



# Geostationary Operational Environmental Satellite (GOES)

## GOES-R Series Level I Requirements (LIRD)

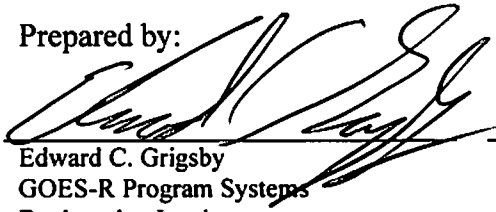
June 2020



U.S. Department of Commerce (DOC)  
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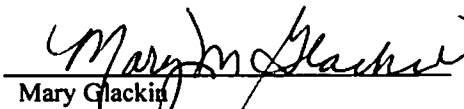
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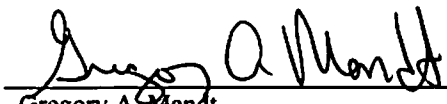
  
\_\_\_\_\_  
Edward C. Grigsby  
GOES-R Program Systems  
Engineering Lead

8/29/11  
\_\_\_\_\_  
Date

Approvals:

  
\_\_\_\_\_  
Mary Glackin  
Deputy Undersecretary of Commerce  
for Oceans and Atmosphere

10/25/11  
\_\_\_\_\_  
Date

  
\_\_\_\_\_  
Gregory A. Mandt  
GOES-R System Program Director

8/29/11  
\_\_\_\_\_  
Date

**LEVEL 1 REQUIREMENTS DOCUMENT (LIRD)  
 DOCUMENT CHANGE RECORD**

| VERSION  | DATE     | CCR # | SECTIONS AFFECTED  | DESCRIPTION  |
|----------|----------|-------|--|--|
| Baseline | 08/06/07 | 1066  | All  | Baseline the Level 1 Requirements Document   |
| 1.1      | 12/12/08 | 1259  | TOC, LIRD83, LIRD84, LIRD244, LIRD245; LIRD246;<br>Deleted LIRD 71- LIRD78; deleted LIRD 85-87; LIRD79 - LIRD84; LIRD245 – 246 | CCR 1259 partially approved by DUS/ implemented.<br>* Updates TOC<br>* Adds new LIRD244 " Operational Capability Status"<br>*Adds new LIRD245 and LIRD246 "Level I Budget and Schedule Requirements"<br>*Deletes LIRD71- LIRD78 and LIRD85 - LIRD87<br>*Modifies LIRD83 and LIRD84 to reflect "System Operational Lifetime"<br>*Re-numbers sections 5 & 6. |
| 1.1      | 12/12/08 | 1275  | LIRD246  | Revises LIRD246 "Level I Budget and Schedule Requirements"   |
| 2.0      | 08/18/09 | 1296  | LIRD109, TOC   | *Delete Cloud Imagery: Coastal<br>*DOORS automatically renumbers sections following a deletion   |
| 2.0      | 08/18/09 | 1314  | LIRD159  | Add CONUS & Mesoscale Coverages for Total Precipitable Water (TPW)   |
| 2.0      | 08/18/09 | 1318  | LIRD161, TOC   | *Delete Entire Product: Total Water Content (TWC)<br>*DOORS automatically renumbers sections following a deletion  |
| 2.0      | 08/18/09 | 1346  | LIRD131, LIRD153, LIRD155, LIRD157, LIRD166, LIRD187, LIRD223  | * Add CONUS & Mesoscale (meso) to Refresh Rate/Coverage Rate (RR/CR) (LIRD131)<br>* Add FD, CONUS, meso to RR/CR (LIRD153, LIRD155)<br>* Add Full Disk coverage (LIRD157)<br>* Updates Geo coverage/condition and RR/CR (LIRD166)<br>* Updates FD RR/CR (LIRD187)<br>* Delete CONUS & Mesoscale coverages (LIRD223)  |
| 2.0      | 08/18/09 | 1378  | LIRD32, LIRD222, LIRD223, TOC  | Change the name from Sea Surface Temperature to Sea Surface Temperature (skin)   |
| 2.0      | 08/18/09 | 1383  | LIRD192  | Change the accuracy  |
| 2.0      | 08/18/09 | 1384  | LIRD211  | Change the accuracy  |

**LEVEL 1 REQUIREMENTS DOCUMENT (LIRD)  
 DOCUMENT CHANGE RECORD (CONTINUED)**

|     |          |       |  |   |
|-----|----------|-------|--|---|
| 2.0 | 08/18/09 | 1385  | LIRD32, LIRD169, LIRD172, LIRD173, LIRD174, LIRD175, LIRD177, TOC  | Radiation Budget: Updates<br>* Downward Solar Insolation: Surface to Downward Shortwave Radiation: Surface (LIRD32, 172, 173)<br>* Reflected Solar Insolation: TOA to Reflected Shortwave Radiation: TOA (LIRD32, 174, 175)<br>* change measurement accuracy (LIRD169, 175, 177)  |
| 2.0 | 08/18/09 | 1386A | LIRD187  | Updates Derived Motion Winds measurement accuracy & RR/CR   |
| 2.0 | 08/18/09 | 1417  | LIRD153, LIRD155, LIRD157, LIRD159 LIRD204   | Soundings: Product Parameter Updates<br>* Legacy Vertical Moisture Profile – threshold for geo coverage/ conditions (LIRD153)<br>* Legacy Vertical Temperature Profile - threshold for geo coverage/ conditions ; measurement accuracy (LIRD155)<br>* measurement acc., removes ± (LIRD157)<br>* TPW - threshold for geo coverage/ conditions ; measurement accuracy (LIRD159)<br>* Surface Emissivity – measurement accuracy (LIRD204) |
| 2.0 | 08/18/09 | 1418  | TOC, LIRD32, LIRD193, LIRD194, LIRD198, LIRD200, LIRD215, LIRD218, LIRD219 LIRD221   | Cryosphere: Prod Parameter Updates<br>* deletes “Landlocked” (TOC, LIRD32, LIRD193, LIRD194)<br>* deletes Sea & Lake Ice: Extent (TOC, LIRD32 LIRD219)<br>* measurement accuracy and RR/CR (LIRD194, LIRD198)<br>* measurement accuracy (LIRD200, LIRD215, LIRD221)   |
| 2.0 | 08/18/09 | 1419B | TOC, LIRD27, LIRD32, LIRD90, LIRD91, LIRD98, LIRD102, LIRD107, LIRD108, LIRD110, LIRD111, LIRD113, LIRD117, LIRD121, LIRD123, LIRD125, LIRD127, LIRD129, LIRD137, LIRD141, LIRD159, LIRD160, LIRD164, LIRD204, LIRD225 | Clouds: Product Parameter Updates<br>* update figure (LIRD27)<br>* remove “Thickness” (LIRD32, LIRD110, LIRD111)<br>* add “Appendix”(LIRD90)<br>* update AA (LIRD91)<br>* correct typographical errors/ omissions (LIRD98, LIRD102, LIRD107, LIRD108, LIRD137, LIRD141, LIRD159, LIRD160, LIRD204, LIRD225)<br>* Measurement accuracy (LIRD107, LIRD111, LIRD113, LIRD117, LIRD121, LIRD123, LIRD125, LIRD127, LIRD129. LIRD164)        |
| 2.0 | 08/18/09 | 1425  | TOC, LIRD32, LIRD105, LIRD131, LIRD133, LIRD139, LIRD140, LIRD141, LIRD143, LIRD184  | Aviation: Product Parameter Updates<br>* Turbulence to Tropopause Folding Turbulence Prediction (TOC, LIRD32, LIRD140, LIRD141)<br>* Measurement accuracy (LIRD105, LIRD131, LIRD133, LIRD139, LIRD141, LIRD143, LIRD184)<br>* typographical error (LIRD133)  |
| 2.0 | 08/18/09 | 1426A | LIRD148, LIRD150   | Hydrology: Product Parameter Updates<br>*Measurement accuracy (LIRD148, LIRD150)  |

**LEVEL 1 REQUIREMENTS DOCUMENT (LIRD)  
 DOCUMENT CHANGE RECORD (CONTINUED)**

|     |          |          |  |   |
|-----|----------|----------|--|---|
| 2.0 | 08/18/09 | 1437     | LIRD66, LIRD137  | Revises Description of Geostationary Lightning Mapper (GLM) and lightning detection   |
| 2.0 | 08/18/09 | 1469     | TOC, LIRD32, LIRD96, LIRD99, LIRD100, LIRD182  | Aerosols: Product Parameter Updates<br>* change Suspended Matter/Optical Depth to Aerosol Optical Depth (TOC, LIRD32, LIRD99, LIRD100)<br>* typographical error (LIRD96, LIRD100)<br>* Measurement accuracy (LIRD96, LIRD100, LIRD182)  |
| 3.0 | 04/29/10 | 1766     | LIRD243  | Remove temp reference in SXI refresh rate/coverage time   |
| 3.0 | 08/09/10 | 1841A    | LIRD52   | Clarifies GOES-R provides data to CLASS but does not archive data in CLASS  |
| 3.0 | 08/09/10 | 1842A    | LIRD31, LIRD32, LIRD206, LIRD208   | Increase coverage for vegetation products   |
| 3.0 | 09/23/10 | 1890     | LIRD29, LIRD58 (deletes both)  | Deletes requirement for additional instrumentation  |
| 3.0 | 09/23/10 | 1898     | LIRD107, LIRD113, LIRD117, LIRD119, LIRD133, LIRD135, LIRD187, LIRD206, LIRD211, LIRD213 | Relaxations of requirements – measurement accuracy: Cloud Ice Water Path, Cloud Liquid Water, Cloud Optical Depth; Cloud Particle Size Distribution, Enhanced “V”/Overshooting Top Detection, and Hurricane Intensity                   |
| 3.0 | 04/26/11 | 2017     | All  | Rebaseline to V3.0  |
| 3.0 | 12/12/11 | CMO Note | LIRD25, LIRD269-271, LIRD31, LIRD32, LIRD28, LIRD137                                     | Corrected errors –capitalized East, make degree symbols consistent, annotated CCR-01842A as the applicable CCR, removed yellow highlight, LIRD28 – updated xxx to correct DIs, bolded “will”, revised footer to correct location in V3. |
| 3.0 | 1/24/12  | CMO Note | LIRD157  | Also included as part of CCR-01842A   |
| 3.1 | 1/11/12  | 2154     | <u>Deviation:</u> LIRD236  | Deviation for LIRD236 (Geomagnetic Field Measurement Accuracy) to "2.3 nT after calibration, with 4 nT at end of life".<br>Related to SCFPS CCR-02139.  |
| 3.1 | 1/11/12  | 2169     | <u>Deviation:</u> LIRD31   | This deviation captures the implementation decision of the products in Set 3 and 4.   |
| 3.2 | 5/15/12  | 2286     | LIRD246  | Changes Program Management Directive (PMD) to Program Commitment Agreement (PCA).   |
| 3.3 | 10/03/12 | 2164     | LIRD242  | Change name of product from Solar Imagery: X-ray to Solar Imagery: EUV.   |
| 3.3 | 10/03/12 | 2311     | LIRD84   | Clarify mission lifetime requirements.  |
| 3.3 | 10/03/12 | 2312     | LIRD236  | Change the Geomagnetic Field product Horizontal / Angular Resolution from +/- 0.25 degrees to N/A.  |

