

40 Years Afore the Mast

Volume 1

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Comment: Anywhere, anytime

Where do you start to being to describe a helicopter that can fulfill your wildest dreams of anywhere - anytime? The limits prescribed by the length of this article will mean that I can only scratch the surface of what the MH-60K is like. Similarly, it's hard to separate the aircraft from the people that fly it and the missions that they have to carry out. A mission of the complexity and sensitivity given to the US Special Forces calls for a different kind of person as well- that in itself is a separate article.

PROPERLY EQUIPPED

In any operation, aircraft have to be properly equipped and the crews properly selected and trained, in order for the mission to be accomplished effectively. When you consider the variety of missions that could be laid on the Special Forces (virtually unlimited) it stands to reason that they need special equipment and people.

Perhaps the most complex mission that could be given to a helicopter is that of the long range, all weather, covert, special mission into hostile territory. Two helicopters have been devised recently for this mission, and R&WI was recently given the opportunity to fly one of these machines. The other, the MH-47E, will be covered in the near future.

Fort Campbell Kentucky is the home of a lot of different helicopters, but none quite so special as those operated by the 160th Special Operations Aviation Regiment (Airborne). Their fleet is a variety ranging from the much modified OH-6 (MD-500 series) to the MH-47E Chinook, and new versions of these are always being worked on. The most recent addition is the MH-60K.

My host, who must remain nameless, emphasized the reasons for the invitation were many-fold- a recent relaxation of security about their mission, a desire to set the record straight about what they do, and a small desire to display what they can do. You've probably seen the advertisements- "We're nice guys, you just don't want to meet us when we're at work." Was this really true?

Since I had flown the UH-60A at the Naval Test Pilot School, this was going to be an interesting experience. I was given personalized attention - the man who was to fly with me in both the aircraft and simulator and answer as many of my questions as security permitted was one of the main developers of the MH-60K - and had been in the 160th for 7 years and involved with the MH-60K project for 4 years.

PRE-FLIGHT - 57 AERIALS, BUMPS AND BULGES

We started with a brief discussion about some of the airframe differences between the 60K and 60A before our trip to the flight line. The briefing was short and to the point, and covered all the points I thought I needed. This briefing only served to highlight the initial impression of the aircraft. The UH-60 series always had a certain beauty to it - rugged, powerful and compact. This version was more serious looking- lower to the ground, with more bumps and bulges, antennae and appurtenances than I had ever seen on a helicopter. "57 antennae" my safety pilot commented- fortunately he didn't show me all of them or we'd still be on the pre-flight. The major changes in the structure to take care of the

greater weight were evident during the walkaround, as well as the changes to doors, folding stabilator, avionics compartment cooling intake and so on. Several of the antennae were missing for some of the warning and jamming devices, but they were all going to be installed. Of course the huge refueling probe and the external wing tanks dominated the scene. Since the multi-mode radar is still under development, we had only ballast in the nose.

The cabin looked vaguely familiar, but had two huge ceiling-high fuel tanks, and the roof had the rapid rapping rig installed. By the two gunner's windows were the mounts for the 23mm door guns. Passengers in the MH-60K won't have a good view, but then again, they're not there for the scenery.

We were heavy for this flight, the external tanks had about 1,000 lb of fuel in them, and there was fuel in the cabin tanks as well.

DETAILED WALKAROUND

It took a later, more detailed walkaround in the hangar to pick up the details added to make the helicopter more suitable for the mission- integral winch points for hauling into C-5's, wheel- tie downs for ship board operations, and so on. Opening the various panels around the aircraft showed that a different APU and slightly different engines were fitted, as well as some minor changes in the flight control system.

I'm not sure that any amount of briefing would have prepared me for the cockpit- the door looked the familiar, and the seat was as comfortable as I remembered- but little else was the same. The center console had evidently been eating it's Wheaties - it had grown to a much larger, higher and more complex tableau of stuff that I would never figure out on this trip. The briefing had given some indication of the amount of equipment that was fitted to the 60K, but seeing it in real life was another thing altogether. My first impression was that training someone to use all this black magic was going to be a major task.

