EDITORIAL

Adoption of the CH-47 to MEDEVAC Special Operations Forces in USAFRICOM

Ryan M. Leone, MSc[1]; Mason H. Remondelli, BS[2]; Sheldon S. Smith, BS[3]; Brandon J. Moore, BS[4]; Shelbi L. Wuss, BS[5]; Matthew D'Angelo, DNP[6]*

Introduction

The U.S. is pivoting to future conflicts requiring multi-domain, large-scale combat operations (LSCO). As such, military medical planning, resourcing, and training have shifted focus away from the counterinsurgency efforts utilized in the global war on terrorism (GWOT).[1] This is an appropriate redirection, especially given the tremendous casualty estimates under simulated Indo-Pacific conflicts. However, irregular warfare and low-intensity conflicts remain a threat in the shadow of LSCO and prompt specific evacuation needs.[2]

The U.S. maintains a diplomatic and military presence throughout many remote regions. The nation projects power through Special Operations Forces (SOF) to protect national interests and provide regional stability. To complete these missions, SOF often operate in austere environments far from definitive care facilities.[3]

Although the long-distance challenge is not unique to the U.S. Africa Command (AFRICOM) and U.S. Indo-Pacific Command (INDOPACOM) theaters, we anticipate that regional air superiority in AFRICOM will enable unconstrained aeromedical evacuation. For this reason, SOF in AFRICOM could benefit from larger flight medical teams with greater capacity, in-flight damage control resuscitation or surgery (DCR/DCS) capabilities, and faster transport to definitive care. The U.S. military should augment its regional medical evacuation (MEDEVAC) platform with CH-47 Chinooks (Boeing, Ridley Park, PA; https://www.boeing.com/defense/ch-47-chinook#overview) to improve these medical capabilities.

AFRICOM Theater Characteristics

U.S. interests in Africa are continuously threatened, with contributions from weak regional governance, unequal civil development, disease, violent extremism, crime, conflict, and food insecurity.[4] The weaponization of these threats by state and non-state actors, alongside the dispersed nature of deployments across 22 African nations, places Operators assigned to Special Operations Command Africa (SOCAF) at risk.[5]

These threats are particularly troubling when viewed through a medical evacuation lens. The "tyranny of distance" complicates evacuation approaches in the theater. When coupled with dispersed personnel and limited rescue options, distance conveys a high mortality risk to those who are injured in the theater.[6,7]

Prior medical evacuations from the AFRICOM theater have predominantly been due to non-battle injury and disease, with one study finding that 97% of transports were for disease or non-battle injuries.[8] Of those evacuated due to trauma, 22% were gunshot wounds, and 24% were sports injuries. Further, 29% of cases required wound debridement, and 22% required fracture or joint dislocation reduction.[8,9] Based on an analysis of combat casualties in Ukraine, it can be extrapolated that the injury severity score could be higher in future kinetic scenarios in AFRICOM due to modern weaponry, drones, and advanced technology. Non-state actors and militia groups may utilize drones or even chemical, biological, and nuclear weapons of mass destruction, while state-funded private actors like Russia's Wagner Group have been supplying ground-to-air missiles to Sudan's paramilitary forces.[10–12] This underscores the necessity of advanced provider-assisted transport, and the requirement for sufficient space to transport them.[13] More specifically, the types of injuries that may be encountered in AFRICOM demand an aeromedical evacuation platform to address trauma, toxic exposures, or even severe infectious diseases.

Aeromedical Evacuation Approaches

The aeromedical platform of choice throughout the campaigns in support of the GWOT was focused mainly on the UH-60M/HH-60M platform (Sikorsky, Stratford, CT; https://www.lockheedmartin.com/en-us/products/sikorsky-black-hawk-helicopter.html). The platform includes the UH-60M for MEDEVAC (which bears a red cross without carrying weapons to align with Geneva Convention protections), the MH-60 for tactical evacuation (TACEVAC) without such protections, and the HH-60 for combat search and rescue. This platform and its variations will be referred to hereafter as the UH-60M for simplicity.

