2018 Secretary of Defense

Environmental Awards

Environmental Excellence in Weapon System Acquisition
Large Program, Individual/Team
Combat Rescue Helicopter Program ESOH Team

Introduction

The Combat Rescue Helicopter (CRH) Program is a United States Air Force Acquisition Category IC program replacing aging HH-60G Pave Hawk helicopters with a new system designated as the HH-60W. The primary mission of this helicopter is recovering isolated personnel from hostile or denied territory. The CRH Program, which is wrapping up engineering and manufacturing development, is based on the already military-qualified and proven UH-60M Black Hawk platform.

The Program's overall approach for integrating Environment, Safety, and Occupational Health (ESOH) into the systems engineering process and acquisition strategy is the responsibility of the CRH Program ESOH Team comprised of cross-functional government-contractor members including engineers, managers, maintenance specialists, and user representatives from the government program office, Air Combat Command, Sikorsky Aircraft Company, and other stakeholders.

Background

The CRH is a dual-piloted, multi-engine helicopter that will provide updated vertical lift and other technologies to meet Air Force personnel rescue mission requirements for at least the next thirty years. The Air Force plans to acquire 112 HH-60Ws, capable of employment day or night, in adverse weather, and in a variety of threat spectrums from terrorist attacks to chemical, biological, radiological, and nuclear threats. Additionally,

the system has enhanced survivability capabilities for the recovery of personnel. The CRH Program manages not just the air vehicle, but its support equipment and training systems throughout the lifecycle. The Program's critical design review occurred in May 2017, with production of the first test articles underway, and flight testing projected to begin during the fourth quarter of 2018.

Primary CRH Program ESOH Team Members

- David Diaz, Chief of Systems Engineering (Air Force)
- Gene McKinley, Environmental Engineer (Air Force)
- Luis Diaz-Rodriguez, Aircraft Structural Integrity Manager (Air Force)
- Sam Hunt, System Safety Manager (Air Force)
- Arnold Godsey, Environmental Engineer (Air Force)
- Jeffrey Miller, Logistics Specialist (Air Force)
- Scott Misner, HQ ACC/A5RH (Air Force)
- Henry Howard, Material and Process (Sikorsky)
- Karen Williams, Material and Process (Sikorsky)
- Chris Knott, Material and Process (Sikorsky)
- Pam Alte, System Safety (Sikorsky)

The CRH ESOH Team is responsible for all aspects of ESOH management and risk reduction targeting all phases of the lifecycle. The Team achieved its notable ESOH successes within the challenging constraints of an acquisition program that is based on a state-of-the-art legacy helicopter system that the Air Force selected specifically to minimize the need for fundamental changes to the platform. This acquisition strategy allows the Program to focus on combat rescue capability enhancements, while meeting demanding cost and schedule objectives. The Team embraced the challenge and deftly utilized Department of Defense (DoD) and Air Force ESOH policy, guidance, procedures, tools, and collaboration structures to push the envelope to achieve ground-breaking ESOH risk and hazardous materials (HAZMAT) reductions without impacting the Program's cost, schedule, or performance objectives.

CRH Program ESOH Team
Team members depicted (from left to right) include: Mr. Hunt, Mr. Miller, Mr. Godsey, Mrs. Lambert, Mr. McKinley, Mr. Diaz, and Mr. Davis. Air Combat Command, Air Force Research Lab, Air Logistics Center, and Sikorsky team members are not shown.

Incorporating ESOH Integration into Systems Engineering

The CRH Program has thoughtfully integrated ESOH into systems engineering planning and execution starting with the capability development document, through specific, detailed contract requirements, and extending into the Program's structure, procedures, documentation, and technical priorities and decision-making.

Warfighter-generated documentation includes the following broad ESOH requirements:

- Avoiding health hazards associated with mechanical forces, toxic substances, radiation, noise, or other emissions
- Eliminating Highly Volatile Organic Compounds
- Identifying and eliminating safety hazards, or reducing their risk to acceptable levels
- Ensuring the ability to train, operate, maintain, and dispose of the system in full compliance with environmental laws, regulations, and executive orders

HH-60W, Combat Rescue Helicopter

The CRH is based on the already military-qualified and proven UH-60M Black Hawk platform. The CRH integrated ESOH considerations in early acquisition contract efforts and system specifications through collaboration with contracting and configuration management to set the foundation for an exceptional risk management process that continues today.

