Evolution of the Tomahawk Land-Attack Missile Operational Test Launch Methodology

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Agenda

- Background
- Goals
- Tactical Tomahawk Block IV
- Overview of Operational Test Launch (OTL) Program
- Evolution of Methodology
- Lessons Learned
- Summary

Background

- The Tomahawk Weapon System (TWS) has been traditionally viewed as a strategic asset whose employment has been directed by the National Command Authority, rather than controlled by Fleet, Task Force, or Combatant Commanders
- The system test office of the Tomahawk Weapon System program (PMA-280) has actively been engaged in the planning and transition of the Tomahawk Land-Attack Missile (TLAM) Operational Test Launch (OTL) program to promote increased operational realism in testing
- This evolution of methodology from “tester-centric” participation to more “user-centric” participation is to integrate new tactics, techniques, and procedures (TTPs) with a stable weapon system, and to augment our traditional role of identifying issues

Goals

- The goals of the presentation are to provide:
  - examples of the transformation of the OTL program, with a focus on the Tactical Tomahawk Block IV missile, as a path forward in the program's evolution to achieve improved operations and ease-of-use
  - useful information to identify areas in which to inject additional operational realism to more accurately accomplish programmatic objectives
  - lessons learned to assist other weapon system programs in the successful evolution to a more operationally realistic test and evaluation program

Tactical Tomahawk Block IV

- **The Tactical Tomahawk Block IV missile provides increased capabilities with the introduction of a new communications system, using a two-way ultra-high frequency (UHF) satellite data link:**
  - **In-flight redirection**
  - **Missile health and status feedback**

Ref: Jane's Online (Defence Equipment and Technology Intelligence Centre)

Overview of Operational Test Launch (OTL) Program

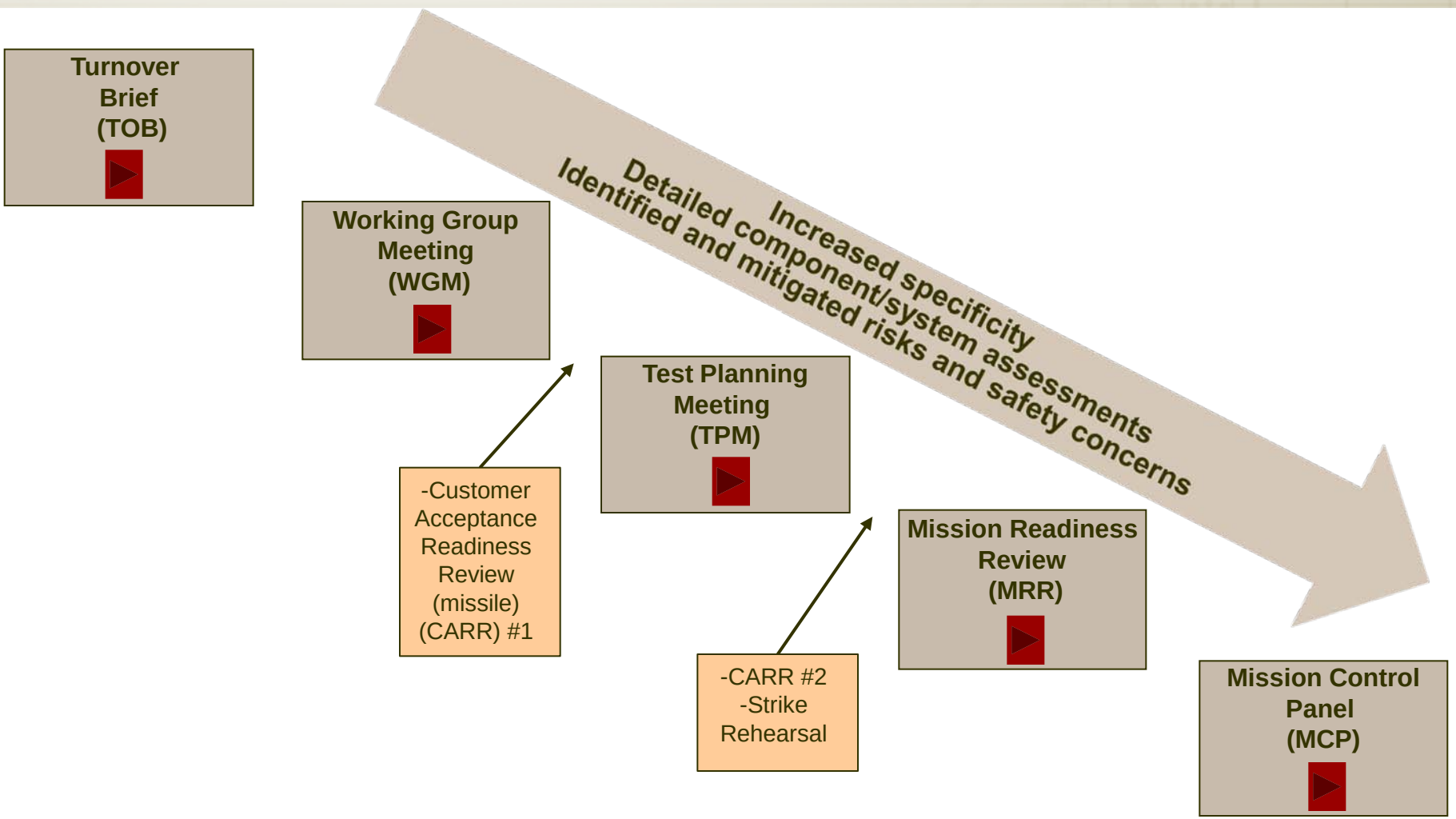
- The OTL Program is a follow-on test and evaluation (FOT&E) program established by the Chief of Naval Operations (CNO)
- A robust test planning and execution process is employed to assess the readiness and effectiveness of the TWS through several annual launches of fleet-representative weapons

