TECHNICAL GUIDANCE
FOR CWRS ACCORDING TO THE COUNCIL REGULATION (EC) 1306/2013 (ARTICLES 6(B), 21) AND ITS IMPLEMENTING REGULATIONS NO. 908/2014 (ARTICLE 26), NO. 809/2014 (ARTICLES 24, 38, 39, 40), NO. 2333/2015, AND FOR THE LPIS QA THE DELEGATED

VHR IMAGE ACQUISITION SPECIFICATIONS
CAMPAIGN 2018

Text highlighted in YELLOW contains changes from 2017

<table>
<thead>
<tr>
<th><strong>Author:</strong></th>
<th>Pär Johan ÅSTRAND</th>
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<tbody>
<tr>
<td><strong>Co-authors:</strong></td>
<td>Blanka VAJSOVA, Csaba WIRNHARDT, Giovanni DI MATTEO, Juergen BREUNIG, Slavko LEMAJIC, Agnieszka WALCZYSKA, Susanne HAIN, Angsar KORNHOFF, Melanie RANKL, Tine FLINGELLI</td>
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<td><strong>Approved:</strong></td>
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<tr>
<td><strong>Date:</strong></td>
<td>05/01/2018</td>
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<td><strong>Int. ref:</strong></td>
<td><a href="http://ies-intranet/h04/apps/Chrono/22345.docx">http://ies-intranet/h04/apps/Chrono/22345.docx</a>, earlier years <a href="http://ies-intranet/h04/apps/Chrono/21955.docx">http://ies-intranet/h04/apps/Chrono/21955.docx</a>, profiles: <a href="http://ies-intranet/h04/apps/Chrono/21615.xls">http://ies-intranet/h04/apps/Chrono/21615.xls</a></td>
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<tr>
<td>1.0</td>
<td>01/05/2008</td>
<td>1st release includes updates of 2007 specifications (FMP 7528) incorporating exclusion of OrbView3, changes to EROS8, changes to Formosat2, inclusion of WorldView1, backup procedure changes, image return etc.</td>
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<td>12/03/2009</td>
<td>Updates on GeoEye-1</td>
<td>Image Providers</td>
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<td>1.31</td>
<td>23/03/2009, 02/04/2009, 22/06/2009</td>
<td>Administrative routines, image return, change on EROS B, and SPOT backup; Final check, minor corrections on Image return, and GE1 sw suites;</td>
<td>PA, ME, CA</td>
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<tr>
<td>2.0</td>
<td>01/05/2010</td>
<td>New edits 2010: WV1, WV2, copyrights</td>
<td>EUSI, PA</td>
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<tr>
<td>3.0 - 3.1</td>
<td>10/02/2011, 25/02/2011</td>
<td>Update of document for the 2011 Campaign: intro. of auto-backup, intro. of new backup approach, elevation angle restrictions, introduction of 2010 years edits including WV2 (ref doc JRC IPSC/G03/C/PAR/par (2010)(11936)), introduction of the THEOS sensor, invoicing issues, other miscellaneous (e.g. sensor formats, zones: no 500/5 km rule on shapes); all edits in RED.</td>
<td>PA</td>
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<tr>
<td>3.2</td>
<td>05/03/2011</td>
<td>Further updates according to EG, BW (minor clarifications, and edit to pricing issue), updates on LioDotNet by EG (e.g. upload with shapefile , plus minor other changes); introduction of checksum by Image Providers and Contractors to be able to check correct image data delivery by FTP (AB)</td>
<td>EG, BV, SG, AB</td>
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<td>3.3</td>
<td>13/03/2011</td>
<td>Clarifications on data return, introduction of functional email LioDotNet, ref. THEOS FWC no., and THEOS products, elevation angle clarifications, clarifications upon EUSI input 10/3/2011 (e.g. inserted WV2 tiling options, deleted minimum width of an AOI, clarification on feasibility iterations, and references on benchmarks inserted).</td>
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<td>3.31</td>
<td>17/03/2011</td>
<td>Grammatical edits and minor clarification on elevation angle and Image Data Access.</td>
<td>CA, PA</td>
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<td>3.32</td>
<td>04/04/2011</td>
<td>Accept of Image Providers: EUSI (no further input); e-GEOS (Minor corrections allowing PAN to be prime upon MS request with a possible additional HR/VHR if requested). Renumbering of erroneously numbered chapters</td>
<td>MW, BB, RN, (Image Providers)</td>
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<td>4.0</td>
<td>20/10/2011</td>
<td>New version for 2012 and future: Constellation tasking, feasibility categories, elevation angle thresholds for LPIS and for hilly/mountainous control zones, no dedicated VHR backup, tiling, LioDotNet upgrades on zone definition parameters and on ordering. Moreover some chapters have been rearranged to avoid repetitions (e.g. the sensor zone description chapter has been moved to be together with the sensor product description)</td>
<td>PA</td>
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<td>4.1</td>
<td>21/11/2011</td>
<td>Introduction of Constellation WV2 and WV1. Update on chapter on Feasibility. Updates on F2, Theos products.</td>
<td>PA, BB, MW</td>
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<td>4.2</td>
<td>16/12/2011</td>
<td>Inputs after Tallinn Conference Nov 2011 - e-GEOS (elevation angle typo, on copyright text, GE1 specs, IK2 specs), EUSI (recommendation is to keep shapes of simple shape but no compulsory limit, QB may be chosen as prime, QB tiling).</td>
<td>PA, AO, ES</td>
</tr>
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<td>4.3</td>
<td>26/10/2012</td>
<td>Updates on Unit name; Introduction of the new VHR sensor - Pleiades (PL1); Updates on zone parameters; Updates on speculative backup; Updates on licensing text</td>
<td>EG, BV, PA</td>
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<td>5.0</td>
<td>10/02/2013</td>
<td>Rework of document to fit the Framework Contract for supply of Satellite Remote Sensing (SRS) data and associated services in support to checks within the Common Agricultural Policy (CAP) - Very High Resolution (VHR) sensor independent profile</td>
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<td>5.1</td>
<td>26/03/2013</td>
<td>Edits after CID-IAT, and AB input on 5.0: roles of stakeholders, and other edits on Zone parameters, Acquisition Window (AW), Feasibility, Delivery Image Data Return, and VHR Profile sensors.</td>
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<td>Check, acceptance, and insertion of certain elements regarding iteration of specified area/shapefile/corrections; update of profiles, and complete check of document for the 2015 Campaign</td>
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<td>7.7</td>
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<td>7.8</td>
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<td>29/02/2016</td>
<td>Final version after MS Administrations and their Contractors input and LPIS A5 issue update (§ 12.1.3 and Table 1 p28)</td>
<td>JRC (PA, JB, GDM, BV, CW)</td>
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<td>15/03/2016</td>
<td>Final version after EUSI input on above, and on % of A5/A2 (§4.1.7-8); JRC edits in dense haze flag (becomes dense haze/snow/flood flag or meteo flag §7.1.8).</td>
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<td>JRC (PA, JB, GDM, BV, CW)</td>
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<td>9.1</td>
<td>13/03/2017</td>
<td>JRC final check, and edits on e.g. feasibility, and profiles</td>
<td>JRC (PA, JB, GDM, BV, CW)</td>
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<td>9.3</td>
<td>29/03/2017</td>
<td>Delete column rmse error to be proven in benchmark (table 1); and error in 12.1.4 75cm. Finalization of Feasibility section after having concluded Feasibility module development in G4CAP</td>
<td>JRC (PA, JB, GDM, BV, CW)</td>
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<td>9.4</td>
<td>17/10/2017</td>
<td>Added Details on buffer around zones, AComp possibility, procedure with an exchange of letters, pre-image request chapter, LPIS separate chapter, image return (source). Update of profile characteristics, zone and AW parameters, link on Digital Globe’s archive, copyrights (WV4 added, EROS B deleted), references (WV4 and S2B added), XML metadata file structure.</td>
<td>JRC (PA, JB, GDM, BV, CW) / EUSI</td>
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<td>9.5</td>
<td>13/11/2017</td>
<td>LPIS Chapter updated, Invoice Chapter updated</td>
<td>JRC (SL, PA, GDM, CW, BV)</td>
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Authors acronyms

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<tr>
<td>AB</td>
<td>Armin Burger</td>
<td>JRC</td>
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<tr>
<td>AK</td>
<td>Ansgar Kornhoff</td>
<td>EUSI</td>
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<td>AO</td>
<td>Axel Oddone</td>
<td>e-Geos</td>
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<td>BB</td>
<td>Bruno Biagini</td>
<td>e-Geos</td>
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<td>BV</td>
<td>Blanka Vajsova</td>
<td>JRC</td>
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<td>SO</td>
<td>Susanne Oberdorf, now Hain</td>
<td>EUSI</td>
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## Abbreviations, Acronyms and Terms

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<th>Abbreviation/Term</th>
<th>Explanation</th>
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<tr>
<td>AOI</td>
<td>Area Of Interest (of a control zone)</td>
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<tr>
<td>AR(s)</td>
<td>Acquisition Request(s); a Closed AR is an AR that has one of the following status Accepted/Full, Accepted/Partial or Failed</td>
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<tr>
<td>AR ID</td>
<td>Identifier of an Acquisition Request</td>
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<td>AW</td>
<td>Acquisition Window (AW)</td>
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<td>CA</td>
<td>Contracting Authority</td>
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<td>CAP</td>
<td>Common Agricultural Policy</td>
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<td>CAPI</td>
<td>Computer Assisted Photo Interpretation</td>
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<td>CC</td>
<td>Cloud Cover</td>
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<td>CD</td>
<td>Calendar days (working days is throughout this document calculated as calendar days minus weekends (national holidays are not taken in account))</td>
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<td>CFT</td>
<td>Call for Tender</td>
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<td>CID portal</td>
<td>Community Image Data portal</td>
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<td>Contractor</td>
<td>A Contractor of the MS Administration responsible for the CAP subsidy diagnosis of the MS using the SRS imagery; not to be confused with the Successful Tenderer (ST) of the Framework Contract (FWC) signed in [ref. 6]</td>
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<tr>
<td>COTS</td>
<td>Commercial Off-The-Shelf software</td>
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<td>CTS</td>
<td>Common Technical Specifications</td>
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<td>CwRS</td>
<td>Control with Remote Sensing</td>
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<td>DEM</td>
<td>Digital Elevation Model</td>
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<td>DG AGRI</td>
<td>The Directorate General for Agriculture and Rural Development</td>
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<tr>
<td>DRA</td>
<td>Dynamic Range Adjustment</td>
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<td>EC</td>
<td>European Commission</td>
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<td>EC Services</td>
<td>In this text: Joint Research Centre of the European Commission</td>
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<td>EFA</td>
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<td>European Petroleum Survey Group</td>
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<td>EULA</td>
<td>End User Licence Agreement</td>
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<td>Framework Contract(s)</td>
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<td>FWC</td>
<td>Framework Contract</td>
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<td>G4CAP</td>
<td>Final evolution of *LIO systems, available from August 2015 onwards</td>
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<tr>
<td>GAEC</td>
<td>Good Agricultural and Environmental Condition (CAP Cross Compliance)</td>
</tr>
<tr>
<td>GCP</td>
<td>Ground Control Point</td>
</tr>
<tr>
<td>GEO/GEOSS</td>
<td>Group on Earth Observations / Global Earth Observation System of Systems</td>
</tr>
<tr>
<td>GSD</td>
<td>Ground Sampling Distance, the nominal size of one sensor pixel projected onto the imaged surface</td>
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<tr>
<td>HR</td>
<td>High Resolution (SRS imagery) - used also as generic term for high resolution imagery in this document</td>
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<td>HHR</td>
<td>High High Resolution (SRS imagery)</td>
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<tr>
<td>IACS</td>
<td>Integrated Administration and Control System (CAP)</td>
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<tr>
<td>Abbreviation/Term</td>
<td>Explanation</td>
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<tr>
<td>ICP</td>
<td>Independent Check Point (used in ortho image external QC)</td>
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<td>ICT</td>
<td>Information and Communication Technology</td>
</tr>
<tr>
<td>IDQA</td>
<td>Input Data Quality Assessment</td>
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<tr>
<td>IES</td>
<td>Institute for Environment and Sustainability, Joint Research Centre</td>
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<tr>
<td>INSPIRE</td>
<td>Infrastructure for Spatial Information in the European Community</td>
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<td>IP(s)</td>
<td>Image Provider(s), in this document considered the successful FW Contractor or successful consortium of Image Providers who has signed a FC with the JRC as of [ref. 6]</td>
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<td>Joint Research Centre of the EC</td>
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<td>LD</td>
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<td>LF</td>
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<td>LioDotNet, G-LIO.NET, NG-LIO.NET, G4CAP</td>
<td>JRC Web-based software for the management of image acquisitions</td>
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<td>LPIS</td>
<td>Land Parcel Identification System</td>
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<td>Land Parcel Identification System Quality Assurance</td>
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<td>Monitoring Agricultural ResourceS Unit, JRC IES</td>
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<td>Member State(s)</td>
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<td>MS Administrations (of Contractors)</td>
<td>MS Administrations or appointed contractor/s of the MS Administration responsible for the CAP subsidy diagnosis using the SRS imagery delivered by the EC Services.</td>
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<td>RMSE</td>
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1. Introduction

1.1. VHR Image Acquisition for the CAP checks programme

1.1.1. Since 1993, DG AGRI has promoted the use of “Controls with Remote Sensing” (CwRS) as an appropriate control system suitable for checking whether aids are correctly granted. The legal basis of the CwRS is the Council Regulation (EC) 1306/2013 (Articles 6(b), 21) and in its implementing regulations No. 908/2014 (Article 26), No. 809/2014 (Articles 24, 38, 39, 40), and No. 2333/2015 [ref. 1]. On this basis the Commission Services are required to centralize the Satellite Remote Sensing (SRS) image acquisition. This task was transferred to DG JRC in 1998 (September 1998/VI/34942) and it is managed through a horizontal co-delegation (Type I) between DG AGRI/DG JRC (via DG BUDG) (ref. Ares[2015]1215220) to implement the yearly CAP image acquisition work programme.

1.1.2. Regards to timing of the operations the Commission Implementing Regulation (EU) No 908/2014, mentioned above, its art 26 says:
1. For the purposes of Article 21 of Regulation (EU) No 1306/2013, each Member State shall inform the Commission by 1st November of each year at the latest, as to: (a) whether it wishes the Commission to acquire the satellite images necessary for its programme of checks and/or for its Land Parcel Identification System Quality Assessment; (b) the area to be checked and the number of planned control zones.
2. Member States requesting the Commission to obtain the satellite images shall finalize, in cooperation with the latter and before 15 January, following the communication of information referred to paragraph 1, the zones to be covered and the timetable for obtaining those images.

