

## AC-130J Ghost Rider

### Executive Summary

- The program completed Block 20 developmental testing in March 2017.
- The 18th Flight Test Squadron (18th FLTS), along with aircrews from the 1st Special Operations Group, Detachment 2, conducted an IOT&E of the Block 20 AC-130J from March 15 to July 20, 2017, to support a Full-Rate Production decision. The IOT&E included a Cooperative Vulnerability and Penetration Assessment (CVPA) in April 2017 and an Adversarial Assessment (AA) in June 2017.
- Although analysis is ongoing, preliminary data from the IOT&E indicate that the Block 20 AC-130J will support most elements of the Close Air Support and Air Interdiction missions, but some shortfalls remain:
  - The AC-130J's Gun Weapon System (GWS) fire control performed inconsistently when accounting for changing ballistic conditions. The 30 mm GWS also displayed problems maintaining a full rate of fire.
  - The complexity of system software, inadequate training and technical manuals, and the overall operating environment aboard the AC-130J diminishes usability.
- The Program Office has initiated efforts to correct the shortfalls identified during IOT&E.
- Block 30 commenced developmental testing in July 2017 and will include several new capabilities such as an integrated Combat System Officer (CSO) station, a special mission processor, and wing-mounted AGM-114 HELLFIRE missiles.
- The program declared Initial Operational Capability (IOC) on September 30, 2017.

### System

- The AC-130J is a medium-sized, multi-engine, tactical aircraft with a variety of sensors and weapons for air-to-ground attack.
- The AC-130J is operated by nine aircrew members: two pilots, one CSO, one weapons system operator, and five special mission aviators (one sensor operator, one load master, and three gunners).
- U.S. Special Operations Command (USSOCOM) is developing AC-130J through the integration of modular components onto existing MC-130J aircraft. The AC-130J includes an open architecture to allow for follow-on development and future integration of block capabilities.
- Block 20 consists of the following modular components:
  - A dual-console Mission Operator Pallet (MOP) in the cargo bay controls all subsystems with remote displays and control panels on the flight deck.
  - An interim, limited-functionality, carry-on flight deck workstation for a CSO.
  - The weapon suite consists of an internal, pallet-mounted 30 mm side-firing chain gun and 105 mm cannon; wing-mounted GBU-39/B GPS-guided Small Diameter Bombs (SDBs) and GBU-39B/B Laser SDBs; and



- AGM-176 Griffin laser-guided missiles mounted internally and launched through the rear cargo door.
- Two MX-20 electro-optical/infrared sensor/laser designator pods and multiple video, data, and communication links.
- A side-mounted heads-up display (HUD) enhances pilot situational awareness in the cockpit.
- Block 30 future updates include:
  - A permanent CSO station on the flight deck.
  - A Special Mission Processor.
  - Wing-mounted AGM-114 HELLFIRE missiles.
- Block 40 will include a radio-frequency countermeasures (RFCM) system.
- The AC-130J retains all survivability enhancement features found on the MC-130J aircraft.
  - Susceptibility reduction features include the AN/ALR-56M radar warning receiver, the AN/AAR-47(V)2 Missile Warning System, the AN/ALE-47 countermeasure dispensing system, and the Large Aircraft Infrared Countermeasures system with the Next Generation Missile Warning System.
  - Vulnerability reduction features include fuel system protection (fuel tank foam to protect from ullage explosion), redundant flight-critical components, and armor to protect the crew and the oxygen supply.
- The AC-130J will replace legacy AC-130H/U aircraft.

### Mission

The Joint Task Force or Combatant Commander will employ units equipped with the AC-130J to provide close air support and air interdiction using battlespace wide area surveillance, target geolocation, and precision munition application. Additionally, the AC-130J provides time-sensitive targeting, communications, and command and control capabilities.

