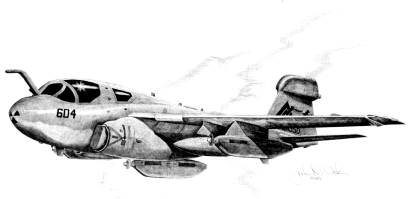
EA-6B Weapon System Support Laboratory (WSSL) Simulations



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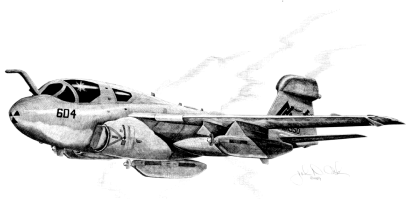
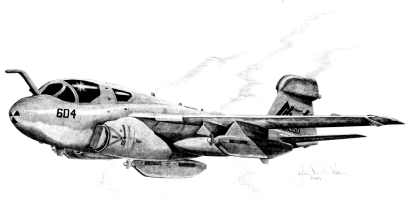


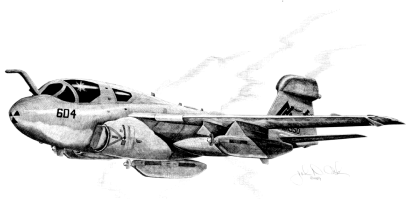
- EA-6B Simulation Summary
  - Basic Architecture
  - Avionics
  - Navigation
  - Threat Environment
  - Data Analysis
- Simulation Development and Testing
  - Development
  - Test and Update Process
  - Discrepancy Reporting, Tracking and Version Control

Basic Architecture



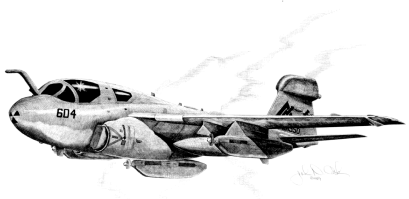
- VME based client server protocol
  - real time server applications run on VME based Alpha processor running VxWorks operating system
  - client applications run under Microsoft Windows and X-Windows (VMS and UNIX), communication to server via TCP-IP
- Hardware specific signals generated by use of COTS VME boards
  - synchro
  - analog
  - digital
  - Mil-std 1553 A and B
  - Arinc-429
- Relay switching between actual hardware and simulation controlled by Alpha

Avionics



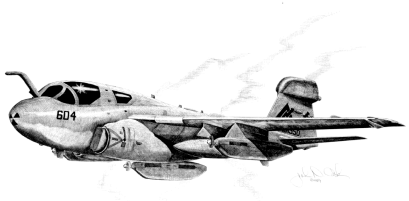
- Due to inability or difficulty in stimulating actual avionics some boxes are simulated, while others are simulated for convenience
  - AN/ALQ-99 Jamming pods
  - Navigation
    - CAINS, EGI, MAGR, AHRS, SCADC
  - Raymond Recorder Set (RRS)
  - Mission Data Loader (MDL)
  - Link 4A
  - HARM Block 6

AN/ALQ-99 Pods



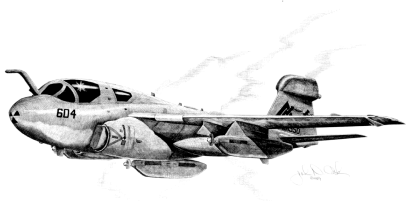
- Universal Exciter (UE) or Universal Exciter Upgrade (UEU) simulation
  - simulates up to 5 pods with 10 transmitters
  - supports all existing transmitters (1,2,4,6,7,8,9 and 10) as well as Low-Band Transmitter
  - allows antenna steering failures
  - allows power loss failures
  - status and failures in 1553 messages can be set

Navigation



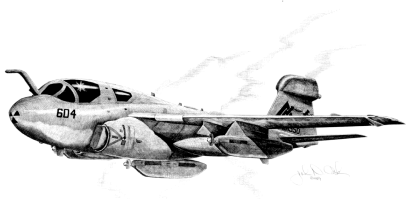
- AN/ASN-130A CAINS and AN/ASN-172 EGI including 1PPS signal
- AN/ASN-50 Attitude Heading Reference System
- Simulates Miniaturized Airborne GPS Receiver as used Block 89 aircraft
- CPU-140/A SCADC
  - Simulations do not attempt to reproduce internal processing
  - Only fields required for current OFP operation are modeled
  - status and failure bits can be set

