Capturing Commander's Intent in User Interfaces for Net-centric Operations

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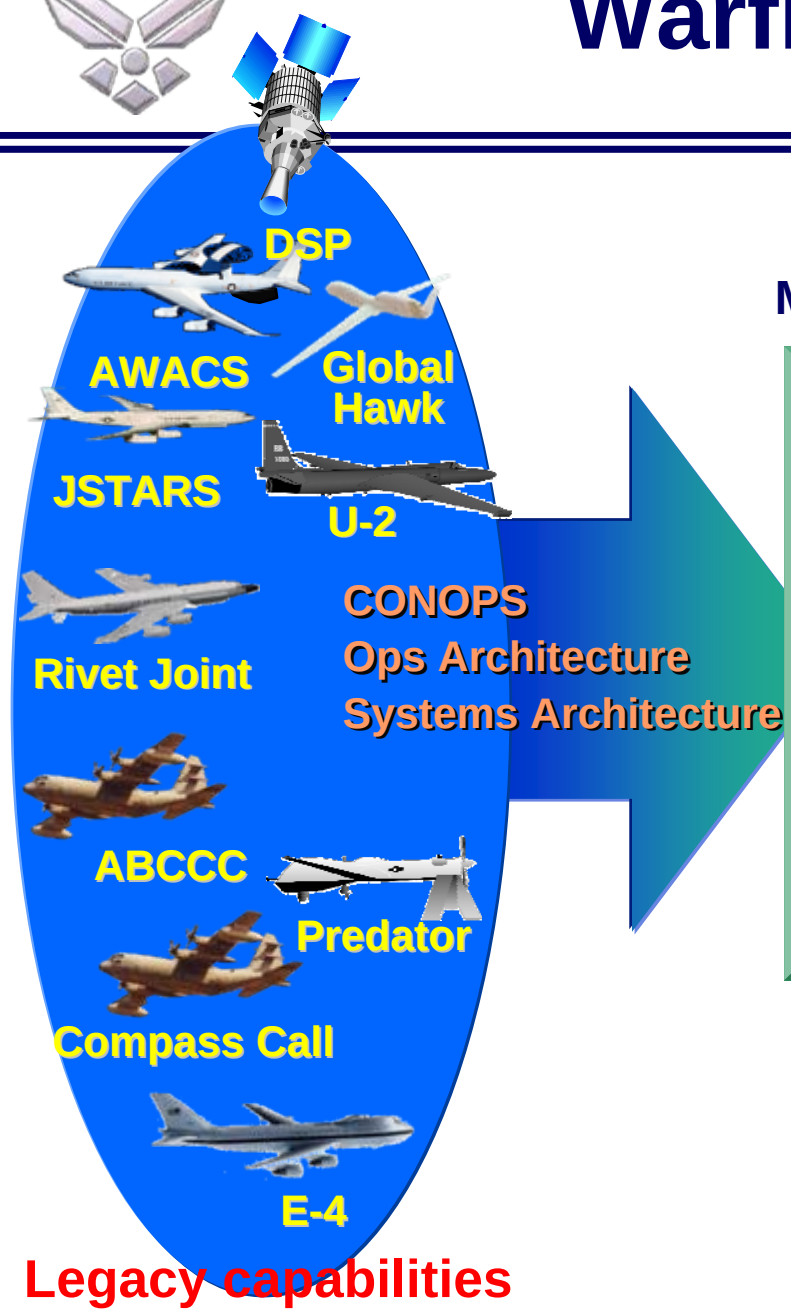
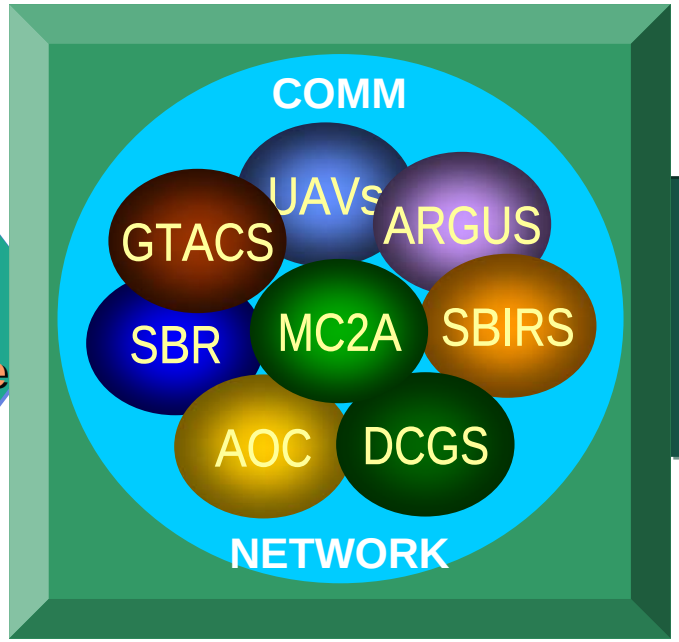
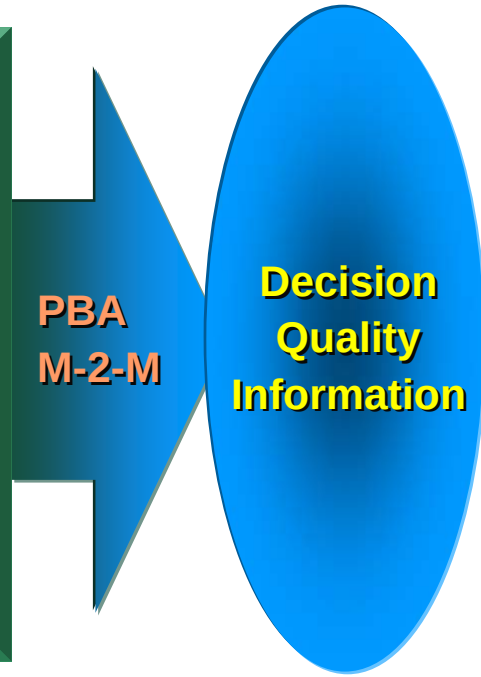
Outline

- Motivation – Warfighter's Vision
- BMC2 101
- Capturing Commander's Intent
  - Strategic to Tactical
  - Assessor to Planner to Warfighter
- Working both sides of the human-machine interface
  - Prioritization – embedded common logic
  - Battle Management, Command & Control (BMC2) in 4D – shared SA

