

FAA Software Standardization Seminar

REUSE of Software Life Cycle Data



Software Reuse

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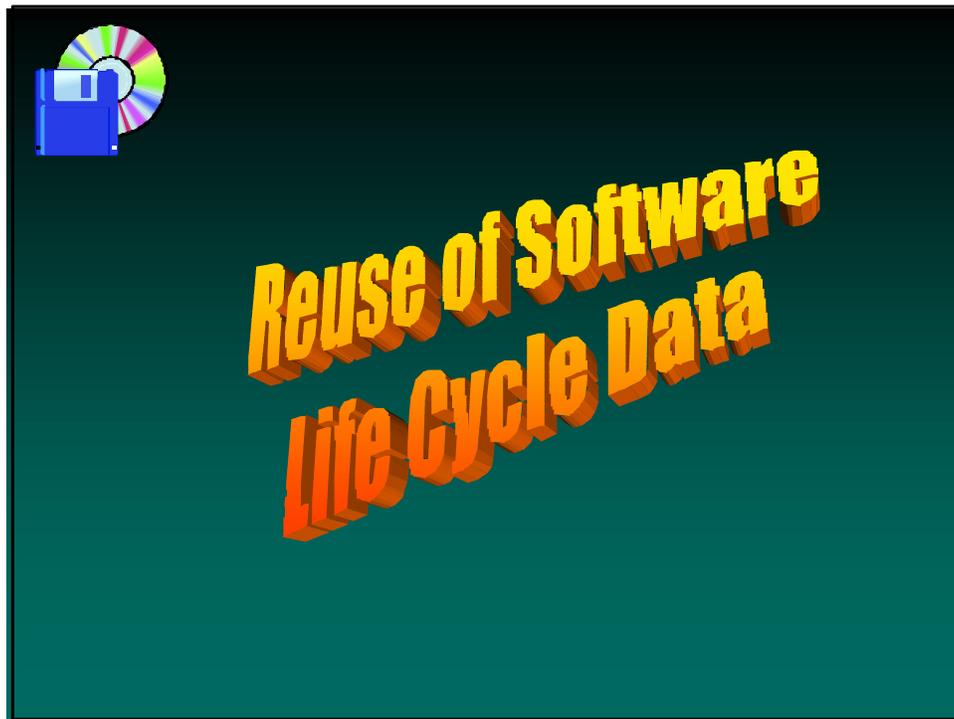


Several Efforts

- ❖ ***SSAC (Streamlining Software Aspects of Certification) Breakout Session
 - Draft Notice: “Guidelines for Reuse of Software Life Cycle Data”
- ❖ ***TRUST (Technical ReUsable Software Team)
 - Draft Position Paper: “Reuse of Software Components”
- ❖ RTCA/SC-182
 - Draft Document: “**MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR AVIONICS COMPUTER RESOURCE (ACR)**”

