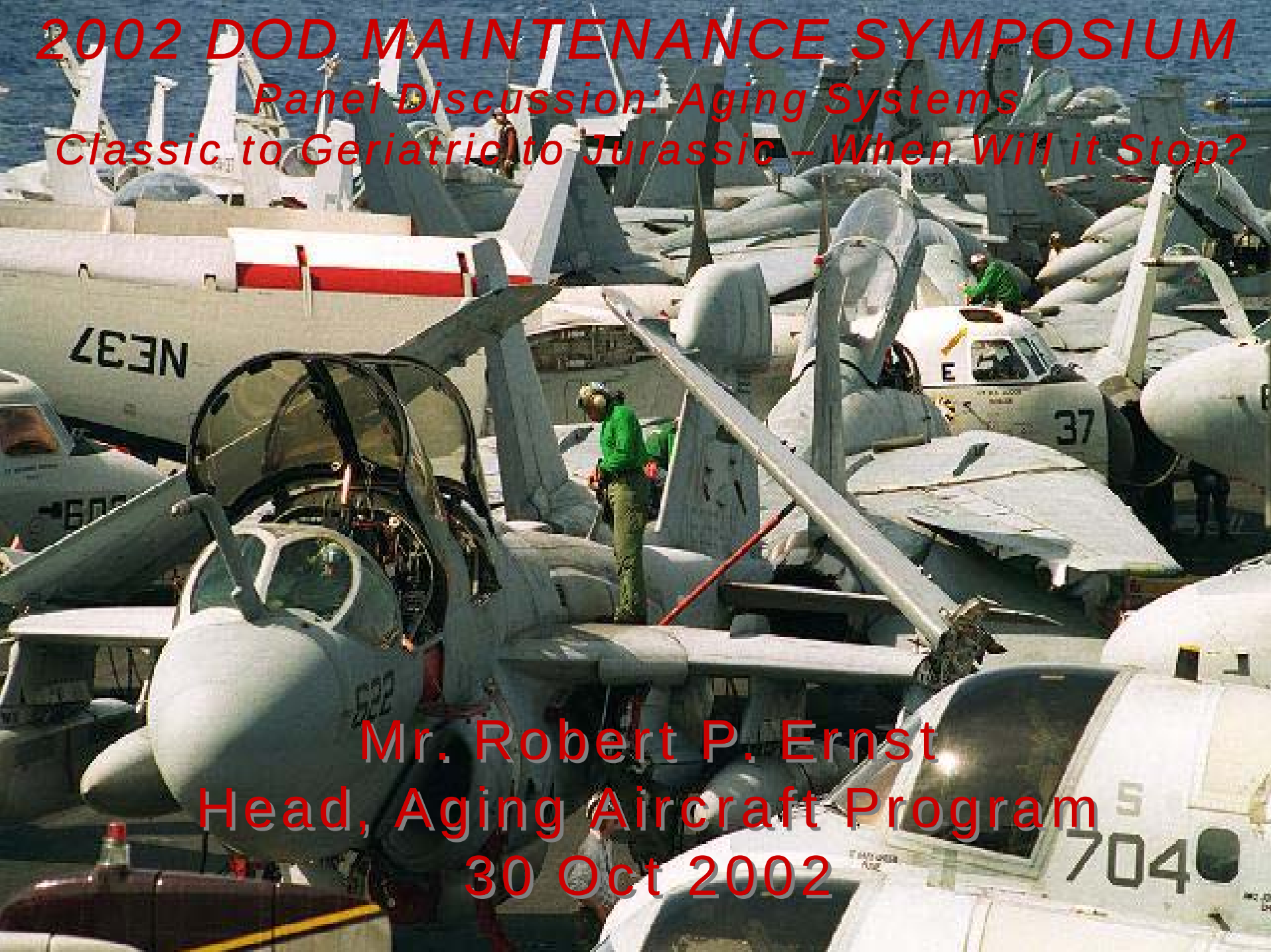
2002 DOD MAINTENANCE SYMPOSIUM

Panel Discussion: Aging Systems

Classic to Geriatric to Jurassic – When Will it Stop?



