Comprehensive C2 Architecture

Clean Sheet Study

Executive Overview for NDIA JADC2 Conference

(Comprehensive: NLC2, C/JADC2, NC2, and Non-military Planning and Execution)

July 2022

Slides are Unclassified
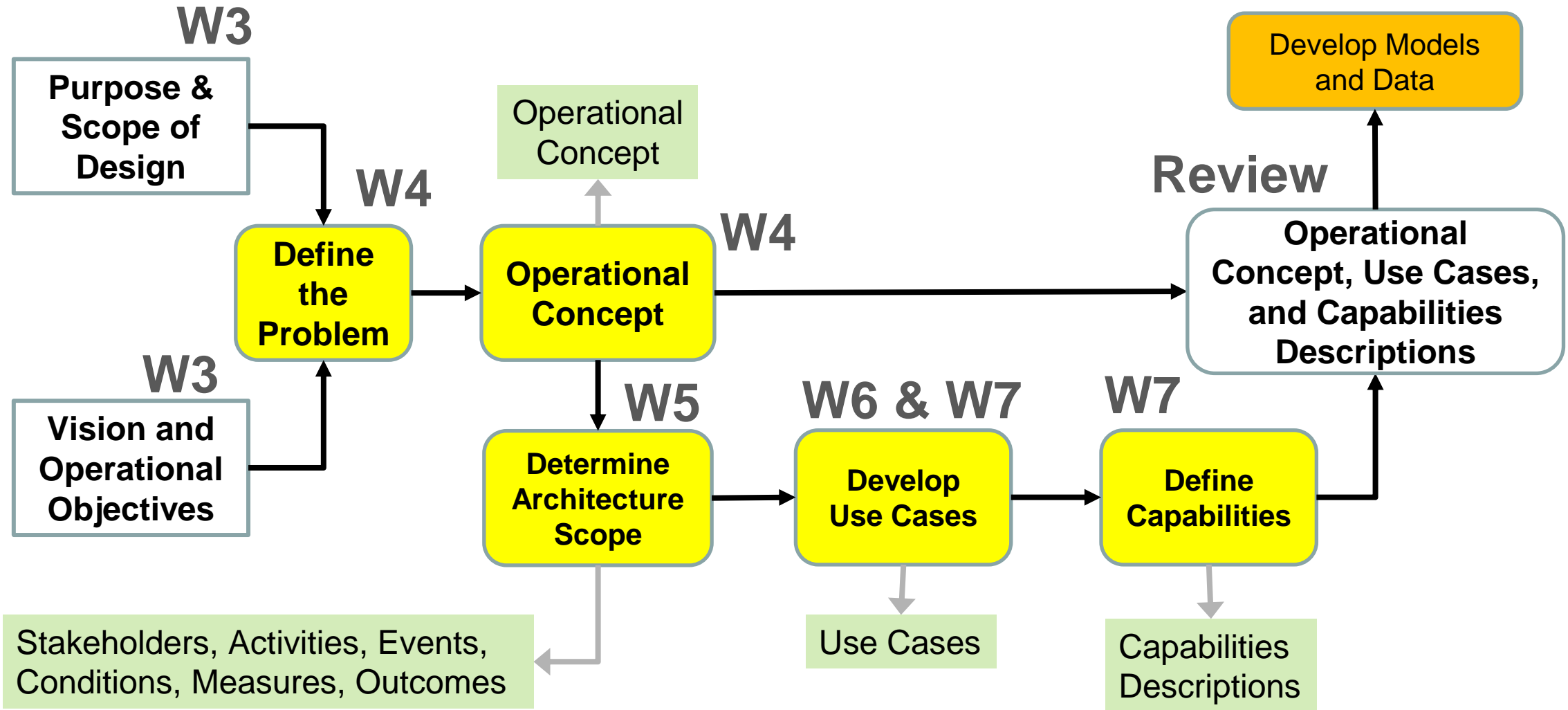
Approved for Public Release

Comprehensive C2 Architecture Overview

- **Background**
  - **STRATCOM and HAF/A10 Request**
  - **Problem Statement**
  - **Definitions and Architecture Relationships**

- **Comprehensive C2 Intended Use Overview**

- **Clean Sheet Architecture Study Findings**

- **Clean Sheet Architecture Study Recommendations**
  - **Near-term Comprehensive C2 Doctrine and Concepts**
  - **Science and Technology, Prototyping and Experimentation**
  - **JADC2-Related Recommendations**
  - **Comprehensive C2 architecture development Phase 2**

AFRL conduct a follow on study to its 2017 MD-C2 "Clean Sheet" study to develop an integrated C/JADC2/C3-NC2/C3 conceptual architectural framework and then use this framework as a foundation to propose incremental technical solutions (nominally to applicable ABMS and NC2 program offices) for Combined/Joint All-Domain C2 (JADC2)/C3 and National C2/C3 (inclusive of Nuclear C2/C3) applications.