OTL Planning Process

- **Flight test planning begins with the Turnover Brief (TOB), during which test interfaces and preliminary objectives are identified and utilized to establish the initial mission architecture**
- **Additional planning meetings address mission generation and test weapon preparation, solidify test objectives, and assess test team readiness to conduct the OTL**
- **Flight test planning is completed upon receipt of Flag-level approval for the conduct of the test launch at the Mission Control Panel (MCP)**

Ref: "Tomahawk Flight Test and Evaluation Directive," PEO(U&W) Inst 3960, 02 November 2009

OTL Planning Process Details



Evolution of Methodology

- Numerous enhancements in command and control (C2) planning, communications, and strike execution have been introduced while preparing for and conducting recent OTLs to more accurately reflect existing user operating procedures

- Lessons learned in these three areas have identified specific steps to continue promoting the evolution of the OTL program toward more operationally realistic test and evaluation

Command and Control (C2) Planning

Previous Approach	Enhancements
• Cruise Missile Support Activities (CMSAs) plan all OTL missions	**•Fleet mission planners used for OTL mission planning, when feasible**
• Mission planning worksheet generated by test team and provided to planning organization to direct mission creation	• Target Information Package (TIP) provided by representatives of Commander, Operational Test and Evaluation Force (COTF) to initiate mission •Missions planned via Mission Planning Requests
• Strike execution test plans developed by the Johns Hopkins University Applied Physics Laboratory (JHU/APL) to provide test-specific scripting to all participants	**• Strike Organization (STKORG) develops and adheres to Pre-Exercise (Pre-Ex) message for test conduct, utilizing Standard Operating Procedures (SOPs)**
• Preplanned mission and/or retarget route(s) employed	• Real-time mission and retarget route generated, when feasible

Communications

Previous Approach	Enhancements
• Consistent use of the same satellite footprint for the communications network	• Variety of satellite footprints used for the communications network, when feasible
• Active participation by test team in conducting pre-test communications checks	**• Test team participants monitor STKORG conduct of pre-test communications checks**
• Test team and STKORG communicate in a single Secure Internet Protocol Router (SIPR) chat room during test conduct, with test team interacting through chat “whispers”	• Multiple SIPR chat rooms established during test conduct to reduce test team interference in STKORG activities
• Test team representatives relied upon to troubleshoot and resolve issues with weapon system configuration settings	**• Test team representatives assist STKORG only if successful OTL execution is threatened**

