

JRC Scientific and Technical Reports

VHR Image Specifications for the CwRS Programme Campaign 2009

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Specifications

VHR Image Specifications for the CwRS Programme Campaign 2009

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Document History

Version	Date	Comment	Who	Modified Pages
1.0	01/05/2008	1 st release includes updates of 2007 specifications (FMP 7528) incorporating exclusion of OrbView3, changes to ErosB, changes to Formosat2, inclusion of WorldView1, backup procedure changes, image return etc.	PA, ME, Image providers	
1.1	30/05/2008	Final version after draft revision deadline 30/05/08	PA	
1.2	12/03/2009	Updates on GeoEye-1; RED colour indicates new or changed issues .	Image providers	
1.31	23/03/2009, 02/04/2009, 22/06/2009	Administrative routines, image return, change on EROS B, and SPOT backup; RED colour indicates new or changed issues . Final check, minor corrections §11.1.1 Image return, and 12.1.3 GE1 sw suites;	PA, ME, CA PA	

1. Introduction

1.1. VHR Image Acquisition for the CwRS Programme

1.1.1. Since 1993, DG AGRI has promoted the use of “Controls with Remote Sensing” (CwRS) as an appropriate control system suitable to check if aids are correctly granted. On the basis of the Council Regulation (EC) 165/94 and of the Commission Regulation (EC) 601/94, the Commission Services are required to centralize the satellite images acquisition. This task was transferred to DG JRC in 1999 (ref.17 September 1998/VI/34942). It is managed through a sub-delegation of signature by DG AGRI to DG JRC.

1.1.2. 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) Satellite Remote Sensing (SRS) data, to the MS Administrations for their CwRS of area-based subsidies. VHR data indeed allows for accuracy in parcel measurement, compliant with Commission Regulation (EC) No. 796/2004, § 30.

1.2. Objectives, referencing and structure of this document

1.2.1. This document constitutes the specifications for VHR imagery to be used within the CwRS Programme. Its objective is to give the stakeholders¹ in the image acquisition management chain 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 Campaign (see Figure 1). This document is available on the EC, JRC Institute for the Protection and Security of the Citizen (IPSC), Agriculture Unit, Community Image Data portal (CID) webzone at: <http://mars.jrc.ec.europa.eu/> (or directly <http://cidportal.jrc.ec.europa.eu/home/image-acquisition/> , through LIODOTNET at <http://lio2.jrc.it/LioDotNet/Default.aspx>).

1.2.2. Reference is made to the Common Technical Specifications (CTS) for the Remote Sensing Controls of area-based subsidies [Ref 2]. Reference is also made to the WikiCAP website [Ref 4] for further recommendations.

1.2.3. Reference is also made to the HR Image Specifications for the CwRS Programme [Ref 3] which should be used in conjunction with present document.

1.2.4. Reference is also made to the terms and conditions of the satellite remote sensing (SRS) data Framework Contracts (FCs) for image procurement to the EC Services signed with image providers [Ref 5]

¹ Stakeholders, or Actors = JRC, Image Provider, Administration/Contractor performing the CwRS

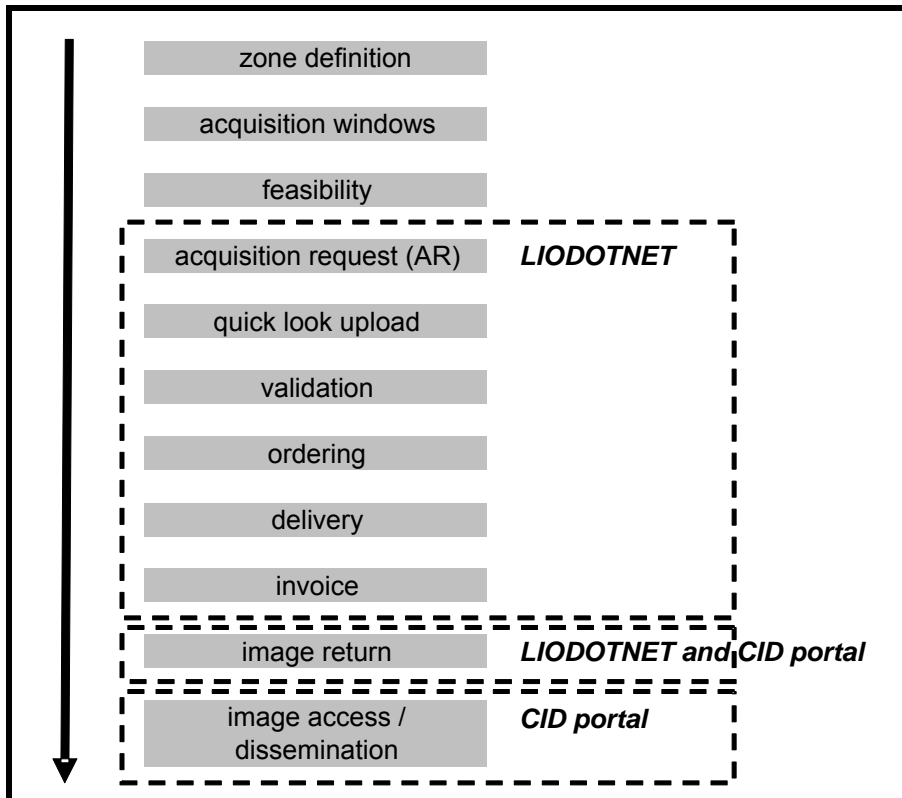


Figure 1 - Figure showing structure of document and image acquisition process flow

2. Zone Definition

2.1. General

- 2.1.1. General principles and the Regulatory basis for selecting the zones to be checked by Remote Sensing are laid down in Commission Regulation (EC) No. 796/2004 [Ref 1]. These are further described in the Common Technical Specifications for the Remote Sensing Controls of area-based subsidies [Ref 2]. The WikiCAP website [Ref 4] on “selection of control zones” recommends that: *“whether the control zones are selected on the basis of a risk analysis or at random, the technical constraints of satellite remote sensing sensors should be taken into account to optimize the probability of acquisition”*. These technical constraints, which are further detailed below, include: swath widths, elevation angles, AOI definition, window adjustments, feasibility assessment etc.
- 2.1.2. A CwRS zone (or Area Of Interest; AOI) consists of a minimum of 4 vertices in Lat/Long Geographic coordinates (decimal degrees, WGS 84 ellipsoid). It is represented by a shapefile containing all files with extensions .shp, .shx, .dbf, .sbx, .sbn, .prj and should be provided by the MS Administration, via EC Services, to the Image Provider. It has a maximum of 500 vertices, and a minimum distance between vertices of 5 km.
- 2.1.3. As imagery is acquired, depending on the sensor’s technical characteristics, the zone is gradually covered wholly or strip-wise. The image provider, which is responsible for the implementation of an

efficient image acquisition system, always aims to cover the zone in as few acquisitions as possible, but multi-temporal collection is valid if performed within the time limit of the acquisition window.

- 2.1.4. Normally an order is placed when the whole zone is fully covered, but a partially covered zone may be ordered at the contractor's request. This is to be considered exceptional, and will only be accepted if contractor is clearly suffering a time constraint. The area to be ordered is calculated (rounded to whole km²) as the intersection between georeferenced quicklooks (QLs) of collection (using final ephemeris data) with the zone in geographic projection UTM/WGS 84.
- 2.1.5. All zones (prime/backup) are "dedicated zones". This has been judged to give the best programming and acquisition results. This means that each zone is allocated to one prime sensor (Ikonos (IK), **GeoEye-1 (GE1)** or Quickbird (QB)). However to increase the overall success rate of the Campaign, there will be a backup solution of Eros A, Eros B, WorldView1², Formosat2 (F2) or Spot5 supermode (SPS) over selected zones. **If this backup is only panchromatic i.e. Eros A, Eros B, WorldView1, or SPS, an extra HR multispectral image (Spot5) (see §4.3.2 CTS [Ref2]) will upon request be programmed during the VHR window (a so called HR(VHR) window will be opened).** Upon successful zone collection by a VHR prime sensor the corresponding backup VHR, and HR(VHR) window will close. Vice versa, if the window comes to an end without a successful prime dedicated acquisition, but with panchromatic backup and multispectral HR imagery available, the window will close and the contractor will use the available data, therefore allowing the dedicated prime sensors to concentrate on other objectives.
- 2.1.6. The VHR zone will, if completed by the prime dedicated sensor, be covered by a bundle image (PAN and MSP as separate bands) or the pansharpened product.
- 2.1.7. All zone definition parameters should be defined by EC Services, in conjunction with MS Administrations, and given to image providers in the feasibility communication. Relevant zone definition parameters:
- ✓ Member State
 - ✓ Zone name
 - ✓ **Dedicated Sensor**; IK, **GE1** or QB
 - ✓ Dedicated Backup Sensor; Eros A/B, Spot supermode (SPS), WV1, or F2.
 - ✓ VHR window (from, to)
 - ✓ Product; bundle or pansharpened
 - ✓ Delivery; DVD or FTP
 - ✓ Shapefile; files with extensions .shp, .shx, .dbf, .sbx, .sbn, .prj (one shapefile / zone)
 - ✓ Zone (AOI) area (rounded to whole km², UTM)
 - ✓ Maximum Cloud Cover (CC); default values: **<10 %** QB, SPS, EROS A/B, WV1, F2, **GE1**; < 5 % IK

