



New Lease on Lives

MH-60T systems and structures improve the capability and extend the life of the Coast Guard's hard-flown Medium Range Recovery helicopter

By Frank Colucci

In-house modernization will give the US Coast Guard 42 MH-60T Medium Range Recovery helicopters by 2013. The Aviation Logistics Center at Elizabeth City, North Carolina is rebuilding and rewiring the worn HH-60J Jayhawk fleet around an integrated cockpit with the Common Avionics Architecture System, a new Electro-Optical Sensor System, modern weather radar and more capable communications/navigation suite. "It's just a quantum increase in situational awareness for the aircrew," summarizes MH-60T systems manager LCdr Eric Bader. The expanded Programmed Depot Maintenance (PDM) effort will also stretch the service life of the rescue helicopters to 2027 or beyond, budgeting 735 flight hours a year. LCdr Bader observes, "That's a lot; we have aircraft over 10,000 hours now. We really fly the hell out of them."

Proving the point, AHS awarded its 2009 Frederick L. Feinberg Award to an Alaskan Jayhawk crew who flew an 8.5-hour non-stop mission to pull 15 sailors from the Bering Sea on Easter Sunday 2008. The crew of Coast Guard 6007 flew 200 nm from base to hover over 25 ft

HH-60J 6027 was the first Jayhawk to receive the Common Avionics Architecture System cockpit and served as one of two MH-60T Test aircraft. (All photos courtesy of US Coast Guard.)

seas at night in blinding snow squalls and hoist 12 people in one sortie. They landed the helicopter on a rolling, pitching cutter deck to unload the rescued, Hover-In-Flight-Refueled to return to the scene, and hovered again amid high seas to pull three more people from the churning water. The HH-60J unloaded its last three survivors and HIFR'ed once more to resume the search before returning to base on remote St. Paul Island.

The new MH-60T achieved Initial Operational Capability at Coast Guard Air Station E-City in October 2009, by which time the co-located Aviation Logistics Center (ALC) had completed six airframes. Nine MH-60Ts are expected operational by early 2010, including an attrition replacement rebuilt from a Navy SH-60F. While still in testing last May, the first production Tango model – Coast Guard 6028 – logged its first rescue when it hoisted a diver with the bends off the coast of Wilmington,

North Carolina for a flight to Duke University Hospital in Durham. Enroute, the Coast Guard crew used their new radios to communicate with Raleigh-Durham air traffic control. According to LCdr Bader, "One of the challenges flying the H-60J is you can't talk to Air Traffic Control. . . . The fact that you can talk to ATC from miles away is groundbreaking for us."

The Coast Guard received 42 Sikorsky HH-60Js from 1990 to 1996 with a databased Teledyne mission architecture inherited from the SH-60F. One was lost in 1994 to high seas and fierce winds while hoisting survivors from a grounded ship in Skan Bay, Alaska. The balance of the fleet faces structural fatigue and systems obsolescence. Around 20% of the Jayhawk fleet has exceeded its original 10,000-hour service life. The original RDR-1300C analog weather radar on the HH-60J will become unsupported within the next year; software support for current aircraft systems will be unavailable or uneconomical by 2015.

Jayhawks generally go through PDM every four years and are currently in their third cycle of teardown, inspection, rebuilding and repainting at E-City. Piecemeal systems improvements have given the HH-60J a FLIR (Forward Looking Infrared) sensor, GPS (Global Positioning System) navigators, and a HUD (Head-Up Display). However, the latest PDM cycle provided an economic opportunity to recapitalize the aircraft totally with all-new wiring, structural modifications, and integrated systems. "You had to pay for the depot overhaul anyway," notes LCdr Bader.

Smarter Hawk

MH-60T modernization began with money from the Integrated Deepwater System plan, a post-9/11 mix of acquisitions unhappily managed at the outset by Northrop Grumman and Lockheed Martin. In its system-of-systems vision, Deepwater Air Domain leader Lockheed Martin planned to scrap the 22,000 lb Jayhawk in favor of the 15,000 lb AgustaWestland AB/AW139 with less payload and endurance. The search portion of Search And Rescue would be assumed by Unmanned Air Vehicles or other networked assets.