Overview: Comprehensive C2 Study

AFRL — THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

W3 Purpose & Scope of Design

W3 Vision and Operational Objectives

W4 Define the Problem

Operational Concept

W4 Operational Concept

Review Operational Concept, Use Cases, and Capabilities Descriptions

Develop Models and Data

W5 Determine Architecture Scope

Stakeholders, Activities, Events, Conditions, Measures, Outcomes

W6 & W7 Develop Use Cases

Use Cases

W7 Define Capabilities

Capabilities Descriptions

Key Comprehensive C2 Study Contributors

AFRL/RI

George Mason University

Georgia Tech Research Institute

STRATCOM NC3 Enterprise Center

HAF/A10 NC3 Division

HAF/A5 JADC2 and NC3 Teams

AF NC3 Center (AFGSC)

AFGSC A36 and A58

ACC A58

PEO NC3 (Hanscom)

PEO Strategic Systems

DoD-CIO (SLC)

NDRC NC3 Consortium

OSD (A&S/NC3)

OSD (R&E/FNC3)

HQ AFRL (M&S)

Problem Statement

The U.S. **lacks comprehensive capabilities** and associated requirements to command and control **Unified Action nuclear and non-nuclear** operations

- In all threat environments

- Synchronized at the national through tactical levels of decision-making

- Across the **competition-conflict spectrum of operations** through post-nuclear employment

Unified Action: "The synchronization, coordination, and/or integration of the activities of governmental and nongovernmental entities with military operations to achieve unity of effort."

Comprehensive Command and Control (CC2) is defined as the comprehensive capabilities to command and control the entire spectrum of operations – nuclear and non-nuclear, military and non-military, U.S. and coalition – from peacetime cooperation through competition, crisis, and conflict, in all threat environments to include trans- and post-nuclear employment, aligned from the national through tactical levels of decision-making.   (Proposed Definition)

Note: Comprehensive C2 elements are national leader command and control, nuclear C2, and combined/joint all domain C2

- **National Leader C2 (NLC2)** consists of the activities, processes, and procedures performed by appropriately designated senior national leaders and their support personnel to collectively **counter, mitigate, or deter threats to U.S. vital interests and national survival** to include the nation's ability to ensure society's welfare and security. (Proposed Definition)

- **Nuclear Command and Control (NC2)** is the exercise of authority and direction by the President, as Commander-in-Chief of the U.S. Armed Forces, through established national command authority lines over nuclear weapons, nuclear weapon systems, and nuclear weapon operations of military forces.

Combined/Joint All Domain C2 (C/JADC2) is defined as the military capabilities to command and control U.S. and international partner military operations in all threat environments, aligned at the strategic through tactical levels of decision-making, across the competition-conflict spectrum of operations. (Proposed definition)

