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Assessment of Air Power Concepts – A Multimethod Approach

Anders Tavemark, Christian Carling,
Patrik Thorén, Johan Blixt

Swedish Defence Research Agency

The Project

The project

- Part of the Swedish Armed forces Aeronautics R&D program
- A multi-year project started in 2017, continuing to 2021
- 16 researchers from 3 FOI divisions (part-time)
- Improve assessment of Air Power / Air Forces
- Mid-term to long-term planning purposes rather than operational assessment

Project tasks

- How to assess:
  - The effect of a Combat Aircraft System in a given scenario? Other systems like C2, Air base concepts, etc.
  - Systems of systems? E.g. Combat Aircraft and GBAD i DCA?
- The pros and cons of different assessment methods and M&S approaches?
- How to use The Swedish Air Force Combat Simulation Centre in assessment?

The assessment framework

Challenges in air power assessment

- Air Forces are complex system-of-systems
  - Height, speed, reach – complications for the analyst
  - Strong links between some parts, ad-hoc/temporary between others

- Hierarchical modelling approach is still reasonable
  - Top-down decomposition into loosely coupled parts
  - Bottom-up aggregation of effects hard but possible

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Our design principles

- Results should express consequences on the tactical/operational level

- Create a framework of methods and tools, not a single tool
- Apply multimethodology – select and combine methods for a given task

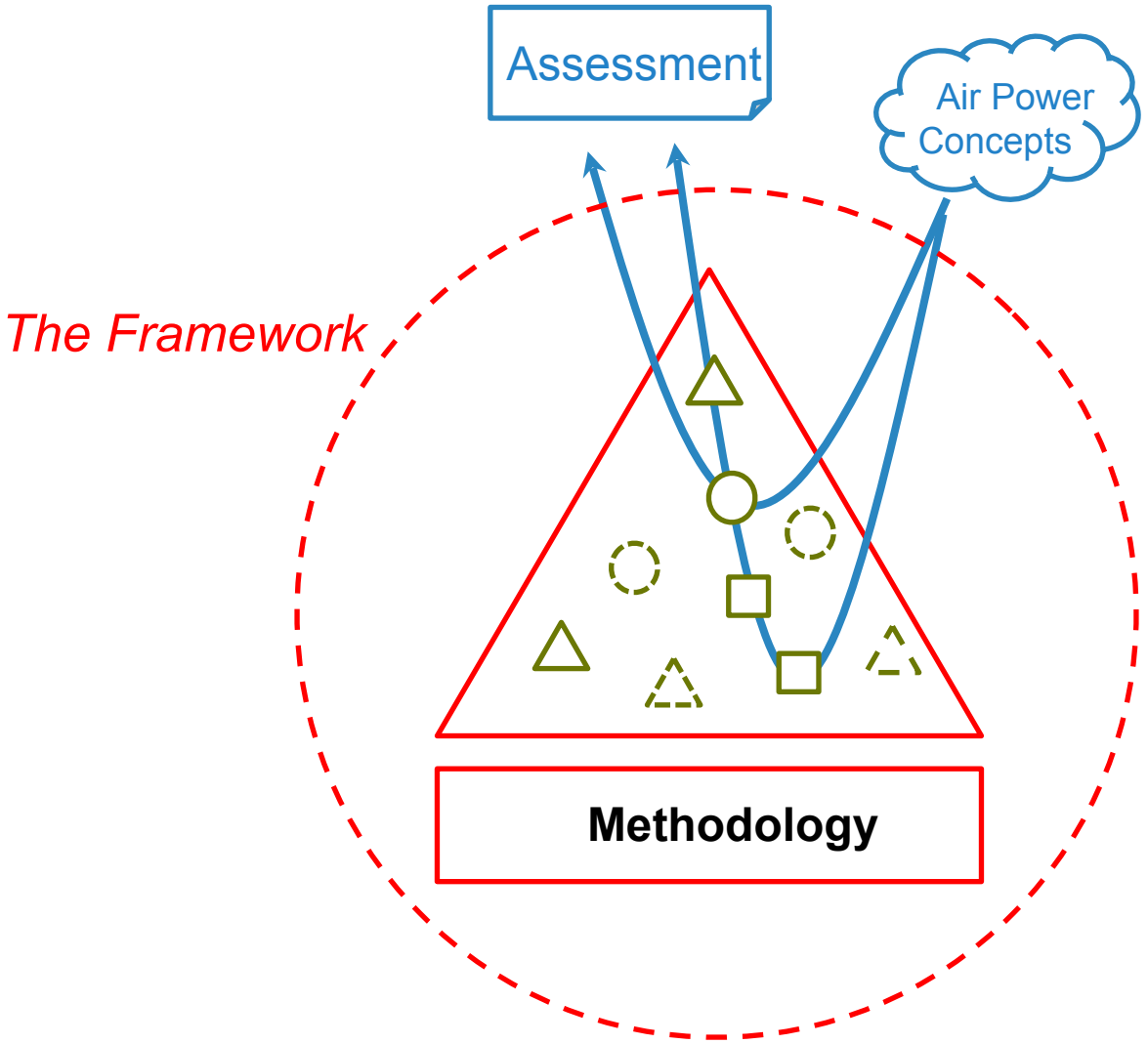
- Modeling and simulation is an important part, but will not fill all our needs
- Wargaming is an effective and flexible method, in combination with others

