

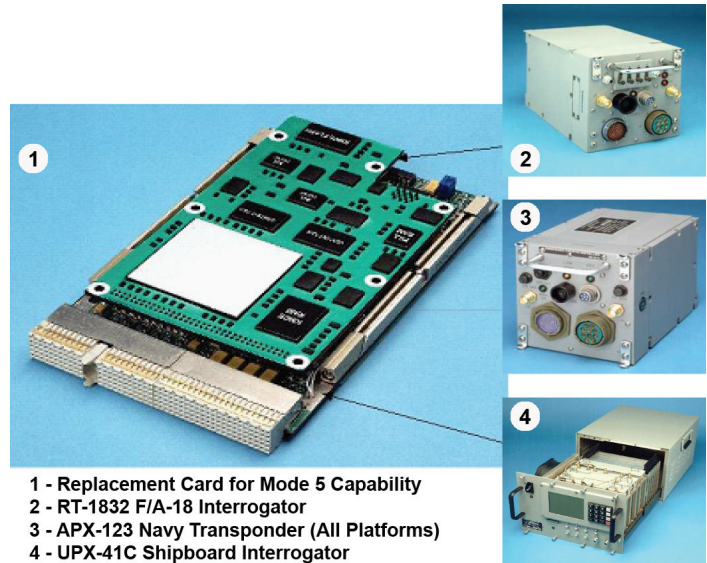
## Mark XIIA Identification Friend or Foe (IFF) Mode 5

### Executive Summary

- Independent Mark XIIA Mode 5 Identification Friend or Foe (IFF) (referred to as “Mode 5”) development efforts exist in each U.S. Military Service as well as some NATO countries. Since Mode 5 is not a joint program, the Services are separately developing IFF equipment for use on various land, sea, and air platforms.
  - Of these separate Service efforts, only the Navy has an established Acquisition Category II program.
  - The Army and Marine Corps are procuring Mode 5 transponders developed in the Navy program.
  - The Air Force is developing its own Mode 5 transponders and interrogator capabilities.
- Although the Services are designing and building Mode 5 systems to comply with NATO and DoD IFF standards, DOT&E initiated oversight in 2006 because of the concern that the multiple programs and vendors add risk to achieving joint IFF systems interoperability.
- The Navy conducted an IOT&E of Mode 5 capability that included significant joint Service participation in FY12. During the June 2013 Joint Staff J-6-led Bold Quest Coalition Capability Demonstration and Assessment event, the Navy conducted a major joint operational test event off the U.S. East Coast that focused on Mode 5 interoperability and identification in a system-of-systems context. This two-week event included extensive participation by joint Service and allied systems equipped with a wide variety of Mode 5 equipment produced by different U.S. and allied manufacturers. Test results are currently being analyzed with the final assessment due for completion in time to support Initial Operational Capability in 2014.
  - This realistic operational test event has helped resolve earlier DOT&E concerns about lack of testing of Mode 5 interoperability and identification in a system-of-systems context.
  - Similar future events will evaluate Mode 5 interoperability and identification as other IFF systems in development are integrated into Service platforms.

### System

- The Mark XIIA Mode 5 IFF is a cooperative identification system that uses interrogators and transponders located on host platforms to send, receive, and process friendly identification data.
- Mode 5 is a military-only identification mode, which modifies the existing Mark XII Mode 4 IFF (referred to as “Mode 4”) system and addresses known shortcomings of the legacy Mode 4 identification mode. Mode 5 will eventually replace Mode 4 and allows National Security Agency-certified secure encryption of interrogations and replies. Primary system features include:



1 - Replacement Card for Mode 5 Capability  
 2 - RT-1832 F/A-18 Interrogator  
 3 - APX-123 Navy Transponder (All Platforms)  
 4 - UPX-41C Shipboard Interrogator

