



# Side-By-Side Comparison of Mobile Force Modeling Methods for Operational Effects and Virtual Prototyping

Defense Threat Reduction Agency (DTRA) Joint Science and Technology Office – Chemical and Biological Defense (JSTO-CBD) program.

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# The Mobile Forces Assessment Objective

To perform a comparative assessment of the available field of models and simulations (M&S) for their analytical and modeling potential with regard to

- Modeling chemical and biological (CB) effects on mobile forces,
- Exposing CB impacts on operations, and
- Performing analyses of alternatives for determining optimum courses of action under various adverse CBRN conditions.



# Background

- The assessment was fostered with a view to identifying analytical M&S tools that will be recommended for membership among the Joint Operational Effects Federation (JOEF) CBRN M&S tool suite.
- The intended users of JOEF are Warfighters at the three major levels of warfare
  - Strategic
  - Operational
  - Tactical



# Assessment philosophy

- Users define application requirements
- Application requirements drive tool capabilities requirements
- Everything else is secondary

So

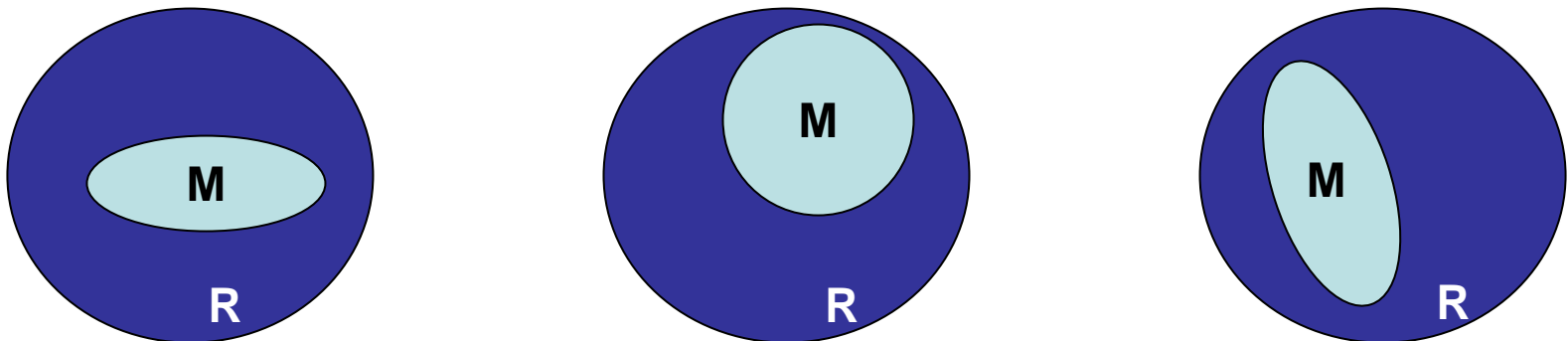
- Who are the users?
- What are their application requirements?
- What are their tool requirements?



# Assumptions

- All models are wrong (imperfect); some are useful
  - No single M&S tool will adequately answer all questions
  - The task or the analytical questions drive the choice of M&S tool

## *The Case of Three Rotary Wing Flight Models*





# Practical Example

- COCOMs worry about TPFFDL flow
  - They need M&S that help them optimize throughput through available nodes (such as a port) and the impact and best alternative if a node is lost to a CBRN attack.
- Port commanders worry about port operations.
  - Port commanders require M&S that will help them optimize port operations in the event of a CBRN attack.

