TNO innovation for life

The GM-VV Tailored for a Naval Ship-Handling Training Simulation

Jeroen Voogd, TNO
Manfred Roza, NLR
Ad van Lier, MinDef


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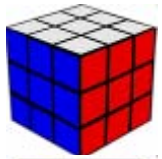
GM-VV

- **Generic Methodology for Verification and Validation to Support Acceptance of Models, Simulations & Data**
- **Generic**
  - independent from M&S technology, development process and application domain
- **Full methodology**
  - Products, Processes, Organization
- **Customer oriented**
  - Who runs the real risk?
- **Documentation**
  - Traceable, documents the V&V work itself

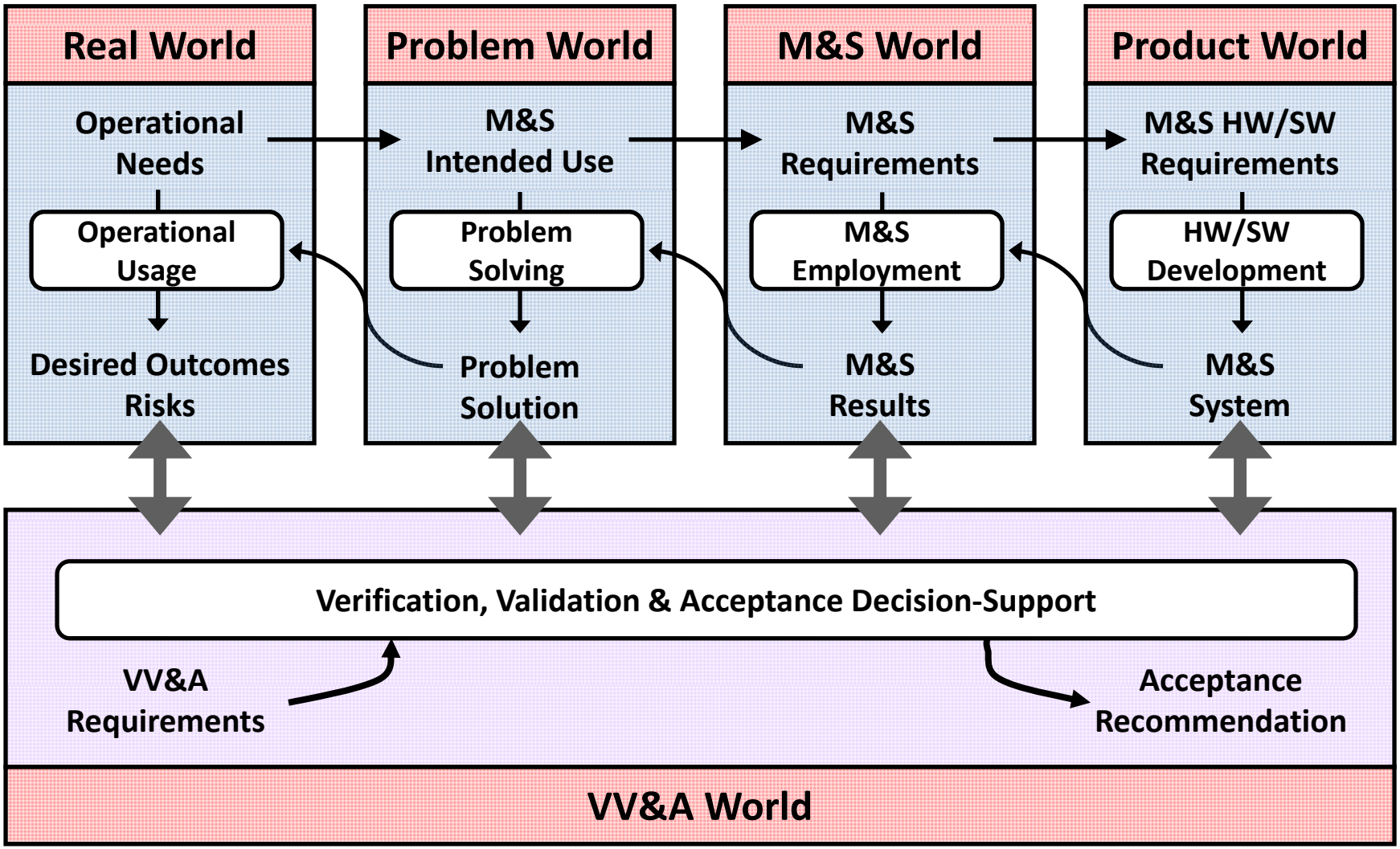
GM-VV

- **Conceptual Framework**
  - Basis van GM-VV
- **Implementation Framework**
  - Basis of a VV&A project
- **Tailoring Framework**
  - Optimal project execution