VERY BUSY COCKPIT

Obviously, the latest in multi-function screens replaced the old instrument panel- there were no dedicated engine instruments- instead the center of the panel had the steam driven standby instruments. One change that was evident was the SH-60B AFCS control panel with hover height controls. There were about twice the number of circuit breakers behind and overhead than I remembered from the -60A. The flight controls were different as well- the cyclic had a beeper trim that was accessible (finally) as well as switches for canceling the voice warning system, controlling the cursors on the CRT's along with the standards like trim release, radio and so on. The collective had a trim release and heading trim as well as more familiar switches.

Not much else looked the same- the field of view was much better than before- the instrument panel seemed lower, certainly the glare shield was shorter, and the CRT's did not extend the panel all the way to the side of the cockpit. The refueling probe dominated the things the left seat pilot would be looking at. The center console was a lot higher than before, and immediately behind both pilots seats were very large boxes that held avionics equipment- accessible in flight to change digital maps, or video tapes for recording the flight, and so on.

Battery on, and we got down to business- the first pleasant surprise was the Voice activated intercom- not normal on many military helicopters. Given the amount of intercom work that was going to be necessary in this machine, it was a nice touch.

FIRING UP THE BEAST

Pre-start checks to get the APU going were more simple than I remembered and once the aircraft was powered up- the real differences hit me between the eyes.

I read the checklist (secretly I'm sure the safety pilot had it memorized- I missed one-line item and had turned the page- and he said we missed something) It was not a minor item, so perhaps it was natural he noticed that we hadn't turned on the avionics- sorry - I'll read the checklist as printed next time!

Now I've had the privilege of seeing lots of new avionics systems over the last few years, but this was in a completely different league. Listing all the systems that are on board (and I was allowed to see) would take a lot of room. Think about how long it would take to get totally at home with them, and use them on a day to day basis. We didn't have a flight plan to feed in, but if we had, it could have been done very quickly and easily at this point.

It appeared that someone had been working on the aircraft overnight and left some avionics items in an unusual manner. This was fixed in a few minutes of finger flashing- it was obvious the safety pilot was very familiar with the system. He explained the fundamentals of the displays, how to change them, and what it meant when he said 'R3' (third button down on the right side) and we were ready to start the engines. The MH-60K is the first Army helicopter I am aware of that has a rotor brake- (for ship borne operations), and we started with the brake on. Once both engines were at idle, I released the brake, and the blades spun up smoothly. No rocking- this airframe wouldn't let it happen. I was pleasantly surprised at how quickly the whole sequence was- for an aircraft of this complexity and my level of understanding, we were ready a lot sooner than I expected.

Brake release and taxiing was about the same- smooth and positive, easy to control. We got to the runway and after the brief takeoff checks were ready to commit aviation.

INTO THE AIR

The flight controls were light but positive from the helicopters I have been flying recently, and there was no problem getting used to a collective release again. Hovering was easier than I remembered in the 60A, due to the improved AFCS- even pedal turns were easier to stop. Vibration levels were low, as well as the noise. Now it was time to pay attention to the displays and see what we were doing. Torque on the left side was easy to read, and there was an indication of the maximum power available today (124%- the transmission limit and we were using about 80% torque). The CRT display was busy, lots of things moving around, and it took some time to get used to this way of presenting things.

It was explained later that the display was not as well laid out as the operators would like, but that they were stuck with it for the time being, as key decisions had been made quite some time ago, and there was a commonality problem with the MH-47E to consider.

BASIC AIRFRAME HANDLING

Traffic patterns were straightforward, and the MH-60K was rock steady in all respects. Performance with the new T700-701C engines was stellar- over 2,000 fpm vertical rate of climb straight up from the hover, even at this weight and on a standard day. We accelerated to forward flight, and joined the traffic pattern at Campbell.

