THE SPECTRUM GROUP

Systems Integration: Effective DOD Test & Evaluation

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ACCESS | INSIGHT | EXPERIENCE

Bob Koczat

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- **Senior Engineering Fellow: Raytheon (retired 2008) 35 years Systems, Software, Test, Project engineering, Program Management**
- **DOD PATRIOT Air Defense Systems: Technical director, Lead Engineer, Systems Integration**
  - ***Lead Roles in systems/software development, integration, systems testing, search-track test events, missile firings, interoperability, DTE & OTE testing (4) at various test sites and missile ranges (i.e. WSMR, etc)***
- **FAA STARS Air Traffic Control Systems: Systems Integration Lead**

- **The SPECTRUM Group, Wash DC: Engineering Member**
- **TESTPLANT Consulting: Introduction of Automated Testing with eggplant into DOD, Aviation, and Aerospace Sectors**

Systems Integration: Agenda

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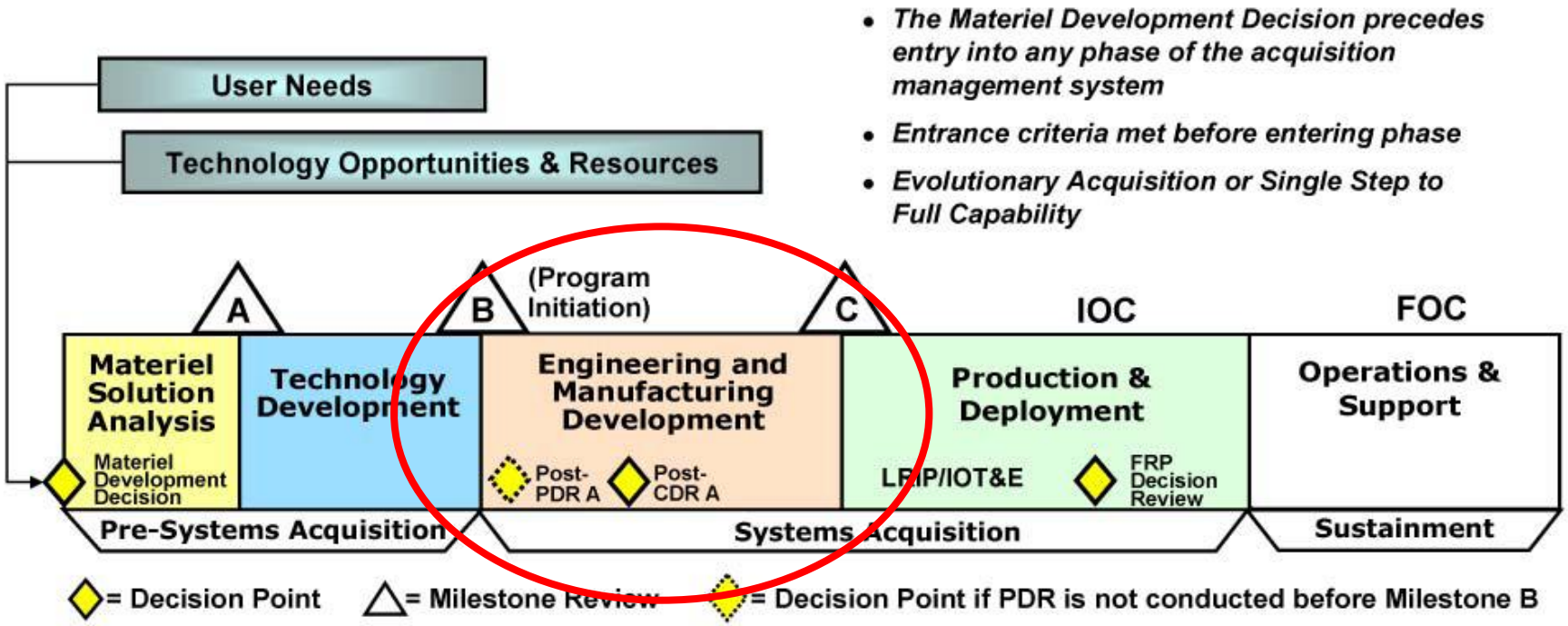
- Test & Evaluation: Stating the Issues
- Effective Test & Evaluation: Objectives
- System Integration planning, Test Configurations, and Team definition
- Systems Integration execution
- System base-lining, regression testing, automated testing strategies
- T & E readiness evaluation and assessments
- Summary

Test & Evaluation: Goals and Objectives

DAS: Defense Systems Acquisition Cycle



Engineering Development: Test & Evaluation Conceptually & Historically

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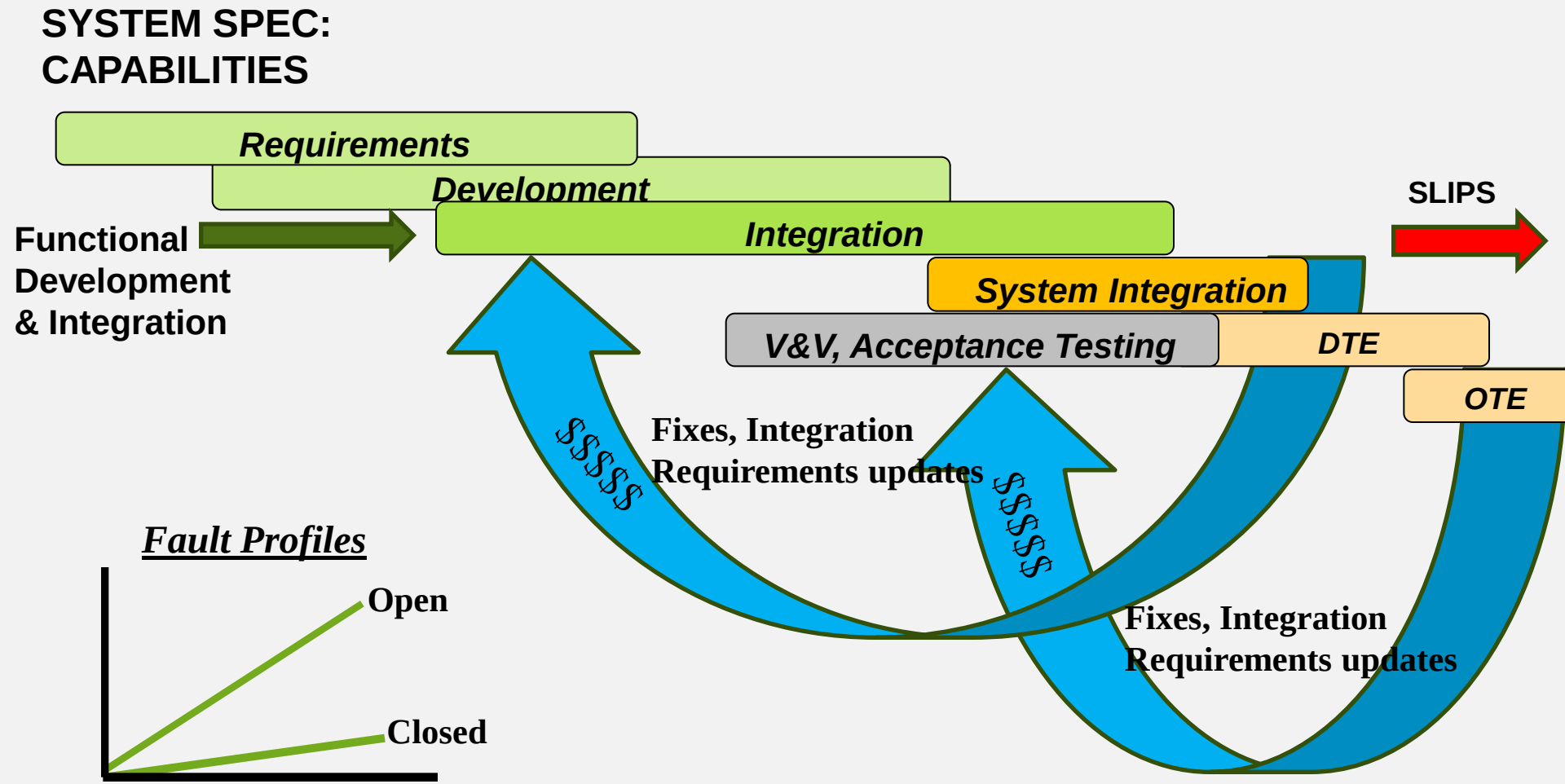