² Worldview1 is not used for the 2009 campaign

- ✓ Requested range of angle of elevation³; default values: 50-90° for QB, IK, WV1, GE1; 70-90° for Eros A; 57-90° for Eros B; 56-90° for Spot5, 67-90° for F2
- ✓ Requested Programming; default value: Priority Programming

VHR Sensor	Products	GSD [m]	Swath (at nadir)	Approx Capacity [km2] in a Dedicated scenario	Proposed role	Comments / Constraints
IKONOS	PAN, MSP (4 bands), PANMERGE	1 / 4	11,3	120.000	PRIME	most efficient site 30x30, but may be larger up to 40x60km ; capacity will be forced
QUICKBIRD	PAN, MSP (4 bands), PANMERGE	0,6 / 2,4	16,5	10-15.000	PRIME	to be within 1 fragment 14 km max width, most efficient size 12x30km
GEOEYE1	PAN, MSP (4 bands), PANMERGE	0,5 / 2	15,2	120.000	PRIME	1st Campaign 2009 ; will not be programmed > 50.000 km2
EROS A	PAN	1,8	14	10.000	BACKUP (*)	most efficient site 13x25km (or longer)
EROS B	PAN	0,7	7	30.000	BACKUP (*)	most efficient site 26x28km
SPOT5	SPS PAN supermode	2,5	60,0	25.000	BACKUP (*)	acquisition of SPS PAN and SPOT 5 MSP is possible in same pass
F2	PAN, MSP (4 bands), PANMERGE	2	24	15.000	BACKUP	resolution at off-nadir angle 30deg approx 3m ; across angle max 20deg. ; along angle max 25 deg.
WorldView1	PAN	0,5	17,6	10.000	BACKUP (*)	ongoing geometric accuracy testing / - NOTE: THIS SENSOR IS NOT AVAILABLE FOR CAMPAIGN 2009
SUM PRIME				150.000		
SUM BACKUP				90.000		

(*) - upon request coupled with HR (SPOT 5) to obtain MSP component over VHR window i.e. HR(VHR). RE capacity will be tested for HR only before introducing as HR(VHR)

Figure 2 - The VHR Dedicated sensors menu

2.2. The QuickBird (QB) prime dedicated zone

- 2.2.1. The best satellite tasking optimisation may be reached by ordering single areas of 12km width with variable length (approx 30km). A second strip may be defined but will be imaged at a later date. Even if the satellite is capable of acquiring diagonally, or horizontally, the most efficient scenario is N-S aligned strips. The minimum width of an AOI is 10km, and minimum size is 100 Km2.
- 2.2.2. The necessary overlap (N-S or E-W) between subsequent acquisitions or strips should be a minimum of 0.5km in order to ensure the orthorectification process.
- 2.2.3. Due to the very high resolution of the QB sensor (Ground Sampling Distance (GSD) of 0.6m) there will be a tendency to allocate this satellite sensor to zones with small parcel sizes, or where CAPI of specific crops could benefit from the higher resolution of both the panchromatic, and multispectral data.

³ This document normally uses the term elevation angle and not off-nadir view angle. Relation between the 2 angles can be seen in Annex.

2.3. The Ikonos (IK) prime dedicated zone

- 2.3.1. The most efficient IK zone, for the purpose of a large set of CwRS zones, is a 30x30 km² square acquired in one pass consisting of 3 strips of 10km width (technically the Ikonos sensor may acquire also larger areas in one acquisition; 20x40km, 20x60km, 40x60km). The minimum width of an AOI is 5km, and minimum size is 100km².
- 2.3.2. The necessary overlap (N-S or E-W) between subsequent acquisitions or strips should be a minimum of 0.5km in order to ensure the orthorectification process.
- 2.3.3. The Ikonos system can acquire forwards and backwards giving a high collection rate, which means that there will be a tendency to acquire larger zones with this satellite sensor.

2.4. The GeoEye-1 (GE1) prime dedicated zone

- 2.4.1. The GeoEye-1 system is built to acquire large areas in a single pass (up to 100x100 Km or 300x50 Km), anyway the best efficiency (meaning the capacity to acquire as many zones per pass as possible) is achieved with sites up to 40x40 Km
- 2.4.2. The minimum width of an AOI is 5km, and minimum size is 100km².
- 2.4.3. The GeoEye-1 system can acquire forwards and backwards (bi-directional scan) giving a high collection rate, which means that there will be a tendency to acquire larger zones with this satellite sensor. The satellite is designed to work in a preferred East-West scanning direction (but it works also North-South), therefore it is especially recommended for sites having such an orientation.
- 2.4.4. Due to its very high resolution (GSD of 50 cm) and high geolocation accuracy, this satellite is especially recommended for sites where CAPI of specific crops could benefit from the higher resolution of both the panchromatic and multispectral data, or where there is the need to get very high ortho accuracies and there are not many (or good) GCPs.

2.5. The Eros A/B dedicated backup zone

- 2.5.1. The most efficient Eros A zone is 13x25km, but longer N-S strips (approx. 40km) are acceptable.
- 2.5.2. The swath width of the Eros B satellite is 7km, but a mosaic of multiples of this can be acquired in the same path. The most efficient Eros B zone is 26kmx28km.
- 2.5.3. The Eros A/B data only exists as PAN. Such data will be used as a backup at the Administration's request and most often in difficult climatic zones (e.g. above 45 ° Lat.), or in zones which present difficulties in the feasibility assessment.
- 2.5.4. MS Administrations need to ensure that their contractors can handle Eros A/B data orthorectification otherwise such backup will not be programmed by the EC Services. See further Chapter 12 Eros A/B products and available orthorectification sw suites.

2.5.5. Zones programmed with EROS B will be imaged starting half a second earlier and finishing half a second later in order to ensure correct telemetry at start/end of scene, this will allow usage of GCPs close to the boarder of the zones (a problem which was noted in 2008 campaign)

2.5.6. The quality and efficiency of the EROS B data has been assessed by the EC Services (REF 7).

2.6. The Spot5 supermode (SPS) dedicated backup zone

2.6.1. For Spot5 “supermode”, the zone may be full scenes 60x60km or where possible ½ scene (40x40km), ¼ scene (30x30km), 1/8 scene (20x20km). The EC Services will provide the size of scene fitting the CwRS zone.

2.6.2. The Spot5 HRG sensor, with its “supermode” 2.5m resolution imagery (resulting from interleaving, interpolation, restoration of 2 simultaneous HRG 5m PAN images) will be programmed as a backup at MS Administrations’ request and most often in difficult climatic zones (e.g. above 45 ° Lat.), or of zones which presents difficulties in the feasibility assessment. It will be used where the mean parcel size of the claimed area allows the use of such resolution, with relevant buffer tolerance [Ref 4]. The MS Administrations keep the responsibility of allowing usage of this type of data.

2.6.3. Acquisition of SPS (2.5m) and Spot 5 MSP (10m) is possible contemporarily in order to obtain the requested MSP component over the zone for the VHR window. This may be performed in order to produce Spot 2.5m colour (which however reduces Spot 5 HRG instruments’ chances of looking elsewhere since one of the HRG instruments must acquire three images simultaneously), or 5 m colour (need of 2 images simultaneously). Another option is to programme SPS (2.5m) and SPOT 5 MSP (10m) separately but this does not guarantee acquisition the same day. The products SPOT 5 COL 5m or the product SPOT 5 COL 2.5m is offered as an option.

2.7. The Formosat2 (F2) dedicated backup zone

2.7.1. The most efficient Formosat2 zone will be a single scene 24x24 km or a longer N-S strip of 24 km width. The nature of the satellite being geo- and sun- synchronous permits a daily revisit time of locations on earth which can be reached from its orbit.

2.7.2. Formosat2 (F2) bundle data (PAN plus 4 MSP bands) or pansharpened (upon request) of 2m respectively 8m GSD at nadir will be used as a backup at MS Administrations’ request and most often in difficult climatic zones (e.g. above 45 ° Lat.), or of zones which present difficulties in the feasibility assessment.

