

# Guidelines for Hosted Payloads Integration Product Overview

May 8, 2014

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Prepared for:

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Contract No. FA8802-14-C-0001

Authorized by: Space Systems Group

**Developed in conjunction with Government and Industry contributions as part of the U.S. Space Program Mission Assurance Improvement Workshop.**

**Distribution Statement A:** Approved for public release; distribution unlimited.

# Acknowledgments

This presentation provides a summary overview of TOR-2014-02199, “Guidelines for Hosted Payloads Integration”, which was produced as part of the 2014 Mission Assurance Improvement Workshop.

This document was created by multiple authors throughout the government and the aerospace industry. For their content contributions, we thank the following contributing authors for making this collaborative effort possible:

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A special thank you for co-leading this team and efforts to ensure completeness and quality of this document goes to Ken Dodson (Co-Lead), SSL and Steve Kuritz (Co-Lead), Northrop Grumman Aerospace Systems.

## Acknowledgments (Cont)

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# Guidelines for Hosted Payloads Integration

## *Product Overview*

Steve Kuritz, Northrop Grumman Aerospace Systems

Ken Dodson, SSL

Jack Kawamoto, The Aerospace Corporation

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U.S. SPACE PROGRAM MISSION ASSURANCE IMPROVEMENT WORKSHOP  
ORBITAL SCIENCES CORPORATION | DULLES, VA | MAY 7 - 8, 2014

# Agenda

- Motivation for the Project
- Examples that Motivated the Project
- Product Overview
- Topic Details
- Product Implementation Recommendations
- Topic Follow-on Recommendations
- Team Membership and Recognition



# Motivation for Guidelines for Hosted Payloads Integration

- Independently developed payloads can enter service more economically as a “Hosted Payload” than as a dedicated mission.
- An operator can defray its own costs by providing hosted payload opportunities to an independently developed payload.
- Because of these advantages and others, Hosted Payloads are an attractive approach for government missions.
- Early hosted payload projects have met with success, but have also experienced problems during integration, test, and on orbit due to unforeseen schedule, technical, and operational compatibility issues.
- This product is motivated by a desire to reduce the number of problems and the disconnects that can cause those problems.



# Examples and Concerns

- Concerns and experiences of the project framers included
  - *Coupling between primary and redundant command channels*
  - *Premature connection of battery to power bus in “dead bus recovery”*
  - *Power in-rush current and relay isolation from “smart shorts”*
  - *Radiated interference and conducted susceptibility issues*
- Our own group had several experiences including
  - *Ripple on downlink signal in orbit due to non-representative ground test*
  - *Physical interference of components after delivery for integration*
  - *System test environments exceeding hosted payload design*
  - *Contamination of optics due to venting flow and chamber issues*
  - *Mismatch between payload qualified environments and those of the host*

# Team Considered Wide Variety of Impacts

- Programmatic information exchange disconnects
- Interface issues
- Performance compromises
- Resource deficiencies or excesses
- Schedule mismatches
- Many others

