



**Component  
Obsolescence**

Presented by  
**GENERAL DYNAMICS**  
C4 Systems

# GENERAL DYNAMICS

## C4 Systems

### Coping with Component Obsolescence in Manufacture of a Legacy Military Product:

#### STANDARD MISSILE MK45 TDD Obsolete Part Roadmap

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# Preface

- **Extending useful life of existing military products**
- **Commercial component technologies continue to outpace legacy DOD products**
- **Obsolescence & legacy systems**
- **Component obsolescence & system requirements evolve**
- **Marriage of old & new component technology**

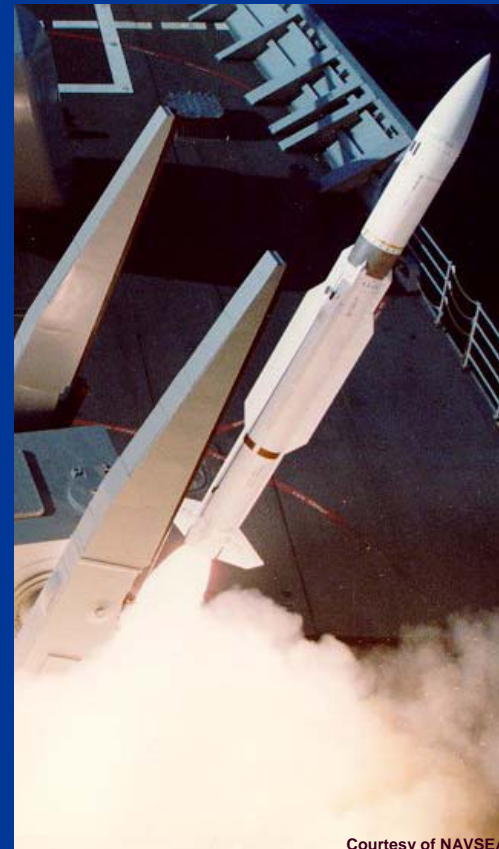
# Agenda

- **STANDARD MISSILE & the MK45 TDD**
  - What is a TDD
  - A look inside
- **An approach to solving Part Obsolescence**
  - Supporting legacy equipment
  - Avoiding the “Train Wreck”
  - Establishing a plan, process, options, solutions
  - Applying discipline and rigor to part evaluations
- **Where to go for help**
  - Diminishing Manufacturing Sources/ Center of Excellence
- **Questions**



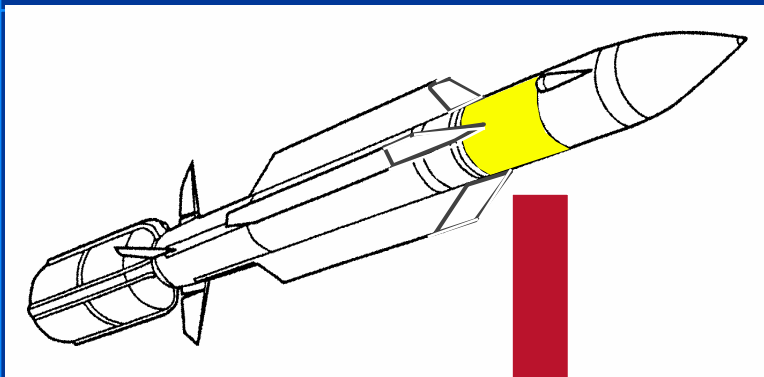
## STANDARD MISSILE- Background

- **STANDARD Missile is an all-weather, ship-launched, medium-to-long range, surface-to-air missile family widely deployed aboard combatant ships of the U.S. and allied Navys. It is the U.S. Navy's primary surface-to-air weapon against aircraft and anti-ship cruise missiles.**

