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RePLACE™

Reconfigurable
Processor for
Legacy
Avionics
Code
Execution

A Software Solution for Legacy System Upgrades

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Today's Situation

- Key military aviation areas of concern
  - Aircraft procurements down, force structure reduced
  - Existing and older technology is being forced to meet new requirements
  - Current avionics pressed to keep pace with requirements

- **Fewer people doing more with outdated systems**

- Existing avionics need improvements to:
  - Keep mission capable A/C flying longer at reduced cost
  - Solve parts obsolescence problems
  - Meet new/changing mission requirements

Software re-write is a major cost and risk factor

What Can Be Done? - *A Cost Effective, Lower Risk Approach to Avionics Upgrades*

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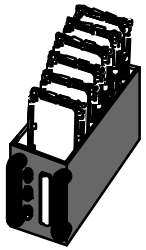
Reconfigurable **P**rocessor for **L**egacy **A**vionics **C**ode **E**xecution

RePLACE™ The Enabling Technology

Modernize + **Maintain Capability** + **Add functionality**

Change the H/W

Form - Fit - Function
COTS replacement



- Capitalize on technology advances
- Replace current obsolete HW with open system standards

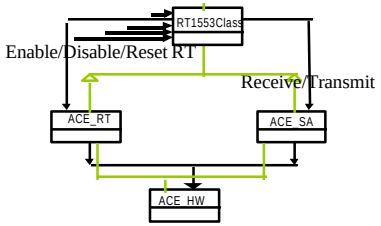
Save the Software

Current (Legacy)
Operational Flight Program
SW Code

- Preserve investment
- Set baseline for future enhancements

New Software

New Functions added to the
Operational Flight Program
SW Code in C++-ADA



- Incrementally add capability
- Rapid deployment
- Managed change, less risk

RePLACE™ - a Software Technology

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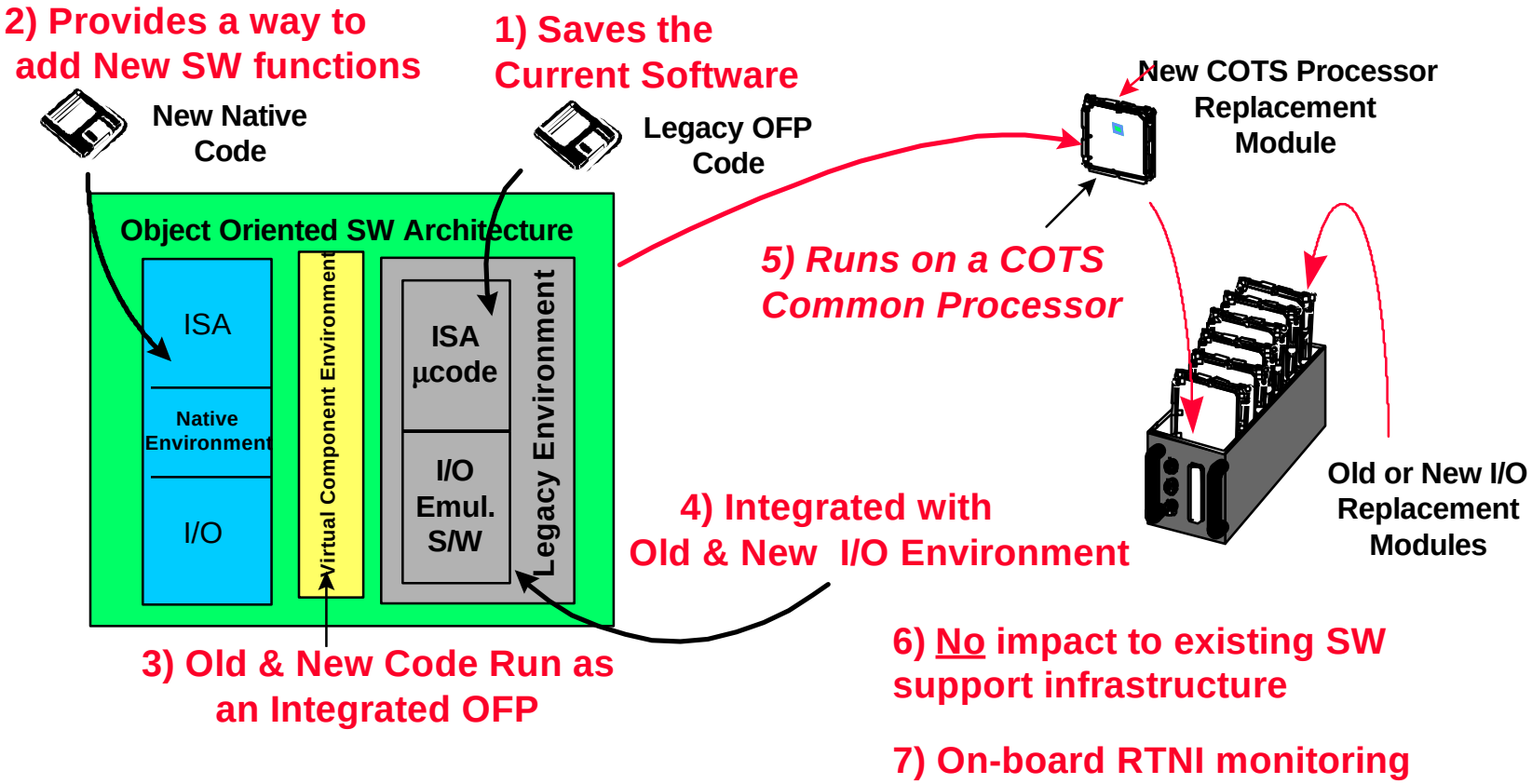
RePLACE™ is an* <u>Object Oriented Software Emulation Technology</u> *that ---