**Successful accommodation goes far beyond  
“Do No Harm”**





# Intended Audience for the Document

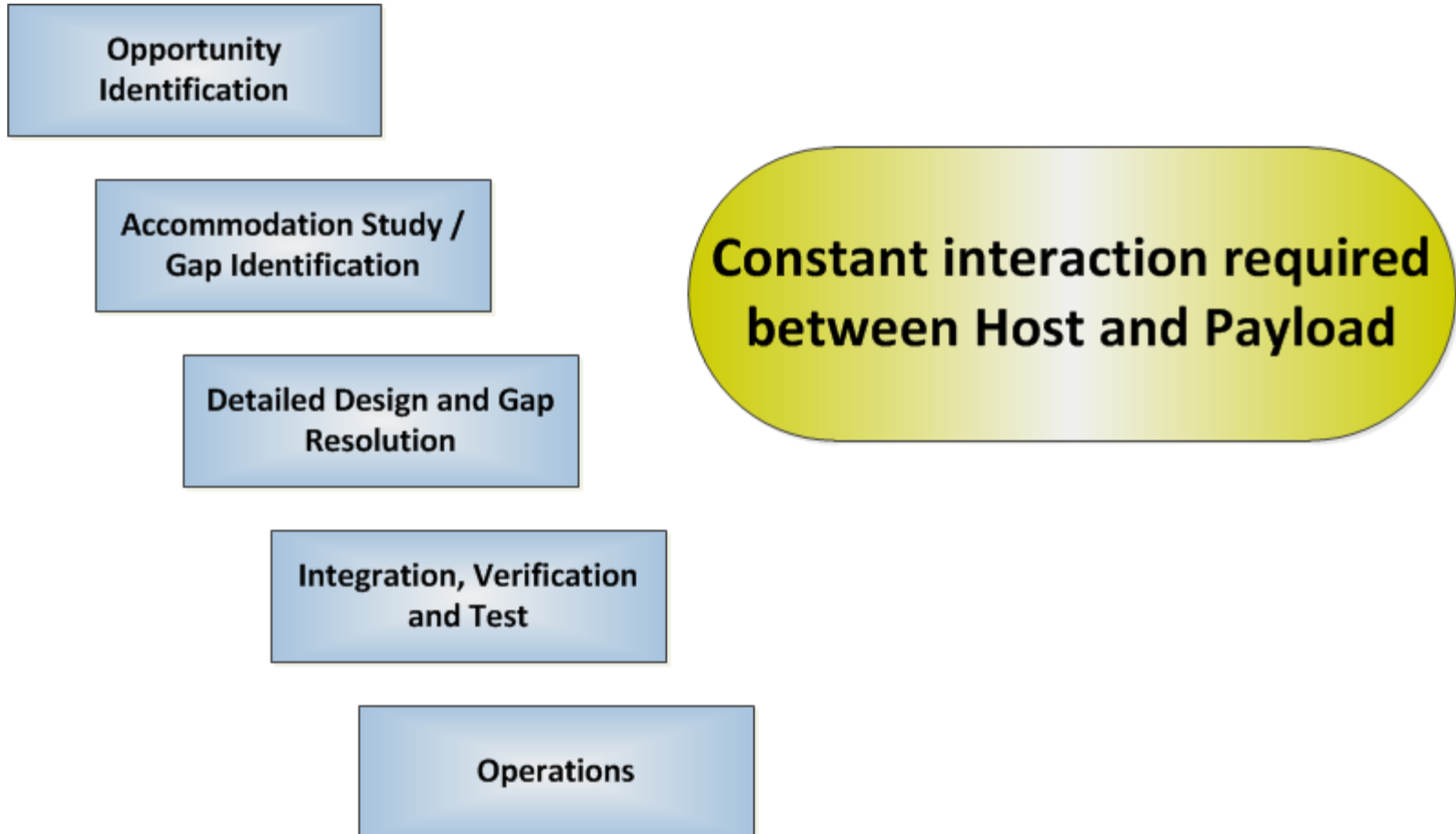
- It is intended to aid those involved in a hosted payload project
  - *Requirements generators*
  - *Program managers and planners*
  - *Designers and analysts*
  - *Systems engineers*
  - *Test planners and engineers*
  - *Mission assurance and other relevant specialty engineering disciplines*



