

Headquarters U. S. Air Force

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Operational Thread Development



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Overview

- **Benefit**
- **Purpose**
- **Definitions**
- **Thread Integration Framework**
- **Thread Development**

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This briefing will cover the benefit and purpose of operational threads, some definitions of basic terms, and a phased approach for operational thread development.



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Benefit

- **Standardized approach**
 - Facilitates cross-team collaboration
 - Consistent terminology usage
 - Improves experiment design
 - Supports joint and service capability-based assessment framework
- **Analysis support**
 - Core analysts will assist in application of this approach
- **Phased approach**
 - Manageable workload for CDTs
 - Clearly identified milestones for thread development products

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The primary benefit to operational thread development is standardization across the CDTs. Because every team is employing the same approach and using the same terminology, cross-team collaboration will be much easier. In addition, experiment designers and planners should be able to build supporting plans that integrate experiment activities rather than simply deconflicting the many moving parts.

In addition, the core AFEO analysts and experiment designers will all be thoroughly knowledgeable about the mechanics of this approach. This approach will improve our integration into related analytic activities, such as the Integration Capability Review and Risk Assessment.

By taking a phased approach, the workload will be spread out over time, and the various CDTs will be generally performing the same activities in the same timeframe. There will be clearly identified milestones for each deliverable.



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Purpose of Operational Threads

- **Facilitate examining a potential improvement to a deficient capability**
 - **The contribution of one or more initiatives or improved infrastructure either through**
 - a new process or modification to an existing process
 - a new organizational construct
 - a new system or system-level (i.e., “machine-to-machine”) exchange between databases, applications, or hardware
- **Allow us to influence player activity (by tailoring scenario events) to ensure we are able to demonstrate capability goals**
- **Provide operational context and therefore relevance**
 - **When reporting results (of initiatives, capability goals, anything else)**

Identify the contribution of initiatives to operationally significant activities and processes (i.e., operational threads)

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The basic purpose of operational thread development is to allow us to examine the capability deficiencies described by the capability and sub-capability goal statements. The operational threads will describe **how** initiatives or new infrastructure can potentially contribute to a series of operational tasks and provide a framework for answering the question: “did we demonstrate the capability?”

A secondary purpose for operational thread development is to provide the basis for control inputs into the experiment. By identifying the variables that must be controlled, the operational thread will allow us to influence player activity where necessary in order to demonstrate the capability goals.

A final benefit of operational thread development is the context they provide when reporting results.



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Basic Definitions

- **Capability:** The ability to **achieve a desired effect** under specified **standards** and **conditions** through combinations of means and ways to perform a **set of tasks** (CJCSI 3170.01E, Joint Capabilities Integration and Development System). Inherent to a capability are the organizations and people, processes, and technical means used to accomplish a military task or mission. Standard US Air Force capabilities are found in the Master Capability Library.
- **Task:** A discrete event or action—not specific to a single unit, weapon system, or individual—that enables a mission or function to be accomplished—by individuals or organizations (AF Doctrine Center glossary.) Standard C2 tasks are found in the C2 Task List developed by the C2 Capability Assessment Team.

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These definitions have been copied from various DOD and AF sources. It is important to use consistent terminology when designing the experiment. Miscommunication may lead to false expectations or inconsistent objectives.



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Basic Definitions

- **Initiative:** Any potential solution—across the DOTMLPF spectrum—for addressing a recognized warfighting need or **capability gap**. Initiatives result from the JEFX initiative selection process.
- **Innovation:** Any deviation from an operational or systems baseline; approved by Configuration Control Board (CCB)
- **Capability Gaps:** The inability to achieve a desired effect under specified standards and conditions through combinations of means and ways to perform a set of tasks (CJCSI 3170.01E). For JEFX, this term is synonymous with capability “deficiency”. Capability gaps are chosen by CDTs based on the experiment focus areas and capability goal statements. CDTs must be selective in choosing capability gaps; time and resource limitations often prevent us from achieving all aspects of a broadly stated capability goal

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Operational Thread Definition

- **Definition:** A series of operational tasks that relate initiatives and/or improved infrastructure systems to one or more C2 processes

- **Characteristics**
 - A design feature of the experiment; used by Capability Development Teams to assess capability goals
 - Should be represented by an operational architecture and supporting systems views; facilitates transition within the Joint Capabilities Integration and Development System (JCIDS) (OV-6C)
 - Observable and measurable; defines specifically what the assessment team will examine

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This is an overall definition of what we mean by “operational thread.” An operational thread is related to--but not the same as--a “system” thread.