Joint All Domain Command and Control (JADC2) is defined as the warfighting capability to sense, make sense, and act at all levels and phases of war, across all domains, and with partners, to deliver information advantage at the speed of relevance. (**Current Definition**)
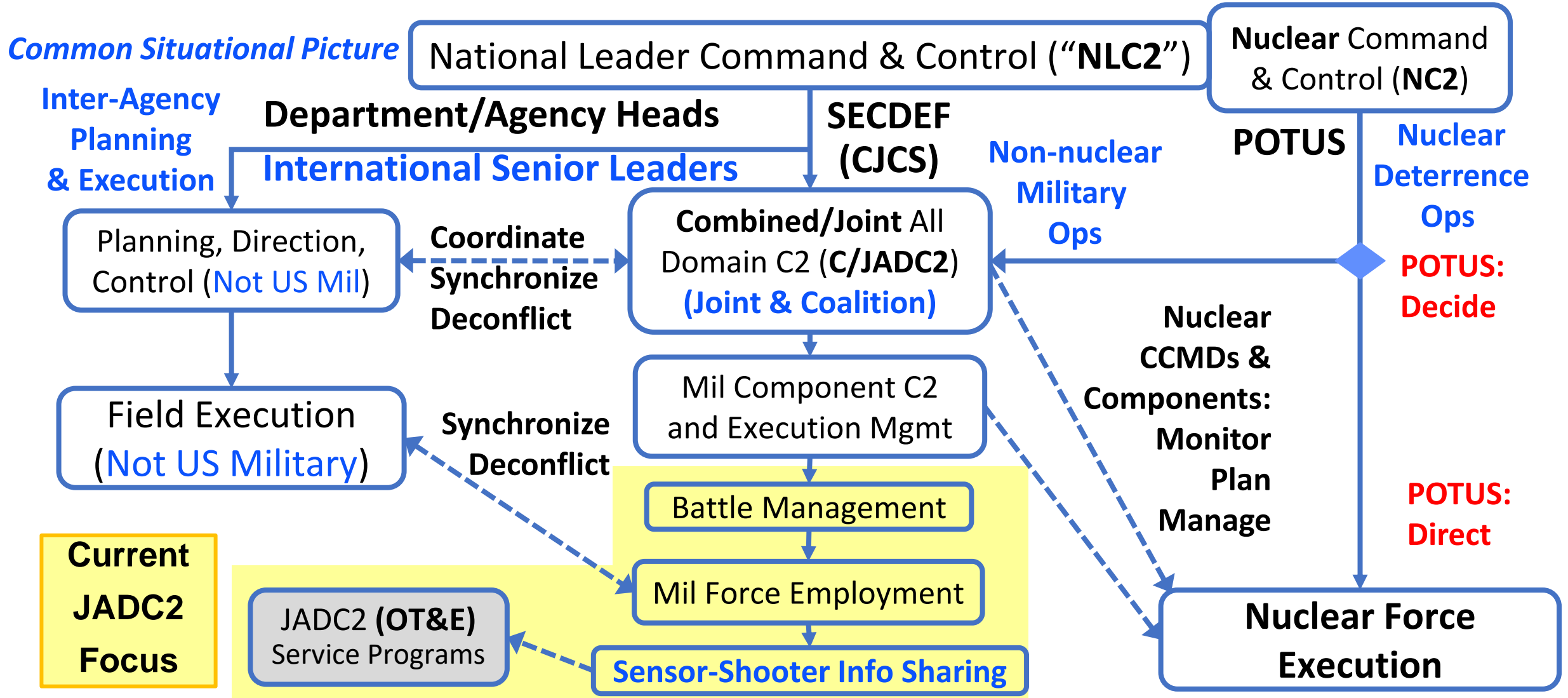
- **Monitor**
- Analyze
- Assess
- Predict
- **Plan**
- **Decide**
- **Manage**
- Synchronize & Deconflict
- **Direct**
- (Execute)
- Report

NC2 Minimum Essential Functions are in bold type

**Other Functions extracted from JP5-0, Joint Planning**

Comprehensive C2 Relationships: NLC2, NC2, C/JADC2, Non-Mil "C2"

Common Situational Picture

Inter-Agency Planning & Execution

National Leader Command & Control ("**NLC2**")

Nuclear Command & Control (**NC2**)

Department/Agency Heads

SECDEF (CJCS)

POTUS

International Senior Leaders

Non-nuclear Military Ops

Nuclear Deterrence Ops

Planning, Direction, Control (Not US Mil)

Coordinate Synchronize Deconflict

Combined/Joint All Domain C2 (**C/JADC2**) **(Joint & Coalition)**

POTUS: Decide

Nuclear CCMDs & Components: Monitor Plan Manage

Field Execution (Not US Military)

Synchronize Deconflict

Mil Component C2 and Execution Mgmt

Battle Management

Current JADC2 Focus

Mil Force Employment

JADC2 (**OT&E**) Service Programs

Sensor-Shooter Info Sharing

POTUS: Direct

Nuclear Force Execution

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Comprehensive C2 Architecture Relationships to Other Architectures