On multimethodology

- Simple ecclectic approach – the art of ”make do”
- Alternatives not necessarily more effective, or efficient
- Theoretical foundation (from Mingers 1997)
  - Paradigm: primarily *empirical/analytical* + basics of *interpretative*
  - Varieties: mostly *Methodology combination* + some *multimethodology*

- Elements in framework will have varying maturity
- Framework elements owned by others, access not assured

The assessment framework



Assessment process – 5 steps

1. Customer dialogue
   Understand the task and its context, agree on object, scope and criteria
2. Preparations
   Understand the assessment problem, plan and prepare
3. Data collection
   Multimethodology – M&S, wargaming, analytical models, workshops…
4. Analysis
   Check quality and sensitivity, aggregate results
5. Overall assessment
   Formulate balanced overall conclusions, discuss uncertainties, report

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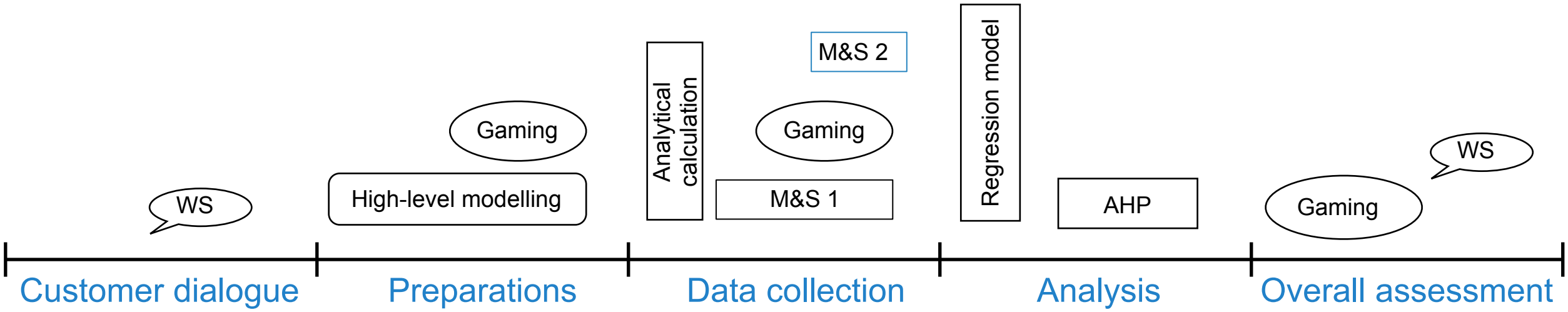
Multimethod approach in practice



Modeling & simulation for air power assessment

M&S supporting air power assessment

- Simulations used alongside wargaming, analytical models and other techniques
- Select and combine multiple models for each assessment task
- Use existing, proven models, adapt as needed
- New development only for identified long-term needs

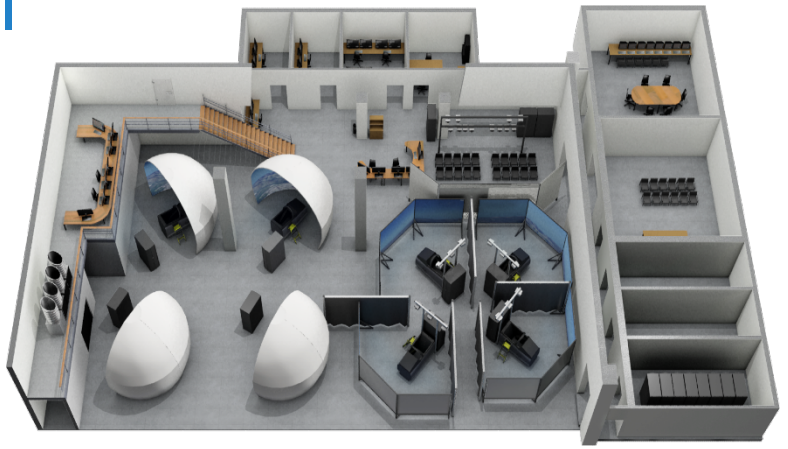
- How do we ensure availability of M&S resources over time?
- Retaining competence – key personnel?

Air domain M&S at FOI

- Several models/platforms/tools relevant for the air domain
- Most have been developed independently, for separate purposes, by a single project
- Majority of models developed in-house
- Mix of stand-alone models, bespoke tool suites, open-source and commercial platforms
- Assuring long-term availability is a problem

The Swedish Air Force Combat Simulation Centre (FLSC)

- Air Combat Simulation Facility for training and tactics development
- Real-time man-in-the-loop simulation
- BVR air combat with the JAS 39 Gripen aircraft, many vs. many
- Data generated in realistic scenarios by real pilots



- In-house, flexible and accessible resource
- How to use it in support of assessment?

Wargaming for air power assessment

Wargaming to support assessment

- Wargaming is an effective and flexible method at several stages in in the assessment process
  - Simple games to create understanding and identify critical situations in Step 2 (Preparation)
  - Course of event games in Step 3 (Data colletion)
  - Scenario-based discussions in Step 5 (Overall assessment)
- Can be used in close cooperation with other methods
  - M&S can provide pre-game adjudication and baseline data
  - Games can identify critical and uncertain situations for post-game M&S analysis

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Reflections on air power wargaming

- Wargaming in the air domain is different (from land and maritime)
- Need for improved representation and visualisation
  - Enabling overview of entities and actions
- Same scenario may be played at multiple levels in the same game
  - i.e. individual air bases and tactical level

Questions?