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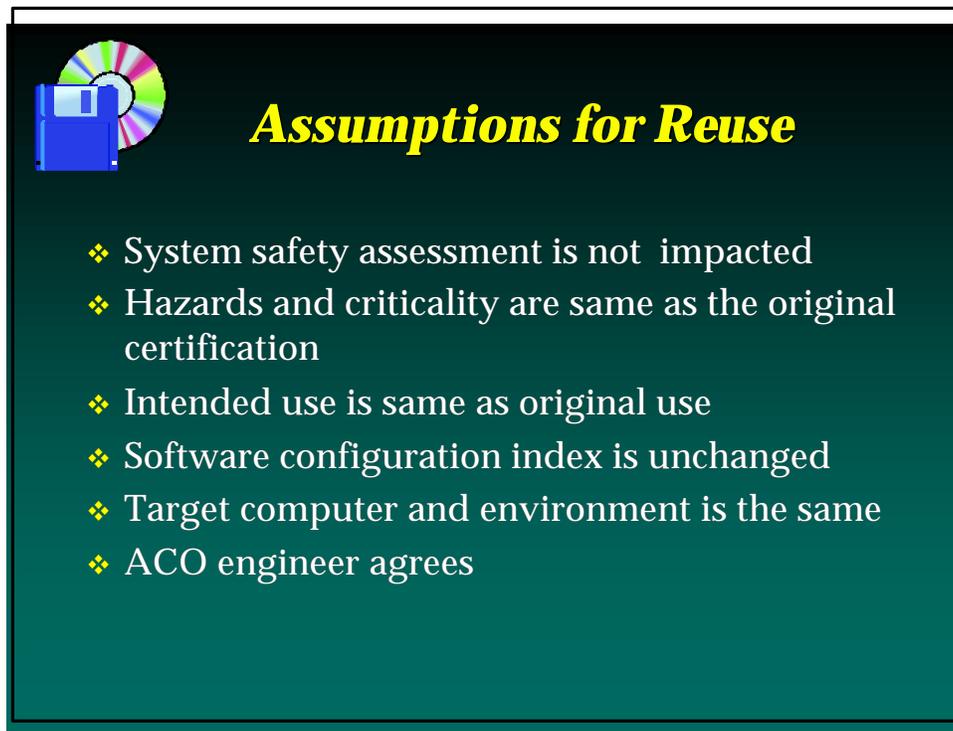
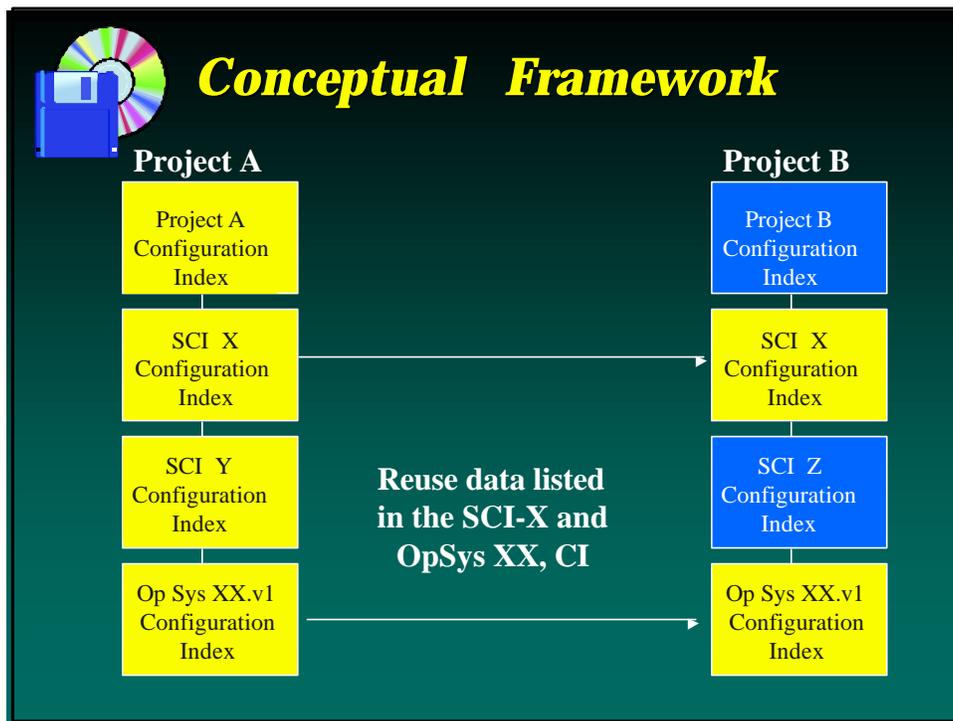


Background/Status

- ❖ Raised as an issue at January 1998 Software Streamlining Aspects of Certification (SSAC) Workshop
- ❖ Worked by team at May '98 SSAC Workshop - led by Cheryl Dorsey & Will Struck
- ❖ Very Draft Notice Submitted to FAA Oct. '98
- ❖ Currently being coordinated within FAA
- ❖ Put on hold while other reuse efforts evolved
- ❖ Targeted for completion in early 2001.

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Safety Considerations

- ❖ Intent is no review of data needed by ACO, so . . .
- ❖ To make sure that safety is addressed:
 - No effect on safety margins, operational capability or functions or crew workload should occur
 - Reused data should not change and should be applicable
 - Agreement with ACO early in project should be obtained



Factors Affecting Reuse

- ❖ In-service problems with previous uses does not exist
- ❖ Product and software complexity are manageable
- ❖ Similarity/identity of operational and development environments exist
- ❖ Change history and stability of the original product and software are in place
- ❖ Software is designed for reuse

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Items for Reuse Consideration

- ❖ Software Plans and Standards
- ❖ Requirements, Design and Code, if unchanged
- ❖ Verification, QA and CM data, if unaffected
- ❖ Software Configuration Indices, if unaffected
- ❖ Tool qualification data
- ❖ Software Life Cycle Environment Configuration Index



Packaging for Reuse

- ❖ Data should be packaged with the intent of reuse. For example:
 - Plans and standards applicable to all software projects
 - Build and package the software so it can be used on multiple projects
 - Tool qualification data separate for tools used on all software projects

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Packaging for Reuse (cont)

- ❖ Make individual configuration indices (CIs) for components that may later be reused
- ❖ Have the PSAC reference the reusable data items with a rationale for reuse
- ❖ Have the CI for the new product reference the software CIs to be reused
- ❖ Design the software components for reuse (high cohesion, low coupling)



Summary of Reuse of Software Life Cycle Data Effort

- ❖ Reuse of software life cycle data on multiple certification projects is feasible
- ❖ If a data item hasn't changed and is applicable for the current project, it is a candidate for re-use
- ❖ Present plan for reuse in PSAC and get early ACO agreement

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A slide with a dark green background. In the top left corner, there is an icon of a blue floppy disk and a colorful CD. The title "TRUST Background" is written in yellow, italicized font. Below the title, there is a bulleted list of three items.

