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An Update on the CH-53K: September 2021



By Robbin F. Laird

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VMX-1 SQUADRON PERFORMS EMERGENCY LIFT OF U.S. NAVY HELICOPTER WITH CH-53K3

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VMX-1 Squadron Performs Emergency Lift of U.S. Navy Helicopter with CH-53K

09/10/2021

By NAVAIR

The CH-53K King Stallion successfully recovered a Navy MH-60S Knighthawk helicopter from Mount Hogue in the White Mountains of California on Sunday, September 5.

The two-day operation was the first official fleet mission for the Marine Corps' new heavy lift capability, which is in the midst of Initial Operational Test and Evaluation with Marine Operational Test and Evaluation Squadron One (VMX-1) at Marine Corps Air Ground Combat Center Twentynine Palms, Ca.

"VMX-1 received a request for assistance from the Naval Safety Center about an MH-60S Knighthawk that suffered a hard landing near Mt. Hogue, Ca., at an elevation of 12,000' Mean Sea Level (MSL) in July," said LtCol Luke Frank, CH-53K Detachment Officer in Charge for VMX-1.

The MH-60S Knighthawk was sitting on a high-altitude ridge in very rugged terrain near the California-Nevada line on July 16 following a hard landing. The helicopter was supporting a search and rescue effort for a lost hiker. All four crewmembers survived without injury and were rescued the following day.

According to Frank, both the MH-60S unit and the Naval Safety Center had exhausted all other resources for recovery, including Army National Guard, Navy and Marine Corps fleet squadrons. "They all lacked the capability to lift the aircraft without an extensive disassembly," he said.

VMX-1's CH-53K detachment quickly examined the environmental conditions and conducted a quick feasibility assessment of support and determined that the CH-53K could conduct the lift. The CH-53K fulfills the heavy lift mission of the Marine Corps as it greatly expands the fleet's ability to move equipment and personnel throughout its area of operations

"After two weeks of exhaustive planning and assembling a team of more than 25 Marines and sailors from VMX-1 and 1st Landing Support Battalion from Camp Pendleton, Ca. we deployed two CH-53Ks to Bishop, Ca., and got to work," he said.

The CH-53K was designed to lift nearly 14 tons (27,000 lbs.) at a mission radius of 110 nautical miles in high and hot environments; a capability that expands the service's range in supporting joint and coalition forces against potential adversaries.

The MH-60S weighed approximately 15,200 lbs. and was positioned in a tight ravine at nearly 12,000' MSL and needed to be transported over 23 nautical miles to the Bishop, Ca. airport.

"After six months of flight operations with the CH-53K, the detachment had every confidence in the aircraft's abilities to conduct the mission safely. Our main concern was the environmental factors ground support personnel would have to endure," said Frank.

“This is exactly what the K is made to do,” he said.



A Marine Corps CH-53K King Stallion lowers a Navy MH-60S Knighthawk helicopter to the ground after recovering it from the nearby mountain ranges after it conducted a hard landing near, Bishop, California, Sept. 5, 2021. The two-day operation was the first official fleet mission for the CH-53K King Stallion, as it is currently undergoing an operational assessment while the Marine Corps modernizes and prepares to respond globally to emerging crises or contingencies. (U.S. Marine Corps photo by Lance Cpl. Colton Brownlee)

“Heavy lift is a unique and invaluable mission for the Marine Corps. Horsepower is our weapon system and the CH-53K is armed to the teeth.

“The entire team of Marines at VMX-1, 1st Landing Support Battalion, and NAS Fallon Search and Rescue were extremely motivated to execute this mission and we are all very proud to have completed this one flawlessly.

“To be the first group of professionals to complete a real-world, heavy lift/high altitude mission in support of a unit who thought all options were off the table is extremely rewarding,” said Frank.

“This is sure to be the first of what will be many, many successful missions for this aircraft and for heavy lift squadrons.”

This article was published by NAVAIR on September 9, 2021.

Enabling Flexible Basing Across the Combat Chessboard: The Contribution of the CH-53K

08/16/2021

As the Marines rework how they are going to shape their way ahead with regard to the joint force and full spectrum crisis management, their ability to operate from seabases to expeditionary bases to the wider littoral operations is a crucial contribution.

With their Osprey and F-35B capabilities already providing for significant ability to move Marines across the areas of interest from HA/DR to combat operations, the coming of the CH-53K adds significant capability of logistical support to combat Marines.

Recently, NAVAIR released a video showing the progress in the new aircraft operating at night in terms of extending its range via tanking operations which can be viewed here:

<https://vimeo.com/576395487>

And NAVAIR added in its note accompanying the video: “It is the Expeditionary Advanced Base Operations vertical, long-range, heavy-lift, logistic backbone of the Marine Corps, today and for the next fight. Day. Night. All weather.”

I had a chance recently to discuss this development with Colonel Jack Perrin, Program Manager, PMA-261, H-53 Heavy Lift Helicopters, Naval Air Systems Command at Patuxent River, Maryland

When I discussed the progress indicated in the video with Col. Perrin this is what he underscored:

“We’ve now gone through and have validated the CH-53K’s performance in helicopter aerial refueling, both day, night, both with and without the external loads. This is extremely significant because now we move a heavy external load and extend our range so that we can really get anywhere that the Marines are going to need heavy lift logistics support within the world.