- **NC3 "As Is" Architecture (Includes National Leader Command Capability)**
- **C/JADC2 "As Is" Architecture**
- **NC3 "To Be" Architectures (NC3 Next): Program Driven**
- **C/JADC2 "To Be" Architectures: Program Driven**
- **Objective: Comprehensive C2 "Should Be" Architecture**
  - **Phase 1: Develop the Functional Comprehensive C2 Architecture**
  - **Purpose is to inform NC3 and C/JADC2 "To Be" Architectures**
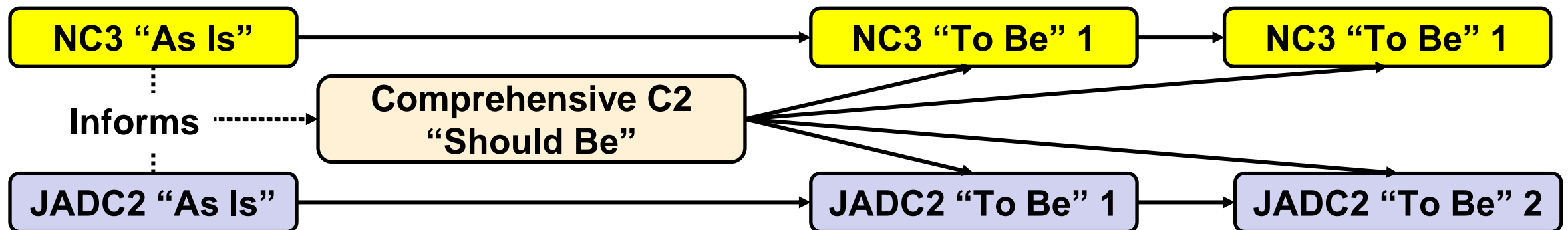
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Architecture Intended Use Document Elements

- **Problem Statement**
- **Vision, Goals, and Objectives**
- **Included Mission Areas**
- **Stakeholders and Requirements**
- **Users and Affected Personnel**
- **Scenarios and Associated Use Cases**
- **Activities**
- **Events and Conditions**
- **Effects (Outcomes) and Measures**
- **Products**
- **Capabilities** (Details in the Intended Use Document)

- **Multinational cooperation and capacity building activities: Routine Competition**
- **Near-peer activities to (apparently) gain competitive advantage ("Long War"): Escalatory**
- **Near-peer high intensity competition (short of armed conflict): Escalatory**
- **Non-nuclear conflict (Primary JADC2 Focus): Military Operations**
- **Nuclear-capable adversary regional conflict: Crisis**
- **Nuclear-capable third party regional conflict: Crisis**
- **Near-peer threat to employ nuclear or other strategic weapons: Crisis**
- **Actions to degrade U.S. or partner strategic capabilities: Strategic Attack**
- **Attack against U.S. homeland or territories: Strategic Attack**
- **Attack against U.S. allies or partners: Crisis**
- **Near-peer nuclear weapon employment (not against US): Crisis**
- **Regional adversary nuclear weapon employment: Crisis**
- **Nuclear weapon employment in regional conflict: Crisis**
- **Post-nuclear use stability restoration and further use deterrence: Trans/Post Nuclear Use**

Use Cases and Goals

- **Routine Competition**: Detect or forecast a military or non-military (Information, Political, Economic, Trade, other) disturbance or evolving threat (even from individually uncertain data)

- **Escalatory Competition**: Forecast intent, prevent further escalation, ensure U.S. advantage in competition space

- **Crisis**: Prepare forces, plan and execute response, terminate crisis on favorable terms (De-escalate crisis, encourage all actor restraint)

- **Conflict**: Prevent escalation, terminate conflict on terms favorable to U.S.

- **Strategic Attack against U.S. or partner**: Protect key leaders, iterate COAs, decide COA, direct selected COA

- **Trans/Post Strategic Attack against U.S**: Protect key leaders, de-escalate crisis on favorable terms to U.S., plan post-use activities