The UH-60M medical crew was conventionally composed of one flight paramedic whose primary focus was en-route care

*Correspondence to rml2207@cumc.columbia.edu

[1]**2LT Ryan M. Leone** is a medical student at Columbia University Vagelos College of Physicians and Surgeons, New York, NY. [2]**2LT Mason H. Remondelli,** [3]**2LT Sheldon S. Smith,** and [5]**2LT Shelbi L. Wuss** are medical students in the School of Medicine, The Uniformed Services University of the Health Sciences, Bethesda, MD. [4]**MAJ (Ret) Brandon J. Moore** is a postgraduate student at Columbia University, School of General Studies, New York, NY. [6]**COL Matthew D'Angelo** is Chief of the Division of Nurse Anesthesiology at the University of Maryland, Baltimore, MD.

and maintaining the patient until the next level of care.[14] UH-60M flight medical teams could doctrinally care for a maximum of four patients, but operationally support care for two patients given vertical space limitations.[15,16] Crews primarily provided Tactical Combat Casualty Care; however, they had the capability of offering more advanced care when appropriately resourced. Access to DCR/DCS was delayed until the patient was transferred to a Role 2 Surgical Team or Role 3 Medical Treatment Facility because a surgical team could not be carried far-forward on the UH-60M platform. While these crews and capabilities were sufficient for counterinsurgency operations in the relatively condensed geography of the CENTCOM area of responsibility, optimizing support to SOF in AFRICOM will require these crews to be extended beyond their current capabilities and capacity.

The aeromedical casualty evacuation continuum during the GWOT routinely involved multiple assets that moved patients from the point of injury to definitive in-theater care. The UH-60M would provide short-distance aeromedical evacuation, and the mission of the fixed-wing C-130 aircraft was primarily the intra-theater transfer of casualties. This model is challenging in AFRICOM; while air superiority exists in theater, the nature of the activities and sheer geographic size demands that evacuation assets have a smaller footprint with the capability to cover more considerable distances. The requirements of the UH-60M/C-130 model, classically used in CENTCOM, can be met by a CH-47/C-130 model, which could augment UH-60Ms to provide DCR/DCS aeromedical evacuation and intra-theater rotary-wing critical care air transport platform.

Prior CH-47 Medical Uses

The U.S. military classifies the CH-47 as a cargo and heavy lift transport helicopter that can be used as an ad hoc casualty evacuation (CASEVAC) platform during unexpected mass casualty events.[17] However, the CH-47 has been used by the Canadian and British militaries to field the Medical Emergency Response Team (MERT).[18] This aeromedical platform was used by the British Armed Forces in Afghanistan[19] and by the Canadian Armed Forces during Operation Presence in Mali.[20]

Conventionally, the British fielded the MERT with a flight nurse and flight paramedic; however, they introduced the MERT-E model with an in-flight physician in 2006, which improved patient survival.[21] Including an emergency or anesthesiology-trained physician within the MERT-E enabled a "scoop and play" formula of medical care, where resuscitation measures could begin during transport.[22] Furthermore, the addition of other advanced providers facilitated triage, medical decision-making support, and leadership capabilities in-flight.[21]

Overall, patients with less severe injuries showed no differences between the various transport platforms, but those patients with severe but survivable injuries had decreased mortality with physician-assisted transport.[23] Specifically, the British MERT-E platform showed improved patient mortality and hemodynamic stability with resuscitation using blood products.[24,25] Beyond administering pre-hospital blood products, MERT-E allows for the placement of advanced airway devices in trauma patients with the presence of a consultant-grade anesthetist.[26]

Similarly, after-action reports from the U.S. military's elite Surgical Resuscitation Teams showed that physician-supplemented teams could augment Military Treatment Facilities (MTFs), offer medical assistance during transport from other evacuation platforms, perform critical care transport between MTFs, or provide in-flight damage control care at the point of injury (including procedures such as resuscitative thoracotomy, laparotomy, and extremity fasciotomy).[27] Less commonly, the CH-47 has even been used by the United States Air Force Tactical Critical Care Evacuation Teams (TCCETs); these teams include a critical care or emergency physician, a certified registered nurse anesthetist, and an emergency room nurse to provides critical care at the point of injury from rotary-wing aircraft.[28]

