

Military System Analysis in an Ill-Posed World: Shaping the T&E Strategy

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For NDIA 29th T&E Conference, 22 July 2014



U.S. Army Test and Evaluation Command



Agenda

The T&E Problem

Definitions: Capability and Environment

T&E Ill-Posed Problem

Task Network = Context

T&E Framework

T&E Well-Answered Problem

Feedback Loop & Use of Task Network



The T&E Problem

DoD

DOD 5000.1 – “The primary objective of Defense acquisition is to acquire quality products that satisfy user needs with measurable **improvements to mission capability...**”¹

DUSD(AT&L)

Section 231 Report: “All testing and evaluation programs ... should learn and understand the **strengths and weaknesses of a system** and its components, **and the effect on operational capabilities and limitations.**”²

DOT&E

Director, Operational Test and Evaluation – “The evaluation of operational effectiveness is linked to **mission accomplishment.**”³

Goal: T&E Focused on Mission Capability

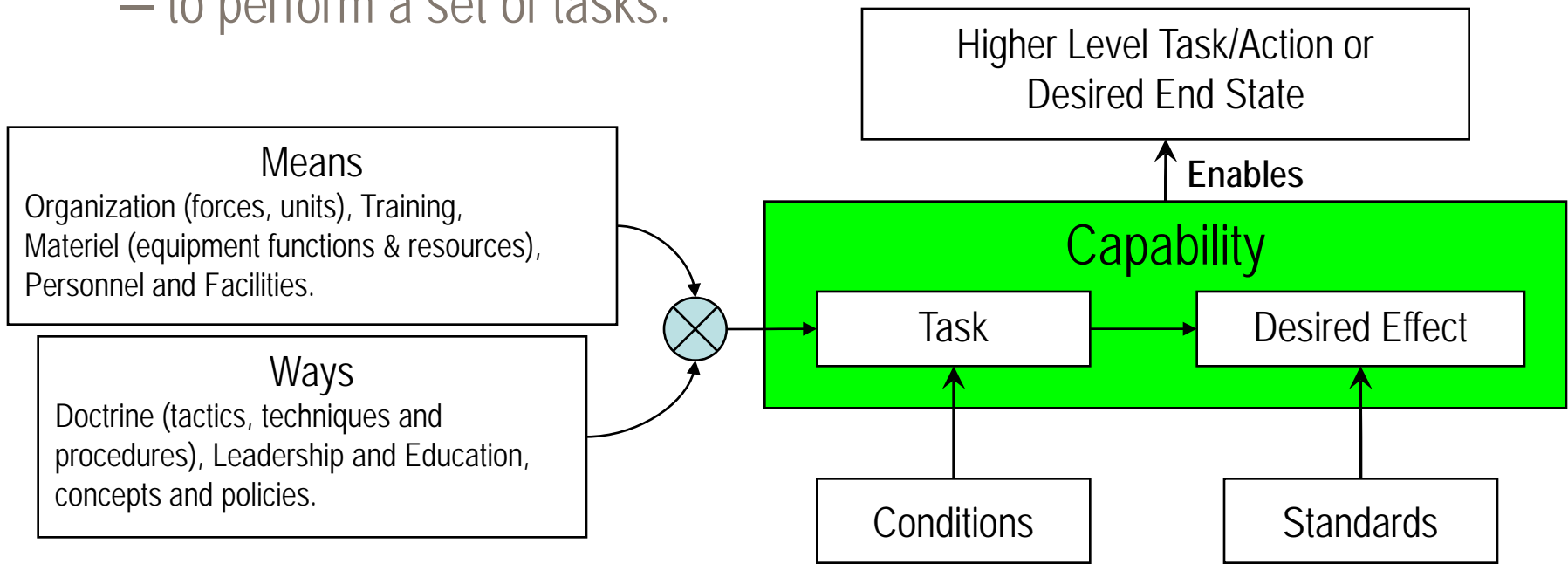
1. Office of the Under Secretary of Defense, Acquisition, Technology and Logistics, Department of Defense Directive Number 5000.1, 12 May 2003.
2. Office of the Under Secretary of Defense (AT&L), Section 231 Report, Jun 07.
3. Memorandum, OSD DOT&E, subject: Reporting of Operational Test and Evaluation Results, 6 Jan 10.



Capability Defined and Decomposed

Capability¹ – The ability to achieve a **desired effect** [or result, outcome, or consequence of a task²] ...

- under specified **standards and conditions**
- through a combination of **means and ways**
- to perform a set of tasks.



