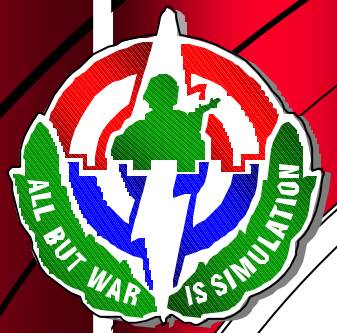
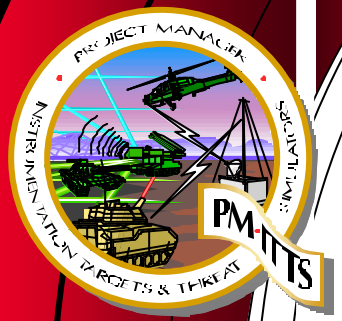
U. S. ARMY
TARGETS MANAGEMENT OFFICE





OVERVIEW OF
TMO
INTEGRATED AVIONICS PROGRAM

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Integrated Avionics Program

Common Avionics Package (CAP) & MQM-107 Electronics Re-design

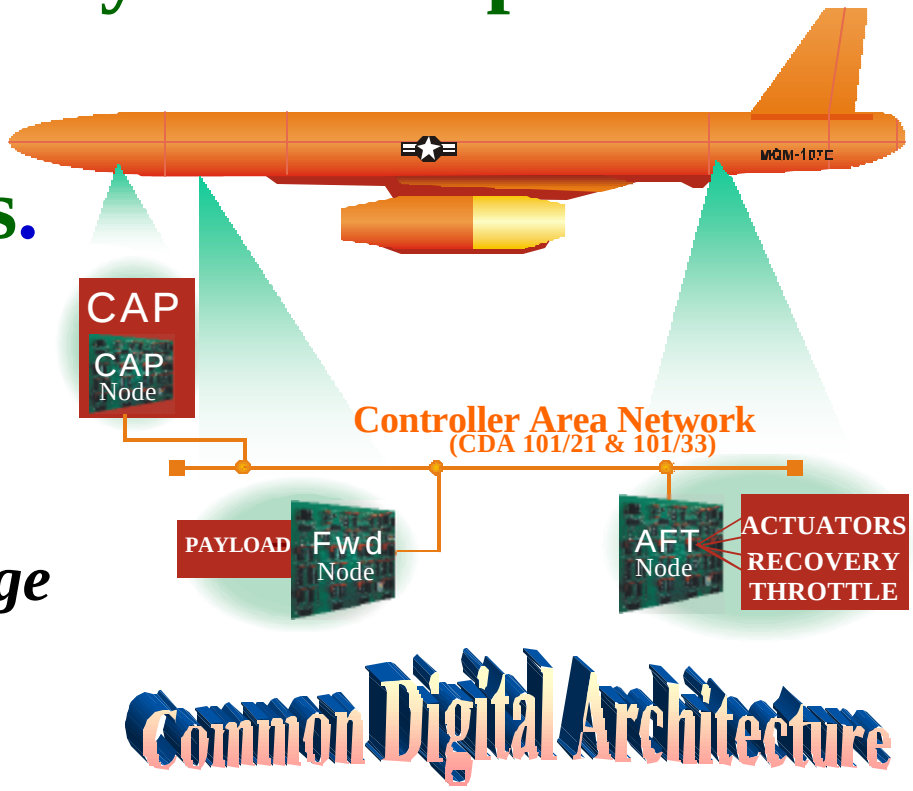
TMO

PM-ITTS

Integrated Avionics Program

Description of Program

- **IAP is an "umbrella" program to redesign the Target's Control System components to reduce cost, weight, and complexity of the aircraft avionics.**



The MQM-107 IAP consists of three main units:

