ESA’s SSA Programme

Holger Krag

27/11/2018
SSA Programme Participants in Periods 1, 2 and 3 (2009 – 2019)

- 18 Participating States
- Activities in the areas of SWE, NEO and SST

Funding: 200 M€
Technological Achievements

Bi-static Radar

Fly-eye & robotic telescopes

Envisaged

Mono-static Radar
Community Approach to SST Core Software
Space-based Component as Core ESA SST Task
Laser Tracking
Commercial SSA
Academic SSA

SmartNet

ISON
ESA Space Debris Tools

This portal addresses the user community of ESA’s Space Debris Software. It serves as entry gate for software license applications and for the retrieval of the software. Registered users may retrieve updated data and software patches and may raise support requests.

**THE FOLLOWING ESA SPACE DEBRIS TOOLS CAN BE REQUESTED:**

**MASTER**

MASTER (Meteoroid and Space Debris Terrestrial Environment Reference) allows to assess the debris or meteoroid flux imparted on a spacecraft on an arbitrary earth orbit. MASTER also provides the necessary computational and data reference for DRAMA and needs to be installed before DRAMA is installed.

**DRAMA**

DRAMA (Debris Risk Assessment and Mitigation Analysis) is a comprehensive tool for the compliance analysis of a space mission with space debris mitigation standards. For a given space mission, DRAMA allows analysis of:

- Debris and meteoroid impact flux levels (at user-defined site regimes)
- Collision avoidance manoeuvre frequencies for a given spacecraft and a project-specific accepted risk level
- Re-orbit and de-orbit fuel requirements for a given initial orbit and disposal scenario
- Geometric cross-section computations
- Re-entry survival predictions for a given object of user-defined components
- The associated risk on ground for at the resulting impact ground worth

Please beware that the installation of MASTER is a necessary pre-condition for the successful operation of the DRAMA suite. MASTER provides the necessary computational and data reference for DRAMA and needs to be installed before DRAMA is installed.

**DISCOSWEB**

DISCOS (Database and Information System Characterising Objects in Space) serves as a single-source reference for launch information, object registration details, launch vehicle descriptions, spacecraft information (e.g. size, mass, shape, mission objectives, owner), as well as orbital data histories for all trackable, unclassified objects which sum up to more than 40000 objects. Today, DISCOS not only plays an essential role in the various daily activities at the ESA’s Space Debris Office, and it is the basis for operational processes in collision avoidance, re-entry analyses, and for contingency support. DISCOS also provides input to numerous and very differently scoped engineering activities, within ESA and throughout academia and industry. DISCOS-based routine activities also comprise the maintenance of a Re-entry Events Database to

https://sdup.esoc.esa.int
The new DISCOS Web Frontend

Launch Number

Launch Path

Launches per Launcher with Country

ESA UNCLASSIFIED - For Official Use
Collision Avoidance in ESA
Conjunction Statistics for 2017

![Conjunction Statistics Graph]

- **Aeolus**
- **Cryosat 2**
- **Proba 2**
- **SAOCOM 1A**
- **Sentinel 1A**
- **Sentinel 1B**
- **Sentinel 2A**
- **Sentinel 2B**
- **Sentinel 3A**
- **Sentinel 3B**
- **Sentinel 5P**
- **Swarm A**
- **Swarm B**
- **Swarm C**

**Miss distance [m]**

**Frequency of events**

**LEO missions**

Miss distance [m]:

0 250 500 750 1000 1250 1500 1750 2000

Frequency of events:

0 25 50 75 100 125

Klaus Merz, Holger Krag | 27/11/2018 | Slide 13
Debris Risk Estimation and Automated Mitigation (DREAM)
> 1000 conjunction notifications processed for ESA’s fleet every day
From Manual Expert Work....

### Orbit determinations

<table>
<thead>
<tr>
<th>Program</th>
<th>Schedule</th>
<th>2016-04-30</th>
<th>2016-07-01</th>
<th>2016-08-01</th>
<th>2016-08-04</th>
<th>2016-08-07</th>
<th>2016-08-10</th>
<th>2016-08-13</th>
<th>Error log</th>
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<td>09:00</td>
<td>v (08:51:24)</td>
<td>v (08:52:07)</td>
<td>v (08:52:10)</td>
<td>v (08:52:44)</td>
<td>v (08:53:46)</td>
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<td>v (08:06:15)</td>
<td>v (08:06:22)</td>
<td>v (08:07:25)</td>
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### Daily programs

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... To Machine learning

Training data  Classification  Prediction

Decision
Demonstrating Automated Risk Mitigation in Space (DARMSAT)