DEFENSE.info

Next Generation Heavy Lift: An Update on the CH-53K

September 2020

Enhanced Expeditionary Basing Capabilities: CH-53K + TAGRS

08/19/2020

By Robbin Laird

Recently, the Marines tested their new forward base refueling system with the CH-53K.

The two together provide new capabilities for forward refueling points or for expeditionary basing.

According to the Marines:

Marines with Marine Wing Support Squadron 371, 3rd Marine Aircraft Wing, employ a tactical aviation ground refueling system (TAGRS) while conducting expeditionary advanced base operations in support of a CH-53K King Stallion training evolution at a forward arming refueling point at Yuma Proving Grounds Range, Ariz., July 15, 2020.

The King Stallion is the most powerful aircraft in the Department of Defense, providing unmatched heavy-lift capability to the Marine Corps.

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 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.

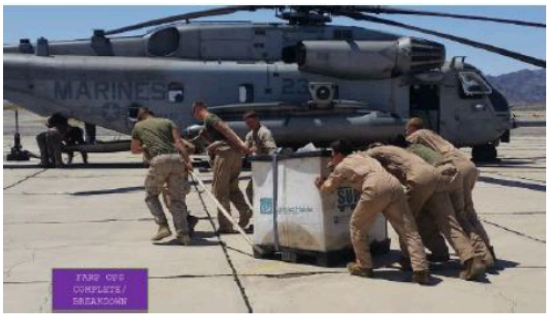
Obviously, this solution is too limiting so they are working a new solution set.

They are testing a mobile refueling asset called TAGRS or a Tactical Aviation Ground Refueling system.

UNCLASSIFIED

Helicopter Expedient Refueling System (HERS)

- Requires 6 Marines



Tactical Air-Ground Refueling System (TAGRS)

- Requires 4 Marines

UNCLASSIFIED

As noted in the discussion of TAGRS at the end of this article: “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 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?

I am not holding Maj. Bancroft responsible for this idea, but the broader point is that if distributed FARPs are an important contribution to the joint and coalition forces, then it will certainly be the case that "autonomous" systems will play a role in the evolution of the concept and provide some of those new tools which Maj. Bancroft highlighted.

A Next Generation Helicopter and Sustainability: The Case of the CH-53K

08/24/2020

By Robbin Laird

Next generation air platforms encompass several changes as compared to the predecessors which are at least thirty years old or older, notably in terms of design.

Next generation air platforms are designed from the ground up with the digital age as a key reality.

This means that such systems are focused on being able:

- To provide connectivity with other platforms,
- To have upgradeability built in through software enablement and anticipated code rewriting as operational experience is gained,
- Operating with cockpits built to work with new digital ISR and C2 systems onboard or integratable within the cockpit of the platform,
- Are built with materials technology, which leverages the composite revolution,
- And have management systems designed to work with big data to provide for more rapid and cost-effective upgradeability and maintainability.

Such is the case with the CH-53K compared to its legacy ancestor, the CH-53E or with the venerable but legacy Chinook medium lift helicopter.

Comparing the legacy with the next generation is really about comparing historically designed aircraft to 21st century designed and manufactured aircraft.

As elegant as the automobiles of the 1950s clearly are, from a systems point of view, they pale in comparison to 2020s automobiles in terms of sustainability and effective performance parameters.

I have followed the progress of the CH-53K much like I have with the F-35 and the Osprey, three innovative new combat systems.

As I have argued earlier,

With peer adversaries emphasizing technological change and force modernization, focusing on strategic advantage for US and allied forces is a key element for combat success. At the heart of such an approach, clearly will be the ability to operate more effective distributed forces and to leverage the capability of US and allied forces to operate flexibly and not relying on a rigid centralized system with a core emphasis on combat mass.

Working ways to distributed force but concentrate fires is at the heart of the transformation necessary to prevail in the strategic shift. For the MAGTF, this means taking the core approach around which a MAGTF has been created and extending its reach with integrated fires, as is conceived of with regard to F-35-HIMARS integration or the use of the new G/ATOR system, and building effective force packages that can operate in an integrated but flexibly deployed distributed force.

The CH-53K comes at a time when this transition is being worked.

As the heavy lift member of the MAGTF team, the CH-53K will provide a key element of being able to carry equipment and/or personnel to the objective area. And with its ability to carry three times the external load of the CH-53E and to be able to deliver the external load to different operating bases, the aircraft will contribute significantly to distributed operations.

But the digital nature of the aircraft, and the configuration of the cockpit is a key part of its ability to contribute as well. The aircraft is a fly-by-wire system with digital interoperability built in.

And with multiple screens in the cockpit able to manage data in a variety of ways, the aircraft can operate as a lead element, a supporting element or a distributed integrated support node to the insertion force.

A key change associated with the new digital aircraft, whether they are P-8s or Cyclone ASW helicopters, is a different kind of workflow. The screens in the aircraft can be configured to the task and data moved throughout the aircraft to facilitate a mission task-oriented workflow.

In the case of the CH-53K, the aircraft could operate as a Local Area Network for an insertion task force, or simply as a node pushing data back into the back where the Marines are operating MAGTBs.

Marines carrying MAGTB tablets onboard the CH-53K will be able to engage with the task force to understand their role at the point of insertion. The K as a digital aircraft combined with the digital transformation of the Marines create a very different ground force insertion capability.

From an operational standpoint, the K versus the E or the legacy Chinook for that matter, offers new capabilities for the combat force.

What is more difficult to grasp is how the new generation of aircraft also change how sustainability is managed and how the new aircraft provide a ramp launching a new way to manage the aircraft, and to provide for enhanced reliability for those digitally managed aircraft.

Recently, I had a chance to talk with Pierre Garant, now a program director with Sikorsky, but whom I met many years ago when he was the aviation sustainment director at Headquarters Marine Corps.