Systems Integration: Effective Test & Evaluation Objectives

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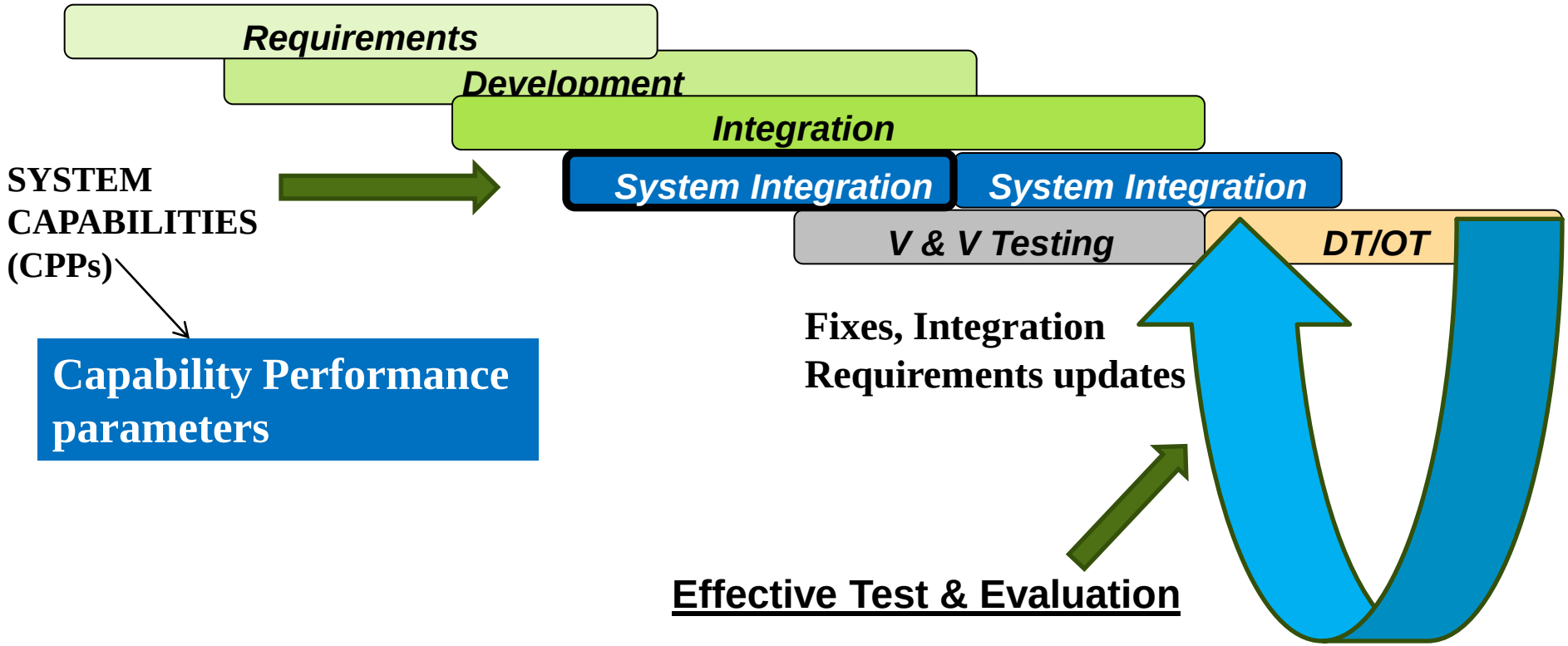
- **Systems Integration is embedded in the critical path of the engineering development Life-Cycles (PLM) , project planning, software integration, V & V testing, and system & operational testing**



Effective Test & Evaluation: Objectives

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Systems Integration strategies provide for:

- Early visibility into the system, hardware, and software operational condition
- System capability situational awareness throughout engineering development and Program Life-Cycles (PLM), Phases
- A midgame-endgame mechanism to adapt to requirements & software agility, managing the chaotic phases
- Achieve T & E operational readiness
- Ability to conduct a cost effective, quality evaluation and assessment of system and operational performance during DTE and OTE Tests

