CID Survey Report

Satellite Imagery and Associated Services used by the JRC
Current status and future needs

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JRC Scientific and Technical Report

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Current status and future needs

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EXECUTIVE SUMMARY

The 5th GMES Coordination meeting (May 2006) concluded that the vast amounts of satellite (and aerial) data acquired at the JRC, and the corresponding heterogeneous storage and access/dissemination framework should be inventoried in view of defining a single JRC portal through which imaging requests could be addressed. The Agriculture and Fisheries Unit (IPSC) together with the Informatics, Networks and Library Unit (ISD) received consensus to perform this inventory called the Community Image Data portal Survey (the CID Survey). Interviews were made in the period mid-November 2006 to end December 2006. A screening through JRC resulted in 20 Actions from 4 different Institutes (ISD, IPSC, IES, and IHCP) to be interviewed regarding their handling of Satellite (and aerial) Remote Sensing data.

The objectives of the survey were therefore:
✓ to make an inventory of existing satellite data and future requirements;
✓ to obtain an overview of how data is acquired, used and stored
✓ to quantify human and financial resources engaged in this process
✓ to quantify storage needs and to query the staff involved in image acquisition and management on their needs and ideas for improvements

Answers should form the basis for the definition of the CID portal components (e.g. search ability, harmonized data access respecting relevant IPRs, and need of centralized storage) and also to assess possible added value services like the need for coordination of procurement, avoiding overlap and duplicate purchases, etc.

The survey was divided into four parts: <u>Project overview</u> (research area, main deliverables, financial and human resources); <u>Source data</u> (i.e. sensors, amount, coverage, acquisition, and provider); <u>Derived products</u> and <u>Storage and dissemination</u> (i.e. storage, backup, metadata, added value services, and future needs).

The global expenditure on satellite remote sensing data through the JRC in 2006 was 7.2 M€. This fits within the ceilings placed for the 14 Image Framework Contracts (FCs) currently in place at a yearly 8.8 M€ (35 M€ over 4 years). The annual human resources used for data acquisition management at JRC are 6 person-years, and the annual human resources used for image data management (excluding resources for data processing) are 9 person-years. This means that at the JRC an annual 15 person-years total are placed on image acquisition and data management, where therefore CID could stimulate synergy between Actions by creating a coordinated approach to data management.

Within the JRC there are (including 2006) more than 700 000 low resolution (LR) and 50 000 medium resolution (MR) images, with time series as far back as 1981 for the LR data. There are more than 10 000 high resolution (HR) images and over 500 000 km^2 of very high resolution (VHR) images. For the LR and MR data, cyclic global or continental coverage dominates, while the majority of HR and VHR data is acquired over Europe. The expected data purchase in the future (2007, 2008) known which enables good planning. Most purchases of VHR and HR data are made using the established FCs with common licensing terms. Otherwise multiple types of licensing govern data usage which emphasises the need for CID to establish adequate means of data access. A wide variety of file formats, projections and processing levels are used. The main products generated are classifications, change detections and orthocorrected images.

The total amount of image data stored (2006 inclusive) is 55 TB, with an expected increase of 80% in 2 years. Most of the image data is stored on internal network storage inside the corporate network which implies that the data is accessible from JRC, but difficulties arise when access is to be made by external users via Internet. In principle current storage capacity in the JRC could be enough, but available space is fragmented between Actions which therefore implies that a deficit in storage could arise. One solution to this issue is the sharing of a central storage service. Data reception is dominated by FTP data transfer which

therefore requires reliable and fast Internet transfer bandwidth. High total volumes for backup requires thorough definition of backup strategy (total volumes may become up to 80 TB in 2008).

The user groups at JRC are heterogeneous which places requirements on CID to provide flexible authentication mechanisms. There is a requirement for a detailed analysis of all metadata standards needed for reference in a catalogue. There is a priority interest for such Catalogue Service and also for a centralized storage. The services to implement for data hosted on central storage should be WCS, WMS, file system access.

During the analysis of the results mentioned above, some major areas could be identified as a base for common services to be provided to interested Actions, such as: provision of a centralized data storage facility with file serving functionality including authentication service, image catalogue services, data visualization and dissemination services. Specialized data services that require highly customized functionality with respect to certain properties of the different image types will usually remain the sole responsibility of the individual Actions. An orthorectification service for semi-automated orthorectification of HR and VHR data will be provided to certain Actions. The priorities and implementation schedule for the Community Image Data portal (CID) are summarized as follows;

✓ Set up of server architecture and image storage as base for the Image Portal
✓ Setup up of authentication system
✓ Implementation of Catalogue Service
✓ Development of Image Portal Web Mapping and search application
✓ Set up, testing and management of the orthorectification system
✓ Specification of data workflow and implementation of image data management system
✓ Migration of imagery data from two or three Actions to the new Community Image Data portal (CID) system (depending on staff)

To conclude, this survey could be extended to GMES Fast Track and Future Services (Core, Downstream) to determine GMES service requirements if DG Enterprise so requests.

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Image courtesy front page; Eumetsat © Meteosat, ESA Envisat Meris, SPOTImage © CNES SPOT, Eurimage © DigitalGlobe Quickbird.

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1.   <u>Introduction</u>

1.1.   Survey Objectives

Satellite data are used for a wide variety of purposes in the JRC encompassing from global land cover mapping to monitoring of small agricultural parcels, and temporally from dramatic changes by forest fires to impacts of climate change. The acquisition and storage of data is correspondingly heterogeneous, each project has set up their own systems and there is little coordination across the JRC except for the coordinated procurement of satellite remote sensing data through common Framework Contracts.

The Community Image data Portal, CID, was suggested as a means to improve many aspects of this. Some of these aspects are:

-   harmonized access to data respecting relevant IPRs

-   search ability

-   coordination of procurement

-   avoiding overlap and duplicate purchases

-   providing centralized storage

The objective of this survey was to:

-   set up an inventory of existing satellite data and future requirements

-   get an overview of how data is acquired, used and stored

-   quantify human and financial resources used for image acquisition and data management

-   quantify storage needs

-   query the staff involved regarding their needs and ideas for improvements.

An overview of above would, in turn, assess an improved definition of the CID components.