In an article which Murielle Delaporte and I wrote for *Military Logistics International* in 2007, we interviewed Garant with regard to how the Marines were working expeditionary logistics to support what was the disruptive impact of the Osprey.

Garant himself provided his perspective on the transformation of Marine Aviation logistics in a 2004 Marine Gazette piece.[1]

The simple point is that Garant has been at this for a long time.

What he brings to the CH-53E and CH-53K is years of credible experience in working 21st century transformation regarding combat logistics.

In a later article, I will focus on our discussion about the evolution of the Performance Based Logistics (PBL) framework as the approach within which digital capabilities can be wrapped to provide for significant advancements in effective maintainability and weapons system reliability.

Here I want to simply highlight some key parameters to understand what a 21st century digital next generation aircraft provides for a new sustainment approach.

What Garant argued was that by establishing an effective PBL process in place, which Sikorsky has with both the Seahawk and now with the CH-53E, they can now with the new digital aircraft embed those tools into a PBL framework.

With the PBL framework there is solid working relationship between the government and Sikorsky to better manage the supply chain and to shape more accurate data with regard to parts performance while already setting the foundation for a CH-53K PBL.

They can then take that data and rework how the supply chain can deliver a more effective outcome to reliability and effectiveness in operations.

With the data generated by the CH-53K, the "smart" aircraft becomes a participant in providing inputs to a more effective situational awareness to the real performance of the aircraft in operational conditions.

Then that data then seamlessly flows into the sustainment management system to provide a much more realistic understanding of parts performance.

This then allows the maintenance technicians and managers to provide higher levels of performance and readiness than without the data flowing from the aircraft itself.

Put in other terms, the data which the aircraft generates makes the aircraft itself an "intellectual" participant in the sustainment eco system.

The question then is how best to operate such an ecosystem?

This is a different question than the legacy aircraft and its sustainment system poses.

There the question is determining laws of averages for parts performance from collecting data, and then shaping ways to make sure parts are available at the right time and the right place.

With the aircraft as a participant in the fully-integrated eco system, much more performance is being provided in a much more timely fashion and the question then is how to work the suppliers into the eco system so that they can be informed significantly earlier about what they need to do to contribute more effectively to the fleet.

Another dimension of how the aircraft contributes to its own enhanced reliability is its ability to provide information with regard to fault isolation.

With the digital systems onboard the CH-53K, the aircraft not only generates fault detection, but can precisely isolate where that fault is to be found with accuracy.

This can eliminate false replacements, a problem which the Osprey had for many years in its initial operations.

High reliability of fault detection and fault isolation is a significant game changer for maintenance, and it is the aircraft that will generate the information for this more effective process.

Furthermore, the digital aircraft delivers a tenfold increase of actionable information that fully enables condition-based maintenance as a future reality.

Garant noted the nature of the shift as follows: "The shift is from reactive maintenance to predictive maintenance."

And the data flows will enable a continuous learning process which can be shaped for the global fleet of the aircraft, rather than being simply being done well at one base and only word of mouth spreading the message on a new way to maintain the aircraft.

As Garant put it: "It's almost like virtual surgeon, where his knowledge comes to the point of need."

With all the noise about autonomous systems and AI, what one can overlook is how digital aircraft are now participants in their own maintainability.

Try that with a legacy Chinook or CH-53E.

In short, the CH-53K is a smart aircraft birthed in a digital age that is doing support and manufacturing differently.

In other words, it's symmetrical with a significant strategic change, rather than being a legacy system struggling to adapt to the new age.

The Performance-Based Logistics (PBL) Foundation for the CH-53K Sustainment Approach: Shaping a New Way Ahead for Next Generation Digital Aircraft

09/03/2020

By Robbin Laird

In the article above, I focused on CH-53K sustainment, I highlighted how the next generation digital aircraft reshape how sustainment is managed and executed. I concluded that "the CH-53K is a smart aircraft birthed in a digital age that is doing support and manufacturing differently. In other words, it's symmetrical with a significant strategic change, rather than being a legacy system struggling to adapt to the new age."

Even though the digital nature of the aircraft allows for significant innovation in maintenance and sustainment of the fleet, for its full effects to be realized, the process whereby maintenance is managed is crucial in providing a framework for shaping a more effective way ahead.

In the interview with Pierre Garant, we discussed the performance-based logistics (PBL) experience with Sikorsky helicopters and how this experience shaped a core process within which new digital aircraft would be able to leverage and in turn improve the performance of the process itself.

Currently, Garant is the Director of Sustainment for Marine Corps Helicopter Programs – which includes delivering support to the current fleet of Presidential/Executive Transport ("Marine One"

aircraft fleet, VH-3D and VH-60N as well as introduction of the VH-92A) and the USMC/USN Heavy Lift Aircraft fleet (CH-53E and MH-53E and introduction of the CH-53K).

Pierre has 38 years of leadership experience in the field of aviation. He held a number of leadership positions in the U.S. Marine Corps, highlighted by his tenure as the Director of the Aviation Logistics at Headquarters (Pentagon) Marine Corps Aviation as a Marine Colonel.

Following his 26-year career in the Marine Corps, he was the Director of Support at Bell-Boeing for the V-22 (Osprey) Tilt-Rotor Aircraft Program before joining Sikorsky in 2013. He holds a BA from Cornell University, an MS from University of Southern California and an MS from the National Defense University. Along with his academic degrees, Pierre holds many military decorations and professional certifications.

Continuing with what I learned in the interview with Garant, we discussed how Sikorsky has taken its experience working with the government in the PBL for Seahawk and with the new PBL contract to support CH-53E to expand the scope of PBL support.

According to Garant: "We're rapidly maturing the PBL model to not just do material availability with supply material deliveries, but now expanding the focus on aircraft availability metrics and incentives."

