

Aging Aircraft Integrated Product Team



Corrosion Efforts & Barriers

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How bad is the problem?



Aging Aircraft IPT

- **Naval Aviation Spends 10 *Million* Man Hours per year on corrosion Inspection, Prevention and Treatment**
 - Average of 7.27 MMhrs per Flight Hour

High: MMHrs/FH

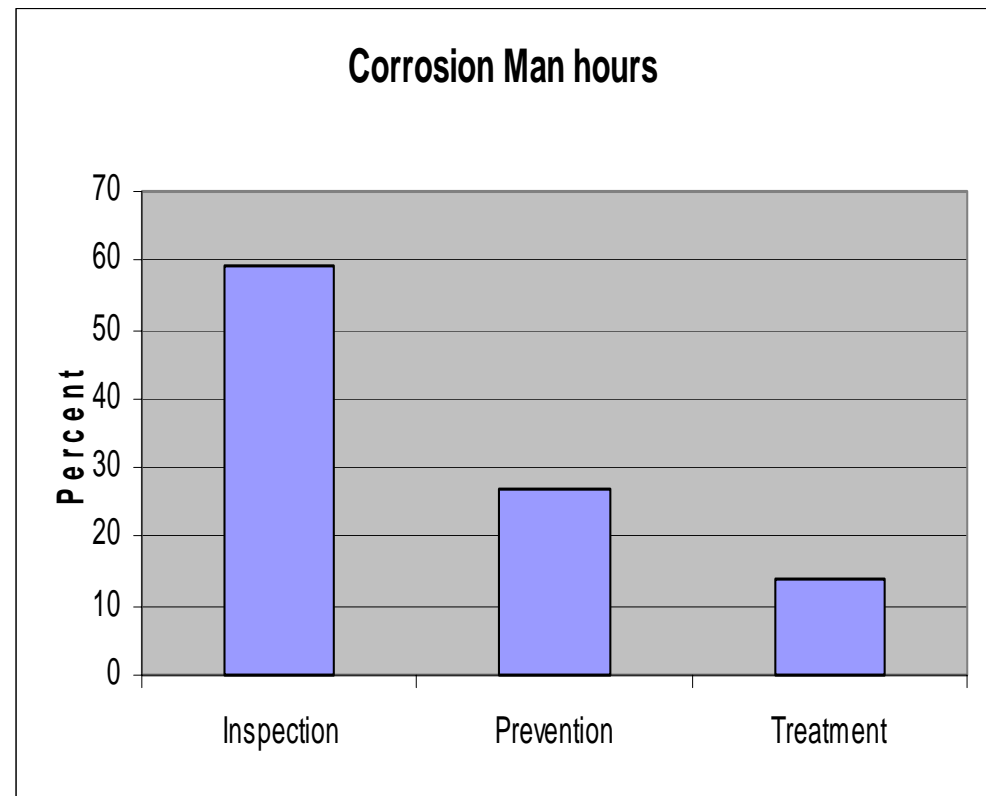
F-14 @ 23.23

EA-6B @ 20.26

Low: MMHrs/FH

H-46 @ 5.61

AV-8B @ 4.11

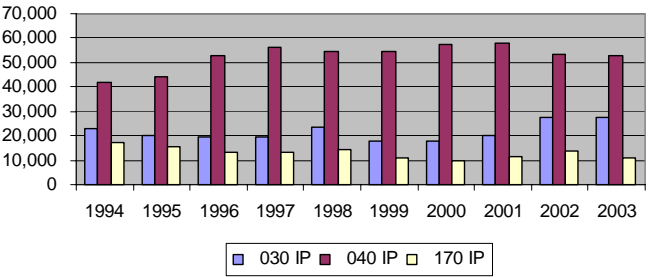




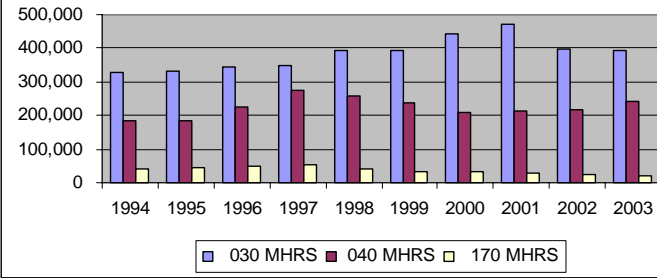
EA-6B Corrosion Summary

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ML1 ITEMS PROCESSED



ML1 MAN HOURS



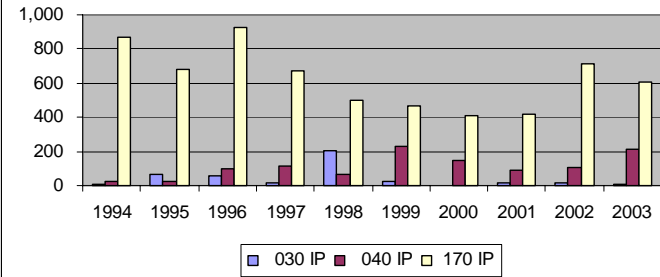
Legend

- 040/049 – Prevention/Preservation
- 170 – Corrosion Discrepancy:
- C – Repair
- R – Remove & Replace
- Z - Treatment
- 030 – Corrosion Inspection
- BCM - Beyond Capable Maint