There are several characteristics of an operational thread that relate to both the purpose and method for developing them. It is important to keep in mind that these threads are a design feature of this experiment, to be used primarily by the CDTs to achieve their capability goals. As such, the information contained within each thread is applicable to a variety of related tasks, such as scenario and events development, systems development and operational architecture development.

The threads should be represented by an integrated architecture (operational, system, and technical views). We do not plan on strict adherence to the DOD architectural framework; however, the closer we are able to mirror that standard, the more effective the architecture will be as a tool for representing the operational threads.

Finally, the threads must be observable and therefore measurable. They will provide the basis for the rest of the assessment planning.



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Scenario & Vignettes

- **Scenario will define level of war (MTW, SSC, etc) and Area of Responsibility (AOR)**
 - Also includes all associated materials (IPB, databases, background material, etc)
 - *You* define scenario requirements for the Execution IPT
- **Scenario vignettes will be used to sequence threads during execution**
 - Associated with Master Scenario Events List (MSEL) development
 - Vignettes are specific sequences of adversary activity within the scenario
 - Designed to elicit an expected response from blue forces (i.e., operational thread)

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Operational Thread Required Elements

- **Name & Identifier:** Uniquely identifies the thread (e.g., “01A: Joint Air Estimate Process”). Will also distinguish between “operational” and “technical” and among monitor-assess-plan-execute
- **Description:** Description of the capability deficiency or gap this operational thread will examine. Describe any *variations* of this thread that will occur.
- **Operational Tasks:** Related C2 & ISR tasks and player activities
- **Measures:** Characterize the performance of tasks and overall effectiveness of the operational thread
 - **Success:** Capability gaps; broad (e.g., shared awareness)
 - **Effectiveness:** Operational threads (e.g., time for F2T2EA)
 - **Performance:** Tasks; specific (e.g., accuracy, timeliness, completeness)
- **Initiatives:** Initiatives (and innovations) that contribute to the thread (i.e., potential “solutions”)

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These are the minimal essential elements of an operational thread. Without all of these elements, there is no “thread.” There are many details associated with each of these elements, but we’ll save that for a later discussion. The online Jefxlink thread development toolset requires the entry of this information.



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Operational Thread Integration

- **A conceptual framework allows us to understand the interrelationship among operational threads**
 - **May not incorporate all threads or all capability gaps**
 - **May be based on joint or service doctrine or Tactics, Techniques and Procedures (TTP)**
 - **For example: Joint Air Tasking Cycle or Joint Air Estimate Process**

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There should be some overall framework that can tie all of the operational threads together. Conceptually, the threads should be “integrated” into an overall framework, such as the Joint Air Tasking Cycle, that defines the basic areas under examination in the experiment. This conceptual framework may be based on joint doctrine or TTP. For the scheduling and execution of operational threads, a series of scenario “vignettes” will cause the desired operational threads to happen. These vignettes are most likely based on specific adversary actions (i.e., movement of troops or weapons, employment of weapons, provocative statements) that evince the desired blue forces activity. A balance must be achieved here between complete “free play” by the OPFOR and BLUEFOR (closer to an exercise) and complete scripting (more like a formal test).



