. During the IOT&E, MCOTEA also conducted a Cooperative Vulnerability and Penetration Assessment, and the Marine Corps Information Assurance Red Team conducted an Adversarial Assessment. DOT&E published a classified CAC2S IOT&E report in August 2016.
- In 4QFY16, the Program Executive Officer Land Systems conducted the Fielding Decision Review.

Assessment

- The following assessment is based on quantitative and qualitative evaluation of data from the DT-C2 developmental test period and IOT&E that the Marine Corps conducted

during the 1QFY16 and 3QFY16 WTI courses. It is also based on previous data fusion testing. Results are as follows:

- CAC2S demonstrated that it was both operationally effective and operationally suitable to support the primary mission areas for all three agencies – direct air support for the DASC, control aircraft and missiles for the TAOC, and C2 aviation and planning support for the MAGTF commander in the TACC.
- CAC2S demonstrated an ability to fuse real-time, near real-time, and non real-time data onto a single tactical display, at low and high operational tempos, and densities of aircraft and targets against current generation threats.
- DOT&E did observe interoperability/integration of CAC2S with G/ATOR, but since that system is still undergoing development, the Marine Corps will need to conduct an additional evaluation. However, with respect to currently fielded radars (AN/TPS-59) and datalinks, testing successfully demonstrated CAC2S's ability to receive information from those systems displaying both radar plot and track data.
- Throughout testing, DOT&E observed Tactical Display Framework Chat and Transverse Chat instability as well as problems associated with Voice Laptop freezes. The root causes of these problems were not clear.
- Reliability, availability, and maintainability data collected during DT-C2 and IOT&E showed CAC2S met its availability and maintainability requirements. CAC2S also met reliability requirements for Mean Time Between Operational Mission Failure but did not meet Mean Time Between Failure requirements during testing. However, Mean Time Between Failure did not affect mission effectiveness as operational availability exceeded the threshold value throughout testing.
- CAC2S has significant cybersecurity vulnerabilities that make it susceptible to compromise in a contested network

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environment. As identified in the classified CAC2S IOT&E report, one cyber-related vulnerability found during penetration assessments should be corrected prior to system fielding.

Recommendations

- Status of Previous Recommendations. The Marine Corps addressed all the previous recommendations.
- FY16 Recommendations. Based on the results of IOT&E and related testing, the Marine Corps should:
 1. Correct cybersecurity vulnerabilities identified in the CAC2S IOT&E report.
 2. Continue data fusion testing of CAC2S with the AN/TPS-80 G/ATOR in FOT&E when G/ATOR becomes available.
 3. Identify root causes and correct Tactical Display Framework Chat and Transverse Chat instability and problems associated with voice laptop freezes. Verify the resolution of both during FOT&E.

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