**The optimum types of M&S for each of these applications would probably be different**

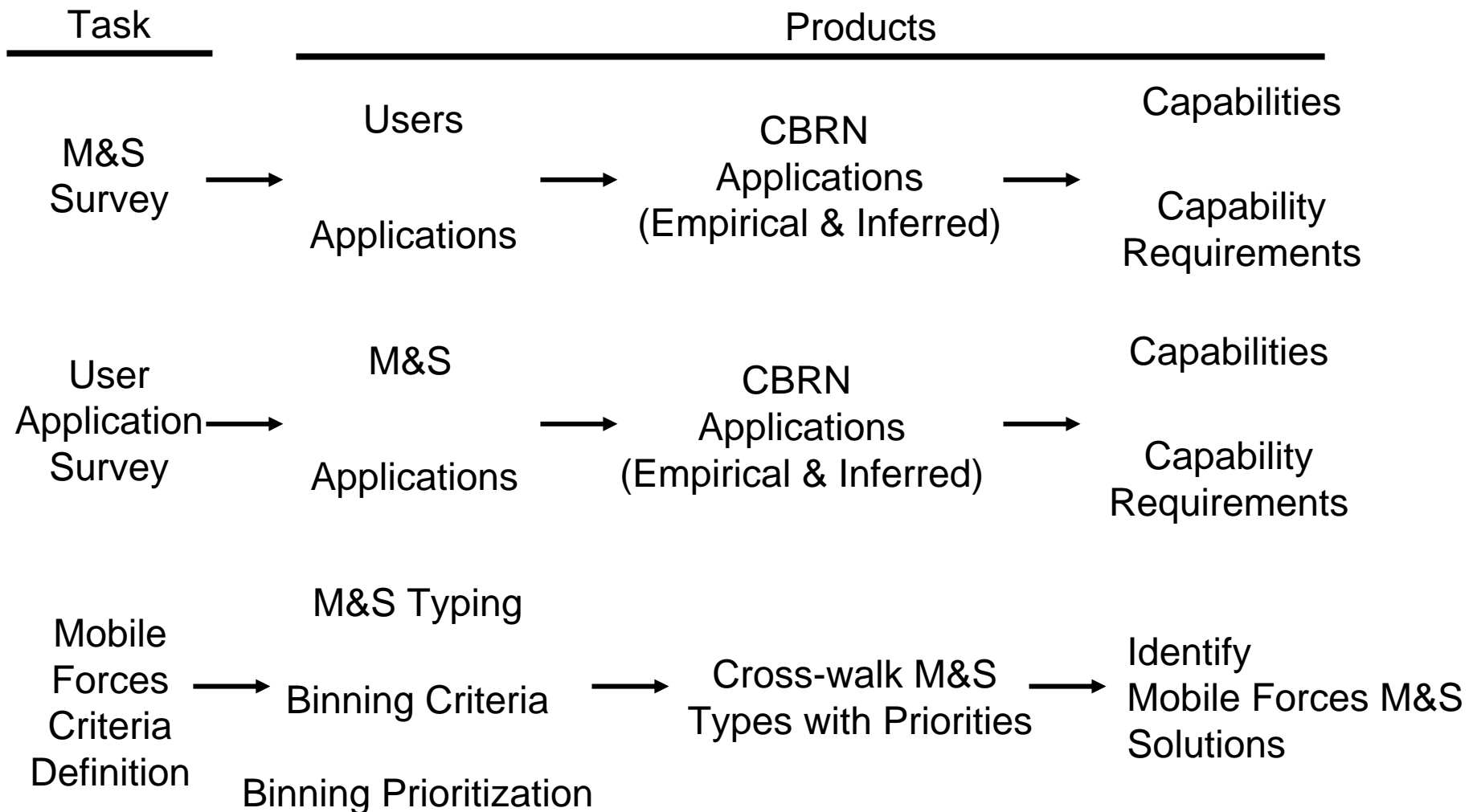


# Assumptions (continued)

- The Army and JFCOM will have the preponderance of potential mobile forces M&S tools
- “Analytical potential” requires statistical reliability
- The three major levels of warfare will have different questions and will probably require different tools



# Approach







# Approach

- Mobile Forces M&S survey
- CBRN application survey
- Mobile forces criteria definition



# Mobile Forces M&S Survey

- What CB M&S currently exist or are planned for development?
- What are their use histories?
- Who are the M&S proponents/owners and their clients?
- What services and what agencies within those services use these M&S
- What are their resolutions and fidelities?
- What CB modeling currently exists within them?
- What CB applications have been conducted or are projected to be conducted with them?
- What CB analyses are envisioned which cannot be conducted for a want of CB modeling?