6) <u>No</u> impact to existing SW support infrastructure

7) On-board RTNI monitoring

RePLACE™ - the Technology

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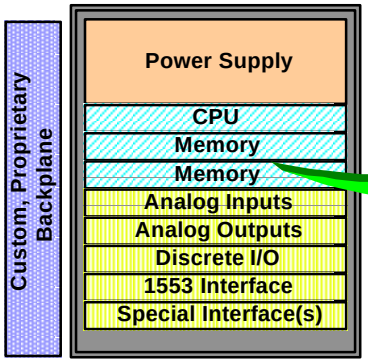
Current Legacy Embedded Computer



Custom hardware & backplane

Obsolete 16 bit instruction set

Little or no modern HOL support

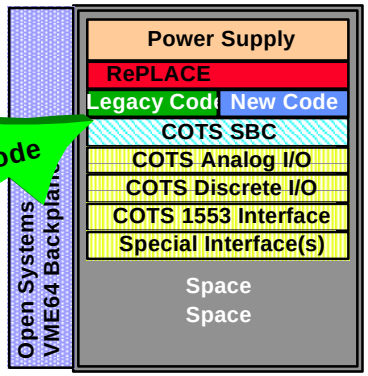
Max'd out throughput & memory

No real-time monitoring

Legacy Binary Code

"as is"

New Replacement



New Native Code (for new functions)