2.7.3. The quality and efficiency of the F2 data has been evaluated by the EC Services [REF 6]. RMSE_{1D} and have been set conservatively to 5m which may be revised downward after further assessment. Restrictions have also been set on the across/along angles to 20/25 deg. These restrictions on off-nadir view angles, not only ensure reaching required location accuracy, but are also consistent with

GSD as a function of satellite viewing angles. GSD remains below 2.5m if mentioned restrictions on angles are maintained, and F2 may therefore be considered similar to SPOT supermode as far as the panchromatic image content is concerned.

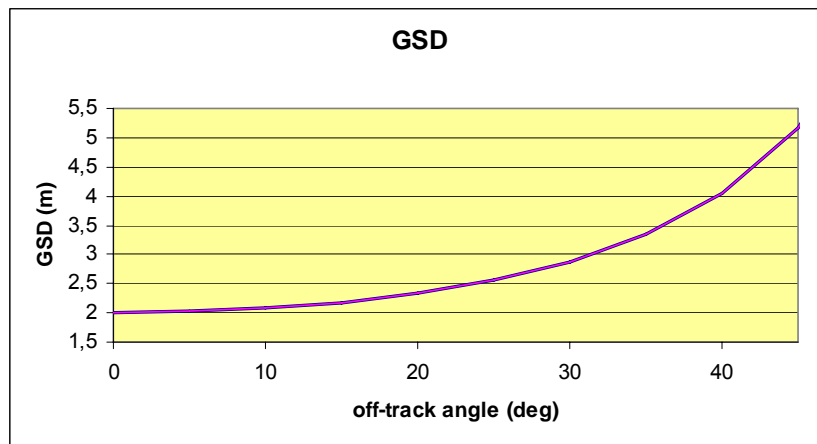


Figure 3 - GSD at, at Nadir, is 2m PAN, and 8m MSP

2.7.4. See further Chapter 12 on Formosat2 products and available orthorectification sw suites.

2.8. The WorldView1⁴ dedicated backup zone

2.8.1. The swath width of the WorldView1 sensor is 17.6km. To increase capacity, both forward and reverse scan of the satellite will be used in collection.

2.8.2. The WorldView1 PAN data of 0.50m GSD will be programmed as a backup at MS Administrations' request and most often in difficult climatic zones (e.g. above 45 ° Lat.), or of zones which presents difficulties in the feasibility assessment.

2.8.3. The quality and efficiency of the WorldView1 data has been assessed by the EC Services (REF 7).

2.8.4. See further Chapter 12 WorldView1 products and available orthorectification sw suites.

3. Acquisition Windows

3.1.1. There is one VHR image acquisition window defined for each CwRS zone. This window will be defined by the MS Administrations and will be placed in order to enable measurement of the largest amount of agricultural parcels possible. Exact dates will depend on crop cycle and will vary with Latitude.

⁴ Worldview1 is not used for the 2009 campaign

- 3.1.2. The VHR prime window should be at least 6 but preferably 8 weeks long. If an HR(-1) window is open it will close when the VHR prime window opens. If a backup acquisition is programmed, this window normally opens 10 days after the prime dedicated window has opened.
- 3.1.3. If extraordinary weather conditions prevail in any region, a window may change (opening and closure date move). This will be dealt with on a case by case basis. Such acquisition window date changes should occur in very rare cases. If feasible, notice will be given by the contractor to the EC Services (who will contact the image provider) at the latest 2 weeks before scheduled opening.
- 3.1.4. An acquisition window may be extended if there is no back-up programmed. This will be dealt with on a case by case basis. Notice will be given by the contractor to EC Services (who will contact the image provider) at latest 5 working days before window closure. This will allow the image provider to extend or re-task. Such extensions will be made if crop cycle permits, or if the zone has only been partially covered (see Fig. 3).
- 3.1.5. **If adequate backup (including HR MSP component if requested) exists at window ending no extension is made of the prime window, which is closed (ref § 2.1.5, and Fig. 3)**

VHR type of window - CwRS Campaign			
PRIME	DEDICATED PRIME SENSOR	IKONOS, GEOEYE1 or QUICKBIRD	
	BACKUP	N	Y
BACKUP	DEDICATED BACKUP SENSOR	n/a	F2 (BUNDLE or PANMERGE); EROS A,B (PAN); WORLDVIEW1 (PAN); SPS (PAN, COL5m, COL 2.5m) opens 10 days later than dedicated prime window
	HR SENSOR IN VHR WINDOW	if VHR acquisition late possible archive HR search for earlier MSP component	SPOT5 MSP (if dedicated backup sensor is ≠ F2)
	EXTENSION	possible if no acquisition at window end	only possible if no prime, no backup (incl. MSP HR)

Figure 4 - VHR; type of windows

- 3.1.6. It is not advantageous to open an acquisition window 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.
- 3.1.7. When the dedicated prime sensor has fully acquired the zone the backup window will close. Only the area acquired by the backup sensor before window closure will be ordered. A maximum time of 2 working days allowing ending of programming is however allowed after email notification of window closure. This is important so that the backup sensor may be used dynamically and moved to other critical zones. The time delay for such change of programming from one zone to another is 5 working days.

- 3.1.8. If a VHR dedicated sensor acquires late in the window, upon request and if budget is available, the EC Services may perform an archive search for an earlier HR sensor acquisition within the window (see Fig. 3).
- 3.1.9. If a window comes to an end with only a partial acquisition, the procedure outlined below will apply:
- ✓ partial acquisition by dedicated prime sensor will be purchased (minimum deliverable area 100 km²)
 - ✓ acquired area by dedicated backup will be purchased
 - ✓ acquired area by speculative backup will be purchased. Such backup acquisition may be performed by any sensor on a zone dedicated to another sensor on a speculative basis. The image provider will already have told the EC Services in advance for which zones such speculative backup will be performed so that an Acquisition Request (AR) (see Chapter 5) may be issued. If a sensor has completed a speculative backup acquisition it will be purchased for the area not covered by the dedicated sensors (prime or backup) at the end of the window. In addition to this complementary area, an overlap area of 0.5km will be purchased. If more than one speculative backup exists the contractor will normally decide which to use (EC Services have the final decision).
 - ✓ acquisitions outside the window, outside acquisition specification of elevation angle, or outside CC thresholds may be proposed by the image providers and will be chosen if no other imagery is available to cover zone and if the contractor accepts.
 - ✓ recent archive imagery may be proposed by the image providers (or contractors accessing image providers' on-line archives) at the end of the acquisition window. Such imagery will be chosen if no other imagery is available to cover zone and if the contractor accepts.
- 3.1.10. It is imperative that no sensor should use collection capability of their dedicated zones' programming for any speculative backup. There should be no conflict between a dedicated zone (always on priority tasking) and a zone programmed for speculative backup.
- 3.1.11. Upon request from the EC Services, the image providers will inform on zone image acquisition status (e.g. attempts left before window closure, or possible attempt close afterwards).

4. Feasibility

- 4.1.1. The image requests from the MS Administrations including zone definition parameters (see § 2.1.7) are received by the EC Services. The information is passed to the image providers and a technical and competitive "feasibility" assessment is performed.
- 4.1.2. Such feasibility includes among others; satellite characteristics, zone size, zone shape, zone latitude, elevation angle, acquisition window, priority level, cloud cover, statistical weather forecasting and other competitive tasking requests. All tasking made by EC Services is placed at priority (or rush, or RED) programming.

- 4.1.3. 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 orthorectification accuracy specification thresholds [Ref2]. In general the elevation angle should be kept as high as possible by the image providers in order to facilitate orthorectification.
- 4.1.4. The image providers will report back to the EC Services within two weeks of reception of all zone definition parameters. Finally, after required iterations, an optimum acquisition scenario should be reached with final acquisition windows, final division of zones between dedicated prime sensors and final division of zones between dedicated backup sensors. This result is then iterated and accepted by the MS Administrations.

5. Acquisition Request

- 5.1.1. After the feasibility assessment, dedicated and backup (and possibly any speculative) programming is known, an Acquisition Request (AR) for the product is issued in LIODOTNET⁵. Each AR has a unique identifier called ARid.
- 5.1.2. LIODOTNET is a WEB-based informatics application developed by the EC Services in order to manage Acquisition Request (AR), image upload, validation, ordering, delivery, invoicing and image return/archiving of satellite images.
- 5.1.3. LIODOTNET is the main communication tool between the CwRS actors⁶ during the Campaign; automatic email exchange may be chosen to synchronize actions between different actors. Web address is <http://lio2.jrc.it/LioDotNet/Default.aspx> and manuals can be found online from the system.
- 5.1.4. Preview of uploaded QLs is made using the CID QL Browser which is an online application for displaying and browsing Quick Looks and shape files from the image acquisitions. It is reachable directly from within LIODOTNET (or externally at <http://lio2.jrc.it/pub/lioqlbrowser09/>)
- 5.1.5. An Acquisition Request (AR) will close 2 working days after a window end.