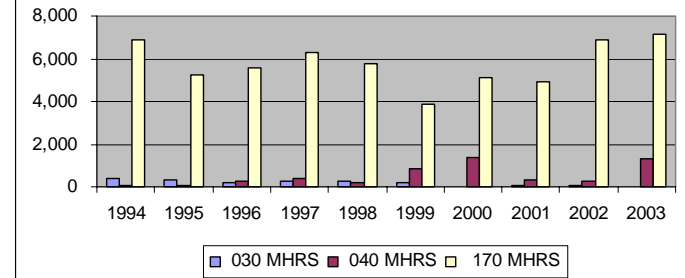
YEAR	C-170	R-170	Z-170	BCM
1994	864	52	16,468	429
1995	614	46	15,057	191
1996	727	34	12,887	294
1997	679	111	12,790	204
1998	628	41	13,901	180
1999	566	28	10,759	216
2000	713	29	9,127	162
2001	1360	48	10,089	127
2002	2267	33	11,624	379
2003	1982	34	9,078	293

YEAR	# A/C	FLT HRS
1994	118	31,290
1995	120	25,172
1996	111	31,506
1997	117	31,727
1998	117	30,604
1999	120	34,686
2000	119	33,864
2001	120	35,230
2002	122	33,481
2003	119	34,223

ML2 ITEM PROCESSED



ML2 MAN HOURS



CORROSION TOP DEGRADERS					
ML1		ML2			
WUC		MHRS	WUC		MHRS
11	Airframe	233,411	13	landing gear System	8,912
13	landing gear System	26,247	14	Flight Control	8,089
14	Flight Control	20,007	11	Airframe	6,885
29	Power plant	17,122	76	Countermeasures	5,762
42	Electrical systems	8,917	12	Furnishings	5,036

Aging Barriers

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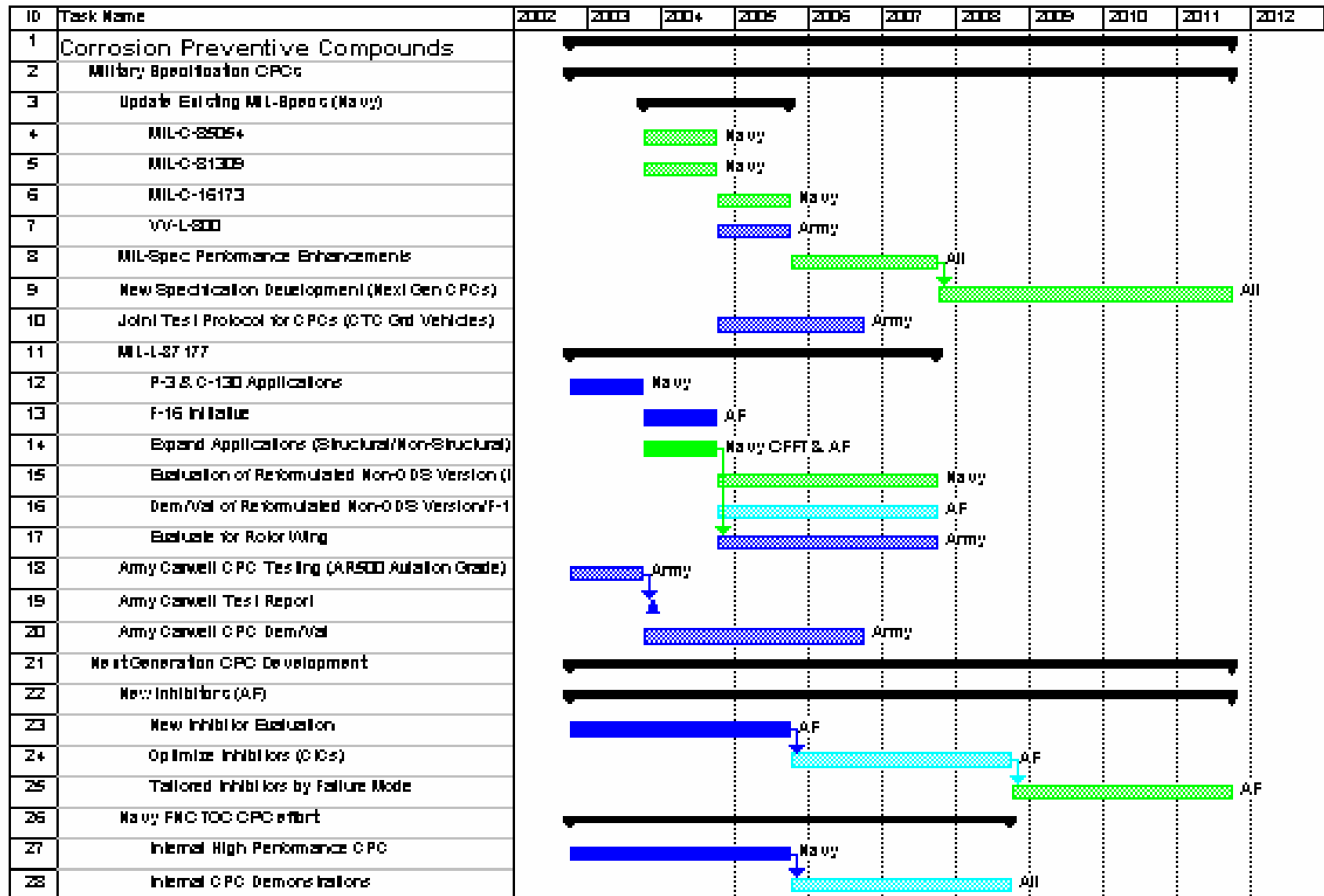
- Competing Technologies & Roadmaps
- Lack of Transition Funding
- Poor Data
- Simple Solutions are Effective
- Emphasis of Age in Acquisition

