

# SPECIAL MISSIONS



**RAPID RESPONSE  
PROVEN SOLUTIONS**

## **Rapid Integration of the M197 onto the MH-60S**

**– Abstract 11584**

**31 August 2011**

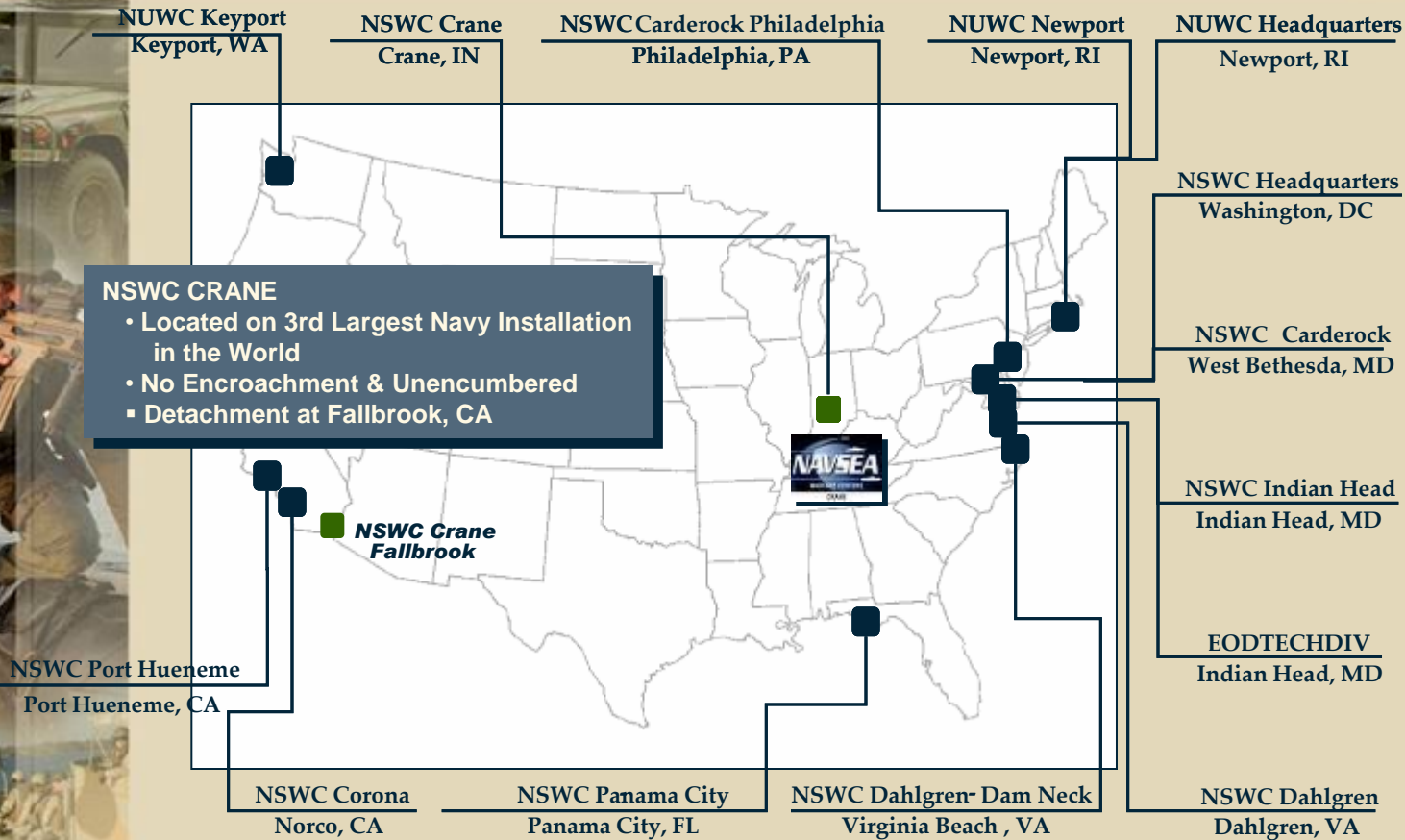
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**Stewards of  
14 NAVSEA Technical Capabilities**



