

GEMCAR

PROJECT WORKSHOP

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MIRA

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Workshop agenda

- Introduction to GEMCAR
 - Alastair Ruddle, MIRA
- Computational electromagnetics
 - Jean-Philippe Parmantier, ONERA
- Correlation between testing and simulation
 - Pascal Gondot, Aerospatiale-Matra
- GEMCAR user requirements
 - Ivan Hendikx, Hevrox

INTRODUCTION TO

GEMCAR

Use of electromagnetic modelling
techniques in automotive EMC

Overview

- Motivation
- Existing capabilities
- Practical difficulties
- GEMCAR project
- Current status
- Conclusions

Traditional automotive EMC

- Functional performance of whole vehicle
 - immunity and emissions testing
- Influences on test time/cost
 - number and integration of systems
 - increasing frequency range
 - many vehicle variants
- Component level testing
 - installation influences performance
 - more stringent specifications

Why use modelling?

- Cannot rely on measurements alone
 - may not be reliable
 - may not have anything to measure
 - may have too many things to measure
- Modelling provides more information
 - absolute values
 - simulated measurements
 - controlled environment
- Modelling realistic problems now feasible

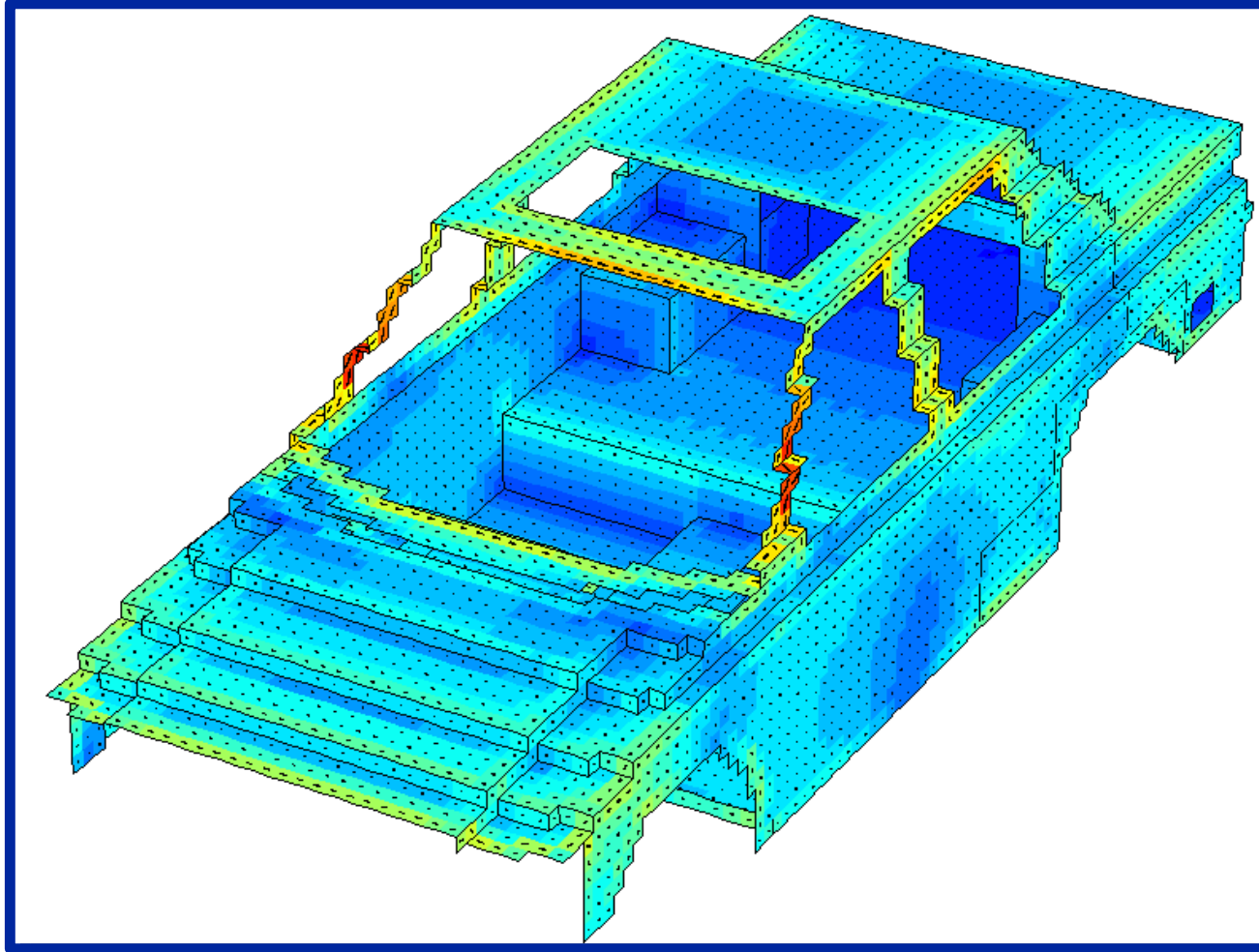
Potential applications

- Electromagnetic compatibility
 - large systems (vehicles etc.)
 - component level
- Antennas
 - antenna design
 - installed performance of vehicle antennas
- Standards and metrology
 - EMC and antenna measurements
 - analysis of emissions/immunity limits

Current capabilities

- Model scope
 - whole vehicles and entire chambers (>1 Gbyte)
 - antennas on and/or near (ie. 30 m) vehicles
 - simple wiring harness
- Output
 - spatial fields and surface currents
 - antenna gain, pattern and impedance
 - current and voltage on simple cables
 - scattering matrix