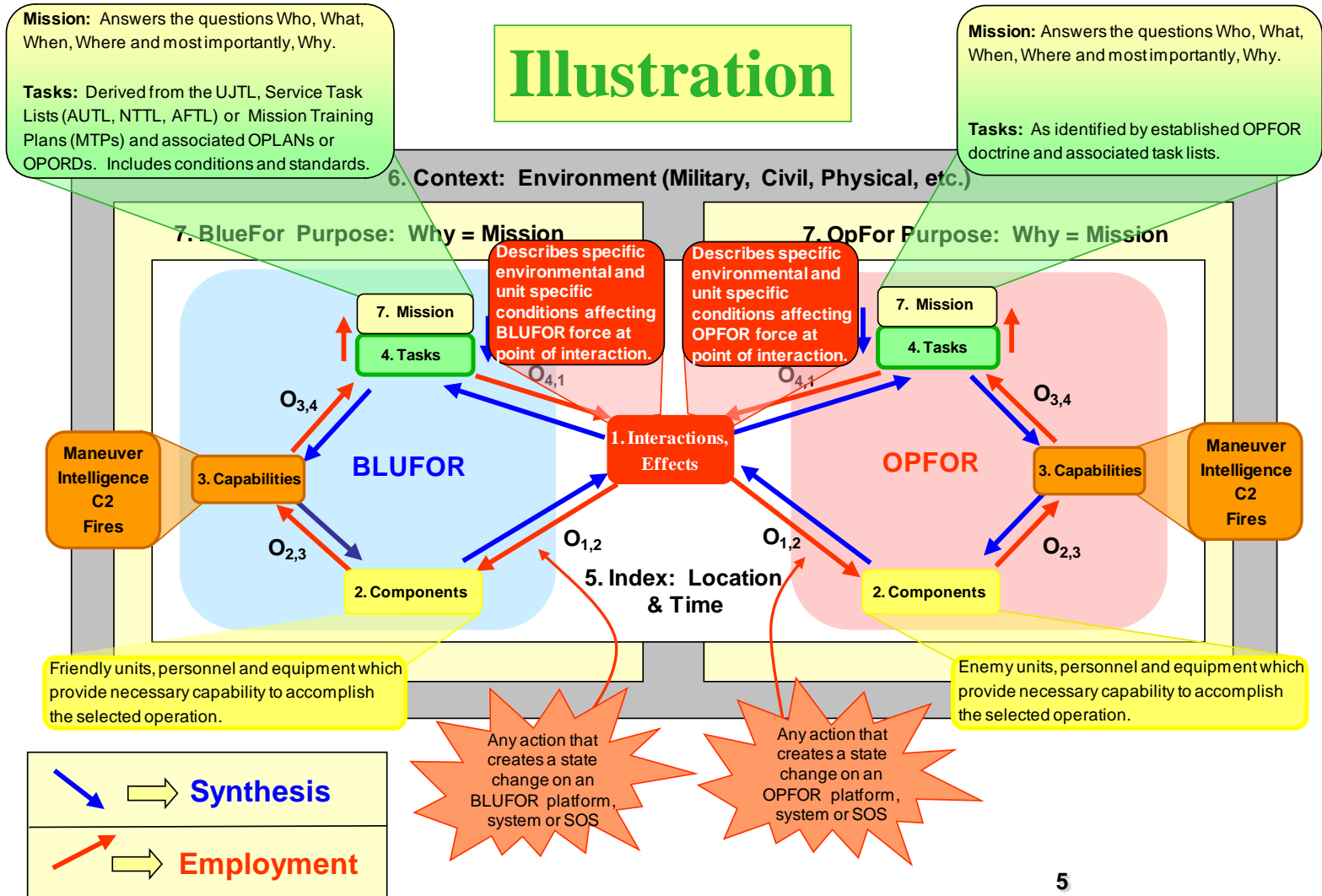
1. CJCSI 3170.01F, May 2007

2. Taken from JP 1-02, Mar 2007, definition of effect.



Environment Fully Defined

Illustration





The T&E III-Posed Problem

Cause

Missing linkage between requirements and operational capability

- How does the system support the Soldier's capability?
 - What Unit/Soldier/System User is doing, to what desired effect.
 - What the system does to support the Soldier's capabilities.

Cause

Missing complete operational context

- What conditions needed to assess system performance in operational environment?
 - What operational conditions are relevant to task accomplishment.
 - How the Soldier will employ the system.
 - Threat actions and responses.
- Under-determined technical and operational requirements
 - How I know when Soldier is successful in applying the capability.
 - How the system under test integrates with the SoS.
 - How the materiel + Soldier interact.

