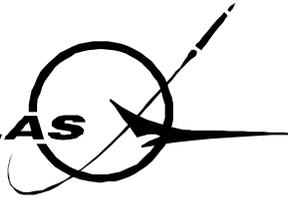


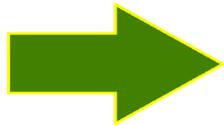
MCDONNELL DOUGLAS



AIR-4.1.2
AV-8B HARRIER CLASS DESK

Open Systems Ada Technology Demo
Open Systems-Joint Task Force
WALCOFF AUDITORIUM
29 May 1996
FAIRFAX VA

Maj. Glenn Hoppe
AV-8B CLASS DESK
Don Winter
MCDONNELL DOUGLAS AEROSPACE



BACKGROUND

- TECHNICAL DETAILS
- FY97 RECOMMENDATIONS
- SUMMARY

GENERAL PROBLEM:

- Use of COTS is growing in military embedded applications
- Ada 95 is language of choice where COTS/GOTS can't be applied
- Mixed language situations may arise as a result
- Risk reduction demonstrations are called for, employing Ada 95 in COTS RT environment (POSIX, C)

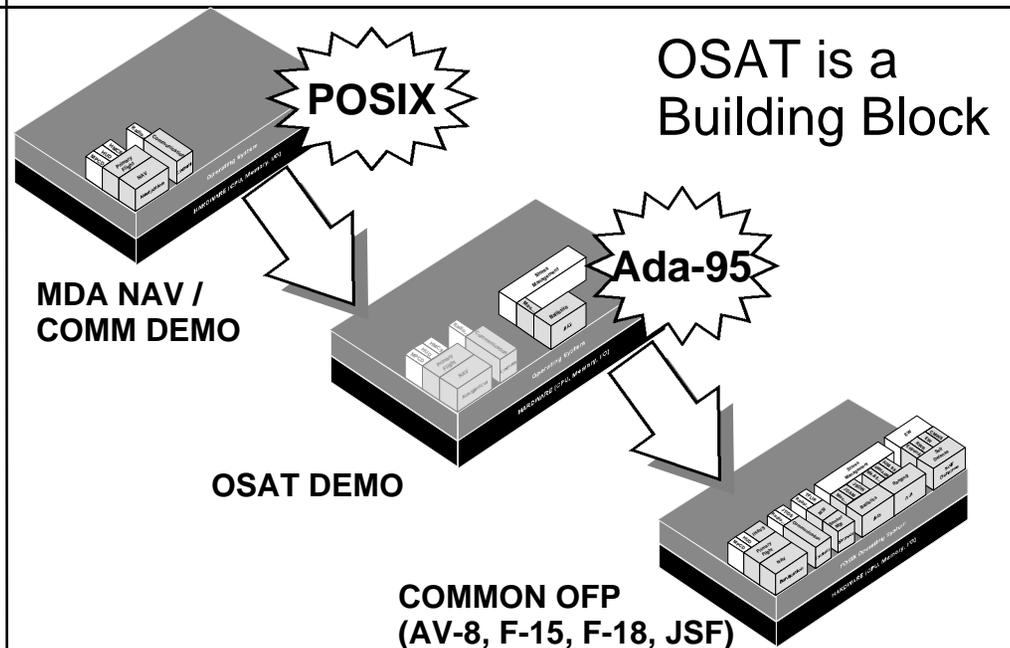
SOLUTION:

McDonnell Douglas Aerospace will:

