



Artemis II Medical Operations Integration – From Design to Flight



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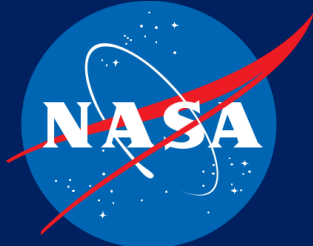
NASA Johnson Space Center, Houston, TX

Background: The Artemis II crew health systems development started numerous years prior to the actual mission. In this presentation, a review will be held on select lessons learned from the period covering medical system design and mission preparation. These lessons will include a review of key milestones achieved and discussing how requirements for topics such as launch and landing day operations, medical system design, and life support systems, were ultimately translated into meeting the crew health and performance needs of the planned mission.

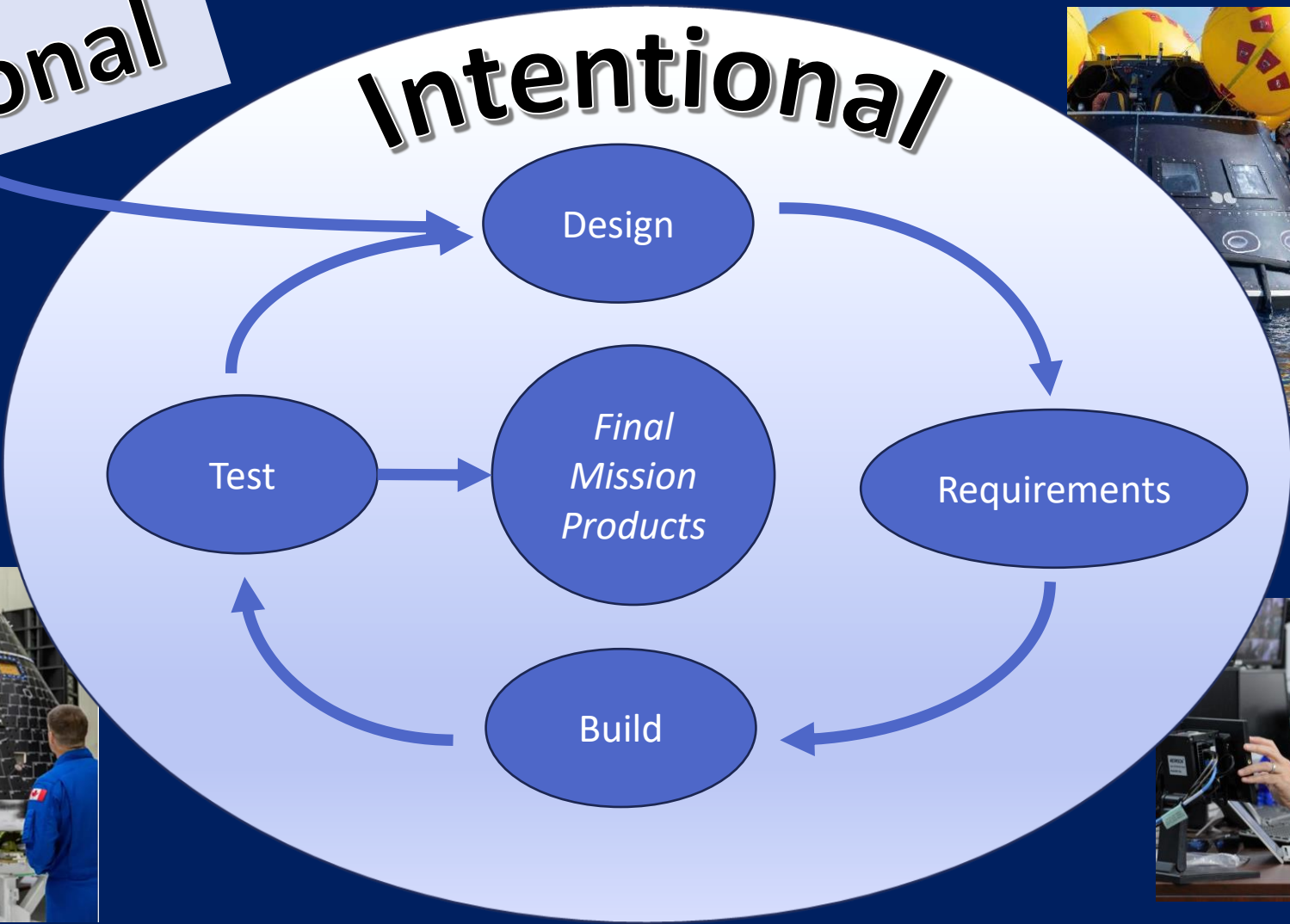


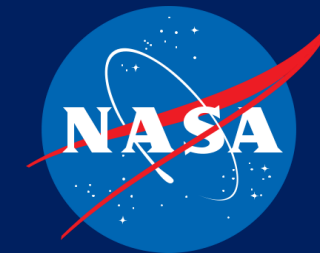


Mission Evolution: Intentional & Operational



Operational





Many Milestones – to name a few...

Event	Dates	Purpose	Participants	Resources/Assets
Day of Launch Conops Training (Johnson Space Center)	2023 - 2026	Practice nominal ingress and emergency capsule egress modes	Launch Team Leads, Flight Crew, Closeout Crew, Pad Rescue Team, Suit Team	Orion Mockup
Integrated System Verification and Validation Tests (Kennedy Space Center)	2023 - 2024	Demonstrate nominal and emergency launch day operations	Launch Team Leads, Flight Crew, Closeout Crew, Pad Rescue Team, Suit Team, Training reps	Crew Quarters, Suit Room, Crew Transport Vehicles, Mobile Launcher