“I can imagine us taking off from the shipboard environment with a heavy 27,000 pound or more external load and extending our reach because we’re able to aerial refuel along the way, day or night, and deliver those logistics support wherever they need that. For example, we will be able in the PACOM region to reach the outer island chain and operate up and down the chain or the other supporting areas where the U.S. Navy might be operating.”

Also, the automation of the aircraft which allows for ease of flight coupled with day-night air refueling capabilities makes longer range for heavy lift possible for Marines. And these Marines are drawing upon their legacy as the joint forces most mobile and expeditionary force to enhance the ability of the joint force to operate across a combat chessboard.

As Col. Perrin noted: “Not only are flight operations more manageable for the flight crew but we are now safer because of the stability of the aircraft and the fly-by-wire system. One of the notes that we have from the development testing for the night refueling is that it was actually an ITT event, by which we mean that it is both a developmental test pilot and an operational test pilot conducting the test together.

“We have an increased safety margin associated with the 53K in executing its missions. And we can do so with heavier loads and get more performance from leveraging the digital backbone and its ability to work the networks when it’s operating. You’re also reducing the pilot workload and enhancing the safety when you’re flying behind the tanker. Going over long distances, the air crew is not flying their aircraft on altitude and airspeed. The aircraft’s flying itself.”

We then discussed the coming of the CH-53K to the North Carolina-based Marines.

From April through July, I have had the opportunity to spend time with II MEF and 2nd MAW, who are working the challenging transition from the Middle East land wars to European defense. And they are doing so without the benefit have having F-35s in their operating force. Both the II MEF and 2nd MAW commanders explicitly noted how important they saw the CH-53K for them in working that transition as they begin to operate the aircraft in their operating force.

And they are looking to leverage the new aircraft as they evolve their concepts of operations. Interestingly, 2nd MAW will be transitioning to the F-35B in the same time frame as the coming of the CH-53K which will provide an opportunity to think through how the two aircraft can interact in shaping the wing’s concepts of operations.

In discussing this development with Col. Perrin, he underscored the significant interaction which the CH-53K can have with the expeditionary basing capabilities inherent in the F-35B as a S/TOVAL aircraft. He underscored that “we can bring three 800-gallon fuel tanks with us. That’s 2,400 gallons of fuel. This means we can support multiple aircraft with all that fuel.

“That also means that the aircraft can land and get re-armed and receive fuel in a single landing operation at an expeditionary base rather than having to land to get re-armed and do an air-refueling to get fuel.”

During a recent exercise involving 2nd MAW Marines, they worked in Finland and learned how the Finns operated from roads to work in high threat environments. They also worked with the Finns in shaping the Marines own capability to do so. With CH-53K support, such coalition operations could support Marine F-35Bs or coalition aircraft whether it be the Swedish Gripens or the Finn’s F-18s.

And when thinking of expeditionary basing and support, there is another way to look at how to use that other F-35 flown by Marines, namely the F-35C.

That kind of flexibility is crucial as the U.S and its allies work the flexibility and ability necessary to operate across the combat chessboard against peer or near-peer competitors.

During a visit to MAWTS-1 last year, an F-35 pilot, Major Shockley, highlighted the impact of F35-B thinking on base mobility. In my book Training for the High-End Fight, I discussed with him how this thinking might apply to the entire F-35 force and to take advantage of the kind of expeditionary fuel support which the CH-53K could provide.

The F-35As and F-35Cs have some advantages in terms of fuel, and then range and loitering time with regard to the B, notably with regard to the C. Because the force is so inherently integratable, how best to work the chessboard of conflict with regard to where the various F-35 pieces move on the chessboard. From this standpoint, he argued for the importance of shaping a “rolodex of basing locations” where F-35s could land and operate in a crisis.

He had in mind, not only what the very basing flexible B could provide but thinking through deployment of “expeditionary landing gear” to allow the A’s and C’s to operate over a wider range of temporary air bases as well.

Here, he was referring to preparing locations with the gear to enable landing on shorter run “airfields” as well as the kind of modifications the Norwegians have done with their F-35s enabling them to land in winter conditions in the High North as well.

With the F-35B as well, a much wider range of afloat assets are being used to enable the F-35 as a “flying combat system” to operate and enable ISR, C2, and strike capabilities for the joint and coalition force. This is being demonstrated throughout the amphibious fleet, a fleet which can be refocused on sea control and sea denial rather than simply transporting force to the littorals.

A key consideration when highlighting what the F-35 as a wolfpack can bring to the force is deploying in the force multiples that make sense for the force. This rests upon how the combat systems are configured on that force. In simple terms, the integrated CNI systems operate through a multiple layer security system, allowing a four ship F-35 force to operate as one.

With the Block IV software coming into the fleet, now an eight ship F-35 force can operate similarly. This allows for wolfpack operations and with the ability of the reach of the F-35 into other joint or coalition F-35 force packages the data flowing into the F-35 and the C2 going out has a very significant reach and combat impact.

This is not widely known or understood but provides a significant driver of change to being able to operate and prevail in denied combat environments.

Leveraging this capability is critical for combat success for the U.S. and allied forces in the Pacific. And my visits to NAWDC and MAWTS-1 certainly underscored that these warfighters get that.

