
Modelling and Analysis of Different Localization of JSF Squadron Using Causal Maps

Professor Dobrila Petrovic
d.petrovic@coventry.ac.uk
Pawel Zdanowicz –Research Assistant
ab3145@coventry.ac.uk
Coventry University, UK



Colin Irwin – Technical Partner
DSTL, Policy & Capability Studies Department, UK

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- Work presented in this presentation is continuation of the project presented on the 29th ISMOR
- Theoretical description of the method with “common sense” causal map and demo of the software

Presentation with more details of the theoretical part:

http://www.ismor.com/29ismor_papers/29ismor_zdanowicz_petrovic.pdf

Outline

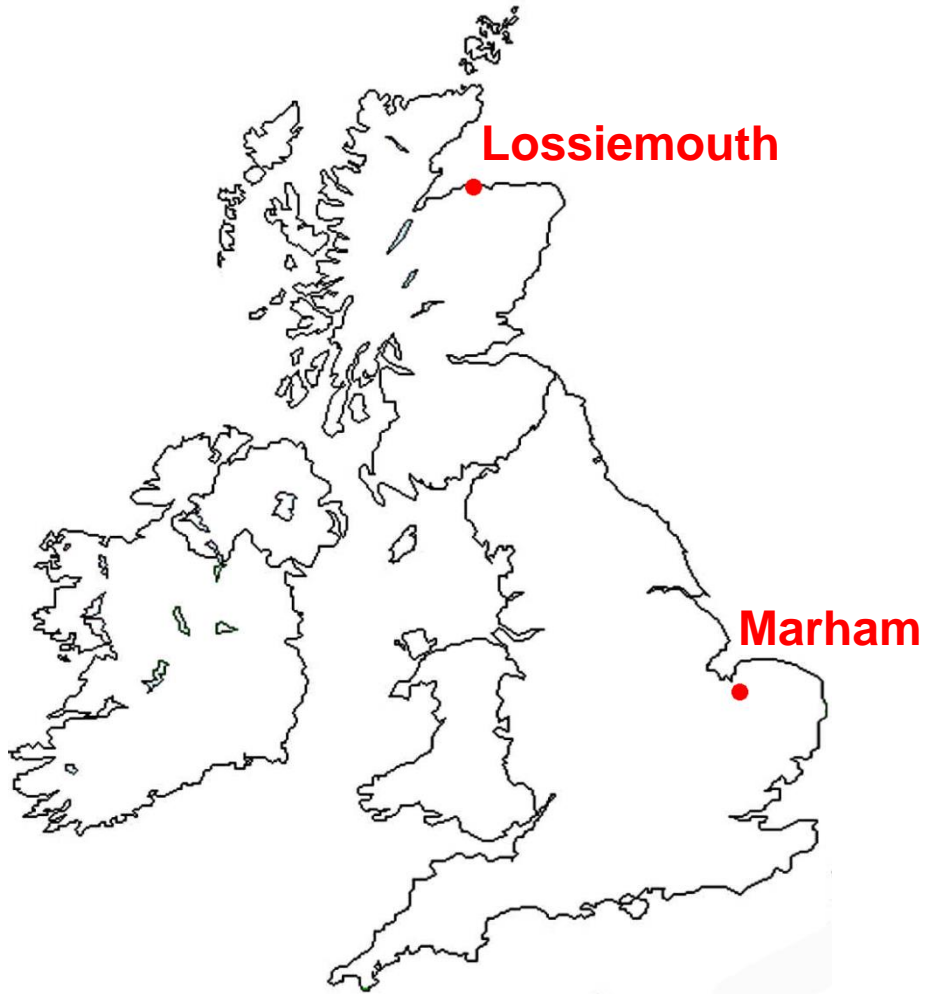
1. Objectives
 2. Proposed methodology
 3. Causal map
 - Elements of causal map
 - Membership Functions
 - New types of relationships
 4. Results
 5. Conclusions and further development
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Objectives

Design a new system:

- for modelling and analysis of allocation of resources to Defence Lines of Development (DLoDs); and
 - as test case, example analysis of the potential impacts upon military capability and budget requirements of location options for the future UK Joint Strike Fighter (JSF) force.
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Objectives



DLODS:

Training
Equipment
Personnel
Infrastructure
Doctrine and Concept
Organisation
Information
Logistics

