



Cost of Corrosion for Ships, Submarines and Naval Aviation



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Naval Systems Cost of Corrosion



- Why Corrosion? Why Now?
- Cost of Corrosion
- DON Corrosion Organization
- Cost by Platform
- Trends and Discussion



Why Corrosion? Why Now?

- Congressional Mandates (FY03 → Present)
 - ❑ OSD Senior Corrosion Official (2003)
 - ❑ OSD CPO Office Establishment (2008)
 - ❑ Military Department Corrosion Executives (2009)
- DoD Strategic Shift to Pacific Theater & Middle East
- Acquisition Excellence & Better Buying Power

Combined with



- Increased Demand Signal from Combatant Commanders
- Elevated Fleet OPTEMPO (Underway days +15% since 2000)
- Longer Deployments, Shorter Turnaround Times
- Reduction in Active-Duty Fleet (Fleet size -10% since 2000)

Resulting in



- Increased Maintenance Requirements
- Difficulty for Assets to Achieve Expected Service Life (ESL)
- \$7B Annual Cost of Corrosion
- Increased Oversight/Corrosion Assessments

“70% of Commissioned Fleet Will Still Be Active in 2020.”

VADM Burke, VADM McCoy, VADM Architzel Testimony on “Navy Readiness Posture,” 22 March 2012



DON Annual Cost of Corrosion: ~\$7B

Aviation



\$2.6B

A photograph of an F-35 fighter jet on a runway, viewed from a low angle. The jet is white with black markings, and the number "304" is visible on the side. It is positioned on a dark asphalt runway with a blue sky and distant mountains in the background.

Ships



\$3.1B

A photograph of a modern grey Littoral Combat Ship (LCS) sailing on the open ocean. The ship has a distinctive angular superstructure and is viewed from a distance, showing its full length and the wake it leaves in the blue water.

Ground Vehicles



\$0.5B

A photograph of a green military truck, possibly a Humvee, driving on a dirt road. The truck is loaded with supplies on its back and is set against a backdrop of dry, hilly terrain under a clear sky.

Facilities



\$0.6B

An aerial photograph of a large ship, likely a submarine, in a drydock facility. The ship is dark grey and is being worked on by several people. The facility includes large hangars and various pieces of equipment.

Future OSD Studies to Assess Availability, Safety, Additional Systems



DON Corrosion Organization

Secretary of the Navy (SECNAV)

Chief of Naval Operations (CNO)

Commandant of Marine Corp (CMC)

Assistant Secretary of Navy (RDA)

Assistant Secretary of Navy (EI&E)

Program Executive Officers

- JSF
- MRAP
- Ships
- C4I
- Carriers
- Tactical Air
- Unmanned Aviation & Strike Weapons
- IWS
- SSP
- Subs
- Space
- LCS
- EIS
- Land Systems
- Air ASW Assault & Special Mission

SYSCOMs

- NAVAIR
- NAVSEA
- NAVSUP
- NAVFAC
- SPAWAR
- MARCOR
- ONR
- USCG

Deputy Assistant Secretaries of the Navy (DASNs)

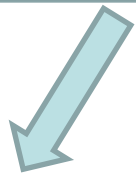
- Ships
- Management & Budget
- C4I/IO & Space
- Expeditionary Programs & Logistics Management
- Air
- International Programs
- Acquisition & Procurement
- RDT&E
Ms. Mary Lacey
- CHSENG
CAPT Peterson
- Corrosion Executive
Mr. Spadafora