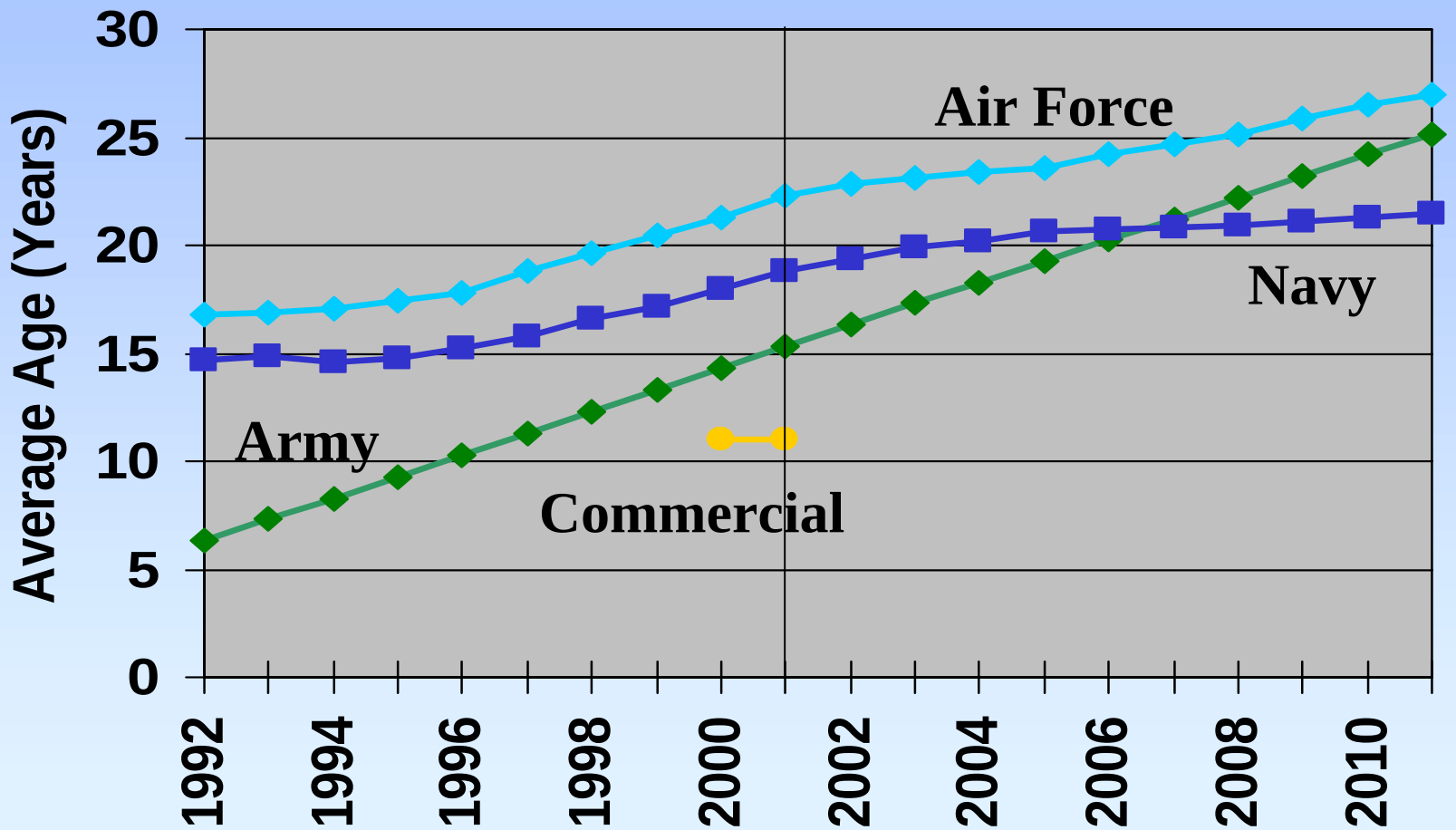
Mr. Robert P. Ernst

Head, Aging Aircraft Program

30 Oct 2002

Aircraft Age Trend

Fleet-Wide Average



Differences In Business Operating Rules Readily Apparent

Effect: Increased Depot maintenance Difficulty forecasting parts

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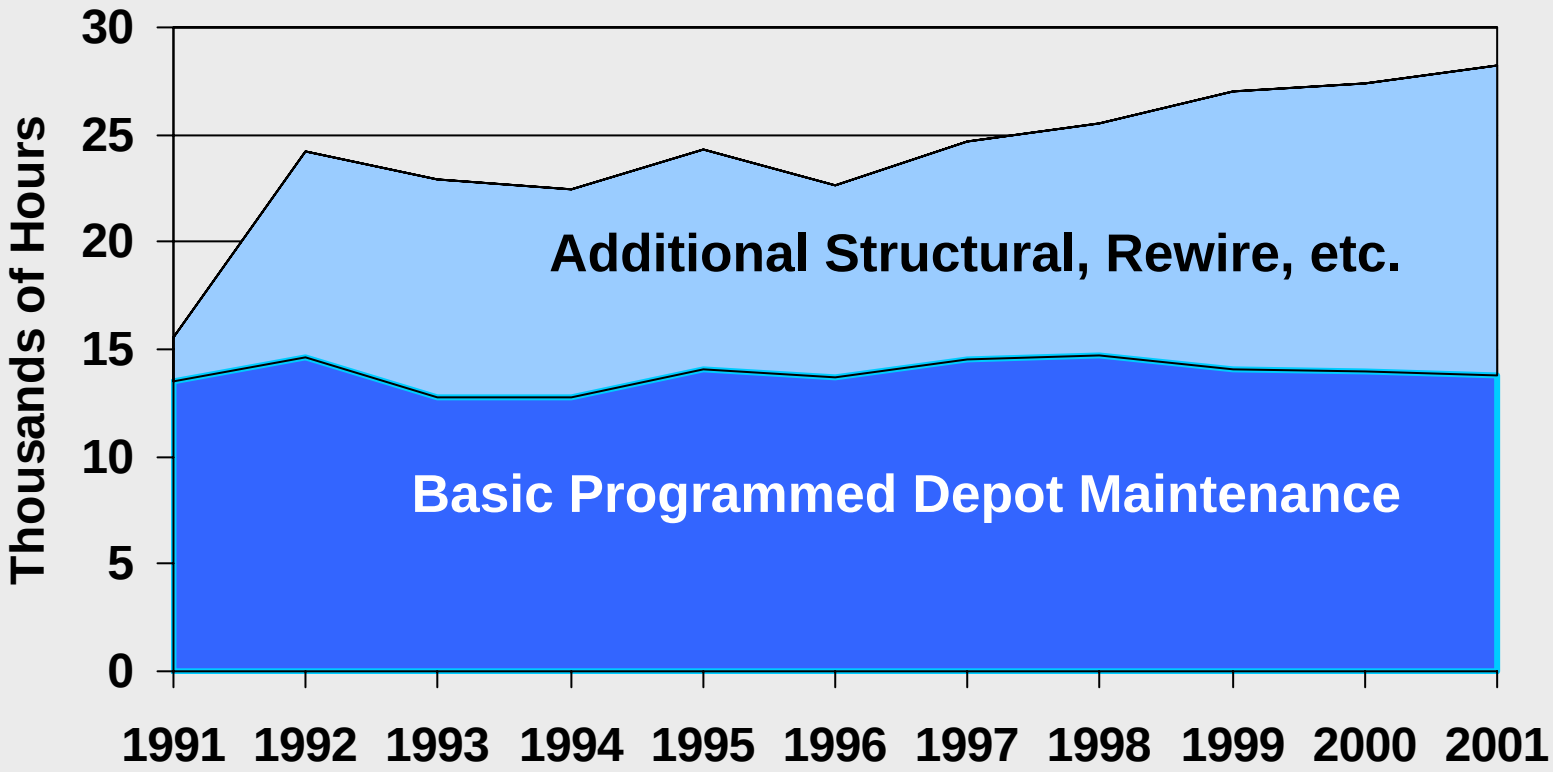

Parts/Component Management

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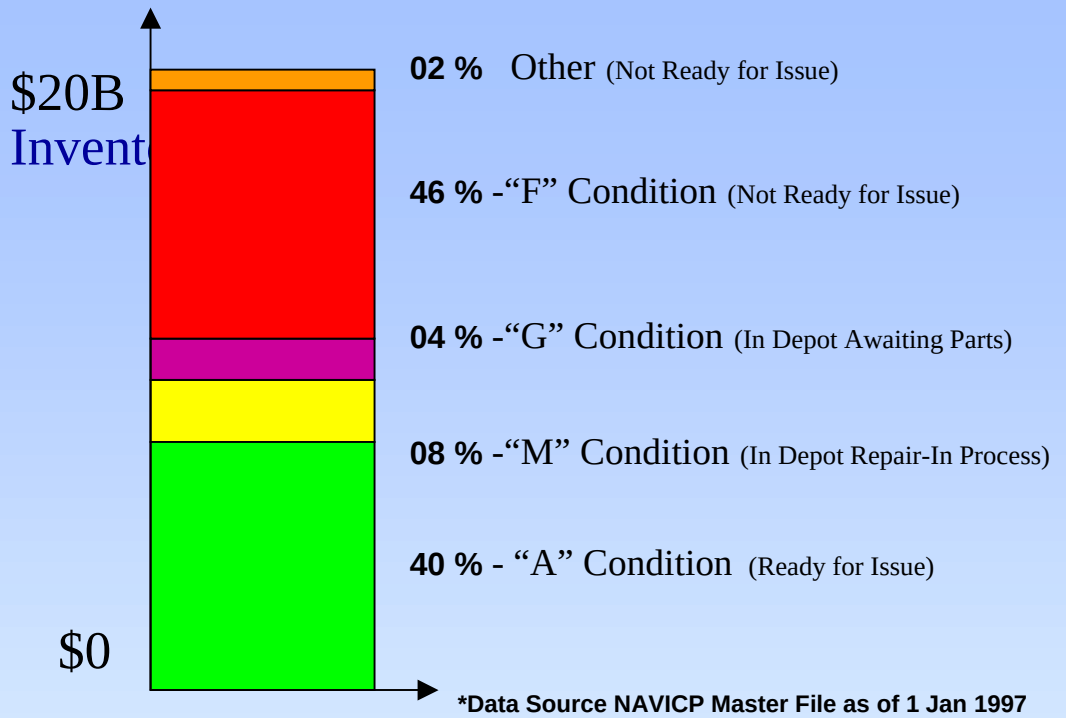

Component Pipeline

Component Pipeline → Reinvestment $ → Combat Readiness

Converting Inventory to Readiness ...
Requires a "Business" Approach

Unitized Cost/Flight Hour

Fleet-Wide Average

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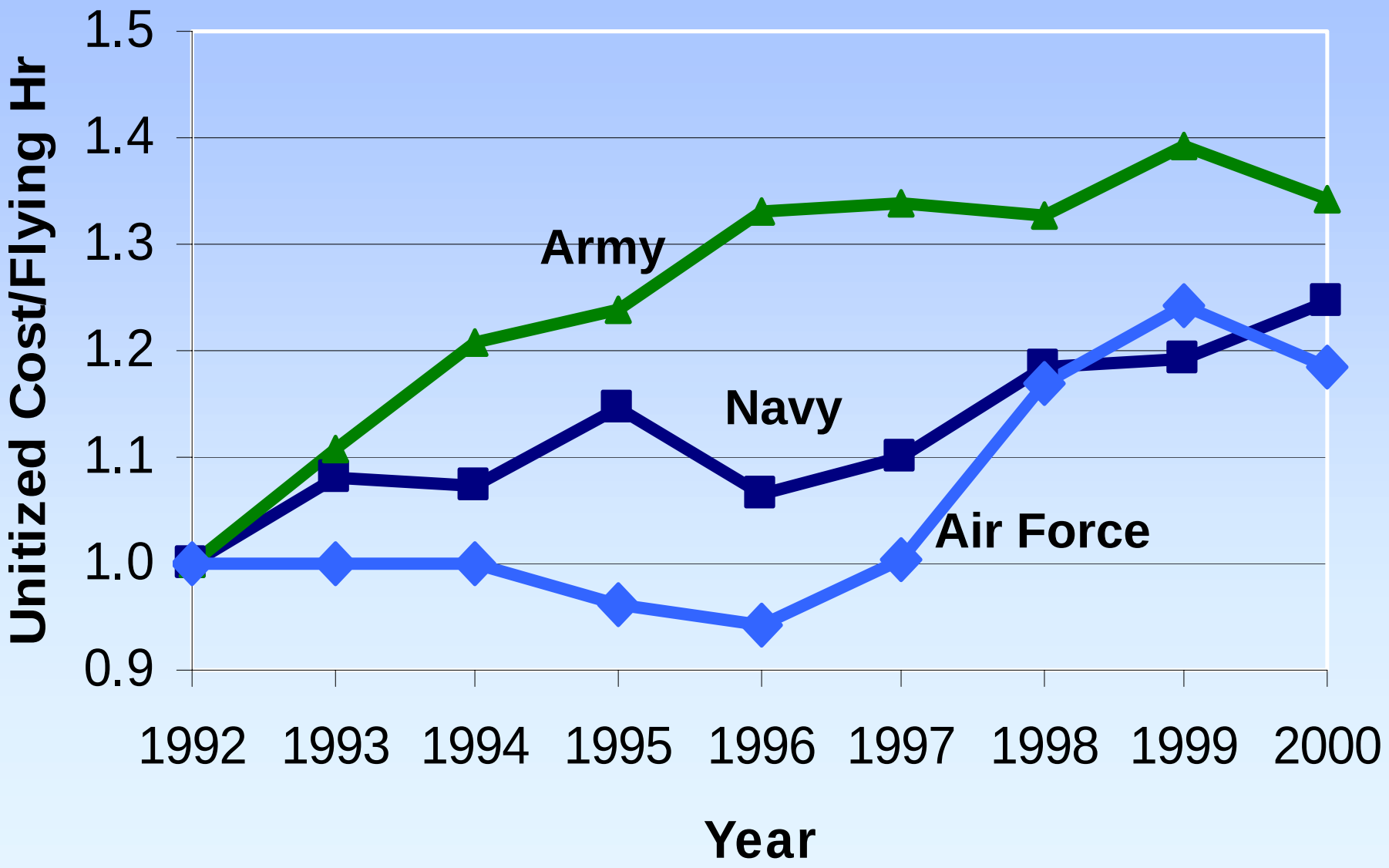