**LEVEL 1 REQUIREMENTS DOCUMENT (LIRD)  
 DOCUMENT CHANGE RECORD (CONTINUED)**

|     |          |          |  |  |
|-----|----------|----------|--|--|
| 3.3 | 10/03/12 | CMO Note | Cover  | Revised GOES logo  |
| 3.4 | 10/24/13 | 2417     | <u>Deviation:</u> LIRD198  | Deviation to implementation of a baseline Snow Cover product   |
| 3.4 | 01/28/14 | CMO Note | Header, Footer, DCR, LIRD3, LIRD249, LIRD250   | * Revised footers to display new link for GOES-R portal from V3 to SharePoint.<br>* Revised headers for document number to reflect the NASA code for GOES-R Program from P417 – to 410-.<br>* Revised the Effective and Expiration dates to have consistent formats among GPO managed documents.<br>* Revised DCR to clearly indicate which CCRs were deviations.<br>* Revised document numbers from P417 to 410 for the MCP and CM Plan references.   |
| 3.5 | 05/02/17 | 3085     | LIRD236  | Add administrative note to Geomagnetic Field Product Measurement Accuracy.   |
| 3.6 | 05/17/19 | 3361C    | <u>Waiver:</u> LIRD236   | Geomagnetic Field Product Measurement Accuracy Waiver-G16<br>Related to Flight CCR 3307  |
| 3.6 | 05/17/19 | 3444     | LIRD3, LIRD249, LIRD308, LIRD310, LIRD323 (new), LIRD324 (new), LIRD325 (new)  | * Updated Applicable documents<br>* Changed oversight from Program Management Directive (PMD) to Program Commitment Agreement PCA<br>* Additional of Compact Coronagraph   |
| 3.7 | 03/18/20 | 3524A    | <u>Waiver:</u> LIRD236   | Geomagnetic Field Product Measurement Accuracy waiver- G17 (related to MRD CCR-03525A; GS FPS CCR-03148)   |
| 3.8 | 03/09/20 | 3493     | <u>Waiver:</u> LIRD102, LIRD115, LIRD116, LIRD117, LIRD119, LIRD121, LIRD123, LIRD125, LIRD127, LIRD150, LIRD153, LIRD155, LIRD157, LIRD159, LIRD187, LIRD196, LIRD223 | ABI Loop Heat Pipe performance impact waiver during non-nominal ‘marginal’ operational conditions. Waiver of Product Measurement Accuracy: Radiances, Cloud and Moisture Imagery, Clear Sky Masks, Cloud Optical Depth, Cloud Particle Size Distribution, Cloud Top Phase, Cloud Top Height, Cloud Top Pressure, Cloud Top Temperature, Legacy Vertical Moisture Profile, Legacy Vertical Temperature Profile, Derived Stability Indices, Total Precipitable Water, Rainfall Rate/QPE, Land Surface Temperature, Sea Surface Temperature, Volcanic Ash Detection and Height, and Derived Motion Winds. (GOES-17/S Only)<br>(related to MRD CCR-03492A; ABIPORD CCR-03043, GS FPS PC-03149) |
| 3.8 | 05/6/20  | 3520A    | LIRD102  | Modify Volcanic Ash requirement to provide ABI L1b data and L2 CMI product.<br>(related to MRD CCR-03521A; GS FPS PC-03150)  |
| 3.8 | 05/14/20 | 3477A    | LIRD135  | Modify Hurricane Intensity requirement to provide ABI L1b data needed for hurricane intensity estimates, such as the Advanced Dvorak Technique produces (related to MRD CCR-03476A)  |
| 3.8 | 06/12/20 | 3188     | LIRD243  | Administrative note to clarify the Solar Imagery: EUV Product Measurement Accuracy (related to MRD CCR-03165A)   |

Effective Date: June 12, 2020  
Expiration Date: five years from date of last change  
Responsible Organization: GOES-R Program/Code 410

410-R-L1RD-0137  
Version 3.8

**LEVEL 1 REQUIREMENTS DOCUMENT (L1RD)  
DOCUMENT CHANGE RECORD (CONTINUED)**

|     |        |             |         |  |
|-----|--------|-------------|---------|--|
| 3.8 | 7/9/20 | CMO<br>Note | Footers | * Revised footers to display new link for GOES-R portal<br>from SharePoint to portal |
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410-R-LIRD-0137, RM Version, Level I Requirements Document

Version: 3.8

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| <b>ID</b> | <b>Object Number</b> | <b>410-R-LIRD-0137, RM Version, Level I Requirements Document</b> |
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|       |   |                       |
|-------|---|-----------------------|
| LIRD1 | 1 | <b>1 Introduction</b> |
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|       |     |                    |
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| LIRD4 | 1.1 | <b>1.1 Purpose</b> |
|-------|-----|--------------------|

|       |         |  |
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| LIRD5 | 1.1.0-1 | This document provides the Level I functional and performance requirements for developing the Geostationary Operational Environmental Satellite (GOES) System, R- Series (GOES-R). The purposes of this document are to: |
|-------|---------|--|

- |  |  |   |
|--|--|---|
|  |  | <ul style="list-style-type: none"> <li>a) Provide a brief summary of background, mission need, and fundamental objectives of the GOES-R Series.</li> <li>b) Provide the top-level performance and functional requirements of the GOES-R Series for policy-level review, management control and generation of lower level requirements documents.</li> </ul> |
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| LIRD6 | 1.2 | <b>1.2 Scope</b> |
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| LIRD7 | 1.2.0-1 | These Level I requirements reflect results obtained from system capabilities studies and document the GOES-R series requirements for the Acquisition and Operations Phase. They also serve as the basis for generation of lower-level, system requirements documents (e.g., Level II requirements documents). |
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| LIRD2 | 1.3 | <b>1.3 Applicable Documents</b> |
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|-------|---------|--|
| LIRD3 | 1.3.0-1 | <ul style="list-style-type: none"> <li>• Consolidated User Observation Requirements List (COURL) housed in the NOAA Earth Observation Requirements Evaluation System (EORES). [The COURL was formerly the Consolidated Observational Requirements List (CORL) house in NOAA's CasaNOSA network. The current EORES link is <a href="https://eores.nesdis-hq.noaa.gov">https://eores.nesdis-hq.noaa.gov</a>].</li> <li>• Program Commitment Agreement, current Fiscal Year revision</li> <li>• Memorandum for the Delegation of Key Decision Point Authority for the GOES-R Program, December 21, 2007</li> <li>• GOES-R Program Management Control Plan, (MCP), 410-R-PLN-0067</li> <li>• GOES-R Configuration Management Plan, 410-R-PLN-0084</li> <li>• GOES-R Series Acronym &amp; Glossary Document, 410-R-LIST-0142 (CCR 03444)</li> </ul> |
|-------|---------|--|

| ID      | Object Number | 410-R-LIRD-0137, RM Version, Level I Requirements Document   |
|---------|---------------|--|
| LIRD8   | 2             | <b>2 GOES-R Series Background</b>  |
| LIRD9   | 2.1           | <b>2.1 System Need</b>   |
| LIRD10  | 2.1.0-1       | <p>The primary missions of NOAA are to understand and predict changes in climate, weather, oceans, and coasts, to share that knowledge and information with others, and to conserve and manage coastal and marine ecosystems and resources.</p> <p>GOES satellites meet current and near-term national operational environmental sensing requirements for continuous observation of weather, Earth's environment, and solar and space environment. To meet requirements and accomplish its mission, the geostationary satellites program performs three major functions:</p> <ol style="list-style-type: none"> <li>a) Provide continuous Geostationary Environmental Sensing.</li> <li>b) Provide Data Collection Service capability.</li> <li>c) Provide continuous relay of environmental data to distributed users and relay of distress signals from aircraft or marine vessels to search and rescue ground stations.</li> </ol>  |
| LIRD14  | 2.1.1         | <b>2.1.1 Observational Gap Addressed</b>   |
| LIRD15  | 2.1.1.0-1     | <p>There is no single environmental observing system that can meet the geographic coverage, vertical and horizontal resolution, measurement accuracy and timeliness requirements of the hundreds of environmental parameters needing to be sensed throughout our atmosphere, oceans, land and ice masses, and space and solar regimes to accomplish NOAA's mission. While NOAA's complementary polar-orbiting system of satellites provides data across the entire globe, its lower temporal coverage of four or more hours does not allow detection and monitoring of rapidly developing storms threatening US life and property. Similarly, nationwide radar systems, while able to continually detect precipitation areas, are unable to image the cloud systems and provide the 3-D fields of atmospheric temperature and moisture needed to predict the onset, intensity, duration and direction of these storms. Geosynchronous satellites are a vital, but not the only, part of this operational solution.</p> |
| LIRD16  | 2.1.2         | <b>2.1.2 Ownership and Oversight</b>   |
| LIRD12  | 2.1.2.1       | <b>2.1.2.1 Program Management</b>  |
| LIRD248 | 2.1.2.1.0-1   | <p>The GOES-R Series <b>shall</b> be established in accordance with NOAA/NASA Memorandum of Understanding (MOU).</p>   |
| LIRD249 | 2.1.2.1.0-2   | <p>The GOES-R Series Management and Oversight <b>shall</b> be conducted in accordance with the GOES-R Management Control Plan (MCP) (410-R-PLN-0067) and Program Commitment Agreement (PCA) as appropriate. (CCR 03444)</p>  |
| LIRD18  | 2.1.2.2       | <b>2.1.2.2 Requirements</b>  |
| LIRD250 | 2.1.2.2.0-1   | <p>Level I requirements changes <b>shall</b> be approved by the NOAA Operating Systems Council (NOSC), after being vetted by the GOES-R Operational Requirements Working Group (GORWG). Detailed descriptions of the requirements change process is described in the GOES-R Configuration Management Plan (410-R-PLN-0084).</p>  |
| LIRD323 | 2.1.2.2.0-2   | <p>The GOES-R system <b>shall</b> collect coronal mass ejection observations utilizing the GOES-U spacecraft. (CCR 03444)</p>  |
| LIRD20  | 2.1.2.2.0-3   | <p>The GOES-R requirements documents <b>shall</b> be reviewed / approved as summarized in Table 1</p>  |

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LIRD20 2.1.2.2.0-3

**Table 1 - GOES-R Requirements Documents Reviews and Approvals**

| Requirements Level                         | Baseline Document   | Document Custodian and Control Process | Reviewing Body  | Approving Body                       |
|--|---|--|---|--------------------------------------|
| NOAA Observing Systems Architecture (NOSA) | Consolidated Observational Requirements List (CORL)           | NOAA Observing Systems Council (NOSC)  | NOSC  | NOAA Executive Council (NEC)         |
| Level I                                    | GOES-R Level I Requirements Document                          | Final: GOES-R Program                  | NOSC, NOAA PMC, NESDIS AA/DAAS                              | NOAA DUS                             |
| Level II                                   | GOES-R Management Control Plan                                | Program Systems Engineering (PSE)      | NESDIS AA/DAAS, NASA/Goddard Space Flight Center (GSFC) CMC | NESDIS AA, NASA/GSFC Center Director |
| Level IIa                                  | Mission Requirements Document                                 | PSE                                    | GPO GORWG   | GOES-R SPD                           |
| Level III                                  | GOES-R Project Plans  | GOES-R Projects                        | GOES-R Program  | GOES-R SPD                           |
| Level IIIa                                 | Project level Interface Documents & Functional Specifications | GOES-R Projects                        | GOES-R Program  | GOES-R Project Managers              |

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|---------|---------------|--|
| LIRD21  | 3             | <b>3 GOES-R Series Procurement Requirements</b>  |
| LIRD251 | 3.1           | <b>3.1 Segments</b>  |
| LIRD252 | 3.1.0-1       | The GOES-R Series <b>shall</b> contain a space segment.  |
| LIRD253 | 3.1.0-2       | The GOES-R Series <b>shall</b> contain a ground segment.   |
| LIRD254 | 3.2           | <b>3.2 Organization and Management</b>   |
| LIRD255 | 3.2.0-1       | The GOES-R Series organization, program management, control and authority <b>shall</b> be in accordance with the GOES-R Management Control Plan.   |
| LIRD245 | 3.2.1         | <b>3.2.1 Budget and Schedule Requirements (CCR 1259)</b>   |
| LIRD246 | 3.2.1.0-1     | Budget and schedule milestones <b>shall</b> be managed in accordance with the annual Program Commitment Agreement (PCA) submitted by the GOES-R System Program Director (SPD) and approved by the NESDIS AA and the NOAA Deputy Under Secretary (DUS) for Oceans and Atmosphere. (CCR 02286) |
| LIRD256 | 3.2.1.1       | <b>3.2.1.1 Regular Reporting</b>   |
| LIRD257 | 3.2.1.1.0-1   | Regular reporting of the GOES-R Program <b>shall</b> be in accordance with the Management Control Plan.  |
| LIRD258 | 3.2.1.2       | <b>3.2.1.2 Deviation Reporting</b>   |
| LIRD259 | 3.2.1.2.0-1   | GOES-R Series deviation reporting <b>shall</b> be made as specified in the conditions outlined in the Department of Commerce Memorandum for the Delegation of Key Decision Point Authority for the GOES-R Program, and current Congressional and NOAA guidance.                              |
| LIRD260 | 3.3           | <b>3.3 Acquisition Strategy</b>  |
| LIRD261 | 3.3.0-1       | The GOES-R Series instruments <b>shall</b> be procured by NASA/GSFC in accordance with the GOES-R Management Control Plan and applicable NASA/GSFC acquisition plan.   |
| LIRD262 | 3.3.0-2       | The GOES-R Series spacecraft <b>shall</b> be procured by NASA/GSFC in accordance with the GOES-R Management Control Plan and applicable NASA/GSFC acquisition plan.  |
| LIRD263 | 3.3.0-3       | The GOES-R Series launch services <b>shall</b> be procured by NASA/GSFC, in accordance with the GOES-R Management Control Plan and applicable NASA/GSFC acquisition plan.  |
| LIRD264 | 3.3.0-4       | The GOES-R Series ground segment <b>shall</b> be procured by NOAA, in accordance with the GOES-R Management Control Plan and applicable NOAA acquisition plan.   |