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The Coming of the CH-53K to the USMC: The Perspective of Lt. Col. Frank

07/25/2021

In recent visits to both II MEF and 2nd Marine Air Wing (2nd MAW), it is clear that the coming of the CH-53K to the North Carolina-based Marines is crucial. As the Marines work enhanced naval integration and expanded force mobility in dealing with the evolving strategic environment, the capabilities which the CH-53K brings to the force is not a nice to have but a critical capability. And the new digital aircraft provides a solid foundation for evolution not only of the platform but for changes in concepts of operations as well.

Both the CG of II MEF, and the CG of 2nd MAW indicated in interviews I did with them this year, that the coming of the CH-53K is especially important for their force generation capabilities to deal with the evolving threats in the Euro-Med region. As I noted in the April interview with [Lieutenant General Brian D. Beaudreault](#): “Although IIMEF is not the epicenter for receiving new Marine Corps kit, with the exception of the CH-53K (it does not have F-35Bs as part of its organic fighting force, e.g.), it must find was to innovate with the kit it has and to find new ways to work with an evolving US Navy to sort through how to deliver combat effects from ashore and at sea in support of the maritime fight.”

During my July 2021 visit to 2nd MAW, I had a chance to visit the VMX-1 CH-53K detachment at New River Marine Corps Air Station and to continue my discussions with LtCol Frank, Officer in Charge of the CH-53K Operational Test Detachment at New River. During my December 2020 visit to New River, I had a chance to work the new CH-53K simulator and to discuss the way ahead with the new aircraft with LtCol Frank.

As he put it during [the December 2020 visit](#): “It is crucial to have a CH-53 fleet that works effectively as it is a unique capability in the USMC crucial for our way ahead operationally. It is the only aircraft we have that can move an expeditionary brigade off of our amphibious ships.”



The author with Lt. Col. Franks at New River, July 13, 2021.

During the July 2021 visit, Lt. Col. Frank provided an update on progress through the testing process but we took the opportunity to discuss as well the wider impacts which the CH-53K has on training and on operations as the USMC works its evolving approach to crisis management as part of the high-end fight.

Since my visit in December, Lt. Col. Frank indicated that they had received new aircraft and had begun and then ramped up the flying hours. With their flight certification, they have now flown around 235 flight hours on the aircraft. They have certified five aircraft commanders, five co-pilots, 10 crew chiefs and more than a required number of maintainers with the appropriate level of qualifications for the next phase of training. That next phase will occur in August at 29 Palms.

They have completed their initial operational training but are waiting for certification to begin initial operational test and evaluation. In the meantime, they have engaged in a number of “rehearsal test and evaluation” sessions with Marines at 2nd MAW and Camp Lejeune to prepare for the August training efforts at 29 Palms.

The digital aircraft has many advantages and one can be seen on the training dimension. As with the F-35, pilots can train to core proficiencies more rapidly, which leaves room for expanding training options for the evolving mission sets which the Marines are clearly focusing on for full spectrum crisis management.

With regard to conversion training, they have discovered at VMX-1, that hours and flight events could be reduced for the pilots. As LtCol Frank put it: “the initial conversion syllabus from the CH-53E to the CH-53K was tailored based on our best guess of what events and flight hours would be required for the conversion aircrew. Following our initial foray into our own flight and simulator training and through our evaluations of the current syllabus we realized we could reduce those numbers by around 25%.

“Currently, we are focusing heavily on the co-pilot series-conversion syllabus which began as 17 total flight events for 26 flight hours. After our pilots completed this period of instruction, surveys taken at the end indicated that we could pare those numbers down by 7 events and 10 less flight hours. My hope is that this 25% savings will result in a typical Marine Heavy Helicopter Squadron saving 6 months over the duration of their transition.

“So now, if we can capitalize on the flight hours savings and pair that with an enhanced focus on the higher-level syllabus, we could expand training for those missions to meet high end events that the Marine Corps has decided is important in the evolving context.”

We then discussed what he saw as the clear advantages of the K over the Echo for the USMC. As he put it: “There is nothing sexy about assault support. Horsepower’s our weapons system, and reliability is the key to providing the horsepower for the heavy lift needed for assault support.”

Reliability is crucial; and the K is focused on enhancing reliability over the legacy aircraft. As he put it: If the grunts want a lift, and they need six to eight helicopters, it will take a whole MAG effort of 53 ECHO to put the package in the air for a battalion. With more reliability, we would not need a whole MAG to do this.

"We're hoping that's where the K is going to help, with its digital systems, engine, rotor, and drivetrain system reliability. The Full Authority Digital Electronic Control (FADEC) provides enhanced control, health monitoring, maximum power and efficiency as often as possible. They also provide what we call automatic power assurance checks and integrated power assurance checks. So we know exactly how engines are performing all the time. And it's providing real-time data.

"Automatic means the FADEC is just pulling numbers all the time. It's a behind the scenes process. It's just going all the time and it gets downloaded onto our maintenance data card, which then the maintainers will plug into their ground module, their ground computer, and they can see the engine health.

"Also, we can initiate power assurance checks as pilot, and the pilot can then bring up the summary of those and I can see, okay, power is doing good. Based on the spec engine performance, I'm actually plus 38 from the spec engine. So I've got more power than even the spec engine should have. The engine power available and limitations will be reflected on the primary flight display so we can be aware of that in the plane.