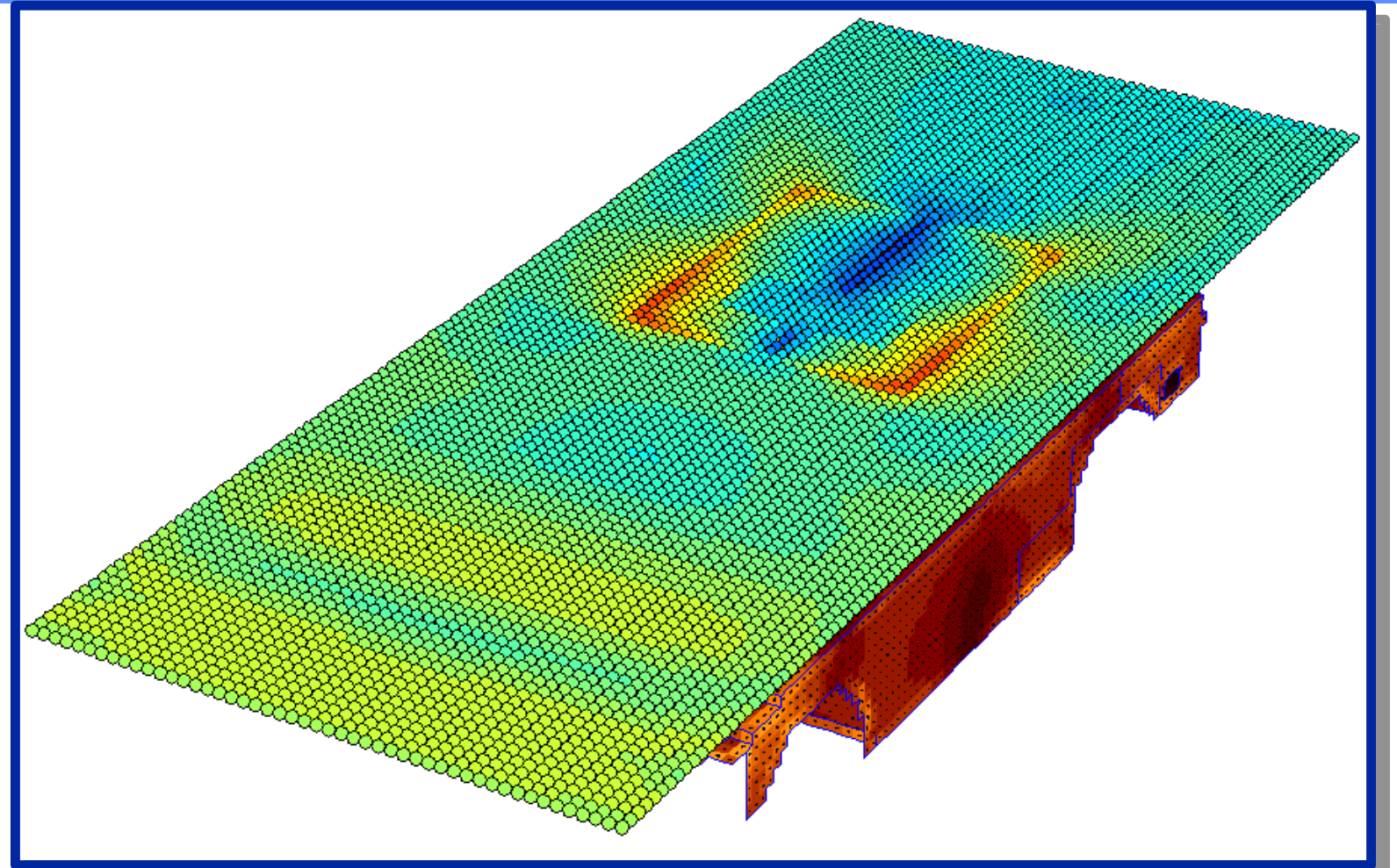
Surface current distribution



