



**esoc**

European Space Operations Centre  
Robert-Bosch-Strasse 5  
D-64293 Darmstadt  
Germany  
T +49 (0)6151 900  
F +49 (0)6151 90495  
[www.esa.int](http://www.esa.int)

**DOCUMENT**

# ENVISAT MISSION EXTENSION INSTRUMENT SWITCHING PLAN



## APPROVAL

<b>Title</b> ENVISAT MISSION EXTENSION INSTRUMENT SWITCHING PLAN	
<b>Issue</b> 1.0	<b>Revision</b> 1
<b>Author</b> J-N Berger	<b>Date</b> 12/10/2010
<b>Approved by</b>	<b>Date</b>
Frank Diekmann	13/10/2010

Digitally signed by  
 Frank Diekmann  
 Date: 2010.10.13  
 17:13:08 +02'00'

## CHANGE LOG

Reason for change	Issue	Revision	Date
	1.0	1	12/10/10

## CHANGE RECORD

Issue	Revision		
Reason for change	Date	Pages	Paragraph(s)
Updates from Operation Readiness Meeting 5 Oct.	13/10/2010	7 to 10	4.2 to 4.5, 4.9
AATSR outgassing timeline update		7	4.1



## Table of contents:

1	SCOPE .....	4
2	INTRODUCTION.....	4
3	REFERENCE AND SUPPORT DOCUMENTS.....	5
4	REQUIRED OPERATIONS .....	7
4.1	<i>AATSR</i> .....	7
4.2	<i>ASAR</i> .....	7
4.3	<i>DORIS</i> .....	8
4.4	<i>GOMOS</i> .....	8
4.5	<i>MERIS</i> .....	8
4.6	<i>MIPAS</i> .....	8
4.7	<i>MWR</i> .....	9
4.8	<i>RA-2</i> .....	9
4.9	<i>SCIAMACHY</i> .....	9
5	SYNOPSIS .....	10



## 1 SCOPE

The Envisat mission extension beyond 2010 implies the satellite altitude to be decreased through a series of in-plane manoeuvres. This document has been issued following the Orbit Change Operational Plan Work Package **WP.E2.1.FOS.1080** and describes the Envisat instrument activities that shall be carried out before, during and after the altitude reduction.

## 2 INTRODUCTION

In the context of the Envisat mission second extension, the satellite semi-major axis shall be reduced by 17.4 km in a series of 3 manoeuvre pairs:

- On 22<sup>nd</sup> October, two in-plane OCMs
- On 26<sup>th</sup> October, two in-plane OCMs
- On 2<sup>nd</sup> November, two SFCMs.

For the whole duration of the orbit change, the PDS does not intend to process the instrument scientific data. Consequently each instrument is expected to be kept in a safe, manoeuvre-compliant operational mode (e.g. protection of optical instruments against accidental solar illumination, instrument thermally stable, manoeuvre shock/acceleration preservation, etc.).

In supplement of the real-time telemetry down-linked during ground passes, the SSR1 shall record the satellite and payload housekeeping telemetry outside ground station coverage. Since SSR playback only occurs when at least one completely filled Word Group (256Mbit) is available, it is foreseen to keep some instruments in science data producing mode.

The following sections describe the operational considerations in that respect.



