

## JRC TECHNICAL REPORT

# HHR Image Acquisition Specifications Campaign 2021

*For CAP On-The -Spot-Checks (OTSCs), Control With Remote Sensing (CwRS), according to 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 And 40), and No 2333/2015*

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## Document history

Version	Date	Comment	Author
1.0	01/03/2008	First release; information taken from CTS FMP 8451, Recs 1 FMP 5608, Recs 2 FMP 7658, selection of control sites and risk analysis	ME, PA
	01/05/2008	FMP 8218, Geom. Guidelines FMP 2402 and from very high resolution (VHR) image specifications for the Control with Remote Sensing (CwRS) Programme	
1.1	30/05/2008	Final version after draft revision deadline 30/05/2008	ME, SPOT
1.2	02/04/2009	2009 Campaign update, introduction of RapidEye (RE)	ME, RapidEye
1.3	20/06/2009	Final review; edits figures, introduction of RE and completion of text for RE	PA
2.0	11/11/2011	Updates to European Union (EU) legislation references and to the administrative requirements (restriction to the use of circles for zone identification; insertion and updates of sensor features and products for THEOS, DMC (constellation), Formosat2 and RapidEye, sensor benchmarking references	JRC (PA, CA, EG, BV, SG, CA)
2.2	12/11/2012	Unit name updated. SPOT4 sensor will not be available after 10/01/2013; RapidEye not available for CwRS 2013. Addition of Resourcesat-2. Changes to previous versions in red. Image request – shapefiles. Changed text in intellectual property rights paragraph. Copyright terms updated	JRC (CA, EG, PA, CD)
3.0	20/02/2013	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) – HR/HHR profile tender: high resolution (HR) sensor-independent ‘profile’	PA
3.1	04/07/2013	Final review	JRC (PA, EG, BV, ISM, AB, CD, CW)
3.2	28/08/2013	Edited feasibility chapter and reintroduced ortho image return	PA, CW
3.3	13/02/2014	Introduction of G-LIO.NET as workflow management tool for 2014 campaign	GDM
4.0	16/03/2014	Final review after HR/HHR profile KO meeting held 17-18/02/2014	PA, ISM, CW, JB
4.1	17/11/2014	Airbus review for Campaign 2015	Airbus
5.0	01/12/2014	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	JRC
5.1	17/12/2014	Minor updates based on Airbus comments (e.g. Haze flag as from HR-1), update of HR/HHR profiles	JRC
5.2	16/10/2015	Updates by Airbus for 2016 campaign, including insertion of image return tables	JRC
5.3	21/11/2015	Updates by JRC after meeting with EUSI, and AB (12/10/2015, and 29/10/2015)	JRC
6.0	01/03/2016	Finalisation after Member State’s (MS’s) administrations/contractors input	JRC
6.1	13/03/2017	Finalisation after KO meeting HHR image provider 02/03/2017; and JRC finalisation (including edits on feasibility)	AB/JRC
6.2	29/03/2017	Finalisation after HR/HHR feasibility implementation	JRC (PA, GDM)
7.0	20/11/2017	Update after campaign review meeting with Airbus; pre-IRs details; update of zone parameters; introduction of AW parameters; removal of autumn, winter, and HRB2 period; update of Feasibility chapter; update of profiles.	AB (MR, NR)/JRC (PA, BV, GDM, CW, JB)

7.1	05/01/2018	Change of front page image; update of para. 4.1.1	JRC (PA, GDM)
8.0	05/03/2018	Proof read final	JRC proof read service, checked by JRC staff (PA, BV, GDM, JB)
8.1	31/01/2019	Airbus review for 2019 Campaign	CR
8.2	12/02/2019	JRC acceptance and review	JB, PA
8.3	20/08/2019	JRC revised profiles in Table 1 to allow for PSH in profile F1., paragraph 3.2.5, 3.3.1.7 and 13.1.2	PA
8.4	15/01/2020	Airbus review for 2020 Campaign	CR
8.5	20/02/2020	Final version accepted by Airbus and JRC	PA, CR
8.6	03/03/2020	PlanetScope referencing to VHR specs (13.1.7)	PA
8.7	12/10/2020	Refinement on AirCAP part. Airbus review for 2021 Campaign	CR
8.71	19/10/2020	JRC check; replaced all HR to HHR; update of Table 1; etc.	PA, JB
8.72	06/11/2020	Section 12.4.3 precision. Version accepted by Airbus	CR
9.0	08/12/2020	Accept Airbus, JRC	PA, CR

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CR	César Rodrigues	Airbus
NR	Nicolas Rousseau	Airbus

## Abbreviations, acronyms and terms

Abbreviation/term	Explanation
AOI	Area of interest (of a control zone)
AR	Acquisition request
AW	Acquisition window
CA	Contracting authority
CAP	Common Agricultural Policy
CC	Cloud cover
Contractor	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 of the framework contract signed in [1]
CwRS	Control with Remote Sensing
DEM	Digital elevation model
DG AGRI	Directorate General for Agriculture and Rural Development
DRA	Dynamic range adjustment
EC	European Commission
EFA	Ecological Focus Area
EOC	End of Campaign
EPSG	European Petroleum Survey Group
EU	European Union
EULA	End-user license agreement
FW contractor	The successful tenderer/s who has/have been awarded a FWC with the JRC as of [1]; the equivalent as IP (see below)
FWC	Framework contract
G <sup>4</sup> CAP	Final evolution of *LIO systems, available from August 2015 onwards; URL, and manual (4, 8)
GAEC	Good agricultural and environmental condition (CAP Cross Compliance)
GCP	Ground control point
GSD	Ground sampling distance, the nominal size of one sensor pixel projected onto the imaged surface
HHR	High High Resolution (SRS imagery) - see Table 1
HR	High Resolution (SRS imagery) - imagery of coarser resolution not financed any more through the COM (see 1.1.3)
IACS	Integrated Administration and Control System (CAP)
IDQA	Input Data Quality Assessment
IP(s)	Image Provider(s), in this document, considered the successful IP or successful consortium of image providers who has signed an FWC with the JRC as of [1] - in the text referred to in the text as FW contractor
JRC	Joint Research Centre of the European Commission EC
KO meeting	Kick-Off meeting
LioDotNet, G-LIO.NET, NG-LIO.NET, G <sup>4</sup> CAP	JRC web-based software for the management of image acquisition
MARS	Monitoring Agricultural ResourceS
MS	Member State(s)
MS administration (or contractor)	MS administrations or appointed contractor/s of the MS administration responsible for the CAP subsidy diagnosis using the SRS imagery delivered by the JRC.
MSP	Multispectral