Coast Guard leadership noted MH-60Js armed for Air-



Coast Guard 6032 was the fourth Jayhawk converted to MH-60T standards and the first with the Electro-Optical Sensor System. The Coast Guard Aviation Logistics Center will upgrade all 42 helicopters to the MH-60T configuration.

borne Use Of Force (AUF) haul about 200 lb of armor plus 7.62 mm or .50 cal guns and marksmen. (HH-60Js become MH-60Js when armed and armored.) Even heavier configurations include Tactical Law Enforcement or Maritime Safety and Security Teams and up to 6,000 lb of fuel. Jayhawk performance also gives the Coast Guard important Vertical Insertion and Vertical Delivery capability. The service ultimately retook the role of Deepwater Lead Systems Integrator, and the Coast Guard Aviation Forces Office used Deepwater funds to buy the Jayhawk new avionics that could remedy obsolescence and improve communications with other law enforcement agencies. The equipment specification was generated by the ALC (then the Coast Guard Repair and Supply Center). "This upgrade is mostly comm-centric," notes LCdr Bader. "It started off as a legacy sustainment effort."

The Rockwell Collins Common Avionics Architecture System (CAAS) at the heart of the MH-60T upgrade leverages common hardware and software to reduce the cockpit workload, enhance situational awareness and integrate evolving mission equipment. The MH-60T, for example, integrates CAAS cockpit and cabin displays with the FLIR Systems Electro-Optical Sensor System (ESS) and new Honeywell Primus 700A weather radar. According to LCdr Bader, "Eventually we'll get a surface search radar. This puts some of the pieces in place to get there."



The five-screen CAAS in the MH-60T provides a Pilot Vehicle Interface with Coast Guard symbology and functionality.

CAAS went to war in 2007 aboard the Boeing MH-47G Special Operations Chinook with five 6 by 8 inch color Multi-Function Displays (MFDs), two Control Display Units (CDUs), a video processing module, power supply and Ethernet switch for ARINC 429 and MIL-STD-1553B bus systems. The Coast Guard bought identical hardware under a US Army contract, but an MH-60T cockpit working group in coordination with the Presidential VH-60N program developed a new Pilot-Vehicle Interface (PVI). LCdr Bader says, "Everything in our cockpit is really Coast Guard-specific. It looks different from what the Army CAAS looks like." The Coast Guard obtained Government Purpose Rights to Operational Flight Program source code and used the CAAS open graphics language to give MH-60T displays their Coast Guard functionality.

While Army Chinook crews split MFD portrait displays top and bottom to post vertical or horizontal situation indicators over maps or satellite pictures, the MH-60T cockpit shows the Primary Flight Display (PFD), ESS imagery or the hoist camera picture on one page for easier management. The Coast Guard Avionic Selection and Placement team sought to simplify transition from -60J to -60T cockpits with a more traditional display of primary flight instruments on the PFD. Barometric altimeter symbology was made more prominent and audible low-altitude alerts were added to enhance night hovering safety. Expanding square and other automated search patterns can be superimposed over the MH-60T dig-

ital map display. "We operate in close proximity to terrain all the time," says LCdr Bader. "This is really going to be a game-changer." Weather radar symbology can also be overlaid on the digital map.

MH-60T mission plans can be formulated on computer workstations and transferred via memory card to the CAAS dataloader or downloaded via radio link. Bravo Zero readiness nevertheless calls for Coast Guard helicopters to launch within 30 minutes of a call for assistance, and the MH-60T cockpit was designed for pilots to program their navigation computer through their CDUs on-the-fly. "We don't have the luxury of planning most of our missions before we launch," says LCdr Bader. "It needed to be very intuitive and easy to use in a stressful situation."

The HH-60J had no true autopilot other than radar and barometric altitude hold functions. With its SH-60F Automatic Flight Control System, the Jayhawk could fly a "hot" sub-hunter-style approach to a coupled hover. The MH-60T introduces a three-axis flight director system with hands-off search patterns. The Tango pilot can pick a geographic point for an automated approach but still manages the collective to a rescue hover. An EFW Inc. HUD on armed AUF aircraft shows the pilot basic flight and heading information.

Rockwell Collins provides the MH-60T VOR/ILS, TACAN, ADF and DF navigation aids, and integrated the Traffic Collision Avoidance System (TCAS) into CAAS. CAAS has MIL-STD-1553B interfaces for control functions and ARINC 429 interfaces for commercial equipment qualified for helicopters. Rockwell Collins set up MH-60T Systems Integration Laboratories (SILs) at both the company's Cedar Rapids facilities and the Coast Guard Aviation Logistics Center. The SILs continue to integrate CAAS with new MH-60T systems and sensors, and the E-City SIL provides a training aid for crews transitioning to their new cockpit.



The original HH-60J Medium Range Recovery Helicopter was designed to fly 300 miles offshore, remain on scene 45 minutes, hoist six people on board, and return. The H-60 gives the Coast Guard a rescue platform with six to seven hours endurance.