Systems Integration Planning, Teams

Systems Integration Test Configurations

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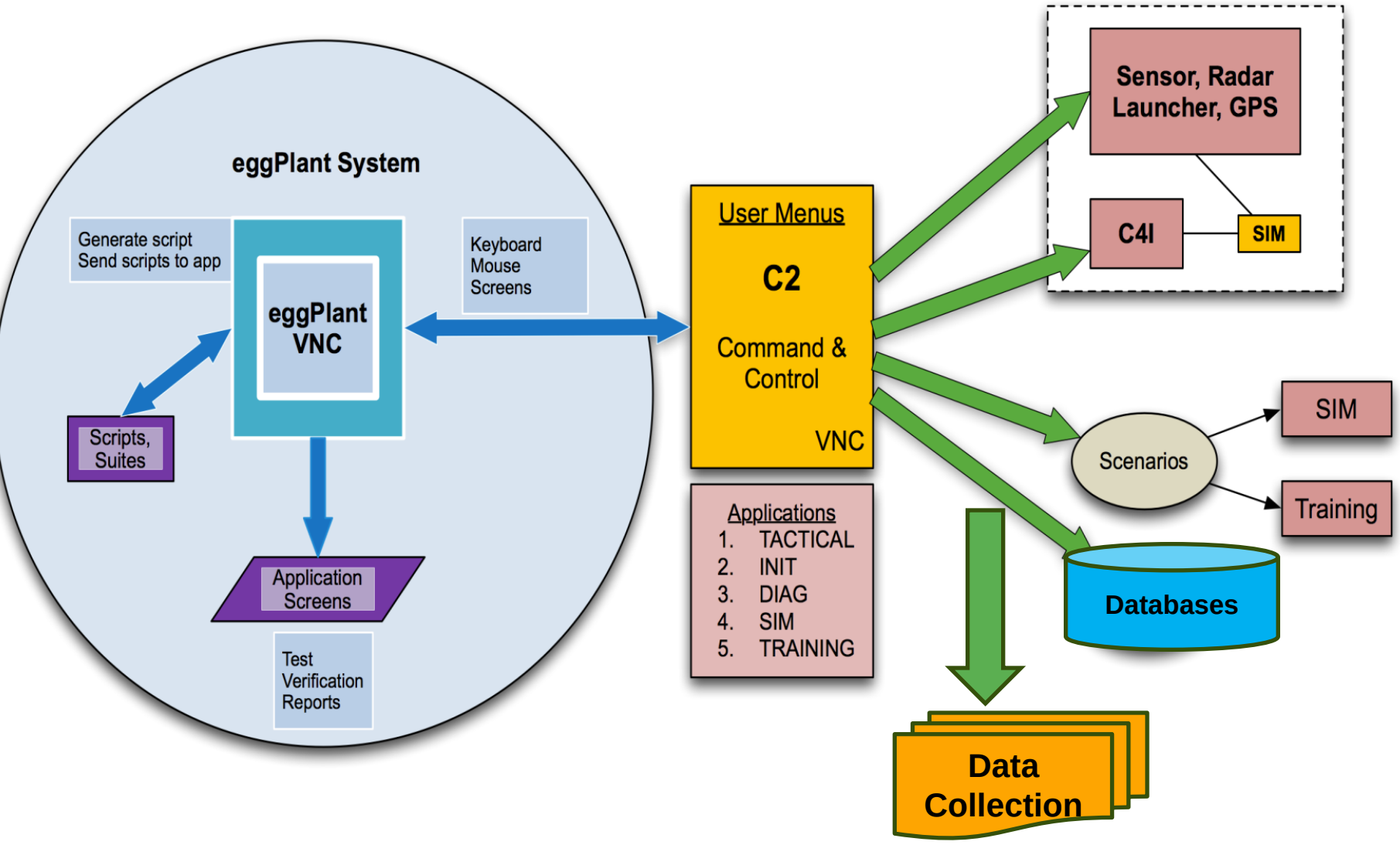

Engineering Development: Systems Integration Planning

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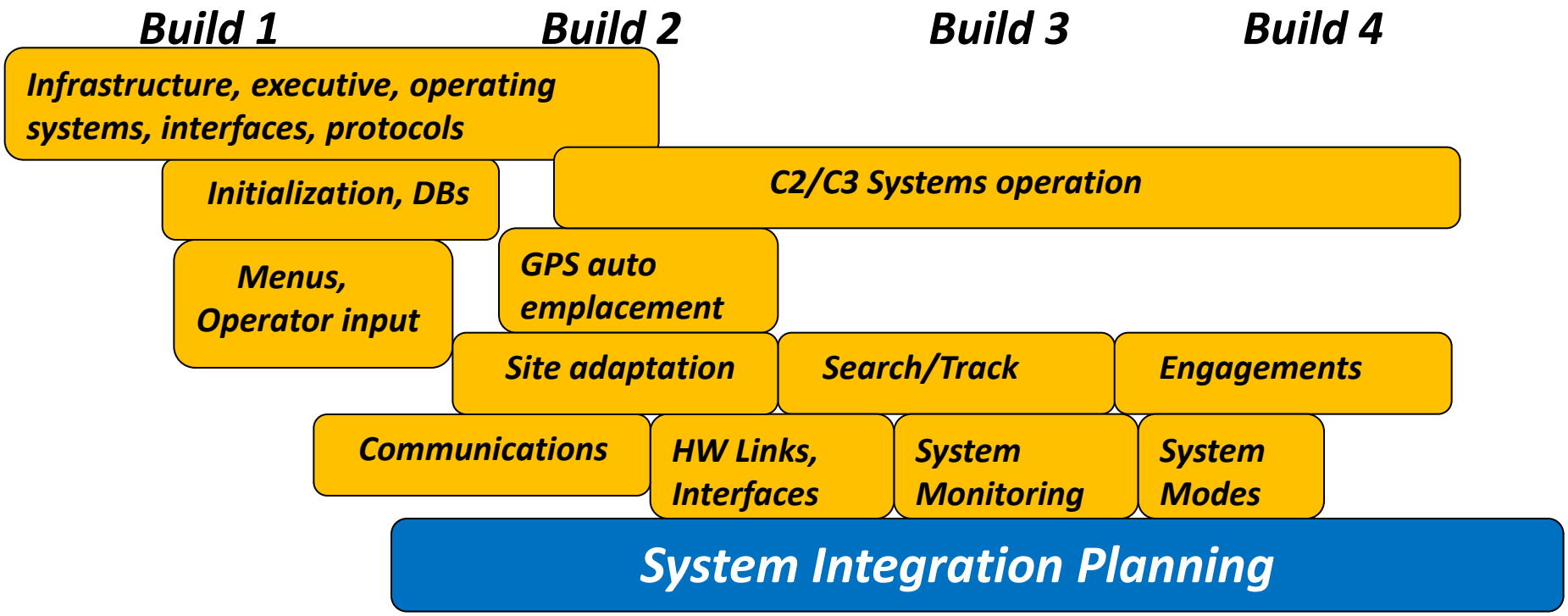
Incremental Development, Test:



Capability Performance Parameters: define and build upon a set of systems integration tests for continuous base-lining and regression tests by Incremental build

CPP1 CPP2 → CPP1 CPP2 CPP3 → CPP1 CPP2 CPP3 CPP4 → CPP1 CPP2 CPP3 CPP4 CPP5 →

CPPs (Capability Performance Parameters)

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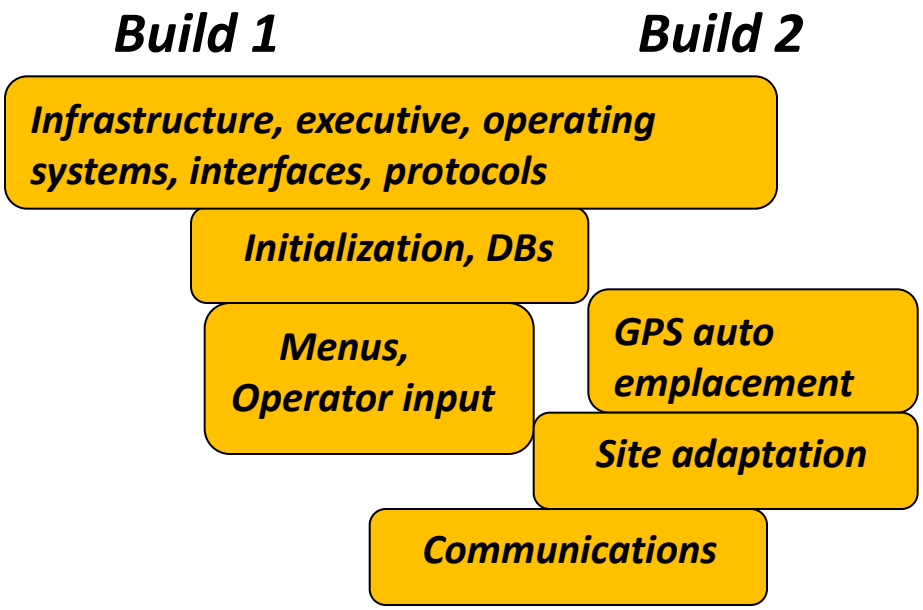