1.1.3. Following the real time evaluation in 2003 and the successful operational application since 2004, DG JRC, in agreement with DG AGRI, continues to supply Very High Resolution (VHR) SRS imagery, to the Member States’ (MS) Administrations for their CwRS of area-based subsidies.

1.1.4. Since 2010, DG AGRI calls for a yearly LPIS Quality Assurance (LPIS QA). Reference is made to the legal basis for the LPIS QA, given in Delegated Regulation (EU) No 640/2014 (Article 6). Specific VHR imagery satisfying the technical LPIS QA recommendations e.g. including specific conditions of elevation angle, and CC (see Chapter 13.2) is acquired for this purpose (see further §3.1.2 below and [ref. 3]).

1.1.5. As from the 2014 Campaign the detailed management of VHR image acquisitions - to cover the correct areas at the correct times of the growing season required for the CAP checks - has passed to industry to act within quality specifications managed by the JRC. This choice has been made since there are today several suppliers of SRS imagery that have a proven competency in supplying the JRC efficiently with the SRS data needed for the CAP checks.
1.1.6. There may be one or more FW Contractor appointed by the Contracting Authority (CA) JRC, to perform above task. In these specifications the Image Provider (IP) therefore refers to the FW Contractor with whom the JRC has signed a Framework Contract (FWC) [ref. 6].

1.2. Objectives, referencing and structure of this document

1.2.1. This document constitutes the VHR profile-based specifications to be used within the CAP checks programme (CwRS and LPIS QA). Its objective is to give the stakeholders\(^1\) in the image acquisition process clarity in the technical details of the process and describes the process flow starting from zone definition, through the image use, reaching image return and possible re-use of imagery at end of the Campaign (see Figure 1).

1.2.2. The JRC has an overarching role as responsible for the well-functioning of the framework contracts, and of the Quality Control (QC) of the operations, while most of the interaction necessary within the image acquisition process takes place between the FW Contractor and the MS Administrations (or Contractors) performing the CAP checks. These specifications intend to describe these interactions.

1.2.3. This document is available in the Documentation section of G\(^4\)CAP Web application [ref. 11].

1.2.4. Several references are made here: to the Common Technical Specifications (CTS) for the Remote Sensing Controls of area-based subsidies and relevant guidance documents found at the MARS WikiCAP [ref. 2], to the Guidelines for Best Practice and Quality Checking of Ortho Imagery [ref. 4], and to the HR profile-based specifications [ref. 5] that shall be used in conjunction with the present document. Reference is also made to the terms and conditions of the Framework Contracts (FWCs) for image procurement to the EC Service [ref. 6].

\(^1\) stakeholders, or actors, are the JRC, the DG AGRI, the FW Contractor acting as IPs and operators and the Member State (MS) Administrations (or their contractor) performing the CAP Checks.
1.2.5. In the following Figure, we are representing in a graphical way the overall process of the SRS image acquisition process, split in macro-actions and colored in function of the type of user responsible for the single macro-action. This document tries to follow the same flow as the one depicted here after.

![Diagram of G4CAP process](image)

**Figure 1**: Figure showing structure of this document and the SRS image acquisition process

1.3. **G4CAP**

1.3.1. *LIO systems, that were born in 2005 to manage the CwRS Campaigns online, have been replaced in 2015 by G4CAP system, a Web application that is kept updated and constantly improved by the JRC to enhance the daily work of the campaign stakeholders and in line with the CAP needs evolution.

1.3.2. G4CAP is the Web-based application used to manage the whole campaign workflow. Its functionalities are described in its manual, available on-line at the G4CAP Web site under the Documentations Tab. [ref. 11, 12]. G4CAP is also the main communication tool between the CAP checks actors during the Campaign: its automatic e-mail notifications are used to synchronize actions between different actors.

1.3.3. It is compulsory to use G4CAP by all the stakeholders involved in the CAP checks.
2. **Pre-Image Request**

2.1.1. All MS Administrations participating in the CAP checks Campaign shall insert in the Pre-IRs module of G^4^CAP their forecasted requests for imagery for the Campaign to be started. This input provides the EC Services information on:
- basic OTS information;
- basic CwRS information;
- details on foreseen CwRS methods, with relevant justifications;
- VHR/HR profiles requests (for each type of profile see chapter 13, and [ref. 5]).

2.1.2. In accordance with Regulation (EU) No 908/2014; Art 26 (see 1.1.2), each Member State shall finalize insertion of the Pre-IRs request by 1st November before the campaign to be started.

2.1.3. Imagery will only be allocated if MS Administrations justify their image choice needed for effective CAP checks. The JRC will use inserted information to efficiently model image allocation. This will be done to fit established budgetary envelope (indices such as efficient image use, and fair image cost/OTSC area are used).

2.1.4. It is strongly advised that the MS Administration refers to G^4^CAP in-line help (information and tip-over) as pre-IRs is inserted, and also refer to the instructions given in Chapter 4 Feasibility.

2.1.5. The JRC recommendation is to use 1 VHR and 1 to maximum 3 HR (plus any number of S2) but exceptions to this rule may occur: the methodology must be justifiable by the MS Administrations in pre-IRs module.

2.1.6. The JRC also recommends to substitute any need of a second VHR window with a VHR Aerial, or with a fixed HHR window (placing earliest and latest start date to be the same) and giving suitable window length (e.g. 6 weeks).

3. **Data requests**

3.1. **General**

3.1.1. The regulatory basis for the CwRS programme (see Chapter 1.1.1) allows MSs to use remote sensing techniques as a mean of carrying out On The Spot checks (OTSC) on agricultural parcels. Guidance to this Regulation is given in the document “Guidance for on the-spot checks and area measurement” [ref. 2], which describes that a "control zone" is a geographical area defined on the basis of GIS analysis, taking account of technical constraints (e.g. standard satellite “scenes”). These technical constraints, which are further detailed below, include swath widths, elevation angles, Area Of Interest (AOI) definition, AW adjustments, feasibility assessment, etc.

3.1.2. The Regulation (see 1.1.4) also calls for a yearly LPIS Quality Assurance (QA) [ref.3]. Specific VHR imagery is acquired during the CwRS Campaign for this QA exercise (see chapter 13.2). In addition, MS Administrations not

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2 Special profiles may be asked from the JRC; these will allow elevation angle uplift or certain GSD requirement [e.g. VHR+ Topographic, or VHR_EFA_LF etc.], or [8/16 bands and pan bundle data], but MS Administrations will need to justify such option in detail. See Chapter 13.
participating in the CwRS programme can obtain specific acquisitions for LPIS assessment through the EC Services.

3.1.3. The MS Administration (or contractor), the FW Contractor, and the JRC obligatorily need to name at least one contact person (or functional e-mail address) to be used for interfacing with each other regarding the issues listed above and in all other communication during the Campaign. For any changes of contact persons the stakeholder shall contact the EC Services.

3.1.4. In accordance with Regulation (EU) No 908/2014; Art 26, each Member State shall finalize their Image Requests in G²CAP before the 15th of January providing all parameters (zone and acquisition window (AW)s parameters) necessary for image acquisition initialization.

3.1.5. As the MS Administrations finish insertion of their Image Requests, the FW Contractor will start feasibility assessment. The FW Contractors are responsible for checking completeness of MS inserted parameters, and report to the EC Services if any error or incongruence is discovered before start. After EC Services validation, the zones and acquisition windows parameters lie as basis for the feasibility assessment and the image acquisition.

3.2. Zone definition

3.2.1. A CAP control zone (or AOI) consists of a minimum of 4 and a maximum of 999 vertices in Lat/Long Geographic coordinates (decimal degrees, WGS 84 ellipsoid), represented by a shapefile containing all files with extensions .shp, .shx, .dbf, .sbx, .sbn, .prj and should be provided by the MS Administration to the FW Contractor. The MS Administration should strive to make shapefiles of simple, regular shapes and to avoid creating too narrow corridors (e.g. < 5km width since FW Contractor is not obliged to deliver bigger area to enable a smooth orthorectification of an image). There is no regulatory minimum distance between vertices of the shape file. The MS Administration should however strive to create the simplest suitable zone, which shall have a minimum size of 100km².

3.2.2. EC Services will reject Zones shapefiles if they:

- overlap within the MS (only in exceptional cases, e.g. the control schemes/measures over the overlapping area are different and require separate AW(AW)s like crops for vineyards, may this be allowed);
- overlap with adjoining MS borders (this includes MS Regions handling CAP claims individually e.g. Scotland/England/Wales);
- cover large amounts of mountainous or other non-agricultural areas;
- stretch into coastal waters;
- have more than 1000 vertices;
- contain corridors narrower than 5km.

3.2.3. MS having selected control zones in a topographically ‘difficult’ terrain shall consider a buffer around their zones of at least 0.2km (in extreme hilly terrain 0.5km are recommended), depending on topography, to ensure complete coverage of zone after orthorectification. This is due to the fact that the FW Contractor delivers Ortho Ready Standard products that are georeferenced to the average base height of a given area of interest (AOI), and there could therefore be a horizontal offset for each individual pixel depending on the height difference between the actual local height of the pixel and average base height of the AOI, which therefore in
orthorectification may cause further “shift” due to topography. It is therefore highly recommended to consider a sufficient buffer around an AOI to ensure that the AOI is still completely covered with satellite data after orthorectification. The required buffer (equal to the max horizontal offset) can be calculated as follows, taking into account the terrain differences inside the AOI, as well as the minimum allowable satellite elevation angle:

$$\frac{H_{\text{max}} - H_{\text{average}}}{\tan(ELA_{\text{min}})}$$

[maximum possible height difference of the local height to the average base height of the AOI] / TANGENS [min allowable SatElevation]

Please take care to calculate the average base height from the height of all pixels inside the AOI (not just taking highest and lowest height inside the AOI/2). See Annex 19.2 for detailed examples and downloadable excel sheet from G4CAP Documentation section for your own calculations.

3.2.4. In summary, the relevant zone parameters in G4CAP are:

- control zone shapefile (specifications as described above);
- zone name (≤ 5 characters), it needs to be unique for the whole Campaign and shall not include special country-specific characters like é, Ç etc. (i.e. only ISO basic Latin characters and numbers allowed);
- zone (AOI) area (rounded to whole km², UTM) in accordance with the shapefile area;
- optionally - EPSG code (final output national projection used by the MS). It is at this time only relevant for HR image acquisition if HHR ORTHO profile is requested (i.e. the HHR F2 profile).

3.3. Acquisition window (AW) definition

3.3.1. There can be either one or two VHR image AWs (VHR1 and/or VHR2 Periods) defined for each CAP control zone. These AWs will be defined by the MS Administrations and will be scheduled suitable for the measurement and CAPI of the largest number of agricultural parcels possible. Exact dates will depend on crop cycle and will vary with latitude. The programming of the second AW depends on available budget, and is determined by the JRC at the Pre-IRs stage or, latest, at Image requests definition stage (see §2.1.2).

3.3.2. As imagery is acquired, depending on the sensor’s technical characteristics, the AW’s zone is gradually covered entirely or partially. The FW Contractor, who is responsible for the implementation of an efficient image acquisition set-up, always aims to cover the zone in as few acquisitions as possible, but multi-temporal collection is considered valid, if performed within the time limit of the acquisition window (AW). Such multi-temporal acquisitions should be as close as possible in time to favor crop interpretation (CAPI), i.e. “multi-temporality” should be as short as possible.

3.3.3. MS Administrations will request a VHR prime profile to be used to cover the zone. The MS Administration could have to accept a less strict profile after feasibility, and/or also agree to a backup profile for best acquisition success chance (see Chapter 4 - Feasibility assessment). The FW Contactor will programme within agreed AW to cover the control zone efficiently.
3.3.4. The AW’s zone may be covered by multiple sensors fitting the profile selected by the MS Administration (i.e. multi-sensor and multi-temporal acquisitions are allowed). The FW Contractor will task the sensors in an optimal manner to complete the zone as soon as possible with any of the sensors within the AW agreed. It has been proven in earlier Campaigns that multiple sensor tasking has given an efficiency gain to complete zones faster, i.e. a reduction of the acquisition time by adding satellite capacity. Moreover, it has also been proven that there will be more chances that a second acquisition is closer in time to the first acquisition, i.e. less multi-temporality.

3.3.5. In case a MS Administration accepts a VHR backup profile, a successful backup, if acquired, will be proposed to the MS Administration (or Contractor). As long as the MS Administration (or Contractor) does not accept this image, the Contractor will continue in an optimal manner to program the prime profile until the end of the acquisition window (AW). If, on the other hand, the MS Administration (or Contractor) accepts the backup collection, programming of the prime profile for the relevant zone will be closed. If the AW comes to an end without any prime profile acquisitions (or a partial one only), the MS Administration (or contractor) can either accept the backup for the missing part in case a partial image is available, or ask for further extension of the prime profile acquisition window (AW). After maximum extension possible for the positive outcome of the MS Administration’s CAP checks, the MS Administration will need to accept not only the acquisitions made by the prime but also the backup.

3.3.6. When completing any AW for a zone, the FW Contractor shall guarantee an overlap (E-W or N-S) between subsequent acquisitions or strips, of a minimum of 0.5km. Moreover, there shall be an overlap of a minimum of 0.5km between any partial acquisitions between different sensors. Such overlap is necessary for the orthorectification process.

3.3.7. The VHR zone in a relevant AW will be covered either by a bundle product (PAN and MSP as separate bands), or the pansharpened product ⁴, or the PAN only product. If the profile A4 (VHR Stereo) is requested, a stereo product will be delivered.

3.3.8. It is recommended to try to avoid defining many zones with profiles with elevation angle restriction close to each other, as this decreases satellite capacity and will risk that no acquisition is made within AW.

3.3.9. The VHR1 and/or VH R2 Periods should be preferably 8 weeks long but never shorter than 6 weeks (42 calendar days).

3.3.10. If the day before a VHR AW is going to open, the previous HR AW is still open, the HR AW will be closed automatically. Communication on the closure is made via G²CAP.

3.3.11. When defining the VHR1 and VH R2 AWs the MS Administrations shall keep in mind that the final AW might need to be longer, compared to the initial requested one, to make an acquisition feasible. It shall also be taken into account that a potential shift of the VHR1 AW end date may occur, and the subsequent AW start may need to be shifted.