Hawk Eyes

The current Jayhawk fleet has abandoned its legacy FLIR 2000 night vision turrets and their enormous cabin consoles. For AUF missions, select MH-60Js carry the L-3 WESCAM MX12D gimbal tied to a stanchion-mounted 9 inch cabin display. Repeater imagery can be seen in the cockpit, but without pilot control, LCdr Bader says, "You can really get yourself disoriented looking at that." The new Coast Guard EO Sensor System (ESS), derived from the FLIR Systems Talon gimbal, packs infrared, low-light and color TV sensors and a laser pointer/illuminator in a 9 inch diameter ball small enough to share with the MH-65C Dolphin.

The ESS has a geo-pointing function to look at a given latitude/longitude and can anticipate a flight path vector to look six seconds ahead using Embedded GPS/Inertial inputs. An Air Control Mode automatically aims the ESS at the next Air Control Point. "That would have been impossible with our legacy cockpit," observes LCdr Bader. CAAS puts the means to see and steer night infrared and day TV imagery in the cockpit and integrates a bigger cabin crewmember display with the pilots' moving map. "We're trying to increase situational awareness for the whole aircrew, not just the pilots." The aft cabin crew can still monitor and steer the sensors when searching for survivors, but geo-pointing and flight path vector functions lock the rescue crewman out of ESS controls.

The analog weather radar of the HH-60J gives way on the MH-60T to a state-of-the-art Honeywell Primus 700A digital radar with beacon detection and sea clutter reduction to provide some search capability. "Eventually we want to go to a full-on surface search radar," says LCdr Bader. A Request For Proposals is expected in 2010.

The MH-60T communications suite supplements dual Rockwell Collins ARC-220 HF and ARC-210 UHF/VHF military radios with two Wulfsberg RT-5000 civil-band radio modules to communicate with other law enforcement agencies. "We've been flying with an RT-5000 kind of 'Frankensteined' in there for awhile," explains LCdr Bader. "Now it's fully integrated. It's a radio that works."

The new digital Jayhawk gives Coast Guard crews basic text-messaging capability and can send automated position reports aircraft-to-aircraft and aircraft-to-ground. A comprehensive C4ISR (Command, Control, Communications, and Computers, Intelligence, Surveillance, Reconnaissance) insertion beginning in 2013 will network the modernized Jayhawk with other Deepwater assets. The objective is to share ESS imagery and other



The Wescam MX-12D FLIR was used to outfit Airborne Use of Force helicopters. It will be replaced by the smaller, more modern FLIR Systems Electro-Optical Sensor System. (Author)



The FLIR Systems Talon sensor gimbal is the basis of the Coast Guard ESS and packs infrared, color TV, low light TV, and laser pointer/illuminator in a 9 inch ball.

data with other law enforcement and Homeland Defense forces. Rockwell Collins is working with the Coast Guard on enhanced interdiction and coastal defense capabilities to manage imagery and put Automatic Identification System (AIS) data on digital maps or FLIR imagery. Ultimate plans call for the MH-60T crew to put annotated imagery on a storage device and transmit it to other Department of Homeland Security or Department of Defense users.

CAAS integration gives the MH-60T new caution, advisory and systems health pages on the MFDs. Built-In Test functions appear on a color-coded systems page and the system keeps track of diagnostics for general maintenance and systems surveys. The Coast Guard has



MH-60T testing included the anechoic chamber at Patuxent River.

also begun evaluating the Army-style VMEP (Vibration Management Enhancement Program) to replace the antiquated track-and-balance system now in use at ALC, but LCdr. Bader cautions, “It doesn’t get you to on-condition maintenance.”

Stronger Hawk

The E-City Aviation Logistics Center has become expert at rebuilding hard-flown Jayhawks. Coast Guard technicians have replaced cabin roof transmission beams cracked by heavy loads. “Most of that stuff is new metal now,” notes LCdr Bader. ALC technicians use eddy current inspections to check for anomalies in rivet holes in main beams. Dye penetrant inspections look for suspected cracks.

The MH-60T emerges from its expanded PDM with a package of structural fittings in the tailcone and elsewhere that gives the airframe effectively indefinite service life. Sikorsky Aircraft supported the structural Service Life Extension Program with parts and engineering services including creating the drawings, providing the non-recurring engineering for a box frame cabin absorber qualification, and stress analyses. CAAS itself requires a new instrument panel structure and new avionics shelves. MH-60T gross weight stays at 21,884 lb; analysis showed an increase to 23,500 lb would have required intrusive structural modifications.

With manually-folded main rotors, Coast Guard Jayhawks can operate from 270-foot WMEC and 378-foot WHEC cutters. Deck Recovery, Secure, Assist and Traverse (RAST) fittings on the HH-60J were never used and only caused corrosion problems. Current plans call for

the hardware to be removed and faired over. However, a Coast Guard HH-65 is testing an ASSIST (Aircraft Ship Integrated Secure and Traverse) probe compatible with RAST fittings. “If the prototype works, we may revisit the RAST issue,” says LCdr Bader.