The CRH ESOH Team leveraged key warfighter-identified objectives into specific technical requirements in contract requirements and system specifications. This represented an early engineering analysis and advocacy victory for the Team and demonstrated how serious CRH program management was about integrating ESOH into its system design approach. Without specific requirements in those contract documents, engineering resources would not have been available during system design to perform the analyses and materiel modifications that enabled the successful CRH ESOH effort. In all, the contract package had 14 ESOH-related deliverables, eight ESOH-related clauses, and extensive, carefully crafted scope of work language.

Contract documents set the objective of eliminating hexavalent chromium (Cr6+) in the delivered aircraft and required ESOH risk management. Cr6+ is one of the top-three HAZMAT streams and a significant occupational health risk in Air Force-wide workplace surveys.

The Systems Engineering Plan provides the framework for integrating ESOH into the Program's systems engineering process, technical reviews, and decision-making. The complementary Programmatic Environment, Safety, and Occupational Health Evaluation (PESHE) currently serves as the Program's detailed ESOH strategy and contains the schedule for supporting National Environmental Policy Act (NEPA) compliance. Over time, the PESHE will also include data from the CRH hazard tracking database. Finally, appropriate ESOH requirements are threaded into the Test and Evaluation Master Plan and the Lifecycle Sustainment Plan to ensure integration with the test, operation, maintenance, and eventual disposal of the HH-60W.

The CRH ESOH Team has prioritized reducing risks to Air Force personnel and the environment during the often-neglected operations and sustainment phase, when most ESOH costs and risks occur. It was this prioritization that led the Team from its inception to identify Cr6+ as a top ESOH risk.

The Team proactively coordinated with the test centers and applicable Air Force Major Commands to catalog requirements for NEPA-related analysis and develop a robust NEPA compliance schedule. The CRH ESOH Team has developed an innovative environmental analysis data report, delivered under contract, to

support NEPA analysis. This helps to estimate HH-60W air emissions, hazardous waste, noise, system releases to ground or surface water, and other data under test and operations scenarios. It is utilized by bed-down and test locations to produce quantitative data for NEPA analyses. To date, several HH-60W basing locations have completed the NEPA process, allowing construction activities to progress without schedule impact. This outcome is expected for all testing and basing locations.

ESOH Risk Management

The CRH ESOH Team has implemented a textbook DoD ESOH risk management effort. It utilizes the MIL-STD-882 system safety process to eliminate hazards or reduce risk to the lowest practicable level consistent with cost, schedule, and performance requirements. ESOH hazards are maintained in an ESOH hazard tracking database for the system lifecycle. User representatives are intimately involved in the risk identification and mitigation process. Risk acceptance decisions are coordinated with the user prior to acceptance by decision makers. Significantly, the CRH Program has gone beyond basic DoD ESOH requirements by establishing a stretch goal that all ESOH risks will be mitigated to no higher than medium prior to fielding.

The CRH Program's decision to mitigate risks by eliminating proven legacy Cr6+ coatings on both external and internal surfaces of the aircraft could increase risk of internal, and more difficult to detect, corrosion. This represented a major departure from the Program's legacy system-based acquisition strategy, but it was the right thing to do. The CRH ESOH Team launched an intensive qualification effort with Air Force Research Laboratory partners of available, but unimplemented, chromium-free coating technologies. In addition, the Team engaged in extensive coordination with DoD and Air Force Corrosion offices, the Air Force Aircraft Structural Integrity Program Authority, and Air Force depots to ensure that key stakeholders were comfortable that reducing ESOH risk did not unacceptably increase risks to the planned service life of the aircraft.

Environmentally Friendly Primer
Hazardous Cr6+ primer on the interior and exterior of aircraft have been replaced with non-chrome alternatives through targeted identification and risk mitigation processes. Replacements eliminate exposure risks for operators and maintainers.