Countdown Demonstration Test (Kennedy Space Center)	2025	Full Launch Day Rehearsal	Launch Team, Flight Crew, Closeout Crew, Pad Rescue Team, Suit Team, Training reps	Launch Center, Orion Vehicle w/ SLS in Vehicle Assembly Building
Neutral Buoyancy Lab (NBL) Crew Recovery Diver Training (Johnson Space Center)	2023 - 2026	Identify, practice, and demonstrate methods for crew recovery	NASA Recovery Team Leads, Navy and Air Force Divers, Flight Crew	Orion Mockup in NBL and capsule/crew recovery hardware
Underway Recovery Tests (Naval Base San Diego / Pacific Ocean)	2014 - 2025 <i>(Pre-Dates Artemis II Crew Assignments)</i>	Test and validate recovery requirements for the crew capsule and the flight crew from the open water	NASA Recovery Team, Navy and Air Force Recovery/Rescue Team, Flight Crew, Flight Operations Team	Navy Ship and support boats, Orion Mockup, Air Assets, Medical Bay with Equipment

Medical Team Supported All Events!



Crew Time on Back (CTOB)



Anticipated extended periods of CTOB at launch drove implementation of mitigations

- Requirement of 5 hours, 15 minutes total for a launch attempt
- Worked with suit team to trial out crew on back for extended periods
- Launch control team granted establishment of a deputy crew surgeon position in Launch Control Center (LCC) to monitor CTOB and receive a call from flight crew on the launch pad if needed

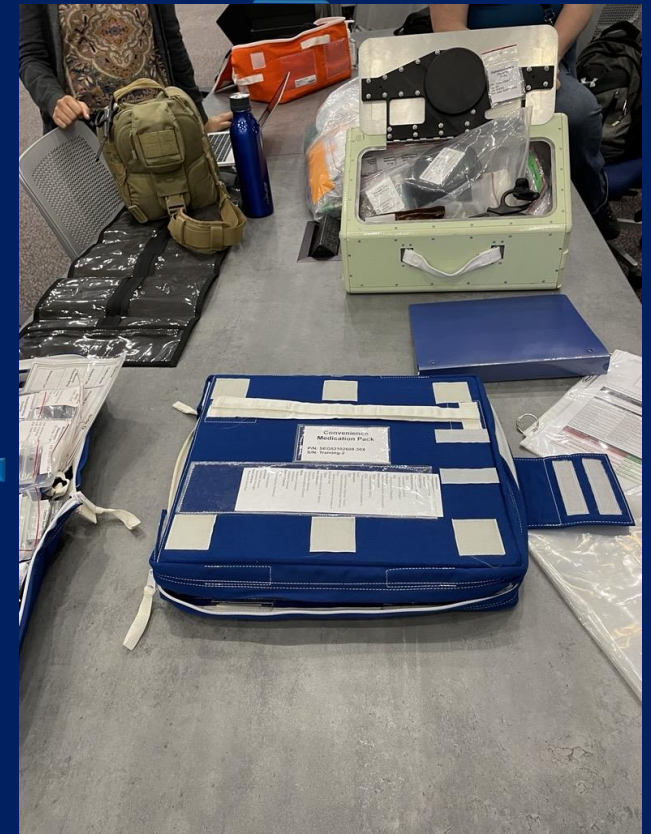
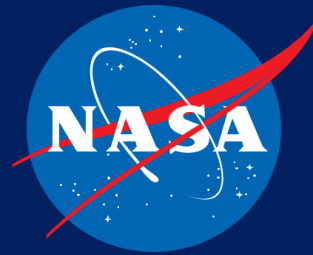