6. QL (Browse Image) Upload

- 6.1.1. Image Provider will “notify” the EC Services of an acquisition through an upload in the LIODOTNET system (or email in case of temporary system unavailability) within 2 working days of an acquisition (validated, proposed, or partial upload).
- 6.1.2. Uploading image acquisition details into the LIODOTNET starts by clicking on the proper AR (giving automatically some of the parameters: zone name, sensor, product, and acquisition type (dedicated,

⁵ LIODOTNET = Live Image Ordering system developed within Microsoft .NET domain

⁶ Stakeholders, or Actors = JRC, Image Provider, Administration/Contractor performing the CwRS

backup, or speculative)). Image details such as ARId, Country (ISO name), Zone Name, Product, Acquisition date (dd-mm-yyyy), Cloud Cover (%), Haze Flag, Elevation angle, Display order (the display order of the given layer in the VHR Browser), Provider status (Validated, Proposed, not required), Filename etc. are defined in the XML⁷ file. The XML file with image QL, shapefile and other necessary files for georeferencing are zipped and uploaded.

- 6.1.3. Image Providers may also use an automatic upload of their image acquisition details. In this case email should be sent to a generic mailbox lio.net@jrc.it. The automatic upload will generate the same Email notification as a normal upload. In automatic upload it is essential to specify the ARId in the XML: <ARId>**21041**</ARId>⁵
- 6.1.4. Upon upload of dedicated or backup acquisition the LIODOTNET system will automatically send message to subscribed users. The other image providers are included in this message in order to avoid any unnecessary speculative backup tasking. User subscription in general is done through the LIODOTNET system, where also filters for which emails to receive may be applied.
- 6.1.5. A speculative backup is also introduced in LIODOTNET according to above procedure but will NOT be visible to contractors until the end of the window.
- 6.1.6. The image providers' own archives may be consulted by the contractors (services are normally free of charge and subject to subscription). Such archives include EURIMAGE EiNet for QB, DigitalGlobe Browse Tool for QB and WV1⁸, SPOTImage (DALI), GeoEye's **GeoFUSE (for Ikonos and GeoEye-1⁹)**, etc. Contractors may consult these archives and propose any imagery suitable for their controls activity to the EC Services; the EC Services will proceed, via image providers, to upload QLs of such imagery into LIODOTNET for acceptance.

7. **Validation**

- 7.1.1. Validation may be performed over the whole zone or over a part of a zone (partial upload). It is always done on intersection of the "upload (or acquisition)" with the zone shapefile. The "upload (or acquisition)" has one date, is of a minimum 100km² of contiguous area, and has a regular and simple shape. It is a strip for QUICKBIRD, EROS A; a strip/multiple strip for IKONOS, **GeoEye-1**, EROS B, WV1 and is images for SPOT5 supermode, F2.
- 7.1.2. For a VHR zone the validation of an upload is done on the basis of cloud cover (CC) content. Haze, which is not considered cloud by image provider, does not cause rejection but is flagged (see below § 7.1.8) and may trigger an extra re-tasking. The image provider uploads georeferenced QL and relevant XML file including CC assessment (following established CC threshold criteria) and haze assessment (haze flag) into LIODOTNET.

⁷ XML File Specification – see Annex 17.1

⁸ <http://browse.digitalglobe.com/>

⁹ <http://geofuse.geoeye.com/>

7.1.3. VHR CC thresholds are defined as follows:

- ✓ A “validated” acquisition is defined by a maximum CC of $\leq 5\%$ for IK¹⁰, $\leq 10\%$ for QB, GE1, EROS A/B, SPOT SPS, WV1, and F2. Validation of imagery is done within 2 working days by EC Services (no action is required by contractor). Validated images are delivered directly to contractor (after order has been received by image provider from the EC Services) having passed through Quality Control (QC) of the Image Provider (see Chapter 9 Delivery, and 13 Quality Assurance / Quality Control)
- ✓ A “proposed” acquisition is defined by a CC of > 5 and $\leq 30\%$ for IK¹¹, > 10 and $\leq 30\%$ for QB, GE1, EROS A/B, SPOT SPS, WV1, and F2. Proposed images are delivered to the contractor only upon final agreement by EC Services. Programming continues for better acquisitions during the period of accept/decline which must not exceed 3 working days. The Commission notifies the image provider through LIODOTNET and thus gives instructions on future collection. After an “accept” the proposed scene goes through QC of the Image Provider and is shipped to the contractor (after order has been received by image provider from the EC Services).

7.1.4. Validation of a series of “proposed” acquisitions (uploads) - the VHR image providers have agreed to provide “all” the “proposed” acquisitions to the contractor if the contractor accepts one “proposed” acquisition over his control zone. The contractor should therefore react within time limit on “proposed” acquisition (3 days), and reject if not usable; however keeping in mind that when further “proposed” acquisitions are made available over the same zone these can be used together with already rejected acquisitions by him.

7.1.5. The contractor and image provider should produce regular mosaics of “proposed” imagery to aid in decision on usability of such series of acquisitions. “Accept” of a series of “proposed” acquisitions will allow Image Providers to release satellite capacity for other zones.

7.1.6. Re-upload of a rejected acquisition – image provider may re-upload part of a rejected “proposed” acquisition if it, in combination with, a new “validated” acquisition serves to complete a zone. The re-uploaded “proposed” acquisition has to be of “validated” CC threshold, of one date, of minimum 100km² of contiguous area, and has to have a regular and simple shape.

7.1.7. In case of a conglomeration of CC within part of a large acquisition, this part (minimum 100km²) can be re-tasked, upon request of the EC Services, even if whole acquisition is “validated”. A new AR will be issued for this part of the zone if contractor cannot use the portion of the validated acquisition covered by the CC conglomeration. Contractor will have to follow procedure similar to section below (Haze flag) in order to prove that the re-tasking is required by the EC Services. Decision will be taken by EC Services within 3 working days.

7.1.8. VHR Haze flag is validated as follows:

¹⁰ Ikonos will be tasked for $<5\%$ CC throughout the window length; however if only $<10\%$ CC exists after window closure it will be purchased.

- ✓ Validated CC upload with flag for dense haze - the flag will trigger an e-mail to the Contractor who will assess if the dense haze prevents control of the parcels. This will be done within 3 working days by contractor who has to answer the EC Services on following issues in order for decision on possible re-tasking to be taken:
 - prepare a shape file of the control parcel structure (lat/long DD WGS 84, less than 500 vertices, no vertices closer than 5km);
 - assess preliminary T4 coding due haze (reference CTS [Ref2]);
 - check if any proposed image is available;
 - check if any backup images are available (EC Services will inform of any speculative images are available);
 - assess whether opening of an HR image may satisfy CAPI needs and haze image is still acceptable for parcel measurement;
 - assess whether the haze image can be used if an atmospheric correction sw is applied to 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 image¹¹.

If the above steps cannot ensure a successful control procedure:

- prepare (possible) new shape file, if not complete zone, to re-collect (minimum 100km²);
- decide on a new window, and assess the time delay that a re-tasking implies for the success of your control procedure;

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

- ✓ Proposed CC upload with flag for dense haze - treated as proposed “acquisition”

8. Ordering

8.1.1. Ordering of all imagery will be made using the EC Services’ LIODOTNET system, and sent to the Image Provider in digital form. Order will contain all relevant acquisition details¹² including:

- European Commission - Joint Research Centre (JRC), Institute for the Protection and Security of the Citizen, IPSC order #, Acquisition Request ID (ARid)
- VHR: country, zone, period, state, area, acquisition date, elevation angle, product, cloud cover, delivery media
- delivery address
- any other order parameters according to Chapter 12 Products.

8.1.2. Orders will be made in order letters containing a single zone, or agreed partial zone.

¹¹ EUSI, provider of Ikonos, may upon request provide final image on FTP for evaluation

¹² Extracted from zones definition parameters (§ 2.1.7), and metadata as defined in XML (§ 6.1.2)

- 8.1.3. Ordering of all dedicated imagery (prime and backup) will be done within 2 working days after acceptance of validated acquisition (complete or partial).
- 8.1.4. Ordering of other backup imagery will be done after window closure.
- 8.1.5. All orders will be placed with commercial priority tasking (QB, IK, **GE1**, WV1, F2), rush service (EROS A/B), and Red Programming (SPOT).