1.2.   Survey Background

The idea of a Community Image data Portal was first raised in the 5th GMES coordination meeting in the JRC where it was stated: *"Images available through the JRC Institutes will be inventoried to evaluate the possibility of having a single Portal where imaging requests can be addressed to the JRC. A meeting has been held [between AGRIFISH and INLU Unit] to start this inventory. Other Units/images' repositories will be contacted soon to continue this process".* Based on this, AGRIFISH and INLU Units received consensus to make this survey and held several introductory technical discussions with stakeholders. These events coincided with the preparation for the transition between Framework Programmes and the creation of the new Action CID (Community Image Data portal) in the AGRIFISH Unit. This Action would deal with the continued development of the existing MARS-PAC image portal, the expansion of JRC image procurement/coordination services, and address the GMES user requirements in this domain. (JRC Action # 11604, http://skm.jrc.it/ , ref. Annex 6.2). From INLU's point of view this project is one of a series of continual initiatives to extend IT service propositions more directly to the scientific Actions through the JRC.

1.3.   Methodology of the Survey

The survey was based on interviews with representatives from all Actions dealing with remote sensing data. The interviews were supported by an electronic data-collection software[1] on a portable PC which was used

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[1] PHP Surveyor (http://www.phpsurveyor.org/index.php)

at the meetings. This software allows calculation of statistics, development of graphical representations and so forth.

The majority of the questions were "closed" meaning that the respondent had to choose from a predefined set of alternative answers. This facilitates the processing of the results. The respondents were also invited to express their thoughts in general and this gave a plentiful set of suggestions, expectations and requirements which is of high importance for the survey itself and for the future of CID (ref. chapter 3.4). The survey took place in the period mid-November 2006 to end December 2006 with some completions during January 2007, and the 20 interviews were shared between four interviewers; the authors of the present report. An interview lasted in average 2 hours.

2.   <u>Presentation of the Survey</u>

2.1.   Selection of Actions to Interview

Based on inventory information from the GMES coordination office[2] a list of 26 Actions which use satellite data was drawn up. To ensure completeness, all JRC directors were asked to amend the list of Actions to be interviewed[3]. After initial screening, the list was reduced to 20 and the final list of actions is listed here below:

Institute	Unit	Action	Action Acronym	Unit Head	Person interviewed	Function
ISD	C05	9999	INLU	Marc Wilikens	Antonio Puertas	Scientific officer
IPSC	G02	41002	ISFEREA	Delilah Al Khudhairy	Christophe Louvrier	Scientific officer
IPSC	G03	21102	MARS-PAC	Jacques Delincé	Pär Åstrand	Scientific officer
IPSC	G03	21103	MARS-STAT	Jacques Delincé	Bettina Baruth	Scientific officer
IPSC	G03	21201	FISHREG	Jacques Delincé	Marlene Alvarez	Scientific officer
IPSC	G03	21202	MASURE	Jacques Delincé	Guido Ferraro	Action leader
IPSC	G03	42002	MARS-FOOD	Jacques Delincé	Felix Rembold	Scientific officer
IPSC	G08	53105	VERTEC	Willem Janssens	Joao Goncalves	Action leader
IES	H03	21203	PROCAS	Alan Belward	Wolfram Schrimpf	Action leader
IES	H03	24004	SOLO	Alan Belward	Mark Dowell	Action leader
IES	H03	42001	MONDE	Alan Belward	Philippe Mayaux	Action leader
IES	H03	42003	TREES-3	Alan Belward	Frédéric Achard	Action leader
IES	H05	22005	ENSURE	Giovanni Bidoglio	Stefan Sommer	Scientific officer
IES	H06	11601	COSIN	Alessandro Annoni	Stephen Peedell	Action leader
IES	H06	11602	INSPIRE	Alessandro Annoni	Paul Smits	Action leader
IES	H07	22003	FOREST	Guido Schmuck	Jesus San-Miguel-Ayanz	Action leader
IES	H07	22004	SOIL	Guido Schmuck	Hannes Reuter	Scientific officer
IES	H07	32001	NAHA	Guido Schmuck	Ad De Roo	Action leader
IES	H08	13106	SOLAREC	Heinz Ossenbrink	Ewan Dunlop	Action leader

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[2] Current use of Satellite Imagery by the Commission, June 2006 v0.3, GMES Activities in JRC and ESA: Analysis and Recommendation, September, 2006, GMES JRC Focal points

[3] Email from Pär Johan Åstrand to Institute directors sent on 20/12/2006

| IHCP | I05 | 23003 | EXPO-TOOLS | Dimitrios Kotzias | Jean Verdebout | Scientific officer |

Table 1: List of actions interviewed in the survey

A key to all the Actions with a short description is found in Annex 6.1.

2.2.   Typology of Respondents

Invitations to interviews were sent to all Action leaders. In most cases the Action leader in person was interviewed, often supported by technical staff of the Action.

2.3.   Structure of the Survey

The survey was divided into four parts:

1. Project overview (research area, main deliverables, financial and human resources)

2. Source data (sensors, amount, coverage, acquisition, provider)

3. Derived products (type of product, coverage, production cycle, users)

4. Storage and dissemination (storage, backup, metadata, added value services, future needs)

The complete list of questions is found in Annex 6.5.
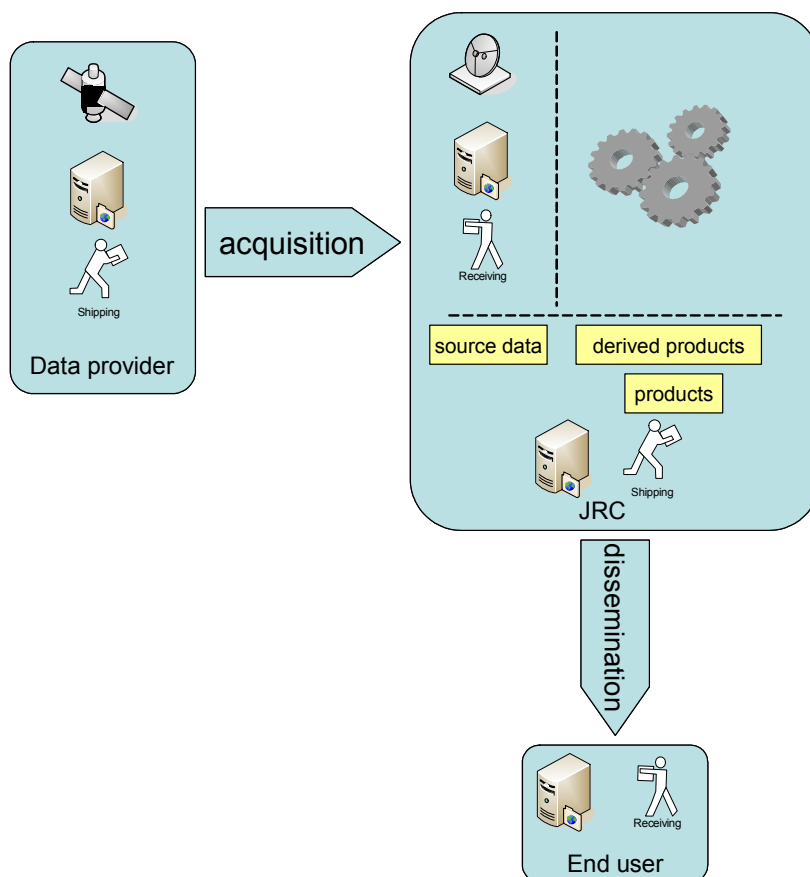
Figure 1: Typical data workflow

Figure 1 explains the data flow as it is accessed by the JRC Actions (acquisition), processed and disseminated to end users.