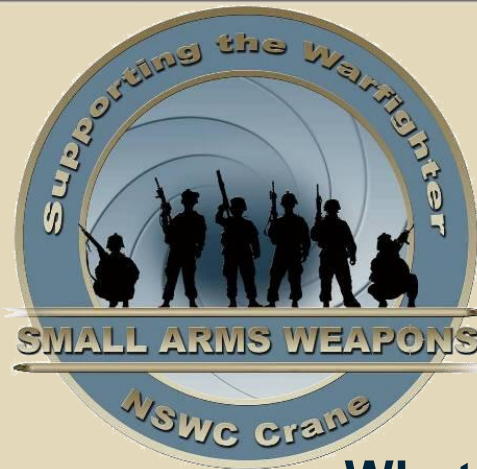
**NSWC Crane Mission Focus Areas:**

- Special Missions*
- Strategic Missions*
- Electronic Warfare / Information Operations*

**Four Outputs:**

- Knowledge
- Contracts
- Hardware
- Software





- **Who are we?**
  - We are a team of engineers, logisticians, and technicians with vast crew served weapons and electronics integration experience.
  - We have the capability to support the full life cycle of the systems we deploy.
  - We support multiple platform offices and team with industry partners.
  - We take great pride in providing high quality support to our customers in a timely manner.
- **What do we do?**
  - Design and integrate weapon systems for various aircraft.
  - Fabricate prototype parts for fit checks and testing.
  - Support flight certification process through the NAVAIR Performance Monitors.
  - Provide Finite Element Analysis (FEA) modeling for fatigue and crash loads.
  - Procure production hardware through GOV contracts.
  - Receive, inspect, kit, and deploy high quality systems.
  - Provide interim supply support.

# Various Air Platforms Supported



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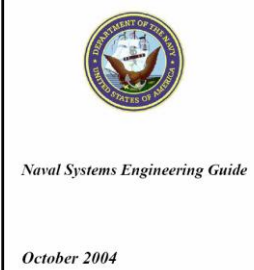
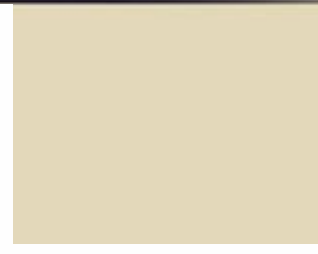
# Rapid System Integration

- How can we rapidly integrate weapon systems at a reduced cost that will provide enhanced capability for the fleet?
- How are we using Systems Engineering to solve this?



# Systems Engineering Plan

- Established the Process or Guidelines for the Project
- We used applicable Systems Engineering Guides to derive a tailored Systems Engineering Plan
- Used NAVAIR Systems Engineering Technical Reviews (SETR) Guide to establish Checklists and Entrance/Exit Criteria



Systems Engineering Guide for Systems of Systems



Systems Engineering Plan Preparation Guide

Version 1.0 August 2008

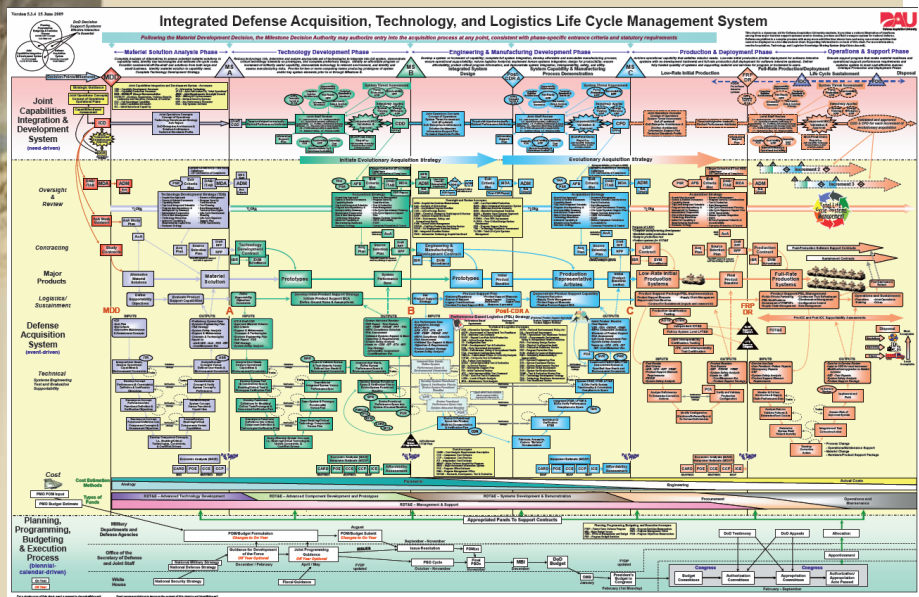
Director, Systems and Software Engineering  
Secretary of Defense (Acquisition) or  
Deputy Under Secretary of Defense  
Acquisition, Technology and Logistics



