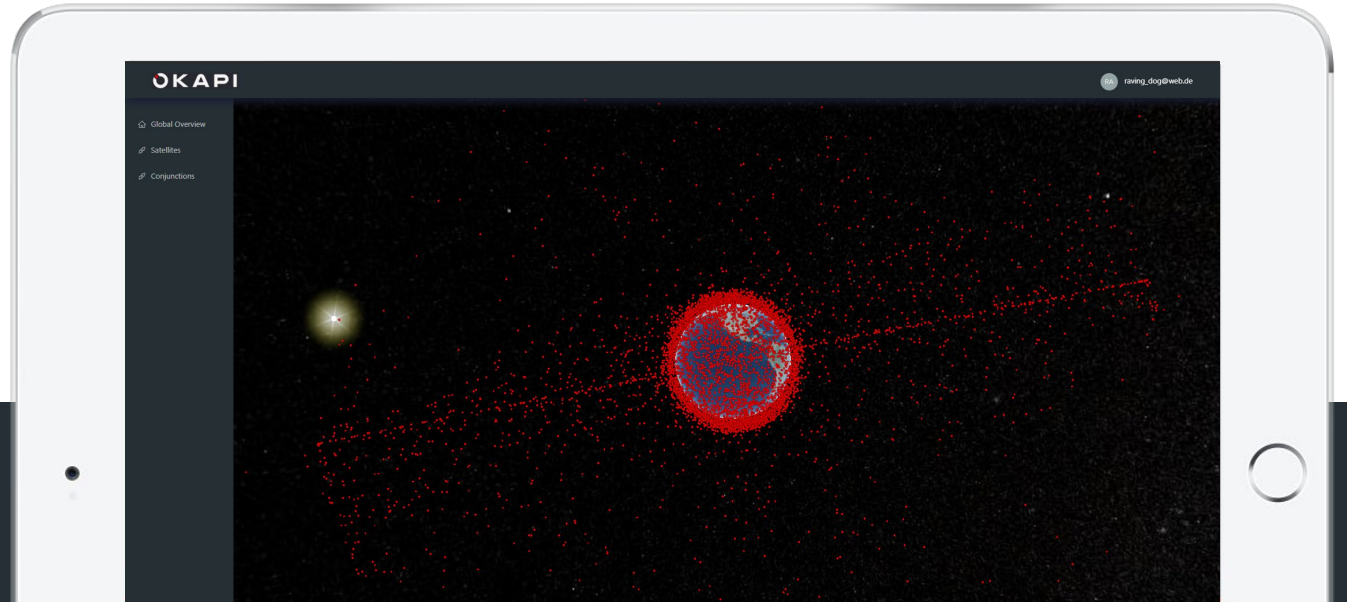
OKAPI

Debris Mitigation Facility
- A new way to use MASTER -



Debris Mitigation Facility
Introduction

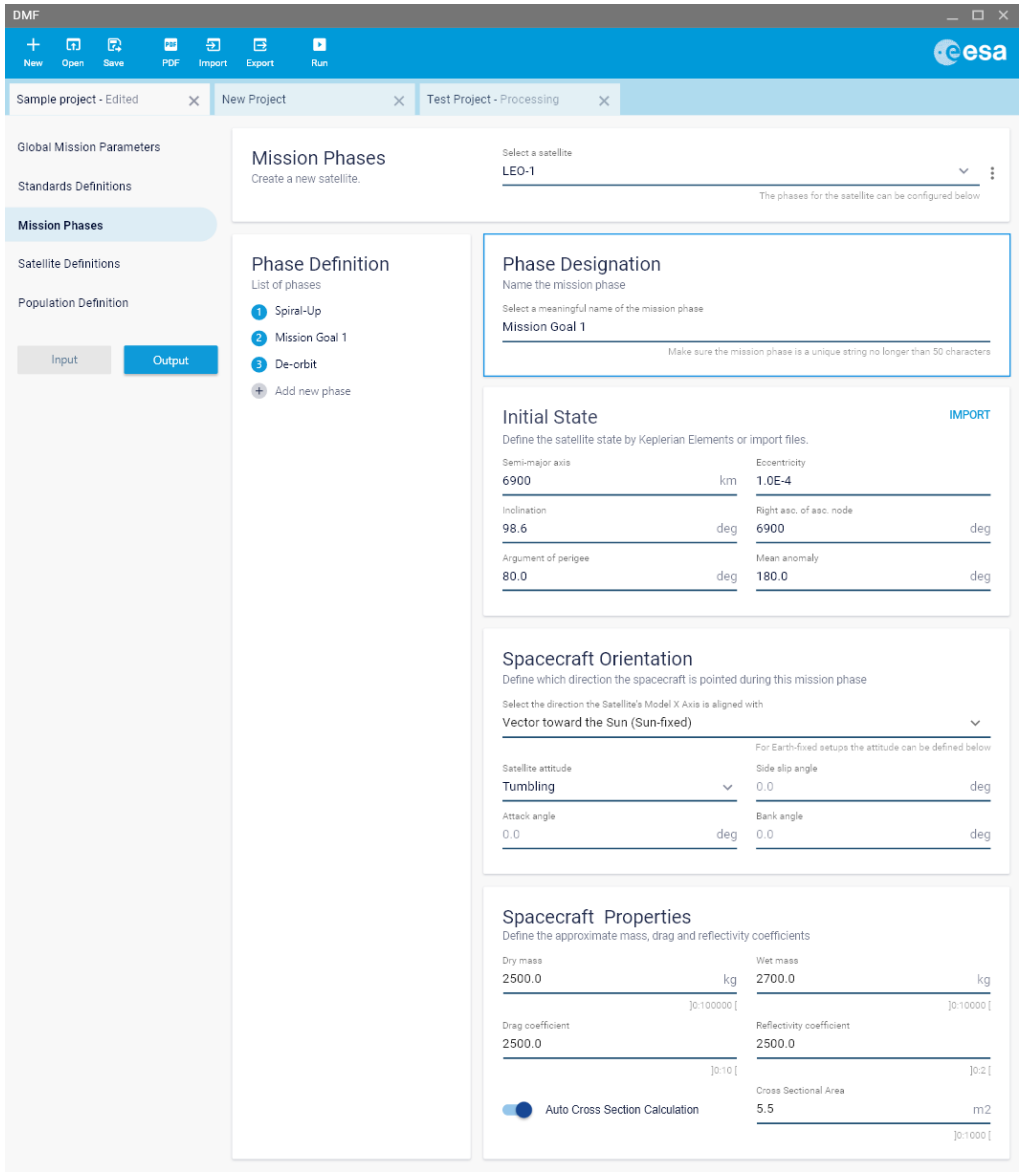
- This project is a **starting point** for an open framework to create a common ground for “debris mitigation” related analyses, based on **mission centric** inputs

- The first version will
  - running DRAMA and MASTER standalone analyses
  - allow generic SDMG requirement verification, based on:
    - ESA Requirements (ESSB-HB-002 and ESSB-ST-004)
    - U.S. Government Orbital Debris Mitigation Standards
    - French Outer Space Act

    (or parts) using **DRAMA** and **MASTER**
- Other applications will follow, and are in part in preparation

Debris Mitigation Facility
Introduction

- Every project will be defined by:
  - Mission Definition
    - Satellite definitions (1 … n)
      - 3D model
      - Propulsion System
    - Mission phases (1 … n)
  - Population definition
  - Standards definition
  - Additional outputs
  - Databases
- Via GUI, API or OCDT



Debris Mitigation Facility
Introduction

- Requirements to be verified are represented by adaptable workflows
- All requirements that can be verified using the DRAMA/MASTER tools are assessed
- Results are presented as report, with a generic and requirement specific compliance sections

Debris Mitigation Facility
Space Debris Mitigation Guidelines Compliance report

esa

Generic section

Mission: Esa Mission One

The verification has been performed according to:

ESSB-HB-002

considering the following standards and guidelines:

ISO-24113:2011
ECSS-U-AS-10C
ESA/ADMIN/IPOL(2014)2

Following generic rules have been evaluated:

Limit debris during normal operations
Protect region clearance
On-ground re-entry casualty risk

The verification has found the stated mission to be **compliant**. No descriptencies between applied verification procedures have been detected.