Downwind, I was spending a lot of time trying to find the airspeed scale, and then spending even more time trying to decipher it. Trying to maintain straight and level flight using

the CRT was not easy, but I had only been doing it for a few moments. At this point, I didn't realize that the displays had lots of declutter modes- this came later in the simulator, and I'm sure that the operational pilots would have their own display formats sorted out in short order. Flying visually outside was quite straight forward.

Approaches to the hover were much like the UH-60- even with the added weight, there was a slight lateral shuffle on approach, and a slight left sideways motion to the left in the last stages of landing. This sideways motion is due to the mechanical mixing in the flight control system that was designed for a 16,000lb weight. Since we were considerably heavier than that the mixing was more evident. The only reason it was noticeable at all was that the wind was calm, and in an operational environment, it wouldn't be a problem at all.

A note here about the voice warnings- the voice came on at various times in the flight with warnings about altitude, etc, and it was easy to cancel it by pressing the button on the cyclic. A neat idea that had been well implemented.

The added weight and relatively light winds were making me look good, until we tried a landing. I judged the tail wheel touchdown OK, but the familiar Blackhawk tail wheel bounce was still there. Everyone assured me that the tail wheel was over-pressured. At least it wasn't me.

LOOKING AT THE MAGIC

Enough of basic airframe stuff, lets start to look at the magic. We turned on the FLIR and headed over for a more remote section of the base. I turned my attention to the FLIR system and tried to fly using the CRT with the FLIR overlaid. A few minutes of this, convinced me that the system was well set up, and I tried to be more adventurous. A part of the clearing we were in was designated in the navigation system as the 'target point' where we to drop off the 'customers', and we departed to set up for the approach. The navigation system set us up for a turn into the light wind, and marked out the flight path, kept the FLIR pointing at the target, and I just had to follow the line on the display.

What, it's not all hooked up to be done by the autopilot? You ask- unfortunately no. Evidently there is some problem of Sikorsky not permitting anything to be hooked up to their AFCS's except what they put in. Since they did not install all the magic, it remains to be flown by the pilot.

In any case, it was not difficult to fly the pattern, and using the excellent cues from the flight director and FLIR, judge the approach to the hover just short of the designated target (it's supposed to terminate the approach just short...) and have the mythical 'customers' deplane. Once they were clear, a brisk departure using the CRT and FLIR was done. The only disconcerting thing was that suddenly the FLIR turned and kept pointing at the target as we flew away from it. That was hard to get used to.

FOLLOWING THE FLIGHT DIRECTOR

Another unique feature of the 160th's aircraft is the full 'airways' avionics fit. They have complete set to let them use all the civil nav aids, so that maximum use of whatever is available is possible. We set up for an ILS to try out the Flight Director portion of the system, since this was the closest we could come to trying out the terrain following part of the multi-mode radar. I would like to be able to say it was a piece of cake, but it wasn't easy, and I don't think it was me. I tried to keep the Instant Vertical Speed Indicator at zero, and the airspeed at the commanded value, but it wasn't possible. The collective command was overly sensitive for

small corrections, and then too slow for larger ones. The bar for the collective command was very small in respect to the whole display, and the trend information from the other indications was a bit slow. The result was that the ILS was pretty ragged. I had the same result in the sim. Later it was mentioned this was one of the areas they were also not happy with, and were working hard to make better.

During the ILS set up, I tried my hand at the magic ways of changing frequencies and altimeter settings- no real problems with this, although it was different to punch in an altimeter setting.

A short bit of hovering later, we were finished with the 'real' airframe flying- taxiing in and shutdown were uncomplicated and easy. What I had seen of the airframe and some of it's modes was quite impressive- this machine had plenty of promise, but I was not quite prepared for what was to come.