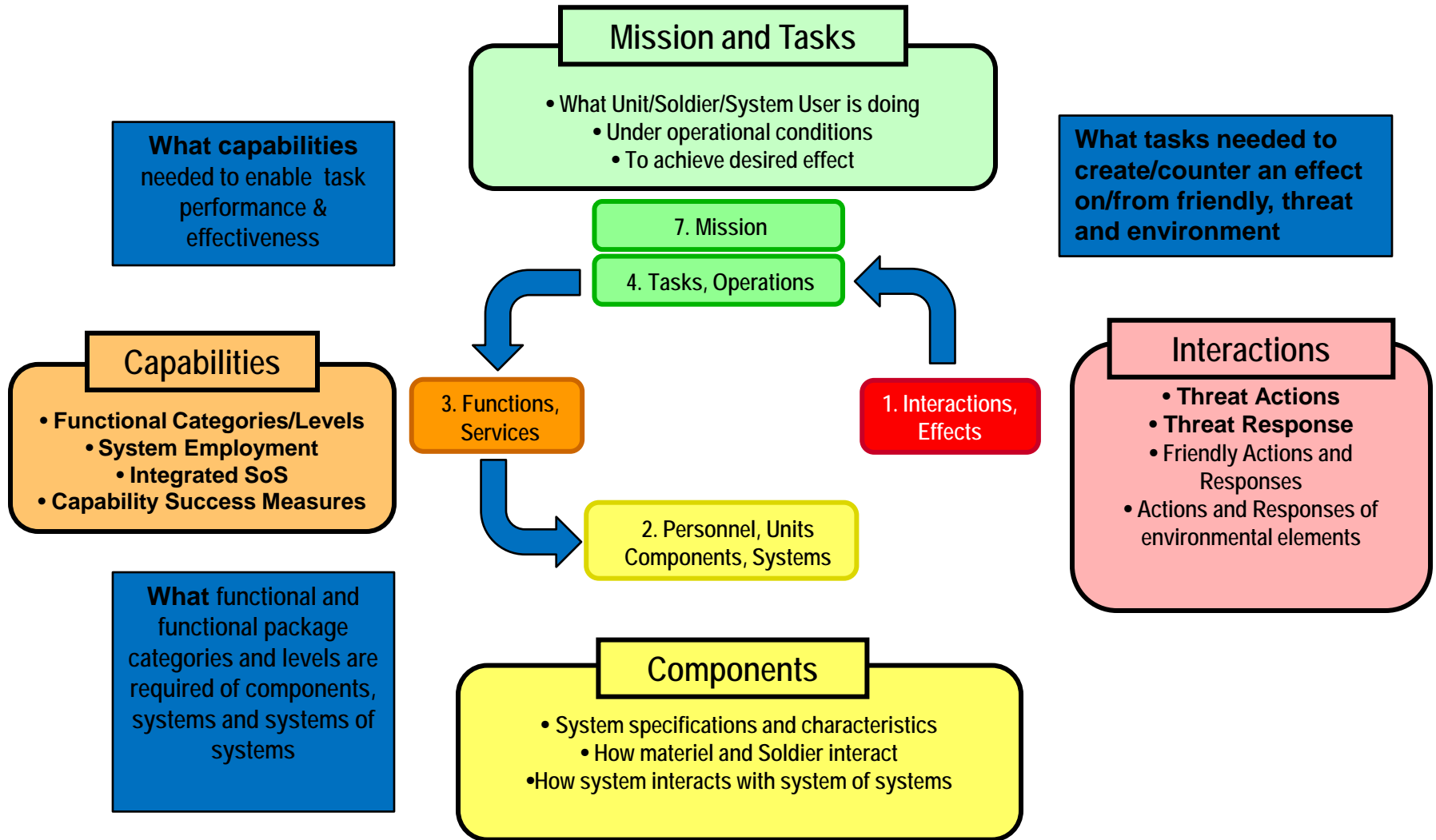
Effect

The "so what" question is not answered

- The system meets/doesn't meet requirements,
 - What is the impact on operational capability?

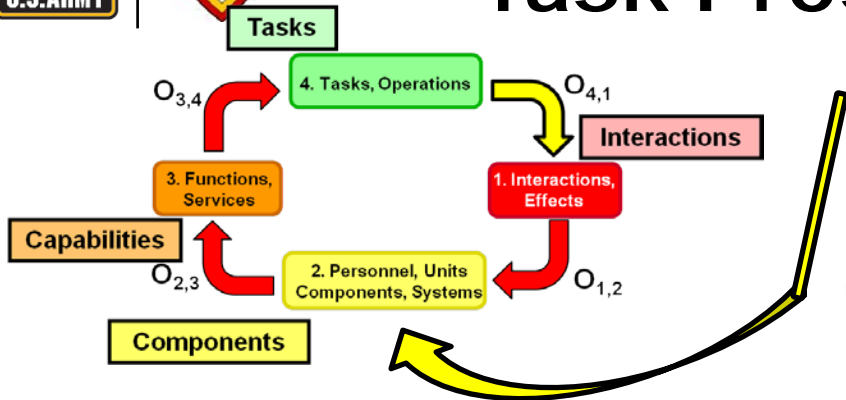


Developing Relevant Metrics & Conditions





Task Prosecution and DT/OT

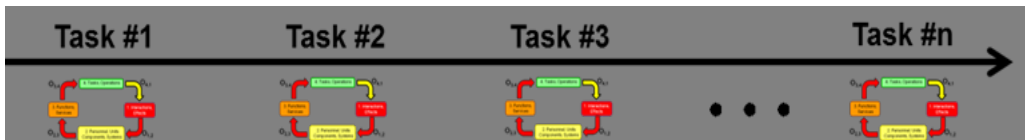


- All Interaction Mechanisms must focus on component state change
- Aggregation of effects of multiple mechanisms (over time) must take place at the platform component level