Architecture Use Case Relationships
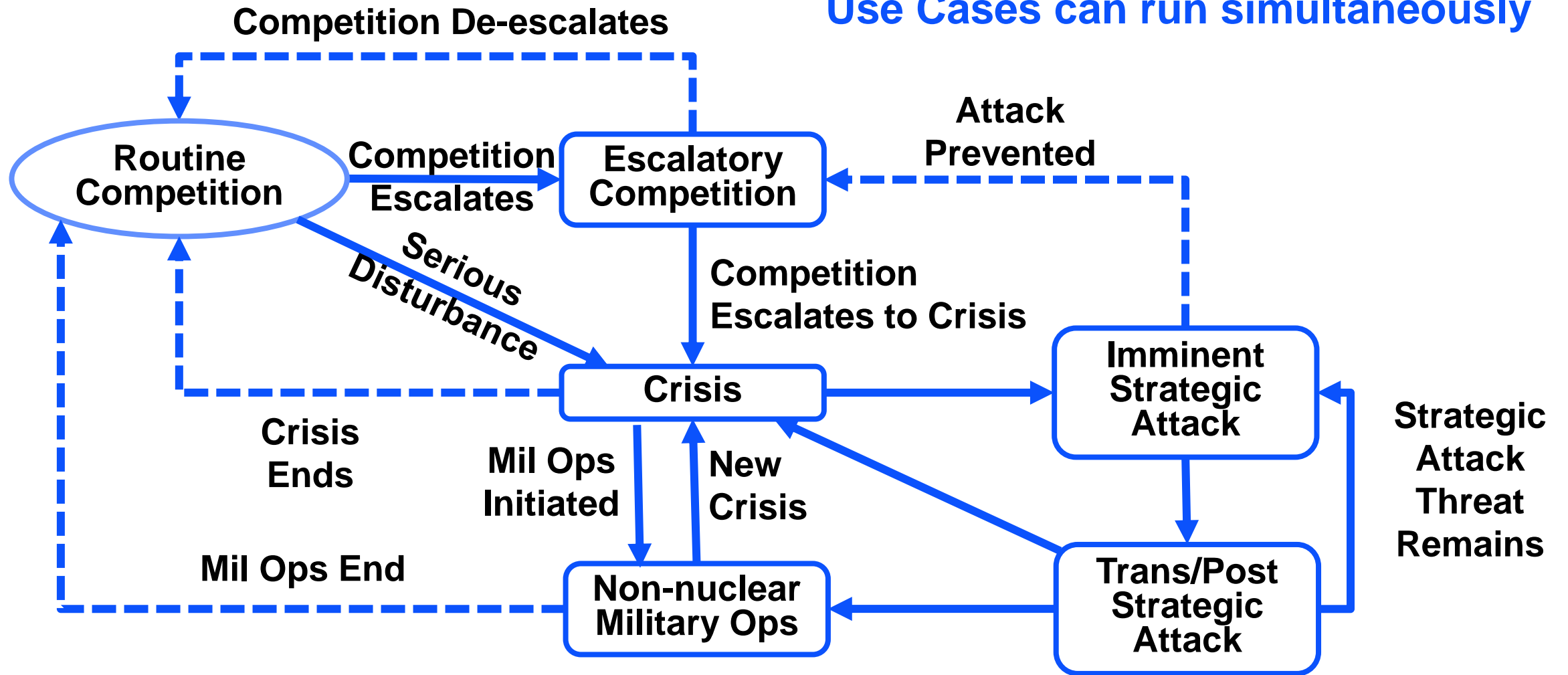
Use Case Scopes

The Scope of a Use Case identifies the functions of the System under discussion

- **Routine Competition:** All-domain, Multi-agency environmental analysis and disturbance forecasting

- **Escalatory Competition:** All-domain, Multi-agency competitor action analysis, intent forecasting, and response planning

- **Crisis:** All-domain, Multi-agency mission analysis, strategic and military COA development and assessment, COA selection, COA planning, and plan execution

- **Conflict:** All-domain, Multi-agency situation and mission analysis, strategic options development and assessment, COA selection, COA planning, and plan execution and assessment

- **Strategic Attack against U.S. or partner:** Threat Visualization, COA presentation-adaptation and selection, COA direction and execution

- **Trans/Post Strategic Attack against U.S:** All-domain mission analysis, Strategic and Military COA development and assessment, COA selection, COA planning, and plan execution and assessment

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Comprehensive C2 Architecture Products

- **Decision-quality situation assessments and predictions**

    - **Continuous threats characterization, status of forces, environmental conditions, potential adversary courses of action**

- **Courses of action and assessments**

- **Operational plans and orders**

- **Decision-quality information presentations to decision makers**

- **Mission rehearsal and wargaming tools**

- **Execution status reports (with measures of performance and effectiveness)**

- **Plan assessments (and update recommendations)**

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Findings: Comprehensive C2 Architecture

- **NC3, JADC2 relationship is better articulated as a "Comprehensive C2" architecture rather than an "Integrated NC3-JADC2" Architecture**
  - **Emphasize C2 needs for Whole of Government and Multinational Operations**
- **Comprehensive C2 encompasses NLC2, NC2, and C/JADC2 at the national, strategic, operational, and execution levels**
- **Comprehensive C2 encompasses six use cases: Routine Competition, Escalatory Competition, Crisis, Non-nuclear Military Ops, Imminent Strategic Attack, Trans-Post Strategic Attack**
- **JADC2 systems can support nuclear and non-nuclear applications with common C2 functions: Monitor, assess, analyze, predict, plan, and report**
  - **JADC2 can support common decide and direct functions for nuclear and non-nuclear applications, but NC2 will require some unique capabilities to support POTUS activities**