CPC Roadmap

August 03



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Transition Funding

Transition

Development

Acquisition

Sustainment

The Frogger Affect



Corrosion Repair Kit



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- **Mechanical and Chemical Kit**
 - Design and Implementation
 - Dod Wide Application
 - Accomplish Required Corrosion Efforts
 - Aircraft and Ground Support Equipment
- **Accomplishments**
 - USA and USAF Implementation of USN Products
 - NSNs Developed

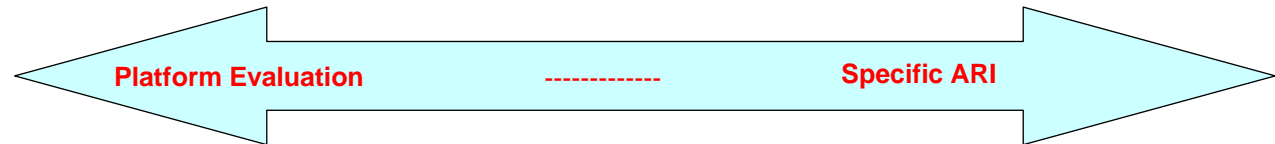


One Product Multiple Users

Bob's View of Data



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	T/M/S ROI		ARI Evaluation		Verify Corr actions	
	O	D	O	D	O	D
Platform Level						
MMHRS						
Material						
Aircraft Zone						
Component						
Type						

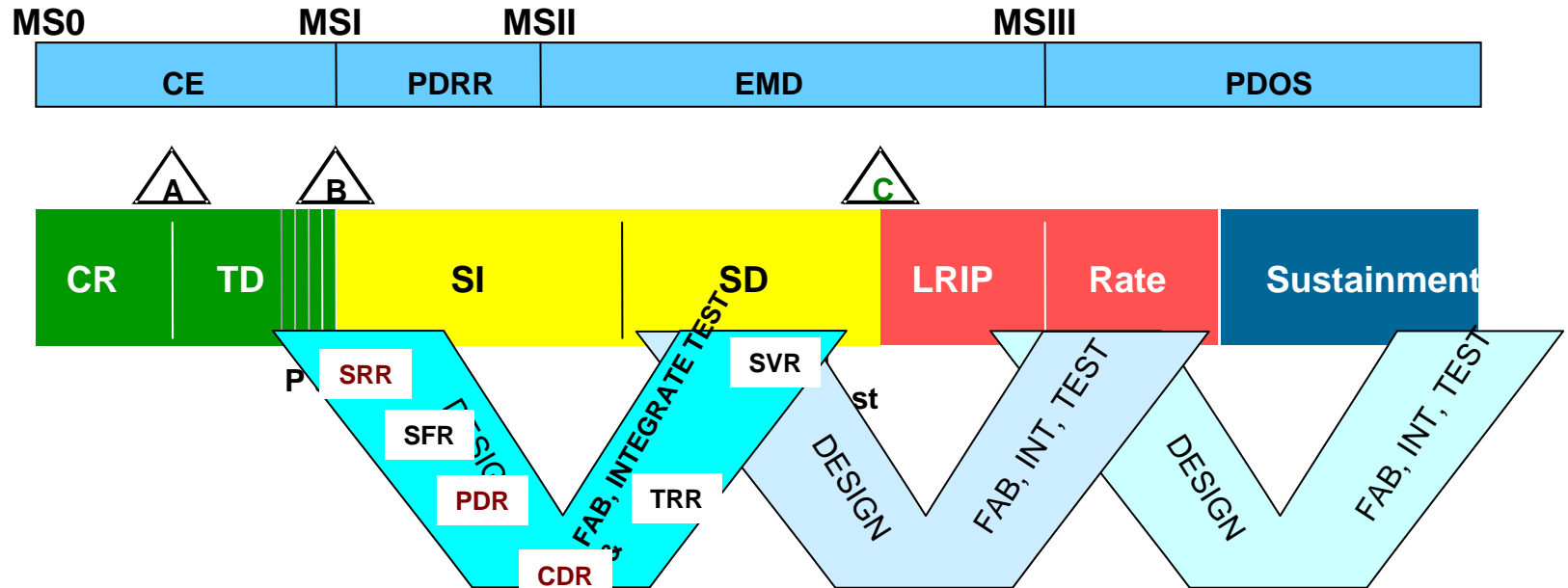
Data "Requirements":

- Specific zone or part
- Type
- Minimize manual data entry

Systems Engineering Supporting New Acquisitions



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AGING AIRCRAFT 2005

THE 8TH JOINT DOD/FAA/NASA
CONFERENCE ON AGING AIRCRAFT



JANUARY 31 - FEBRUARY 3, 2005

Wyndham Palm Springs • Palm Springs, CA

SELECT...