Warfighter's Vision







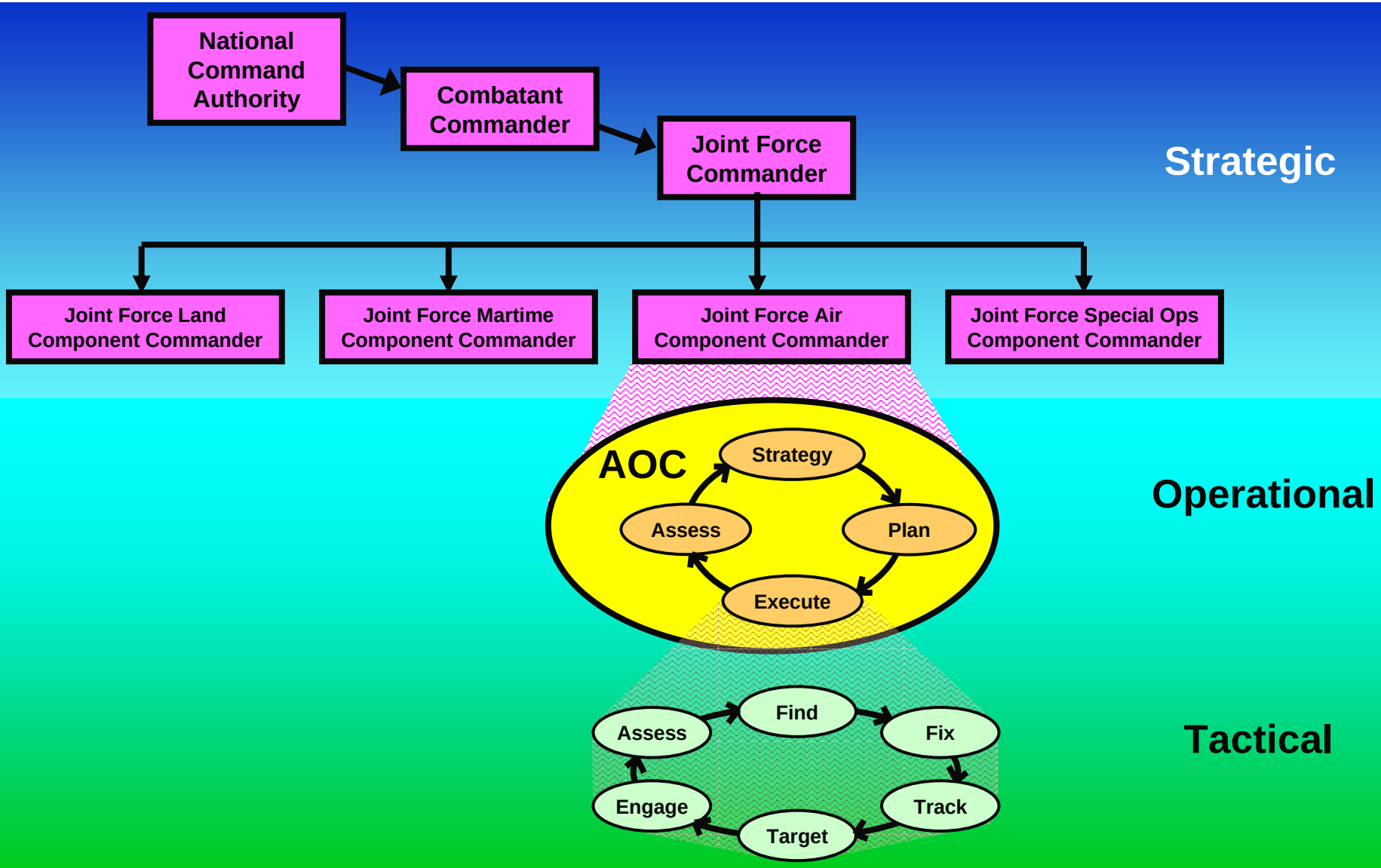
BMC2 101

- Monitoring globe now (CNN)
- Event occurs that sparks interest
- Course of action planning starts
- ISR assets realigned
- Orders issued
- Assets mobilized
- Campaign executes
- Assets redeployed/repositioned

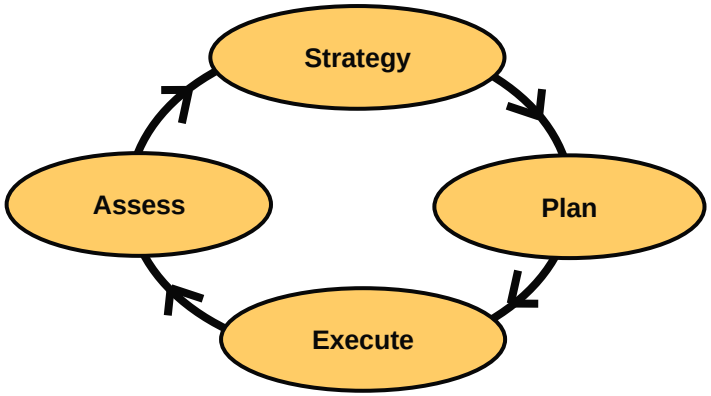
BMC2 101 (cont)

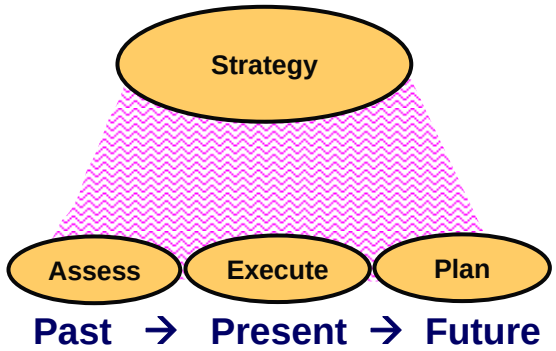
- The JFC "Owns" the campaign
  - All BMC2 supports Commander's Intent
- For the AOR, want 'Picture' as close to truth as possible
  - Sense all, ID all, keep track of all (to some level of fidelity)
  - Everything being tracked has a *dynamic priority*
- Resource mgt (sensors, weapons, assets, bandwidth, etc) is a function of JFC's priorities
  - Resources & budgets are finite
  - Resources are apportioned/expended wrt objectives
  - Goal: execute the plan; respond to contingencies as needed
- Need a common prioritization taxonomy for all BMC2
  - Ensures smart, dynamic reallocation of resources

Capturing Commander's Intent
Levels of War



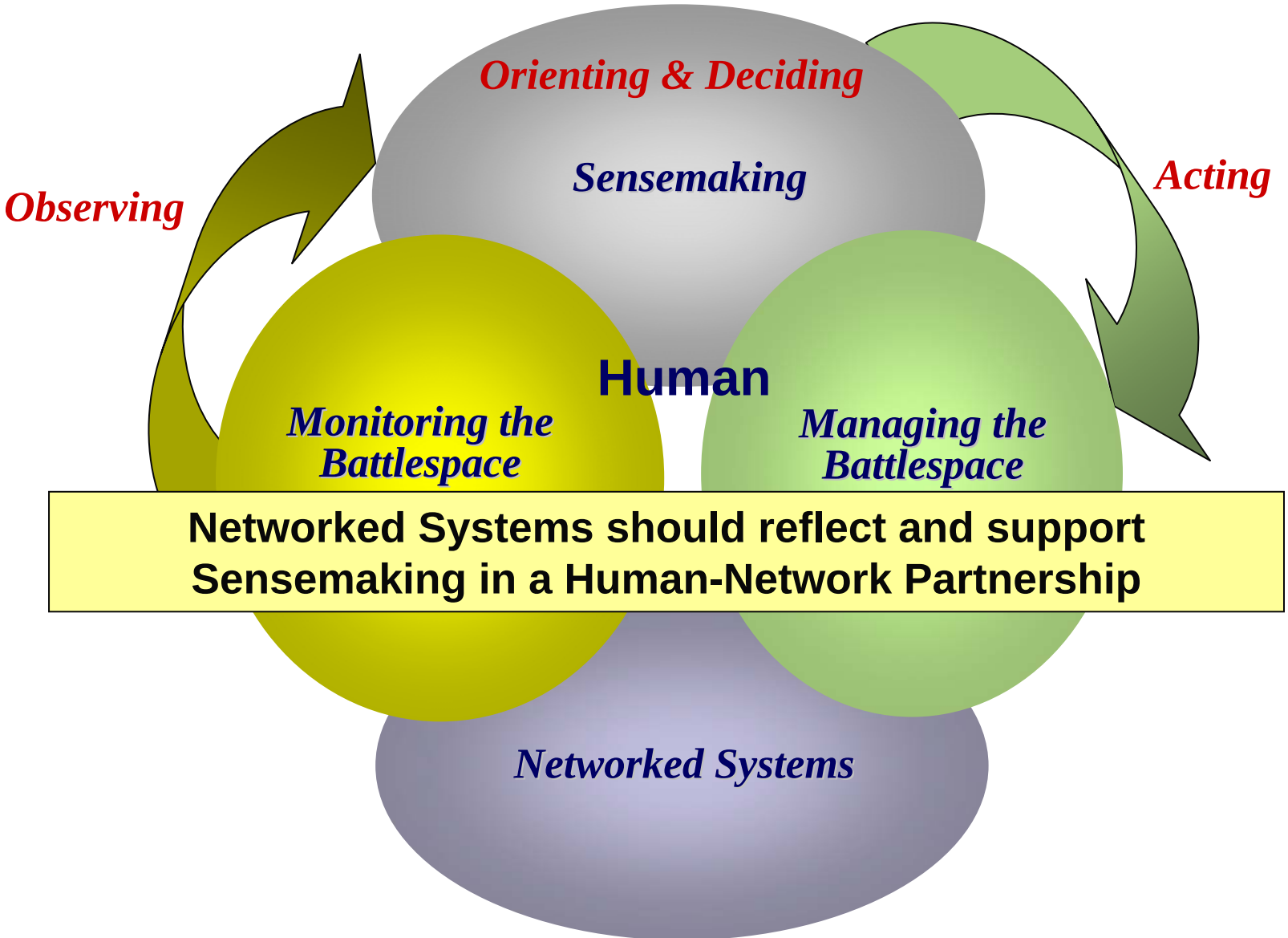
Capturing Commander's Intent
Battle Rhythm – Functions