In 2011, the Defense Health Board recommended that the U.S. develop advanced TACEVAC care capability modeled off of the MERT approach using the most capable platform, such as the CH-47.[29] In 2023, the director of the Medical Evacuation Concepts & Capabilities Division similarly advocated for CASEVAC considerations to be explicitly "planned, synchronized, trained and rehearsed" to meet the evacuation needs of future battlefields.[30] Despite the aforementioned successes and these decade-old recommendations, the U.S. military has yet to officially adopt the CH-47 to be explicitly used for MEDEVAC or TACEVAC.

Unique Benefits of the CH-47

Compared with the UH-60M, the CH-47 has increased capabilities to accommodate far-forward care delivery while providing ICU-level treatment in-flight across large geographic distances in AFRICOM (Table 1). These advantages include a larger fuselage space to increase the number and technological capabilities of medical providers, a higher lift capacity for the transport of critical care resuscitative medical equipment, the ability to transport more combat casualties per flight—up to 24 litters or 33 fully equipped ground troops, compared with four litters or 11 fully equipped ground troops—and a faster cruising speed to maneuver throughout the battlespace.[31,32] The CH-47's ability to accommodate a larger medical team footprint and increased life-saving equipment allows for a higher level of trauma and resuscitative management while en route to the next role of care. Furthermore, the confined space of the UH-60M has been shown to increase the risk of lower-body injury, partly due to awkward positions in the aircraft, so using CH-47s in rotation with UH-60Ms could reduce this risk.[33]

The CH-47's expanded and modular fuselage allows a variety of configurations that are critical for pre-hospital trauma and resuscitative care or useful for rotary-wing critical care air transport. Table 2 shows a possible basic equipment list for the CH-47 to accomplish either mission set. Additionally, the CH-47 could be outfitted with an internal bio-isolation unit to deal with patients affected by highly infectious diseases or bioweapons, both potential threats in AFRICOM.

The equipment could be stored within the labeled aid bags and hang bags of transported surgical team members and modulated onto a rail system within the fuselage of the CH-47 for ease of access, efficiency of use, and interchangeability between mission sets. An analogous rucksack system is depicted in Figure 1 (left) by the Canadian MERT.[18] Similarly, the U.S. Army provides an example in Figure 1 (right) of a modeled litter set up in a CH-47 with a potential medical equipment rail system within the fuselage. This modeled set-up has four

TABLE 1 *Technical Specification Comparison Between the CH-47 Chinook and UH-60M Blackhawk*[17,32]

Specifications	CH-47 Chinook	UH-60M Blackhawk
Fuselage length	30 ft, 9 in	12 ft
Fuselage width	7 ft, 6 in	7 ft
Fuselage height	6 ft, 5 in	4 ft, 6 in
Fuel capacity	1034 gal	360 gal
Cruise speed	120–140 kts	110–130 kts
Mission range	310nm	275nm
Max gross weight	50,000 lbs	22,000 lbs
Litter capacity	24	4
Non-crew fully equipped troop seating capacity	33	11
FY2020 cost requests	\$357.9 million	\$1,673.4 million

TABLE 2 *Basic Equipment List for Forward Aeromedical Resuscitative / Surgical Teams or Rotary-Wing Critical Care Air Transport Teams on a CH-47*

Forward Aeromedical Resuscitative / Surgical Team	Rotary-Wing Critical Care Air Transport Team
Oxygenation equipment	Oxygenation equipment
Anesthesia equipment	Anesthesia equipment
Anesthesia medications	Anesthesia medications
Analgesic medications	Analgesic medications
Cold-store whole blood	Cold-store whole blood
Rapid infusion devices	Rapid infusion devices
Blood gas analyzer	Blood gas analyzer
Hemodynamic monitoring	Hemodynamic monitoring
Warming devices	Warming devices
Cricothyroidotomy set	ECMO equipment
Chest thoracostomy set	Intravenous lines
ER thoracotomy Set	Mechanical ventilators
Ultrasound machine	Burn management
Airway equipment	
REBOA catheters	