According to Garant, the Seahawk PBL set the industry standard in terms of being able to cover a full "tip to tail" approach to support for the aircraft, and "through the years, the Seahawk PBL team continue to drive process and product improvements into the value stream. And clearly the contract is driving cost savings for the customer and enhanced aircraft availability." Of note, the Seahawk PBL was awarded the DOD best PBL in 2019.[1]

In an interview with Garant conducted two years ago, we first discussed the then new PBL contract with NAVAIR to support the CH-53E. Sikorsky – working with NAVAIR at Pax River Maryland – have established a Fleet Common Operating Environment (or "FCOE") database and analytics toolset to support CH-53E operations.

"It is our government version of the Sikorsky proven Customer Care Center we employ to support our commercial helicopter fleet.

"The goal is the same, namely to rapidly and reliably understand the performance of the aircraft in the real world in order to proactively create readiness and cost reduction solutions for the global fleet within a 'total mission assurance (PBL-like)'commercial customer business model. "

The establishment and operation of the FCOE capability has paved the way for the creation of an expanded performance-based logistics (PBL) business model and contract between Sikorsky and the government to support the H-53E.

"Traditional PBLs focus on parts availability: the contractor delivers the part within a certain timeframe and is measured by success in terms of a 'Supply Response Time' metric.

"The traditional PBL is focused on the supply chain performance.

"The new approach expands performance to aircraft availability.

"With the new PBL, the contractor is also incentivized to contribute to an 'aircraft availability' metric."

"With the opportunity to use an agreed-upon database and proven data analytics toolset – the FCOE – we have the ability to measure the discreet level of how we can create aircraft availability.

"For example, when we change the logistics posture, maintenance procedures, and supply response time for a gear box, we will also be able to demonstrate to the government that we generated a measurable amount of aircraft availability because we improved one part's value stream.

"Once we do that, we earn increased incentive on the contract in addition to meeting supply response times."

In this interview, Garant provided an update on the how the CH-53E PBL works and how the relationship with the government is evolving in aircraft support. Garant highlighted that the public-private partnership between Sikorsky and the Fleet Readiness Center East Cherry Point is at the heart of the PBL's evolution and success.

According to Garant:

"The Fleet Readiness Center East Cherry Point does half of the repairs, and the other half of the repairs are done at our overhaul and repair facility in Connecticut.

"There are two sources of repair, and we can fully leverage lessons learned and capacity from both.

"A clear measure of progress can be seen in the case of the main rotor head repairs where we have already demonstrated an improved repair turnaround time from over 1,100 days down to 270 days in the first year of performance.

This enhanced velocity will increase material availability, get ahead of fleet needs and drive down costs.

"The PBL contract is being expanded to include ninety parts by early 2021.

"We are seeing more parts added while we are performing ahead of metric 'ramp-up.' We are already performing two years ahead of supply response time improvement thresholds."

A key challenge is to manage a cold supply chain for a legacy platform like the CH-53E.

With PBL, one can generate a more realistic demand side projection and then reach out to the supply chain and provide more stable projections of demand.

With a five-year PBL contract, and by bringing in "big-data" analytics to bear, Sikorsky can work with the suppliers to come up with a realistic forecast and long-term approach to deliver the parts likely to be needed.

This is obviously important always, but in a situation like COVID-19 having stable demand projections is crucial for industry to determine how best to meet demand.

According to Garant, "we are also pursuing smarter repairs.

"We are focusing on subcomponent performances and based on those judgments informed by data analytics can determine how better manage the repair schedules for the major parts."

By shaping the PBL process, the new digital aircraft is able to expand and accelerate the envelope of effective logistics support and management.

As Garant put it: "The digital capabilities become a greater opportunity within the PBL process. We're going to leverage the digital aircraft throughout the value stream right from the moment when the signal is more accurately captured and diagnosed on the aircraft, and it helps shape smarter maintenance packages for the Marines.

"The whole maintenance department will have much improved tools with a connected and digital maintenance work-space which will help with improved troubleshooting and maintenance with the data coming off the aircraft."

"The data coming off the K is an order of magnitude more actionable information and quicker than it is on the E – by at least tenfold. In effect, the digital flows are enabling a better PBL by empowering a rapid journey from reactive to planned and predictive maintenance."

Garant concluded: "We are taking the lessons learned from the legacy aircraft and shaping a way ahead with regard to the next support structure.

"But clearly, you don't want to take a legacy program and try to force a model on it that they never were designed for nor grew up with.

"What you're going to do on the K is, it's going to be born right out of the gate with a better process and the opportunity to leverage the digital systems of the new smart aircraft to reduce life-cycle costs while ensuring operational availability and mission reliability for all CH-53K customers.

Platforms, Concepts of Operations and Defense Decisions: The German Case

08/17/2020

By Robbin Laird

With the launch of our defense information website (defense.info) , we introduced a micro-site on defense decisions. We wrote: "In this new section of the defense.info website, we will address U.S. and allied upcoming procurement choices and decisions.

"We are focused on how platform and system choices affect the evolution of the capabilities, concepts of operations of a particular ally or of U.S. services or the joint force.

"Too often, the focus of the defense press or of analysts is narrowly focused on platforms, rather than placing platform decisions or system decisions into the broader context of the evolution of core capabilities.

"We will focus on such decisions by placing them in a broader context.

"In particular, we are focused on the building, shaping, operating and sustainment of what we have called the integrated distributed force.

"We have built a separate micro site focused on this theme, but here we are focused on procurement, or equipment decisions which play into this strategic shift."

To further develop a discussion of how to evaluate platforms in the evolving concepts of operations for full spectrum crisis management forces, we will focus on Germany, and key procurement choices which they face in the context of the direct defense of Europe.

We are publishing this Fall our book entitled *The Return of Direct Defense in Europe: Meeting the 21st Century Authoritarian Challenge.* In this book we identify the key trends reshaping the direct defense challenge and the approaches being taken to reshape capabilities for enhanced direct defense

In that book, we focus on how key states in Europe are reshaping their forces and their approach to defense to deal with the new strategic challenges.

