MEMORANDUM FOR: The Record

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SUBJECT: NPP CrIS SDR beta status and public release

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The successful launch of the Suomi National Partnership Program (SNPP) Spacecraft on Oct. 28th, 2011 with the Crosstrack Infrared Sensor (CrIS) propels a new generation of capabilities for operational environmental remote sensing for weather, climate, and other environmental applications. CrIS succeeds the NASA EOS AIRS spectrometer on the AQUA satellite. The CrIS Sensor Data Record (SDR) product, namely the radiance and its related geolocation information, will be processed by the CrIS and Microwave Sounder Suite (CrIMSS) to produce the Environmental Data Records (EDRs) and assimilated by the NWP models to significantly improve the weather forecast.

CrIS has 1305 spectral channels in the infrared divided into 3 frequency bands, namely the long wavelength (LWIR, 650 to 1095 cm^{-1}), the medium wavelength (MWIR, 1210 to 1750 cm^{-1}), and the short wavelength (SWIR, 2155 to 2550 cm^{-1}). In only 8 seconds span, CrIS acquires measurements of 30 Earth scenes or field-of-regards (FOR). The 30 FORs form a scan line with a swath of 2200 Km. Each FOR has 9 field-of-views (FOVs) arranged in a 3 by 3 grid. At the nadir view, each FOV has a 14 Km footprint on the ground. During the normal operational mode, CrIS acquires a total of 10,800 scan lines amounting to over 8.7 million Earth view spectra covering over 95% of the Earth surface per day. More information about CrIS can be found at the following CrIS website: http://www.star.nesdis.noaa.gov/jpss/CrIS.php, where users can find the user's guide, algorithm theoretical basis documents (ATBD), instrument performance data on-orbit, conference presentations, and image gallery, etc. Finally, a wealth of information on CrIS is stored in the CasaNosa portal, accessible to the CrIS SDR/SDR and EDR team members.

Following a series of spacecraft and sensor activation and checkouts, the CrIS firstlight data were acquired on January 20th, 2012. Several CrIS SDR algorithm bugs were uncovered. Urgent algorithm fixes were quickly implemented. On April 2nd 2012, IDPS started the production of the CrIS SDR product using the code version MX5.3. Since launch, the CrIS SDR calibration/validation has been progressing well. A team of experts from NOAA, NASA, University of Wisconsin, Space Dynamic Laboratory (SDL), MIT/Lincoln lab, University of Maryland Baltimore County (UMBC), and industry partners Northrop Grumman, Exelis (formely ITT), and Raytheon have worked intensively and performed a thorough evaluation of the CrIS on-orbit performance focusing on 20 cal/val tasks. One of the primary outcomes of the early calval work is the engineering packet (EP) versions33. The EP is part of the downloaded data stream that contains the necessary calibration coefficients. EP version 33 changes with

respect to EP version 32 included new non-linearity coefficients (a2 coefficients), new instrument line shape (ILS) parameters, and a new ICT emissivity curve. Moreover, radiometric bias with sweep direction dependency or 'striping' uncovered an issue with the on-board digital FIR filter. A new digital FIR filter coefficients were uploaded onto the S/C for on-board internal processing on April 18th 2012.

On April 4, 2012, a CrIS SDR Review Meeting was held at the World Weather Building in Camp Springs, Maryland, hosted by NOAA/NESDIS/STAR. More than 40 people attended this review meeting including SNPP/JPSS CrIS SDR Team members, Program and Project Scientists, Joint Center for Satellite Data Assimilation, and representatives from Numerical Weather Prediction (NWP) Centers. The purpose of this meeting was to assess the readiness of the CrIS SDR data product maturity level to be declared "Beta" by the Algorithm Executive Review Board (AERB). The CrIS SDR team members presented early results and progress on the 20 cal/val tasks, and EDR users also offered their independent assessments of data product quality based on their early analyses. A total of 13 presentations were made. Through interactions with the data product users, the SDR chairs and team collected feedback on recommended CrIS SDR product improvements. The discussion provided an overview of the overall performance of the CrIS instrument and algorithms as known at that time.

After a discussion in the review meeting, the CrIS SDR team, the product users and the review panel members reached consensus that the declaration of the Beta maturity level is conditional to the following 3 items:

1) Upload of the proposed engineering packet (EP) version 33.

2) Upload of the proposed new digital FIR filter.

3) Verification of the CrIS SDR product created by IDPS (production code) after the upload of the EP version 33 and the new digital FIR filter.

On April 25th 2012, the CrIS SDR team held a review meeting on the work to satisfy the three conditions above. Shortly after the meeting, a summary report together with the presentations was sent to JPSS/NPP managers. AERB approved that the CrIS SDR product overall had reached beta status.

At the time of the Beta maturity level declaration, the users shall be made aware that the CrIS SDR team is addressing several high priority issues all related to the data quality labeling (or flagging). These issues will be addressed before declaring the CrIS SDR product as provisional maturity level. They are:

1) The CrIS Overall data quality flag (DQF) is not reliable. This DQF is part of the CRISSDR_QF3 bits 0 and 1. It can have 3 values: 1) 0 = good, 2) 1=degraded, 3) 2= invalid. At the time of writing, the Raytheon IDPS production code produces the CrIS SDR overall DQF that have a dependency on the scan line. In some case, it has a dependency on the sweep direction. The user is advised to look at the imaginary part of the spectrum to assess the quality of the radiance. The imaginary part of a 'good' spectrum will have very small value of its mean and very small value of its RMS. It is worth noting that a new DQF based on the imaginary part of the spectrum will be added for declaring the provisional maturity level.

2) The CrIS Overall DQF may have a value of 3. This is due to a coding error that is planned to be fixed for declaring the provisional maturity level.

3) Less than 0.1% of the interferograms contains 'filled' values. It is believed that they were corrupted during the transmission on the ground. The current CrIS SDR code does not check for the presence of these filled values and processes the IFGM as if they were valid. A code fix is planned and is needed for declaring the provisional maturity level.

4) The fringe count error (FCE) detection and correction algorithm has been disabled because it was found to be defective. A FCE occurs when there are an integer number of laser fringe shifts of the interferogram optical path difference sampling position. The user should look at the imaginary for data quality assessment (see item 1 above). The lack of the FCE detection and correction module currently does not pose a problem, since FCE is a rare event.

5) The geolocation accuracy has been assessed at the first look level (crude). Precise assessment will be performed during the upcoming intensive calibration and validation (ICV) phase.

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