ECMO = extracorporeal membrane oxygenation; ER = emergency room; REBOA = resuscitative endovascular balloon occlusion of the aorta.

litters—equivalent to the UH-60M's capability—but can be increased to hold four more litters in the front of the aircraft for eight total, in addition to transporting multiple ambulatory patients. As a note, the CH-47's maximum capacity of 24 litters would be less functional for the provision of care, but decreasing it to eight would still exceed the UH-60M's capacity. Beyond equipment, the CH-47 could carry a larger aeromedical team optimized for either mission set—far-forward DCR/DCS interventions in pre-hospital environments or rotary-wing critical care air transport.

CH-47 Limitations

Although the CH-47 has advantages over the UH-60M, several limitations exist. First, it is resource-intensive to sustain normal CH-47 operations, including more fuel and maintenance per flight hour. The CH-47 also has a larger radar cross section and is susceptible to being targeted by advanced enemy radar and missile systems in flight. CH-47 aircrews also require a slightly larger landing area than the UH-60M because of the inherent size differences between airframes. While the UH-60M is much more versatile for use in urban combat, the rural terrain where AFRICOM operations are occurring might mitigate the downside of the lower maneuverability of the CH-47. Still, this limitation must be considered for kinetic operations that could arise in urban environments. Lastly, the larger equipment load of these potential medical teams will affect the range of the CH-47 in a similar capacity to the UH-60M, so this tradeoff for increased casualty care capabilities must be understood.

Conclusion

As the U.S. military shifts doctrinal focus towards INDOPACOM while retaining SOF in AFRICOM, leadership must also establish an effective plan for transporting critically injured casualties. Introducing the CH-47 into the U.S. aeromedical evacuation strategy for SOCAF personnel would add a specialized tool to the toolbox for medical evacuation, far-forward physician-augmented care provision, and critical care missions to improve survivability. The CH-47's larger fuselage, higher maximum gross weight, and faster cruising speed have contributed to decreased mortality in prior use cases, addressing gaps in prolonged field care to complement the UH-60M's capabilities. Successful utilization of the CH-47 in AFRICOM may even validate this capability in a lower-threat theater to forecast its utility in LSCO scenarios. Integrating the CH-47 would enhance—not replace—the current medical evacuation approach, offering multiple options to respond to the multifaceted challenges of modern warfare while furthering efforts to permit zero preventable battlefield deaths.

FIGURE 1 **LEFT:** *Rucksack configuration of medical supplies (Canadian MERT).* **RIGHT:** *Modeled 4-litter (U.S. Army).*

Author Contributions

RML, MHR, SSS, BJM, SLW, and MDA contributed to the manuscript's ideation, research, drafting, and revisions. All authors read and approved the final draft.