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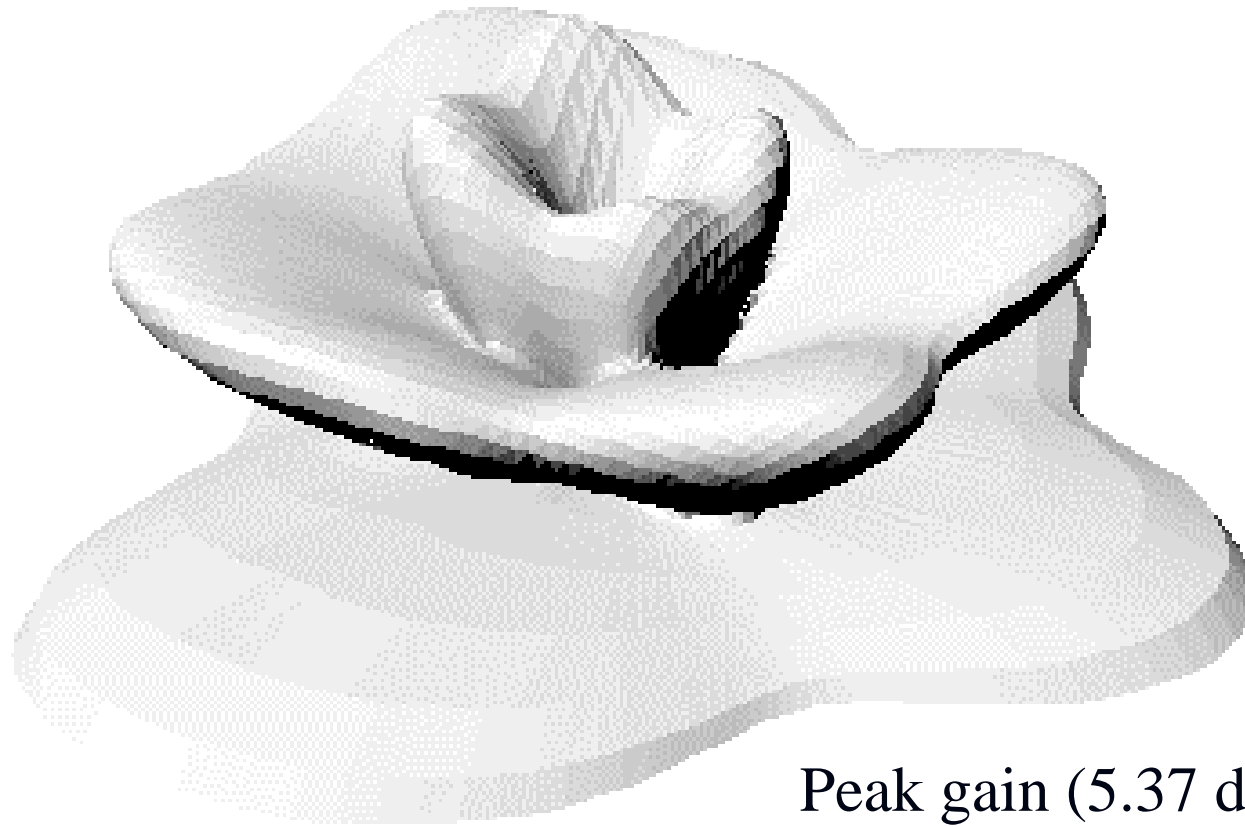
Spatial field distribution