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LIRD265    4

### 4 Series System Requirements

LIRD266    4.0-1

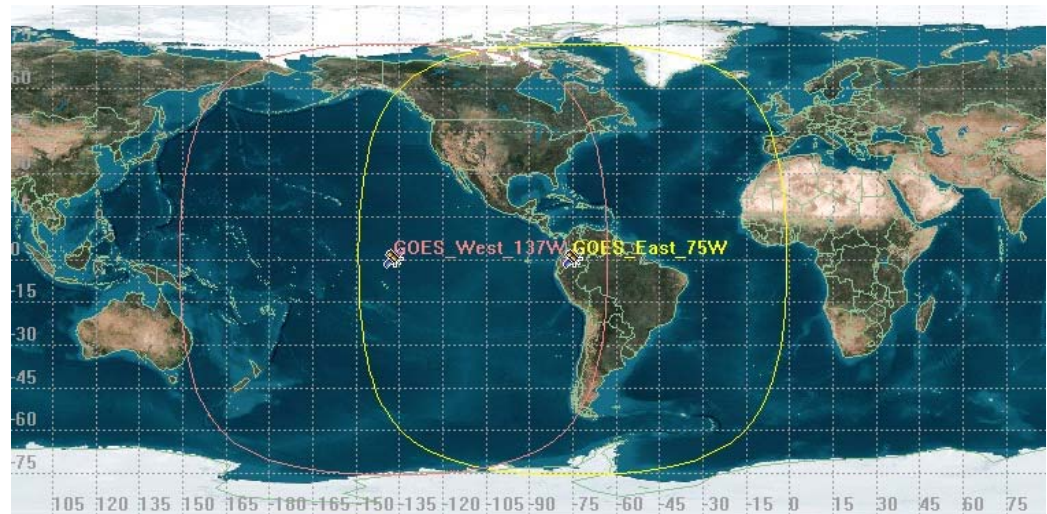
The GOES-R constellation observes two operational coverage areas with the capacity to rapidly replace that coverage as needed. The development and launch of GOES assets prior and subsequent to the GOES-R series is assumed in order to maintain constellation availability.

LIRD267    4.1

#### 4.1 Series Coverage

LIRD25    4.1.0-1

The GOES-R Series **shall** provide geosynchronous-viewed operational imagery of a minimum coverage area bounded by latitude 68° North to 68° South and longitude 150° East eastward to 2° West, as shown in Figure 1.



**Figure 1 - GOES-R Series Imagery Coverage Area**

LIRD269    4.1.0-2

The GOES-R Series **shall** have on-orbit geosynchronous operational locations designated as GOES-R West at 137° W longitude and GOES-R East at 75° W longitude.

LIRD270    4.1.0-3

The GOES-R Series Eastern operating zone (GOES East) **shall** be centered at 75° W longitude and cover an area bounded by 68° North and South latitudes, 148° West to 2° West longitudes.

LIRD271    4.1.0-4

The GOES-R Series Western operating zone (GOES West) **shall** be centered at 137° W longitude and cover an area bounded by 68° North and South latitudes, 150° East to 64° West longitudes.

LIRD272    4.2

#### 4.2 GOES-R Series Facilities

LIRD43    4.2.0-1

The GOES-R Series **shall** implement communication interfaces to relay GOES-R sensor data in real time.

LIRD27    4.2.0-2

The GOES-R Series **shall** utilize existing NOAA primary ground operations locations.

LIRD275    4.2.0-3

The GOES-R Series **shall** utilize a Remote Backup facility for satellite terrestrial communications, command and control, and Key Performance Parameter (KPP) processing functionality as a secondary location.

LIRD276    4.2.0-4

The GOES-R Series Remote Backup location **shall** be located such that it is not susceptible to the same credible threat as the primary ground operations locations.

LIRD30    4.3

#### 4.3 Observational Requirements

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LIRD31    4.3.0-1

The GOES-R Series Observational Requirements **will** be grouped into sets as described in Table 2. These sets are used to prioritize product implementation.

**Table 2 - Observational Requirements Prioritization**

| Product Set | Comment  |
|-------------|--|
| 1           | Includes the Cloud and Moisture Imagery Product (KPP) and highest priority products. |
| 2           | Includes next highest priority legacy and related products                           |
| 3           | Includes next highest priority and related products                                  |
| 4           | Includes remaining products  |

*(CCR 1842A)(CCR 02169 (RDW))*

LIRD279    4.3.1

**4.3.1 Terrestrial Weather**

LIRD32    4.3.1.0-1

The GOES-R Series Atmospheric products are listed in Table 3 and detailed in Appendix Level I Requirements Document Product Performance Table.

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LIRD32 4.3.1.0-1

**Table 3 - GOES-R Series System Atmospheric Products**

| <b>Atmosphere</b>                            | <b>Product Set</b> |
|--|--------------------|
| <b>AEROSOLS</b>                              |                    |
| Aerosol Detection (including Smoke and Dust) | 1                  |
| Aerosol Particle Size                        | 3                  |
| Aerosol Optical Depth                        | 1                  |
| Volcanic Ash Detection and Height            | 2                  |
| <b>CLOUDS</b>                                |                    |
| Aircraft Icing Threat                        | 4                  |
| Cloud Ice Water Path                         | 3                  |
| Cloud Layer Heights                          | 3                  |
| Cloud Liquid Water                           | 3                  |
| Cloud and Moisture Imagery                   | 1                  |
| Cloud Optical Depth                          | 1                  |
| Cloud Particle Size Distribution             | 1                  |
| Cloud Top Phase                              | 1                  |
| Cloud Top Height                             | 1                  |
| Cloud Top Pressure                           | 1                  |
| Cloud Top Temperature                        | 1                  |
| Cloud Type                                   | 3                  |
| Convective Initiation                        | 3                  |
| Enhanced "V"/Overshoot Top Detection         | 4                  |
| Hurricane Intensity                          | 2                  |
| Visibility                                   | 4                  |
| Low Cloud and Fog                            | 3                  |
| Tropopause Folding Turbulence Prediction     | 3                  |
| Lightning Detection                          | 2                  |
| <b>PRECIPITATION</b>                         |                    |
| Probability of Rainfall                      | 4                  |
| Rainfall Potential                           | 4                  |
| Rainfall Rate/QPE                            | 2                  |
| <b>PROFILES, INDICES, TOTAL WATER</b>        |                    |
| Legacy Vertical Moisture Profile             | 1                  |
| Legacy Vertical Temperature Profile          | 1                  |
| Derived Stability indices                    | 2                  |
| Total Precipitable Water                     | 1                  |
| <b>RADIANCES</b>                             |                    |
| Clear Sky Masks                              | 1                  |
| Radiances                                    | 1                  |
| <b>RADIATION</b>                             |                    |
| Absorbed Shortwave Radiation: Surface        | 3                  |
| Downward Longwave Radiation: Surface         | 3                  |
| Downward Shortwave Radiation: Surface        | 2                  |
| Reflected Shortwave Radiation: TOA           | 2                  |
| Upward Longwave Radiation: Surface           | 3                  |
| Upward Longwave Radiation: TOA               | 3                  |
| <b>TRACE GASES</b>                           |                    |
| Ozone Total                                  | 3                  |
| SO2 Detection                                | 3                  |
| <b>WINDS</b>                                 |                    |
| Derived Motion Winds                         | 2                  |

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LIRD32    4.3.1.0-1

The GOES-R Series Land products are listed in Table 4 and detailed in Appendix Level I Requirements Document Product Performance Table.

**Table 4 - GOES-R Series Land Products**

| Land                            | Product Set |
|---------------------------------|-------------|
| Fire/Hot Spot Characterization  | 2           |
| Flood/Standing Water            | 4           |
| Ice Cover                       | 4           |
| Land Surface (Skin) Temperature | 2           |
| Snow Cover                      | 2           |
| Snow Depth (over Plains)        | 4           |
| Surface Albedo                  | 3           |
| Surface Emissivity              | 3           |
| Vegetation Fraction: Green      | 4           |
| Vegetation Index                | 4           |

The GOES-R Series Ocean products are listed in Table 5 and detailed in Appendix Level I Requirements Document Product Performance Table.

**Table 5 - GOES-R Series System Ocean Products**

| Ocean                           | Product Set |
|---------------------------------|-------------|
| Currents                        | 4           |
| Currents: Offshore              | 4           |
| Sea and Lake Ice: Age           | 4           |
| Sea and Lake Ice: Concentration | 4           |
| Sea and Lake Ice: Motion        | 4           |
| Sea Surface Temperature (skin)  | 2           |

*(CCR 1385)(CCR 1419B)(CCR 1425)(CCR 1469)(CCR 1378)(CCR 1418)(CCR 1842A)*

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LIRD283 4.3.2      **4.3.2 Space Weather**

LIRD284 4.3.2.0-1      The GOES-R Series Space and Solar Weather products are listed in Table 6 and detailed in Appendix Level I Requirements Document Product Performance Table.

**Table 6 - GOES-R Series System Space and Solar Weather Products**

| Space and Solar  | Product Set |
|--|-------------|
| Energetic Heavy Ions   | 2           |
| Magnetospheric Electrons and Protons: Low Energy             | 2           |
| Magnetospheric Electrons and Protons: Medium and High Energy | 2           |
| Solar and Galactic Protons                                   | 2           |
| Geomagnetic Field  | 2           |
| Solar Flux: EUV  | 2           |
| Solar Flux: X-Ray  | 2           |
| Solar Imagery: EUV   | 2           |

(CCR 2164)

LIRD285 4.4      **4.4 Product Requirements**

LIRD33 4.4.0-1      The GOES-R Series mission product data latency **shall** be less than or equal to the associated product refresh rate.

LIRD324 4.4.0-2      The GOES-R system **shall** make coronal mass ejection L0 data from the GOES-U Compact Coronagraph (CCOR) available to users. (CCR 03444)

LIRD46 4.4.1      **4.4.1 Product Generation Requirements**

LIRD47 4.4.1.0-1      The GOES-R Series **shall** ingest externally generated ancillary data and metadata from NOAA.

LIRD48 4.4.1.0-2      The GOES-R Series **shall** utilize internally generated environmental instrument data and externally generated ancillary as well as meta data required to produce the products listed in Table 3, Table 4, Table 5, and Table 6.