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References

1. **Remondelli MH, Remick KN, Shackelford SA, et al.** Casualty care implications of large-scale combat operations. *J Trauma Acute Care Surg*;95(2S Suppl 1):S180–S184. doi:10.1097/ta.0000000000004063
2. **Gibbs JM.** Army operational doctrine: too much LSCO and not enough bellum ligula: a monograph. US Army Command and General Staff College. Updated 2020. Accessed 2024. https://apps.dtic.mil/sti/trecms/pdf/AD1159085.pdf
3. **Atlamazoglou S.** US special operators and their allies say taking on Russia and China in Africa requires 'strange bedfellows'. *Business Insider*. July 23, 2021. Accessed 2024. https://www.businessinsider.com/us-special-operators-taking-on-russia-and-china-in-africa-2021-7
4. **Cronk TM.** Africa Command faces challenges across continent, commander says. U.S. Department of Defense. Updated April 7, 2016. Accessed 2024. https://www.defense.gov/News/News-Stories/Article/Article/715911/africa-command-faces-challenges-across-continent-commander-says/
5. **Turse N, Mednick S, Sperber A.** Exclusive: Inside the secret world of US commandos in Africa. *The Mail & Guardian*. August 11, 2020. Accessed 2024. https://atavist.mg.co.za/inside-the-secret-world-of-us-commandos-in-africa/
6. Hudson A. The Tyranny of Distance In Africa. *Air & Space Forces Magazine*. June 30, 2014. Accessed 2024. https://www.airandspaceforces.com/the-tyranny-of-distance-in-africa/
7. **Mouton CA, Chan EW, Grissom AR, Godges JP, Ahtchi B, Dougherty B.** Personnel recovery in the AFRICOM area of responsibility: cost-effective options for improvement. RAND Corporation. Updated August 27, 2019. Accessed 2024. https://www.rand.org/pubs/research_reports/RR2161z1.html.
8. **Carius B, Davis WT, Linscomb CD, et al.** An analysis of US Africa command area of operations military medical transportations, 2008-2018. *Afr J Emerg Med*. 2020;10(1):13–16. doi:10.1016/j.afjem.2019.09.005
9. **Schauer SG, April MD, Naylor JF, et al.** A descriptive analysis of casualties evacuated from the Africa area of operations. *Afr J Emerg Med*. 2019;9(Suppl):S43–S46. doi:10.1016/j.afjem.2018.09.004
10 Allen K. Drones and Violent Nonstate Actors. Africa Center for Strategic Studies; 2021. Accessed 2024. https://africacenter.org/spotlight/drones-and-violent-nonstate-actors-in-africa/
11. **United Nations Office for Disarmament Affairs. Eastern** African countries strategize on strengthening implementation of resolution to prevent the proliferation of weapons of mass destruction to non-State actors. United Nations. 2023. Accessed 2024. https://disarmament.unoda.org/update/eastern-african-countries-strategize-on-strengthening-implementation-of-resolution-to-prevent-the-proliferation-of-weapons-of-mass-destruction-to-non-state-actors/
12. **Psaledakis D.** US warns Wagner Group seeking arms, slaps sanctions on group's head in Mali. *Reuters*. May 25, 2023. Accessed 2024. https://www.reuters.com/world/us-imposes-sanctions-head-wagner-group-mali-2023-05-25/
13. **Kazmirchuk A, Yarmoliuk Y, Lurin I, et al.** Ukraine's Experience with management of combat casualties using NATO's fourtier "Changing as Needed" healthcare system. *World J Surg*. 2022;46(12):2858–2862. doi:10.1007/s00268-022-06718-3
14. **Mabry RL, De Lorenzo RA.** Sharpening the edge: paramedic training for flight medics. *US Army Med Dep J*. 2011:92-101.
15. **Barazanji K, Eslinger A, Brown D, et al.** USAARL Report No. 2015-07: Aeromedical Evacuation Enroute Critical Care Validation Study. U.S. Army Aeromedical Research Laboratory. Updated February 2015. Accessed 2024. https://apps.dtic.mil/sti/tr/pdf/ADA616947.pdf
16. **Barel O, Shapira S, Levinson L, Levite R, Barenboim E. Airmedical** evacuation during a mass-casualty incident in a remote location. *Prehospital and Disaster Medicine*. 2010;25(S1):S8–S9. doi:10.1017/S1049023X00021890