Proposed methodology

Rule Based Fuzzy Causal Maps (RBFCM)

Existing systems:

- Forest Fire Modelling
 - Fishermen's behaviour in a pelagic fishery
 - Students' behaviour

 - Defence Lines of Development ← new system
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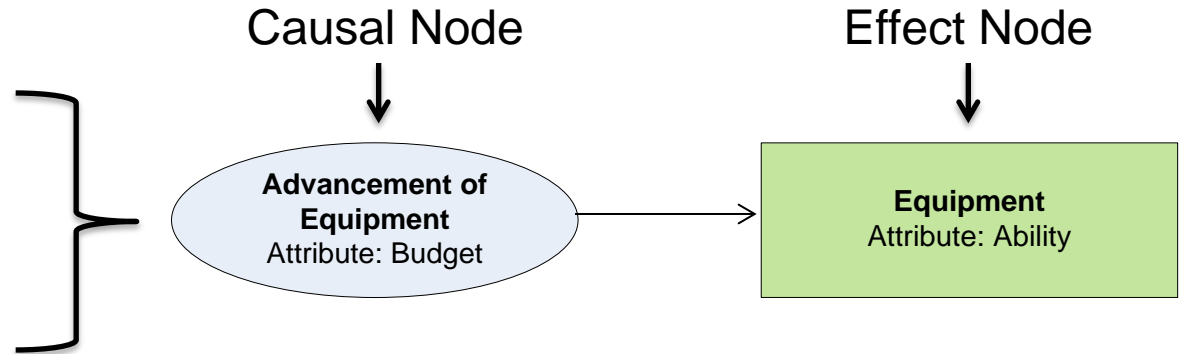
Elements of a causal map

- Concepts

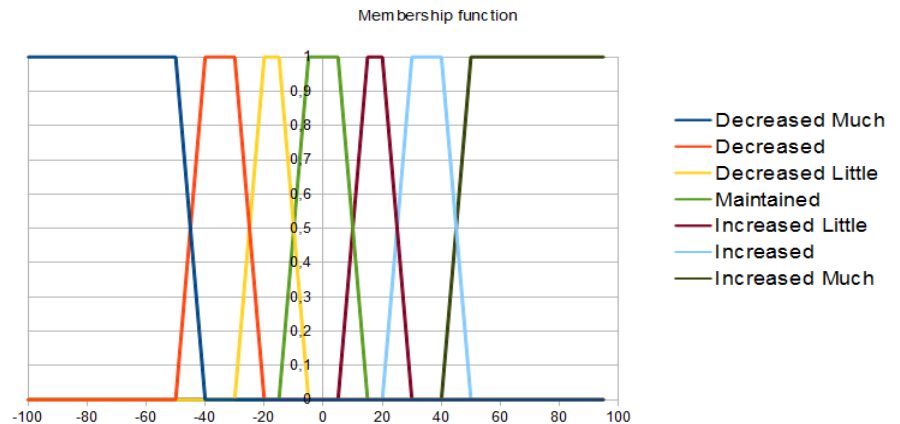
- Relationships

- Rules

- Membership functions



IF Budget for Advancement of Equipment is *Increased*
THEN Ability of Equipment is *Increased Little*