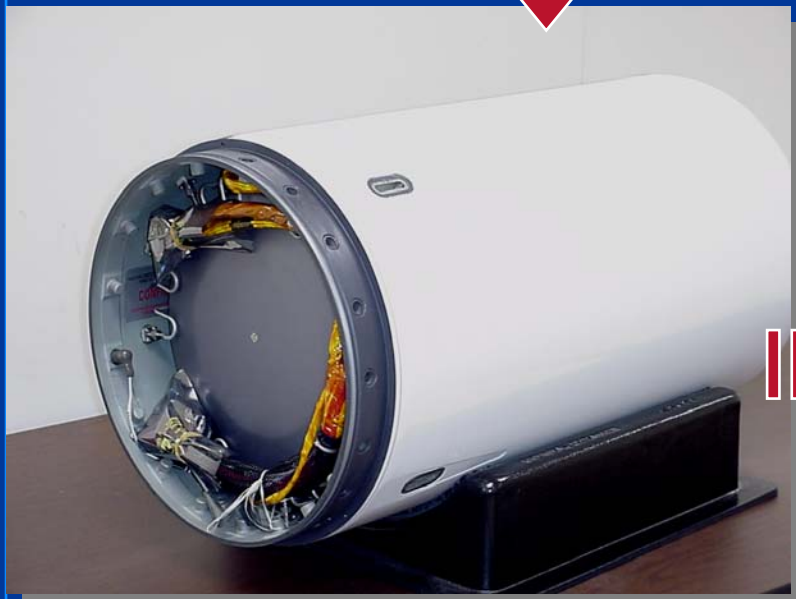


Courtesy of NAVSEA

# MK 45 TDD



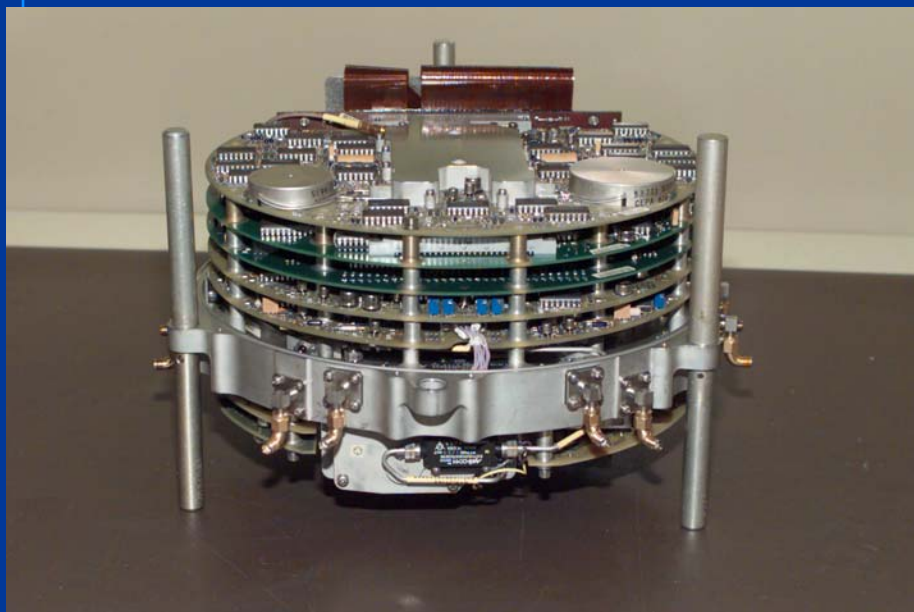
The Target Detecting Device(TDD) is an integral part of the Warhead Section of the missile.



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# ELECTRONICS ASSEMBLY (EA)