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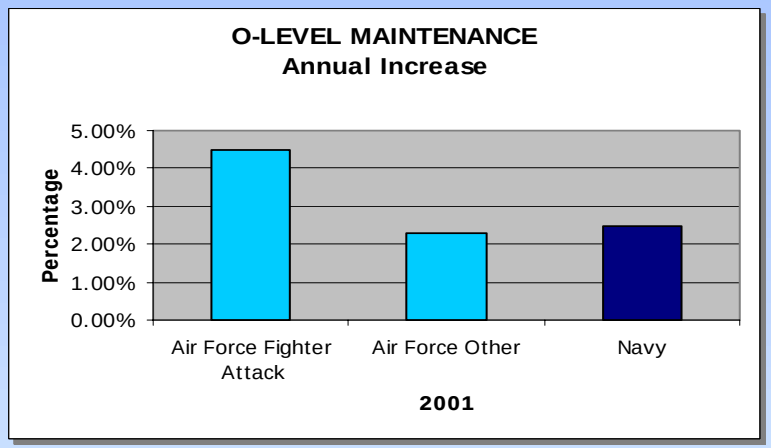
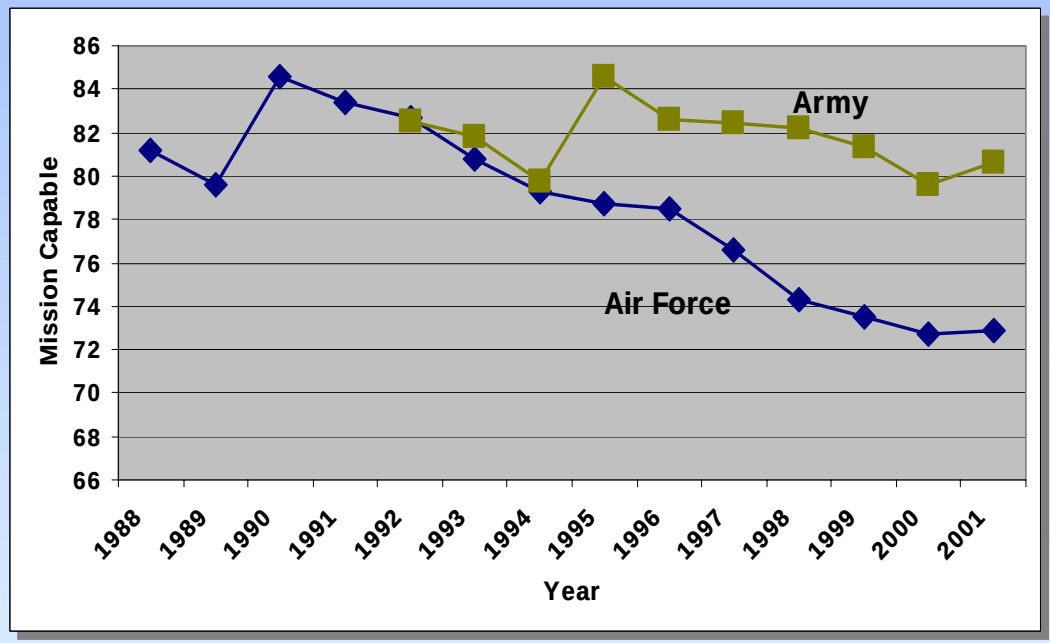
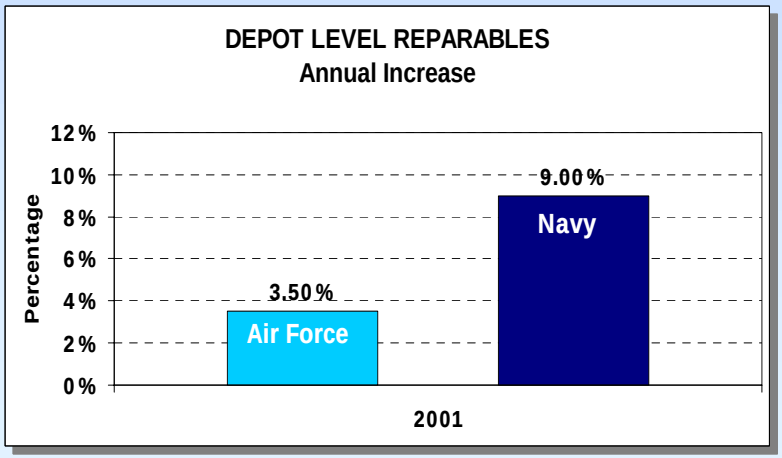
Cost Trends And Operational Readiness





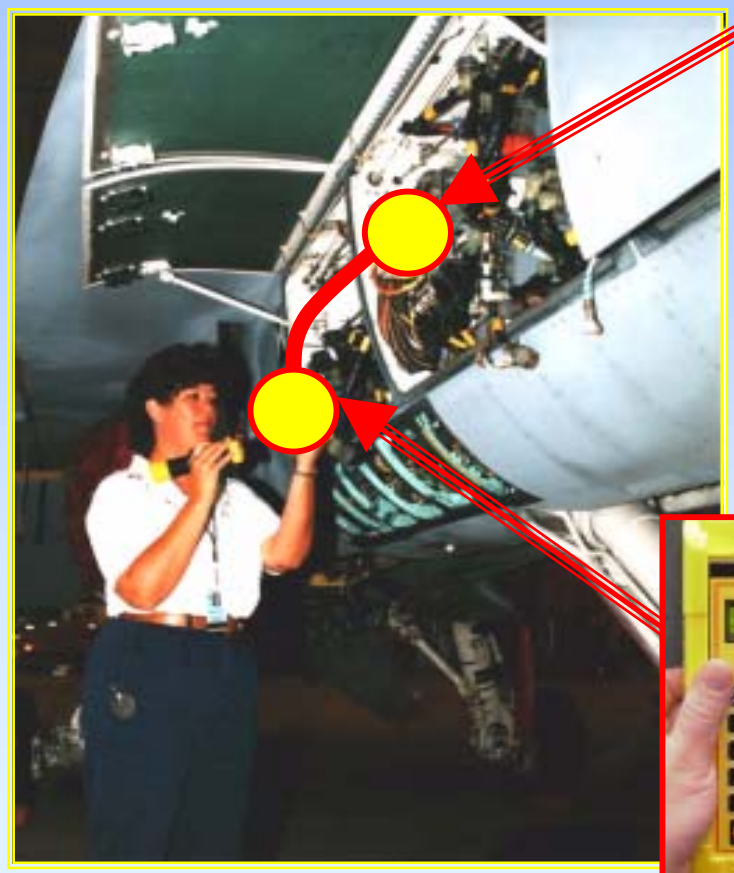


Different Symptoms, Same Cause

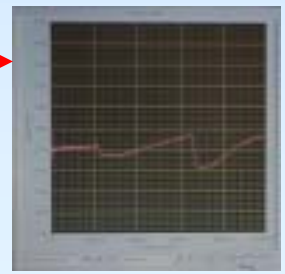
- *Age* -

SWR TECHNOLOGY LOCATES FAULT DOWN THE PATH

Connects quickly to Aircraft with test lead in this example. Will be automated through AWA.



Provides easy operations and simple to understand response



Reflected measurement data will be ported to data base

Tech Transition – Pubs/Training

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Control Surfaces
(New honeycomb, PAA)

Wings/Exterior
(Thick Film)

Deep Zonal
(Aerosol)

Inaccessible
(Sensors)

1. **Map compound/material to application**
2. **Coordinate procurement**
3. **Supply**
4. **Pubs (-509 changes)**
5. **Training**