Navigation



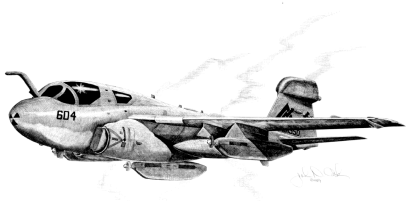
- Navigation avionics are controlled by one or a combination of several methods
  - Stick and Throttle
    - allows user to interactively fly the aircraft
  - Static
    - preset values are determined and do not change with time
    - allows failures to be set
  - Dynamic
    - a user defined flight path is used to determine output values
  - IMUX replay
    - uses IMUX recorded navigation data to determine output values
  - TACAN station and ILS simulations
    - support TACAN and ILS modes of EFIS navigation

Load Devices



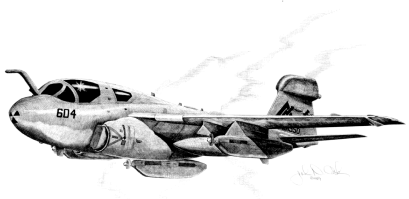
- In general simulation of load devices simplify development and test efforts by eliminating dependence on RRS tapes and DDS cartridges
- RRS simulation
  - Due to the lack of reliability and availability of RRS tapes the RRS is simulated in the WSSL
  - Computer loading is faster
  - Utility functions allow reading and writing of RRS tapes
- MDL simulation
  - Allows faster development and test by eliminating the need to reprogram DDS cartridges
  - Utility functions also allow reading and writing of DDS cartridges

Link 4A



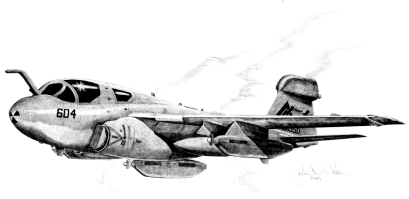
- Simulates Link 4A input to AN/ASW-25 receiver
  - used for Carrier Inertial Alignment
  - Airborne Data Link Strike Attack Vector
- Custom VME circuit
  - COTS base card
  - Intel 87C51 microcontroller based

Threat Environment



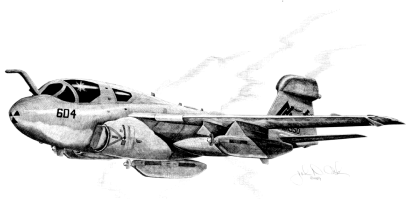
- Video ATEWS
  - generates video and emulates ALQ-99 receivers for bands 1,2,4,6,7,8,9 and 10
- Electronic Order of Battle
  - DMA map based simulation allows user to define threat platform locations
  - links to ATEWS for threat signal generation
  - generates flight profiles
    - CDNU compatible flight plan
    - control file for dynamic navigation
  - monitors actual flight path when used with stick and throttle or IMUX replay

Data Analysis



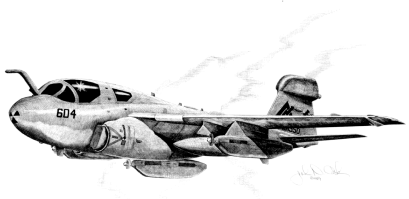
- IMUX
  - data collected via IMUX analyzed using ITAS software package
- PASS-1000
  - Mil-std-1553 and Arinc-429 data collected and analyzed by SBS technologies PC based hardware
- Custom Programs
  - VME Mil-std-1553, Arinc-429 and serial interface to HARM 10.4 khz
  - fully parses and interprets in engineering units as well as graphical bitwise representations
    - HARM handoff
    - UE/UEU main data word