Clearly, Germany is a key lynchpin state in how Europe is reshaping its approach, and within that approach key procurement decisions will be taken in the period ahead.

In particular, Germany is currently facing three key procurement choices which illustrate the complexity of choice.

To often, a simple platform versus platform presentation is made which confuses rather than clarifies what the tactical and strategic implications of particular platform decisions in a key functional area for force development and tactical and strategic evolution of a nation's defense posture.

With regard to this series, we will address, the following procurement choices facing Germany in three key operational areas:

The first is the face-off between the legacy Chinook medium-lift helicopter versus the new generation CH-53K heavy lift helicopter.

The second is the decision to pursue signals intelligence with a manned aircraft option versus an unmanned option, or the face-off between the Pegasus versus the Global 6000 program.

The third is the question of how Germany will replace the Tornado aircraft in its nuclear role.

In each case, much of the analysis has been to compare platform versus platform: Chinook versus CH-53K; a Triton variant versus a manned Canadian aircraft with both systems delivering signals intelligence but in very different ways and with very different implications for force structure development; how to transform the legacy Tornado into its replacement with no clear lineage from Tornado to what will replace it.

The German case provides an opportunity to address the broader question of how to analyze platform choices in a very different strategic context and with significant changes in how US and allied force structures need to evolve to meet the challenges of full spectrum crisis management.

Obviously, more to come.

German Platform Decisions: CH-53K versus the Chinook

08/14/2020

By Robbin Laird
As I suggested in the lead article in this series on how to evaluate platform choices in the context of evolving needs and concepts of operations, too often, a simple platform versus platform presentation is made which confuses rather than clarifies what the tactical and strategic implications of that particular platform choice might be.

Germany is facing a number of such platform choices, and in this second article in the series, I will address the face-off between the CH-53K and the Chinook and what this choice means for the evolution of the German armed forces.

Recently, there have been a number of articles which have directly raised the question of how the Chinook compares with the CH-53K which suggested that the venerable though legacy Chinook is good enough to consider treating the CH-53K as an outlier to both U.S. Army modernization and for the German armed forces.

For example, Loren Thompson wrote a piece published on July 22, 2020 for *Forbes* which is entitled, "Why Boeing Believes it Will Win the competition to Supply Heavy-Lift Helicopters to Germany and Israel."

This is a good place to start.

Thompson noted that "Boeing, builder of the rival CH-47F twin-rotor Chinook, has other ideas. It thinks it can displace the CH-53 from both the German and Israeli markets by offering an upgraded version of its own heavy lifter that meets all customer performance requirements at considerably less cost."

We should note at the outset that the CH-53K is a heavy lift helicopter; the Chinook is not—it is a medium lift helicopter, based on weight that each can carry. But putting aside that point, the argument boils down to the notion that the CH-53K is built to support unique Marine Corps missions which the Germans will not need, and that Chinook is more than adequate for German needs.

"Although King Stallion is a bigger aircraft than Chinook, Boeing notes that the size of their cabins is virtually identical. In fact, it says that due to weight limits on the CH-53K's wheels, the CH-47F can "oftentimes carry more weight internally than the CH-53K." Since Germany and Israel do not conduct the kind of ship-to-shore maneuvers practiced by the U.S. Marine Corps, Boeing figures that the greater external lifting power of King Stallion isn't worth the additional cost to either country."

Then Thompson highlights that Boeing believes that the "CH-53K is so new that its future reliability and maintainability are not yet proven." And associated with this is that there is a higher level of risk in buying a new helicopter and in the potential challenges of customization of the aircraft for Israeli and German needs. Boeing ignores that the block upgrade that they offer in thier medium lift Chinook is a development and not production program.

But the core point of comparison highlighted by Boeing is the question of cost. "Boeing contends that the cost of procuring and operating the latest version of Chinook is far below that of King Stallion. In an apples-to-apples comparison, it calculates that 'CH-47F aircraft cost is about half the CH-53K.' The higher price-tag for King Stallion could be justified if it were a markedly better fit for German and Israeli performance requirements, or more reliable and maintainable, but Boeing doubts that a case for either claim could be made convincingly."

This presentation highlights why the legacy aircraft has perceived advantages over a new, 4th generation aircraft, but does not really answer the question of how Chinook fits into the new demands being placed on the German armed forces not how it relates to the overall modernization strategy of German defense.

If this was the Cold War, where the primary focus was really upon moving support around Germany to reinforce the direct defense of Germany, then there might be a compelling case for the legacy Chinook.

But that is not what Germany is facing in terms of the return of direct defense in Europe. In our forthcoming book, *The Return of Direct Defense in Europe: Meeting the 21st Century Authoritarian Challenge*, we focus on the major challenges facing the allies in terms of defense against the Russians in terms of the Poland-to Nordic arc. Within this arc, the challenge is to move force rapidly, to reinforce deterrence and to be able to block Russian movement of force.

Germany faces the challenge of reinforcing their Baltic brigade, moving rapidly to reinforce Poland, and to move force where appropriate to its Southern Flank. In the 2018 Trident Juncture exercise, German forces moved far too slowly to be effective in a real crisis, and it is clear that augmenting rapid insertion of force with lift is a key requirement for Germany to play an effective role.

This is where the CH-53K as a next generation heavy lift helicopter fits very nicely into German defense needs and evolving concepts of operations. The CH-53K operates standard 463L pallets

which means it can move quickly equipment and supply pallets from the German A400Ms or C-130Js to the CH-53K or vice versa.

This is not just a nice to have capability but has a significant impact in terms of time to combat support capability; and it is widely understood that time to the operational area against the kind of threat facing Germany and its allies is a crucial requirement.

With an integrated fleet of C-130Js, A400Ms and CH-53Ks, the task force would have the ability to deploy 100s of miles while aerial refueling the CH-53K from the C-130J.

