Reasons Behind Program Delays
2014 Update

Overview

- **This analysis examines the reasons behind program delays**

- **Five reasons for delays were considered:**
  - Problems in test conduct
    - » Test resources, test instrumentation, or test execution problems that are typically beyond the control of the program manager
  - Performance problems discovered in DT
    - » System problems identified during developmental testing that must be addressed before the program can move forward
  - Performance problems discovered in OT
    - » System problems identified during operational testing that must be addressed before the program can move forward
  - Programmatic
    - » Funding, scheduling, or management problems
  - Manufacturing, Software Development, and Integration
    - » Manufacturing, software development, integration, or quality control problems

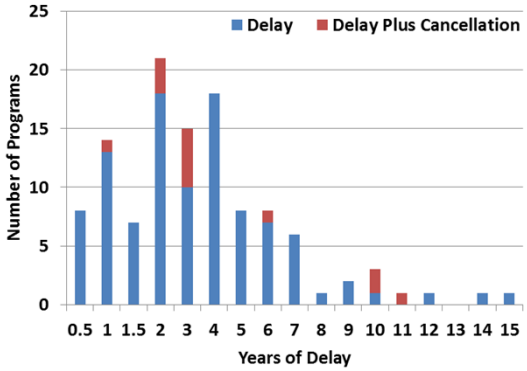
- **Next four slides look at:**
  - Which programs were examined
  - Overall conclusions
  - Conclusions from the subset of programs with a critical Nunn-McCurdy breach
  - Conclusions from the programs sorted by Service

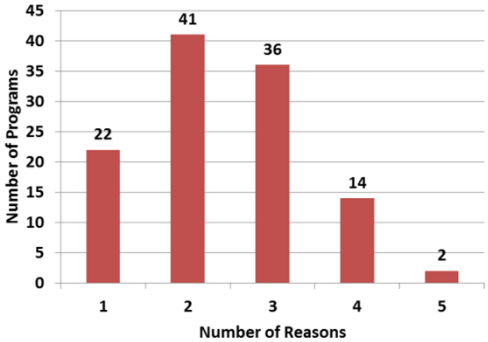
Programs Examined

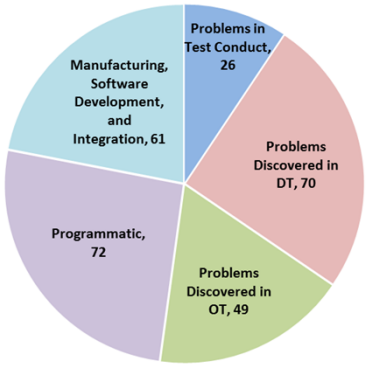
- **This analysis developed case studies for 115 programs on the DOT&E oversight list that have experienced a delay**
- **320 programs on the DOT&E oversight list were candidates for case studies**
  - DOT&E oversight list is regularly updated
  - 320 programs on oversight list as of 25 April 2014
- **Programs for which case studies were developed:**
  - Experienced a delay of 6 months or more
  - And had a full-rate production decision after 2000
- **Programs for which case studies were not developed:**
  - Did not experience a delay of at least 6 months
  - Or had a full-rate production decision in 2000 or before
  - Some programs would have yielded a case study that is classified (small number), and were excluded

Overall Conclusions

- **Delays on the 115 programs studied ranged from 6 months up to 15 years, and in some cases programs were cancelled after the delays; see top bar graph**
- **The reasons behind the delays are varied**
  - In most cases, as shown in middle bar graph, the delay is not due to a single reason; rather multiple reasons led to a delay
- **A common misperception is that testing causes program delays**
  - It is not testing per se that causes a delay, rather it is a problem with the system that is discovered during testing that causes a delay
  - As shown in the pie chart, problems in test conduct occur in a fraction of the case studies, 26 of 115 cases
  - The most common reason that contributes to a delay is a performance problem is discovered during DT or OT that must be addressed before a program moves forward
    - » 38 cases discovered problems in DT only
    - » 17 cases discovered problems in OT only
    - » 32 cases discovered problems in both DT and OT
    - » For a total of 87 of 115 cases
  - Programmatic and manufacturing, software development, and integration problems are also common, affecting 72 and 61 of the 115 cases respectively
  - All programs that had problems in test conduct also had at least one other reason that contributed to the delay



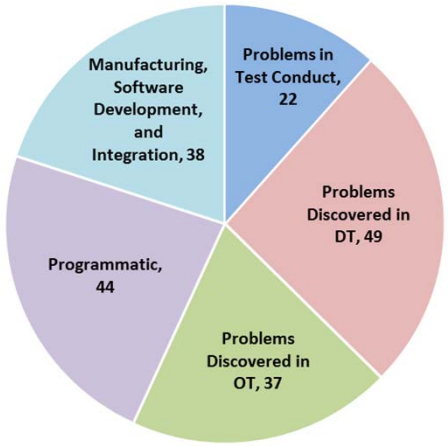




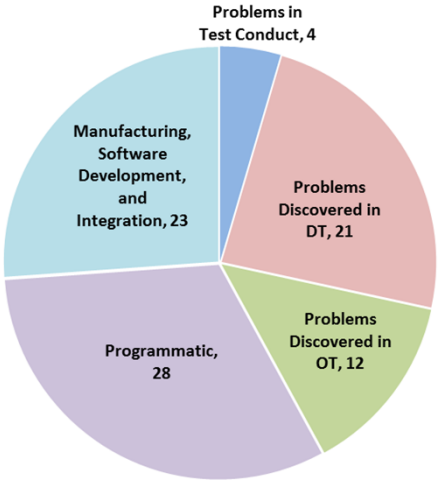
Totals in graphs are greater than number of programs because most programs have more than one reason for the delay

Nunn-McCurdy Conclusions

- **This analysis also compares the subset of programs that experienced a critical Nunn-McCurdy breach to those that had not; see pie charts**
  - A critical breach occurs when the program acquisition unit cost or the procurement unit cost increases by at least 25 percent over the current baseline estimate or at least 50 percent over the original baseline estimate*
  - Programs that have a critical Nunn-McCurdy breach frequently experience a program delay
  - Analysis was conducted on programs that had a critical Nunn-McCurdy breach after 2000
  - Analysis was conducted to determine if delays for programs with a critical Nunn-McCurdy breach had different characteristics from systems that did not have a critical Nunn-McCurdy breach
- **Not surprisingly, programs with a critical Nunn-McCurdy breach had more programmatic or manufacturing, software development, and integration problems**
  - Programmatic issues increase from 54% (44/81) to 82% (28/34) of the cases
  - Manufacturing issues increase from 47% (38/81) to 68% (23/34) of the cases
- **This conclusion and the earlier conclusion that delays typically are due to multiple reasons are consistent with the March 2011 GAO report, *Trends in Nunn-McCurdy Cost Breaches for Major Defense Acquisition Programs,* which states:**
  - "Our analysis of DOD data and SARs showed that the primary factors responsible for the unit cost growth that led to Nunn-McCurdy breaches are engineering and design issues, schedule issues, and quantity changes [number of units to be procured]. Major defense acquisition programs that breached Nunn-McCurdy cost growth thresholds often cited multiple, interrelated factors for the breaches."



Without Nunn-McCurdy breach (81 Programs)



With Nunn-McCurdy breach (34 Programs)

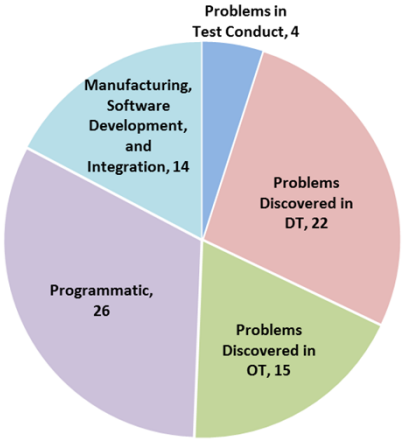
Totals in graphs are greater than number of programs because most programs have more than one reason for the delay

*Significant breaches, which are not examined in this analysis, occur when the program acquisition unit cost or the procurement unit cost increases by at least 15 percent over the current baseline estimate or at least 30 percent over the original baseline estimate

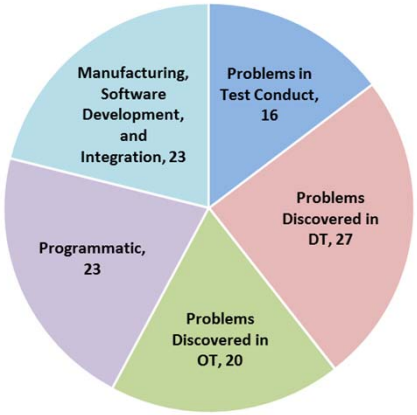
Reasons Behind Program Delays: by Service

- **This analysis also examined the results by Service, from which we draw three conclusions**
- **First, Air Force programs are statistically more likely to experience delays from manufacturing issues**
  - This conclusion is consistent with the March 2011 GAO report, *Trends in Nunn-McCurdy Cost Breaches for Major Defense Acquisition Programs*, which notes that Air Force programs had a higher proportion of total Nunn-McCurdy breaches, which the GAO report also linked to engineering and design issues, schedule issues, and quantity changes
- **Second, Army programs are statistically more likely to experience delays from programmatic issues**
  - 26 of 35 Army programs experienced programmatic issues
- **Third, Navy programs are statistically more likely to experience problems in test conduct**
  - The Navy experienced test execution problems in 16 of the 43 Navy programs examined (see slides 9 and 10)
    - » Many of the test execution problems were because required ships, system under test, or targets were not available
    - » Other problems included test instrumentation or procedure problems
  - Title 10 defines operational testing as "the field test, under realistic combat conditions, of any item of (or key component of) weapons, equipment, or munitions for the purpose of determining the effectiveness and suitability of the weapons, equipment, or munitions for use in combat by typical military users"
  - This testing requires fleet operators on fleet units operating against threat-representative targets; consequently testing may be delayed as the appropriate resources are made available

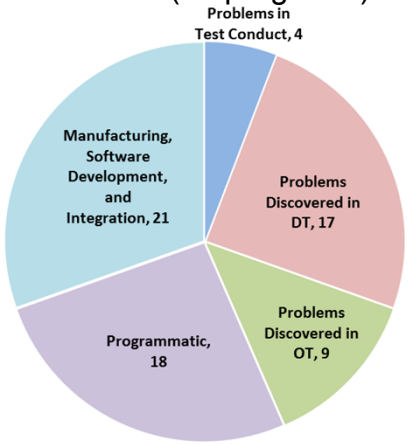
Army (35 programs)



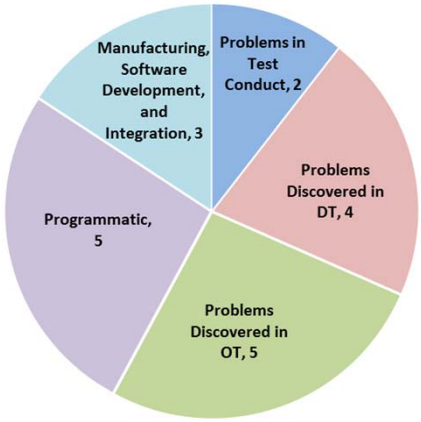
Navy (43 programs)



Air Force (29 programs)



Other (8 programs)



Totals in graphs are greater than number of programs because most programs have more than one reason for the delay

Army Programs

Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
Patriot PAC-3	FRP delayed 15 years	15			X		X		
MEADS	FRP delayed 11 years, then the program was cancelled	11		X	X				
THAAD	Material Release delayed nearly 2 years	10		X	X	X	X	X	Target unavailability
Spider Networked Munition	FRP delayed 7 years	7					X		
Rifleman Radio	FRP delayed more than 6 years	6			X	X	X		
Stryker MGS	FRP delayed more than 6 years, then the program was cancelled	6		X			X		
ATIRCM/CMWS	FRP delayed more than 5 years	5	X	X	X	X			
Precision Guidance Kit (PGK)	FRP delayed more than 5 years	5				X			
CIRCM	FRP delayed 4 years	4			X	X			
DoD ABIS	FDD delayed more than 4 years	4		X	X				
Gray Eagle	FRP delayed 4 years	4			X		X		
Manpack Radio	FRP delayed more than 4 years	4			X	X	X		
NBCRV	FRP delayed more than 4 years	4				X	X		
PIM	FRP delayed 4 years	4			X	X			
WIN-T Inc 2	FRP delayed more than 4 years	4			X		X	X	Test unit unavailability
XM25 CDTE	FRP delayed more than 4 years	4				X			
CH-47F	FRP delayed 3 years	3	X		X	X	X		
Comanche	MS III delayed 3 years, then the program was cancelled	3	X	X	X	X			
Excalibur Increment Ia-2	FRP delayed nearly 3 years	3	X		X	X			

Army Programs (cont'd)

Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
FCS	IOC delayed 3 years, then the program was cancelled	3			X				
JTRS GMR	FRP delayed 3 years, then the program was cancelled	3	X	X	X	X			
Apache Block III	FRP delayed 2 years	2	X		X				
Armed Recon Helo	FRP delayed 3 years, then the program was cancelled	2	X	X	X	X	X		
ATACMS-BAT	Production decision delayed more than two years, then the program was cancelled	2	X			X	X		
FBCB2	MS C delayed 2 years	2		X				X	Test unit unavailability
GCSS-Army	FDD delayed 30 months	2		X		X			
JLENS	FRP delayed more than 2 years, then the program was cancelled	2	X	X	X				
JLTV	IOC delayed more than 2 years	2			X	X			
DCGS-A	Fielding decision delayed 18 months	1.5		X	X	X			
AIAMD	FRP delayed more than 1 year	1			X				
E-IBCT	MS C delayed 1 year, then 3 of 5 systems were cancelled	1			X	X	X		
Excalibur Increment Ib	MS C delayed more than a year	1	X	X	X	X			
Hellfire Romeo	Fielding decision delayed 14 months	1				X			
SIRFC	FRP delayed more than a year	1		X	X	X	X		
Q-53	IOT&E delayed 6 months	0.5			X		X	X	Test unit unavailability

Navy Programs

Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
MV-22 Osprey	MS III delayed 14 years	14		X	X	X	X		
RMS	FRP delayed nearly 12 years	12	X		X	X	X		
EFV	FRP delayed 10 years, then the program was cancelled	10	X	X	X	X	X		
AMNS	FRP delayed 9 years	9		X		X			
MH-60S Block 2A AMCM	FRP delayed 8 years	8		X	X	X	X		
ALMDS	FRP delayed more than 7 years	7		X		X	X		
CJR	IOC delayed 6 years	6		X	X	X			
VTUAV	FRP delayed more than 6 years	6	X		X	X		X	System unavailability
DDG 1000	IOC delayed 5 years	5	X	X	X				
H-1 Upgrades	MS III delayed more than 5 years	5	X	X		X	X		
AH-1Z	FRP delayed more than 4 years	4		X		X	X		
CH-53K	FRP delayed 4 years	4		X	X				
COBRA Block I	IOC delayed more than 4 years	4		X		X		X	Range and VTUAV
IDECM Block 3	FRP delayed 4 years	4				X	X		
JPALS Inc 1	FRP delayed more than 4 years	4	X		X			X	Ship unavailability
LCS	IOC delayed more than 4 years	4		X	X	X		X	System unavailability
ASDS	IOC delayed nearly 3 years, then the program was cancelled	3	X				X		
CEC AN/USG-2	FRP delayed 3 years	3			X	X	X	X	Ship unavailability
E-2D Advanced Hawkeye	IOC delayed more than 3 years	3	X		X	X			
IDECM Block 4	IOC delayed about 3 years	3		X		X	X		
LHA 6	IOC delayed more than 3 years	3		X				X	Targets and JSF unavailability
LPD 17	MS III delayed nearly 3 years and eventually cancelled, all ships in class procured	3	X	X			X	X	Targets and Marines unavailability

Navy Programs (cont'd)

Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
VH-71 Presidental Helo	Program delayed 3 years then cancelled	3	X	X	X				
AARGM	FRP delayed more than 2 years	2		X		X	X	X	Target unavailability
ECH	IOC delayed more than 2 years	2		X	X	X		X	Improper test procedures
GCCS-M	FRP delayed 2 years	2			X				
MQ-4C Triton	IOC delayed more than 2 years	2		X	X				
MUOS	Initial launch delayed more than 2 years	2		X	X	X			
RAM	FRP delayed more than 2 years	2				X	X	X	Target unavailability
SM-6	FRP delayed more than 2 years	2				X		X	Telemetry
UISS	MS C delayed more than 2 years	2			X				
Virginia	MS III delayed 2 years	2		X	X	X	X	X	Target unavailability
AIM-9X 8.212	Fielding delayed 18 months	1.5				X	X		
MIDS JTRS	FRP delayed 18 months	1.5		X			X		
P-8A Poseidon	FRP delayed nearly 18 months	1.5		X				X	Improper instrumentation
AIM-9X Block 2	FRP delayed more than a year	1					X		
CANES	IOC delayed more than 1 year	1			X			X	Ship unavailability
DoN LAIRCM	FRP delayed a year	1			X		X		
G/ATOR	IOC delayed a year	1			X	X			
SMCM UUV	IOC delayed a year	1			X				
CEC AN/USG-3B	FRP delayed more than six months	0.5				X	X	X	FAA clearance, test unit, spare parts, and targets unavailability; data collection
DCGS-MC	MS C delayed 5 months	0.5				X		X	Test unit unavailability
DoN LAIRCM ATW	Fielding decision delayed six months	0.5				X			

Air Force Programs

Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
NPOESS	Launch delayed 10 years, then the program was cancelled	10	X	X	X				
SBIRS High	First geosynchronous launch delayed 9 years	9	X	X	X	X			
AEHF Satellite	IOC delayed more than 7 years	7	X	X		X			
F-22 Raptor	FRP delayed 7 years	7	X	X	X	X			
MQ-9 REAPER	FRP delayed more than 7 years and changed to IPR; aircraft deliveries unaffected	7		X	X		X		
AMRAAM	Material Release delayed more than 6 years	6			X	X	X		
C-130 AMP	FRP delayed 6 years	6	X	X	X	X			
ALR-69A RWR	FRP delayed 5 years	5		X		X			
C-130J Hercules	Operational testing delayed more than 5 years	5	X	X	X		X		
Global Hawk	FRP delayed more than 5 years	5	X	X	X	X		X	Test unit unavailability
GPS OCX	IOC delayed nearly 5 years	5		X					
C-5 Modernization	IOC delayed more than 4 years	4	X	X	X	X	X		
LAIRCM Phase II	FRP delayed more than 4 years	4			X	X			
WGS	IOC delayed more than 4 years	4	X	X					

Air Force Programs (cont'd)

Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
GBS	IOC delayed 3 years	3		X	X				
SDB II	IOC delayed nearly 3 years	3		X	X	X			
B-2 RMP	FRP delayed 2 years	2		X					
GPS-III	Initial launch delayed more than 2 years	2		X				X	Constrained satellite component test resources
JMS Inc 1	Fielding decision delayed 2 years	2		X	X	X			
MALD	FRP delayed more than 2 years	2		X		X	X	X	Range unavailability
CITS AFNet Increment 1	FDD delayed more than 18 months	1.5			X	X	X		
MALD-J	FRP delayed 18 months	1.5					X	X	Range unavailability
AC-130J	IOC delayed 15 months	1			X				
AOC-WS 10.1	FRP delayed up to 1 year	1				X			
JASSM	FRP delayed a year	1	X	X	X		X		
JPATS	FRP delayed more than 1 year	1	X	X	X	X	X		
B-2 EHF Inc 1	FRP delayed 8 months	0.5		X		X			
F-15E RMP	FRP delayed 6 months	0.5				X			
HC/MC-130J	FRP delayed 6 months	0.5			X				

Other Programs (DoD, DISA, NSA, DLA)

Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
Chem Demil-ACWA	Operations delayed 7 years	7	X		X				
Joint Strike Fighter	IOC delayed up to 6 years	6	X	X	X	X			
PKI Incr 2	FDD delayed 6 years	6		X	X		X	X	Delays issuing SIPRNet tokens
KMI	FDD delayed up to 4 years	4		X		X	X		
Mark XIIA Mode 5	FRP delayed more than 3 years	3				X	X		
Net-Centric Enterprise Services	FRP delayed 2 years	2			X		X	X	Lack of user base
Chem Demil-CMA Newport	Operations delayed 18 months	1.5	X		X				
GCCS JOPES 4.2 and 4.2.1	Fielding delayed 5 months	0.5				X	X		

Reasons Behind Program Delays: Program Details

- **For each of the 115 case studies, an individual slide is included in this briefing that provides**
  - Timelines at two or more points in time that illustrate how the delays affected the program schedule
  - Reasons for the delay and, if applicable, the Nunn-McCurdy critical breach
  - Additional details on specific reasons for program delays

- **Program slides are grouped by Service or Agency**
  - Army Programs
  - Navy Programs
  - Air Force Programs
  - Other Programs (DoD, DISA, NSA, DLA)

- **Within each Service, case studies are ordered by the length of the program delay**

Acronym Definitions for Program Details Charts

ACAT – acquisition category
ADM – acquisition decision memorandum
AOA – analysis of alternatives
ASP – acquisition strategic plan
AT&L – acquisition, technology, and logistics
BLRIP – beyond low rate initial production
BUR – bottom up review
CDD – capability development document
CDR – critical design review
CFT – contractor flight test
COTS – commercial-off-the-shelf
CT – certification test
DAE – defense acquisition executive
DEM/VAL – demonstration and validation
DT – development test
DT&E – developmental test and evaluation
EDT – engineering development test
EMD – engineering and manufacturing development
EOA – early operational assessment
EOC – early operational capability
EUT – early user test
FD – fielding decision
FDD – full deployment decision
FDE – force development evaluation
FF – first flight
FOT – follow on operational test
FOT&E – follow on operational test and evaluation
FRP – full rate production
FUE – field user evaluation
FY – fiscal year
IOC – initial operational capability
IOT – initial operational test
IOT&E – initial operational test and evaluation
IPR – in process review
IPR – interim program review
IR – infrared
ISR – intelligence, surveillance and reconnaissance
IT – integrated test
JROC – joint requirements oversight council
KDP – key decision point
KPP – key performance parameter
LRIP – low rate initial production
MAIS – major automated information system
MDD – materiel development decision
MFHBA – mean flight hours between aborts
MOT&E – multi-service operational test & evaluation
MS – milestone (e.g. MS B, MS C, MS II, MS III)
MTBF – mean time between failure
MTBOMF – mean time between operational mission failure
NDI – non-developmental item
NIE – network integration evaluation
NM – Nunn-McCurdy breach
OA – operational assessment
OEF – operation enduring freedom
OFP – operational flight program
OIF – operation Iraqi freedom
OPEVAL – operational evaluation
ORD – operational requirements document
OT – operational test
OTRR – operational test readiness review
OUE – operational utility evaluation
PEO – program executive office
PM – program manager
PQT – production qualification test
PRTV – production representative test vehicle
QDR – quadrennial defense review
QOT&E – qualification operational test & evaluation
QRC – quick reaction capability
RDT – reliability demonstration test
RDT&E – research, development, test, and evaluation
RF – radio frequency
RM&A – reliability, maintainability, and availability
SAR – selected acquisition report
SDD – system development and demonstration
SIL – system or software integration lab
SV – space vehicle
TECHEVAL – technology evaluation
TEMP – test and evaluation master plan
TRL – technology readiness level
TRR – test readiness review
UMR – urgent materiel release
VCD – verification of correction of deficiencies
WIPT – working integrated product team
WSEP – weapon system evaluation program

Outline

- Army Programs
- Navy Programs
- Air Force Programs
- Other Programs

Army Programs

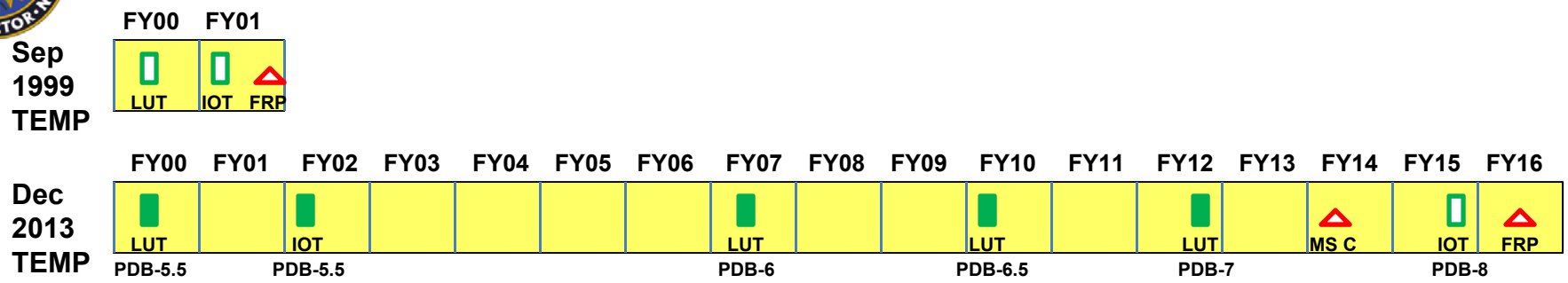
Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
Patriot PAC-3	FRP delayed 15 years	15			X		X		
MEADS	FRP delayed 11 years, then the program was cancelled	11		X	X				
THAAD	Material Release delayed nearly 2 years	10		X	X	X	X	X	Target unavailability
Spider Networked Munition	FRP delayed 7 years	7					X		
Rifleman Radio	FRP delayed more than 6 years	6			X	X	X		
Stryker MGS	FRP delayed more than 6 years, then the program was cancelled	6		X			X		
ATIRCM/CMWS	FRP delayed more than 5 years	5	X	X	X	X			
Precision Guidance Kit (PGK)	FRP delayed more than 5 years	5				X			
CIRCM	FRP delayed 4 years	4			X	X			
DoD ABIS	FDD delayed more than 4 years	4		X	X				
Gray Eagle	FRP delayed 4 years	4			X		X		
Manpack Radio	FRP delayed more than 4 years	4			X	X	X		
NBCRV	FRP delayed more than 4 years	4				X	X		
PIM	FRP delayed 4 years	4			X	X			
WIN-T Inc 2	FRP delayed more than 4 years	4			X		X	X	Test unit unavailability
XM25 CDTE	FRP delayed more than 4 years	4				X			
CH-47F	FRP delayed 3 years	3	X		X	X	X		
Comanche	MS III delayed 3 years, then the program was cancelled	3	X	X	X	X			
Excalibur Increment Ia-2	FRP delayed nearly 3 years	3	X		X	X			

Army Programs (cont'd)

Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
FCS	IOC delayed 3 years, then the program was cancelled	3			X				
JTRS GMR	FRP delayed 3 years, then the program was cancelled	3	X	X	X	X			
Apache Block III	FRP delayed 2 years	2	X		X				
Armed Recon Helo	FRP delayed 3 years, then the program was cancelled	2	X	X	X	X	X		
ATACMS-BAT	Production decision delayed more than two years, then the program was cancelled	2	X			X	X		
FBCB2	MS C delayed 2 years	2		X				X	Test unit unavailability
GCSS-Army	FDD delayed 30 months	2		X		X			
JLENS	FRP delayed more than 2 years, then the program was cancelled	2	X	X	X				
JLTV	IOC delayed more than 2 years	2			X	X			
DCGS-A	Fielding decision delayed 18 months	1.5		X	X	X			
AIAMD	FRP delayed more than 1 year	1			X				
E-IBCT	MS C delayed 1 year, then 3 of 5 systems were cancelled	1			X	X	X		
Excalibur Increment Ib	MS C delayed more than a year	1	X	X	X	X			
Hellfire Romeo	Fielding decision delayed 14 months	1				X			
SIRFC	FRP delayed more than a year	1		X	X	X	X		
Q-53	IOT&E delayed 6 months	0.5			X		X	X	Test unit unavailability

Patriot Advanced Capability-3 (PAC-3) System

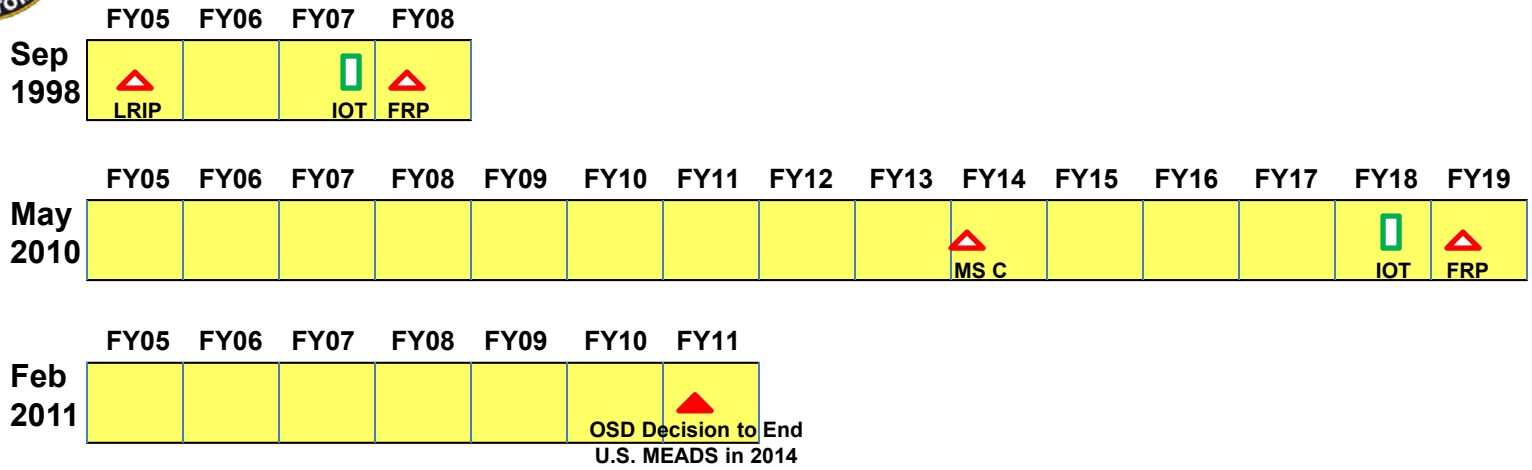
A System to Defend against Aircraft and Missile Attacks



- **Patriot PAC-3 Full-Rate Production (FRP) has been delayed by at least 15 years because of performance and programmatic reasons**
  - PAC-3 Configuration-3 IOT&E in 2002 revealed that Patriot did not meet all its Key Performance Parameter (KPP) threshold requirements
  - The FRP decision was deferred and the program has made 2-year missile purchases since then without a "full-rate production" decision
  - Patriot showed good performance against simple Iraqi tactical ballistic missiles during Operation Iraqi Freedom (OIF) in 2003 (as predicted by IOT&E), but Patriot units also shot down two friendly aircraft and killed three Allied airmen
  - The Army has modified Patriot system software to address problems revealed in IOT&E and OIF and has operationally tested each major system software drop (Post-Deployment Build or PDB) in Limited User Tests (LUTs)
  - The Army is developing the PAC-3 Missile Segment Enhancement (MSE) interceptor to address some of the problems Patriot has in meeting its KPP threshold requirements
  - The MSE LRIP decision occurred in FY14 and the FRP decision is scheduled for FY16 (after an FY15 IOT&E)
  - The FY16 FRP will be a system-level decision since the original PAC-3 Configuration-3 FRP was deferred

Medium Extended Air Defense System (MEADS)

A System to Defend against Aircraft and Missile Attacks



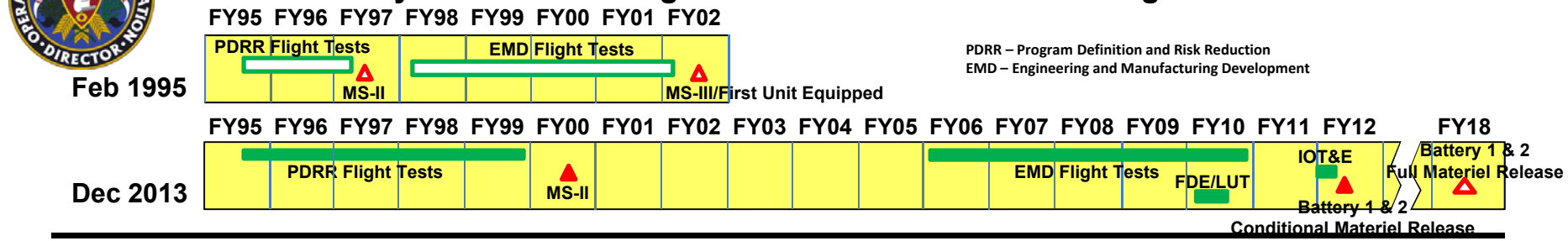
- **The 11-year slip in MEADS Full Rate Production (FRP) between 1998 and 2010 was caused by programmatic and manufacturing problems that led to a 2011 decision to cancel the program**
  - **MEADS was an international co-development program between the United States, Germany, and Italy**
  - **Some program delays were caused by the three nations shifting funding to later years**
  - **Most program delays were caused by technical problems in designing and developing the system**
  - **MEADS cost overruns exceeded 25 percent but it was not subject to Nunn-McCurdy because it was an international program**
  - **In November 2010, the NATO MEADS Management Agency indicated that the program was slipping another 3 years and would require an additional $1 billion of U.S. funding (on top of the $1.5 billion spent to date, the $800 million scheduled to be spent through 2014, and at least $800 million required to complete U.S.-unique development, integration, and testing)**
  - **In February 2011, DoD decided to end U.S. MEADS participation in 2014**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Terminal High Altitude Area Defense (THAAD)

A land-based system to defend against short- to intermediate-range ballistic missiles



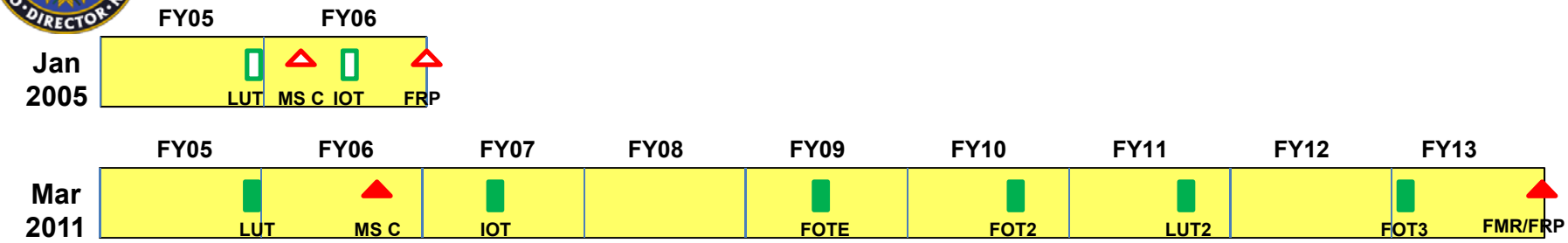
- Transitioning an initial THAAD unit from the Missile Defense Agency to the Army was delayed 10 years because of manufacturing, test conduct, programmatic, and performance issues discovered in DT and OT
- Six consecutive intercept flight test failures occurred early in the PDRR phase, each with a different failure mode
  - Failures were attributable to poor quality control of the interceptor missile (contaminated battery, foreign object debris, possible contaminated dewar), manufacturing/reliability issues with the missile (connector didn't disconnect at booster separation, Attitude Control System torn from bracket, booster flare didn't deploy), and an avionics software error.
- Two additional successful flight tests were conducted, but direction from USD (AT&L) resulted in the cancellation of the remaining flight tests and a shift in program emphasis to missile redesign and EMD phase planning
  - The test program stood down for 5 years while the missile was fully redesigned.
  - During that time, SECDEF issued a memo exempting elements of the Ballistic Missile Defense System such as THAAD from formal milestones and requirements documents.
    - » The first major program decision point after the restructure was materiel release of the first two THAAD batteries from the Missile Defense Agency (MDA) to the Army, then planned for FY10.
- EMD Flight testing began in FY06 and was largely successful, although development of flight test targets significantly affected the pace of testing and caused further delays
  - Target development within MDA was not able to keep pace with the THAAD flight test schedule; it was technically challenging, underfunded, and had insufficient schedule margin. Additionally, two target failures prevented flight tests from being conducted in 2008 and 2009.
  - This resulted in a major rebaselining of the THAAD schedule; three flight tests were eliminated and the schedule and objectives of the remaining flights were revised. An additional test needed to be added and was designated an IOT&E.
  - Problems were also discovered in developmental ground testing of the missile Laser Initiated Ordinance System, fire control unit shelters, missile transport containers, and reliability of the radar; these required fixes and additional testing
- The Materiel Release decision took place in FY12, a 10-year slip from the PDRR schedule and a 2-year slip from the 2006 EMD schedule
  - A conditional materiel release was granted rather than a full materiel release because of testing that had not been completed before the decision point, the incomplete delivery of training devices, items that still needed to be fixed because of the problems found in DT and new problems discovered during the IOT&E, such as inaccuracies in the radar Inertial Measurement Unit, Common Data Link message generation issues, and the reliability of the launcher and radar
  - Closeout of all of the Materiel Release conditions for Batteries 1 and 2 is scheduled for FY18