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- ▶ POINTS OF CONTACT
- ▶ 2003 CONFERENCE

YOUR

MARK

Calendar

The 8th Joint DoD/FAA/NASA
Conference on Aging Aircraft
will be held at the
Wyndham Palm Springs
31 January - 3 February, 2005.



<http://www.agingaircraft.utcdayton.com/>



Questions?

Robert P. Ernst (AIR-4.1D)

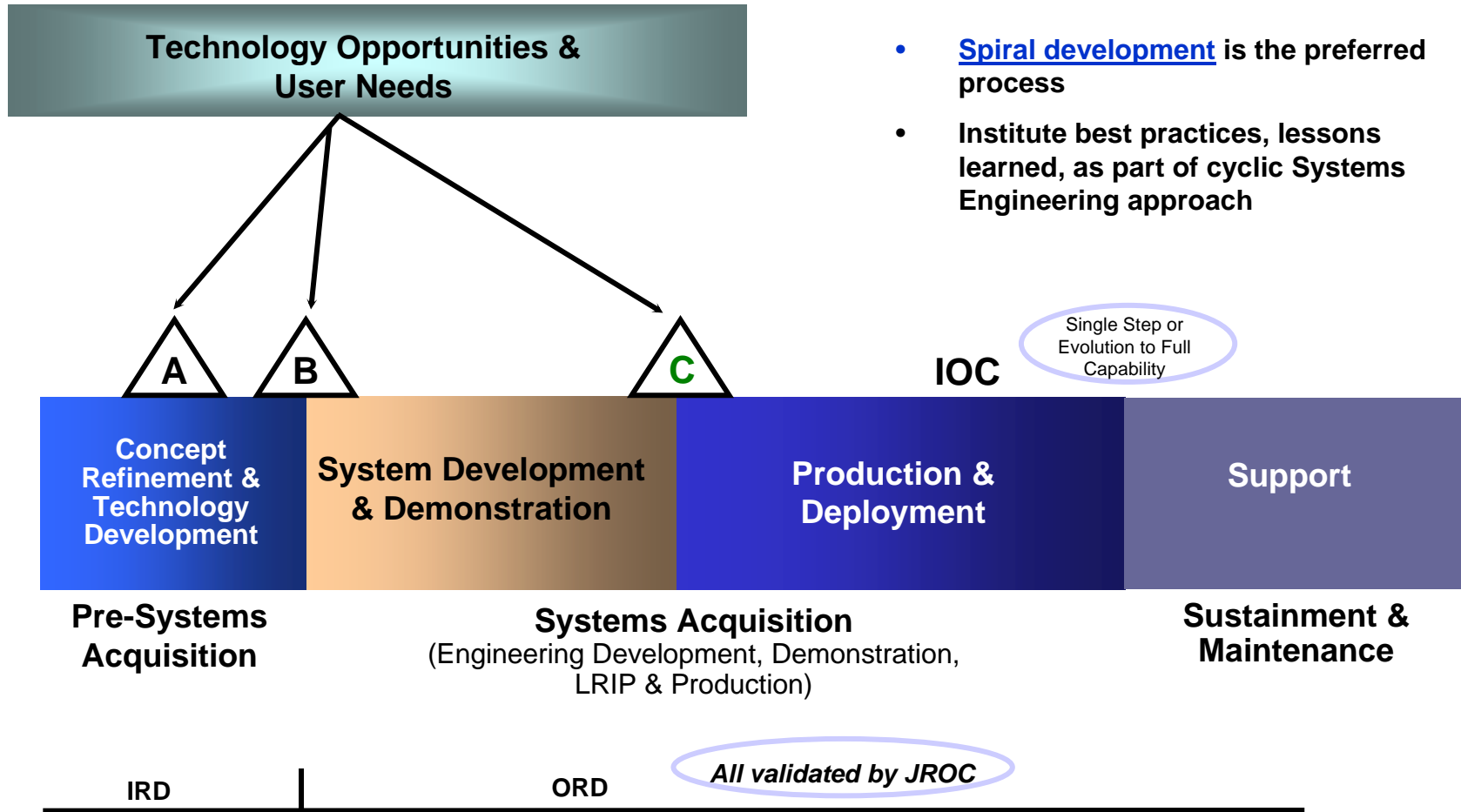
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The 5000 Model

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- Evolutionary acquisition is the preferred strategy for rapid acquisition of mature technology
- Spiral development is the preferred process
- Institute best practices, lessons learned, as part of cyclic Systems Engineering approach