Abbreviation/term	Explanation
OIR	Ortho Image Return
OTSC	On-the-spot checks
PAN	Panchromatic
Pre-IRs	Pre-image requests
PSH	Pansharpened
QC	Quality Control
QL(s)	Quick-Look, reduced resolution browse image
SOC	Start of Campaign
SRS	Satellite Remote Sensing
UTM	Universal Transverse Mercator
VHR	Very High Resolution (SRS imagery)
WGS 84	World Geodetic System 1984



## 1. Introduction

### 1.1 HHR image acquisition for the CAP checks programme

- 1.1.1 Since 1993, the Directorate-General for Agriculture and Rural Development (DG AGRI) has promoted the use of ‘Control with Remote Sensing’ (CwRS) as an appropriate control system suitable for checking whether or not aid is granted correctly. The legal basis of CwRS is Council Regulation (EC) 1306/2013 (Article 6(b), 21) and in its implementing Regulations No 908/2014 (Article 26), No 809/2014 (Articles 24, 38, 39 and 40) and No 2333/2015 [2].
- 1.1.2 It should be mentioned that in May 2018, (EU) Regulation was further amended to allow for the introduction of the so called ‘checks by monitoring’. In fact, several MS Regions are, according to the recently adopted Article 40a of the implementing regulation (EU) 746/2018 of 18 May 2018 amending the Implementing Regulation (EU) No. 809/2014, opting to introduce an agricultural aid check system based on monitoring. This change will be of importance for the future CAP. The purpose of these specifications is however to describe the rules for the presently used CwRS for the On-The-Spot-Checks (OTSC), and not yet the checks by monitoring [3]. It is envisaged that this type of controls approach will be used at least until, and inclusive, campaign 2022<sup>1</sup>.
- 1.1.3 Financing of the CwRS imagery is in accordance with above mentioned Council Regulation (EU) 1306/2013 and Commission Implementation Regulation (EU) 809/2014, 908/2014, where the Commission services are asked to centralize the acquisition of SRS imagery, and their free of charge supply to the MS. This responsibility was transferred to DG JRC in 1998. It is today managed through a co-delegation of signature by DG AGRI (via DG BUDG; internal ref. Ares (2015)1215220) to DG JRC’s D.5 Food Security Unit.
- 1.1.4 Regarding the timing of the operations, Commission Implementing Regulation (EU) No 908/2014, specifies, in Article 26:
1. For the purposes of Article 21 of Regulation (EU) No 1306/2013, each Member State shall inform the Commission by 1 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 finalise, 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.
- 1.1.5 High-High-resolution (HHR) imagery may be used in the CwRS Programme (in addition to very high resolution (VHR) imagery) for crop and/or land use identification, to check if the requirement of keeping the land in

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<sup>1</sup> Brussels 31.10.2019 COM (2019) 581 final; 2019/0254 (COD);

good agricultural and environmental condition (GAEC) is maintained and for further checks of the new 'greening' requirements defined in the CAP reform implemented as of 2015. A series of images over the control zones suitably acquired during the crop cycle is supplied to the MS administrations (or their contractors) for them to fulfil their area-based subsidy control in accordance with EC Regulation 809/2014 [2]. The control methods are further described in the document 'Guidance for on the-spot checks and area measurement' [3]. Today (2021 Campaign), the goal for the MS should be to use one VHR image plus not more than two HHR images in addition to the freely available S2 (or other) data in their CwRS OTSCs.

- 1.1.6 Since the 2014 Campaign, the detailed management of HR/HHR image acquisitions – to cover the correct areas required for the CAP checks at the correct times of the growing season – has passed to industry to carry out under the quality control (QC) of the JRC. This choice has been made because there are currently several suppliers of satellite remote sensing (SRS) imagery that have proven competency in supplying efficiently the imagery needed for the CAP checks, adhering to JRC quality specifications.
- 1.1.7 There may be one or more framework (FW) contractors appointed by the contracting authority, the JRC, to manage the HHR image acquisition. In these specifications, the image provider (IP) therefore refers to the FW contractor(s), with which the JRC has signed a framework contract (FWC). Currently, Airbus DS GEO SA holds the contract for high-high resolution (HHR) profile [1].

## 1.2 Objectives, referencing and structure of this document

- 1.2.1 This document defines the HHR profile-based and HHR profile-based specifications to be used within the CAP checks programme. Its objective is to give the stakeholders<sup>2</sup> clarity regarding the technical details of the process of SRS image acquisition (see **Figure 1**).
- 1.2.2 The JRC has an overarching role to be responsible for the functioning of the FWCs and for the 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 their contractors) performing the CAP checks. These specifications are intended to describe these interactions.
- 1.2.3 This document is available in the documentation section of the G<sup>4</sup>CAP Web application [4].
- 1.2.4 Several references are made here to 'Guidance for on the-spot checks and area measurement' [5], to the Guidelines for Best Practice and Quality Checking of Ortho Imagery [6] and to the VHR profile-based specifications [7], which should be used in conjunction with the present document. Reference for the Image providers (IPs) is also made to the terms and conditions of the FWCs for image procurement with the JRC [1].

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<sup>2</sup>The stakeholders, or actors, are the JRC, DG AGRI and the FW Contractor/s acting as IPs and operators, and the MS administrations (or their contractor) performing the CAP checks.

1.2.5 Figure 1 depicts the overall process of the SRS image acquisition process, split into macro-actions and coloured by the function of the type of user responsible for the single macro-action. This document tries to follow the same flow as that shown here.