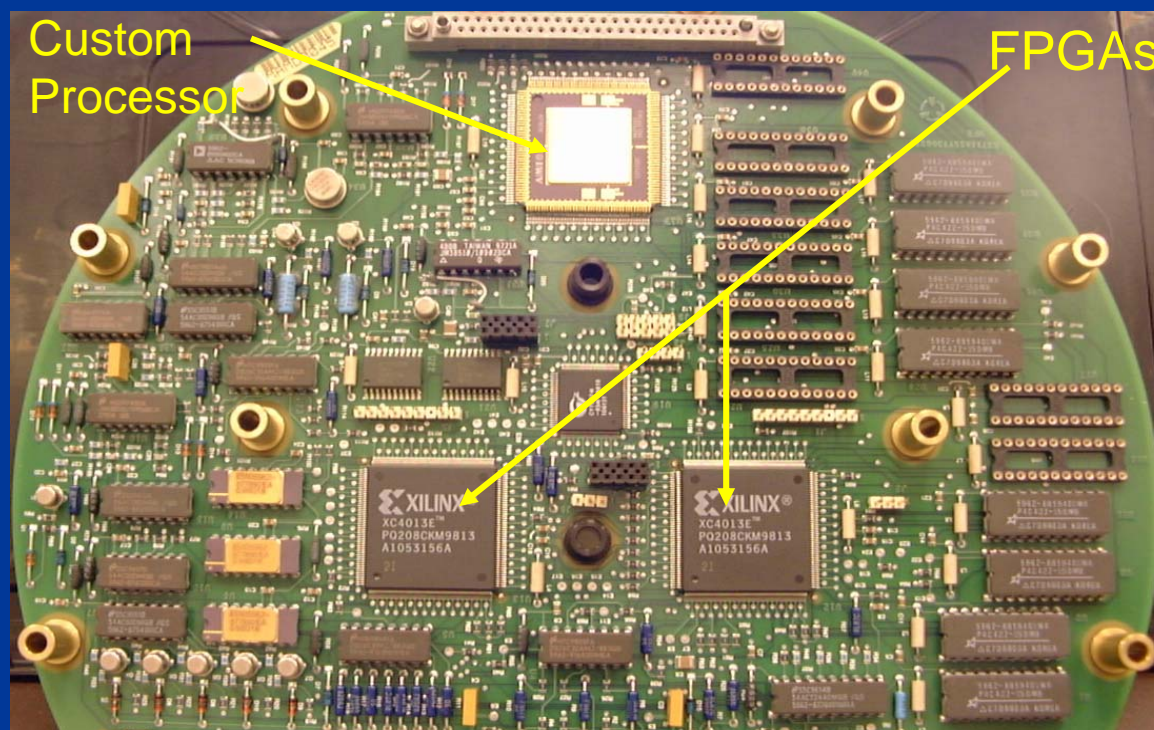
- The Electronics Assembly is made up of 7 Printed Wiring Assemblies (PWAs) and many microwave components. The EA houses a power supply, transmitter, receiver and signal processing assemblies. Signal processing is accomplished using a high speed custom processor, ASICs, FPGAs, CPLDs, and a variety of other digital and analog components.