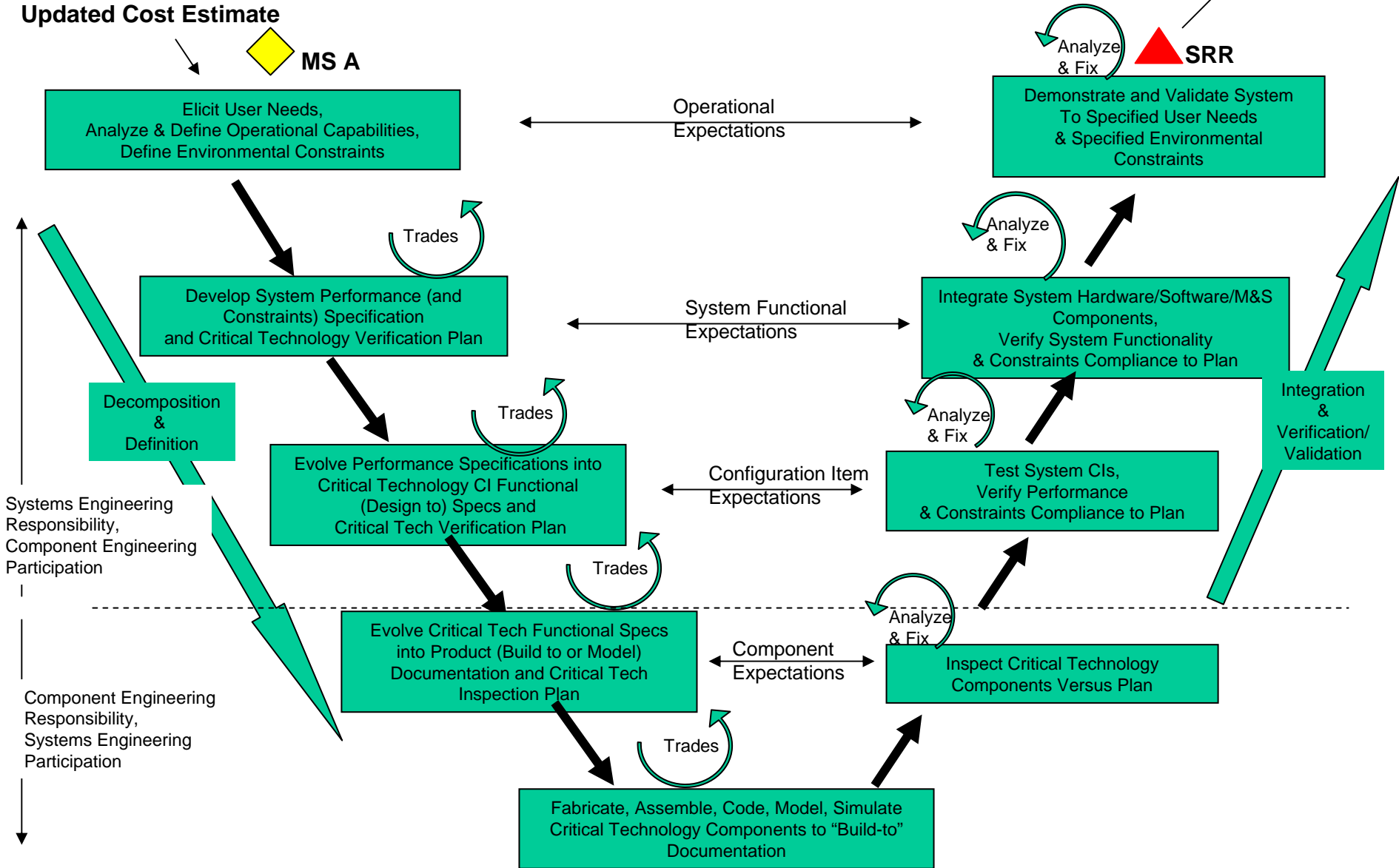
Relationship to Requirements Process

Systems Engineering As Applied To Technology Development

ICD
Completed AoA
Preferred Sys Concept
Tech Dev Strategy
Prelim Sys Spec
Updated Cost Estimate

Matured Technologies
Sys Perf Spec
Updated Cost Estimate
SD&D PLAN

MS A

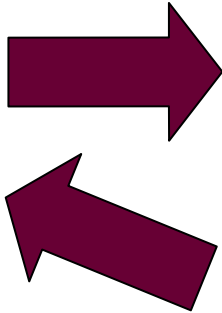




Where do we need to be?

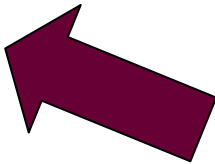
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Step N

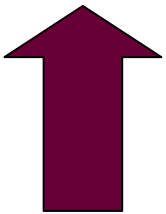


Automatic Data Recording (where feasible)
Zone or Component Specific
Type of Corrosion
Able to track Corrective action

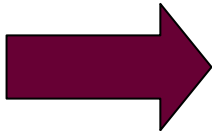
Step 3



Step 1



Utilize USCG tracking S/w
Allows for tracking by zone
Not feasible at "O"
Can measure some effectiveness



Step 2

Today

Take "Bite Sized" Steps



MIL-L 87177A

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P-3

Replaced **Daily** VV-L-800 with **28 Day** MIL-L-87177
Expanding use to C-130 and other T/M/S inventory.

P-3 Flapperon Jack Screws



Daily application of VV-L-800



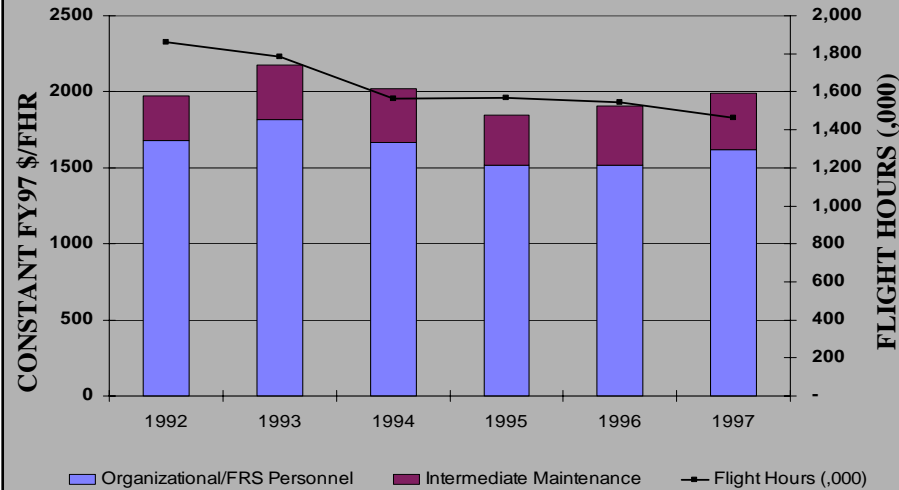
Application **28 day cycle** MIL-L-87177