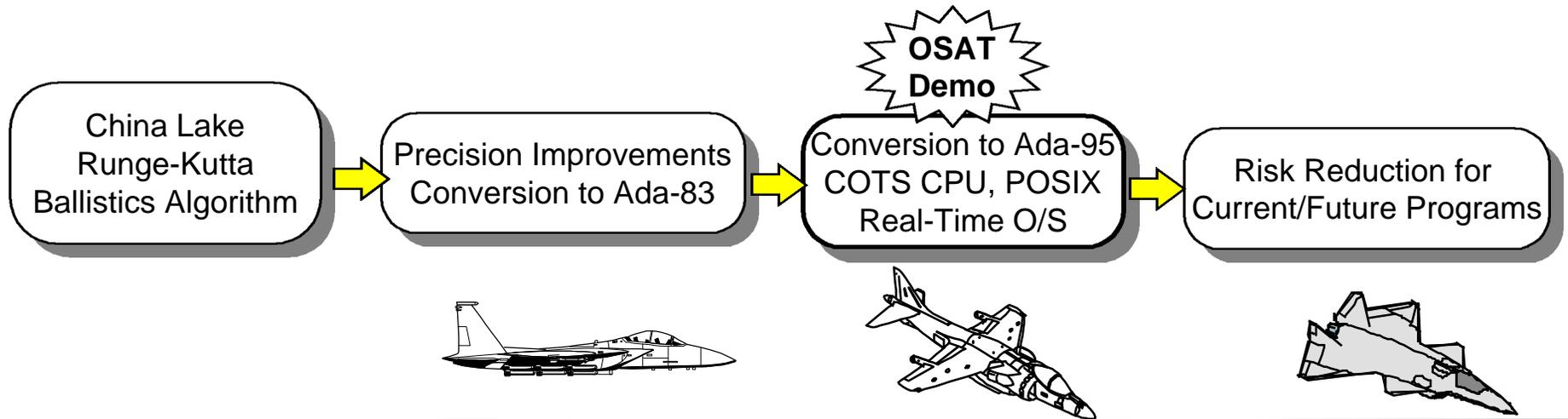
- Develop an air-to-ground ballistics algorithm using Ada 95
- Link this algorithm into the AV-8B demonstration OFP (C, C++)
- Perform a flight demonstration on an AV-8B equipped with COTS MC, POSIX-compliant RTOS
- Apply/evaluate Wright Lab DFIP

BENEFICIARIES:

- AV-8B OSCAR
- F-15 MPDP Upgrade
- F/A-18 Blk 18E
- C-17 CIP
- Joint Strike Fighter

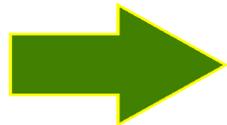


OPEN SYSTEMS ADA TECHNOLOGY DEMONSTRATION



- **RE-ENGINEERED F-15 RUNGE-KUTTA ALGORITHM**
 - ADA 95, OBJECT-ORIENTED DESIGN
 - DFIP FAULT TOLERANT INPUT/OUTPUT PROCESSING
- **COTS RUN-TIME ENVIRONMENT**
 - POWER PC MISSION COMPUTER
 - POSIX-COMPLIANT OPERATING SYSTEM (VX WORKS)

- **BACKGROUND**



- **TECHNICAL DETAILS**

- **FY97 RECOMMENDATIONS**

- **SUMMARY**



OSAT DEMONSTRATION



AIR-4.1.2
AV-8B HARRIER CLASS DESK

Software Development Tasks

- **Reengineer/rewrite F-15 Runge-Kutta (Ada83) ballistics algorithm**
 - Object-oriented design in accordance with MDA Common OFP architecture
 - Code in Ada95
 - POSIX-compliant RTOS (VX Works)
 - PowerPC host
 - Implement DFIP input and output algorithms
- **Integrate with AV-8B demo (C) OFP, C++ NAV module**
 - Enhance demo OFP to add A/G
 - Transform to/from platform coordinates
 - Accommodate 20 Hz algorithm (legacy code is 10 Hz)
 - Hard code Mk 76 Practice Bomb ballistics