3.3.12. If extraordinary weather conditions prevail in any region, an AW may change (opening and closing dates will move). This will be dealt with on a case-by-case basis. Such AW dates changes should occur in very rare cases.
Notice shall be given by the MS Administration (or Contractor) to the FW Contractor at the latest 2 weeks before scheduled opening.

3.3.13. It is not useful to open an AW too early in the season as the sun angle is generally low and the crops may not have developed sufficiently to provide a scene with adequate contrast for a good delineation of the parcels. It is suggested not to open any AW when sun angle is still below 20 deg., in order to ensure sufficient contrast and to minimize the effect of shadows.

3.3.14. Conversely, this is also true for late start dates of the VHR2 AW, where the sun elevation could drop below 20 degrees again.

3.3.15. If a VHR profile sensor (see Chapter 13.1.2) acquires imagery late in the acquisition window (AW), the MS Administration may request an archive search for an earlier HR sensor acquisition within the acquisition window (AW). In this case, the FW Contractor shall contact the JRC who will (or will not) give clearance. This obligatorily needs to be communicated between the FW Contractor. It is however strongly advised to use Copernicus Sentinel 2 (S2) imagery.

3.3.16. The MS Administrations (or Contractors) have the possibility to ‘pre-extend’ acquisition windows (AWs). This ‘pre-extension’ can be used on any acquisition window that has not opened yet, in case an acquisition window needs to be shifted to an earlier start date than agreed during the feasibility process. No extra feasibility (see Chapter 4) has to be performed by the FW Contractor since the end date of the window remains as agreed, while the start date is set to an earlier date (according to the request from the MS Administration (or Contractor), resulting in an overall longer acquisition window. The option to ‘pre-extend’ an acquisition window should be used carefully by the MS Administrations (or Contractors), whenever the weather conditions and CAP checks method allow for such change. The FW Contractor shall be notified in due time (e.g. 5 days to minimum 2 days in advance of the new acquisition window start) to allow the FW Contractor to change its satellite programming.

The ‘pre-extend’ request will trigger an automatic notification to the responsible FW Contractor, who will have the right to accept the request or to refuse the request, providing explanations. In case the request is accepted by the IP, G4CAP will manage automatically all the needed edits to the AW within max. 24 hours.

3.3.17. An AW may be extended if none of the prime or backup profile tasking has successfully completed the zone with IDQA accepted acquisitions. Since 2018 campaign, G4CAP automatically manages the extension of AWs, which have been agreed by a MS Administration, by maximum one or two (default) weeks at a time. To provide such agreement the MS Administration needs to set the extension flag either in the acquisition window or in the acquisition request modules. G4CAP will send an automatic notice of the extension to the FW Contractor at the latest 3 working days before AW closure. This will allow the FW contractor to change its satellite programming. Such extensions will be made if crop cycle permits and shall be as long as possible. AW will not be extended in case there are some proposed or backup Acquisitions not yet managed by MS Administration (or contractor) that could potentially cover the whole zone area.

3.3.18. The procedure outlined below will apply at AW end:
• acquisitions outside elevation angle specification or outside Cloud Cover (CC) thresholds may be uploaded by the FW Contractor, as proposed, and may be accepted by the MS Administration (or Contractor);
• if above option does not provide enough images to complete the area, the acquisition window (AW) can be extended for the prime and backup VHR profiles. The MS Administration (or contractor) will evaluate the maximum acceptable AW extension based on the status of the crop phenology.

3.3.19. In case IP is able to acquire a valid imagery within the original AW, even if this AW was already extended, the AW will be automatically de-extended by G4CAP.

3.3.20. MS Administration (or Contractor) is notified about AW coming to an end by selecting the dedicated notification option in G4CAP. If no request for the extension of an AW is set in G4CAP, the AW will close at planned closure (defined end date of the AW).

3.3.21. Upon request from the JRC, the FW Contractor shall inform the JRC and the MS Administrations (or Contractors) of image acquisition status over the zone (e.g. attempts left before AW closure or possible attempt soon afterwards).

3.3.22. MS Administration should not allow an AW to extend longer than any MS Contractor contract end date. If the MS Administrations allows this, they will themselves be responsible for the proper use of the imagery in their controls procedure.

3.3.23. The relevant AW parameters are summarized as follows (each AW is identified in G4CAP by a unique integer value called ID):
• Period: VHR1, VHR2;
• Image profile (see Table 1);
• Start and end dates;
• Previous acquisition window (AW), where applicable;
• Image mode: Bundle/PSH³/MSP/PAN (possible choices are dependent on chosen Image profile);
• Delivery method: DVD/FTP.

³ please note that Pansharpened 4 Bands product always comes with the 4 first bands i.e. Blue, Green, Red, Near-IR1 (so-called MS1)
It is not possible to produce Pansharpened 4 Bands product using the remaining 4 bands (so-called MS2) or SWIR bands.
4. **Feasibility assessment**

4.1.1. The basic zone and AWs parameters explained above are received by the FW Contractor through the ‘Reporting’ or the ‘Zones’ and ‘Image Requests’ modules in G4CAP. They shall be made available to the FW Contractor 6 weeks before the first window starts. These parameters also form the basis for the relevant specific contracts (SCs) set up between the JRC and the VHR FW Contractor.

4.1.2. The FW Contractor are then responsible (see §3.1.5) to interact with the MS Administrations (or Contractors) to check and finalize any remaining feasibility parameters, and perform the feasibility study in G4CAP. For these tasks, a timeframe of at least 4 weeks shall be given to the FW Contractor.

4.1.3. Since feasibility is no longer made in one single batch, but by period and zone, if any window is requested to start earlier than others, their feasibility can be performed earlier. Actually, it is up to the IP to make feasibility as efficient as possible and start with the earliest windows in the period undergoing feasibility.

4.1.4. A technical and competitive feasibility assessment by the FW Contractor includes among other things: satellite characteristics, zone size, zone shape, zone latitude, elevation angle, acquisition window, priority level, CC, statistical weather forecasting and other competitive tasking requests. All tasking is placed at priority programming for the CwRS and LPIS zones.

4.1.5. One of the parameters of the feasibility assessment is the elevation angle. It is well known that a lower elevation angle puts higher requirements on ancillary data (DEM, GCPs, etc.) to reach orthocorrection accuracy specification thresholds (see Chapter 13 VHR profiles), and [ref. 4]. The FW Contractor should keep the elevation angle as high as possible, in order to facilitate orthocorrection.

4.1.6. A higher elevation angle threshold may be requested for certain control zones, e.g. if the control zone is situated in hilly, or mountainous areas/complex topology (see Chapter 13 VHR profiles). The allowed area for such elevation angle uplift will have been agreed between MS Administration and the JRC prior to the feasibility at the pre-IRs stage, and the basic AW parameters (see Chapter 2) will include relevant profiles per MS.

4.1.7. **MS Administrations should be aware that feasibility suffers if control zones with elevation angle restriction are too concentrated and close to each other; collection attempts will decrease substantially between an A.1 profile, to an A.2, A5, or A.6 profile (see Chapter 13 VHR profiles).** Therefore, MS Administrations are advised to consider maximum possible window length for control zones with elevation angle restriction when defining their Image Requests.

4.1.8. MS Administrations are reminded that they should keep their requests for the A.2 plus A.6 plus A.5 profile elevation angle restriction to be ≤ 25% of their overall VHR campaign control area.

4.1.9. MS Administrations are reminded that they should keep their requests for the A.5 profile to be ≤ 10% of their overall VHR campaign control area (preferably well distributed for best acquisition success).
4.1.10. MS Administrations should also have in mind that they should keep their requests for the A.4, A.11, A.51, A.61, A.62, A.71, A.81 profile to be \( \leq 1000\text{km}^2 \) of their overall VHR campaign control area (see Chapter 13 VHR image profiles, and G4CAP pre-IRs tip over help under VHR Profiles tab).

4.1.11. Special profiles such as [A.11, A.12, A.51, A.52, A.61, A.62], i.e. 8/16 bands with relative elevation angles, will be provided depending on feasibility, and budget availability. These should be asked for by the MS Administrations already in the Pre-IRs stage since they require bilateral agreement with the JRC.

4.1.12. If the FW Contractor, when checking, notice any discrepancy between the areas/parameters, as of §2.1.1 in the pre-IRs, and the areas/parameters inserted in the subsequent data requests (zones and AW) in G4CAP by the MS Administrations, a final accept shall be obtained from the JRC before feasibility start.

4.1.13. The feasibility assessment performed by the FW Contractor shall divide the windows in three categories:

1. **GOOD (GREEN) - FEASIBLE WITHIN WINDOW - approaching 100% probability;**
2. **MEDIUM (YELLOW) - FEASIBLE WITHIN WINDOW - 70% probability (may need EXTENSION) - can have suggestion to improve probability of success;**
3. **LOW (RED) - NOT FEASIBLE WITHIN WINDOW - with suggestion to make feasible (e.g. window extension with suggestion of new start/end date, change profile allowing a less strict elevation angle, accept backups).**

In G4CAP, after a suggestion to change the original window by the IP in their dates, or their image profile, or by accepting backups, the window will have an improved feasibility status compared to the original one and FW Contractor will specify this status in the new suggestion.

In case the original window was not feasible and it was not possible to find a valid agreement between FW contractor and MS Administration, the FW contractor has two possibilities, exploiting a fourth category:

4. **BLACK - acquisition is not feasible within the requested window and ‘no agreement has been reached between FW Contractor and MS Administration to make it feasible’.**

FW Contractor can:

- program the window anyway, even if the feasibility is still “not feasible”, or if the window is not compliant with technical specifications. In this case the FW contractor will make a new proposal having a BLACK feasibility status with same or changed new dates agreed with MS Administration, even if such change will not make the window feasible. In case of failure, such windows will NOT be counted in the Campaign statistics for the FW Contractor, and the MS Administrations MUST BE PREPARED TO USE ALTERNATIVE CONTROL METHOD SINCE NO IMAGE IS GUARANTEED. This situation is called BLACK-BLACK feasibility.
- Choose NOT to program the window. The FW contractor will upload a black feasibility without proposing a new solution. The window will be marked as “Refused” and no acquisition request will be open. The MS Administrations MUST USE ALTERNATIVE CONTROL METHOD SINCE NO IMAGE WILL BE PROVIDED.

4.1.14. Above feasibility, results will require some iterations between the MS Administrations and the FW Contractor. This will normally be made during the first months of the calendar year, before the Campaign starts (see however above § 4.1.1, and §4.1.3). All interactions between MS Administration and the FW Contractor in this feasibility process are performed in G4CAP ‘Feasibility’ module.
4.1.15. Finally, an optimum acquisition scenario shall be reached, with clearly defined profiles, zone constraints, final windows and products to be delivered, etc. This result, completed in G\(^4\)CAP, and accepted by the MS Administrations, will lie as basis for the campaign (accepted by all parties, including JRC) for each zone AW. Feasibility should be ready not later than 2 weeks before the AW opening, under the condition that the timelines under §4.1.1 and §4.1.2 are met. In case a phased feasibility assessment is performed (see §4.1.3), the FW Contractor and the JRC shall agree on a shorter timeframe to finalize the first feasibility assessment for the early zones (e.g. 1 week before the first VHR window of the early zones opens).
5. **Acquisition Requests (ARs)**

5.1.1. An AR is defined as the implementation by the FW Contractor of an AW of the MS Administration, to cover a zone with its defined ancillary parameters.

5.1.2. After the feasibility assessment, G\(^4\)CAP will automatically open an AR 3 days before the AW start date is reached. Each AR has a unique identifier called ID.

5.1.3. If no request for the extension of a window is received by the FW Contractor, its AR will close at planned closure (defined end date of the AW) (see § 3.3.20).

6. **QuickLook (QL) upload**

6.1.1. The FW Contractor will notify an acquisition through its upload in the G\(^4\)CAP system (or e-mail in case of temporary system unavailability) within 2 working days\(^4\) from the acquisition date (validated/proposed, or partial/full upload). In the exceptional case of multiple national holidays or after a weekend this time limit will be extended so those days do not count.

6.1.2. Image Providers can upload image acquisitions details into G\(^4\)CAP either via batch upload, available in the AR module, or by clicking on the proper AR. Required acquisition metadata need to be defined in the metadata XML\(^5\) file. This XML file needs to be compressed in a zip archive together with QL images, shapefiles and other necessary files for geo-referencing and uploaded into G\(^4\)CAP (See Annex 19.1 for details).

6.1.3. Upon upload of an acquisition, the G\(^4\)CAP system will automatically send a dedicated notification to interested actors. Users’ subscriptions to these notifications are managed through G\(^4\)CAP system. By default, all users receive this message, unless they deactivate the notification option for this item on purpose (see under G\(^4\)CAP Tab Acquisition acceptance)

6.1.4. Preview of uploaded QuickLooks can be performed using the G\(^4\)CAP QL Browser (G\(^4\)QLB), which is an online Web application for displaying and browsing QLs, metadata and shape files from the image acquisitions. It is reachable directly from within G\(^4\)CAP. Every user can also use this tool at any time during campaign to check the overall status of the acquisitions over Zones of their responsibility for a specific campaign in the Zones module of G\(^4\)CAP.

6.1.5. The MS Administrations (or Contractors) may consult the FW Contractor’s archives. Services are normally free of charge, but often subject to subscription. The MS Administrations (or Contractors) may propose any imagery for upload to the FW Contractor suitable for their controls activity. The FW Contractor will proceed to upload QLs of such imagery into G\(^4\)CAP for acceptance by the MS Administrations (or their Contractors).

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\(^4\) working days is throughout this document calculated as calendar days minus weekends (national holidays are not taken in account) - see Abbreviations

\(^5\) XML metadata file specification - see Annex 19.119.1
6.1.6. From 2018 Image Acquisition Campaign onwards, the VHR FW Contractor has a possibility to use the Atmospheric Compensation Algorithm (AComp)\(^6\) to improve image clarity by mitigating effects of haze and atmospheric scattering [ref. 20]. The AComp is currently available for imagery acquired by GE1, WV2 and WV3. All QL images related to these satellites uploaded in G\(^6\)CAP are enhanced by the AComp algorithm.

\(^6\) For more information on the AComp algorithm see here: https://g4cap.jrc.ec.europa.eu/g4cap/Default.aspx?tabid=172
7. **Acquisition acceptance - validation**

7.1.1. Acquisition acceptance or ‘validation’ is performed on the QLs uploaded by the FW contractor/ s. They may cover the whole zone or just a part of a zone (partial upload, defining an area to be validated by a vector shapefile). The area to be validated has to be contiguous and should have a regular and simple shape. It can be composed of one or multiple strips. The validation of an acquisition is done on the basis of CC content. Snow, flooding and haze, which is not considered cloud by the FW Contractor, do not cause rejection, but are flagged and may trigger an extra re-tasking (see below ‘MeteoFlag’).