- ***Common Avionics Package***
- ***Forward Node***
- ***Aft Node***

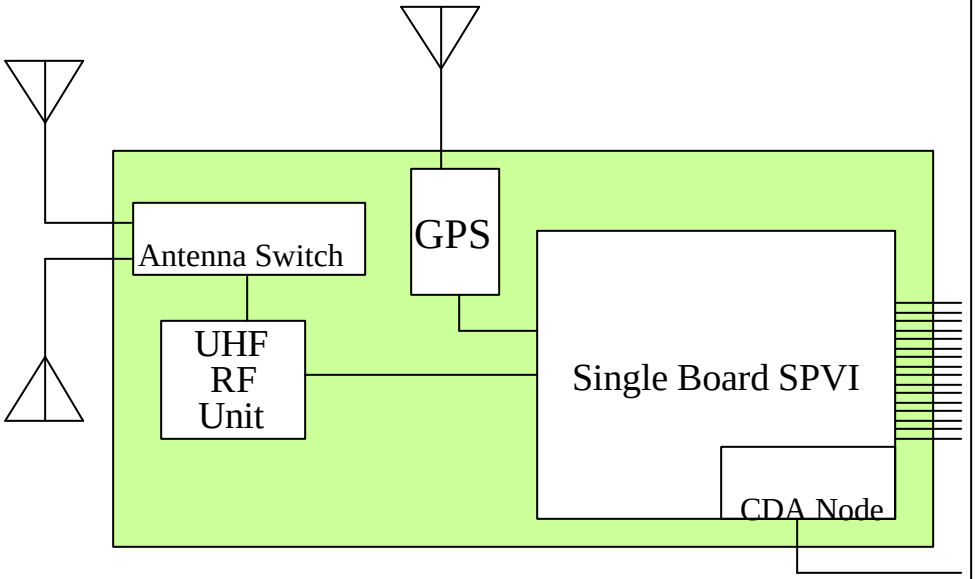
CDA Background Information

Common Digital Architecture Program is an initiative to replace bulky & costly point-to-point wiring with single bus network

Why CAN?

- **CAN = Controller Area Network**
  - Automotive standard developed by BOSCHE Automotive.
  - Now proliferated throughout the world.
- **Proven in Automobiles & Heavy Machinery**
- **Inexpensive & Reliable**
  - Many other communications systems either too expensive or not reliable enough.
  - 1 undetected error in 800 yrs@ 125 Kbit/s
- **Availability**
- **Reconfigurable**

Model 99 -- *Universal*
Signal Processor Vehicle Interface



- ***Each Target Requires Target Specific Interface Cable & Target Specific Software.***

Flight tested in September 2001

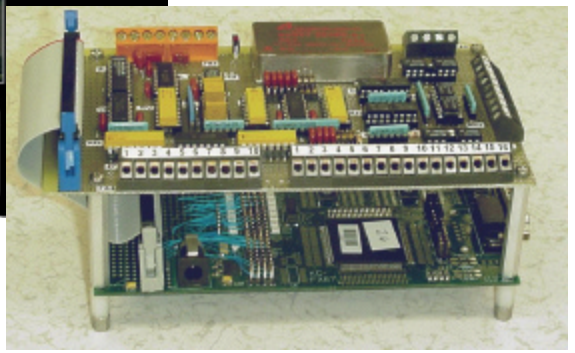
Model 99 -- *Universal*
Signal Processor Vehicle Interface

- Interface virtually any aerial or ground target with a target-specific interface cable & software.
- Can be reprogrammed with a laptop.
- Allow CDA compliant devices to be controlled by the Target Tracking Control System (UHF).
- The USPVI replaces the current Army Aerial Target Group Set (SPVI, Antenna Switch, Transponder)
- Current SPVIs contain up to 7 boards. The USPVI contains a single board, GPS receiver, and transponder.

Cost of the USPVI is 30% of the TGS!

CDA Integration Test Flight

- Laboratory Simulation and analysis of CDA.
- Develop CDA flight nodes for Autopilot control and actuator functions.
- Use USPVI CDA interface.
- Flight test 26 September 2001.
- Proof of Principal for CDA flight control.



Integrated Avionics Program

What's the next step?

- Develop new avionics packages based on CDA network technology.