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|---------|---------------|--|
| LIRD49  | 4.4.1.0-3     | The GOES-R Series <b>shall</b> maintain performance of generated environmental data products listed in Table 3, Table 4, Table 5 and Table 6.  |
| LIRD50  | 4.4.2         | <b>4.4.2 Product Distribution Requirements</b>   |
| LIRD51  | 4.4.2.0-1     | The GOES-R Series <b>shall</b> provide user access to all generated environmental data products.   |
| LIRD293 | 4.4.3         | <b>4.4.3 Product Data Archiving Requirements</b>   |
| LIRD52  | 4.4.3.0-1     | The GOES-R Series <b>shall</b> make products and associated supporting data available to the NOAA Archival Data Centers. ( <i>CCR 1841A</i> )  |
| LIRD295 | 4.5           | <b>4.5 Availability Requirements</b>   |
| LIRD28  | 4.5.0-1       | The GOES-R Series <b>shall</b> maintain a mission availability of 0.80 over the operational lifetime for the combination of the specified operational coverage areas (as specified in LIRD270 and LIRD271).                            |
| LIRD297 | 4.5.0-2       | In the event of a failure of a satellite requiring replacement, where an on-orbit replacement is available, the GOES-R Series Maximum Time to Restore Service (MaxTTRS) <b>shall</b> not exceed three weeks.                           |
| LIRD26  | 4.5.0-3       | The GOES-R Series <b>shall</b> provide continuous (with outages less than 6 hours per year) sensor data for ground generation of the KPP.  |
| LIRD299 | 4.5.0-4       | In the event of a failure of one of the two GOES-R Series ground sites, the failover time to a backup site for those functions supporting the collection, generation and distribution of the KPP <b>shall</b> not exceed five minutes. |
| LIRD325 | 4.5.0-5       | The GOES-R system <b>shall</b> provide continuous (with outages less than 75 hours per year) sensor data for ground generation of coronal mass ejection L0 data. ( <i>CCR 03444</i> )  |
| LIRD36  | 4.6           | <b>4.6 Auxiliary Communication Services Requirements</b>   |
| LIRD37  | 4.6.0-1       | The GOES-R Series <b>shall</b> relay Earth-based Search and Rescue Satellite Aided Tracking (SARSAT) emergency beacon signals to Earth-based receivers.  |
| LIRD38  | 4.6.0-2       | The GOES-R Series <b>shall</b> relay Earth-based Emergency Managers Weather Information Network (EMWIN) data to Earth based receivers.   |
| LIRD39  | 4.6.0-3       | The GOES-R Series <b>shall</b> relay Earth-based High Rate Image Transmission (HRIT) data to Earth based receivers.  |
| LIRD40  | 4.6.0-4       | The GOES-R Series <b>shall</b> relay Earth-based Data Collection Platform (DCP) data to Earth based receivers.   |
| LIRD305 | 4.6.0-5       | The GOES-R Series <b>shall</b> relay Earth-based Data Collection Platforms' (DCP) commands to Earth based receivers.   |
| LIRD41  | 4.6.0-6       | The GOES-R Series <b>shall</b> relay ground-processed GOES Rebroadcast (GRB) data to Earth based receivers.  |
| LIRD307 | 4.7           | <b>4.7 On-orbit Checkout Location</b>  |
| LIRD308 | 4.7.0-1       | The GOES-R Series <b>shall</b> have a post-launch on-orbit geosynchronous check-out location of 89.5° W longitude for post launch testing. ( <i>CCR 03444</i> )  |
| LIRD309 | 4.8           | <b>4.8 On-orbit Storage Location</b>   |

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|---------|---------------|--|
| LIRD310 | 4.8.0-1       | The GOES-R Series <b>shall</b> have an on-orbit geosynchronous storage location of 105° W longitude capable of periodic check out in storage. <i>(CCR 03444)</i>   |
| LIRD79  | 4.9           | <b>4.9 Initial Operational Capability (IOC)</b>  |
| LIRD80  | 4.9.0-1       | The GOES-R Series <b>will</b> realize Initial Operating Capability (IOC) upon the successful generation and user availability of the KPP, following the Post Launch Test mission phase, as listed in Table 3 for either West or East coverage areas.   |
| LIRD81  | 4.10          | <b>4.10 System Full Operational Capability (FOC)</b>   |
| LIRD82  | 4.10.0-1      | The GOES-R Series <b>will</b> realize Full Operational Capability (FOC) upon the success of IOC for both the East and West on-orbit coverage areas, activation of Auxiliary Communications Services, and the production and availability to users of the full product set.   |
| LIRD83  | 4.11          | <b>4.11 Series Operational Lifetime (CCR 1259)</b>   |
| LIRD84  | 4.11.0-1      | Individual satellite lifetime of the GOES-R Series satellites <b>shall</b> consist of five years on-orbit storage and 10 years of operations. The GOES-R Series Operational Lifetime is dependent on the satellite lifetime and the launch schedule (defined in the Program Commitment Agreement (PCA)) and is defined as the period of time beginning with a GOES-R Series satellite operating at GOES-East or GOES-West and ending when the last GOES-R Series satellite is decommissioned. <i>(CCR 1259) (CCR 2311)</i> |

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| <b>ID</b> | <b>Object Number</b> |  |
|-----------|----------------------|--|
| LIRD88    | 5                    | <b>5 MINIMUM PERFORMANCE SUCCESS CRITERIA</b>  |
| LIRD313   | 5.0-1                | The GOES-R Series minimum success criteria <b>will</b> be defined as the successful generation and availability to users of the Key Performance Parameter (KPP). |
| LIRD314   | 5.0-1.0-1            | The GOES-R Series Key Performance Parameter (KPP) <b>will</b> be the Cloud and Moisture Imagery Product as listed in Table 3.                                    |



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LIRD92    6                      **6 Appendix: Level I Requirements Document Product Performance Table**

LIRD93    6.1                      **6.1 Observational Requirements: Atmosphere**

LIRD94    6.1.1                      **6.1.1 Aerosols**

LIRD95    6.1.1.1                      **6.1.1.1 Aerosol Detection (including Smoke and Dust)**

LIRD96    6.1.1.1.0-1                      The GOES-R System **shall** produce Aerosol Detection (including Smoke and Dust) observational products in accordance with the table below.

| <b>Aerosol Detection (including Smoke and Dust)</b> | <b>Threshold</b>  |
|---|---|
| Primary Instrument                                  | ABI   |
| Geographic Coverage/Conditions                      | CONUS<br>Full Disk<br>Mesoscale   |
| Vertical Resolution                                 | Total column  |
| Horizontal Resolution                               | 2 km  |
| Measurement Accuracy                                | Dust: 80% correct detection over land and ocean<br>Smoke: 80% correct detection over land; 70% correct detection over ocean |
| Refresh Rate/Coverage Time                          | 15 min  |

(CCR 1469)

LIRD97    6.1.1.2                      **6.1.1.2 Aerosol Particle Size**

LIRD98    6.1.1.2.0-1                      The GOES-R System **shall** produce an Aerosol Particle Size observational product in accordance with the table below.

| <b>Aerosol Particle Size</b>   | <b>Threshold</b>          |
|--------------------------------|---------------------------|
| Primary Instrument             | ABI                       |
| Geographic Coverage/Conditions | Full Disk                 |
| Vertical Resolution            | Total column              |
| Horizontal Resolution          | 2 km                      |
| Measurement Accuracy           | 0.03 $\mu\text{m}$ radius |
| Refresh Rate/Coverage Time     | 15 min                    |

(CCR 1419B)(CCR 02169 (RDW))

LIRD99    6.1.1.3                      **6.1.1.3 Aerosol Optical Depth (CCR 1469)**

LIRD100    6.1.1.3.0-1                      The GOES-R System **shall** produce an Aerosol Optical Depth observational product in accordance with the table below.

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LIRD100    6.1.1.3.0-1

| <b>Aerosol Optical Depth</b>   | <b>Threshold</b>   |
|--------------------------------|--|
| Primary Instrument             | ABI  |
| Geographic Coverage/Conditions | CONUS<br>Full Disk   |
| Vertical Resolution            | Total column   |
| Horizontal Resolution          | 2 km   |
| Measurement Accuracy           | Based on Aerosol Optical<br>Depth ranges: Over land:<br>< 0.04: 0.06<br>0.04 – 0.80: 0.04<br>> 0.80: 0.12<br>Over water:<br>< 0.40: 0.02<br>> 0.40: 0.10 |
| Refresh Rate/Coverage Time     | CONUS: 5 min<br>Full Disk: 15 min  |

(CCR 1469)

LIRD101    6.1.1.4

**6.1.1.4 Volcanic Ash: Detection and Height**

LIRD102    6.1.1.4.0-1

The GOES-R System **shall** provide ABI L1b data and L2 CMI product that are used to detect and track volcanic ash

| <b>Volcanic Ash: Detection and Height</b> | <b>Threshold</b>      |
|---|-----------------------|
| Primary Instrument                        | ABI                   |
| Geographic Coverage/Conditions            | Full Disk             |
| Vertical Resolution                       | 3 km (top height)     |
| Horizontal Resolution                     | 2 km                  |
| Measurement Accuracy                      | 2 ton/km <sup>2</sup> |
| Refresh Rate/Coverage Time                | 15 min                |

(CCR 1419B) (CCR 03493(RDW)) (CCR 3520A)

LIRD103    6.1.2

**6.1.2 Clouds**

LIRD104    6.1.2.1

**6.1.2.1 Aircraft Icing Threat**

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LIRD105    6.1.2.1.0-1

The GOES-R System **shall** produce an Aircraft Icing Threat observational product in accordance with the table below.

| <b>Aircraft Icing Threat</b>   | <b>Threshold</b>           |
|--------------------------------|----------------------------|
| Primary Instrument             | ABI                        |
| Geographic Coverage/Conditions | Full Disk                  |
| Vertical Resolution            | Cloud top                  |
| Horizontal Resolution          | 10 km                      |
| Measurement Accuracy           | 50% correct classification |
| Refresh Rate/Coverage Time     | 60 min                     |

*(CCR 1425)(CCR 02169 (RDW))*

LIRD106    6.1.2.2

**6.1.2.2 Cloud Ice Water Path**

LIRD107    6.1.2.2.0-1

The GOES-R System **shall** produce a Cloud Ice Water Path observational product in accordance with the table below.

| <b>Cloud Ice Water Path</b>    | <b>Threshold</b>   |
|--------------------------------|--|
| Primary Instrument             | ABI  |
| Geographic Coverage/Conditions | CONUS – for limited cloudiness<br>Full Disk – for limited cloudiness<br>Mesoscale – for limited cloudiness |
| Vertical Resolution            | Surface – 20 km  |
| Horizontal Resolution          | 2 km   |
| Measurement Accuracy           | 40% (Day); and Greater of 25 g/m <sup>2</sup> or 30% (Night)   |
| Refresh Rate/Coverage Time     | CONUS: 5 min<br>Full Disk: 15 min<br>Mesoscale: 5 min  |

*(CCR 1419B)(CCR 1898)(CCR 02169 (RDW))*

LIRD110    6.1.2.3

**6.1.2.3 Cloud Layers/Heights (CCR 1419B)**

LIRD111    6.1.2.3.0-1

The GOES-R System **shall** produce a Cloud Layers/Heights observational product in accordance with the table below.

**ID            Object  
                 Number**

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LIRD111    6.1.2.3.0-1

| <b>Cloud Layers/Heights</b>    | <b>Threshold</b>                                       |
|--------------------------------|--|
| Primary Instrument             | ABI  |
| Geographic Coverage/Conditions | CONUS<br>Full Disk<br>Mesoscale                        |
| Vertical Resolution            | 1 cloud layer  |
| Horizontal Resolution          | CONUS: 10 km<br>Full Disk: 10 km<br>Mesoscale: 4 km    |
| Measurement Accuracy           | 80% correct classification                             |
| Refresh Rate/Coverage Time     | CONUS: 60 min<br>Full Disk: 60 min<br>Mesoscale: 5 min |

*(CCR 1419B)(CCR 02169 (RDW))*

LIRD112    6.1.2.4

**6.1.2.4 Cloud Liquid Water**

LIRD113    6.1.2.4.0-1

The GOES-R System **shall** produce a Cloud Liquid Water observational product in accordance with the table below.

| <b>Cloud Liquid Water</b>      | <b>Threshold</b>   |
|--------------------------------|--|
| Primary Instrument             | ABI  |
| Geographic Coverage/Conditions | CONUS<br>Full Disk<br>Mesoscale  |
| Vertical Resolution            | Total column   |
| Horizontal Resolution          | 2 km   |
| Measurement Accuracy           | Greater of 50 g/m <sup>2</sup> or 30%<br>(Day); and Greater of 25<br>g/m <sup>2</sup> or 15% (Night) |
| Refresh Rate/Coverage Time     | CONUS: 5 min<br>Full Disk: 30 min<br>Mesoscale: 5 min  |

*(CCR 1419B)(CCR 1898)(CCR 02169 (RDW))*

LIRD114    6.1.2.5

**6.1.2.5 Cloud and Moisture Imagery**

LIRD115    6.1.2.5.0-1

The GOES-R System **shall** produce a Cloud and Moisture Imagery observational product in accordance with the table below.