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Spider Networked Munition

A non-persistent anti-personnel landmine system



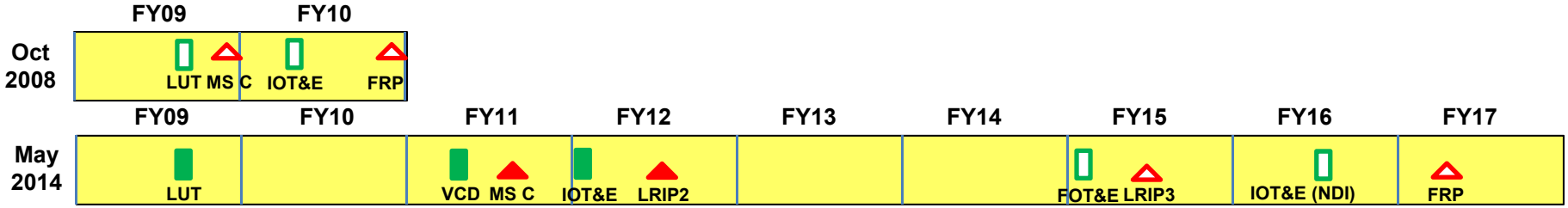
- Full Rate Production (FRP) was delayed 7 years due to poor operational test performance
- Developmental testing focused on demonstrating technical requirements but did not focus on the soldiers ability to operate the system
- In operational testing, soldiers were unable to operate and sustain the system
  - September 2005 LUT: Limited operational environment → Effective with limitations but Not Suitable
  - April 2007 IOT: Adequate operational environment → Not Effective and Not Suitable
  - March 2009 FOTE: Adequate operational environment → Not Effective and Not Suitable
  - May 2010 FOT2: Adequate operational environment → Effective but Not Suitable
  - June 2011 LUT2: Limited operational environment → Improved Suitability
- Recurring deficiencies
  - Effective employment of a Spider field requires a unit well trained in non-Spider specific soldier and unit skills
  - Prior to FOT2, test units could not effectively operate the system to produce threat casualties
  - System C2 software was complex and difficult to operate
- Software upgrades and training enhancements were implemented prior to FOT3
  - November 2012 FOT3: Adequate operational environment → Effective and Suitable
- Urgent Materiel Release (UMR) fielding of 66 systems occurred in 2009, but only limited system use was reported

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Rifleman Radio

Handheld Beyond-Line-of-Sight voice and data radio for Platoon Echelon Soldiers



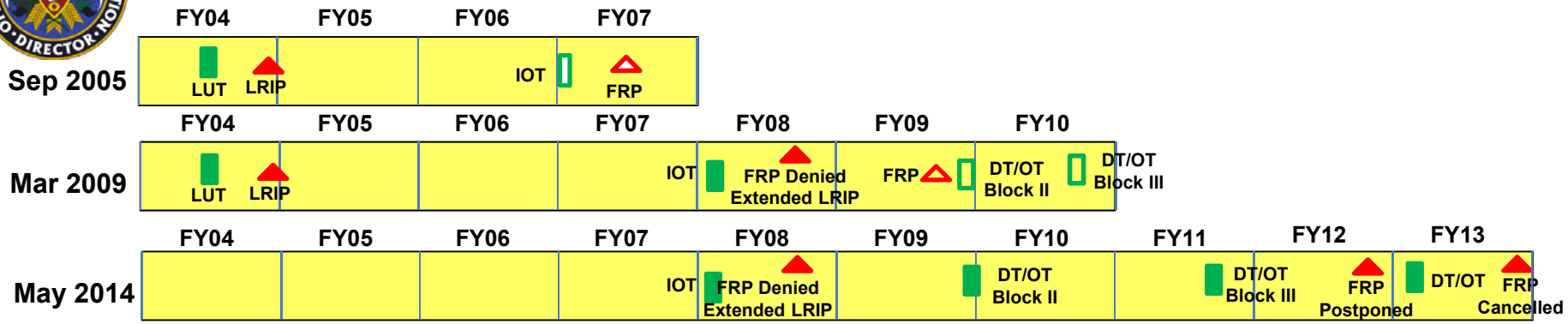
- **Full Rate Production (FRP) delayed more than 6 years because of performance problems in testing**
- **Poor system performance at the FY09 limited user test (LUT) led to the FY11 Verification of the Correction of Deficiencies (VCD) test; after the VCD, the combined Handheld, Manpack, & Small Form Fit (HMS) program (Rifleman Radio and Manpack) was given a FY11 MS C and a first LRIP**
  - **Performance problems were primarily network stability and voice range and reliability**
- **Performance at the FY12 IOT&E was improved, but did not receive a FRP**
  - **Major issues included poor reliability, inadequate training, and poor integration with the Soldier Radio Waveform Network Manager (SRWNM)**
- **In FY12 the DoD decided to change the acquisition strategy and move from a conventional program of record to a non-developmental item open to competition, with FRP scheduled for FY17**
- **The FY15 testing supports a full materiel release for current LRIP quantities to supply Army needs prior to the planned FY17 FRP on the non-developmental Rifleman Radio**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Stryker Mobile Gun System (MGS)

A variant of the Stryker family equipped with a 105mm cannon



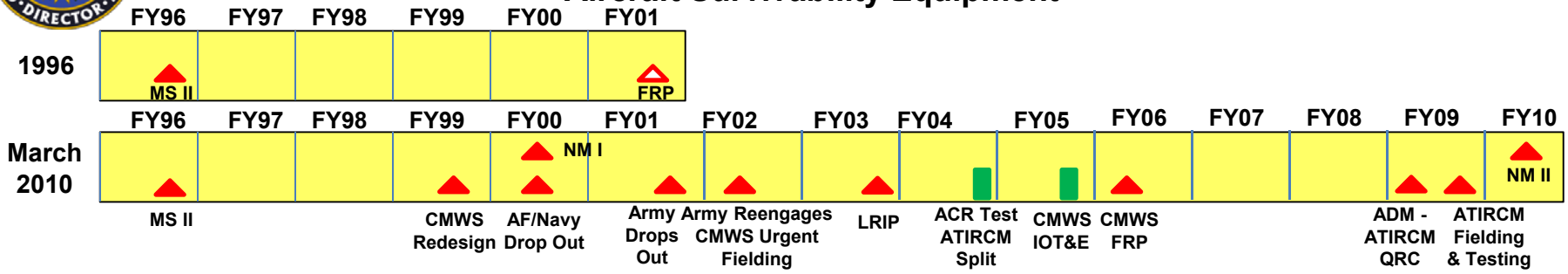
- **Full rate production (FRP) delayed more than 6 years, program cancelled Oct 2013, for performance problems in testing**
- **2008 Secretary of Defense Report to Congress identified 23 performance deficiencies (sights, secondary weapons, reliability, survivability) to be corrected before FRP**
- **In 2009 the FRP was delayed due to performance issues identified in operational testing and initial deployment**
- **In 2010 testing of corrective actions (DT/OT Block III) was delayed by 1 year due to quality problems with the Extended LRIP production**
- **Operational Testing demonstrated incremental fixes to identified issues**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Advanced Threat Infrared Countermeasures/ Common Missile Warning System (ATIRCM/CMWS)

Aircraft Survivability Equipment



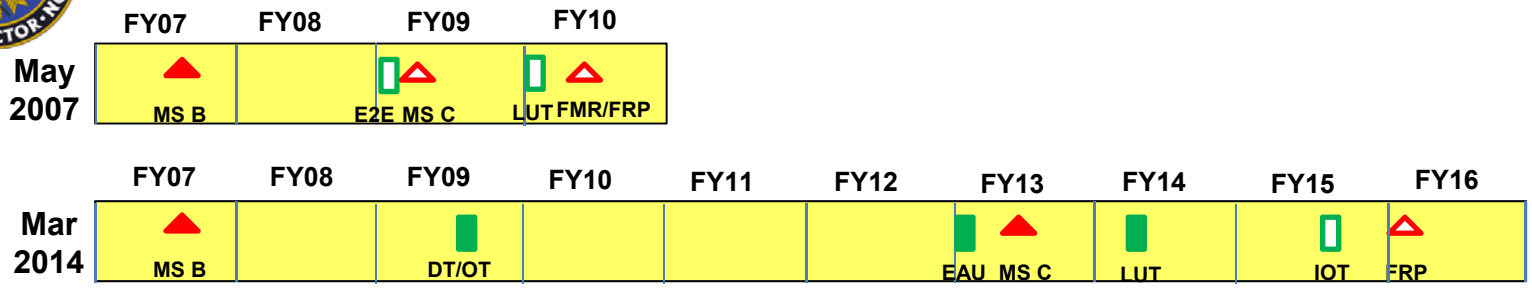
- **Full Rate Production (FRP) delayed more than 5 years because of complex acquisition, programmatic, and technical issues**
  - **Developmental testing revealed technical and reliability problems with the system**
  - **The program has had two Nunn-McCurdy breaches**
- **In FY1996-2000, the program was restructured three times because of cost overruns and delays**
  - **The contractor had delays in producing prototypes to be used for test**
  - **Major problems were experienced in the development of the digital system model**
  - **The Air Force and Navy dropped out of the program in 2000 resulting in a Nunn-McCurdy breach**
- **The Army withdrew funding in 2001, but the Special Operations Command continued to fund CMWS**
- **In 2002, the Army began limited production and urgent fielding in response to wartime urgent needs; an LRIP decision was made in 2003**
- **In 2004, the ATIRCM failed pre-test preparations for DT because of water intrusion and the inability to distinguish targets from IR clutter; ATIRCM and CMWS were split into two separate activities**
- **ATIRCM languished because of poor performance and reliability problems attributed to an immature design coupled with unrealistic schedules and competing resources**
- **Because of an urgent operational need in 2009, an Acquisition Decision Memorandum authorized ATIRCM as a Quick Reaction Capability activity to purchase 83 systems to equip CH-47 Chinooks**
- **A second Nunn-McCurdy breach occurred in 2010 because of the length of the program, wartime urgent needs, changes in required production quantities, and inconsistencies in cost computations for CMWS and ATIRCM costs and quantities**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Precision Guidance Kit (PGK)

An artillery fuze providing GPS guidance for 155mm high explosive projectiles



E2E - End-to-End Firing Demonstration

EUA - Early User Assessment

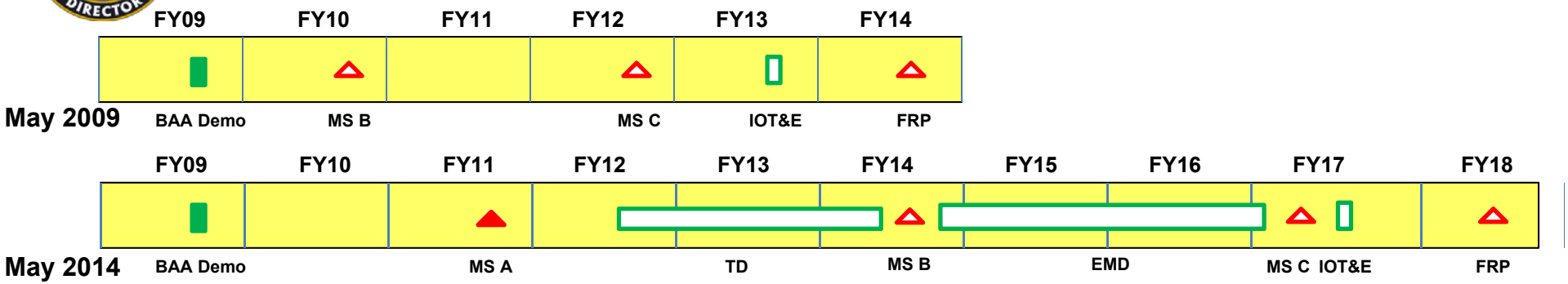
- **Full Rate Production (FRP) was delayed more than 5 years by recurring performance and reliability problems in developmental testing**
  - May 2007 TEMP's 18-month developmental schedule (May '07 – November '08) was acknowledged by PGK's milestone decision authority (MDA) to be "aggressive"
  - Demonstrated reliability in 2009 - 2010 testing was 63% versus the planned growth curve value of 87%
  - Extensive failure analyses indicated the need for design changes and additional performance testing
- **In January 2011 the Army Acquisition Executive approved a rebaselined program**
  - Successful reliability testing and Early User Assessment supported a March 2013 MS C decision
- **Following MS C the Army executed a pre-planned move of the production line to a permanent facility**
  - Fuzes produced at the new facility demonstrated significant reliability deficiencies in First Article Testing
  - A scheduled February 2014 IOT was changed to a limited user test (LUT) and executed with fuzes from the original production line
  - Fuzes to support a scheduled May 2015 IOT will be produced at the original production facility
- **Urgent Materiel Release (UMR) fielding of approximately 1,300 PGKs to deployed forces occurred in 2013**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Common Infrared Countermeasure (CIRCM)

Countermeasures against IR-guided missile threats



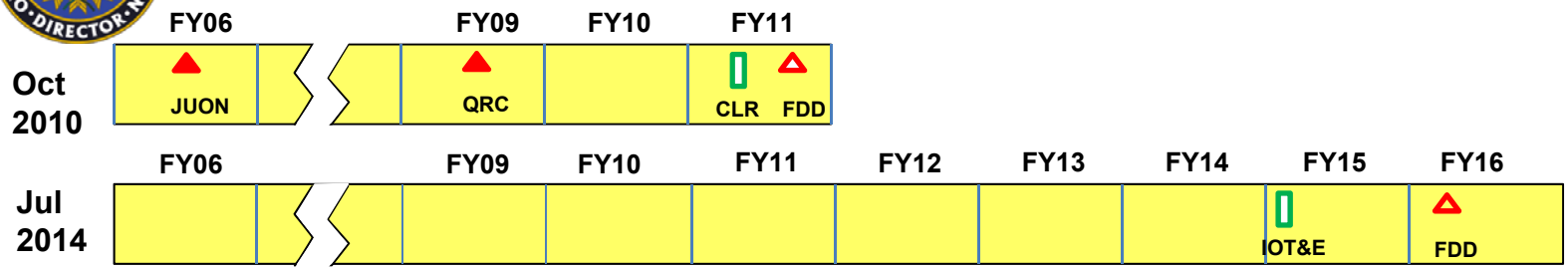
- **Full rate production (FRP) delayed 4 years because of performance problems and programmatic issues**
- **The Broad Area Announcement (BAA) Demonstration Test in 2009 was originally planned to:**
  - **Demonstrate mature technologies (Technology Readiness Level (TRL) 6) for fiber optic transmission of jamming laser energy and a small and lightweight pointing and tracking system suitable for application on helicopters**
  - **Provide test results to inform an MS B and down-select decision in 2010**
- **The BAA Demonstration Test proved that the technologies were not mature**
- **OSD decided that a formal MS A and Technology Development (TD) Phase was required**
  - **Developing the needed technology delayed the FRP for 4 years**
- **A formal protest was lodged in 2011 after source selection narrowed the field to two vendors, which delayed the Technology Development phase an additional 6 months**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

DoD Automated Biometrics Identification System (ABIS)

Receives, processes, and stores biometrics from world-wide collection assets, matches to existing assets, and shares responses to identify known and potential adversaries

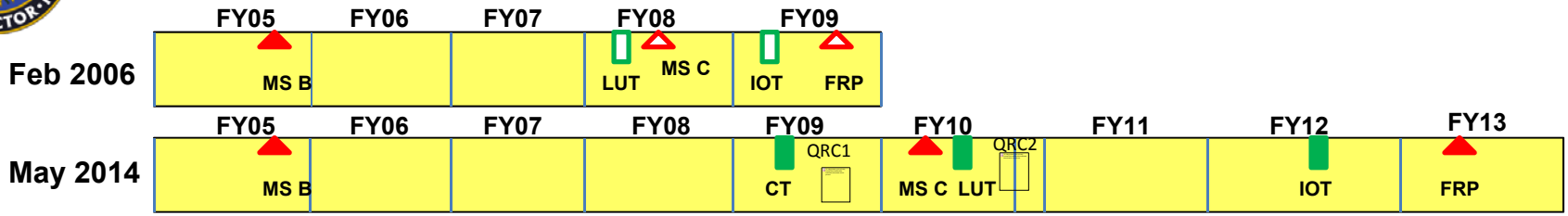


CLR – Capabilities and Limitations Report JUON – Joint Urgent Operational Need

- **Full Deployment Decision (FDD) delayed more than 4 years for multiple reasons**
- **Since 2010, four attempts to deploy the ABIS 1.2 upgrade have failed, all resulting in decisions to roll back to the ABIS 1.0 operational baseline**
- **Ad hoc development and sustainment effort coupled with poor configuration management and control prevented a comprehensive knowledge of the current capability, causing delays in defining the baseline requirements**
- **Lack of a standards compliance program across the Biometrics enterprise caused new, unforeseen interoperability issues at each deployment attempt, preventing ABIS 1.2 from completing urgent missions and causing further delays to deploying the upgrade**
- **No independent OT in the 10-year history of ABIS (prototype started in 2004)**
- **Lack of operational relevance and rigor during developmental testing caused excessive high priority failures during each deployment attempt, necessitating fallback to legacy**

Gray Eagle Unmanned Aircraft System

Provides the Army Division Commander with unmanned Reconnaissance, Surveillance, Security, Attack, and Command and Control Capabilities



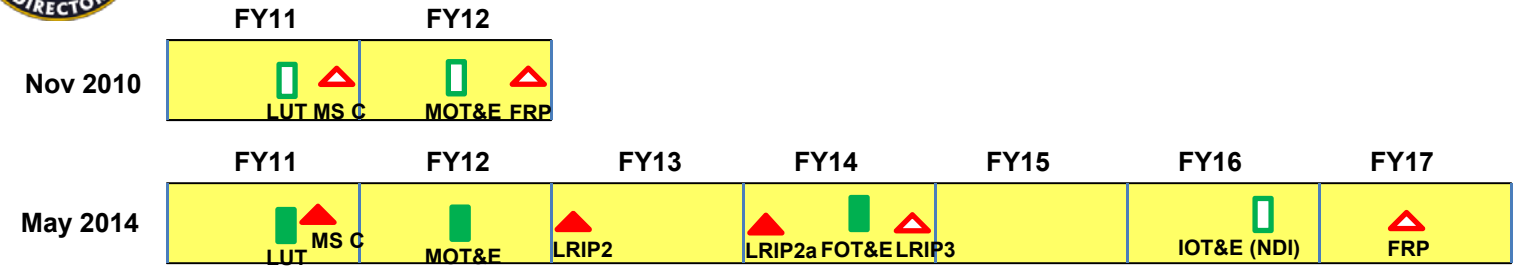
- **Full Rate Production (FRP) decision was delayed 4 years due to requirements changes and Intelligence, Surveillance, Reconnaissance (ISR) surge for combat operations**
- **Requirements changes after MS B**
  - **Originally Corps-level intelligence asset, now a Division-level armed reconnaissance/attack asset**
  - **Originally contractor maintenance concept, now a 100% soldier maintenance concept**
  - **Increase in system capability requirements**
  - **Deferment of Threshold CPD requirements – not having full production-representative configuration at IOT&E – has resulted in FOT&E being required in FY 15**
- **SECDEF direction in March 2008 to support the ISR surge requirement – "rapidly field the capability to the Warfighter"**
  - **Deployed Quick Reaction Capability (QRC) 1 to 1st Cavalry Division in July 2009**
  - **Deployed Quick Reaction Capability (QRC) 2 to Special Operations Command in September 2010**
- **Customer Test (CT) and LUT performed in conjunction with QRC pre-deployment unit training certification rotations added no additional time to the rapid fielding schedule**
  - **Provided the program insights into reliability issues**
  - **Demonstrated operational capabilities of each quick reaction unit; both short of program of record requirement**
  - **Performance of deployed quick reaction units consistent with operational test results**
- **IOT conducted July-August 2012**
  - **Effective and suitable, but Army must continue developing the tactics, techniques, and procedures, the training, and the doctrine required to more effectively integrate this capability into combat operations**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Manpack Radio

Dual-Channel Software-Defined Radio for vehicles and dismounts



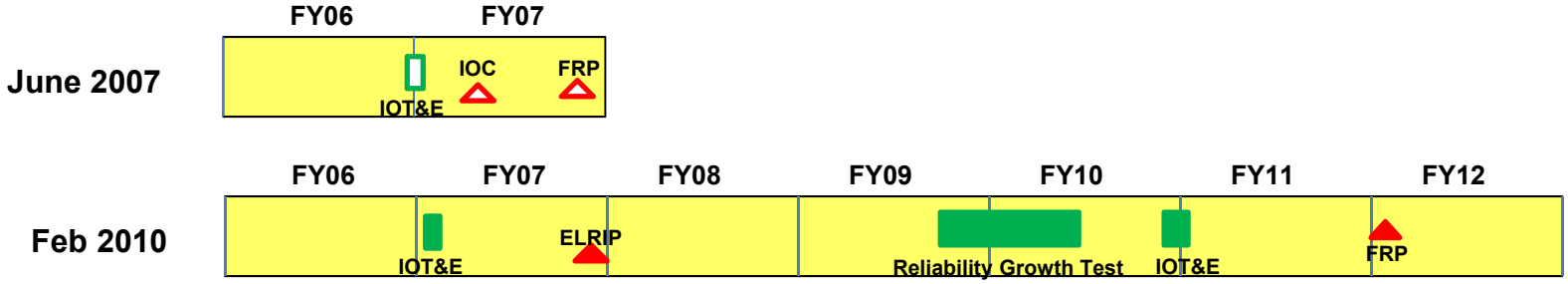
- Full Rate Production (FRP) delayed more than 4 years for performance problems found in testing
- Poor system performance at the FY11 LUT led to a limited scope LRIP at the MS C of 100 radios
  - Performance problems were primarily network stability, voice range, and voice quality
- Performance at the FY12 MOT&E was improved but not sufficient to get FRP
  - While improved, voice quality and range were not sufficient; a number of Manpack requirements, including network gateway features, were not ready and thus not tested
- In FY12 the DoD decided to change the acquisition strategy and move from a conventional program of record to a non-developmental item open to competition
  - The Program Office had to redesign the acquisition strategy, submit requests for proposal, and go through source selection
- The FY14 FOT&E supports a conditional materiel release, prior to the planned FY17 FRP on the non-developmental Manpack
- In June 2014 the CG of the Maneuver Center of Excellence formally assessed the radio as not suitable for fielding due to excessive weight, limited range, unacceptably high operating temperature, and short battery life, and recommended that the acquisition community and HQ DA (G3/5/7) suspend fielding the radio to brigade combat teams

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Stryker NBCRV

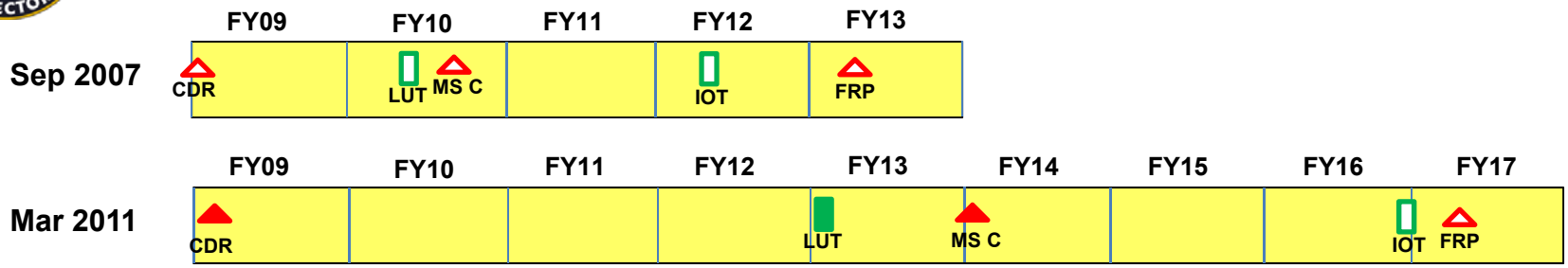
Stryker-based Nuclear, Biological and Chemical Reconnaissance Vehicle (NBCRV)



- **Full Rate Production (FRP) decision was delayed more than 4 years because of reliability problems encountered during DT and 2006 IOT&E**
  - **The NBCRV demonstrated poor reliability during DT conducted prior to IOT&E but the program proceeded to operational testing anyway**
  - **During IOT&E, both base vehicle and NBC sensor reliability failures adversely affected the capability of the NBCRV to accomplish its mission**
- **USD(AT&L) directed the Stryker NBCRV program office to undertake a reliability growth strategy, including a reliability growth test and additional operational testing prior to receiving a FRP decision**
  - **An extended low rate initial production (ELRIP) decision was granted in lieu of a FRP decision**
- **In 2008, the Stryker NBCRV prime contractor enacted a Design for Reliability engineering process that identified reliability failure modes and fixes to increase system reliability**
- **A Reliability Growth Test and an additional IOT&E were conducted in 2009-2011 and the Stryker NBCRV demonstrated increased reliability in both events**
- **The system received a FRP decision in 2012**

Paladin Integrated Management (PIM)

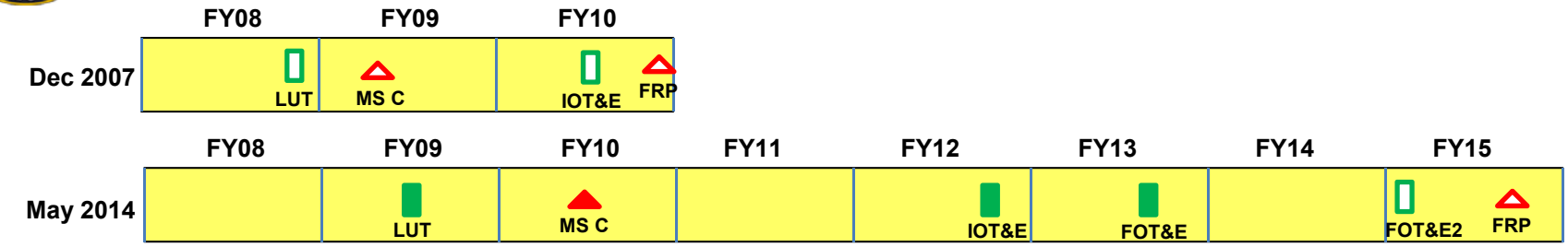
A Service Life Extension Program for the Paladin self-propelled howitzer and ammunition carrier



- **Full Rate Production (FRP) delayed 4 years due to optimistic initial expectations, technical and management issues, and programmatic changes**
- **Program Office's initial schedule was optimistic**
  - **Assumed immediate contract award was possible**
  - **Assumed prototype deliveries could be made by 4QFY09**
  - **Assumed prototypes could meet reliability requirements as soon as delivered, so no reliability growth plan was needed**
- **Technical and management issues became apparent during prototype development**
  - **Prototype reliability below expectation in contractor checkouts**
  - **Poor communication of survivability requirement to contractor required design changes and delay in commencement of Ballistic Hull and Turret test**
  - **Prototype deliveries for government testing delayed approximately 21 months to 3QFY11**
  - **Delivery of IOT LRIP test articles expected 36 months from MS C**
- **Programmatic changes delayed initiation of a viable program schedule**
  - **Army Acquisition Objective change raised PIM to ACAT ID, increasing documentation requirements**
  - **Army sought JROC approval to reduce reliability KPP threshold from 0.81 to 0.75 probability of mission completion**

Warfighter Information Networking – Tactical (WIN-T) Increment 2

On-the-move, high-speed, high-capacity communications



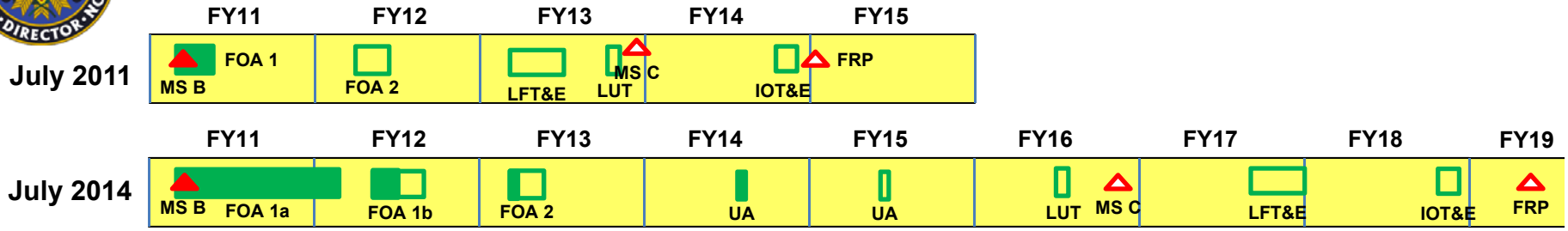
- **Full Rate Production (FRP) delayed more than 4 years for multiple reasons**
- **Limited user test (LUT) was delayed due to unavailability of test units**
- **WIN-T Increment 2 performed poorly at the LUT, with effectiveness and suitability shortcomings that required subsequent developmental tests and delayed MS C**
  - **The system was unable to send line-of-sight messages via the Highband Networking Waveform beyond 3.5 km**
  - **Full spectrum operations were not tested and the tactical operations centers remained stationary**
  - **None of the individual configuration items met their reliability requirements**
- **The IOT&E was delayed by the Army to combine testing at the Network Integration Evaluation (NIE)**
- **Poor performance and reliability issues delayed the FRP decision, requiring additional development and two follow-on operational tests; during this time, the program received three LRIPs; the FRP decision is scheduled for May 2015**
  - **The system continues to have poor line-of-sight range, network instabilities, and poor reliability; system complexity hampers commanders engaged in action**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

XM25 CDTE

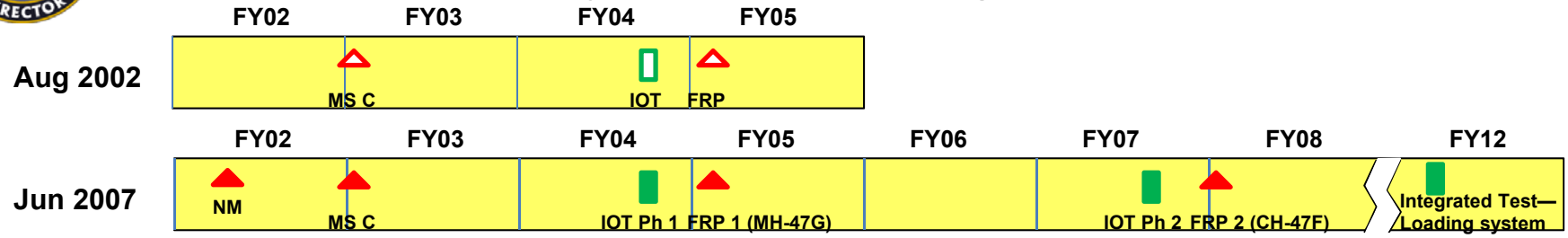
Counter Defilade Target Engagement (CDTE) System



- **Full Rate Production (FRP) delayed more than 4 years because of problems discovered during DT**
  - Malfunctions occurred that terminated three different Field Operational Assessments (FOA) that collected developmental test data during combat operations in Operation Enduring Freedom (OEF)
  - The nose of a following cartridge impacted the primer of a cartridge in the chamber, igniting the propellant; the malfunction was caused by the gunner failing to properly clear his weapon
  - The first two of three fixes did not correct the problem; the third fix appears to have
- **In FY11, malfunction occurred in OEF during FOA 1a**
  - Malfunction incorrectly attributed to cartridge feed mechanism
- **In FY12, malfunction occurred in OEF during FOA 1b**
  - Malfunction incorrectly attributed to bolt face design
- **In FY13, malfunction occurred in OEF during FOA 2**
  - Video of New Equipment Training disclosed actual cause of malfunction was the gunner failing to properly clear his weapon
  - Fix was to recess the primer on the cartridge and lengthen the firing pin and improving gunner training on immediate action for a weapon jam
  - User Assessments (UA) were added to the schedule to ensure human factors changes were acceptable to the user

CH-47F Chinook Cargo Helicopter

Upgrades, including digital cockpit, to Army heavy lift helicopter that provides combat resupply and transportation for ground forces



- **Full Rate Production (FRP) for all aircraft delayed 3 years for multiple reasons**
- **Reliability problems discovered in developmental and operational testing**
  - Program not funded or structured for reliability growth
- **In IOT Phase 1, helicopter was effective, but not suitable**
  - Did not meet two of four reliability requirements
  - Could not send/receive digital messages as required by key performance parameter (KPP)
  - Airframe fatigue cracking prevalent throughout the fleet
- **Army merged this program with Special Operations MH-47G program**
  - Approved FRP 1 for Lots 1 through 5
  - Production line front-loaded with 46 MH-47G aircraft; one CH-47F of this design produced for Army
- **Army then redesigned cockpit, avionics, and airframe**
  - All-digital displays, flight controls, and avionics (initial design had been a mix of analog and digital)
  - Funded for reliability growth
  - New monolithic frames for fuselage
- **Effective and Suitable at IOT Phase 2**
  - FRP 2 approved for production of CH-47F aircraft with new cockpit and airframe design

IOT Phase 1 Reliability

	ORD Threshold (HRS)	Demonstrated Reliability (HRS)
MTBMA	44	19.7
MTBMAF	7	11
MTBEMA	3.3	2.5
MTBUMA	0.79	1.28

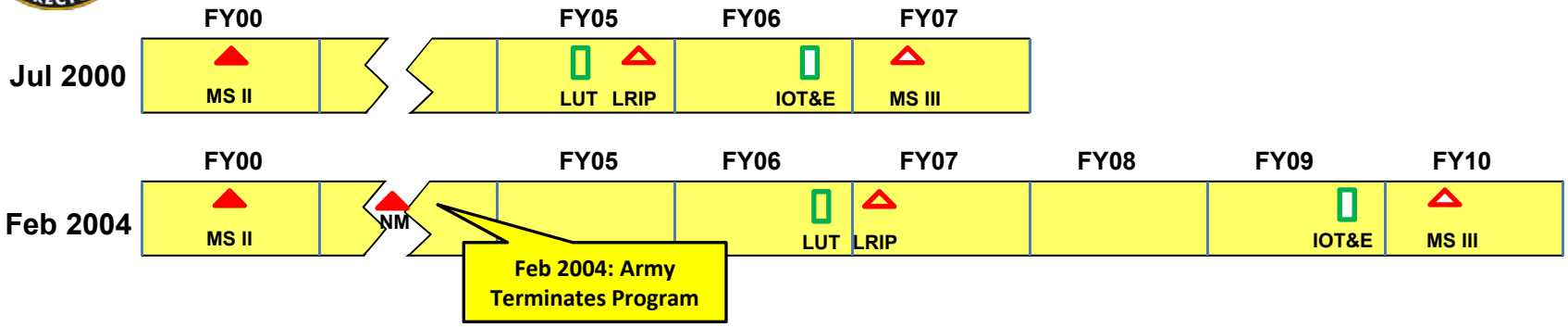
MTBMAF – Mean Time Between Mission Affecting Failures
MTBMA – Mean Time Between Maintenance Actions
MTBEMA – Mean Time Between Essential Maintenance Actions
MTBUMA – Mean Time Between Unscheduled Maintenance Actions

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

RAH-66 Comanche

Twin-engine, two-pilot, stealthy armed reconnaissance/attack helicopter



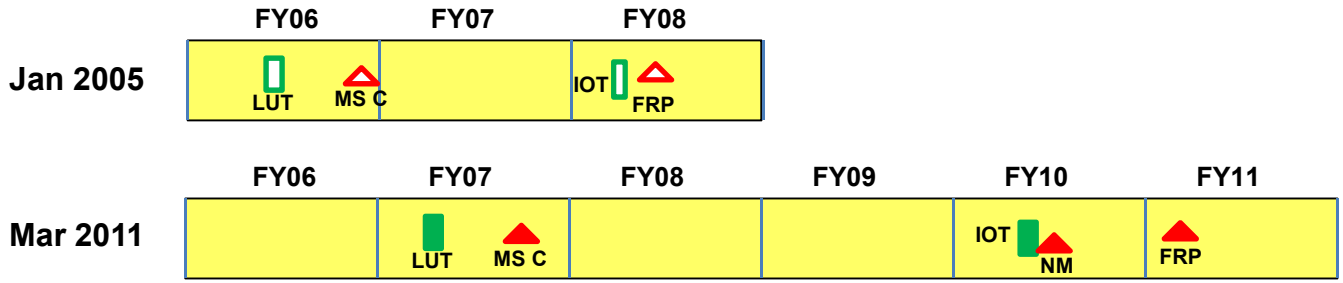
- MS III and IOT&E delayed 3 years, then the program was cancelled for multiple reasons
- Technical challenges existing at MS II, and others discovered soon after, led to sixth program restructure in 2002
  - Additional time needed to develop fly-by-wire and mission equipment software
  - Projected weapon accuracy would not meet specifications; weapons integration behind schedule
  - Competing requirements to increase antenna performance while reducing radar cross section
  - Current and projected aircraft weight exceeded goals; flight performance requirements at risk
- Restructured program proposed evolutionary capabilities in three blocks
  - Program unable to meet all requirements by FY10; Block III capability projected for FY13
  - Production quantity reduced from 1,205 to 646
  - Fielding postponed by 3 years
- In February 2004, the Army terminated the Comanche program
  - Funds retained within Army Aviation

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Excalibur Increment Ia-2

An extended-range, GPS-aided, precision 155mm artillery projectile



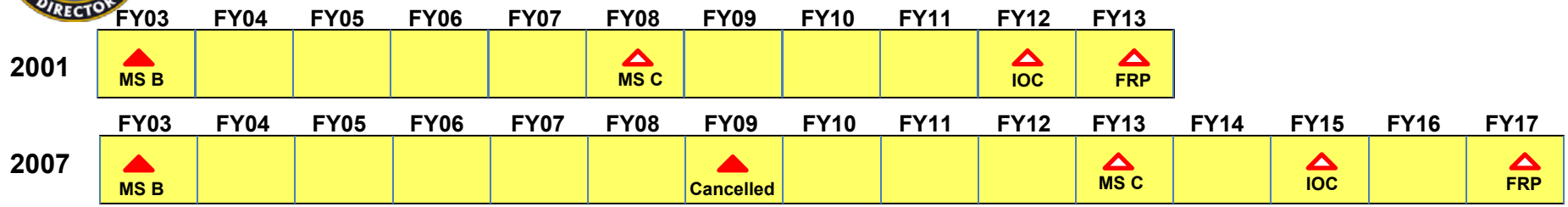
- **Full Rate Production (FRP) was delayed 33 months due to reliability problems and programmatic changes**
- **MS C was delayed 9 months because of reliability problems in developmental tests**
  - **Assessed reliability in December 2006 was 73% against an 85% requirement**
- **The IOT was delayed an additional 15 months because of reliability problems that surfaced in developmental testing and a change in the threat**
  - **Replaced Inertial Measurement Unit vendor to improve reliability**
  - **Change in description of the GPS jamming threat required redesign of GPS antennas**
  - **Reliability problems continued with top propellant charge in IOT (50% reliable)**
- **The FRP decision was further delayed 9 months because of a Nunn-McCurdy breach triggered when the Army reduced the acquisition objective from 30,000 to 6,264 rounds**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