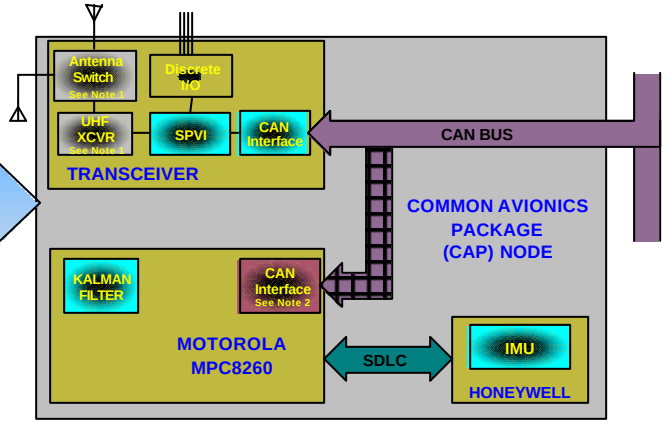
Combine functions, update circuits, reduce size, weight, and cost.

Integrated Avionics Program
Common Avionics Package

Common Avionics Package (CAP):

- The CAP makes use of the hardware and software developed for the USPVI.
- The CAP will communicate to the target via the CDA bus interface.
- Replacement for Vehicle Interface, Autopilot, Transponder, Antenna switch, Gyros, Baroaltimeter, and Pendulum.
- Also houses the 12 Channel GPS unit.

CAP Development Funded by TMI Program

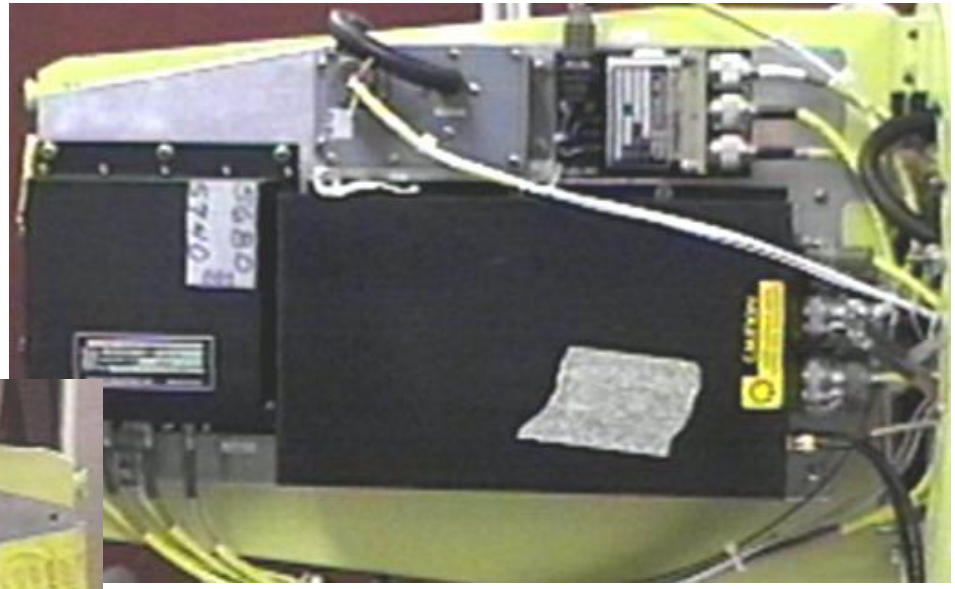


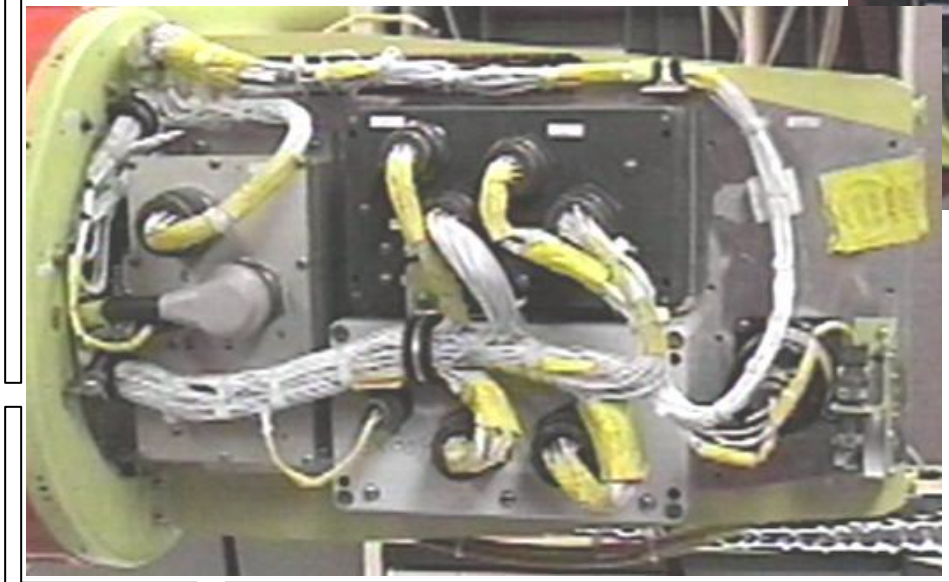
FWD, AFT Node Development & Test Funded by TMO Engineering

