

	<h2>Operation Change Request</h2>	<p>OCR No: 012</p> <hr/> <p>Issue: A</p>
<p>Title: Improvement of limb/nadir matching in early orbit phase</p>		
<p><u>Description of Request:</u></p> <p>It is proposed to improve the limb/nadir matching in the early orbit phase by modifying the first 3 nadir states in the timeline which starts immediately after the SO&C window. With the implementation of the modified limb scans (OCR 11) the limb/nadir matching is improved such that the resulting limb pixel (as defined by state start/stop tangent heights) falls into the center of the matching nadir pixel. This occurs whenever limb and nadir state are separated by about 429 sec, i.e. the limb states have a duration of 55.87 sec and the nadir states of 68.56 sec.</p> <p>At the beginning of the timelines after the SO&C window 3 nadir states have a longer duration of 83.56 sec due to the requirement to have at least 8 readouts and the Pixel Exposure Time of 10 sec in channel 1. This causes the separation of limb and nadir states (nad04 & nad05) to be > 429 sec, i.e. the limb/nadir matching is not as good as for the states from nad06 onwards. In summer, the nadir pixels nad04 & nad05 are geolocated in the polar region while in winter they occur over mid-Europe. In order to achieve a good limb/nadir matching also for these nadir states it is proposed here to modify the separation between the early limb and nadir states in a timeline. This can be done in three ways:</p> <ol style="list-style-type: none"> Replace nadir states nad01, nad02, nad03 (see attached t/l example) by state nad04. State nad04 has the required duration of 68.56 sec. The PETs of nad01 - nad04 are listed in the attachment. Reduce largest PET in nad01 & nad02 to 5 sec and number of readouts in nad03. Then a measurement duration of 65 sec can be achieved leading to a total state duration of 68.56 sec. Reduce measurement duration in states nad01 - nad03 to 60 sec or 70 sec. This is equivalent to reduce the number of readouts. <p>All options impact the S/N ratio in the first 3 nadir states of a timeline. Option a) would be the preferred one since</p> <ul style="list-style-type: none"> it only requires modification of a subset of timelines from set 31 (note: in case state duration of nad01 - nad03 would be changed all timelines including these states would need re-definition) leaves nad01 - nad03 untouched which are also used at the end of the illuminated part of the orbit (where limb/nadir matching does no longer exist) leaves nad09 (calls PET table of nad01) untouched which is used in the eclipse phase <p>Important note: The options above have to be discussed by retrieval experts. If option b) or c) would be selected, these experts have to specify the PET and co-adding settings or the required measurement duration (to be as close as possible to 65 sec).</p> <p>In the northern hemisphere the total nadir coverage would be reduced by 45 sec while over the southern hemisphere an additional nadir state might be added at the end of a timeline.</p> <p>If the OCR is approved, a two-step implementation approach as in OCR 11 is required:</p> <ol style="list-style-type: none"> At the beginning of the next planning cycle, a 2 day test phase shall execute timelines with the modified nadir sequence. Quick analysis of these measurements enables us to ensure that nadir and limb states are executed at the correct orbital phase. In case no e.g. saturation is observed, these test timelines will become the operational timelines, otherwise the test timelines have to be modified. Implement the timelines defined in step a) plus all remaining timelines as the timelines for nominal operations. This can be done for the planning cycle succeeding the one in step a). <p>The 2-day test is considered to provide supplemental information as it allows to detect potential inconsistencies in timeline definition up to a certain degree which can then be corrected for the definition of the operational timelines. No scientific measurement time is lost since the test timelines are equivalent to those intended to be used in nominal operations.</p>		
<p>Originator: M. Gottwald, DLR-IMF</p>	<p>Date of Issue: 09/10/2003</p>	<p>Signature: via e-mail 09/10/2003</p>

<u>Assessment of SSAG (necessary for requests by scientists):</u>		
The OCR was discussed at the 29. SSAG. It is recommended to replace nad01-03 with nad04 in the NH and in the SH to improve the limb-nadir matching in NH and in parallel to improve horizontal resolution in SH and NH. It was explicitly stated that the loss in SNR is acceptable.		
SSAG: H. Bovensmann		Signature: 29. SSAG, MoM
<u>Classification of OCR:</u> D		
<u>OCR Analysis (incl. Implementation Option):</u>		
The option to replace nadir states nad01 - nad03 by another nadir state is considered to be the desired implementation option. It requires the modification of timelines only.		
Note that at the time of issue of this OCR, the nadir state selected to replace nad01 - nad03 was nad04. Since then OCR 15 has been submitted which asks for a higher spatial resolution in channel 3 / cluster 15 (30 km x 30 km for NO ₂ between 60N-60S). In order not to be forced to modify OCR 12 driven changes when implementing OCR 15 at a later date, it was decided between SOST and SSAG (telecon Bovensmann/Noël/Gottwald, 19/02/2004) to use nad05 instead of nad04 and also replace nad04 by nad05. The loss in SNR is considered to be acceptable.		
Another modification of the originally described implementation option is the extension of nad01 - nad03 replacement onto the southern hemisphere. Thus not only all timelines to be executed immediately after the SO&C window need to be changed, but also those which start at the sub-solar window or after the MO&C window. Therefore a new timeline set 32 for nominal measurements will be defined. In the proposed 2-day test, implementation of only the most frequently used timelines (47-52) is planned.		
It is expected that the test will run at the start of the next planning cycle (April 15 - May 15). Upon successful timeline verification, the full nominal timeline set can be generated and submitted to ENVISAT such that nominal operations will use it from mid May onwards.		
Note: If definition of the test timelines shows that the orbital positions of states in a timeline do not change significantly, the test could be omitted. This will be discussed within SOST and project management as soon as the timeline definition is finished.		
SOST: M. Gottwald, DLR-IMF (ESA, Industry if necessary)	Date: 19/02/2004	Signature: via e-mail 19/02/2004
<u>Approval of Proposed Implementation:</u>		
The implementation as proposed in the OCR analysis is approved. It is recommended that data processing checks that the test orbits are processed nominally.		
Originator Approval:	Date:	Signature:
SSAG Approval: H. Bovensmann	Date: 19.2.2004	Signature: via e-mail 19.2.2004
<u>Decision / Approval:</u>		
DLR Approval: Ch. Chlebek	Date: 2004-02-19	Signature: e-mail, 2004-02-19