3.   Survey Results

> **Remark**: For several figures the number of answers displayed on the chart can be higher than the number of interviewed Actions because multiple answers were possible.

3.1.   Source Data Acquired and Stored by the Surveyed JRC Actions

3.1.1. Resources for image acquisition and data management in 2006

3.1.1.1.   Annual budget for image acquisitions

> The total expenditure on satellite remote sensing data in the JRC in 2006 was 7.2 M€.

The expenditures differ very much between Actions and Units. 8 Actions do not spend money at all for image acquisitions because they either use image data from another Action or because they use data that is available free of charge.

> The AGRIFISH Unit is responsible for 95% of the total annual expenditure for image acquisitions. The expenditures for the Actions of the other Units purchasing image data ranges from 10 to 100 k€ per annum.

14 Framework Contracts for satellite remote sensing data procurement are currently in place with a yearly ceiling of 8.8 M€ (more than 35 M€ over 4 years).

3.1.1.2.   Human resources for image acquisition and data management

The total amount of human resources used for data acquisition in 2006 at the JRC was more than 6 person years. The total human resources used for image data management – without taking into account resources for data processing – were nearly 9 person years. The amount of person months used for data acquisition and data management differs very much per Action and is shown in Figure 2.
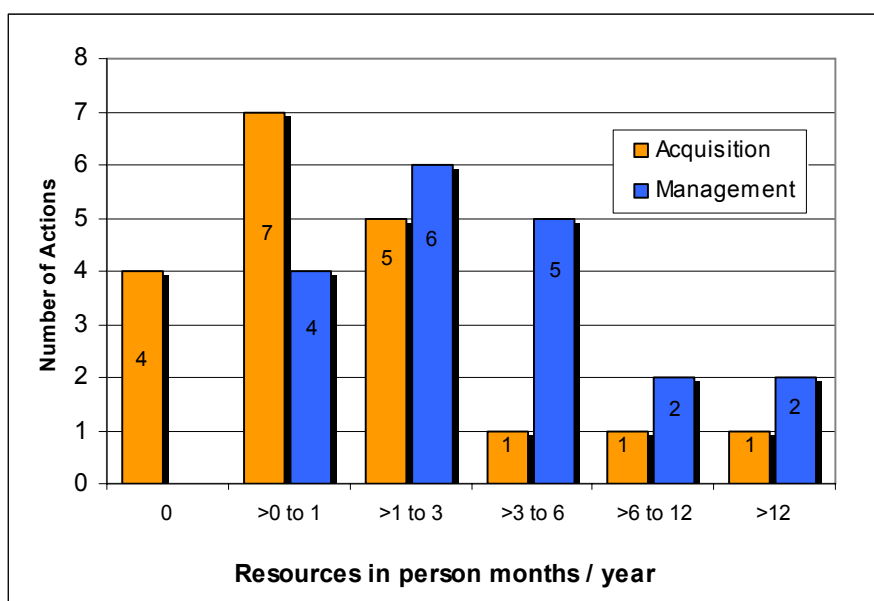
Figure 2: Human resources for image acquisition and image data management

There are some actions without any resources for image acquisition. This mainly corresponds to the Actions that did not spend any budget for this but received data free of charge. Most of the Actions with image acquisition activities spent in the range of 1 to 3 person months per year for this task. 1 Action invested more than 6 person months and 1 Action more than 12 person months per year.

Typically the resources allocated to image data management tasks are much higher than those allocated to acquisition. Also some Actions without their own acquisition programme spend noticeable time for the management of the image data in their archives. The majority invested 1 to 6 person months per year, 2 Actions allocated more than 6 person months and another 2 Actions more than 1 person year for the data management. A clear correlation between time resources for image management and the amount of images to be handled could not be identified. The time required for data management depends very much on the characteristics and heterogeneity of the images and can therefore not be generalized.

> The results about allocation of human resources give a clear indication that on the one hand – except for 3 Actions – image acquisition is not a main source of work load. On the other hand, image data management is a considerable time consuming task for at least 9 Actions, investing from 4 to 18 person months for it.

3.1.2. Low resolution source data used at the JRC

3.1.2.1. Presentation of the sensors

Below follows a short description of the 6 Low Resolution (LR) sensors used at the JRC. This data normally has resolution in the kilometre range, and is used by the following JRC Actions: EXPO-TOOLS, INLU, MARS-FOOD, MARS-STAT, MONDE and SOLO.

1. The METEOSAT4 1st and 2nd generation sensors – Meteosat 1st generation (3 spectral channels; spatial resolution: 5km in water vapour band, and infra red bands, 2.5 km in visible band) and GOES (5 channels; 8 km in water vapour band, 4 km in infrared bands, and 1km in visible). Full radiometric and spatial resolution data transmitted digitally (as opposed to analogue, WEFAX). The MSG (Meteosat 2nd generation was launched in 2002) has the SEVIRI (Spinning Enhanced Visible and InfraRed Imager) instrument on board with 12 spectral bands (resolution 3 km, and 1 km). Apart from increased spectral and spatial resolution, compared to the Meteosat 1st generation, an increased sampling allows imaging every 15 minutes, enabling monitoring of rapidly evolving events.

2. The ORBVIEW2[5] – SEAWIFS sensor; successfully launched in August 1997. GeoEye's OrbView-2 satellite has a swath width of 2,800 km, eight channels of data from the visible to the near-infrared spectrum; spatial resolution of 1.1 km.

3. The NOAA AVHRR[6] - The first AVHRR was a 4-channel radiometer, first carried on TIROS-N (launched October 1978). This was subsequently improved to a 5-channel instrument (AVHRR/2) that was initially carried on NOAA-7 (launched June 1981). The latest instrument version is AVHRR/3, with 6 channels, first carried on NOAA-15 launched in May 1998; 6 spectral channels, spatial resolution 1.09 km. This instrument will also be available from MetOp-A, launched on 19 October 2006.