There was not enough time to look at any one aspect in great detail, and to be honest, that's not what I had come for, and I wouldn't have been able to do any greater view any justice. For example, I did not have the NVG's on, which are to be fitted with a pseudo-helmet mounted display. We did everything in daylight in good visibility, and without a specific flight plan.

ADVENTURES IN THE SIMULATOR

The next morning, we went to the newly commissioned simulator to see some of the features not yet in the airframe. We had a two hour block between training times for other 160th pilots, and so had to cram a lot into the time.

The first impression was that the sim was not your ordinary procedures trainer. The complexity of helicopter aerodynamics means that a good dim takes a lot of computing power, and evidently this machine has twice the computing power of the Space Shuttle simulator. It was worth the effort. Little things impressed me, like the positioning of the displays for 'out the window' view. It's not till you have something taken away that you realize how much you use something, and it's the same with field of view. The simulator has very good forward, side and up and down views, but there were holes, and these were missed at times.

We were all set up and running in minutes and off we went to the hover- fairly impressive modeling of the real aircraft- controls felt slightly lighter but the response was remarkably good. I did a traffic pattern and found it as straightforward to fly using visual references as the real helicopter. A few hovering landings, turns in the hover and I felt right at home. On to the real reasons for the simulator.

The mission of the 160th requires the capability to do damn near anything, so they have to be able to land on Navy ships, refuel from C-130 tankers, fly through the mountains in the fog, - literally anything you can name. Imagine the costs of trying to get a Navy ship for some night shipboard landing training, or the cost and difficulty of getting a Hercules tanker for several hours of low level, lights out, NVG refueling. If this can be done in the simulator with a good deal of training transfer, the sim would quickly pay for itself.

OUT TO SEA

So what to do first? Why not ships? Two minutes later, I was on long final to a Navy LPH (assault carrier for the Marines) and trying to land on a very large deck. This is one area

where the reduced field of view caused by the display screens made the task a good deal more difficult, but, if it was more difficult in training than the real thing, that's good. The ship's wake and motion of the waves was realistic enough to convince anyone that this was not as easy as it sounded. But we had other ships to look at.

I can't tell you what the next type was we landed on, and all I'm permitted to say was that the full lights used for night landings weren't used. Now I've never landed on a small ship before (even in a sim) but this was bloody difficult. We sort of arrived, with the tail wheel well off the deck edge (I found out when the simulator operator showed us the screen of where we were on the deck) and probably a crunched 60K fouling the deck- that's what sims are for. My lack of instrument flying in the recent past also came to haunt me- I didn't look too good trying to do a traffic pattern and line up to land. Found out that the sim doesn't mind having the wheels get a bit wet.

BASKET STRIKES AND PIO

Well, the next thing I really wanted to see was air-to-air refueling. Another thing I've never done in my helicopter flying, and only heard about it from fixed wing guys. Promptly, a C-130 appeared on the screen, we were set at 100 knots, and about 300 feet behind where we were supposed to be to hook up. We extended the probe, and the tanker slid out it's basket. I concentrated on closing slowly with the basket, and promptly fell into the trap of first time refuelers- I got into a PIO (Pilot induced oscillation) caused by trying to follow the basket and put the probe into it.

We had a probe strike on the basket, but it was pretty clear this was not the way to go. My hand was getting tight from trying to squeeze the blackness out of the cyclic grip. The safety pilot suggested calmly that I back off, try again, and this time concentrate on looking at the tanker wing, and cross checking with the fuselage. I relaxed slightly, lined up again, eased in with about 2 knots of overtake, and kept my head moving around- looking at the basket every once in a while, and finally I got a hook-up. I felt quite pleased with myself- this was a simulator, the cues weren't quite right, the visuals were a bit suspect- again, if anything this was probably more difficult than the real thing, and I had done it. Not so fast, moose breath- I had to stay hooked up, which meant, climbing slightly, moving out to parallel the wingtips and stay within the hose limits. Couldn't do it for very long, and we promptly ran out of hose and we disconnected - involuntarily. The sensations were incredibly realistic.