- Strategy is the first derivative of CC's intent
  - Translates concise vision of future into objectives
  - Objectives, in turn, describe the path to the vision
  - Relatively stable over time, if it's good
- Planning translates objectives into action; future focus
  - Includes time-sensitive re-planning during execution
- Execution is focused on the here and now
  - Adapting the plan to current constraints/contingencies
- Assessment has a historical focus
  - What happened? Was it what we wanted/expected?

The Human-Network Partnership



Capturing Commander's Intent
What's Missing from the Interface

- **Common prioritization logic across the network**
  - **The network needs to 'think like an operator'**
  - **Priority = ∫ {CID, location, engagement status, time,…}**
    - **Needs to be vetted to community**
    - **Want positive ID, prefer no procedural IDs**
  - **Resource management is a function of priorities**
- **A truly common picture, both time and space**
  - **Manage the battle as we fight: in 4-D**
  - **A common temporal-geospatial picture**
  - **Prerequisite for shared situation awareness**
  - **Both halves of the picture linked to the same data**

The Machine Side:
Notional Prioritization Taxonomy

Default dynamic prioritization taxonomy to support automated functions:

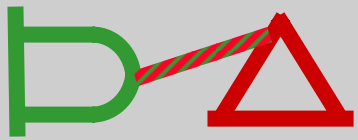
- “900s” (Highest, Track continuity): Hostile targets & Blue forces engaging
- “800s”: Blue force emergencies, SOF, Operator-designated

OITL ↑ ROE

- “700s” (System max): Suspect targets, other potential Hostiles
- “600s” (ID Sensor tasking): Unknowns, Targets of interest
- “500s”: Unengaged Blue Air in the Area of Responsibility (AOR)
- “400s”: Non-combatants and Neutral Forces in AOR
- “300s”: Blue Surface Forces in AOR
- “200s”: US/Allied military forces outside AOR, not on ATO
- “100s”: Civilian air traffic including emergencies (19X)
- “000s”: Civilian surface traffic

ROI ↓ ID Automation

Dynamic Prioritization
An Example

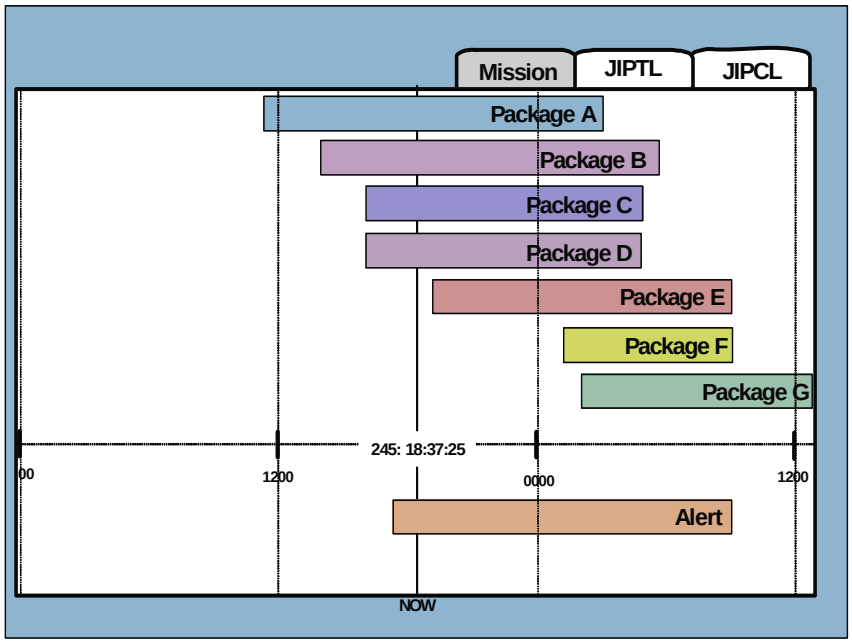
	Symbols	Priority
• Time 0: Blue CAP in AOR, no PPLI		590
• Time 1: Unknown detected		660
• Time 2: CID info accumulated (ROI)		770
• Time 3: Hostile act (ROE) committed		970
• Time 4: Blue CAP cleared to engage		970 (Both)
• Time 5: Tgt destroyed; Blue ftr damaged		890

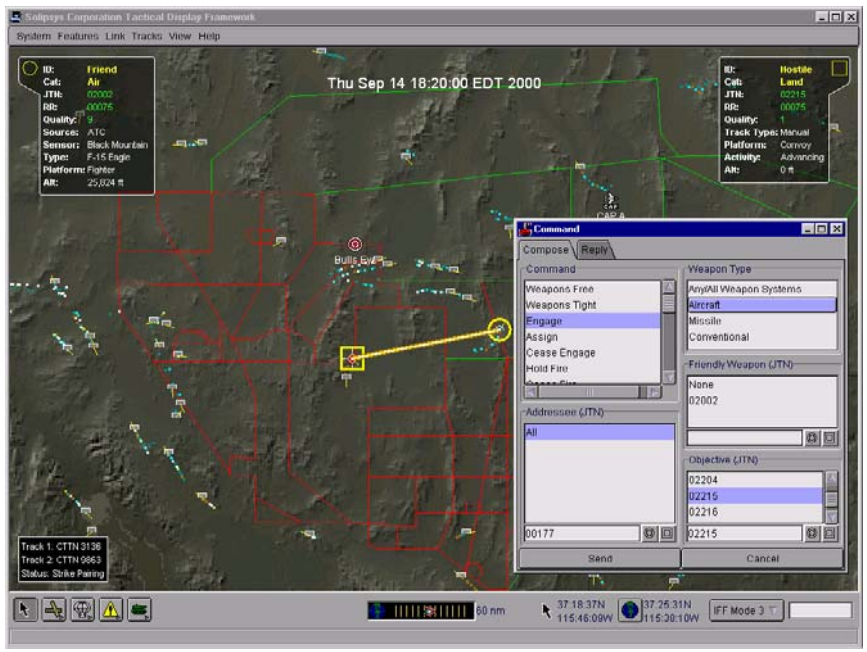
Benefits of Common Prioritization

- **Prevents inversions between systems competing for resources (sensor timelines, bandwidth, etc)**
  - **Enables automated resource allocation according to priority (allows for manual override) and ID/tracking req'ts**
- **Allows for simplified metrics of 'how we're doing'**
  - **Are resources being allocated according to priority (tracking, ID, engagement, etc) ?**
  - **Load-shedding: does what matters get shed last?**
- **Focus: common understanding of JFC's intent**
  - **Allows self-synchronization**
  - **Enforces efficient resource management**

The Operator Side:
BMC2 in Four Dimensions

- Operations occur in space and time, so manage them in 4-D
- Fully linked spatial and temporal display of battlespace
- Scalable resolution, tactical/mission level to operational obj's
- Method of managing resources against mission requirements





