

# *IV&V International Workshop 2013*

## **IV&V Guidance for IV&V for Product Line Software**

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# *Purpose*

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**Interchange of ideas  
regarding performing IV&V on  
Product Line Software**

# ***Definitions***

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## **Product Line Software**

- A series of software deliveries produced by a developer
- For use in different space missions
- That share commonalities that present advantages of reduced cost and higher reliability through reuse.

## **Heritage Software**

- Software components that have successfully flown
- That are to be used again in other spacecraft
- And can be either
  - unchanged
  - modified

# The scale of reuse can be significant !

← *time* →

Flight S/W Modules	Project 5		Project 4		Project 3		Project 2		Project 1	
	# of modules	%	# of modules	%	# of modules	%	# of modules	%	# of modules	%
New	4	3%	12	9%	4	7%	11	16%	35	32%
Reuse	63	52%	85	61%	25	44%	22	32%	20	18%
Re-data	29	24%	5	4%	15	26%	4	6%	0	0%
Re-eng	25	21%	38	27%	12	21%	30	44%	55	50%
COTS	0	0%	0	0%	1	2%	1	1%	0	0%
Heritage Modules	117 / 121	97%	128 / 140	91%	52 / 57	91%	56 / 68	82%	75 / 110	68%

*Single developer projects over the past ~8 years,  
Refers to module count only, not SLOCs.*

# *The Developer Practice*

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## **A software developer is obliged to assert:**

- why it is advantageous to use heritage components
- how any risks associated with their use will be mitigated

## **A developer can also:**

- describe the prior use of earlier components
- their intended use in the new mission
- describe changes in the modified components
- rationale for any reduction of rigor in the testing
- test all modified components as if they were new

## ***The IV&V Practice***

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**An IV&V Heritage Review is conducted and a report written by an IV&V team member that addresses the following questions about each asserted heritage software module:**

1. Is the functionality the same?
2. If not, what are the functional changes?
3. What are the effects of the hardware differences between the target system and the heritage system and how do those changes affect each module?
4. Have all heritage mission IV&V issues that could affect the module's reuse status been satisfactorily closed?
5. Have the reuse modules been used operationally?

**Any issues identified are recorded, tracked, and resolved.**

# ***IV&V Heritage Review Resources***

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## **Internal IV&V resources:**

- ORBIT issue database
- On-Orbit Anomaly Research team and reports
- Project close out reports
- Pertinent project heritage reviews
- Spacecraft configuration database
- IV&V Lessons learned database

## **External NASA resources:**

- Mission Point of Contact personnel
- Mission and project web sites
- NASA anomaly databases
- NASA Lessons Learned database
- NASA Engineering Network Lessons Learned (<https://nen.nasa.gov/web/ll/home>)
- NASA Engineering Safety Center (NESC)

## *Two questions for IV&V*

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*“Should there be any change to our current IV&V process for heritage components?”*

*“What should we expect from a developer who is establishing a Product Line approach to flight software development?”*



## ***IV&V Discussion Points***

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1. Should IV&V establish a multi-project information management system that supports tracing of requirements, code, testing, and issues across all projects of each product line?
2. Should Diff compares be run between each heritage module (requirements and code, respectively) and all its predecessor(s) to identify/resolve any inconsistencies?
3. Should a Unit test of a non-modified heritage module be optional if prior unit testing can be proven?  
What proof is acceptable?
4. Should integrated tests assume all heritage modules are new?
5. Other?

# *IV&V Expectations from a Project*

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What comprises the Heritage Artifact that we want from a project?

e.g.

1. Heritage software identification
2. Rationale for use
3. Traceability to prior project(s) software
4. Description of prior use
5. Identification of all issues
6. Description of modifications
7. Test plan differences between heritage and new modules
8. Risk mitigation assertions and rationale
9. Shoe size of the test engineer?

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**Questions?**

**Comments?**

**Further Discussion?**

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