DEMONSTRATION ENVIRONMENT



AIR-4.1.2
AV-8B HARRIER CLASS DESK

- **TAV-8 CUM 6 WILL BE DEMONSTRATOR AIRCRAFT**
 - BASED AT NAWC-CL
- **XN-6 MISSION COMPUTER WILL BE REPLACED WITH POWER PC-BASED UNIT**
 - SUPPLIED BY CDI
- **WIND RIVER VX WORKS RTOS (POSIX-COMPLIANT)**
- **BASELINE OFP WILL BE MDA C-OFP WITH C++ COMMON NAV/COMM MODULES (USED FOR MDA DEMO FLIGHT)**
- **GREEN HILLS ADA 95 NATIVE AND CROSS COMPILERS**
- **FLIGHTS WILL BE CONDUCTED AT CHINA LAKE**
 - MK 76 DROPS WILL OCCUR AT CHINA LAKE'S TEST RANGE



OUTLINE



AIR-4.1.2
AV-8B HARRIER CLASS DESK

- **BACKGROUND (AGENT BRIEFS)**
- **TECHNICAL DETAILS**
- **FY97 RECOMMENDATIONS**
- **SUMMARY**

- **BACKGROUND (AGENT BRIEFS)**
- **TECHNICAL DETAILS**
- ➔ **FY97 RECOMMENDATIONS**
- **SUMMARY**



PROJECT SCHEDULE



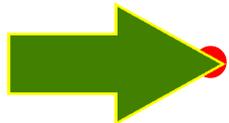
AIR-4.1.2
AV-8B HARRIER CLASS DESK

ID	Task Name	1995				1996				1997				1998				1999			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3													
1	COFP																				
2	Define and Acquire OO Toolset																				
3	Achieve proficiency with new toolset																				
4	Requirements Tool Decision																				
5	Architecture Development																				
6	Initial Mission Computer (MC) Arch. Review																				
7	Detailed Arch. Review - A/A & A/G wpn, NAV pt/pt																				
8	Detailed Arch. Review - all Common MDA MC S/W																				
9	Navigation																				
10	Point to Point Steering																				
11	A/G Weapons (Targeting/Steering/Zones)																				
12	Ballistic																				
13	Gun																				
14	Rockets (OSCAR)																				
15	Maverick																				
16	GBU-10/12/24/28 (Laser)																				
17	GBU-15 (TV/IR)																				

FY97 RECOMMENDATIONS

- **COMPLETE ALL OSAT DEMO OBJECTIVES (\$200K REQ'D)**
- **OSAT FOLLOW-ON CANDIDATES:**
 - **DISTRIBUTED PROCESSING DEMONSTRATION (MULTIPLE POWER PCs)**
 - **POSIX/ORB/ADA 95**
 - **IMPLEMENT/DEMONSTRATE F-15 ZAP MISSILE ALGORITHM**
 - **5-DOF MISSILE FLY-OUT ALGORITHM**
 - **REDESIGN USING ADA 95, OBJECT-ORIENTED DESIGN**
 - **DEMONSTRATE OFF-BOARD LINK PROCESSING**
 - **AUTOMATIC TARGET HAND-OFF SYSTEM (ATHS)**
 - **ELEMENT OF MULTI-SENSOR INTEGRATION**
 - **IMPLEMENT/DEMONSTRATE OTHER COMMON OFF COMPONENTS USING ADA 95**

- **BACKGROUND (AGENT BRIEFS)**
- **TECHNICAL DETAILS**
- **FY97 RECOMMENDATIONS**
- **SUMMARY**



SUMMARY



- **OSAT BUILDS UPON MDA'S COMMON OPF IRAD AND OFFERS REAL RISK MITIGATION**
 - **BENEFICIARIES INCLUDE ALL AVIONICS PROGRAMS EVOLVING TOWARD OPEN SYSTEMS AND/OR ADA 95**
- **DFIP ANALYSIS AND TEST HAS IMMEDIATE PAYBACK POSSIBILITIES**
 - **ENHANCEMENT TO COMMON BALLISTICS MODULE TARGETED FOR AV-8B, F-15, F/A-18, JSF**
- **FY97 FOLLOW-ON OBJECTIVES SHOULD ADDRESS OTHER KEY RISK AREAS**
 - **DISTRIBUTED PROCESSING**
 - **NEW FUNCTIONALITY (E.G. OFF-BOARD DATA)**