### 3 REFERENCE AND SUPPORT DOCUMENTS

- [RD1] AATSR during ENVISAT orbit lowering : 25/03/2010, teleconference minutes.
- [RD2] MERIS Mission Extension, PE-TN-ASG-MER-0019, issue 2, 30.11.2007.
- [RD3] MERIS Operations Report Switch on and Data Acquisition Phase, PO-RP-DOR-ME-1087, July2002.
- [RD4] ESOC mail Hugues.Dufort@esa.int, Re: AW: Contamination of the optical payload during the ENVISAT orbit descent, Fr 23.04.2010 11:36
- [RD5] MERIS Mini Commissioning Plan after Orbit Change, PE-PL-ASG-MER-0022, May 2010.
- [RD6] MIPAS Thermal Analysis Report PO-RP-FOK-MP-0125
- [RD7] MIPAS Mission Extension Analysis, ENV-TN-ASG-MP-045, May 2009.
- [RD8] ENVISAT mission extension beyond 2010, PLSO, ESRIN – May 2010.
- [RD9] Envisat Mission Extension IOP Review #16 Summary, PE-RP-ESA-PLS0-293, June 2010.
- [RD10] Envisat MWR in-Orbit Performance Review 16, PLSO-MOM-MWR-0014, June 2010.
- [RD11] Envisat DORIS in-Orbit Performance Review 16, PLSO-MOM-DOR-0014, June 2010.
- [RD12] Envisat SCIAMACHY IOP Review 16, PE-MN-ESA-SCI-289, June 2010.
- [RD13] ENVISAT Mission Extension Impact on SCIAMACHY Scanner Control System, TN-SCIA-0000DO/31, Astrium GmbH, 03.02.2010.
- [RD14] Envisat GOMOS in-Orbit Performance Review 16, PE-MN-ESA-GOM-288, June 2010.
- [RD15] Dave Smith: AATSR Status, IOP ESRIN June 2010.
- [RD16] Envisat ASAR in-Orbit Performance 16 MoM, PE-MN-ESA-ASR-294, June 2010.
- [RD 17] E2010+Orbit Change Operations Plan.
- [RD18] Orbit Change Operations Readiness Meeting MoM, 5 Oct. 20, en2010\_001mom.



[RD19] AATSR Instrument Operations Request #40, Rutherford Appleton Laboratory.

[RD20] Envisat Mission Extension Spacecraft Operations Timeline,  
ENVI-MIS-TN-1004-OPS-OEV, ESOC, October 2010.



## 4 REQUIRED OPERATIONS

### 4.1 AATSR

The recommended operational mode during OCMs is commonly Heater. Since the major difference between Heater and Measurement modes resides in the transmission of measurement data, AATSR is therefore seen as the perfect candidate for remaining in Measurement mode in order to produce the necessary data that would fill the SSR.

Until potential contamination by hydrazine residues is completely ruled out, it is foreseen to operate the instrument with its cooler mechanisms switched to zero amplitude to protect the cryogenic FPA: With its coolers switched off on 20<sup>th</sup> October (RD19), the Focal Plane Assembly would warm up to ambient, and would provide in the mean time the opportunity for an out-gassing that would be manually terminated on 27<sup>th</sup> October.

### 4.2 ASAR

Since Wave mode is recommended during the orbit change period, it makes the instrument another candidate for producing data to the SSR. Nevertheless prior to the actual burns, the instrument shall be commanded to Pre-Op.

During the altitude reduction period, it is foreseen that MPS would manage the mode change from Pre-Op to Wave when required, on top of the Orbit Data MCMDs. Each Wave segment would be of 100 minute duration. At least one Orbit Data MCMD shall be uplinked per day.

Few hours after the second OCM pair on 26<sup>th</sup> October, MPS is expected to resume nominal operations.

Some updates of the Configuration Table Interface (CTI) files are foreseen. The new CTIs with a validity start time of 20-10-2010 00.00.00.000 shall be manually uploaded within one orbit, preferably prior to the first manoeuvre (currently around 19:00 on 21<sup>st</sup> October)

Would any problem occur during or after the upload of the files, the former tables shall be transferred from RGT and be restored onboard. The affected CTIs are shortlisted in the table below:

Table	Table
CTI WS[1...5] SR	CTI SA[1...7]2SR (TBC)
CTI IA[1...7] SR	CTI SV[1...7]1SR
CTI WV[1...7]	CTI SV[1...7]2SR
CTI GM[1...5]	CTI SG[1...5]1SR
CTI SI[1...7]1SR	CTI SG[1...5]2SR
CTI SI[1...7]2SR	CTI SW[1..5]1
CTI SA[1...7]1SR (TBC)	CTI SW[1..5]2



#### 4.3 *DORIS*

It is foreseen to keep the instrument in Acquisition mode as typical during manoeuvres.

Ten minutes prior to the first manoeuvre of an OCM pair, the onboard frequency bias shall be zeroed then be reset to nominal values at least 8 hours after the second manoeuvre of that pair.