Findings: Terminology Issues

- **Functional architectures (such as NC2) are not discriminated from systems (such as NC3) and strategies (JADC2)**

- **JADC2 is described by system attributes rather than operational functions**

- **NC3 is acronym for Nuclear C3, but involves many non-nuclear operations**

- **NC3 minimum essential functions frequently involve national leaders performing non-nuclear activities**

- **National Leader Command Capability is defined as a set of systems**

    - **NLCC encompasses Presidential and senior leader communications, NC3, and continuity of operations and government (COOP/COG) communications**

- **National Leader C2 ("NLC2") proposed as a new C2 functional concept**

- **Observation: NC2 is well defined and consistently applied**

Findings: JADC2 Strategy

- **JADC2 is a strategy focused on developing kill chain capabilities**
  - Deliver information advantage at the speed of relevance to accelerate kill chains
  - JADC2 activities, measures, and products are focused on combat operations
  - Primary emphasis is U.S. joint operations, not multi-agency or multinational operations

- **JADC2 use cases are ambiguously defined**
  - No competition, crisis, or conventional-nuclear integration use cases
  - JADC2 focus is on information sharing (not how information is used)

- **Current JADC2 efforts are making significant execution-level, cross-service sensor-to-shooter improvements but are not addressing higher level Combatant Command and Joint Force Command C2 needs**
  - Examples include situation assessment and analysis, environment forecasting, course of action development and risk assessment, and interagency and international partner coordination, synchronization, and deconfliction

- **Nuclear and Non-nuclear C2 functions (Monitor, Assess, Analyze, Predict, Plan, Decide, Manage, Direct, Execute, Report) are individually listed in Joint Doctrine, but not presented as a coherent set of C2 functions**

- **Descriptions of Comprehensive C2 and National Leader C2 (or equivalent concepts) do not exist in doctrine**

- **JADC2 strategy initiatives would benefit from use of a functional architecture and associated use cases to guide their implementation**

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- Add Comprehensive C2 and National Leader C2 **Definitions** to Doctrine (JS/J7 | AU)

- Differentiate C2 **concepts from their associated systems** with clear designations: NC2 systems, JADC2 systems, NLC2 systems (OSD, JS/J6 | HAF/A5, HAF/A10)

- Differentiate among National (NLC2), Strategic (Unified Action), Operational (C/JADC2), and Employment-level execution management, battle management, and sensor-shooter execution, but **ensure linkages are established across levels, departments, & international partners** (JS/J6 | HAF/A5, HAF/A10)

- Revise **C/JADC2 definition** based on functions rather than systems (JS/J6 | HAF/A5)

- Develop **JADC2 use cases** to cover entire ops spectrum to include peacetime, cooperation, competition, non-nuclear conflict, and nuclear operations (JS/J6 | HAF/A5, HAF/A10)