Future Combat System (FCS)

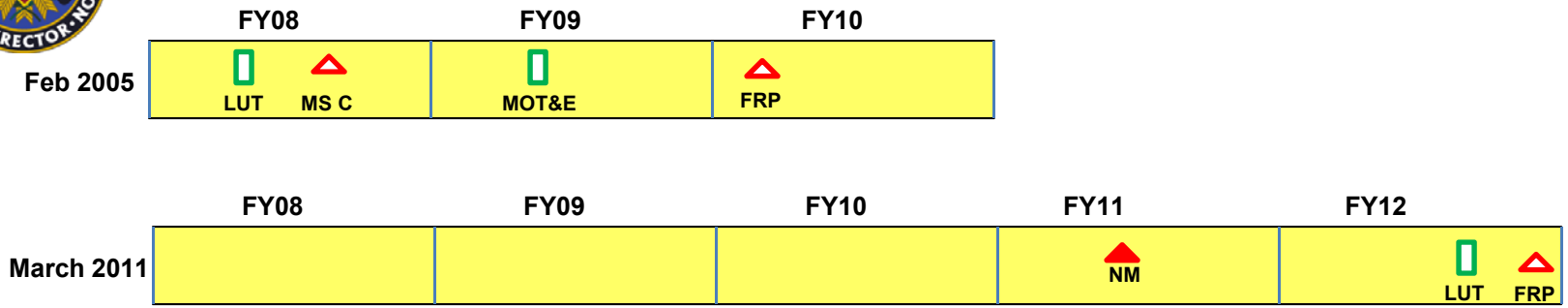
A collection of manned ground vehicles and sensors for Army brigades



- **Initial Operational Capability (IOC) delayed 3 years because of programmatic issues caused by aggressive schedule and lack of mature technology, then the program was cancelled**
- **The FCS program was an ambitious effort to simultaneously field a complete brigade set of nine manned ground combat vehicle variants, six unmanned robotic ground vehicles, four unmanned air vehicles, and three robotic sensors and munitions**
- **The original program schedule showed IOC to be in FY12**
  - **The original schedule was ambitious; nonetheless in 2001 at the Army Requirements Review the IOC was <u>accelerated</u> two years from FY12 to FY10**
  - **The final Selected Acquisition Report (SAR) produced in 2007 showed IOC to be in FY15**
- **The program incurred a Acquisition Program Baseline (APB) breach for schedule but was cancelled before the breach was acted upon**
- **The FCS program never conducted an operational test, and only had one prototype of one vehicle variant , the Non-Line-of-Sight Cannon (NLOS-C), built before it was cancelled**
- **The manned ground vehicle program was cancelled by the SecDef in April 2009, and the remaining segments of the FCS program were transferred into the Early Infantry Brigade Combat Team (E-IBCT) program (see separate slide on E-IBCT)**
  - **All of the E-IBCT programs were eventually also cancelled after an operational test determined they had little military utility, except for the Small Unmanned Ground Vehicle (SUGV), which was procured in a single brigade set**

Joint Tactical Radio System - Ground Mobile Radio

Wide and Narrowband connectivity on the move



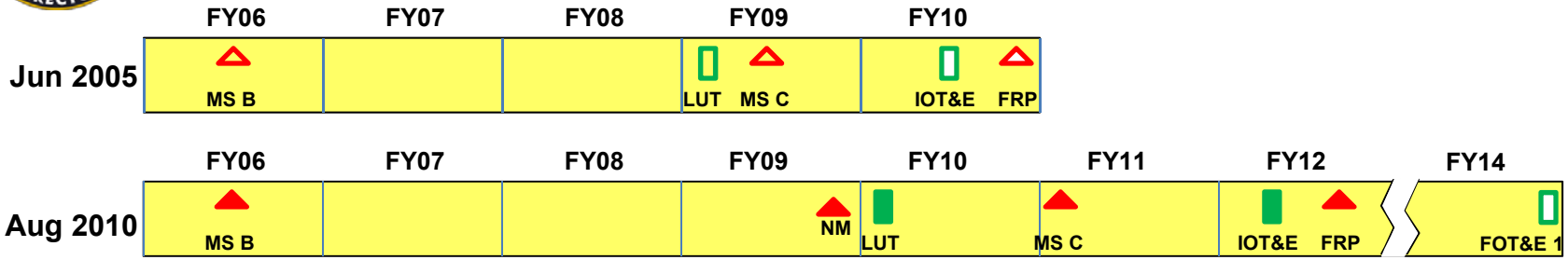
- **Full Rate Production (FRP) delayed 3 years; program cancelled in FY12 for multiple reasons**
- **The limited user test (LUT) was delayed repeatedly due to poor performance in developmental testing: Field Experiment 3 (2007), Field Experiment 4 (2008), System Integration Tests Part 1 and 2 (2010), Field Experiment 5 (2011)**
- **Ground Mobile Radio continued to have multiple deficiencies:**
  - **Mean Time Between Essential Function Failure has been on the order of 10 hours in developmental testing (1200 hours required)**
  - **The scaling performance of the wideband networking waveform (WNW) continues to be disappointing with no physical network ever scaling more than 35 nodes (requirement is 100 nodes)**
  - **Range performance of the radio has been disappointing, typically 6-7 kilometers for WNW on a single hop (about 15-20 kilometers needed for brigade operations)**
  - **The complexity and size of the system is such that integration into combat vehicles (Bradleys, Abrams, and Strykers) is not possible**
- **The 2011 Nunn-McCurdy breach resulted in a program reevaluation and move of the LUT to the Army NIE 12.2 in April-May 2012**
  - **The LUT was downgraded to a customer test and the Nunn-McCurdy breach resulted in the program being terminated**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

AH-64D Apache Block III

Modernized AH-64D attack helicopter with Level II-IV Unmanned Aircraft System (UAS) control, improved performance, and enhanced survivability



- **Full Rate Production (FRP) delayed 2 years for programmatic reasons**

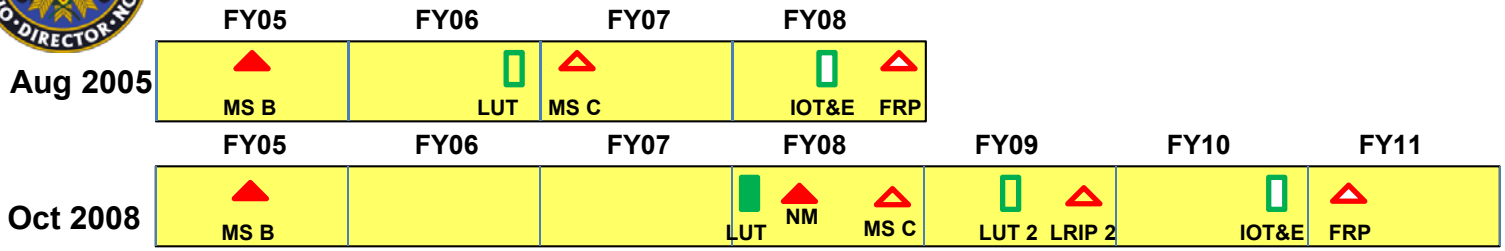
- **2009 Nunn-McCurdy cost breach from increase in fleet requirements**
  - **Just before MS C, OSD directed creation of new aviation brigade, adding 56 Apache Block III aircraft to the production quantity**
  - **MS B program envisioned rebuilding 634 existing Apache aircraft**
  - **All 56 new aircraft must be built new using all new high-dollar components (engines, drives, sensors)**
  - **IOT&E and FRP were delayed to accommodate new funding profile**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Armed Reconnaissance Helicopter

Replacement for OH-58D helicopter for armed reconnaissance helicopter missions



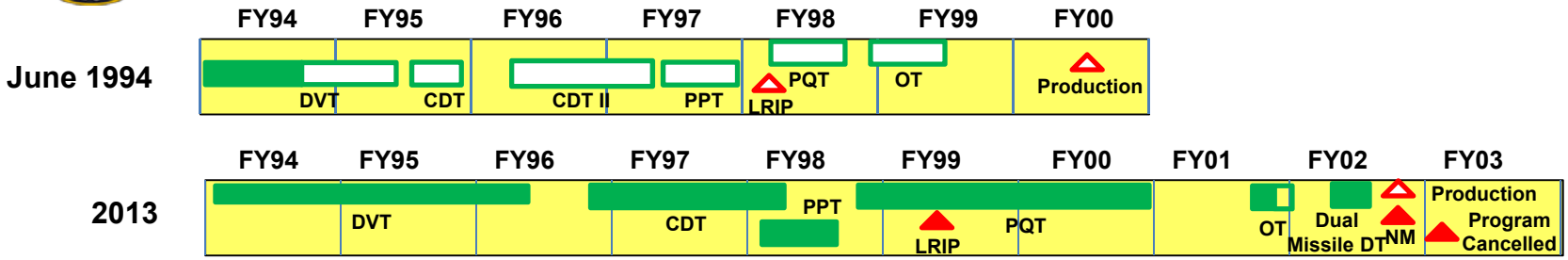
- **Full Rate Production (FRP) delayed more than 2 years for multiple reasons, then the program was cancelled**
- **Bell Helicopter design was not as mature as briefed at MS B**
  - **While based on the commercial Bell 407 design, the ARH needed new designs for the engine, landing gear, sensor, tail cone, exhaust faring, and other structural components**
  - **Bell was unable to produce test data on flight components that Bell asserted were qualified for flight; this necessitated additional unplanned testing to qualify Bell 407 components**
- **MS B development timeline was unrealistic**
  - **Bell underestimated the integration challenges**
  - **Engine upgrade and integration of sensor package, laser, cockpit software, and armament did not go well**
  - **MS C delayed to address most pressing development and integration challenges**
- **Immature integration of cockpit controls and sensor was evident at Nov 07 limited user test (LUT)**
  - **Sensor tracking and target location performance was not acceptable; one mission failed for inability to locate and track targets – a fundamental reconnaissance task**
  - **Crew workload and frustration was unacceptably high**
  - **Weapons, survivability equipment, and secure communications equipment were not yet integrated**
- **Defense Acquisition Executive (DAE) terminated program prior to MS C**
  - **Cited Nunn-McCurdy cost breach**
  - **Initiated Analysis of Alternatives (AoA) for OH-58D replacement**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

ATACMS Block II/ BAT

Army Tactical Missile with brilliant anti-tank submunitions



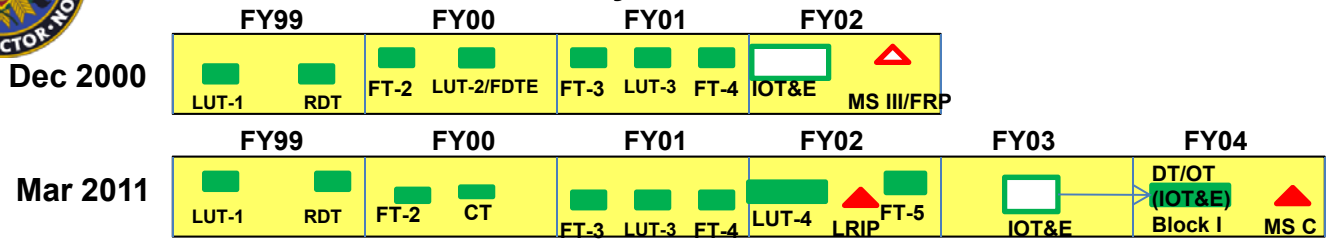
- **Production decision delayed 2 years, then program cancelled**
  - Design, reliability, production issues created early delays
  - Poor OT performance and outdated requirements resulted in program cancellation
- **Early delays due to design and technical problems**
  - BAT submunition was a complex munition designed to autonomously kill moving armored targets using acoustic and infrared sensors
  - Early Design Verification Test (DVT) and Contractor Design Test (CDT) focused on single BATs dropped from a fixed wing aircraft
  - Early drop tests and modeling uncovered numerous design problems
  - Later Pre-Production Test (PPT) and Production Qualification Test (PQT) focused on missile dispenses, uncovering additional submunition issues
- **IOT&E cancelled due to poor performance**
  - Army cancelled OT after two of five planned missile firings
  - Poor performance due to accredited threat countermeasures, targeting issues, and weather; none of these conditions were emphasized in DT
  - Dual-missile firing in FY02 resulted in poor results when one missile dispensed at low altitude due to launcher software issue
- **Nunn-McCurdy breach occurred in 2002 and program cancelled in 2003**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Performance problems in DT	Performance problems in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Force XXI Battle Command, Brigade and Below (FBCB2)

Track friendly and hostile forces on the battlefield



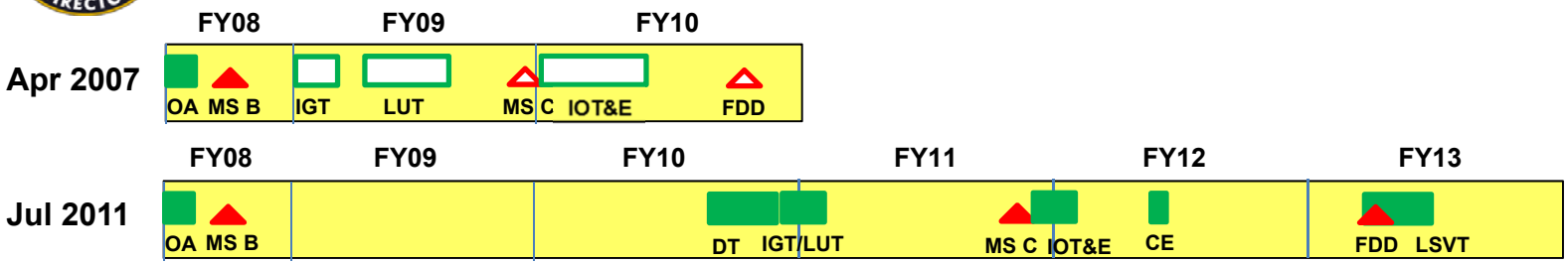
- **MS C delayed 2 years for multiple reasons**
- **As a result of immature software, the Field Test-2 (FT-2) was repeatedly slipped and eventually conducted without meeting entrance criteria; the LUT-2 was downgraded to a Customer Test (CT)**
  - **Needed enhancements include: robust network management capability, interoperability with Army Tactical Command and Control System (ATCCS), and rapid reestablishment of network when communications are lost or task organization changes**
- **Blue Force Tracking (BFT) capability was added to the FBCB2 in early CY03 with the pending imminent deployment of the 4th Infantry Division to Operation Iraqi Freedom (OIF)**
  - **BFT system uses an L-band satellite radio rather than the terrestrial EPLRS network of FBCB2**
- **IOT&E in 2003 was cancelled/delayed because test unit was deployed in support of OIF**
- **A distributed DT/OT including both BFT and terrestrial FBCB2 systems was conducted in February 2004 with linkages among Ft Huachuca, Ft Hood, and Ft Bragg**
- **DOT&E BLRIP report in 2004 based on DT/OT Block I, field assessments from OIF, and LUT in 2001**
  - **Follow-on testing to demonstrate corrections to shortcomings – principal among these is reliability**
  - **Interoperability of the FBCB2/BFT version and the FBCB2 terrestrial enhance position location reporting system (EPLRS) has not yet been demonstrated; in addition, FBCB2/BFT are identified as main legacy components required to be interoperable with the Future Combat Systems Modular Brigade Combat Teams**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Global Combat Support System-Army (GCSS-Army)

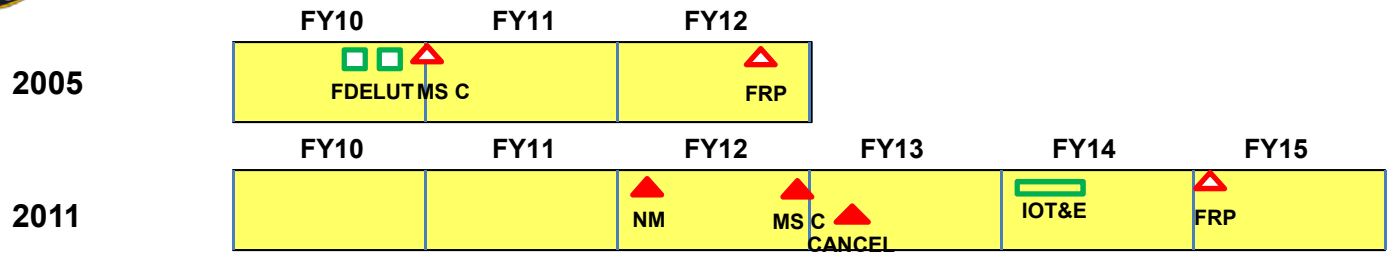
Tactical Logistics and Financial Management System



- **Full Deployment Decision (FDD) delayed by 30 months because of software development and integration problems and problems discovered during DT**
  - **Schedule slipped the FDD 24 months to analyze, design, and build system prior to DT in FY2010**
  - **Planned FDD slipped an additional 6 months from June 2012 to December 2012 in response to the prediction for future scalability shortfall reported by the GCSS-Army project office**
    - » **SAP, the provider for the Enterprise Resource Planning software, discovered through their model run that Army force structure is too complex and will incur performance limitations when the system is fully deployed to the Army**
    - » **DOT&E IOT&E report, published June 2012, recommended monitoring computational and human impacts of increased size of user base**
    - » **The GCSS-Army project office reported the scaling problem and started implementing mitigation measures:**
      - **Modified the organization representation in the software, and demonstrated the potential for resolving the scalability issue in their lab in Oct 2012**
      - **Initiated development and verification and validation of modelling and simulation capabilities to monitor the scalability problem**
    - » **Based on the reduced risk, the Under Secretary of Defense for Acquisition, Technology and Logistics approved the FDD but mandated continuous monitoring of the system performance**

Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS)

Tethered Aerostat Sensor Platform



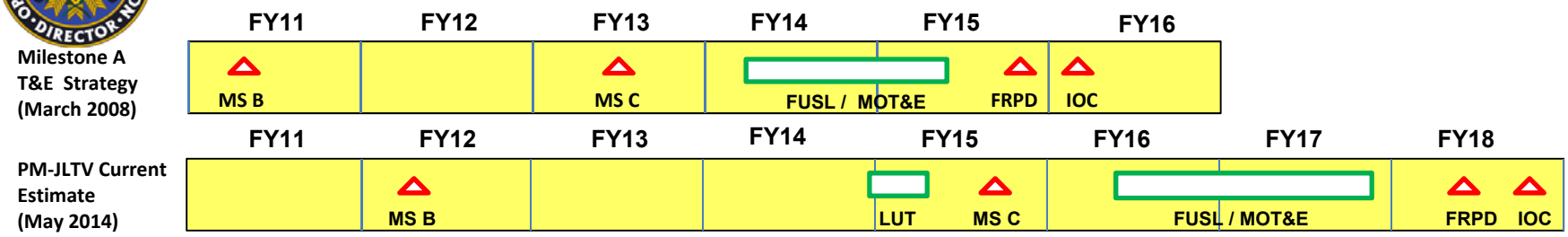
- Full Rate Production (FRP) delayed more than 2 years for programmatic reasons, then the program was cancelled
- 12-month development delay because of restructure to support alignment with other Army Integrated Air and Missile Defense (AIAMD) systems
- One aerostat destroyed after collision with aerostat from another program during a storm, causing delay while replacement aerostat was produced
- Nunn-McCurdy breach occurred because of unit cost growth after budget decision not to buy production systems

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Joint Light Tactical Vehicle (JLTV)

HMMWV replacement with improved capabilities



- **Initial Operational Capability (IOC) delayed 2.5 years due to programmatic issues**
- **MS C has been delayed from February 2015 to July 2015 (5 months)**
  - **2-week extension of the RFP submission deadline**
  - **2-month delay in the release of the RFP contract award to allow the source selection board more time to sort through the large volume of proposals submitted**
  - **Additional delays due to government budget sequestration**
- **MS B was previously delayed from March 2011 to August 2012 (17 months)**
  - **4-month delay in contract award (July 2008–October 2008)**
  - **3-month delay after contract award was protested (November 2008–February 2009)**
  - **Additional delays were attributable to requirements refinements, to include changes in required Force Protection levels and composition of the Family of Vehicle variants, and congressional pressure concerning program cost**
    - » **Developmental testing illuminated the types of requirements refinements and capability tradeoffs that are necessary, particularly with respect to transportability, mobility, payload, reliability, and force protection**

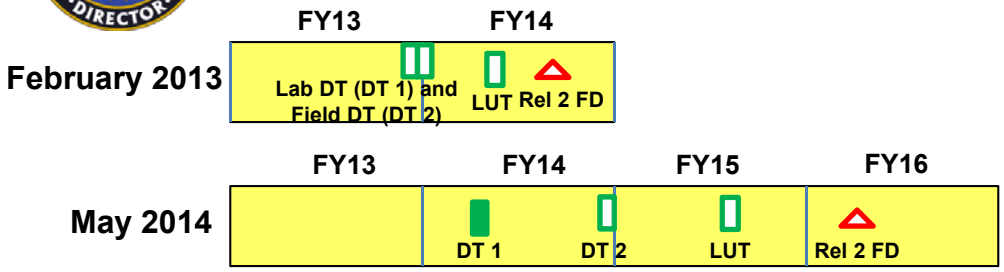
FRPD: Full Rate Production Decision FUSL: Full Up System Level Live Fire Test & Evaluation HMMWV: High Mobility Multipurpose Wheeled Vehicle IOC: Initial Operational Capability	LUT: Limited User Test MOT&E: Multi-service Operational Test & Evaluation RFP: Request for Proposal

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Distributed Common Ground System – Army (DCGS-A)

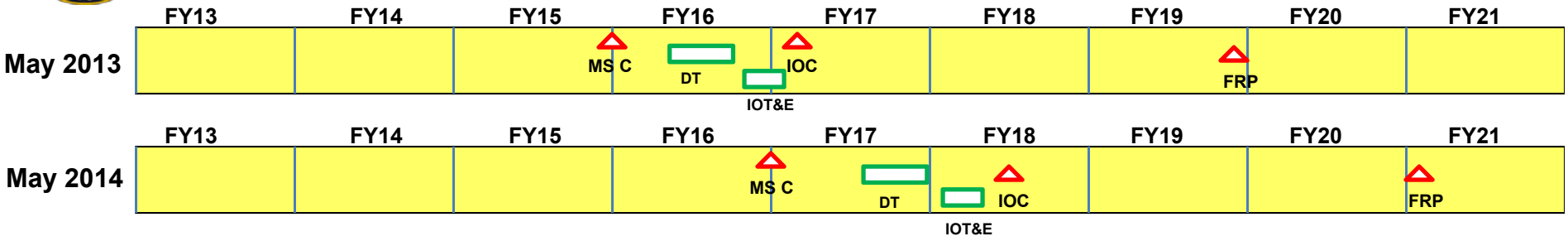
Army Net-Centric Intelligence, Surveillance, and Reconnaissance System



- **Fielding Decision (FD) and Release 2 LUT slipped 1.5 years to fix software problems**
  - Army user representatives asked for sufficient time between DT 2 and the LUT for user training
  - Program failed to enter Lab DT (since renamed DT1) on time because of software development problems
  - The delay of DT-1 caused delays to subsequent test events
- **Decision to delay LUT from October 2014 made in February 2013**
  - Done at the request of the Director, Capabilities Development and Integration Directorate, Army Intelligence Center of Excellence based on the concern for adequate time to conduct collective training with mature software
- **Discussions within Army led to decision in June 2013 to conduct LUT in May 2014**
  - LUT venue would have been NIE 14.2
- **Decision to further delay the LUT made in November 2013 and request to delay further made by Test Schedule Review Committee to Army Vice Chief of Staff in April 2014**
  - DT1 delayed 6 months, and DT2 delayed 11 months
  - Significant problems discovered during prior tests influence the decisions to delay
  - Test planning and resource constraints also a factor—some planning constraints because of furloughs and government shutdown

Army Integrated Air and Missile Defense System (AIAMD)

Integrated Battle Command System (IBCS) architecture that includes sensors and shooters

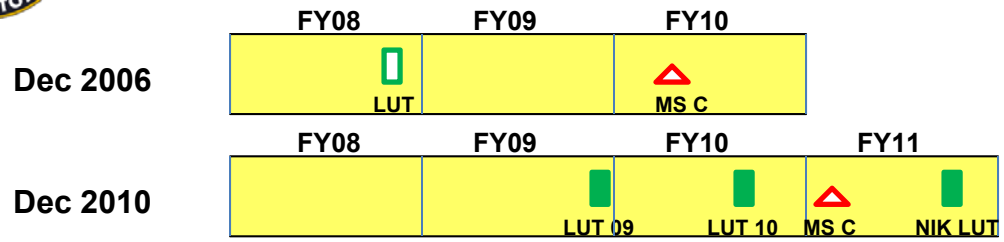


- **Full Rate Production (FRP) delayed more than 1 year for programmatic reasons**

- **$240M reduction to RDT&E in the FY15 President's Budget resulted in APB schedule breach for MS C, IOT&E, Initial Operational Capability (IOC), and FRP**

Early Infantry Brigade Combat Team (E-IBCT)

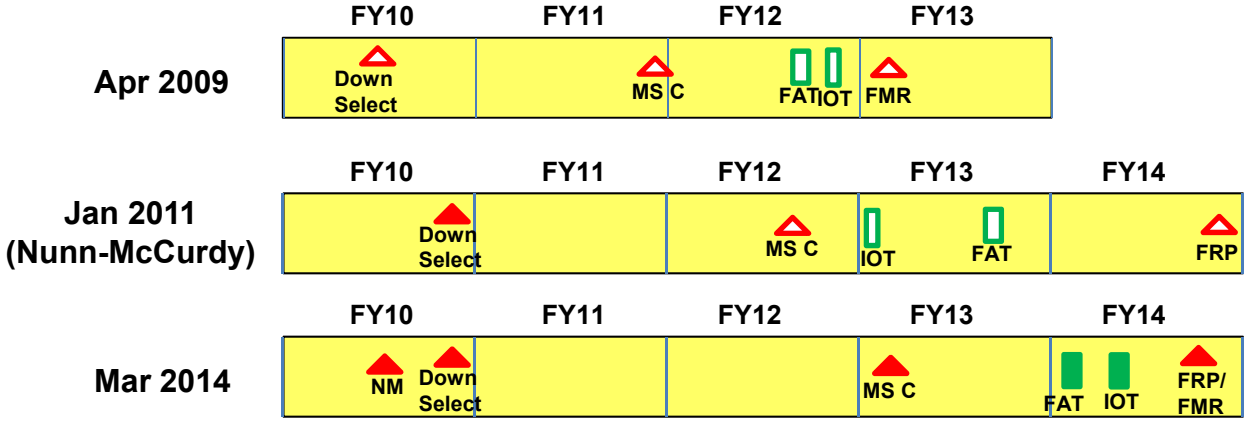
A collection of sensors and communications to improve situational awareness of infantry brigades



- MS C delayed 1 year, then three of five subsystems cancelled for performance problems found in testing
- Planned FCS Spin-Out (Dec 06 Future Combat Systems Selected Acquisition Report (SAR))
  - Limited user test (LUT) in Jun 08
  - MS C in Jan 09
- Due to programmatic changes, LUT in CY08 was cancelled
  - Focus shifted from heavy brigade combat team (HBCT) to infantry brigade combat team (IBCT)
  - Systems not ready for test
- As a result, MS C slipped 1 year from Jan 09 to Dec 09
- LUT in Sep 09 revealed poor reliability
- Acquisition Decision Memorandum (ADM) in Dec 09 approved purchase of one brigade set of each of the five subsystems; these brigade sets are now discarded
  - Tactical unattended ground sensor (T-UGS), urban unattended ground sensor (U-UGS), Class I unmanned aircraft system (UAS), small unmanned ground vehicle (SUGV), and network integration kit (NIK)
- LUT in Sep 10 revealed improved reliability, but lack of military utility for several of the subsystems
- ADM in Dec 10 cancelled three subsystems, approved two others; cancelled E-IBCT program
  - T-UGS, U-UGS and Class I UAS cancelled
  - SUGV approved for two brigade sets
  - NIK approved for one additional brigade set and continued development
  - NIK LUT held in June 2011
  - NIK program was transitioned to the GMR radio program, which was itself cancelled

Excalibur Increment Ib

An extended-range, GPS-aided, precision 155mm artillery projectile



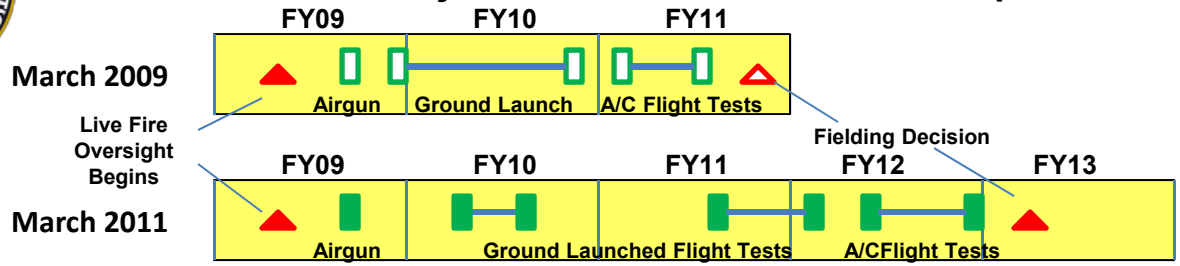
- **MS C delayed more than a year for multiple reasons**
- **Increment 1b MS C was initially delayed 4 months for risk mitigations and because of Army decision to reduce Excalibur procurement objective triggered a Nunn-McCurdy review**
  - **Army reduced procurement objective from 30,000 to 6,264 projectiles**
  - **Nunn-McCurdy decision directed 1a-1, 1a-2, and 1b be managed as a single program and authorized Excalibur procurement buy-out with 3 years of 1b production**
  - **IOT&E was scheduled to support second Increment 1b LRIP contract award, First Article Test (FAT) would support Full Materiel Release**
- **Program did not initially plan to conduct an Increment 1b FRP decision**
- **Increment 1b MS C was further delayed to 1QFY13 because of base development and reliability growth problems**
  - **Raytheon returned to using the Increment 1a-2 base and warhead for Increment 1b**
- **The Army delayed the IOT from 2QFY13 to 2QFY14 because of continued reliability problems and a desire to combine the Excalibur and precision guidance kit (PGK) OTs**
  - **The FAT was moved ahead of the IOT**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Hellfire Romeo

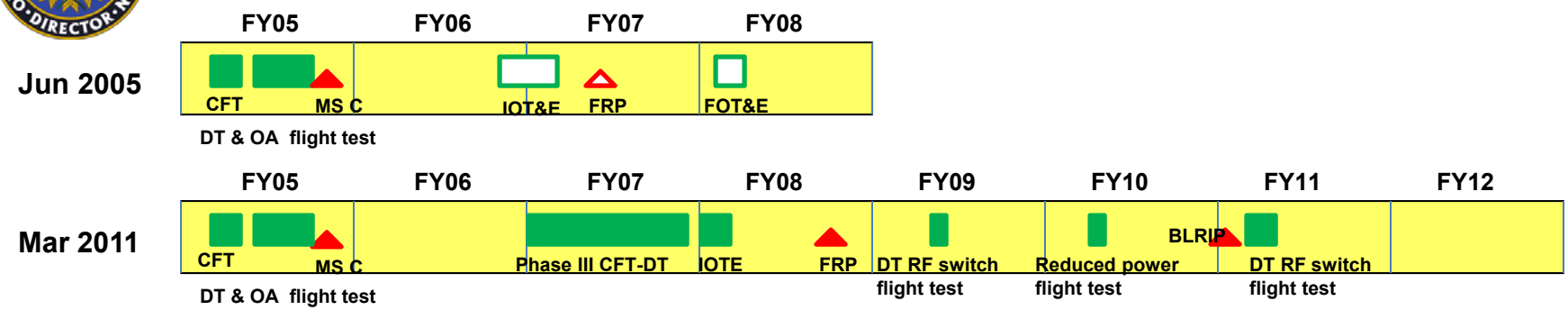
Air-to-Ground Army Tactical Missile with Multi-Purpose Warhead Upgrade



- **Fielding decision delayed 14 months because of performance problems revealed in DT**
  - **No TEMP or official schedule for this product improvement program; schedules were proposed by program**
- **Multi-purpose fragmenting warhead developed as product improvement to defeat armor and personnel in open and buildings**
  - **Required hardened shell and fuze**
  - **Some testing prior to putting system on live fire oversight in March 2009**
  - **Full rate production starts after fielding decision**
- **4-month slip to developmental ground-launched flight tests in FY09**
  - **Due to unexpected case fracture and fuze failure in airgun tests against brick over block wall**
  - **Added new, harder steel case and protective covering for fuze**
- **Second slip of 10 months to remaining developmental ground-based and aircraft flight tests in FY10**
  - **In second flight test against brick over block wall, warhead failed to detonate**
  - **Redesigned fuze for higher shock loads**
- **Airgun test limitations (without full explosive train function) "hid" failure modes that were revealed through flight testing**

Suite of Integrated Radio Frequency Countermeasures

Threat warning and self-protection jamming for Army aircraft



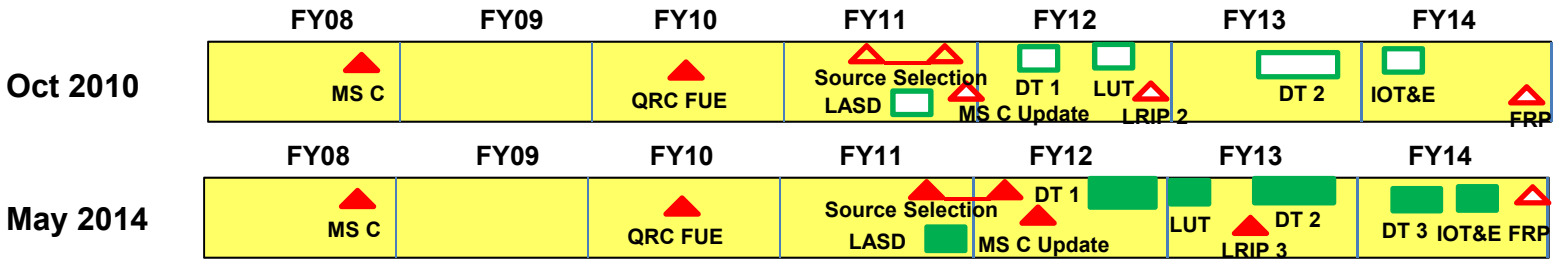
- Full Rate Production (FRP) delayed more than a year for multiple reasons
- Original SIRFC program was scheduled for IOC in about 1999
- Army defunded program in 2001, and SOCOM took over program management
- IOT&E delayed to address low-band antenna and radio frequency (RF) limiter hardware shortfalls
  - BLRIP delayed pending resolution of RF switch failures
  - SOCOM determined system to be effective, but not suitable
  - Developing corrections to RF switch failures was delayed, so DOT&E published a BLRIP concluding the system was not effective and not suitable
  - DOT&E's FY10 Annual Report to Congress stated SIRFC would be operationally suitable once DT confirmed corrections to switch failures, which was done in early FY11
- Major Findings in the BLRIP report include:
  - RF switch failures reduced reliability to less than one-tenth of requirement
  - Laboratory test fixture did not replicate aircraft installation
  - RF countermeasures did not reduce the number of shots or the probability of hit per shot sufficiently "to provide necessary performance required for adequate survivability"
  - RF countermeasures transmitted power and/or techniques were insufficient
  - Radar Warning Receiver (RWR) subsystem was operationally effective and suitable
- Substantial redesign of RF switch and improvements in test methods
  - RF countermeasures subsystem were suitable when redesigned RF switch tested

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

AN/TPQ Q-53 Radar

Replacement of Firefinder Projectile Tracking Radar



- IOT&E delayed 6 months for programmatic reasons; Full Rate Production (FRP) date slip is likely due to performance and reliability problems discovered during OT
- Source selection process and Government furloughs caused testing delays, but program full rate production decision currently remains unchanged
- Early delays in testing due to programmatic issues with source selection
  - Army contracted Lockheed Martin to produce Quick Reaction Capability (QRC)
  - Competition required to determine program of record contractor
  - Setting up competition delayed the primary source selection test - Live Ammunition System Demonstration (LASD)
  - Delay in selection of Lockheed Martin caused delay in the limited user test (LUT) and LRIP decision
  - Program was on schedule for start of second developmental test (DT 2)
- FY14 Government furloughs delayed IOT&E 6 months
  - Soldiers began training for IOT&E in October
  - Government travel restrictions prevented deployment of test team, resulting in IOT&E cancelation
  - Delay created opportunity to conduct additional reliability testing (DT 3)
  - IOT&E rescheduled and completed May 2014
- FRP date uncertain, but August 2014 FRP as planned is possible