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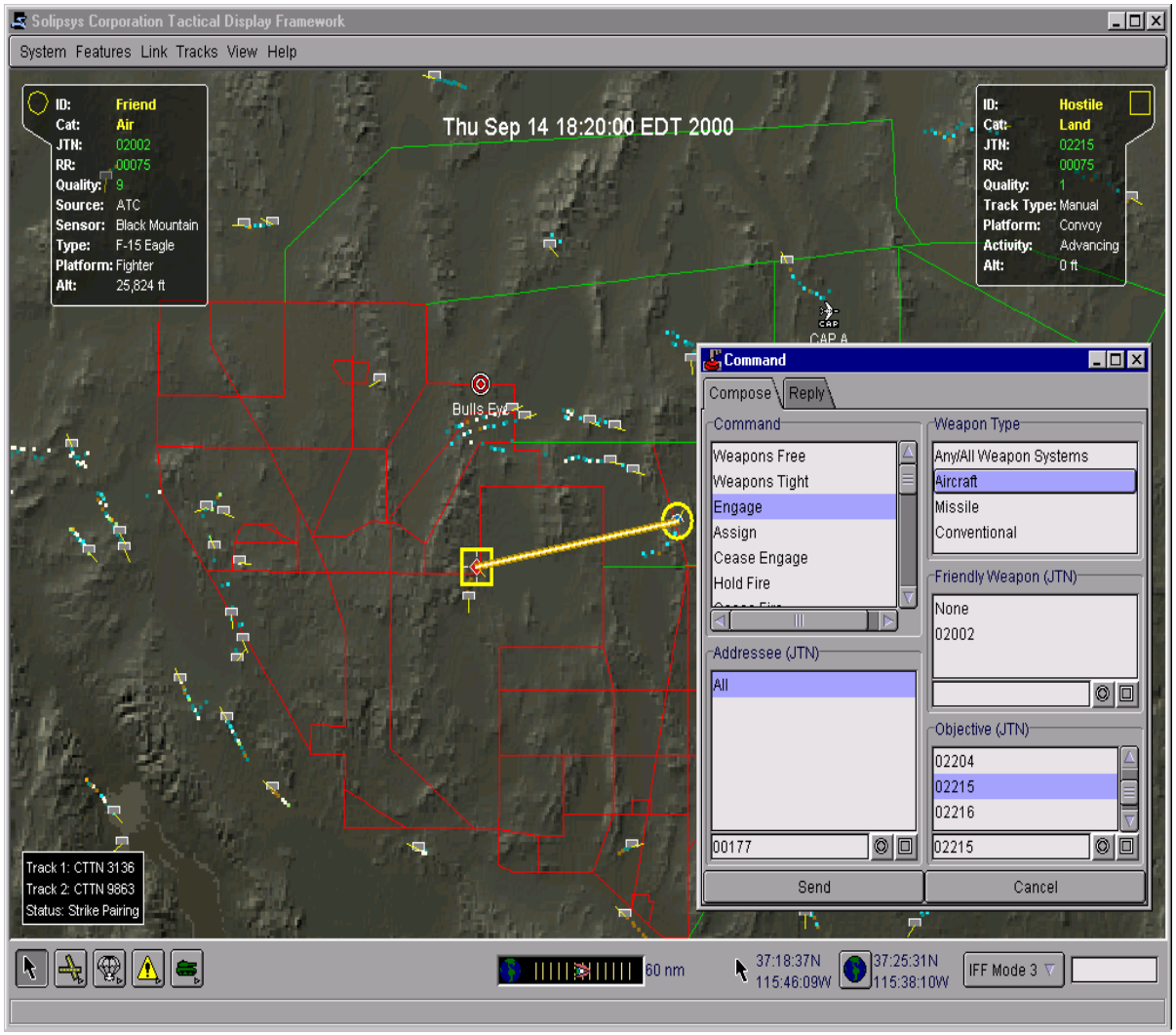
BMC2 in 4-D
Geospatial Display