# Charter

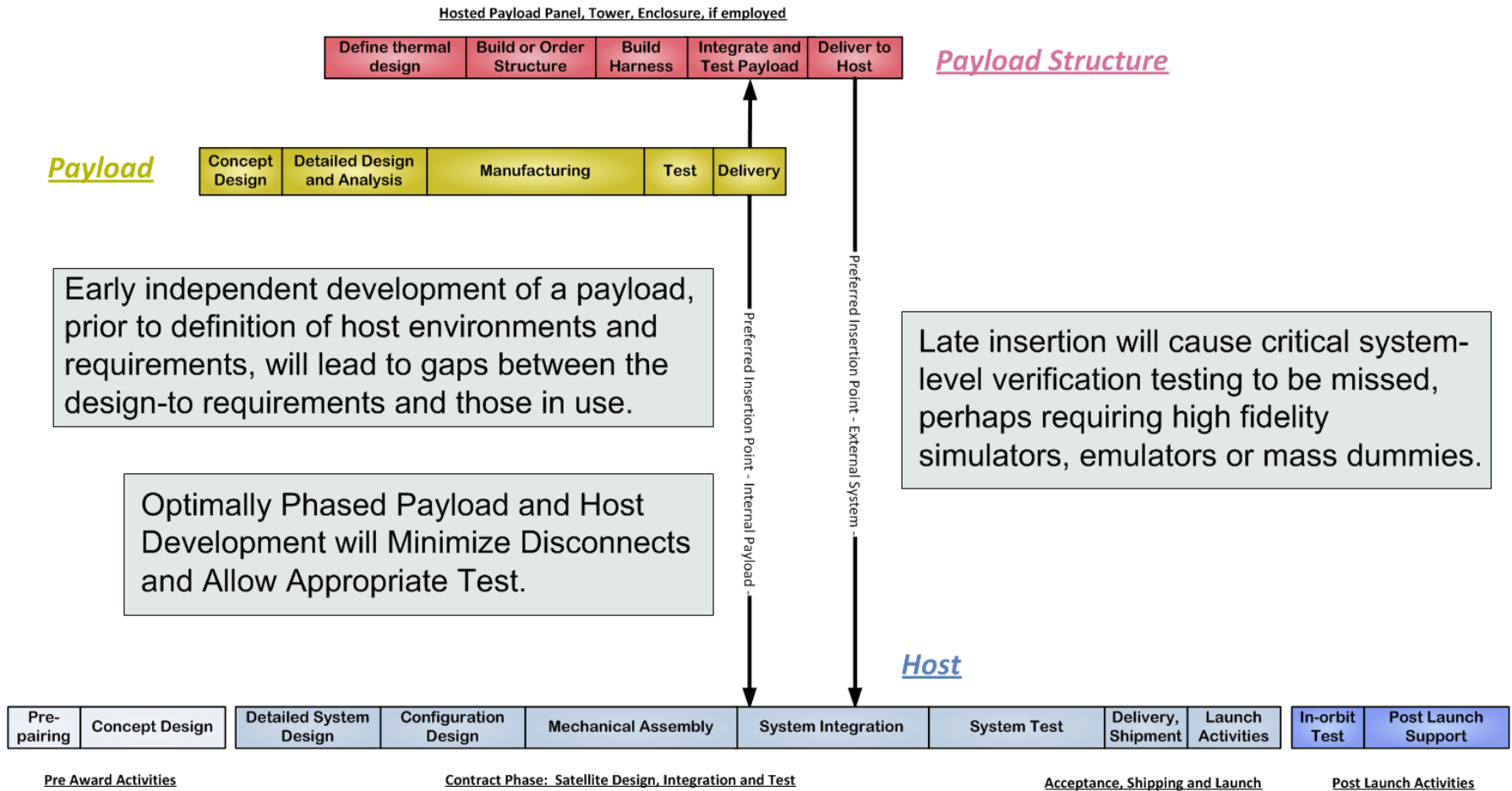
- Provide an overall approach to the process of hosting payloads
  - *Evaluation criteria to ensure the payload and host are compatible*
  - *Help identify and resolve environmental and interface incompatibilities*
  - *Provide analyses to ensure compatible interface and functionality*
  - *Recommend testing of mechanical, electrical and thermal interfaces*
  - *Assess fault tolerance/impact to the host and payload components*
  - *Provide guidelines for deliverable information and documentation*
  - *Provide references for further information*
- Done using text, tables and checklists, emphasizing the latter
  - *Easy to compile, use and update*