Compliant DMF

Mission description

Mission section

...

Verification details for verification via ESSB-HB-002

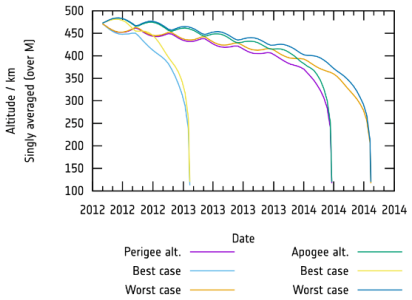
Detailed section

...

Requirement 6.3.3.1: LEO Clearance

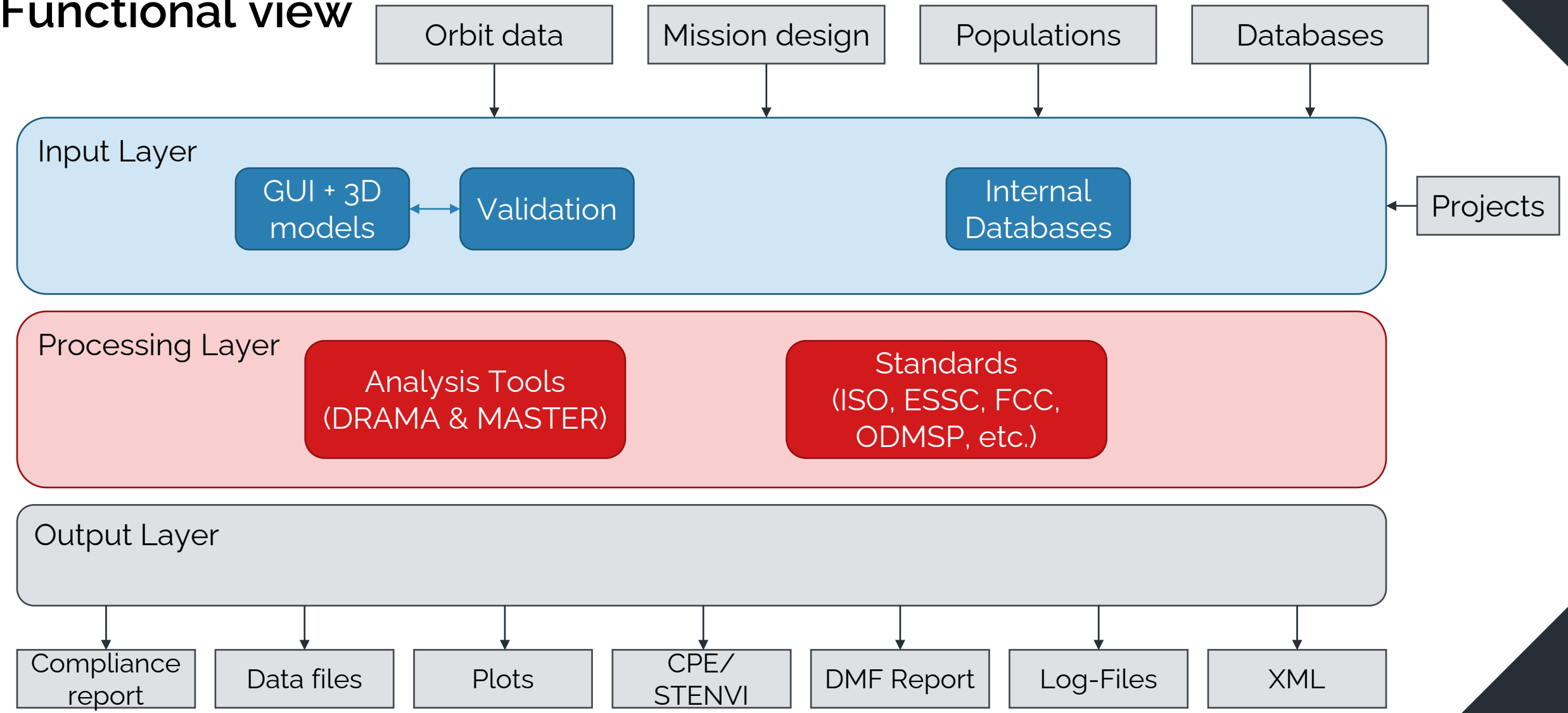
The verification has been performed using the following settings:

Tool:	DRAMA/OSCAR v3.1.8
Perturbations:	Geopotential, Atmosphere, etc.
Solar & Geomagnetic Activity:	Best case / worst case (50%)
Accepted lifetime:	25 years
Projected lifetime (nominal):	2.00 years
Best-case lifetime:	0.76 years
Worst-case lifeimte:	2.33 years

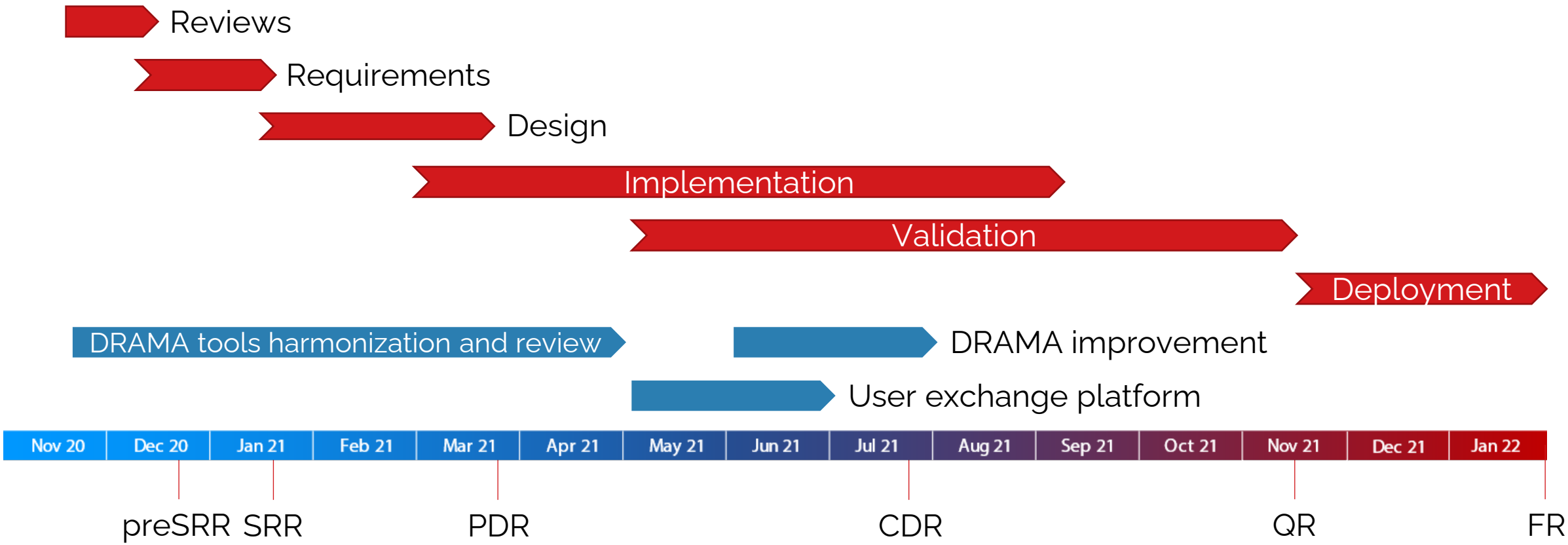


OKAPIiTTi HTG HYPERSCHALL TECHNOLOGIE GÖTTINGEN GMBH Institute of Space Systems

Software
Functional view



Roadmap

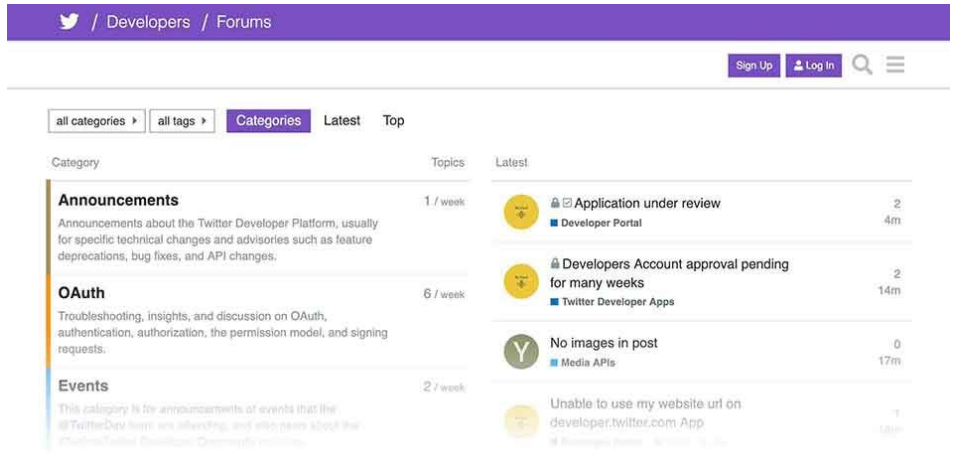

Reviews
Requirements
Design
Implementation
Validation
Deployment
DRAMA tools harmonization and review
DRAMA improvement
User exchange platform
Nov 20
Dec 20
Jan 21
Feb 21
Mar 21
Apr 21
May 21
Jun 21
Jul 21
Aug 21
Sep 21
Oct 21
Nov 21
Dec 21
Jan 22
preSRR
SRR
PDR
CDR
QR
FR

Debris Mitigation Facility
Use cases

- Perform space debris mitigation requirements verification (standalone and/or via CDP4)
