

# CH-53K King Stallion



Marine Operational Test and Evaluation Squadron One (VMX-1) conducted IOT&E from July 30, 2021 to April 11, 2022 in accordance with the DOT&E-approved test plan. The United States Marine Corps declared Initial Operational Capability (IOC) in April 2022 based on the Service's assessment of the CH-53K's operational effectiveness, suitability, and survivability demonstrated in IOT&E. DOT&E's assessment of the CH-53K's performance will be detailed in the IOT&E report and its classified annex in 1QFY23. The Navy has not funded the Phase II Live Fire test and evaluation (LFT&E) program which is necessary to evaluate the CH-53K's survivability against operationally relevant threats in accordance with the DOT&E-approved Test and Evaluation Master Plan.

## SYSTEM DESCRIPTION

The CH-53K is a dual-piloted, multi-engine helicopter. Composite material construction, new engine design, a glass cockpit, and fly-by-wire flight controls are indicative of the improved technology designed throughout the CH-53K when compared to the 1980s era CH-53E. The Marine Corps will assign CH-53Ks to existing Marine heavy helicopter squadrons to replace their current fleet of CH-53Es.

The Marine Corps will support CH-53K Organizational-Level (O-level), Intermediate-Level (I-level), and Depot-Level (D-level) maintenance concepts. The number of personnel per squadron required to maintain the CH-53K is expected to remain the same as for the CH-53E.

## MISSION

Commanders employ the Marine Air-Ground Task Force equipped with the CH-53K for:

- Heavy-lift missions, including assault transport of weapons, equipment, supplies, and troops
- Supporting forward arming and refueling points and rapid ground refueling
- Assault support in evacuation and maritime special operations
- Casualty evacuation
- Recovery of downed aircraft, equipment, and personnel
- Airborne control for assault support

## PROGRAM

The CH-53K is an Acquisition Category IC program. DOT&E approved the Milestone C Test and Evaluation Master Plan (Revision C) in February 2017 and the Alternative LFT&E Strategy (Revision C) in May 2010. DOT&E approved the OT-C1 IOT&E Plan in June 2021. IOT&E data and analysis will support the Full-Rate Production decision scheduled for 1QFY23. The United States Marine Corps declared IOC in April 2022.

### » MAJOR CONTRACTOR

- Sikorsky Aircraft (a Lockheed Martin subsidiary company)
  - Stratford, Connecticut

## TEST ADEQUACY

VMX-1, under the auspices of the Navy's Operational Test and Evaluation Force (OPTEVFOR), conducted IOT&E equipped with four CH-53Ks from July 30, 2021 to April 11, 2022 in accordance with the DOT&E-approved test plan and observed by DOT&E. VMX-1 conducted flight events at Marine Corps Air-Ground Combat Center (MCAGCC) Twentynine Palms, California; Marine Corps Air Station (MCAS) New River, North Carolina; and aboard USS *Iwo Jima* (LHD 7) operating off the coast of North Carolina. Naval Air Warfare Center, Aircraft Survivability Division, China Lake, California, collected data during Phase I live fire testing from 2QFY14 to 4QFY22.

CH-53K testing was adequate to support the evaluation of operational effectiveness, operational suitability, cybersecurity, and live fire testing. Aircraft survivability equipment testing was not adequate. The Navy's test design was insufficient to acquire the necessary data in the necessary conditions and issues with the test execution further restricted the data acquired. Additional DECM testing is scheduled for 2QFY23.

During IOT&E, VMX-1 accumulated 451.1 flight hours over 114 flights. These flights occurred in desert, mountainous, and forested environments and aboard ships during the day and at night. VMX-1 transported internal cargo ranging in weight from 2,500 to 10,000 pounds in all environments. Externally transported loads included Light Armored Vehicles, M777 Howitzers, and High Mobility Multipurpose Wheeled Vehicles. External loads also included the unplanned and successful recovery of a 15,200-pound Navy MH-60S from its crash site located at 12,000 feet above mean sea level. VMX-1 did not conduct troop transport missions with 30 combat equipped troops down to minimum fuel due to incomplete aircraft center of gravity developmental testing.

IOT&E operations did not assess CH-53K secondary missions of air evacuation, forward arming and refueling point operations, air delivery, or rapid insertion and extraction operations. CH-53K operational testing of these missions is scheduled for 2QFY23.

A CH-53K structural repair manual was not available for evaluation during IOT&E. The program expects to deliver the structural repair manual in FY25.

IOT&E did not assess initial accession training curricula (scheduled for delivery in October 2022) and logistics supportability (material support date scheduled for January 2024).