CPP1: Establish basic system operating system-applications scheduling functions, system execution, display menus/switches/mouse functionality, system initialization for site adaptation, initial communications links, data collection

CPPs: Build upon CPP1, to create full regression test suite for system base-lining, regression throughout the remaining development, integration, and system test phases , DTE readiness

New Requirements

CPP1-CPP5: Establish system, displays, initialization, search/track, engagement functions, ID changes, C3 link communications, Status monitor, full data collection

Systems Integration Planning

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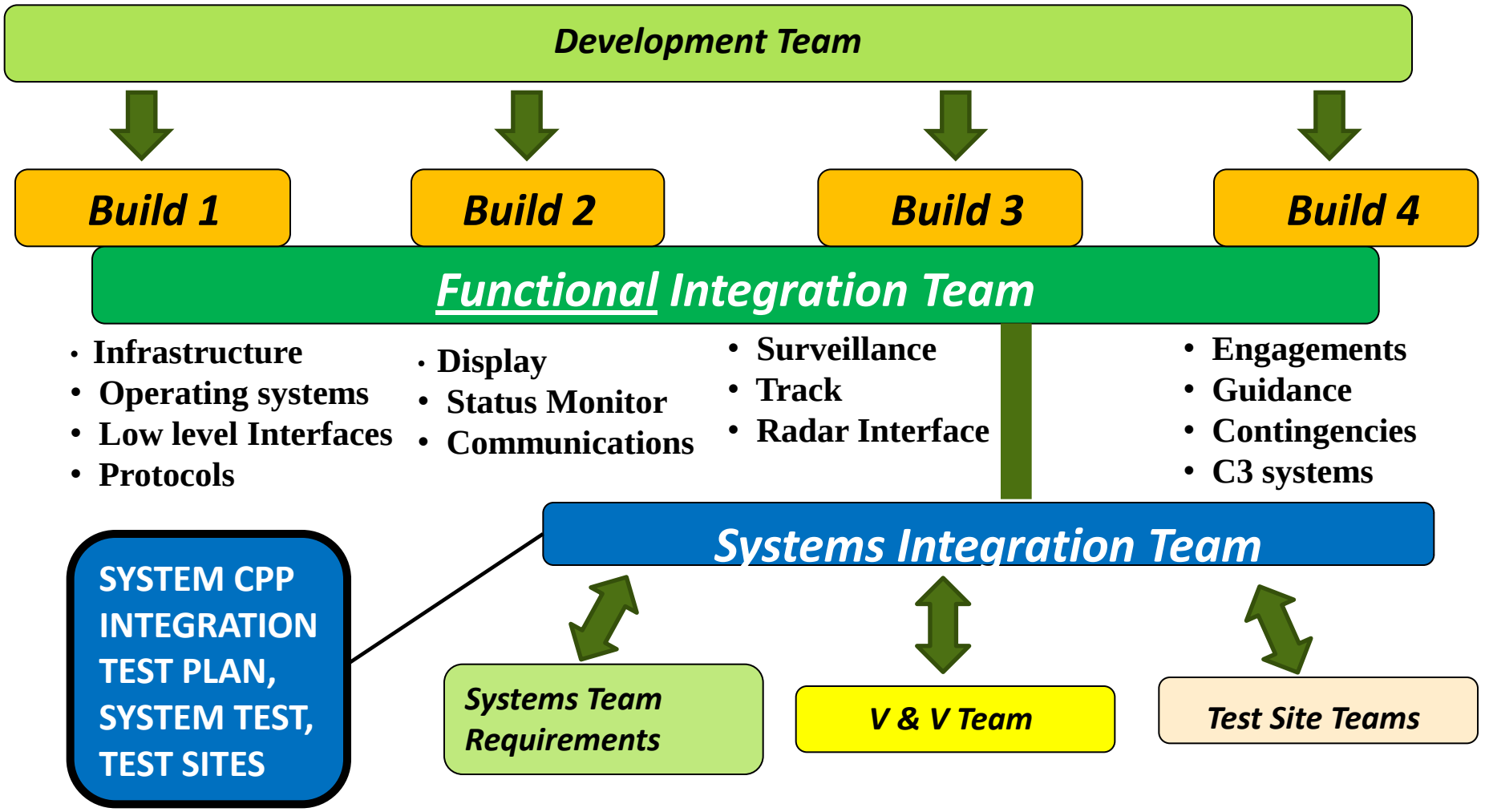

Systems Integration Team

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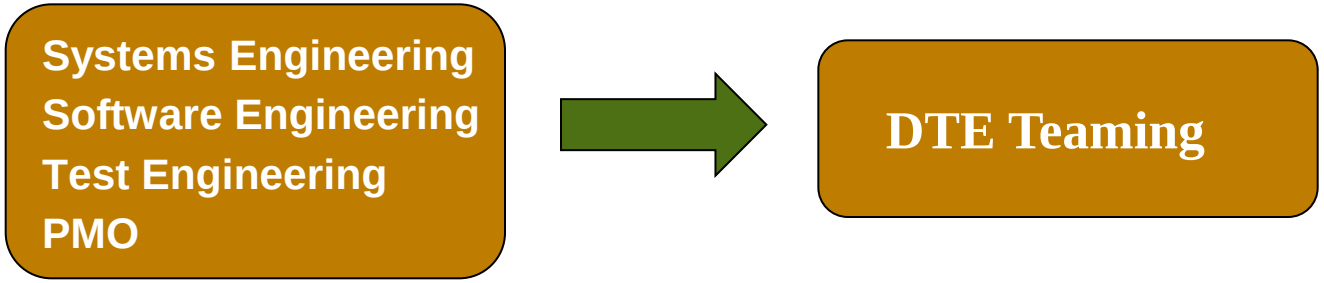
The CMMI Product Integration process area describes system integration strategies supporting effective Test and Evaluation execution, such as:

- ***Setup a team, identify stakeholders, team roles & responsibilities:***



- Establish a System integration plan via “system capability” testing, tracking, and capability/limitation measurement techniques through base-lining, regression, & auto testing
- Coordination of integration, V & V, system Test, and operational Test “system shall” test coverage, breadth & depth
- Establish and utilize entrance and exit criteria disciplines to form the basis of readiness review meetings and critical release decisions
- Establishment of integrated lab facility and test site resources, Build/Test tools, and an instrumentation/analysis logistics plan
- Execute an incremental plan for achieving “full” system level integration by testing with “live” hardware, with a planned mix of simulators in the total system

