ISS Displays
Standards and Process Overview

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Definitions

- **Display** - Any onboard Graphical User Interface (GUI), visual, haptic, or auditory display used by the ISS Crew to support operations (systems and payloads)

- **IDAGS Panel** - The Integrated Display and Graphics Standards (IDAGS) Multilateral Panel is an ISS program-level panel controls changes to the ISS display standard documents for all ISS International Partners/Participants (IP/Ps)

  - The IDAGS Panel is comprised of all the IPs, Flight Operations Directorate (FOD), Avionics and Software, Safety, JSC Human Factors, and Payload Displays Review Team (PDRT).

Purpose of Display Standards and Review

- Ensure crew-centered design of on-orbit displays
  - Rotating crewmembers from different countries with varying English language proficiency
  - Varying experience with software and technology
  - Minimal ground training, long interval between training and flight, multiple systems, and multiple, diverse payloads to operate
  - Robust variety of display types and operating systems
  - Microgravity environment challenges
- Adherence to display standards and guidelines to achieve an optimal user experience is paramount to ensuring a safe, effective, and efficient onboard environment
  - Ensure no conflict between display standards/guidance and safety standards
- Ensuring consistency between displays and procedures with proper use of terms and registered Operations Nomenclature (OpNom)
- Usability testing is strongly encouraged and often required to assure crew productivity and successful achievement of scientific and technological objectives

What displays are subject to review?

- All onboard displays
  - Classifications
    - Commercial Off The Shelf (COTS)
    - Modified Off The Shelf (MOTS)
    - Custom Developed
  - Types
    - Physical/rack-mounted/hardware-mounted (LED array, LCD/LED/OLED front panel, touchscreen, push button panel, etc.)
    - Laptop (PCS, SSC, Facility, etc.)
    - Mobile (Tablet, Phone, etc.)
    - Wearable
    - Augmented/Virtual Reality
    - Haptic
    - Auditory
  - Operating Systems (OS)
    - Microsoft Windows
    - Apple iOS
    - Google Android
- Ground displays are recommended to follow the standards for consistency

Requirements

- All ISS displays shall be reviewed and approved by the IDAGS Multilateral Panel prior to being integrated into a platform
  - SSP 50313, Display and Graphics Commonality Standard [Systems]
  - SSP 57000, Pressurized Payloads Interface Requirements Document
    - Appendix I (C&DH), Section I.3.1.2 >> Appendix T contains the user interface requirements

Approval Process

- Each ISS partner is responsible for the display development of their segment, module, or payload
- Development
  - Iterative review of draft displays coordinated with IDAGS, IP Team (PDRT, IDDT, ESA ODF), and User (PD, PI, GUI Developer)
  - Early review is encouraged to help avoid schedule/cost impacts later in development cycle
    - Note: COTS has an expedited process and Proprietary interfaces are accommodated
  - Display OpNom review and approval
  - Requirements applicability is focused on what is necessary and sufficient to provide an effective product to meet scientific goals while maintaining critical look and feel aspects

Approval Process

- Verification
  - Usability testing may be conducted, depending on the interface complexity and schedule
    - Testing is performed to evaluate the displays and obtain the crew perspective, identify human factors issues, recommend enhancements, ensure optimal user experience, and ensure display interoperability with other ops products (procedures, training, etc.)
- Baseline
  - Submittal of final displays via applicable Workflow and Board approval process
  - Posting of final displays to appropriate control center
- Delivery

Websites and Resources

- IDAGS Home Page
  - https://fod1.sp.jsc.nasa.gov/FOD/CO/CO7/CO75/IDAGS/default.aspx
- PDRT SharePoint Page >> Payload Displays 101 Site
  - https://aeonsp.hosc.msfc.nasa.gov/branches/EO20/PDRT/PDRT/Payload%20Displays%20101.aspx
- Platform Guidance
  - Apple iOS Human Interface Guidelines
    - https://developer.apple.com/library/ios/documentation/UserExperience/Conceptual/MobileHIG/index.html
  - Google Android User Interface Guidelines
    - https://developer.android.com/guide/topics/ui/index.html
  - Microsoft Windows Desktop App User Interface Guidelines
    - https://msdn.microsoft.com/en-us/library/windows/desktop/ff657751(v=vs.85).aspx
- Display Checklist
  - Filtered requirements based on display type
- Best practices and examples
- Introduction to Crew Displays (public domain)