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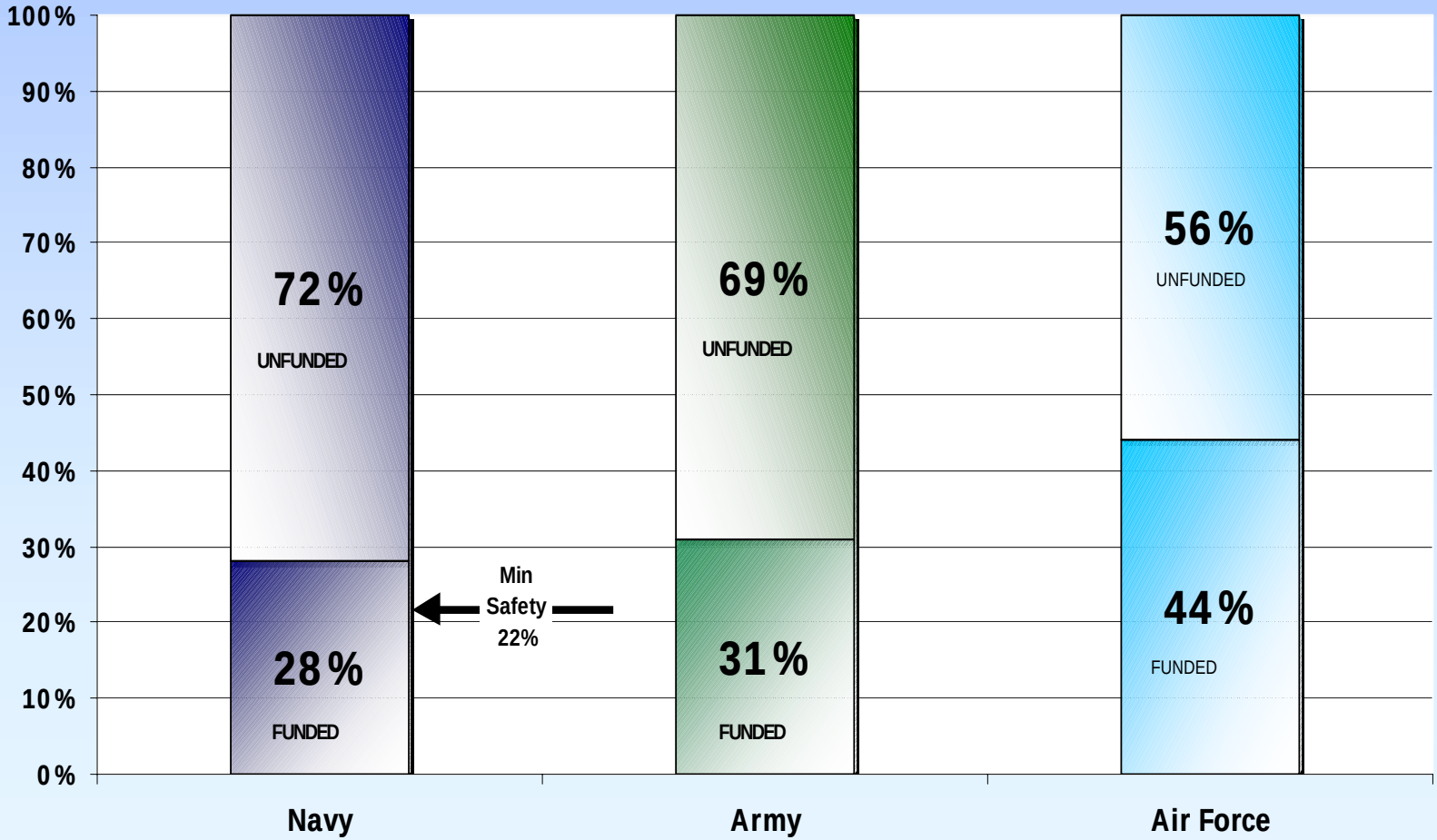
What Changes Can we Make?

Change: Preserve Limited "Sustaining Engineering" and use Common Solutions

FY01 Sustaining Engineering — Required vs. Funded



Flying Hour Program Costs

"Real Budgeting"

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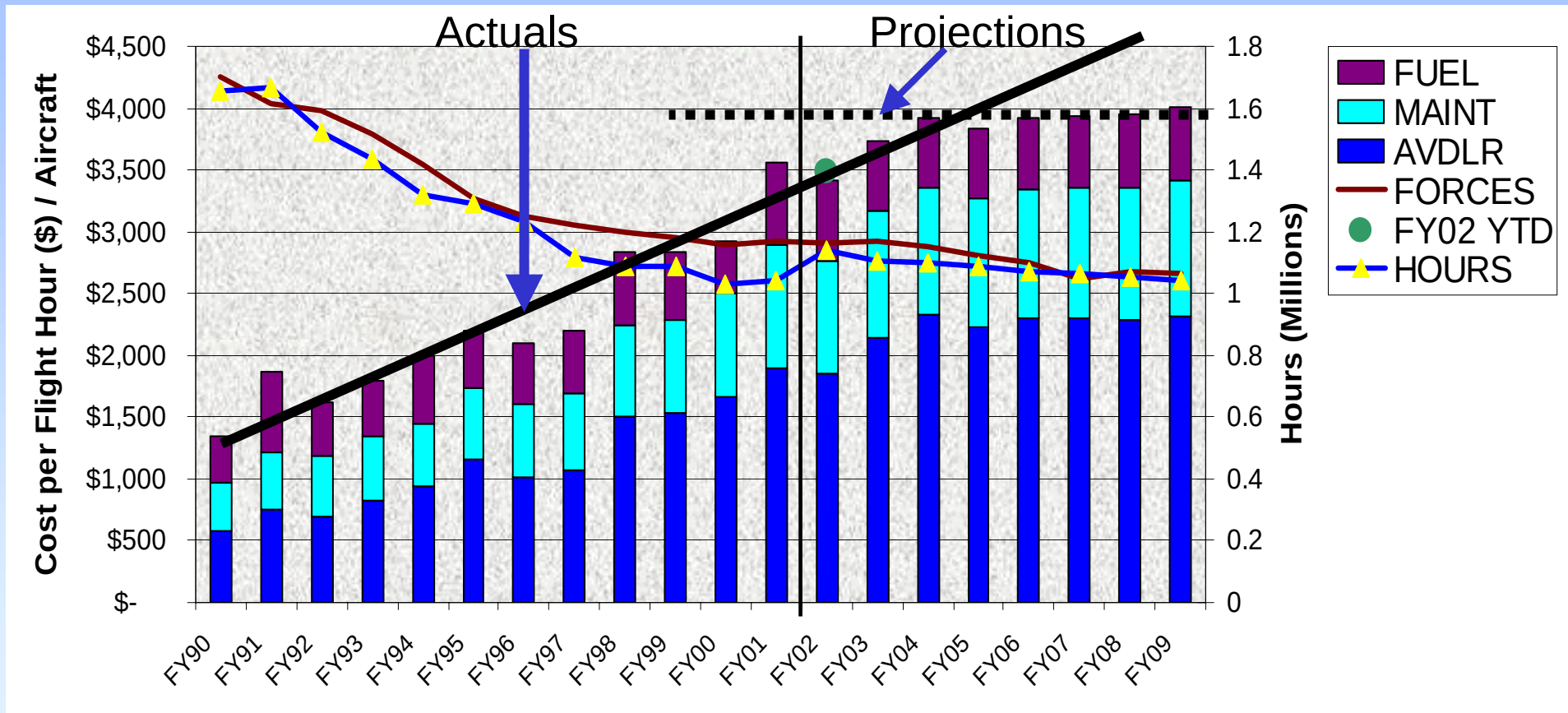

Future budget =/ Projected growth

Answer = "steal" from current FY budgets

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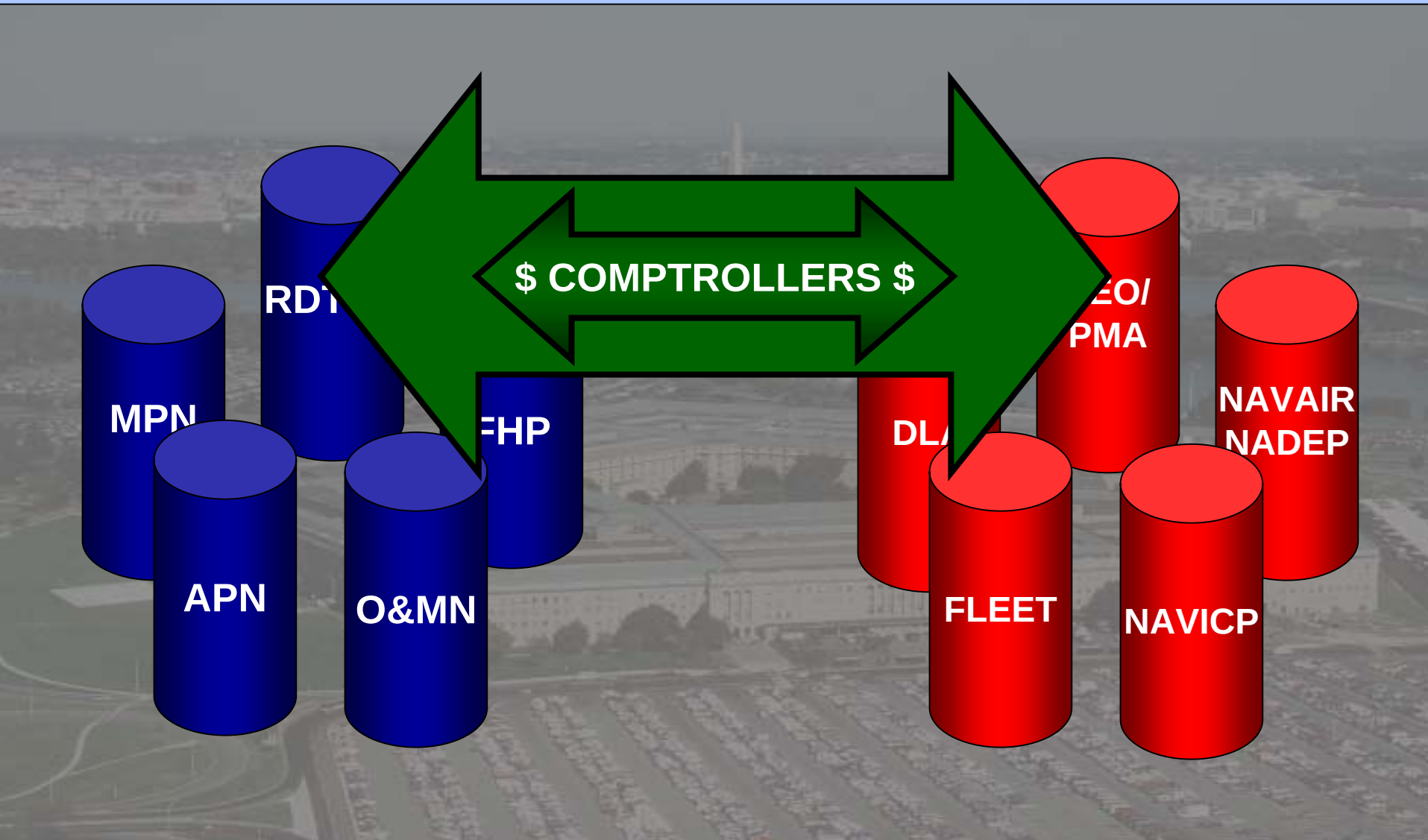
Eliminate Funding Stovepipes & Fragmented Program Management