9. Delivery

- 9.1.1. Delivery will normally take place after completion of the whole zone. The product will thus contain imagery covering the whole zone, possibly of more than one date (many validated partial acquisitions), in the format and on the media asked for. If requested by the contractor, delivery of validated “proposed” imagery will include “all” proposed uploads over the zone.
- 9.1.2. Partial delivery may occur upon special request by a contractor, or when acquisition window has come to an end, or when image provider reports his tasking over the zone is finished. As a minimum (single partial delivery) the product will have one acquisition date, be of a minimum 100km² of contiguous area, and have a regular and simple shape. It is a strip for QUICKBIRD, EROS A; a strip/multiple strip for IKONOS, **GE1**, EROS B, WV1 and is images for SPOT5 supermode, F2.
- 9.1.3. The contractual delivery period (production, internal QC, and ex-works availability) agreed with the EC Services from the date of ordering are 6 working days for VHR data.
- 9.1.4. Images (after validation according to procedure in § 7.1.3) are delivered directly to the contractor after having passed through the internal Quality Control (QC) of the Image Provider.
- 9.1.5. The contractor receives a “delivery note”, through LIODOTNET, as soon as the product is shipped by the Image Provider. The delivery note includes order #, Acquisition Request ID (ARid), Acquisition ID (Aid). If product is delivered via FTP, the delivery note will contain also the FTP address, username and password (in some cases such information is also contained in the comments textbox of the upload itself).
- 9.1.6. If product is delivered on FTP, please take in mind that FTP download of e.g. 1.4 GByte scene at 1MBit/sec takes approx. 3½ hours. The contractor must download the product within **8 working days** of the day placed on ftp server by image provider.
- 9.1.7. **All Image Providers will not only deliver product to the contractor on DVD or FTP as requested, but will also deliver product to the EC Services on specific FTP account for automatic harvest (see Chapter 11 Image Return)**
- 9.1.8. **The contractors will insert the actual date of actual receipt of each product in LIODOTNET (order page). The contractor will also fill in the IDQA (Input Data Quality Assessment) directly on the order page within 5 working days of reception. These actions will allow**

- ✓ the EC Services to assess whether the observed delays comply with those agreed with the image providers
- ✓ to trigger the invoicing procedure
- ✓ assess initial quality of delivered imagery

9.1.9. Upon request from the EC Services, the Image Provider will inform on Image production/QC status (production pending, production finished, production date)

10. **Invoicing**

10.1. **Pricing**

10.1.1. Pricing for products will be according to Framework Contracts (FC) stipulated with the 5 Image Providers; Eurimage for QB, WV1 imagery, EUSI for IK imagery, Telespazio for **GE1** imagery, ImageSat for Eros A/B imagery, and SPOTImage for Spot and F2 imagery (see § 1.2.4).

10.1.2. Any ad-hoc agreement valid for the specific constraints inherent to the CwRS Programme regarding e.g. cloud cover uplift, priority uplift, programming, shipment cost per delivery, further volume discounts, etc. may have been introduced as supplementary conditions of the above-mentioned FCs.

10.2. **Invoicing**

10.2.1. As soon as image dispatch has been made by the image provider, he will send a “draft” invoice to the EC Services. He will “tick” the draft invoice “sent” box in LIODOTNET (order page). **Each “draft” invoice will be checked by the EC Services within 5 working days of reception.**

10.2.2. **After IDQA is filled in by contractor (see § 9.1.8 above), a “final” invoice can be sent by the Image Provider to the EC Services.**

10.2.3. Final Invoice will be sent to the EC Services with following address on invoice:

European Commission - Joint Research Centre (JRC)
Institute for the Protection and Security of the Citizen, IPSC
Management Support Unit
For the attention of: Payments Office
TP 268
Via E. Fermi, 2749
I-21027 Ispra (VA)
ITALY

In order to speed up the invoice handling, address the envelope to:

European Commission - Joint Research Centre (JRC)
Institute for the Protection and Security of the Citizen, IPSC

Cherith Aspinall
CID - TP 266
Via E. Fermi, 2749
I-21027 Ispra (VA)
ITALY

10.2.4. The EC Services will proceed with payment if imagery is collected according to given specifications and invoicing by image provider follows the procedures described above. The EC Services' payment terms as defined in FCs is calculated from date of reception of final invoice in the CAD Office of the JRC, Ispra.

11. Image Data Return

11.1.1. From 2009 years campaign all source imagery supplied to the EC Services will be harvested automatically by the EC Services. For this purpose each Image Provider will provide the EC services with access to either an FTP account with a "Country / Site_name / Image_1" directory structure under it, or to one FTP account per country with a "Site_name / Image_1" directory structure under each of them. The Image Provider should provide such account independent of delivery media to contractors.

11.1.2. The VHR ortho-corrected imagery used in the CwRS Campaign must be returned to the EC Services at JRC, Ispra no later than 01.12.2009. The delivery should include the data and the necessary documentation:

- ✓ the source images in the original format/structure/level delivered to the contractor on a CD or DVD. The CDROM or DVD should be labelled with "Contractor", "Zone", and "Campaign year".
- ✓ the metadata describing content of CD/DVD will be introduced in LIODOTNET¹³; one image return # will be given for each PERIOD (VHR), and PROCESSING LEVEL (source or ortho).
- ✓ moreover for the orthorectified images the specific XML file needs to be filled in . Please read carefully the instructions on how to fill in this XML file and save it together with your orthoimage file keeping the name convention *imgmeta.xml*. XML form and instruction is available on the following URL: <http://marsmap.jrc.it/public/tools/metadata/>

All images will be stored on the CID portal server and will be available to the MS Administrations under specific conditions.

11.1.3. For the VHR images, for every single image received by the contractor, all bands that have been orthorectified shall be returned in GeoTIFF or Erdas IMG. If an uncompressed (possibly pansharpened) mosaic of the zone is available, this can be returned instead or in addition to the single images. In case the file corresponding to the product to be returned is larger than 2GB

¹³ <http://lio2.jrc.it/LioDotNet/Portals/0/Volume%20%20-%20Image%20Return.pdf>

uncompressed, it must be split into tiles not larger than 2GB uncompressed. The file formats accepted are uncompressed GeoTIFF and Erdas IMG. It is absolutely mandatory to specify the coordinate reference system (CRS) associated to every single product as an EPSG code (<http://www.epsg.org/Geodetic.html>). In case an EPSG code does not exist for the CRS used in the product, the CRS specifications shall be provided in Well Known Text format (description in the OpenGIS Project document 01-009 available at <http://www.opengeospatial.org/docs/01-009.pdf>).

11.2. Image Access

11.2.1. MS Administrations may access imagery purchased by the EC Services on their Framework Contracts (FCs). This is valid for any use in the domain of the CAP IACS e.g. IACS GIS updating, or another Ministry requiring imagery for e.g. environmental checks, etc. (such parallel domain users should not exceed two additional users). Access services include discovery, download of source data, and discovery, view, and download of primary derived data. Following information is required from the MS Administration:

- ✓ full name of user and details of the organisation which will make use of imagery
- ✓ description of the purpose for which the imagery shall be used
- ✓ indication of the images; satellite sensor, acquisition date, name of the control zone, any unique identifier of the images.

Letter containing above information will be sent to:

European Commission - Joint Research Centre (JRC)
Institute for the Protection and Security of the Citizen, IPSC
Mr Jacques Delince
MARS Unit
TP 266
Via E. Fermi, 2749
I-21027 Ispra (VA)
ITALY

The EC Services will thereafter inform the Image Providers of the image usage.

11.2.2. Research/Academic Organisations may also access imagery purchased by the EC Services on the Framework Contracts (FCs). This is valid for any research use linked to the CAP IACS, and in agreement with the MS Administration and the EC Services. Access services include discovery, download of source data, and discovery, view, and download of primary derived data.

11.2.3. Following information is required from the MS Administration:

- ✓ full name of user and details of the Research/Academic organisation which will make use of imagery
- ✓ description of the purpose for which the imagery shall be used
- ✓ indication of the images; satellite sensor, acquisition date, name of the control zone, any unique identifier of the images

- ✓ EC Services Commission will receive a summary report containing the results obtained at the end of the work

Letter containing above information will be sent to:

European Commission - Joint Research Centre (JRC)
 Institute for the Protection and Security of the Citizen, IPSC
 Mr Jacques Delincé
 MARS Unit
 TP 266
 Via E. Fermi, 2749
 I-21027 Ispra (VA)
 ITALY

The EC Services will thereafter obtain agreement from the Image Providers for image usage.

11.2.4. Images used in above operations may neither be disseminated nor the resulting products sold. Image access and return should be arranged through the CID server of the EC Services, Ispra.