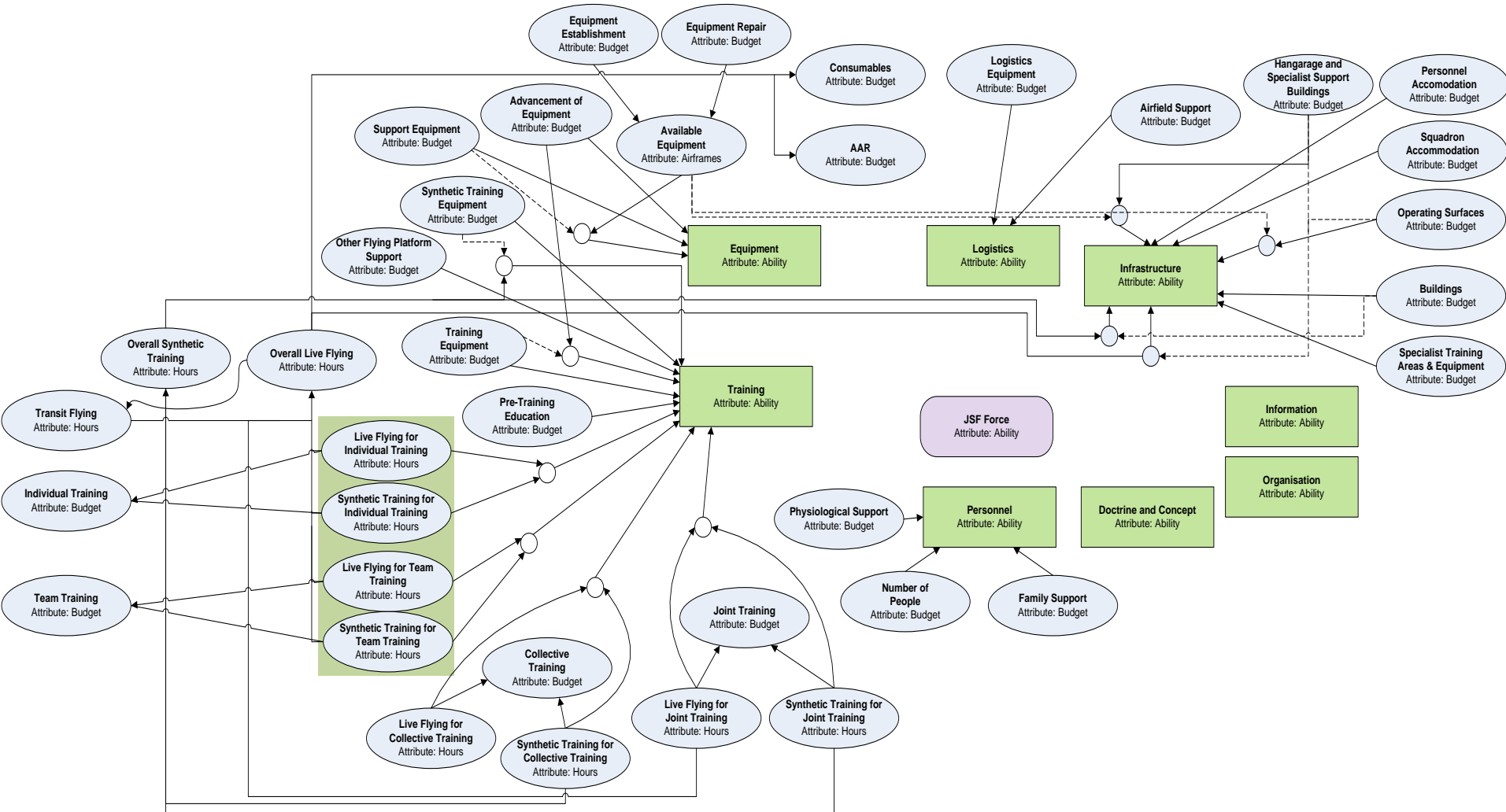
Causal Map (1st part of the project)