# Mobile Forces M&S Survey

- Centers of excellence (M&S and CBRN)
- Web
- Symposia (ITSEC, etc)



# Approach

- Mobile Forces M&S survey
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# CBRN Application Survey

Start with the three levels of warfare

- What is the scope of the M&S that are currently used?
- Search areas: Army centers of excellence
  - Battalion/brigade (tactical?) TRAC-WSMR
  - Division/corps (operational?) TRAC-FLVN
  - Army/theater (strategic?) CAA
  - JFCOM
  - OSD support?



# CBRN Application Survey

## (Continued)

- What are their issues and how are they examined? Then
  - Derive notional questions on how a CBRN attack might affect those results?
  - Look for similarities and differences
  - Derive CBRN related functionality requirements that we can use to define classes of applications and classes of M&S tools to support them
- Caveat: No intent to suggest that the assessment will identify all possible application questions.



# Approach

- Mobile Forces M&S survey
- CBRN application survey
- Mobile forces criteria definition



# Mobile Forces Criteria Definition

- Classify applications by M&S resolution/fidelity types
- Cross-walk M&S with application survey
- Develop and prioritize binning criteria
- Assess M&S within M&S resolution/fidelity types by binning criteria





# Initial Binning Criteria

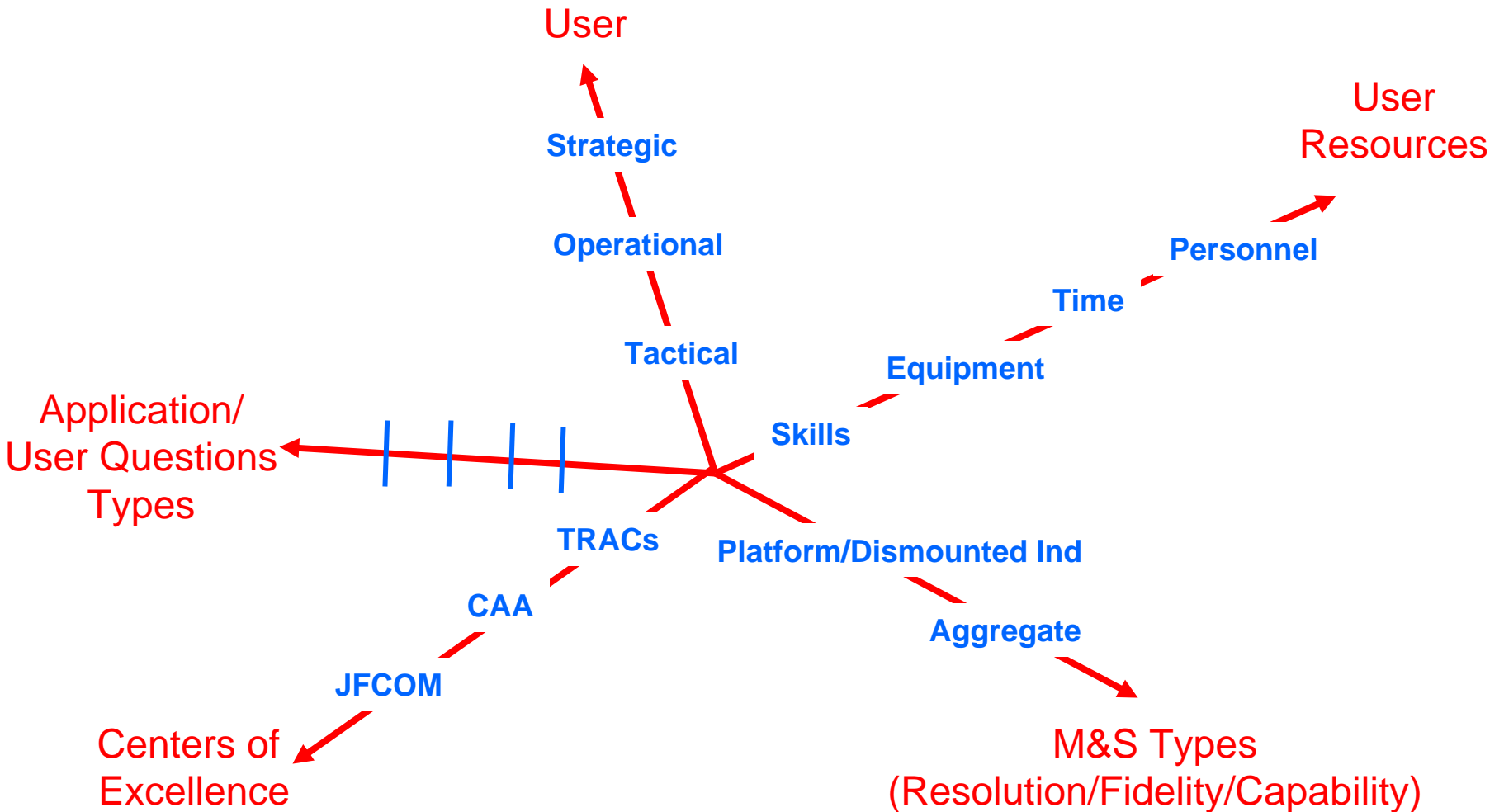
- CBRN application history
- Resolution (individual vs corps)
- Fidelity (movement, sight, respiratory, etc.)
- Statistical reliability
- Ease of modeling (for rapid prototyping)
- Joint (Army & USMC)
- Resource requirements (adequate and skilled staffing)