Strike Execution

Previous Approach	Enhancements
• **Strategic C2 represented in STKORG**	• **Operational C2 reflected in STKORG, through use of simulated Maritime Operations Centers (MOCs), as feasible**
• Strike Folder created by test team and provided to Tasking Authority (TA) with additional test-specific system employment guidance	• Strike Folder created by TA strike team in accordance with SOP
• Electronic Strike Package (ESP) with test team provided parameters, created by TA and reviewed by test team representatives before distribution	• ESP created by TA, with minimal input from and/or review by test team, prior to distribution
• **Hardware-in-the-Loop (HWIL) device operated by test team during Strike Rehearsal**	• **STKORG utilizes a resident Strike Rehearsal Tool to lead Strike Rehearsal**

Lessons Learned

- As the OTL program transitions toward a more operationally realistic test and evaluation program, several lessons learned have been documented which relate to:

  - C2 Planning
  - Communications
  - Strike Execution

C2 Planning

- User C2 operational concepts should be included in test events to fulfill user needs and to promote increased operational realism
- C2 planning should be conducted under operational timeline and constraints
- User participants should be involved early on in the C2 planning for test events

Communications

- STKORG participants should utilize pre-defined and/or widely utilized procedures and diagnostic tools to evaluate communications status
- Firing Units should ascertain communications status prior to getting underway
- User communications requirements should be clarified prior to test events and distributed via standard operational methods

Strike Execution

- STKORG participants should review SOPs for the applicable area of responsibility (AOR) for test events
- STKORG participants should review applicable weapon system documentation (i.e., technical notes, technical bulletins, users guides, etc.) in preparation for test events
- Ample weapon system training should be provided when turnover of Fleet personnel occurs