Interaction Mechanisms

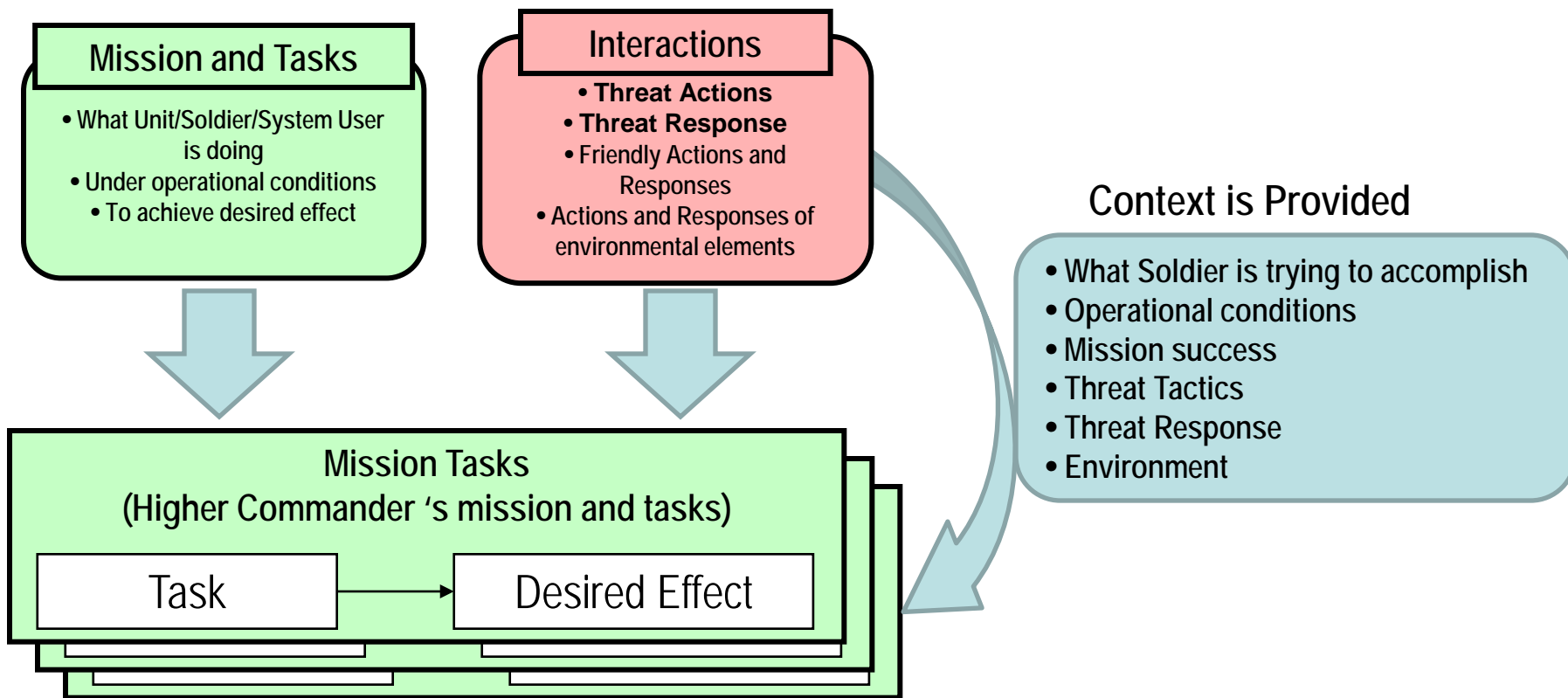
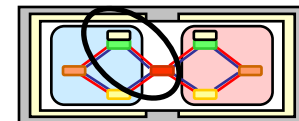
- Ballistic Effects
- Jamming
- Damage Repair
- Chemical
- Resupply
- Repair
- Laser Damage
- Sleep
- Directed Energy
- Nuclear
- Physics of Failure
- Logistics Burdens
- Reliability
- Fair Wear & Tear
- Fatigue
- Heat Stress
- . . .
- . . .

- In Developmental Testing:
 - Identify expected interaction mechanisms based on mission profile
 - Confirm ability to model/simulate via test
- In Operational Testing and M&S:
 - Operational scenario based on mission profile
 - Vary the time sequence and frequency of interaction effects based on mission profile



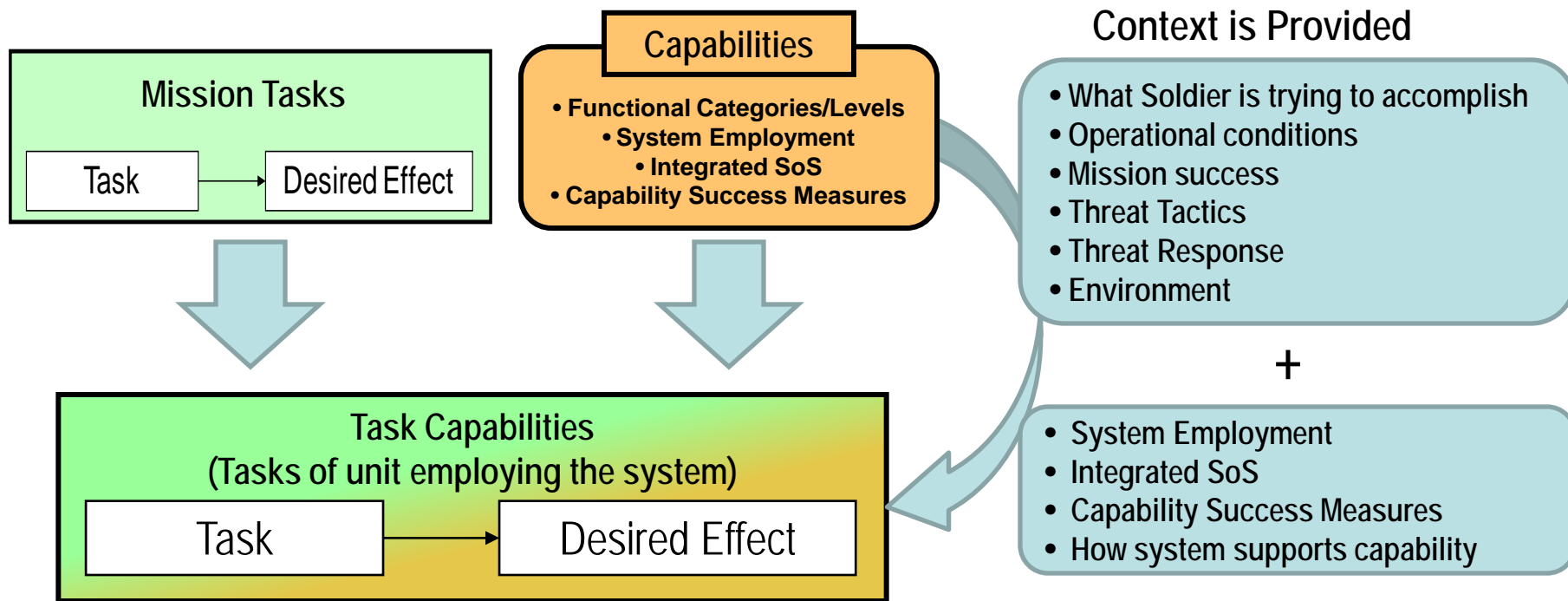
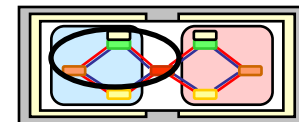