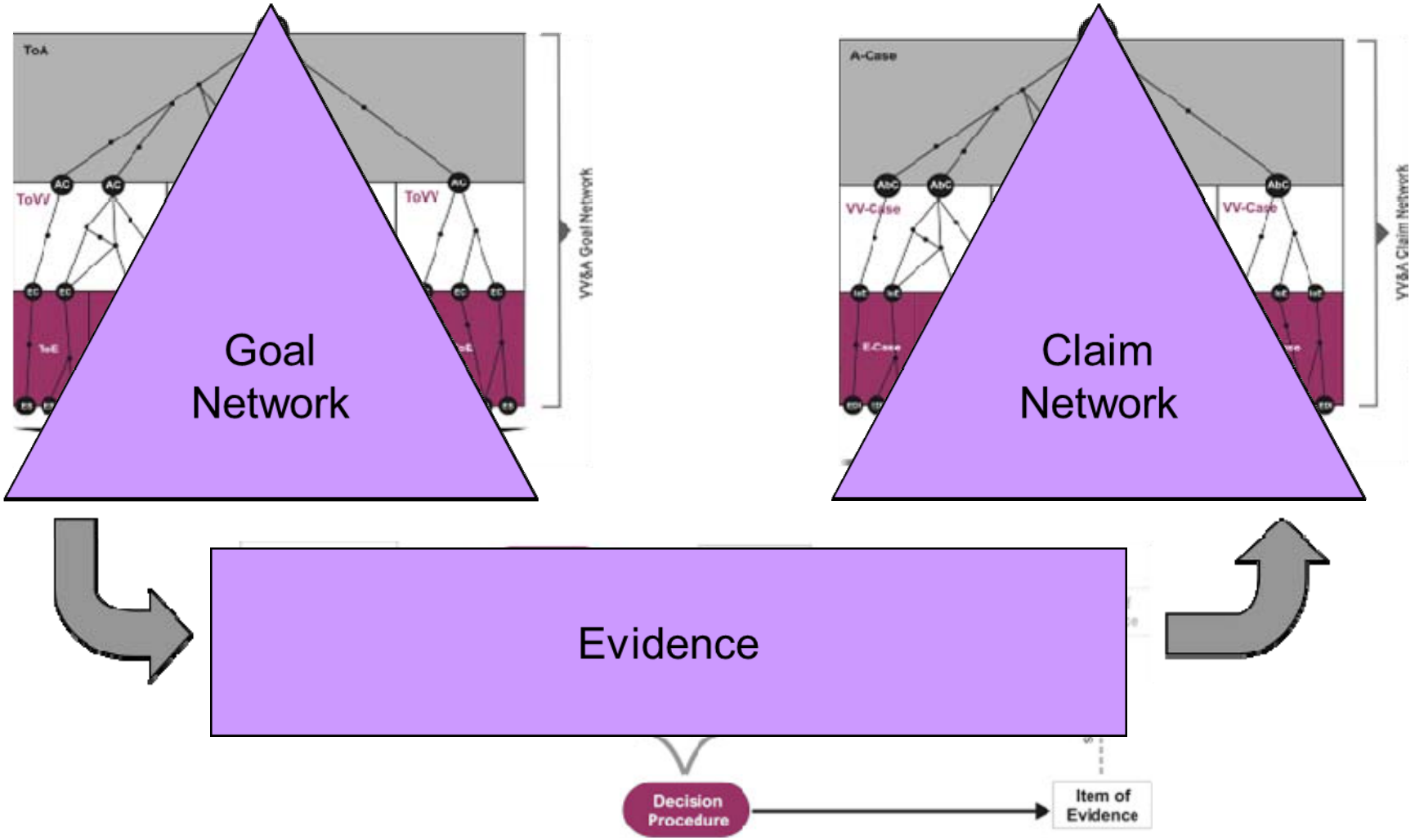
GM-VV Conceptual Framework

- System Engineering
- M&S Based Problem Solving
- VV&A Problem Solving Approach
- Acceptability Criteria
- VV&A Goal-Claim Network
- VV&A Enterprise and Project Approach
- Levels of Independence
- VV&A Information & Knowledge Management

4 + 1 worlds model

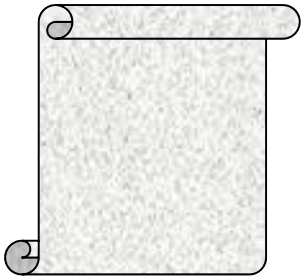


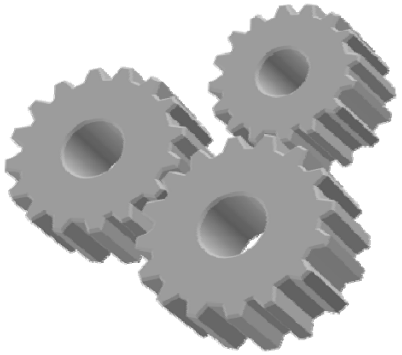
VV&A Goal-Claim Network

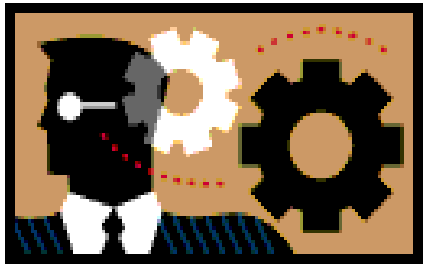


GM-VV Implementation Framework

- **Products**
  - Primary: V&V Agreement, ..., Acceptance Recommendation
  - Support: Project & enterprise Memory, ...
- **Processes**
  - Management
  - Technical
  - Support
- **Organization**
  - VV&A User/Sponsor
  - Enterprise Manager
  - Acceptance Leader, V&V Leader
  - V&V Implementer