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Vehicle antenna pattern



Peak gain (5.37 dB)
at 90 degrees to axis

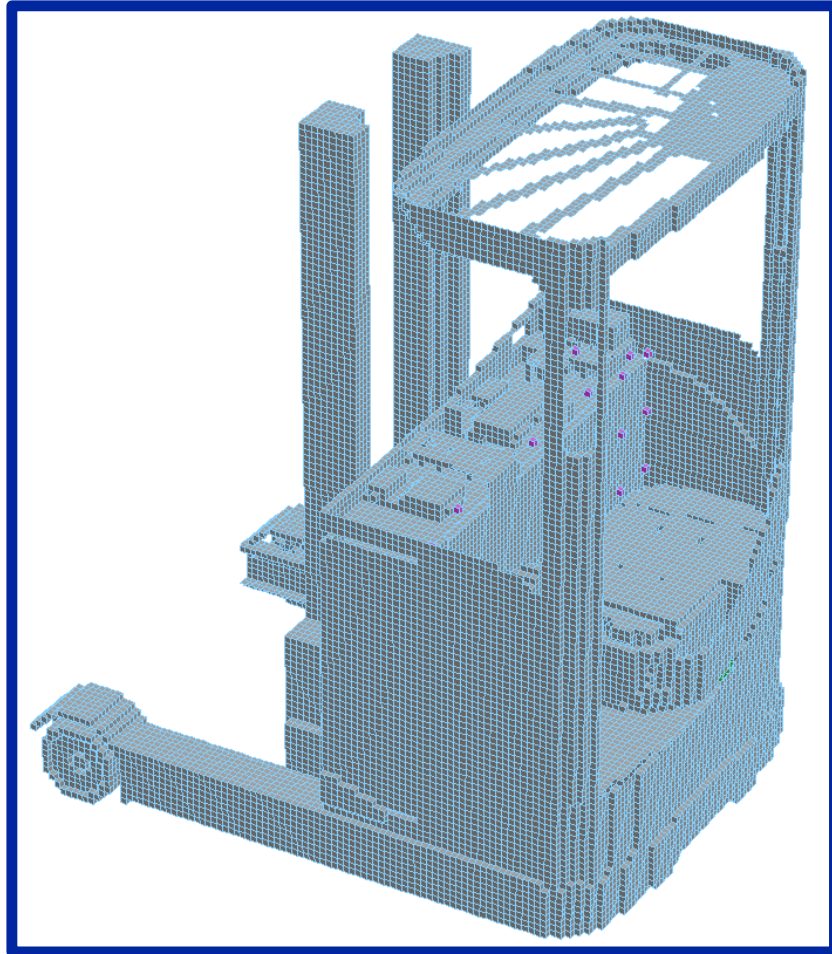
Model exploitation

- Design
 - more realistic specification
 - feasibility studies and design analysis
 - vehicle EMC and antenna performance
 - test facilities and equipment
 - problem identification and resolution
- Testing
 - better test methods (more efficient/accurate)
 - better targeted testing (fewer physical tests)