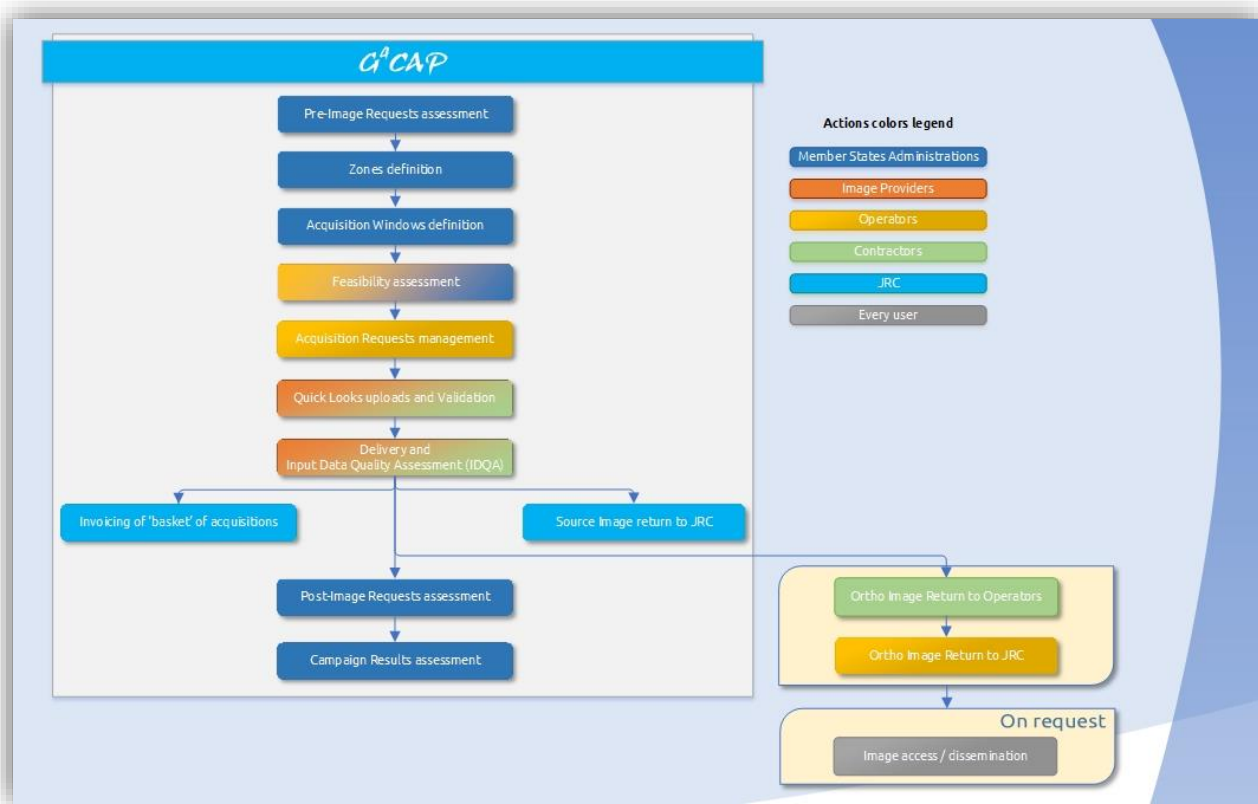


Figure 1 - The overall process of the SRS image acquisition

### 1.3 G<sup>4</sup>CAP

- 1.3.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 1.3.]
- 1.3.2 The JRC is for the Campaign year 2021 introducing a new authentication system for the G<sup>4</sup>CAP application, based on the Commission obligatory EU Login. It will be the task of each stakeholder (user) of G<sup>4</sup>CAP to obtain a EU Login user/pwd instead of their presently running [Microsoft .net] credentials. Instructions will follow, before the end of 2020, thereof by the JRC.

## 2. Pre-image request

- 2.1.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 2.]

### 3. Data Requests

#### 3.1 General

3.1.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 3.1]

#### 3.2 Zone definition

3.2.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 3.2 , paragraphs 3.2.1 - 3.2.3]

3.2.2 The swath of the HHR satellite sensors is usually not a constraint in the HHR image acquisition, since scene sizes are significantly larger than the control zones. However, if it is a constraint, the same rules apply to such HHR sensors' acquisitions as to the VHR sensors [7], paragraph 3.3.2, aiming to acquire the zone in as few acquisitions as possible.

3.2.3 In summary, the relevant zone parameters in G<sup>4</sup>CAP are:

- control zone shapefile
- zone name (≤ 5 characters); this must be unique for the whole campaign and shall not include special country-specific or non-alphanumeric characters, such as 'é', 'Ç', . (full stop), \_ (underscore), dashes, hyphens, etc. (i.e. only ISO basic Latin characters and numbers allowed);
- European Petroleum Survey Group (EPSG) code (optional); this is the final output national projection used by the MS. Currently, this is relevant to HHR image acquisitions only if the HHR ORTHO profile is requested (i.e. the HHR F2 profile).

3.2.4 If an ORTHO profile<sup>3</sup> F2 is chosen, the MS Administration has to use its defined national projection (which shall be same as for the MS LPIS QA), and indicate relative EPSG code in the pull-down menu of G<sup>4</sup>CAP in the IR menu. In case the requested projection cannot be provided by the IP FW contractor, by default the orthorectified F2 product will be produced in WGS 84 / valid UTM zone for the location of the control zone. If this is not acceptable for the MS Administration it will have to revert to the non ortho profile F1.

3.2.5 If a pansharpened (PSH) product mode is requested, it may be requested as F.1 profile or F.2 profile. The latter is an orthorectified product and the rule for the projection is as explained above in the previous item.

#### 3.3 Acquisition window definition

3.3.1 An acquisition window (AW) is the time interval in which the HHR satellites are tasked. One AW before and one or two AWs after the VHR AWs are normally defined within the crop season (see VHR specifications for the CAP checks [7, chapter 2, paragraph 2.1.5]. More AWs may be defined in accordance with the JRC if

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<sup>3</sup> For further information see Chapter 13 on HRR profiles and also <http://www.intelligence-airbusds.com/en/4594-spot-67-products>

cross-compliance and GAEC or 'greening' requirements need to be controlled. Such HHR AWs can also lie between two VHR AWs (see HRB1 below). The minimum HHR AW length is 4 weeks (28 calendar days), preferably longer (6 weeks, 42 calendar days) and the HHR AWs must have at least a 1-week dead period, that is, the minimum time between the last acquisition in the previous AW and the new AW. Reference is however made to § 1.1.5 where the EC Services recommend that today (2021 Campaign), the goal for the MS should be to use one VHR image plus not more than two HHR images in addition to the freely available S2 (or other) data in their CwRS OTSCs.

