



ADVANCED EXPLORATION SYSTEMS

CLOSE OUT REPORT JANUARY 2018

REV 0

*Exploration Docking Hatch
David Hall/JSC
Habitation Domain*



David Hall | JSC EA52 | 281.483.9781

January 2018 – Rev 0 – EDH AES Close Out Report



2017 was the delivery year for Exploration Docking Hatch. The customers' return on investment is realized this year.

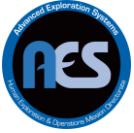
Note:

There are patent proceedings in process to protect several technologies developed in the course of this project. Because of this, and to prevent an SBU classification, there are no design details or design graphics included in this presentation.





Project Objectives



Achieve significant and measurable progress on the advancement of a light weight docking hatch that:

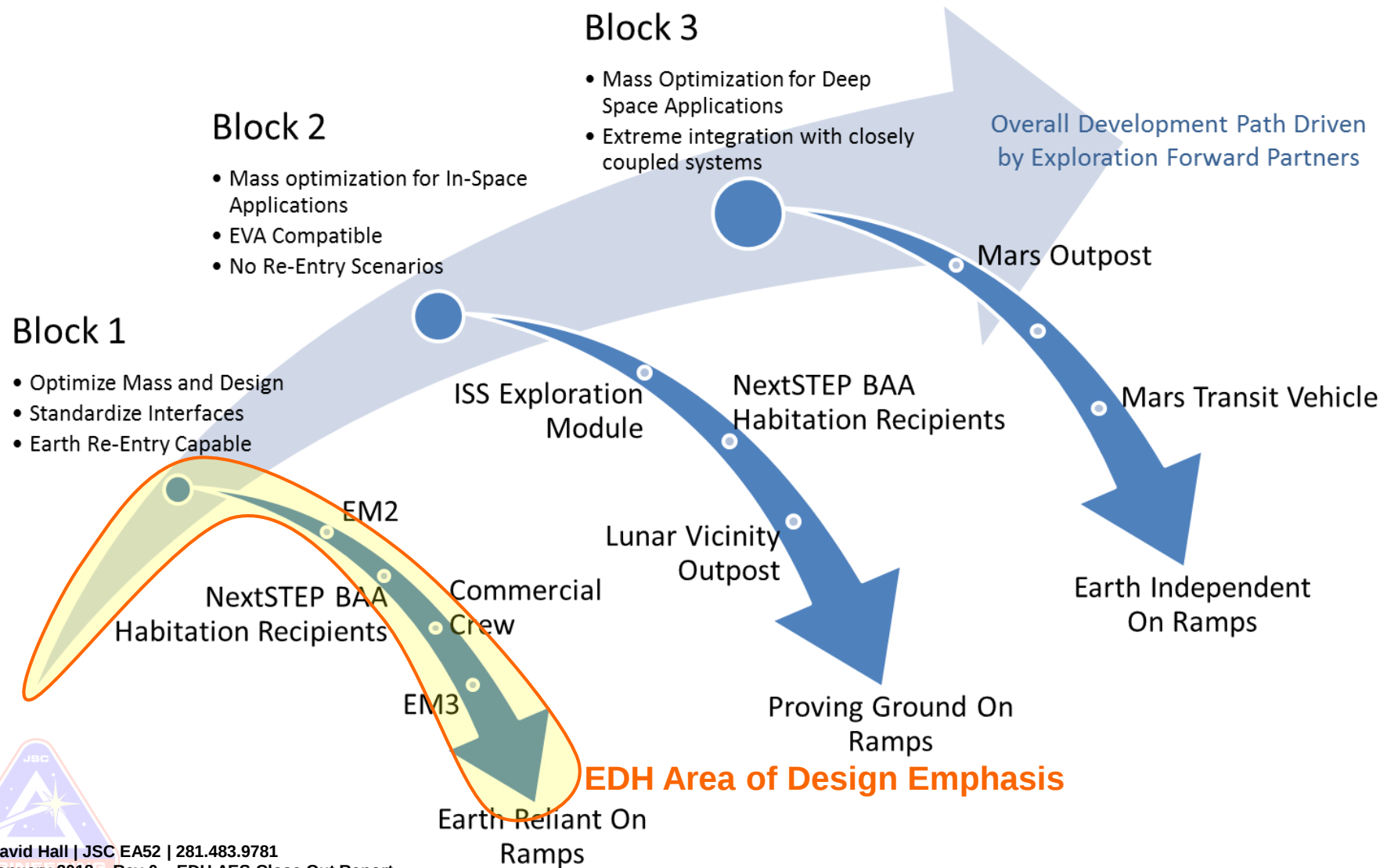
- Can be cleanly transferred to other NASA endeavors (such as NextSTEP BAA awardees, Commercial Crew, International Partners, etc.).
- Takes meaningful steps toward an advanced hatch applicable toward deep space exploration goals.