Integrated Avionics Program

Common Avionics Package

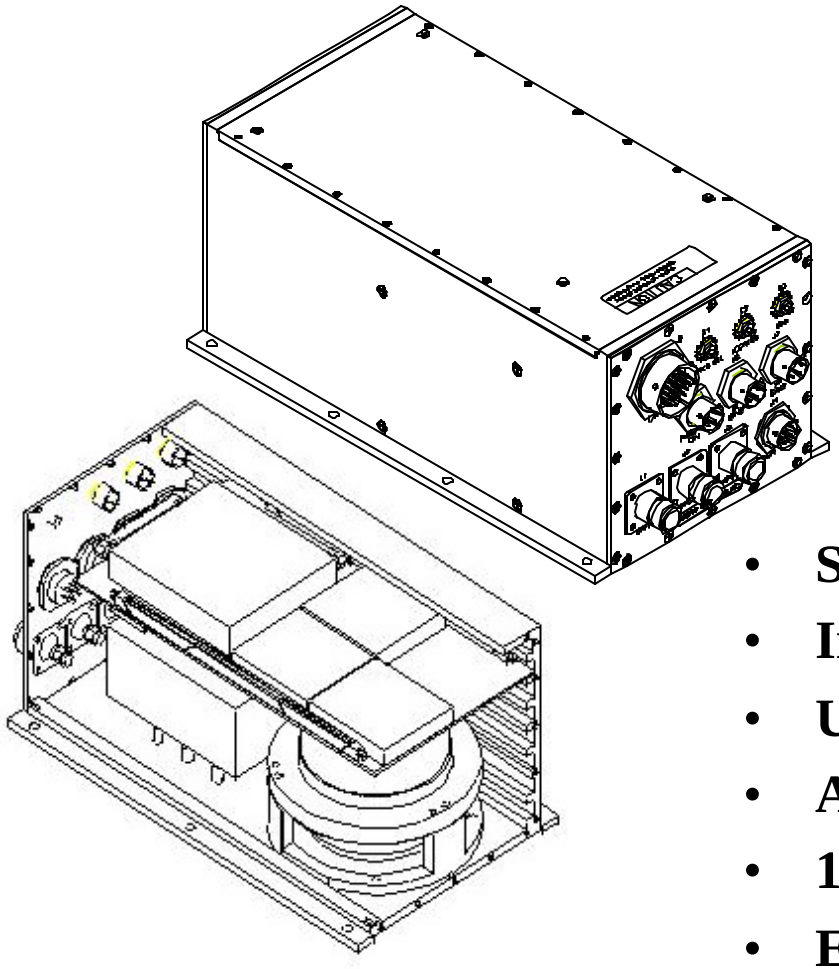
- **SPVI**
- **Autopilot**
- **Transponder**
- **Antenna Switch**
- **Gyros**
- **Pendulum**
- **Baroaltimeter**





Integrated Avionics Program

Common Avionics Package



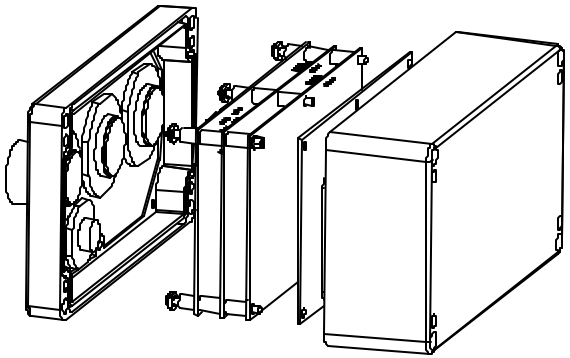
- **Single board DAP and SPVI functions**
- **Inertial Measuring Unit (IMU)**
- **UHF RF transponder**
- **Antenna Switch**
- **12 Channel Differential GPS unit**
- **External Test ports**