- 3.3.2 It should be mentioned that the MS administrations should make correct use of the earliest/latest start dates of their HHR AWs to fit with their crop calendars. This is of great importance, since the correct use of these dates gives the best basis for feasibility and the best likelihood of acquisition success (Chapter 4: Feasibility).
- 3.3.3 The number of multi-temporal HHR images tasked over a control zone may vary depending on MS control strategy and agriculture. MS administrations need to justify their choices in the pre-IRs (chapter 2) and the JRC needs to accept this information.
- 3.3.4 Only one HHR period (AW) between the two VHR periods is accepted. This period is called HRB1 and can be defined only if there are two VHR AWs. The previously used HRB2 AW (i.e. a second HHR AW between two VHR periods) has been removed.
- 3.3.5 The HHR AWs are named as follows: HR-1, HRB1, HR+1, HR+2 and HR+3. It should be mentioned that the previously used autumn and winter periods shall, as of Campaign 2018, be replaced with Copernicus free-of-charge S1/S2 imagery. The MS administration is welcome to use the S2alert function of G<sup>4</sup>CAP to receive appropriate alerts when imagery (service available for S2 only) has been collected over its zone, in any relevant AW or time gap. Thereafter, the MS administrations will, however, handle download of imagery (e.g. from ESA or other archives) individually. G<sup>4</sup>CAP provides a direct link for download from ESA SCIHUB.
- 3.3.6 For early spring (HR-1) AWs or very late HR+ AWs, the JRC suggests defining them only if the sun angle is above 20 degrees, to ensure sufficient contrast and to minimise the effect of shadows. The FW contractor is informed that validated imagery, that is, cloud cover  $\leq 1\%$ , will not be accepted if quick-looks (QLs) are not interpretable (e.g. too dark).
- 3.3.7 In general, only perennial snow is allowed in any validated imagery and it is the MS administration's task to warn the IP/operator (FW contractor) in due time in the event of extraordinary weather conditions (e.g. snow) so that the AW can be moved. If there is no notice given by MS administration, and if in doubt, the FW contractor shall upload a snow-covered image as validated but with the special 'meteo' flag [7, chapter 7]. Please also refer to the VHR profile-based specifications [7, chapter 3], for details regarding changes in AWs due to climatic conditions, in which case the MS administrations should inform the FW contractor in due time if a AW needs to be moved.
- 3.3.8 Moreover, if the VHR AW is extended by the MS administration (or its contractors) as a result of lack or incomplete coverage of the control zone (e.g. due to adverse weather conditions), the subsequent HHR AW's

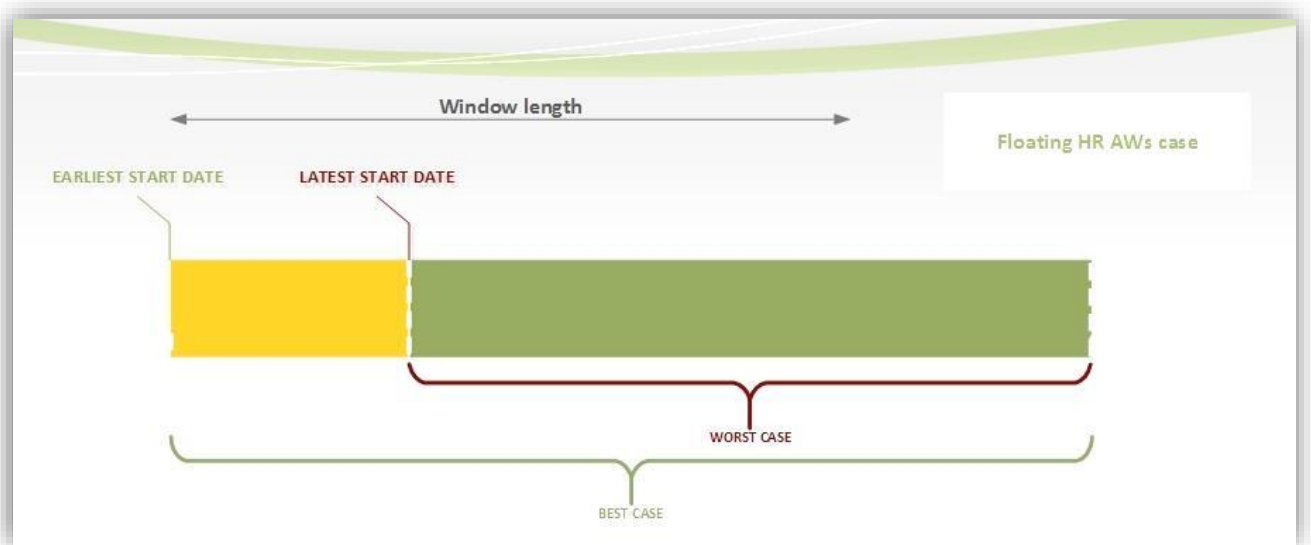
opening and closing dates will change by the same number of days to allow the HHR AW to last for the same time as originally defined. This process will be automatically managed by G<sup>4</sup>CAP.

- 3.3.9 If an HRB1 AW comes to an end without acquisition, it can be extended only if a dead period is possible before the subsequent VHR2 AW opening. If this limit is exceeded, the HRB1 will be considered failed or partially acquired.
- 3.3.10 In the event of an aerial VHR, it is important that the MS administration (or its contractors) enter its acquisition date in the aerial AWs management module in G<sup>4</sup>CAP to trigger the definition of the starting date of any subsequent HHR AW.
- 3.3.11 When HHR imagery has been acquired by the HHR FW contractor and has been accepted by the MS administration (or its contractors) for a given AW, the AW will be closed automatically in G<sup>4</sup>CAP.
- 3.3.12 If no image has been acquired at the end of the HHR AW, or if the whole area has not been acquired, the MS administration (or its contractors) can request an archive search for the period of the AW or earlier if applicable.
- 3.3.13 In the case of an HR-1 period, the AW may be extended up to the opening of the VHR AW or the start date of the aerial photo flight. In the cases of HR+1, HR+2 and HR+3, AWs can be extended until the image has been acquired or until the MS administration (or its contractors) indicates that the AW should be considered failed. In these cases, it is strongly advised to use Copernicus S1/S2 imagery.
- 3.3.14 If the VHR image is acquired late in the AW, the MS administration (or its contractors) may request an archive search for a suitable HHR image acquired during the first part of the VHR AW. The FW contractor should obtain permission from the JRC before such an SRS image is approved and can be delivered. Even in this case, it is strongly advised to use Copernicus S1/S2 imagery.
- 3.3.15 Reference is made to the VHR specifications for the CAP checks [7, chapter 3, paragraphs 3.3.5 and 3.3.16-21].
- 3.3.16 The relevant AW parameters are therefore summarised as follows (each AW is identified in G<sup>4</sup>CAP by a unique integer value called an ID):
- period: HR-1, HRB1, HR+1, HR+2, HR+3;
  - image profile (see 13.1.1);
  - start and end date (HR-1); earliest start date and latest start date (HRB1 and HR+ AWs)
  - length of AW (in weeks); default minimum is 4 weeks, preferable longer
  - previous AW, where applicable;
  - image mode: Bundle/PSH/Multispectral (MSP)/Panchromatic (PAN);
  - delivery method: DVD/file transfer protocol (FTP)
  - possibility of automatic extension of AW