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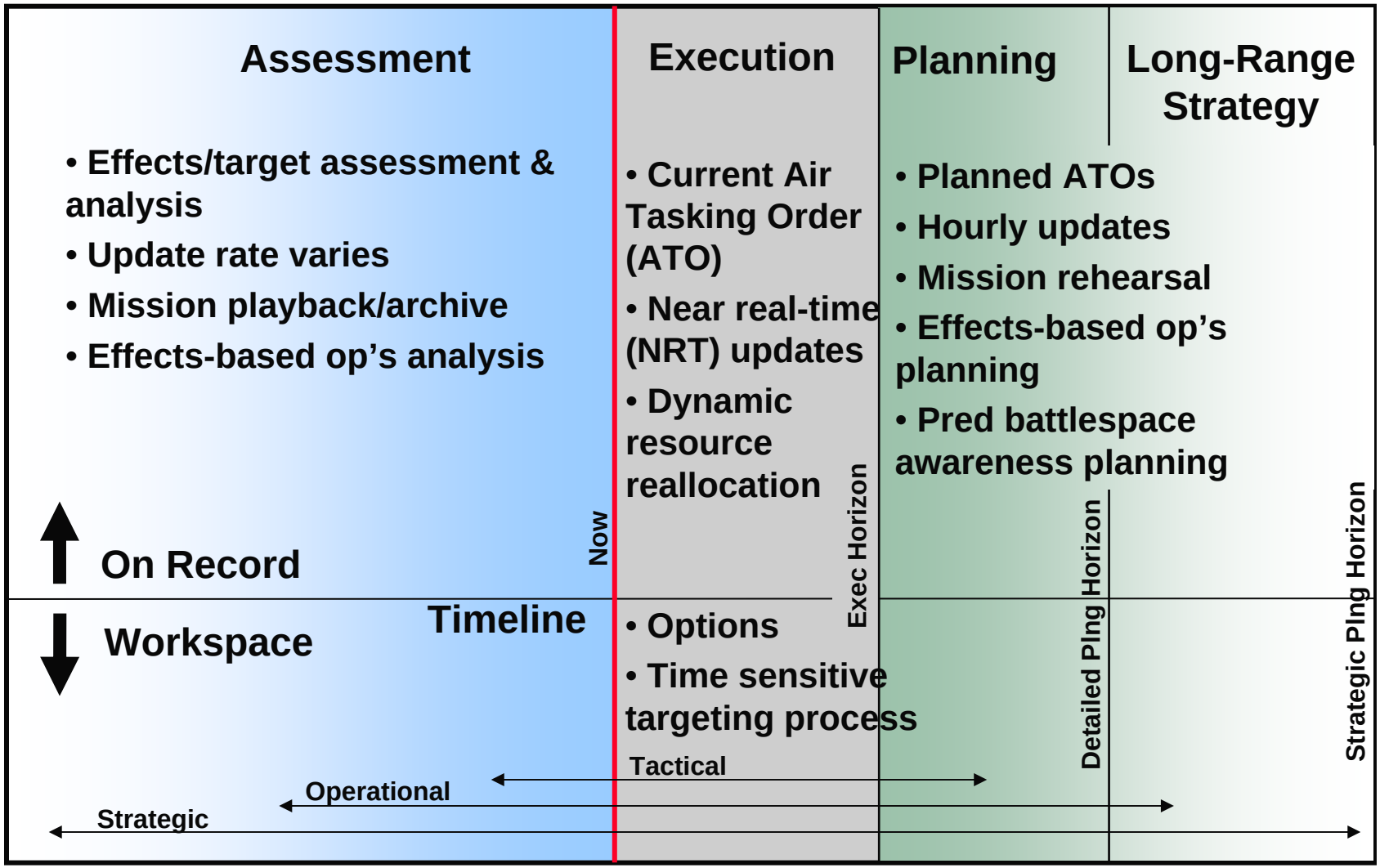
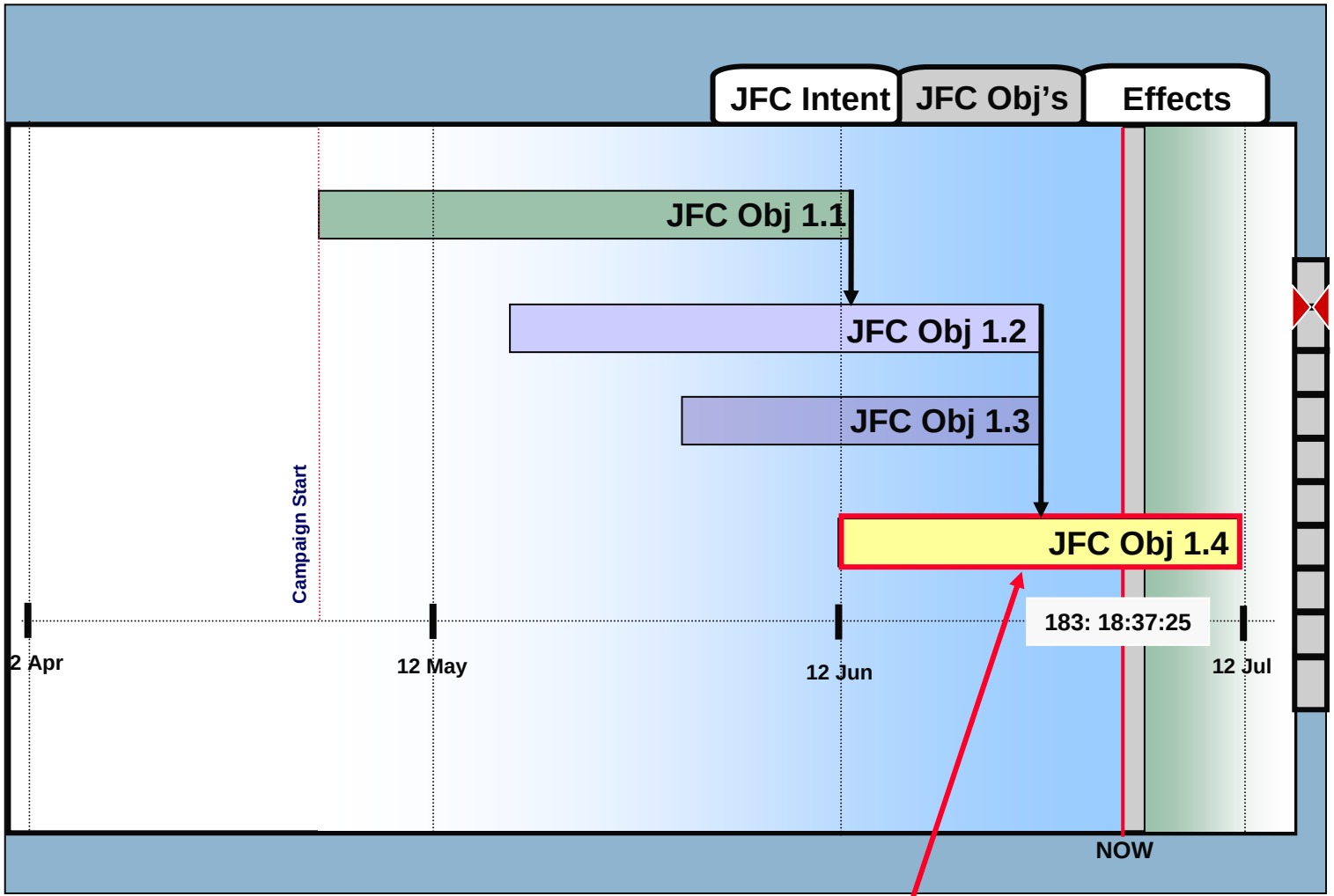
- Many good examples; build off common baseline
- C2 HMI Design Guide
  - E-3, E-8, BCS-M, -F
- Extend to all C2ISR
- Dashboard to show input freshness
  - FOB position updates
  - Key sensor status
  - NAVACC status
  - Link connectivity/status
  - Key comm status
  - Etc

BMC2 in 4-D
Temporal Display (Components)



Example of BMC2 in 4-D

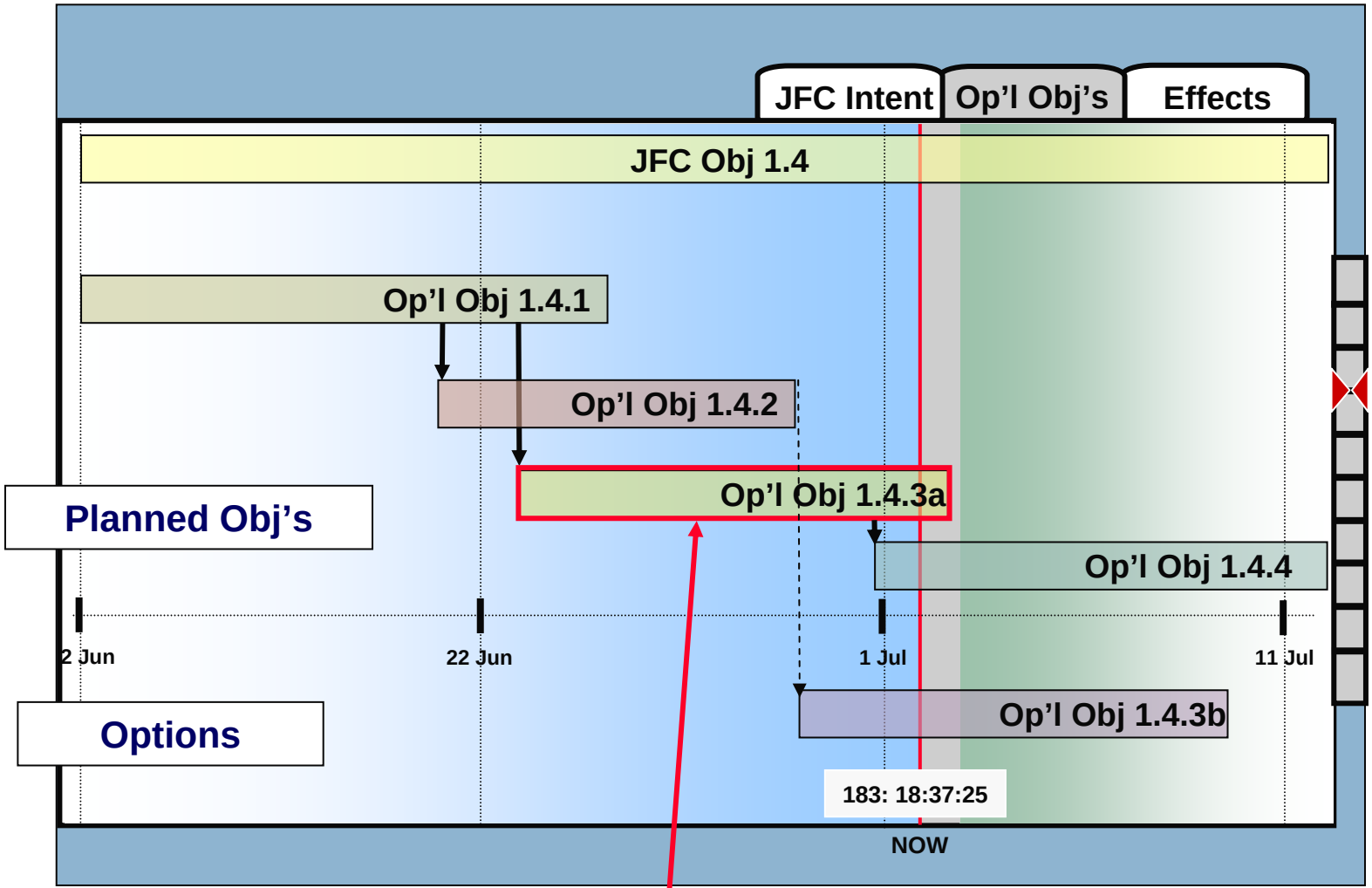
Temporal Display (Strat/Op'l Zoom)