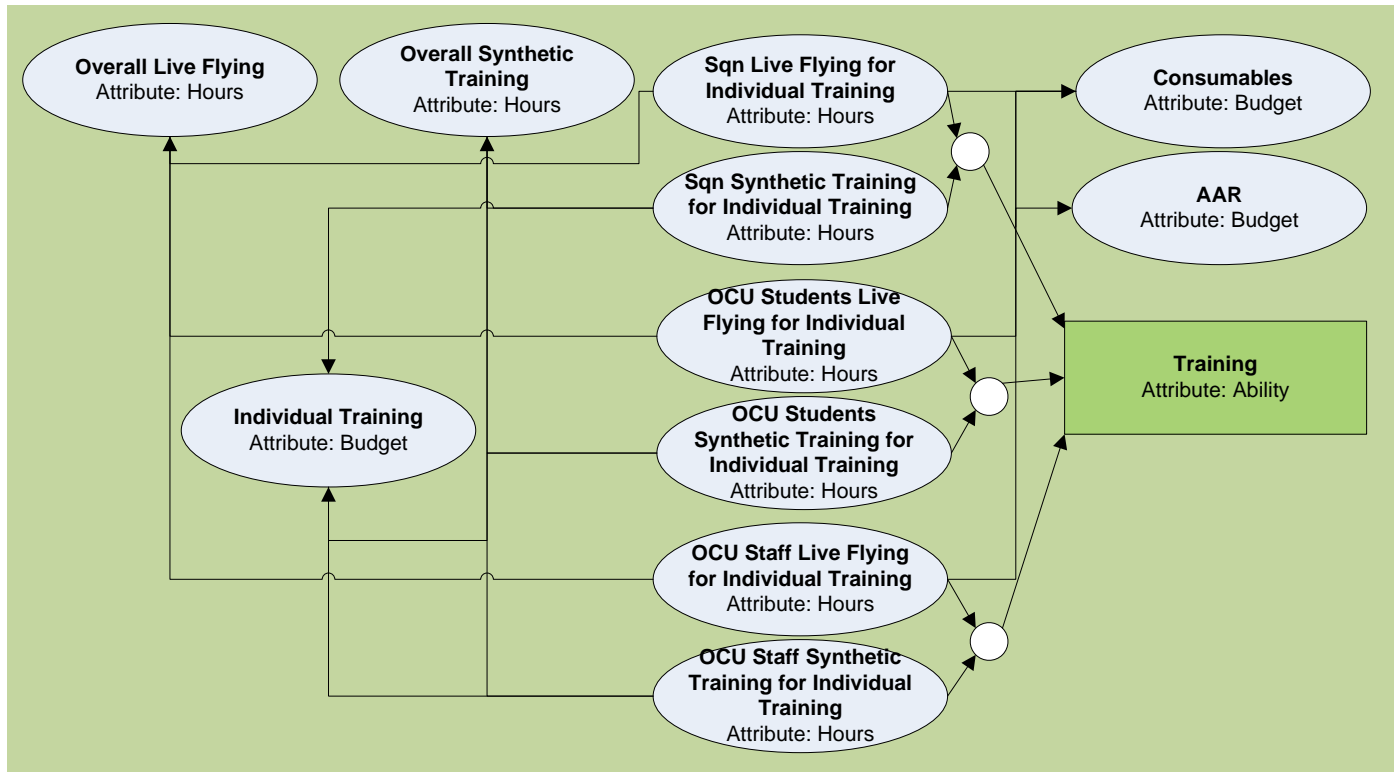
Real World Case more Complex...