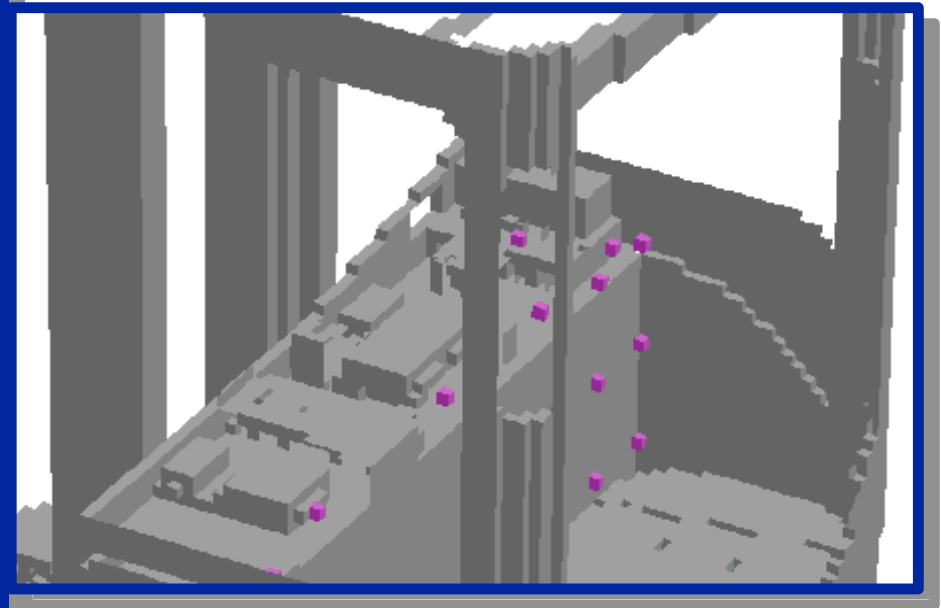
Modelling techniques

- Geometric modelling
 - hand-built or representative synthetic geometry
 - CAD import and repair
 - mesh generation
- Electromagnetic simulation
 - time or frequency domain
 - surface or volume meshing
 - separated or consistent cable models
 - hybrid methods

Vehicle TLM model



**Entire structure,
showing TLM mesh**



Interior detail, showing outputs

Simulation issues

- Model building
 - geometrical data and material properties
 - high overhead for single simulation
- Computing costs
 - Gbyte memory requirements
- Credibility
 - validation against measurement
- Results analysis
 - volume of data may lead to information overload