Operator selects a JFC objective for drill down

BMC2 in 4-D (cont)

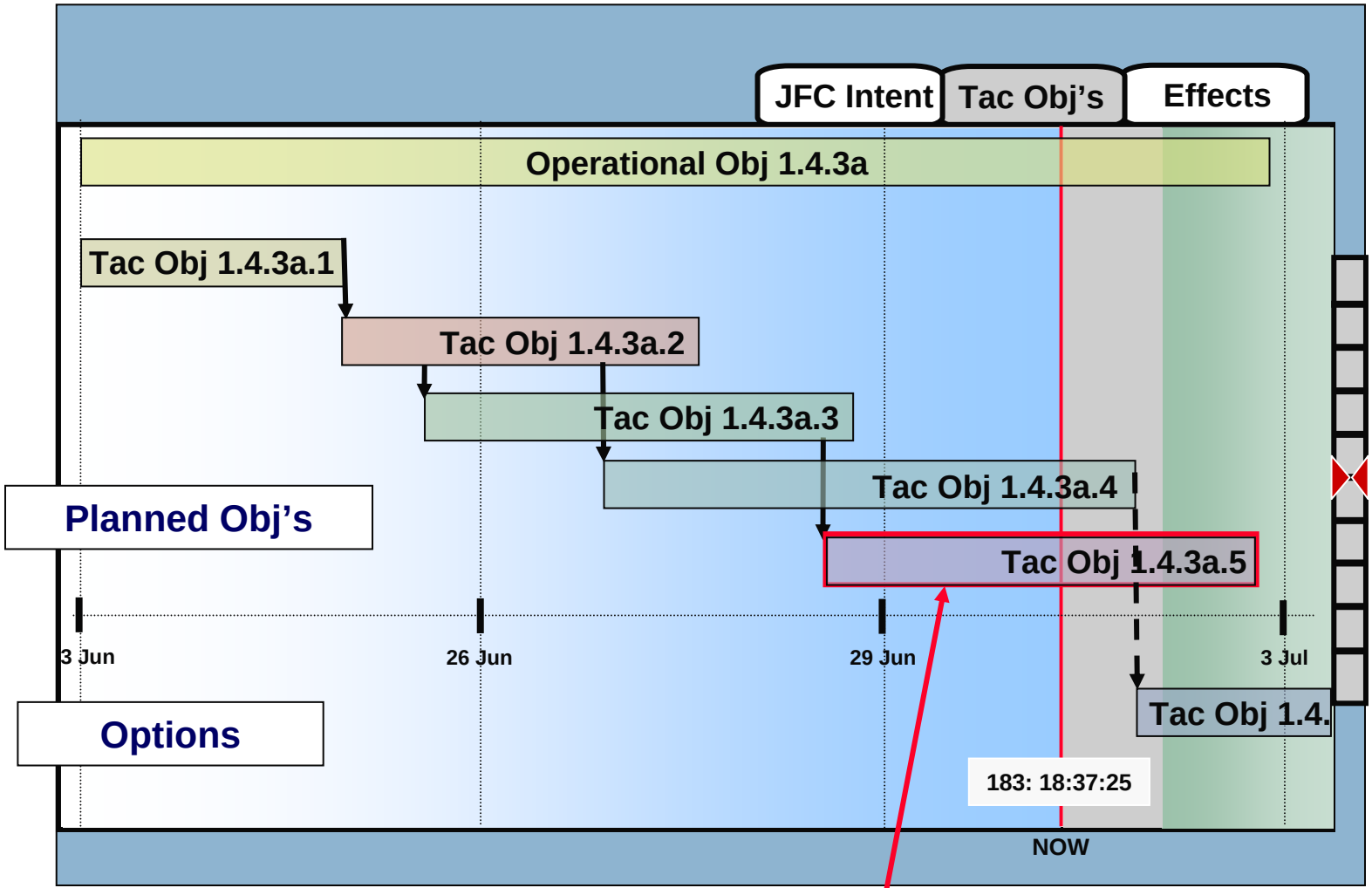
Temporal Display (Op'l Zoom)



Operator selects an operational objective for drill down

BMC2 in 4-D (cont)

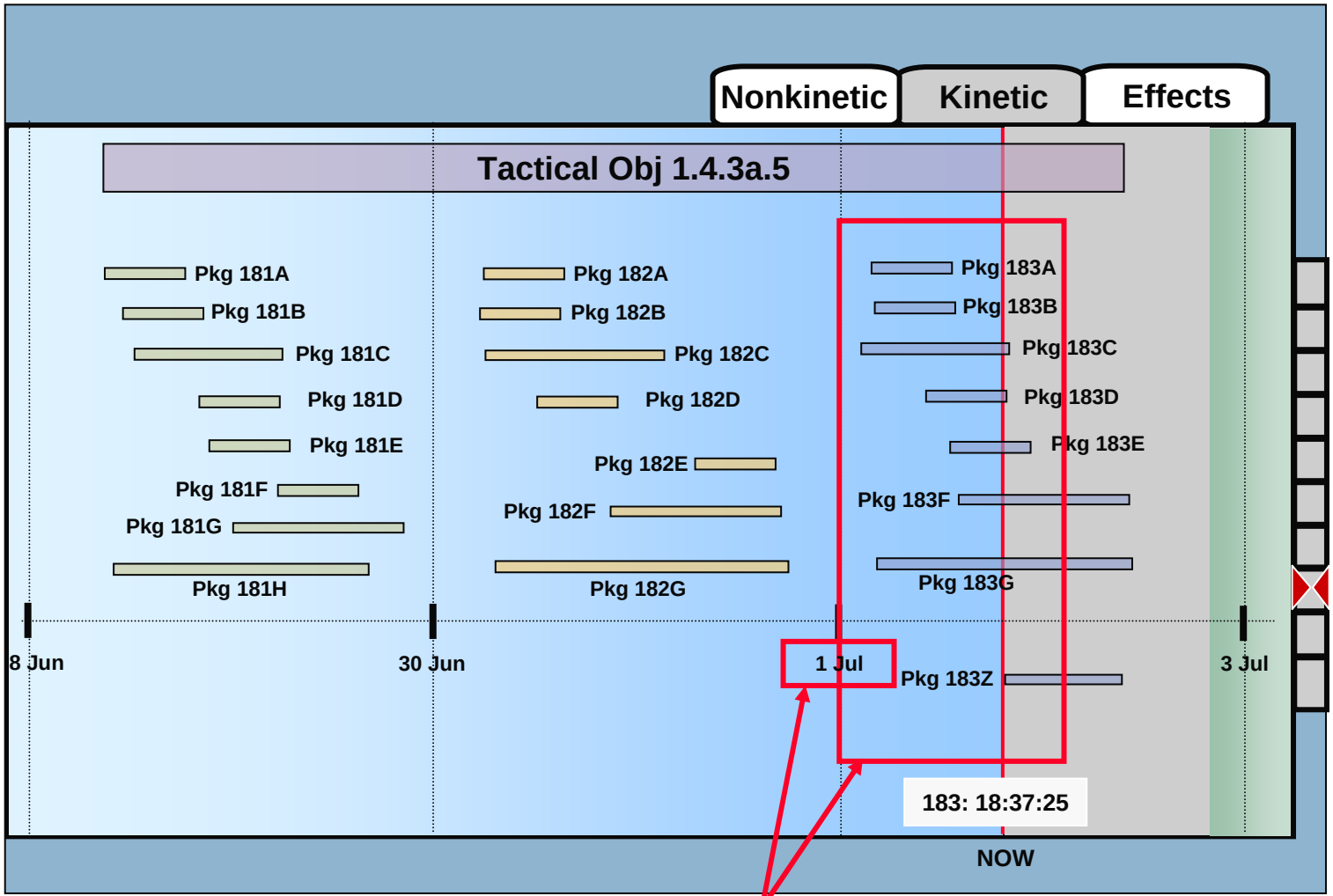
Temporal Display (Op'l/Tactical Zoom)