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[4] http://noaasis.noaa.gov/NOAASIS/ml/avhrr.html

[5] http://www.geoeye.com/products/imagery/orbview2/default.htm

[6] http://noaasis.noaa.gov/NOAASIS/ml/avhrr.html

4. The ENVISAT MERIS[7] reduced and low resolution - MERIS (Medium Resolution Imaging Spectrometer) is a programmable, medium-spectral resolution, imaging spectrometer operating in the solar reflective spectral range. The full ground spatial resolution (FR) is 300 m, and 15 spectral bands can be selected by ground command, each of which has a programmable width and a programmable location in the 390 nm to 1040 nm spectral range. The reduced resolution (RR) is 4xFR i.e. 1.2 km, and the low resolution (LL) is 4xRR i.e. 4.8 km.

5. The ENVISAT AATSR[8] - The prime scientific objective of the Advanced Along Track Scanning Radiometer (AATSR) is to establish continuity of the ATSR-1 and ATSR-2 data sets of precise sea surface temperature (SST). Spatial resolution IR ocean channels: 1 x 1 km, Visible land channels: 1 x 1 km.

6. The SPOT[9] VEGETATION; The VEGETATION instrument is present onboard the SPOT 4, and 5 vehicles; 4 spectral bands with spatial resolution 1 km, swath 2.25 km; revisit time 1 day.

3.1.2.2. Division by sensor, budget, licensing, and data providers

Figure 3 shows that data acquired by Meteosat 2nd generation and SPOT vegetation are the most often used. All other sensors are used by only one action (MERIS low resolution is counted twice as INLU is acquiring data but not using it).
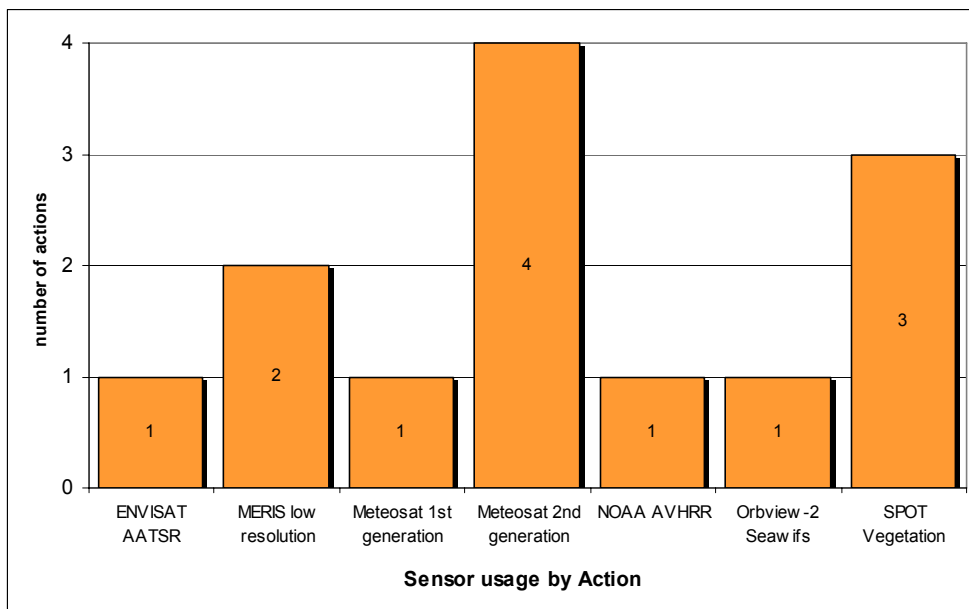
Figure 3: Low resolution sensor usage by Action

The number of scenes acquired until end of 2006 (Figure 4) ranges from 11 550 for Spot Vegetation to 451 000 for Meteosat 2nd generation, the median value being 30 000.

> The JRC stores a total of more than 650 000 scenes coming from low resolution sensors. This has to be taken into consideration during the design of the CID IT architecture.

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[7] http://envisat.esa.int/object/index.cfm?fobjectid=1665

[8] http://envisat.esa.int/object/index.cfm?fobjectid=3773

[9] http://www.spotimage.fr/html/_167_171_.php

This high number is due to the existence of time series archives initiated many years ago. More details about this can be found in paragraph 3.1.2.4. The importance of the archive of Meteosat 2nd generation data compared to other sensors is due to the very high acquisition rate (up to every 15 minutes) which leads to a higher number of stored scenes.
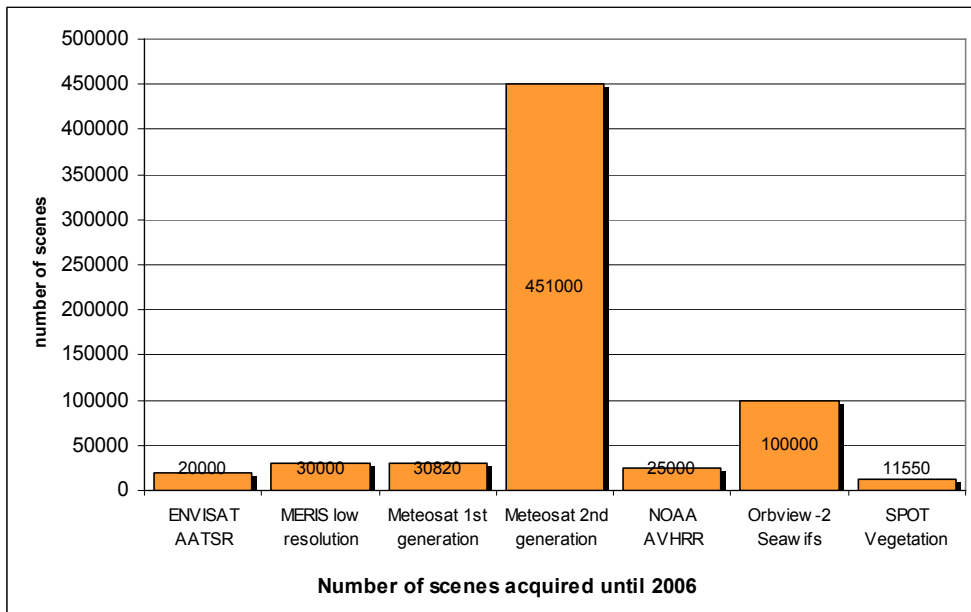
Figure 4: Number of low resolution scenes acquired until 2006

The estimated number of scenes to be acquired in 2007 and 2008 range from 1 000 for NOAA AVHRR to 38 800 for Meteosat 2nd generation (Figure 5). 2007 figures are identical to 2008 for all sensors as the acquisition rate for these data will not change.