Contacts

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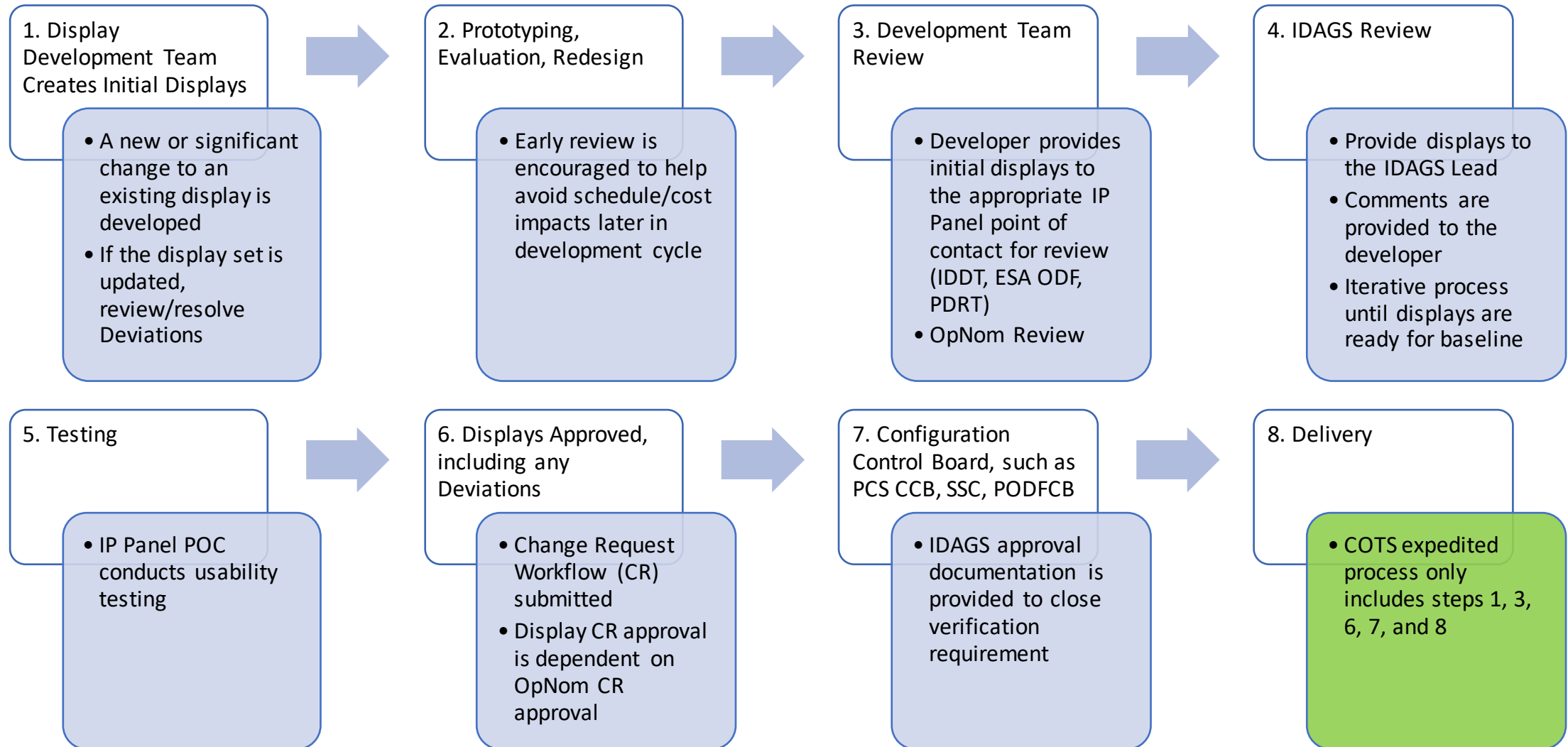Mathew Reed, PDRT
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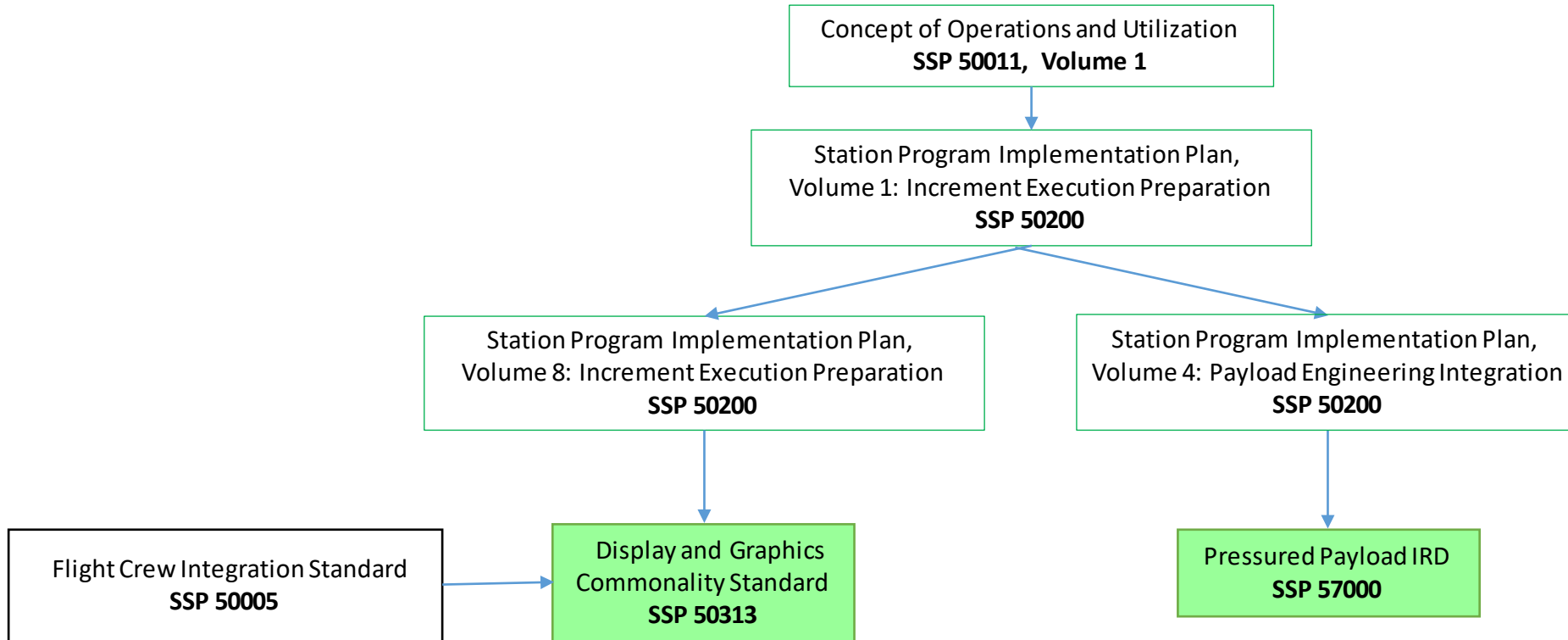john.p.gettys@nasa.gov