11.2.5. It should be mentioned that the EC Service purchases a right to the use of the images, but not the copyright, which remains the property of the image providers. If extracts of the images are used in a publication, the following references must be quoted, according to the case:

- ✓ SPOT: "Distributed by SPOTImage, © CNES [year of the image]"
- ✓ Formosat2: © NSPO [year of the image], Distributed by SPOTImage
- ✓ QuickBird: "© DigitalGlobe [year of the image], distributed by Eurimage S.p.A."
- ✓ WorldView-1: "© DigitalGlobe [year of the image], distributed by Eurimage S.p.A."
- ✓ Ikonos: "© [year of the image] GeoEye, Inc. All Rights Reserved, distributed by Telespazio S.p.A."
- ✓ GeoEye-1: "© [year of the image] GeoEye, Inc. All Rights Reserved, distributed by Telespazio S.p.A."
- ✓ EROS A "© ImageSat International N.V. [year of the image]"
- ✓ EROS B "© ImageSat International N.V. [year of the image]"

11.2.6. A separate statement that "the data use was funded by the European Commission" needs to complement this referencing.

12. Products

12.1.1. For QUICKBIRD the products ordered will be /km²:

- Standard Ortho-Ready (or Standard 2A)¹⁴, Basic format (1B)¹⁵

¹⁴. A Standard Image is radiometrically calibrated, corrected for sensor and platform-induced distortions and mapped to a cartographic projection. More in detail the radiometric corrections applied to the Standard product include: relative radiometric response between detectors, non-responsive detector fill, and a conversion for absolute radiometry. The sensor corrections account for internal detector
 Internal ref: « file://S:\FMPArchive\C\10617.doc »

- Bundle (Panchromatic and 4 multispectral separate bands; 2 files), or Pansharpened (4 multispectral bands at PAN resolution; 1 file), resolution PAN 0.6-0.7m / MSP 2.4-2.8m
- The tiling option will be used in order to avoid files larger than 2 GB; all QB orders will be produced with 16k tiling for the Bundle orders (if the zone is small there will be no tiling) and 14k tiling for all the Pansharpened orders. These options will permit having the smallest number of tiles, while maintaining the size of each piece below 2 GB. In the delivered QB products there is included the folder named GIS_FILES with detailed shape files of the different tiles provided, which gives an overview of the product structure.
- Off-nadir angle 0-37° (elevation angle 50-90°), (see Annex for conversion between the two angles)
- Cloud cover “validated” 0 - ≤ 10 %, “proposed” > 10 - ≤ 30 % CC
- Resampling Cubic Convolution CC, for Pansharpened product kernel “pansharpened”
- Format GeoTIFF 1.0
- bit depth 16 Bit (image 11bit)
- UTM Datum WGS84
- Commercial Priority Tasking
- DVD delivery or FTP delivery

12.1.2. For IKONOS the products ordered will be /km²:

- Geo Ortho-Kit
- Bundle (Panchromatic and 4 multispectral separate bands), or Pansharpened (4 multispectral bands at PAN resolution), resolution PAN 0.8-1.0m / MSP 3.28-4.0m
- Elevation angle 50-90° (i.e. off-nadir angle 0-36° for IK), (see Annex for conversion between the two angles)

geometry, optical distortion, scan distortion, any line-rate variations, and mis-registration of the multi-spectral bands. Geometric corrections remove spacecraft orbit position and attitude uncertainty, earth rotation and curvature, and panoramic distortion. Additionally, a coarse DEM is used to normalize for topographic relief with respect to the referenced ellipsoid. The degree of normalization is relatively small, so while this product has terrain corrections, it is not considered orthorectified. The Ortho-Ready Standard product (OR Standard 2A) is also available, without use of the mentioned coarse DEM, which allows ortho-rectification with accuracies comparable to those obtained from Basic Imagery. EC Services are obtaining very good orthorectification accuracies with this Std Ortho Ready format (OR Standard 2A) using the Rational Polynomial Coefficients (RPCs), and adequate ancillary data (GCPs, DEM) both for QB, and in initial tests of WV1.

¹⁵ Basic format (1B) is delivered only upon request since the Std Ortho Ready format (2A) with Rational Polynomial Coefficients (RPCs) is giving very good results⁴. Basic imagery is the least processed image product; only corrections for radiometric distortions and adjustments for internal sensor geometry, optical and sensor distortions have been performed. This imagery is more difficult to handle, it has pixel size depending on off-nadir view angle, requires reference data of higher quality, and more GCPs to orthorectify. The format however includes orbital parameters (ATT and EPH) updated every 0,02 seconds of an acquisition scan and allows more accurate modelling of the acquisition. In the specific case a sw suite requires the Basic format for orthorectification this format may be delivered by the EC Services.

- Cloud cover “validated” 0 - ≤ 5 %, “proposed” > 5 - ≤ 30¹⁰ % CC
- Resampling CC
- Format GeoTIFF 1.0
- DRA (dynamic range adjustment) off
- bit depth 16 Bit (image 11bit)
- UTM Datum WGS84
- Commercial Priority Tasking
- DVD delivery or FTP delivery

12.1.3. For GeoEye-1 the products ordered will be /km²:

- Geo products (which include RPCs)
- Bundle (Panchromatic and 4 multispectral bands as 4 separate files or as a single 4-layers file), or Pansharpened (4 multispectral bands at PAN resolution, provided as 4 separate files or as a single 4-layers file), resolution PAN 0.5 m / MSP 2.0 m
- Elevation angle 50-90°
- Cloud cover “validated” 0 - ≤ 5 %, “proposed” > 5 - ≤ 30 % CC
- Resampling CC
- Format GeoTIFF
- DRA (dynamic range adjustment) off
- bit depth 16 Bit (image 11bit)
- UTM Datum WGS84
- Commercial Priority Tasking
- DVD delivery or FTP delivery
- Until specific module is provided for GE1 by sw vendors the EC services have reached very good orthorectification results using:
 - PCI 10.1 Geomatica OrthoEngine (RPC IKONOS model, degree 1 polynomial)
 - ERDAS LPS 9.2. (RPC IKONOS model, degree 1 polynomial)

12.1.4. For Eros A the products ordered will be /km²:

- Eros A level 1A (plus pass file); BW, resolution 1.8 – 2.1 m
- Maximum off-nadir view angle 18.5° (i.e. 70-90° elevation angle), (see Annex for conversion between the two angles)
- Cloud cover “validated” 0 - ≤ 10 %, “proposed” > 10 - ≤ 30 % CC
- Format tiff (1A)
- bit depth 16 Bit (image 11 bit)
- UTM Datum WGS84
- Commercial Priority Service

- DVD delivery or FTP delivery
- Sw recommended – PCI Geomatica 9.0, Socet Set (EROS model), SIP Ortho, and ERDAS Imagine 9.0.

12.1.5. For Eros B the products ordered will be /km²:

- Eros B level 1A (plus pass file); BW, resolution 0.7 – 0.8 m.
- Swath width at nadir is 7km
- Maximum off-nadir view angle 30° (i.e. 57-90° elevation angle), (see Annex for conversion between the two angles)
- Cloud cover “validated” 0 - ≤10 %, “proposed” > 10 - ≤ 30 % CC
- Format tiff (1A)
- Bit depth 16 Bit (image 11 bit)
- UTM Datum WGS84
- Commercial Rush Service
- DVD delivery or FTP delivery
- SW recommended – Socet Set (EROS B model), ERDAS Imagine 9.2 and PCI Geomatica 10.1.1.

12.1.6. For SPOT 5 supermode (SPS) the products ordered will be full scene; 60x60km, ½ scene; 40x40km, ¼ scene; 30x30km, or 1/8 scene; 20x20km scene:

- SPOT5 supermode; BW, 1A
- upon request SPOT5 COL5m, COL 2.5m
- Off-nadir view angle 0-30° (56-90° elevation angle), (see Annex for conversion between the two angles)
- Cloud cover “validated” 0 - ≤10 %, “proposed” > 10 - ≤ 30 % CC
- Resampling CC
- Format GeoTIFF 1.0
- bit depth 16 Bit (image 11bit)
- UTM Datum WGS84
- Blue / Red Programming Service
- DVD delivery or FTP delivery

12.1.7. For WorldView1 (WV1) the products ordered will be /km²:

- Standard Ortho-Ready (OR Standard 2A), Basic format (1B)
- the data is panchromatic (PAN), BW, with resolution 0.50m
- The tiling option will be used in order to avoid files larger than 2 GB; all WV1 orders will be produced with 16k tiling (if the zone is small there will be no tiling). In the delivered WV1

products there is included the folder named GIS_FILES with detailed shape files of the different tiles provided, which gives an overview of the product structure.

- Off-nadir angle 0-37°, (elevation angle 50-90°), (see Annex for conversion between the two angles)
- Cloud cover “validated” 0 - ≤ 10 %, “proposed” > 10 - ≤ 30 % CC
- Resampling Cubic Convolution CC
- Format GeoTIFF 1.0
- bit depth 16 Bit (image 11bit)
- UTM Datum WGS84
- Commercial Priority Tasking
- DVD delivery or FTP delivery
- recommended minimum versions of software suites that can ortho correct WV1 data are e.g. ERDAS Imagine 9.2 (Basic format using rigorous modelling, Std Ortho-Ready format using QB RPC model), ERDAS Imagine 9.1 (std ortho ready format using QB RPC model), PCI 10.1.2., Keystone SIPOrtho.