# Accommodation Phases



# Host – Payload Integration

## In-phase development presents best opportunity



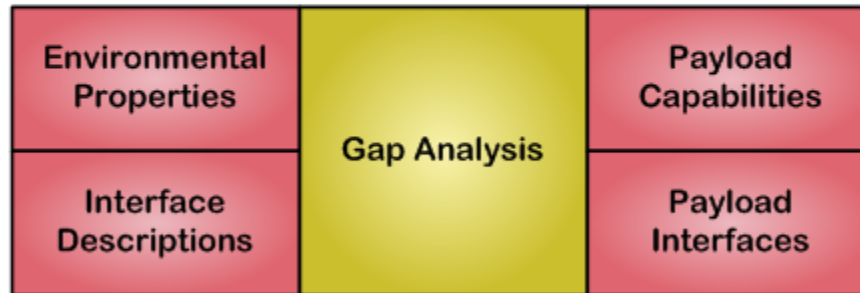
# Gaps Between Payload & Host Must be Resolved

## Analysis of Gaps

Always relevant and essential

Host Environments

Host Interface Descriptions



Payload Qualified Environments

Payload Analyzed Properties

Payload Interface Descriptions

Requirement and interface disconnects for any cause will necessitate modification and verification on the Host or Payload side of the interface.

# Document Topics Include

- Gap Identification and Resolution
- Control of Budgeted and Expendable Items
- Survival in Space and Ground Environments
- Mission Operations
- Critical Analyses
- Deliverable Products
- On-orbit Fault Management
- Verification by Test
- Detailed checklists
  - *An aid in gap identification, provided as an appendix*

# Intended Product Use

- A reference and resource to promote a comprehensive accommodation approach that also evaluates risk
- Evokes questions like
  - *Have all relevant environments been taken into account?*
  - *Is hardware designed /qualified to the correct environments?*
  - *Are all appropriate analyses required /performed for my project?*
  - *Does my RFI, RFP or ICD have sufficient content?*
  - *Are all appropriate deliverables planned and available at key decision points?*
  - *Are these tests required /performed or are analyses required to reduce risk?*
  - *Are the interfaces and properties in the checklists relevant and accounted for?*

# Summary Findings from Lessons Learned

Finding	Recommendation
Payloads are often developed to requirements that are different from those of the Host	Hosts should publish and distribute their environments and interfaces
There is no universally accepted cross-industry interface standard	Industry should move toward a common interface standard
Insufficient interaction or too many layers between Host and Payload engineering teams often disrupts information flow	Teams should collaborate to define roles, analyze gaps and exchange information directly
Insufficient participation by Payload representatives in system-level test / test planning leads to problems	Payload should participate in planning and execution of relevant system level tests
Late Payload delivery can lead to insufficient testing of the integrated system	Test Like You Fly with actual Payload or realistic simulator



# Recommended Follow-on Activities

Activity	Status
Present to Industry	Abstract submitted to RAMS 2015
Define realistic cross-industry environmental ranges	2015 MAIW topic submitted
Develop cross-industry interfaces	Suggested for future MAIW
Collect & evaluate lessons going forward to improve document	Aerospace Corp. can be a focus; Industry cooperation needed
Revisit and update as necessary	2 to 3-years more experience

# Workshop Accomplishments

- Silver Updates Reviewed and Agreed Upon
  - *Silver-to-gold transition in process*
- Lessons and Conclusions Discussed
  - *Recommendations provided on previous slides*
- Identify, resolve and report on any significant conflicts
  - *There are no significant conflicts*
- Additional pending recommendations
  - *Suggest more appropriate title for the TOR:*
  - *Guidelines for Hosted Payload Integration*



# Team Introductions

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SK0670

## External Distribution

REPORT TITLE

Guidelines for Hosted Payloads Integration Product Overview

REPORT NO.

TOR-2014-02158

PUBLICATION DATE

May 8, 2014

SECURITY CLASSIFICATION

UNCLASSIFIED

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DATE June 30, 2014