This is achieved by progressing along the EDH Development and Extensibility Strategy allowing AES to transfer flight pedigree technology at a shared cost level.



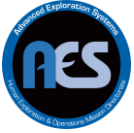


Project Objectives: EDH Extensibility Strategy





Project ROI



Project Lifecycle Investment	AES	Total
Procurement Cost	\$591k	\$2,506k
Civil Servant Labor	32 FTE	37 FTE
Schedule Time	3.5 yrs	

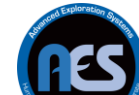
Results and Deliverables

- Optimized, Tested, Flight-Fidelity Docking Hatch and MPEV Design
 - Mass down 51# from previous design
 - Pressure capability up 61% from previous design
 - Leak rate >100x below requirement
 - 100% Drawings and 100% Stress Analysis Reports at CDR
- Flight-like Hatch development unit
- Flight-like MPEV development unit
- Docking Hatch Standard strawman





Docking Hatch Comparisons

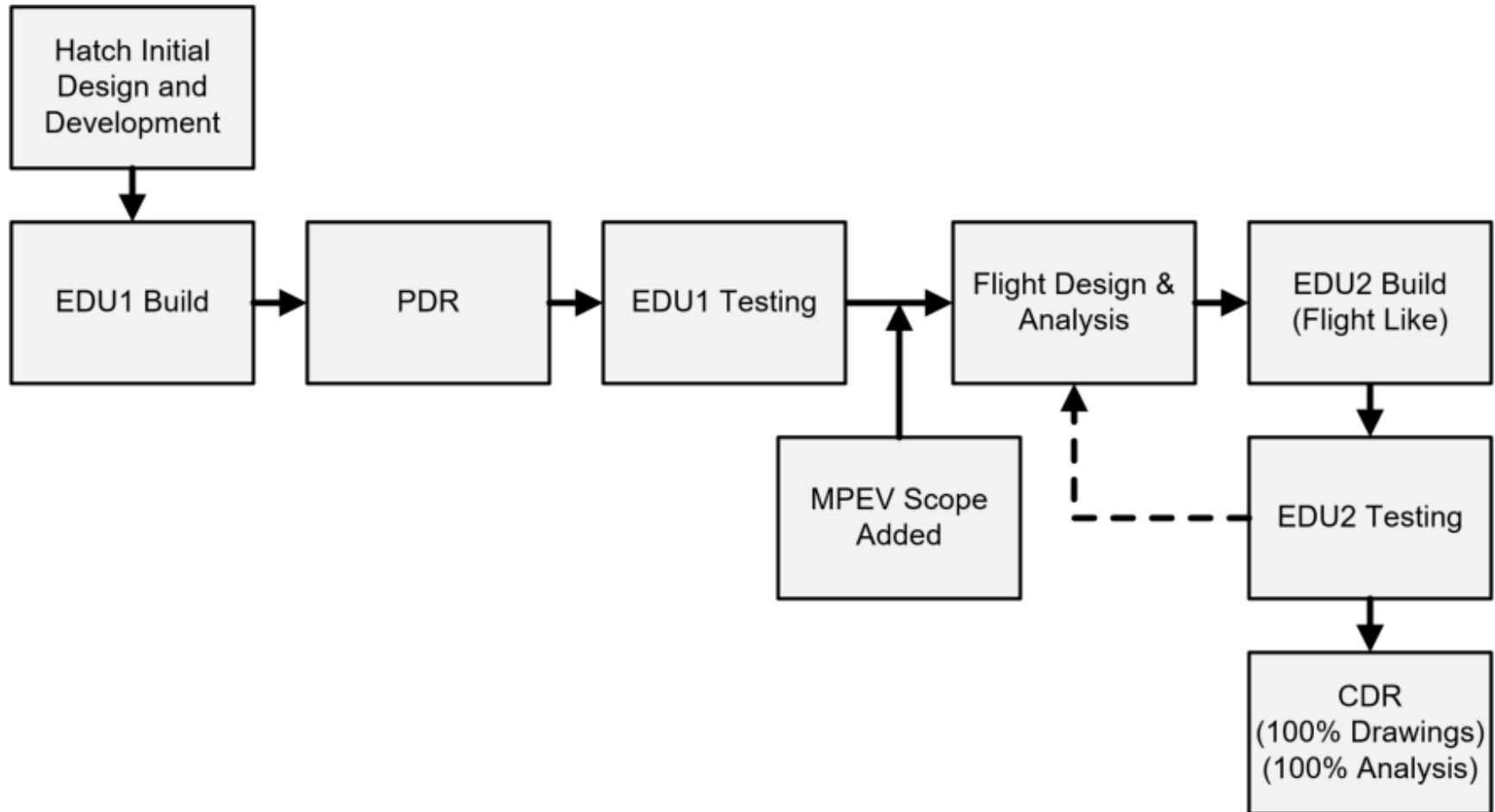


Attribute	Apollo	Orion	Commercial Crew	Habitat	EDH
Leak Rate	No info available	0.08 lbm/day	No info available	Similar to or less than Orion	< 0.0007 lbm/day