## 4. **Feasibility**

- 4.1.1 Reference is made to the VHR specification [7, chapter 4; the relevant paragraphs valid for the HHR feasibility are 4.1.1 to 4.1.5 and 4.1.12 to 4.1.16].
- 4.1.2 The main difference between HHR and VHR feasibility is that the HR (HHR profile) AWs, except HR-1, are not known, since they depend on a preceding VHR or aerial acquisition. Therefore, the FW contractor should first check the correctness of the AW (e.g. that the AW is placed correctly in time and that there is enough time for it to fit between any already defined AWs) and that the MS administration is making the correct use of the earliest/latest starting dates (e.g. if the MS administration is systematically setting these as equal to each other, the MS administration should be contacted). Any iteration can take place with the MS administrations in this respect. The only time that the earliest start date and the latest start date should be same is if a VHR2 AW has been removed in favour of an HHR profile acquisition to allow for a fixed AW (setting in the G<sup>4</sup>CAP AW module the earliest and latest start date to the same date and AW length to, for instance, 6 weeks).
- 4.1.3 Thereafter, the Feasibility module in G<sup>4</sup>CAP regarding these ‘floating’ HRB1 and HR+ AWs will allow the FW contractor to interact with the MS administration, giving it two results, each with the possible values GOOD, MEDIUM, LOW (GREEN, YELLOW, RED) and any suggestions of changes:
- the maximum possible length of the AW, that is, from earliest start date to latest start date plus AW length, unless a subsequent VHR AW is starting before that date, in which case the end date would be the day before the start of that VHR AW – result 1 (‘best case’);
  - the minimum possible length of the AW, that is, from latest start date of AW plus window length, unless a subsequent VHR AW is starting before that date, in which case the end date would be the day before the start of that VHR AW – result 2 (‘worst case’).

G<sup>4</sup>CAP AWs exported to perform the feasibility assessment will automatically include these ‘best case’ and ‘worst case’ dates, to avoid creating confusion for the FW contractor and giving them responsibility for determining these scenarios.



**Figure 2 – Floating HHR AWs feasibility cases**

- 4.1.4 Therefore, for the HR-1 AW, a VHR feasibility approach is followed [7, chapter 4], starting from initially requested AWs. Extended dates will be optional in the case of MEDIUM and compulsory in the case of LOW feasibility results.
- 4.1.5 The above procedure will give MS administrations the best basis for accepting a feasibility proposal from the FW contractor. At the end of this procedure, it will therefore be up to the MS administration to accept or reject the proposal within the constraints of adjacent AWs and crop calendars.

## 5. Acquisition request

- 5.1.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 5].

## 6. Quick-look upload

- 6.1.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 6, paragraphs 6.1.1-4]
- 6.1.1 The MS administrations (or contractors) may consult the FW contractor's archives<sup>4</sup>. Services are normally free of charge, but often require registration. The MS administrations (or contractors) may suggest to the IP any imagery for upload that is suitable for their controls activity. The FW contractor will proceed to upload QLs of such imagery into G<sup>4</sup>CAP for acceptance by the MS administrations (or their contractors).
- 6.1.2 The use of the 'MeteoFlag' is also mandatory for HHR images [7, chapter 7; paragraph 7.1.10].

<sup>4</sup> <https://www.intelligence-airbusds.com/en/8235-access-to-our-products> ; <https://www.planet.com/>



6.1.3 The FW contractor is requested to upload SRS image QLs to best fit the shapefile provided by the MS administrations (or their contractors). More than one acquisition can be uploaded for a unique control zone (see paragraph 3.2.2).

## **7. Acquisition acceptance and validation**

7.1.1 Acquisition acceptance or validation is performed on the QLs uploaded by the FW contractor. The procedure follows the same process as described in the VHR Specifications [7, chapter 7], except that cloud cover (CC) thresholds for HHR acceptance is different from the VHR thresholds, as explained below.

7.1.2 For an HHR zone and each open AW, the QL uploaded by the FW contractor with cloud cover  $\leq 1\%$  is considered **Validated**. For low sun angle imagery, please refer also to paragraph 3.3.6.

7.1.3 If the AOI has cloud cover  $> 1\%$ , dense haze, etc., then:

- if cloud cover over the AOI is  $\leq 5\%$ , the QL of the HHR profile image is uploaded as **Proposed** in G<sup>4</sup>CAP by the FW contractor; upon acceptance by the MS administration (or its contractors), the FW contractor may close the AR; upon rejection, the FW contractor shall continue tasking;
- if  $5\% < \text{cloud cover} \leq 20\%$ , the image is **Retained**; the MS administration (or its contractors) shall accept the image as soon as possible if it is usable for the CAP checks, but the FW contractor will continue tasking until such acceptance is received;
- if cloud cover is  $> 20\%$ , the FW contractor should not upload the QLs, but may inform the MS Administration of such imagery, and upon agreement with the MS administration (or contractor), upload respective QLs (e.g. when an AW has come to an end without a validated acquisition).

7.1.4 MS administrations (or contractors) should accept/reject proposed/retained SRS imagery in G<sup>4</sup>CAP within 3 working days after upload.

7.1.5 Reference is made to the VHR specifications for the CAP checks [7, chapter 7, paragraph 7.1.6 to 7.1.8].

## **8. Ordering**

8.1.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 8].

## **9. Delivery**

9.1.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 9].

## **10. Input data quality assessment**

10.1.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 10].

## **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 [1].

### **11.2 Invoicing - the HHR 'basket'**

11.2.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 11, paragraph 11.2].

## **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 Reference is made to the VHR specifications for the CAP checks [7, chapter 12, paragraph 12.1].

### **12.2 Source image return to the JRC by the FW contractor**

12.2.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 12, paragraph 12.2].