I asked for one more run, and did a good hook-up, got into steady state position and stayed there for long enough to understand all the things to look for, and then I felt really satisfied- this was an unbelievably good training device. But wait, there's more.

The sim had the multi-mode radar installed, and all the modes working. This was being used for familiarity before the real developmental testing started. Within minutes we were in the mountains, in the fog, with the terrain-following radar set up for a ride at 100' AGL. The FLIR was turned on as well, and a mission route was in the nav system. Pretty neat what simulator operators can do with a few button pushes. By the way, it was also pretty dark in the mountains, it being night time.

NIGHT, MOUNTAINS, FOG, 100' AGL

Off we went, and I had to follow the flight director and sort of cross check on the FLIR what was happening. It was relatively easy to keep the FD bars where they were supposed to be, and the collective command I had complained about in the real aircraft was only slightly better here, because we were maneuvering all the time. An incredible sense of detachment set

in- I had no idea whether we were 10° nose up or nose down as we pulled and pushed and turned our way over the hills and valleys, around corners and through gaps. We certainly stayed low and fast, and it was not too difficult. In the real mission, the nav system would have been generating a groundspeed to fly to make good the time on target, but we weren't playing that hard.

Next, I wanted to see how the sim handled NVG's- since I wouldn't get a chance to see them on the real helicopter. We paused to put them on and get them adjusted, but they did not have the integral head-up display system integrated with them yet. Had I known this, I probably wouldn't have bothered with the NVG's, as I don't have that much real world experience with them, and the sim already had a disadvantage for field of view. Having said that, we did sort of manage to fly around for a while before I managed to loose the helicopter completely, and we flew through the bottom of the world. Some masterful flying inverted by the safety pilot got us back to reality, and we decided enough was enough.

A SEVERE CASE OF HELMET FIRE

We then took some time to look at some of the de-clutter modes of the CRT's and only scratched the surface on the potential for setting the displays up. Each pilot, by the way, will be able to store his own preferences in the pre-flight planning and call them up quickly in the real machine. It was about then that I saw what I had been warned about- helmet fire. There was more stuff here than the brain could take in at one time, and it was easy to see how you could get a fire inside your helmet thinking about all this.

What more can I say? The simulator showed the capabilities of the helicopter in a very convincing way, and also showed it's potential for thorough, realistic training. I am sure that I could have stayed for several weeks to see more magic, but quite honestly, I had seen enough to be convinced that this was a real step forward. My concerns about training and use of this incredible level of technology were put to rest after a long chat with several members of the 160th. (see the other article)

Problems? Of course there are problems- the equipment is still under development, and not all the bugs are ironed out. Problems with the display symbology and sensitivity of some of the parameters will be taken care of in due course. Some aspects of the impressive array of self-defense equipment remain to be integrated in a comprehensive manner. When you consider that this machine has more sensors and jammers and radios than perhaps even the B2 bomber and the Army doesn't have a long history of complex avionics, then it's not difficult to see why there are problems. Given the drive and talent that the 160th has mustered so far, though, they will solve it soon.

Consider what you have just read- here is a helicopter that will deliver the customers where ever they want to go, whenever they want to be there, with a degree of stealth and precision that was not conceivable even 10 years ago. I am positive that I did not see even a fraction of the capabilities of the machine, and yet what I saw outstripped anything else I have seen.

OVERALL IMPRESSIONS

My overall impression? The UH-60 series has always been the utility helicopter I would want to be in if I had to go to war- with the equipment fitted to the MH-60K it is easy to see how it could do it's job anywhere - anytime. I almost wish I could be there with them.



Figure 14-1 In It's Element



Figure 14-2 And They Do This at Night on NVGs...



Figure 14-3 A very, very Full Cockpit

Overall Impressions



Figure 14-4 If internal Fuel isn't Enough...