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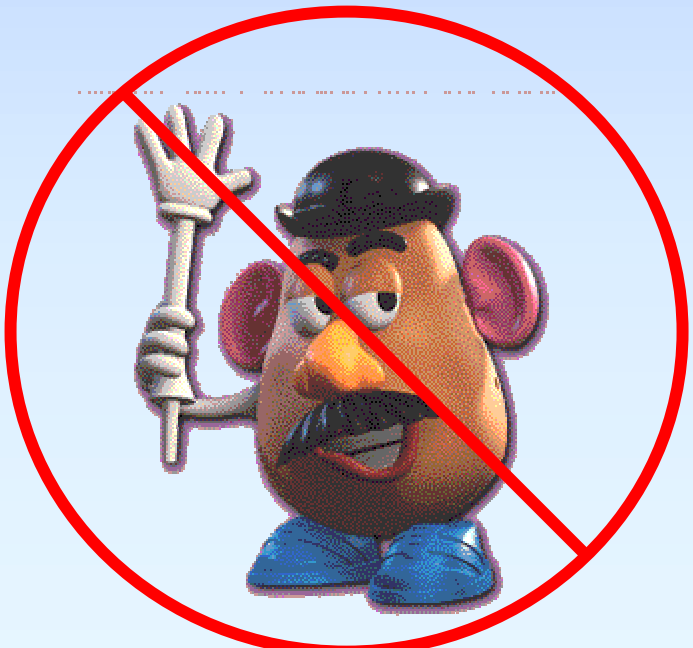
Change: Integrated prognostics strategy

1. Start with top maintenance drivers not new technology
2. Develop Common Failure “standards”
3. Integrate ALL Systems



Open Systems
Deciphering the Tower of Babel

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- Move from open systems (for a vendor) to “plug –n-play”
- Which interfaces should be the standard?
- Will the “real” standard please stand up?

JCAA/AVSI Interface Standards

Airframe (What is the best of breed?)

Corrosion Protection -- Recommended		Penetration As measured by Capillary Migration in 16"	Aged Film Characteristics (7 da. + @ 160F)	VOC	SALT SPRAY Days to Failure Steel	SALT SPRA Days to Failure Aluminum		
FILMS (foggable?)								
orrosion X Aviation)		9	Viscous Fluid	52g/l	<12,<12,17,18	35 & 35		
lass 2 Grade 4		5	Fluid	99g/l	7, 11	15 & 15		
lass 2 Grade 5		13	Fluid	335g/l	4, 4	5,10,10, &		
		10	Viscous Fluid	576g/l	<1, 2	26 & 27		
		9	Oily Fluid	>166.9g/l	2, 3	4 & 4		
		8.5	Oily Fluid	?	2,3	13 & 19		
lass 2 Grade 5		10	Fluid	19g/l	1, 2	5 & 7		
THICK FILMS								
		0	Soft Waxy Solid	255g/l	42, >63	> 60, >60		
		2 (9 overnight)	Soft Waxy Film	82g/l	4, 5	> 60, >60		
			Soft Solid	557g/l	>40	> 60, >60		
lass 2 Grade 1		5	Soft Solid	310g/l	24, 29	> 60, >60		
e 1		0	Soft Solid	291-324g/l	21, 29	54 & 54		
e 2		0	Oily Fluid	478 g/l	18,23	> 60, >60		
ass 2 Grade 2		7	Soft Waxy Solid	335g/l	5, 8	54 & >60	17, 17	>12,>12,>12
s 2 Grade 4		9.5	Soft waxy solid	335g/l	15,19	35 & 45	<4, <4	>12,>12,>12
SOFT SOLID THIN FILMS								
P-144	Omega 2775	9	Soft Solid	480g/l	7,8,10,11	26 & 27	5, & 5	>12,>12,>12
000324-OC-6	Tectyl 894 Class 2 Grade 3	8.5	Soft Waxy Solid	335g/l	8, 9	*60, *60	8, & 8	3,4,>12
000301-OC-3	Nox-Rust X-502-LS Class 1 Grade 2	10	Soft Waxy Solid	2.8#/gal	8,12	47 & 54	<4, & <4	7,>12,>12
000403-OC-1	Lubrigard 97-SX-92	9	Soft Solid	500g/l	4, 5	14 & 19	<4 , & <4	10,>12,>12
000324-OC-1	AR-500	10	Soft waxy solid	478g/l	4, 4			>12,>12,>12
000605-OC-4	ZC-026	8	Soft Solid	186g/l	6	28 & 29	<4 & <4	>12,>12,>12
000605-OC-2	ZC-015	9	Soft waxy solid	514g/l	<1	6, 8, 8 & 26		1,2,3
000228-OC-9	Esgard PL-2 Class 2 Grade 2	5	Fluid Paste	<10g/l	1, 2	4 & 4		1,2,3
000228-OC-10	Esgard PL-3 Class 2 Grade 3	5	Fluid Paste	9g/l	1, 2	3 & 3		1,1,1
Grade 1		7	Firm Asphaltic	3.3#/gal	3,19,19, & 21	> 60, >60		>12,>12,>12
		4	Firm Asphaltic	335g/l	24, 26, 26, 63	*60, *60		>12,>12,>12
		5	Dry Paste	412g/l	41, 47	> 60, >60	5, & 5	>12,>12,>12
de 4		10	Firm Waxy Solid	3.6#/gal	19,24	32 & 33	4, & 8	>12,>12,>12
		10	Firm waxy solid	600g/l	3	4,16, 24,&30		1,3,4
		7.5	Dry Film	448g/l	4,6,7,8,14	45 & *60	5, & 5	>12,>12,>12
		9	Hard pliable film	556g/l	3	6 & 6	<4 & <4	>12,>12,>12
6, 3-29		11	Hard Brittle Film	557g/l	< 5			
		10	Hard Tacky film	489g/l	3, 5	15,22,33, &4		
		10	Hard, non-tacky		2, 2	7,7,8,&13		
		10	Hard Brittle Film	573g/l	<1	26 & 26		
		8			1	13 & 29		
		14	Hard Pliable Film	<100g/l	<1	7 & 7		
		8	Tacky Firm Film	?	<1	<1		
		11.5	Hard Peelable Film	?	<1	<1		
		9	Oily Fluid	298g/l	1	4 & 4		
		10	Oily Fluid	312g/l	2	3 & 3		

mended due to opacity
ended due to brittle film

Replace current CRII-coated aluminum honeycomb cores in control surfaces


JOINT COUNCIL ON AGING AIRCRAFT
DEPARTMENT OF THE AIR FORCE
UNITED STATES OF AMERICA
DEPARTMENT OF THE ARMY
UNITED STATES OF AMERICA
FEDERAL AVIATION ADMINISTRATION
UNITED STATES COAST GUARD
1790
"A STITCH IN TIME..."

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Joint Opportunities

JCAA Wiring Steering Group Update

	00	01	02	03	04	05	06	07	$	S	P	Holes	Board ?
1.0 Acquisition, Logistics and Policy													
1.1 Joint Wiring Policy												BH	
1.1.1 Wiring System Management Policy													JCAA
1.1.2 Wiring System Maintenance Reporting Policy													ALB
1.1.3 Wiring Forum Consolidation													ALB
1.2 Joint Maintenance Manual												SH	
1.2.1 Joint Publications													ALB
1.2.2 Joint Maintenance Strategy													ALB
1.3 Joint Procurement Strategy												BH	
1.3.1 Acquisition Model for Wiring Systems													JCAA
1.3.1.1 Acquisition Reform Toolkit													JCAA
1.3.1.2 COTS Implementation Strategy													ALB
1.3.1.3 Parts and Suppliers Strategy													ALB
1.3.1.4 Spec and Standards Strategy													ALB
1.3.1.5 Material Selection Criteria													ALB

Current Initiative:

Building Wiring Maintenance Database

Legend: **$** = Funding **S** = Schedule **P** = Performance

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Questions?