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Outline

- Army Programs
- Navy Programs
- Air Force Programs
- Other Programs

Navy Programs

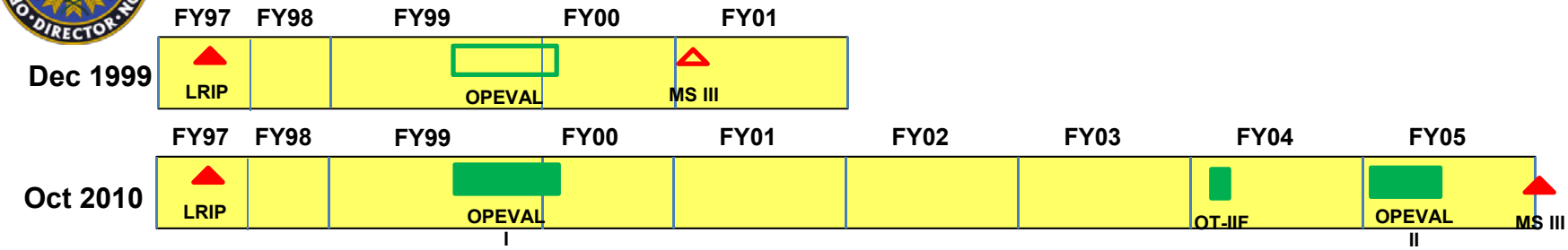
Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
MV-22 Osprey	MS III delayed 14 years	14		X	X	X	X		
RMS	FRP delayed nearly 12 years	12	X		X	X	X		
EFV	FRP delayed 10 years, then the program was cancelled	10	X	X	X	X	X		
AMNS	FRP delayed 9 years	9		X		X			
MH-60S Block 2A AMCM	FRP delayed 8 years	8		X	X	X	X		
ALMDS	FRP delayed more than 7 years	7		X		X	X		
CJR	IOC delayed 6 years	6		X	X	X			
VTUAV	FRP delayed more than 6 years	6	X		X	X		X	System unavailability
DDG 1000	IOC delayed 5 years	5	X	X	X				
H-1 Upgrades	MS III delayed more than 5 years	5	X	X		X	X		
AH-1Z	FRP delayed more than 4 years	4		X		X	X		
CH-53K	FRP delayed 4 years	4		X	X				
COBRA Block I	IOC delayed more than 4 years	4		X		X		X	Range and VTUAV
IDECM Block 3	FRP delayed 4 years	4				X	X		
JPALS Inc 1	FRP delayed more than 4 years	4	X		X			X	Ship unavailability
LCS	IOC delayed more than 4 years	4		X	X	X		X	System unavailability
ASDS	IOC delayed nearly 3 years, then the program was cancelled	3	X				X		
CEC AN/USG-2	FRP delayed 3 years	3			X	X	X	X	Ship unavailability
E-2D Advanced Hawkeye	IOC delayed more than 3 years	3	X		X	X			
IDECM Block 4	IOC delayed about 3 years	3		X		X	X		
LHA 6	IOC delayed more than 3 years	3		X				X	Targets and JSF unavailability
LPD 17	MS III delayed nearly 3 years and eventually cancelled, all ships in class procured	3	X	X			X	X	Targets and Marines unavailability

Navy Programs (cont'd)

Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
VH-71 Presidental Helo	Program delayed 3 years then cancelled	3	X	X	X				
AARGM	FRP delayed more than 2 years	2		X		X	X	X	Target unavailability
ECH	IOC delayed more than 2 years	2		X	X	X		X	Improper test procedures
GCCS-M	FRP delayed 2 years	2			X				
MQ-4C Triton	IOC delayed more than 2 years	2		X	X				
MUOS	Initial launch delayed more than 2 years	2		X	X	X			
RAM	FRP delayed more than 2 years	2				X	X	X	Target unavailability
SM-6	FRP delayed more than 2 years	2				X		X	Telemetry
UISS	MS C delayed more than 2 years	2			X				
Virginia	MS III delayed 2 years	2		X	X	X	X	X	Target unavailability
AIM-9X 8.212	Fielding delayed 18 months	1.5				X	X		
MIDS JTRS	FRP delayed 18 months	1.5		X			X		
P-8A Poseidon	FRP delayed nearly 18 months	1.5		X				X	Improper instrumentation
AIM-9X Block 2	FRP delayed more than a year	1					X		
CANES	IOC delayed more than 1 year	1			X			X	Ship unavailability
DoN LAIRCM	FRP delayed a year	1			X		X		
G/ATOR	IOC delayed a year	1			X	X			
SMCM UUV	IOC delayed a year	1			X				
CEC AN/USG-3B	FRP delayed more than six months	0.5				X	X	X	FAA clearance, test unit, spare parts, and targets unavailability; data collection
DCGS-MC	MS C delayed 5 months	0.5				X		X	Test unit unavailability
DoN LAIRCM ATW	Fielding decision delayed six months	0.5				X			

MV-22 Osprey

Tilt-rotor aircraft capable of airplane flight and vertical take-off and landing



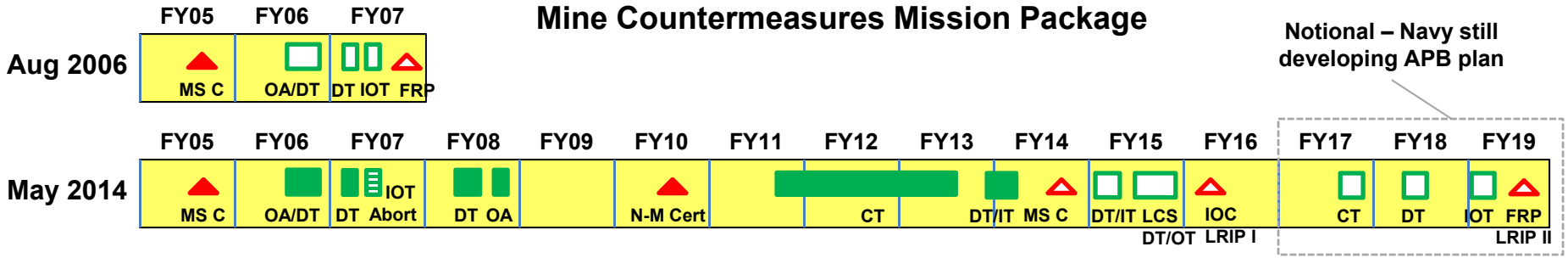
- **MS III delayed by 5 years from 1999 baseline and 14 years from 1982 baseline**
- **Technical and funding challenges throughout DT that began in 1982**
  - **SECDEF attempted to cancel the program in 1989-1990**
  - **Full scale development (FSD) aircraft were overweight – did not meet performance requirements**
  - **Development of fly-by-wire software – unstable in hover near the ground and over ships**
  - **Two crashes during development**
  - **MTBF reliability requirement > 1.4 hours; at best, 0.4 hours demonstrated in DT**
- **OPEVAL I – Effective, but not suitable**
  - **Some missions successfully completed, but fatal crash during test**
    - » **Effect of vortex ring state on aircraft performance not well tested or understood**
  - **Failed to meet all reliability, availability, and maintainability requirements**
    - » **MTBF reliability requirement > 1.4 hours; at best, 0.5 to 0.7 hours**
- **Another fatal crash before MS III decision**
  - **Poorly designed wiring and hydraulics in engine nacelles**
  - **Emergency procedures not fully tested or understood**
- **Program restructured in 2000**
  - **Major redesign of engine nacelles**
  - **Extensive testing at high rates of descent to understand aircraft response to vortex ring state**
- **Return to OPEVAL with MV-22 Block A aircraft in 2005**
  - **MV-22 effective and suitable**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Remote Minehunting System (RMS)

Remote semi-submersible vehicle and AN/AQS-20A towed sonar set to detect, localize and identify mines; key component of Littoral Combat Ship Mine Countermeasures Mission Package



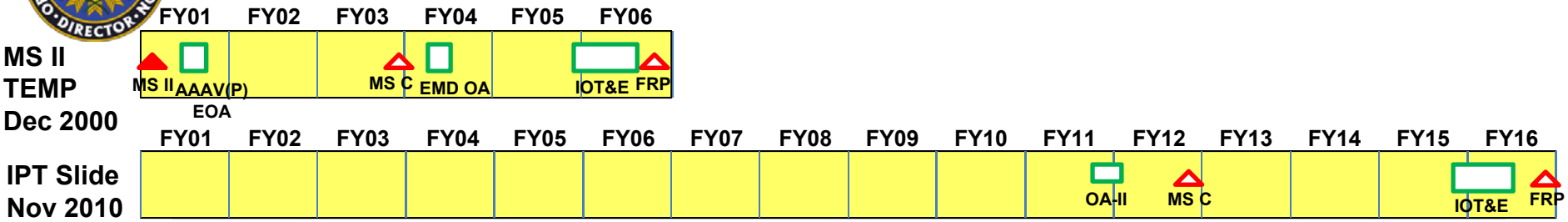
- **Full Rate Production (FRP) has been delayed by nearly 12 years because of need for additional system development to improve Remote Multi-Mission Vehicle (RMMV) reliability and correct other performance problems**
- **FY07 IOT&E was aborted and system was decertified for test because of numerous reliability issues**
- **IOT&E was rescheduled for FY08 but test was changed to an OA at the operational test readiness review (OTRR) because of continuing concerns about reliability**
- **Program was restructured in 2010 because of a critical Nunn-McCurdy cost breach**
  - **MS C was rescinded and a new MS C established in FY14**
  - **The reliability requirement was reduced from 150 hours Mean Time Between Operational Mission Failures (MTBOMF) for the complete system to 75 hours MTBOMF for a subset of system components, principally the RMMV**
  - **Navy was directed to embark on a program to grow RMMV reliability to at least 75 hours MTBOMF**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

Expeditionary Fighting Vehicle (EFV)

USMC amphibious assault vehicle



AAAV(P) – Advanced Amphibious Assault Vehicle Personnel

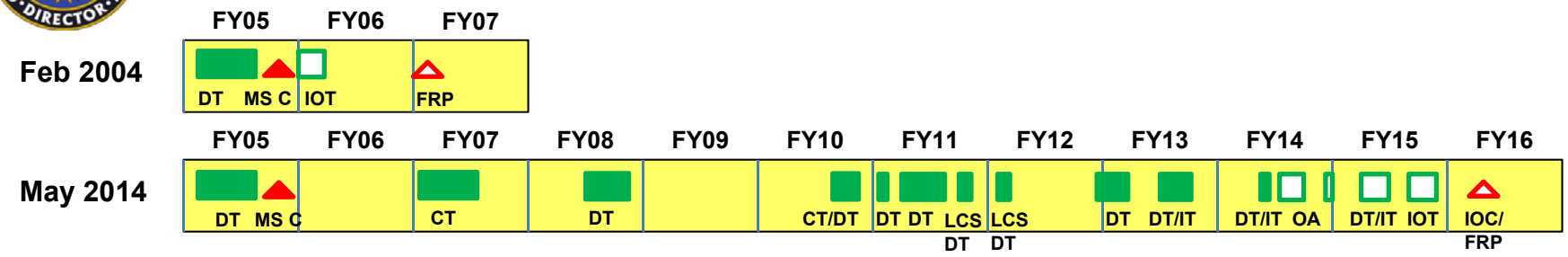
- **Full rate production (FRP) delayed 10 years, then the program was cancelled for multiple reasons**
  - In 1998, the program received the David Packard Award for Excellence in Acquisition and the Secretary of Defense Superior Management Award
- **EFV program was rebaselined in 2002, adding an additional year, and then rebaselined again in 2003, adding another year to the program schedule**
  - Initial EMD schedule of approximately 3 years did not allow sufficient time to test, evaluate the results, fix the problems, and retest to make certain that problems are fixed before moving forward
- **Because of demonstrated problems with hydraulics, hydrodynamic appendages, and key electronic systems, the program was rebaselined again in 2005, adding an additional 2 years**
- **In June 2007, the EFV program was restructured as a result of Nunn-McCurdy-level cost overruns and operational effectiveness and suitability problems identified during the 2006 EFV OA**
  - Performance and reliability shortfalls required a significant vehicle redesign; the EMD phase had to be redone (additional $1B+ and nearly 5-year delay)
  - As part of Nunn-McCurdy certification, the Navy developed a restructuring plan to allow time to construct a second generation of EMD-phase prototypes and to conduct a second OA
  - Restructuring (and additional post-restructuring delays caused by delays in delivering new prototype vehicles) resulted in the program's MS C being delayed from Jan 2007 to Dec 2011
  - Funding decisions further postponed MS C (from Dec 2011 to Sept 2012) and FRP until FY16
- **Program was cancelled in Jan 2011 by the Secretary of Defense for affordability reasons**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Airborne Mine Neutralization System (AMNS)

Component of Littoral Combat Ship (LCS) Mine Countermeasures Mission Package



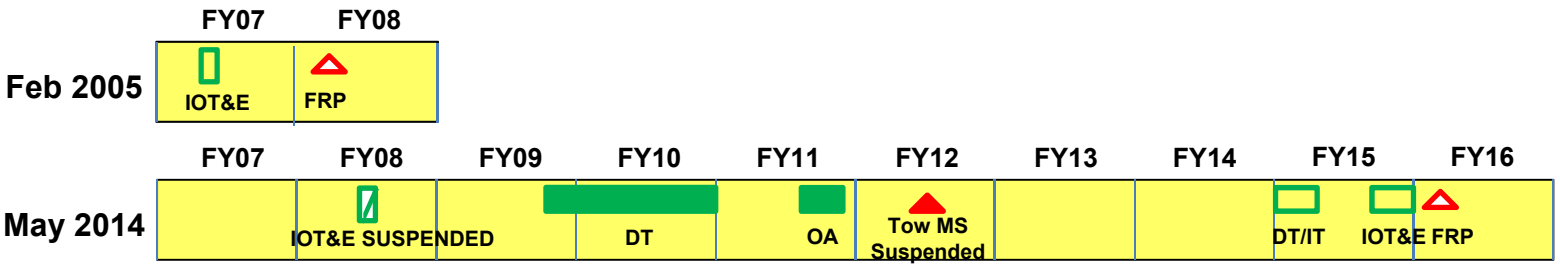
- **Full Rate Production (FRP) delayed 9 years because of developmental delays for the system and LCS mission package**
- **Problems revealed in DT**
  - **Difficulty passing fuze environmental performance tests (drop test)**
  - **Multiple neutralizer failures**
  - **Ethernet communications failures within launch and handling system**
  - **Software errors**
  - **Premature battery failures**
  - **Neutralizer fiber optic cable failures**
  - **Launch and handling system failed underwater explosion test**
  - **Limited neutralizer control authority in swift current environment**
- **In July 2011, the Navy changed its acquisition strategy to downgrade the planned IOT&E to an Operational Assessment and realign IOT&E with Littoral Combat Ship Mine Countermeasures Mission Package IOT&E (then planned in FY13)**
  - **Navy subsequently delayed mission package IOT&E to FY15 because of integration and developmental delays**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

MH-60S Block 2A Airborne Mine Countermeasures (AMCM) Helicopter with AN/AQS-20A Minehunting Sonar

Key Components of Littoral Combat Ship (LCS) Mine Countermeasures Mission Package



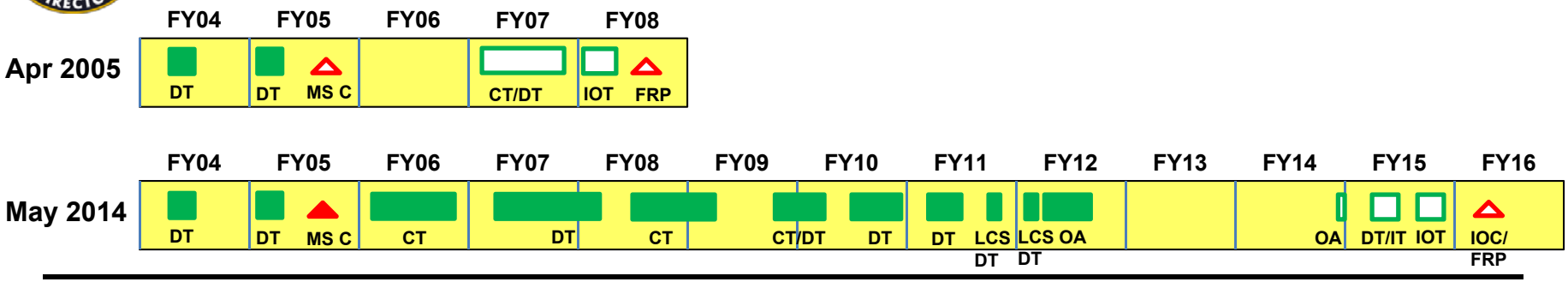
- AN/AQS-20A Full Rate Production (FRP) Decision delayed 8 years by developmental problems, programmatic decisions, and Airborne Mine Countermeasures (AMCM) Mission Kit performance deficiencies identified in DT and OT
- Commencement of 2007 IOT&E delayed until March 2008 because of tow cable/winch problems discovered in DT
- IOT&E suspended and systems decertified from OT in April 2008 because of numerous system reliability deficiencies, primarily associated with AMCM Mission Kit's tow cable and winch (cable mis-wrap on drum, jammed cable)
- Modifications incorporated and systems reentered DT in July 2009; officially completed in Aug 2010
- Navy decided to recharacterize 2011 shore-based phase of IOT&E as an Operational Assessment (OA) and align IOT&E with LCS MCM mission package IOT&E, now scheduled in FY15
- After the OA, Navy suspended MH-60S AMCM tow missions because the aircraft lacks sufficient power to safely tow AN/AQS-20A and other AMCM devices
  - AN/AQS-20 will be towed only by the Remote Multi-Mission Vehicle as part of the Remote Minehunting System (RMS)

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Airborne Laser Mine Detection System (ALMDS)

Component of Littoral Combat Ship (LCS)
Mine Countermeasures Mission Package for Shallow Mine Detection



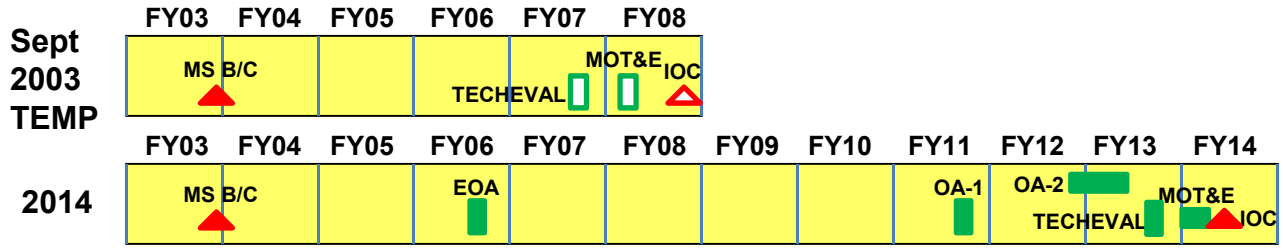
- **Full Rate Production (FRP) delayed more than 7 years because of developmental delays for the system and LCS mission package**
- **Problems revealed in DT**
  - **Inability to meet depth requirement (partially mitigated by reducing first increment depth requirement to 70 percent of ORD requirement)**
    - **Current depth performance is ~ 67 percent of ORD requirement**
  - **Large number of false contacts, ~ 180 percent of ORD limit**
  - **Slightly below threshold probability of detection and correct classification in good environmental conditions, ~ 95 percent of ORD requirement**
  - **Receiver failures**
- **Navy decided in July 2011 to change the planned IOT&E to an Operational Assessment (OA) and realign IOT&E with LCS Mine Countermeasures IOT&E (then expected in early FY13)**
  - **In FY12, the first phase of the OA confirmed DT results in good environmental conditions and identified degraded detection/classification performance under environmental conditions not examined in DT, ~ 60 percent of ORD requirement**
  - **Navy subsequently delayed mission package IOT&E to FY15 because of integration and developmental delays**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Cobra Judy Replacement (CJR)

A shipboard radar system to collect foreign ballistic missile data



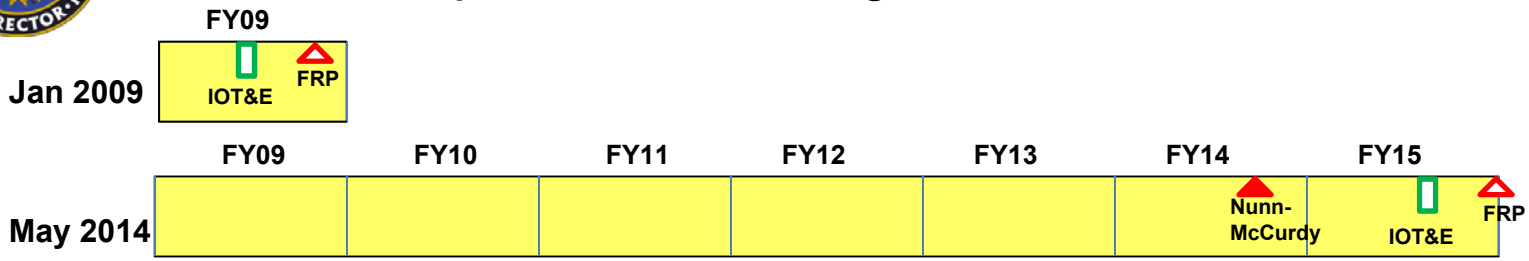
- Initial Operational Capability (IOC) was delayed by 6 years for programmatic; manufacturing, integration, and quality control; and DT reasons
- The FY04 Presidential Budget Decision (PBD) directed the program to upgrade the S- and X-band radar systems to active phased array radars, which extended the program by 3 years
- Delays in developing the mission planning tool and data processing system caused IOC to slip at least another year
  - Eventually, the program office decided to pursue two development spirals for the mission planning tool to prevent further slip in IOC
  - Delivery of the first spiral occurred just prior to the start of the Multi-Service Operational Test and Evaluation (MOT&E); the second spiral will deliver in 2015, after the IOC date
- In May 2011, the ship failed its at-sea acceptance trials, causing a 9-month slip in the delivery of the ship and delaying integration of the phased arrays onto the ship
  - The ship was judged inadequate during electrical, damage control, and aviation inspections and also had problems with its anchor, steering, and thrust bearing temperature
  - The ship was sent back for repairs before the Navy would accept the ship
- In September 2012, the program manager decided to delay the start of the Technical Evaluation (TECHEVAL) and MOT&E by 3 months to support completion of the radar integration efforts
  - In the DT lead-up to the start of Operational Assessment-2 (OA-2), full powered operations of the radar arrays had been minimal, and both arrays had not yet been simultaneously operated
  - Soon after the beginning of full power operations, a part failure in one of the X-band antenna power conditioning units rendered half of the array inoperable for 6 months

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Vertical Take-off and Landing Unmanned Aerial Vehicle (VTUAV)

Provides a ship-based, tactical, Intelligence, Reconnaissance, and Surveillance asset



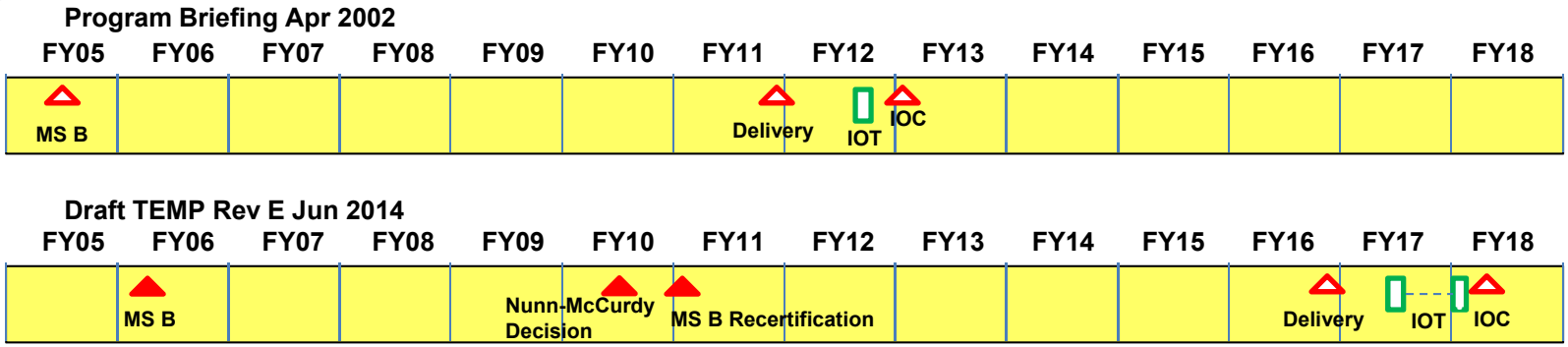
- **Full rate production (FRP) delayed more than 6 years for multiple reasons**
- **June 2009 IOT&E delayed by developmental test issues**
  - **Reliability issues**
    - **Excessive Operational Mission Failures (MTBOMF = 15.1 versus threshold value of 30.0)**
    - **Numerous False Alarms (Mean Time between False Alarm = 0.8 hours versus threshold value of ≥ 4.0 hours)**
  - **Implementing threshold capabilities required more software drops than anticipated**
    - **Four major software versions in 2005 plan increased to nine versions by 2011**
- **September 2011 IOT&E delayed by funding and early fielding**
  - **Early fielding of system to support ISR Task Force in Afghanistan from 2011 - 2014**
  - **Near continuous shipboard deployments to Horn of Africa since 2011**
  - **Deployed systems received spare parts priority**
- **Navy funding and program of record switching from MQ-8B to MQ-8C further delayed IOT&E to FY15**
- **2014 Nunn-McCurdy cost breach**
  - **Per unit cost increased because of reduced number of air vehicles and switch from MQ-8B to MQ-8C**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

DDG 1000 Zumwalt Class Destroyer

Multi-Mission Land Attack Destroyer



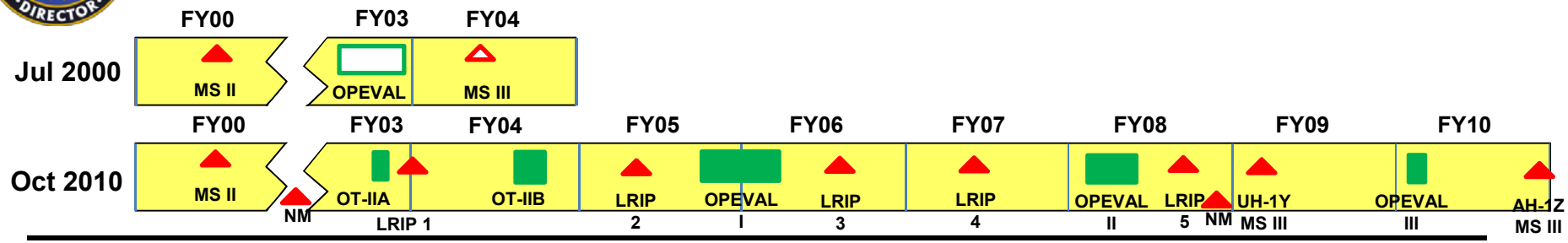
- **Initial Operational Capability (IOC) delayed 5 years due to production and programmatic delays**
- **Revisions to the program's schedule also delayed IOT&E by 5 years**
- **Original MS B decision rescinded by AT&L in June 2010 following Nunn-McCurdy breach caused by increased unit cost when the total number of ships was reduced from seven to three**
  - **Restructured program achieved new MS B in October 2010**
- **The restructured program eliminated the Volume Search Radar from the ship to reduce cost**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

H-1 Upgrades

Upgrades USMC Cobra and Huey helicopters with digital cockpits, common power train, and common tail section



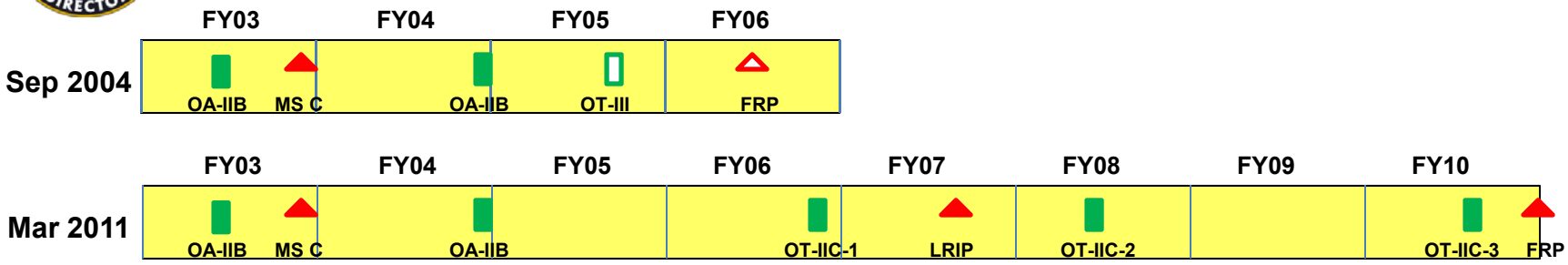
- **MS III delayed more than 5 years for multiple reasons**
- **Technical difficulties in DT and early OT postponed start of OPEVAL I**
  - Pressure and heat spikes in hydraulic system
  - Delamination of composite main rotor yoke and cuff; designed for 10,000-hour life, achieves 1,500 hours
  - Redesign of engine exhaust required to prevent overheating tail section
  - Integration and reliability deficiencies with AH-1Z targeting sensor
- **OPEVAL I – Effectiveness and suitability shortfalls with both aircraft**
  - Assault support mission success was 36% (17 of 48)
    - » Poor performance of targeting sensor
    - » Rocket and Hellfire missile delivery was not effective
    - » Helmet performance and restrictions limited operations in expected low-light operational conditions
  - Suitability issues include reliability, human factors, and interoperability
    - » AH-1Z MFHBA requirement > 24.0 hours; demonstrated 17.3 hours (problems with targeting sensor)
    - » UH-1Y MFHBA requirement > 33.1 hours; demonstrated 26.1 hours
- **OPEVAL II – UH-1Y effective and suitable; AH-1Z withdrawn from test**
  - AH-1Z targeting sensor performance and reliability so poor that missions could not be conducted
- **OPEVAL III – AH-1Z effective and suitable**
  - Aircraft equipped with new production targeting sensors

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

USMC AH-1Z Attack Helicopter

Upgrades and extends life of existing fleet of USMC Cobra helicopters with digital cockpits and four-bladed rotors



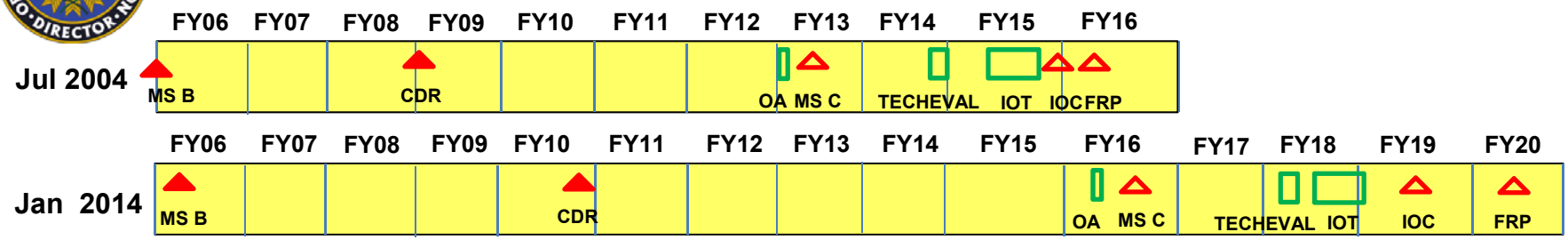
- **Full Rate Production (FRP) delayed more than 4 years for multiple reasons**
- **IOT Phase 1 (OT-IIC-1) delayed by technical difficulties with hydraulic system, composite rotors, integrated helmet, and integration of targeting sensor**
  - **OT with "production representative" EMD aircraft and targeting sensor; not LRIP items**
  - **AH-1Z effectiveness limited by poor Targeting System reliability, excessive pilot workload, poor performance of integrated helmet, and rocket delivery restrictions**
  - **Navy continued in LRIP, scheduled IOT Phase 2**
- **In OT-IIC-2, AH-1Z reliability (primarily Targeting System failures) was so poor that the Navy terminated AH-1Z testing**
  - **OT again with "production representative" EMD aircraft and targeting sensor; not LRIP items**
  - **Navy shifted most LRIP quantities to UH-1Y variant and scheduled IOT Phase 3**
- **In OT-IIC-3, AH-1Z was effective and suitable**
  - **OT with LRIP aircraft and targeting sensor**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

CH-53K Heavy Lift Replacement Program

Replaces the CH-53E to increase lift, range and reliability



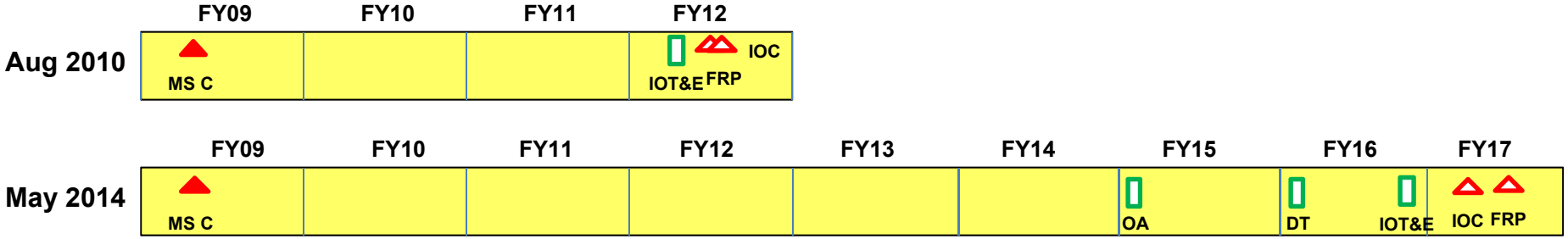
- **Full Rate Production (FRP) delayed by 4 years due to programmatic and manufacturing issues**
  - **Miscommunication between contractor and program about requirements specification and system engineering tasks delayed test schedule**
  - **Funding reductions led to revised or delayed requirements (e.g., Tactical Data Link and Identification Friend or Foe Mode V) and Initial Operational Capability (IOC) postponement to FY19**
  - **Slow contractor staffing and late subcontract awards led to schedule delays**
  - **Part shortages and late part deliveries by sub-contractors delayed test aircraft deliveries**
  - **Technical issues during engineering, manufacturing, and development delayed test schedule; engineering and quality control problems led to modification of some components or delayed testing**
    - **Delivery of ground test vehicle delayed due to problems with quality of main gear box castings**
    - **Problems with test stand led to delay in main gear box testing**
    - **Tail rotor flex beam modified to reduce delamination**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Coastal Battlefield Reconnaissance and Analysis (COBRA) Block I

VTUAV System for Detection of Mines and Obstacles in the Beach and Surf Zones

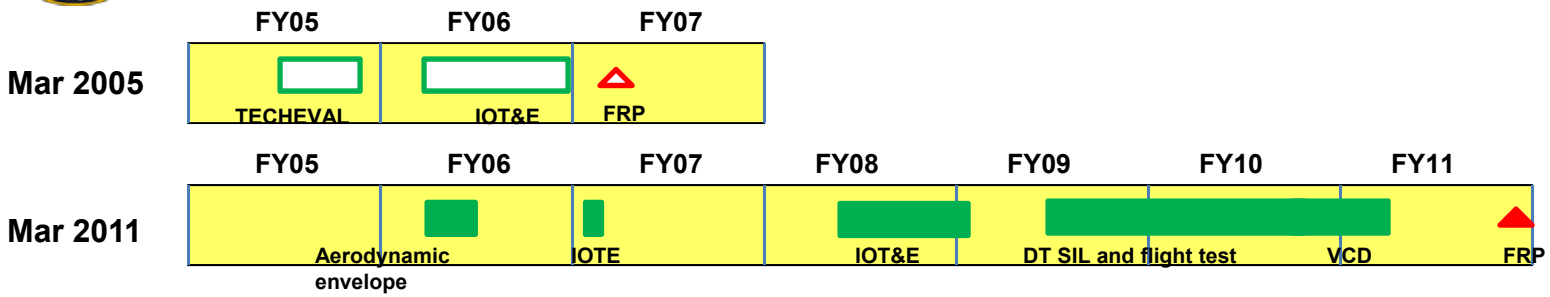


VTUAV – Vertical Take-off Unmanned Aerial Vehicle

- **Initial Operational Capability (IOC) and IOT&E delayed more than 4 years because of requirement for system redesign, change in acquisition strategy, and insertion of risk-reduction Operational Assessment (OA)**
- **Procurement focus shifted to Block I because Block II was not maturing as rapidly as anticipated**
- **Cybersecurity issues identified in FY12 forced significant redesign**
  - **Unable to obtain Platform-IT Risk Assessment (PRA) approval because of obsolete operating systems and insufficient hard drive space for upgrades**
- **Navy directed addition of FY14 OA as risk reduction measure in FY13**
  - **OA has slipped to early FY15 because of test range scheduling and unavailability of VTUAV**

Integrated Defensive Electronic Countermeasures (IDECM) Block 3

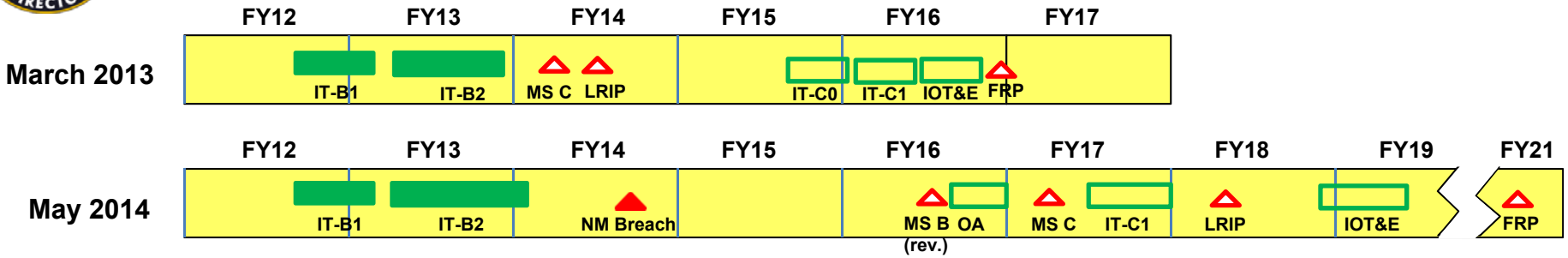
RF countermeasures suite for Navy F/A-18E/F aircraft