> Constant number of acquisitions allows medium term planning in terms of storage requirements.
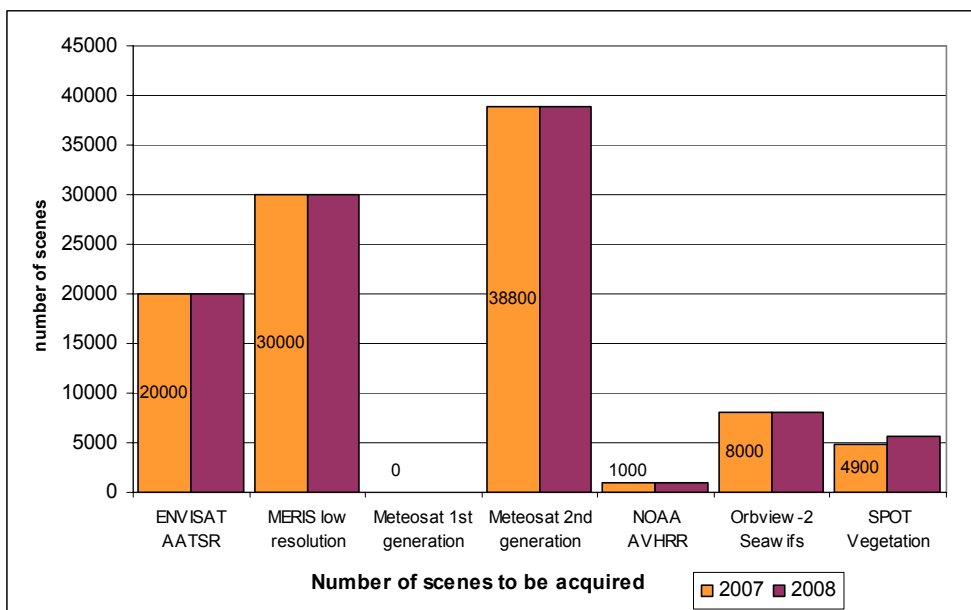
Figure 5: Number of low resolution scenes to be acquired in 2007 and 2008

The budget (Figure 6) related to these acquisitions is extremely low. Values range from 0 to 40 k€.

Most of the low resolution data are being provided free of charge to the Actions using them.
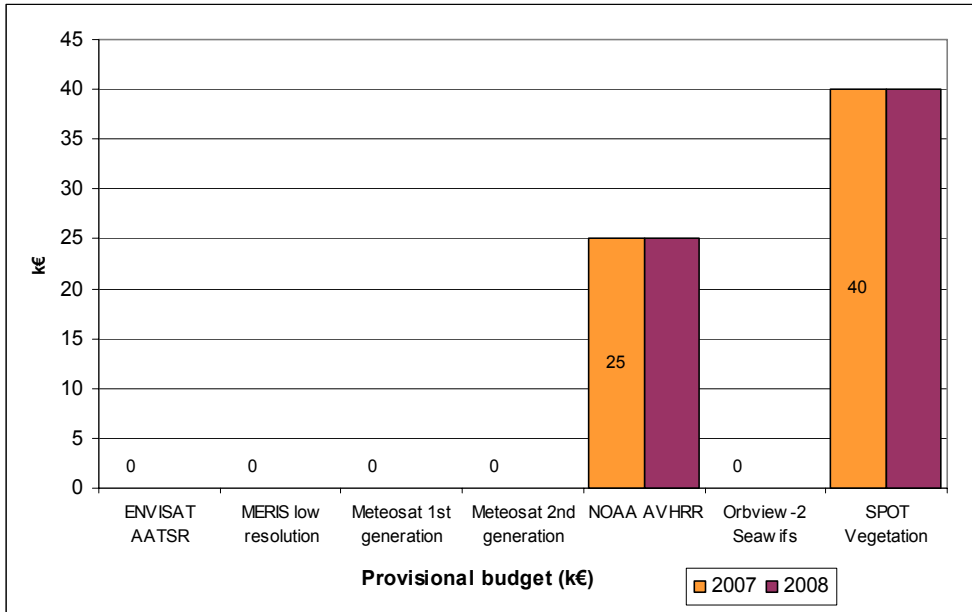
Figure 6: Provisional budget for acquisition of low resolution data in 2007 and 2008

Providers of low resolution data are varied (Figure 7) and almost all of them provide access to their data free of charge for research projects. Sometimes, access to data is granted only to the project which sent a request to the provider.

Licensing agreements imply that some data are not necessarily freely available to everybody within the JRC.
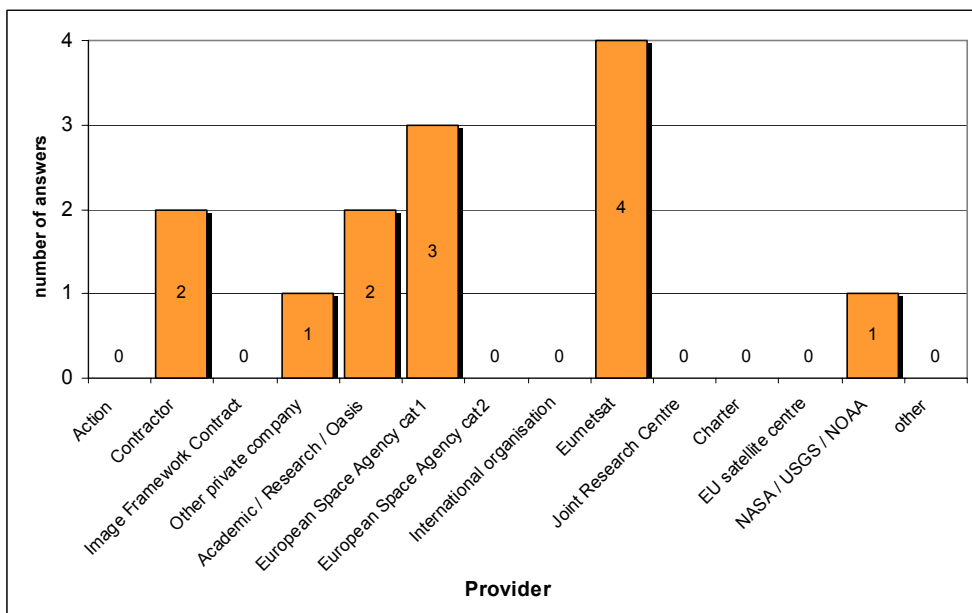
Figure 7: Providers of low resolution data