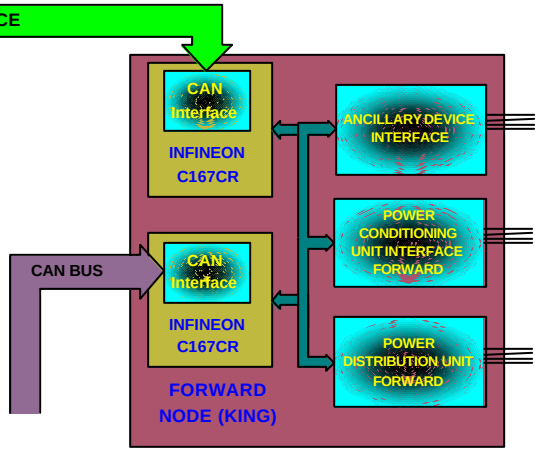
Integrated Avionics Program

Forward Node

Forward Node (FN):

- Perform the functions of the Power Distribution Unit and the Payload PDU.
- Interface to other electronic modules in the forward areas of the MQM-107 as well as future CDA compliant devices.
- KING node on the CDA bus.
- Same physical size as the PDU.

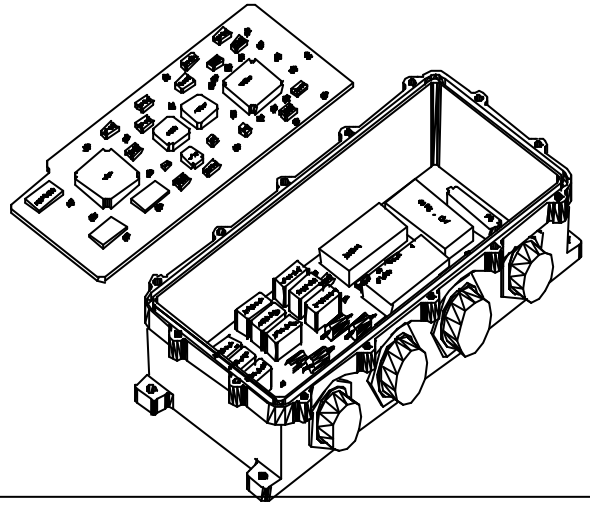


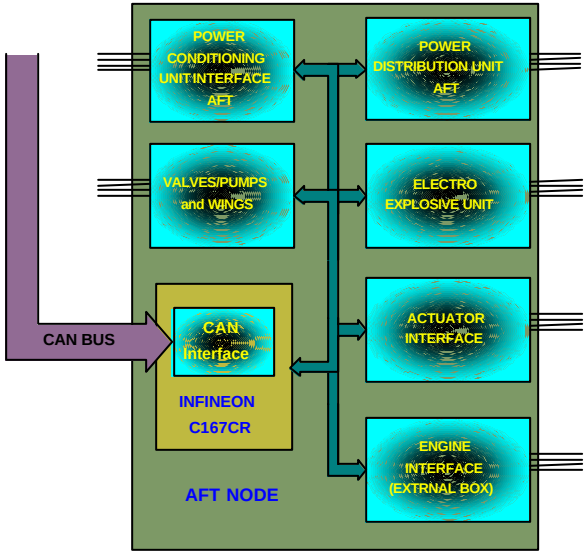


Integrated Avionics Program

Aft Node

- ***Aft Node (AN):***
  - Replaces the current Electro-Explosive Device unit.
  - PDU functions for the Wings and Aft of the Aircraft.
  - Interface to the control surface actuators.
  - Same form factor as current EED.