Phase I of the LFT&E program began with risk reduction testing in 2008, major component testing in 2QFY14, and completed in 4QFY22. Risk reduction tests addressed design questions on high risk components prior to the approval of the Alternate LFT&E Strategy. The test plans were individually concurred with and tests observed by DOT&E. Phase I tested critical components and the Ground Test Vehicle against threshold and some objective threats. The Navy conducted ballistic testing at Naval Air Warfare Center, China Lake, California.

Sikorsky completed tail rotor blade endurance testing to evaluate threat-damaged test articles to representative fly-home loads in 4QFY22.

From 2QFY21 to 1QFY22, the Navy conducted Ground Test Vehicle testing to dynamically evaluate high-risk shots, including gearboxes, structure, flight controls, the hydraulic accumulator, and engine bay fire suppression systems under representative flight conditions.

The Navy performed ballistic vulnerability analyses

supplementing the extensive live fire testing to assess the CH-53K overall ballistic vulnerability. The assessment did not include a threat-specific radio frequency or infrared tests. Electromagnetic effects were primarily assessed through electromagnetic environmental testing. In accordance with the DOT&E-approved strategy, no high-altitude electromagnetic pulse or electromagnetic pulse testing was performed. These threats should be evaluated in future survivability testing.

The Program Office has continued to defer Phase II of the LFT&E program due to lack of funding. Phase II of the LFT&E program, defined in the DOT&E-approved Alternative LFT&E Strategy, is essential for a complete survivability assessment of the CH-53K against operationally relevant threats expected to be encountered in combat. The majority of Phase II testing was originally planned to occur prior to the Full-Rate Production decision and will test components not tested in Phase I and components added or modified during aircraft development.

Cybersecurity Red Teams from OPTEVFOR and Naval Air Warfare Center – Aircraft Division Patuxent River conducted a cooperative vulnerability and penetration assessment and an adversarial assessment at MCAS New River from March 14 – 25, 2022. This testing included the Personal Computer Memory Card International Association Card,

Military Standard 1553 Non-Internet Protocol and Ethernet network testing, and ARC-210 very high frequency/ultra-high frequency radio transceiver testing. The Navy did not test ARINC 429 buses onboard the CH-53K. Comprehensive integrated cyber-survivability testing is scheduled for 2QFY24.

The Navy tested the DECM system on January 12 and 19, 2022 during transit and on-site at Ingalls Field in Hot Springs, Virginia, and at the Atlantic Test Range at Patuxent River Naval Air Station, Maryland in February 2022. The DECM system was in an “interim” configuration. The Navy will upgrade and test the aircraft’s survivability equipment to the Data Transfer Unit DECM System Replacement in FY23, which will require additional integration and flight testing for an updated survivability determination.

The test data are not adequate to determine if the AAQ-24 and APR-39C(V)2 systems were properly integrated on the platform or to determine effects on CH 53K survivability. DOT&E did not have enough data to determine the detailed performance of the system. The data provided by the Navy for the APR-39C(V)2 were time-to-detect. Without additional data pertaining to the simulated threats and system performance, aircraft survivability cannot be determined. Issues during the conduct of the test also led to inconsistent system configurations that the Navy should correct for FOT&E.

## PERFORMANCE

---

### » EFFECTIVENESS

---

United States Marine Corps declared IOC in April 2022 based on the Service's assessment of the CH-53K's operational effectiveness demonstrated in IOT&E. DOT&E's assessment of the CH-53K's effectiveness will be described in detail in the IOT&E report in 1QFY23.

### » SUITABILITY

---

United States Marine Corps declared IOC in April 2022 based on based on the Service's assessment of the CH-53K's operational suitability demonstrated in IOT&E. DOT&E's assessment of the CH-53K's suitability will be described in detail in the IOT&E report in 1QFY23.

## » SURVIVABILITY

---

United States Marine Corps declared IOC in April 2022 based on based on the Service's assessment of the CH-53K's operational survivability demonstrated in IOT&E and LFT&E. DOT&E's assessment of the CH-53K's survivability will be described in detail in classified IOT&E report annex in 1QFY23.

## RECOMMENDATIONS

---

The Navy should:

1. Fund and complete the planned Phase II LFT&E program to fully assess CH-53K vulnerability against operationally relevant threats.
2. Complete additional center-of-gravity developmental testing for transporting 30 combat-equipped Marines.

3. Review internal cargo loading procedures to optimize loading heavy pallets.
4. Expedite structural repair manual to facilitate combat damage repair at the organizational level
5. Conduct Data Transfer Unit DECM System Replacement operational testing prior to fielding to characterize aircraft susceptibility to threat weapon systems.
6. Conduct additional cybersecurity testing on wireless intercommunications system, deterministic Ethernet, and ARINC 429 network to fully characterize cyber threats.
7. Address recommendations found in DOT&E's IOT&E report and classified annex for effectiveness, suitability, and survivability.