Systems Integration Execution & Test Configurations

Systems Integration Execution

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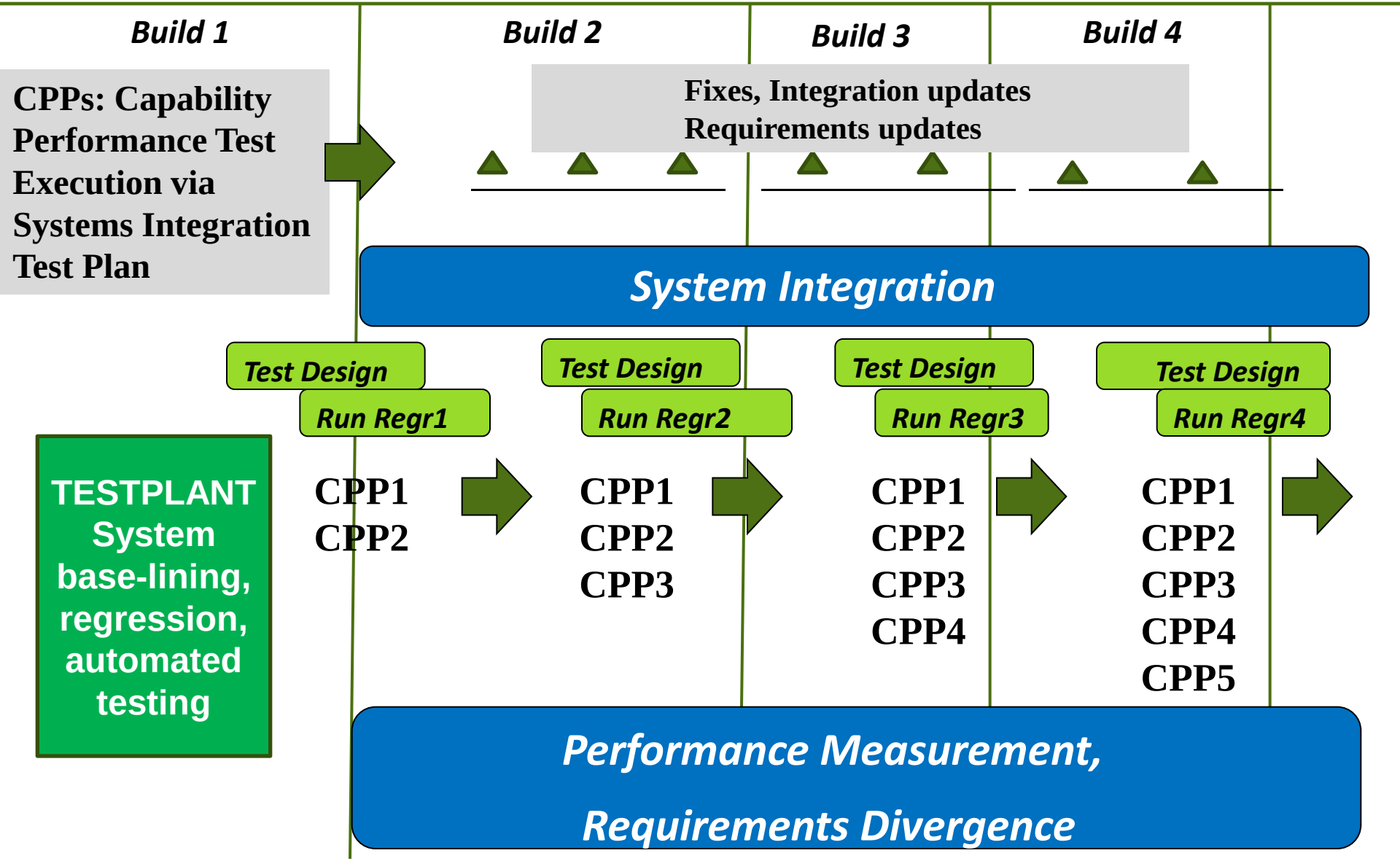

System base-lining, Regression testing automated testing strategies

System Base-Lining, Regression test

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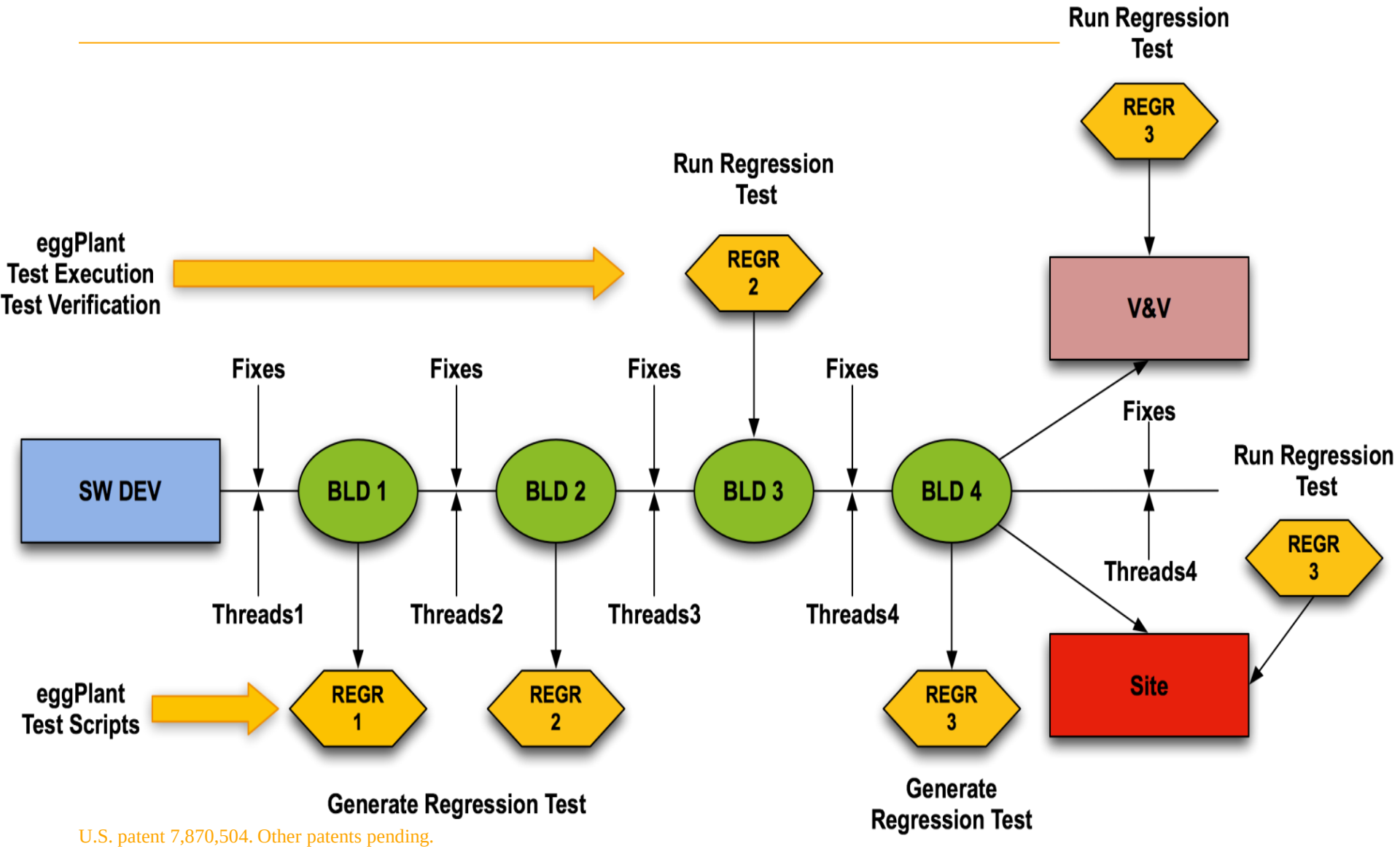

U.S. patent 7,870,504. Other patents pending.