12.1.8. For Formosat2 data the product order will be /scene:

- Processing level - Radiometrically corrected level 1A with basic radiometric normalisation for detectors calibration, but with no geometric correction.
- Swath width at nadir is 24km
- DIMAP format (image in GeoTIFF, and metadata in XML file METADATA.DIM); Formosat-2 is delivered with filtered ephemeris and attitude data, refined focal plane calibration.
- Off-nadir view angles (across 0-20°, along 0-25°); (see Annex for conversion between off-nadir and elevation angle)⁶
- Cloud cover “validated” 0 - ≤ 10 %, “proposed” > 10 - ≤ 30 % CC
- 8 bits/pixel
- priority tasking
- recommended minimum versions of sw suites are PCI Geomatica 10 with fix 10031, Erdas Imagine 9.1 with fix 33599, Erdas IMAGINE 9.2, Keystone SIPOrtho, Prodigeo of EADS SPOTImage and Socet Set.

13. Quality Assurance / Quality Control

13.1. Image Quality Control (QC)

13.1.1. Quality Assurance (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. Quality Control (QC) aims to detect nonconformities in a product.

- 13.1.2. QC includes assessment of issues like data integrity, completeness, cloud cover, haze or thin clouds, fog, smoke, smog, snow, flares and possibly cloud shadows, etc. It will proceed on the image product where geometry, radiometry, image characteristics (dropouts etc.), production parameters (resampling algorithm, bit depth), etc are evaluated.
- 13.1.3. The Image Providers will follow their internally-defined QC procedures including at least above issues. They will deliver a conformal product (or propose a non-conformal product for evaluation clearly stating reasons for QC failure – such an image will be treated as a “proposed” image). Such an image can also be e.g. an acquisition at elevation angle below requirement.
- 13.1.4. The contractor receiving the product needs to report on any non-conformity within 5 days after reception of imagery, through upload of IDQA in LIODOTNET.

13.2. Cloud Cover (CC)

- 13.2.1. Cloud will be defined as white opaque with little or no image information available of the ground features below. Dense haze which causes consistent muting of imagery should be included.
- 13.2.2. IP have different CC assessment routines¹⁶;
1. 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.
 2. manual photo interpretation and subsequent vector digitizing. If a definite boundary between affected pixels and un-affected pixels is visible it is cloud.
- 13.2.3. It has been decided by the EC Services that a common CC assessment approach by all Image Providers does NOT solve CwRS assessment problems. The Image Providers' routines are used worldwide commercially and are difficult to homogenize, but the CC is interpreted rather similarly through methods. Among the contractors there are varying opinions.
- 13.2.4. Both of above approaches are therefore accepted by the EC Services who insist on their need to manage the CwRS programme efficiently (limited budget) and to guarantee success of the programme. They also insist on their need to have clear decision rules, common definitions and optimize the use of acquired imagery. These issues should be considered by all actors¹ in the CwRS programme for reciprocal benefit.
- 13.2.5. CC validation and haze flagging should therefore follow the procedure described in Chapter 7 Validation.
- 13.2.6. The accuracy to which CC will be performed is to a definition better than 1%.

¹⁶ http://agrifish.jrc.it/marspac/meetings/Toulouse2006/Parallel3/S3_PMilenov_CC_Assessment.pdf

14. Risk of Satellite Failure

- 14.1.1. The Image Providers are responsible for communicating to the EC Services, in near real time, any technical problem connected to a satellite system, to the receiving station or to the processing chain. This is important in order to limit risks of the campaign facilitating switching to other satellite systems or allowing switching to traditional on-the-spot checks for the control of the area-based subsidies.

15. Responsibles and email addresses

15.1.1. IPSC / CID Action

Responsible for the CID (Community Image Data portal) Action par-johan.astrand@jrc.it

Responsible for Image data Acquisition CID maria.erlandsson@jrc.it (until 1/6/2009),
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HR / VHR ordering, invoicing, and image return

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Technical details on image return and CID image server

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15.1.2. IPSC / GEOCAP Action

Contact persons for CwRS at GEOCAP herve.kerdiles@jrc.it

16. References

- 1.) Commission Regulation (EC) No. 796/2004 of 21 April, 2004 laying down detailed rules for the implementation of cross-compliance, modulation and the IACS provided for in the Council Regulation (EC) No. 1782/2003 establishing rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers.
- 2.) European Commission (2008); Common Technical Specifications announced in ITT no. 2008/S 228-302473 (22 November 2008); JRC IPSC/G03/P/HKE/hke D(2008)(10021)
- 3.) HR Specifications for the CwRS Programme – 2009 Campaign [ref JRC JRC IPSC/G03/C/MER/mer D(2009)(10621)
- 4.) WikiCAP: <http://marswiki.jrc.ec.europa.eu/wikicap/index.php> (requires user/password). This wiki allows access to information concerning former documents; Selection of Control Zones and Risk Analysis - Draft Guidance Document [JRC IPSC/G03/P/HKE/hke D(2007)(8218)], European Commission (2003). Guidelines for Best Practice and Quality Checking of Ortho Imagery [Issue 3.0 available at: <http://mars.jrc.ec.europa.eu/mars/News-Events/New-version-of-the-Guidance-for-Best-Practice-and-Quality-Checking-of-Ortho-Imagery>
- 5.) The satellite remote sensing (SRS) data Framework Contracts (FCs) for image procurement to the EC Services signed with image providers EURIMAGE (# 251.537 for Quickbird, WorldView1 imagery), EUSI (# 251.395 for Ikonos), Telespazio (# 254.610 for GeoEye1 imagery), IMAGESAT (#

251.398 for Eros imagery), and SPOTIMAGE (# 251.603 for SPOT5 supermode (SPS) and Formosat2 (F2) imagery), and any specific ad hoc agreements on top of these FCs valid for the CwRS programme.

- 6.) Orthorectification of Formosat-2 data for use in the Common Agricultural Policy Control with Remote Sensing Programme - Title of paper: "Orthorectification Tests Continued..." [JRC IPSC/G03/C/PAR/D(2008)(9233 V 1.1)]
- 7.) **Benchmarking the WorldView-1 and EROS B sensors for use in the Common Agricultural Policy Control with Remote Sensing programme [PUBSY # JRC49378, Category 3.4 Oral presentation, Available at: http://mars.jrc.ec.europa.eu/mars/News-Events/MARS-Conference-2008/Agenda-and-Presentations/T2_Nowak_WV1_EROS2_JRC]**

17. Annexes

17.1. XML File Specification for Image Provider

Zip File

The provider must upload a zip file containing the following files:

1. One XML file with the information of the image file(s) or shape(s) used in the validation process. The XML File does not include information about geo reference.
2. Image file(s).
3. Shape file(s)
4. Other file(s) for geo referencing.

XML Structure

```
<root>
  <Images>
    <Image>
      See nodes needed for the image
    <Image>
  </Images>
</root>
```

A section **<Image>** must be included in the file for each image uploaded in the zip file used in the validation process.

