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From Hours to Minutes: Transforming Air Movement Planning in Army Aviation

With effective and timely planning of such missions, Army Aviation creates a significant tactical advantage over the enemy.

Air assault missions are characterized by their complexity and coordination; these maneuvers require a massive collaborative effort involving various personnel, each providing a specific contribution toward the mission's success.

Air movement operations represent the majority of combat aviation activities, driven by the high demand from troops needing rapid movement across the battlefield. Furthermore, air movement operations require agile planning that prevents the “all hands-on deck” mentality of air assault missions. A proficient helicopter

crew can arrive just hours before take-off, receive their air mission requests (AMRs) and routing from the aviation mission planners, complete the necessary preparations, and execute the mission. Aviation mission planners work behind the scenes where the air crew is usually unaware of the effort required.

Problem: Aviation mission planners' objectives are to rapidly develop effective assignments of AMRs to helicopter teams and generate the best route for each aircraft. Air mission request planning is a complex task that requires tracking each crew member's flight time by hour and mission type. Additionally, the planners must weigh mission priorities, allocate required activities to available resources, verify available routes, and conduct feasibility checks on potential execution schedules. The current process for aviation mission planners takes several hours to complete. This process considers priority levels, locations, number of personnel, and pickup/drop-off time windows. Time is a high priority, with rapid production of good plans yielding an operational advantage. Any resource that could shift planner effort from plan construction to

Background: Army utility and cargo helicopters are crucial, yet limited, assets in the execution of air assault and air movement missions.

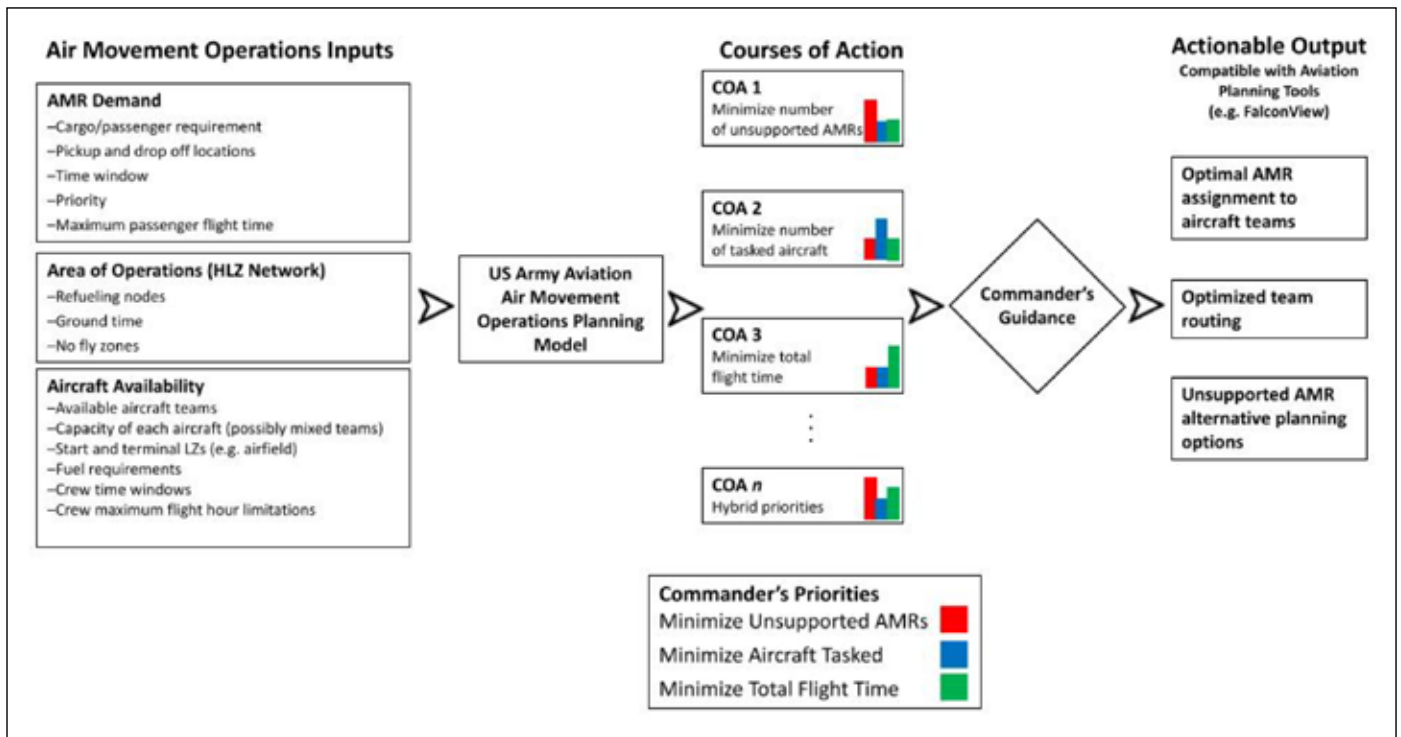


Figure. Model's inputs and outputs (Nelson et al., 2022).



