

Unclassified (U)



EFV Lessons Learned Studies & Investments



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Agenda

- High Water Speed (HWS) Challenges
 - EFV Background
 - Capability Comparisons
 - Complexity to Get On-Plane (video)
- HWS ACV Trade Study
- PM AAA Technology Investments
 - Hydrodynamics
 - Alternative Power Train



High Water Speed Expeditionary Fighting Vehicle Background



- Marine Corps has desired high water speed amphibious vehicle capability for many decades.
- S&T activities were conducted from 1980s to early 1990s
- Became Acquisition Program of Record 1995 to 2011
 - Called Advanced Amphibious Assault Vehicle (AAAV) then EFV
- Original acquisition objective: 1013 platforms
- \$14B acquisition program
- Nineteen (19) prototypes built



Capability Comparisons

AAV7A1 RAM/RS	CAPABILITY	EFV
7 Knots	Max Water Speed	25 knots
Displacement	Watercraft Type	Semi-Planing
>12 NM	Launch Distance from Shore	12-25 NM
200 miles @ 25 mph	Range (Land Only)	250 miles @ 25 mph
58,105 lbs	GVW (with Embarked Troops)	78,200 lbs
525 HP	Required Horsepower	2750 HP
3 & 21	Crew & Troop Capacity	3 & 17
27'	Length (Land/on Ship)	30'10"
12'	Width (on Ship)	12'
11'	Height (on Ship)	10'
Turret, Unstabilized, Dual Mk 19 AGL/M2 .50 cal	Weapons System	Turret, Stabilized, 30mm, Coaxial 7.62
1972	IOC	



Current AAV7A1

Cancelled EFV



Complexity to Get On-Plane



Video

- Retracting Tracks
- Chine System
- Moving Appendages
 - Bow
 - Track Cover Doors
 - Transom Flap



Expeditionary Fighting Vehicle Lessons Learned



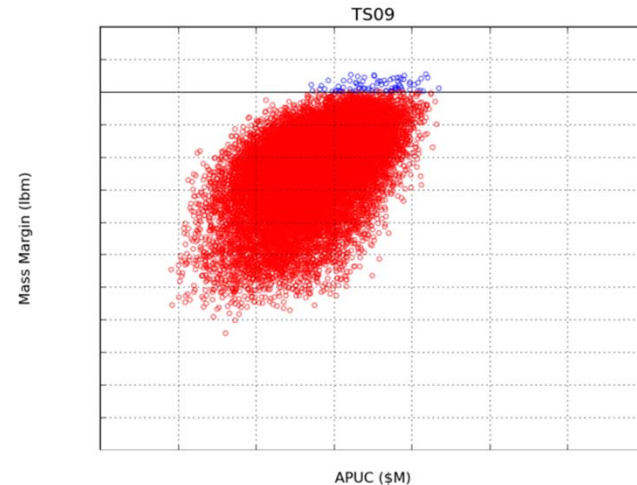
- EFV achieved high water speed but:
 - Complexity due to water performance drove cost
 - Vehicle was weight critical
 - Weight to get on plane required use of expensive materials
 - Weight not as critical on land
 - Power for water mission 3X that required for land mission
 - Underbody protection requirements grew
- 2011: EFV program cancelled due to affordability. Amphibious Combat Vehicle (ACV) replaced but was a low water speed vehicle
- 2013: Marine Corps established a cross functional project office to look at options for a High Water Speed (HWS) ACV



HWS ACV Trade Study



- Identified Vehicle Design/Cost Drivers
 - Number of troops
 - 14 or 17
 - Protection/Armor
 - Under body
 - Direct Fire
 - Weapons Systems
 - 50 Cal up to 30mm
- Not all Desired Configurations were Feasible
 - Weight to get on plane limited options
- Invested in reducing weight and getting more weight on plane
 - Cost Benefit