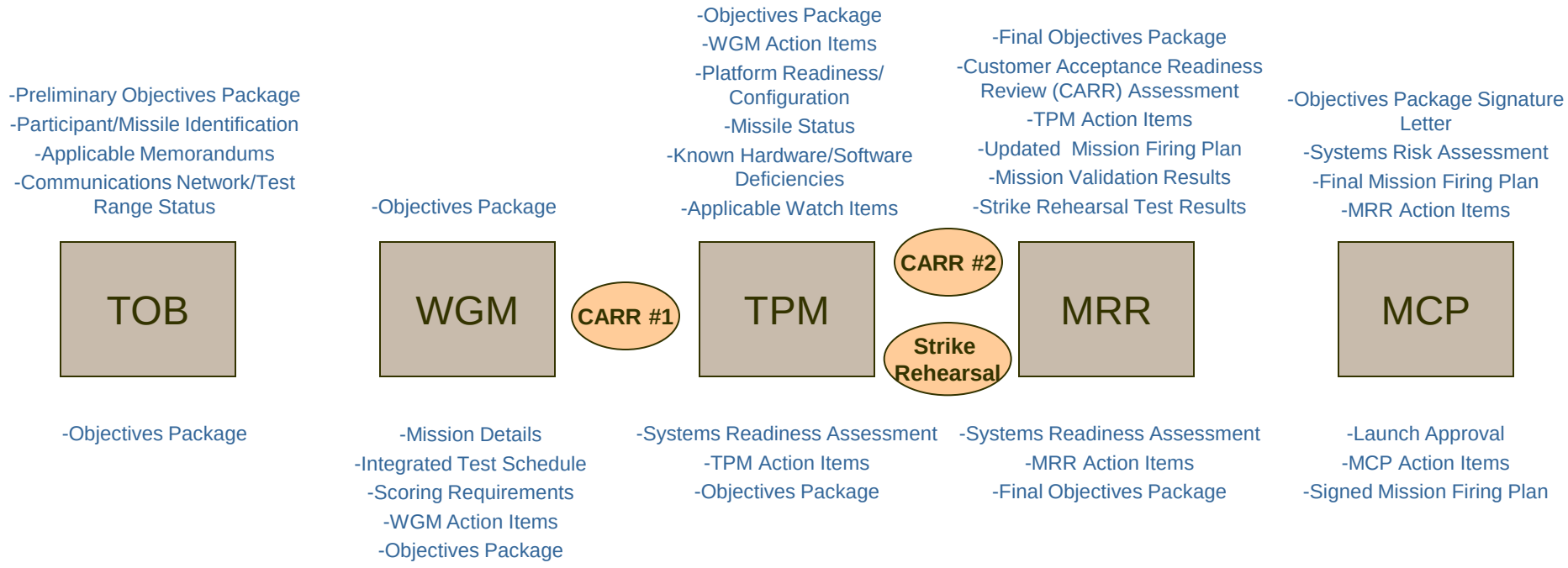
Summary

- By evaluating potential weapon system employment scenarios identified by users in CNO-directed FOT&E, the Tomahawk Weapon System OTL program has evolved toward a more operationally representative test and evaluation program
- Collaboration between PMA-280 and users has validated novel TTPs, improved weapon system utility, and expanded war-fighter capability
- Lessons learned from recent changes in OTL planning, communications, and strike execution can be adopted by other weapon system programs to promote a more operationally realistic test and evaluation program

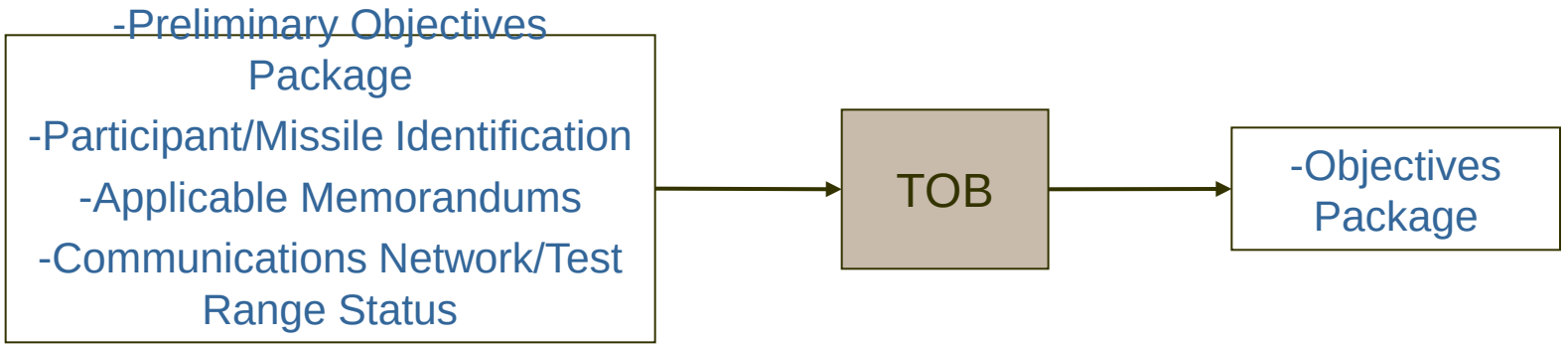
Questions?