Thermal Envir.	?F to 200F	35F to +135F	Expect less severe than Orion	Expected to be more severe than Orion. Expect heater use at low end temp	15F to 153F
Radiation Envir.	Not considered?	Deep Space	Low Earth Orbit	Deep Space	Deep Space
+ Diff. Press.	+8.6 psid	+15.55 psid	Expect similar to Orion	+15.55 psid	+15.55 psid
- Diff. Press.	-13.3 psid	-12.1 psid	Expect similar to Orion	-2.0 psid; TBD	-12.1 psid
Maximum Accel Loads	Parachute water landing. Launch Abort?	53g axial 42g radial	Parachute water landing? Ground landing? Launch Abort?	No landing loads. No launch abort.	54g axial 43g radial
Mass (incl. Window, TPS, & supporting equip.)	Final mass unclear. 110 lbm in SAR. No window, valves, or lowering hardware.	153 lbm legacy design (+mass growth due to not meeting psid reqmts)	No info available	Target 80 lbm	102 lbm
Passage Diameter	711 mm (28")	813 mm (32")	813 mm (32")	1000 mm (39.4")	813 mm (32")
Operational Life	Single use	300 cycles with ground maintenance	No info available	Repetitive use over several years with only on orbit maintenance	Tested with over 1200 continuous cycles with no operational degradation