U.S. Army Soldiers conduct air assault operations in South Korea. U.S. Army photo by SGT Alexander Knight.

schedule evaluation and optimization could yield better overall efficiency and quality of air movement operations.

Process: The *Aviation Digest* article by Nelson et al. (2022), “Army Aviation Air Movement Automation for the Mission Planner,” proposed developing a user-friendly planning model (Figure) to empower AMR planners to function more efficiently. U.S. Army researchers, in coordination with academia, have completed a recent proof of concept that fulfills this initial vision. In collaboration with military aviators, these researchers developed an algorithm designed to efficiently assign AMRs to aviation teams and optimize their routing.

This system is built to empower human planners by enhancing their decision-making through interaction, rather than replacing them. In its final form, the researchers envision planners uploading AMRs—in Excel or other format—for preprocessing. The planning model will then output several courses of action (COAs) that consist of AMRs’ assignment to helicopter teams, as well as helicopter team routing, ensuring fuel, capacity, and time window limitations are not exceeded. Planners can then accept or augment COAs for further

improvement. The final assignment and routings will then output in a user-friendly format compatible with aviation mission planning tools.

In the model’s current form, the following simplifying assumptions are made:

Number of AMRs	Number of Helicopter (UH-60) Teams	Number of HLZs (total)	Number of HLZs with fuel	Average Solution Time
100	10 teams	10	5 of 10	22 minutes

Table. Model performance summary (Nelson et al., 2025b).

Table. Model performance summary (Nelson et al., 2025b).

1. Helicopter capacity is limited by passenger seats. Cargo weight and volume must be converted to passenger equivalency.
2. Each AMR has a single time window in which it is to be picked up from its pickup location and delivered to its destination.
3. An AMR is defined as a set of passengers with a shared pickup and drop off helicopter landing zone (HLZ), time window constraint, and priority level.
4. Service time (ground delay) is a function of the HLZ and includes time to refuel at HLZs with fuel services.

The model has the capability to shorten plan construction from many hours to just a few minutes. This capability pro-

vides many benefits, enabling the planners to take system output and blend it into the desired execution schedule. Users provide mission specifications, enabling the system to use established assignment and routing methods to produce an initial solution. The air

movement-specific techniques are then applied to search for improved plans.

Real-world considerations include multiple refuel nodes, minimization of unsupported demand by priority level, AMR time windows, aircraft team time windows/maximum duration, and passenger ride time limits. The inputs can be grouped into AMR Demand, Area of Operations (HLZ Network), and Aircraft Availability. The system balances three commander priorities: maximizing supported AMRs, minimizing aircraft utilization, and minimizing total flight time. These priorities can be tuned up or down as needed. The model can generate multiple viable options, allowing AMR planners to use



The 2-82 Assault Helicopter Battalion participates in a mission brief ahead of an air assault mission. U.S. Army photo by CPT Shervon Pope.

this output to plan better air movement missions more rapidly.

Performance: This system has been tested and improved to reduce computation time and provide multiple COAs based on adjustable parameters. A developed experimental design process can optimize these parameters for a given environment.

The system was tested in high-density (urban) and low-density (rural) environments. In HLZ-dense environments, it provided superior AMR support. In areas with fewer HLZs, the utilization of high-cost helicopter teams (e.g., standby or reserve helicopter teams) was reduced. These improvements help preserve scarce Army Aviation maintenance personnel and resources while enhancing the support provided to the units involved. As shown in the Table, the system processed scenarios with 100 AMR requests and gave feasible AMR assignment and team routing solutions in an average of 22 minutes.

The system is flexible and can be adjusted to accommodate bulk assignments for an aircraft fleet, helping to minimize the helicopter teams needed. Overall, the versatility and efficiency of this system enable both resource allocation optimization and support effectiveness assistance for military operations across diverse environments.

Future Steps: The methodology and proof of concept algorithm is now available for Army Aviation to consider and pursue for future development, including potential integration with aviation planning tools (e.g., FalconView).¹ Having funded this research, the U.S. Army already owns the intellectual property for this model. For more information regarding the model, reference Nelson et al. (2023; 2025a).

The planning model can have an immediate impact by reducing time planning, providing route generation, and maximizing resources. Ultimately, the suc-

cessful integration of these systems can revolutionize air movement operations, ensuring that Army Aviation can deliver timely and practical support to troops when needed.

Biographies:

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¹“FalconView is a Windows mapping system that displays various types of maps and geographically referenced overlays” (National Geospatial-Intelligence Agency, n.d.).