3.1.2.3.   Geographic coverage

Low resolution data are mainly acquired over Europe, Africa or as world coverage (Figure 8).
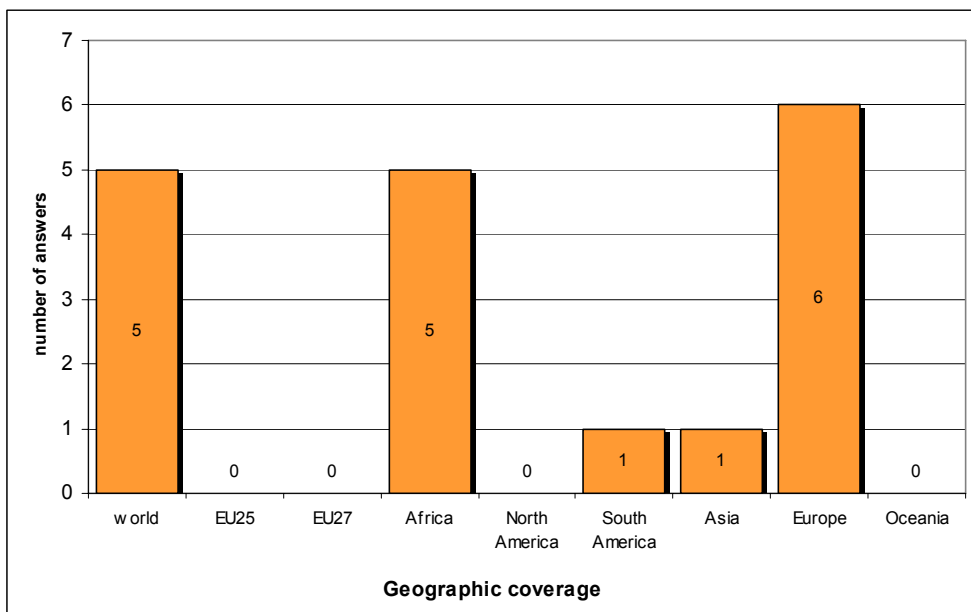
Figure 8: Geographic coverage of low resolution data

3.1.2.4.   Acquisition cycles, time series

All data are acquired regularly; most of them are acquired daily or more often (Figure 9) as for example Meteosat data. Some are acquired with different acquisition cycles, typically daily and decadal. The longest acquisition cycle used is monthly.

> Long time series are available for all low resolution sensors used at the JRC.

Table 2 shows the earliest time series start date available at the JRC. It is worth noticing the availability of an archive covering a 25 year period of NOAA AVHRR data and an archive covering more than 20 years of Meteosat data.

Sensor	Start date	Coverage
ENVISAT AATSR	Nov-05	World
MERIS low resolution	Sep-02	World
Meteosat 1st generation	Jan-84	Europe
Meteosat 2nd generation	Jul-04	Europe, Africa
NOAA AVHRR	Jan-81	Europe
Orbview-2 Seawifs	Sep-97	World
SPOT Vegetation	Jan-98	Europe

Table 2: Time series start date for low resolution data
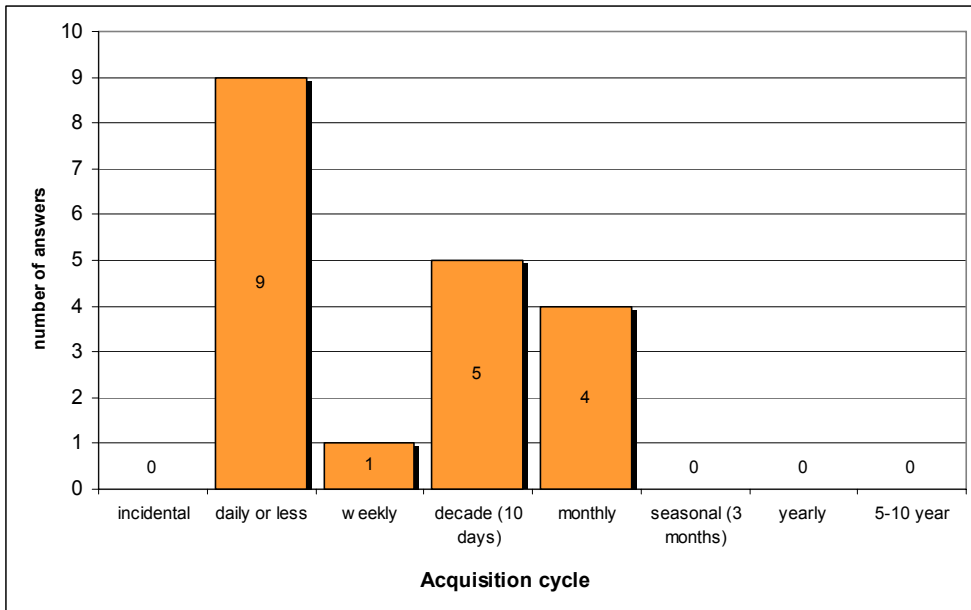
Figure 9: Acquisition cycles of low resolution data

3.1.2.5.   Image characteristics: formats, processing levels, projections

Most of the data are delivered in specific file formats or flat binary (Figure 10) and the CRS[10] mainly used are geographic and Lambert Azimuthal Equal Area (Figure 11).
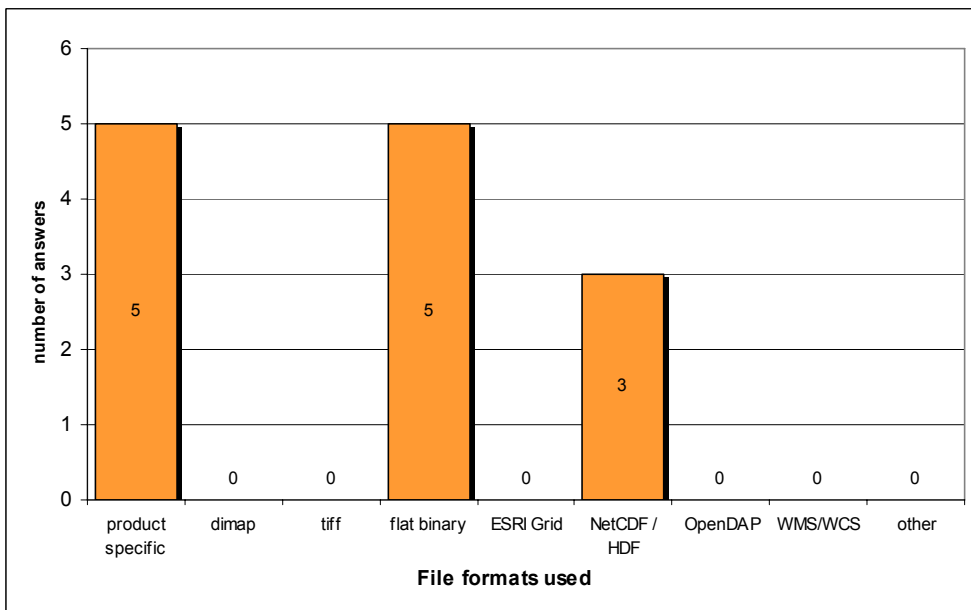
Figure 10: File formats used for low resolution data