Robert P. Ernst

Head, Aging Aircraft Program, AIR-4.1D

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AAIPT Fleet Focus Teams

Phased Growth

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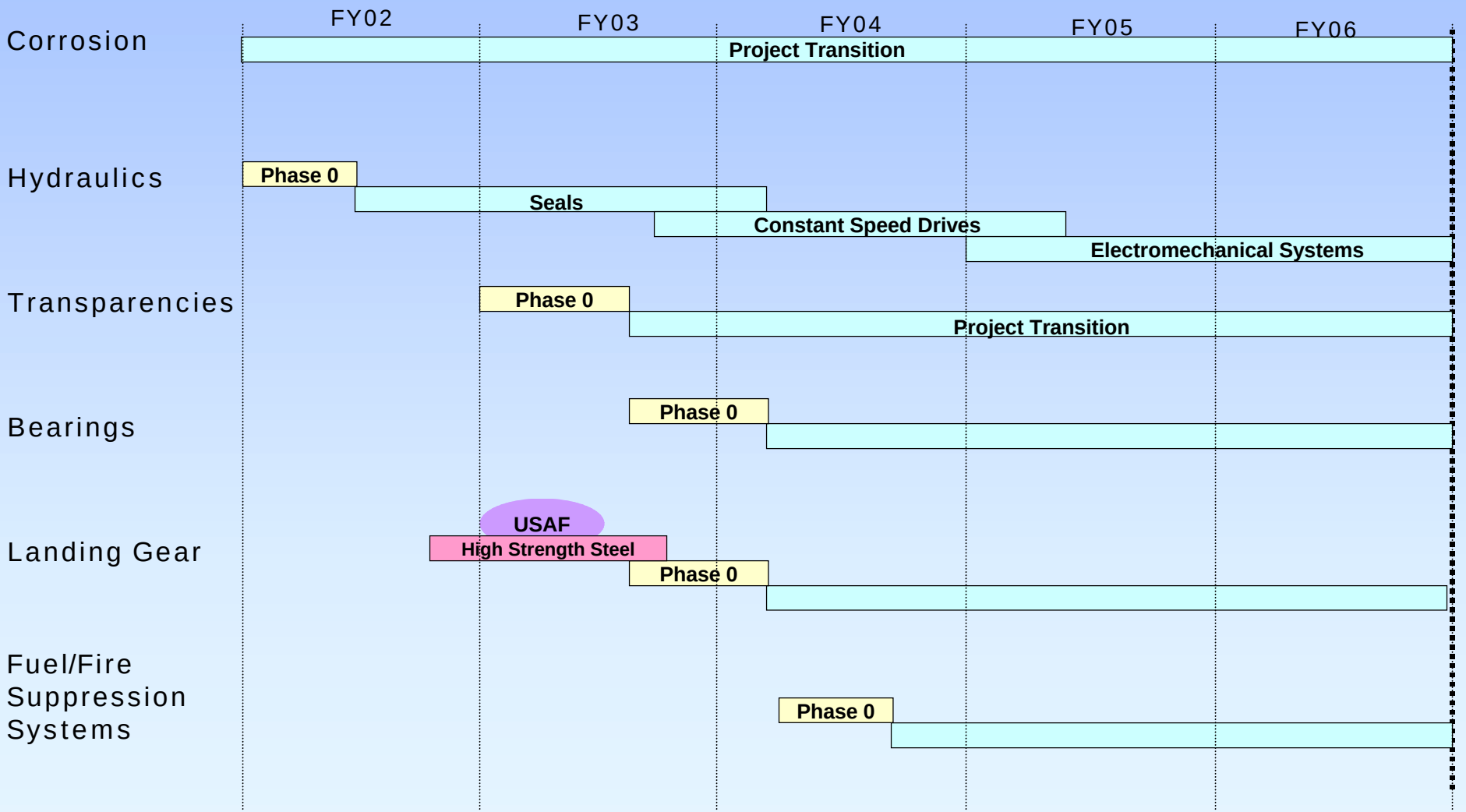
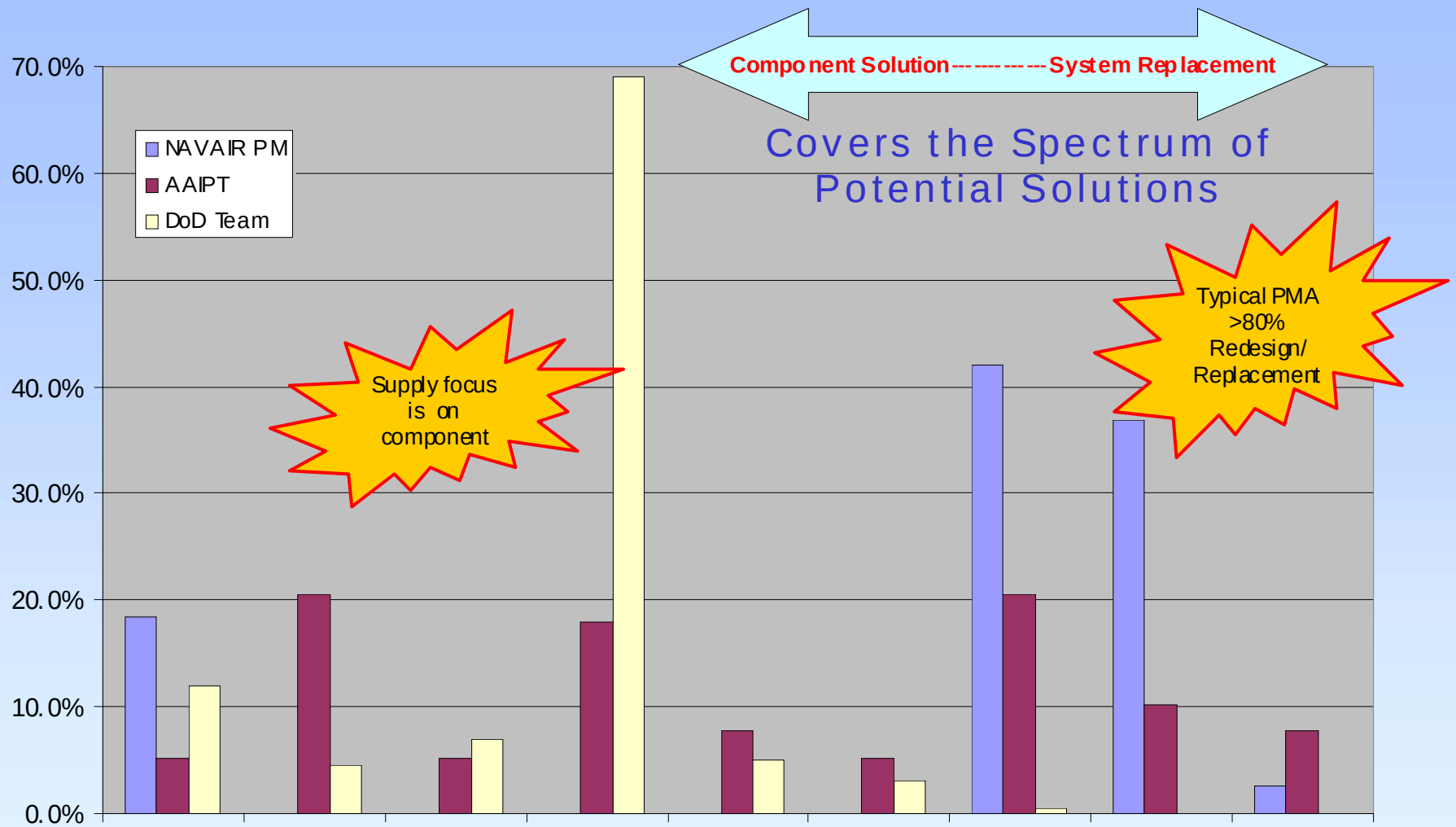


Current Obsolescence Efforts



	EOL	Source	Substitute	Alternate	Aftermarket	Emulation	Minor Redesign	Major Redesign	Replacement
NAVAIR PM	18.4%	0.0%	0.0%	0.0%	0.0%	0.0%	42.1%	36.8%	2.6%
AAIPT	5.1%	20.5%	5.1%	17.9%	7.7%	5.1%	20.5%	10.3%	7.7%
DoD Team	12.0%	4.5%	7.0%	69.0%	5.0%	3.0%	0.5%	0.0%	0.0%