Low cost COTS, Open Systems

Runs *both legacy ISA & new 32/64 bit ISA*

Compatible with Ada95 & C++

***Faster* & more memory!**

Powerful real-time, non-intrusive monitoring capabilities

RePLACE™ Approach - Software View

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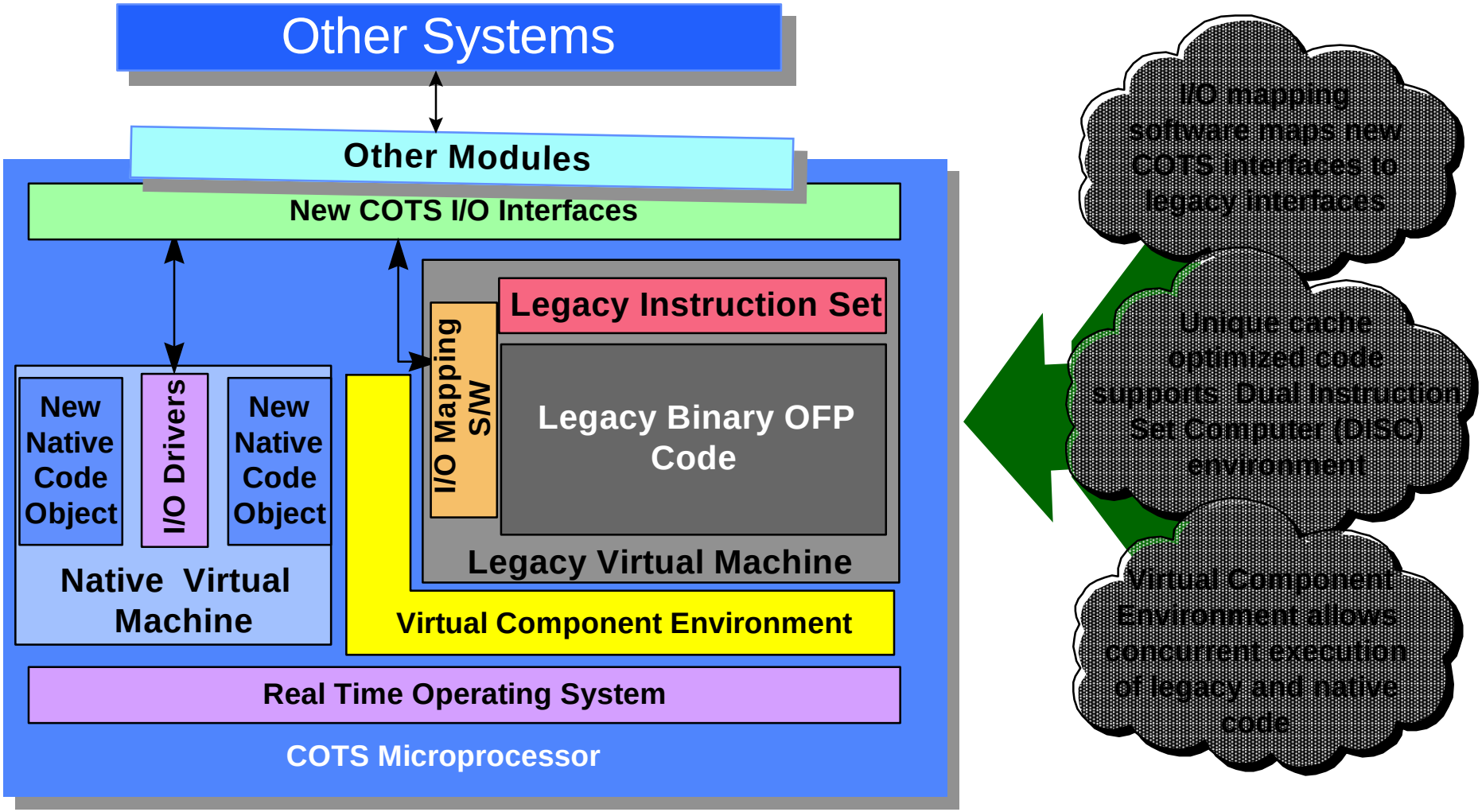