PERSONNEL TRENDS VS. MAINTENANCE WORKLOAD

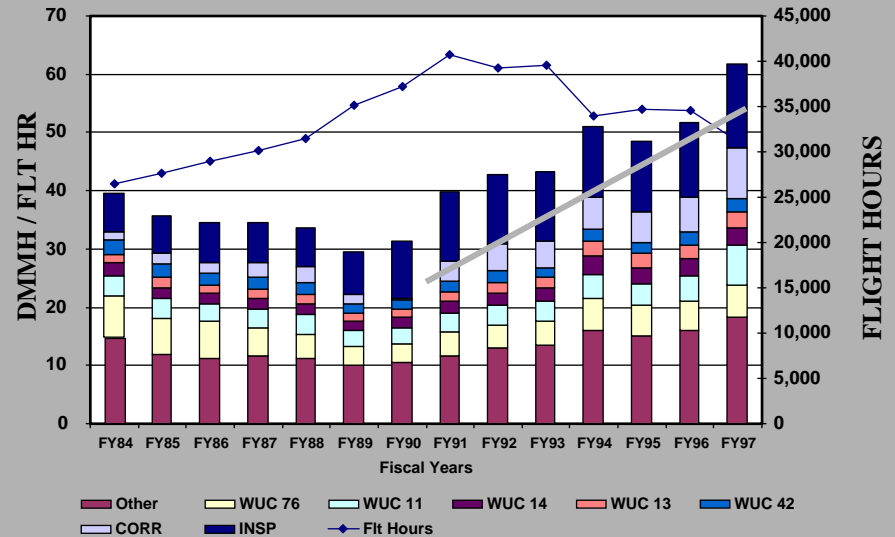


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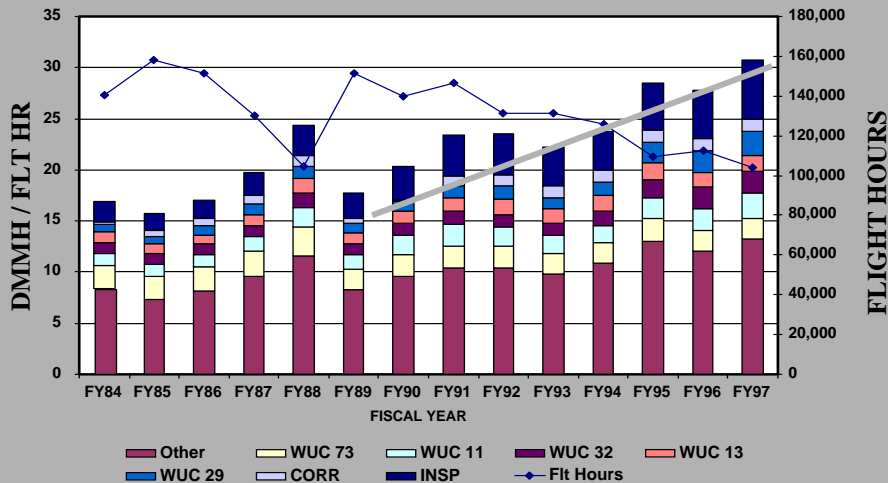
FLIGHT HOUR PROGRAM



EA-6B MAINTENANCE HISTORY OVER TIME



P-3C MAINTENANCE HISTORY OVER TIME



- Dollars for manning relatively stable
- All T/M/S have greatly increasing maintenance man-hours/flight hr
- Concentrated growth areas in inspections, corrosion control, critical systems associated with age issues
- Funding shortfalls in other accounts drive additional maintenance: cannibalization, ASPA inspections, etc.

Man-hours per Flight-hour

T/M/S	# A/C AVG	FLT HRS.	DMMH	DMMH AVG
F-14	231	321,783	7,477,439	23.23
EA-6B	118	321,783	6,522,033	20.26
H-53	445	396,902	4,746,570	11.95
S-3	120	454,546	5,179,155	11.39
H-60	301	1,006,966	10,476,151	10.40
E-2	75	239,329	2,432,954	10.16
C-2	37	95,801	925,461	9.66
*V-22	7	576	5,526	9.59
H-3	74	183,222	1,515,074	8.26
F/A-18 A-D	772	2,239,845	15,846,976	7.07
P-3	266	1,158,867	7,682,464	6.62
*F-16	9	1,723	10,223	5.93
*RQ-2	24	4,568	26,848	5.87
H-46	304	760,216	4,267,923	5.61
E-6	16	146,696	799,893	5.45
C-130	69	432,391	2,048,494	4.73
AV-8B	184	345,140	1,420,648	4.11
*F/A-18 E/F	82	89,409	368,091	4.11
AH-1W	185	311,857	1,280,608	4.10
H-1	129	255,614	917,236	3.58
C-9	28	299,124	929,712	3.10
*OH-58C	4	2,475	6,893	2.78
T-38	10	10,585	22,574	2.13
F-5	35	92,264	157,701	1.70
T-2	98	275,430	460,828	1.67
C-20	7	60,654	77,693	1.28
T-45	99	493,168	582,849	1.18
C-40	6	21,815	19,861	0.91
C-12	79	453,204	1,349	0.02
TOTAL	3,812	10,475,953	76,209,227	7.27

* Less than 10 yrs
of data available.