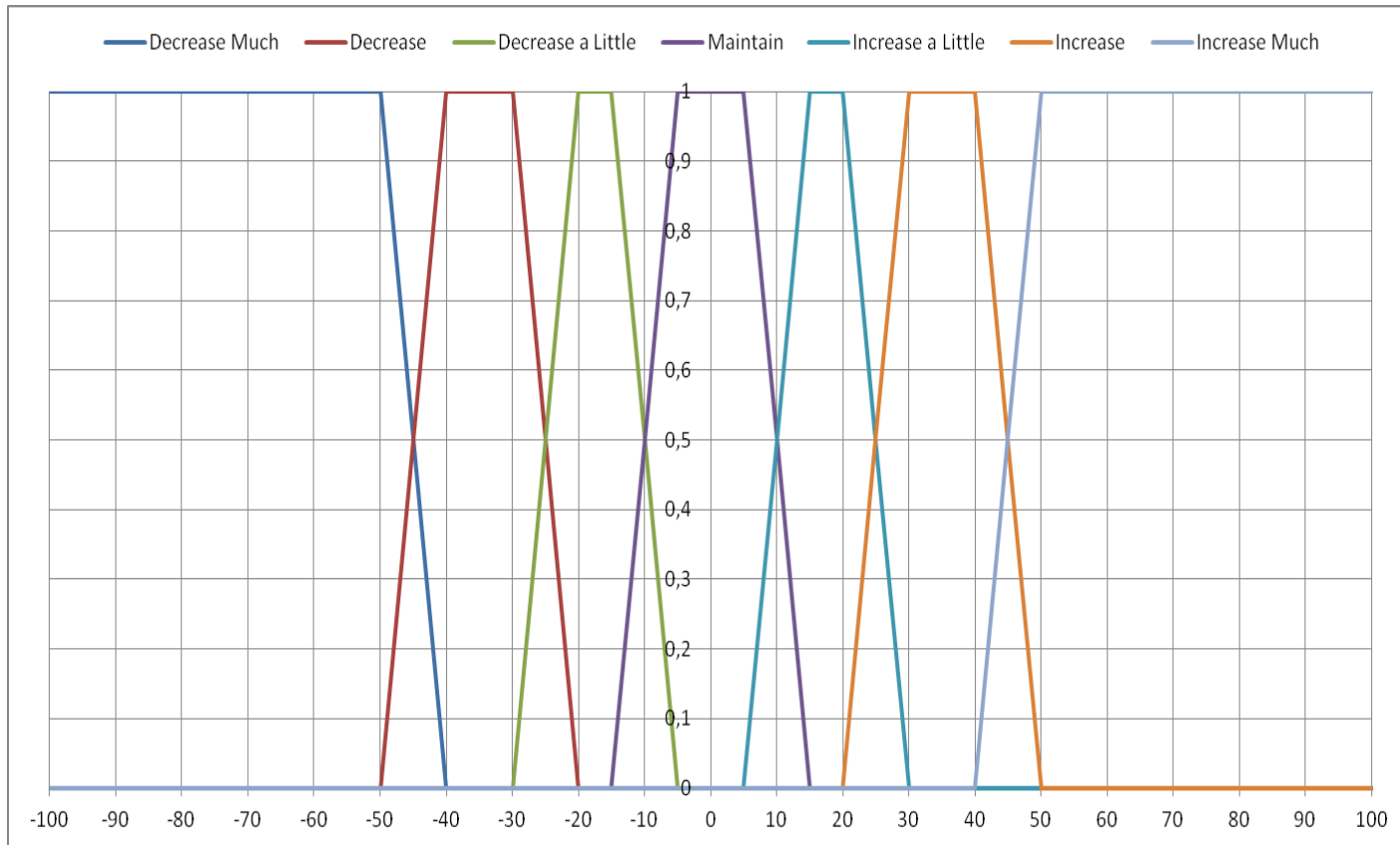
Causal Map (2nd part of the project)