Upon landing at an austere airfield, cargo on a 463L pallet from a A400M or C-130J can transload directly into a CH-53K on the same pallet providing for a quick turnaround and allowing the CH-53K to deliver the combat resupply, humanitarian assistance supplies or disaster relief material to smaller land zones dispersed across the operating area.

Similarly, after aerial refueling from a C-130J, the CH-53K using its single, dual and triple external cargo hook capability could transfer three independent external loads to three separate supported units in three separate landing zones in one single sortie without having to return to the airfield or logistical hub.

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

If the German Baltic brigade needs enhanced capability, it is not a time you want to discover that your lift fleet really cannot count on your heavy lift helicopter showing up as part of an integrated combat team, fully capable of range, speed, payload and integration with the digital force being built out by the German military.

It should be noted that the CH-53K is air refuellable; the Chinook is not. And the CH-53 K's air refuellable capability is built in for either day or night scenarios.

A 2019 exercise highlighted the challenge if using the Chinooks to move capability into the corridor. In the Green Dagger exercise held in Germany, the goal was to move a German brigade over a long distance to support an allied engagement. The Dutch Chinooks were used by the German Army to do the job. But it took them six waves of support to get the job done.

Obviously, this is simply too long to get the job done when dealing with an adversary who intends to use time to his advantage. In contrast, if the CH-53K was operating within the German Army, we are talking one or two insertion waves.

And the distributed approach which is inherent in dealing with peer competitors will require distributed basing and an ability to shape airfields in austere locations to provide for distributed strike and reduce the vulnerabilities of operating from a small number of known airbases.

Here the CH-53K becomes combat air's best friend. In setting up Forward Operating Bases (FOBs), the CH-53K can distribute fuel and ordnance and forward fueling and rearming points for the fighter aircraft operating from the FOBs.

Being a new generation helicopter it fits into the future, not the past of what the Bundeswehr has done in the Cold War. It is not a legacy Cold War relic, but a down payment on the transformation of the Bundeswehr itself into a more reactive, and rapid deployment force to the areas of interest which Germany needs to be engaged to protect its interests and contribute to the operational needs of their European allies.

From an operational standpoint, the K versus the E or the Chinook for that matter, offers new capabilities for the combat force. And from this perspective, the perspective of the two platforms can be looked at somewhat differently than from the perspective presented in the Thompson article.

Next generation air platforms encompass several changes as compared to the predecessors which are at least thirty years old or older, notably in terms of design. Next generation air platforms are designed from the ground up with the digital age as a key reality.

This means that such systems are focused on connectivity with other platforms, upgradeability built in through software enablement and anticipated code rewriting as operational experience is gained, cockpits built to work with new digital ISR and C2 systems onboard or integrateable within the cockpit of the platform, materials technology which leverages the composite revolution, and management systems designed to work with big data to provide for more rapid and cost effective upgradeability and maintainability.

Such is the case with the CH-53K compared to its legacy ancestor, the CH-53E or with the venerable legacy Chinook medium lift helicopter. Comparing the legacy with the next generation is really about comparing historically designed aircraft to 21st century designed and manufactured aircraft. As elegant as the automobiles of the 1950s clearly are, from a systems point of view, they pale in comparison to 2020s automobiles in terms of sustainability and effective performance parameters.

To take two considerations into account, the question of customization of the German and Israeli variants and the question of sustainability both need to be considered with next generation in mind.

With regard to customization and modernization, digital aircraft provide a totally different growth path than do a legacy aircraft like the CH-53E or the CH-47. Software modifications, and reconfigurations can provide for distinctive variants of aircrafts in a way that legacy systems would have to do with hardware mods. And with regard to security levels of information flows, software defined systems have significant advantages over legacy systems as well.

With regard to sustainability, NAVAIR and the USMC have taken unprecedented steps to deliver a sustainable aircraft at the outset. The logistics demo effort at New River has taken the new aircraft and worked through how to best ensure sustainability when the first squadron is deployed.

With the data generated by the CH-53K, the "smart" aircraft becomes a participant in providing inputs to a more effective situational awareness to the real performance of the aircraft in operational conditions, and that data then flows into the management system to provide a much more realistic

understanding of parts performance. This then allows the maintenance technicians and managers to provide higher levels of performance and readiness than without the data flowing from the aircraft itself.

Put in other terms, the data which the aircraft generates makes the aircraft itself an "intellectual" participant in the sustainment eco system. This is certainly not the case with legacy aircraft which were not birthed in the digital software upgradeable world.

The next generation system which the CH-53K represents brings capabilities to the challenges which Germany faces in terms of getting force rapidly to the point of attack or defense required by the Bundeswehr. It is no longer about defending against breakthroughs in the Fulda Gap; it is about moving force rapidly to make a difference in a time urgent combat setting on Germany's periphery and flanks.

As I wrote earlier:

For Germany, the K clearly would be part of how they might adjust flexibility to the strategic shift facing the liberal democracies in dealing with the Russians.

For example, Germany needs to rapidly reinforce their Baltic brigade or move forces forward to reinforce Poland in a crisis.

Compared to Chinook, the K goes further, faster and brings a significantly greater combat load to the fight rapidly.

And flying with the A400 M or the C-130J, the ability to carry standard pallets means a rapid movement of cargo from an airlifter to the K to move support within an area of interest.

And the K is changing as well the meaning of what a support helo really is.

It is in an information or C2 asset through the nature of the cockpit and how information can be managed within the cockpit or delivered to the combat soldiers onboard the aircraft.

This means that for Germany, the K is already FCAS enabled, or able to operate in a combat cloud in a way certainly neither the E nor the Chinook can do.