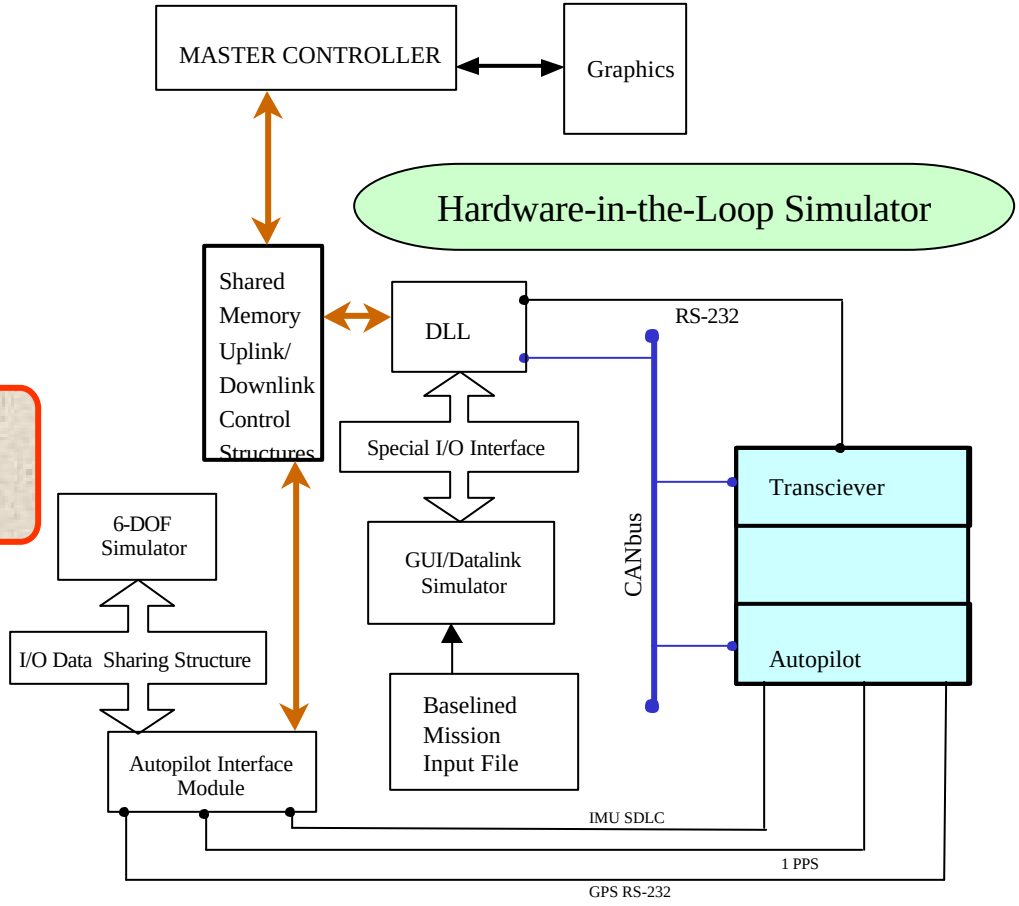


IAP Testing

Software-in-the-loop Testing

Hardware-in-the-loop Testing

Flight tests.



Cost Savings

MQM-107 Estimated with IAP

	Current Cost	Est. Future Cost
Common Avionics Pkg (qty 25)		$ 22,000.00
Tgt Group Set-(SPVI, Ant Sw., Transponder)	$ 35,000.00	
Vertical Gyroscope	$ 7,200.00	
Pendulum Assembly	$ 700.00	
Yaw Rate Gyroscope	$ 1,500.00	
Power Distribution Unit/Fwd Node	$ 4,000.00	$ 4,500.00
Electro Explosive Device/Aft Node	$ 6,000.00	$ 4,500.00
Autopilot	$ 10,000.00	$ -
Baroaltimeter	$ 2,000.00	$ -
Wiring & Connectors (Matl & Labor)	$ 19,000.00	$ 5,000.00
TOTAL COST	**$ 85,400.00**	**$ 36,000.00**
ESTIMATED COST SAVINGS	**(per Target)**	**$ 49,400.00**

CAP Replaces Target Group set, Gyroscopes, Pendulum, and Baroaltimeter

Space Savings

Estimated with IAP

AREA

Current Control Electronics 262 in^2

Estimate with IAP 78 in^2

184 in^2 (70%) SAVINGS

VOLUME

Current Control Electronics 964 in^3

Estimate with IAP 343 in^3

621 in^3 (64%) SAVINGS

Based on Existing Avionics v. IAP Avionics estimates

IAP Chronology

2001

- Specification Development
- Basic DAP software porting.
- Brassboard hardware development.
- Kalman Filter development.