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[10] Coordinate Reference System
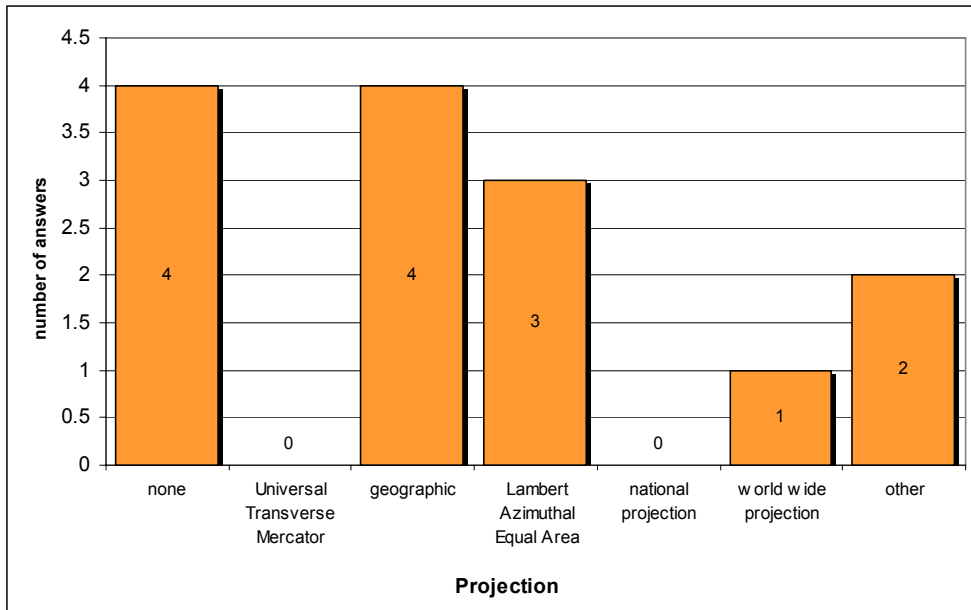
Figure 11: Projections used for low resolution data

3.1.2.6. Acquisition characteristics: programming, cloud cover

No programming for acquisition can be done for most of the sensors used to acquire low resolution data. Cloud cover is not a relevant criterion for this type of imagery thus all respondents answered none to question 50 (*Cloud cover criteria*).

3.1.2.7. Data reception: time to receive data, media and delivery services

Data are usually received in near real time via a receiving station or within 2-3 days via download from the image provider website (Figure 12 and Figure 13).

Handling of Near Real Time (NRT) processes by CID requires a high availability of its services and resources.
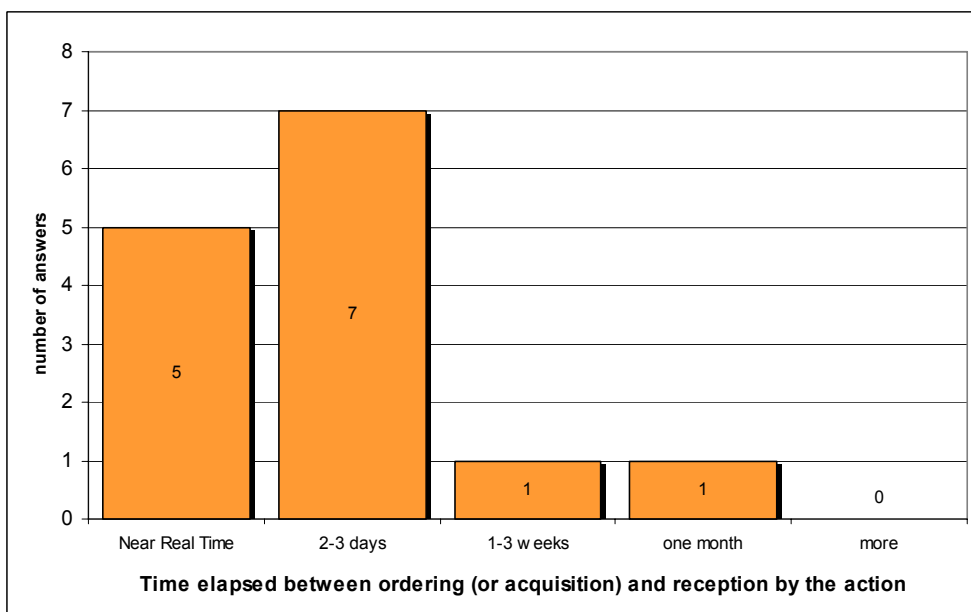
Figure 12: Time elapsed between ordering (or acquisition) and reception of low resolution data
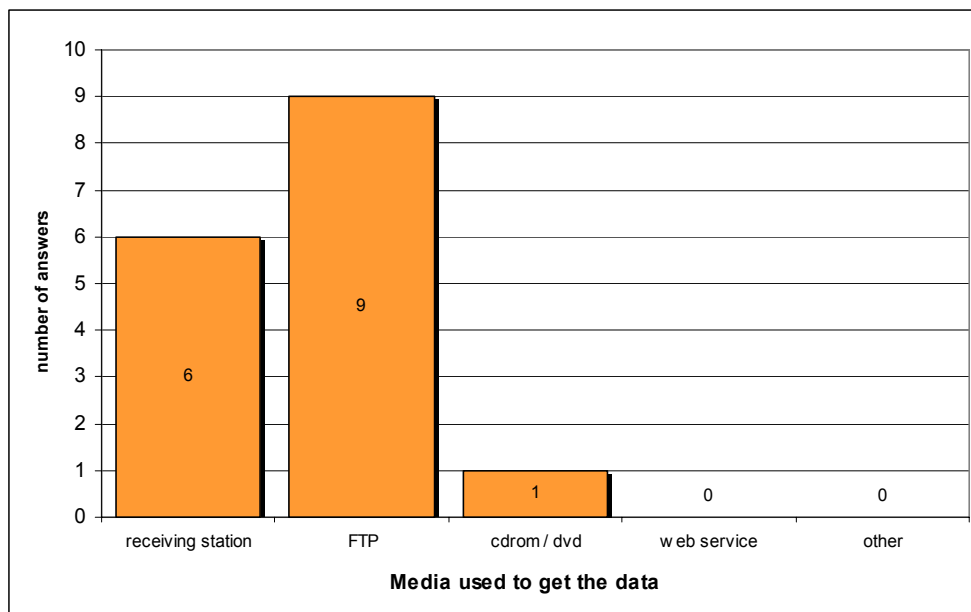
Figure 13: Media used to get low resolution data

3.1.3. Medium resolution source data used at the JRC

3.1.3.1. Presentation of the sensors

There follows a short description of the 3 Medium Resolution (MR) sensors used at the JRC. This data normally has 100's of meters resolution, and is used by following JRC Actions: ENSURE, FOREST, MARS-STAT, NAHA, SOIL, SOLO, and TREES-3.