- **Full Rate Production (FRP) delayed 4 years due to performance problems found in testing**
- **Original IDECM program was scheduled for IOC in 2001**
  - **Program separated into blocks in 2001 to provide incremental capability**
- **Block 3 IOT&E delayed, started, stopped, restarted, then additional testing conducted to confirm correction of major deficiencies:**
  - **2QFY06: Towed decoy aerodynamic envelope had to be reexamined because the original test assets were not operationally representative**
  - **Aug 2006 IOT&E: Flight testing stopped after four flights for safety (decoys hit aircraft)**
  - **Feb to Sept 2008 IOT&E: Effective and not suitable (safety and reliability)**
  - **1st – 2ndQtr FY11 VCD: Effective and suitable, safety issues and reliability improved**

Joint Precision Approach and Landing System (JPALS)

All Weather Landing System using Differential GPS



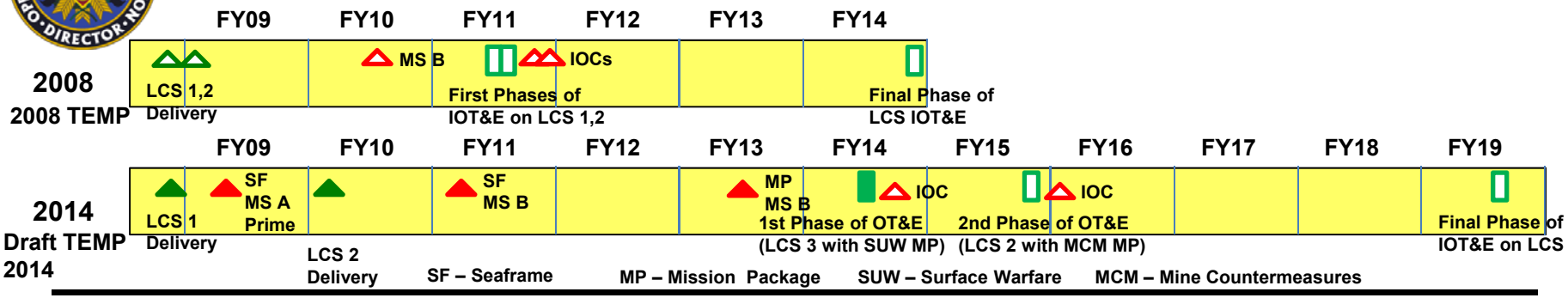
- **Full Rate Production (FRP) delayed 4.5 years due to Nunn-McCurdy breach resulting from programmatic changes**
- **Root cause was delay and ultimate suspension of the Federal Aviation Administration's (FAA) plan to transition from Instrument Landing System (ILS) to GPS-based landing systems**
  - **Interoperability with civilian airfield requires ILS, and ILS is not supportable with JPALS**
  - **Army and Air Force canceled their participation in JPALS**
  - **Navy determined that retrofitting existing aircraft with JPALS in addition to ILS was not cost effective**
- **Restructured JPALS program incurred cost growth**
  - **Reduction in planned quantities**
  - **Development program extended to include sea-based auto-land capabilities for UCLASS and F-35**
  - **These items are directed by the Precision Approach and Landing Capability (PALC) roadmap, but were not part of the original program**
  - **Restructured program is still being finalized**
- **Difficulties in coordinating availability of an aircraft carrier equipped for JPALS integrated testing resulted in programmatic delays**
  - **USS George H.W. Bush experienced delays in the shipyard unrelated to JPALS**
- **No JPALS capable aircraft will be fielded until FY18**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Littoral Combat Ship (LCS)

High speed, shallow draft ships designed for operations in the littorals



- **Initial Operational Capability (IOC) delayed for more than 4 years for multiple reasons**
- **Start of *Freedom* (LCS 1) class OT&E and IOC delayed more than 3 years**
  - **Navy decision to deploy LCS 1 in 2010 and ship's participation in RIMPAC exercise later that year delayed completion of post-delivery tests, trials, and DT and hence start of OT**
  - **OT further delayed by 2013 LCS 1 deployment and shift of *Freedom* class seaframe/Surface Warfare Mission Package OT to LCS 3**
- **Start of *Independence* (LCS 2) class OT&E and IOC delayed more than 4 years**
  - **LCS 2 delivery slipped nearly 1 year because of construction delays and problems encountered during Builder's Trials (flooding and propulsion issues)**
  - **Slow progress of LCS 2 post-delivery tests and trials and ship**
  - **Mine Countermeasures system performance problems during DT**
- **Completion of final phase of IOT&E will be delayed nearly 5 years**
  - **Delays in development of some Mine Countermeasures mission modules and Surface Warfare mission module forcing multiple phases of OT as modules are fielded**
  - **Cancellation of Army's Non-Line of Sight (NLOS) missile system and delays in selection of replacement have postponed availability of surface-to-surface missile module needed for final phase of Surface Warfare mission package OT**
  - **Navy concluded that original Anti-Submarine Warfare (ASW) mission package would not meet requirements; subsequent reconfiguration has delayed first ASW OT to FY16 or later**

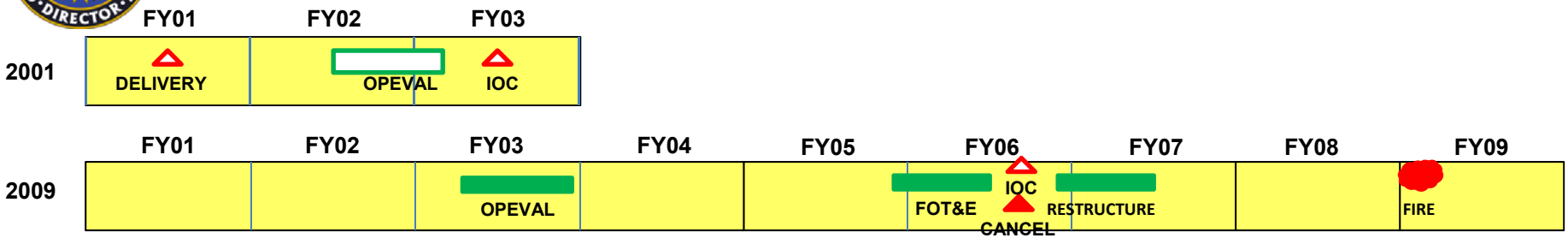
Scheduled Program Event | **Completed Program Event**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Advanced Seal Delivery System (ASDS)

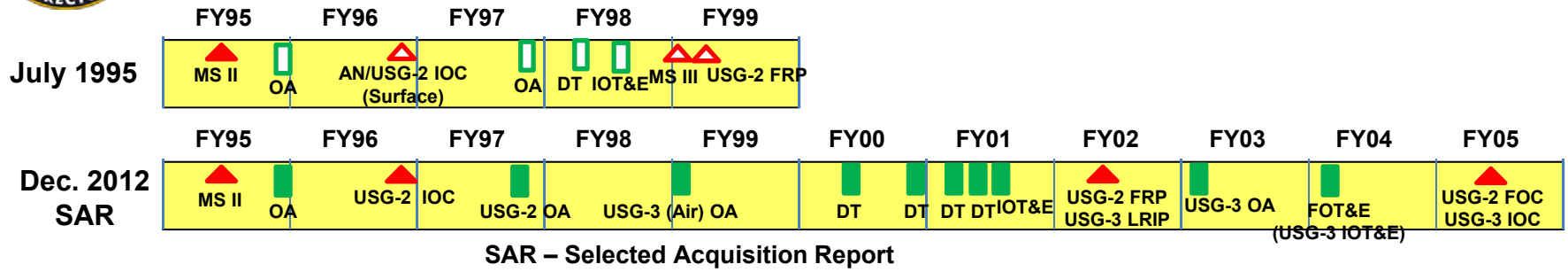
Manned Combatant Submersible for Clandestine Operations



- Initial Operational Capability (IOC) delayed nearly 3 years, then the program was cancelled
- Most performance and endurance thresholds were not attempted in the 2003 OPEVAL due to unit failure
  - Acoustic emissions were out of specification
  - Required sonar improvements identified
  - Battery and low electrical ground performance caused poor availability and long turnaround times
  - Structural failures when transported on host submarine during testing
- Propulsion system redesigned after OPEVAL, but assembly failed during FOT&E in September 2005
- FY06, SOCOM decides to restructure the ASDS Program
- FY08, ASDS1, the only vehicle produced, is destroyed by fire and the Navy decides not to repair the vehicle

Cooperative Engagement Capability (CEC) AN/USG-2

System of Hardware and Software for Sharing Radar Data on Air Targets among Ships and E-2 Aircraft

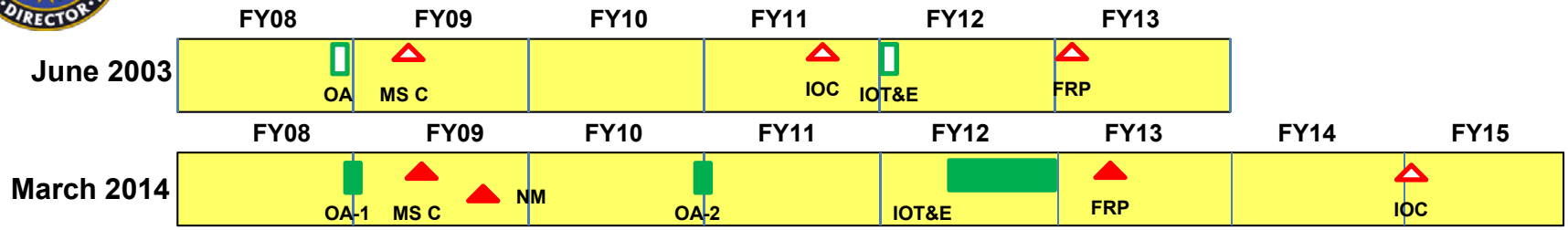


SAR – Selected Acquisition Report

- **Full Rate Production (FRP) of AN/USG-2 (CEC surface ship hardware) delayed 3 years because of significant battle group interoperability problems found in early DT and OT**
  - System of systems interoperability problems experienced in 1997 and 1998 involved CEC, Aegis Weapon System (AWS), and the tactical data link Command and Control Processor (C2P)
  - Multiple software problems degraded track management, network operations, cooperative engagement, engagement support, composite identification, and data link interoperability
  - Problems severe enough that two CEC-equipped Aegis cruisers were withdrawn from deployment schedule
  - AN/USG-3 (E-2 aircraft CEC hardware) also delayed
  - Navy established a senior systems engineering council to address interoperability issues
- **Programmatic problems involving software maturity on the host ship, outside of the CEC program, led to a delay**
  - CEC software configuration frozen and CEC development slowed so that associated host ship combat system software (primarily AWS Baseline 6.1) could mature
  - Identification of root causes and correction of observed deficiencies required extensive data analysis and cooperation across multiple program offices
- **Replanned program called for multiple periods of at-sea developmental testing in 2000 followed by Technical Evaluation (TECHEVAL) and Operational Evaluation (OPEVAL) in 2001**
  - Test scheduling challenged by need to synchronize testing with fleet deployment schedules

E-2D Advanced Hawkeye

Carrier-based Airborne Early Warning and Command and Control System



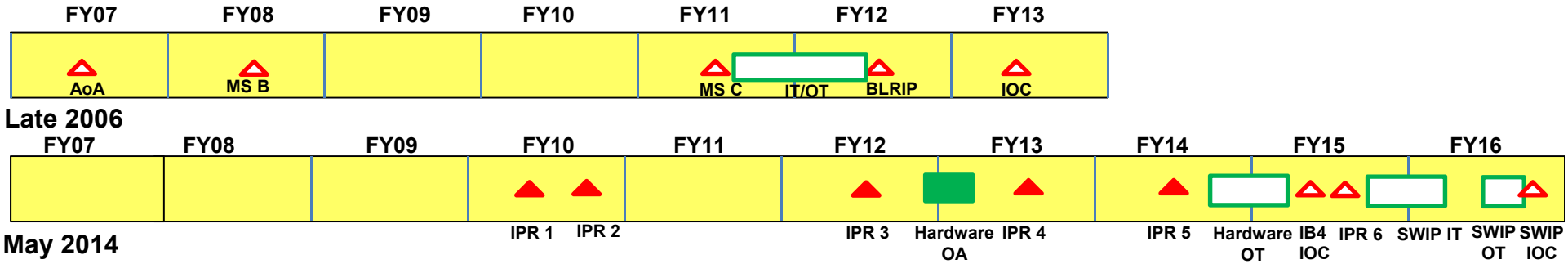
- Initial Operational Capability (IOC) delayed more than 3 years because of programmatic issues and problems found in testing
- Full Rate Production (FRP) slipped only a few months, even with a Navy-added OA, a Nunn-McCurdy breach, and a Congressionally mandated loss of one Low Rate Initial Production (LRIP) aircraft
- OA-1 and MS C slipped one month due to DT test delays
  - Due to overheating, radar was tested at half max power, delaying the execution of some test points
- Prior to starting OA-1, the Navy added OA-2 to support the buy of LRIP Lots 3 and 4
- First IOC slip to 3QFY13, because of IOC definition change (no change in test schedule)
  - Previous E-2 IOT&Es were performed by fleet squadrons preparing for deployment; as a result, IOC had to be declared prior to giving the aircraft to the fleet squadron for IOT&E
  - In FY08 when the E-2 received a permanent test squadron, IOT&E could occur before IOC
- Second IOC slip to 1QFY15 because Congress cut Advanced Hawkeye (AHE) budget
  - Congress removed an aircraft from AHE's LRIP (resulted in Nunn-McCurdy breach)
  - Delayed until there would be enough aircraft to train and deploy the first E-2D AHE squadron
- IOT&E slipped 2 months
  - Delivery and integration of the Cooperative Engagement Capability (CEC) equipment (see separate slide on E-2D CEC equipment) was delayed because it was supplied late by a different program office and the E-2D schedule had to accommodate the delay

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Integrated Defensive Electronic Countermeasures Block 4 (IB4) and Software Improvement Program (SWIP)

Improved RF countermeasures suite for Navy F/A-18C/D/E/F aircraft



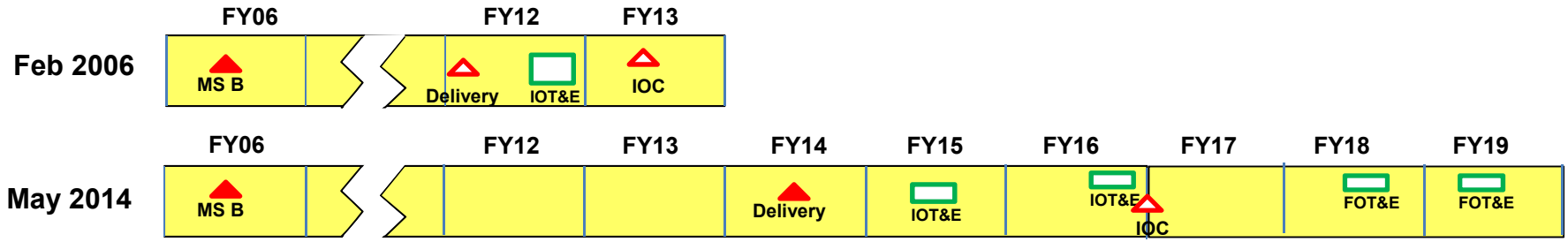
- Initial Operational Capability (IOC) delayed about 3 years total by funding and reliability issues and software immaturity
  - Projected FY13 IOC included hardware and software; now, full capability available after FY16 SWIP IOC
- The IDECM Block 3 upgrade was originally known as Digital RF Jammer, providing new hardware and significant new software capabilities; eventually split into separate hardware (IB4) and software (SWIP) programs for funding reasons
- IB4 was implemented as an ECP with in process reviews (IPR) instead of milestone decisions
- IB4 hardware is essentially brand-new with software that retained ~ 70% of the original code
  - FOT&E beginning in June 2014 will test mature system in open-air range against threat radars
- System maturity issues including built-in test false alarms and resets have delayed IB4 a total of 7 months from the 2011 TEMP goal of IOC in FY 2014
  - Three hardware-in-the-loop (HITL) tests from the OA were postponed due to system maturity issues and the remaining tests revealed major suitability problems
- Program delays resulted when built-in test, system stability, and radar warning receiver integration issues discovered during the OA were corrected in software
- SWIP schedule slips were caused by IB4 delays and a rebaseline of the jammer software because of deficiencies in the IB4 code it is based on

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

USS America Class (LHA 6)

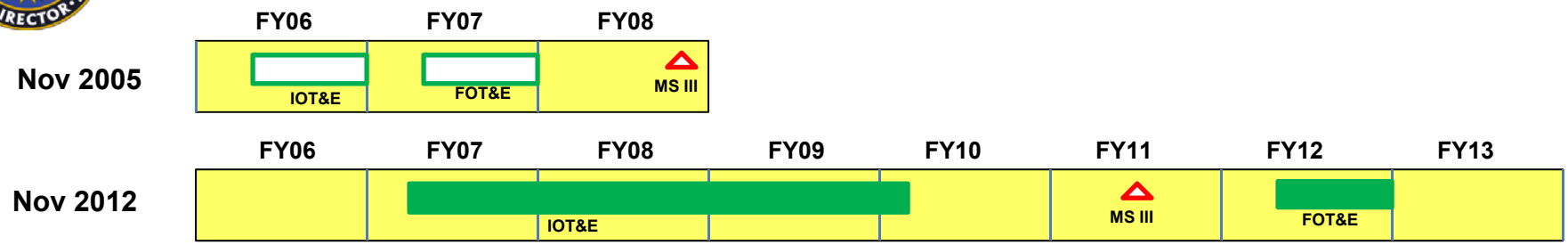
Large Deck Amphibious Assault Ship for deploying and transporting Marines and Equipment



- **Initial Operational Capability (IOC) delayed by more than 3 years because of production problems**
- **LHA 6's delivery delayed nearly 2 years because of production problems at the shipyard**
  - **Start of construction was delayed by 6 months in FY07 because of shipyard damage caused by Hurricane Katrina**
- **Time between delivery and IOC increased because of extensive post-delivery and post-shakedown availabilities to correct construction deficiencies and modify ship to operate F-35B, a prolonged transit (nearly 16 weeks) from Pascagoula to San Diego, and the need for 28 weeks of crew training prior to amphibious warfare IOT&E in FY16**
- **Unavailability of certain IOT&E resources – GQM-173 multi-stage supersonic target and sufficient numbers of F-35Bs – pushed some critical OT events into FOT&E periods currently scheduled for FY18 and FY19 but will not delay IOT&E**

USS San Antonio (LPD 17)

An Amphibious Transport Dock used for transporting and deploying Marines and their equipment



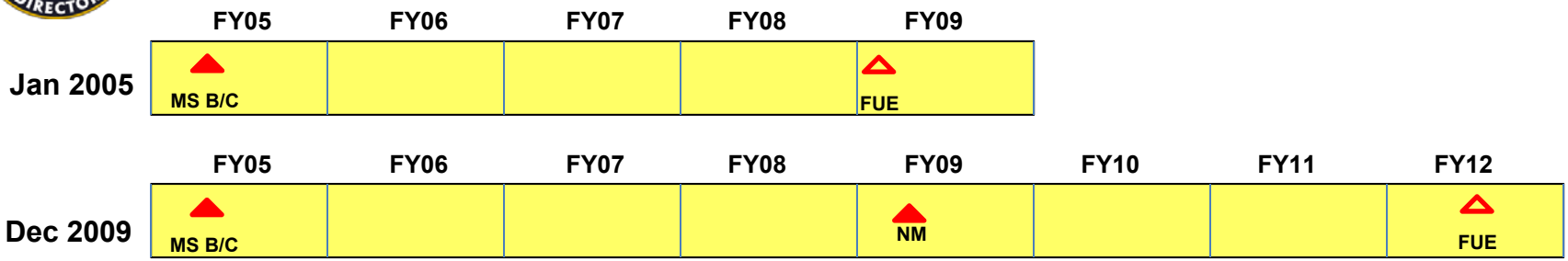
- **MS III delayed nearly 3 years for multiple reasons and eventually cancelled (all ships in class procured)**
- **Program delayed by more than 3 years because of materiel condition of early ships, delivery schedules (e.g., extended post-delivery and post shakedown availabilities), and the unavailability of test resources (e.g., aerial targets and Marines)**
- **Navy accepted delivery of LPD 17 in July 2005 in unfinished condition (delivery threshold in original APB was Dec 2002)**
  - **March 2007 Navy Inspection described 193 of the ship's 943 spaces as unfinished and noted numerous materiel deficiencies, including problems with the ship's network, steering system, vehicle ramps, cargo weapons elevators and freshwater production system**
- **Scheduling and materiel condition forced IOT&E to be completed on multiple ships (LPD 17, LPD 18, and LPD 19)**
- **Cost growth during system design resulted in a Nunn-McCurdy breach in 2002**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

VH-71 Presidential Helicopter

USMC Marine One Replacement



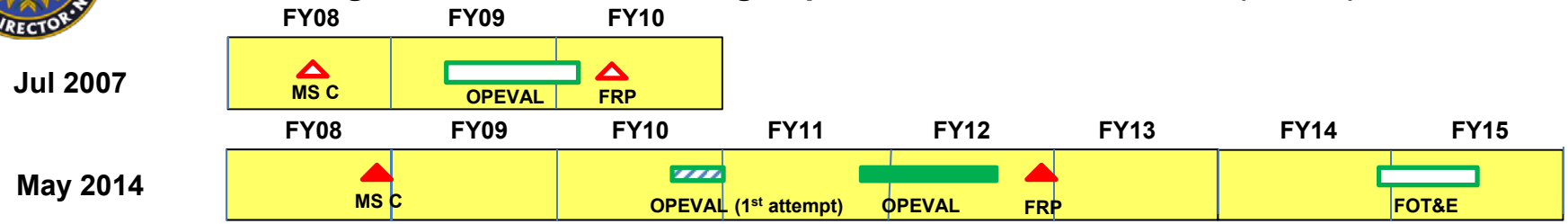
- Program delayed 3 years, then cancelled for programmatic issues and integration problems
- Compressed schedule dictated by the White House
- Source selection process was shorter than desired and contributed to confusion about specifications
- Confusion among program manager, contractor, design, testing, and production
- Program was at risk from the start
  - Unexecutable schedule
  - Inaccurate cost estimates
  - Integration of communications equipment was much more challenging than expected
- Nunn-McCurdy breach in Jan 2009
- White House cancelled the program in 2010

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Advanced Anti-Radiation Guided Missile (AARGM)

A dual-mode guidance section on a high-speed anti-radiation missile (HARM) airframe



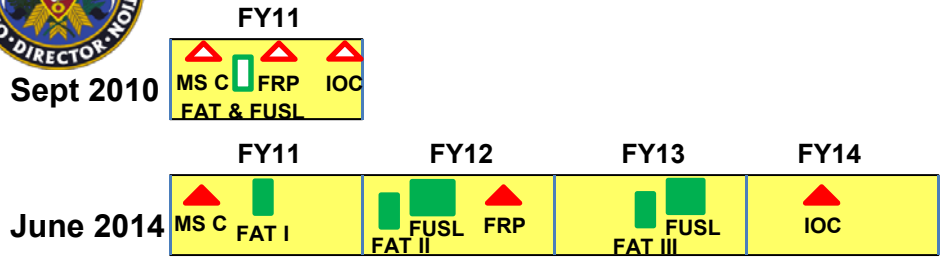
- **Full rate production (FRP) delayed more than 2 years due to several factors:**
  - **Problems discovered during system development phase led to changes in missile subsystem designs**
    - **Radome material failures, electronic obsolescence, tail fin design and function**
  - **Sub-tier supplier quality control problems led to delays of 6 months to 1 year**
  - **Delays in validating targets led to a slowdown in engineering tests and DT**
  - **The first OPEVAL was halted because of severe reliability issues and the discovery of additional deficiencies**
  - **Some deficiencies discovered during operational testing remain to be corrected; additionally, a deferred Key Performance Parameter (KPP) has yet to be tested**
- **First OPEVAL attempt terminated early because of eight anomalies and seven Operational Mission Failures (OMF) in a 3-month period (late FY10)**
- **During the second OPEVAL attempt, the system was found to have one Severe and four Major deficiencies**
  - **A verification of correction of deficiencies program was added to the second OPEVAL, the results of which indicated that most deficiencies were corrected, and the program was allowed to proceed to Full-Rate Production**
- **An FOT&E is scheduled to test corrections for all remaining deficiencies and to test against the deferred KPP; prior to this event, significant contractor-run DT and a government-run IT period will be conducted to ensure all known deficiencies are corrected and there are no additional problems**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Enhanced Combat Helmet (ECH)

Combat helmet that protects troops against some fragmenting and direct-fire threats



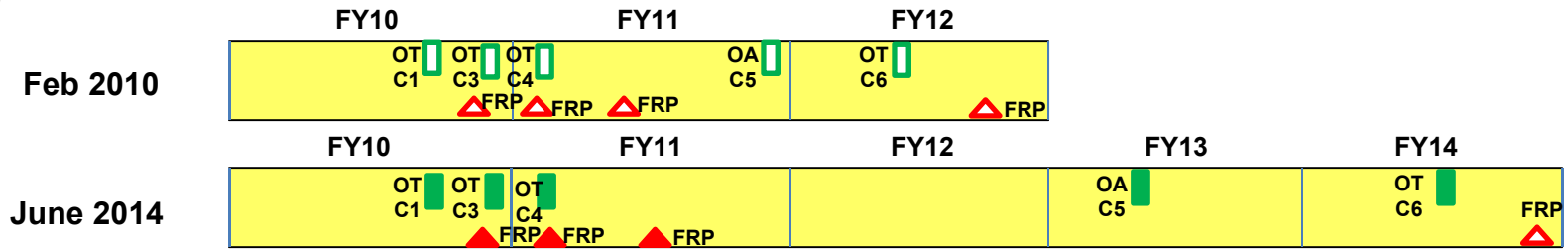
- **Initial Operational Capability (IOC) delayed more than 2 years for multiple reasons**
  - **FRP slipped 15 months because of an overly optimistic schedule and failures during the First Article Test (FAT)**
  - **IOC slipped an additional 15 months as a result of manufacturing problems**
- **The ECH schedule as of September 2010 was overly optimistic**
  - **The schedule allowed 5 months between issuing FAT option awards and the FRP**
- **In February 2011, the ECH failed both ballistic and non-ballistic components of FAT**
  - **The ECH exceeded the allowed shell deformation when impacted with a ballistic threat**
  - **The vendor introduced manufacturing changes to address the causes of the non-ballistic FAT failures**
- **The Marine Corps, in coordination with DOT&E and the Army, established new test procedures for assessing ECH ballistic performance**
  - **The ballistic failures during FAT I were attributed to test procedures that were unsuitable for helmets made from ultra-high molecular weight polyethylene helmets; previously-fielded helmets had aramid-based ballistic shells**
- **The ECH passed FAT in November 2011 and had its FRP in June 2012**
- **Manufacturing problems delayed IOC until April 2014**
  - **After FRP, during testing of engineering change proposals intended to increase manufacturing capacity, the ECH failed small arms testing**
  - **In February 2013, the manufacturer changed the ballistic shell laminate to improve small arms protection; this change required the helmet to undergo a third FAT and a follow-on Full Up System Level (FUSL) live fire event**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Global Command and Control System Maritime (GCCS-M)

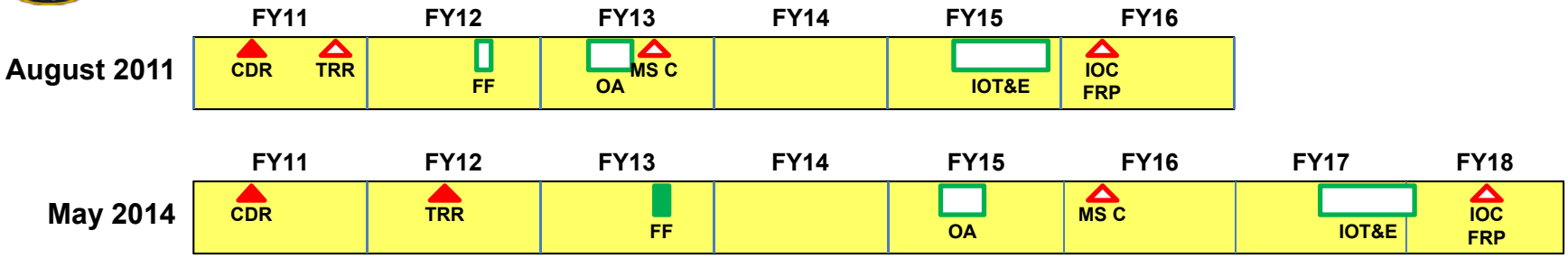
Maritime Command and Control and Situational Awareness



- **Full Rate Production (FRP) for GCCS-M 4.1 for Group-level ships expected to be delayed 2 years due to programmatic delays**
  - There are three different versions of GCCS-M 4.1
    - Group-level ships: aircraft carriers, amphibious assault ships, and command ships
    - Force-level ships: guided missile cruisers, destroyers, and submarines
    - Patrol Coastal ships
  - Testing and FRP decision for OT-C1 (GCCS-M 4.1 for Patrol Coastal ships) on time
  - Testing and FRP decision for OT-C3 (GCCS-M 4.1 for Force-level ships using 4-server configuration) on time
  - Testing for OT-C4 (GCCS-M 4.1 for Amphibious ships) on time
    - Minimal delay for data analysis and FRP decision
  - Testing for OT-C6 (GCCS-M 4.1 on Group-level ships) delayed total of 2 years
    - Release built on Consolidated Afloat Networks and Enterprise Services (CANES) which is a separate program of record
    - CANES delays were the primary cause for GCCS-M 4.1 Group Level delays
    - Operational Assessment C5 for GCCS-M 4.1 for Group-level ships delayed 15 months
    - Operational testing (OT-C6) concluded in June 2014, test report being drafted

MQ-4C Triton Unmanned Aircraft System

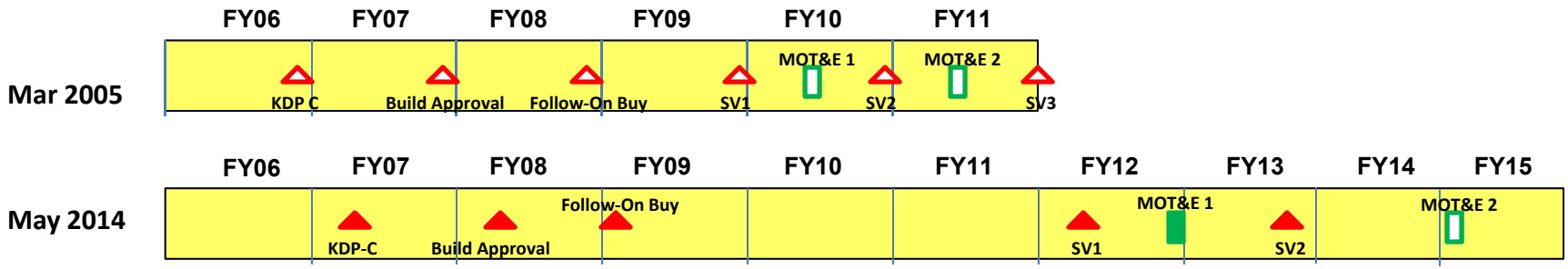
Persistent, broad area, maritime patrol and reconnaissance aircraft



- **Initial Operational Capability (IOC) delayed more than 2 years due to programmatic and system integration problems**
- **Developmental delays and elimination of production funds in the 2014 President's Budget caused an acquisition program baseline (APB) breach**
  - **New plan approved by USD(AT&L) on 20 December 2013**
- **System integration and software development difficulties caused developmental delays**
  - **Extended development times and stability problems on the Integrated Mission Management Computer – the avionics computer – were the primary driver of delays to the test readiness review (TRR) for entry into system integrated test and first flight (FF) and continues to contribute to delays**

Mobile User Objective System (MUOS)

Provides Ultra-High Frequency Satellite Communications to users around the world



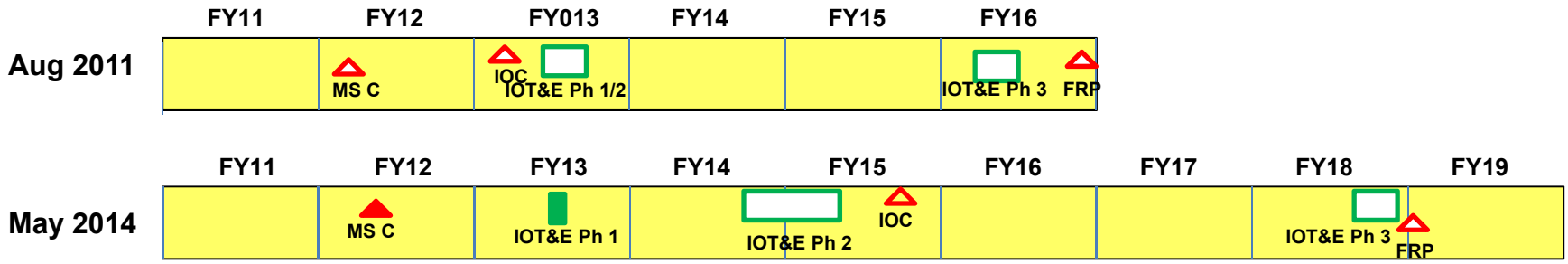
- **First satellite launch delayed more than 2 years due to manufacturing problems**
  - **Passive Intermodulation between systems on the satellite created unacceptable levels of radio frequency noise in the communications payload**
  - **Quality control issues**
  - **Parts rework and requalification**
- **Network Management System (NMS) for new communications payload delayed**
  - **Only the Satellite Control System is operational; the NMS is still in development**
  - **Difficulty in adapting commercial cell-phone system for use as part of a space system was underestimated**
  - **Development of the communications waveform and the need for cooperation with another program office (JTRS) for integration onto the JTRS radios was underestimated**
- **Problems found during DT integration of the MUOS waveform with terminals and ground segment resulting in some delays**
- **FY15 MOT&E 2 is dependent on the availability of Handheld, Manpack, and Small Form Factor radios, formerly Joint Tactical Radio System (JTRS)**
  - **Without radios, the Wideband Code Division Multiple Access (WCDMA) waveform cannot be tested**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Rolling Airframe Missile (RAM) Block II

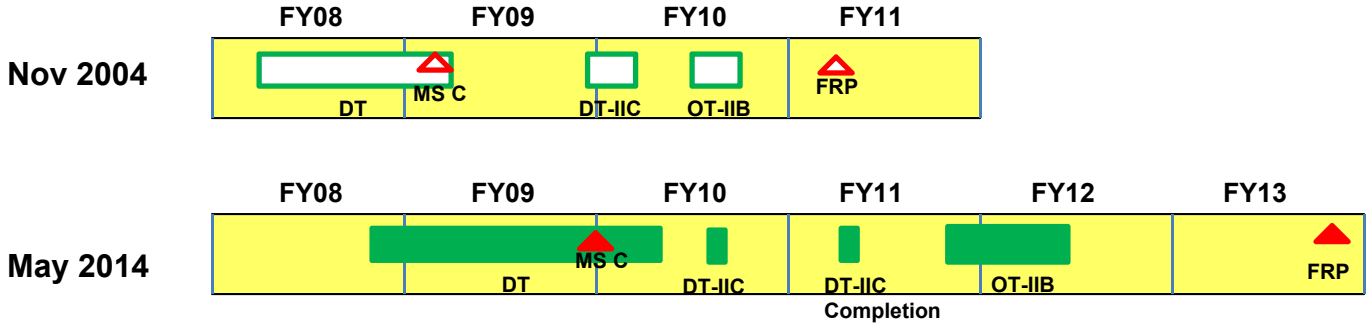
Short-range air-defense missile intended for self defense against anti ship missiles



- **Full Rate Production (FRP) delayed more than 2 years from FY16 to the end of FY18 (and potentially further) because a critical IOT&E resource – the GQM-173 multi-stage supersonic target – is not yet available and because of problems with related systems and systems integration found in DT and OT**
- **Corrections to problems found during developmental testing and operational testing on other programs has delayed completion of IOT&E Phase 2 by 1.5 years**
  - **Cooperative Engagement Capability integration with the SPQ-9B and SPS-48E radars**
  - **SPQ-9B radar tracking problems**
  - **Integration problems between ship self defense system (SSDS) Mk 2, RAM Blk 2, and the SLQ-32 electronic warfare system**

Standard Missile - 6 (SM-6)

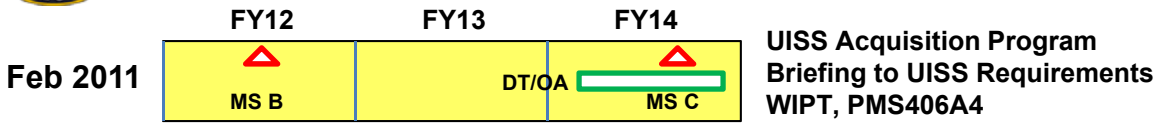
Aegis ship surface-to-air missile



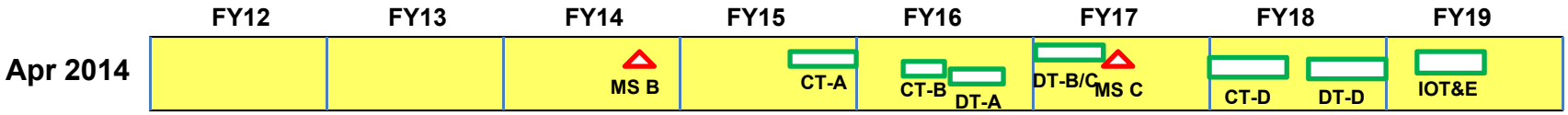
- **Full Rate Production (FRP) and IOT&E (OT-IIB) were delayed more than 2 years in part because of two significant hardware problems identified in DT**
- **In DT, a missile failed to launch because the missile computer fired both tactical seeker batteries early, causing electrical damage**
  - Missile circuitry was redesigned to protect against electrical surges
- **Two failures of the Target Detection Device delayed completion of DT-IIC until January 2011**
  - Failures were caused by test telemetry equipment that is not included in the tactical missile
  - Software redesigned and ground tested to prevent recurrence