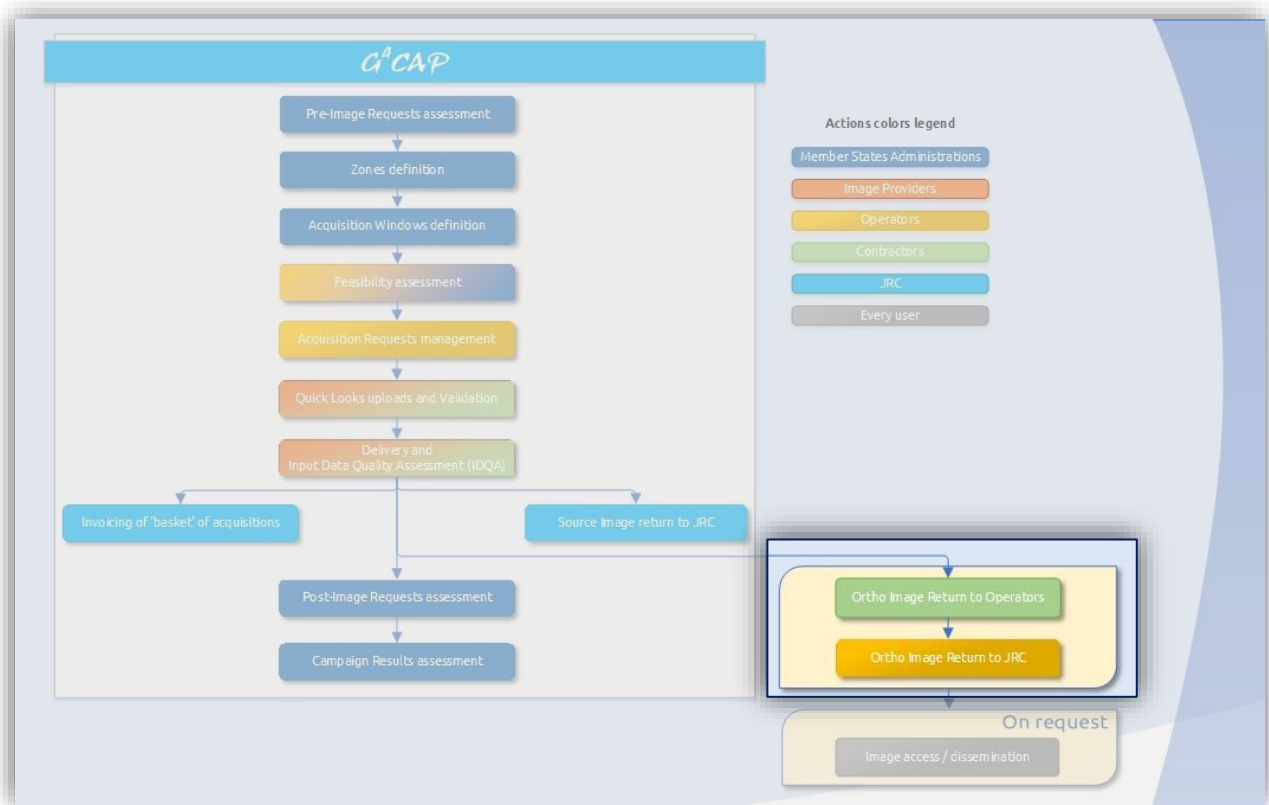
### **12.3 Ortho image return to the JRC by the FW contractor**

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 the JRC and provide them to the JRC. Since the JRC automatically harvests the source data, and also any orthocorrected data delivered directly from the image provider, only imagery delivered with the profile F1. HHR has to be returned by the MS. The deadline for this data collection is at the end of the control campaign year (i.e. 31<sup>st</sup> December of each year for CwRS).

12.3.2 Reference is made to the VHR specifications for the CAP checks [7, chapter 12, paragraphs 12.3.2-7]

12.3.3 HHR orthoimage data shall be made available to the FW contractor by the MS administrations (or their contractors) through AirCAP [15], the dedicated web portal developed by the FW contractor. AirCAP supports the management of the OIRs and a dedicated team of the HHR image provider (FW Contractor) is in charge of its maintenance and support.

12.3.4 The AirCAP solution has been developed by the FW contractor following the recommendations of the JRC. It is out of the scope of G<sup>4</sup>CAP, but Figure 3 below which re-uses the Figure 1 (see paragraph 3.2.2) highlighting the scope of AirCAP.



**Figure 3 - The overall process of the SRS image acquisition focused on OIR process covered by AirCAP**

12.3.5 The User Manual is available through the Help page of AirCAP [16]. The relevant objectives are:

- Rely on Cloud performances to enhance storage management and free from volume limitations.
- Quality controls, formatting and corrections are applied by the system. Reduction of errors risk.
- Setting up a transition towards a homogenized/unique workflow, thanks to portal features.
- Monitoring and log management provided by the system to enhance traceability.
- Accessibility with the possibility to submitting the ortho imagery at any time throughout the campaign, from any common browser.
- Facilitate the upload with “drag and drop” or browse solution and the possibility to submit step by step an OIR directory and take over the deposit later.
- A massive mode has also been implemented in order to enable the deposit of several OIR at the same time.
- The loading of one or several OIRs have to be directly launched from AirCAP, via one of these three modes: browse ("Import New Files"), "drag and drop", or FTP transfer.

12.3.6 Each MS Administration has received the access details (login and password) from the IP (Airbus). If not, please do not hesitate to contact the FW contractor who will promptly provide with these details. Details of each of these three modes are specified through AirCAP User Manual available from the Help page.

12.3.7 A specific access is given to the JRC to monitor the status of all the OIR before their final submissions by the FW contractor on G<sup>4</sup>CAP.

## 12.4 HHR image access

12.4.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 12.4.1-2]

12.4.2 The JRC purchases a limited right of use, but the images themselves remain the property of the FW contractor. In addition, according to the end-user licence agreement (EULA) [9], paragraph 6 on intellectual property rights, imagery must have proper references. When using the imagery, the licensee must 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 JRC.

12.4.3 For the presently running FWCs [1] for HHR profile data, the first sentence above shall be substituted with:

- Spot 6/7 © Airbus DS (year of acquisition)
- © (year of acquisition) Planet Labs

## 13. HHR image profiles

### 13.1 Profiles

13.1.1 A summary of the profile characteristics is given in Table 1.

**Table 1 - HHR profiles adopted within the CAP checks**

Image Profile ID	Description (image MODE)	Spatial Resolution (*) GSD	Radiometric resolution (**) and minimum spectral bands	abs. 1-D RMSE	Cloud Cover (CC) over AOI	Acquisition programming	Remarks	Example of sensors
F1. HHR prime - CwRS [HHR]	Bundle (PAN plus MSP bands), PSH	GSD ≤ 3m	PAN band plus 4 MSP bands including B, G, R, NIR	$x,y \leq 5m$ (reachable with off the shelf sw suite and performed by MS Administration or its contractor)	≤ 1% validated (profile F11) ≤ 5% proposed (profile F12) ≤ 20% retained (profile F13) archive (profile F14)	Priority programming (excluding F14)	for PSH mode the GSD of the PAN band is applied for GSD threshold	SPOT 6/7, Deimos-2, etc.
	MSP bands only	GSD ≤ 12m	4 bands including B, G, R, NIR	$x,y \leq 1.5 \times GSD$ (reachable with off the shelf sw suite and performed by MS Administration or its contractor)			for MSP mode the GSD of the MSP band is applied for GSD threshold	SPOT 6/7, Planet Scope, Deimos-2, etc.
F2. HHR prime - CwRS [ORTHO]	Bundle (PAN plus MSP bands), PSH	GSD ≤ 3m	PAN band plus 4 MSP bands including B, G, R, NIR	$x,y \leq 5m$ (orthorectified by image provider)	≤ 1% validated (profile F21) ≤ 5% proposed (profile F22) ≤ 20% retained (profile F23) archive (profile F14)	Priority programming (excluding F14)	for PSH mode the GSD of the PAN band is applied for GSD threshold	SPOT 6/7, Deimos-2, etc.
	MSP bands only	GSD ≤ 12m	4 bands including B, G, R, NIR	$x,y \leq 10m$ (orthorectified by image provider)			for MSP mode the GSD of the MSP band is applied for GSD threshold	SPOT 6/7, Planet Scope, Deimos-2, etc.