Implementation by SOST :

Note: During timeline definition a few states shifted in orbital position such that an exchange was required. Therefore our actual implementation of OCR12 includes the test phase.

The implementation of OCR12 is done in 2 steps. Only timelines are affected.

Step 1 (test phase):

Test timelines 47-52 are defined in the test timeline set 9. In all test timelines the nadir states nad01-nad05 are replaced by nadir state nad05 as described above. The test timelines will be submitted to ESOC in preparation of the April 15 - May 15 planning cycle. In this period a 2 day test phase (orbits 11108-11135, April 15/16) will execute the modified timelines. Quick analysis of the NRT products shall prove that timeline definitions are correct (no saturation, etc.).

Step 2 (nominal operations):

All timelines of timeline set 31 are regenerated in the new timeline set 32 for nominal operations. In all timelines the nadir states nad01-nad04 are replaced by nadir state nad05. Since duration of nad05 is shorter than duration of nad01-nad03, it is required to define 6 more moon-related timelines in order to cover the entire variability of moon-related orbital phase intervals. Timeline set 32 consist of 106 timelines in total. Timeline set 32 will be submitted to ESOC for the planning cycle starting May 22. Upload is currently foreseen on May 22 (approx. orbit 11638).

SOST: M. Gottwald, DLR-IMF

Date: 08/03/2004

Signature: via e-mail 08/03/2004

State Running Index	State ID	State Description	State TT (relative, ct)	State TT (relative, sec)
		T/L setup		
1	29	limb02	709	2,77
2	29	limb02	14303	55,87
3	29	limb02	14303	55,87
4	29	limb02	14303	55,87
5	1	nad01	14303	55,87
6	30	limb03	21392	83,56
7	2	nad02	14303	55,87
8	30	limb03	21392	83,56
9	3	nad03	14303	55,87
10	31	limb04	21392	83,56
11	4	nad04	14303	55,87
12	32	limb05	17551	68,56
13	4	nad04	14303	55,87
14	32	limb05	17551	68,56
15	5	nad05	14303	55,87
16	32	limb05	17551	68,56
17	6	nad06	14303	55,87
18	32	limb05	17551	68,56
19	6	nad06	14303	55,87
20	32	limb05	17551	68,56
21	6	nad06	14303	55,87
22	32	limb05	17551	68,56
23	6	nad06	14303	55,87
24	32	limb05	17551	68,56
25	6	nad06	14303	55,87

Fig. 1: Part of timeline 47 showing the limb/nadir matching at the start of the timeline together with the imperfectly matching nadir states nad04 & nad05

EXPOSURE PARAMETERS (sec)												
State ID	Data Rate	Channel 1a	Channel 1b	Channel 2b	Channel 2a	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	corresponding PET/Coadd-table
1	Low	10,00000	10,00000	10,00000	10,00000	1,00000	1,00000	10,00000	5,00000	1,00000	1,00000	N1
	High	10,00000	10,00000	10,00000	10,00000	1,00000	1,00000	10,00000	5,00000	1,00000	1,00000	N1
2	Low	10,00000	1,00000	1,00000	1,00000	1,00000	1,00000	1,00000	0,50000	1,00000	1,00000	N2
	High	10,00000	1,00000	1,00000	1,00000	1,00000	1,00000	1,00000	0,50000	1,00000	1,00000	N2
3	Low	5,00000	1,00000	1,00000	1,00000	0,25000	0,25000	0,50000	0,25000	1,00000	1,00000	N3
	High	5,00000	1,00000	1,00000	1,00000	0,25000	0,25000	0,50000	0,25000	1,00000	1,00000	N3
4	Low	1,00000	1,00000	0,50000	1,00000	0,25000	0,12500	0,50000	0,25000	1,00000	1,00000	N4
	High	1,00000	1,00000	0,50000	1,00000	0,25000	0,12500	0,50000	0,25000	1,00000	1,00000	N4

Fig. 2: Pixel Exposure Times in sec for the nadir states nad01 (table N1) - nad04 (table N4)