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JEFX 06 Joint Air Tasking Cycle

- Joint Air Tasking Cycle selected as operational thread integration framework for JEFX 06
- Based on Joint Doctrine (JP 3-30)
- Operational thread developed within each of the 6 phases of this cycle
- Provided a recognizable structure for associating threads to each other

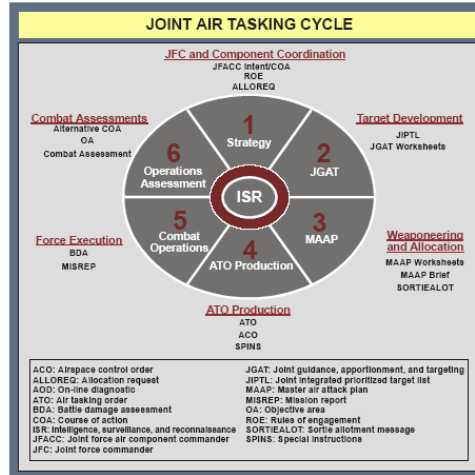


Figure III-13. Joint Air Tasking Cycle

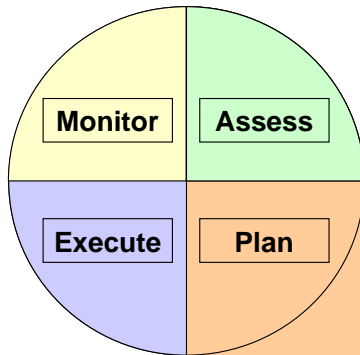
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JEFX 08 Monitor-Assess-Plan-Execute

JEFX 08 Operational Thread Framework



Example Ops Thread

- Time Sensitive Planning Process
- **Measures:** Ability of new collaborative tools to improve SA in a distributed planning environment
- **Tasks:** Analyze Mission, Develop COA, Develop Cmdr's Estimate
 - Sub-Tasks for each

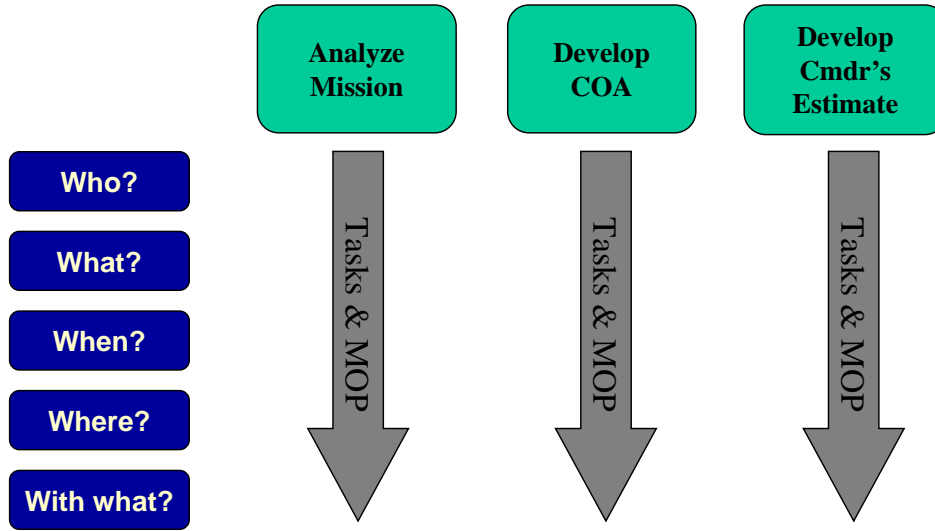
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JEFX 08

Example Operational Thread



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How do I get started?

-
- ❑ **Review capability gaps**
 - ❑ Ensure shared understanding within your CDT
 - ❑ Revise/clarify MOS as required
 - ❑ Forms basis for developing threads
 - ❑ **Identify “broken” processes, insufficient systems and dysfunctional organizational structures**
 - ❑ Requires input from operational community
 - ❑ Serve as baseline (“as is” situation)
 - ❑ Processes are candidates for operational threads
 - ❑ Should reflect capability gaps
 - ❑ Picture is worth 1000 words
 - ❑ **Determine best allocation of workload**
 - ❑ Requires knowledge of team member skills & experience
 - ❑ Task appropriate sub-groups to develop threads and serve as thread managers
 - ❑ Example: one sub-team per gap

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How do I get started?