- Run stand-alone analyses with [MASTER; DRAMA; OTHER] analysis modules
- Adapt/customize guidelines available in DMF
- Use DMF to lecture on and show the impact of Space Debris
- Use analysis modules via programmable interfaces

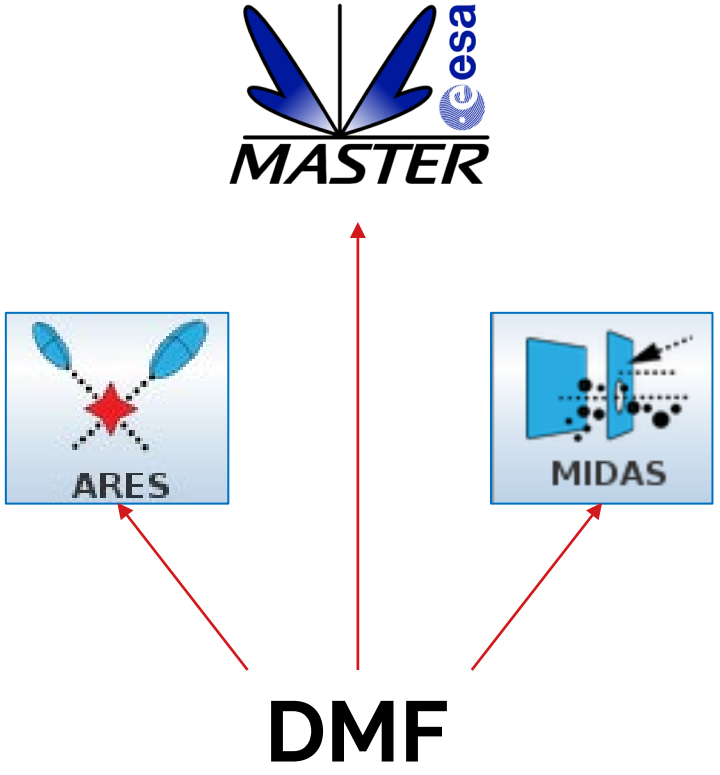
Debris Mitigation Facility
User exchange platform

- DMF framework development will be accompanied by a user exchange platform, using Discourse as technology
- The exchange platform will provide a multilateral exchange between users, developers and other stakeholders



Debris Mitigation Facility
User needs for MASTER

- For the **current** developments in DMF:
  - Requirement verification: Clearly defined and by standard accepted reference populations.
  - Risk and impact computation → next presentation by Stijn.