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## Major Contractor

Lockheed Martin – Bethesda, Maryland

### Activity

- The USSOCOM Acquisition Executive declared Milestone C for the AC-130J on October 5, 2016.
- The AC-130J Combined Test Force (CTF) of the 96th Operations Group completed the majority of Block 20 developmental testing in December 2016. The CTF conducted additional testing on the newly installed side-HUD in January and February, and verification of a deficiency correction to the SDB bomb rack in March 2017.
- The 18th FLTS, along with aircrews from the 1st Special Operations Group, Detachment 2, conducted an IOT&E of the Block 20 AC-130J from March 15 to July 20, 2017, in accordance with a DOT&E-approved test plan. Aircrew flew a total of 29 sorties and 130 flight hours from Hurlburt Field, Florida, and Marine Corps Base Kaneohe Bay, Hawaii. The IOT&E included a CVPA in April 2017 and an AA in June 2017.
- During IOT&E, the 18th FLTS completed 11 mission vignettes on specific capabilities; 10 full mission profile scenarios; 1 day of cold weather testing; and 2 phases of cybersecurity testing to fully characterize and evaluate the system. Testing expended 5,707 rounds of 30 mm and 105 mm ammunition and 26 precision-guided munitions.
- During IOT&E, the 780th Test Squadron, in coordination with DOT&E and the AC-130J CTF, conducted Phase 2 live fire testing to support the lethality evaluation of the AGM-176 Griffin missile against static ground targets and maneuvering boats, and the 105 mm gun against structures, personnel, technical vehicles, and lightly armored air defense vehicles.
- The program received the ninth aircraft in July 2017 to support declaring an IOC with six Block 20 aircraft. The twelfth MC-130J aircraft was inducted for modification to a Block 20 AC-130J in August 2017.
- Production line cut-in of the Block 30 configuration is expected to begin with aircraft 14. The second and third aircraft, originally Block 10 configuration, were inducted for retrofitting to Block 30 to support developmental test and evaluation (DT&E) and the RFCM program.
- The U.S. Air Force Combat Effectiveness and Vulnerability Analysis Branch completed the Ballistic Vulnerability Analysis, Anti-Aircraft Artillery Susceptibility Analysis, Proximity Burst Analysis, and Occupant Casualty Analysis in 2QFY17.
- USSOCOM is developing the RFCM system for MC-130J and AC-130J under a separate Acquisition Category II program, with three AC-130J aircraft supporting trial-kit installation and testing beginning in 2QFY18. The RFCM program expects to conduct IOT&E in FY19 and will become part of the Block 40 AC-130J.

### Assessment

- Analysis of IOT&E data was ongoing at the end of FY17. DOT&E expects to issue an IOT&E report in 1QFY18 to inform the 2QFY18 Full-Rate Production decision.
- A problem with the integration of the Bomb Rack Unit (BRU)-61/B was discovered late in DT&E and delayed the start of IOT&E by 2 weeks. A software conflict between the MOP and the BRU-61/B during multi-round salvos caused the BRU computer to lock up and inhibit release of SDBs. Regression testing verified the correction of the software error prior to IOT&E.
- Preliminary data indicate the Block 20 AC-130J will support most elements of the Close Air Support and Air Interdiction missions, but some notable shortfalls remain.
  - In live fire testing during IOT&E, the AC-130J successfully engaged operationally representative targets with its entire precision-guided munitions suite. Testing also included long-range engagements at the edge of the Launch-Acceptable Region that demonstrated the AC-130J's increased stand-off range.
  - Although the AC-130J aircrew were able to engage targets successfully with both guns throughout IOT&E, the GWS displayed performance inconsistencies.
    - Once calibrated, the Gun Fire Control System (GFCS) should compensate for changes in altitude, slant range, and ambient wind to enable accurate first rounds on target. However, changes in altitude or slant range would sometimes require a calibration update.
    - Operators are unable to independently update the GFCS wind calibration factor without changing the inherent gun-mount calibration factor, as they can on the same GWS on AC-130W.
    - The 30 mm GWS on the AC-130J experiences excessive "retriggers" in full rate of fire that reduce the utility of the firing mode, and which are not observed on the AC-130W. A retrigger occurs when the aim point of the gun is perturbed by recoil beyond a preset angular limit, called Tracking Inhibit; the gun will stop firing when it exceeds this limit so that it can re-center itself, and the operator must release and re-depress the trigger to resume fire.
  - Autonomous threat acquisition by aircraft defensive equipment is improving with each generation of aircraft in ways that may not be thoroughly demonstrated in operational test conditions; these capabilities may require follow-on tactics development by 18th FLTS.
  - Although Block 20 computational performance and stability improved over Block 10 operational utility evaluation (OUE) results, (preliminary data indicate fewer