- **Formulate propositions for the initiatives**
 - What gaps, specifically, does each initiative contribute to?
 - How do those initiatives contribute? What is important to measure?
 - What processes identified above do the initiatives support?
 - Qualify your propositions as needed
- **Break down processes into steps (i.e., tasks)**
 - Example: Time Sensitive Planning
 - Add details over time
 - Eventually need measures for these tasks
 - Where does the process start and end (for our purposes)?
- **Identify method to cross-check with other CDTs**
 - Will become more important as we proceed
 - Must identify relationship among threads (MAPE)
 - Will probably involve a regular inter-CDT meeting

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Additional considerations

- **Planning or execution? (Temporal focus)**
- **Inter-theater or intra-theater? (Geographic focus)**
- **Where do initiatives fit into this thread?**
 - **How do they support operational tasks?**
- **What measures are relevant?**
 - **Example: Network Centric Operations Conceptual Framework**
- **What variations of this thread must occur?**
 - **Under what conditions must each trial occur?**
- **What scenario supports this thread?**
 - **Real-world or fictitious?**
 - **What scenario vignettes are required?**

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There are several considerations when developing operational threads. A basic question to consider is whether the thread will cover planning or execution activities. There should be both types of threads.

Because experiment planning, design, assessment, and execution resources are limited, the operational threads should be prioritized as they are developed. The weight of effort will go towards those threads that are higher priority.

Prior experience has indicated that 15-20 operational threads will be manageable with the resources available. There must be a balance between spreading this activity too thin and not focusing too narrowly on only a few threads.



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Additional considerations

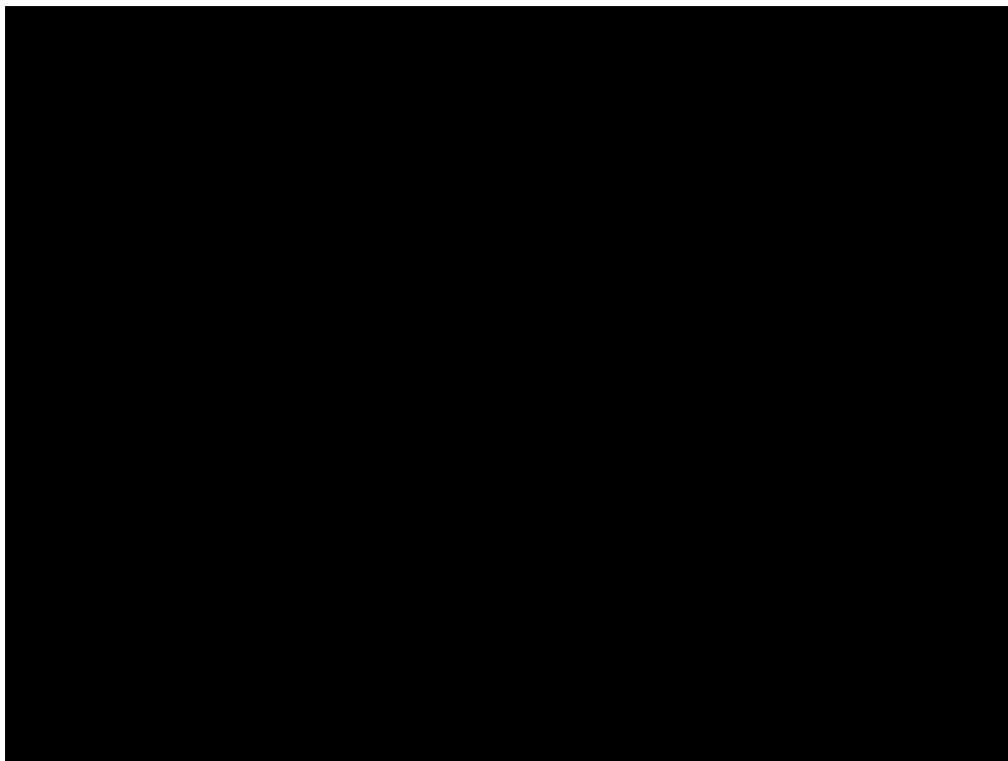
- **What level of command does this thread address (Strategic, Operational, or Tactical)?**
 - **Or does this thread examine sharing of information between levels?**
- **What phase of the thread integration framework does this thread address (Monitor, Assess, Plan, or Execute)?**
 - **Or does this thread examine the transition from one phase to another?**
- **What, if any, live assets are required?**
- **Will foreign nationals participate in this thread?**
 - **Or, is there a portion of this thread that is “US only”?**
- **Operational threads should be prioritized**
- **Expectation: 5-8 operational threads *per CDT***