# Summary



# Perceived Survey & Assessment Space





# Notional Result

Binning Priority	Tactical		Operational		Strategic	
	M&S <sub>a</sub>	M&S <sub>b</sub>	M&S <sub>c</sub>	M&S <sub>d</sub>	M&S <sub>e</sub>	M&S <sub>f</sub>
Statistical Reliability	x	x	x	x	x	x
Resource Rqts	x	x	x		x	x
Resolution		x	x		x	
Fidelity		x	x	x	x	
Joint	x			x	x	
CBRN History				x		x
Ease of modeling	x		x	x		



# Emerging Results

- There are legacy mobile forces M&S resident at Army and USMC centers of excellence that meet most critical binning criteria, but...
- The use of M&S by Warfighter CBRN staffs is revolutionary (not evolutionary) with an inherent problem
  - CBRN staff sections are often one or two deep
  - Most often they do not have requisite technical skills.
  - Categorically, they would never have enough time to prepare an M&S and analyze the output data.
- The above begs solutions such as
  - Simplification of M&S use.
  - Incorporation of existing centers of excellence or creation of CBRN center(s) of excellence resourced to support the Warfighter (similar to the DTRA HPAC paradigm)



# Emerging Results

## (Continued)

- There is little tradition of CBRN M&S application analyses and resulting CBRN related modeling
- The above suggests that CBRN M&S capabilities need to be resident in current Warfighter mobile forces M&S analysis tools
  - The history of CBRN analyses probably would not justify the overhead of unique mobile forces M&S for CBRN analysis



# Emerging Results

## (Continued)

- In process of surveying human in the loop (HITL) M&S (Janus, OTB, etc) for analysis
  - How are users of HITL conducting analysis and is it applicable to JOEF?
  - Known users,
    - TRAC-WSMR
    - Ft Knox
    - JFCOM?
- Intuitively, statistical reliability an issue
- HITL requires far greater resources for M&S execution (terminals, personnel, time, etc) and would appear less of a candidate for use at Warfighter HQs (COCOMs, service component commands, corps, etc)