A Sikorsky Overhaul and Repair facility repairs gearboxes, rotor blades and other dynamic assemblies. Sikorsky engineers also wrote the Aircraft Test Plans (ATPs) for the MH-60T final check out, and they are currently working on a Digital Electronic Control Unit (DECU) upgrade for the General Electric T700-GE-401C engines. “Our highest cost driver right now is engines,” says LCdr Bader. “A good chunk of that is controls.” Besides reliability improvements, the new DECU and a new but unchanged hydromechanical unit increases power 5% with no changes to the engine hot section. The new control also provides automatic contingency power and automatic relight functions in emergencies.

Much of the extra PDM work on the MH-60T is associated with the totally new wire harnesses supporting CAAS and other systems. A new Rewire Cell at the ALC dealt with the challenges of low rate initial production and helped set up and program a DITMCO wiring continuity checker to perform 27,000 checks throughout the aircraft. The electrical test takes about 12 days including hookup, testing, repairs, and breakdown.

Coast Guard 6027 was the first Jayhawk to receive the MH-60T avionics upgrade and – along with CG 6017 – was committed to the test and training program at multiple sites. The Coast Guard performed its own Airworthiness Certification following a test plan formulated with the help of a pilot from the Naval Test Pilot School. The first production MH-60T – CG 6028 – was delivered



The Aviation Logistics Center at Elizabeth City can process eight Coast Guard MH-60Ts and two Air Force HH-60Gs under Joint Depot Level Maintenance at a time.

to Coast Guard Air Station Elizabeth City on June 3, 2009. MH-60T crew transition training is underway at the Coast Guard Aviation Training Center in Mobile, Alabama. Plans convert the Jayhawk full motion simulator at Mobile from the -60J to -60T configuration in 2012. An avionics training program runs at the Aviation Technical Training Center in Elizabeth City.

The HH-60J PDM cycle time at the Aviation Logistics Center averaged 135 work-days. The MH-60T modernization including the depot maintenance currently takes 210 days. Once MH-60T conversions wrap up, the ALC will likely restore its 135-day rhythm. E-City can process eight Coast Guard MH-60Ts and two Air Force HH-60Gs under Joint Depot Level Maintenance at a time. A second hangar recently allocated will give more space to work on helicopters. Current work schedules return an HH-60J inducted in October 2009 to the fleet as an MH-60T by the end of July 2010.



Continuity checks for the totally re-wired MH-60T take about 12 days to verify 27,000 connections.

Included in MH-60T modernization is Frankenrotor, a replacement SH-60F converted to MH-60T standards. To restore the Medium Range Recovery fleet to authorized strength, Coast Guard managers considered buying and modifying a new UH-60M airframe, but according to LCdr Bader, "It would have been expensive to buy a new Mike, and it would have been a one-off variant." The retired Navy helicopter required extensive modifications on the left fuselage with new window, seat rails, and flight mechanic's station. "All that was done at ALC by our metal smiths," says the MH-60T systems manager. "That saved us a ton of money." Coast Guard 6043 joins the fleet in November.

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Forecast International Anticipates a New Era for the U.S. Defense Market

After years of steady, some would say unprecedented growth, the pace of overall U.S. defense spending appears to have reached a plateau and will likely commence a steady decline in coming years, according to analysts at Forecast International. The basis for the downturn is a shifting security environment overseas, particularly in Iraq. Of the total funding for military operations overseas since 2001, over 76 percent was spent in support of Operation Iraqi Freedom. On the other hand, less than 20 percent of all U.S. war funding has been dedicated to operations in Afghanistan. Defense Secretary Robert M. Gates has identified a need for at least a two percent real growth in the defense budget, in contrast to the administration's initial plans for spending to remain flat. Rather than separate the requirements for conventional and unconventional war, Secretary Gates has pushed for greater flexibility within the military, in terms of both the types of weapons being bought and the ability of soldiers and Marines to adapt to new threats. The 2010 base budget request called for \$524 billion, plus \$130 billion to cover the wars in Iraq and Afghanistan, and this did not include the additional \$30 billion requested by the administration for the "Afghanistan surge." The budget included \$109 billion, or 20 percent of the total, for procurement, and \$79 billion or 15 percent for research, development, test and evaluation. In mid-December, however, the administration abruptly called for additional spending of \$100 billion during the 2011-2015 period – an apparent victory for Secretary Gates – to cover new Air Force global strike programs (including manned and unmanned platforms), Army brigade combat team modernization, a Navy attack submarine and the Navy's new Carrier Long-Range Strike system, plus other programs. Media reports during December failed to speculate on the impact, if any, of the plus-up upon vertical lift programs.