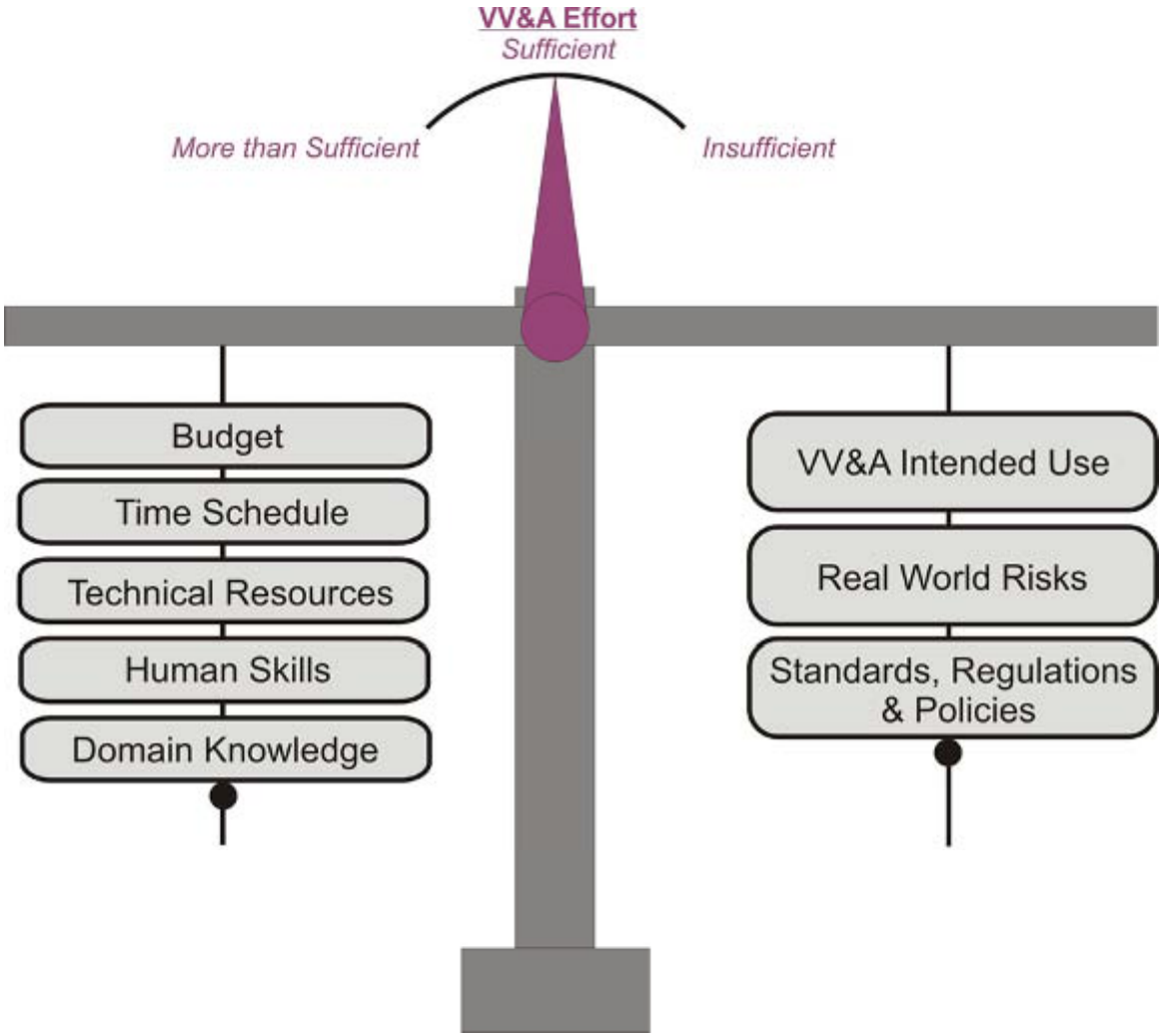






GM-VV Tailoring Framework

- Extension
- Reduction
- Specialization
- Balancing




Case study

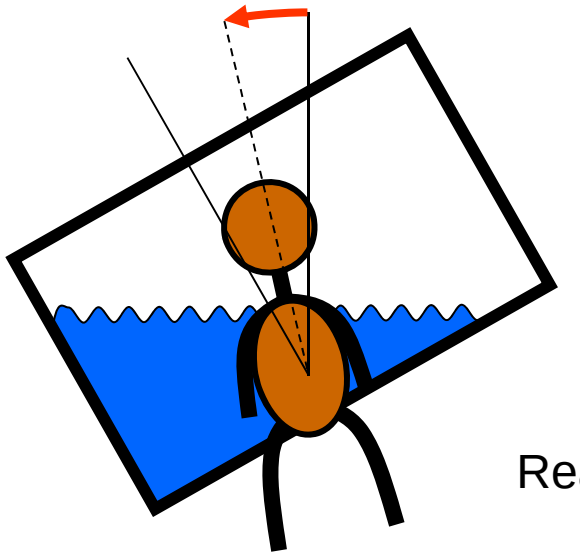
- **Royal Netherlands Navy**
- **Heavy Weather Ship Handling**
  - on the job under guidance of experienced officers
- **Simulation for training and doctrine identification**
  - safer, cost effective, less time consuming
- **Scenario:**
  - Sea state ≈ 5, blue water
  - following a ship, changing course, 180 degrees turn
- **Fixed base? Motion base?**
  - Experiment!
- **V&V: Are the results of the experiment useful?**