Upgrade Strategies with RePLACE™

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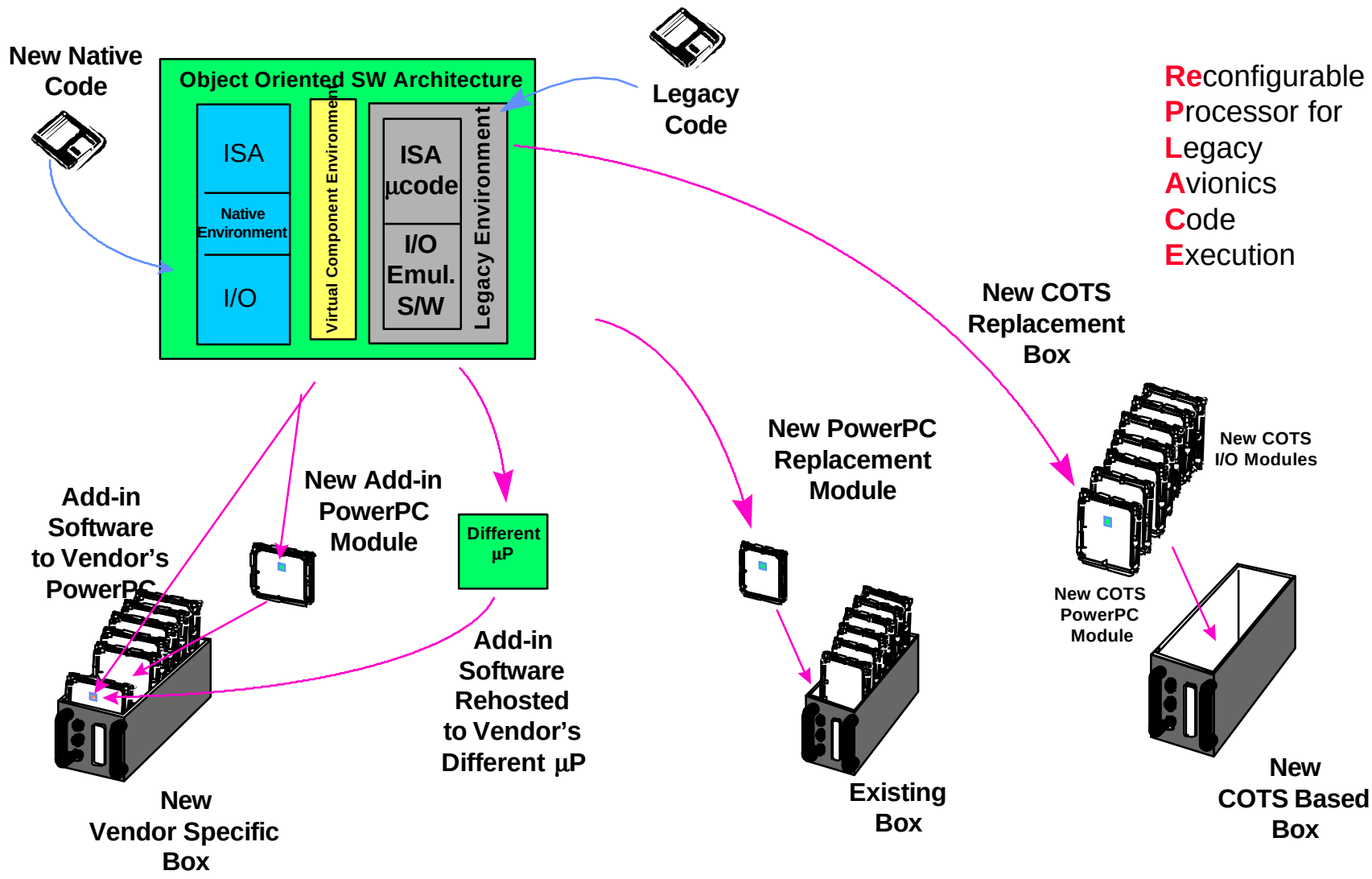

Comparing RePLACE™ to Other Upgrade Strategies

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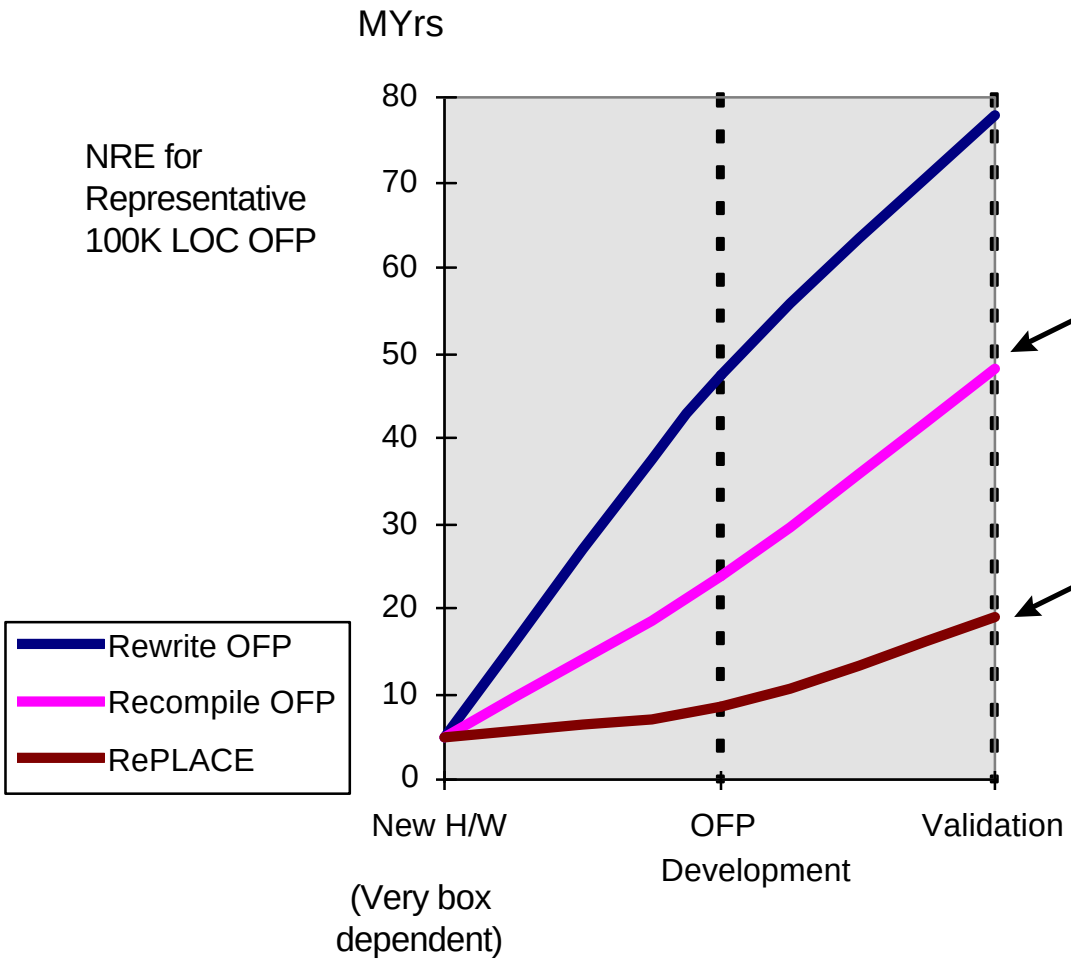