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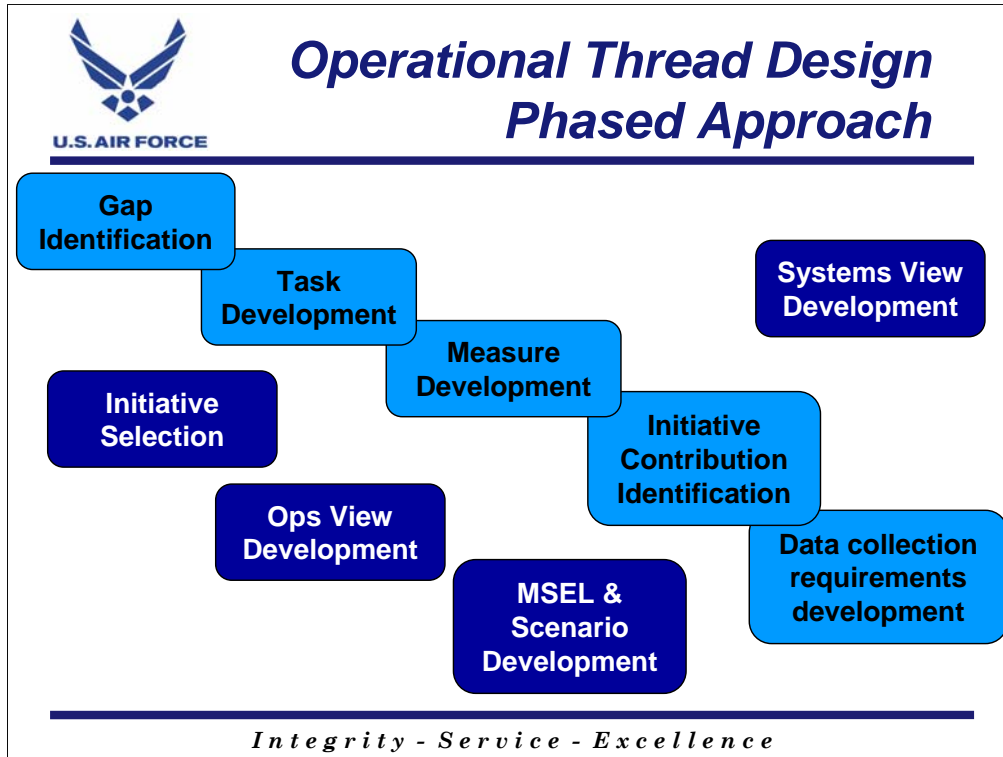




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Backups

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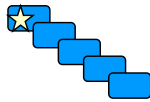


This is the phased approach we will use for operational thread development. Some of these activities are already occurring. In reality, these phases are overlapping, iterative and recursive. In other words, each phase may be re-visited based on the results of subsequent phases.

As shown, there are related activities (e.g., Ops View Development and Scenario Development) that are related to the development of operational threads. Again, these are shown in general chronological sequence, but there will necessarily be considerable overlap and “re-visiting” of these activities.



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Gap Identification

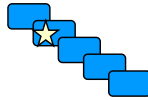
- **Identify the specific capability gap or deficiency in sufficient detail to ...**
 - Facilitate call for initiatives
 - Determine measures of success that are associated with each gap
- **Focus of CDC**
 - Should be complete; reflected in the sub-capability goal statements and documentation
 - Adding or revising capability gaps at this point affects all follow-on activities

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The first phase is gap identification. This activity was a primary focus of the Concept Development Conference, and should be complete. This is one of the few phases that generally should not be revised or re-visited, other than to add additional required detail.