- Clarify Monitor, Assess, Analyze, Predict, Plan, Decide, Manage, Direct, Execute, and Report **C2 functions and their relationships** in Joint Doctrine (JS/J7 | AU)
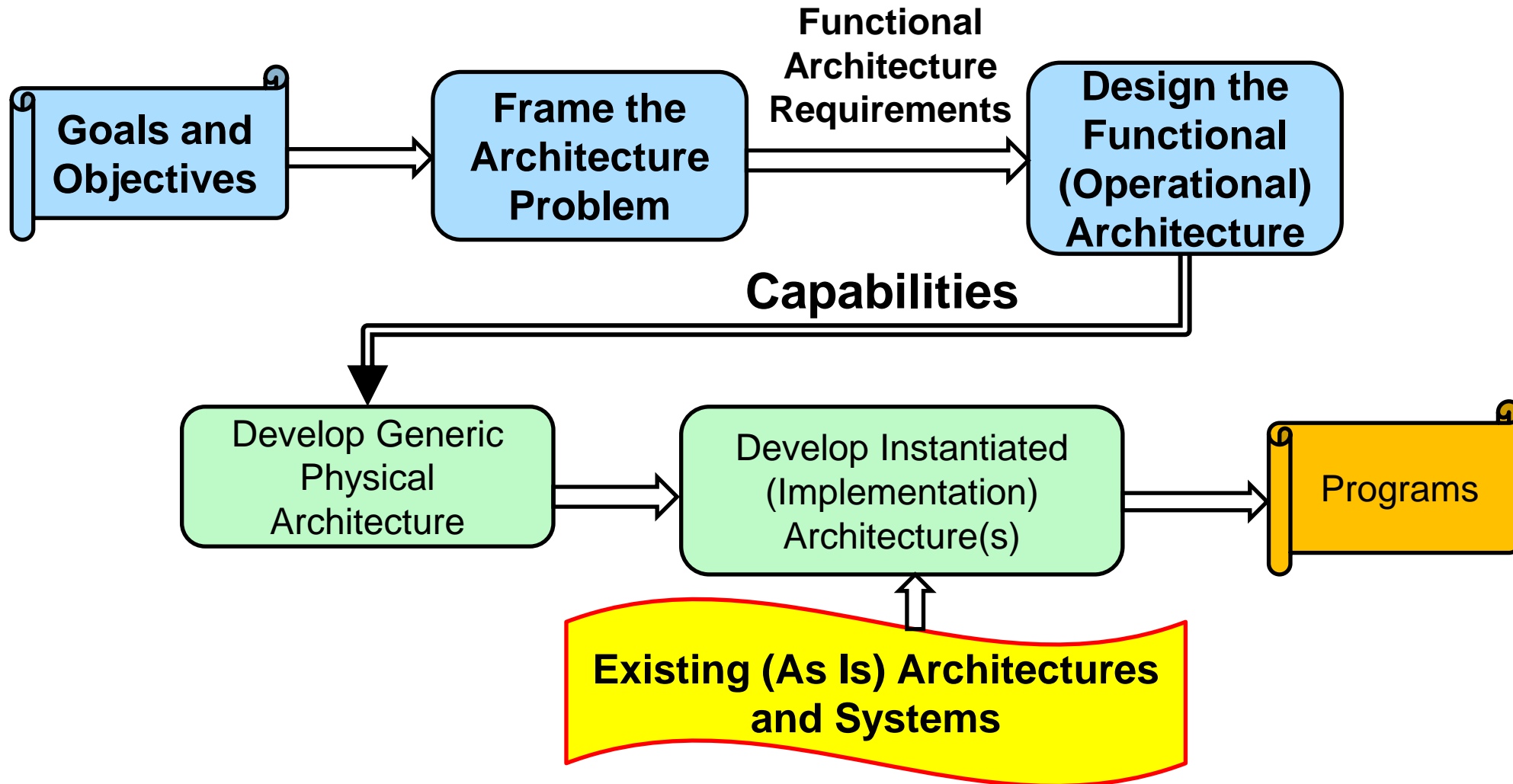
- **Advance C2 Capabilities to Monitor, Assess, Analyze, and Predict (AFRL)**

    - **Information sharing: Cross-agency, multinational data validation**

    - **Monitor/Assess: Information gap identification and mitigation**

    - **Analyze/Predict: Situation change detection and disturbance forecasting**

- **Improve Comprehensive Planning and Plan Evaluation Capabilities (AFRL)**

    - **Planning: Real-time strategic and operational COA development, risk assessment, and presentation**