"Technical Planning for Mission Success"

Version 2.01  
April 2008

Department of Defense  
Office of the Deputy Under Secretary of Defense for  
Acquisition and Technology  
Systems and Software Engineering  
Enterprise Development



## SYSTEMS ENGINEERING FUNDAMENTALS



January 2001

SUPPLEMENTARY TEXT  
PREPARED BY THE  
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Item	Pass	Fail	Open	Comments/Remarks
1. The program manager has approved the program manager's responsibility for the program.				
2. The program manager has approved the program manager's responsibility for the program.				
3. The program manager has approved the program manager's responsibility for the program.				
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# Tailor vs. Cut

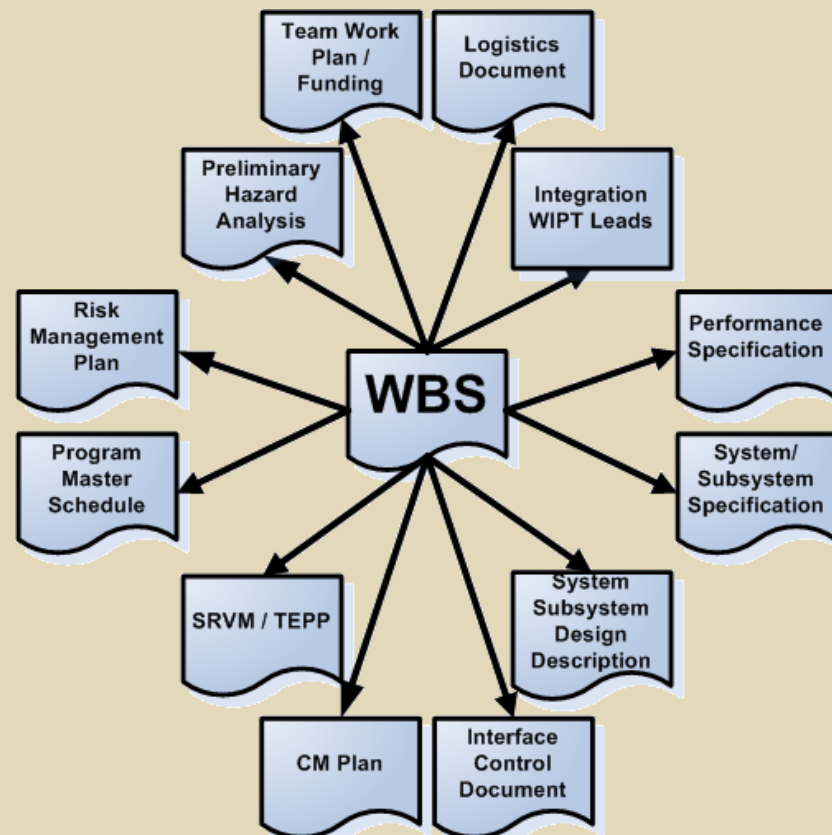
- The use of ‘Tailor’ instead of ‘Cut’ was key to our systems engineering process
  - Tailor: to fit to a particular circumstance
  - Cut: reduction; break off
- Key Questions:
  - How can we apply guides and instructions written for an ACAT I program to a small rapid development effort?
  - What is the purpose of the process/document?
  - Does the purpose add value to the program?
  - How can we benefit from the purpose within cost and schedule?
- Readdressed how we ‘Tailor’ the Guides and Instructions to ensure we’re meeting the intent of the document
- Putting ‘Pen to Paper’ forces tough decisions to be made early and greatly aid in the planning process and gets everyone on the same page