Unmanned Influence Sweep System (UISS)

Offboard, semi-autonomous neutralization of acoustic/magnetic influence mines in littorals



UISS Acquisition Program
Briefing to UISS Requirements
WIPT, PMS406A4



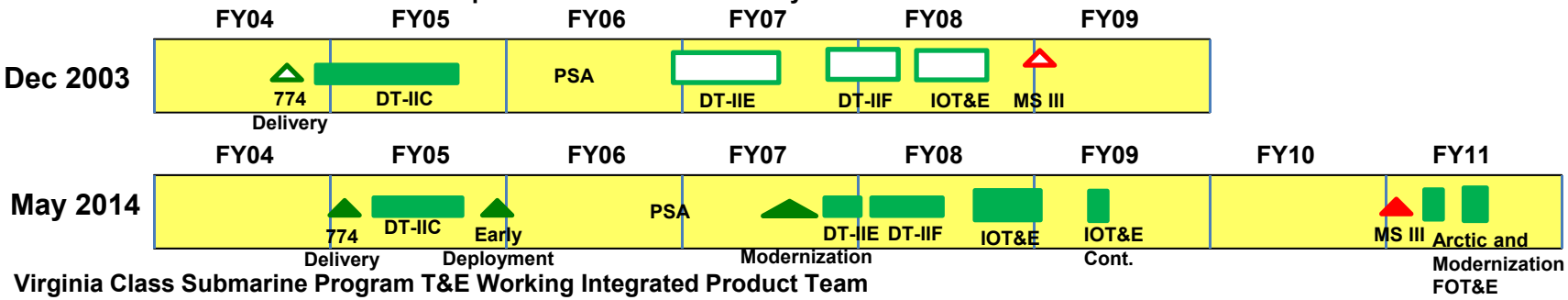
UISS T&E WIPT, PMS406

- **MS B and MS C delayed more than 2 years because of programmatic issues**
- **Program start slipped 1 year because of a high volume of contracting actions in FY12**
  - **Overall contracting actions required in FY12/13 exceeded available contracting capacity in Program Executive Officer Ships Organization**
  - **Resulting prioritization of contracting effort resulted in a 1-year delay in the UISS program**
- **FY13 budget sequestration caused an additional 1-year delay**

SSN 774 Virginia Class Submarine

Nuclear-powered fast attack submarine

TEMP Rev D Oct 2002 and Defense Acquisition Executive Summary review 2003



Virginia Class Submarine Program T&E Working Integrated Product Team

- MS III delayed 2 years for multiple reasons
- Addition of an early deployment soon after ship delivery, a modernization period, and a lengthy Post-Shipyard Availability (PSA) period contributed to an overall slip in schedule
- OPEVAL start was delayed by several months due to materiel and reliability issues discovered during TECHEVAL
- Completion of OPEVAL was delayed due to the materiel condition of the ship
  - USS *Virginia* experienced four fail-to-sails during IOT&E due to poor materiel reliability
  - Lead ship spent 2 months in dry dock to repair Main Seawater Valves
  - Lack of available target services (test resources) contributed to the delays
- DOT&E BLRIP report issued November 2009
  - Several missions/capabilities planned for IOT&E in 2008 were untested and required FOT&E to complete
  - Testing to confirm capability to conduct operations with Navy SEALs and Dry-Deck Shelter was postponed to FY13; redesign of equipment was required; original test assets were unavailable

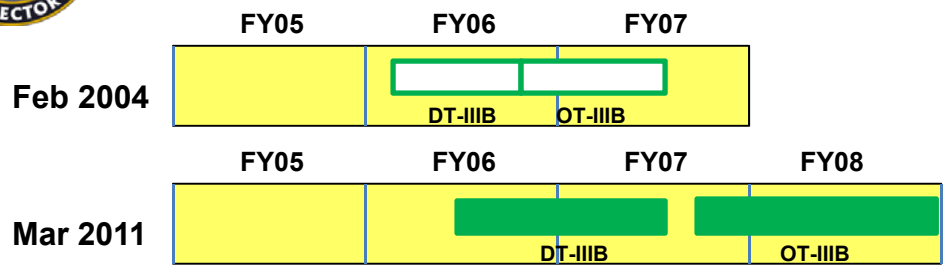
Scheduled Program Event | Completed Program Event

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

AIM-9X 8.212 Software Upgrade

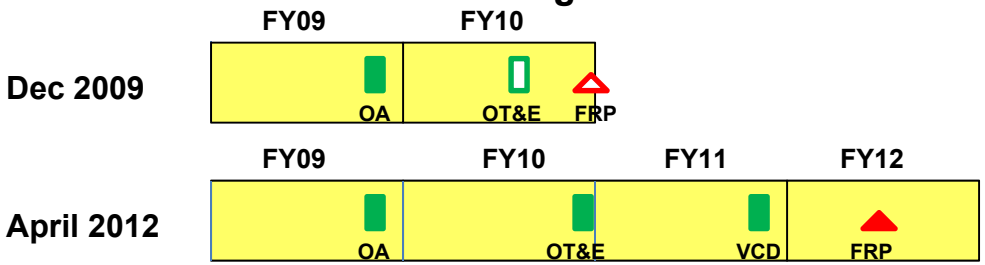
Sidewinder Missile: infrared guided air-to-air missile



- **Fielding was delayed about 18 months because of performance problems found during DT and OT**
  - **Software upgrade fielded in existing missiles once OT is complete**
- **In DT, two areas caused additional program effort**
  - **Surface Attack – an attempt to develop a residual capability against moving ground vehicles added testing; in the end, the program office did not certify the capability for OT**
  - **Lock-On After Launch capability was tested in both DT and OT**
    - **Lock-On After Launch was not certified for warfighter use because of fratricide concerns**
    - **Lock-On After Launch moved to Block II software 9.313, starting OT in June 2014**
- **In OT, the program had two software problems that led to an 11-month pause in OT**
  - **One software problem caused an unexpected reduction in acquisition range relative to earlier versions**
  - **A second software problem was a "near-divide-by-zero" that produced wild initial missile motion and created a safety of flight problem with the F-16**
  - **Both OT problems were fixed, and 8.212 was fielded after OT-IIIB**

Multifunctional Information Distribution System Joint Tactical Radio System (MIDS JTRS) Core Terminal

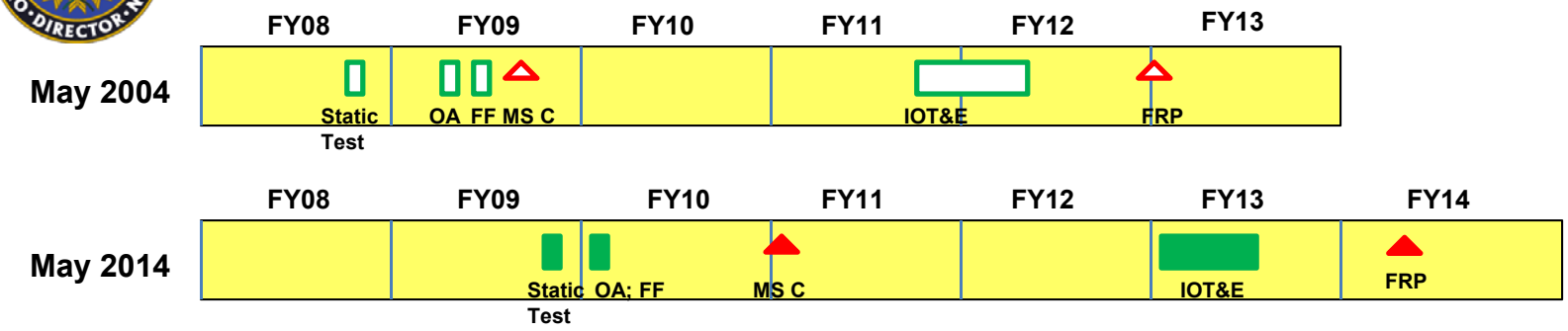
Next-generation multichannel voice-and-data radio



- **Full Rate Production (FRP) delayed 18 months due to performance problems discovered during OT**
- **In final DT events, system appeared to function properly and Assessment of Operational Test Readiness (AOTR) recommended proceeding to OT&E**
  - **OT&E found the system reliability to be 8.1 hours compared to the threshold requirement of ≥25 hours**
  - **The MIDS program did not execute a planned MIDS JTRS reliability growth program due to funding shortfall**
  - **Other performance problems included poor Tactical Air Navigation performance, delays in entering the Link 16 network, missed Link 16 messages including those supporting the Close Air Support mission area**
- **During OT, the MIDS JTRS as integrated into the F/A-18E/F exhibited failure modes not identified during DT**
  - **One of two terminal vendors changed hardware configuration between end of DT and start of OT&E; and Via Sat terminals contributed to 80% of the terminal operational mission failures**
  - **DT did not test all of the mission areas; as a result, OT test evaluated as unsatisfactory**
- **Post OT&E testing**
  - **The MIDS and F/A-18 Program Managers and manufacturing team addressed performance and suitability issues**
  - **DOT&E's Verification of Correction of Deficiencies Operational Test Report stated that the MIDS JTRS Core Terminal, as integrated into the F/A-18E/F aircraft, was now operationally effective and operationally suitable**

P-8A Poseidon

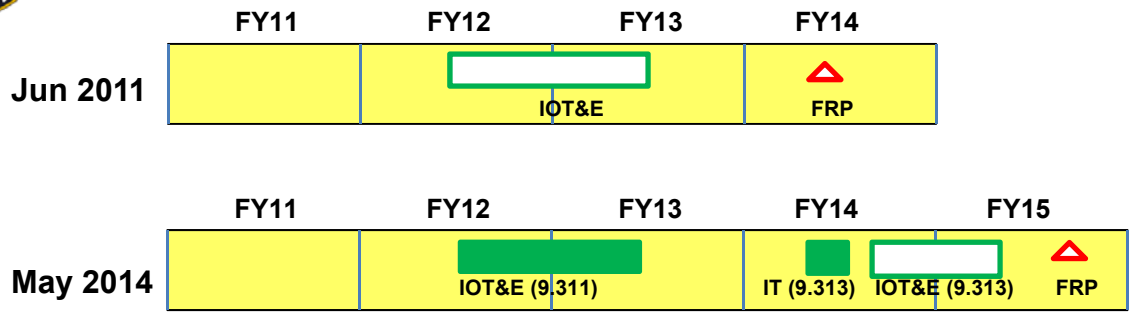
Multi-mission Maritime Aircraft, replacement for P-3



- **Full Rate Production (FRP) was delayed nearly 18 months because of manufacturing and test problems**
- **First flight (FF) and the start of developmental flight testing was delayed by 10 months due to delays in completing the aircraft design drawings and building the test aircraft**
- **During developmental flight testing, problems with instrumentation in the airworthiness flight test aircraft (T-1) caused additional delays and reduced the number of completed flights prior to original MS C**
  - **Flight tests on the mission systems (T-2) and weapons drop (T-3) test aircraft also were delayed**
- **Boeing, the prime contractor, underestimated the complexities and time required for the static load testing, which delayed the start of testing by 12 months and extended testing by 7 months**
  - **In static load testing, improper loading of some aircraft components caused premature failure and a need to repeat the test**

AIM-9X Block II Hardware/9.313 Software Upgrade

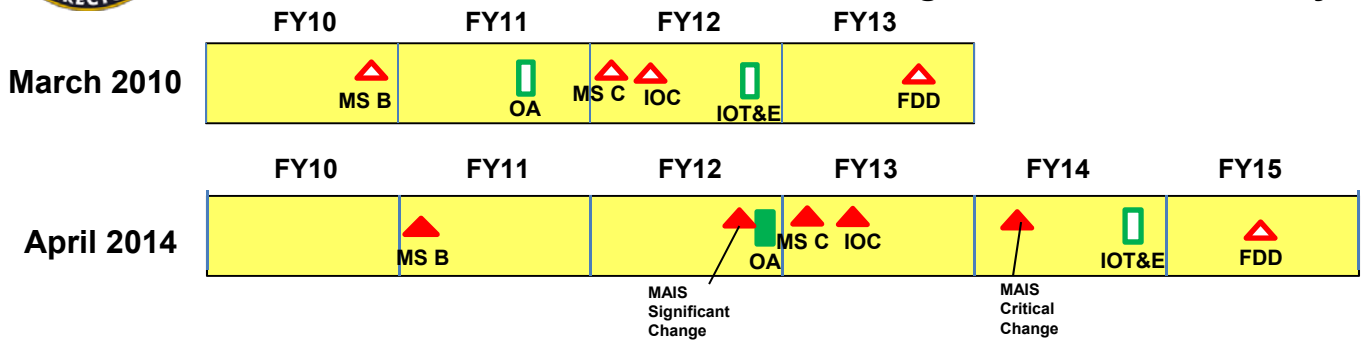
Sidewinder Missile: infrared guided air-to-air missile



- **Full rate production (FRP) and OT completion were delayed more than 1 year because of Inertial Measurement Unit (IMU) failures that occurred in IOT&E**
- **Seven of fourteen IOT&E shots with 9.311 software failed**
  - **Poor IMUs were contributors in four of seven failures**
  - **Two failures were hangfires caused by missile hardware**
  - **One failure was a launch outside the kinematic envelope of the missile**
- **OT was suspended to allow the program office to fix the IMU and hangfire problems**
  - **The contractor developed new production processes for the IMU and to address the hangfires**
  - **The contractor also developed a new guidance algorithm to improve Block II performance (9.313 software)**
- **Five IT shots with 9.313 were all successful**
  - **The program is preparing to enter IOT&E in June 2014**

Consolidated Afloat Networks and Enterprise Services (CANES)

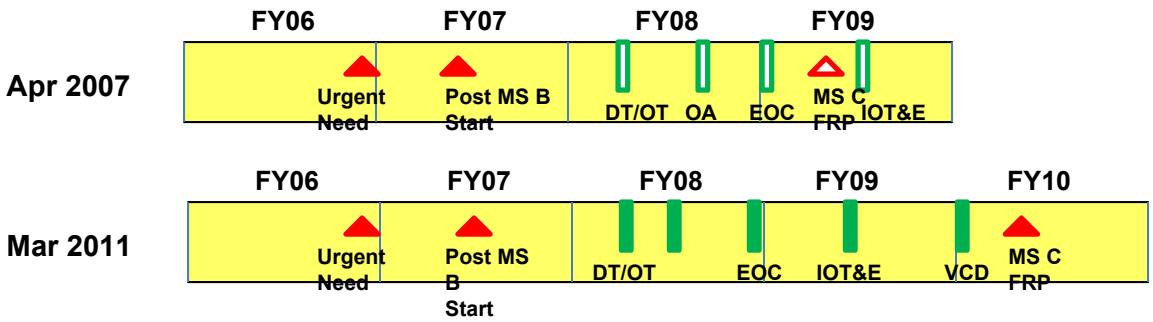
Network system to provide hosting and communication for naval warfare, intelligence, and business systems



- **Initial Operational Capability (IOC) delayed more than 1 year due to programmatic problems**
  - **Engineering, Manufacturing and Development phase was extended 8 months due to FY11 Continuing Resolution**
  - **Lockheed-Martin protested down-select decision, causing 1-month delay and causing MAIS significant change for delay in MS C**
- **IOT&E was delayed due to programmatic problems and obstacles in conducting the test**
  - **CANES IOT&E platform (USS *Milius*) ship availability was delayed 4 months**
  - **Problems moving to the laboratory test system delayed the integrated test by about 4 months, thereby delaying IOT&E**
  - **Scheduling of the IOT&E platform (USS *Milius*) caused a switch in test platform to USS *Higgins***

Department of the Navy Large Aircraft Infrared Countermeasure System (DoN LAIRCM)

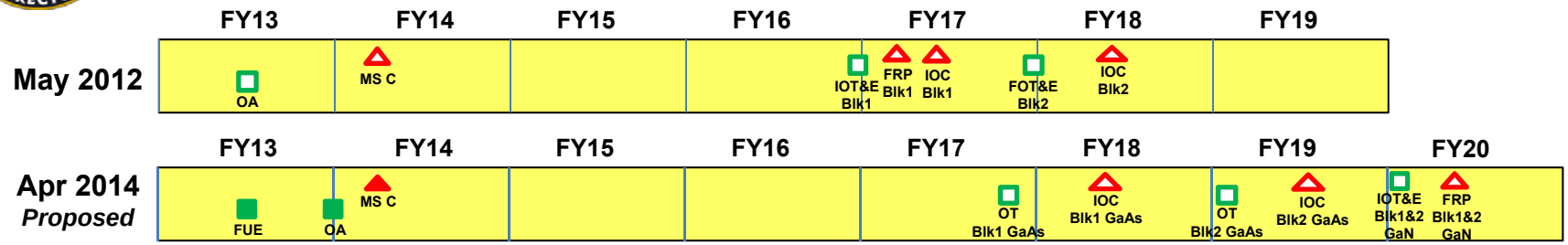
IR Countermeasures for USMC CH-53E and CH-46E



- **Full Rate Production (FRP) delayed by a year because of problems found in testing**
- **Initial schedule delay while determining Acquisition Strategy**
  - **Quick Reaction Capability versus Formal Acquisition Program**
  - **Resulted in a combination of both**
- **Delay in MS C was because of a major classified deficiency found in IOT&E**

Ground/Air Task Oriented Radar (G/ATOR)

Block 1 Air Defense and Surveillance Radar
Block 2 Ground Weapons Locating Radar



* Milestones/Test Events indicated are based on Acquisition Program Baseline (APB) Threshold vice Objective dates

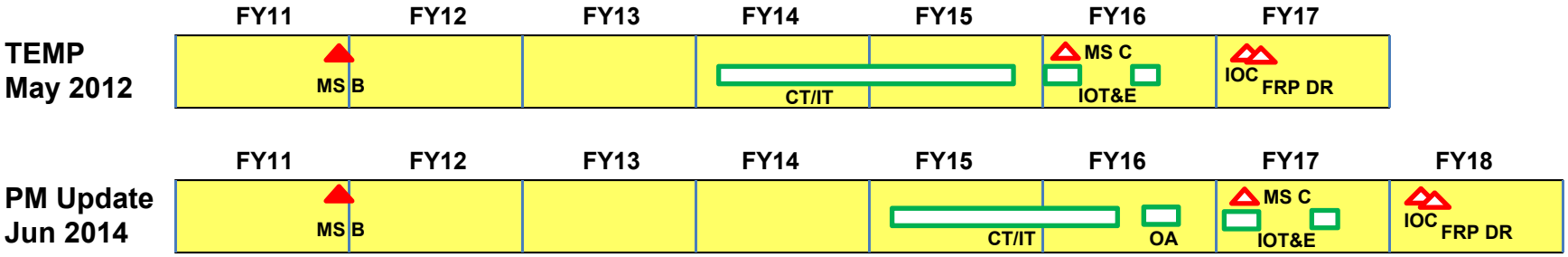
- **Initial Operational Capability (IOC) delayed for 1 year because of programmatic issues and problems discovered in DT**
- **Program determined that it was cost effective to change from Gallium Arsenide (GaAs) Transmit/Receive (T/R) modules to Gallium Nitride (GaN) during initial production**
- **IOT&E slipped 3 years primarily to support operational test of GaN-based systems**
  - **Program agreed to conduct OT on GaN-based system vice earlier GaAs-based systems, since the majority of the production will be GaN**
  - **Earliest delivery of LRIP GaN-based system is FY18**
- **FY13 OA changed to Field User Evaluation (FUE) due to system performance concerns and reliability issues identified during DT**
  - **System Mean Time Between Operational Mission Failure (MTBOMF) and Mean Time Between System Failure (MTBSF) were not meeting planned reliability growth milestones**
  - **The OA moved 6 months to 1st Qtr FY14**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Surface Mine Countermeasures UUV (Knifefish)

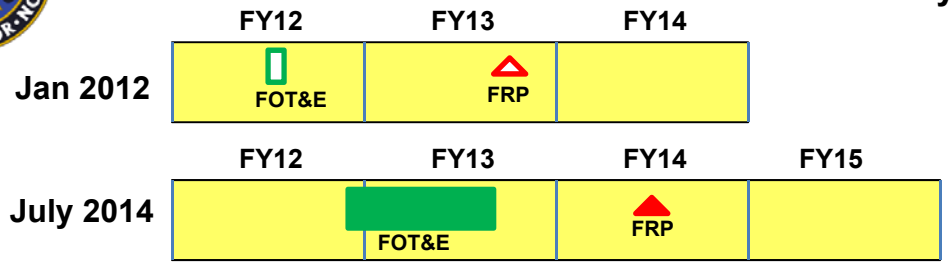
Autonomous Offboard Vehicle for Detection of Proud and Buried Mines



- **Initial Operational Capability (IOC) delayed by 1 year**
- **FY13 programmatic decisions slowed E&MD and stretched program 1 year**
  - **Caused by sequestration and Navy funding priorities**
- **All T&E and MS C moved 1 year to right**

Cooperative Engagement Capability (CEC) AN/USG-3B

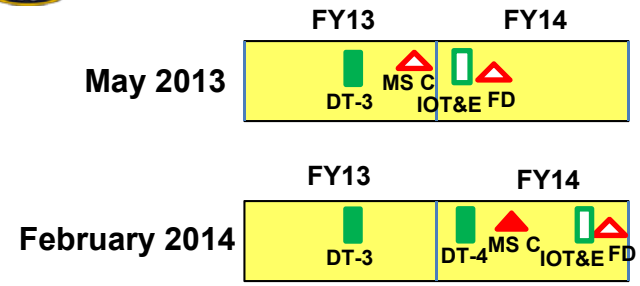
System of Hardware and Software for Sharing Radar Data on Air Targets on the Advanced Hawkeye (E-2D)



- **Full Rate Production (FRP) of AN/USG-3B (CEC E-2D aircraft hardware) delayed more than 6 months to correct problems discovered during the CEC AN/USG-3B and E-2D DT (see separate slide on E-2D program) and two major deficiencies discovered during the CEC AN/USG-3B FOT&E**
  - Correction of track processing and display interoperability problems between the CEC processor and the E-2D mission computer found in DT delayed entry into FOT&E from March 2012 to September 2012
- **Duration of FOT&E was extended to compensate for poor E-2D reliability and test execution problems:**
  - Planned test events were missed because the Navy failed to obtain FAA permission to radiate E-2D's sensors
  - Spare part kits did not arrive at test locations in time to support maintenance requirements
  - Data collection failed during some key test events
  - Insufficient number of E-2D aircraft were available to achieve minimum CEC test requirements
  - Lack of availability of GQM-163 aerial target events
- **FRP of the CEC AN/USG-3B delayed to allow time for root cause assessment and correction of two major deficiencies found during the CEC USG-3B FOT&E**
  - Track File Concurrence - ensuring that tracks on one CEC unit are identical to tracks on another CEC unit
  - Dual Tracks – two CEC tracks appearing when only one threat is present

Distributed Common Ground System–Marine Corps (DCGS-MC)

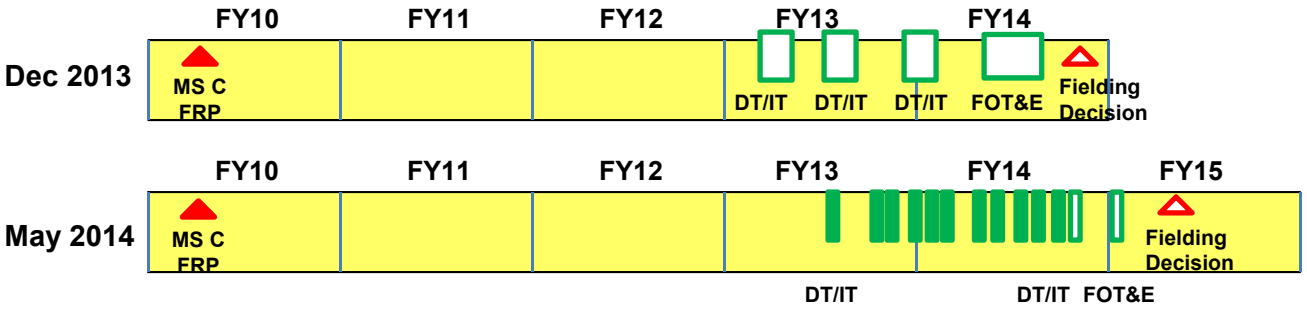
Marine Corps Net-Centric Intelligence, Surveillance, and Reconnaissance System



- **MS C delayed 5 months and IOT&E 8 months because of problems found in DT and delays in obtaining an IOT&E test unit**
  - **Significant problems discovered during DT-3 required time to fix problems and verify the fixes**
  - **DT-4 was added to verify the fixes, causing the delay of MS C and IOT&E**
  - **Insufficient test resources also contributed to minor delay following successful MS C**
- **Decision to delay MS C made in May 2013**
  - **Program manager decided to delay after DT-3 uncovered significant problems**
  - **Added DT-4 in November 2013 to demonstrate improvement and MS C rescheduled for January 2014**
- **IOT&E delayed from November 2013 to July 2014**
  - **Delay of MS C caused delay of IOT&E; May 2014 initially proposed as new date for test**
  - **Test unit unavailability forced additional delay to July 2014**

Department of the Navy Large Aircraft Infrared Countermeasure System (DoN LAIRCM) Advanced Threat Warning (ATW)

IR Countermeasures with new Laser and Hostile Fire warning for USMC CH-53E



- **FOT&E and fielding decision delayed 6 months due to several performance failures discovered during DT and Integrated Test (IT)**
  - **Lessons learned from previous tests (specifically the DoN LAIRCM IOT&E) were incorporated into DT/IT which enabled testing to identify more failure points during DT/IT – prior to FOT&E**
  - **Each software update during DT had to be either retested or regression tested for Missile Warning (MW), Hostile Fire Indicator (HFI), and Laser Warning (LW)**
    - **Tests were conducted on all previous test points and environments**

- **Major factors in delay**
  - **Data analysis to determine cause of each performance failure was lengthy**
    - **10 terabytes of data for each hour of flight test needed to be analyzed**
  - **A software solution implementation and certification to obtain flight clearance of new software takes 6 to 8 weeks on average for each new software update**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

Outline

- Army Programs
- Navy Programs
- Air Force Programs
- Other Programs

Air Force Programs

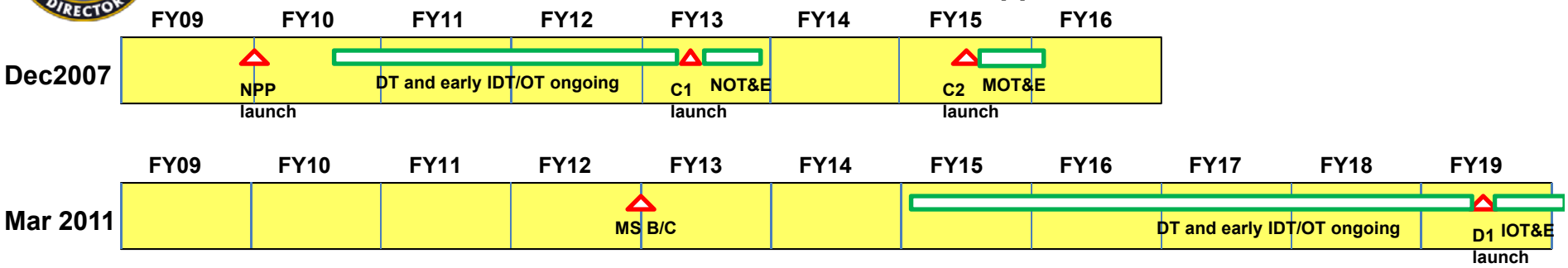
Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
NPOESS	Launch delayed 10 years, then the program was cancelled	10	X	X	X				
SBIRS High	First geosynchronous launch delayed 9 years	9	X	X	X	X			
AEHF Satellite	IOC delayed more than 7 years	7	X	X		X			
F-22 Raptor	FRP delayed 7 years	7	X	X	X	X			
MQ-9 REAPER	FRP delayed more than 7 years and changed to IPR; aircraft deliveries unaffected	7		X	X		X		
AMRAAM	Material Release delayed more than 6 years	6			X	X	X		
C-130 AMP	FRP delayed 6 years	6	X	X	X	X			
ALR-69A RWR	FRP delayed 5 years	5		X		X			
C-130J Hercules	Operational testing delayed more than 5 years	5	X	X	X		X		
Global Hawk	FRP delayed more than 5 years	5	X	X	X	X		X	Test unit unavailability
GPS OCX	IOC delayed nearly 5 years	5		X					
C-5 Modernization	IOC delayed more than 4 years	4	X	X	X	X	X		
LAIRCM Phase II	FRP delayed more than 4 years	4			X	X			
WGS	IOC delayed more than 4 years	4	X	X					

Air Force Programs (cont'd)

Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
GBS	IOC delayed 3 years	3		X	X				
SDB II	IOC delayed nearly 3 years	3		X	X	X			
B-2 RMP	FRP delayed 2 years	2		X					
GPS-III	Initial launch delayed more than 2 years	2		X				X	Constrained satellite component test resources
JMS Inc 1	Fielding decision delayed 2 years	2		X	X	X			
MALD	FRP delayed more than 2 years	2		X		X	X	X	Range unavailability
CITS AFNet Increment 1	FDD delayed more than 18 months	1.5			X	X	X		
MALD-J	FRP delayed 18 months	1.5					X	X	Range unavailability
AC-130J	IOC delayed 15 months	1			X				
AOC-WS 10.1	FRP delayed up to 1 year	1				X			
JASSM	FRP delayed a year	1	X	X	X		X		
JPATS	FRP delayed more than 1 year	1	X	X	X	X	X		
B-2 EHF Inc 1	FRP delayed 8 months	0.5		X		X			
F-15E RMP	FRP delayed 6 months	0.5				X			
HC/MC-130J	FRP delayed 6 months	0.5			X				

National Polar-Orbiting Operational Environmental Satellite System (NPOESS):

Weather Satellite with Ground Support



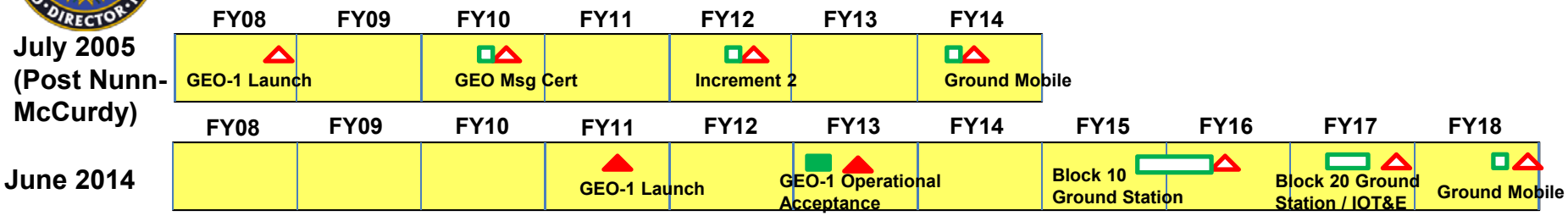
- Launch delayed 6 years from 2007 program baseline and 10 years from original program baseline; then the program was cancelled for multiple reasons
- A large number of delays caused by issues discovered in contractor testing, primarily identifying performance shortfalls
  - 2003-2005: Production failures plague the visible infrared imaging radiometer suite and the ozone sensor
  - Other delays primarily due to management issues (several GAO reports on this)
- Nunn-McCurdy breach occurred in 2006
- Program was split into separate Department of Defense and Department of Commerce programs, then cancelled before reaching DT

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Space-Based Infrared System (SBIRS) High

Constellation for missile warning, missile defense, battlespace awareness, and technical intelligence



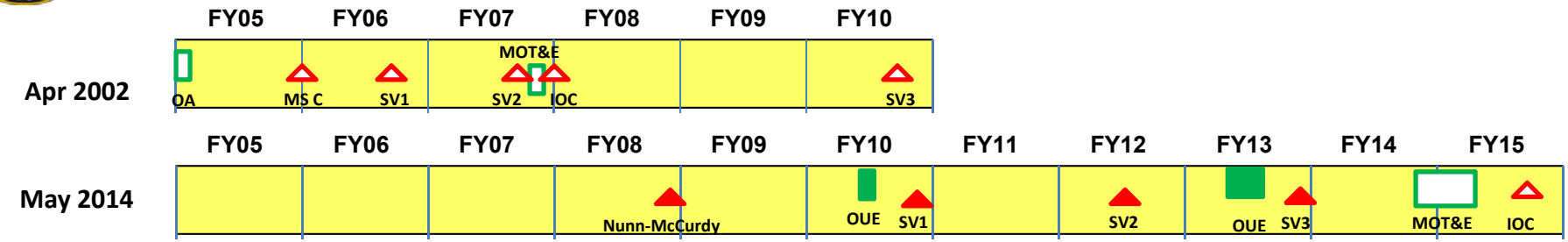
- **First SBIRS satellite in geosynchronous orbit delayed 3 years since 2005 baseline and 9 years since original program plan**
  - Additional delays in the 10 years from the 1996 requirements definition to the 2005 rebaselining were primarily caused by unrealistic requirements, immature technology, and a contract structure (Total System Performance Responsibility) that limited government insight into system development
  - Nunn-McCurdy breach in 2001
- **Lack of a consolidated acquisition strategy document makes it difficult to assess the top-level schedule**
  - The last delivery, called Effectivity-5, was the first SBIRS geosynchronous (GEO-1) satellite and ground facilities
  - The next delivery, Block 10, will consolidate and replace the current ground architecture
  - The final ground delivery, Block 20, combined with the remaining satellites to be launched, will complete the system and bring the system up to full levels of performance
  - Delivery of the ground mobile assets is not yet on contract
- **Significant delays were caused by problems discovered in DT while preparing for the GEO-1 launch**
  - Development of the satellite flight software was delayed repeatedly due to reliability issues
  - The discovery of non-space-qualified parts required the contractor to replace some satellite components
  - Attention and resources allocated to resolving the GEO-1 problems meant that the completion of the ground system with Block 20 was not put on contract until 2013

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Advanced Extremely High Frequency (AEHF) Satellite

Provides secure and protected satellite communication to tactical and strategic forces



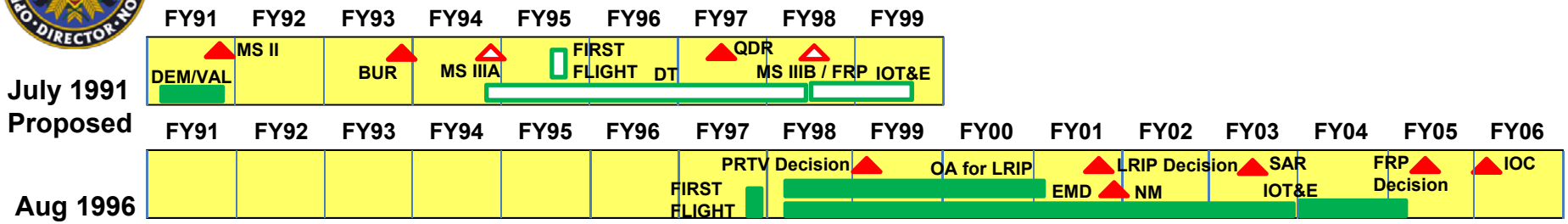
- **Initial Operational Capability (IOC) delayed by more than 7 years from 2002 baseline, and 8 years from original baseline, due to performance and manufacturing problems**
  - **Development of a dedicated crypto chip**
  - **Immaturity of ground control software found in DT**
  - **Manufacturing problems with reaction wheel assemblies, the scalable power regulator unit, the onboard computers, the demodulator, and the cross-link lock assemblies**
  - **2010 failure of the apogee engine during orbit-raising of Space Vehicle One (SV1)**
- **September 2008 Nunn-McCurdy breach was due to unit cost (not schedule)**
- **FY10 Operational Utility Evaluation (OUE) of backward compatible mission control software revealed concerns with cybersecurity, reliability, availability, and maintainability of ground control systems**
- **FY13 OUE of interim mission planning system demonstrated substantial improvement in cybersecurity, reliability, availability, and maintainability of ground control systems**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