- A lethal interrogation format, which is used by a weapons-capable platform prior to weapons release as a final attempt to get a valid Mode 5 reply from the target, even with the target’s interrogated Mode 5 transponder system in standby; this is intended to reduce the possibility of fratricide.
- A random-reply-delay, which prevents overlapping replies and provides better display discrimination for closely-spaced platforms.
- Mode 5 offers more modern signal processing, compatibility with legacy Mode 4 systems and civilian air traffic control, and secure and encrypted data exchange through use of the new waveform.
- Mode 5 serves as a component of the combat identification process used on ground-based systems such as the Army’s Patriot missile system, sea-based systems such as Aegis-equipped ships, and military aircraft to include the E-3 Sentry Airborne Warning and Control System (AWACS) and E-2 Hawkeye command and control platforms.
- Independent Mode 5 development efforts exist in each U.S. Military Service as well as some NATO countries. Although not a joint program, the Services are developing equipment capable of employment on multiple Service platforms.
  - Of the four separate Service efforts, only the Navy has the established Acquisition Category II Program of Record, with incorporation of Service-specific Mode 5 capability through platform-specific Engineering Change Proposals.
  - The Army and Marine Corps are leveraging the Navy program, and the Air Force will execute individual Engineering Change Proposals on its affected hardware.

# NAVY PROGRAMS

## Mission

The Combatant Commander employs the Mode 5 system to provide positive, secure, line-of-sight identification of friendly platforms equipped with an IFF transponder. In the future, this system's information will be combined with other cooperative and non-cooperative combat identification techniques in order to provide identification of all platforms – enemy, neutral, and friendly.

## Activity

- In July 2012, the Navy Acquisition Executive approved full-rate production of the Navy Mode 5 system that includes both transponders and shipboard interrogators following the Navy Mode 5 IOT&E.
- The Army and Air Force are separately developing and testing Service-specific Mode 5 capabilities:
  - The Army developed, tested, and is fielding a Mode 5 Air Defense Interrogator for the Patriot and Sentinel air defense systems.
  - The Air Force is developing a Mode 5 interrogator for AWACS.
  - The Air Force-developed, integrated, and tested Mode 5 interrogators and transponders into F-15C/E and F-16C aircraft.
- USD(AT&L) and DOT&E worked with the Services to develop and approve a revised Joint Operational Test Approach (JOTA) document to guide Mode 5 interoperability testing across the DoD.
  - Utilizing the approved JOTA guidance, the Navy led the development of a DOT&E-approved joint test concept and test plan for the conduct of an operationally realistic JOTA evaluation of Mode 5 capability.
  - During the June 2013 Joint Staff J-6-led Bold Quest Coalition Capability Demonstration and Assessment event, the Navy conducted a JOTA event in 3QFY13 off the U.S. East Coast, which involved a variety of joint Service and allied aircraft equipped with interrogators and transponders produced by different U.S. and allied manufacturers. The Navy executed air warfare events under Navy Aegis destroyer, AWACS, or ground controlled intercept control. During the event, U.S. and allied aircraft flew 272 of 294 planned aircraft sorties. Representative operational flight profiles and tactics were used during the event.
  - This JOTA event will inform the DoD-wide FY14 Mode 5 Initial Operational Capability declaration. Future JOTA events will support the planned FY20 Full Operational Capability declaration.

## Major Contractors

- Navy Transponder and Interrogator: BAE Systems – Arlington, Virginia
- Air Force Transponder and Interrogator, Army Air Defense Interrogator: Raytheon Systems – Waltham, Massachusetts
- Air Force E-3 Interrogator: Telephonics Corporation – Farmingdale, New York

## Assessment

- The 3QFY13 JOTA test event addressed DOT&E concerns about joint interoperability and identification in a system-of-systems context for the systems under test. The JOTA schedule included a mixture of blue and red forces consisting of a variety of platforms equipped with transponders and interrogators from different vendors. Preliminary JOTA results revealed no new Mode 5-associated deficiencies.
- Following the Navy IOT&E, the Navy Program Office developed new software builds for both its transponder and interrogator systems to address discrepancies encountered during IOT&E. The installed performance of these software fixes, as well as Mode 5 interoperability with both existing and planned IFF systems, is being validated in combined development/integration testing. The fixes will be incorporated into Navy Mode 5 systems over the next several years.
- The Navy and DOT&E are currently assessing the results from the 2013 JOTA event and will report them in a subsequent annual report.

## Recommendations

- Status of Previous Recommendations. The Navy has adequately addressed all previous recommendations.
- FY13 Recommendations.
  1. In order to ensure interoperability between interrogators, transponders, and combined interrogator-transponders, Service program managers must ensure that developmental and operational testing of Mode 5 capabilities and systems address compatibility with both joint Service and allied IFF systems.
  2. The Services must fully participate in future JOTA interoperability and identification exercises to ensure that Mode 5 capabilities continue to be tested in a realistic joint Service environment.