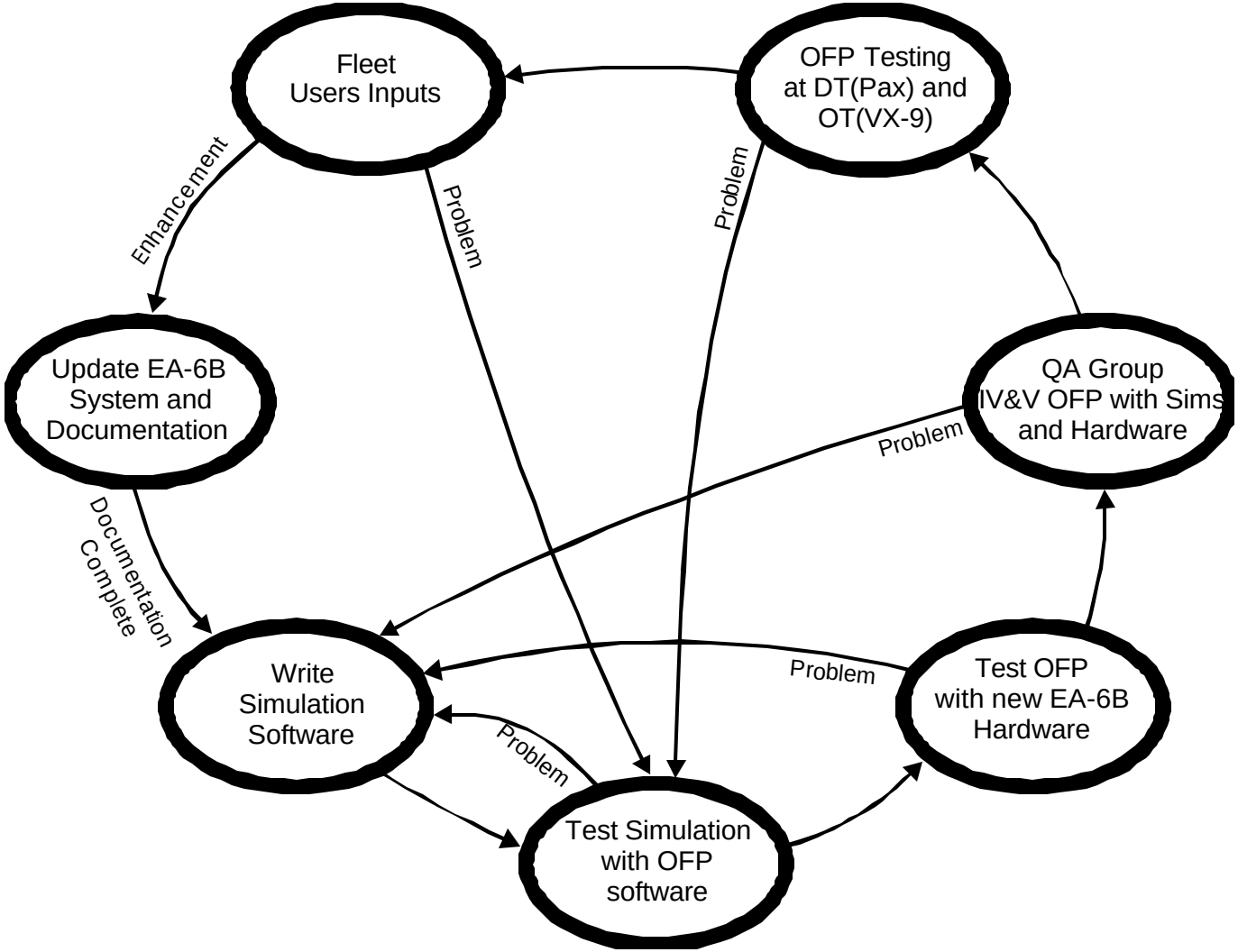
Simulation Development



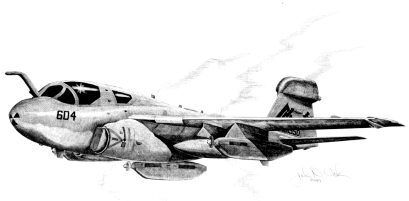
- Developed prior to availability of new hardware/software
- Developed with new system interface specifications
- Simulation is debugged with the new OFP software
- OFP is updated when tested with actual hardware
  - These changes are then updated in the simulation and re-tested on the OFP.

Test and Update Process



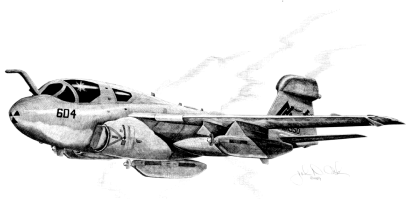


Discrepancy Reporting, Tracking and Version Control



- WSSL Discrepancy/Enhancement Forms
  - Available in the WSSL to report problems
- Software Version Control
  - Maintain Version descriptions within the source code for both Client and Server sides
- Problem Tracking System
  - Currently implementing an Intranet based Access database for Discrepancy/Enhancement inputs

Summary



- 15 years of development has resulted in a set of scenario generation, aircraft simulations and data analysis tools that serves both the aircraft S/W and H/W integration and test environments
- The Simulation Verification and Validation process has evolved over time to the current process
- There is a good working relationship between OFP engineers, system engineers, and simulation engineers
- Since these Simulations are used only for development and initial testing, there have no formal attempts at Accreditation.