**ID            Object  
Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD115    6.1.2.5.0-1

| <b>Cloud and Moisture Imagery</b> | <b>Threshold</b>                                       |
|-----------------------------------|--|
| Primary Instrument                | ABI  |
| Geographic Coverage/Conditions    | CONUS<br>Full Disk<br>Mesoscale                        |
| Vertical Resolution               | N/A  |
| Horizontal Resolution             | 2 km, with finer daytime observations                  |
| Measurement Accuracy              | N/A  |
| Refresh Rate/Coverage Time        | CONUS: 5 min<br>Full Disk: 15 min<br>Mesoscale: 30 sec |

*(CCR 3493(RDW))*

LIRD116    6.1.2.6

**6.1.2.6 Cloud Optical Depth**

LIRD117    6.1.2.6.0-1

The GOES-R System **shall** produce a Cloud Optical Depth observational product in accordance with the table below.

| <b>Cloud Optical Depth</b>     | <b>Threshold</b>  |
|--------------------------------|---|
| Primary Instrument             | ABI   |
| Geographic Coverage/Conditions | CONUS: optical depth > 1<br>Full Disk: optical depth > 1  |
| Vertical Resolution            | Total column  |
| Horizontal Resolution          | CONUS: 2 km<br>Full Disk: 4 km  |
| Measurement Accuracy           | Liquid phase: Maximum of 2 or 20% (Day); and 30% (Night).<br>Ice phase: Maximum of 3 or 30% (Day); and 30% (Night). |
| Refresh Rate/Coverage Time     | CONUS: 30 min<br>Full Disk: 15 min  |

*(CCR 1419B)(CCR 1898)(CCR 3493(RDW))*

LIRD118    6.1.2.7

**6.1.2.7 Cloud Particle Size Distribution**

LIRD119    6.1.2.7.0-1

The GOES-R System **shall** produce a Cloud Particle Size Distribution observational product in accordance with the table below.

**ID            Object  
Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD119    6.1.2.7.0-1

| <b>Cloud Particle Size Distribution</b> | <b>Threshold</b>   |
|---|--|
| Primary Instrument                      | ABI  |
| Geographic Coverage/Conditions          | CONUS<br>Full Disk<br>Mesoscale  |
| Vertical Resolution                     | Cloud Top  |
| Horizontal Resolution                   | 2 km   |
| Measurement Accuracy                    | Liquid phase: 4 $\mu\text{m}$ (Day);<br>and maximum of 4 $\mu\text{m}$ or<br>30% (Night).<br><br>Ice phase: 10 $\mu\text{m}$ (Day);<br>and 10 $\mu\text{m}$ (Night). |
| Refresh Rate/Coverage Time              | CONUS: 5 min<br>Full Disk: 15 min<br>Mesoscale: 5 min  |

(CCR 1898)(CCR 3493(RDW))

LIRD120    6.1.2.8

**6.1.2.8 Cloud Top Phase**

LIRD121    6.1.2.8.0-1

The GOES-R System **shall** produce a Cloud Top Phase observational product in accordance with the table below.

| <b>Cloud Top Phase</b>         | <b>Threshold</b>                                      |
|--------------------------------|---|
| Primary Instrument             | ABI   |
| Geographic Coverage/Conditions | CONUS<br>Full Disk<br>Mesoscale                       |
| Vertical Resolution            | Cloud Top   |
| Horizontal Resolution          | 2 km  |
| Measurement Accuracy           | 80% correct classification                            |
| Refresh Rate/Coverage Time     | CONUS: 5 min<br>Full Disk: 15 min<br>Mesoscale: 5 min |

(CCR 1419B)(CCR 3493(RDW))

LIRD122    6.1.2.9

**6.1.2.9 Cloud Top Height**

LIRD123    6.1.2.9.0-1

The GOES-R System **shall** produce a Cloud Top Height observational product in accordance with the table below.

**ID            Object  
Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD123    6.1.2.9.0-1

| <b>Cloud Top Height</b>        | <b>Threshold</b>                                       |
|--------------------------------|--|
| Primary Instrument             | ABI  |
| Geographic Coverage/Conditions | CONUS<br>Full Disk<br>Mesoscale                        |
| Vertical Resolution            | Cloud top  |
| Horizontal Resolution          | CONUS: 10 km<br>Full Disk: 10 km<br>Mesoscale: 4 km    |
| Measurement Accuracy           | 500 m for clouds with<br>emissivity > 0.8              |
| Refresh Rate/Coverage Time     | CONUS: 60 min<br>Full Disk: 60 min<br>Mesoscale: 5 min |

*(CCR 1419B)(CCR 3493(RDW))*

LIRD124    6.1.2.10

**6.1.2.10 Cloud Top Pressure**

LIRD125    6.1.2.10.0-1

The GOES-R System **shall** produce a Cloud Top Pressure observational product in accordance with the table below.

| <b>Cloud Top Pressure</b>      | <b>Threshold</b>                          |
|--------------------------------|---|
| Primary Instrument             | ABI                                       |
| Geographic Coverage/Conditions | CONUS<br>Full Disk                        |
| Vertical Resolution            | Cloud top                                 |
| Horizontal Resolution          | 10 km                                     |
| Measurement Accuracy           | 50 mb for clouds with<br>emissivity > 0.8 |
| Refresh Rate/Coverage Time     | CONUS: 60 min<br>Full Disk: 60 min        |

*(CCR 1419B)(CCR 3493(RDW))*

LIRD126    6.1.2.11

**6.1.2.11 Cloud Top Temperature**

**ID            Object  
              Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD127    6.1.2.11.0-1    The GOES-R System **shall** produce a Cloud Top Temperature observational product in accordance with the table below.

| <b>Cloud Top Temperature</b>   | <b>Threshold</b>                        |
|--------------------------------|---|
| Primary Instrument             | ABI                                     |
| Geographic Coverage/Conditions | Full Disk<br>Mesoscale                  |
| Vertical Resolution            | At cloud tops                           |
| Horizontal Resolution          | 2 km                                    |
| Measurement Accuracy           | 3 K for clouds with<br>emissivity > 0.8 |
| Refresh Rate/Coverage Time     | Full Disk: 15 min<br>Mesoscale: 5 min   |

*(CCR 1419B)(CCR 3493(RDW))*

LIRD128    6.1.2.12

**6.1.2.12 Cloud Type**

LIRD129    6.1.2.12.0-1    The GOES-R System **shall** produce a Cloud Type observational product in accordance with the table below.

| <b>Cloud Type</b>              | <b>Threshold</b>  |
|--------------------------------|---|
| Primary Instrument             | ABI   |
| Geographic Coverage/Conditions | CONUS<br>Full Disk<br>Mesoscale                         |
| Vertical Resolution            | N/A   |
| Horizontal Resolution          | CONUS: 10km<br>Full Disk: 2km<br>Mesoscale: 2 km        |
| Measurement Accuracy           | 60% correct classification                              |
| Refresh Rate/Coverage Time     | CONUS: 30 min<br>Full Disk: 15 min<br>Mesoscale: 15 min |

*(CCR 1419B)(CCR 02169 (RDW))*

LIRD130    6.1.2.13

**6.1.2.13 Convective Initiation**



**ID**      **Object  
Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD131 6.1.2.13.0-1 The GOES-R System **shall** produce a Convective Initiation observational product in accordance with the table below.

| <b>Convective Initiation</b>   | <b>Threshold</b>                 |
|--------------------------------|----------------------------------|
| Primary Instrument             | ABI                              |
| Geographic Coverage/Conditions | CONUS<br>Mesoscale               |
| Vertical Resolution            | N/A                              |
| Horizontal Resolution          | 2 km                             |
| Measurement Accuracy           | 70% correct detection            |
| Refresh Rate/Coverage Time     | CONUS: 5 min<br>Mesoscale: 5 min |

(CCR 1346)(CCR 1425)(CCR 02169 (RDW))

LIRD132 6.1.2.14

**6.1.2.14 Enhanced "V"/Overshooting Top Detection**

LIRD133 6.1.2.14.0-1 The GOES-R System **shall** produce an Enhanced "V"/Overshooting Top Detection observational product in accordance with the table below.

| <b>Enhanced "V"/Overshooting Top Detection</b> | <b>Threshold</b>   |
|--|--|
| Primary Instrument                             | ABI  |
| Geographic Coverage/Conditions                 | CONUS<br>Mesoscale                                       |
| Vertical Resolution                            | N/A  |
| Horizontal Resolution                          | 2 km   |
| Measurement Accuracy                           | 75% correct detection (in terms of 1 – False Alarm Rate) |
| Refresh Rate/Coverage Time                     | 5 min  |

(CCR 1425)(CCR 1898)(CCR 02169 (RDW))

LIRD134 6.1.2.15

**6.1.2.15 Hurricane Intensity**

LIRD135 6.1.2.15.0-1 The GOES-R System **shall** provide ABI L1b data needed to produce hurricane intensity estimates, such as the Advanced Dvorak Technique produces.

| <b>Hurricane Intensity</b>     | <b>Threshold</b>   |
|--------------------------------|--------------------|
| Primary Instrument             | ABI                |
| Geographic Coverage/Conditions | Full Disk          |
| Vertical Resolution            | N/A                |
| Horizontal Resolution          | 2 km               |
| Measurement Accuracy           | 6.5 m/s over ocean |
| Refresh Rate/Coverage Time     | 30 min             |

(CCR 1898)(CCR 03477A)

LIRD136 6.1.2.16

**6.1.2.16 Lightning Detection**

**ID            Object  
                 Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD137    6.1.2.16.0-1

The Product **will** include the collection of Lightning Events, identification of contiguous Events as “Lightning Groups” and events having discrete time and space continuity as “Lightning Flashes.”

The GOES-R System **shall** produce a Lightning Detection observational product in accordance with the table below.

| <b>Lightning Detection</b>     | <b>Threshold</b>            |
|--------------------------------|-----------------------------|
| Primary Instrument             | GLM                         |
| Geographic Coverage/Conditions | Full Disk                   |
| Vertical Resolution            | Surface to cloud top        |
| Horizontal Resolution          | 10 km                       |
| Measurement Accuracy           | 70% total flashes detection |
| Refresh Rate/Coverage Time     | 20 sec                      |

(CCR 1419B)(CCR 1437)

LIRD138    6.1.2.17

**6.1.2.17 Low Cloud and Fog**

LIRD139    6.1.2.17.0-1

The GOES-R System **shall** produce a Low Cloud and Fog observational product in accordance with the table below.

| <b>Low Cloud and Fog</b>       | <b>Threshold</b>      |
|--------------------------------|-----------------------|
| Primary Instrument             | ABI                   |
| Geographic Coverage/Conditions | Full Disk             |
| Vertical Resolution            | 0.5 km (depth)        |
| Horizontal Resolution          | 2 km                  |
| Measurement Accuracy           | 70% correct detection |
| Refresh Rate/Coverage Time     | 15 min                |

(CCR 1425)(CCR 02169 (RDW))

LIRD140    6.1.2.18

**6.1.2.18 Tropopause Folding Turbulence Prediction (CCR 1425)**

LIRD141    6.1.2.18.0-1

The GOES-R System **shall** produce a Tropopause Folding Turbulence Prediction observational product in accordance with the table below.

| <b>Tropopause Folding Turbulence Prediction</b> | <b>Threshold</b>  |
|---|---|
| Primary Instrument                              | ABI   |
| Geographic Coverage/Conditions                  | Full Disk<br>Mesoscale  |
| Vertical Resolution                             | Surface – 100mb   |
| Horizontal Resolution                           | 2 km  |
| Measurement Accuracy                            | 50% correct detection of<br>Moderate or Greater<br>turbulence |
| Refresh Rate/Coverage Time                      | Full Disk: 15 min<br>Mesoscale: 5 min                         |