Operator selects a tactical objective for drill down

BMC2 in 4-D (cont)

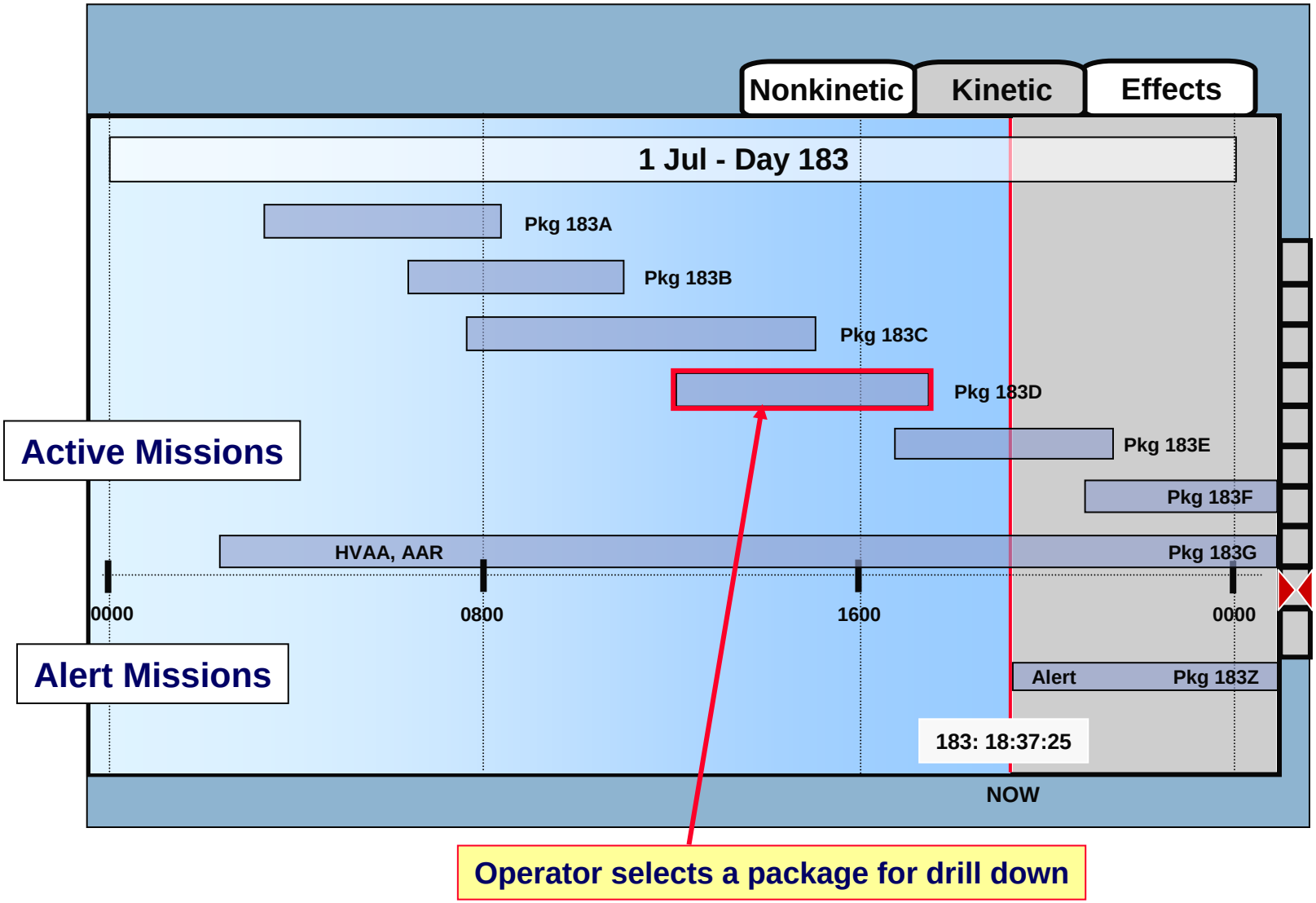
Temporal Display (Tactical Zoom)



Operator selects a day for drill down;
Could alternatively hook block of time

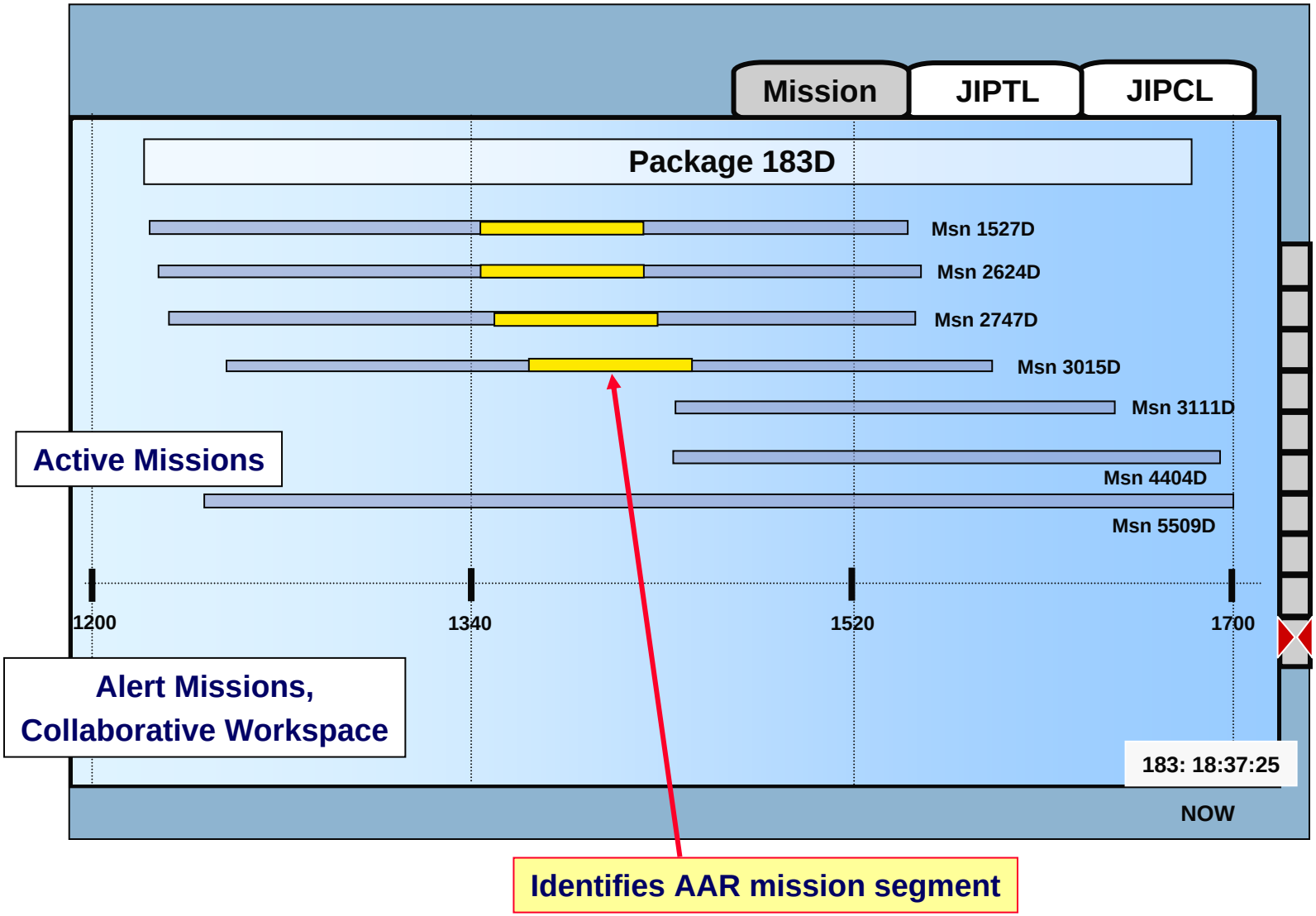
BMC2 in 4-D (cont)