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# PRINTED WIRING ASSEMBLY

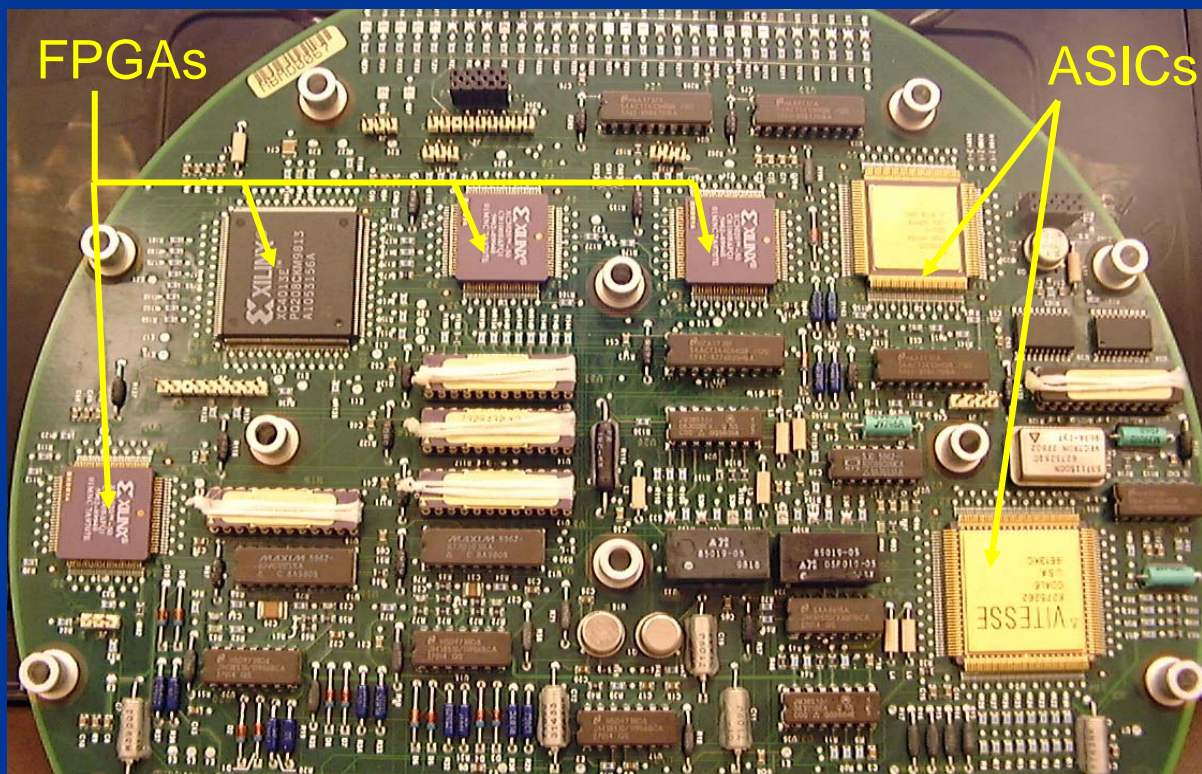
- Shown below is one of the PWAs from the Electronics Assembly. The assembly, a 12 layer board containing a custom high-speed processor, FPGAs, and other digital components.