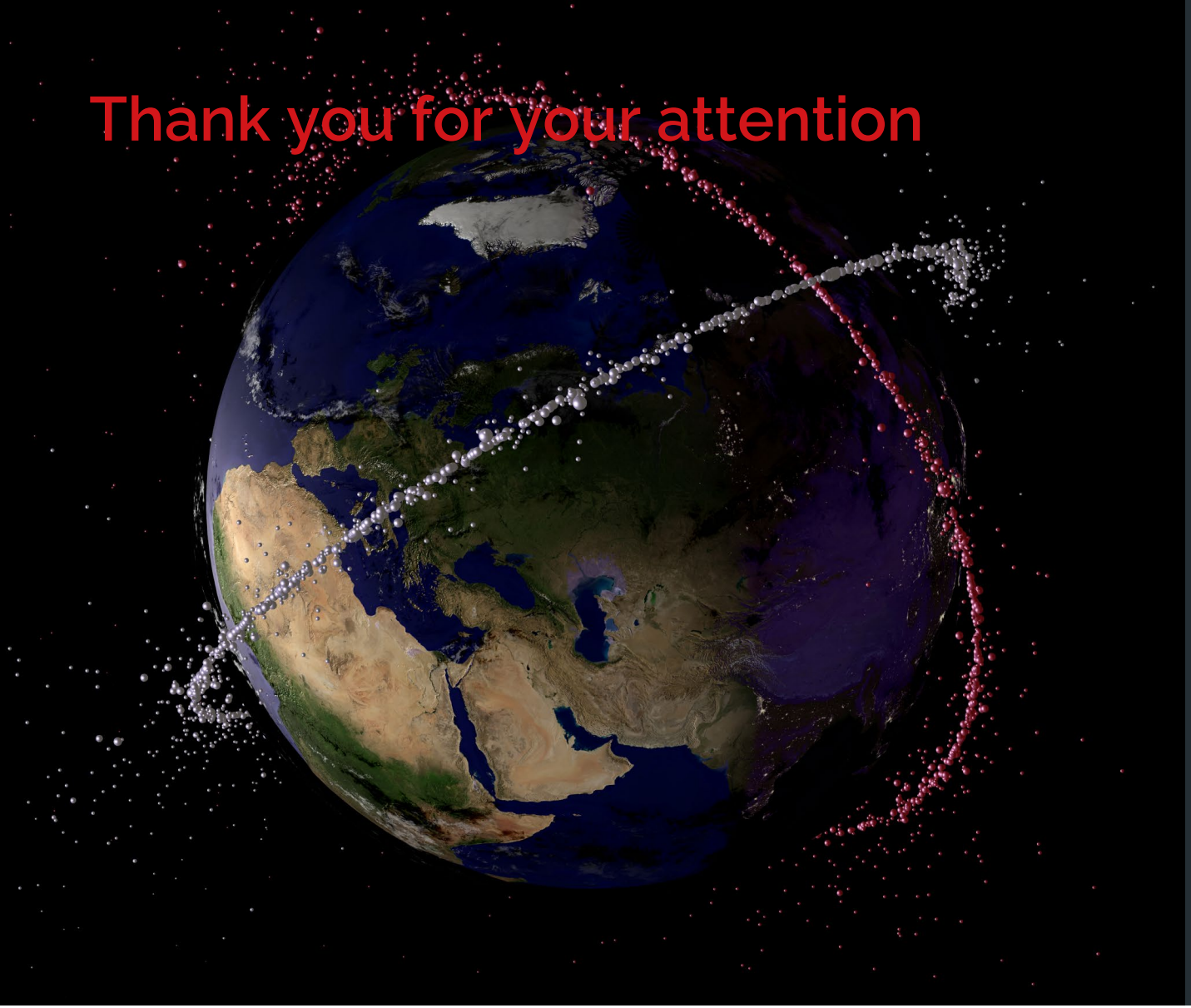


Questionnaire ;-)

If you see yourself as stakeholder for DMF, please contribute

https://survey.lamapoll.de/DMF-User-Questionnaire/

Thank you for your attention



jonas.radtke@okapiorbits.com

www.okapiorbits.com

OKAPI iTTi HTG HYPERSCHALL TECHNOLOGIE GÖTTINGEN GMBH Institute of Space Systems