Summary of EDH Activities

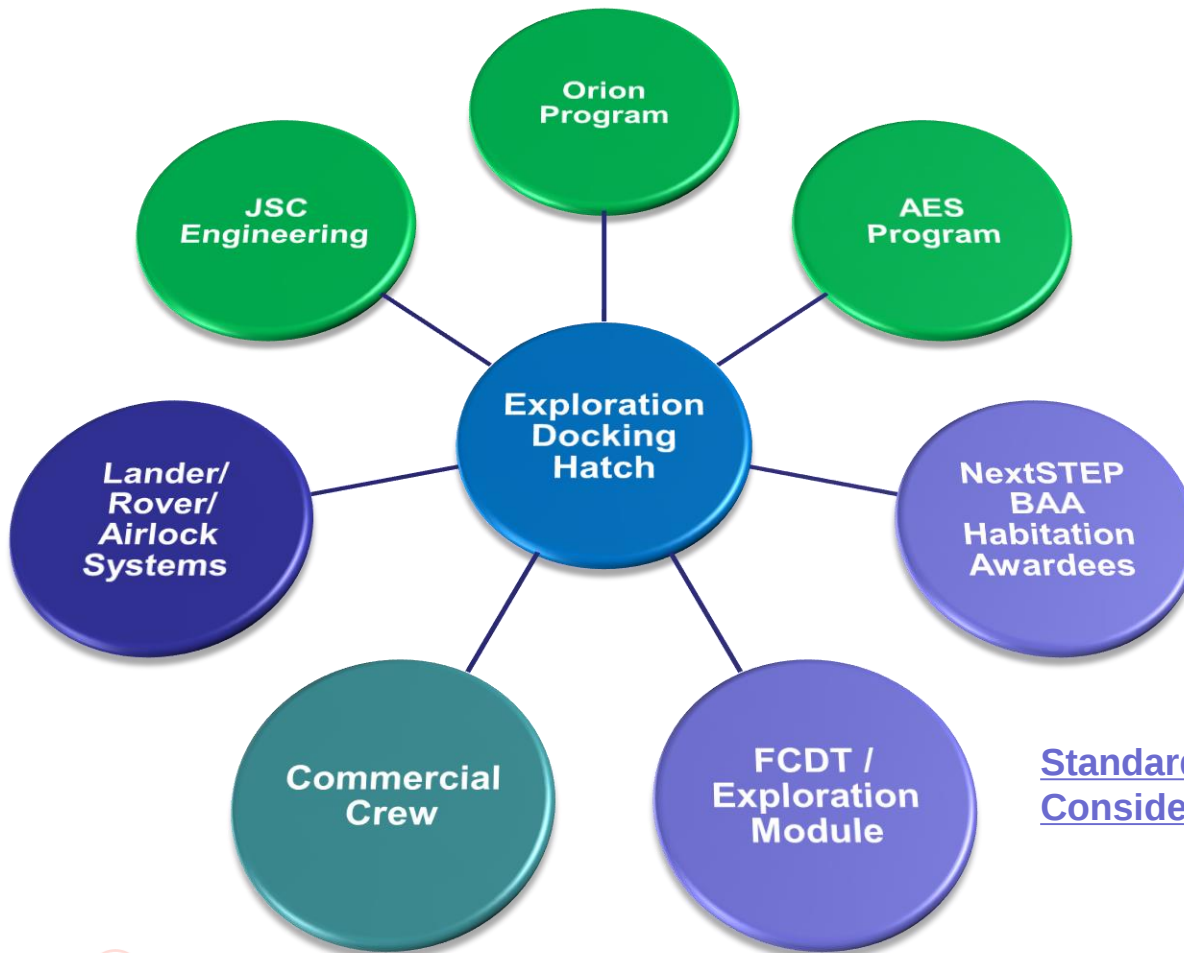




Partnerships



Customers / Technology Owners



Benefits of Partnering

- Cost Efficiency
- Schedule Efficiency
- Clear, Distinct Interfaces
- Common Design Benefits
- Commonality in Use (Standardization)

Standard, Design Considerations & Guidelines

Design Reuse



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Partnership Activities



Deliverable From Project	Description	Benefactors
Docking Hatch Design Standard	- Provides design guidance, considerations and lessons learned. - Provides a starting point for the user community to converge on a hatch standard or set of standards.	Cis-Lunar Habitat "Consortium"
Docking Hatch Flight Design Transfer	- Straight usage/transfer of the docking hatch design for use on partner vehicles. - Legal proceedings are in progress targeting 6 patents to cover innovative technologies developed in the course of the project. - Preserves design technologies for open source usage.	Commercial Crew Partners