# PRINTED WIRING ASSEMBLY

- Another assembly contains custom ASICs & FPGAs that were designed for this product when space was a premium and typical DESC and MIL-STD-883 micro-circuit components became obsolete



## Perspective: Supporting a Legacy Product

- **MK 45 TDD has several configurations (MODs) and has been in production at Motorola/General Dynamics since the early 1970's**
  - **Has included Upgrades or New Designs to implement new system requirements**
    - **The current configurations (MOD 9/10) were developed in the early 1990's**
    - **Several Obsolescence issues had to be periodically addressed by MOD changes to improve capability**
  
- **Our approach somewhere between Reactive & fully Proactive DMSMS (Diminishing Manufacturing Sources and Material Shortages), LEVEL 2**
  - **Track & notify, but funding on an as required basis by the Customer**
  
- **We became more involved in DMSMS the mid 1990's**
  - **Vendors became more focused on commercial parts vs. military.**

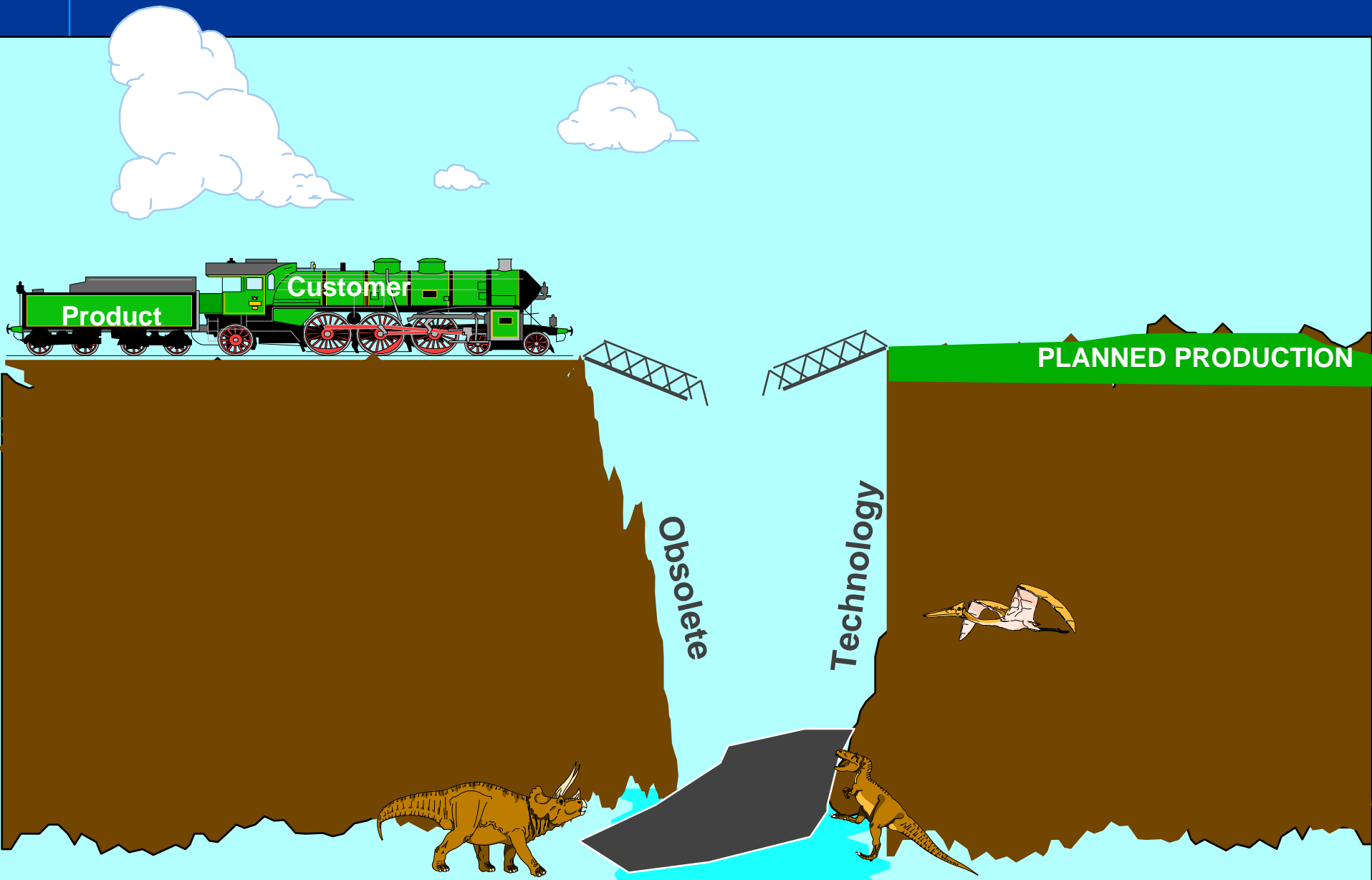
*Maintains a cost efficient methodology for providing a production support base*

# Defining and Resolving Obsolescence

- What does “obsolete” mean?
  - No longer active for new designs
  - No longer available from manufacturer
  - No longer available from any source
- Navy plans have been typically multi-year contracts for a given number of production TDDs & Depot Support.
  - Therefore, in some cases, a single buy solution is adequate!
- Downside is another buy of a given design of TDDs requires another pass at obsolete part.
  - It’s a “Fact of Life” in order to resolve separate procurements