"Such accuracy and certainty is critical when you do a high altitude and a high ambient air temperature lift. That's when the K would be power limited. Knowing exactly how much power the engines are putting out, if I'm called to extract a platoon of Marines from a mountain top that's very high and it's very hot, and I have a lot of fuel on board, so I might be power critical, I can do a power assurance check and know that I'll be able to do it. Unlike the Echo, the K will give you a visual readout of your power status in real time while you are executing the lift."

LtCol Frank then addressed the reliability piece which the Integrated Vehicle Health Monitoring System (IVHMS) delivers.

"Our main gearbox pressure sensor will say it's starting to fail or it's getting a false reading. It's still performing, but it's getting a false reading. And what our maintenance Marines will do is they'll interpret that maintenance data when we give them the data card and they'll say, "Okay, your main gearbox pressure sensor reported itself. Your intermediate gearbox reported itself for vibrations. That means there's a bearing failing in it."

"As opposed to the ECHO where we would fly, and we would see chip light, caution light, oil pressure failures in the gearbox. That means the gearbox literally seizes or fails itself. That's when we know it's failed. In the K we'll get proceeding indications of that. Ideally, it leads to parts being removed before they fail. That should lead to increased maintenance readiness."

"Things fail a lot in the legacy aircraft. As a flight crew, you build an anecdotal seat of the pants data base. I have had dozens of hydraulic system failures, multiple engine failures, oil system failure, , electrical components failing, attitude gyros failing at night and in IMC.

"All those things create the seat of the pants sense that you need a lot of hours to accumulate, those failures help you get the experience you need."

One benefit of these machine-aided pilot systems in the K clearly is that the less experienced pilots can approach capability levels of more experienced pilots. This will enable the man-machine system

to deliver more safety for flights, and enhanced combat capability for the Marines as well. Assuming you're an experienced pilot, you have combat experience from which you could make judgments. But if I'm a less experienced pilot, now I have actually some machine aids that can help me.

Given that Marines are onboard one is talking about a lot of lives. And when the USMC Commandant and the Sergeant Major of the Marine Corps visited VMX-1 at New River in March, this was a key point which LtCol Frank underscored. Pilot vertigo can be a Marine killer and has been in past accidents. With the ability to push a button and let the aircraft fly itself, this should not happen in the future.

The advantages of a digital aircraft are very clear. But this means as well that cyber threats need to be dealt with on an ongoing basis, and clearly, the CH-53K program is not only aware of this but working it. Regular upgrading of software on the aircraft is part of the solution as well as cyber defensive capabilities as well. Both are being pursued with regard to the aircraft and its support systems.

What does LtCol Frank conclude with regard to the aircraft coming to the Marine Corps?

"With the 53-K I would fly it 1,000 times over with my hair on fire before I would set foot in an ECHO again. Don't get me wrong, I love the old iron, still wear a 53D patch. I cherish my time in that plane. It's my first love. It's like an old Jeep, simple and reliable but unrefined, the ECHO is similar. However, most of the time I would prefer to drive the Denali, that is the KIL0. Its operational capabilities are much enhanced over those legacy aircraft simply by the awareness and aides it can provide to the flight crew, our crew chiefs and maintainers feel the same."

Being a generational shift, the new digital aircraft is in LtCol Frank's words "a blank slate."

"You have an aircraft that can carry significant supplies or Marines inside and can carry 36,000 pounds externally. They can carry a lot of stuff. It has automated flight control systems that allows you to land in the degraded visual environments that you would not dare land an ECHO or a DELTA in. It can fly long distance without the air crew being fatigued. If you're aerial refueling and flying 1,000 miles in the E, the air crew would be wet noodles getting out after the flight. In the K you can relax a little, take a breath, allow the aircraft to help you fly and thus reduce aircrew fatigue significantly.

"I think when the necessity for conflict rears its head the K will be able to respond, and using human ingenuity, the operators will be able to find a way to support any mission that the Marine Corps needs it to do. The K is so versatile that I don't see people being pigeonholed into not being able to do something with a K. I think they'll be able to answer the call 99.9% of the time;"

"It'll be able to pick it up. It'll be able to transport it, fly it any distance and land it anywhere. And you're not going to be afraid to do it. In the ECHO, if it was low light at night, the visibility was bad, you didn't have a moving map, and you were headed to a dusty and tight zone the pucker factor would be through the roof. The altitude hold was suspect, it didn't have lateral navigation and flight director capability, your attitude gyros would fail often. So you get this hair on the back of your neck stands up that, I don't want to be flying in this environment. The aircraft's not going to help me, and I can't help myself because I don't have my sensory cues."

“But in the K, you know the aircraft’s going to help you. We’ve sat in brown out dust, just sitting there hovering and talking to each other with position hold on. And we’ve been debriefing the landing, and the aircraft’s just holding a hover perfectly.

“So that’s what I like about the K is that I think it will be able to answer the call for the mission most anytime the Marine Corps needs it, whether we know what the mission is going to be, or not.”