The FCAS enabled part is also crucial for Germany. The FCAS approach is forward leaning and ultimately rests on shaping the networks which enable an integratable force. It is not about simply building a replacement combat aircraft; it is about building out a system of networks which can able an integratable force to work effectively together. Simply buying legacy systems and leaving networked capabilities to show up in a future FCAS really misses the point; integratability has to be built in which it clearly is with the CH-53K.

It is a down payment on building out the kind of networked force Germany has committed itself too with its FCAS commitment. Put in other terms, platform choices should be considered as well from

the vantage point of whether or not that platform choice advances the integratable force able to move rapidly to the point of attack or defense or not.

From this standpoint the choice is clear: The Chinook represents the Cold War past; the CH-53K the future of the integratable force.

With the shaping of a new force structure within the context of the current and projected security context for Germany, it makes sense that each new platform or program be made with regard to where Germany is headed in terms of its 21st century strategic situation, and not be limited by the thinking of the inner-German defense period.

CH-53K Sea Trials: One Step Closer to First Deployment

07/29/2020

Last month, the Marine Corps wrapped up its first sea trials with the new CH-53K King Stallion.
In an article by Megan Eckstein published by USNI News on June 25, 2020, the crossing of one of the "last big items on the to do list before the heavy lift helicopter program can turn the aircraft over to the fleet for operational tests and a 2023 first deployment" was highlighted.

She interviewed Col. Jack Perrin, the H-53 heavy lift helicopters program manager for Naval Air Systems Command.

Col. Jack Perrin, the H-53 heavy lift helicopters program manager for Naval Air Systems Command, told USNI News in a June 24 interview that the sea trials were meant to test all the ways the helicopter interfaces with a ship: communications while in flight, the ability to land on all nine spots on the flight deck in all weather and lighting conditions, the ability to be towed around the flight deck and hangar bay, the ability to be folded up and tied down, the ability to be maintained at sea and more.

The helicopter conducted two flight periods a day, one in daylight and one at night – taking off, with the pilots recording notes on the difficulty and safety of that particular evolution; flying a mile or so from the ship; flying back in the traditional landing pattern to attempt a landing; recording notes on that landing; and then the ship turning into a new wind condition for the process to start over again.

Though sea trials with some other programs have exposed problems that needed to be addressed through technical or procedural changes, "we were very fortunate; we did not find that big thing that was going to cause us risk or delay or a big technical issue. With this, we have now gone through this program and hit pretty much everything that they aircraft needs to do in order to deploy. We still have some more data to take, we have some tests to finish up, but we've been to every big thing," Perrin said.

"We've done the external loads, done the internal loads, we went out and did helicopter aerial refueling, and now we've gone to the ship and been out there and seen that. Our risk on this program, for the 53K not being able to go out and support that first deployment and get through [operational testing], is

greatly reduced now because of the success we've had and the performance the aircraft has shown during this test and the test previous. So we're pretty happy as a program."

Perrin added:

"(With) operational test Marines out on the ship, with pilots in the cockpit, crew chiefs in the back of the helo and maintainers on the ship – all getting a sneak peak at how this helicopter compares to its predecessor.

"They now understand what it can do and what tactics, techniques and procedures, or TTPs, that they're going to need to adjust from what we do with the 53E to how the 53K operates. So they are getting a complete heads start on having those tactics, techniques and procedures developed, so that when they go to the official IOT&E or initial operational test and evaluation, they've already been on the aircraft, they've already been flying the aircraft, they've already seen this," he said.

"When they go out to the ship as part of the test – and they will go out to a ship as part of the IOT&E – they're going to be running instead of learning at that time. They're going to be executing. And that's the key of an ITT or integrated test team, is that everybody gets to learn together."

We interviewed Col. Perrin earlier this year, and in that interview he highlighted the importance of the CH-53K for the Marine Corps.

In a visit to Pax River in January 2020, there was a chance to discuss the progress of the program with Colonel Jack Perrin Program Manager, PMA-261 H53 Heavy Lift Helicopters, US Naval Air Systems Command at Pax River Naval Air Station….

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.

And this Marine Corps-Navy capability is suggestive of a broader set of considerations for the Army and the Air Force.

If Expeditionary Basing is crucial, certainly the CH-53K could provide capabilities for the Army and the Air Force, to compliment fixed wing lift aircraft.

And in many cases, only a vertical lift support capability will be able to do the job.

Remember the USAF flies the CV-22s and if they are part of the distributed fight and requiring expeditionary basing, it may be the case that such a base can be set up and sustained only by vertical heavy lift.

Both considerations, how to cross-operate across the seabase and the expeditionary base, and the question of whether vertical heavy lift is now becoming a strategic asset, will be dealt with in later pieces.

But for now, the core point is simple – the K needs to come into the USMC-Navy team as soon as possible to enable the shift in concepts of operations required to deal with the new strategic environment.

And if the CH-53K became part of the joint team, the question of cost is very manageable.

By producing more aircraft, the cost curve comes down. And shaping a more effective cost curve is a significant challenge which the program is addressing.

A Naval Air Station Pax River Update on the CH-53K: August 2020

08/28/2020

According to an August 21, 2020 press release by Naval Air Station Patuxent River, the CH-53K sea trials went extremely well.

A team of pilots and engineers from Air Test and Evaluation Squadron (HX) 21 based at Naval Air Station Patuxent River recently completed a crucial series of sea trials of the CH-53K King Stallion that not only provided them with valuable developmental test information about the aircraft, but could change the way the squadron conducts similar tests in the future.

The test team of 96 personnel embarked on the USS Wasp (LHD 1) in early June to conduct an intensive series of tests that were designed to establish the helicopter's performance envelope for day and night launches and recoveries at a wide range of wind speeds, to test engaging, disengaging, folding, and unfolding the rotors in a variety of wind conditions, and to allow maintenance crews from Sikorsky and Marine Operational Test and Evaluation Squadron (VMX) 1 to practice working on the aircraft in at-sea conditions.

