Frazer-Nash ATD3 - High Speed Propagator for D4D.

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SYSTEMS AND ENGINEERING TECHNOLOGY

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Agenda

- Aims and Objectives of the Current De-Risk Activity
- Review of the Current State of the Art
- User Requirements
- Discussion

Aims and Objectives of the Current De-Risk Activity

Aims of the Current ‘De-Risk’ Activity: Overview

Aim: Investigate, and de-risk, the development of the next-generation of predictive Design for Demise tools.

Why: Create a step-change in safer spacecraft development.

How: Multi-facetted approach:

- Improved usability (increasing uptake).
- Improved physical modelling (improve accuracy).
- Improved solution speed (improve reliability).

Aims of the Current ‘De-Risk’ Activity: What Does a New Tool Look Like?

- De-risk activity, aim to de-risk the development of any future tool.
- Phase 001 - Explore
  - Identify the user requirements.
    - User Requirements workshop held on the 8th November.
    - What are you pain points, what would you like to see in a new tool?
    - We want to hear from all stakeholders – e-mail me on m.probyn-skoufa@fnc.co.uk
  - Identify areas of modelling improvement.
- Phase 002 – Investigate
  - Investigate an aspect of the modelling targeted to improve the accuracy.
  - Design an intuitive interface
- Phase 003 – Learn through feedback
  - Combine the outputs of the above and share with the community.

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Review of the State of the Art

Review of the Current State of the Art – Available Tools

‘Simplified’ Tools

Using for instance altitude-based or joint-based fragmentation models.

- ‘Historic’ Tools
  - DAS
  - SARA V1
- State of the Art Tools
  - DEBRISK
  - SAMj
  - SARA V2
  - SCARAB
  - PAMPERO

‘Full’ Physics Modelling

Using DSMC for rarefied flows followed by CFD for the continuum flows coupled to FEA methods.

- Extremely complex to create
- Long run times
- Requires expert input

- Running such models are probably extremely interesting from an R&D perspective, but due to the limitations, the ability to run only a few runs restricts the usefulness for design and certification.
- Should be closely studied and results fed back into ‘engineering’ models.

Review of the Current State of the Art – Strengths and Weaknesses

Strengths and weaknesses vary from tool-to-tool, and can't simply be summarised, but here are some talking points to think about before the discussion…

Strengths	Weaknesses
Continuum Aerothermodynamics for standard shapes, particularly in DEBRISK, SAMj, and PAMPERO.	Continuum Aerothermodynamics for complex shapes.
Free Molecular Aerothermodynamics.	Fragmentation modelling?
Aerodynamics.	Spacecraft representation? Somewhat mitigated by the latest DIVE guidance?
	Rarefied Aerothermodynamics.
Material Modelling – significant improvements made, but room for improvement around CFRP and GFRP?	

Very keen to hear feedback in the discussion or after the workshop on what areas you think require further work.

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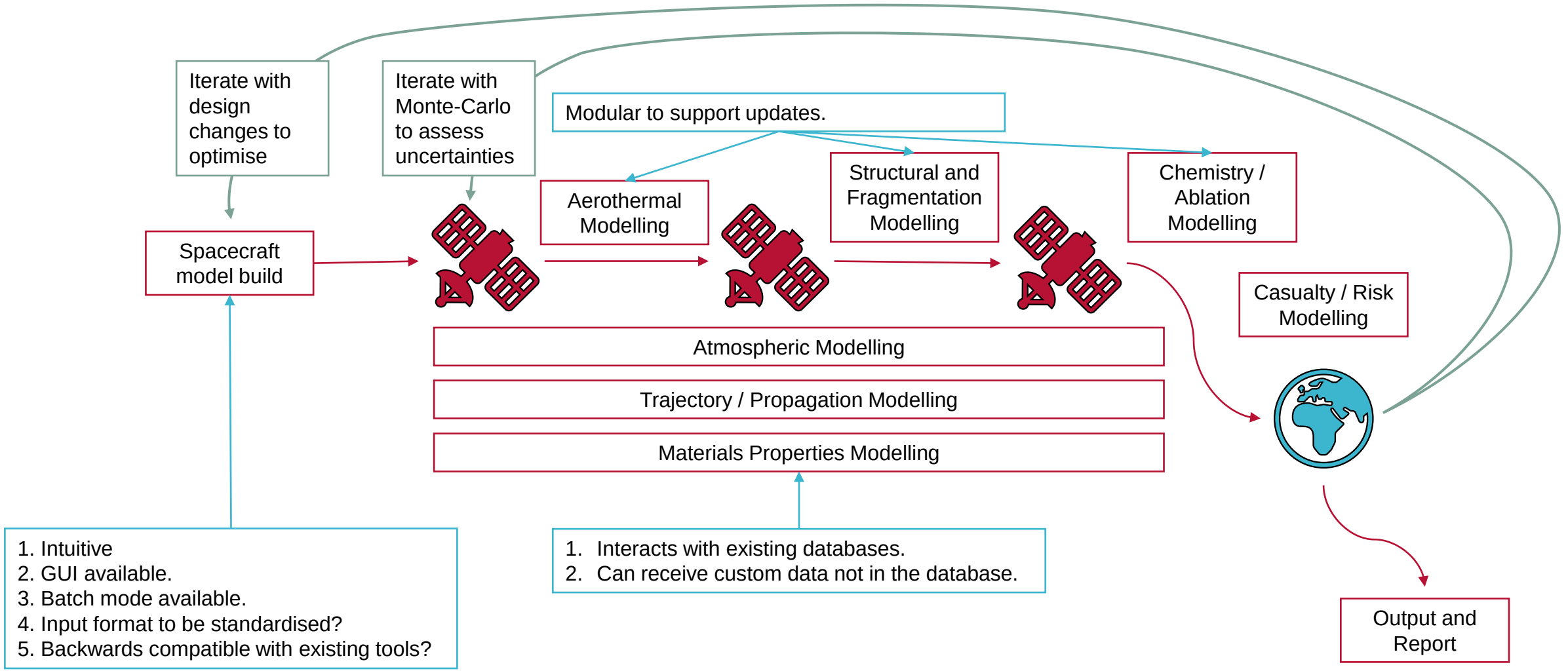
User Requirements

User Requirements



Non-Functional Requirements

- What is the requirement on **speed?**
- What is the requirement on **accuracy?**
- What **security** requirements are users subject to?
- What **operating systems** are most prevalent in your industries / companies?

- With what **frequency** and for what **duration** are projects run?
  - These are useful to determine availability, reliability, and scalability requirements.

Very keen to hear feedback in the discussion or after the workshop on what key requirements you would have in a future tool.

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Discussion

Discussion and Closeout

- Aiming to de-risk development of a new state-of-the-art multi-physics propagator.
- We need to understand **your** requirements so please do get in touch.
- We want to understand **your challenges** and pain points.
- **Discuss!**

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Thank you for your time and attention.