As usual the acceleration file generated by the FOCC prior to each OCM is expected to be executed onboard 3 minutes prior to each thrust.

In case of a manoeuvre being cancelled whilst the manoeuvre characteristics are already onboard, the ad hoc TCH that cancels the manoeuvre characteristics in the MVR has to be manually uplinked.

Additionally some Kalman Filter Parameters shall be modified within 30 hours prior to the first OCM; their original values shall be restored following the completion of the last manoeuvre pair.

#### 4.4 *GOMOS*

The instrument is expected to remain in Heater mode / MDE ON from the first orbit lowering manoeuvre until the end of the last one. Nominal MPS operations shall be resumed afterwards following successful generation of RGT plan files.

#### 4.5 *MERIS*

Likewise AATSR, a potential contamination by hydrazine residues is not completely ruled out. It is therefore expected that prior to each OCM manoeuvre pair MERIS shall be switched into Standby mode so that its shutter remains closed.

Soon after the completion of the second burn of each OCM pair the instrument shall be returned to Heater mode in order to speed up the resumption of nominal operations.

For the third set of manoeuvres, similar in acceleration to the usual SFCM, MERIS shall remain as nominal.

Whilst the instrument is in Standby mode, opportunity should be taken to load the MER24.P04 patch via Cold Reset as per AI\_054 recommendations. Those operations are expected to take place on 22<sup>nd</sup> October.

#### 4.6 *MIPAS*

Due to the MIPAS sensitivity to the sun incidence (IR detectors), the ASU shutter shall be closed prior to the first manoeuvre by switching the instrument into Heater Mode. Nominal measurements would be resumed two orbits after the last OCM on 26<sup>th</sup> October and when any Sun incidence risk is eliminated.





The idea of a potential decontamination during the orbit lowering period was abandoned since in Standby mode (unlike Heater) the interferometer slides are not kept in the commanded "end" position under static control and therefore might reach unsafe positions.

#### 4.7 *MWR*

The instrument is expected to remain in Nominal mode.

#### 4.8 *RA-2*

The instrument is expected to remain in Measurement mode, producing science data in order to fill the SSR.

#### 4.9 *SCIAMACHY*

The current baseline foresees that the instrument shall operate in nominal orbit until the first manoeuvre on 22<sup>nd</sup> October, with a monthly calibration (without moon) close to the end of this period. From that time until 26<sup>th</sup> October, SCIA shall remain in MEASUREMENT IDLE.

From the first complete orbit on 27<sup>th</sup> October, the instrument shall operate in nominal timeline-driven operations.



## 5 SYNOPSIS

<b>Instrument</b>	<b>MPS Mode prior orbit lowering</b>	<b>Mode in OCM</b>	<b>Mode between OCMs</b>	<b>Mode in SFCM</b>
<b>AATSR*</b>	Measurement	Measurement <sup>1</sup>	Measurement <sup>1</sup>	Measurement
<b>ASAR *</b>	Pre-op	Pre-op	Wave ↔ Pre-op <sup>2</sup>	MPS-driven
<b>DORIS *</b>	Acquisition	Acquisition	Acquisition	Acquisition
<b>GOMOS</b>	Occultation ↔ Pause	Heater MDE on	Heater MDE on	Occultation ↔ Pause <sup>4</sup>
<b>MERIS</b>	Direct AVG ↔ Heater	Standby <sup>3</sup>	Heater	Direct AVG ↔ Heater
<b>MIPAS</b>	Measurement	Heater	Heater	Measurement
<b>MWR *</b>	Nominal	Nominal	Nominal	Nominal
<b>RA-2 *</b>	Measurement	Measurement	Measurement	Measurement
<b>SCIA</b>	Timeline	Measurement Idle	Measurement Idle	Timeline

\* the instrument science data is used for filling the SSR during orbit lowering operations.

<sup>1</sup> with cooler off

<sup>2</sup> MPS-planned

<sup>3</sup> Opportunity for Patch Upload

<sup>4</sup> Potential resumption of MPS-driven operations, otherwise Heater mode.