(CCR 1419B)(CCR 1425)(CCR 02169 (RDW))

**ID            Object  
                 Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD142    6.1.2.19

**6.1.2.19 Visibility**

LIRD143    6.1.2.19.0-1

The GOES-R System **shall** produce a Visibility observational product in accordance with the table below.

| <b>Visibility</b>              | <b>Threshold</b>           |
|--------------------------------|----------------------------|
| Primary Instrument             | ABI                        |
| Geographic Coverage/Conditions | Full Disk                  |
| Vertical Resolution            | N/A                        |
| Horizontal Resolution          | 10 km                      |
| Measurement Accuracy           | 80% correct classification |
| Refresh Rate/Coverage Time     | 60 min                     |

*(CCR 1425)(CCR 02169 (RDW))*

LIRD144    6.1.3

**6.1.3 Precipitation**

LIRD145    6.1.3.1

**6.1.3.1 Probability of Rainfall**

LIRD146    6.1.3.1.0-1

The GOES-R System **shall** produce a Probability of Rainfall observational product in accordance with the table below.

| <b>Probability of Rainfall</b> | <b>Threshold</b> |
|--------------------------------|------------------|
| Primary Instrument             | ABI              |
| Geographic Coverage/Conditions | Full Disk        |
| Vertical Resolution            | N/A              |
| Horizontal Resolution          | 2 km             |
| Measurement Accuracy           | 25%              |
| Refresh Rate/Coverage Time     | 15 min           |

*(CCR 02169 (RDW))*

LIRD147    6.1.3.2

**6.1.3.2 Rainfall Potential**

LIRD148    6.1.3.2.0-1

The GOES-R System **shall** produce a Rainfall Potential observational product in accordance with the table below.

| <b>Rainfall Potential</b>      | <b>Threshold</b>                      |
|--------------------------------|---------------------------------------|
| Primary Instrument             | ABI                                   |
| Geographic Coverage/Conditions | Full Disk                             |
| Vertical Resolution            | N/A                                   |
| Horizontal Resolution          | 2 km                                  |
| Measurement Accuracy           | 5 mm for pixels designated as raining |
| Refresh Rate/Coverage Time     | 15 min                                |

*(CCR 1426A)(CCR 02169 (RDW))*

LIRD149    6.1.3.3

**6.1.3.3 Rainfall Rate/QPE**

**ID            Object  
                 Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD150    6.1.3.3.0-1

The GOES-R System **shall** produce a Rainfall Rate/QPE observational product in accordance with the table below.

| <b>Rainfall Rate/QPE</b>       | <b>Threshold</b>  |
|--------------------------------|---|
| Primary Instrument             | ABI   |
| Geographic Coverage/Conditions | Full Disk   |
| Vertical Resolution            | N/A   |
| Horizontal Resolution          | 2 km  |
| Measurement Accuracy           | 6 mm/hr at 10 mm/hr rate<br>with higher values at<br>higher rates |
| Refresh Rate/Coverage Time     | 15 min  |

*(CCR 1426A)(CCR 3493(RDW))*

LIRD151    6.1.4

**6.1.4 Profiles, Indices, Total Water**

LIRD152    6.1.4.1

**6.1.4.1 Legacy Vertical Moisture Profile**

LIRD153    6.1.4.1.0-1

The GOES-R System **shall** produce a Legacy Vertical Moisture Profile observational product in accordance with the table below.

| <b>Legacy Vertical Moisture Profile</b> | <b>Threshold</b>   |
|---|--|
| Primary Instrument                      | ABI  |
| Geographic Coverage/Conditions          | CONUS<br>Full Disk<br>Mesoscale  |
| Vertical Resolution                     | Reflects layering of<br>numerical weather<br>prediction models;<br>Inherent vertical resolution<br>is only 3 to 5 km |
| Horizontal Resolution                   | 10 km  |
| Measurement Accuracy                    | 20% relative humidity  |
| Refresh Rate/Coverage Time              | Full Disk: 60 min<br>CONUS: 30min<br>Mesoscale: 5 min  |

*(CCR 1346)(CCR 1417)(CCR 3493(RDW))*

LIRD154    6.1.4.2

**6.1.4.2 Legacy Vertical Temperature Profile**

LIRD155    6.1.4.2.0-1

The GOES-R System **shall** produce a Legacy Vertical Temperature Profile observational product in accordance with the table below.

**ID            Object  
                 Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD155    6.1.4.2.0-1

| <b>Legacy Vertical Temperature Profile</b> | <b>Threshold</b>   |
|--|--|
| Primary Instrument                         | ABI  |
| Geographic Coverage/Conditions             | CONUS<br>Full Disk<br>Mesoscale  |
| Vertical Resolution                        | Reflects layering of<br>numerical weather<br>prediction models;<br>Inherent vertical resolution<br>is only 3 to 5 km |
| Horizontal Resolution                      | 10 km  |
| Measurement Accuracy                       | 1 K below 400 hPa and<br>above boundary layer  |
| Refresh Rate/Coverage Time                 | Full Disk: 60 min<br>CONUS: 30 min<br>Mesoscale: 5 min   |

*(CCR 1346)(CCR 1417)(CCR 3493(RDW))*

LIRD156    6.1.4.3

**6.1.4.3 Derived Stability Indices**

LIRD157    6.1.4.3.0-1

The GOES-R System **shall** produce a Derived Stability Indices observational product in accordance with the table below.

| <b>Derived Stability Indices</b> | <b>Threshold</b>   |
|----------------------------------|--|
| Primary Instrument               | ABI  |
| Geographic Coverage/Conditions   | Full Disk<br>CONUS<br>Mesoscale  |
| Vertical Resolution              | N/A  |
| Horizontal Resolution            | Full Disk: 10km<br>CONUS: 10 km<br>Mesoscale: 10 km  |
| Measurement Accuracy             | Lifted Index: 2.0K<br>CAPE: 1000 J/kg<br>Shoemaker index: 2<br>Total totals Index: 1<br>K-index: 2 |
| Refresh Rate/Coverage Time       | Full Disk: 60 min<br>CONUS: 30 min<br>Mesoscale: 5 min   |

*(CCR 1346)(CCR 1417)(CCR 1842A)(CCR 3493(RDW))*

LIRD158    6.1.4.4

**6.1.4.4 Total Precipitable Water**

LIRD159    6.1.4.4.0-1

The GOES-R System **shall** produce a Total Precipitable Water observational product in accordance with the table below.

**ID**      **Object Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD159 6.1.4.4.0-1

| <b>Total Precipitable Water</b> | <b>Threshold</b>  |
|---------------------------------|---|
| Primary Instrument              | ABI   |
| Geographic Coverage/Conditions  | Full Disk<br>CONUS<br>Mesoscale                           |
| Vertical Resolution             | N/A   |
| Horizontal Resolution           | Full Disk = 10 km<br>CONUS = 10 km<br>Mesoscale = 10 km   |
| Measurement Accuracy            | 1 mm  |
| Refresh Rate/Coverage Time      | Full Disk = 60 min<br>CONUS = 30 min<br>Mesoscale = 5 min |

*(CCR 1314)(CCR 1419B)(CCR 1417)(CCR 3493(RDW))*

LIRD162 6.1.5

**6.1.5 Radiances**

LIRD163 6.1.5.1

**6.1.5.1 Clear Sky Masks**

LIRD164 6.1.5.1.0-1

The GOES-R System **shall** produce a Clear Sky Masks observational product in accordance with the table below.

| <b>Clear Sky Masks</b>         | <b>Threshold</b>                                       |
|--------------------------------|--|
| Primary Instrument             | ABI  |
| Geographic Coverage/Conditions | CONUS<br>Full Disk<br>Mesoscale                        |
| Vertical Resolution            | N/A  |
| Horizontal Resolution          | 2 km   |
| Measurement Accuracy           | 87% correct detection                                  |
| Refresh Rate/Coverage Time     | CONUS: 15 min<br>Full Disk: 15 min<br>Mesoscale: 5 min |

*(CCR 1419B)(CCR 3493(RDW))*

LIRD165 6.1.5.2

**6.1.5.2 Radiances**

LIRD166 6.1.5.2.0-1

The GOES-R System **shall** produce a Radiances observational product in accordance with the table below.

**ID            Object  
                 Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD166    6.1.5.2.0-1

| <b>Radiances</b>               | <b>Threshold</b>  |
|--------------------------------|---|
| Primary Instrument             | ABI   |
| Geographic Coverage/Conditions | CONUS<br>Full Disk<br>Mesoscale   |
| Vertical Resolution            | N/A   |
| Horizontal Resolution          | Individual channel<br>resolutions<br>(0.5 km, 1.0 km, and 2.0 km)                               |
| Measurement Accuracy           | 1.0 K equivalent when<br>converted into brightness<br>temperature units for known<br>emissivity |
| Refresh Rate/Coverage Time     | Full Disk: 15 min<br>CONUS: 15 min<br>Mesoscale: 5 min  |

(CCR 1346)(CCR 3493(RDW))

LIRD167    6.1.6

**6.1.6 Radiation**

LIRD168    6.1.6.1

**6.1.6.1 Absorbed Shortwave Radiation: Surface**

LIRD169    6.1.6.1.0-1

The GOES-R System **shall** produce an Absorbed Shortwave Radiation: Surface observational product in accordance with the table below.

| <b>Absorbed Shortwave Radiation: Surface</b> | <b>Threshold</b>  |
|--|---|
| Primary Instrument                           | ABI   |
| Geographic Coverage/Conditions               | Mesoscale   |
| Vertical Resolution                          | N/A   |
| Horizontal Resolution                        | 5 km  |
| Measurement Accuracy                         | 90 W/m <sup>2</sup> at low value (100 W/m <sup>2</sup> ); 45 W/m <sup>2</sup> at mid value (400 W/m <sup>2</sup> ); 55 W/m <sup>2</sup> at high value (800 W/m <sup>2</sup> ) |
| Refresh Rate/Coverage Time                   | 60 min  |

(CCR 1385)(CCR 02169 (RDW))

LIRD170    6.1.6.2

**6.1.6.2 Downward Longwave Radiation: Surface**

**ID            Object  
                 Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD171    6.1.6.2.0-1

The GOES-R System **shall** produce a Downward Longwave Radiation: Surface observational product in accordance with the table below.

| <b>Downward Longwave Radiation: Surface</b> | <b>Threshold</b>                  |
|---|-----------------------------------|
| Primary Instrument                          | ABI                               |
| Geographic Coverage/Conditions              | CONUS<br>Full Disk                |
| Vertical Resolution                         | N/A                               |
| Horizontal Resolution                       | CONUS: 25 km<br>Full Disk: 100 km |
| Measurement Accuracy                        | 25 W/m <sup>2</sup>               |
| Refresh Rate/Coverage Time                  | 60 min                            |

(CCR 02169 (RDW))

LIRD172    6.1.6.3

**6.1.6.3 Downward Shortwave Radiation: Surface (CCR 1385)**

LIRD173    6.1.6.3.0-1

The GOES-R System **shall** produce a Downward Shortwave Radiation: Surface observational product in accordance with the table below.

| <b>Downward Shortwave Radiation: Surface</b> | <b>Threshold</b>   |
|--|--|
| Primary Instrument                           | ABI  |
| Geographic Coverage/Conditions               | CONUS<br>Full Disk<br>Mesoscale  |
| Vertical Resolution                          | N/A  |
| Horizontal Resolution                        | CONUS: 25 km<br>Full Disk: 50 km<br>Mesoscale: 5 km  |
| Measurement Accuracy                         | 85 W/m <sup>2</sup> at high end of<br>range (1000 W/m <sup>2</sup> );<br>65 W/m <sup>2</sup> at typical<br>value/midpoint<br>(350 W/m <sup>2</sup> );<br>110 W/m <sup>2</sup> at low end of<br>range (100 W/m <sup>2</sup> ) |
| Refresh Rate/Coverage Time                   | 60 min   |

(CCR 1385)

LIRD174    6.1.6.4

**6.1.6.4 Reflected Shortwave Radiation: TOA (CCR 1385)**

LIRD175    6.1.6.4.0-1

The GOES-R System **shall** produce a Reflected Shortwave Radiation: TOA observational product in accordance with the table below.