Backup Slides

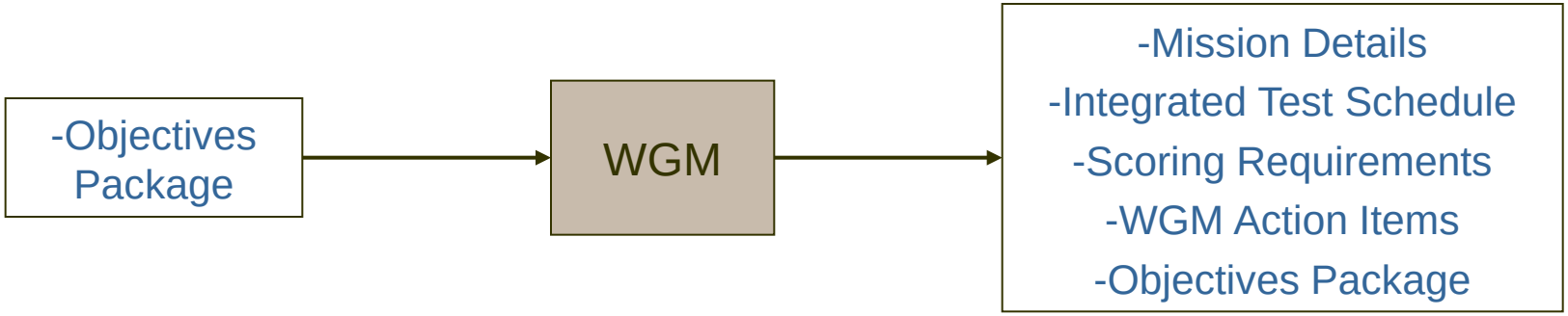
Flight Test Planning with Products



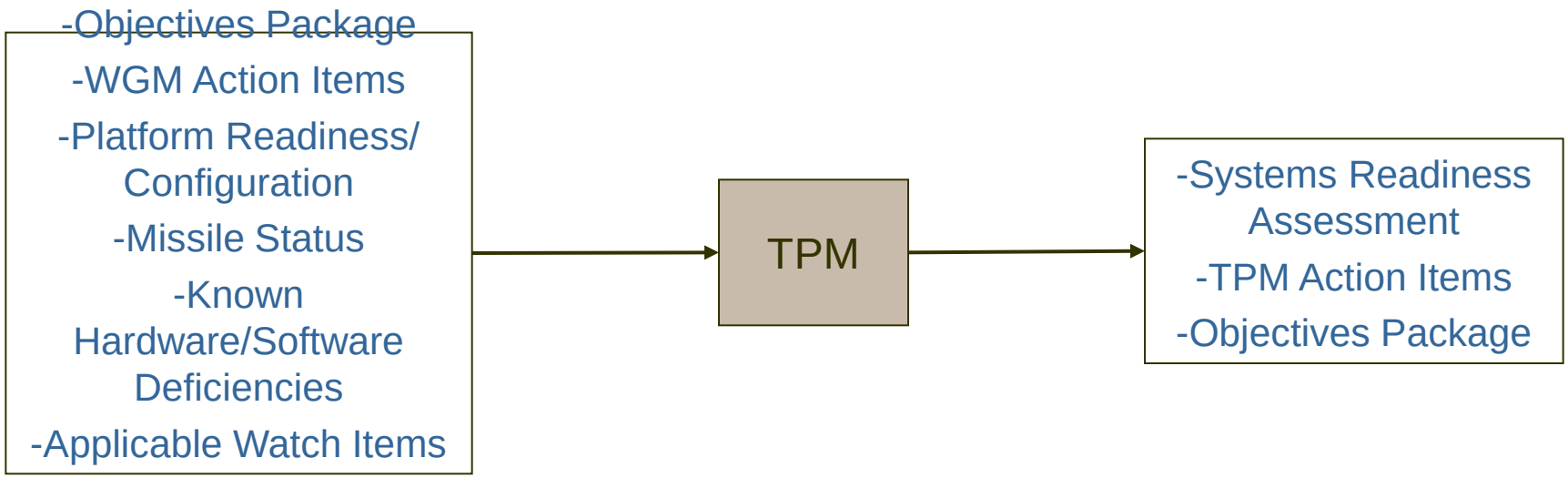
Turnover Brief Products



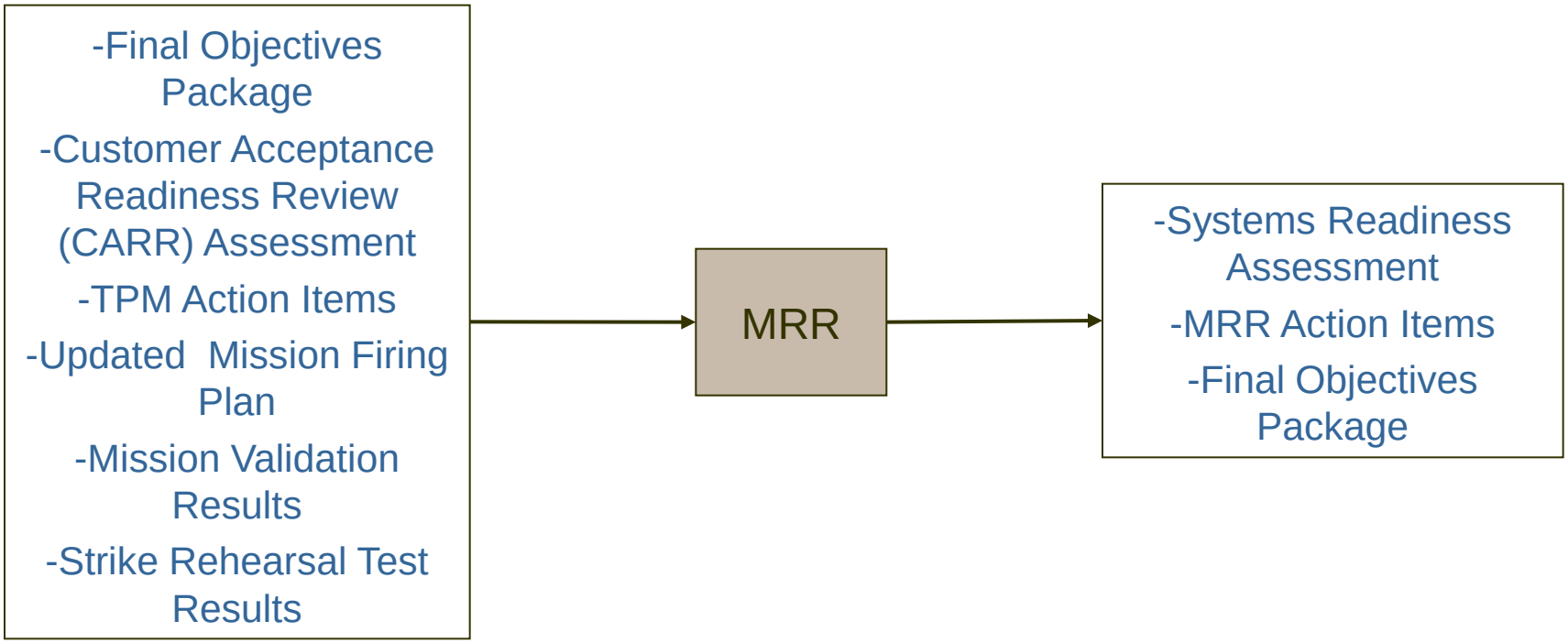