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Task Development

- **Identify a series of operational tasks (i.e., an operational thread) that allow examination of each capability gap**
 - **Begin at a high level (e.g., 1. Find, 2. Fix, 3. Track, 4. Target, 5. Engage, 6. Assess)**
 - **Add details and supporting activities over time, as required**
 - **Player-operator participation is essential**
- **Reference the Master Capabilities Library, Functional Area Assessment, AOC functional decomposition, AFOTTP, functional area CONOPS & CONEMPS**
- **Most difficult step—but the most critical**

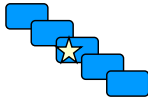
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The next phase is task development. The tasks are discreet events and actions that lead to the accomplishment of a mission. For the operational thread, these are the activities that allow us to examine a specific capability deficiency. This can be a daunting phase and should be approached in steps, starting with identification of the high-level tasks. Eventually, there will be several additional elements of information required for each task (e.g., who, what, when, where, how, with what)

There are several useful sources of information, in addition to subject matter expertise, that should be consulted during this phase. Those listed are examples of where current (baseline) operational processes are documented.



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Measure Development

- **Identify measures for each task**
 - Measures of performance for each task and measures of effectiveness for each operational thread
- **Refine measures of success**
 - Developed at CDC
 - Characterize success in achieving capability goals

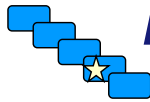
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The next phase is development of the measures associated with the operational thread and each task. Measures that are associated directly with the thread (independent of a single task) are measures of effectiveness. These measures characterize the achievement of the desired result. Measures of performance examine individual tasks within the thread.

At this point, the measures of success for the overall capability and sub-capability goals should be revised as appropriate.



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Initiative Contribution Identification

- **Identify the contribution each initiative will make to the operational tasks**
 - **Could lead to additional measures**
 - **Initiatives may contribute to many operational threads and associated tasks**

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The next phase will not occur until after initiative selection. During this phase, the contribution of initiatives to each operational thread should be identified. This process could (and likely will) lead to additional measures.



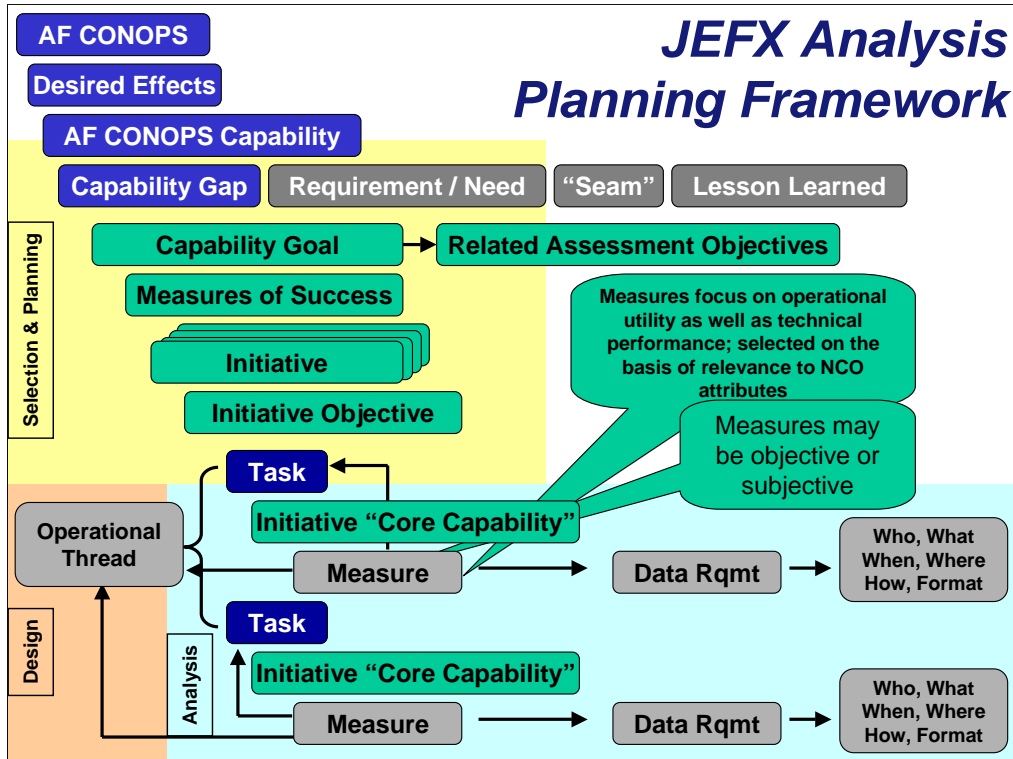
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Data Collection Requirements Development