T&E Framework - Mission



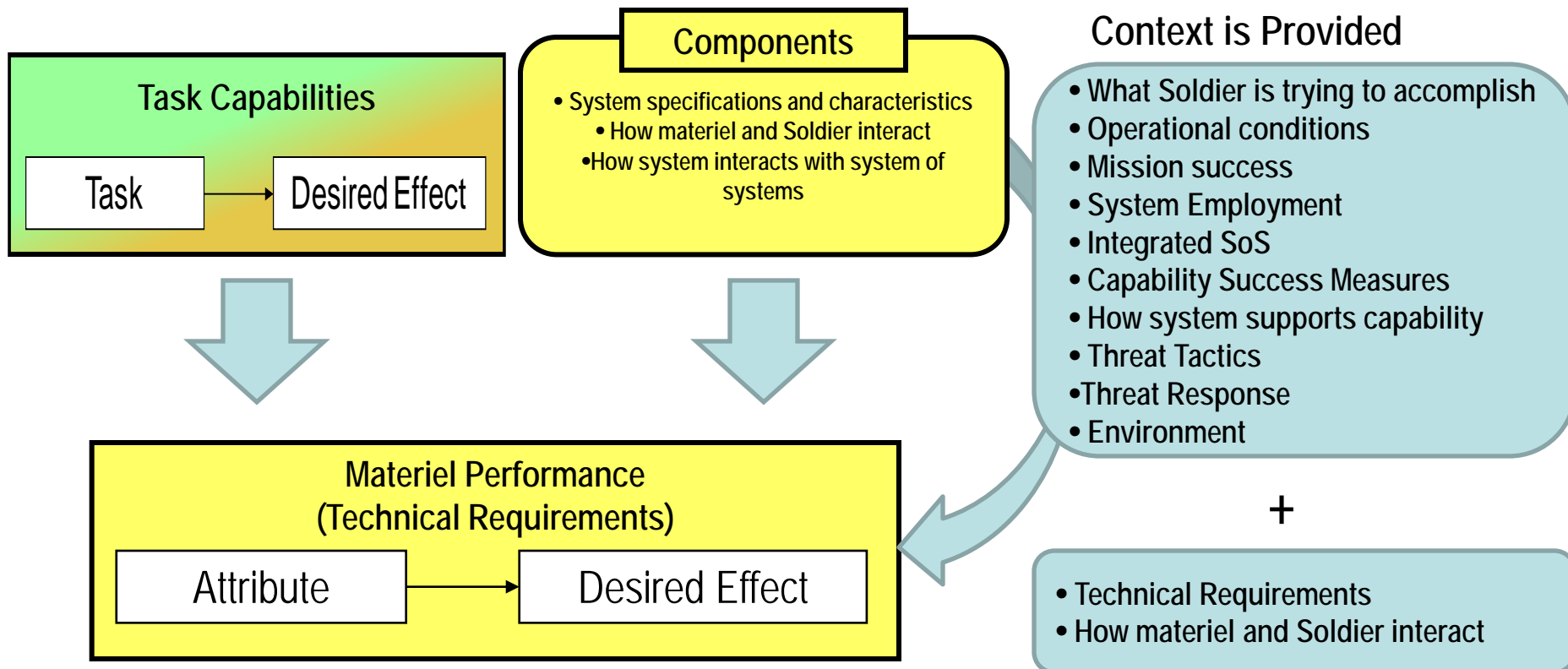
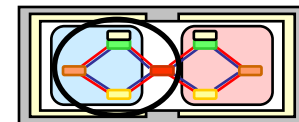


T&E Framework – to Task





T&E Framework – to System

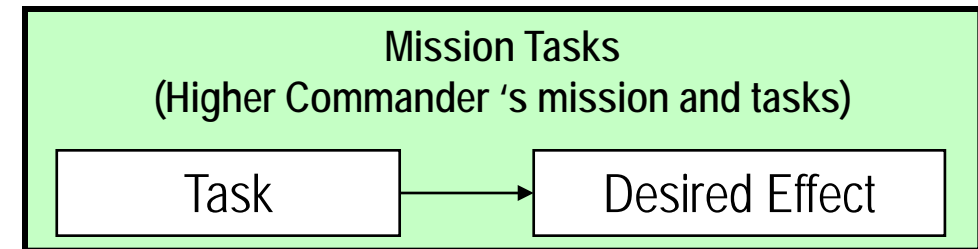




T&E Framework – to Evaluation

MISSION AND SYSTEM

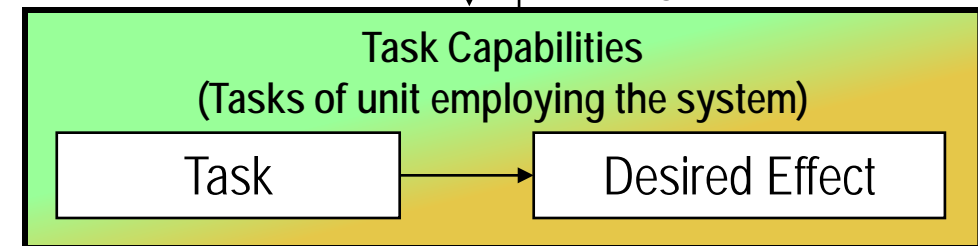
EVALUATED BY



- Operational conditions
- Mission success
- Threat Tactics
- Threat Response
- Environment