(\*) - the maximum GSD is calculated including the effect of the earth's curvature

(\*\*) - minimum 8 bits/pixel, preferably 11-12.

- 13.1.2 When the MS administration selects its profile in G<sup>4</sup>CAP, it will therefore choose HHR prime profiles as F1, or F2, and will be served by the following sensors:
- F1 - HHR prime Bundle - Spot 6 and 7 - this profile is available as a bundle, MSP and PSH
  - F2 - HHR prime Ortho - Spot 6 and 7 - for cartographic projections available, please refer to paragraph 3.2.3 or options implemented in G<sup>4</sup>CAP; this profile is available as a bundle, MSP and PSH.
- 13.1.3 Notwithstanding above, in case of unsuccessful acquisition with SPOT 6/7 sensors preventing from providing any acquisition, mosaic, or archive (profile F.14, F24) SPOT data, PlanetScope data can be proposed by the IP as HHR acquisition. Planet archives will be searched by image provider during or at the end of the relevant AW. PlanetScope data, being available in 4 multispectral bands only, without the panchromatic band, is compliant only with the existing image mode multispectral (MSP) (see Table 1). The following workflow therefore apply:
- Spot data
  - Regular Mosaic from Spot data [7], chapter 7, paragraph 7.1.7
  - Planet data during AW (if MS Administration accepts image mode MSP). Profile F11, F12, F13, F21, F22, F23
  - Archive after AW end from SPOT
  - Archive after AW end from Planet (if MS Administration accepts image mode MSP). Profile F14, F24
- 13.1.4 Equally, for areas where initially no HHR has been ordered and upon request by the MS administration, the IP can also search for and offer HHR data (SPOT 6/7 and PlanetScope where available). In summary the following workflow will apply:
- Archive from SPOT
  - Archive from Planet (if MS Administration accepts image mode MSP). Profile F14, F24
- 13.1.5 For a complete description of image-processing levels and data formats, please consult the technical documentation regarding respective sensors (Chapter 18.5).
- 13.1.6 For HHR satellite benchmarks pls. see references [10, 11, 12, 13]
- 13.1.7 For possible XML metadata file values, and values of the sensor tag, their allowed abbreviations and their combination with profiles pls. see Tables 3, 4 in reference [7].

## **14. Quality assurance / quality control**

### **14.1 Quality assurance/quality control**

- 14.1.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 14, paragraph 14.1].

## **14.2 Specificities on cloud cover**

14.2.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 14, paragraph 14.2].

## **15. Risk of satellite failure**

15.1.1 Reference is made to the VHR specifications for the CAP checks [7, chapter 15, paragraph 15.1.1].

## **16. JRC responsible staff and e-mail addresses**

16.1.1 Directorate D Sustainable Resources/Unit D.5 Food Security/image acquisition: [par-johan.astrand@ec.europa.eu](mailto:par-johan.astrand@ec.europa.eu).

16.1.2 Directorate D Sustainable Resources/Unit D.5 Food Security/contractual FWC: [philippe.loudjani@ec.europa.eu](mailto:philippe.loudjani@ec.europa.eu).

## 17. References

- 1 FWs for SRS imagery purchase administered by the JRC:
  - a) Framework contracts for supply of SRS data and associated services in support to checks within the CAP;
    - (1) VHR profile II FWC 931.886, with **European Space Imaging** GmbH;
    - (2) HHR profile FWC 938.376 with **Airbus Defence and Space**.
  - b) Framework contract for supply of any type of satellite remote sensing data; Broker FWC 391.782.
- 2 Access to European Union law. Available online: <http://eur-lex.europa.eu/homepage.html>
- 3 OTSC guidance and discussion documents on the future checks by monitoring; (WikiCAP). Available online: [https://marswiki.jrc.ec.europa.eu/wikicap/index.php/Main\\_Page](https://marswiki.jrc.ec.europa.eu/wikicap/index.php/Main_Page)
- 4 G<sup>4</sup>CAP. Available online: <https://g4cap.jrc.ec.europa.eu>
- 5 Technical guidance document (Campaign 2017) for On-The-Spot Checks (OTSC) and area measurement; Technical guidance document on the On-The-Spot Check of Crop Diversification requirements; Technical guidance document on the On-The-Spot Check of Ecological Focus Areas requirements. Available online: [https://marswiki.jrc.ec.europa.eu/wikicap/index.php/Main\\_Page](https://marswiki.jrc.ec.europa.eu/wikicap/index.php/Main_Page)
- 6 Kapnias, D., Milenov, P. and Kay, S., *Guidelines for best practice and quality checking of ortho imagery*, Issue 3.0. Available online: <https://g4cap.jrc.ec.europa.eu/g4cap/Portals/0/Documents/10133.pdf>
- 7 VHR profile-based technical specifications. See Documentation section in G<sup>4</sup>CAP.
- 8 G<sup>4</sup>CAP manual. Available online from the G4CAP documentations page: <https://g4cap.jrc.ec.europa.eu/g4cap/Default.aspx?tabid=172>
- 9 Satellite Remote Sensing Data EULA. Available online: <https://g4cap.jrc.ec.europa.eu/g4cap/EULA.htm>
- 10 Benchmarking THEOS
  - a) Nowak Da Costa, J. K. and Åstrand P. J., *WorldView-2, GeoEye-1, Cartosat-2, Kompsat-2, RapidEye and THEOS image*. JRC Oral presentation (Cat3.4 JRC60286 JRC IPSC/G03/C/JNO/jno D(2010)(12136), Int. ref file: //S:\FMPArchive\C\12136.ppt), MARS Unit's GEOCAP Action's Control Methods Workshop – 2010 campaign; 13-14 April 2010, Ispra, Italy.
  - b) Walczynska, A. and Nowak Da Costa, J. K., *THEOS Geometric Image Quality Testing – Initial Findings*, JRC Scientific and Technical Report (Category 2.2 no. 24655 EN, ISSN 1831-9424, ISBN 978-92-79-18908-1. JRC PUBSY No JRC61992, 2010. <http://publications.jrc.ec.europa.eu/repository/handle/JRC61992>
  - c) Nowak Da Costa, J. K. and Walczynska, A. *Evaluating the WorldView-2, GeoEye-1, DMCI, THEOS and KOMPSAT-2 imagery for use in the Common Agricultural Policy Control with Remote Sensing Programme*, oral presentation (JRC61995), 16th Conference on 'Geomatics in support of the CAP', GeoCAP Action of the MARS Unit, IPSC, DG JRC (organiser), 24 November 2010, Bergamo, Italy, 2010..
- 11 Nowak Da Costa, J. K. and Walczynska, A., *THEOS Geometric Quality Assessment for use in the Common Agricultural Policy control*, 16th Conference on 'Geomatics in support of the CAP', JRC PUBSY No JRC61994, Category 3.5, 24–26 November 2010, Bergamo, Italy.