- **Identify the data that must be collected during thread execution**
 - Based on measures identified for each operational thread
 - Specified as Data Collection Requirements (DCRs) in operational thread toolset
- **Managed by Assessment IPT**
 - Data Collection Cell (DCC) is responsible for collecting all data

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The final phase is to identify the data that must be collected during execution of the operational threads. These requirements may be captured in a data management plan and also in the Jefxlink thread planning tool. The data collection team will be responsible for collecting, processing, storing and disseminating the collected data.



This slide depicts the analytic breakdown that will be used for this experiment, starting with the high-level guidance provided by AF CONOPS. Supporting these CONOPS are a group of warfighting capabilities. Some of these capabilities are associated with a capability gap—identified by a formalized requirement, need, seam, or lesson learned.

Click. Given this guidance, we have built this experiment around capability goals, each of which has a set of assessment objectives. These **assessment** objectives support the basic objectives identified in the respective CONOPS for these capabilities. Aligned with one or more of the capabilities are a set of formal and informal experiment initiatives. There are many of these, as shown in the slide, and each should have its own set of assessment objectives. Establishing all of these objectives is the fundamental work that must be done prior to any further analytic planning.

Click. The next step is to decompose the capability and sub-capability goals into measurable tasks. In general, these are tasks that will be facilitated by initiatives. Taken together, these tasks support or define an operational thread or AOC process, as described in AFI, TTP, SOP, or other relevant document. Although not explicit in this slide, there may be many different initiatives or innovations supporting a single operational thread.

Click. Once we have identified these tasks, we can identify initiative core capabilities that support those tasks. Each of these core capabilities will be associated with one or more measures that will tell us something about the performance of these tasks during the experiment. These measures should focus on the extent to which the initiative facilitated that task, and the associated contribution to the desired capability. By associating these measures in the way depicted here, we will be able to easily report results relevant to an initiative, capability gap or AOC process.

Click. In general, the measures shown here will describe the performance of a task (MOP) and may be either objective or subjective. In addition, the measures will describe both operational utility as well as technical performance. In some cases, the measures may describe the effectiveness of an operational process (MOE).



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Developing Measures Definitions

- **Attribute:** Some aspect of an event, situation, person or object considered important to understanding the subject under study (DODCCRP Experimentation Code of Best Practices). Examples include range of a weapon system, time required to complete a decision cycle or number of nodes in a network.
- **Measure:** A standard by which some attribute of interest (e.g.; extent, dimensions, or quantity) is recorded. Examples include pounds, miles per hour, or minutes and seconds.
- **Metric:** The application of a measure to two or more cases or situations. Metrics help explain variation in the dependent variable across a range of values for the independent variables.
- **Indicator:** An indirect or “proxy” measure when direct measurement is not possible.

- **Example**
 - Operational Thread: Detection of target types during TCT
 - Attribute: Likelihood of detection
 - Measure: Percentage of detections
 - Metric: Relative probability of detection across the interesting range of conditions (target type, sensor array, weather)

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These definitions have been copied from the DODCCRP Experimentation Code of Best Practices.



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Developing Measures Levels of Measurement

- **Nominal Measurement**: Assignment of observations to categories, when the categories have no natural order. Examples include gender and nationality.
- **Ordinal Measurement**: Categories have a natural order, but the distance between them has no meaning. Examples include threat levels (low, medium, high) or level of training (novice, journeyman, expert).
- **Interval Measurement**: Distances between points on a scale are meaningful, but they are anchored arbitrarily (i.e., zero has no empirical meaning). Example includes temperature or IQ.
- **Ratio Measurement**: Equal level intervals and a meaningful anchor point. This is the preferred level of measurement, if possible. Examples include time to complete a task, weapons range, or years of experience.

Avoid falling into the trap of over-precision

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These definitions have been copied from the DODCCRP Experimentation Code of Best Practices.