**ID            Object  
Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD175    6.1.6.4.0-1

| <b>Reflected Shortwave Radiation: TOA</b> | <b>Threshold</b>   |
|---|--|
| Primary Instrument                        | ABI  |
| Geographic Coverage/Conditions            | CONUS<br>Full Disk   |
| Vertical Resolution                       | N/A  |
| Horizontal Resolution                     | CONUS: 25 km<br>Full Disk: 100 km  |
| Measurement Accuracy                      | 85 W/m <sup>2</sup> at high end of<br>range (1000 W/m <sup>2</sup> );<br>65 W/m <sup>2</sup> at typical<br>value/midpoint<br>(350 W/m <sup>2</sup> );<br>110 W/m <sup>2</sup> at low end of<br>range (100 W/m <sup>2</sup> ) |
| Refresh Rate/Coverage Time                | 60 min   |

(CCR 1385)

LIRD176    6.1.6.5

**6.1.6.5 Upward Longwave Radiation: Surface**

LIRD177    6.1.6.5.0-1

The GOES-R System **shall** produce an Upward Longwave Radiation: Surface observational product in accordance with the table below.

| <b>Upward Longwave Radiation: Surface</b> | <b>Threshold</b>                  |
|---|-----------------------------------|
| Primary Instrument                        | ABI                               |
| Geographic Coverage/Conditions            | CONUS<br>Full Disk                |
| Vertical Resolution                       | N/A                               |
| Horizontal Resolution                     | CONUS: 25 km<br>Full Disk: 100 km |
| Measurement Accuracy                      | 30 W/m <sup>2</sup>               |
| Refresh Rate/Coverage Time                | 60 min                            |

(CCR 1385)(CCR 02169 (RDW))

LIRD178    6.1.6.6

**6.1.6.6 Upward Longwave Radiation: TOA**

LIRD179    6.1.6.6.0-1

The GOES-R System **shall** produce an Upward Longwave Radiation: TOA observational product in accordance with the table below.

| <b>Upward Longwave Radiation: TOA</b> | <b>Threshold</b>    |
|---------------------------------------|---------------------|
| Primary Instrument                    | ABI                 |
| Geographic Coverage/Conditions        | CONUS<br>Full Disk  |
| Vertical Resolution                   | N/A                 |
| Horizontal Resolution                 | 25 km               |
| Measurement Accuracy                  | 20 W/m <sup>2</sup> |
| Refresh Rate/Coverage Time            | 60 min              |

(CCR 02169 (RDW))

**ID**      **Object  
Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD180 6.1.7      **6.1.7 Trace Gases**

LIRD181 6.1.7.1      **6.1.7.1 Ozone Total**

LIRD182 6.1.7.1.0-1      The GOES-R System **shall** produce an Ozone Total observational product in accordance with the table below.

| <b>Ozone Total</b>             | <b>Threshold</b>   |
|--------------------------------|--------------------|
| Primary Instrument             | ABI                |
| Geographic Coverage/Conditions | CONUS<br>Full Disk |
| Vertical Resolution            | Total column       |
| Horizontal Resolution          | 10 km              |
| Measurement Accuracy           | 15 Dobson Units    |
| Refresh Rate/Coverage Time     | 60 min             |

(CCR 1469)(CCR 02169 (RDW))

LIRD183 6.1.7.2      **6.1.7.2 SO<sub>2</sub> Detection**

LIRD184 6.1.7.2.0-1      The GOES-R System **shall** produce an SO<sub>2</sub> Detection observational product in accordance with the table below.

| <b>SO<sub>2</sub> Detection</b> | <b>Threshold</b>      |
|---------------------------------|-----------------------|
| Primary Instrument              | ABI                   |
| Geographic Coverage/Conditions  | Full Disk             |
| Vertical Resolution             | Total column          |
| Horizontal Resolution           | 5 km                  |
| Measurement Accuracy            | 70% correct detection |
| Refresh Rate/Coverage Time      | 60 min                |

(CCR 1425)(CCR 02169 (RDW))

LIRD185 6.1.8      **6.1.8 Winds**

LIRD186 6.1.8.1      **6.1.8.1 Derived Motion Winds**

LIRD187 6.1.8.1.0-1      The GOES-R System **shall** produce a Derived Motion Winds observational product in accordance with the table below.

**ID            Object  
Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD187    6.1.8.1.0-1

| <b>Derived Motion Winds</b>    | <b>Threshold</b>   |
|--------------------------------|--|
| Primary Instrument             | ABI  |
| Geographic Coverage/Conditions | CONUS<br>Full Disk<br>Mesoscale  |
| Vertical Resolution            | Cloud motion vector<br>winds: At cloud tops;<br>Clear-Sky water vapor<br>winds: 200mb  |
| Horizontal Resolution          | CONUS: 38 km<br>Full Disk: 38 km<br>Mesoscale: 38 km   |
| Measurement Accuracy           | Mean Vector Difference:<br>7.5 m/s   |
| Refresh Rate/Coverage Time     | CONUS: 15 min<br>Full Disk: 60 min (based<br>on a single set of 3<br>sequential images 5 or<br>more minutes apart)<br>Mesoscale: 5 min |

*(CCR 1346)(CCR 1386A)(CCR 1898)(CCR 3493(RDW))*

LIRD188    6.2

**6.2 Observational Requirements: Land**

LIRD189    6.2.1

**6.2.1 Fire/Hot Spot Characterization**

LIRD190    6.2.1.0-1

The GOES-R System **shall** produce a Fire/Hot Spot Characterization observational product in accordance with the table below.

| <b>Fire/Hot Spot Characterization</b> | <b>Threshold</b>                  |
|---------------------------------------|-----------------------------------|
| Primary Instrument                    | ABI                               |
| Geographic Coverage/Conditions        | CONUS<br>Full Disk                |
| Vertical Resolution                   | N/A                               |
| Horizontal Resolution                 | 2 km                              |
| Measurement Accuracy                  | 2.0 K within dynamic<br>range     |
| Refresh Rate/Coverage Time            | CONUS: 5 min<br>Full Disk: 15 min |

LIRD191    6.2.2

**6.2.2 Flood/Standing Water**

LIRD192    6.2.2.0-1

The GOES-R System **shall** produce a Flood/Standing Water observational product in accordance with the table below.

**ID            Object  
                 Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD192    6.2.2.0-1

| <b>Flood/Standing Water</b>    | <b>Threshold</b>           |
|--------------------------------|----------------------------|
| Primary Instrument             | ABI                        |
| Geographic Coverage/Conditions | Full Disk<br>Mesoscale     |
| Vertical Resolution            | N/A                        |
| Horizontal Resolution          | 10 km                      |
| Measurement Accuracy           | 60% correct classification |
| Refresh Rate/Coverage Time     | 60 min                     |

(CCR 1383)(CCR 02169 (RDW))

LIRD193    6.2.3

**6.2.3 Ice Cover (CCR 1418)**

LIRD194    6.2.3.0-1

The GOES-R System **shall** produce an Ice Cover observational product in accordance with the table below.

| <b>Ice Cover</b>               | <b>Threshold</b>      |
|--------------------------------|-----------------------|
| Primary Instrument             | ABI                   |
| Geographic Coverage/Conditions | Full Disk             |
| Vertical Resolution            | N/A                   |
| Horizontal Resolution          | 2 km                  |
| Measurement Accuracy           | 85% correct detection |
| Refresh Rate/Coverage Time     | 180 min               |

(CCR 1418)(CCR 02169 (RDW))

LIRD195    6.2.4

**6.2.4 Land Surface (Skin) Temperature**

LIRD196    6.2.4.0-1

The GOES-R System **shall** produce a Land Surface (Skin) Temperature observational product in accordance with the table below.

| <b>Land Surface (Skin) Temperature</b> | <b>Threshold</b>   |
|--|--|
| Primary Instrument                     | ABI  |
| Geographic Coverage/Conditions         | CONUS<br>Full Disk<br>Mesoscale  |
| Vertical Resolution                    | N/A  |
| Horizontal Resolution                  | CONUS: 2 km<br>Full Disk: 10 km<br>Mesoscale: 2 km   |
| Measurement Accuracy                   | 2.5 K with known<br>emissivity, known<br>atmospheric correction,<br>and 80% channel<br>correlation;<br>5 K otherwise |
| Refresh Rate/Coverage Time             | 60 min   |

(CCR 3493(RDW))

**ID**      **Object  
Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD197 6.2.5

**6.2.5 Snow Cover**

LIRD198 6.2.5.0-1

The GOES-R System **shall** produce a Snow Cover observational product in accordance with the table below.

| <b>Snow Cover</b>              | <b>Threshold</b>                |
|--------------------------------|---------------------------------|
| Primary Instrument             | ABI                             |
| Geographic Coverage/Conditions | CONUS<br>Full Disk<br>Mesoscale |
| Vertical Resolution            | N/A                             |
| Horizontal Resolution          | 2 km                            |
| Measurement Accuracy           | 0.30                            |
| Refresh Rate/Coverage Time     | 60 min                          |

(CCR 1418)(CCR 2417 (RDW))

LIRD199 6.2.6

**6.2.6 Snow Depth (over Plains)**

LIRD200 6.2.6.0-1

The GOES-R System **shall** produce a Snow Depth (over Plains) observational product in accordance with the table below.

| <b>Snow Depth (over Plains)</b> | <b>Threshold</b>   |
|---------------------------------|--|
| Primary Instrument              | ABI  |
| Geographic Coverage/Conditions  | CONUS - tall grassy<br>plains only<br>Full Disk - tall grassy<br>plains only<br>Mesoscale - tall grassy<br>plains only |
| Vertical Resolution             | N/A  |
| Horizontal Resolution           | 2 km   |
| Measurement Accuracy            | 9 cm   |
| Refresh Rate/Coverage Time      | 60 min   |

(CCR 1418)(CCR 02169 (RDW))

LIRD201 6.2.7

**6.2.7 Surface Albedo**

**ID**      **Object  
Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD202    6.2.7.0-1

The GOES-R System **shall** produce a Surface Albedo observational product in accordance with the table below.

| Surface Albedo                 | Threshold           |
|--------------------------------|---------------------|
| Primary Instrument             | ABI                 |
| Geographic Coverage/Conditions | Full Disk           |
| Vertical Resolution            | N/A                 |
| Horizontal Resolution          | 2 km                |
| Measurement Accuracy           | 0.08 (albedo units) |
| Refresh Rate/Coverage Time     | 60 min              |

(CCR 02169 (RDW))

LIRD203    6.2.8

**6.2.8 Surface Emissivity**

LIRD204    6.2.8.0-1

The GOES-R System **shall** produce a Surface Emissivity observational product in accordance with the table below.

| Surface Emissivity             | Threshold |
|--------------------------------|-----------|
| Primary Instrument             | ABI       |
| Geographic Coverage Conditions | CONUS     |
| Vertical Resolution            | N/A       |
| Horizontal Resolution          | 10 km     |
| Measurement Accuracy           | 0.05      |
| Refresh Rate/Coverage Time     | 60 min    |

(CCR 1419B)(CCR 1417)(CCR 02169 (RDW))

LIRD205    6.2.9

**6.2.9 Vegetation Fraction: Green**

LIRD206    6.2.9.0-1

The GOES-R System **shall** produce a Vegetation Fraction: Green observational product in accordance with the table below.

| Vegetation Fraction: Green     | Threshold  |
|--------------------------------|--|
| Primary Instrument             | ABI  |
| Geographic Coverage/Conditions | CONUS<br>Full Disk   |
| Vertical Resolution            | N/A  |
| Horizontal Resolution          | 2 km   |
| Measurement Accuracy           | 0.10 (SZA <55 degrees),<br>0.20 (55 degrees < SZA <<br>70 degrees) |
| Refresh Rate/Coverage Time     | 60 min   |

(CCR 1898)(CCR 1842A)(CCR 02169 (RDW))

LIRD207    6.2.10

**6.2.10 Vegetation Index**

**ID**      **Object  
Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD208    6.2.10.0-1

The GOES-R System **shall** produce a Vegetation Index observational product in accordance with the table below.