MISSION PLANNING

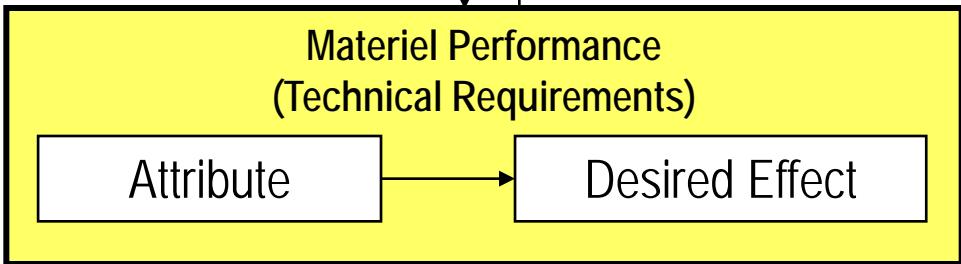
ENABLES



- What Soldier is trying to accomplish
- System Employment
- Integrated SoS
- Capability Success Measures

SYSTEMS ENGINEERING

ENABLES



- How system supports capability
- How materiel and Soldier interact
- Technical Requirements



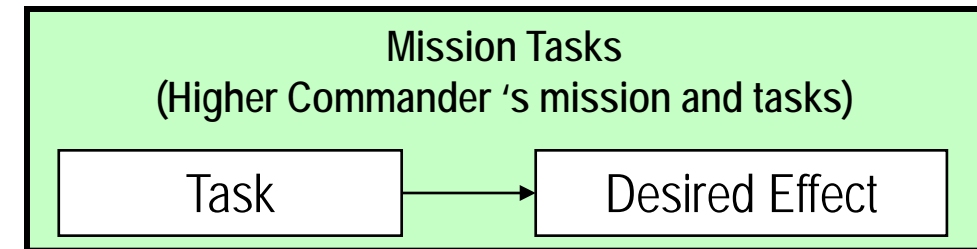


T&E Framework – to Testing/Data

MISSION AND SYSTEM

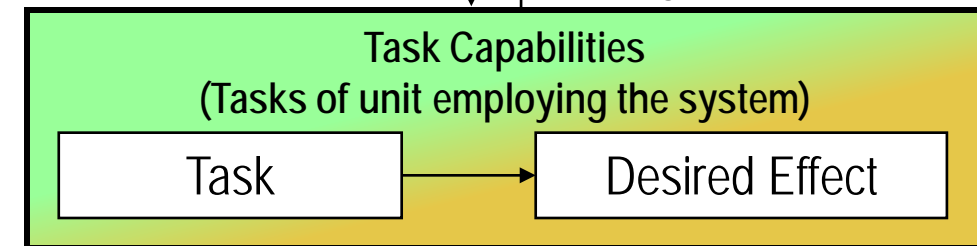
EVALUATED BY

TESTED BY



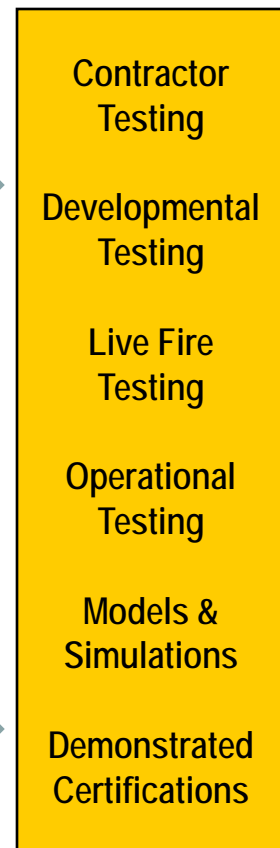
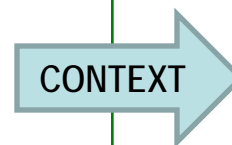
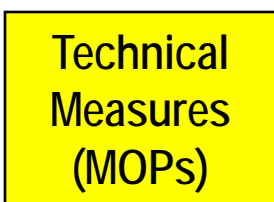
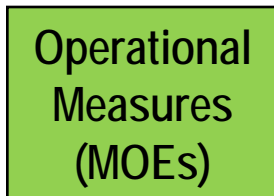
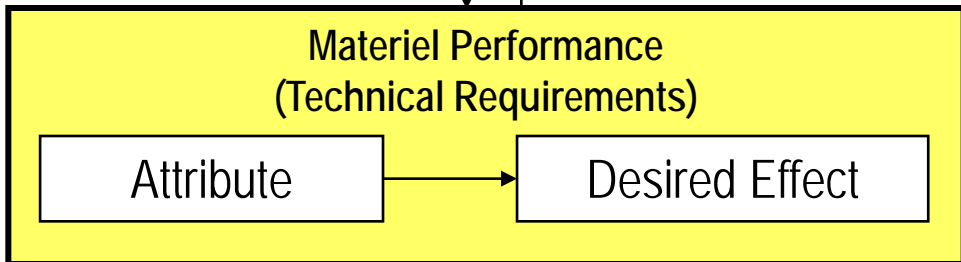
MISSION PLANNING