An Update on the CH-53K, June 2021: Colonel Jack Perrin Provides an Overview

06/16/2021

The coming of the CH-53K™ to the USMC could not come at a more appropriate time. As the Marines are focused on mobile basing as a key aspect of how they contribute to crisis management, the capabilities of the new aircraft will be in immediate demand.

It was clear from my visit to [II MEF](#) that the CH-53K was an important addition to the force as they faced increased demands with reduced force structure. Although II MEF is not the epicenter for receiving new Marine Corps kit, with the exception of the CH-53K (it does not have F-35Bs as part of its organic fighting force, e.g.), it must find ways to innovate with the kit it has and to find new ways to work with an evolving U.S. Navy to sort through how to deliver combat effects from ashore and at sea in support of the maritime fight.

Clearly, heavy lift is a key part of being able to meet their missions. When looking at the North Atlantic arc from North Carolina to the Nordics, strategic mobility is delivered by a triad of airlift, sealift and pre-positioning.

Where best to pre-position?

How best to protect those stockpiles?

And how to move critical supplies to the point of need rapidly?

Reworking the Marine Corps force to operate more effectively with the U.S. Navy requires a reset of the logistics enterprise. But with the Navy in flux, the USMC in flux, and the strategic environment in flux, and our allies in flux, [how do you shape effective convergence](#) for effective combat capability?

As [LtCol Smith](#), II MEF logistics lead officer, articulated the challenge: “How do you shape convergence of your technology, your tactics, your techniques and procedures with the assets which are available to an effective combat force?” The CH-53K is coming into this context and will be one of the answers to these questions.

Recently, I had a chance to talk with Colonel Jack Perrin, Program Manager, PMA-261, H-53 Heavy Lift Helicopters, Naval Air Systems Command at Patuxent River, Maryland, to get an update on the coming of the CH-53K to the combat force.

Question: You are on track this summer to fulfill the Initial Operational Test & valuation (IOT&E) requirements?

Col. Perrin: Yes. VMX-1 at New River have our first fleet aircraft, and they are doing extremely well.

“In their Operational Test training, I believe they have trained five aircraft commanders and two co-pilots already.

“They also have four crew chiefs and two aero observers, or the air crew in the back of the aircraft.

“They started flying in January. And in the month of April, they flew over 50 hours on that single aircraft. Although we are working with early data, early information, the aircraft is doing really well and has tremendous availability.

“Though we are in the process of validating maintenance procedures for the first time, it’s been going really well.

“It’s an all-hands effort, I have not only the Marines out there doing it, but they’re supported by Sikorsky, and by my engineering and logistics teams to make sure that we’re working through all the processes, and everything is working well.

“At the end of March, they received two more aircraft at New River. Those aircraft were complete with their modifications to fit into the proper configuration for IOT&E, and those aircraft have recently started flying, and they’re both also doing very well.

“It takes the squadron about a month to go through the process of accepting newly delivered aircraft.

“They’re right on track and doing well. I expect IOT&E to start this summer.

“Our first big detachment for IOT&E is going to be going out to Twentynine Palms for over a month to do operations in the mountainous and desert environment out there in the training area in California.

“The fourth aircraft is going to join them in September. That aircraft is actually going to complete its modifications within the next couple of weeks. We need to validate some modifications we’ve put in that aircraft, specifically for the electromagnetic effects on the aircraft.

“We’re getting ready this month to finish our testing for helicopter area refueling. It’s basically just a check in the box for us. We’ve done most of the testing for that. We’re well ahead of the game on that.

“I expect us to hit IOT&E running.

"It's going to be really good for the Marine Corps., because as soon as we get through IOT&E, the Marine Corps will have the opportunity to declare IOC, and we'll be able to start transitioning that first squadron at New River."

Question: The Twentynine Palms engagement starts this summer?

Col. Perrin: "In August they're going to go out to Twentynine Palms."

Question: I visited New River last December and was quite impressed with the progress evident with regard to the aircraft and its maintainability.

How would you characterize the progress at VMX-1 at New River?

Col. Perrin: "We've learned tremendous lessons in our log demo that we started back in 2018. And from those we found some deficiencies, so things we wanted to change and improve upon, and we've done that. I think you're really seeing the fruits of that labor in the amount of availability that we're seeing out of the initial aircraft at New River.

"As I mentioned earlier that one aircraft was flown 50 hours in one month. 50 hours in one month for any platform is, especially for a helicopter platform, is a tremendous amount of work.

"And, to do that on a single brand-new aircraft in the fleet, that really shows how good the maintenance and the maintenance system is.

"Talking to the digital part of the 53K, we are using a really a leading-edge integrated maintenance device. It's basically a computer, but instead of just having PDFs of the maintenance manuals on it, it provides an interactive maintenance manual designed for and supportive of being able to do that maintenance.

"And that system has really driven a lot of efficiencies into executing maintenance, because the maintainer can take it and have that digital environment right there with him.

"We also have an onboard mission computer, what we call the integrated vehicle maintenance system.

"And that integrated vehicle maintenance allows us to record data on the aircraft, not only the performance data, how the engines are doing, how the gearbox is doing, what the status of the aircraft is, where the pilots put it, what environment it was flying in, but also records the vibrations of the aircraft.

"It's integrated into the maintenance system.

"And that system has a data center that takes the data that we've gotten off the aircraft and reviews it automatically.