The work enabled the CRH Program to adopt chromium-free paint system specifications for the entire aircraft, making the HH-60W the first Air Force aircraft to completely eliminate Cr6+ paints from both the exterior and interior structural surfaces of the aircraft. This initiative addresses what is likely the top ESOH risk facing DoD today. Over 75,000 pounds of Cr6+-containing coatings from the exterior alone will be eliminated from workplaces and waste streams throughout system lifecycle.

In addition to Cr6+, the CRH ESOH Team has identified and is currently mitigating two other serious risks. While integrating the 50-caliber GAU-21 machine gun, the Team identified the potential to break the gunner's arm from recoil due to arm position when firing in certain positions. The Team collaborated on the design

of a backplate and validated that the risk of injury was eliminated during operations. Another serious risk was identified and assessed using the software system safety process that could result in potential directional errors generated by the Terrain Awareness and Warning System. The team advised management that the increased safety from the System compensated for the added serious software risk, and the Program has decided to integrate it into the HH-60W design. Software changes and new sensor system technologies are currently in development to mitigate this risk.

Outdoor Exposure Test for Non-Chrome Coating Systems

Test coupons for non-hexavalent chromium surface paint systems are set up for 18-month exposure tests. Tests are conducted under high humidity, rainfall, and salt conditions, as well as corrosive rocket emissions in Cape Canaveral, Florida.

Status updates and decision-making about top CRH ESOH risks were hot topics discussed at program and technical reviews, including the preliminary and critical design reviews, alongside other important considerations. Warfighter representatives participated in all reviews.

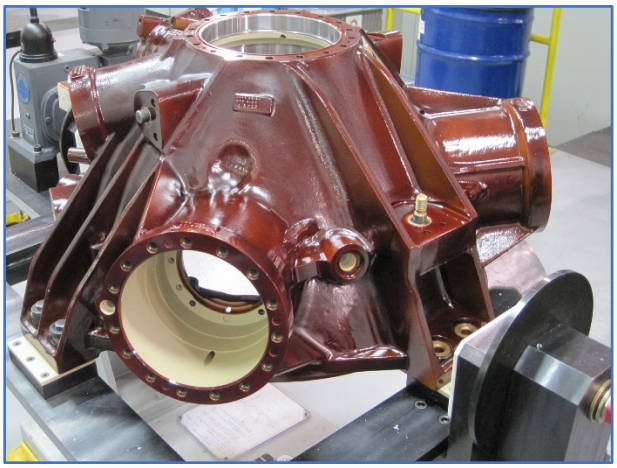
Hazardous Materials Management and Pollution Prevention

The CRH ESOH Team implemented an innovative, custom-made approach to tracking, reducing, and properly controlling HAZMAT throughout the lifecycle. Cutting-edge federal HAZMAT management standards were not yet published when the CRH ESOH Team prepared original contract documents and requirements. Therefore, the Team used early drafts of the requirements to develop detailed contractual tasks modeled on the approach in those unpublished standards. Industry-standard HAZMAT lists were still more than a year away, but the CRH ESOH Team independently developed its own lists of 15 prohibited, 37 restricted, and countless tracked materials. The Team also specified an ESOH hazard tracking database requiring extensive hazard information for all chemicals embedded in the system or used in operations and sustainment, to include the locations, amounts, disposal requirements, and special training requirements.

In addition to Cr6+, a significant pollution prevention accomplishment on its own, the CRH ESOH Team's approach has enabled a comprehensive assessment of HAZMAT on the aircraft, identifying and reviewing 488 unique HAZMAT used in manufacturing or specified in maintenance technical manuals. The Team eliminated 40% of these HAZMATs across airframe, avionics, and maintenance technical documentation, significantly reducing risks to supply chains, personnel, and the environment.

The CRH ESOH Team has exhaustively evaluated noise risks to operators and maintainers and is currently monitoring six noise-related hazards in and near the operating aircraft to ensure they do not pose a risk for long-term hearing loss. One serious risk has

been mitigated to medium through operational procedures and protective equipment.



HH-60W Main Gear Box Housing
Hazardous materials used during CRH assembly were identified and eliminated. Efforts reduced HAZMAT exposure for operators and maintainers and doubled the coating life, thereby reducing lifecycle sustainment costs.