System Integration: automated testing Objectives

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Use TESTPLANT automated testing tools to integrate and test C3-C2 configurations, detect errors, interface & link problems, and operational anomalies through system base-lining, regression and systems integration automated tests. Utilize operator panel scripts and scenarios for designing tests, executing automated tests, verifying system execution results through display image recognition capabilities, and test reporting and analysis tools.

TESTPLANT: Automated testing

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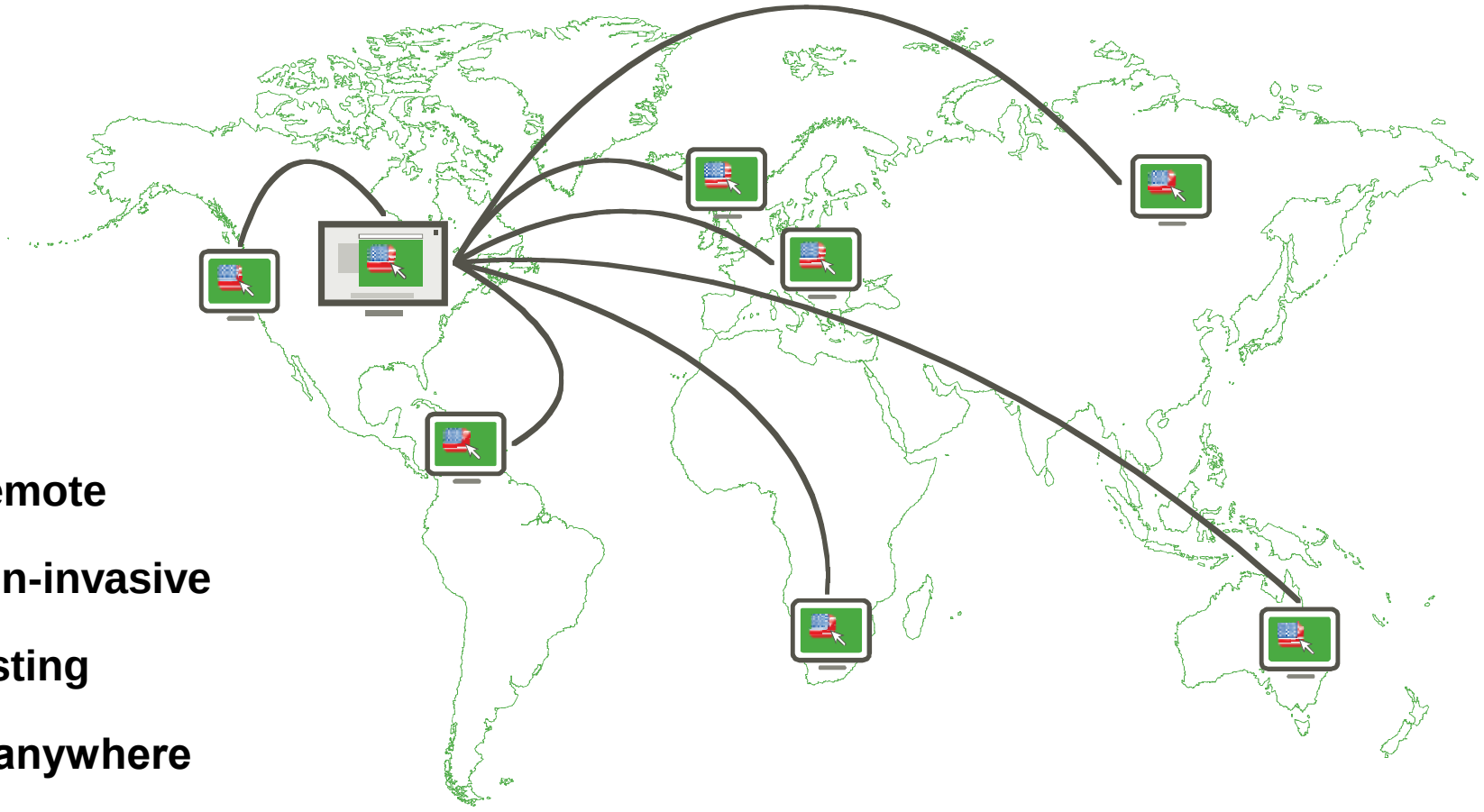

Remote

non-invasive

testing

…anywhere

U.S. patent 7,870,504. Other patents pending.

TESTPLANT Capabilities: CPP Testing

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SCRIPTING	Auto Execution	TEST Verification	Analysis
Auto Test Designs via Image, Mouse, Switch, Keyboard capturing, scripting	**Auto Test Execution via display scripts, scenario events, designed sequences**	**Verify executed Test events via captured real time displays, image recognition capabilities**	**Generate Test Reports from Tests run, events, results**
• Automatic script creation • Script DISPLAY commands, & Test event sequences • Create events on captured images, contingencies • Script elaboration, editing, tailoring • Loops, delays, pause, continue • Expected Results • Build in Auto-Image Verification tests, Pass/Fail • Saved, organize into suites, scenarios, ***REGR*** tests, functional libraries	• Perform Actions on images in scripts • Mouse actions • Keyboard actions • Switch actions • Script, suite, library, scenario selection • Test scheduling • Test management • CM organization • Execution storage of data • Provide repeatability base-lining & regression testing for dynamically changing configurations of Software/Hardware updates/fixes	• Display screens sent back to eggplant • Auto verify expected results built into scripts • PASS/FAIL, bug detection • Save/store results, screens • STOP or Continue test execution	• Test displays, screens saved • Resultant actions during test • Test action timing data • Test results vs. expected • Pass/Fail data saved • Script/Suites ID run, date/time • Correlate Test Results, Reports to operational data