ENABLES



SYSTEMS ENGINEERING

ENABLES





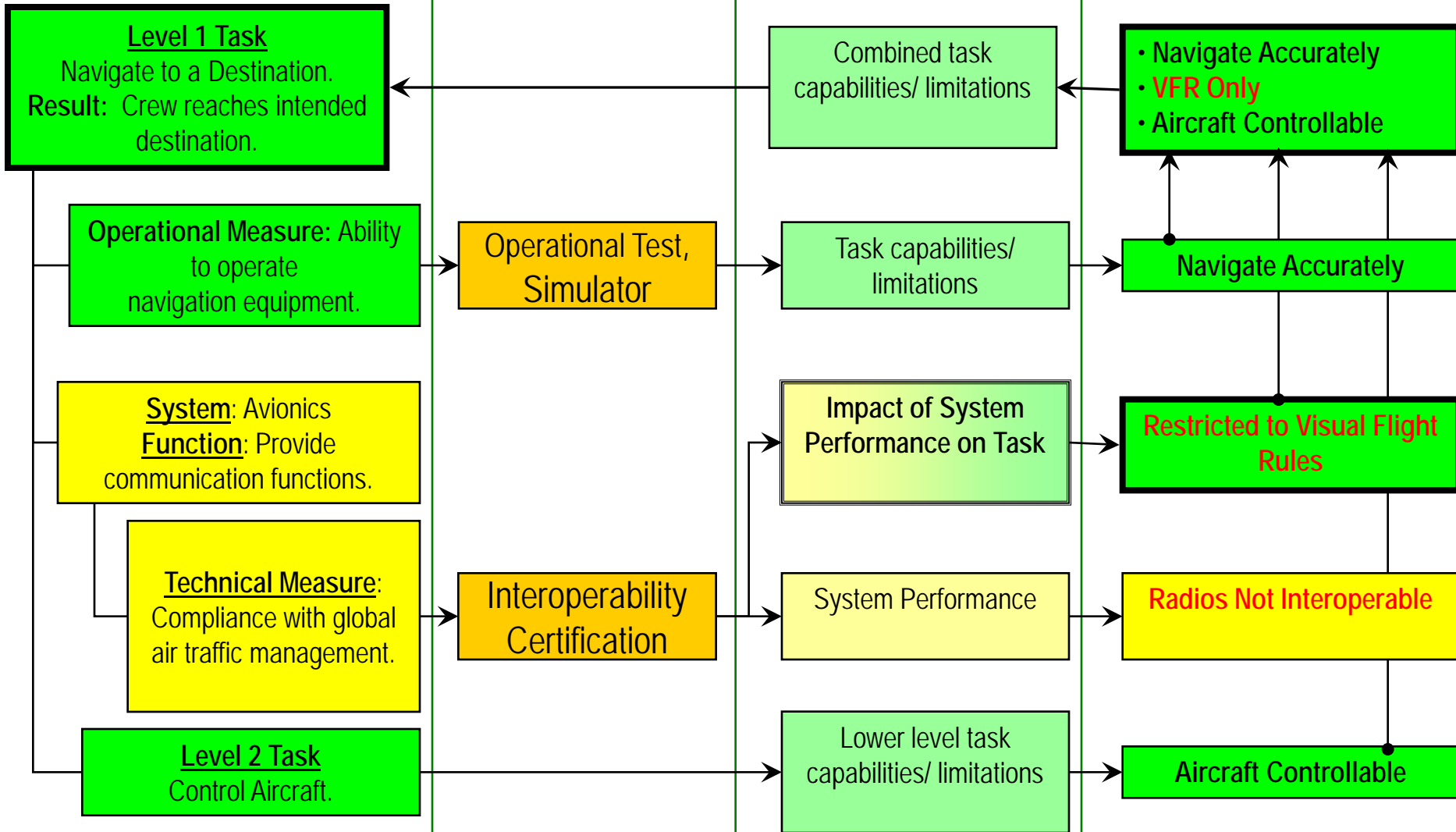
Well Answered Problem

T&E Plan

Test

Evaluation

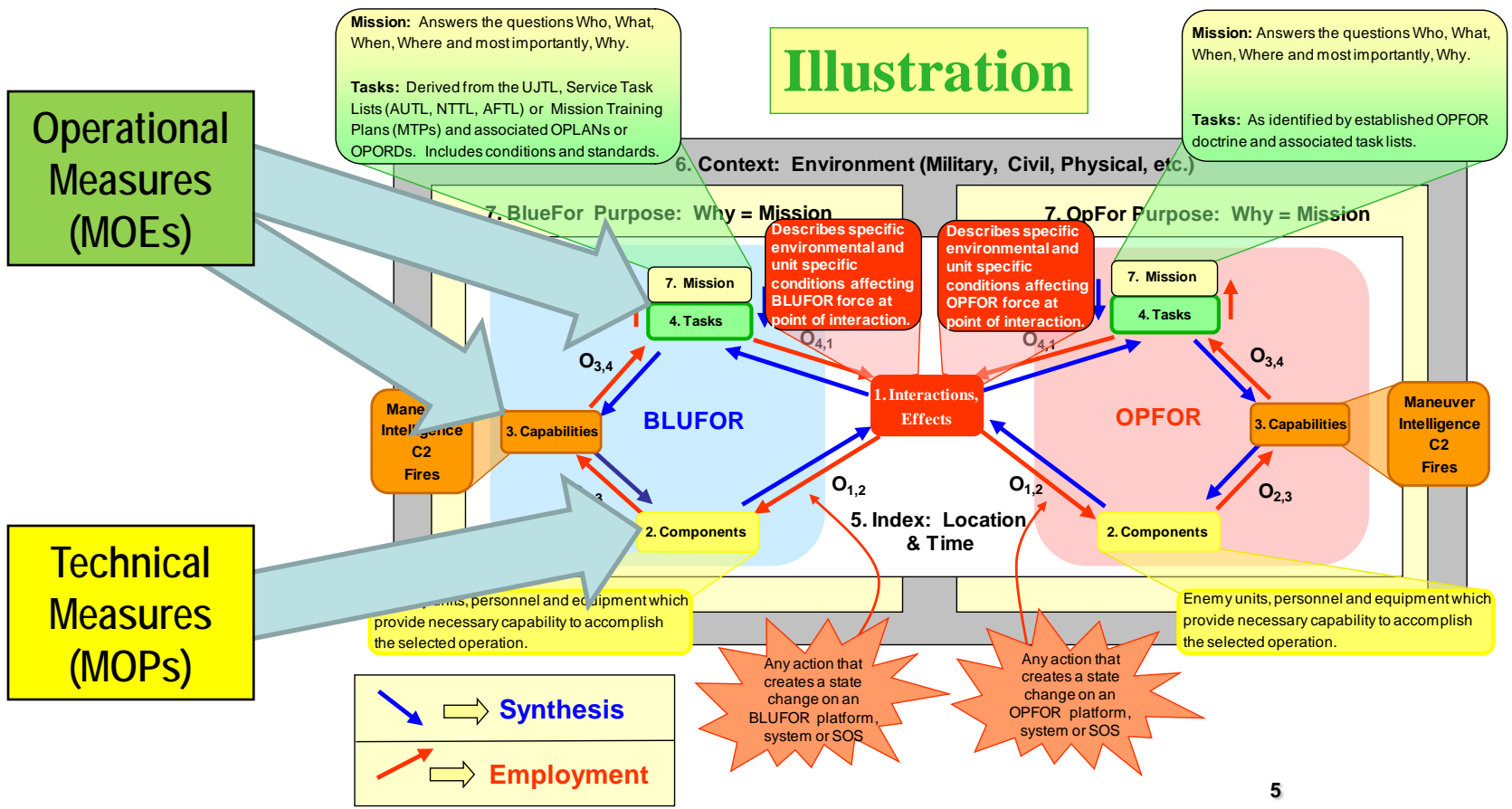
Example





T&E Result as a Feedback Loop

Illustration