*To maintain cost efficiency implies multi-year procurements.*

# The Train Wreck – Always Waiting

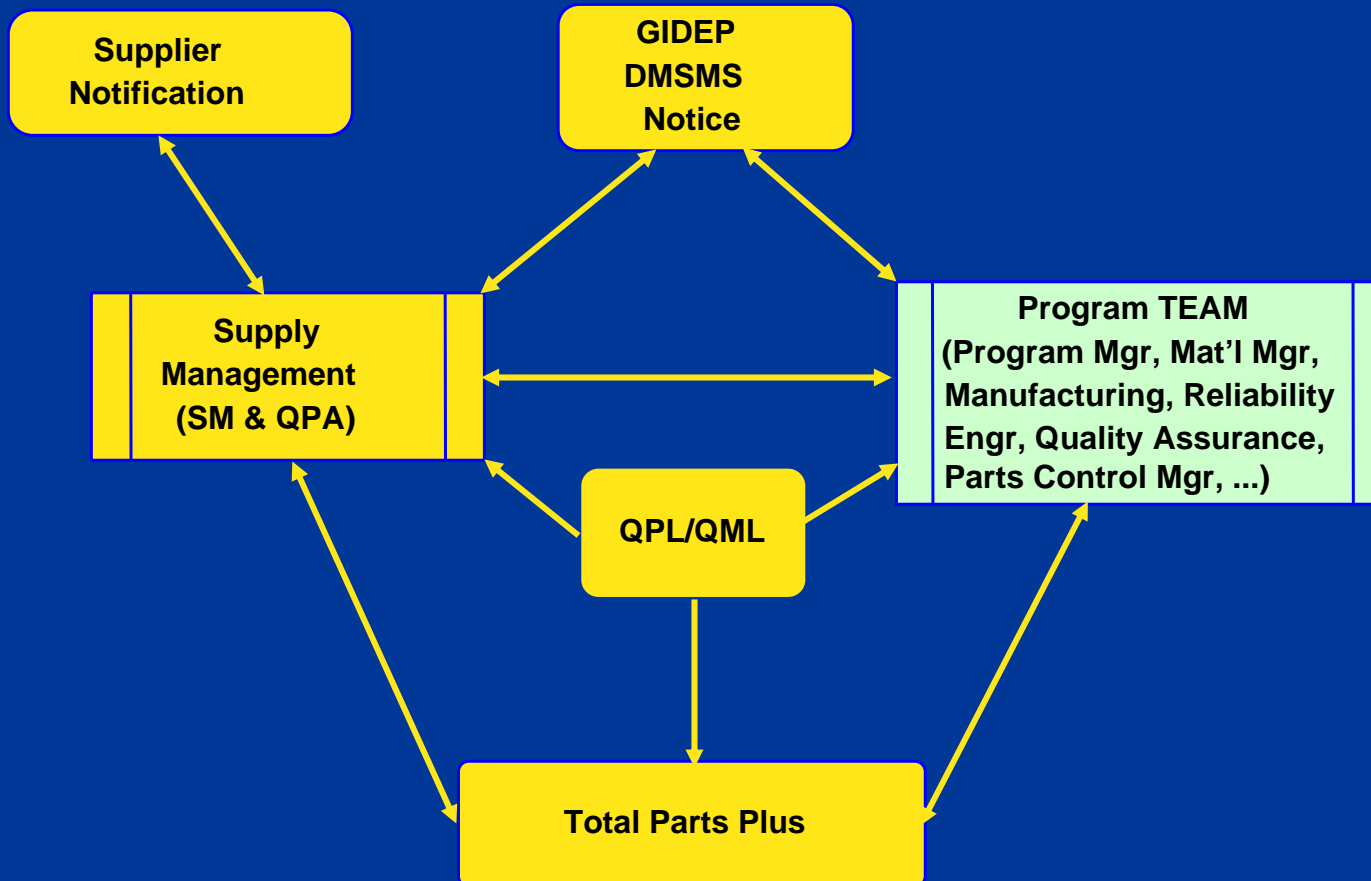




# Resolution of Obsolete Parts

- **Establish the Correct Qualification Plan**
  - **DESC/ MIL-STD parts**
    - Requires no plan - only a change to parts list
  - **MIL-STD-883 screened parts**
    - Requires an SCD (source control drawing) requiring vendor to provide QUAL test data
  - **Plastic parts**
    - Industrial grade parts from “Best-in-Class” part suppliers
    - Requires an SCD which will include
      - Vendor to notify if part changes
      - Vendor to insure operation at needed temperature ranges
      - Other special requirements as needed
  - **Documentation Changes (ECPs and SCDs)**