"We run algorithms on it that can show you a new predictive maintenance procedure for the aircraft.



"I don't really know of any other platform that's at that level of integration already.

"We're going to get to a full condition-based maintenance aircraft, because it is digital, because we do collect all the data on it and we're able to gather that data, store that data, and able to run algorithms and programs on it so that you can manipulate that data and better do predictive analysis of how that aircraft is performing, and where your bad actors are.

"It also helps us reduce the Operations and Support costs of this platform, even compared to the CH-53E.

"So that's another big bonus for us and the Marine Corps, as we move forward, trying to make the aircraft not only affordable in production, of which we certainly are doing.

"We're seeing the cost of the aircraft coming down as we've just recently got a handshake and within the next month or so, we'll be awarding lot five with an option for lot six for a total of 18 more aircraft that we're putting out in the production line to deliver to the fleet.

"But we're also focused on reducing the cost to operate and maintain this aircraft.

"To do this we are shaping a fleet common operating environment to manage the fleet."

Question: I would like to return to the digital point for a moment.

The CH-53K is a digital aircraft as you have said and working digital data as part of the operational and sustainment efforts is a key foundation as the force works towards adding autonomous systems – which are completely software driven to the force.

How would you characterize the impact of the manned digital system preparing the way for unmanned systems?

Col. Perrin: “The digital character of the aircraft reduces the workload of the pilots and the crew so much that they can have that spare capacity to do those additional tasks that they will see in that digital battlefield, whether it’s communicating or operating with other symbiotic platforms that are going be out there.

“Because I agree with you, the future really is about the unmanned world and that force multiplier that they can provide to some of those manned systems, but to get there you have to start by understanding, working with and mastering digital backbone manned systems.”

What if it was called the CH-55?

Transformation in the Vertical Heavy Lift Fleet

12/08/2020

To the casual observer, the Super Stallion and the King Stallion look like the same aircraft.

One of the challenges in understanding how different the CH-53K is from the CH-53E is the numbering part.

If it were called CH-55 perhaps one would get the point that these are very different air platforms, with very different capabilities.

What they have in common, by deliberate design, is a similar logistical footprint, so that they could operate similarly off of amphibious ships or other ships in the fleet for that matter.

But the CH-53 is a mechanical aircraft, which most assuredly the CH-55 (aka as the CH-53K) is not.

In blunt terms, the CH-55 (aka as the CH-53K) is faster, carries more kit, can distribute its load to multiple locations without landing, is built as a digital aircraft from the ground up and can leverage its digitality for significant advancements in how it is maintained, how it operates in a task force, how it can be updated, and how it could work with unmanned systems or remotes.

These capabilities taken together create a very different lift platform than is the legacy CH-53E. In a strategic environment where force mobility is informing capabilities across the combat spectrum, it is hard to understate the value of a lift platform, notably one which can talk and operate digitally, in carving out new tactical capabilities with strategic impacts.

The lift side of the equation within a variety of environments can be stated succinctly. The King Stallion will lift 27,000 lbs. external payload, deliver it 110 nm to a high-hot zone, loiter, and return to

the ship with fuel to spare. What that means is JLTV's (22,600-lb.), up-armored HMMWV, and other heavier tactical cargos go to shore by air, rather than by LCAC or other slower sea lift means. For less severe ambient conditions or shorter distances than this primary mission, the 53K can carry up to 36,000 lbs.

With ever increasing lift requirements and advancing threats in the battlefield, there is no other vertical lift aircraft available that meets emerging heavy lift needs. There are a lot of platforms that can blow things up or kill people, but for heavy lift, the CH-53K is the only option.

For the Marines, this is a core enabling capability. The CH-53K is equipped with a triple external hook system, which will be a significant external operations enabler for the Marine Air Ground Task Force. The single, dual and triple external cargo hook capability allows for the transfer of three independent external loads to three separate supported units in three separate landing zones in one single sortie without having to return to a ship or other logistical hub.

The external system can be rapidly reconfigured between dual point, single point loads, and triple hook configurations in order to best support the ground scheme of maneuver.

All three external hooks can be operated independently supporting true distributed operations. For example, three infantry companies widely dispersed across the battlefield can be rapidly resupplied with fuel, ammo, water or other supplies directly at their location—during the same sortie—eliminating the requirement for the helicopter to make multiple trips or for cargo from a helicopter to be transloaded to ground vehicles for redistribution—saving ground vehicle fuel and MAGTF exposure to ground threats.

The CH-53K's triple external hook system is a new capability for the Marine Corps and an improvement in capability and efficiency over the legacy aircraft it replaces making it a game changer for providing heavy lift in support of combat, humanitarian assistance, and disaster relief operations, notably in a distributed operational space.

The CH-53K design integrates the latest technologies to meet the USMC requirement for triple the lift of the predecessor Super Stallion while still maintaining the size and footprint to remain compatible with today's ships and strategic air transport platforms.

The aircraft is fully marinized for shipboard operations, including automatic blade fold and design robustness to meet new and extreme requirements for salt-fog and corrosion. It is already certified for transport in C-5 (2 x 53Ks) and C-17 (1 x 53K) aircraft and also includes an integral aerial refueling probe for long range missions or self-deployment.