Fixed base problems

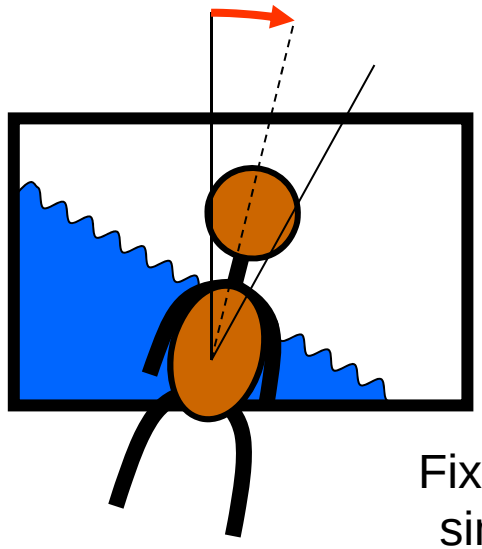
- **Extreme angles**

Fixed base problems

- **Wrong movement to balance**



Real

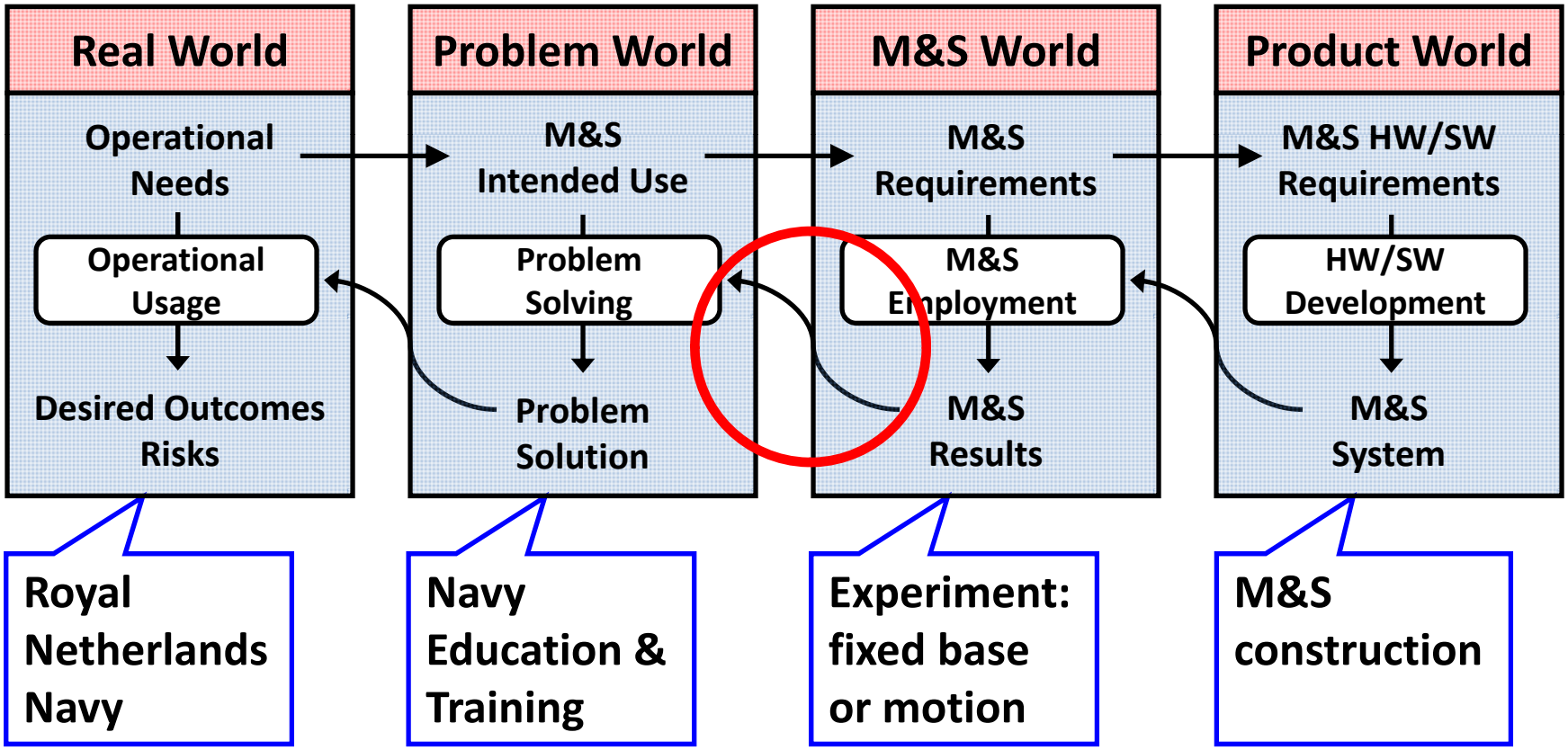


Fixed-base simulator

Experiment

GM-VV Case study instantiation:

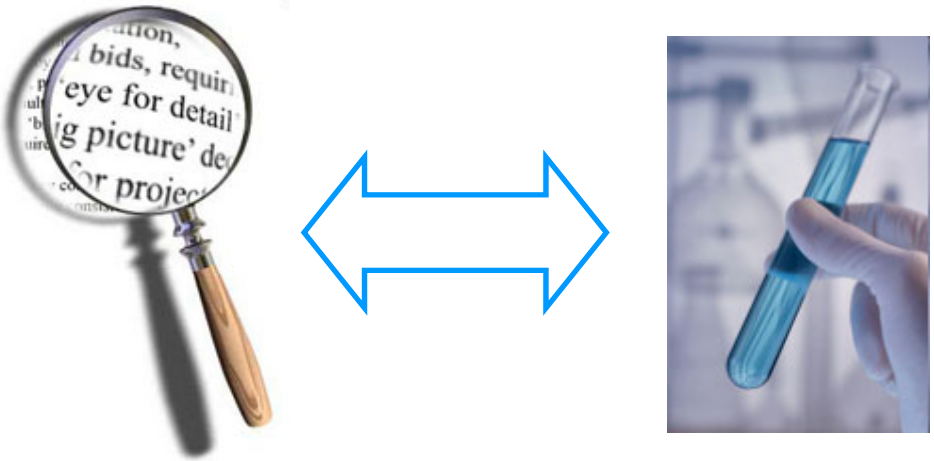
Focal point of the V&V work



GM-VV Case study instantiation:
Relation with experiment

- **V&V executed concurrent with experiment**

- **Independence**
  - Experiment team had no a-priori interest in outcome
  - No independent V&V was necessary
  - Experiment team and V&V team cooperated