F-22 RAPTOR

Air Force Fighter Aircraft



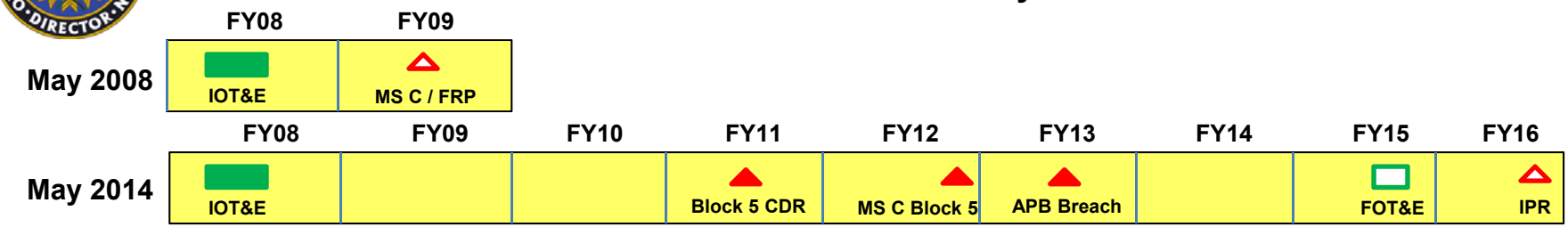
- **Full Rate Production (FRP) delayed 7 years due to programmatic issues, manufacturing, and problems found during testing**
  - A series of funding restructures (FY93-FY96) led to three rephasings of the program that reduced the number of EMD aircraft from 11 to 9 and the number of engines from 33 to 27; the EMD schedule slipped 26 months and the production program slipped 32 months
  - Early manufacturing problems with composite materials, low observable (LO) materials, subassembly integration, and aircraft mounted nozzle sidewalls
  - Developmental testing discovered structures problems with the vertical tails, avionics operational flight program (OFP) instability, and integrated maintenance information system (IMIS) instability
- **Original plan was to procure 750 aircraft; due to cost growth and production delays, planned production quantities decreased over time**
  - July 1991 MS II decision caused a restructure to procure 648 aircraft
  - October 1993 Bottom-Up Review caused a restructure to procure 442 aircraft
  - May 1997, Quadrennial Defense Review caused a restructure to procure 339 aircraft
  - 2001, new Acquisition Program Baseline (APB) was approved, thereby avoiding a Nunn-McCurdy critical breach based on unit cost
  - April 2003, Selected Acquisition Report; 271 aircraft to be procured
  - 2006 Multi-Year Procurement Congressional Decision; 187 aircraft to be procured (Final Inventory)

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

MQ-9 Reaper

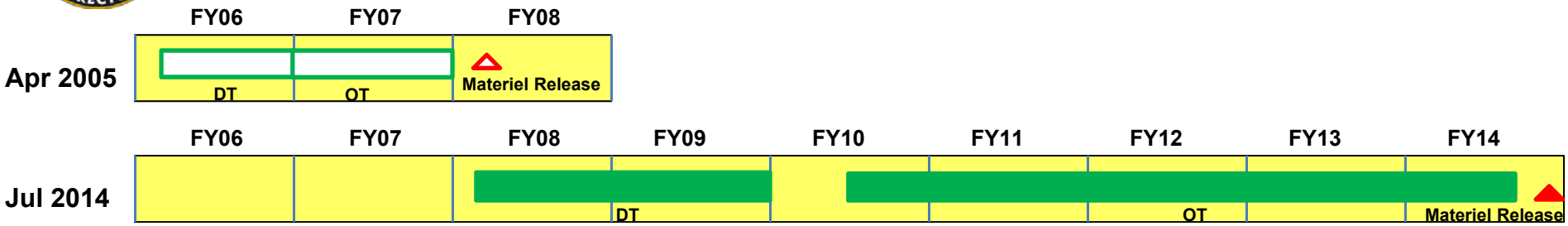
Hunter-Killer Unmanned Aerial System



- Full Rate Production (FRP) decision delayed more than 7 years and changed to an In-Process Review (IPR); aircraft deliveries have been unaffected
- FRP decision did not occur after the IOT&E
  - System did not meet all KPPs as determined by the AFOTEC and DOT&E reports
  - After IOT&E, the Air Force redesigned the aircraft, creating the Block 5 to meet all KPPs
- Addition of new Urgent Operational Needs and Air Force- and OSD-directed capability changes have driven continual hardware and software changes resulting in program delays
- Acquisition Program Baseline (APB) Breach occurred in 2013 due to:
  - Lack of inclusion of required, but significant, Military Construction funding in program budget
  - Immature software, manufacturing processes, and Technical Order development processes led to significant schedule delays
  - Lack of an Integrated Master Schedule
- In spite of these issues, the Air Force has purchased a new lot of aircraft nearly every year since FY04 and plans to continue these annual lot purchases until FY17 in order to meet OSD-directed Combat Air Patrol requirements
- An FOT&E is planned for 2015 to evaluate the new software on the new Block 5 aircraft
- The FRP decision was eliminated by the Air Force in favor of an IPR because nearly all of the aircraft would have been purchased before the FRP decision could occur after the FOT&E

Advanced Medium Range Air-to-Air Missile (AMRAAM) AIM-120D

Radar Guided Air-to-Air Missile



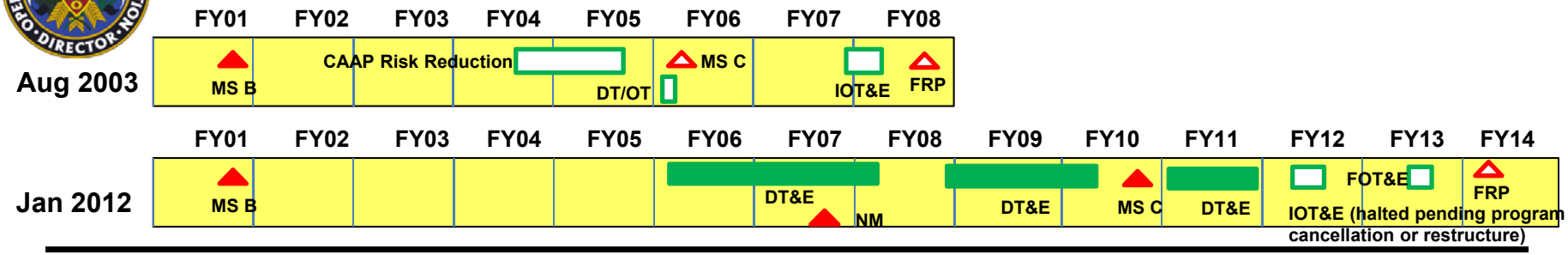
- **Materiel Release decision was delayed more than 6 years because of problems discovered during testing and programmatic issues**
  - **Multiple classified missile problems occurred during DT and OT flight testing that delayed the program while the program office implemented fixes**
  - **Some software-based capabilities were delayed past Materiel Release and will be introduced in a System Improvement Program (SIP)**
  - **AIM-120D was considered an upgrade to an existing missile and did not have the usual program milestones**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

C-130 Avionics Modernization Program (AMP)

Military Transport Aircraft Upgrades



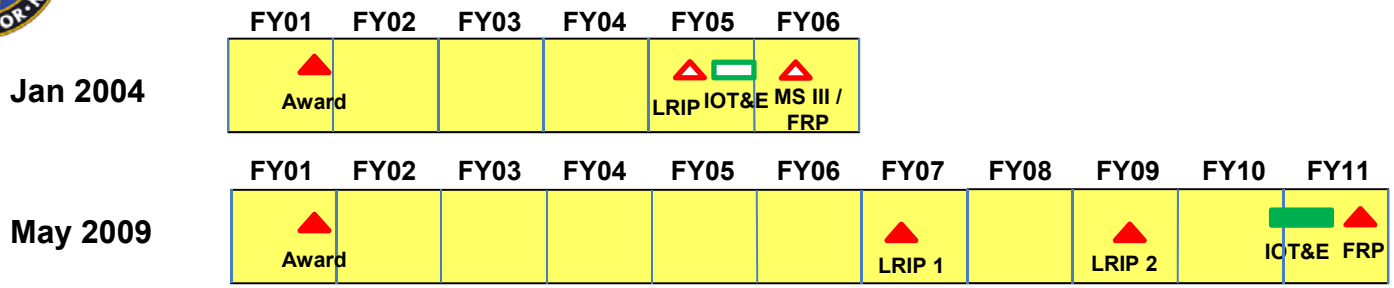
- **Full Rate Production (FRP) delayed 6 years prior to program freeze (pending cancellation initiated by USAF in FY12, currently under Congressional review) for multiple reasons**
- **Program began with intent to modernize up to 485 aircraft with different requirements**
  - **Common Avionics Architecture for Penetration (CAAP) for 71 Air Force Special Operations Command (AFSOC) aircraft was intended to be a rapid acquisition, but full CAAP first required AMP as baseline**
  - **Funding changes immediately after MS B prioritized rapid development of AFSOC-specific capabilities at the expense of 2-year delay in AMP program**
- **Selection of Boeing as AMP contractor led to programmatic delays**
  - **Underestimated time needed to establish baseline technical data for multiple aircraft configurations**
  - **Prior ad hoc modifications to aircraft in the fleet created far more than the 14 configurations assumed**
  - **Led to unplanned changes to program specifications as Boeing reverse-engineered Lockheed aircraft**
  - **DOD IG & GAO investigation into contract bias delayed program, led to a partial recompete for installation of FRP kits, which delayed MS C again in 2008**
- **Special Operations configurations (CAAP) were eliminated from the AMP program after Nunn-McCurdy restructuring in 2007**
  - **Restructure required new Acquisition Program Baseline**
- **DT revealed excessive crew workload during critical phases of flight and immaturity of integrated diagnostics and mission planning that required deferment of capabilities and regression testing of software revisions, delaying IOT&E since 2009**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

ALR-69A Radar Warning Receiver (RWR)

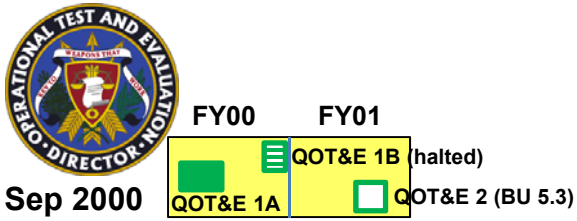
Replacement of ALR-69 RWR on C-130/F-16 Aircraft

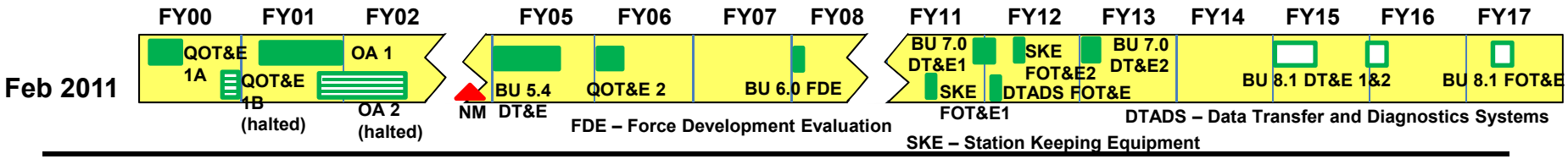


- Full Rate Production (FRP) delayed 5 years because of software development and integration issues followed by multiple issues discovered during DT
- Delays caused R&D funding to run out; production funding was reprogrammed
- Program moved forward even when problems were seen in early testing, leading to poor laboratory and ground test results in later testing, and consequent delays
- Original lead aircraft was the MC-130, but electromagnetic interference from onboard transmitters that were not compatible with the ALR-69A compromised system performance, leading to selection of C-130H without these transmitters instead
- Several issues discovered during DT required extensive troubleshooting to resolve
  - Resets cause by dirty fiber optics connectors
  - Mechanical issues
- Development was delayed by initial requirement to use all-world threat list; change to regional threat list late in development corrected many issues
- Multiple software releases were required during DT to resolve (or at least reduce) problems with detection range, identification, false alarm, and response time

C-130J Super Hercules

Military Transport Aircraft





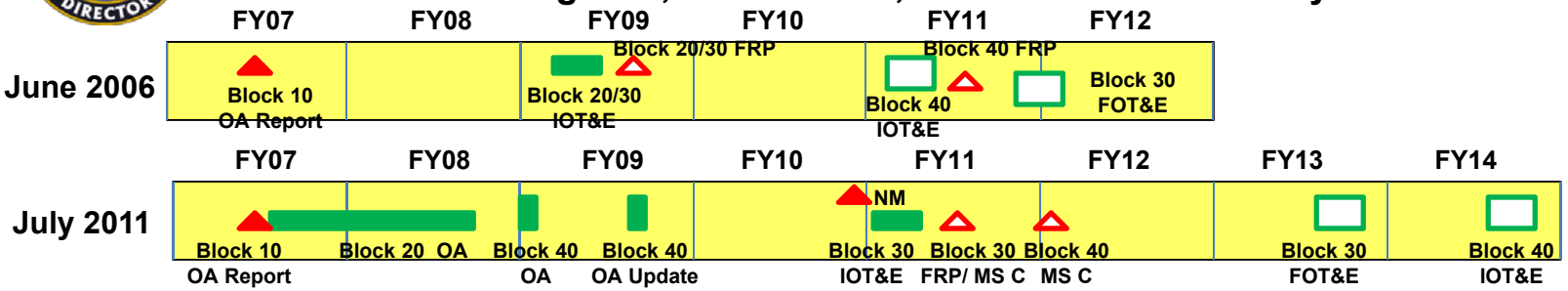
- **Program was delayed but there are no traditional programmatic milestones to measure the delay; operational testing has been delayed more than 5 years**
  - C-130J is a non-traditional acquisition that began as a commercial item with no program decision milestones and no specific Operational Requirements Documents (ORD)
  - DOD Inspector General audit (2004) found that commercial acquisition strategy was unjustified and that first 50 aircraft accepted by the Air Force did not meet contract specifications or operational requirements
  - The program has been restructured
- **QOT&E (Qualification OT&E) Phase 1B was terminated in 2000 with AFOTEC assessing the C-130J not effective, not suitable**
  - Deficiencies in communication/navigation software, airdrop, formation flight, reliability, logistics, tech orders
- **Air Force revised the operational requirements in 2005 to reflect a spiral development with initial requirements reduced and additional capabilities deferred to subsequent Block Upgrades (BU) and modifications, which continued to experience significant technical delays**
  - BU 5.4 achieved contract specification compliance after a 5-year delay in completion of QOT&E Phase 2
  - BU 7.0 OT&E slipped three times (over a year delay) due to software integration problems, then cancelled; Air Force opted not to field BU 7.0 until remaining deficiencies not correctable in BU 7.0 were addressed in BU 8.1
  - Station Keeping Equipment software update required a second FOT&E due to suitability shortfalls and still does not provide originally required capability for C-130J to fly in formation with C-130H
  - Deficiencies still not corrected in BU 7.0 or 8.1 require a new Capability Management Update 1 contract

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Global Hawk (RQ-4A/4B)

Unmanned High Altitude Long Endurance Intelligence, Surveillance, and Reconnaissance System



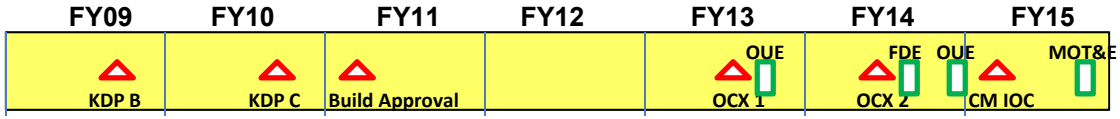
- **Full Rate Production (FRP) was delayed 2 years for Block 30 per the ADM, but the FRP has not been rescheduled because of ongoing Nunn-McCurdy restructure (a total of more than 5 years)**
- **Two Nunn-McCurdy breaches since 2001 MS B have resulted in significant changes to program:**
  - **2002 decision to create both a RQ-4A (original aircraft) and a RQ-4B (a larger aircraft with greater payload) under one program**
  - **2005 decision introduced Blocks with different sensor payloads**
  - **2011 Nunn-McCurdy Recertification (new calendar above) created four new subprograms with separate milestones and requirement and test documentation requirements; restructure is still ongoing**
- **Numerous issues occurring during DT resulted in delays to start of OT:**
  - **Global Hawk Block 30 prioritization lower than other tasking for Combined Test Force at Edwards**
  - **Aggressive schedule allowed no time to fix deficiencies found in DT; almost every performance problem, resource conflict, or sortie delay resulted in a slip to OT**
  - **"Click bonds" had quality control issues in manufacturing**
  - **Weather restrictions and divert runway availability resulted in high sortie cancellation rates and shortened sorties**
  - **Poor hardware reliability resulted in significant test inefficiencies; from July 2008 – May 2009, over 12% of ground and 20% of air events aborted due to reliability related issues**
  - **Problems in Block 30 delayed Block 40 due to common resources and lower priority of Block 40**
  - **Fielding Block 10 systems for operational missions took precedence over the development and test of Block 20, 30, and 40 aircraft systems; additional manpower and funding were not provided**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

Global Positioning System (GPS)
Next Generation Operational Control System (OCX)

Provides worldwide position and time to an unlimited number of users



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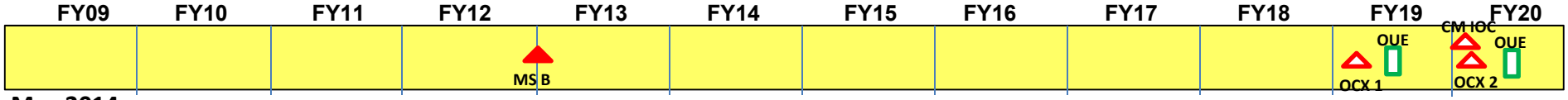
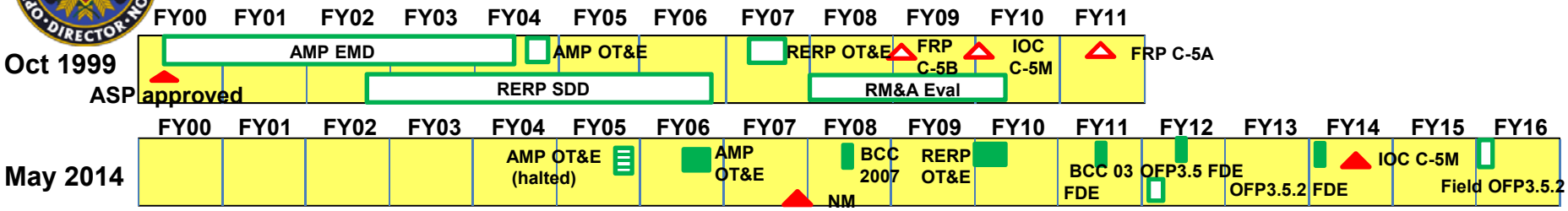


May 2014
(proposed)

- **Constellation Management (CM) Initial Operational Capability (IOC) delayed nearly 5 years due to software development issues**
- **Incomplete systems engineering in software interfaces is driving reworking of software development**
- **Incomplete systems engineering in cyber infrastructure has created many open deficiencies**
- **Problems in deficiency tracking and correction, software release processes, configuration management, and integration and test planning have led to inefficiency in development**

C-5 Modernization (AMP and RERP) Super Galaxy

Military Transport Aircraft Upgrades



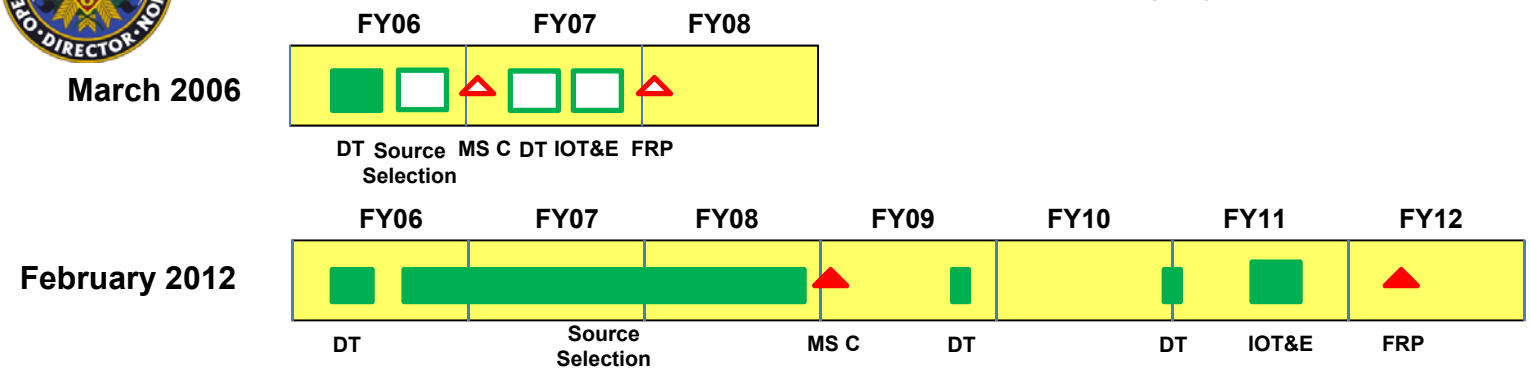
- **Initial Operational Capability (IOC) delayed more than 4 years due to manufacturing, programmatic, and performance problems**
- **Contractor development and testing ongoing over 13 years**
  - **Avionics Modernization Program (AMP) was the baseline configuration for initial Reliability Enhancement and Re-engining Program (RERP) upgrades**
  - **Major design deficiency (computer memory & throughput) identified at AMP critical design review that affects RERP; hardware and software architectures limit design and modification flexibility**
  - **Programs restructured multiple times; Nunn-McCurdy breach occurred in 2007**
- **AMP OT&E started and stopped in 2005; AMP OT&E restarted in 2006 following a crash that precipitated an instrumentation design change;**
  - **Software development and integration shortfalls included flight management system failures and instabilities, autopilot disconnects, display deficiencies**
  - **Deficiencies in reliability, maintainability, built-in test, information assurance, tech orders, and training**
- **RERP entered OT&E with seven major deficiencies or deferred capabilities; RERP IOC (16 aircraft) in Feb 2014; Operational Flight Program (OFP) 3.5.2 fielding delayed to Feb 2016 because of Aircrew Training System delays**
  - **RERP OT&E began with a known deficiency involving thrust reversers**
  - **RERP OT&E also began with known AMP deficiencies including: auto-throttles, built-in test, Communication Navigation Surveillance/Air Traffic Management (CNS/ATM), environmental control system, information assurance, survivability enhancements, and training systems & devices**
  - **Operational suitability is a persistent problem that shows little, if any, improvement**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

Large Aircraft Infrared Countermeasures (LAIRCM) Phase II

Next Generation Missile Warning System



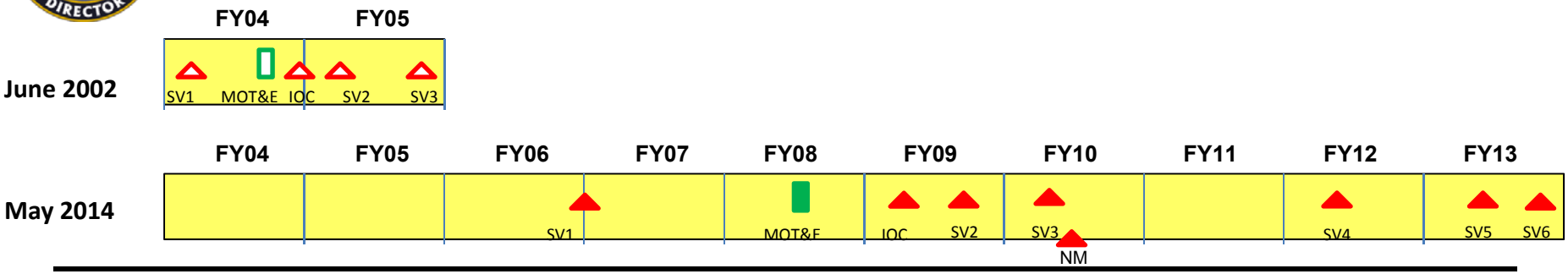
- **Full Rate Production (FRP) delayed more than 4 years because of programmatic issues and performance problems found in testing**
- **LAIRCM Phase II had planned for a quick source selection followed by a quick succession of test events leading to a FRP in 2007**
  - **Initial programmatic delay caused by source selection lasting 2 years instead of 2 quarters**
- **DT in 2009 uncovered issues that had to be resolved and tested in unplanned 2010 DT test**
- **Other major factors that caused the almost 3-year delay between MS C and IOT&E included:**
  - **Implementation of changes to the LAIRCM system required as a result of technical performance issues discovered in testing of the Navy's DoN LAIRCM system**
    - **DoN LAIRCM uses the same next generation missile warning system as the Air Force's system**
    - **Air Force testing likely would have uncovered many of the same issues**
    - **Air Force issued an Engineering Change Proposal to upgrade and synchronize their system with the Navy's**
  - **A misunderstanding of the requirements for delivery of Technical Orders between the Program Office and the User caused additional delays in 2010**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

Wideband Global SATCOM (WGS)

Provides high data rate satellite communication to tactical and strategic forces



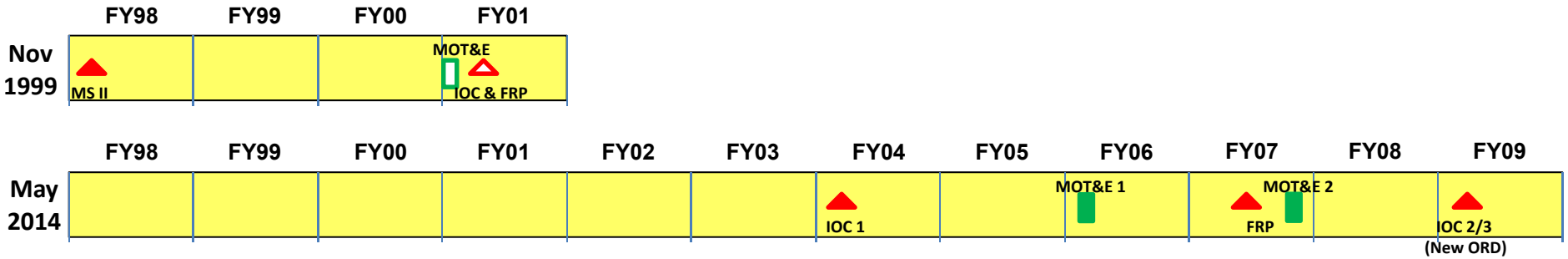
- **Initial Operational Capability (IOC) delayed more than 4 years due to manufacturing and quality control issues**
  - **2003 - Problems with phased-array antenna**
  - **2005 - Performance problems in the payload channelizer oscillator and incorrectly-installed rivet-nuts on SV1**
  - **2006 - Faulty solder joints and microwave power amplifier anomalies**
- **March 2010 Nunn-McCurdy breach due to unit cost (not schedule)**
  - **Unit cost increases were due to below-cost fixed-price of initial block of three satellites, subsequent to decision to expand the constellation, and breaks in production**
- **MOT&E demonstrated the space segment was effective but identified concerns with information assurance of the ground control segment and an inability of the Consolidated Network Planning Software (CNPS) to properly disseminate mission planning information to the network of Wideband Satellite Operations Centers**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

Global Broadcast Service (GBS)

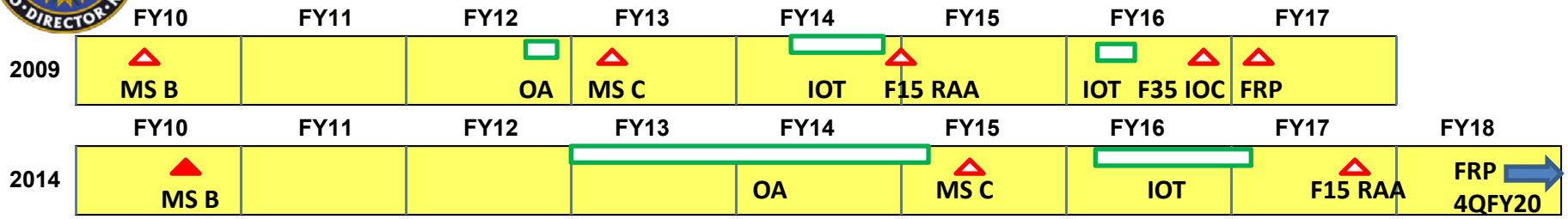
Provides, worldwide, one-way satellite communications



- **Software maturity problems and changing requirements led to a 3-year delay in Initial Operational Capability (IOC) and more than 6-year delay in the Full Rate Production (FRP) decision**
  - **Poor contractor software development practices led to numerous bugs and inefficiency in deficiency correction**
  - **After Asynchronous Transfer Mode (ATM) was working and being used operationally in 2001, the program office was directed to migrate the system to Internet Protocol (IP) requiring redesign of the ground system and user equipment**
  - **Less than 6 months before the MOT&E 1, Air Force Space Command wrote a completely new ORD going from 50 to 137 testable threshold requirements and incurring a delay while testing was replanned**

Small Diameter Bomb II (SDB II)

Multi-Mode Air to Ground weapon



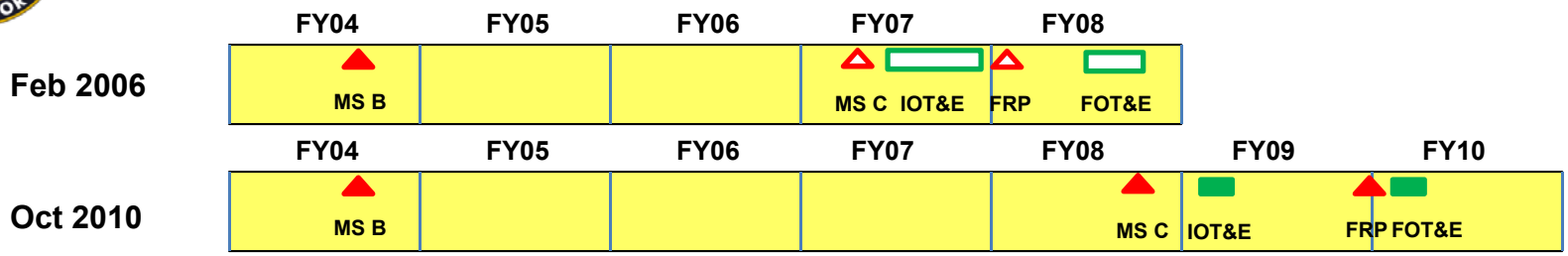
- Initial Operational Capability (IOC), referred to by Air Force as Required Asset Allocation (RAA), delayed nearly 3 years and Full Rate Production (FRP) decision more than 3 years because of programmatic change, contractor DT flight test issues, and F-35 delays
- Insertion of 28 Government Confidence Shots (to increase confidence in systems engineering and DT) at the urging of AT&L and DOT&E and contract issues (change from Cost Plus Fixed Fee with Performance Incentives to Firm Fixed Price) caused 2010 programmatic change delaying RAA by 2 years and FRP by 1 year
- Contractor development and test delays, principally seeker integration issues, led to 2012 delay for MS C to 4QFY13
- Additional MS C delay caused by multiple free flight weapon DT failures and subsequent investigation, redesign, and retest activities
  - Dome cover release failure in November 2012
  - Multiple navigation failures in April 2013
  - Data link connection failure in November 2013
- DT delays pushed back all other testing and decision dates from Initial Operational Test (IOT) through IOC
- Schedule delays in F-35 program induced changes in SDB II testing
  - Lack of F-35 airframe availability prevented fit test and captive carry work for over 2 years
  - Delay of F-35 Block 4 development prevented scheduled integration and test work inducing 3+ year delay

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

B-2 Radar Modernization Program

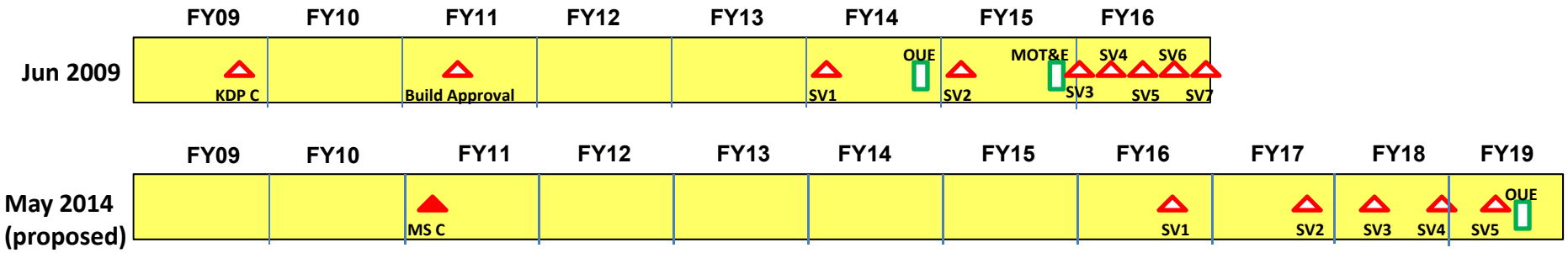
Replacement of the B-2 Bomber's Original Radar



- **B-2 RMP Full Rate Production (FRP) was delayed nearly 2 years because of a manufacturing problem discovered in laboratory testing**
- **Radar circulator subassemblies and the radiator housing separated because the original bonding material had mismatched thermal properties**
- **The program was delayed for failure review, redesign, and laboratory testing of the new bond**

Global Positioning System (GPS) III Satellites

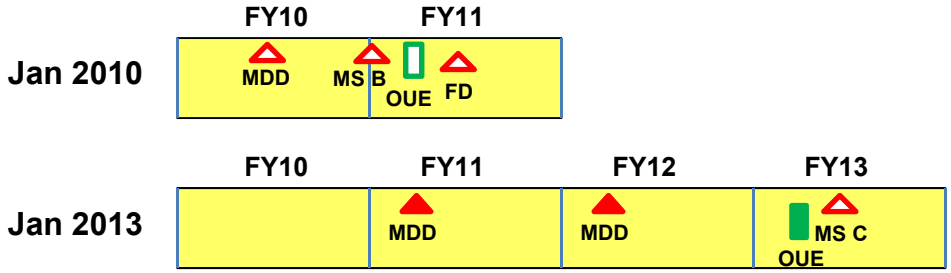
Provides worldwide position and time to an unlimited number of users



- **Satellite launch has been delayed by at least 2 years due to manufacturing problems**
  - **Navigation payload transmitters faulty**
  - **Radio Frequency coupling and cracked solder joints in Mission Data unit**
  - **Constrained satellite component test resources**

Joint Space Operations Center (JSpOC) Mission System (JMS) Inc 1

Space Situational Awareness and Command and Control Management System



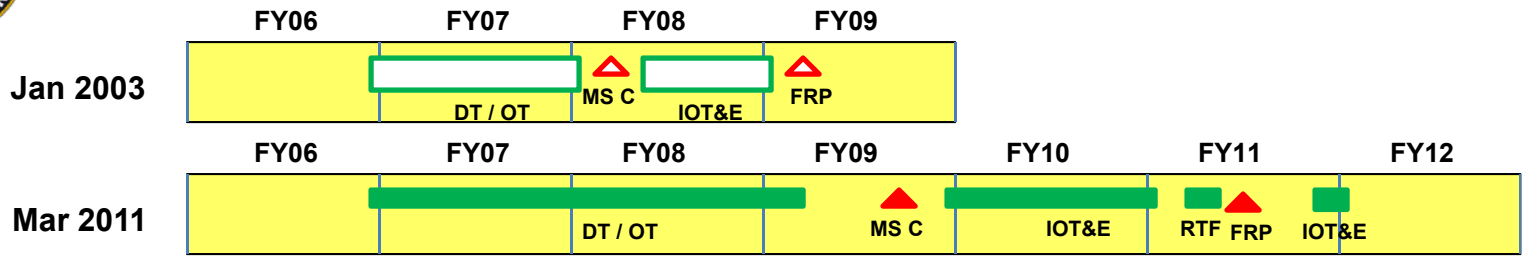
- **Fielding Decision (FD) delayed 2 years then converted to a MS C decision because of programmatic issues and problems found in testing**
- **In 2010, program migration caused significant delay**
  - **Air Force transferred acquisition from the Electronic Systems Command (ESC) to the Space and Missile Systems Command (SMC)**
  - **ESC program office dissolved before a good transition to SMC could be performed**
  - **Complete restart of the program office at SMC**
- **In 2011, program slipped an additional year for restructure**
  - **Lingering issues from the migration prompted a new approach to the program**
  - **Program split into 2 increments to close out initial capability and avoid a critical change**
  - **MS B bypassed and materiel development decision reaccomplished for restructure**
- **Program delayed several months to accomplish fix cycles**
  - **Successive rounds of DT revealed repeated instability and inadequate performance**
  - **Fix cycles were accomplished during programmatic delays**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

Miniature Air Launched Decoy (MALD)

Decoy Missile for use in the Suppression of Enemy Air Defenses



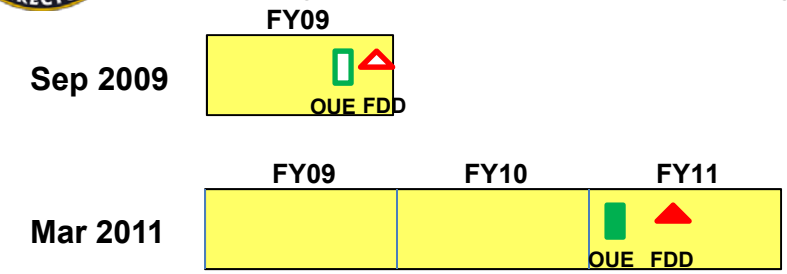
- **Full Rate Production (FRP) delayed more than 2 years because of two early failures in developmental test and manufacturing issues; completion of IOT&E delayed 3 years for multiple reasons**
- **Two critical failures during DT resulted in software updates requiring additional tests and recertifications**
- **Both developmental and operational test schedules extended due to lack of range availability**
  - **Only one DoD range with required electronic warfare test environment**
  - **Multiple DoD test and training requirements compete for a single test range with limited land, airspace, and personnel**
  - **Lack of qualified workforce on range resulted in delayed data analysis and data distribution**
- **IOT&E was extended after two performance failures occurred during IOT&E**
  - **MALD decertified during IOT&E**
  - **Manufacturing issues were identified and corrective actions were incorporated**
  - **Return to Flight (RTF) demonstrated failure modes were mitigated**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Combat Information Transport System (CITS)
Air Force Intranet (AFNet) Increment 1