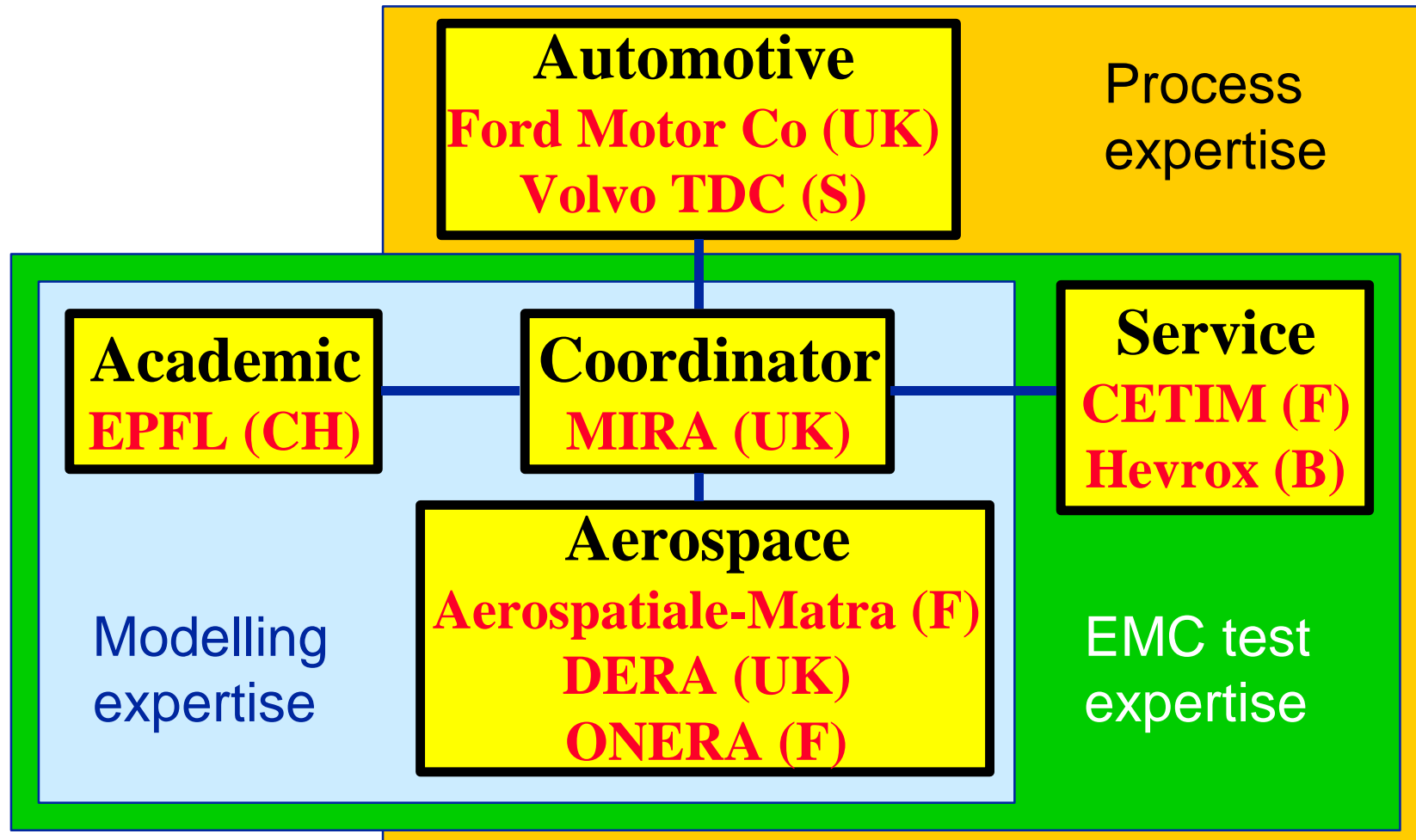
GEMCAR project

- EU Framework V - Growth (Land Transport)
- Motivation
 - many numerical techniques
 - limited practical application
 - uncertainty in model detail
- Objectives
 - user requirements
 - guidelines for use of electromagnetic modelling
 - supporting body of validation evidence
 - illustrative case studies

Limitations of scope

- Practical electromagnetic modelling
 - effective exploitation of existing tools
 - applied to vehicle structures (automotive)
- GEMCAR does NOT aim to
 - identify the “best” numerical technique or code
 - research new field modelling techniques
 - develop alternative software tools
 - implement links to circuit simulation
 - model functional EMC performance