7.1.2. VHR CC thresholds are defined as follows:

- a **validated** acquisition is defined by a CC ≤ 10% over the AOI. Validation of this imagery does not require any interaction with the MS Administration (or Contractor). Validated images are delivered directly to the MS Administration (or Contractor) after having passed through Quality Control (QC) of the FW Contractor (see Chapter 119 and 14);

- a **proposed** acquisition is defined by a 10% < CC ≤ 30% over the AOI. Proposed images are delivered to the MS Administration (or Contractor) only upon the MS Administration (or Contractor) agreement in G®CAP. Programming continues for better acquisitions during the period of accept/decline which must not exceed 3 working days. After having been accepted, the proposed scene goes through QC of the FW Contractor and is shipped to the MS Administration (or it’s Contractor).

7.1.3. Validation of a series of proposed acquisitions: the FW Contractor for the VHR FWCs has agreed to provide all proposed acquisitions to the MS Administration (or Contractor) if they accept one proposed acquisition over the control zone. The MS Administration (or Contractor) needs to keep in mind that when further proposed acquisitions are made available over the same zone, they can be used together with acquisitions previously rejected by him.

7.1.4. The FW Contractor will produce, on a best effort basis, regular mosaics of proposed imagery to aid in decision making on usability of a series of acquisitions. Such mosaics can be sent to MS Administrations bilaterally (with the JRC in c/c). The MS Administration should keep in mind that accepting a series of proposed acquisitions will allow the FW Contractor to release satellite capacity for other zones.

7.1.5. Re-upload of a rejected acquisition: the FW Contractor may re-upload part of a rejected proposed acquisition if, in combination with a new validated acquisition, it will serve to complete a zone. The re-uploaded proposed acquisition has to be of validated CC threshold, acquired in one date, be a contiguous area, and needs to have a regular and simple shape.

7.1.6. In case of a conglomeration of CC within part of a large acquisition, this part (minimum 100km²) may be re-tasked. Even if the whole acquisition is validated, the MS Administration (or Contractor) may ask the FW Contractor to perform such re-task. The FW Contractor will contact the JRC, who will take a decision based on technical and financial justification. A **new zone will be defined in G®CAP for this cloudy part, keeping a link with the original zone, and new AW and AR will be issued for this area**. The MS Administration (or Contractor) will...
follow a procedure similar to the one described in the section below for the ‘MeteoFlag’ case, in order to prove that the re-tasking is required.

7.1.7. An Acquisition having ‘MeteoFlag’ set is validated as follows:

- If the acquisition uploaded with the ‘MeteoFlag’ set for dense haze/snow/flood/mixed is validated, such flag will add dedicated information in the upload notification to the MS Administration (or Contractor). The MS Administration (or contractor) will within 3 working days assess if the dense haze/snow/flood/mixed situation prevents control of the parcels, by:
  - Firstly, assessing whether the haze image can be used if an atmospheric correction or local lookup table stretch is applied to the imagery. It should be kept in mind that the image viewed is a QL, which is always inferior in quality compared to the real source image
  - Secondly, if above does not solve the issue, provide the JRC with information regarding the following issues in order for a decision on possible re-tasking to be taken.
    - To prepare a shape file of the control parcels structure (Lat/Long DD WGS 84);
    - to assess preliminary Technical Coding (e.g. T4) due to haze (reference Guidance for on-the-spot checks [ref 2]);
    - to check if any proposed image is available;
  - If the above steps cannot ensure a successful control procedure, the following actions should be undertaken
    - if the whole zone has not to be re-collected, to prepare a new shape file for the AOI to re-collect (minimum 100km²);
    - to decide on a new window, and assess the time delay that a re-tasking implies for the success of the control procedure.

- Upon reception of information indicated above from the MS Administration (or contractor) the JRC will take a decision on whether to collect additional imagery (re-task) over part of the control zone based on technical and financial justification.

7.1.8. From Campaign 2018 it has been decided to automatically perform AComp processing on all ‘MeteoFlag’ tagged imagery to reduce haze, water vapor and particulates (see § 6.1.6). A MS Administration (or contractor) may ask for re-processing, after receiving the imagery with AComp, if not satisfied by result.

7.1.9. If the acquisition uploaded with the MeteoFlag set for dense haze/snow/flood/mixed is proposed, it will be treated as any other proposed acquisition.

8. Ordering

8.1.1. Ordering follows procedures set up in the FWC signed by the FW Contractor and the JRC [ref. 6]. This is managed via signature of specific contracts (SCs) within the FWC.

8.1.2. Changes of IRs during the Image Acquisition Campaign that result in need of additional request of area (adding new zone, re-tasking) require an update of a relevant SC. The update is managed via an “exchange of letter” between Commission and FW Contractor. In this case, the new requests are inserted in G4CAP only when the whole financial/contractual procedure is finished in order to allow feasibility to start.
9. **Delivery**

9.1.1. Validated partial acquisitions covering a minimum of 100km² contiguous area, and having a regular and simple shape, as defined in §7.1.1, will be delivered in the format and on the media requested. **If, however, a remaining area to close an AOI is less than 100 km², smaller validated acquisitions are acceptable.** If demanded by the MS Administration (or Contractor), the delivery of validated proposed imagery will include all proposed uploads over the zone.

9.1.2. The contractual delivery period that includes production, internal QC, and ex-works availability is 6 working days after acquisition for VHR data.

9.1.3. Images (after acquisition acceptance according to procedure in Chapter 7) are delivered directly to the MS Administration (or Contractor) after having passed through the internal QC of the FW Contractor.

9.1.4. The MS Administration (or Contractor) receives a delivery notification through G⁴CAP, as soon as the product is confirmed as shipped by the FW Contractor. This delivery notification includes the AR ID and the Acquisition identifier. If the product is delivered via FTP, G⁴CAP displays the FTP address, username and password to access it, else by DVD a delivery note is uploaded in G⁴CAP containing the information on the shipment. **Even in case of DVD delivery, an FTP account needs to be set to deliver the acquisition to the JRC and its details need to be filled in G⁴CAP as for FTP delivered acquisitions.**

9.1.5. The MS Administration (or Contractor) must download the product within 6 working days from the day it has been placed on FTP server by the FW Contractor.

9.1.6. The FW Contractor will use checksum for correct delivery between FW Contractor and MS Administration (or Contractor), and for image data provision to the JRC (see Chapter 12).

9.1.7. Upon request from the JRC, the FW Contractor will inform status of image production/QC status (production pending, production finished, and production date) at any time of the Campaign.

10. **Input Data Quality Assessment (IDQA)**

10.1.1. The MS Administration (or his Contractor) will fill in the Input Data Quality Assessment (IDQA) on the acquisition page of G⁴CAP within 8 working days after the image has been delivered. This actions will allow the JRC to obtain Quality Control Records (QCRs) on products, and on delivery performance of the FW Contractor;

10.1.2. If an MS Administration experiences a delay to nominate a Contractor, the MS Administration will have to perform all necessary actions by itself. This means that the MS Administration will act as contractor in G⁴CAP, in order not to delay the process.

10.1.3. When an acquisition has been IDQAd, the JRC will set the Acquisition as “ready to be invoiced” and move it to the “basket” of invoiceable acquisitions.

10.1.4. If the required IDQA is not filled in by the MS Administration (or Contractor) in 8 working days (max. 12 calendar days) from delivery of the imagery, the IDQA state will be assumed to be “accepted” to allow for timely
basketification. Even though the contractual relation is held between the JRC and the FW Contractor, in these cases an automatic notification will be sent by G\textsuperscript{4}CAP to the responsible MS Administration and Contractor stating they will not be able to file complaint on any image characteristics that could have been discovered in the IDQA. This means that all imagery that were delivered more than 12 calendar days ago will be IDQA/accepted and baskettified in any case at the beginning of each month. Exemption from above mention workflow are acquisitions for which MS Administration/Contractor has already filed a complaint (see below).

10.1.5. In case a MS Administration (or Contractor) experiences proven technical malfunction in performing IDQA in legal time, JRC needs to be informed and, in case of confirmation, the IDQA will be set on hold and not automatically accepted.

10.1.6. If in the above IDQA procedure the MS Administration (or Contractor) notes that the image area delivered\textsuperscript{7} does not match with the area the FW Contractor has stated, he will state this incongruence and will upload a correct shapefile in G\textsuperscript{4}CAP. JRC will have a final validation role on non-compliances.

10.1.7. If in the above IDQA procedure the MS Administration (or Contractor) notes that the metadata on which sensor acquired the imagery is wrong, or that the received image mode is not the requested one, he will be able to correct it directly in G\textsuperscript{4}CAP when performing the IDQA. The system will trigger an automatic correction notification to Image Providers and FWCs. In the latter case the acquisition will be re-delivered in the correct image mode.

10.1.8. An AR is closed only after the whole area has been imaged and the acquisitions have been accepted through IDQA by the Contractor (unless other circumstance cause closure, e.g. window comes to an end).

10.1.9. If IDQA is not satisfactory for any other reason, the FW Contractor and the MS Administration (or Contractor) shall solve the situation bilaterally by either an acceptance by the MS Administration (or Contractor), or a reproduction (e.g. different product type, or product of specified quality) or a partial or complete re-task by the FW Contractor. If no agreement is reached, the FW Contractor will report to the JRC, who has final decisive role on what action to undertake. Relevant provisions of the FWC [ref. 6] shall apply.

\textsuperscript{7} Calculated (rounded to whole km\textsuperscript{2}) as the intersection between validated acquisition (using final ephemeris data) with the zone in geographic projection UTM/WGS 84.
11. Pricing and Invoicing

11.1. Pricing

11.1.1. Pricing for products will be in accordance with the FWC signed by the FW Contractor and the JRC [ref. 6].

11.2. Invoicing - the VHR ‘basket’

11.2.1. The FW Contractor can invoice any single acquisition

• that has been accepted (IDQA/Accepted) by the MS Administration (or Contractor) and
• that JRC thereafter has set to the status “ready to be invoiced” (also for all acquisitions where the time delay from delivery is more than 12 calendar days, see § 10.1.4). G4CAP will at this point move the acquisition to the “VHR basket” of invoiceable acquisitions.

11.2.2. Such invoicing shall normally be made cumulatively once per month, according to the rules established in the FWC signed by the FW Contractor and the JRC [ref. 6]. The identification value for an acquisition to be invoiced is the Acq ID displayed in the basket.

11.2.3. If accepted and delivered imagery turns out to be inadequate, relevant provisions of the FWC shall apply [ref. 6], where FW Contractor image warranty applies.
12. **Image data provision to the JRC (image-return) and image access**

12.1. **Image-return to the JRC by FW Contractor - introduction**

12.1.1. Image return involves returning the imagery purchased by DG AGRI for the MS Administration to the EC Services for the purpose of the CAP checks. This follows Article 21 of Regulation (EU) No 1306/2013; “…The Commission shall supply […] satellite images free of charge to the control bodies or to suppliers of services authorized by those bodies to represent them. The Commission shall remain the owner of the satellite images and shall recover them on completion of the work [...]”

12.1.2. Both source and ortho corrected SRS data shall be returned to the EC Services, as described in following sections.

12.2. **Source Image-return to the JRC by FW Contractor**

12.2.1. The source data shall be made available to JRC by the FW Contractor directly after data acquisition with minimum delay, contemporaneously with the data provision to Member States and their Contractors. The FTP address and credentials will be same for Contractor and JRC. The CAP will automatically harvest this account ASAP after IDQA is completed with acceptance by the MS Administration (or contractor) (see § 10.1.1).8

12.2.2. The source data shall be provided to the JRC via standard FTP protocol. The FW Contractor shall ensure minimal transfer speeds of the FTP service of 1 Megabyte/s per connection, with a minimum of 4 possible contemporary connections, and guarantee an uptime of the service of at least 99.0%. The minimum retention time for data on the FTP server of the FW Contractor shall be 2 weeks from IDQA/Accept.

12.2.3. The creation of the source metadata XML files lies in the sole responsibility of the FW Contractor using the metadata information from their proprietary metadata files and converting them into the required metadata XML file structure.

12.2.4. Finally, in order to enable the JRC (and the MS Administrations or their Contractors) to run checks of complete data transfer, the FW Contractor shall provide MD5 checksums for every file included in an acquisition. These MD5 checksums must be added to checksum files named checksum.md5 and placed in the same folder as the data, referencing all files in that folder. The content and structure of the checksum files must follow the syntax of the md5sum tool9, using UNIX style line breaks (newline). The creation of the MD5 checksum files must be performed at the earliest possible stage of the data acquisition workflow.

12.3. **Ortho Image-return to the JRC by FW Contractor**

12.3.1. The FW Contractor shall collect the orthorectified data at the end of every Campaign from the MS Administrations (and/or their Contractors) on behalf of JRC and provide them to the JRC. The deadline for this

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9 [http://en.wikipedia.org/wiki/Md5sum](http://en.wikipedia.org/wiki/Md5sum)
data collection is at the end of the control Campaign year (i.e. 31st December of each year for CwRS), and 31st of January of the year after the campaign for LPIS QA.

12.3.2. The modality on how this process will be managed (a new module is being created for the purpose in G^4CAP) will be communicated in an update of these specifications in due time before ortho image return 2018).

12.4. VHR Image access

12.4.1. MS Administrations (and their Contractors) may access imagery purchased through the FWCs [ref. 6]. This image access needs to follow principles set up in the licensing agreement between the FW Contractor and the JRC, as agreed in the FWC. An End User License Agreement (EULA) based on the same principles will bind the users from the moment of their registration to G^4CAP [ref. 11].

12.4.2. In accordance with the EULA, images used in above operations may neither be disseminated nor the resulting products sold. Image access should be arranged through the JRC, Ispra.