2002

- Integration of IAP-DAP software & IMU.
- Develop IMU & IAP-DAP Simulations.
- Flight hardware development.

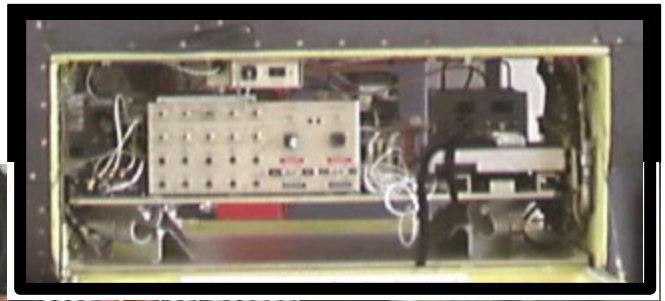
2003

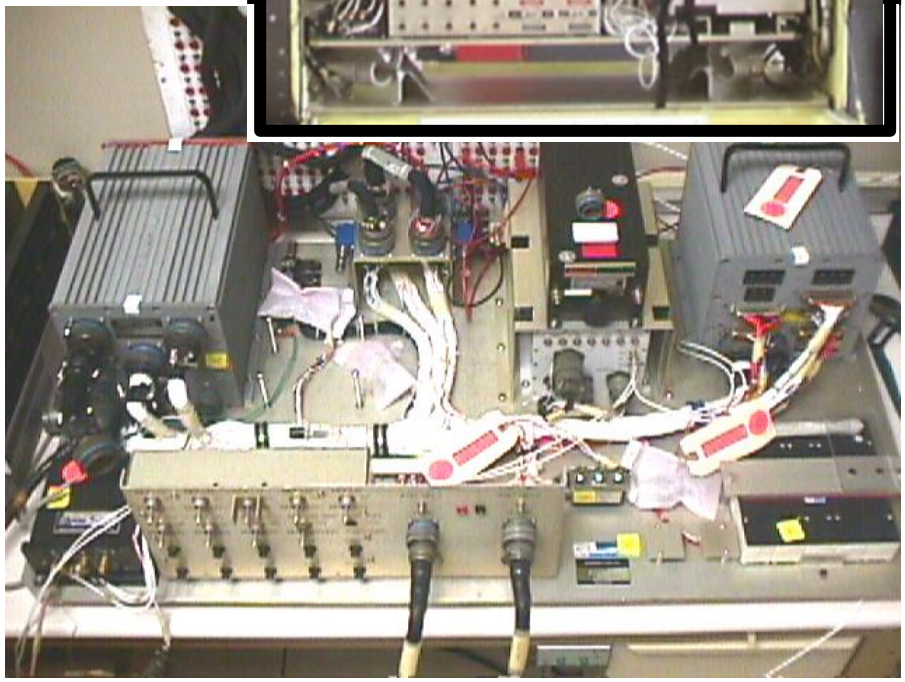
- Complete Software integration
- Laboratory Software-in-the-loop tests.
- Laboratory Hardware-in-the-loop tests.
- Flight tests.

Integrated Avionics Program

Universal Drone System

2004





- *UDS was developed to be capable of droning any helicopter.*
- *Result was complicated and expensive.*
- *CAP will be basis for redeveloping the UDS*
- *Expect to reduce unit count by 60% and cost by greater than 80%.*
- *Could recover development cost in as little as 4 droned helicopters.*

IAP SUMMARY

- Contractor format TDPs for CAP, FWD and AFT Nodes.
- Tested, proven design.
- CAP will be basis for next generation Universal Drone System for Helicopters.
  - Estimated 80% cost savings over current UDS.
- At conclusion of program, CAP will be ready for production.
- Puts CDA to practical use.