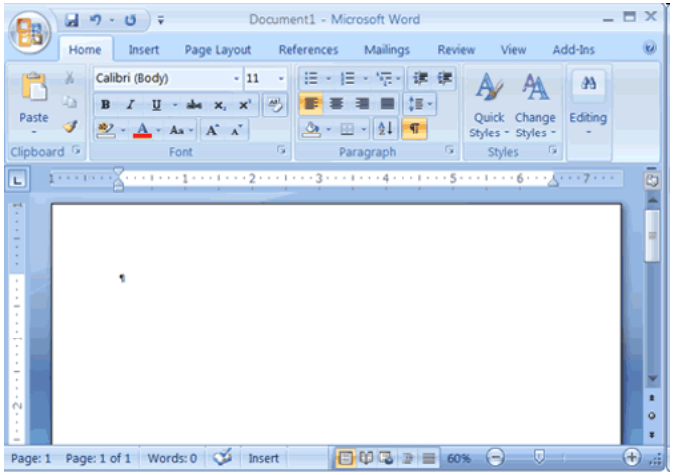


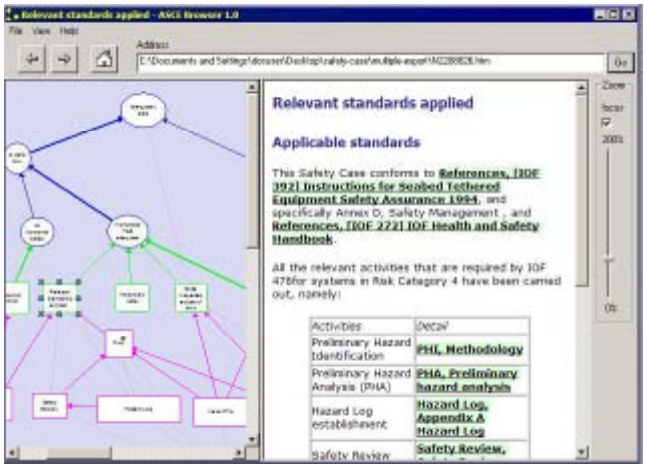

Tailoring the Organization dimension

- **VV&A User/Sponsor: two separate roles**
  - User: acceptance recommendation on experiment
  - Sponsor: show defense organization importance of VV&A
- **Enterprise Manager: no**
- **Acceptance Leader = V&V Leader**
  - and also one of the implementers
- **V&V Implementer**
  - Cooperation between experiment team and V&V team

Tailoring the Products dimension

- **One single document**
  - containing most of the primary products
  - Acceptance Recommendation
- **VV&A Goal-Claim network**
  - Separate document in Adelard's ASCE





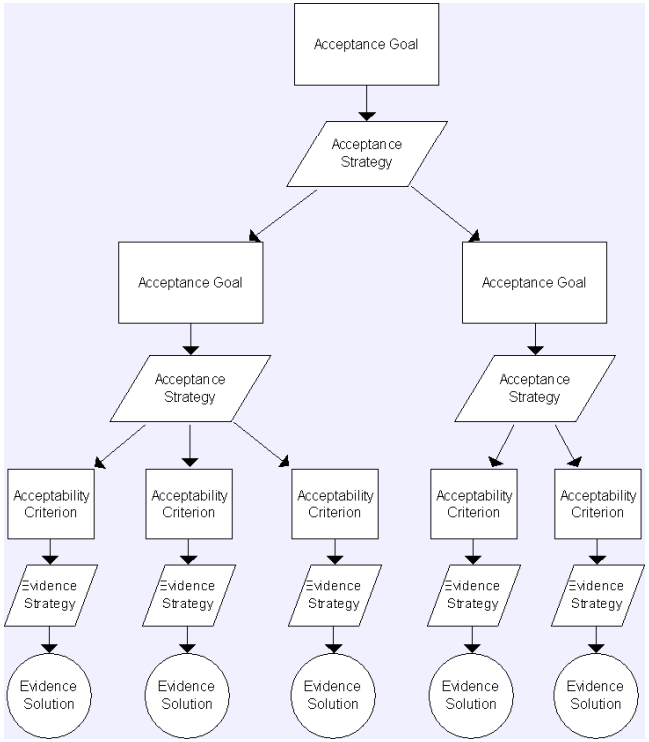
Tailoring the Process dimension

- **Concurrent with experiment**
  - key SMEs were continuously available
  - several large meetings with all SMEs could be used in the construction of the VV&A Goal-Claim Network
  - Experiment team knew criteria

- **Appropriate GM-VV activities or tasks were executed**
  - Some activities were irrelevant
  - Some activities were executed with experiment team