A system to provide a Centrally Managed Air Force Enterprise Network



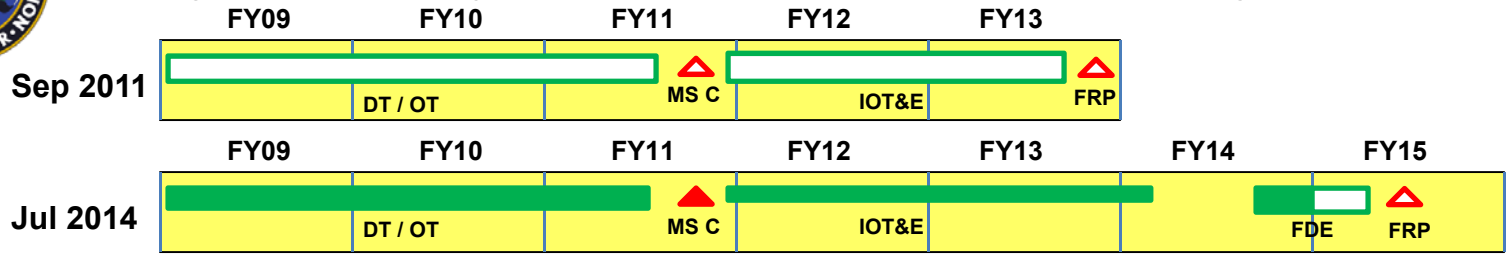
- **Full Deployment Decision (FDD) delayed more than 18 months due to problems found in testing**
- **In 2009, 7 of 16 planned gateways were deployed for testing on Air Force unclassified operational networks; deficiencies found in testing have delayed deployment by about 2 years**
  - **Testing is done on 7 gateways but results need to be extrapolated to 16 gateways (scalability issue)**
  - **Some operational parameters were not met during developmental testing (e.g., 800 Mbps data throughput capability at gateway)**
  - **Challenge of *in situ* transition from 32-bit to 64-bit architecture**
  - **CITS program has components such as Cyber Control System that are not funded and hence the overall effectiveness might not be achieved or tested**
- **Due to CY09 deficiencies, Operational Utility Evaluation was done in Dec 2010**
  - **AFNet Inc 1 is operationally effective and operationally suitable, but with significant limitations, mostly related to Information Assurance and Cyber Defense**
- **Full Deployment Decision Review occurred in 2011**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Miniature Air Launched Decoy with Jammer (MALD-J)

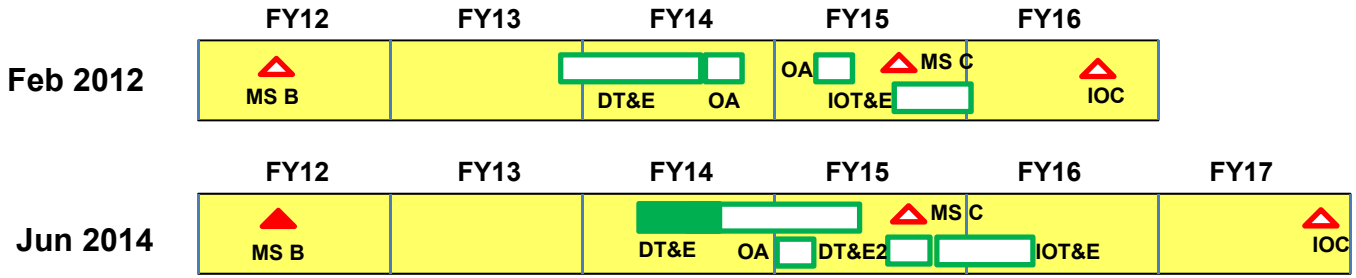
Decoy missile with a jammer for use in the suppression of enemy air defenses



- **Full Rate Production (FRP) was delayed 18 months because of a performance problem discovered in IOT&E and test conduct problems**
- **Delays on MALD program did not significantly delay the MALD-J (see separate slide on MALD program)**
- **Performance problem found during IOT&E was tied to navigation accuracy in certain operational environments**
  - **Inability to hold altitude within a plus or minus 1000 foot boundary led to safety of flight concerns**
  - **Proposed software update to mitigate issue required additional testing (done through an added Force Development Evaluation)**
- **Test conduct problems included:**
  - **IOT&E was extended 6 months because modeling and simulation effort could not be validated or accredited without test range data**
  - **Force Development Evaluation delayed 3 months**
    - **Radio Frequency Authorization clearance not submitted on time**
    - **Lack of communication between test team and range safety personnel**
    - **Unexpected procedural error led to missiles being terminated prematurely by range safety personnel**

AC-130J Ghost Rider

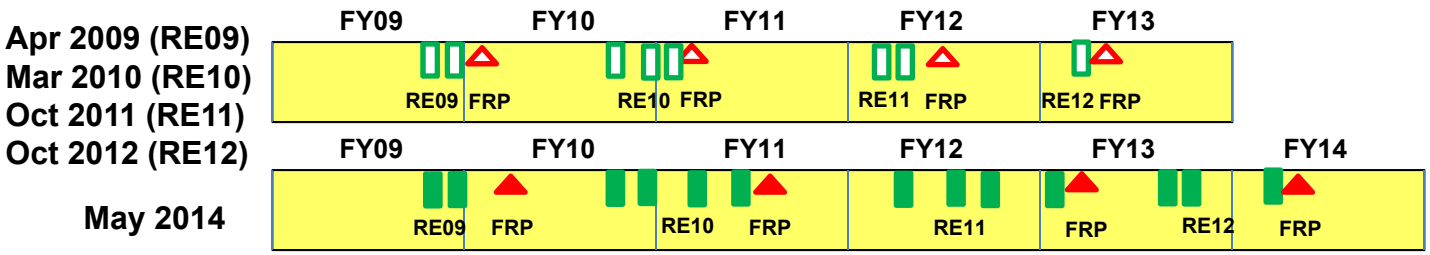
Special Operations gunship variant of the C-130J



- **Initial Operational Capability (IOC) delayed by approximately 15 months for programmatic reasons**
  - Shortly after MS B, the number of aircraft required was changed
  - Initial plan called for an AC-130J fleet of 16 aircraft but was increased to 37 aircraft
  - Delivery schedule of donor MC-130Js for conversion to AC-130Js delayed by contract negotiations
  - There is no Full Rate Production (FRP) decision beyond MS C for this program
- **While the start of DT&E was delayed, it did not affect the revised IOC date**
  - The decision to delay IOC was made before the delay in DT&E occurred
  - DT&E delayed approximately 5 months because aircraft/weapon kit integration took longer than scheduled
- **End of DT&E delayed an additional 3 months after commencement for safety incident review**
  - During flight test, the aircraft experienced an unexpected stall

Air Operations Center – Weapon System (AOC-WS) 10.1

Air Component Commander's Command and Control System that integrates over 40 third-party software systems



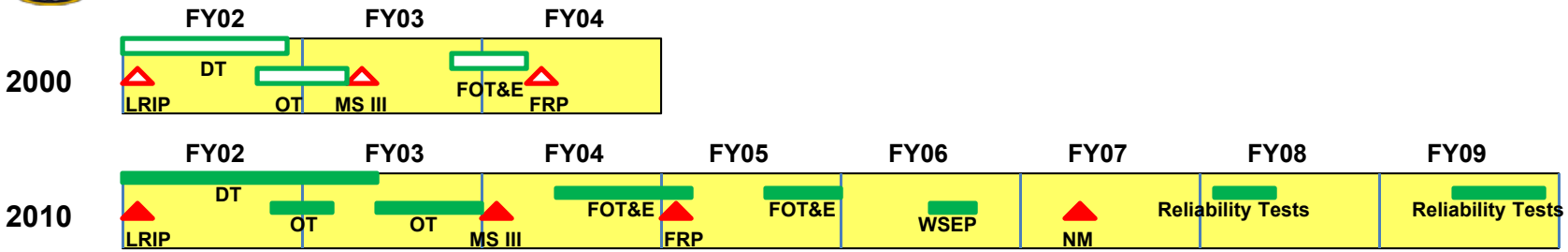
- **Full Rate Production (FRP) for individual releases delayed up to 1 year due to problems with software integration and interoperability; problems also required sustainment upgrades**
- **Recurring Event 09 (RE09) FRP delayed 2 months and down-scoped**
  - **Additional DT events required due to software errors and fixes**
  - **Software content down-scoped, OT cancelled, and only low risk content fielded**
- **Recurring Event 10 (RE10) FRP delayed 4 months and down-scoped**
  - **Additional DT events required due to software errors and fixes**
  - **Software content down-scoped, OT cancelled, and only low risk content fielded**
- **Recurring Event 11 (RE11) FRP delayed 9 months**
  - **Additional DT events required due to software errors, fixes, and hardware server upgrades**
- **Recurring Event 12 (RE12) FRP delayed 1 year**
  - **DT reconducted due to software build problems, and software errors**
  - **OT delayed by 6 months due to reconducted DT**
  - **Additional OT event required to retest the software build because of documentation errors**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Joint Air-to-Surface Standoff Missile (JASSM)

Cruise Missile for Stand-off Attack



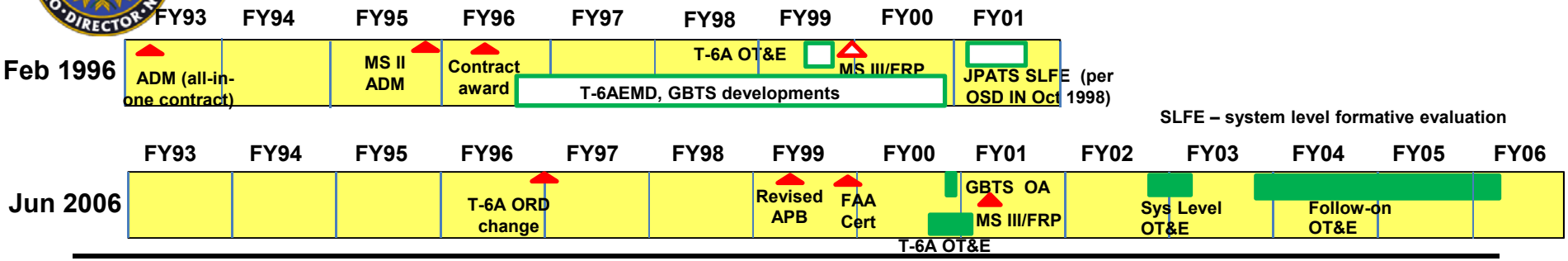
- **Full Rate Production (FRP) delayed by 1 year and FOT&E delayed 2 years because of continuing reliability issues**
- **Major delays were caused by reliability issues (workmanship and quality control); specific examples include failures of the flight control actuator and fuel control mechanism**
- **DT testing was extended, but inadequate DT led to most discoveries occurring in OT**
  - **During original operational testing, testing uncovered issues with arming/detonation, flight control surfaces getting jammed, departures from controlled flight, problems with the low observable coating, and circuitry shorts**
  - **Air Force issued a "stop test" order, delaying the completion of OT**
  - **More discoveries occurred in FOT&E, causing a second "stop test" order and further program delays**
- **A Nunn-McCurdy breach occurred in 2007 because correcting reliability issues led to delays in schedule and increased the cost per missile**
  - **The pursuit of unprogrammed missile variants also contributed to delays and cost overruns**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

T-6A Joint Primary Aircraft Training System (JPATS) Texan II

Primary Training Aircraft



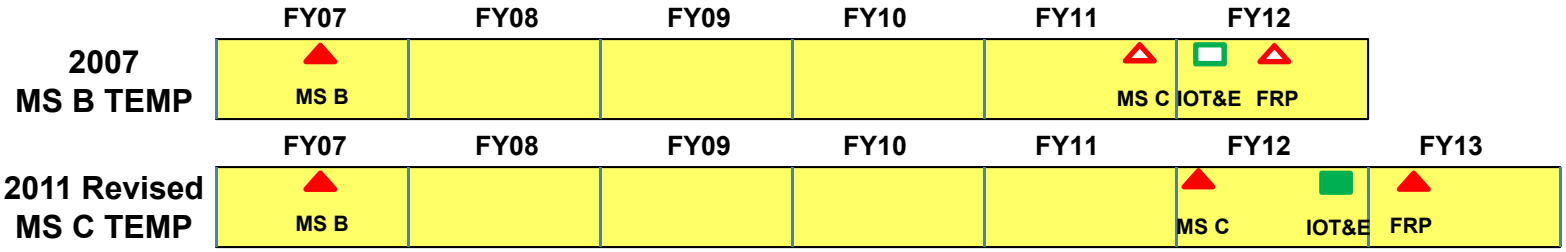
- Full Rate Production (FRP) delayed more than 1 year for multiple reasons
- JPATS was a Pilot Program for Streamlined Acquisition and is comprised of T-6A aircraft; the Ground Based Training System (GBTS) with multiple simulators, computerized courseware, a computerized management system; and Contractor Logistics Support
- Reasons for JPATS delays included:
  - T-6A, a derivative of the Pilatus PC-9, was called Commercial-Off-the-Shelf (COTS) but there were major differences between the T-6A and PC-9
  - FAA certification of T-6A repeatedly delayed development (engine, structural, and other issues had to be addressed to achieve FAA certification); total delay of about 6 months
  - Program restructured multiple times; Nunn-McCurdy breach in September 2007
  - August 2000 crash in which two experienced pilots ejected
  - Engine seizures (lack of oil pressure); insufficient cockpit cooling air; flight controls; durability; tire life
  - OT&E without students: T-6A operationally effective but not safe for student training
  - New USAF Acquisition Strategy in 2001
- 2001 OT&E reduced to OA (incomplete courseware, interfaces, training information management system (TIMS))
- FOT&E added to address additional problems

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

B-2 Extremely High Frequency (EHF) SATCOM and Computer Increment 1

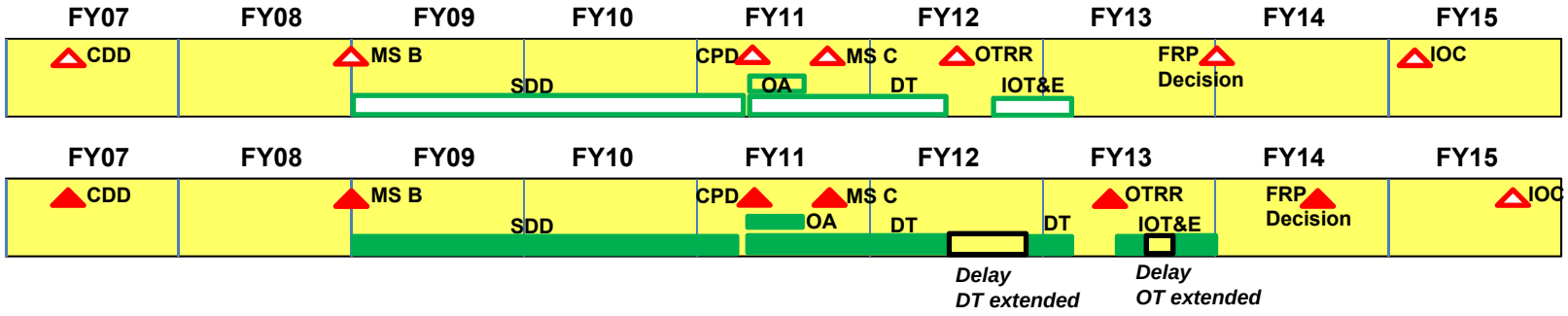
B-2 Bomber's SATCOM upgrade



- **Full Rate Production (FRP) was delayed by 8 months because of software development problems discovered in DT**
- **IOT&E delayed 7 months and MS C delayed 3 months because of software development delays**
  - **Associated with rehosting the Flight Management Operational Flight Program (FMOFP) software from Jovial to C**
- **Five software drops were required during DT**
  - **Three software drops were planned but five software drops were needed to fix problems found during DT, including Classified Data Erase (CDE) time and other FMOFP functionality**

F-15E Radar Modernization Program (RMP)

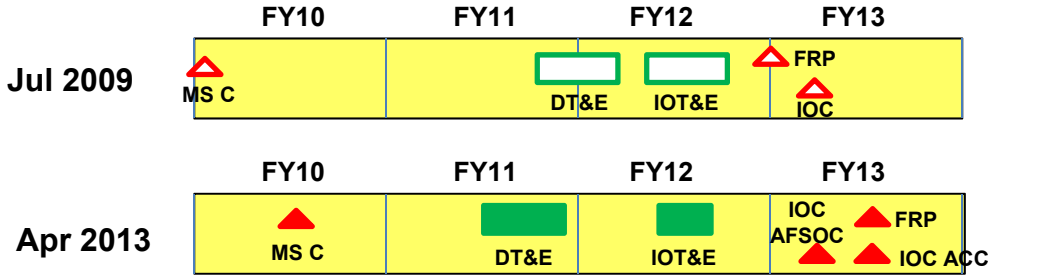
Replacement of the F-15E Fighter's original radar with an Active Electronically Scanned Array (AESA) radar



- **Full Rate Production (FRP) delayed 6 months because of problems discovered in DT**
- **Problems discovered in DT:**
  - **Radio Frequency Tunable Filter (RFTF) Attenuator change due to Electro-Magnetic Interference (EMI) with the radar**
  - **Environmental liquid cooling turbine and Conformal Fuel Tank (CFT) duct modification needed to increase cooling capacity for the radar**
  - **Replacement of the radar transmit/receive tantalum capacitor modules with the polymer capacitor modules due to failures caused by arcing on the similar F-15C Active Electronically Scanned Array (AESA) Radar (APG-63v3)**
  - **Software stability was below the Mean Time Between Software Anomaly (MTBSA) Capability Production Document (CPD) threshold limit**
  - **Software anomaly during DT caused component failure and physical damage to two F-15E RMP APG-82 AESA Radars resulting in factory replacement after the identified problem was corrected**
- **Impact:**
  - **DT extended 8 months**
  - **IOT&E delayed 8 months**
  - **Extended development testing due to discovery of additional problems**

HC/MC-130 Recapitalization

Replacement for tactical transport aircraft with hose and drogue aerial refueling, airdrop, and command and control capabilities



ACC – Air Combat Command
AFSOC – Air Force Special Operations Command

- **Full Rate Production (FRP) Decision slipped 6 months for programmatic reasons**
  - **As a variant of the C-130J, HC/MC-130J started at MS C**
  - **Air Force review of procurement unit cost contributed to delay**
  - **Leadership transition at SAF/AQ delayed scheduling**
  - **FRP Acquisition Decision Memorandum issued October 2013**
- **Developmental and operational testing completed ahead of schedule, in time to support original FRP date**
- **Air Force Special Operations Command declared Initial Operational Capability (IOC) on schedule (December 2012), but Air Combat Command declared IOC in April 2013**

Outline

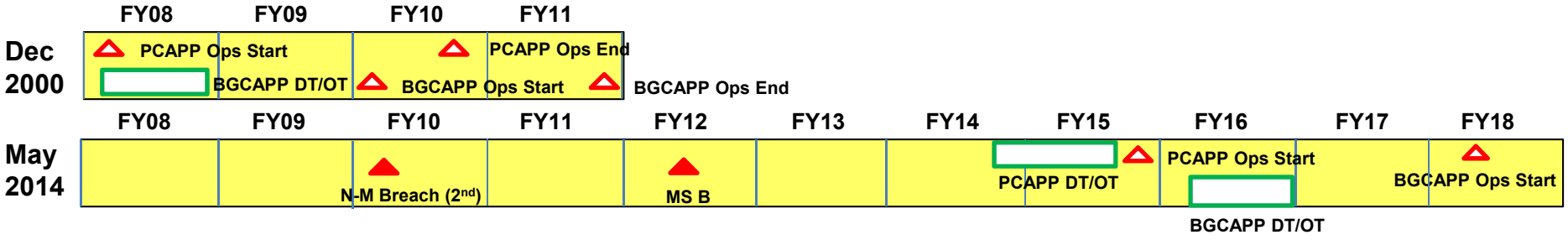
- Army Program Examples
- Navy Program Examples
- Air Force Program Examples
- Other Programs

Other Programs (DoD, DISA, NSA, DLA)

Program	Delay	Delay Duration (years)	Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems Discovered in DT	Problems Discovered in OT	Problems in Test Conduct	Problem Observed Conducting Test
Chem Demil-ACWA	Operations delayed 7 years	7	X		X				
Joint Strike Fighter	IOC delayed up to 6 years	6	X	X	X	X			
PKI Incr 2	FDD delayed 6 years	6		X	X		X	X	Delays issuing SIPRNet tokens
KMI	FDD delayed up to 4 years	4		X		X	X		
Mark XIIA Mode 5	FRP delayed more than 3 years	3				X	X		
Net-Centric Enterprise Services	FRP delayed 2 years	2			X		X	X	Lack of user base
Chem Demil-CMA Newport	Operations delayed 18 months	1.5	X		X				
GCCS JOPES 4.2 and 4.2.1	Fielding delayed 5 months	0.5				X	X		

Chemical Demilitarization-AWCA

Assembled Chemical Weapons Alternatives (ACWA) Program



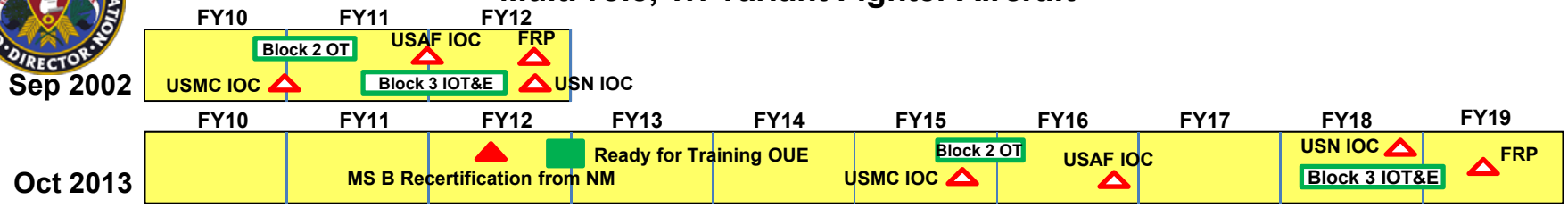
- Chemical Agent Destruction Operations delayed 7 years due to programmatic changes
- Root cause of two Nunn-McCurdy breaches was design immaturity at the time of previous cost estimates
  - ACWA sites are reliant on new technology, including first-of-a-kind waste treatment units, which required a longer research and development program
  - Plant construction and environmental permitting added to schedule delays
  - Other contributing causes were escalation of construction material costs and other costs; program acceleration to complete destruction operations as close to 2017 as possible; and added risks associated with first-of-a-kind equipment testing, integration, and operation
- Facility DT and OT events piggyback on normal facility systemization and pilot testing
  - DT and OT testers coordinate closely with facility site management to integrate required DT and OT into normal facility tests to avoid program delays

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Joint Strike Fighter (F-35)

Multi-role, Tri-variant Fighter Aircraft



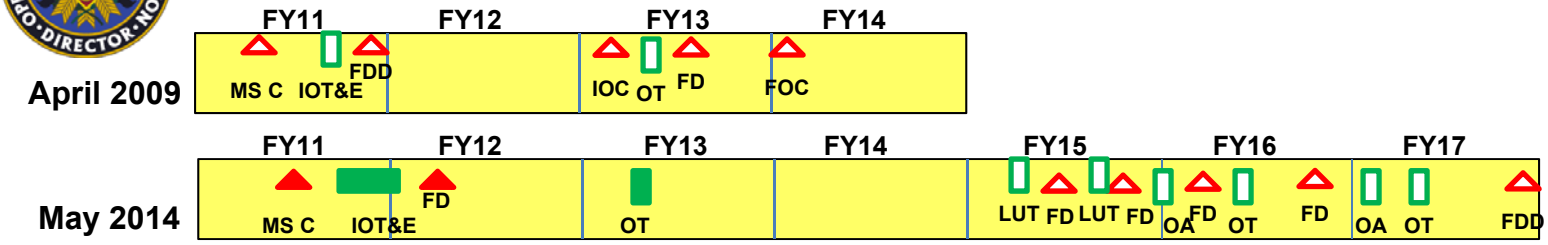
- Initial Operational Capability (IOC) delayed from 4.5 (USMC) to 6 (USN) years for multiple reasons
- Feb 2010 restructuring caused by delayed delivery of test aircraft (manufacturing), unrealistic planning assumptions for flight test progression, inadequate contractor staffing levels, insufficient software and integration lab facilities
- Nunn-McCurdy Recertification
  - Schedule risk and cost assessment confirmed the need to fund program for additional development schedule
  - Late production and checkout of test aircraft (209 days total for first six System Development and Demonstration (SDD) aircraft) and slow progress in STOVL flight sciences highlighted as reasons for delays
- Secretary of Defense FY12 Budget Decisions – based on Technical Baseline Review
  - Immaturity of STOVL design and unexpected component deficiencies inhibited DT progress
  - Slow development of missions systems software forced further delays in DT
  - Planning factor for fly rates per month for developmental test aircraft were lowered to more realistic projections; more time required for software development and incremental builds
- Structural repairs/modifications to main bulkhead (B models) and to wing root ribs (A and B models), required due to life-limiting failures in durability test articles, resulted in reduced availability of SDD test aircraft and delays in availability of OT aircraft
- Ready for Training Operational Utility Evaluation (OUE) added to assess readiness to start training
  - OUE delayed 13 months due to immaturity of aircraft and safety of flight concerns (high air abort rate, high problem discovery rate, extensive use of workarounds for maintenance, low aircraft availability rate)
- Unrealistic scheduling for certification of readiness to start, spin-up, and training for IOT&E led to unacceptable overlapping of key events causing delay in start of IOT&E by 5 months

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

DoD Public Key Infrastructure (PKI) Increment 2

Framework and Services for DoD Public Key Certificates and Corresponding Private Keys



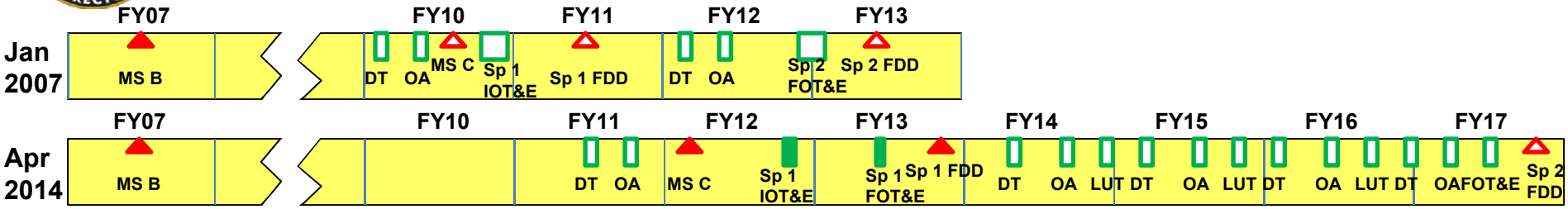
- **Full Deployment Decision (FDD) delayed 6 years when the program declared a critical change in 2013**
  - Program unable to achieve an FDD within 5 years of the selection of the preferred alternative
  - FDD slipped 6 years and was realigned with the original goals of the Full Operational Capability (FOC)
  - Programmatic problems including a compressed schedule and poorly defined requirements
- **First Fielding Decision (FD) slip to 2QFY12 because of delays in issuing SIPRNet tokens to the test population**
  - IOT&E was conducted with an interim Integrated Logistics System (ILS) for tracking tokens due to delays in developing the permanent ILS solution
- **FOT&E, inserted to resolve unsuitable rating from the IOT&E, revealed more problems, causing further schedule delays**
  - FOT&E revealed increasing token failures after issuance and system reliability problems after minor upgrades
  - Logistics problems found during IOT&E persisted due to uncertainty surrounding the long-term ILS solution for token distribution and tracking
- **Requirement instability in the Non-Person Entity (NPE) Certificate Issuance capability and changes to DoD policies that define which devices require these certificates contributed to schedule delays**
  - DoD CIO removed then reintroduced requirement for medium assurance certificates for 1-2 million workstations
  - DoD CIO introduced a less-than-medium-assurance (LTMA) requirement for select devices
- **Deferral of several core capabilities to after FDD resulted in rebaselining of capability deployment schedule**
  - These include NPE, NIPRNet Enhanced Capabilities, and Tactical Environment Capabilities

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Key Management Infrastructure (KMI)

Create, Distribute, and Manage Electronic Cryptographic Key Materiel



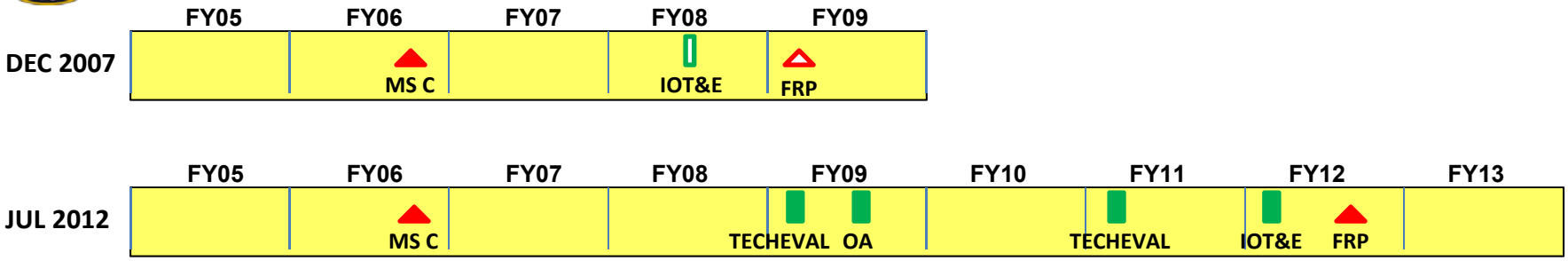
- **Spiral 1 Final Deployment Decision (FDD) delayed more than 2 years and Spiral 2 FDD delayed 4 years for software development issues and problems found in testing**
- **Original Acquisition Strategy called for two Spiral (Sp) deployments**
  - **Each deployment would have two rounds of DT, two rounds of Operational Assessment (OA), and IOT&E (Sp 1) or FOT&E (Sp 2)**
  - **Spiral 2 Full Deployment to be complete in FY13**
- **System DT and MS C slipped 1 year because of software instability and hardware token unreliability**
  - **Problems persisted into first OA**
  - **Multiple rounds of unplanned regression testing were need to resolve problems before the second OA**
  - **Problems found during second OA resulted in further schedule slip and another round of unplanned regression events**
- **Critical Change declared in February 2012**
  - **IOT&E executed nearly 2 years later than planned**
  - **Unscheduled FOT&E added after IOT&E found Spiral 1 not effective and not suitable**
- **Spiral 2 rebaselined into four "spins," each of approximately 1-year duration**
  - **Each spin would culminate in a deployment decision following a successful Limited User Test (LUT)**
  - **Final Deployment Decision (FDD) for the program would be preceded by a comprehensive FOT&E that evaluated all system capabilities by the end of FY17**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Mark XIIA, Mode 5 IFF

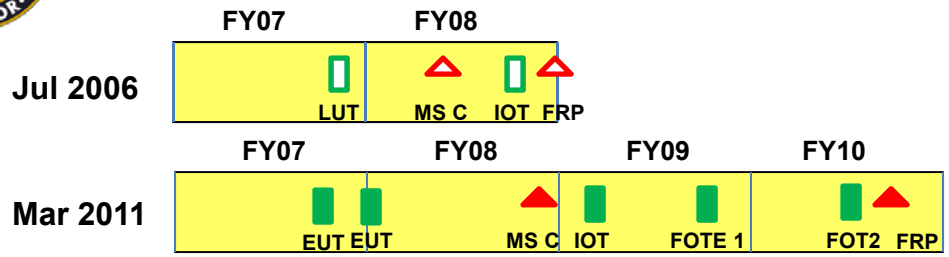
Identification, Friend or Foe System



- **Full Rate Production (FRP) delayed more than 3 years due to performance, suitability and Joint interoperability issues discovered during DT**
  - **Problems included false targets, false target IDs, target track swapping, mis-identifications, low reliability, Electronic Key Management System (EKMS) issues, and test set availability**
- **Serious issues revealed in the 2009 OA led to a new Navy program baseline**
  - **Problems included target misidentifications, tamper events, excessive caution lights, interoperability issues with host platforms, failure to create Mode 5 targets when valid Mode 5 replies were received, technical documentation, and training**
  - **New program allowed a 2-year period to identify and correct known issues**
- **2011 TECHEVAL provided confidence in corrective actions and that the planned IOT&E would be successful**
- **2011 IOT&E Validated Mark XIIA, Mode 5 system effectiveness and suitability in a realistic operational environment that included extensive participation by all military Services**

Net-Centric Enterprise Services (NCES)

Provides DoD Enterprise-level services for Collaboration, User Access, Content Discovery & Delivery, and Service Oriented Architecture Foundation Products



- **Full Rate Production (FRP) has been delayed 2 years because of programmatic issues and the system repeatedly failing operational testing**
- **Technical parameters were initially demonstrated in Developmental Testing**
- **In Operational Testing, users have been unable to operate and sustain the system**
- **Recurring Deficiencies:**
  - **Shifts in the Acquisition Strategy after MS B, which included replacement of managed service providers of core enterprise services, significantly delayed the program**
  - **Lacked testing methodology for rapidly evolving, commercially managed, enterprise services including continuous monitoring of distinct user communities**
  - **OT events identified widespread audio and video latencies and session drop outs for NCES Collaboration services**
  - **Immature policies, processes, and procedures combined with an absence of end-users limited the ability to assess the intended purpose of NCES service-oriented architecture foundation services**
  - **An extremely limited user base for many services at this point in time precluded an assessment of scalability to the levels envisioned in the Capabilities Production Document (CPD)**

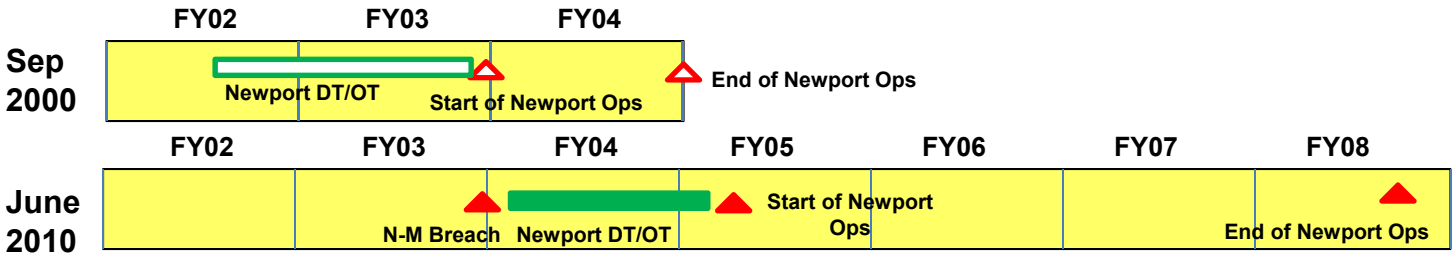
Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Chemical Demilitarization-CMA Newport

Newport Chemical Agent Disposal Facility (CMA-Newport)

Destroy Newport Chemical Agent Stockpile Using Neutralization Process



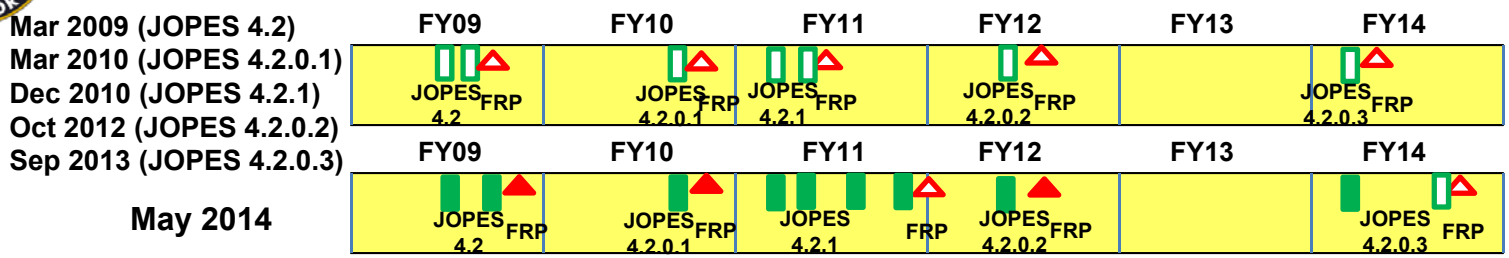
- Chemical Agent Destruction Operations delayed about 18 months due to programmatic changes
- Root cause of Nunn-McCurdy breach was design immaturity at the time of cost estimation
  - Newport was the first stockpile site to use neutralization of nerve agents; this required first-of-a-kind equipment development and testing
  - In general, schedule was impacted by revisions to processing rates; new environmental regulations; increases in equipment, labor rates, and construction costs; and higher emergency preparedness costs
- Facility DT and OT events occurred as part of normal facility systemization and pilot testing
  - DT and OT tests were coordinated with facility site management and integrated into normal facility tests to avoid program delays

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Global Command and Control System (GCCS) JOPES

Planning and Execution System for Joint Task Forces



- **Full Rate Production (FRP) for releases delayed up to 5 months due to problems found in testing**
- **Joint Operations Planning and Execution System (JOPES) 4.2 FRP delayed 1 month**
  - **Software errors discovered during DT/OT required bug fixing and a small regression test**
- **JOPES 4.2.0.1 FRP successfully conducted on time**
  - **Minor bug fix release, tested successfully**
- **JOPES 4.2.1 FRP was not successful, release never fielded**
  - **Critical deficiencies during testing, operational workarounds not accepted by users**
- **JOPES 4.2.0.2 FRP successfully conducted on time**
  - **Release contained upgrades from JOPES 4.2.1 that had tested successfully**
- **JOPES 4.2.0.3 FRP expected to be delayed 5 months**
  - **Critical problems identified during DT/OT and interoperability testing with Defense Readiness Reporting System (DRRS) 4.6**

Nunn-McCurdy	Manufacturing, Software Development, and Integration	Programmatic	Problems discovered in DT	Problems discovered in OT	Problems in Test Conduct

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**