LCC – Kennedy Space Center





Orion Medical Kit Changes





Oxygen in an Emergency Suited Return Case

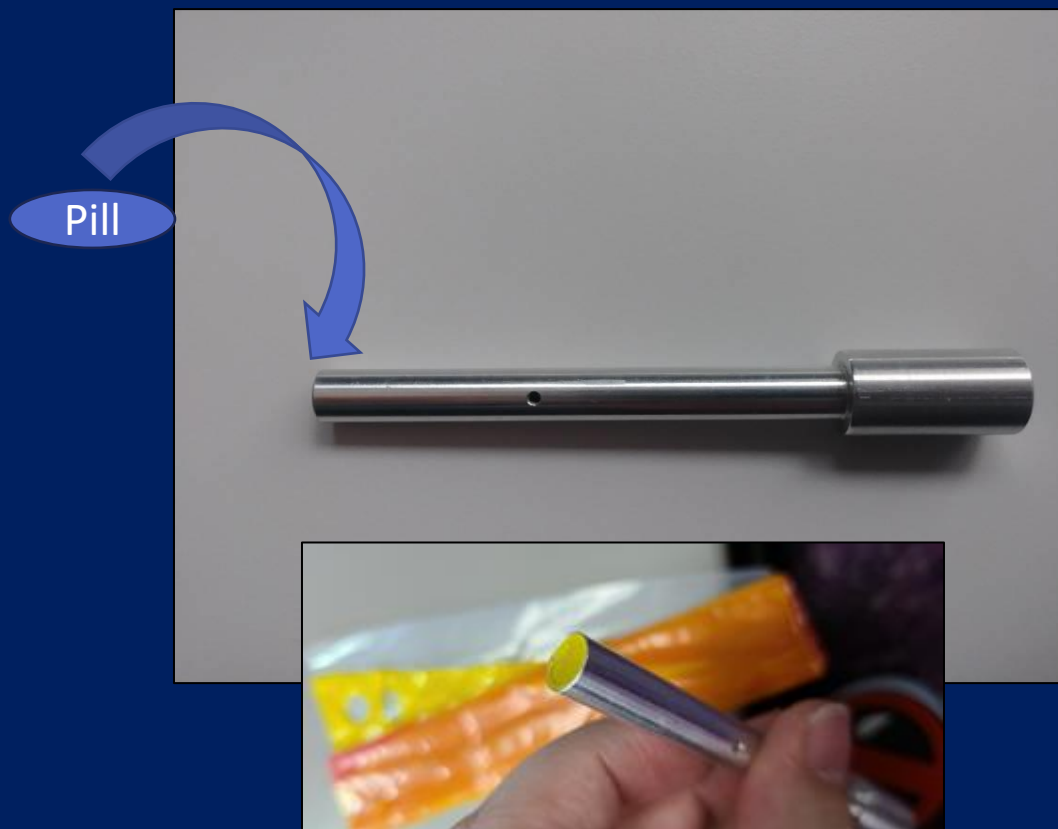


- Crew metabolic rates for up to a 6-day suited contingency return were initially defined by engineering assuming completely healthy crewmembers
- However, metabolic revisions and oxygen needs were refined to include possibility of:
 - Illnesses such as skin & urinary tract infections
 - An assumption that every crewmember would experience some degree of deconditioning during the suited scenario
 - Shortened and altered sleep
- The unanticipated oxygen utilization was added back into the estimation of needed to cover a suited return



Test Like you Fly – Suited Medication Access

- Initial human in the loop testing could have been more extensive to drive out design changes ultimately requested by flight crew





Sim Like You Fly – Landing Day Scenarios





Thank You!