12.4.3. The EC Service purchases a limited right of use, but the images themselves remain the property of the FW Contractor. In addition, according to the EULA [ref. 7, § 6 on IPRs] imagery must have proper references. When using the imagery, the Licensee needs to refer to the supplier with the exact display of the credits as specified in the product’s metadata which will take the form:

“© owner or supplier name or mission name (year of acquisition, or validity of Framework Contract), all rights reserved”

In addition, the End User should indicate the following information:

“Data received via the Joint Research Centre of the European Commission under FWC xxx.yyy”

where the FWC number is available from the EC Services

For the presently running FWCs [ref. 6], with EUSI the first sentence above shall be substituted with:

- “WorldView-1 data, © European Space Imaging/DigitalGlobe ™, year of acquisition, distributed by European Space Imaging”
- “WorldView-2 data, © European Space Imaging/DigitalGlobe ™, year of acquisition, distributed by European Space Imaging”
- “WorldView-3 data, © European Space Imaging/DigitalGlobe ™, year of acquisition, distributed by European Space Imaging”
- “WorldView-4 data, © European Space Imaging/DigitalGlobe ™, year of acquisition, distributed by European Space Imaging”
- “GeoEye-1 data © European Space Imaging/DigitalGlobe ™, year of acquisition, distributed by European Space Imaging”
- “Kompsat 3 data, © Satrec Initiative, provided by European Space Imaging”
13. VHR image profiles

13.1. As of Campaign 2014, the MS Administration can request a sensor independent profile of interest for the control zone from an available menu of profiles (see Table 1 below). Each profile is defined by certain parameters and it is in the FW Contractor responsibility to coordinate collections and assign the sensors in the most efficient and suitable way.

13.2. A summary of the profile characteristics is given in the table below.

<table>
<thead>
<tr>
<th>Image Profile ID</th>
<th>Description</th>
<th>Spatial resolution requirement (*)</th>
<th>Radiometric resolution (**) and spectral bands</th>
<th>Minimum Elevation Angle (**)</th>
<th>Cloud Cover (CC) over AOI</th>
<th>Acquisition programming</th>
<th>Resampling</th>
<th>Remarks</th>
<th>Example of sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1, VHR prime - CwRS [std]</td>
<td>Pan-Multispectral (Bundle)</td>
<td>GSD≤0.75m, MS (at least 4 bands)</td>
<td>PAN at least 4 bands</td>
<td>&gt; 50</td>
<td>≤10% Priority</td>
<td>sensor dependent</td>
<td>standard CwRS profile</td>
<td>WV4, WV3, WV2, GE1, possible others not benchmarked yet</td>
<td></td>
</tr>
<tr>
<td>A1.1, VHR prime - CwRS</td>
<td></td>
<td>GSD&gt;0.75m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1.2, VHR prime - CwRS</td>
<td></td>
<td>GSD&gt;0.75m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2, VHR prime - CwRS [Topographic]</td>
<td>Pan-Multispectral (Bundle)</td>
<td>GSD≤0.75m, MS (at least 4 bands)</td>
<td>PAN at least 4 bands</td>
<td>&gt; 50</td>
<td>≤10% Priority</td>
<td>sensor dependent</td>
<td>sensor dependent</td>
<td>WV4, WV3, WV2, GE1, possible others not benchmarked yet</td>
<td></td>
</tr>
<tr>
<td>A3, VHR prime - CwRS [Pan only]</td>
<td>Pan</td>
<td>GSD≤0.75m, MS (at least 4 bands)</td>
<td>PAN at least 4 bands</td>
<td>&gt; 50</td>
<td>≤10% Priority</td>
<td>sensor dependent</td>
<td>WV3, WV2, possible others not benchmarked yet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A4, VHR prime - CwRS [Stereo]</td>
<td>Pan-Multispectral (Bundle)</td>
<td>GSD≤0.75m, MS (at least 4 bands)</td>
<td>PAN at least 4 bands</td>
<td>&gt; 50</td>
<td>≤10% Priority</td>
<td>sensor dependent</td>
<td>WV3, WV2, GE1, possibly others not benchmarked yet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A5, VHR prime - CwRS [Topographic]</td>
<td>Pan-Multispectral (Bundle)</td>
<td>GSD≤0.50m, MS (at least 4 bands)</td>
<td>PAN at least 4 bands</td>
<td>&gt; 67</td>
<td>≤10% Priority</td>
<td>sensor dependent</td>
<td>WV4, WV3, WV2, GE1, possibly others not benchmarked yet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A6, VHR prime - CwRS [VHR_EFA_LF]</td>
<td>Pan-Multispectral (Bundle)</td>
<td>GSD≤0.50m, MS (at least 4 bands)</td>
<td>PAN at least 4 bands</td>
<td>&gt; 50</td>
<td>≤10% Priority</td>
<td>sensor dependent</td>
<td>2m new profile</td>
<td>WV4, WV3, WV2, GE1, possibly others not benchmarked yet</td>
<td></td>
</tr>
<tr>
<td>A6.1, VHR prime - CwRS</td>
<td></td>
<td>GSD&gt;0.50m</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>A6.2, VHR prime - CwRS</td>
<td></td>
<td>GSD&gt;0.50m</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7, VHR prime - CwRS [VHR_EFA_LF]</td>
<td>Pan-Multispectral (Bundle)</td>
<td>GSD≤0.50m, MS (at least 4 bands)</td>
<td>PAN at least 4 bands</td>
<td>&gt; 50</td>
<td>≤10% Priority</td>
<td>sensor dependent</td>
<td>new profile</td>
<td>WV3, possibly others not benchmarked yet</td>
<td></td>
</tr>
<tr>
<td>A7.1, VHR prime - CwRS</td>
<td></td>
<td>GSD&gt;0.50m</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7.2, VHR prime - CwRS</td>
<td></td>
<td>GSD&gt;0.50m</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note: (*) denotes the spatial resolution, (**) denotes the radiometric resolution, and (***), (****) denote any restrictions. Each profile is defined by certain parameters and it is in the FW Contractor responsibility to coordinate collections and assign the sensors in the most efficient and suitable way.
### Table 1- VHR profiles adopted within the CAP OTSC checks, and the LPIS QA

13.1.3. Due to new CAP requirements, all VHR imagery should have spatial resolution compliant at least with scale of 1:5,000 or larger. This translates into a required positional accuracy of maximum 1.25 m 1-D RMSE and a GSD/pixel size of at least 75cm or smaller. The requirement for absolute accuracy for the VHR sensors are in the FWCs [ref. 6] set to 2m / 1.5m depending on sensor. The RMSEs of the VHR sensors (WV1, WV2, WV3, WV4, GE1) were however proven to be below 1.25m in JRC’s geometry benchmark studies. Regarding Kompsat-3 the RMSE for a maximum allowed off nadir angle of 15˚ resulted in 1.5m, however in other more extensive studies dealing with geolocation accuracy of Kompsat-3 imagery an RMSE below 1m can be found [15], [16], which is why K3 is also allowed as a prime VHR sensor under those restrictions.

13.1.4. For a better overview of the existing profiles, and to facilitate for the MS Administrations in their choice of correct profile for their controls, the profiles can be represented in a graph of Ground Sampling Distance (GSD) versus Elevation Angle (ELA). See Figure 2 below.
13.1.5. The VHR zone will be covered either by a bundle product (PAN and 4 bands MSP as separate bands), or the pan-sharpened product, or the PAN only product. If the profile A4 (VHR Stereo) is requested, a stereo product will be delivered. PAN and 8 bands MSP products (A.11/A.51/A.61 profiles) or PAN and 16 bands MSP products (A.12/A.52/A.62 profiles) are also options but the requirement for such profiles needs to be negotiated bilaterally with JRC at the pre-Image Request (pre-IR) stage.

13.1.6. Technical details of the sensors that fit above profiles are explained in the Annex 19.4

13.2. LPIS specific profiles

13.2.1. For the LPIS QA Campaign, the VHR image acquisition approach guarantees close to nadir (threshold > 80 deg elevation angle (ELA)), haze free, and close to cloud free (0-10% CC) imagery. See Table 1 above for the specific profiles used in the LPIS QA. It is here also referred to Chapter 16 below for a more detailed description of the LPIS QA image acquisition.

14. Quality Assurance / Quality Control

14.1. Quality Assurance / Quality Control (QA/QC)

14.1.1. The principal objective of the CAP image acquisition is to reach the goal of minimum 95% success rate of image supply on time, according to specifications. In order to ensure this, an adequate QA/QC needs to be put in place; the FW Contractor shall therefore apply a QA and internal QC to the imagery and to the process of performing image acquisition. Then JRC will have an overarching role in making external Quality Control on the procedures
14.1.2. QA may be defined to be the steps performed in order to ensure that the production of a product meets a set of accepted standards. QC aims to detect non-conformities in a product.

14.1.3. QC includes assessment of issues such as data integrity, data completeness, CC, haze or thin clouds, cloud shadows, fog, smoke, smog, snow, flares, etc. It also includes assessing the product geometry, radiometry, image characteristics (dropouts etc.), and finally the production parameters (resampling algorithm, bit depth), etc.

14.1.4. The FW Contractor will follow their internally-defined QA/QC procedures on their products including at least the above mentioned issues. They will deliver a conformal product, or propose a non-conformal product for evaluation clearly stating reasons for QC failure - such image will be treated as a “proposed” image. A proposed image can also be e.g. an acquisition at elevation angle below requirement.

14.2. **Specificities on Cloud Cover (CC)**

14.2.1. Cloud will be defined as white opaque with little or no image information available of the ground features below. It does not include cloud shadow. Dense haze which causes consistent muting of imagery should be included.

14.2.2. There are different CC assessment routines, e.g.:

   a) automatic or semi-automatic thresholding, with subsequent quality factor including issues of dense haze, haze, smoke, pollution, snow, shadow, etc. A visual observation after classification is required to adjust CC taking into account issues of dense haze, cloud conglomeration, etc.;

   b) manual photo interpretation and subsequent vector digitizing: if a definite boundary between affected pixels and un-affected pixels is visible it is a cloud.

14.2.3. The JRC decided that imposing of a common CC assessment approach on the FW Contractor is not efficient. The CC assessment should result in an agreement between FW Contractor and the MS Administrations (or Contractors) otherwise the FW Contractor needs to report to the JRC, who has the right to decide.

14.2.4. Both approaches in §14.2.2 are accepted by JRC. The MS Administration (or their Contractors) and the FW Contractor should however, in order to arrive to an efficient CAP checks programme with successful outcome, aim for an optimisation of the image use.

14.2.5. CC validation and Meteo flagging should follow the procedure described in Chapter 7.

14.2.6. The accuracy to which CC will be performed is to a better than 1% definition.

15. **Risk of satellite failure**

15.1.1. The FW Contractor is responsible for communicating any technical problem connected to a satellite sensor, to the receiving station or to the processing chain as soon as possible to the JRC. This is important in order to limit
16. **LPIS QA image acquisition**

16.1. **LPIS QA Intro**

16.1.1. The LPIS Quality Assurance (QA) is a yearly exercise that is jointly organised since 2010 by the European Commission (EC, through the DG JRC) and the member states (MS) administrations. It consists in an evaluation of the quality of the LPIS systems based on a sample of the reference parcels (RP) and a recent photo-interpretation of the parcel boundaries and interior. A set of quality elements (QE) have been defined by the EC and compared to limiting quality thresholds. The LPIS QA sample requirements are driven by the ISO standard 2859/2.

16.1.2. In practice, DG JRC orders the images directly from the image provider. The images are stored and kept confidentially until the MS administration upload the full population subject to the LPIS QA exercise of the Campaign. After several quality checks on the population sent, DG JRC crops the submitted population to the zone delimited by the images and proceeds with a random selection of the so-called *sample pre-selection* that consist of a 3 times the target sample size (i.e. 500/800/1250 Reference Parcels (RPs) depending on the population size).

16.1.3. The LPIS QA exercise is performed at LPIS system-level. Belgium, Germany and United Kingdom split their national territories following their administrative regional boundaries: Belgium is split in 2 regions (WA, FL), Germany in 13 Bundesländer and United Kingdom in 4 countries (EN, SC, WA and NI). It means that the MS inspect what they consider as a homogeneous population (LOT) of their RPs. All MS’s send one lot for each sub-population. It reflects directly to the creation of the LPIS QA zones.

16.1.4. Until 2014 inclusive, the samples were taken from a sub-set of the Control with Remote Sensing (CwRS) zones from the current campaign’s OTS control period to minimize the inspection burden for the Member States. The selection of the zones was in this case known beforehand by the MS administration.

16.1.5. After an evaluation in 2014, DG JRC set up an image acquisition procedure in which the LPIS QA zones are not known by the MS administrations before the beginning of the LPIS QA measurements. The procedure had the objectives to:

- rely on images with better quality for the inspections and
- to reduce the logistic burdens of control zone selection and RP sample generation and as a result
- facilitate complementary field observations.
- and above all relying on a random zone selection

16.2. **Pre-Image Requests assessment**

16.2.1. No input is required from the MS Administrations for this exercise except preparatory work as of chapter above.
16.3. **LPIS QA zones definition**

16.3.1. The number of LPIS QA zones by LPIS system will be determined based on the proper characteristics of the corresponding LPIS system and according to the statistical analysis performed considering RP population. Basically, the concept of determining the number of zones is as follows:

- One image (for small countries/LPIS systems like MT and DE_SL) requiring sample of 500 RPs.
- Two or three images will automatically be assigned to LPIS systems requiring samples of 800 and 1250 RPs respectively.
- Extra image(s) will be allocated to larger LPIS systems:
  - +1 when: $0.05 \leq \sin(lat_{max}) - \sin(lat_{min}) \leq 0.07$
  - +2 when: $\sin(lat_{max}) - \sin(lat_{min}) \geq 0.07$

where $lat_{min}$ and $lat_{max}$ are respectively the minimum and maximum latitudes of the corresponding LPIS system. This latitude parameter is chosen because it is closely linked to the biogeographical zoning.

On top of this, additional images might be allocated based on the statistical analysis of the representativeness of the sample i.e. for LPIS systems with one or two images an additional image will be proposed. Relying on a single image (where sample size is 500 RP’s), according to the above-mentioned concept, might not be appropriate for inferring the result of the sample on the whole population. The reason is that it could highly depend on where this unique zone is located. In order to avoid this possibility, it was decided to guarantee a minimum of 2-3 images per LPIS system (except for DE-SL and MT for which the representativeness of the samples is already satisfactory and for which the unique image of 15 km by 15 km already represents a significant percentage of their total territory: 9% for DE-SL and 70% for MT).

16.3.2. Above gives a total of 44 LPIS systems which will get from 1 to 6 zones each. For the systems getting extra zones, a sub-division of the system will be created as a spatial aggregation of the NUTS2 regions with the constraint that each aggregation should contain roughly the same number of RPs.

16.3.3. Finally, the zones with a density of RPs smaller than 2 parcels per km² will be regrouped into a single zone (PAN EU) for which 2 LPIS QA images will be requested in order to guarantee the chance of selection for reference parcels inside these low density areas. The zones with no RP are completely excluded for the acquisition of the images.