Tailoring by Balancing

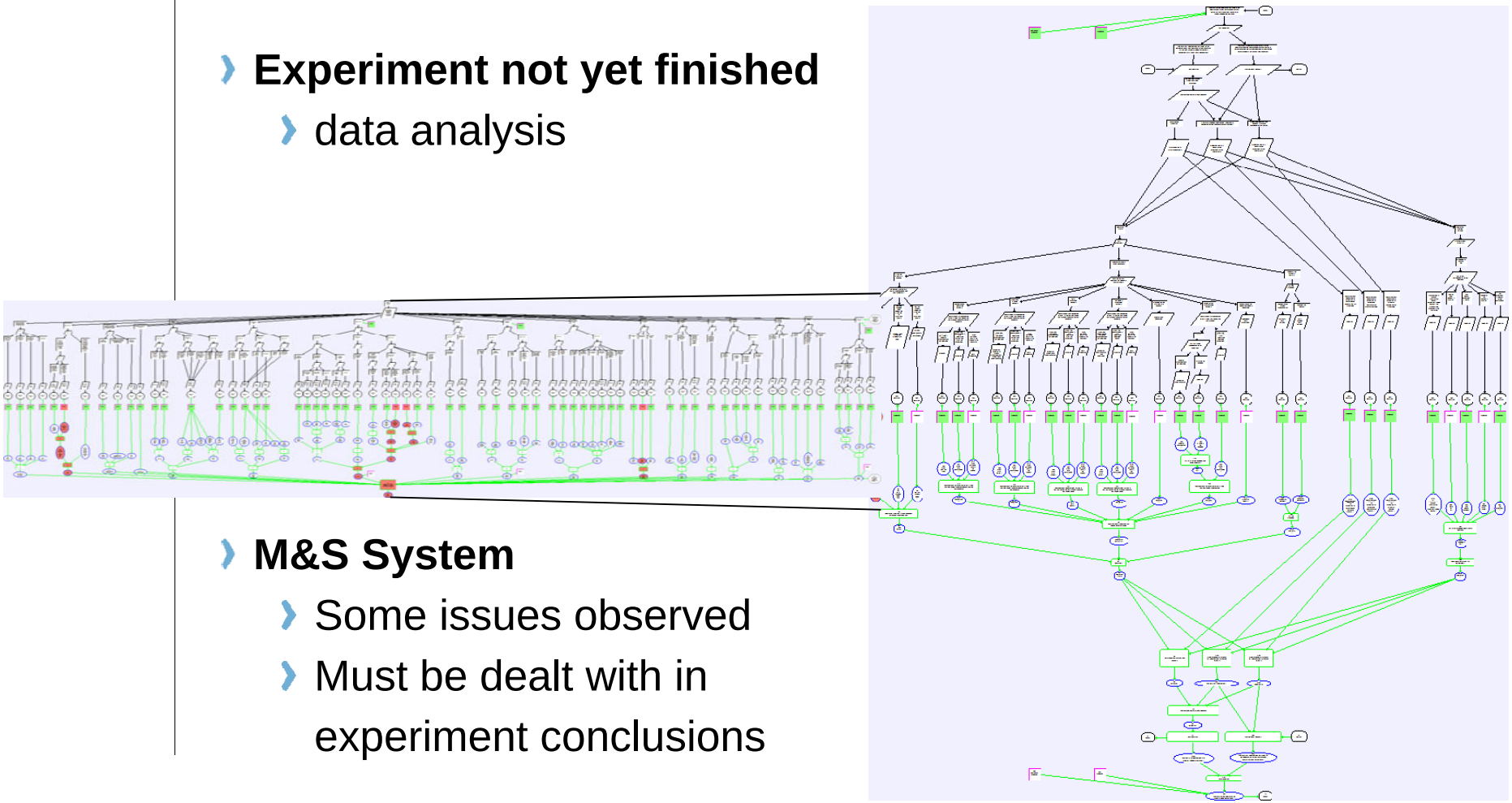
- **Design of Goal-Claim Network and Experimental Frame**
  - Decomposition of a goal in smaller sub-goals
  - Factors included in such a decision:



- Availability of decomposition strategies
- Availability of test methods to obtain evidence
- Costs (budget, time, expertise, etc.) to execute tests
- Expected convincing force of the obtained evidence

GM-VV Case study results

- **Experiment not yet finished**
  - data analysis



- **M&S System**
  - Some issues observed
  - Must be dealt with in experiment conclusions


Conclusions

- **GM-VV has all high level ingredients for rigorous VV&A**
- **GM-VV needs to instantiated and subsequently tailored**
- **Tailoring has been applied in several ways**
  - Instantiation: elements were added or removed
  - During the execution
  - Tailoring: Goal-Claim Network + Experimental Frame
  - The GM-VV tailoring principles worked

Questions?

- Jeroen Voogd
  - TNO - Defence, Security and Safety
  - jeroen.voogd@tno.nl
- Manfred Roza
  - NLR – Training and Simulation Systems - Application, Validation and Quality Assurance
  - manfred.roza@nlr.nl
- Ad van Lier
  - Simulation Expertise Centre, Netherlands MoD
  - Ac.vanLier@mindef.nl