10 Year O & I Level Direct Maint Man Hours

Corrosion Example

Corrosion Preventive Compounds

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LAB ID	Relief for Corrosion Protection Standard / Nonconformity	Penetration As measured by Capillary Migration (7 da. @ 100°F)	Aged Film Characteristics (7 da. @ 100°F)	VOC	SALT SPRAY Days to Failure Steel	SALT SPRAY Days to Failure Aluminum	SO-SALT SPRAY Days to Failure Aluminum	SSA SPRAY Cycles to Failure Steel
OLY FILM FILMS (Responsible?)								
000627-0C-1	New Coat - 2 Coats (11 x 10 mil)	0	Vitreous Flaked	500g/l	> 112 > 112 > 112	30 & 30	5, 5, 5	> 12 > 12 > 12
000228-0C-11	Epigard PE-4 Class 2 Grade 4	0	Film	950g/l	7, 11	18 & 18		> 12 > 12 > 12
000018-0C-1	Epigard 1111 Class 2 Grade 5	13	Film	300g/l	< 4	< 5, 10, 10, 27		1, 4
000005-0C-1	Alu-110	10	Vitreous Flaked	570g/l	< 1, 2	28 & 27		2, 3
000020-0C-1	Alu-110 Type 2	9	Dry Film	1466 g/l	< 2	28 & 28		1, 1
000018CC-1	Corrosion 5	8.5	Dry Film	?	2, 3	13 & 13		1, 2, 3
000028-0C-1	Epigard PE-2 Class 2 Grade 5	0	Film	130g/l	1, 2	1, 2		1, 1
SOFT SOLID THICK FILMS								
000010-0C-1	Corrosion 2275	0	Soft Solid	400g/l	> 80, > 80	> 80, > 80	19, 4	> 12 > 12 > 12
000010-0C-2	Epigard PE-2 Class 2 Grade 4	0	Soft Solid	350g/l	> 80, > 80	> 80, > 80	19, 4	> 12 > 12 > 12
000010-0C-3	Epigard PE-2 Class 2 Grade 4	2 (10 channels)	Soft Waxy Solid	350g/l	> 80, > 80	> 80, > 80	19, 4	> 12 > 12 > 12
000018-0C-1	Corrosion 2275	0	Soft Solid	350g/l	> 80, > 80	> 80, > 80	19, 4	> 12 > 12 > 12
000228-0C-4	Epigard PE-1 Class 2 Grade 1	0	Soft Solid	310g/l	> 24, 29	> 80, 900	28 & 38	> 12 > 12 > 12
000228-0C-5	Epigard PE-1 Class 2 Grade 1	0	Soft Solid	251, 252g/l	> 21, 29	> 81 & 84	29, 4, 24	> 12 > 12 > 12
000228-0C-6	Vul-SBRM Class 2	0	Dry Film	478 g/l	18, 23	> 80, > 80	< 4, < 4	> 12 > 12 > 12
000018-0C-1	Epigard 1111 Class 2 Grade 2	0	Soft Waxy Solid	300g/l	< 6	< 4 & > 80	17, 17	> 12 > 12 > 12
000020-0C-4	Tacky 845 Class 2 Grade 4	0.5	Soft Waxy Solid	335g/l	15, 19	30 & 45	< 4, < 4	> 12 > 12 > 12
SOFT SOLID THIN FILMS								
P-144								
000018-0C-1	Corrosion 2275	0	Soft Solid	400g/l	7, 8, 10, 11	28 & 27	5, 6, 5	> 12 > 12 > 12
000018-0C-2	Epigard PE-2 Class 2 Grade 4	0.5	Soft Waxy Solid	350g/l	8, 10	29, 30	5, 6, 5	> 12 > 12 > 12
000001-0C-3	New Coat - 2 Coats (11 x 10 mil)	0	Soft Waxy Solid	2, 880g/l	8, 12	47 & 58	< 4, < 4	7, 12 > 12
000018-0C-1	Epigard 1111 Class 2 Grade 2	0	Soft Solid	300g/l	4, 4	18, 13	< 4, < 4	> 12 > 12 > 12
000005-0C-4	Alu-110	10	Soft Waxy Solid	180g/l	4, 4	28 & 28	< 4, < 4	> 12 > 12 > 12
000005-0C-5	Alu-110	10	Soft Waxy Solid	110g/l	5	28 & 28	< 4, < 4	> 12 > 12 > 12
000028-0C-1	Epigard PE-2 Class 2 Grade 2	0	Soft Waxy Solid	310g/l	5	16, 8 & 26	1, 2, 3	> 12 > 12 > 12
000028-0C-2	Epigard PE-2 Class 2 Grade 2	0	Film Phases	410g/l	1, 2	16, 8 & 26	1, 2, 3	> 12 > 12 > 12
000028-0C-3	Epigard PE-2 Class 2 Grade 2	0	Film Phases	491	1, 2	16, 8 & 26	1, 1, 1	> 12 > 12 > 12
ASPHALT TYPE								
000001-0C-2	New Coat - 2 Coats (11 x 10 mil)	?	Firm Asphalt	3, 360g/l	3, 19, 18 & 21	> 80, > 80		> 12 > 12 > 12
000018-0C-1	Epigard 1111 Class 2 Grade 1	4	Firm Asphalt	330g/l	12, 26, 26, 30	> 80, > 80		> 12 > 12 > 12
FIRM SOLID or PASTE								
000010-0C-4	Corrosion AV-31	0	Dry Paste	4, 12g/l	4, 1, 27	> 80, > 80	5, 6, 5	> 12 > 12 > 12
000018-0C-1	Epigard 1111 Class 1 Grade 4	0	Firm Waxy Solid	3, 660g/l	1, 2	4, 16, 24 & 30	1, 3, 4	> 12 > 12 > 12
000005-0C-6	Alu-110	10	Firm Waxy Solid	600g/l	3	4, 16, 24 & 30	1, 3, 4	> 12 > 12 > 12
HAIRY FILM TYPES								
000228-0C-3	Corrosion AV-31 (10 mil)	7.5	Dry Film	448g/l	4, 6, 7, 8, 14	45 & 40	5, 6, 5	> 12 > 12 > 12
000018-0C-4	Corrosion AV-31 (10 mil)	11	Hard Brittle Film	557g/l	< 5	15, 22, 31, 44	< 4, 4	> 12 > 12 > 12
000018-0C-5	Cor-Ban 30 BMS 3-2P 3-2P 3-2P	11	Hard Brittle Film	557g/l	< 5	15, 22, 31, 44	< 4, 4	> 12 > 12 > 12
000014-0C-1	Vul-Kaplar	10	Hard non-Brittle	557g/l	2, 9	7, 7, 8 & 15	5, 6, 9	> 12 > 12 > 12
000010-0C-1	Alu-110	10	Hard Brittle Film	572g/l	< 1	29 & 26	1, 2, 3	> 12 > 12 > 12
000010-0C-4	Alu-C-85004	8	Hard Brittle Film	572g/l	< 1	19 & 29	1, 2, 3	> 12 > 12 > 12
000028-0C-1	Process 711X	14	Hard Phosphate Film	< 100g/l	< 1	< 4, 4	< 1, 1	> 12 > 12 > 12
000028-0C-6	Corrosion 2275	17.5	Tacky Film Film	?	< 1	< 1		1, 1, 1
LUBRICATING OILS								
000005-0C-8	Alu-110	0	Dry Film	285g/l	1	5 & 5		1, 2, 3
000005-0C-7	Alu-110	0	Dry Film	315g/l	1	5 & 5		1, 2, 3