The work process is very different as well, because of support for palletization. This may sound like logistic geek language, but it is about speed to deliver to the force for its operating efficacy. Given that speed to operation is a key metric for supporting the strategic shift from the land wars to full spectrum crisis management, the CH-55 (aka as the CH-53K) is a key enabler for the new work flow essential to combat success.

The digital piece is a foundational element and why it is probably better thought of as a CH-55. This starts with the fly-by-wire flight controls. The CH-53K is the first and only heavy lift fly-by-wire helicopter.

The CH-53K's fly-by-wire is a leap in technology from legacy mechanical flight control systems and keeps safety and survivability at the core of the Kilo's design while providing a portal to an optionally piloted capability and autonomy.

The CH-53K's fly-by-wire design drastically reduces pilot workload and minimizes exposure to threats or danger, particularly during complex missions or challenging aircraft maneuvers like low light level externals in a degraded visual environment allowing the pilot to manage and lead the mission vice focusing on physically controlling the aircraft.

The fly-by-wire design further complements safety and survivability through physically separated Flight Control Computers, separated cockpit controls with an Active Inceptor System, and load limiting control laws that will extend component lives. Other cargo Helicopters originated in the late 50s/early 60s, predating the emergence of Aircraft Survivability as an engineering discipline.

Not leaving anything to chance, the overall CH-53K survivability process includes an extensive, ongoing Live Fire Test Program, which started at a component level, and culminates with a full-up aircraft test with turning rotors. The CH-53K is the only heavy lift helicopter designed from the ground up to survive in battle, reflecting a 21st century level of survivability.

In addition, the CH-53K was designed from the start in an all-digital environment, taking advantage of virtual reality tools to optimize both manufacture and support of the aircraft throughout its life cycle. Fleet Marine personnel were engaged from the beginning of the design process to ensure the aircraft was designed for supportability and reduced O&S costs—from component access, support equipment, animated work instruction and electronic publications to the system integration with Sikorsky's fleet management tools that were originally developed to support its commercial S-92 aircraft fleet.

The S-92 has demonstrated greater than 95% availability for a fleet of over 300 aircraft which now boast near 1.5 million flight hours, in harsh North Sea and other off shore Oil & Gas environments. Use of data analytics ("big data") has proven to save money in the commercial fleet and these same tools are already in place for the CH-53K and being proven on the CH-53E in the interim.

The CH-53K's triple redundant fly-by-wire design improves maintainability significantly through fault Detection and isolation capability providing the ability to detect failures in actuators and other electrical and electromechanical components including hydraulic leak detection with fault isolation.

While the CH-53K is bigger and far more capable in many important ways, it's also smaller in terms of its logistics footprint and provides a best O&S value over its entire lifetime. The CH-53K's logistics footprint is 1/3 less by volume with a 5,000 cubic feet reduction and 1/4 less by weight with a 25,000 reduction compared to the legacy CH-53E. That's equivalent to the storage volume of a 2-car garage and the weight of a two up-armored HMMWVs. In the cargo world, that's 2 standard shipping

containers, which is space and available payload on a ship or less equipment to transport to an austere support base.

The design reduces the maintenance workload as well. With no mechanical rigging requirement and fewer moving parts leading to fewer failures, the CH-53K provides a significant reduction in maintenance man hours, a 35% improvement in Mean Time to Repair, and ultimately increased readiness and availability to the warfighter.

Organizational-level maintenance peculiar support equipment for the CH-53K is based on common and CH-53E support equipment in order to reduce the new peculiar support equipment required for the CH-53K. Only 150 items of peculiar support equipment were developed to support organizational-level maintenance, which is 146 less pieces of support equipment or a 52% footprint reduction compared to the CH-53E. Additionally the CH-53K support equipment was designed to reduce and optimize equipment weight and life cycle cost while material selection and coating changes from legacy aircraft to eliminate use of hazardous materials and provide better environmental protection from corrosion.

The T408-GE-400 engine brings more capability to the CH-53K through 57% more horsepower with a smaller logistics footprint compared to the T64 it replaces in the same size package but with 63% fewer parts. The T408 supports engine on aircraft maintenance and was designed to maximize two levels of maintenance—Organizational to Depot—with all on-wing engine maintenance being performed using the common tools in flight line toolbox further reducing the logistics footprint and maintenance man hours while increasing availability and readiness of the CH-53K.

The CH-53K sets the standard and is the 1st and only true 21st Century Heavy Lift Helicopter.

To be more specific, the current heavy / upper medium lift cargo helicopters that the CH-53K replaces—legacy Chinook, CH-53 A/D/G Sea Stallion, CH-53E Super Stallion and their engines—were literally designed in the mid-20th century.

In the more than half century that has elapsed between the design of these legacy aircraft and the first flight of the CH-53K in 2015, there have been significant advancements in helicopter design and manufacturing.

The CH-53K is superior to its predecessors, not by engineering miracles, but by over a half century of steady engineering and technology progress that was designed and incorporated into the CH-53K from the ground up.

The King Stallion is a totally new helicopter that leapfrogs the CH-53E design to improve operational capability, interoperability, reliability, maintainability, survivability, and cost of ownership.