TRUST Background

- ❖ TRUST = Technical ReUsable Software Team
- ❖ Started in January, 1999
- ❖ Joint Sponsors: AND-370 and AIR-100

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TRUST "Big Picture"



1. First Airborne Approval of ACI/ATNSI Router
2. Subsequent Airborne Approvals of Router
3. General Software ReUse (Beyond Router)
4. ReUse on the Ground
5. International Coordination



TRUST Members

- **Leader:**
 - Leanna Rierson
- **Core Team:**
 - Varun Khanna, Matt Wade, Steve Van Trees, Will Struck, Tom Kraft, Ron Stroup, Dave Robinson, Mike DeWalt, John Angermayer, Alex Theodore
- **Consulting Team:**
 - Elizabeth Noon, Calvin Miles, Tom Phan, Clyde Erwin, Jorge Castillo, Dennis Wallace, Greg Frye

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TRUST Milestones

- ❖ ✓ Jan 99 - Team Formation
- ❖ ✓ Mar/Apr 99 - Charter/Planning
- ❖ ✓ June/July 99 - SW Reviews of ACI
- ❖ ✓ July 99 - CMU Manufacturer Meeting
- ❖ ✓ Oct 99 - Draft TRUST Position on RRI/ASEs
- ❖ ✓ Dec 99 - Draft General SW ReUse Position
- ❖ ✓ Jan 00 - Coordinate General SW ReUse Position with international cert authorities



TRUST Milestones (cont)

- ❖ ✓ Feb 00 - Present TRUST Position to CMU Manufactures
- ❖ ✓ March/Apr 00 - Finalize TRUST Position on ACI/ATNSI Software ReUse
- ❖ ✓ April 00 - ReUse Brainstorming Session at Software Standardization Conference
- ❖ ✓ June 00 - Modify TRUST position on General Reuse Based on Brainstorm

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TRUST Milestones (cont)

- ❖ √ June 00 - Coordinate Position with CAST
- ❖ Aug/Sept 00 - Provide TRUST Position to AIR-130 to Begin Policy Coordination
- ❖ Aug/Sept 00 - Provide TRUST Position to AIO and ASU to Begin Integrating Reuse Position into Ground-Based Documents
- ❖ On-going - Ground & International Coordination
- ❖ On-going - Continued Oversight of ACI Software Development



TRUST Milestones (cont)

- ❖ After TRUST positions are completed, AIR is planning to use some of the reuse concepts to apply to reuse of Tool Qualification “credit”

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Some of the Major Reuse Issues Identified

- ❖ Reverification on each target
- ❖ High-level requirements
- ❖ Using test suites
- ❖ Tool qualification
- ❖ Partitioning/Protection
- ❖ Porting Guidelines
- ❖ Scalable Parameters
- ❖ Traceability
- ❖ DO-178B Artifacts



Some of the Major Reuse Issues Identified (cont)

- ❖ Derived requirements
- ❖ Maintenance concerns
- ❖ Partial credit

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Draft General Reuse Concept

- ❖ Goal: To be able to carry certification “credit” for reusable software component from one project to the next
- ❖ Draft Paper developed in December, 99
- ❖ Coordinated paper with CAST January, 00
- ❖ Currently addressing TRUST and CAST comments
- ❖ SW Standardization Conference - April 00
- ❖ Hoping to have a position ready for FAA and industry commenting in June/July 00



Terminology

- ❖ **Reusable software component (RSC)** is the software code and its supporting DO-178B documentation being considered for reuse. It forms a portion of the software that will be implemented by the integrator/applicant.
- ❖ **Reusable software component developer (RSCD)** is the manufacturer of the reusable software component.

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Terminology (cont)

- ❖ **Integrator** is the manufacturer responsible for integrating the re-useable software component into the target computer and with other software components.
- ❖ **Applicant** is the manufacturer seeking certification or authorization of the overall system.