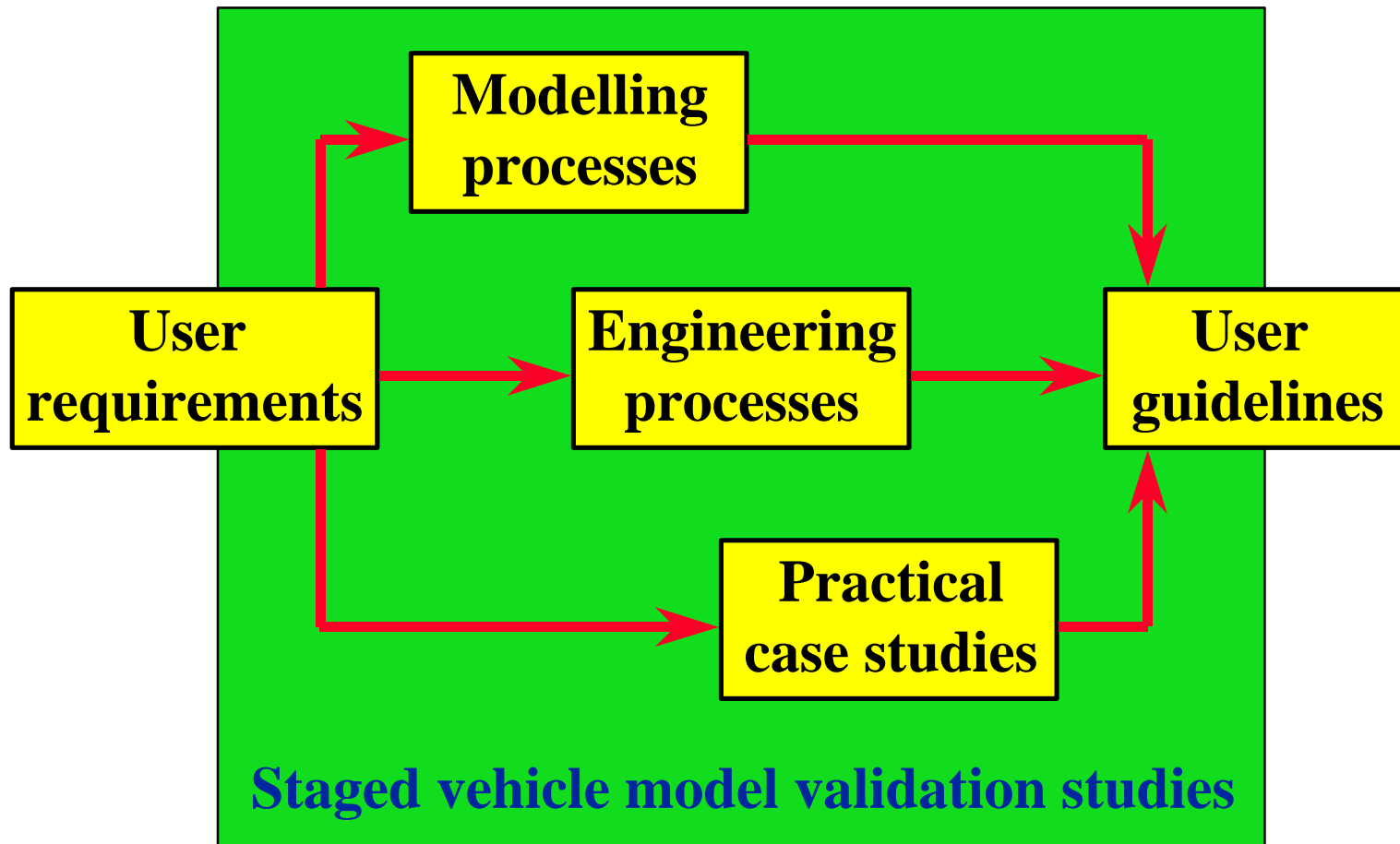
GEMCAR consortium



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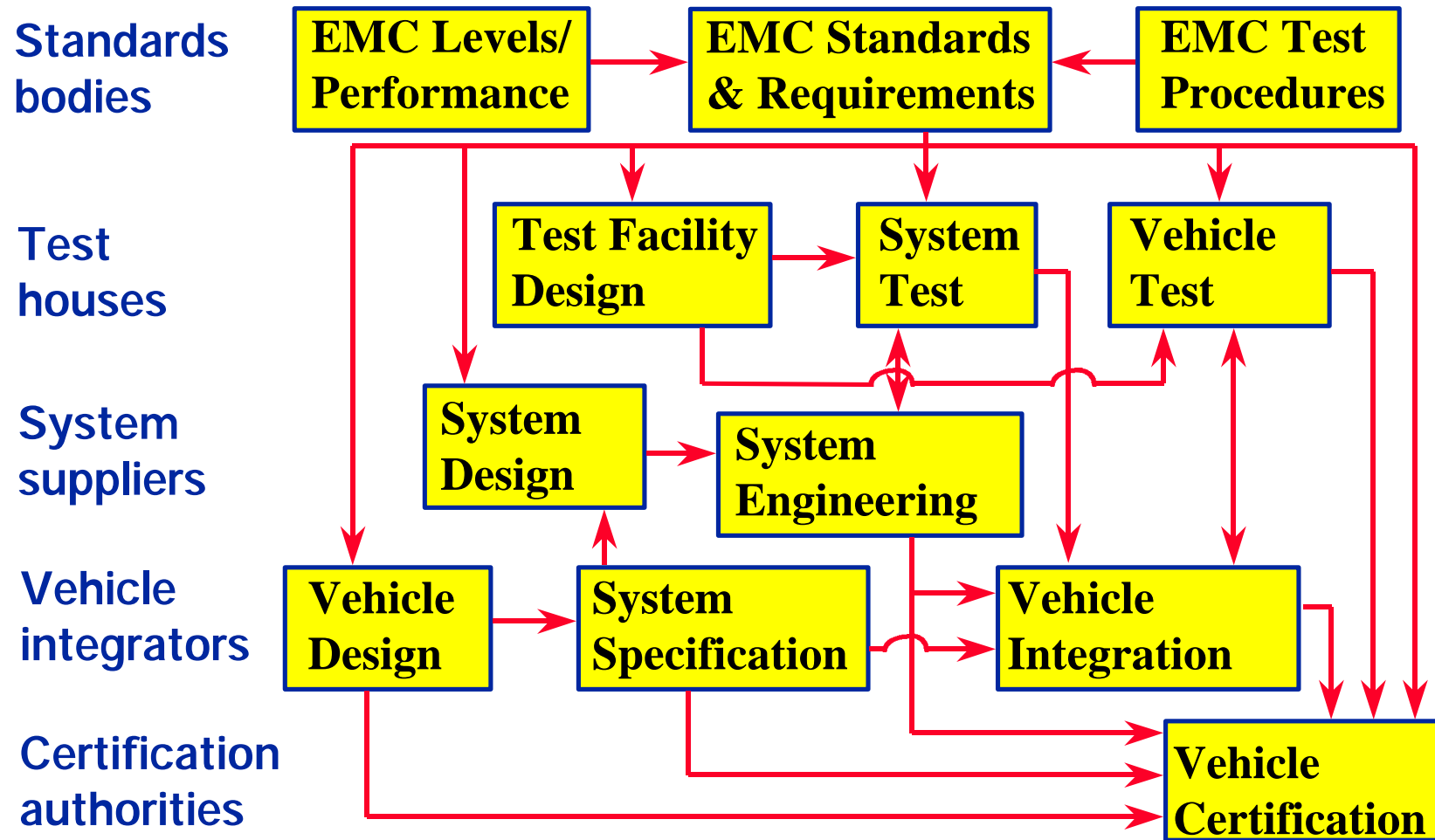
GEMCAR workplan



GEMCAR guidelines

- “Educational” role
 - feasible tasks
 - achievable accuracy
 - geometrical requirements
- Practical advice
 - simulation techniques
 - model building
 - process issues
- Target - all users and applications

Potential users and applications



Current status

- Project at month 8 of 36
- Project website
 - www.gemcar.org
- GEMCAR guidelines
 - first draft due: June 2001
 - final issue expected: January 2003
- User requirements
 - available online
 - “living” document - additional feedback sought

Conclusions

- Electromagnetic modelling of vehicles
 - offers significant commercial benefits
 - becoming technically feasible
 - experience is limited
- GEMCAR project aims
 - identify modelling requirements
 - develop engineering processes
 - demonstrate credibility
 - publish practical guidelines