# Work Breakdown Structure

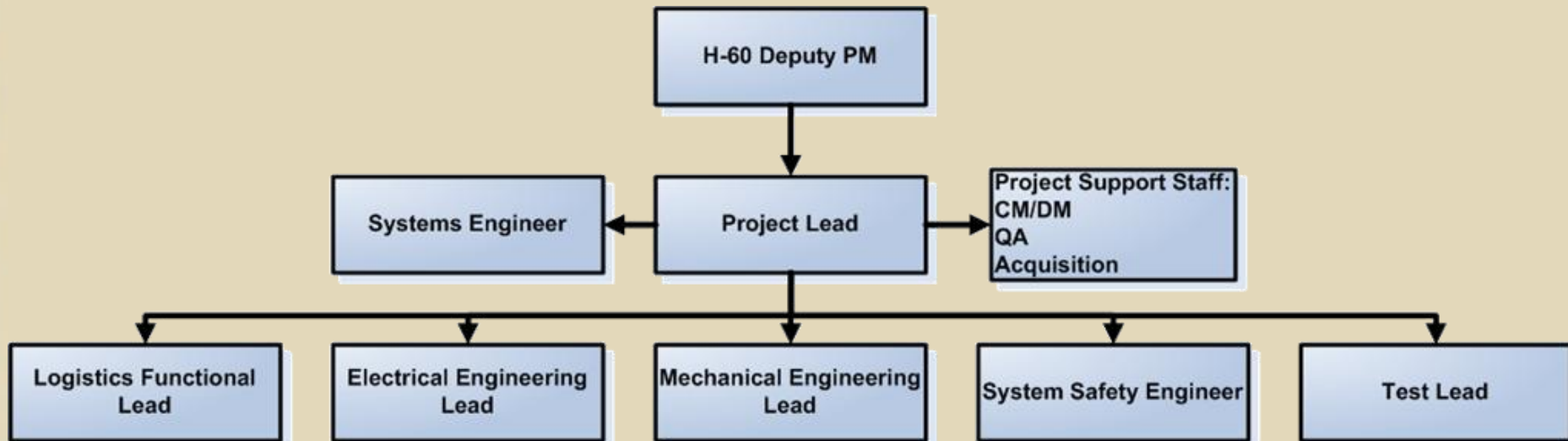


- Scoped the Project and Defined Artifacts
- The WBS was created to capture the total effort to support the development, integration and fielding of the 20mm Gun System.
- Based on MIL-HDBK-881A
- Contains a WBS Dictionary for each element.
- Established Common Terms.
- Assigned each WBS Element to a Functional Lead



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# Team Structure



- **Established a Team that could execute the work**
- **Involved Non-Design Functional Areas from the start of the project**

# Areas of Responsibility

## Project Lead

- Stakeholder Mgt
- Decision Analysis
- Technical Assessment
- Configuration Mgt
- Data Mgt
- Contract Mgt
- Risk Mgt
- Validation

## Systems Engineer

- Technical Planning
- Requirements Mgt
- Requirements Analysis
- Architecture Design
- Implementation
- Interface Mgt
- Verification

## Logistics Lead

- Logistics Documents
- Training

## Electrical Lead

- Electrical Design
- Electrical Component Fabrication

## Test Lead

- Test Planning
- Component Testing
- Subsystem Testing
- System Functional Checkout
- Test Execution
- Test Coordination