Stakeholders

Integrator

Reusable Software
Component Developer
(RSCD)



Applicant

Certification
Authorities

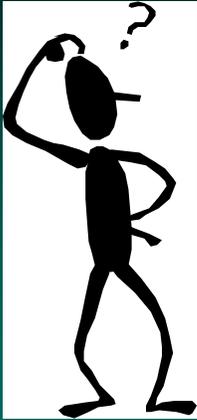
Note: Cert authorities may have more involvement than a traditional software development project for the initial component development.

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Partial DO-178B Credit



- ❖ QUESTIONS:
- ❖ How is partial DO-178B compliance granted for a reusable software component?
- ❖ I.e., How is credit transferred from project to project with minimal rework?



A Potential Approach

Obj #	Obj Description	Credit Sought	Assumption	Activities Remaining For Integrator/Applicant
1-1	Software development and integral processes activities are defined. 4.1 a, 4.3	Full	ACI's plans are completed and not changed for the RRI.	The integrator/applicant will need to create a system level PSAC that references the ACI documents. The ACI software package should be referenced in the applicant's "additional considerations" section(s). Other plans by the applicant will address their specific implementation of the ACI software.
1-2	Transition criteria, inter-relationships and sequencing among processes are defined. 4.1b, 4.3	Full		The applicant's plans should address how the ACI software is transitioned into the applicant's system.

- ❖ Document objective, credit sought, assumptions, and remaining activities in the PSAC and Accomplishment Summary

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A Potential Approach (cont)



- ❖ Address target dependencies.
- ❖ Address assumptions regarding requirements; particularly high-level requirements.
- ❖ Be specific and thorough.
- ❖ Obtain FAA input & agreement on proposals up-front.



Example of Partial Credit

- ❖ **Objective 1-1:** Software development and integral processes activities are defined.
- ❖ **Credit Sought:** Full
- ❖ **Assumptions:** Plans are completed and unchanged for router.
- ❖ **Remaining Activities:** Applicant/integrator to complete LRU level plans, reference router plans/data, & consider reuse in “Special Considerations”

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Example of Partial Credit (cont)

- ❖ **Objective 2-1:** High-level requirements are developed.
- ❖ **Credit Sought:** Partial
- ❖ **Assumptions:** Assuming high level requirements are document XXX, revision - and the LRU manufacturer uses those requirements.
- ❖ **Remaining Activities:** Because the high-level requirements actually exist at the LRU level, they cannot be fully implemented at the software component level. The applicant may reference and tie to the component-level high-level requirements as their own high-level requirements. If this occurred, the applicant would also need to verify the high-level functionality of these requirements in their system.



Overview of the process

Stakeholders agree that reuse is a desirable & obtainable goal.

RSCD, integrator, & applicant plan for reuse.

RSCD, integrator, & applicant document reuse credit per objective.

PSAC reviewed & approved by cert authority.

RSC developed per plans with cert authority oversight.

ACO writes approval letter for RSC to RSCD and applicant.

Same configuration & version of RSC

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Considerations Table

Obj #	Objective Description	Considerations for reusable component developers	Considerations for Integrators/Applicants	Considerations for regulators
1-1	Software development and integral processes activities are defined. 4.1 a, 4.3	<ul style="list-style-type: none"> Create PSAC and other planning documents for reusable SW components (RSWCs) to conform to notice requirements. References: 6.c.(1),	<ul style="list-style-type: none"> Integrate references to RSWCs plans & PSAC into system level Plans & PSAC Coordinate re-useable requirements specified in RSWC PSAC into System level Plans and PSAC. Ref: 6.d(1), 6d(2), 6d(3), 6d(4), 6d(5),	<ul style="list-style-type: none"> Review the RSWCs PSAC and plans with the system level PSAC and plans for consistency, conformance to DO-178B, and conformance with the guidelines of this notice. Provide early agreement on the proposals for reuse specified in both PSACs. Ensure conformance to the provisions of this notice for all planning documents including PSACs Ensure that all technical issues not addressed by guidance are coordinated with directorate, technical specialists and the NRS. Ref: 6e(1), 6e(2), 6e(3)

Lists each objective & considerations for the stakeholders.

- 
- ### Issues
- ❖ Changes to components are inevitable
 - ❖ Consistent documentation of “partial” credit will be difficult
 - ❖ Considerations for each objective is not all encompassing
 - ❖ Uncertain of how concept would work with other types of reuse situations

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Summary

- ❖ Making progress in addressing software reuse
- ❖ Notice on reuse of software life cycle data planned for release in early 2001
- ❖ Notice on reuse of software components planned for release in late 2001
- ❖ Addressing tool qualification reuse in the near future