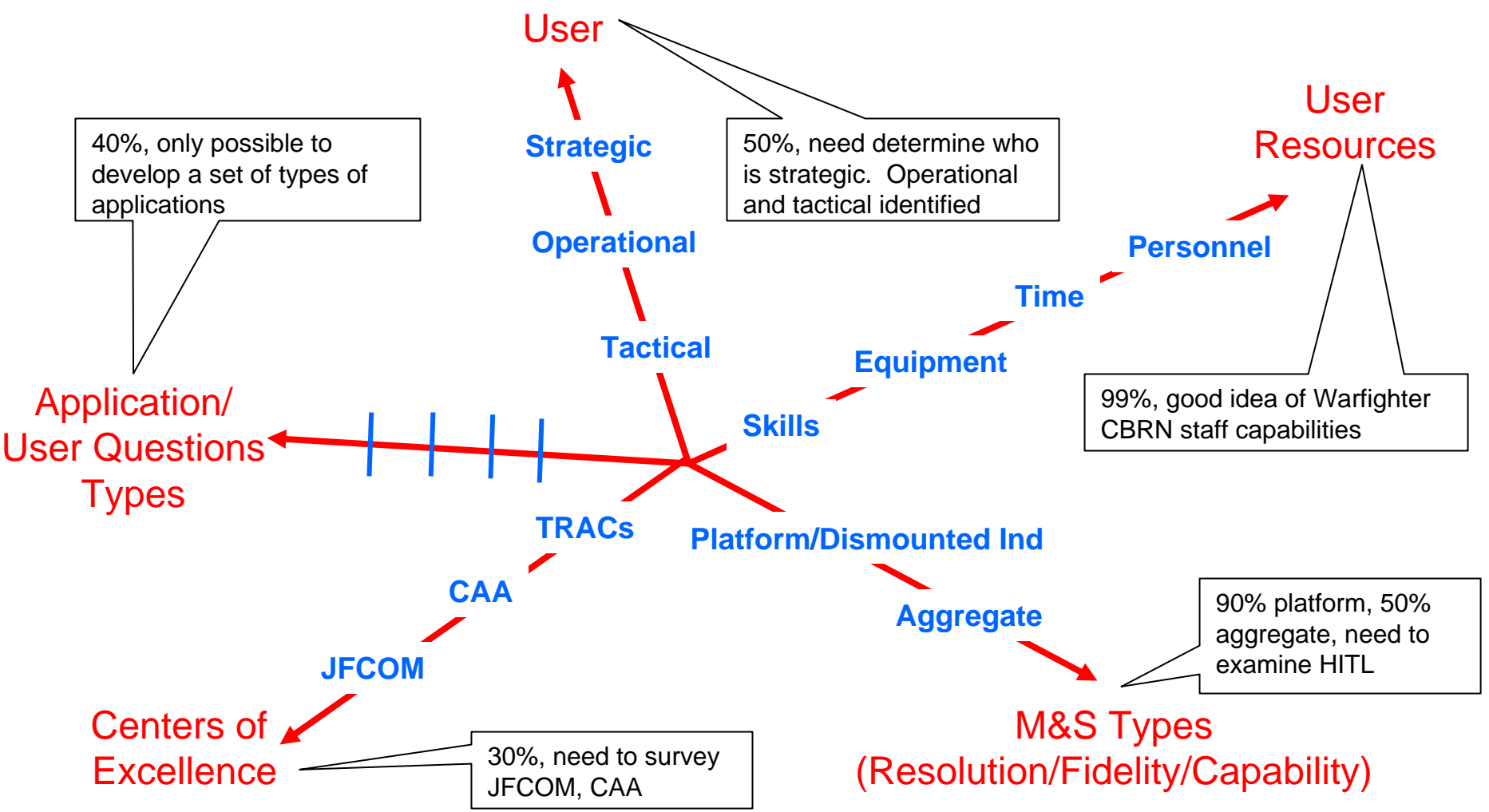
# Emerging Candidates

- Platform/Individual: COMBAT<sup>XXI</sup>
  - Statistical reliability
  - Joint Army-USMC development
  - Tool of choice for their analysis of alternatives
- Aggregate: Multiple possibilities
  - AWARS (Army)
  - JICM (COCOM tool of choice for TPFFDL analysis)





# Status





**Questions and**

**Suggestions**  
(collecting cards)