## System Safety Lead

- WSESRB Data Package
- LSRB Data Package
- System Safety Planning

## Mechanical Lead

- Mechanical Design
- Hardware Fabrication



# Death by Meetings?



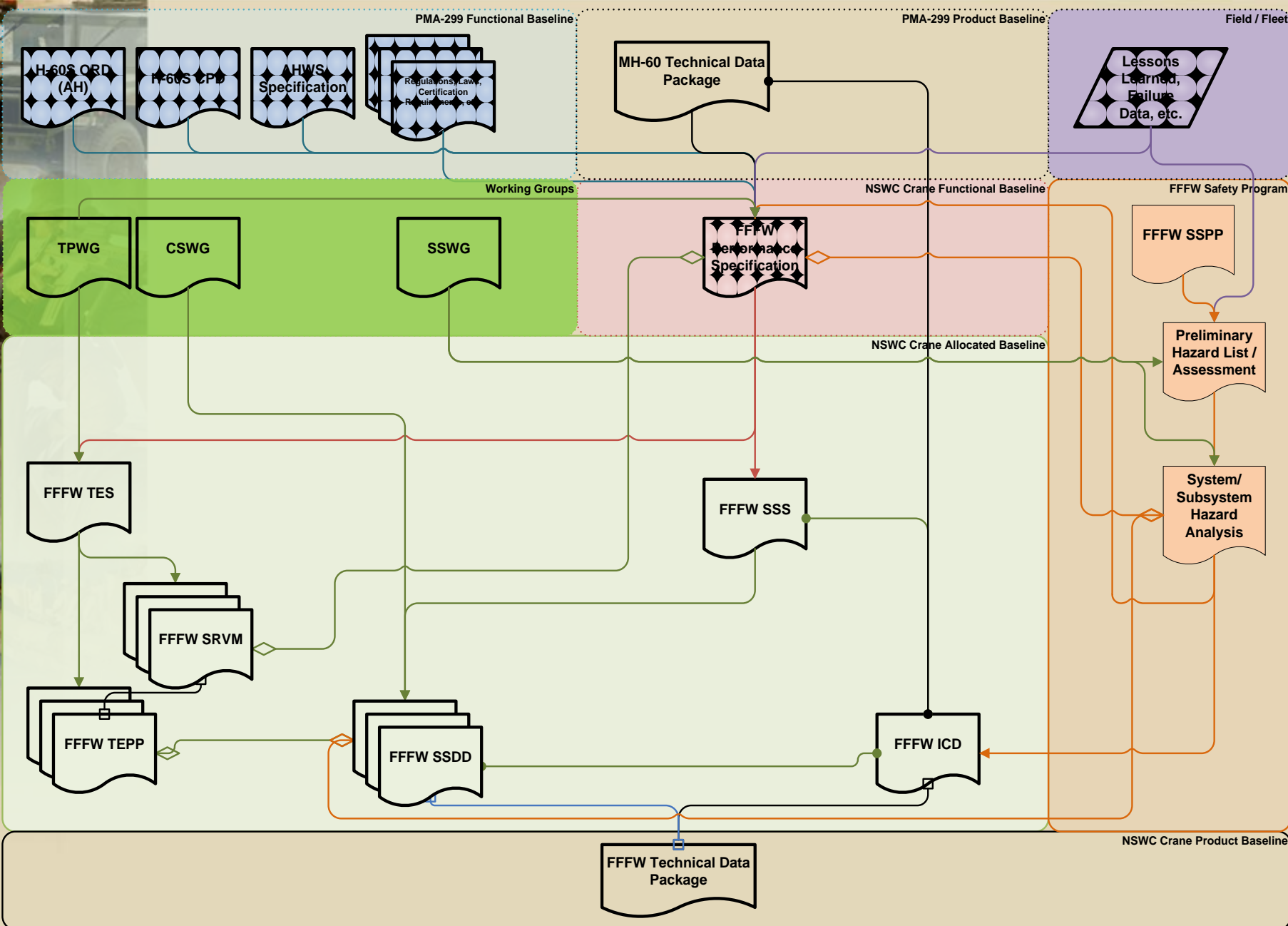
- Enforce Time Limits
- Working Meetings
- Follow an Agenda
- Stay Focused
- Low Preparation Workload
  - Most Preparation is Day-to-Day Tasking
- Follow Up
- Clear Expectations

- IPT Meeting
  - Weekly
- Sponsor Meeting
  - Weekly
- Integration WIPT Lead Meeting
  - Daily
- Integration WIPT Meeting
  - Weekly
- Functional Lead Meeting
  - Weekly

# ***Project Documentation***

- **Systems Engineering Plan**
- **Product Performance Specification**
- **System/Subsystem Specification**
- **System/Subsystem Design Description**
- **Interface Control Document**
- **Initial Functional Analysis**
- **Test and Evaluation Strategy**
- **Test and Evaluation Program Plan**
- **System Requirements Verification Matrix**
- **Team Work Plan**
- **Configuration Management Plan**
- **Risk Management Plan**
- **Work Breakdown Structure**
- **System Safety Program Plan**
- **System/Subsystem Hazard Analysis**
- **Interim Support Plan**
- **User's Logistics Support Summary**
- **Acquisition Logistics Support Plan**