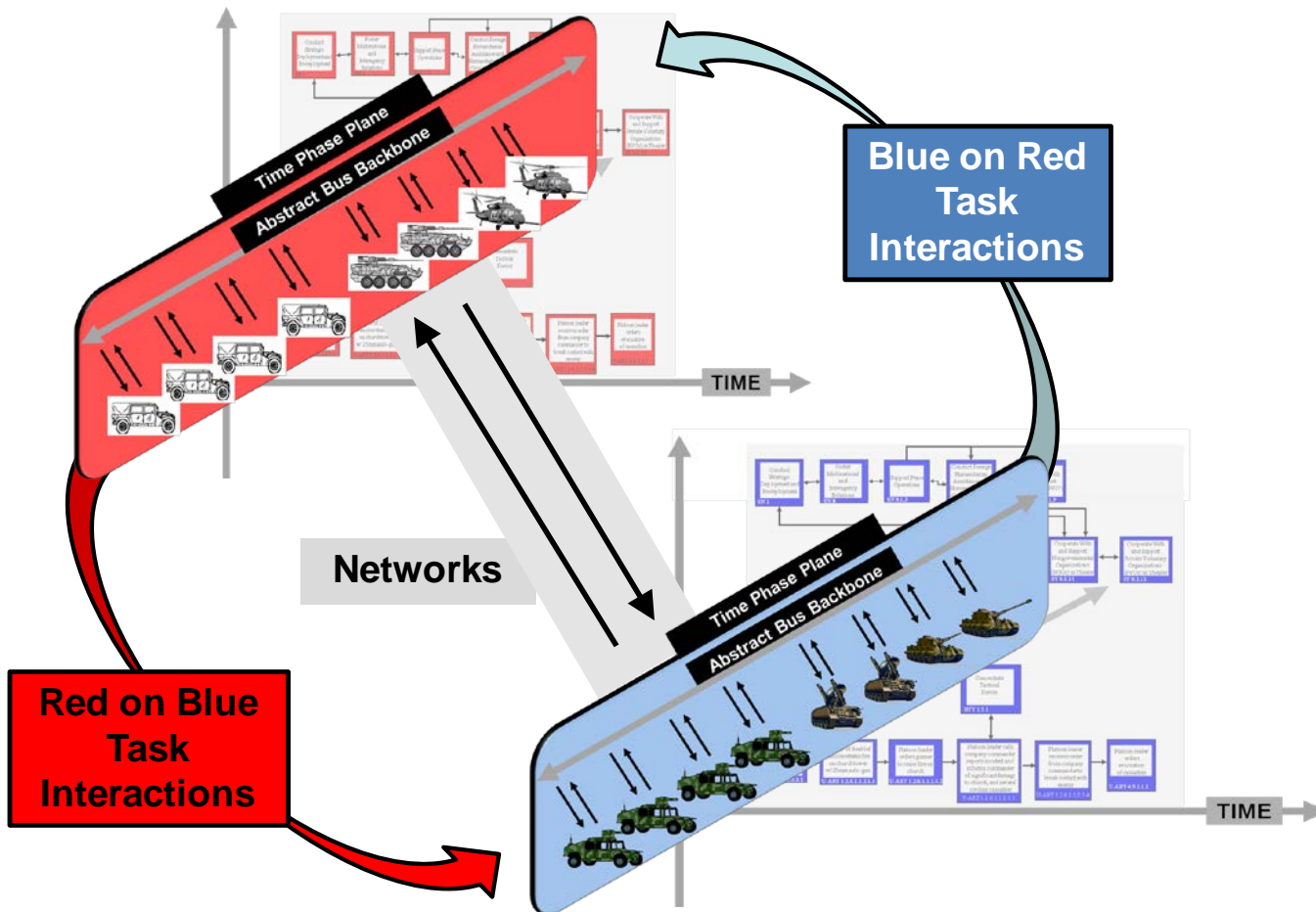


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How the capability and system performance impacts Mission end-state



Task Network Application



OWNFOR and OPFOR Interact over Time