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Hydrodynamic Investments



EFV



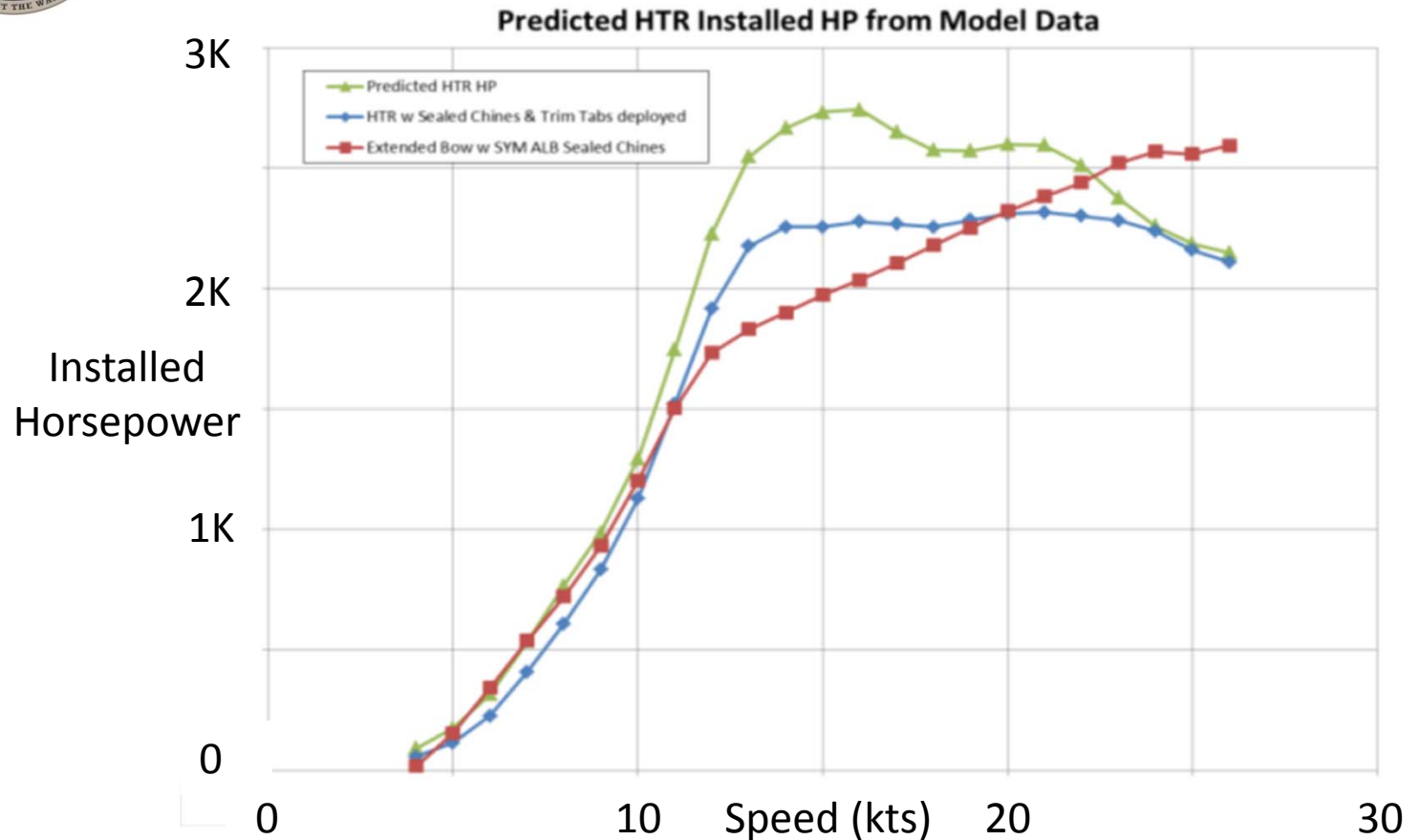
Model Testing – Extended Bow
& Aft Lifting Body



Full Scale Testing
Hydrodynamic Test Rig



Hydrodynamic Investments



PROs

- Allows more weight on plane
- Operation at lower speeds

CONs

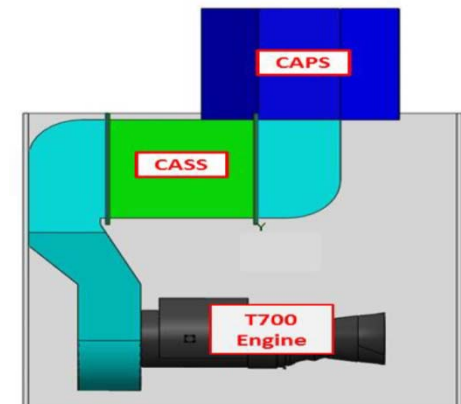
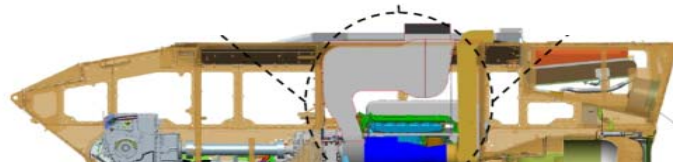
- More drag at higher speeds
- Doesn't reduce complexity



Alternate Power Train Studies



	Baseline	COA 1	COA 2	COA 3	COA 4a	COA 4b	COA 4c	COA 5
	Baseline	Dual Turbines	Single Turbine	Single Diesel (land) / Single Turbine (water)	Electric Drive w/ Dual Diesel Engines	Electric Drive w/ Dual Turbine Engines	Electric Single Diesel (land) / Single Turbine (water)	Dual Diesels in sponsons
Systems Packaging on EFV		Significant Interference with air system		Modified PTM	Significant Interferences	Significant Interferences	Significant Interferences	Repackaged Engines Modified PTM
Increase in Fuel Required for ~1st Mission Day	0%	98%	155%	8%	4%	98%	8%	4%
Volume (cu ft)	276.6	+ 135.7	+ 11.4	+ 37.4	+ 12.1	+ 124.3	+ 41.7	+ 22.2
Weight (lbs)	18,360	- 370	- 4,200	- 3,110	+ 1,790	+ 2,090	- 260	- 560
Readiness			TRL 6	TRL 6 by FY16			TRL 6 by FY16	



Significant Weight Savings with Turbine Engine