    - **Evaluation: Real-time operational assessment**

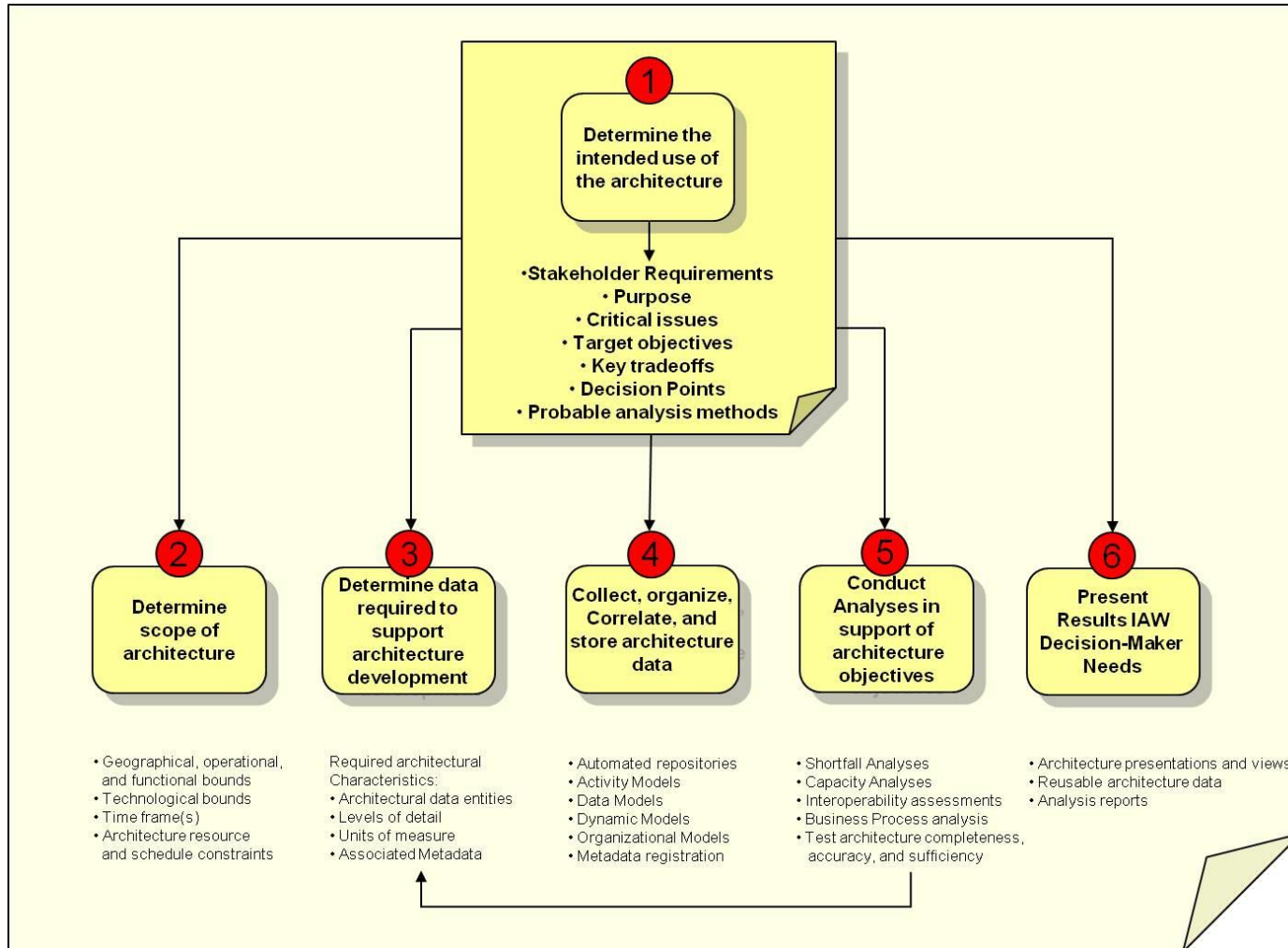**Capability development opportunities detailed in Intended Use Document**

JADC2-Related Recommendations

- Develop competition, crisis, and conventional-nuclear integration **use cases** to address C2 needs beyond combat operations (JS/J6, HAF/A5, HAF/A10)

- Expand JADC2 strategy initiatives across **full range of C2 functions** (JS/J6, HAF/A5)
  - **Monitor, Assess, Analyze, Predict, Plan, Decide, Manage, Direct, Execute, Report**

- Develop JADC2 relationships from National C2 to force employment to include international, whole of government, and non-traditional **Unified Action** partners (JS/J6, HAF/A5)

- Expand **JADC2 scope** to include operations in the areas of adversary deterrence, partner assurance, international actor influence, strategic competition, and international cooperation (JS/J6, HAF/A5, HAF/A10)

- Increase CCMD participation in JADC2 efforts to ensure that service OT&E programs address **CCMD and joint component strategic and operational command and control needs** (JS/J6, HAF/A5, HQ ACC, HQ AFGSC)

Comprehensive C2 Implementation

Goals and Objectives → Frame the Architecture Problem → *Functional Architecture Requirements* → Design the Functional (Operational) Architecture

Capabilities

Develop Generic Physical Architecture → Develop Instantiated (Implementation) Architecture(s) → Programs

Existing (As Is) Architectures and Systems

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Comprehensive C2 Architecture Development Recommended Next Steps

1. ✓ **Determine Intended Use**

2. **Scope architecture effort to meet technology, schedule, and resource constraints**

3. **Determine data required to support the architecture development**

4. <mark>**Collect, organize, correlate, and store architecture data and use to develop models**</mark>

5. **Conduct analyses in support of architecture objectives**