Other information included by standard XML generator is supported:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<root xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
```

Image section

The **<Image>** section must contain the following node:

Node Name	Description	Type	Obligatory
ARId	Acquisition Request ID	Integer	Yes, if uploaded via email
Country	Country Abbreviation (see list)	String	Yes
ProductType	Type of product	String	No
Zone	Zone Name	String	Yes
Path		String	No
Shift		String	No

Node Name	Description	Type	Obligatory
AcquisitionDate	Acquisition Date, interpreted in function of the country setting in your LioDotNet profile), must be inside the window defined in the Acquisition Request	DateTime	Yes
SpotSceneId	Specific for Spot upload	string	No
CustomId		String	No
Elevation	Elevation Angle	String	No
CloudCover		Integer (0><100)	Yes
CloudCode		String	No
DisplayOrder	Used by the VHR browser	Integer (>0)	Yes
ProviderStatus	see for list	String	Yes
Filename		String	Yes
Haze Flag	Haze Flag (Yes – No)	String	No
Comment		String	No

Country list and abbreviation

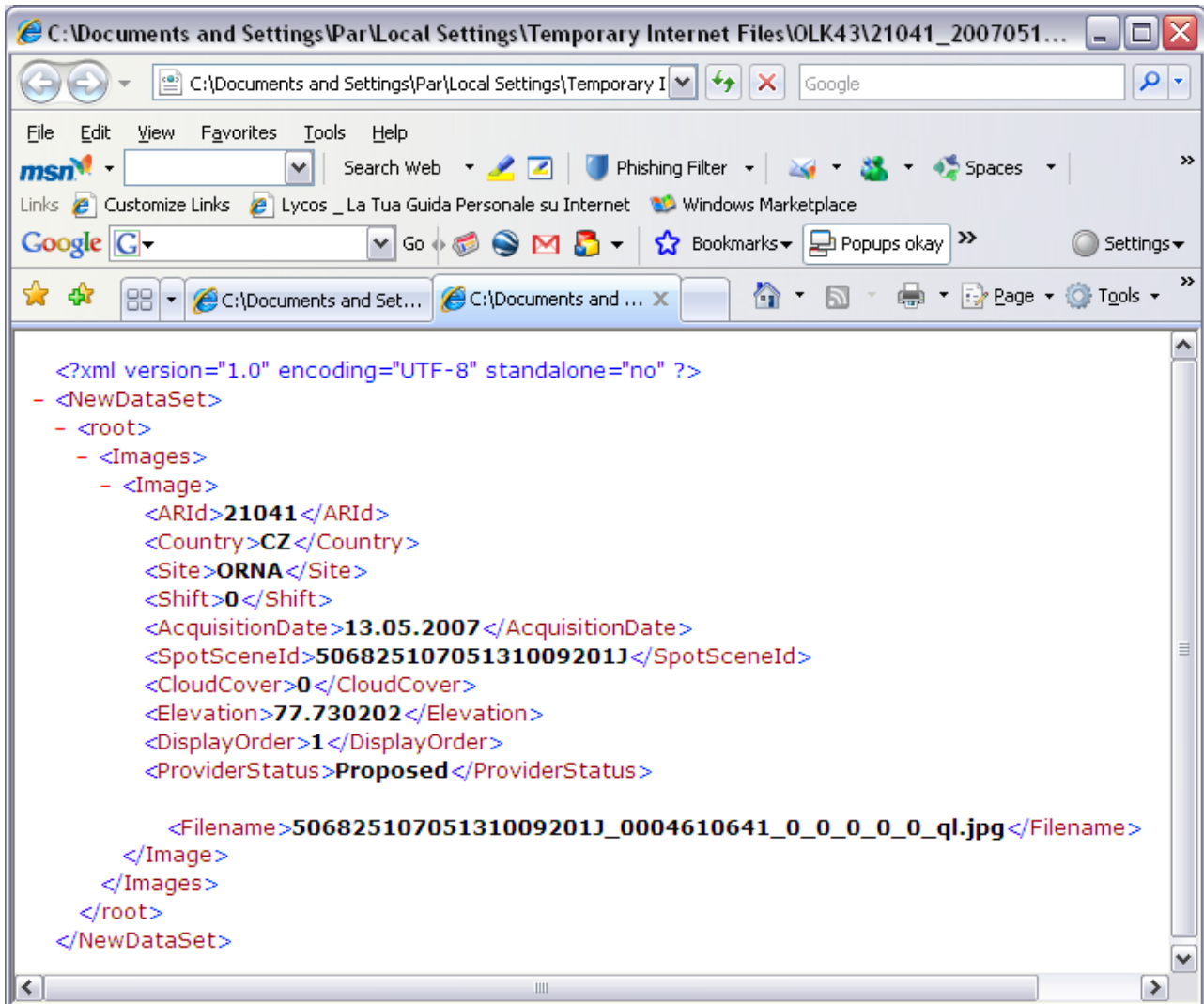
Country	Abbreviation
BELGIUM	BE
CYPRUS	CY
CZECH REPUBLIC	CZ
GERMANY	DE
DENMARK	DK
ESTONIA	EE
SPAIN	ES
FINLAND	FI
FRANCE	FR
GREECE	GR
HUNGARY	HU
IRELAND	IE
ISRAEL	IL
ITALY	IT
LITHUANIA	LT
LUXEMBOURG	LU
LATVIA	LV
MALTA	MT
NETHERLANDS	NL
POLAND	PL
PORTUGAL	PT
SWEDEN	SE
SLOVENIA	SI

Country	Abbreviation
SLOVAKIA	SK
UNITED KINGDOM	UK

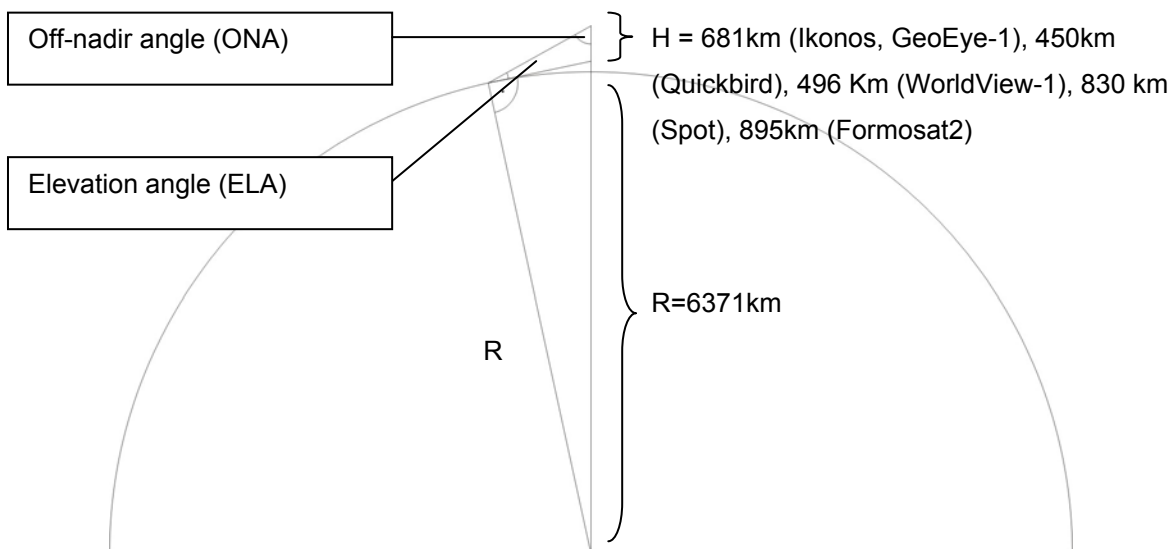
Provider state

Provider Status	Description
Proposed	This acquisition is proposed
Retained	This acquisition is proposed
Validated	This acquisition is validated
Not Requested	A status for this acquisition is not requested

Typical XML structure:



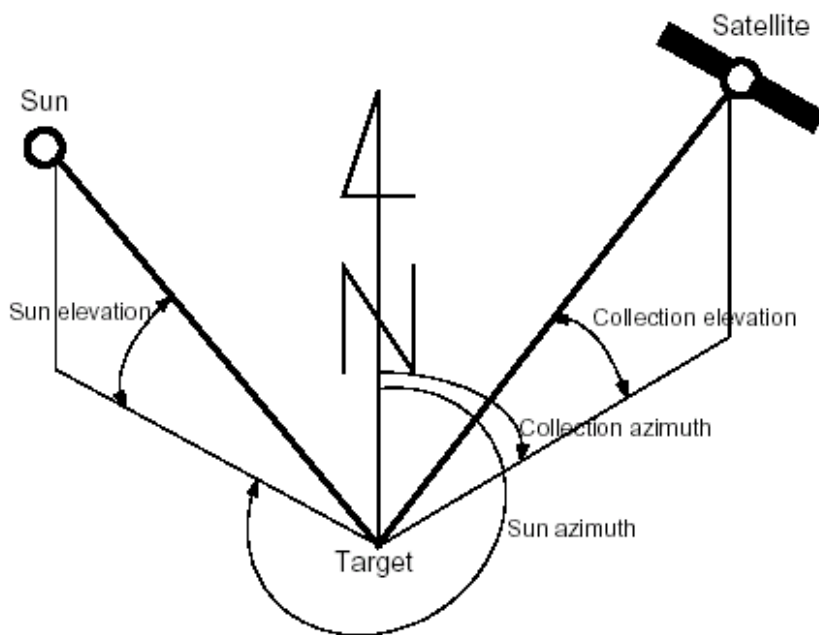
17.2. Relation elevation angle vs. off-nadir angle, and some satellite angles of importance



$$\frac{R}{R+H} = \frac{\sin(ONA)}{\sin(90^\circ+ELA)} = \frac{\sin(ONA)}{\cos(ELA)}$$

$$ELA = \arccos\left[\sin(ONA) * \frac{R+H}{R}\right]$$

$$ONA = \arcsin\left[\cos(ELA) * \frac{R}{R+H}\right]$$



(end document)

European Commission

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Abstract

This document constitutes the specifications for VHR imagery to be used within the CwRS Programme. Its objective is to give the stakeholders¹ in the image acquisition management chain 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 Campaign

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