# PART INFORMATION FLOW



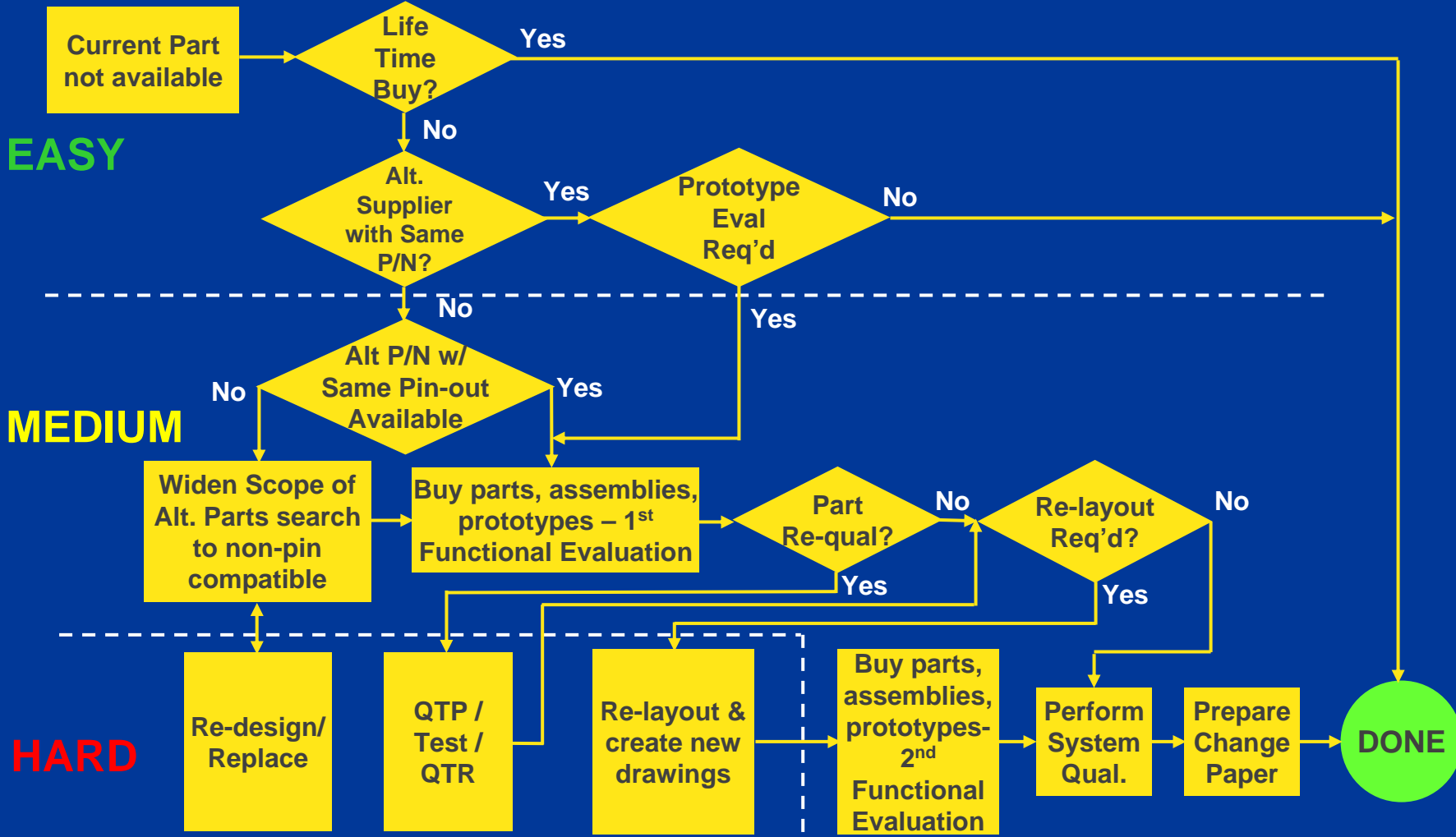
*Within C4 Systems, Supply Management is active in apprising program teams of diminishing sources.*

# COMPONENT RESOLUTION FLOW



*Project Team selects the most effective solution (cost, schedule, etc).*

# SOLUTION STEPS





# Resolution of Obsolete Parts

- **Process**

- **Research - identify a part that does about the same function as old part (identify critical and un-controlled parameters)**
  - **Data books**
  - **Web sites**
  - **Vendors**
- **Circuit emulation/simulation/analysis**
- **Procure samples**
- **Evaluation of part**
  - **Change circuitry**
  - **Mount on ancillary board**
- **Run operational tests at all temperatures**

# Evaluation Process

- Performance Requirements

- Rise Times
- Bandwidth
- Stability
- Pulse Duration
- Timing Diagrams
- Environmental Operating Conditions

- Circuit Simulation

- Analog Workbench
- I/O Analysis

- Component Critical Parameters (Uncontrolled)