16.3.4. In practice, the EU territory will be split in a number of different zones (86 in 2017) for which a number of images are expected to be acquired for the purpose of the LPIS QA. The resulting zones as such will be uploaded directly to the G4CAP.

16.4. **Acquisition windows (AWs) definition**

16.4.1. The AW for the LPIS QA VHR imagery to be acquired will be normally February/March - August. There is no common criteria for the definition of acquisition window dates, however following principles lie as a basis:

- The decision was made for the starting date of LPIS QA acquisition of an LPIS (or a neighbouring system if MS doesn’t participate to the CwRS campaign) at of one month before starting its earliest CwRS acquisition.
- For the PAN EU the most restrictive criteria will be used i.e. the latest starting date for the CwRS over the PAN EU mask (includes the parts over Europe with a low density of agriculture parcels).
- The end date for all zones will be 31/8/2018.
16.4.2. The proposed dates of AWs will be communicated bilaterally between JRC and the MSs. MS’s can propose an alternative AW only with appropriate motivation. The final AW will be inserted for each LPIS QA zone directly in G4CAP.

16.5. Feasibility assessment

16.5.1. No feasibility is performed by the IP. Acquisition is performed since the Image provider will be responsible for acquiring the requested number of LPIS images per LPIS region/zone. He will select LPIS image/s randomly taking into account collection efficiency (within priority tasking), weather forecast, real time weather development and in accordance with the image profile requirement (image profiles see Chapter 12).

16.6. Image acquisition

16.6.1. The LPIS image acquisition (ARs, QLs, acquisition acceptance (validation), and ordering) is managed by the IP and the JRC, without interfacing with the MS Administration (or Contractor)

16.6.2. For the LPIS QA Campaign, the VHR image acquisition approach guarantees images with the following basic characteristics: close to nadir (threshold > 80 deg elevation angle [ELA]), haze free, and close to cloud free (0-10% CC) imagery (image profiles see Chapter 12).

16.6.3. The Image provider which collects the data will decide upon the LPIS image (225 or 169km2) extent depending on profile used. The resampling will be to best accommodate a 1:1 ratio in [acquired GSD]: [delivered output pixel].

16.6.4. General restriction for the data collections per satellite overpass

- It is possible to collect on one pass only one image per LPIS QA zone (exceptionally it’s possible to collect two images in the regions with very bad weather condition (this has to be communicated during the campaign).
- For the PAN EU zone, two images are foreseen but in two passes (i.e. one in the north SE/FI/EE/UK_SC and one more in the south BG, RO, HU, FR)

16.7. Image delivery

16.7.1. The shape of the resulting image shall be as simple as possible and is normally, as mentioned above, a 13x13km (169km2) or a 15x15km (225km2) plain image. However, it may be that an LPIS zone (large areas) has an irregular/complex shape giving following effect on the resulting image:

- Shapes with only four vertices:
  - Square shape (a=b);
  - Rectangular shape (a≠b);
  - Regular but not rectangular shapes [parallelogram, rhombus, kite etc.];
  - Irregular shapes;

- Shapes with more than four vertices (when the shape is depending on borderline, coastline, inland water or created to exclude cloud). These cases will be dealt with bilaterally before delivery.
  - Manual creation of the shape to exclude clouds (and larger parts of the lakes/sees at the border of small area). This applies only to exclude outer perimeter of the initial shape
Cut out by using coastal line shapefile, provided by the JRC. Small islands (without Agricultural Parcels) and reefs shall also be excluded.

16.7.2. Bonus images may be required - as follows:
- After MS finishes with the LPIS population upload, JRC performs evaluation whether the required number of the RP’s can be selected within the acquired images. If required number of the RP’s cannot be selected within already acquired images, a bonus image will be requested from Image provider.
- The AW for the requested bonus image should be at least 8 weeks long. In case it is not possible to assure this minimum length of AW an eventual failure of the acquisition is not counted in the statistics for the LPIS success rate.

16.7.3. Contingency - in case of image acquisition failure the following contingency measures shall be performed:
- extension of the acquisition window
- Use of a CwRS image
- Use of an archive image

16.8. Workflow - simplified

16.8.1. The LPIS QA image acquisition workflow can be summarized as follows:
- JRC manages the image acquisition for all LPIS systems together with the IP
- Zones determination
  - There are total 44 LPIS systems - Germany is divided into 13 systems, Belgium into two, United Kingdom into four systems
  - According to the RP population (from previous year), JRC is calculating the density map
  - JRC performs the analysis of the density and decides about divisions on the country (or LPIS system) level
- JRC uploads the final polygons into G4CAP (LPIS systems, subdivided polygons, PANEU polygon) with the number of images per each polygon
- JRC defines the acquisition windows
- IP performs image acquisition
- JRC performs IDQA
- Success rate on acquisition of LPIS QA imagery which should strive towards 100% after all contingency measures, is kept separate from the calculated 95% contractual threshold on CwRS.

17. JRC responsible staff and e-mail addresses

17.1.1. Directorate D Sustainable Resources / Unit D.5 / image acquisition: johan.astrand@ec.europa.eu

17.1.2. Directorate D Sustainable resources / Unit D.5 / contractual FWC: philippe.loudjani@ec.europa.eu
18. **References**

4. Guidelines for Best Practice and Quality Checking of Ortho Imagery (Issue 3.0 available at: [https://g4cap.jrc.ec.europa.eu/g4cap/Portals/0/Documents/10133.pdf](https://g4cap.jrc.ec.europa.eu/g4cap/Portals/0/Documents/10133.pdf))
5. HR ‘profile based’ Specs (ref. [http://ies-intranet/h04/apps/Chrono/22346.docx](http://ies-intranet/h04/apps/Chrono/22346.docx)). See also G4CAP under Documentation.
6. FWCs for satellite image purchase held at the JRC:
   a. Framework contracts for supply of Satellite Remote Sensing (SRS) data and associated services in support to checks within the Common Agricultural Policy (CAP); (1) VHR profile II FWC 931.886, VHR+ profile FWC 199.309, with European Space Imaging GmbH, (2) HHR profile FWC 198.995 with Airbus Defence and Space.
7. The Satellite Remote Sensing Data EULA: [https://g4cap.jrc.ec.europa.eu/g4cap/EULA.htm](https://g4cap.jrc.ec.europa.eu/g4cap/EULA.htm)
8. Benchmarking GeoEye-1, WorldView-2, GeoEye-1, Cartosat-2, Kompsat-2, RapidEye and THEOS images (JRC Oral presentation Cat.3.4 JRC60286 JRC IPSC/G03/C/JNO/njo D(2010)(12136), Int. ref. file://S:\FMPArchive\C\12136.ppt) - Presented at the MARS Unit’s GEOCAP Action’s Control Methods Workshop - 2010 Campaign; 13-14 April 2010; Ispra (Italy); Authors: Nowak Da Costa J.K, Åstrand P.J.
9. Benchmarking Worldview2
   - Further: “WorldView-2 potentialities for orthoimage production within the Control with Remote Sensing Programme of the European Commission” [ref. file://S:\FMPArchive\C\13959.doc], PUBSY JRC67516

G4CAP manual;
https://g4cap.jrc.ec.europa.eu/g4cap/Portals/0/Documents/G4CAP%20user%20manual%201.2.pdf?ver=2016-02-03-110656-263

http://publications.jrc.ec.europa.eu/repository/handle/JRC93093

http://publications.jrc.ec.europa.eu/repository/handle/JRC99433


Jeong Jaehoon, Kim Jaein, Kim Taejung; Analysis of Geolocation Accuracy of KOMPSAT-3 Imagery; Korean Journal of Remote Sensing; DOI: 10.7780/kjrs.2014.30.1.37,
http://koreascience.or.kr/article/ArticleFullRecord.jsp?cn=OGCSBN_2014_v30n1_37

http://publications.jrc.ec.europa.eu/repository/handle/JRC107673

http://publications.jrc.ec.europa.eu/repository/handle/JRC107674

Digital Globe Atmospheric Compensation; white paper available at:

Archives for the VHR FWC search tools:

19. **Annexes**

19.1. **XML metadata file specification for image providers used for the QL upload**

For more details, please see G^4CAP User Manual [12].
**Zip Archive**

The Image Provider must upload a zip archive containing the following files:

- one XML file with the metadata of the image file(s) or shape(s) that are going to be uploaded;
- image file(s);
- shape file(s);
- other file(s) for geo referencing (if applicable).

Hereafter we paste an example of XML upload to upload two different Acquisitions in the same Acquisition Request. Green nodes and attributes are the ones differentiating from previous LIO XML upload file.

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<G4CAP xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:noNamespaceSchemaLocation="https://g4cap.jrc.ec.europa.eu/Portals/0/g4capAcquisitionUpload.xsd">
   <Acquisition>
     <ARID>65843</ARID>
     <AcquisitionDate>12.02.2016</AcquisitionDate>
     <Sensor backup="true" imageMode="psh">WORLDVIEW02</Sensor>
     <Comment>This is a comment for you.</Comment>
     <CloudCover>1.98</CloudCover>
     <MeteoFlag>SNOW</MeteoFlag>
     <Shape>
       <Filename>test.shp</Filename>
     </Shape>
     <Strips>
       <Strip>
         <Elevation>64.15</Elevation>
         <Filename>WV20250071G101P_000040462_Browse_0.jpg</Filename>
       </Strip>
       <Strip>
         <Elevation>68</Elevation>
         <Filename>WV20250071G101P_000040462_Browse_1.jpg</Filename>
       </Strip>
     </Strips>
   </Acquisition>
   <Acquisition>
     <ARID>65843</ARID>
     <AcquisitionDate>15/02/2016</AcquisitionDate>
     <Sensor>WORLDVIEW04</Sensor>
     <Comment>This is a new comment for you.</Comment>
     <CloudCover>0.0</CloudCover>
     <MeteoFlag/>
     <Shape>
       <Filename>test2.shp</Filename>
     </Shape>
   </Acquisition>
</G4CAP>
```
<Strips>
  <Strip>
    <Elevation>61.15</Elevation>
    <Filename>WV20250071G123P_000040462_Browse_0.jpg</Filename>
  </Strip>
  <Strip>
    <Elevation>60</Elevation>
    <Filename>WV22350071G101P_000040462_Browse_1.jpg</Filename>
  </Strip>
</Strips>
</Acquisition>
</G4CAP>

**Code 1- Example of xml metadata file for G4CAP QL upload**

**XML Schema Definition (XSD)**

This XSD is publicly available at [https://g4cap.jrc.ec.europa.eu/Portals/0/g4capAcquisitionUpload.xsd](https://g4cap.jrc.ec.europa.eu/Portals/0/g4capAcquisitionUpload.xsd).

```
<xs:schema attributeFormDefault="unqualified" elementFormDefault="qualified"
  xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="G4CAP">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="Acquisition" maxOccurs="unbounded" minOccurs="1">
          <xs:complexType>
            <xs:sequence>
              <xs:element type="xs:int" name="ARID"/>
              <xs:element type="xs:string" name="AcquisitionDate"/>
              <xs:element name="Sensor">
                <xs:complexType>
                  <xs:simpleContent>
                    <xs:extension base="xs:string">
                      <xs:attribute type="xs:boolean" name="backup"/>
                      <xs:attribute type="xs:string" name="imageMode"/>
                    </xs:extension>
                  </xs:simpleContent>
                </xs:complexType>
              </xs:element>
              <xs:element type="xs:string" name="Comment" minOccurs="0"/>
              <xs:element type="xs:float" name="CloudCover"/>
              <xs:element type="xs:string" name="MeteoFlag" minOccurs="0"/>
              <xs:element name="Shape">
                ...
              </xs:element>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```
Code 2 - XML metadata file structure

<table>
<thead>
<tr>
<th>TAG</th>
<th>DESCRIPTION</th>
<th>CARDINALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>G4CAP</td>
<td>Main container</td>
<td>1</td>
</tr>
<tr>
<td>Acquisition</td>
<td>Main container for a single Acquisition</td>
<td>1-n</td>
</tr>
<tr>
<td>Shape</td>
<td>Container for shapefile information</td>
<td>1</td>
</tr>
<tr>
<td>Strips</td>
<td>Container for Strips information</td>
<td>1</td>
</tr>
<tr>
<td>Strip</td>
<td>Container for single Strip information</td>
<td>1-n</td>
</tr>
</tbody>
</table>

Table 2 - Main structure nodes

<table>
<thead>
<tr>
<th>METADATA</th>
<th>TYPE</th>
<th>DESCRIPTION</th>
<th>VALUES</th>
<th>REQ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARID</td>
<td>Integer</td>
<td>AR unique identifier</td>
<td>The ID of AR where to upload this Acquisition</td>
<td>X</td>
</tr>
<tr>
<td>AcquisitionDate</td>
<td>Date</td>
<td>Date of acquisition</td>
<td>dd.MM.yyyy or dd/MM/yyyy – It has to be inside the AW and not in the future</td>
<td>X</td>
</tr>
<tr>
<td>Sensor Enum</td>
<td>Name or abbreviation of sensor having acquired the imagery</td>
<td>See Sensors table</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------------</td>
<td>------------------</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Comment String (4096)</td>
<td>Acquisition comment, to be used for any kind of non-standard communication about the Acquisition itself, or for issues that could be useful at AUDIT level, or that could need to be reminded after several time from upload</td>
<td>Free text (4096 characters)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CloudCover Double</td>
<td>Cloud Coverage percentage over the whole Acquisition area</td>
<td>0.00 &lt;= CC &lt; 100.00</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>MeteoFlag Enum</td>
<td>Whether the imagery presents some meteo issue</td>
<td>See Meteo table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filename String</td>
<td>Name of the file inside the .zip archive</td>
<td>Name of one of the files in the uploaded .zip archive</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Elevation Double</td>
<td>Elevation Angle of the single Strip</td>
<td>50.00 &lt;= ELA &lt;= 90.00</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 - XML metadata file, values