17. **Department of the Army.** TM 1-1520-271-10: Operator's Manual for Army CH-47F Helicopter (EIC:RCH). Army Publishing Directorate. December 18, 2023. Accessed 2024. https://armypubs.army.mil/ProductMaps/PubForm/Details.aspx?PUB_ID=84142
18. **Attariwala J.** Building a military aeromedical evacuation capability. *AirMed & Rescue*. June 1, 2021. Accessed 2024. https://www.airmedandrescue.com/latest/long-read/building-military-aeromedical-evacuation-capability
19. **Thomas A.** An overview of the Medical Emergency Response Team (MERT) in Afghanistan: a paramedic's perspective. *Journal of Paramedic Practice*. 2014;6(6):296–302. doi:10.12968/jpar.2014.6.6.296
20. **de Velasco S, Prentice B.** Call Sign "C-MERT": The development of the Canadian Medical Emergency Response Team. *Journal of Military and Strategic Studies*. 2023;22(3):209–220.
21. **Calderbank P, Woolley T, Mercer S, et al.** Doctor on board? What is the optimal skill-mix in military pre-hospital care? *Emerg Med J*. 2011;28(10):882–883. doi:10.1136/emj.2010.097642
22. **Knight RM, Moore CH, Silverman MB.** Time to Update Army Medical Doctrine. *Mil Med*. 2020;185(9-10):e1343–e1346. doi:10.1093/milmed/usaa059
23. **Morrison JJ, Oh J, DuBose JJ, et al.** En-route care capability from point of injury impacts mortality after severe wartime injury. *Ann Surg*. 2013;257(2):330-334. doi:10.1097/SLA.0b013e31827eefcf
24. **O'Reilly DJ, Morrison JJ, Jansen JO, et al.** Initial UK experience of prehospital blood transfusion in combat casualties. *J Trauma Acute Care Surg*. 2014;77(3 Suppl 2):S66–70. doi:10.1097/TA.0000000000000342
25. **Apodaca AN, Morrison JJ, Spott MA, et al.** Improvements in the hemodynamic stability of combat casualties during en route care. *Shock*. 2013;40(1):5–10. doi:10.1097/SHK.0b013e31829793d7
26. **Doyle L.** The creation of the Canadian Emergency Response Team (CMERT) from nascent concept to deployed reality. February 19, 2020. Accessed April 30, 2024. https://codachange.org/the-creation-of-the-canadian-emergency-response-team-cmert
27. **DuBose JJ, Stinner DJ, Baudek A, et al.** Life and limb in-flight surgical intervention: fifteen years of experience by joint medical augmentation unit surgical resuscitation teams. *J Spec Oper Med*. 2020;20(4):47–52. doi:10.55460/SI6S-XHCZ
28. **Bruno PG.** CCATT/TCCET Critical Care Air Transport Teams Tactical Critical Care Evacuation Teams. U.S. Air Force. Accessed April 17, 2022. https://www.amea.us/media/CCATT-by-Patricio-Bruno-DO.pdf
29. **Committee on Tactical Combat Casualty Care.** Tactical Evacuation Care Improvements within the Department of Defense. Defense Health Board. March 2011. Accessed 23 November 2023. https://health.mil/Reference-Center/Reports/2011/08/08/Tactical-Evacuation-Care-Improvements-within-the-Department-of-Defense
30. **Fricks SL.** Casualty Evacuation and the Army of 2030/2040 – Army aviation's vital role. Dedicated unhesitating service to our fighting forces association. March 31, 2023. Accessed 2024. https://dustoff.org/casualty-evacuation-and-the-army-of-2030-2040-army-aviations-vital-role/
31. **Department of Defense.** Technical Manual Operator's Manual for Helicopters, Utility Tactical Transport UH-60M ((NSN 1520-01-492-6324) (EIC: RSP) HH-60M (NSN 1520-01-515-4615) (EIC: RSQ). Army Publishing Directorate. April 30, 2023. Accessed 2024.

https://armypubs.army.mil/ProductMaps/PubForm/Details_Printer.aspx?PUB_ID=1027003

32. **Department of Defense.** Program Acquisition Cost by Weapon System – United States Department of Defense Fiscal Year 2020 Budget Request. Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer. March, 2019. Accessed 2024. https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2020/fy2020_Weapons.pdf

33. **Conti SM, Kroening LR, Molles JJ, Davenport ML, Kinsler RE, Lloyd AL.** Optimal physical space for en route care: medic posture and Injury survey. *Mil Med*. 2021;186(Suppl 1):305–310. doi:10.1093/milmed/usaa223

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