Corrosion Cross-Functional Team



Corrosion Impact on Availability- SHIPS

Ship type	Number of occurrences	Maintenance action FY	Total maintenance cost	Total corrosion cost	Percent corrosion	Total availability days	Corrosion portion	Average corrosion days per availability
Amphibious	10	FY08	\$78	\$15	19%	997	186	18.6
Amphibious	16	FY09	\$301	\$75	25%	2,777	691	43.2
Amphibious	3	FY10	\$83	\$20	24%	470	114	38.1
Carriers	13	FY08	\$422	\$139	33%	1,803	593	45.6
Carriers	9	FY09	\$222	\$96	43%	1,147	498	55.3
Carriers	13	FY10	\$564	\$221	39%	2,368	926	71.2
Surface Warfare	42	FY08	\$382	\$48	12%	3,879	484	11.5
Surface Warfare	51	FY09	\$356	\$61	17%	5,028	861	16.9
Surface Warfare	26	FY10	\$227	\$38	17%	2,542	423	16.3
Submarines	7	FY08	\$337	\$77	23%	2,689	618	88.3
Submarines	15	FY09	\$1,812	\$458	25%	6,849	1,732	115.4
Submarines	9	FY10	\$958	\$163	17%	2,694	458	50.9
Total	214		\$5,742	\$1,411	25%	33,243	8,166	38.2



FY08-10: on average 25% of the cost and 38.2 days of an availability are expended on Corrosion.



Surface Ships, Carriers & Submarines

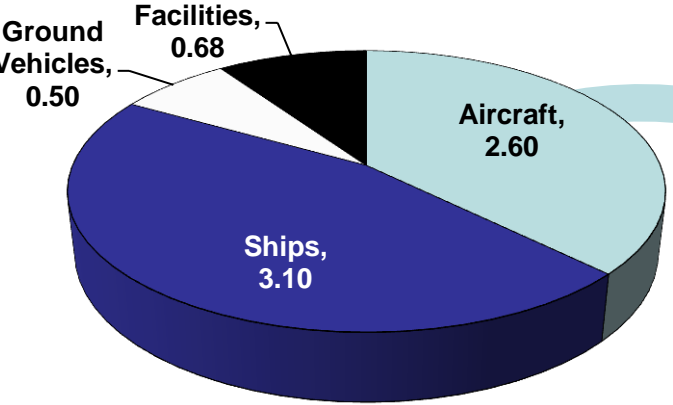
Study year baseline	Study segment	Annual cost of corrosion	Corrosion as a percentage of maintenance	Data
2005-2006	Army ground vehicles	\$2.0 billion	14.8%	FY2004
	Navy ships	\$2.4 billion	21.5%	FY2004
2006-2007	DoD facilities and infrastructure	\$1.8 billion	15.1%	FY2005
	Army aviation and missiles	\$1.6 billion	18.6%	FY2005
	Marine Corps ground vehicles	\$0.6 billion	20.8%	FY2005
2007-2008	Navy and Marine Corps aviation	\$2.6 billion	28.9%	FY2005 and FY2006
	Coast Guard aviation and vessels	\$0.3 billion	25.5%	FY2005 and FY2006
2008-2009	Air Force aircraft and missiles	\$3.6 billion	22.2%	FY2006 and FY2007
	Army ground vehicles	\$2.4 billion	14.3%	FY2006 and FY2007
	Navy ships	\$2.5 billion	20.3%	FY2006 and FY2007
	All other DoD segments	\$5.1 billion	22.1%	FY2006
2009-2010	DoD facilities and infrastructure	\$1.9 billion	11.7%	FY2007 and FY2008
	Army aviation and missiles	\$1.4 billion	20.5%	FY2007 and FY2008
	Marine Corps ground vehicles	\$0.5 billion	18.6%	FY2007 and FY2008
2010-2011	Navy and Marine Corps aviation	\$2.6 billion	26.1%	FY2008 and FY2009
	Air Force aircraft and missiles	\$4.5 billion	24.0%	FY2008 and FY2009
2011-2012	Navy ships	\$3.1 billion	19.0%	FY2008 thru FY2010
	Army ground vehicles	Pending		FY2008 thru FY2010
Total DoD annual corrosion cost		\$21.5 billion	22.4%	

From 2005 to 2012
Corrosion as a percentage of maintenance has steadily decreased.