Systems Integration with TESTPLANT Automated Testing

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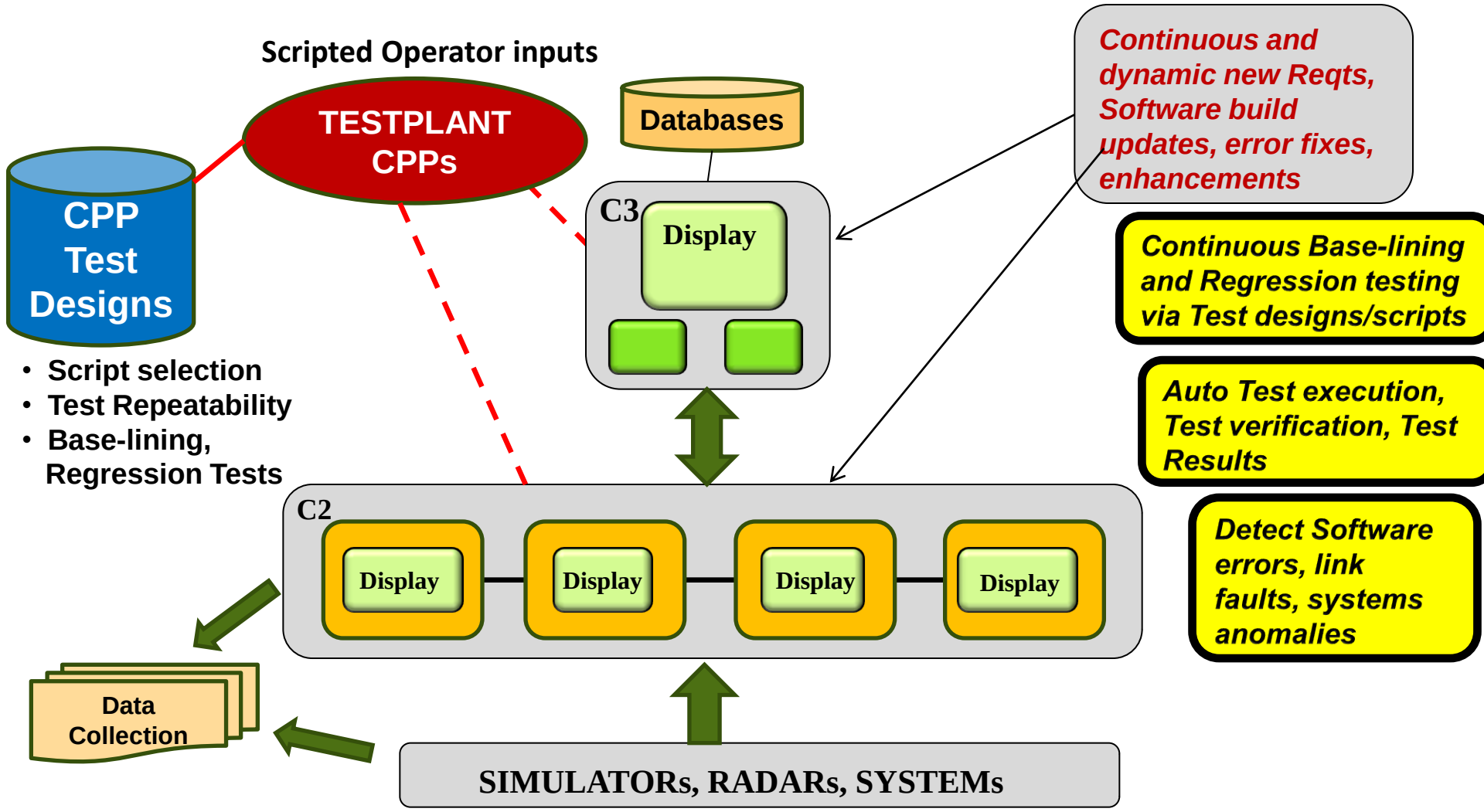

TESTPLANT System Integration/Automated testing in Aviation Systems

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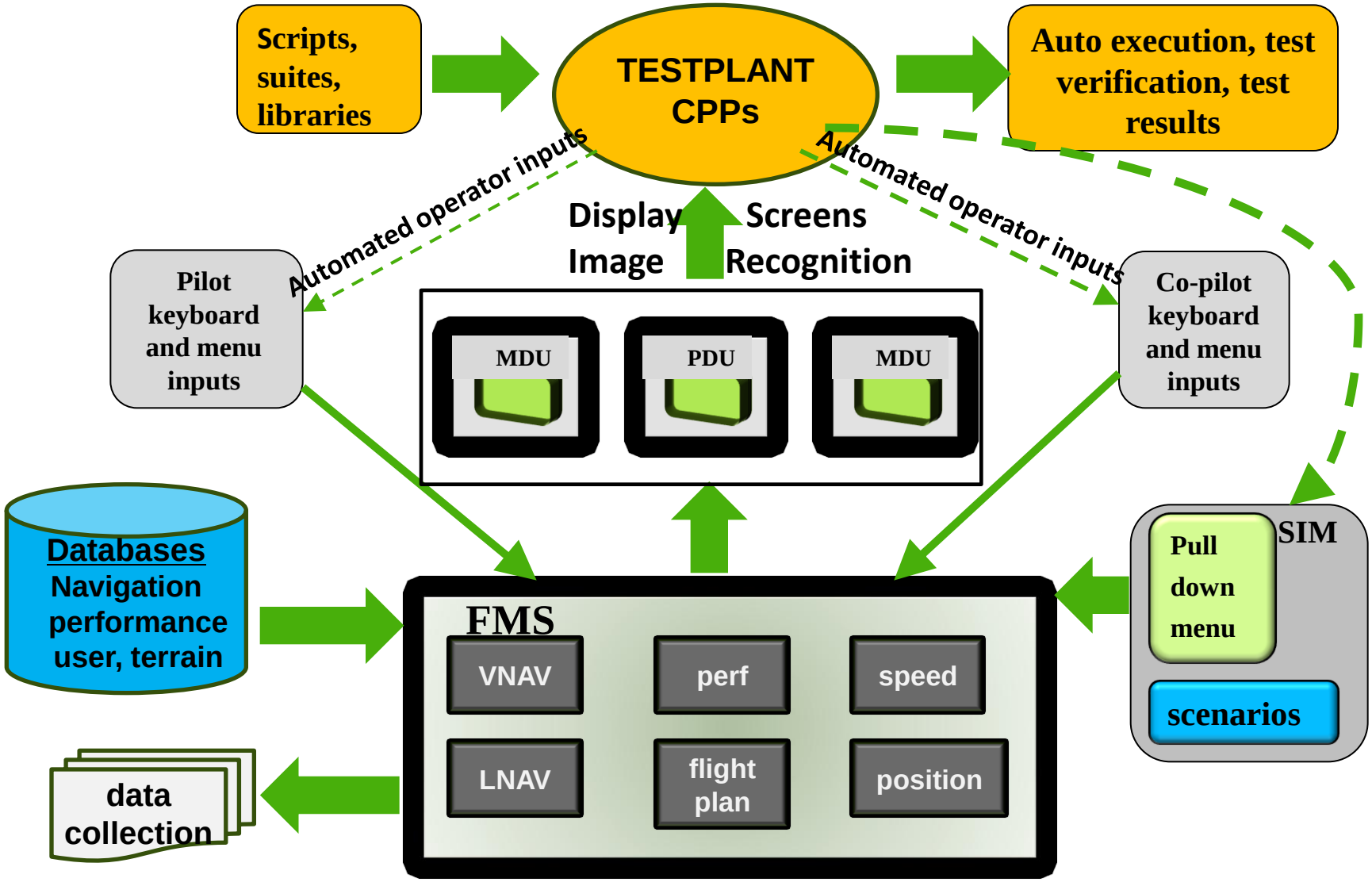

U.S. patent 7,870,504. Other patents pending.