- 12 Benchmarking SPOT7 (PUBSY JRC93987, EUR 27063, ISBN 978-92-79-45053-2, ISSN 1831-9424 doi:10.2788/17914]. Available online: <http://publications.jrc.ec.europa.eu/repository/handle/JRC93987> (details for SPOT 6 (JRC82314); <http://publications.jrc.ec.europa.eu/repository/handle/JRC82314>).
- 13 Vajsova B, and Åstrand P,, *New sensors benchmark report on Sentinel-2B. Geometric benchmarking over Maussane test site for CAP purposes*, (PUBSY JRC107674, EUR 28760 EN, ISBN 978-92-79-73186-0, ISSN 1831-9424, doi: 10.2760/419553), 2017. Available online: <http://publications.jrc.ec.europa.eu/repository/handle/JRC107674>
- 14 Lemajic S, Vajsova B, Pär Johan Åstrand P, *New sensors benchmark report on PlanetScope*, (PUBSY JRC111221, EUR 29319 EN, ISBN 978-92-79-92833-8 ISSN 1831-9424 doi:10.2760/178918), 2018. Available online: <http://publications.jrc.ec.europa.eu/repository/handle/JRC111221>
- 15 AirCAP, Available online: <https://aircap.intelligence-airbusds.com>
- 16 AirCAP manual. Available online: <https://aircap.intelligence-airbusds.com/ui/tutorial>

## **18. Annexes**

### **18.1 XML metadata file specification for image providers used for the QL upload**

18.1.1 Reference is made to the VHR specifications [7, Annex 19.1].

### **18.2 XML metadata file specification for operators used for the OIRTN upload**

18.2.1 Reference is made to the VHR specifications [7, Annex 19.2].

### **18.3 General recommendations for a buffer creation around CwRS zones**

18.3.1 Reference is made to the VHR specifications [7, Annex 19.3].

### **18.4 Relation elevation angle versus off-nadir angle and some satellite angles of importance**

18.4.1 Reference is made to the VHR specifications [7, Annex 19.4].

## 18.5 HHR sensor details

<b>SPOT6/7</b>	
Satellite specification	
Launch information	Date: SPOT 6: 9/09/2012 Date: Spot 7: 30/06/2014 Launch Vehicle: PSLV C23 Launch Site: ISRO, India
Orbit	Altitude: 694 km Type: Sun-synchronous, 10.00 a.m. descending node Period: 98,79 minutes
Sensor bands	PAN: 450–745 nm 4 MSP: Blue: 450–520 nm Green: 530–590 nm Red: 625–695 nm NIR: 760–890 nm
Sensor resolution ground sampling distance	PAN: 1.5m at nadir (native 2.2m) MSP: 6m at nadir (native 8.8m)
Dynamic range	12 bits per pixel
Swath width	60 km at nadir
Retargeting agility	Time to slew 30° in every direction: 14 seconds (stabilisation time included)
Max contiguous area collected in a single pass (at 30° ONA)	60 × 600 km mono
Revisit frequency	3.5 days at 30° off-nadir
Geolocation accuracy (CE90)	35m CE90 without ground control and up to 30° 10m CE90 for orthorectified products when Reference3D available
Product specification	
Tasking level	Priority tasking
Product options	Level primary Level ortho (Elevation 30 (Reference 3D))
<b>Spectral combinations</b>	PAN, MSP, Bundle and PSH
Resolution	PAN: 0.7 m MSP: 2.8 m
CC	Cloud cover 'validated': 0 to ≤ 1%; 'proposed': 1% < CC ≤ 5%; 'retained': 5 < CC ≤ 20%
Resampling kernel	Cubic convolution, nearest neighbours
Format	DIMAP V2 containing a JPEG 2000/GeoTIFF image file
Dynamic range adjustment (DRA)	Off (optional)
Bit depth	12 bit for JPEG2000 and 16 bit for GeoTIFF
Projection/datum	UTM/WGS 84 (default)
Tiling	km <sup>2</sup>
Delivery medium	DVD or FTP

<b>PlanetScope</b>	
Satellite specification	
Launch information	Multiple launches since 2013 Launch Vehicle: PSLV C23 Launch Site: ISRO, India
Orbit	400 km (International Space Station orbit) 475 km (Sun-Synchronous Orbit) Type: Sun-synchronous, 10.00 a.m. descending node Period: 98,79 minutes
Sensor bands	Blue: 455 - 515 nm Green: 500 - 590 nm Red: 590 - 670 nm NIR: 780 - 860 nm
Sensor resolution ground sampling distance	GSD MSP: 3.7m (at reference altitude of 475km) PlanetScope Ortho Tile Product: radiometric and sensor corrections applied to the data; imagery is orthorectified and projected to a UTM projection.
Dynamic range	12 bits per pixel
Swath width	Depending on the orbit : <ul style="list-style-type: none"> <li>• 20 km x 12 km (approximate)</li> <li>• 24.6 km x 16.4 km (approximate)</li> </ul>
Retargeting agility	No targeting, automatic acquisitions at nadir
Max contiguous area collected in a single pass (at 30° ONA)	60 × 600 km mono
Revisit frequency	Daily revisit of any point on the globe
Geolocation accuracy (CE90)	35m CE90 without ground control and up to 30° 10m CE90 for orthorectified products when Reference3D available
Product specification	
Tasking level	No programming, automatic acquisitions at nadir
Product options	Basic Scene - 3.79 - 3.99 m GSD, 4-band multispectral image, with RPCs. It is not orthorectified or corrected for terrain distortions; I think the NIR band is already aligned to the RGB bands;
Spectral combinations	Ortho Scene - 3m pixel size, 4-band multispectral image. It is a single-frame image capture as acquired by a PlanetScope satellite with additional post processing applied. Nominal scene size is approximately 24 km by 7 km, but varies by altitude;
Resolution	Basic Scene - 3.79 - 3.99 m GSD Ortho scene resampled to 3m pixel size
CC	Cloud cover 'validated': 0 to ≤ 1%; 'proposed': 1% < CC ≤ 5%; 'retained': 5 < CC ≤ 20%
Resampling kernel	Cubic convolution, nearest neighbours
Format	GeoTIFF image file
Bit depth	8 bit
Projection/datum	UTM/WGS 84; ortho scene in national projection tbd
Tiling	km <sup>2</sup>
Delivery medium	FTP

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