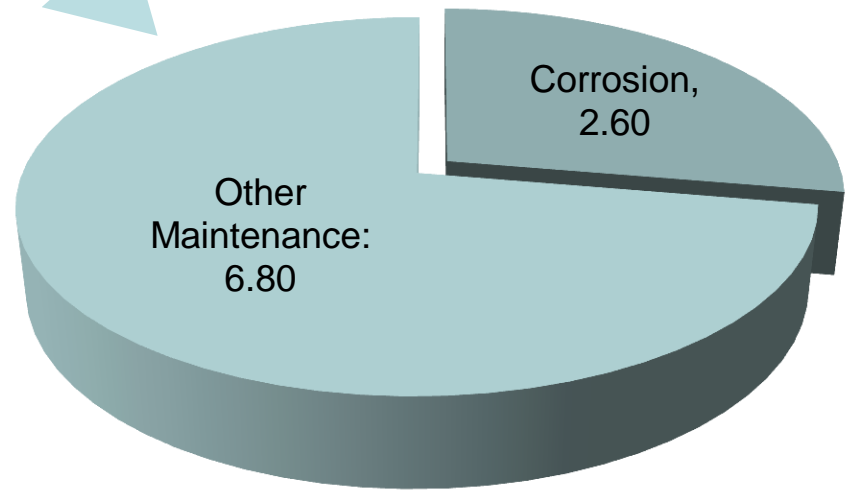


Impact of Corrosion on the NAE

Total Annual Navy Cost: \$7B



NAE FY09 Cost: \$2.6B



Corrosion accounts for 29% of the Navy and Marine Corps aviation maintenance cost



Impact of Corrosion on the NAE

Corrosion Impact on Total Non-Available days by TMS (FY2009)

TMS	Description	Total days		Percentage of total non-available days related to corrosion
		Non-available	Non-available because of corrosion	
SH-60B	Twin turbo shaft engine, multi-mission helicopter	27,331	8,229	30.1%
EA-6B	Twin-engine electronic warfare aircraft	18,940	4,751	25.1%
P-3C	Long-range, anti-submarine patrol aircraft	35,284	8,263	23.4%
CH-53E	Heavy-lift transport helicopter	27,572	6,175	22.4%
CH-46E	Medium-lift tandem rotor transport helicopter	22,672	5,064	22.3%
AV-8B	Vertical-lift aircraft	20,383	4,446	21.8%
MH-60S	Twin-engine medium lift utility helicopter	20,307	3,871	19.1%
AH-1W	Attack Helicopter	19,518	3,262	16.7%
FA-18C	Supersonic, carrier-capable multirole fighter jet	70,908	7,922	11.2%
FA-18F	Supersonic, carrier-capable multirole fighter jet	31,949	3,288	10.3%

Corrosion causes **69K** reported non-available days/year (**22.4%**) for all USN/USMC aircraft (based on FY2009 data)

Corrosion Impact on NMC days by Aircraft System (FY2009)

WUC	Description	Total NMC days	Total NMC days related to corrosion	Percentage of NMC days related to corrosion
3	Scheduled Inspection	10,855	4,357	40.1%
45	Hydraulic systems	12,870	3,774	29.3%
26	Vertical takeoff and landing/short takeoff and landing	11,874	3,423	28.8%
11	Airframe-structural components	31,694	8,965	28.3%
15	Rotary wings	21,483	5,549	25.8%
14	Directional flight	35,865	8,155	22.7%
46	Fuel systems	16,632	3,604	21.7%
42	Electrical power supply/distribution/lighting systems	18,729	3,718	19.8%
13	Alighting/launching systems	27,039	4,912	18.2%
41	Environmental control/pneumatic systems	14,608	2,366	16.2%

Source: LMI Report August 2011

Type/model/series = TMS
Work Unit Code = WUC



Trends & Discussion

- DON has existing statutory and regulatory requirements for corrosion prevention and control planning
- ~25% of DON maintenance expenditures due to corrosion
- Corrosion as a percentage of maintenance has steadily decreased since 2005
- Corrosion causes **69K** reported non-available days/year (**22.4%**) for all USN/USMC aircraft
- 25% of the cost and 38.2 days of a Ship availability are expended on Corrosion

It is clear that DON should continue to incorporate corrosion prevention and control early and throughout the acquisition and sustainment life cycles.