"We went to sea with a robust test plan," said Maj Joshua "Felon" Foxton, CH-53K sea trials project officer. "Typically, you include more test points than you can reasonably expect to accomplish, which gives us greater flexibility in executing the plan. But due largely to the success of the aircraft, we were able to accomplish all of our objectives while we were underway."

Over the course of the 14-day detachment, the team members who were embarked on Wasp accomplished just over 32 hours of flying, well over a third of which were flown at night. Altogether, the team achieved 364 landings, of which 74 were conducted using night vision devices. The team successfully launched and recovered to all spots and was able to launch 13 sorties in the first eight days of ship-based maintenance.

Foxton praised the CH-53K's performance, noting that the responsive and well-tuned fly-by-wire controls make shipboard landings much easier and more precise than is possible with many other helicopters. "It's a real testament to the stability of the aircraft," Foxton said.

Lt. Col. Fred "NOVAC" Neubert, department head and government lead test pilot for the CH-53K program, agreed with Foxton's assessment. "There may be other aircraft out there with similar performance capabilities, but I have not flown a helicopter with the outstanding handling qualities that the 53K provides," Neubert said.

The aircraft performed so well, in fact, that the test team succeeded in testing nearly all of the aircraft's launch and recovery envelope expansion — the team's primary test objective — within the first seven days of the trip, leaving the second week to thoroughly pursue the other objectives. As a result, the test team was able to devote more time to identifying refinements and minor improvements to suggest to the manufacturer than it otherwise would have had. Foxton recalled how, during one post-flight debriefing, one of the team's veteran flight engineers pointed out, "Do you realize we just spent 15 minutes talking about whether we could improve the windshield wipers?"

"We were able to focus on those little things because the big things took care of themselves," Foxton said.

Teamwork was another major factor in the detachment's success. "It can sometimes take weeks or months for a team to coalesce, but we had 14 days underway to forge a team," Foxton said. "Thanks to the professionalism of the contractors, our Marine counterparts in VMX-1, and our colleagues in the Navy, we were able to accomplish everything so thoroughly that we were actually ably to fly the aircraft off a day earlier than we had planned. That was inspiring."

Neubert and Foxton also had plenty of praise for the Wasp's crew. "The crew was amazing," Foxton said. "They carefully negotiated winds and weather for us in order to get the ship in the exact position with the conditions we needed for every test point. Their true professionalism enabled all of our successes."

"One of the things that stands out about this detachment was the quality of the ship's crew from the leadership on down, their commitment to figuring out a way to make it work no matter what we needed," Neubert said. "I think that reflects the command culture. The ship's commanding officer, Capt. Greg Baker, likes to get to 'Yes.' Every department embodied that mentality."

The envelope expansion testing that the team accomplished has resulted in the largest fleet envelope for any Navy and Marine Corps helicopter currently in existence, according to the squadron.

"I think this detachment is going to rewrite how we plan a test phase," Foxton said. "It's an opportunity for us to find very specific efficiencies in our testing, which will in turn increase our speed to the fleet."

Neubert agreed. "In flight test, we specialize in risk mitigation and preparing for how we will respond to something that goes wrong," Neubert explained. "What we discovered in this test is that in the future, we'll want to spend more time planning how we will we respond if something goes unexpectedly great."

"Our objective is to provide the fleet Marines with a safer and more effective platform with greater operational capability, and this detachment was a successful example of that," Neubert said. "This is why we do flight test — because we come from the fleet, and we want to give good products back to the fleet."

Manufacturing a CH-53K: The Central Role of Digital Thread Production

06/11/2020

By Robbin Laird

Sikorsky is working with NAVAIR and the USMC to deliver a new build heavy lift helicopter, the CH-53K.

This is a digital aircraft, while its predecessor the CH-53E, is a mechanical aircraft.

What this means is that the aircraft is digitally designed and manufactured by means of a digital thread production and assembly process.

This digital thread process provides a path to tap into operational data for the sustainment process.

In turn, this enables operational and sustainment data to flow back into the upgrade, redesign, and manufacturing process.

Digital design, build, sustainability forms a feedback process which unlocks more effective, including cost effective ways to manage the aircraft's life cycle

In this article, I will highlight the nature of the design and build process for the CH-53K while the next article will focus on the sustainment and modernization processes which digital build empowers and enables.

After the first two articles, I will focus on the impact on USMC operations of having a digital heavy lift aircraft, empowering evolving expeditionary capabilities of the USMC itself.

On May 20, 2020, I had a chance to hold a teleconference with two Sikorsky manufacturing leaders involved in the design and build process.

My interlocutors for the digital design and build discussion were William Falk and Andrea Ulery.

I have included both of their biographies at the end of this article: William Falk is the Director and Program Manager for CH-53K within Sikorsky and Andrea Ulery is the CH-53K Program Director for Production.

I visited the Connecticut factory two years ago, and had a chance to talk with engineers, managers, and others as I became familiar with the establishment of the CH-53K manufacturing process.

One thing that was obvious from visiting the plant was how much larger the CH-53K is than other helicopters being built at the plant, and the need to accommodate its size on the assembly line and to find ways to enhance productivity working within and outside of the heavy lift aircraft going through an assembly line build process.

Even though the CH-53K has a similar and slightly smaller footprint to the CH-53E, which was done precisely to ensure that the new build helicopter could fit into the Navy's existing amphibious fleet, the CH-53E aircraft was built many years ago. That the production line has been retired in the Sikorsky facility.

A new production line has been set up for the CH-53K built around the digital thread production approach and process.

With regard to the physicality of the CH-53K within the Connecticut plant, Ulery noted: "The CH-53K is a much larger aircraft than the Blackhawk and takes up a larger footprint on the floor."

Bill Falk added: "It's also a very different looking production line.

"The line is much cleaner and more open with regard to the work stands and workstations from position to position on the manufacturing line.

"It is clear right away that we are manufacturing the CH-53K in a very different way as compared to 1970s-designed Hawks."