Working Group Meeting Products



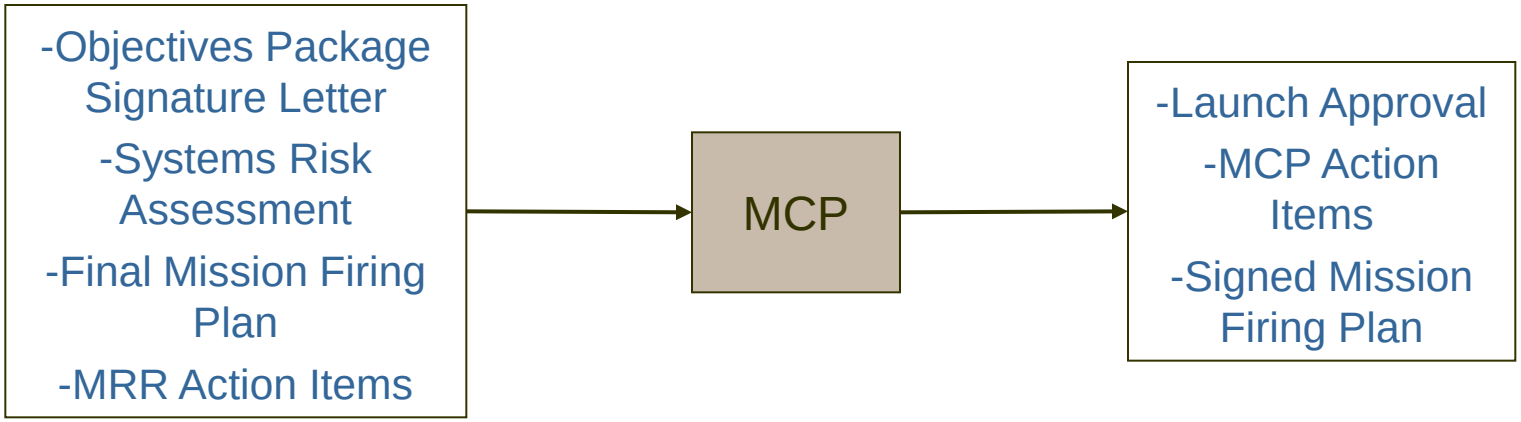
Test Planning Meeting Products



Mission Readiness Review Products



Mission Control Panel Products



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