# Document Traceability



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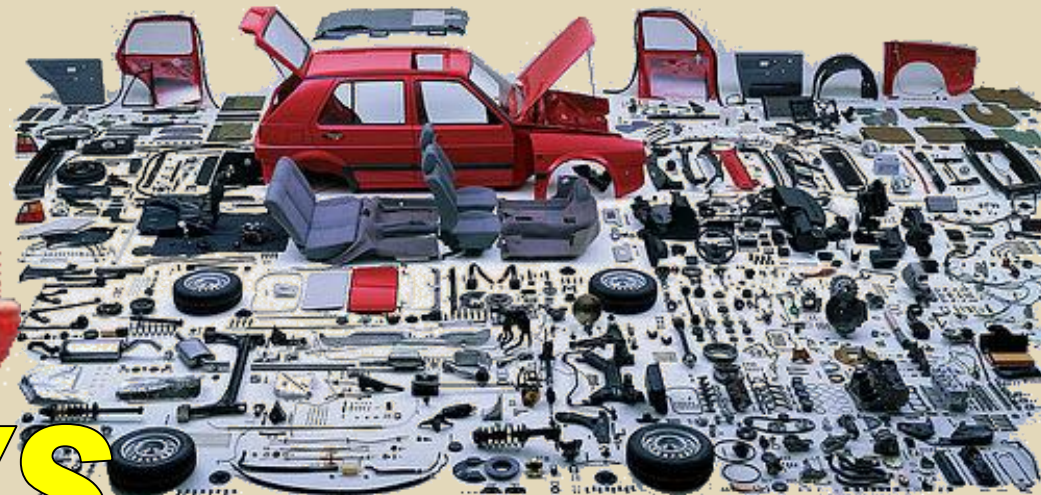
# ***Design Environment***

- **Don't Micro-Manage**
  - **Allowed the Leads to Lead**
    - Helped Leads Identify Risks and Solutions
    - Didn't 'Trump' Functional Lead Decisions
      - 'Maybe sometimes'
  - **Allowed Creativity**
    - "My" Design would have looked vastly different
    - Is the system meeting requirements?
- **Paperwork increased up the chain**



# The Line of Integration

- At what point do we draw the line for integration
  - COTS System onto Platform?
  - COTS Subsystems into a System onto Platform?
  - COTS Components into Subsystems into Systems onto Platforms?
  - The higher the better, within Performance, Schedule and Cost
- Use of Analysis of Alternatives and Trade Studies to identifying level of integration
  - Risk vs. Benefit Chart
    - This places the priority on the performance of the end item
  - Cost and Lead Time
    - Often COTS lead times are longer than entire project schedule