I did raise the question of the challenges of shaping understanding of how different the CH-53K is from the CH-53E given they look similar in many ways externally.

Bill Falk referred to it as both a blessing and a challenge that the CH-53K looks a lot like the CH-53E.

The casual observer would not see a dramatic difference between the two aircraft which is important as it allows for minimal disruption in the fielding of the brand-new aircraft into the existing naval infrastructure.

Falk noted: "However, because the CH-53K looks so similar to the 53E, it's not easily recognizable or understood how different it is in terms of its overall capabilities.

"This is not just about increased lift and range, but also how well it goes together on the production line because we used an all-digital design from the beginning.

" The aircraft on the production line now are coming together much easier than previous generation aircraft at Sikorsky."

"Nobody would know by looking at the CH-53K that it has an all-digital fly-by-wire flight control system that delivers impressive handling qualities and preciseness in flying, landing and picking up and transporting loads."

We then discussed how the digital design process, which preceded the build process, has shaped a more effective way ahead for production and assembly.

A major challenge, of course, is to ensure that the different subsystems on the aircraft are integratable within the overall digital architecture of the aircraft and are built in such a way that the aircraft can operate onboard a ship without interfering with the onboard ship sensors and system as well.

This is what is meant by the marination of an aircraft operating and living onboard a ship.

According to Falk, a key part of the design effort was shaped by the system integration laboratory which was established at the outset of the program.

"In the system integration lab, we worked integration of the fly-by-wire flight control computers, servos and hydraulics allowing us to actually energize and drive the servos just like when it's all fully integrated and built on the aircraft."

With regard to the ship side of the integration process, Falk noted that "the CH-53K will be going onboard an amphibious ship in the near term to test the 'system of systems' effect on the ship and the effect of the ship on the aircraft."

We then discussed the impact of such an integrated digital design and production process on the effectiveness of the manufacturing process.

According to Andrea Ulery: “This is my fourth production program which I’ve worked on in my time with Sikorsky.

“And it’s my third where I started at the very beginning or very early in the production program.

“The CH-53K is the most effective early production process which I have been involved with.”

It is clear that with regard to a digital thread production line, “the manufacturing engineering team is embedded with the team that builds the aircraft,” according to Ulery.

We then discussed some of the digital work constructions and the digital tools that Sikorsky is using to build the aircraft.

Ulery highlighted a number of innovations associated with the production process.

Remembering the size of the aircraft poses specific challenges, the design of the manufacturing process has been shaped to better manage the challenges of producing a large combat helicopter.

The first is managing the workflow by using lifting devices that allow workers to work in an ergonomically safe position.

She mentioned the use of lifting devices to handle the airframe and its integration with landing gears as one example of this process.

The second is “our creative engineering team have come up with ways to allow us to lift and integrate harnesses, which are incredibly heavy, into the aircraft in a safer manner, which also makes it go faster in terms of the production process as well.”

The third is the use of 3D printing technology on the line.

The harnesses are very heavy as they span the length of the helicopter itself. “We’ve been able to manufacture 3D printed devices that allow us to hold and more accurately integrate where the harnesses drop off and work their way through the airframe.”

Ulery highlighted as well that with the digital systems workers can take their work instructions or digital design data into the aircraft and work directly from their computers rather than using remote terminals.

“As they go to work onto aircraft every day, they are able to access their laptop for everything that they need, including, work instructions, 3D modeling, and additional referential material. It’s all at their fingertips. And to a person, they love having that capability easily accessible to them.”

The result according to Ulery: ‘I don’t see the volume of questions that I used to see early in a build which strengthens the case that it we’ve done a good job on the foundation.”

From my perspective, a foundation has been laid from design to production to sustainment and back to modernization and then back to design and production which provides a very new capability to build out capabilities in the future for the CH-53K.

And with an all digital aircraft, one which is digitally interoperable with the entire USMC force, new options and capabilities are opened for the USMC as a centerpiece force for expeditionary warfare.

William Falk, Director and Program Manager, CH-53K

William (Bill) Falk manages all aspects of the CH-53K program, including cost, schedule and technical execution. His responsibilities span across development, production, and sustainment and serves as the primary interface for both internal and external customers. In addition, Falk has a focus on flight testing, transition to production, production execution to full rate, stand-up supportability and sustainment capabilities, and will team with the appropriate stakeholders to support business capture both domestic and internationally.

Bill has over 18 years of Sikorsky experience. Bill joined Sikorsky in 2002 as an Engineer and has held roles of increasing responsibility in engineering, program management, and operations. He most recently served as Program Director, Canadian Maritime Helicopter Program (CMHP) where he successfully managed program execution, including all qualification and production efforts to achieve business objectives and enhance profit potential. Previously he was General Manager, Avionics Product Center, where he was responsible for the Avionics value stream operations, including management of a global supply chain base with over 200 suppliers that span 3 continents and 14 countries. Bill also spent 13 years in positions of increasing responsibility in engineering at Honeywell and General Dynamics prior to joining Sikorsky.

Bill holds a Bachelor of Science degree in Electrical Engineering from Penn State University.

Andrea R. Ulery, CH-53K Program Director, Production

Andrea Ulery was named CH-53K Program Director, Production in March 2019. Ms. Ulery's leadership responsibilities span the capture, production and retrofit of CH-53K aircraft for the United States Marine Corps. Prior to joining the CH-53K team, Ms. Ulery was responsible for development and production on the VH-92A Presidential Helicopter Replacement program.

She has held roles of increasing responsibility in program and operations management within Sikorsky Aircraft, including flight test and production of MH-60R and UH-60M aircraft, Federal Aviation Administration type certification of the VH-92A, and manufacture of avionic and rotor blade assemblies.

Ms. Ulery holds a Bachelor of Science degree in Liberal Studies from Southern Connecticut State University, and a Master of Business Administration from the University of Connecticut.