

Integrating Fall Protection in Design and Requirements to Reduce Lifecycle Cost and Increase Readiness

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Background

- Slips, Trips, and Falls have significant impact on operations and sustainment activities
- Cognitive Bias
 - We all have differing tolerance for fall hazard and all have experienced falls
 - What is tolerance level when designing/developing a system – Lowest common denominator? We may be unnecessarily exposing user and maintainer populations
 - How do we feel about standing on our roof at home?
- Individually - Low probability - Potential High Consequence
- Elements- Task, Height, Working Surface, Access, and Environment
- Fatal falls from operation and maintenance tasks since earliest history
 - Seaman Lymen Amsden, *USS Constitution*, fell overboard and drowned. 2 Sep. 1799.
 - Seaman John Robson, *USS Constitution*, fell from main yard into the sea and drowned. 18 Oct. 1799.



[Casualties: US Naval Personnel Killed and Injured in Selected Accidents and Other Incidents Not Directly the Result of Enemy Action](#)

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Scope of Problem

- Falls are always one of the leading causes of Lost Time Injury/Limited Duty
- Always in OSHA top ten for most violated standards
- DoD several OSHA Notice of Violations citing fall protection
- 2006 DSOC Military Injury Working Group report- Falls leading cause of hospitalizations for all services except USMC (2nd leading cause)
- Non fatal injuries of Military personnel deployed for combat operations 2001-2018, 10% were falls
- 50 year analysis of mishaps at sea
 - 75 falls from height on surface ships 59.2% mortality rate
 - 352 falls overboard 71.9% rate
- FY17-19 Navy MPHA Report - 865 personnel trained as Competent Persons, Fall Protection is not adequately addressed, (2097 falls, 901 reported)
[Injury trends aboard US Navy vessels: A 50-year analysis of mishaps at sea](#)

Scope of problem- continued

- 2023 Navy inspections are identifying many fall protection deficiencies (Local Area Assessments, IGs and audits)
- Executive Safety Review Board, Naval Aviation Enterprise: identified Fall Protection as a readiness degrader
- Leave to operational unit to figure out
- Solutions at Operational Level lead to non standard solutions and utilize a significant amount of resources to fix a problem (different phase stands at different locations for same platform - \$100M)
- Is available equipment the right equipment- B-stands
- Falls result in postponed or longer maintenance task,
- Time to figure out appropriate access also delays maintenance tasks
- Ladders require 3 pts of contact therefore a ladder to access anything other than a butterfly valve is a design failure

Hierarchy of Controls

- Hazard Elimination
 - Substitution
 - Bring Work down – hinged mast
- Passive Fall Protection –Handrails
- Restraint System
- Personal Fall Arrest System- Harness, Lanyard
- Administrative Controls



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Personal Fall Arrest System (PFAS)

- Four elements required
 - Full Body Harness
 - Connecting Device
 - Anchor
 - Rescue
- Challenges
 - Training- 8 hrs every 2 years
 - Supervision- 40 hrs of training
 - Anchors rated at 2 times Maximum Arrest Force
 - Professional Engineer trained as Qualified Person (additional 40 hrs of training)
 - Rescue System, Plan and Personnel
 - Replacement on average of every 5 years
 - Limitations of equipment 130-310 lbs



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Lifecycle Cost and Performance



20' Ladder

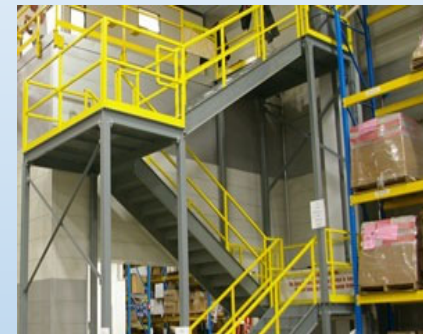
\$1000 Ladder
 \$500 Harness and Lanyard
\$2000 Anchor Point
\$2500 Rescue System
 \$6000 Total Acquisition