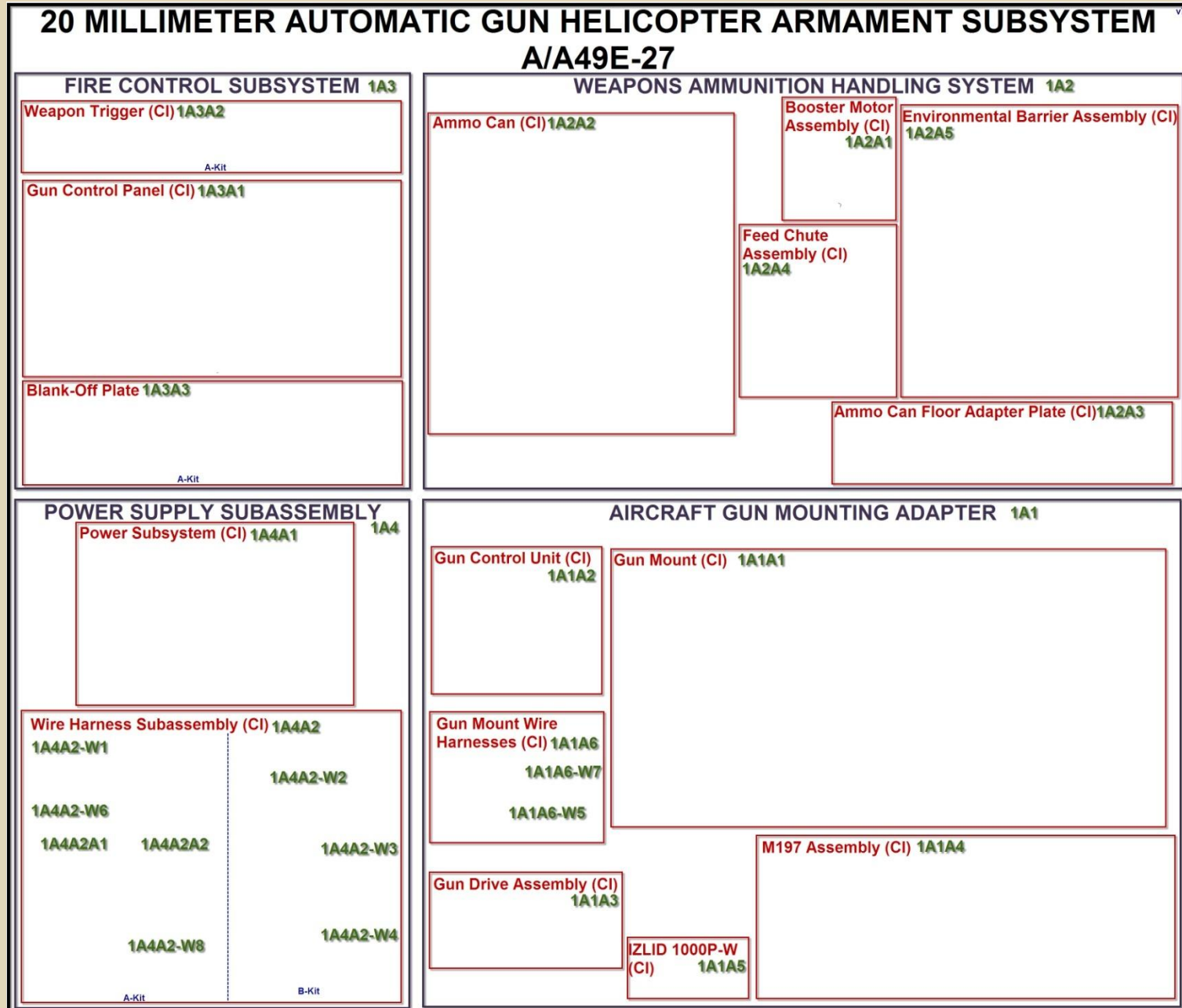
**vs.**

# Key Documents

- **System Subsystem Specification**
  - Allocated Requirements to WBS Elements
  - Assigned to Functional Leads
- **Interface Control Document**
  - Defined External and Internal Functional, Physical, Human Interfaces
  - Established Interface Nomenclature
  - Assigned to Functional Leads
- **System Subsystem Design Description**
  - Established System Architecture
  - Documented System Wide Design Decisions
    - Quality Factors Allocation
    - Fire Controls Design Decisions
    - Power Subsystem Design Decisions
    - Weapons Ammunition Handling System Design Decisions
    - Aircraft Gun Mounting Adapter Design Decisions
  - Consolidated Trade Studies and Analyses to one Location
    - Alternative System Design Analysis
    - Gun Drive Motor Alternative Design Trade Study
    - Booster Motor Assembly Alternative Design Trade Study
    - M197 Assembly Alternative Design Trade Study
    - Firing Rate Selection and Vibration Analysis
    - System Faults Analysis
    - Hardware vs. Firmware Justification White Paper
    - Booster Motor Requirement Analysis
    - Dispersion/Boresight Analysis

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# ***NSWC Crane as the System Integrator***

- **RAPID RESPONSE**

- As a DoD Activity funding can be provided immediately avoiding contract lead times
- This allows us to be fully engaged from the start of the program, working with the sponsor and end user to solidify requirements
- No contract mods when requirements change
- Flexibility to adjust to SE process changes
  - Drop non-value added tasks
  - Add emerging tasks to meet goals



**Thank you for your time and attention!**



For more information on NSWC Crane, please visit [www.crane.navy.mil](http://www.crane.navy.mil)

Images were downloaded via publically accessible websites