Data Toolsets

APG-65 Example

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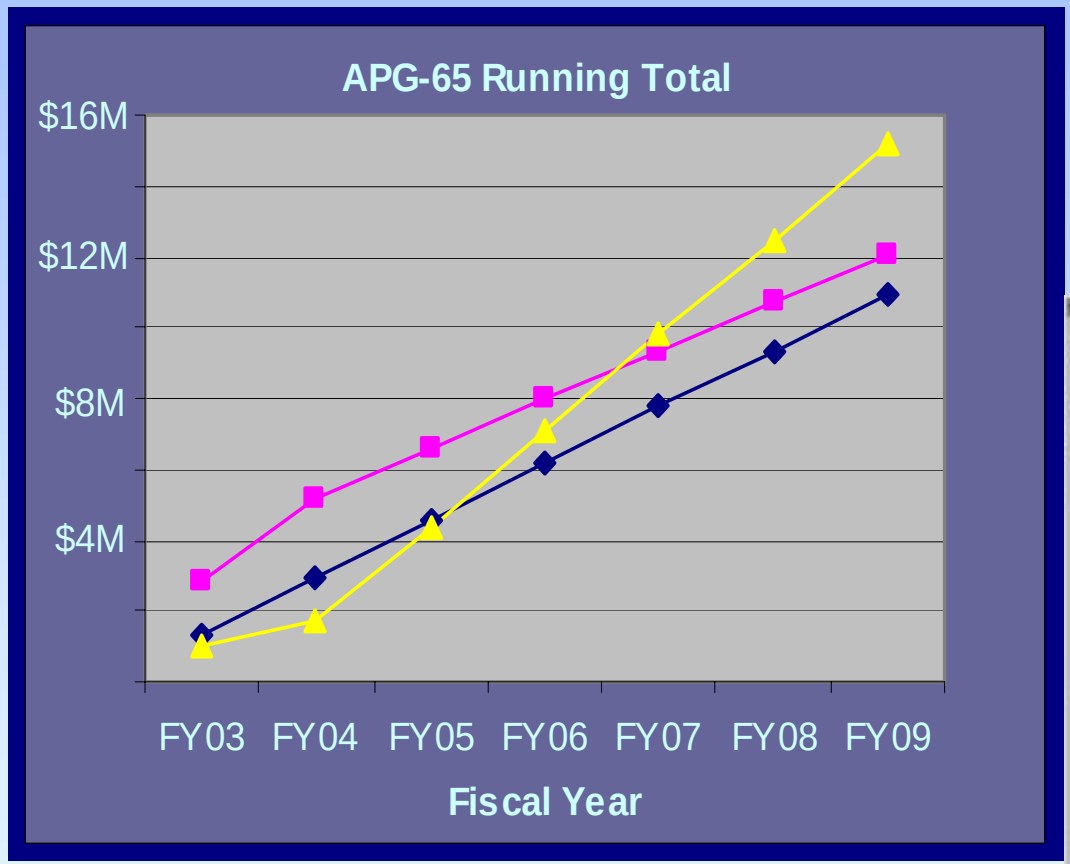
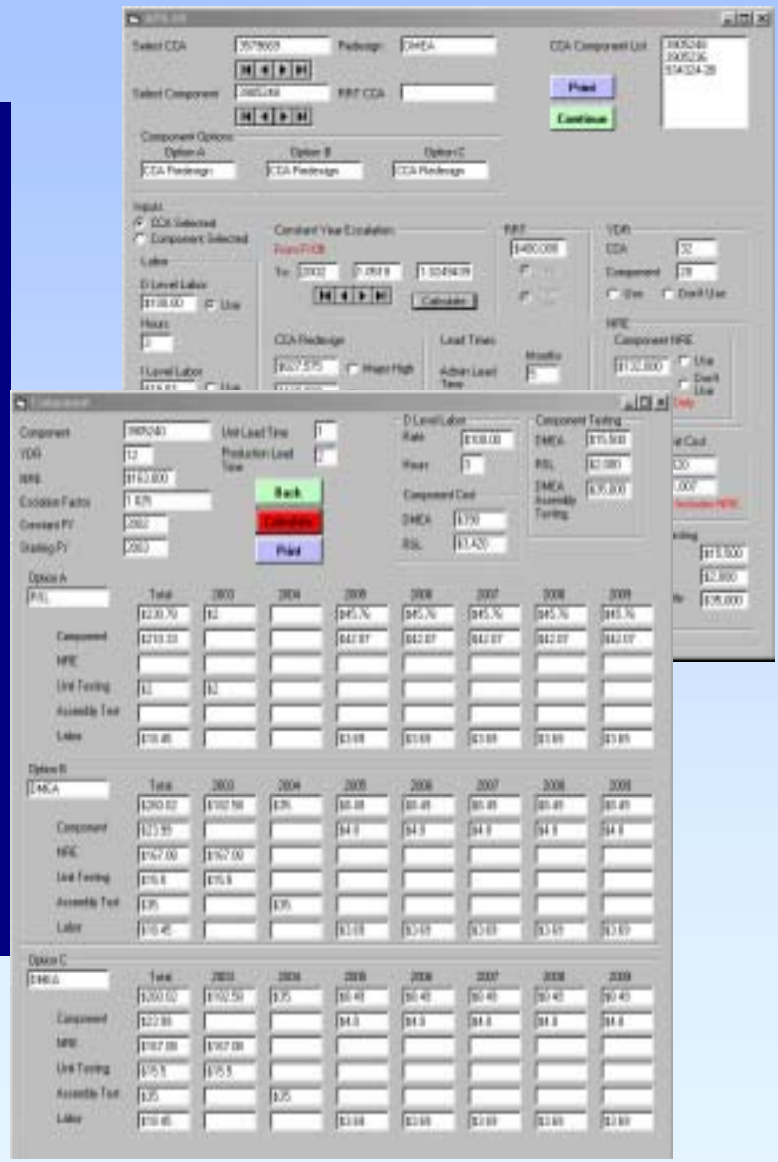
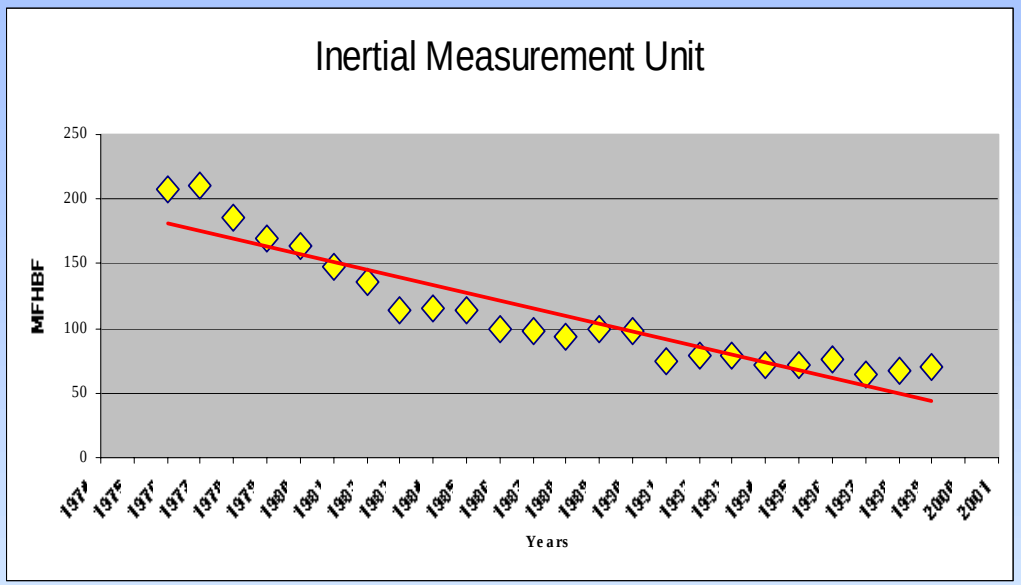
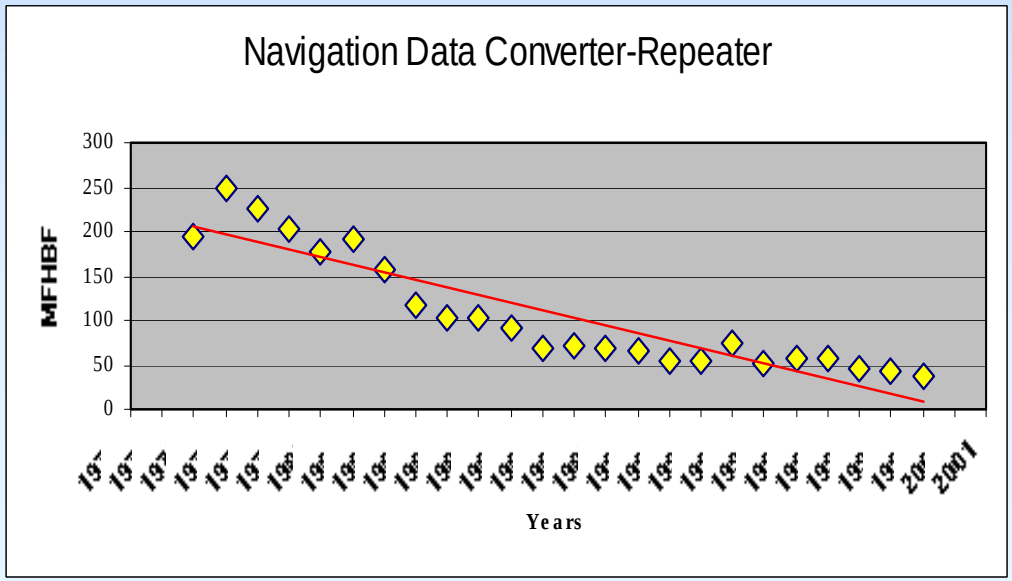




Subsystem Reliability Trends Over Time

Continued Degradation Despite Corrective Actions





Reliability Degradation Impacts Compounded by:

- Diminishing Manufacturing Sources
- Obsolescence
- Configuration Diversity

How does this impact our logistics elements?