<table>
<thead>
<tr>
<th>VALUE</th>
<th>ABBREVIATION</th>
<th>POSSIBLE PROFILES</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK-DMC2</td>
<td>DMC2</td>
<td>F0, G</td>
</tr>
<tr>
<td>GEOEYE-1</td>
<td>GE01</td>
<td>A1, A2, A3, A4, A5, A6, A7, A71, A8, B, C, E</td>
</tr>
<tr>
<td>WORLDVIEW-1</td>
<td>WV01</td>
<td>A3, B, C, E</td>
</tr>
<tr>
<td>WORLDVIEW-4</td>
<td>WV04</td>
<td>A1, A2, A3, A4, A5, A6, A7, A71, A8, A81, B, C, E</td>
</tr>
<tr>
<td>KOMPSAT-3</td>
<td>K03</td>
<td>A1, A2, B, C, E</td>
</tr>
<tr>
<td>KOMPSAT-3A</td>
<td>K03A</td>
<td>A1, A2, B, C, E</td>
</tr>
<tr>
<td>SPOT6</td>
<td>S6</td>
<td>F0, F1, F2, G</td>
</tr>
<tr>
<td>SPOT7</td>
<td>S7</td>
<td>F0, F1, F2, G</td>
</tr>
<tr>
<td>PLEIADES-1A</td>
<td>PL1A</td>
<td>Broker</td>
</tr>
<tr>
<td>PLEIADES-1B</td>
<td>PL1B</td>
<td>Broker</td>
</tr>
<tr>
<td>DEIMOS-1</td>
<td>D1</td>
<td>F0, G</td>
</tr>
<tr>
<td>DEIMOS-2</td>
<td>D2</td>
<td>F1, F2, G</td>
</tr>
<tr>
<td>SENTINEL-2A</td>
<td>S2A</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Table 4 - Possible values for the Sensor tag, their allowed abbreviation and their combination with Profiles

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haze</td>
<td>Haze in the imagery</td>
</tr>
<tr>
<td>Snow</td>
<td>Presence of snow in the imagery</td>
</tr>
<tr>
<td>Flood</td>
<td>Presence of flood in the imagery</td>
</tr>
<tr>
<td>Mixed</td>
<td>Presence of different issues in the imagery, or impossibility to distinguish the actual issue</td>
</tr>
</tbody>
</table>

Table 5 - Possible values for the Meteo flag and their description
### Table 6 - Possible values for ImageMode node and their description

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAN</td>
<td>Panchromatic</td>
</tr>
<tr>
<td>MSP</td>
<td>Multispectral</td>
</tr>
<tr>
<td>PSH</td>
<td>Pansharpened</td>
</tr>
<tr>
<td>BUN</td>
<td>Bundle</td>
</tr>
</tbody>
</table>

#### 19.2. General recommendations for a buffer creation around CwRS zones

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. height difference [m]</td>
<td>Recommended buffer [m]</td>
<td>Max. height difference [m]</td>
</tr>
<tr>
<td>100</td>
<td>84</td>
<td>100</td>
</tr>
<tr>
<td>200</td>
<td>168</td>
<td>200</td>
</tr>
<tr>
<td>300</td>
<td>252</td>
<td>300</td>
</tr>
<tr>
<td>400</td>
<td>336</td>
<td>400</td>
</tr>
<tr>
<td>500</td>
<td>420</td>
<td>500</td>
</tr>
<tr>
<td>600</td>
<td>503</td>
<td>600</td>
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<tr>
<td>700</td>
<td>587</td>
<td>700</td>
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<tr>
<td>800</td>
<td>671</td>
<td>800</td>
</tr>
<tr>
<td>900</td>
<td>755</td>
<td>900</td>
</tr>
<tr>
<td>1000</td>
<td>839</td>
<td>1000</td>
</tr>
<tr>
<td>1500</td>
<td>1259</td>
<td>1500</td>
</tr>
<tr>
<td>2000</td>
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<table>
<thead>
<tr>
<th>Minimum elevation angle 73° Relevant profiles: A2</th>
<th>Minimum elevation angle 80°</th>
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<tbody>
<tr>
<td>Max. height difference [m]</td>
<td>Recommended buffer [m]</td>
</tr>
<tr>
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<tr>
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<td>245</td>
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<tr>
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<td>306</td>
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<tr>
<td>1500</td>
<td>459</td>
</tr>
<tr>
<td>2000</td>
<td>611</td>
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</tbody>
</table>

Maximal height difference = Maximal height of the AOI - Average base height of the AOI

**Figure 3 - General recommendations for a buffer creation around CwRS zones**
19.3. **Relation elevation angle vs. off-nadir angle, and some satellite angles of importance**

\[
R = \frac{\sin(ONA)}{\sin(90^\circ + ELA)} = \frac{\sin(ONA)}{\cos(ELA)} \\
ELA = \arccos \left( \sin(ONA) \cdot \frac{R + H}{R} \right) \\
ONA = \arcsin \left( \cos(ELA) \cdot \frac{R}{R + H} \right)
\]

\[H = 681\text{ km (GeoEye-1), 496 km (WorldView-1),} 770\text{ km (WorldView-2), 617 km (WorldView-3),} \]

\[R = 6371\text{ km} \]

**Figure 4 - Relation elevation angle vs. off-nadir angle, and some satellite angles of importance**
19.4. VHR Sensors

| WorldView-2 |
|-----------------|-----------------|
| **SATELLITE Specification** | |
| **Launch Information** | Date: October 8, 2009 |
| | Launch Vehicle: Delta 7920 (9 strap-ons) |
| | Launch Site: Vandenberg Air Force Base, California |
| **Orbit** | Altitude: 770 kilometers |
| | Type: Sun synchronous, 10:30 am descending node |
| | Period: 100 minutes |
| **Sensor Bands** | Panchromatic: 450 - 800 nm |
| | 8 Multispectral: 4 standard colors: blue / green / red / NIR1 + 4 new colors: coastal / yellow / red edge / NIR2 |
| | Coastal Blue: 400 - 450 nm; Blue: 450 – 510 nm |
| | Yellow: 585 - 625 nm; Green: 510 – 580 nm |
| | Red: 630 – 690 nm, Red Edge: 705 - 745 nm |
| | NIR1: 760 – 900 nm, NIR2: 860 - 1040 nm |
| **Sensor Resolution GSD (Ground Sample Distance)** | Panchromatic: 0.46m at nadir |
| | Multispectral: 1.85m at nadir |
| **Dynamic Range** | 11-bits per pixel |
| **Swath Width** | 16.4 kilometers at nadir |
| **Retargeting Agility** | Time to Slew 200 kilometers: 10 seconds |
| **Max Contiguous Area Collected in a Single Pass (at 30°ONA)** | 138 x 112 km mono (8 strips) |
| | 63 x 112 km stereo (4 pairs) |
| **Revisit Frequency** | 1.1 days at 1 meter GSD or less |
| | 3.7 days at 20° off-nadir or less (0.52 meter GSD) |
| **Geolocation Accuracy (CE 90)** | Demonstrated <3.5 m CE90 without ground control |
| **PRODUCT Specification** | |
| **Tasking Level** | Special Priority Tasking (Select Plus Level) |
| **Product Options** | Ortho Ready Standard Bundle 4 bands (PAN plus 4 Bands MS (BGRNIR1)) |
| | Ortho Ready Standard Pansharpened 4 Bands (BGRNIR) |
| | Ortho Ready Standard panchromatic only |
| | Ortho Ready Standard Bundle 8 bands (PAN plus 4 Bands MS (BGRNIR1) plus 4 Bands MS2 (Coastal, Yellow, RedEdge, NIR2)) |
| | Ortho Ready Standard Stereo Bundle 4 bands (PAN plus 4 Bands MS (BGRNIR1)) |
| | Ortho Ready Standard Stereo Pansharpened 4 Bands (BGRNIR) |
| | Ortho Ready Standard Stereo panchromatic only |
| | Ortho Ready Standard Stereo Bundle 8 bands (PAN plus 4 Bands MS (BGRNIR1) plus 4 Bands MS2 (Coastal, Yellow, RedEdge, NIR2)) |
| **Resolution** | Panchromatic: 0.5m – for VHR+ profiles A5, A51, A52, A8, A81 |
| | Multispectral: 2.0m – for VHR+ profile A5, A51, A52, A8, A81 |
| **Cloud Cover** | Cloud cover “validated” 0 - ≤ 10 %, “proposed” 10 % < CC ≤ 30 % |
| **Resampling Kernel** | Cubic Convolution |
| **Format** | GeoTIFF |
| **DRA** | off |
| **Bit Depth** | 16bit |
| **Projection/ Datum** | UTM/ WGS84 |
| **Tiling** | 4 Band Bundle (32k x 32k tiling): MUL files have a max of 537 MB/tile, PAN files have a max of 2,140 GB/tile |
| | 8 Band Bundle (32k x 32k tiling): MUL files have a max of 1,073 GB/tile, PAN files have a max of 2,140 GB/tile |
| | 4 bands PSH (22k x 22k tiling): files have a max of 3,872 GB/tile |
| **Delivery Medium** | DVD or FTP |
## WorldView-3

### SATELLITE Specification

#### Launch Information
- **Date:** August 13, 2014
- **Launch Vehicle:** Atlas V - 401
- **Launch Site:** Vandenberg Air Force Base, California
- **Altitude:** 617 kilometers
- **Type:** Sun synchronous, 10:30 am descending node
- **Period:** 97 minutes

#### Orbit
- **Altitude:** 617 kilometers
- **Type:** Sun synchronous, 10:30 am descending node

#### Sensor Bands
- **Panchromatic:** 450 - 800 nm
- **8 VNIR Bands:**
  - Blue: 400 - 510 nm
  - Green: 510 - 580 nm
  - Red: 630 – 745 nm
  - Yellow: 585 - 625 nm
  - Coastal Blue: 400 - 510 nm
  - NIR1: 770 – 895 nm
  - NIR2: 860 - 1040 nm
- **8 SWIR Bands:**
  - SWIR-1: 1195 - 1225 nm
  - SWIR-2: 1550 - 1590 nm
  - SWIR-3: 1640 - 1680 nm
  - SWIR-4: 1710 - 1750 nm
  - SWIR-5: 2145 - 2185 nm
  - SWIR-6: 2185 - 2225 nm
  - SWIR-7: 2235 - 2285 nm
  - SWIR-8: 2295 - 2365 nm
- **12 CAVIS Bands:**
  - Desert Clouds: 405 – 420 nm
  - Aerosol: 459 – 509 nm
  - Water: 845 – 885 nm
  - Snow: 1620 – 1680 nm
  - Aerosol: 2105 – 2245 nm

#### Sensor Resolution GSD
- **Panchromatic:** 0.31m at nadir
- **VNIR:** 1.24m at nadir
- **SWIR:** 3.70m at nadir
- **CAVIS:** 30m at nadir

#### Dynamic Range
- 11-bits per pixel (Pan, MS), 14-bits per pixel (SWIR)

#### Swath Width
- 13.1 kilometers at nadir

#### Retargeting Agility
- Time to Slew 200 kilometers: 12 seconds

#### Max Contiguous Area Collected in a Single Pass (at 30° ONA)
- 65.5 x 112 km mono (5 strips)
- 26.2 x 112 km stereo (2 pairs)

#### Revisit Frequency
- 1.0 days at 1 meter GSD or less
- 4.5 days at 20° off-nadir or less

#### Geolocation Accuracy (CE 90)
- Predicted <3.5 m CE90 without ground control

### PRODUCT Specification

#### Tasking Level
- Special Priority Tasking (Select Plus Level)

#### Product Options
- Ortho Ready Standard Bundle 4 bands (PAN plus 4 Bands MS (BGRNIR1)
- Ortho Ready Standard Pansharpened 4 Bands (BGRNIR)
- Ortho Ready Standard panchromatic only
- Ortho Ready Standard Bundle 8 bands (PAN plus 4 Bands MS (BGRNIR1) plus 4 Bands MS2 (Coastal, Yellow, RedEdge, NIR2)
- Ortho Ready Standard Stereo Bundle 4 bands (PAN plus 4 Bands MS (BGRNIR1)
- Ortho Ready Standard Stereo Pansharpened 4 Bands (BGRNIR)
- Ortho Ready Standard Stereo panchromatic only
- Ortho Ready Standard Stereo Bundle 8 bands (PAN plus 4 Bands MS (BGRNIR1) plus 4 Bands MS2 (Coastal, Yellow, RedEdge, NIR2)
- SWIR Band Product 1

#### Resolution
- **Panchromatic:** 0.5m – for VHR+ profiles A5, A51, A52, A8, A81 0.4m
- **Multispectral:** 2.0m – for VHR+ profile A5, A51, A52, A8, A81 1.6m
- **SWIR:** 7.5m

#### Cloud Cover
- Cloud cover “validated” 0 ≤ 10 %, “proposed” 10 % < CC ≤ 30 %

#### Resampling Kernel
- Cubic Convolution

#### Format
- GeoTIFF
### DRA
- off

### Bit Depth
- 16bit

### Projection/ Datum
- UTM/ WGS84

### Tiling
- 4 Band Bundle (32k x 32k tiling): MUL files have a max of 537 MB/tile, PAN files have a max of 2,140 GB/tile.
- 8 Band Bundle (32k x 32k tiling): MUL files have a max of 1,073 GB/tile, PAN files have a max of 2,140 GB/tile.
- 4 bands PSH (22k x 22k tiling): files have a max of 3,872 GB/tile.
- SWIR Product 1default tiling