- ***Tools are available to perform this tradeoff for different opportunities.***

Must address
- **Machine Dependencies**
- **Tool Maturity**

And...
- **Incremental upgrades difficult**

Takes advantage of
- **Existing test plans and procedures**
- **Testing at the black box level**

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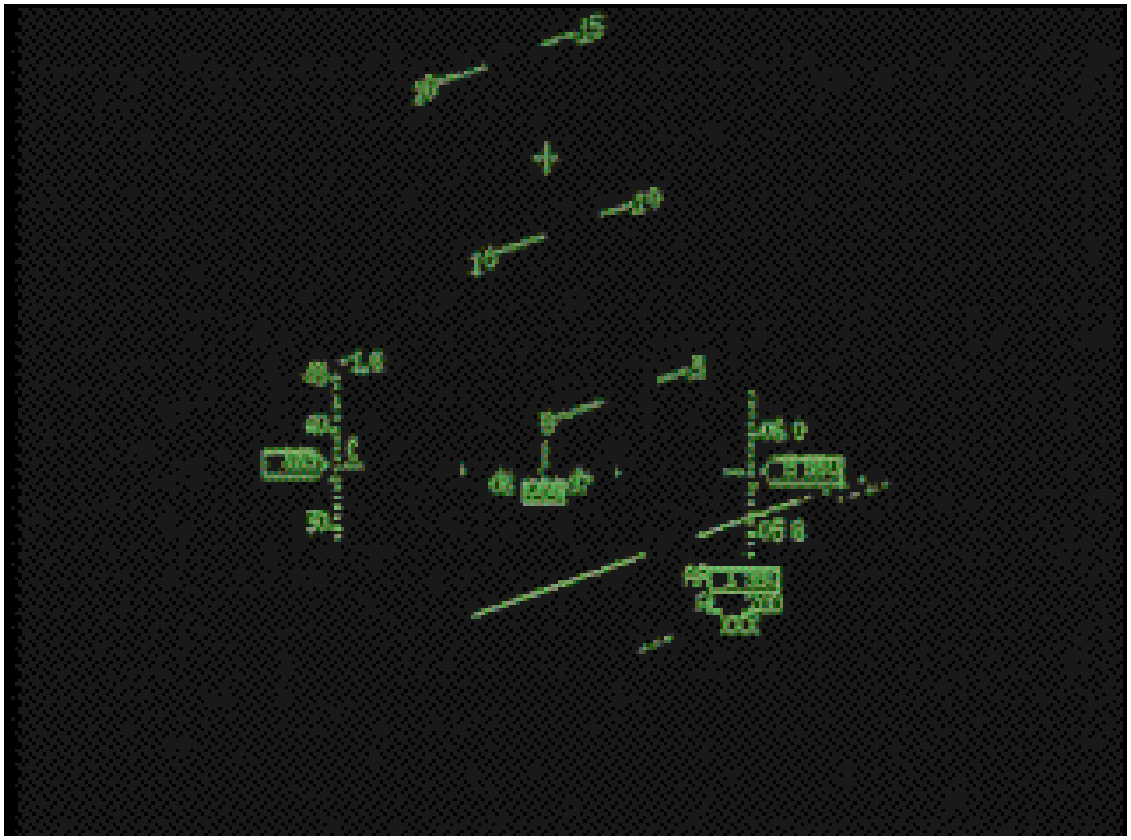
RePLACE™ Executing F-16 HUD OFP