Internal Execution

Program documents, including the Systems Engineering Plan and PESHE, establish the Program's strategy for ESOH risk management and assign responsibility to the CRH ESOH Team working under the direction of the Program Manager and the Chief Engineer. The ESOH hazard tracking database includes the current status of more than 500 operational and maintenance hazards, and hazards associated with HAZMAT usage. For hazards that are not eliminated, the Team ensures that safe-handling procedures are included in technical manuals and disposal procedures that are provided to end-users.

External Coordination

The CRH ESOH Team coordinates its ESOH risk management activities using ESOH working groups that include participation from CRH users and numerous external stakeholders to obtain technical advice, ensure buy-in, and to cross-feed lessons learned and successes. CRH users are well-integrated within the CRH Program's ESOH effort, defining the acceptable levels of mishap risk, supporting risk reviews, establishing ESOH requirements, identifying hazards from similar fielded systems, and identifying NEPA requirements. Quite simply, significant HAZMAT and ESOH risk reduction is impossible on an acquisition program without effective collaboration, advocacy, and coordination. The Cr6+ elimination effort is a good example of the extensive technical collaboration and stakeholder communication needed to accomplish meaningful ESOH risk reductions. As a DoD pathfinder for Cr6+ elimination, the CRH ESOH Team has made it a priority to share the materiel, technical, and stakeholder collaboration lessons learned with programs across DoD and at industry technical forums.

Summary of Accomplishments

The CRH ESOH Team has successfully managed a comprehensive ESOH risk reduction effort across all major subsystems of the aircraft and targeting all phases of the lifecycle. The Team did so within the challenging constraints of an acquisition program based on a state-of-the art, legacy helicopter system that the Air Force selected specifically to minimize the need for fundamental changes to the platform. Instead of settling for *good enough*, the CRH ESOH Team deftly utilized DoD and Air Force acquisition ESOH policy, guidance, procedures, tools, and collaboration structures to *push the envelope* and achieve significant ESOH risk and HAZMAT reductions without negatively impacting the demanding cost, schedule, and performance objectives. Signature accomplishments include:

- **Cr6+ Elimination.** The CRH is the first Air Force, and possibly the first DoD, aircraft to

eliminate Cr6+ paints from both the exterior and interior structural surfaces of the aircraft. This initiative addresses what is likely the top ESOH risk facing DoD today, and on the exterior alone, will remove over 75,000 pounds of Cr6+-containing coatings from workplaces and waste streams.

- **HAZMAT Management.** The CRH ESOH Team engaged in a nose-to-tail assessment of HAZMAT on the aircraft, reviewing 488 unique HAZMAT used in manufacturing or specified in maintenance technical manuals. The Team eliminated 40% of these HAZMATs across airframe, avionics, and maintenance technical documentation, significantly reducing risks to supply chains, personnel, and the environment.
- **Safety Integration.** System safety was fully integrated into the CRH ESOH effort, enabling the Team to identify and mitigate serious mishap risks associated with the Terrain Awareness and Warning System and the 50 caliber GAU-21 machine gun.
- **Noise Abatement.** The CRH ESOH Team comprehensively identified, assessed, and mitigated noise risk to operators and maintainers, protecting Airmen from long-term hearing loss and possible disabilities.
- **Data Management.** The CRH ESOH Team assembled comprehensive HAZMAT and hazard data tracking systems that are providing an authoritative, cost-effective resource for NEPA compliance at bed-down locations, and will provide the basis for continuous ESOH risk reduction throughout the lifecycle. Efforts will ensure that the system can be safely demilitarized at end-of-life.

In summary, the CRH ESOH Team exemplifies DoD leadership while delivering environmental excellence in a premier and crucial weapon system acquisition program.

CRH ESOH Team Members Complete Corrosion Site Survey
Corrosion site surveys, such as this one conducted at Patrick Air Force Base in March 2017, are accomplished with support from the CRH ESOH Team. The Team is comprised of the CRH program, prime contractor, sustainment personnel, Major Command, and Air Force Corrosion Office. They collectively discussed and identified environmental solutions to meet contract requirements and improve aircraft performance capabilities.