### Delivery Medium
- DVD or FTP
### GeoEye-1

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<thead>
<tr>
<th><strong>SATELLITE Specification</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Launch Information</strong></td>
<td><strong>Date:</strong> September 6, 2008</td>
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<tr>
<td></td>
<td><strong>Launch Vehicle:</strong> Delta II</td>
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<tr>
<td></td>
<td><strong>Launch Site:</strong> Vandenberg Air Force Base, California</td>
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<tr>
<td><strong>Orbit</strong></td>
<td><strong>Altitude:</strong> 681 kilometers</td>
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<tr>
<td></td>
<td><strong>Type:</strong> Sun-synchronous, 10:30 am descending node</td>
</tr>
<tr>
<td></td>
<td><strong>Period:</strong> 98 minutes</td>
</tr>
<tr>
<td><strong>Sensor Bands</strong></td>
<td><strong>Panchromatic:</strong> 450 - 800 nm</td>
</tr>
<tr>
<td></td>
<td><strong>4 Multispectral:</strong> Blue: 450 - 510 nm, Green: 510 - 580 nm, Red: 655 - 690 nm, NIR: 780 - 920 nm</td>
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<td><strong>Sensor Resolution GSD</strong></td>
<td><strong>Panchromatic:</strong> 0.41m at nadir</td>
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<td><strong>Multispectral:</strong> 1.65m at nadir</td>
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<td><strong>Dynamic Range</strong></td>
<td>11-bits per pixel</td>
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<td><strong>Swath Width</strong></td>
<td>15.3 kilometers at nadir</td>
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<td><strong>Retargeting Agility</strong></td>
<td>Time to Slew 200 kilometers: 20 seconds</td>
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<tr>
<td><strong>Max Contiguous Area Collected in a Single Pass (at 30° ONA)</strong></td>
<td>44 x 112 km mono (3 strips), 28 x 224 km stereo (2 pairs)</td>
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<td><strong>Revisit Frequency</strong></td>
<td>2.6 days at 30° off-nadir</td>
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<tr>
<td><strong>Geolocation Accuracy (CE 90)</strong></td>
<td>5m CE90 without ground control</td>
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<table>
<thead>
<tr>
<th><strong>PRODUCT Specification</strong></th>
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</tr>
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<tr>
<td><strong>Tasking Level</strong></td>
<td>Special Priority Tasking (Select Plus Level)</td>
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<tr>
<td><strong>Product Options</strong></td>
<td>Ortho Ready Standard Bundle 4 bands (PAN plus 4 Bands MS (BGRNIR1))</td>
</tr>
<tr>
<td></td>
<td>Ortho Ready Standard Pansharpened 4 Bands (BGRNIR)</td>
</tr>
<tr>
<td></td>
<td>Ortho Ready Standard panchromatic only</td>
</tr>
<tr>
<td></td>
<td>Ortho Ready Standard Stereo Bundle 4 bands (PAN plus 4 Bands MS (BGRNIR1))</td>
</tr>
<tr>
<td></td>
<td>Ortho Ready Standard Stereo Pansharpened 4 Bands (BGRNIR)</td>
</tr>
<tr>
<td></td>
<td>Ortho Ready Standard Stereo panchromatic only</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td><strong>Panchromatic:</strong> 0.5m – for VHR+ profiles A5, A51, A52, A8, A81 0.4m</td>
</tr>
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<td></td>
<td><strong>Multispectral:</strong> 2.0m – for VHR+ profile A5, A51, A52, A8, A81 1.6m</td>
</tr>
<tr>
<td><strong>Cloud Cover</strong></td>
<td>Cloud cover “validated” 0 - ≤ 10 %, “proposed” 10 % &lt; CC ≤ 30 %;</td>
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<td><strong>Resampling Kernel</strong></td>
<td>Cubic Convolution</td>
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<tr>
<td><strong>Format</strong></td>
<td>GeoTIFF</td>
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<td><strong>DRA</strong></td>
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<td><strong>Bit Depth</strong></td>
<td>16bit</td>
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<tr>
<td><strong>Projection/ Datum</strong></td>
<td>UTM/ WGS84</td>
</tr>
<tr>
<td><strong>Tiling</strong></td>
<td>4 Band Bundle (32k x 32k tiling): MUL files have a max of 537 MB/tile, PAN files have a max of 2,140 GB /tile. 4 bands PSH (22k x 22k tiling): files have a max of 3,872 GB/tile</td>
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<tr>
<td><strong>Delivery Medium</strong></td>
<td>DVD or FTP</td>
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# WorldView-1

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<tr>
<td>Date:</td>
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<tr>
<td>Launch Vehicle:</td>
<td>Delta 7920 (9 strap-ons)</td>
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<td>Launch Site:</td>
<td>Vandenberg Air Force Base, California</td>
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<td><strong>Orbit</strong></td>
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<td>Altitude:</td>
<td>496 kilometers</td>
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<td>Type:</td>
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<td><strong>Sensor Bands</strong></td>
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</tr>
<tr>
<td>Panchromatic:</td>
<td>400 - 900 nm</td>
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<tr>
<td><strong>Sensor Resolution GSD</strong></td>
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</tr>
<tr>
<td>Panchromatic:</td>
<td>0.5 m at nadir</td>
</tr>
<tr>
<td><strong>Dynamic Range</strong></td>
<td>11-bits per pixel</td>
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<tr>
<td><strong>Swath Width</strong></td>
<td>17.7 kilometers at nadir</td>
</tr>
<tr>
<td><strong>Retargeting Agility</strong></td>
<td>Time to Slew 200 kilometers: 10 seconds</td>
</tr>
<tr>
<td><strong>Max Contiguous Area Collected in a Single Pass (at 30° ONA)</strong></td>
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<tr>
<td>Mono</td>
<td>111 x 112 km (6 strips)</td>
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<tr>
<td>Stereo</td>
<td>51 x 112 km (3 pairs)</td>
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<td><strong>Revisit Frequency</strong></td>
<td>1.7 days at 1 meter GSD or less</td>
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<td></td>
<td>5.4 days at 25° off-nadir or less (0.55 meter GSD)</td>
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<tr>
<td><strong>Geolocation Accuracy (CE 90)</strong></td>
<td>Demonstrated &lt;4.0 m CE90 without ground control</td>
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<tr>
<th>PRODUCT Specification</th>
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<td><strong>Tasking Level</strong></td>
<td>Special Priority Tasking (Select Plus Level)</td>
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<tr>
<td><strong>Product Options</strong></td>
<td>Ortho Ready Standard panchromatic only</td>
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<tr>
<td></td>
<td>Ortho Ready Standard Stereo panchromatic only</td>
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<td><strong>Resolution</strong></td>
<td>Panchromatic: 0.5m</td>
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<tr>
<td><strong>Cloud Cover</strong></td>
<td>Cloud cover “validated” 0 - ≤ 10 %, “proposed” 10 % ≤ CC ≤ 30 %;</td>
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<tr>
<td><strong>Resampling Kernel</strong></td>
<td>Cubic Convolution</td>
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<tr>
<td><strong>Format</strong></td>
<td>GeoTIFF</td>
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<tr>
<td><strong>DRA</strong></td>
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<td><strong>Bit Depth</strong></td>
<td>16bit</td>
</tr>
<tr>
<td><strong>Projection/ Datum</strong></td>
<td>UTM/ WGS84</td>
</tr>
<tr>
<td><strong>Tiling</strong></td>
<td>32k x 32k, PAN files have a max of 2,140 GB /tile</td>
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<tr>
<td><strong>Delivery Medium</strong></td>
<td>DVD or FTP</td>
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## WorldView-4

### SATELLITE Specification

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<th>Launch Information</th>
<th>Date: November 11, 2016</th>
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<td>Launch Vehicle:</td>
<td>Atlas V - 401</td>
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<tr>
<td>Launch Site:</td>
<td>Vandenberg Air Force Base, California</td>
</tr>
</tbody>
</table>

**Orbit**
- Type: Sun synchronous, 10:30 am descending node
- Period: 97 minutes

**Sensor Bands**
- Panchromatic: 450 - 800 nm
- 4 VNIR Bands: 4 standard colors: blue / green / red / NIR1 (Multispectral)

**Sensor Resolution GSD (Ground Sample Distance)**
- Panchromatic: 0.31m at nadir
- VNIR: 1.24m at nadir

**Dynamic Range**
- 11-bits per pixel

**Swath Width**
- 13.1 kilometers at nadir

**Retargeting Agility**
- Time to Slew 200 kilometers: 10.6 seconds

**Max Contiguous Area Collected in a Single Pass (at 30° ONA)**
- 65.5 x 112 km mono (5 strips)
- 26.2 x 112 km stereo (2 pairs)

**Revisit Frequency**
- 1.0 days at 1 meter GSD or less
- 4.5 days at 20° off-nadir or less

**Geolocation Accuracy (CE 90)**
- Predicted <4m CE90 without ground control

### PRODUCT Specification

#### Tasking Level
- Special Priority Tasking (Select Plus Level)

#### Product Options
- Ortho Ready Standard Bundle 4 bands (PAN plus 4 Bands MS (BGRNIR1)
- Ortho Ready Standard Pansharpened 4 Bands (BGRNIR)
- Ortho Ready Standard panchromatic only
- Ortho Ready Standard Stereo Bundle 4 bands (PAN plus 4 Bands MS (BGRNIR1)
- Ortho Ready Standard Stereo Pansharpened 4 Bands (BGRNIR)
- Ortho Ready Standard Stereo panchromatic only

#### Resolution
- Panchromatic: 0.5m– for VHR+ profiles A5, A51, A52, A8, A81 0.4m
- Multispectral: 2.0m – for VHR+ profile A5, A51, A52, A8, A81 1.6m

#### Cloud Cover
- Cloud cover “validated” 0 - ≤ 10 %, “proposed” 10 % < CC ≤ 30 %;

#### Resampling Kernel
- Cubic Convolution

#### Format
- GeoTIFF

#### DRA
- off

#### Bit Depth
- 16bit

#### Projection/ Datum
- UTM/ WGS84

#### Tiling
- 4 Band Bundle (32k x 32k tiling): MUL files have a max of 537 MB/tile, PAN files have a max of 2,140 GB /tile
- 4 bands PSH (22k x 22k tiling): files have a max of 3,872 GB/tile

#### Delivery Medium
- DVD or FTP
## Kompasat-3

### SATELLITE Specification

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<td>Launch Site:</td>
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<td>Orbit</td>
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<td>Sun-synchronous, 13:30 pm ascending node</td>
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<td>Period:</td>
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<td>Sensor Bands</td>
<td>Panchromatic:</td>
<td>450 - 900 nm</td>
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<td></td>
<td>4 Multispectral:</td>
<td>Blue: 450 - 520 nm, Green: 520 - 600 nm, Red: 630 - 690 nm, NIR: 760 - 900 nm</td>
</tr>
<tr>
<td>Sensor Resolution GSD (Ground Sample Distance)</td>
<td>Panchromatic:</td>
<td>0.7m at nadir</td>
</tr>
<tr>
<td></td>
<td>Multispectral:</td>
<td>2.8m at nadir</td>
</tr>
<tr>
<td>Dynamic Range</td>
<td>14-bits per pixel</td>
<td></td>
</tr>
<tr>
<td>Swath Width</td>
<td>16 kilometers at nadir</td>
<td></td>
</tr>
<tr>
<td>Retargeting Agility</td>
<td>Time to Slew 200 kilometers: 10 seconds</td>
<td></td>
</tr>
<tr>
<td>Max Contiguous Area Collected in a Single Pass (at 30° ONA)</td>
<td>48 x 110 km mono (3 strips), 16 x 200 km stereo (2 pairs)</td>
<td></td>
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<tr>
<td>Revisit Frequency</td>
<td>3.5 days at 30° off-nadir</td>
<td></td>
</tr>
<tr>
<td>Geolocation Accuracy (CE 90)</td>
<td>70m (50cm-expectation) CE90 without ground control</td>
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</table>

### PRODUCT Specification

<table>
<thead>
<tr>
<th>Tasking Level</th>
<th>Priority Plus Tasking</th>
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<tbody>
<tr>
<td>Product Options</td>
<td>Level 1R Option Bundle 4 bands (PAN plus 4 Bands (BGRNIR1)</td>
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<td>Level 1R Option pansharpened 4 Bands (BGRNIR)</td>
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<tr>
<td>Resolution</td>
<td>Panchromatic: 0.7m</td>
</tr>
<tr>
<td></td>
<td>Multispectral: 2.8m</td>
</tr>
<tr>
<td>Cloud Cover</td>
<td>Cloud cover “validated” 0 - ≤ 10 %, “proposed” 10 % &lt; CC ≤ 30 %</td>
</tr>
<tr>
<td>Resampling Kernel</td>
<td>Cubic Convolution</td>
</tr>
<tr>
<td>Format</td>
<td>GeoTIFF</td>
</tr>
<tr>
<td>DRA</td>
<td>off</td>
</tr>
<tr>
<td>Bit Depth</td>
<td>14bit</td>
</tr>
<tr>
<td>Projection/ Datum</td>
<td>UTM/ WGS84</td>
</tr>
<tr>
<td>Tiling</td>
<td>default</td>
</tr>
<tr>
<td>Delivery Medium</td>
<td>DVD or FTP</td>
</tr>
</tbody>
</table>
### Kompsat-3A (available after benchmarking)

#### SATELLITE Specification

<table>
<thead>
<tr>
<th>Launch Information</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>March 26, 2015</td>
<td></td>
</tr>
<tr>
<td>Launch Vehicle</td>
<td>RS20 rocket (Dnepr Launch Vehicle)</td>
<td></td>
</tr>
<tr>
<td>Launch Site</td>
<td>Yasny Launch Base, Orenburg region, Russia</td>
<td></td>
</tr>
<tr>
<td>Orbit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Altitude</td>
<td>528 kilometers</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Sun-synchronous, 13:30 pm ascending node</td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td>98.5 minutes</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensor Bands</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Panchromatic</td>
<td>450 - 900 nm</td>
<td></td>
</tr>
<tr>
<td>Multispectral</td>
<td>Blue: 450 - 520 nm</td>
<td>Green: 520 - 600 nm</td>
</tr>
<tr>
<td></td>
<td>Red: 630 - 690 nm</td>
<td>NIR: 760 - 900 nm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensor Resolution GSD (Ground Sample Distance)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Panchromatic</td>
<td>0.55m at nadir</td>
<td></td>
</tr>
<tr>
<td>Multispectral</td>
<td>2.2m at nadir</td>
<td></td>
</tr>
<tr>
<td>Infrared</td>
<td>5.5m at nadir</td>
<td></td>
</tr>
</tbody>
</table>

| Dynamic Range | 14-bits per pixel |            |
| Swath Width   | >12 kilometers at nadir |            |

**Retargeting Agility**

- Time to Slew 200 kilometers: 10 seconds

**Max Contiguous Area Collected in a Single Pass (at 30° ONA)**

- 48 x 110 km mono (3 strips)
- 16 x 200 km stereo (2 pairs)

**Revisit Frequency**

- 3.5 days at 30° off-nadir

**Geolocation Accuracy (CE 90)**

- 70m (50cm-expectation) CE90 without ground control

#### PRODUCT Specification

<table>
<thead>
<tr>
<th>Tasking Level</th>
<th>Priority Plus Tasking</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Options</td>
<td>Level 1R Option Bundle 4 bands (PAN plus 4 Bands MS (BGRNIR1)</td>
<td>Level 1R Option pansharpened 4 Bands (BGRNIR)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resolution</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Panchromatic</td>
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<tr>
<td>Multispectral</td>
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</tr>
<tr>
<td>Infrared</td>
<td>5.5m</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cloud Cover</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloud cover “validated” 0 - ≤ 10 %, “proposed” 10 % &lt; CC ≤ 30 %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resampling Kernel</th>
<th>Cubic Convolution</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Format</td>
<td>GeoTIFF</td>
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</tr>
<tr>
<td>DRA</td>
<td>off</td>
<td></td>
</tr>
<tr>
<td>Bit Depth</td>
<td>14bit</td>
<td></td>
</tr>
<tr>
<td>Projection/ Datum</td>
<td>UTM/ WGS84</td>
<td></td>
</tr>
<tr>
<td>Tiling</td>
<td>default</td>
<td></td>
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<td>Delivery Medium</td>
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