Temporal Display (Tactical Zoom)



BMC2 in 4-D (cont)

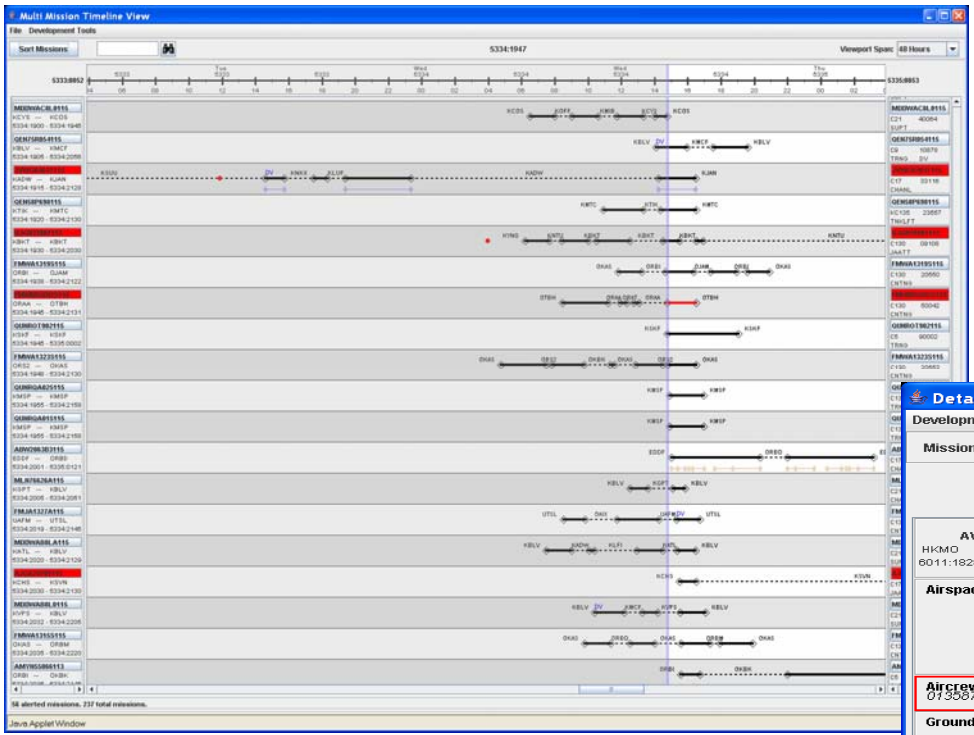
Temporal Display (Tactical Zoom)



BMC2 in 4-D – Real Example

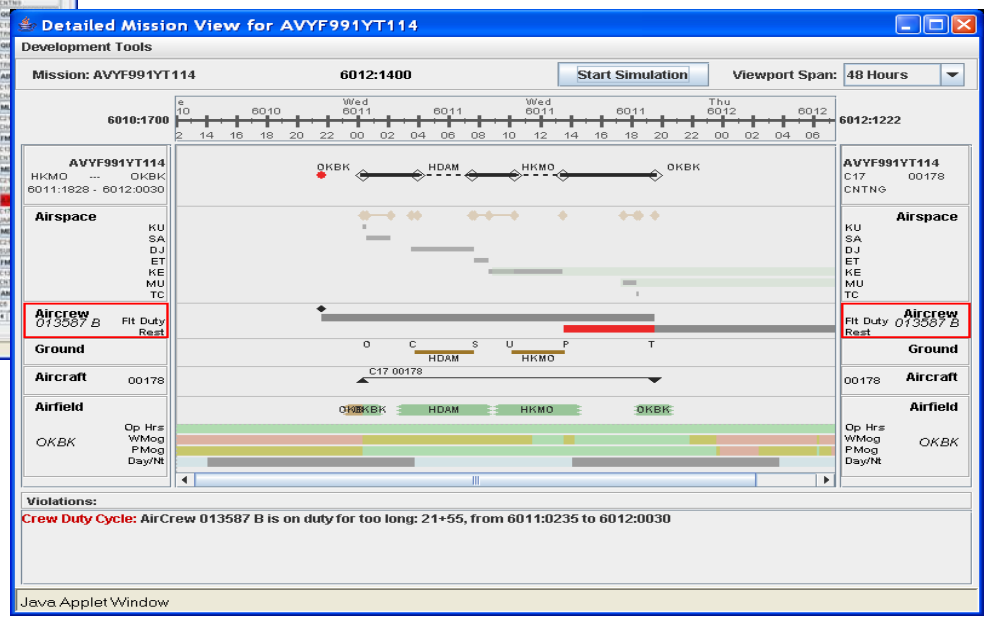
Temporal Display (Tactical Zoom)

AFRL's Work-Centered Interface Distributed Environment ATD

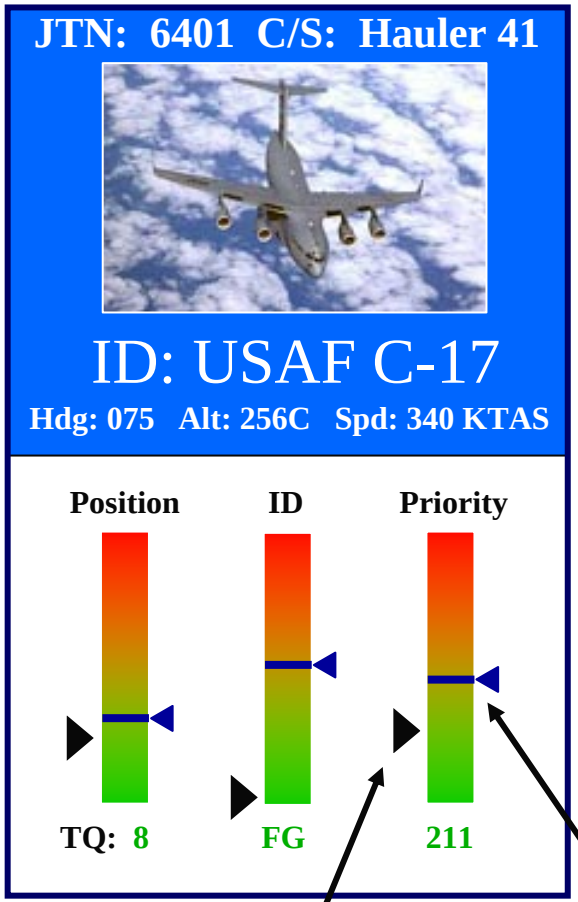


Multi-mission perspective

Single mission detail



Notional Track Information
How much info is enough?



- Keep default info simple; let tip windows give details
- Border color matches ID
- Black pointers correspond to NCW automation results
- Blue markers/bars correspond to operator threshold settings
    - Set only by designated operators (e.g. CIDC)
    - Determine when resources get tasked onboard/offboard
    - Determine when load shedding occurs (low priority targets)
- Sensor automation based on:
    - Requirement for tracking continuity (high priority)
    - Lack of ID (black pointer below threshold)
    - Lack of position quality (black pointer below threshold)
- Information changes dynamically as approved by link authority

Yield from Net-centric Op's

Operator specified threshold

Summary

Questions?

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