Finally, the CH-53K is nearing completion of testing and well into production. The program remains on target for a 2021 IOC and 2023 deployment that meets the USMC's operational needs. The King Stallion is the only aircraft that meets the heavy lift requirements for the USMC, supports the Expeditionary Advanced Base Operations (EABO) concept, and provides that safety, survivability, supportability and growth capability to meet the service's needs for the many decades to come.

A good sense of how the CH-55 (aka as the CH-53K) intersects with the new operating environment was highlighted in interviews I did in both Pax River and Marine Corps Air Station Yuma.

In an interview earlier this summer with a senior MAWTS-1 officer, we discussed the coming of TAGRS and of the CH-53K to the Marine Corps and how these new capabilities would allow for enhanced FARP capabilities and expeditionary basing support.

In that interview with Maj Steve Bancroft, Aviation Ground Support (AGS) Department Head, MAWTS-1, MCAS Yuma, we discussed the way ahead on FARPs enabled by TAGR and CH-53Ks.

Excerpts from that interview follow:

There were a number of takeaways from that conversation which provide an understanding of the Marines are working their way ahead currently with regard to the FARP contribution to distributed operations.

The first takeaway is that when one is referring to a FARP, it is about an ability to provide a node which can refuel and rearm aircraft. But it is more than that. It is about providing capability for crew rest, resupply and repair to some extent.

The second takeaway is that the concept remains the same, but the tools to do the concept are changing. Clearly, one example is the nature of the fuel containers being used. In the land wars, the basic fuel supply was being carried by a fuel truck to the FARP location. Obviously, that is not a solution for Pacific operations.

What is being worked now at MAWTS-1 is a much more mobile solution set. Currently, they are working with a system whose provenance goes back to the 1950s and is a helicopter expeditionary refueling system or HERS system. This legacy kit limits mobility as it is very heavy and requires the use of several hoses and fuel separators.

Obviously, this solution is too limiting so they are working a new solution set. They are testing a mobile refueling asset called TAGRS or a Tactical Aviation Ground Refueling system.

Helicopter Expedient Refueling System (HERS)

- Requires 6 Marines



Tactical Air-Ground Refueling System (TAGRS)

- Requires 4 Marines



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As one source put it: “The TAGRS and its operators are capable of being air-inserted making the asset expeditionary. It effectively eliminates the complications of embarkation and transportation of gear to the landing zone.”

The third takeaway was that even with a more mobile and agile pumping solution, there remains the basic challenge of the weight of fuel as a commodity. A gallon of gas is about 6.7 pounds and when aggregating enough fuel at a Forward Air Refueling Point or FARP, the challenge is how to get adequate supplies to a FARP for its mission to be successful.

To speed up the process, the Marines are experimenting with more disposable supply containers to provide for enhanced speed of movement among FARPs within an extended battlespace. They have used helos and KC-130Js to drop pallets of fuel as one solution to this problem.

The effort to speed up the creation and withdrawal from FARPs is a task being worked by the Marines at MAWTS-1 as well. In effect, they are working a more disciplined cycle of arrival and departure from FARPs. And the Marines are exercising ways to bring in a FARP support team in a single aircraft to further the logistical footprint and to provide for more rapid engagement and disengagement as well.

The fourth takeaway is that innovative delivery solutions can be worked going forward.

When I met with [Col. Perrin](#) at Pax River, we discussed how the CH-53K as a smart aircraft could manage airborne MULES to support resupply to a mobile base. As Col. Perrin noted in our conversation: “The USMC has done many studies of distributed operations and throughout the analyses it is clear that heavy lift is an essential piece of the ability to do such operations.”

And not just any heavy lift – but heavy lift built around a digital architecture.

Clearly, the CH-53E being more than 30 years old is not built in such a manner; but the CH-53K is. What this means is that the CH-53K “can operate and fight on the digital battlefield.”

And because the flight crew are enabled by the digital systems onboard, they can focus on the mission rather than focusing primarily on the mechanics of flying the aircraft. This will be crucial as the Marines shift to using unmanned systems more broadly than they do now. For example, it is clearly a conceivable future that CH-53Ks would be flying a heavy lift operation with unmanned “mules” accompanying them. Such manned-unmanned teaming requires a lot of digital capability and bandwidth, a capability built into the CH-53K.

If one envisages the operational environment in distributed terms, this means that various types of sea bases, ranging from large deck carriers to various types of Maritime Sealift Command ships, along with expeditionary bases, or FARPs or FOBS, will need to be connected into a combined combat force.

To establish expeditionary bases, it is crucial to be able to set them up, operate and to leave such a base rapidly or in an expeditionary manner (sorry for the pun). This will be virtually impossible to do without heavy lift, and vertical heavy lift, specifically.

Put in other terms, the new strategic environment requires new operating concepts; and in those operating concepts, the CH-53K provides significant requisite capabilities. So why not the possibility of the CH-53K flying in with a couple of MULES which carried fuel containers; or perhaps building a vehicle which could come off of the cargo area of the CH-53K and move on the operational area and be linked up with TAGRS?

As this potential development highlights, if we called it a CH-55, we would grasp which the coming of the CH-53K has a significant impact on the way ahead for mobile expeditionary basing, which is itself a key building block in the way ahead for the integrated distributed force. Or put another way, multiple basing is a key capability required for operations in the extended but contested battlespace; and the CH-55 can provide a significant capability to enable multiple basing.