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- system freezes or reboots), operator assessments of system usability did not improve over Block 10. Preliminary data show no statistically significant change in system usability survey scores from flight deck crew and MOP operators between Block 10 and Block 20; scores from special mission aviators, who now have the additional 105 mm gun to operate, decreased from Block 10.
- System complexity, inadequate training and technical data, and multiple layers of logistics support contributed to poor system usability ratings. The multiple datalink systems require precise configuration by contract logistics support or aircrew before each mission. Although datalink availability improved over the Block 10 OUE, inconsistent procedures caused some datalinks to be unavailable on a few IOT&E sorties. Lack of datalink integration with primary MOP controls and displays increases operator workload to monitor them and degrades situational awareness.
  - Many of the deficiencies in the Block 10 aircraft that diminish usability remain a problem on the Block 20 aircraft. Light pollution from the added displays, which interferes with night-vision goggle operations by special mission aviators, has not improved. Although the cargo area floor has been leveled by the addition of floor panels to reduce trip hazards, the modifications now interfere with loading of 105 mm ammunition. The lack of a forward restraint in the 105 mm ammunition rack caused an excessive number of rounds to come loose from the brass in the gun breech.
  - The CTF completed Phase 2 live fire lethality testing of the Griffin missile and 105 mm gun during Block 20 DT&E and IOT&E. Preliminary data analysis indicate:
    - The Griffin demonstrated mobility kills against stationary and moving trucks, as well as small boats, in both height-of-burst and point-detonate modes.
    - The PGU-46/B 30 mm round demonstrated limited effectiveness against personnel in the open on soft ground but is more effective against personnel on hard surfaces. For example, lethality to personnel above a “soft” plywood roof is lower than predicted because the round detonated below the roof’s surface; manikins above a concrete roof incur more fragmentation damage than above a plywood roof.
    - The 105 mm round demonstrated expected lethality against personnel, trucks, and light armored vehicles.
  - Preliminary results from the Vulnerability Analyses did not demonstrate any unexpected vulnerabilities, compared to legacy C-130 aircraft.
  - The IOT&E phase included cybersecurity testing of the Block 20 AC-130J. Details will be described in the classified portion of the IOT&E report.
  - Cold weather testing at McKinley Climatic Lab was halted due to concerns over cold-soaking short supply components likely to break at lower temperatures. The program still needs to address how it will deploy in cold conditions while maintaining full mission capability.

## Recommendations

- Status of Previous Recommendations.
  1. The program closed all but two previous Category I – Urgent Deficiency Reports (DRs); one was downgraded. The program continues to work on a solution to the GPS interference DR.
  2. The program did not pursue fielding the PGU-13D/B 30 mm ammunition, so no additional lethality testing was necessary.
  3. The program has not yet provided a draft update to the Test and Evaluation Master Plan (TEMP) for the Full-Rate Production decision, but DOT&E continues to discuss the future test strategy with the test team.
- FY17 Recommendations. The Program Office should:
  1. Identify and implement upgraded GFCS software to correct accuracy and re-trigger anomalies prior to AC-130J deployment.
  2. Include a clear test strategy for future testing of the new capability increment baseline in the TEMP update for the Full-Rate Production decision. This should incorporate additional cybersecurity testing at the appropriate block of capability enhancement.
  3. Develop a plan to update and test tactics, techniques, and procedures for operational employment of the Block 20 AC-130J defensive systems suite.
  4. Work with 18th FLTS to complete the AC-130J cold climate evaluation.

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