Here's an example during a banking turn



- **Runs binary OFP unmodified**
- **10 X Improvement in throughput (10 Mips vs 1 Mip)**
- **Full 1750A Notice 1 implementation**
- **Instruction set validation completed using AF SEAFAC ATP & VSW**
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RePLACE™ Executing F-16 HUD OFP with New C++ Code Running Concurrently

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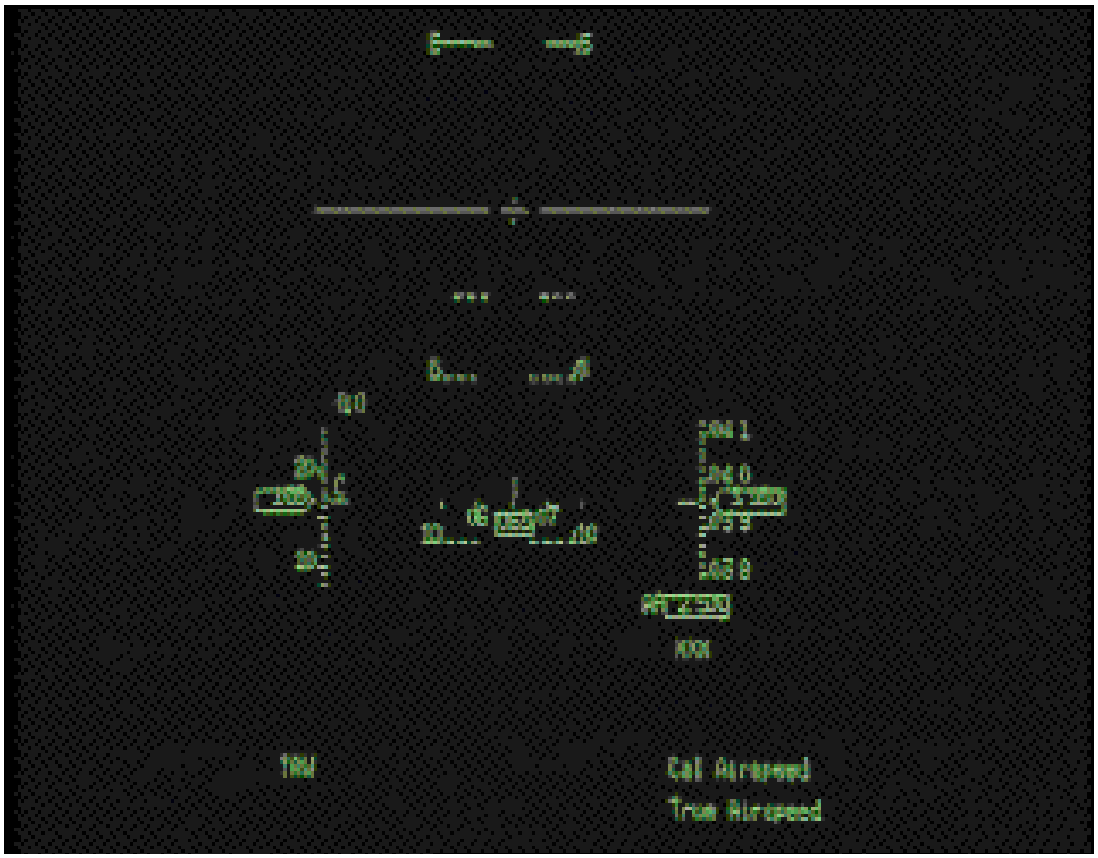
Running concurrently