T & E readiness evaluation and assessments

T & E Readiness Evaluation & Assessment

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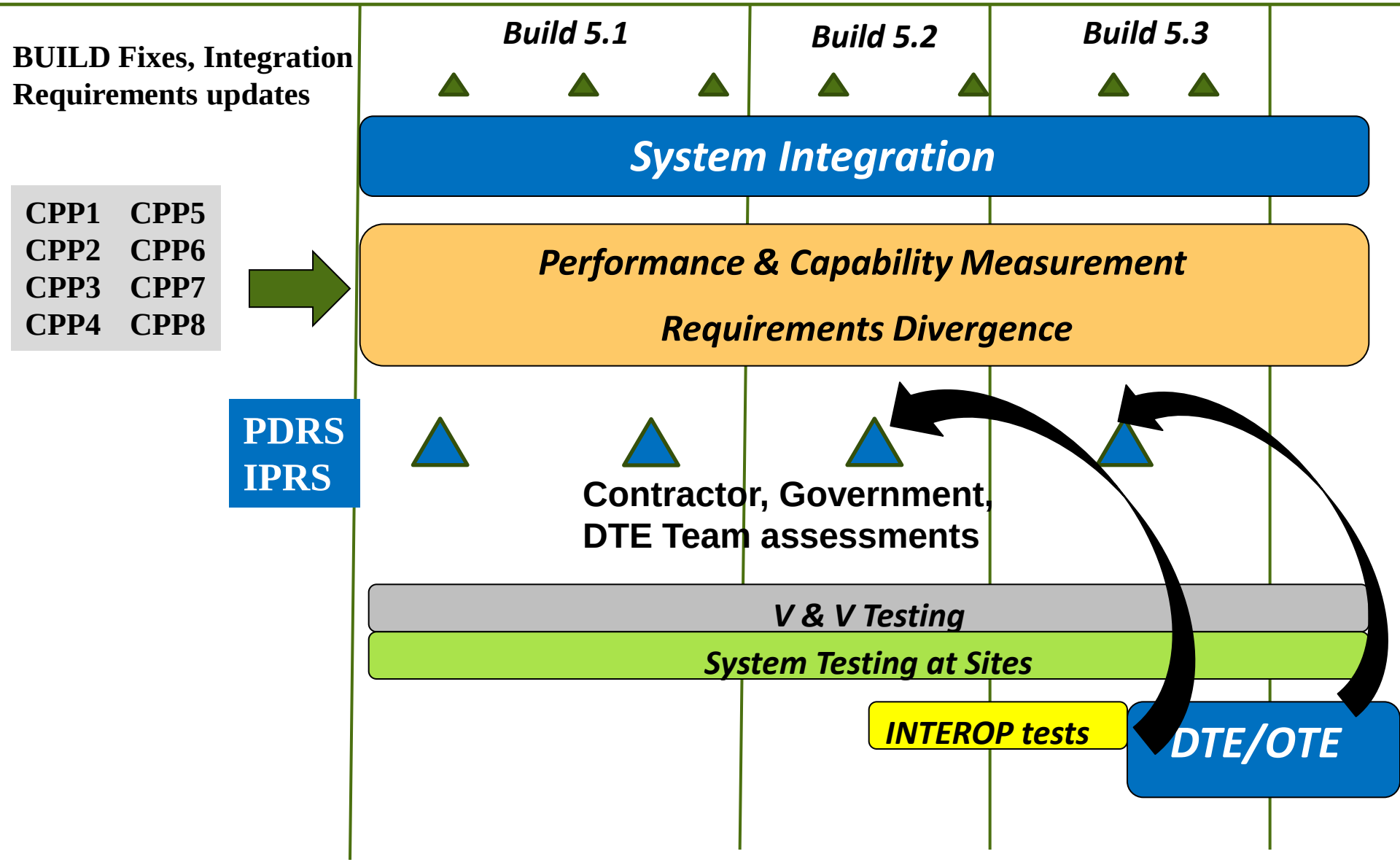

Summary

Recommendations/Solutions

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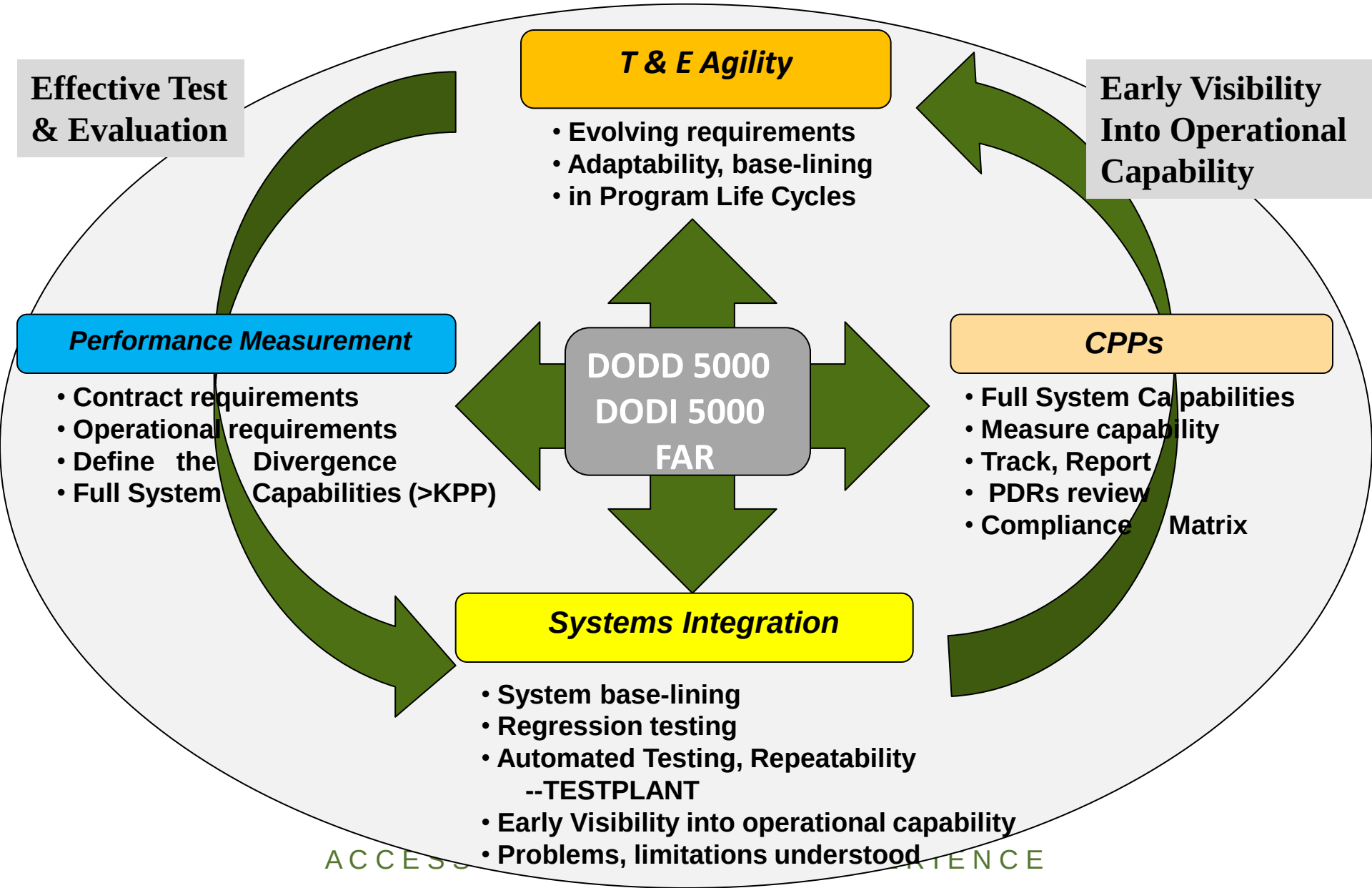

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