Transitioning the Best Solutions

- Transition “best of breed” Corrosion Solutions
- FY-02: 13 projects
- FY-02/03 Project Savings: **Over 250,000 MMHrs eliminated**

Who is the JCAA?



Aging Aircraft IPT



Jointly Identify, Investigate, and Implement Programs that will Field Products to Improve the *Availability* and *Affordability* of all the Services' and Agencies' Aging Aeronautical Systems.

Through the use of Integrated Roadmaps, Shared Data and Analyses, the JCAA will:

- Identify Process Recommendations & Improvements
- Advocate/Enable Promising Technology
- Facilitate Transition of Technology/Program Opportunities
- Promote Knowledge Management on Aging Aircraft
- Coordinate Funding for Promising Areas

Near Term Solution

3 inch Radial Bristle Discs

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Commercially available Roloc™ discs used during down-select testing were too aggressive and damaged the surface; immediately eliminated.

JCAA-CSG FY02-07 Plans



Aging Aircraft IPT

ID	Task Name	2002	2003	2004	2005	2006	2007
1	Technology Roadmaps	[Thick black bar spanning 2002-2007]					
2	Joint Services CPC Roadmap		[Bar]				
3	Joint Services Prognostics/Diagnostics Roadmap			[Bar]			
4	Joint Services Corrosion Mapping Roadmap			[Bar]			
5	Joint Services Protective Finishing System Roadmap				[Bar]		
6	Joint Services Coatings Removal Roadmap				[Bar]		
7	Joint Services Inorganic Coating/Plating Roadmap					[Bar]	
8	Joint Services Cleaning and Preservation Roadmap					[Bar]	
9	Joint Services Maintenance Practices Roadmap						[Bar]
10							
11	Collaborative Technology Initiatives	[Thick black bar spanning 2002-2007]					
12	Clear Water Rinse	[Bar]					
13	Corrosion Kits	[Bar]					
14	Geographic Corrosion Assessment		[Bar]				
15	CPC Spec Updates		[Bar]				
16	OSD Corrosion Guide Aerospace Annex		[Bar]				
17	Specific Initiative FY05 TBD				[Bar]		
18	Specific Initiative FY05 TBD				[Bar]		
19	Specific Initiative FY06 TBD					[Bar]	
20	Specific Initiative FY07 TBD						[Bar]