### Obsolete Component


- High-speed comparator - mixed signal-analog in/ ECL Out no longer available
- Conf
- 3

### Circuit Simulation


Critical Parameters for Comparators U37, U38 and U39 on the Analog Assembly

- 1
- Non Inverting
- -2.12
- Inverting
- -1.98
- Propagation
- 2.5n
- Latch Enable
- 1.3n
- ECL Output
- 23m

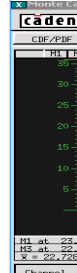
### Comparator SDX Circuit - Analysis



### SDX Slope detector Output



### SDX Output Current - ECL Output HI



### Comparator Critical Parameters – All Uses

Analog BiD Comparators	SDI	SDX	OLL	Chr	Tgt	Critical Parameters Worst Case
Non Inverting Input Voltage Requirement	-1.99 to +3.0V	35 to 37 mV	-1.99 to +3.04	-1.99 to +3.0V	-2.12 to +3.0V	-2.12 to +3.0V
Inverting Voltage Requirement	-1.99 to +3.36V	0 to .531V	-2.25 to +3.08	-1.99 to +1.78V	-1.45 to +2.75V	-1.99 to +3.36V
Propagation Delay	2.5nS	2.5nS	2.5nS	2.5nS	2.5nS	2.5nS
Latch Enable	1.3nS	1.3nS	1.3 nS	1.3nS	1.3nS	1.3nS
ECL Output Current						
HI	9.6mA	23mA	9.6mA	9.6mA	9.6mA	23mA
LO	1.7mA	5.2mA	1.7mA	1.7mA	1.7mA	

# Sources of DMSMS Information

- **DMSMS Center of Excellence (<http://dmsms.org>)**
  - **Sponsored by DoD to encourage communication, education & cooperation**
  - **Information Sources for the COE**
    - **Air Force Material Command (AFMC) DMSMS Program**
    - **Defense Logistics Agency (DLA)**
    - **Defense Logistics Information Services (DLIS)**
    - **Defense Supply Center Columbus (DSCC)**
    - **Defense MicroElectronics Activity (DMEA)**
    - **NAVSEA Crane Division DMS Technology Center**
    - **Navy Logistics Productivity (NLP) R&D**
    - **U.S. Army DMSMS INFO Program**

## Sources of DMSMS Information (continued)

- **DMSMS COE Includes:**
  - **DMSMS/Obsolescence related information including directives, manuals, guidelines, papers, ...**
  - **Training Courses (currently a DMSMS 101, more planned)**
  - **Upcoming Events**
  - **Hot Links to all types of Vendors in DMSMS**
  - **Tools and Management Aids**
- **GIDEP (<http://www.gidep.org>)**
  - **Part of the COE**
  - **Is the data repository for DMSMS Information**
- **DMSMS Conferences and Working Groups are held on a regularly scheduled basis**



# A Guide to DMSMS Practices

- **Sources of DMSMS Guidelines “Program Managers Handbook”**

Published by ARINC, Inc for DMEA in 2000 provides three levels of common practices that include activities implemented to mitigate the risk of DMSMS:

- Level 1 Practices are implemented to resolve current obsolete items. Some of these activities may be considered reactive.
- Level 2 Minimal required practices are needed to mitigate the risk of future obsolete items. The majority of these activities are perceived as proactive.
- Level 3 Advanced practices are required to mitigate the risk of obsolescence when there is a high opportunity to enhance supportability or reduce total cost of ownership. These activities are proactive and may require additional program funding.

Level 1	Level 2	Level 3
DMSMS Focal Point	Awareness Training	Circuit Design
Awareness Briefing	DMSMS Prediction	VHDL
Internal Communications	DMSMS Steering Group	Technology Assessment
External Communications	COTS List	Electronic Data Interchange (EDI)
DMSMS Plan	DMSMS Solution Database	Technology Insertion
Parts List Screening	Opportunity Index	
Parts List Monitoring	Web Site	
Resolution of Current Items		
Supportability Checklist		

## Acknowledgements, Contributors & Contacts:

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