Take Away Points

- Goal of display standards and process is to achieve commonality to the greatest extent possible and assure usability

- Engage the display review team early in the development process

- All crew displays must be approved by IDAGS

Backup

Display Development Process Flow

1. Display Development Team Creates Initial Displays
- A new or significant change to an existing display is developed
- If the display set is updated, review/resolve Deviations

2. Prototyping, Evaluation, Redesign
- Early review is encouraged to help avoid schedule/cost impacts later in development cycle

3. Development Team Review
- Developer provides initial displays to the appropriate IP Panel point of contact for review (IDDT, ESA ODF, PDRT)
- OpNom Review

4. IDAGS Review
- Provide displays to the IDAGS Lead
- Comments are provided to the developer
- Iterative process until displays are ready for baseline

5. Testing
- IP Panel POC conducts usability testing

6. Displays Approved, including any Deviations
- Change Request Workflow (CR) submitted
- Display CR approval is dependent on OpNom CR approval

7. Configuration Control Board, such as PCS CCB, SSC, PODFCB
- IDAGS approval documentation is provided to close verification requirement

8. Delivery
- COTS expedited process only includes steps 1, 3, 6, 7, and 8

ISS Requirements Trace

Concept of Operations and Utilization
SSP 50011, Volume 1

Station Program Implementation Plan,
Volume 1: Increment Execution Preparation
SSP 50200

Station Program Implementation Plan,
Volume 8: Increment Execution Preparation
SSP 50200

Station Program Implementation Plan,
Volume 4: Payload Engineering Integration
SSP 50200

Flight Crew Integration Standard
SSP 50005

Display and Graphics
Commonality Standard
SSP 50313

Pressured Payload IRD
SSP 57000

Acronyms and Abbreviations

COTS	Commercial Off The Shelf		LED	Light Emitting Diode
DGCS	Display and Graphics Commonality Standard		MOTS	Modified Off The Shelf
ESA	European Space Agency		ODF	Operations Data File
FOD	Flight Operations Directorate		OLED	Organic Light Emitting Diode
GUI	Graphical User Interface		OpNom	Operations Nomenclature
IDAGS	Integrated Display and Graphics Standards		OS	Operating System
IDDT	Integrated Display Development Team		PCS	Portable Computer System
IP	International Partner/Participant		PDRT	Payload Displays Review Team
ISS	International Space Station		PODFCB	Payload Operations Data File Control Board
JSC	Johnson Space Center		SSC	Space Station Computer
LCD	Liquid Crystal Display			