 Sustainment Cost
 \$2500 Replacement (5yr)
 \$7500 End user training 8 hrs/2 yrs
 15 x \$500 per student
 \$12000 Competent Person training
 6 x 2000 per student
\$12000 Rescue training 6 x 2000=
 \$34,000 Total cost

 2-3 Personnel required
 1000 lbs Weight (will increase)
 30 min (10 min task, 20 min
 access)

Two sets of stairs with intermediate landing

Landing (galvanized)	\$5,400
2 10ft stairs (4700)	<u>\$9,400</u>
Total Acquisition	\$14,800
Sustainment Cost	
Coating preservation	<u>\$2000</u>
Total Cost	\$16,800
Personnel required-	1
Weight	2500lbs
Time	10 min



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MV-22 OSPREY

- Integrated work platforms and 22 anchor points in airframe
- Well defined walkways
- Acceptable clearance of Fall Protection



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F/A-18

- Boarding ladder is used to access Leading Edge Extension (LEX) into cockpit
 - Also used to access top of aircraft



F/A-18C Hornet (VMFA-112) at Hyakuri Air Base, Japan - December 2021



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Tactical Vehicles

- No steps
- Improvised steps
- Inconsistent step spacing
- Improvised working platforms
- Uneven ground - Stepping down – lots of ankle sprains

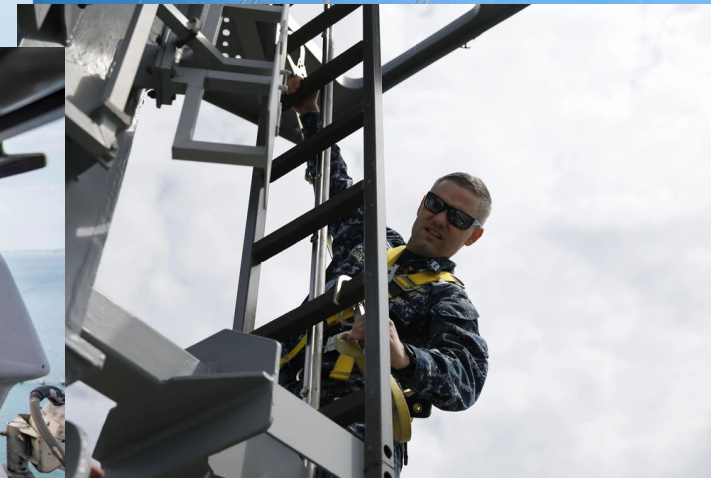
[RR 437 Causes of falls from vehicles, slip and trip hazards on steps and floors](#)



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Ships

- 30 Year platforms and acquisition may span decades
 - Need to get it right at beginning
 - Hard to fix after the fact
- Mast and Antennas
- Weapons systems and over the side operations
- Engineering spaces
- Signature Reduction



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Facilities

- “Appearance of compliance”
- Hangars – work is going to occur atop of aircraft
- Garages and Ship support facilities
- Unified Facility Criteria include Fall Protection Best Practices
- Solutions after design are challenging and expensive
- Criticality of Qualified Person not just a Professional Engineer



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Takeaways

- Familiarity with solutions [Navy Fall Protection Guide](#) or [Army Leader's Guide for Fall Protection](#)
- Identify hazard early: Hazard Analysis and Hazard Tracking System
- Recognize bias that exist regarding fall hazards
- Bring work to lowest level possible -Keep tasking close to worker
- Keep focus on task, if falling is risk, that will be the focus
- Working surface is intended as working surface
- Steps into/onto anything should be equidistant
- Mounting orientation of equipment
- If Harness is solution, someone on design team needs to be trained as Fall Protection Qualified Person
- Understand the sustainment tasks - Read Army PS Magazine
- Terminology differs from ships/aircraft/vehicle/facility (Lifeline) [ASSP Z359.0-2023 Z359 Committee Guidance Document for Definitions and Nomenclature Used in Z359 Fall Protection and Fall Restraint Standards](#)



[PS Magazine](#)

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