Data from S-3 Subsystems

Theoretical Aging Models

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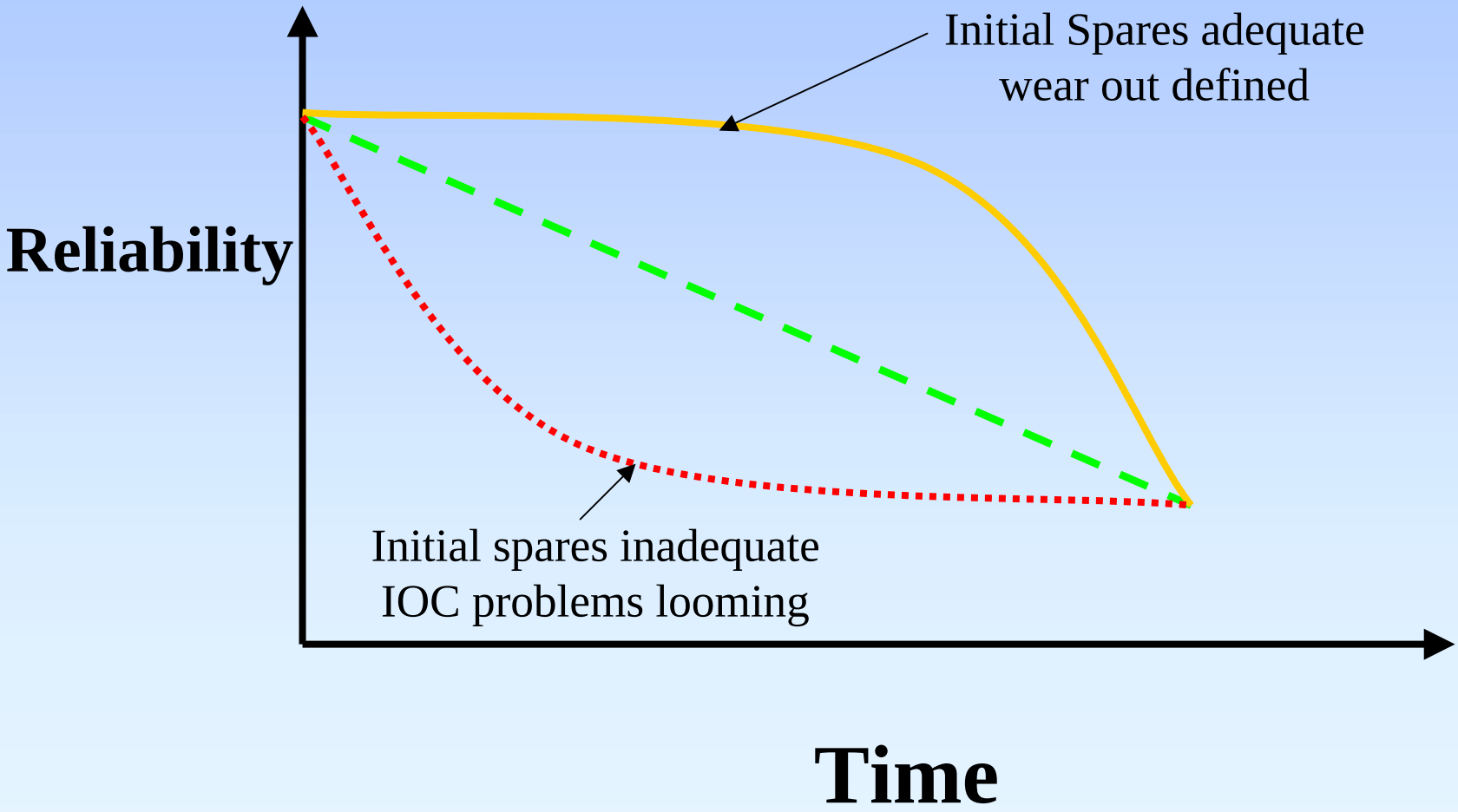
Performance=*f* (Age)



Risk Based Logistics

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Severity

Frequency	Catastrophic	Critical	Marginal	Negligible
Frequent (A)	1	3	7	13
Probable (B)	2	5	9	16
Occasional (C)	4	6	11	18
Remote (D)	8	10	14	19
Improbable (E)	12	15	17	20

Unacceptable — **1-5 High safety risk**
AIR 00

Undesirable — **6-10 Medium safety risk**
AIR 4.0

Acceptable With review — **11-17 Low safety risk**
PMA Acceptance

Acceptable Without review — **18-20 Very low safety risk**
IPT / FST / SSWG Acceptance

Wiring Off-Board Diagnostics:
Focus On I-Level

Standing Wave Reflectometer - With Plain Text Display

TEST SYSTEMS
(MIL-STD-810 EXPLOSIVE ENVIRONMENT)

Ruggedized Laptop

Test Box/Expansion Units

Integrates:
- **Existing Off-The-Shelf Systems**
- **Interfaces To Communicate With Existing Maintenance Data Systems**
- **Technology Readiness Levels 6-8**

Addressing Commonality Through Diverse Requirements

Power Panels and High Density Wiring

Relay Panels and Filter-line Wiring

Integrated Wiring System

Faulty Wiring
Cost Impact

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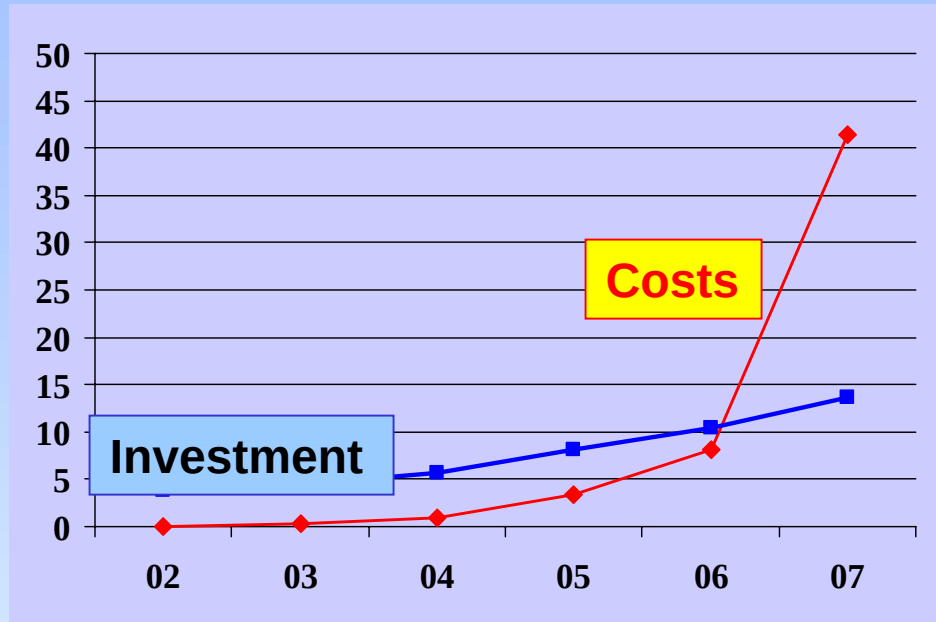
- **15-20% of "No-Fault" Found (A799) due to wiring failures**
- **Industry Survey Estimates 50% reduction of costs through use of Automatic Test Systems**



ISSUES:

- **Prognostic thresholds (red/yellow/green)**
- **Data transfer (AWA-NALCOMIS)**
- **New technology Insertion**

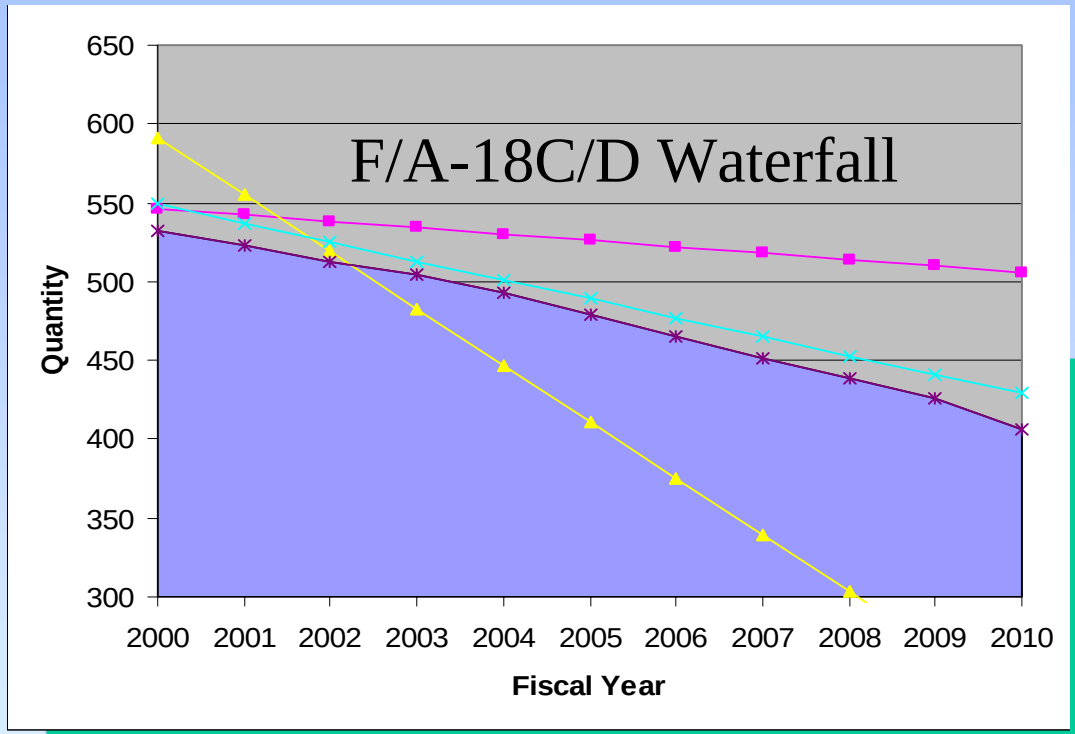
Opportunity for industry support

Commonality

Replacement Attitude Heading Reference System (RAHRS)

- Replaces AN/ASN-50 and A24G (AMSR top 100 item) AHRS with highly reliable NDI Functional unit
  - *Increase reliability to >7500hrs vs. current <200hrs – 500hrs*
- LECP criteria satisfied on 4 of 5 programs

Process Problems!



We're making decisions

Without going thru the

COMPLETE PROCESS

Couple

Parts Evaluation

with

Design Evaluation

- *Let's incorporate reliable solutions*
- *Appropriate use of parts with design applications*