Causal Map (2nd part of the project)

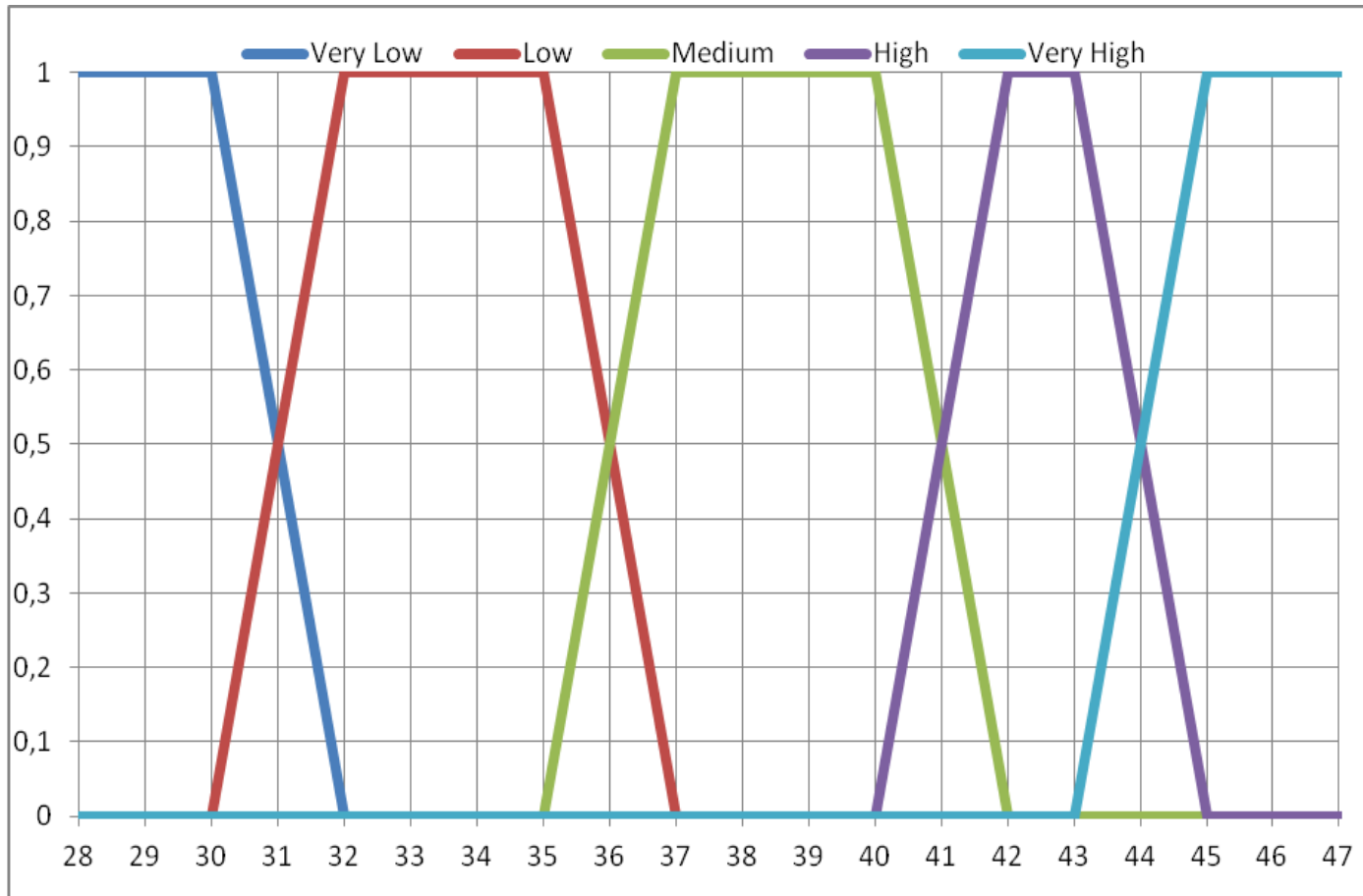


Membership Functions – Variation



Budget, Ability

Membership Functions - Level



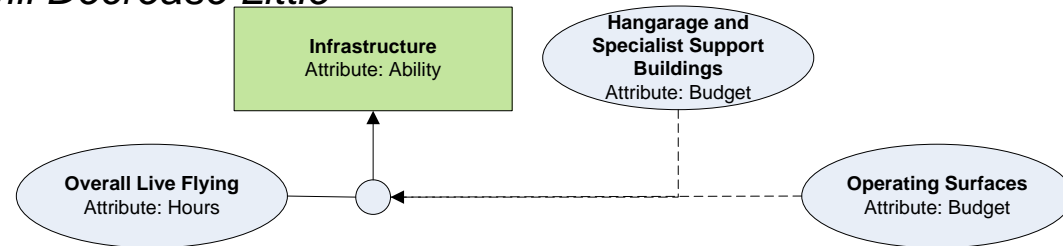
Number of Hours

New types of relationships

Linear relationship: 1 hour of Live Flying Training costs 1200 GBP

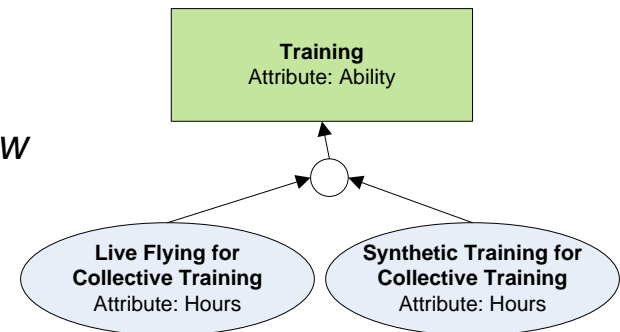
Conditional fuzzy causal relationships:

*IF Number of Hours allocated to Overall Live Flying is Medium
AND NOT (Operating Surfaces is Increased or Increased Much)
AND NOT (Hangarage is Increased Little or Increased or Increased Much)
THEN Ability of Infrastructure DLoD will Decrease Little*



Complex fuzzy causal relationship:

*IF Number of Hours for Live Flying is Very Low
AND Number of Hours for Synthetic Training is Very Low
THEN Ability of Training DLoD will Decrease Much
IF Number of Hours for Live Flying is Very Low
AND Number of Hours for Synthetic Training is Low
THEN Ability of Training DLoD will Decrease Much*




Demo

Further Development


- The demonstration of the JSF Force map was adjudged successful by a second Dstl SME workshop on March 4th.
 - Recommended to develop the GODIVA tool further.
 - In particular, GODIVA should be used to shadow a suitable study to establish its value for long-term use in defence OA.
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Further Development

- Replace abstract DLoDs with more tangible outputs:

Training DLoD Ability  Number of soldiers that are trained to required criteria.

Equipment DLoD Ability  Number and Quality of Equipment that is ready for use.

Infrastructure DLoD Ability  Hangarage, Operating Surfaces, Accommodation, Specialist Training Areas, etc relative to requirements.