Sharing data

Legacy code

- **Jovial & assembly code**
- **Compiled & linked for a MIL-STD-1750A**

New Native code

- **C++ code**
- **Compiled for a Power PC**

VIEWstation™ Software Support Toolset

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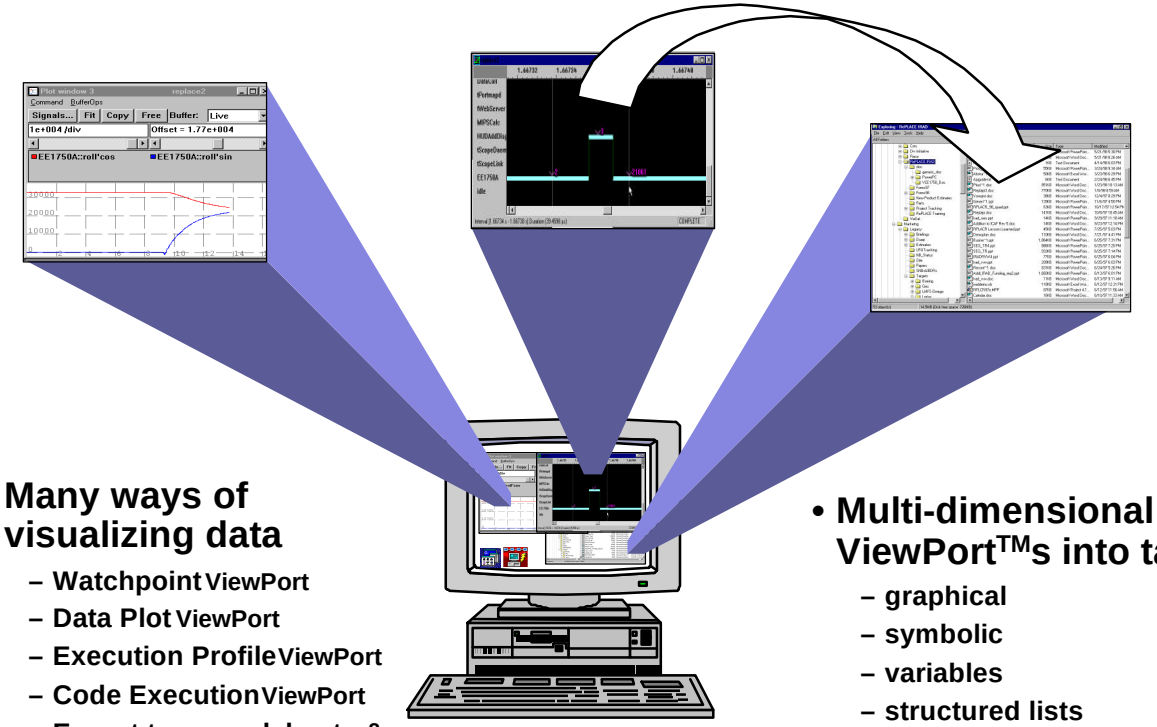
Portable, extensible, web-enabled set of Java Applets



- **Many ways of visualizing data**
  - **Watchpoint ViewPort**
  - **Data Plot ViewPort**
  - **Execution Profile ViewPort**
  - **Code Execution ViewPort**
  - **Export to spreadsheets & 3rd party tools**

- **Intuitive Desktop Paradigms**
  - **drag & drop**
  - **"Explorer"-like multi-pane displays**

- **Multi-dimensional ViewPort™s into target**
  - **graphical**
  - **symbolic**
  - **variables**
  - **structured lists**
  - **objects**
  - **messages**
  - **queues**
  - **execution events**
  - **performance**
  - **source & ass'y code flow**

- **Applets include:**
  - **VIEWmaster™** for session, event, and View specification & control
  - **BullsEye™** debug manager for control of interactive & scripted debug sessions
  - **EagleEye™** real-time monitoring & analysis manager
  - **CruiseMaster™** symbol browser & editor for interactive & automated symbol database exploring, query & control
  - **MixMaster™** RePLACE™ DISC configurator for interfacing native code objects to legacy OFP object(s)
  -

Application Summary

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RePLACE A cost effective solution

- **Lower development cost**
  - Reuses existing software (Preserves original investment)
  - Reduces regression testing
  - Establishes known good starting point for managed software upgrades
  - Supports incremental funding profiles
- **Lower sustainment cost**
  - Takes advantage of COTS-based, open systems hardware
  - Allows for migration path to modern software development environment
  - Offers software and system diagnostics through RTNI monitoring

Enables Affordable Avionics Upgrades

This Technology is Ready to Apply Today