| <b>Vegetation Index</b>        | <b>Threshold</b>   |
|--------------------------------|--------------------|
| Primary Instrument             | ABI                |
| Geographic Coverage/Conditions | CONUS<br>Full Disk |
| Vertical Resolution            | N/A                |
| Horizontal Resolution          | 2 km               |
| Measurement Accuracy           | 0.04 NDVI Units    |
| Refresh Rate/Coverage Time     | 60 min             |

*(CCR 1842A)(CCR 02169 (RDW))*

LIRD209    6.3

**6.3 Observational Requirements: Ocean**

LIRD210    6.3.1

**6.3.1 Currents**

LIRD211    6.3.1.0-1

The GOES-R System **shall** produce a Currents observational product in accordance with the table below.

| <b>Currents</b>                | <b>Threshold</b>   |
|--------------------------------|--|
| Primary Instrument             | ABI  |
| Geographic Coverage/Conditions | Full Disk<br>Mesoscale   |
| Vertical Resolution            | Surface  |
| Horizontal Resolution          | 2 km   |
| Measurement Accuracy           | Speed: 1.0 km/hr (0.3 m/s)<br>in both meridional and<br>zonal directions |
| Refresh Rate/Coverage Time     | 6 hr   |

*(CCR 1384)(CCR 1898)(CCR 02169 (RDW))*

LIRD212    6.3.2

**6.3.2 Currents: Offshore**

**ID**      **Object  
Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD213 6.3.2.0-1

The GOES-R System **shall** produce a Currents: Offshore observational product in accordance with the table below.

| <b>Currents: Offshore</b>      | <b>Threshold</b>  |
|--------------------------------|---|
| Primary Instrument             | ABI   |
| Geographic Coverage/Conditions | CONUS and US navigable waters through EEZ<br>Full Disk      |
| Vertical Resolution            | Surface   |
| Horizontal Resolution          | 2 km  |
| Measurement Accuracy           | 1.0 km/hr (0.3 m/s) in both meridional and zonal directions |
| Refresh Rate/Coverage Time     | 180 min   |

*(CCR 1898)(CCR 02169 (RDW))*

LIRD214 6.3.3

**6.3.3 Sea and Lake Ice: Age**

LIRD215 6.3.3.0-1

The GOES-R System **shall** produce a Sea and Lake Ice: Age observational product in accordance with the table below.

| <b>Sea and Lake Ice: Age</b>   | <b>Threshold</b>      |
|--------------------------------|-----------------------|
| Primary Instrument             | ABI                   |
| Geographic Coverage/Conditions | Full Disk             |
| Vertical Resolution            | Ice surface           |
| Horizontal Resolution          | 1 km                  |
| Measurement Accuracy           | 80% correct detection |
| Refresh Rate/Coverage Time     | 6 hr                  |

*(CCR 1418)(CCR 02169 (RDW))*

LIRD216 6.3.4

**6.3.4 Sea and Lake Ice: Concentration**

LIRD217 6.3.4.0-1

The GOES-R System **shall** produce a Sea and Lake Ice: Concentration observational product in accordance with the table below.



**ID            Object  
                 Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD217    6.3.4.0-1

| <b>Sea and Lake Ice: Concentration</b> | <b>Threshold</b>   |
|--|--|
| Primary Instrument                     | ABI  |
| Geographic Coverage/Conditions         | CONUS/Regional – Great Lakes and US coastal waters containing sea ice hazards to navigation<br>Full Disk – Sea ice covered waters in Northern and Southern Hemispheres |
| Vertical Resolution                    | Ice surface  |
| Horizontal Resolution                  | CONUS: 3 km<br>Full Disk: 10 km  |
| Measurement Accuracy                   | Ice concentration – 10%  |
| Refresh Rate/Coverage Time             | CONUS: 180 min<br>Full Disk: 6 hr  |

(CCR 02169 (RDW))

LIRD220    6.3.5

**6.3.5 Sea and Lake Ice: Motion**

LIRD221    6.3.5.0-1

The GOES-R System **shall** produce a Sea and Lake Ice: Motion observational product in accordance with the table below.

| <b>Sea and Lake Ice: Motion</b> | <b>Threshold</b>  |
|---------------------------------|---|
| Primary Instrument              | ABI   |
| Geographic Coverage/Conditions  | Great Lakes and Chesapeake and Delaware Bays<br>Full Disk – Sea ice covered waters in northern and southern hemispheres |
| Vertical Resolution             | N/A   |
| Horizontal Resolution           | CONUS: 5 km<br>Full Disk: 15 km   |
| Measurement Accuracy            | Direction: 22.5°;<br>Speed: 3 km/day  |
| Refresh Rate/Coverage Time      | CONUS: 3 hr<br>Full Disk: 6 hr  |

(CCR 1418)(CCR 02169 (RDW))

LIRD222    6.3.6

**6.3.6 Sea Surface Temperature (skin) (CCR 1378)**

LIRD223    6.3.6.0-1

The GOES-R System **shall** produce a Sea Surface Temperature (skin) observational product in accordance with the table below.

**ID            Object  
                 Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD223    6.3.6.0-1

| <b>Sea Surface Temperature (skin)</b> | <b>Threshold</b>   |
|---------------------------------------|--|
| Primary Instrument                    | ABI  |
| Geographic Coverage/Conditions        | Full Disk  |
| Vertical Resolution                   | N/A  |
| Horizontal Resolution                 | 2 km   |
| Measurement Accuracy                  | 2.1 K with known emissivity, known atmospheric correction, and 80% channel correlation;<br>3.1 K otherwise |
| Refresh Rate/Coverage Time            | Full Disk: 60 min  |

(CCR 1346)(CCR 1378)(CCR 3493(RDW))

LIRD224    6.4

**6.4 Observational Requirements: Space and Solar**

LIRD225    6.4.1

**6.4.1 Energetic Particles (CCR 1419B)**

LIRD226    6.4.1.1

**6.4.1.1 Energetic Heavy Ions**

LIRD227    6.4.1.1.0-1

The GOES-R System **shall** produce an Energetic Heavy Ions observational product in accordance with the table below.

| <b>Energetic Heavy Ions</b>   | <b>Threshold</b> |
|-------------------------------|------------------|
| Primary Instrument            | SEISS            |
| Orthogonality/Coverage        | 1 direction      |
| Vertical Resolution           | N/A              |
| Horizontal/Angular Resolution | N/A              |
| Measurement Accuracy          | 25%              |
| Refresh Rate/Coverage Time    | 5 min            |

LIRD228    6.4.1.2

**6.4.1.2 Magnetospheric Electrons and Protons: Low Energy**

LIRD229    6.4.1.2.0-1

The GOES-R System **shall** produce a Magnetospheric Electrons and Protons: Low Energy observational product in accordance with the table below.

| <b>Magnetospheric Electrons and Protons: Low Energy</b> | <b>Threshold</b> |
|---|------------------|
| Primary Instrument                                      | SEISS            |
| Orthogonality/Coverage                                  | 5 directions     |
| Vertical Resolution                                     | N/A              |
| Horizontal/Angular Resolution                           | N/A              |
| Measurement Accuracy                                    | 25%              |
| Refresh Rate/Coverage Time                              | 30 sec           |

**ID            Object  
                 Number**

**410-R-LIRD-0137, RM Version, Level I Requirements Document**

LIRD230    6.4.1.3

**6.4.1.3 Magnetospheric Electrons and Protons: Medium and High Energy**

LIRD231    6.4.1.3.0-1

The GOES-R System **shall** produce a Magnetospheric Electrons and Protons: Medium and High Energy observational product in accordance with the table below.

| <b>Magnetospheric Electrons and Protons:<br/>Medium and High Energy</b> | <b>Threshold</b> |
|---|------------------|
| Primary Instrument  | SEISS            |
| Orthogonality/Coverage  | 5 directions     |
| Vertical Resolution   | N/A              |
| Horizontal/Angular Resolution   | N/A              |
| Measurement Accuracy  | 25%              |
| Refresh Rate/Coverage Time  | 30 sec           |

LIRD232    6.4.1.4

**6.4.1.4 Solar and Galactic Protons**

LIRD233    6.4.1.4.0-1

The GOES-R System **shall** produce a Solar and Galactic Protons observational product in accordance with the table below.

| <b>Solar and Galactic Protons</b> | <b>Threshold</b> |
|-----------------------------------|------------------|
| Primary Instrument                | SEISS            |
| Orthogonality/Coverage            | 2 directions     |
| Vertical Resolution               | N/A              |
| Horizontal/Angular Resolution     | N/A              |
| Measurement Accuracy              | 25%              |
| Refresh Rate/Coverage Time        | 1 min            |

LIRD234    6.4.2

**6.4.2 Magnetic Field**

LIRD235    6.4.2.1

**6.4.2.1 Geomagnetic Field**

LIRD236    6.4.2.1.0-1

The GOES-R System **shall** produce a Geomagnetic Field observational product in accordance with the table below.

| <b>Geomagnetic Field</b>      | <b>Threshold</b>  |
|-------------------------------|-------------------|
| Primary Instrument            | Magnetometer      |
| Orthogonality/Coverage        | 3-axis 0.5°       |
| Vertical Resolution           | N/A               |
| Horizontal/Angular Resolution | N/A               |
| Measurement Accuracy          | 1.0 nT (per axis) |
| Refresh Rate/Coverage Time    | 2 samples/sec     |

*(CCR 02154 (RDW))(CCR 2312) (CCR 03361C (RDW)) (Note: LIRD236 Geomagnetic Field Product Measurement Accuracy values in existing LIRD CCR-2154 (RDW) reflect currently known and uncorrected bias plus three standard deviations about that bias. LIRD236 applies to a 250 nT field. Measurement accuracy at a 100 nT field will be  $\leq 1.7$  nT. Accuracy performance scales between the 100 nT and 250 nT field. (CCR 03085)) (CCR 03524A (RDW))*

**ID            Object  
                 Number**

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LIRD237    6.4.3            **6.4.3 Solar**

LIRD238    6.4.3.1        **6.4.3.1 Solar Flux: EUV**

LIRD239    6.4.3.1.0-1    The GOES-R System **shall** produce a Solar Flux: EUV observational product in accordance with the table below.

| <b>Solar Flux: EUV</b>        | <b>Threshold</b>       |
|-------------------------------|------------------------|
| Primary Instrument            | EXIS                   |
| Orthogonality/Coverage        | Solar Disk (40 arcmin) |
| Vertical Resolution           | N/A                    |
| Horizontal/Angular Resolution | N/A                    |
| Measurement Accuracy          | ± 20%                  |
| Refresh Rate/Coverage Time    | 30 sec                 |

LIRD240    6.4.3.2        **6.4.3.2 Solar Flux: X-Ray**

LIRD241    6.4.3.2.0-1    The GOES-R System **shall** produce a Solar Flux: X-Ray observational product in accordance with the table below.

| <b>Solar Flux: X-Ray</b>      | <b>Threshold</b>       |
|-------------------------------|------------------------|
| Primary Instrument            | EXIS                   |
| Orthogonality/Coverage        | Solar Disk (40 arcmin) |
| Vertical Resolution           | N/A                    |
| Horizontal/Angular Resolution | N/A                    |
| Measurement Accuracy          | ± 20%                  |
| Refresh Rate/Coverage Time    | 10 sec                 |

LIRD242    6.4.3.3        **6.4.3.3 Solar Imagery: EUV (CCR 2164)**

LIRD243    6.4.3.3.0-1    The GOES-R System **shall** produce a Solar Imagery: EUV observational product in accordance with the table below.

| <b>Solar Imagery: EUV</b>     | <b>Threshold</b>      |
|-------------------------------|-----------------------|
| Primary Instrument            | SUVI                  |
| Orthogonality/Coverage        | 0.0 - 1.3 Solar Radii |
| Vertical Resolution           | N/A                   |
| Horizontal/Angular Resolution | 7.0 arcsec            |
| Measurement Accuracy          | ± 40% in radiance     |
| Refresh Rate/Coverage Time    | Image: < 2 min        |

(CCR 1766)(CCR 2164)(CCR 03188)