1. ENVISAT MERIS full resolution - The full ground spatial resolution (FR) of the MERIS (Medium Resolution Imaging Spectrometer) is 300 m, and 15 spectral bands can be selected by ground command, each of which has a programmable width and a programmable location in the 390 nm to 1040 nm spectral range (see further ENVISAT description above under LR Source Data).

2. The sensor TERRA/MISR[11] (Multi-angle Imaging Spectro-Radiometer) - the MISR instrument is designed to address the amount of sunlight that is scattered in different directions under natural conditions. It views the Earth with cameras pointed at nine different angles, one camera points towards nadir, and the others provide forward and backward view angles, at the Earth's surface, of 26.1°, 45.6°, 60.0°, and 70.5°. As the instrument flies overhead, each region of the Earth's surface is successively imaged by all nine cameras in each of four wavelengths (blue, green, red, and near-infrared). Resolution 250 m.

3. TERRA/ACQUA MODIS[12] - the MODIS (or Moderate Resolution Imaging Spectroradiometer) is an instrument aboard the Terra (EOS AM) and Aqua (EOS PM) satellites. Terra's orbit around the Earth is timed so that it passes from north to south across the equator in the morning, while Aqua passes south to north over the equator in the afternoon. Terra MODIS and Aqua MODIS are viewing the entire Earth's surface every 1 to 2 days, acquiring data in 36 spectral bands, or groups of wavelengths. Spatial resolution: 250 m (bands 1-2), 500 m (bands 3-7), 1 000 m (bands 8-36).

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[11] http://www-misr.jpl.nasa.gov/mission/minst.html

[12] http://modis.gsfc.nasa.gov/about/specifications.php

3.1.3.2.   Division by sensor, budget, licensing, and data providers

Figure 14 shows that data acquired by MODIS are the most often used, followed by MERIS full resolution.
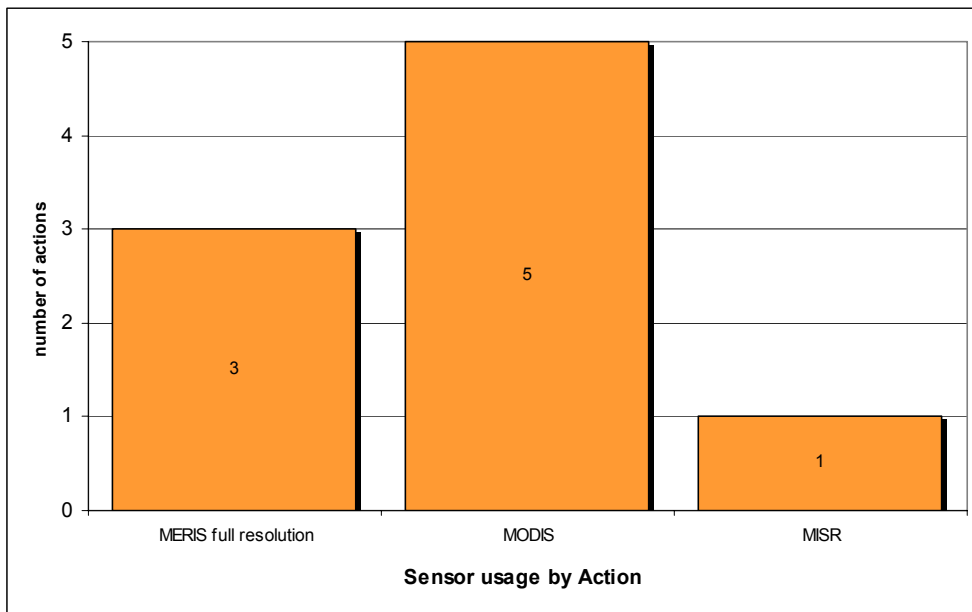
Figure 14: Medium resolution sensor usage by Action

A few hundred MERIS and MISR scenes and more than 50 000 MODIS scenes have been acquired up to the end of 2006 (Figure 15).

> The JRC stores in total more than 50 000 scenes coming from medium resolution sensors.

The high numbers of MODIS scenes acquired and to be acquired (Figure 16) are explained by the high number of Actions acquiring this type of data and acquisition cycles ranging from sub-daily to monthly. 2007 figures are identical to 2008 ones for all sensors as the acquisition rate for these data will not change.
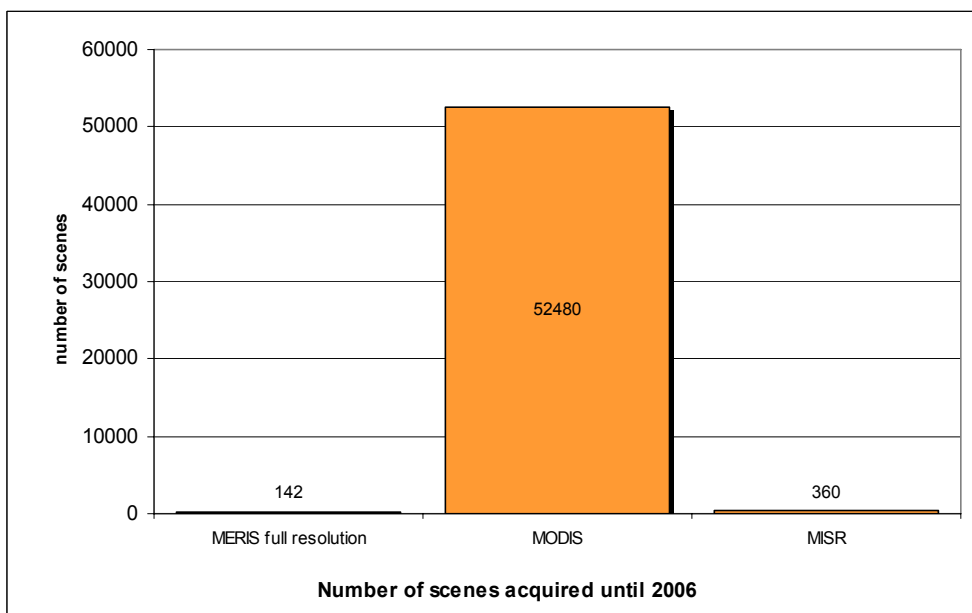
**Figure 15: Number of medium resolution scenes acquired until 2006**

Constant number of acquisitions allows medium term planning in terms of storage requirements.
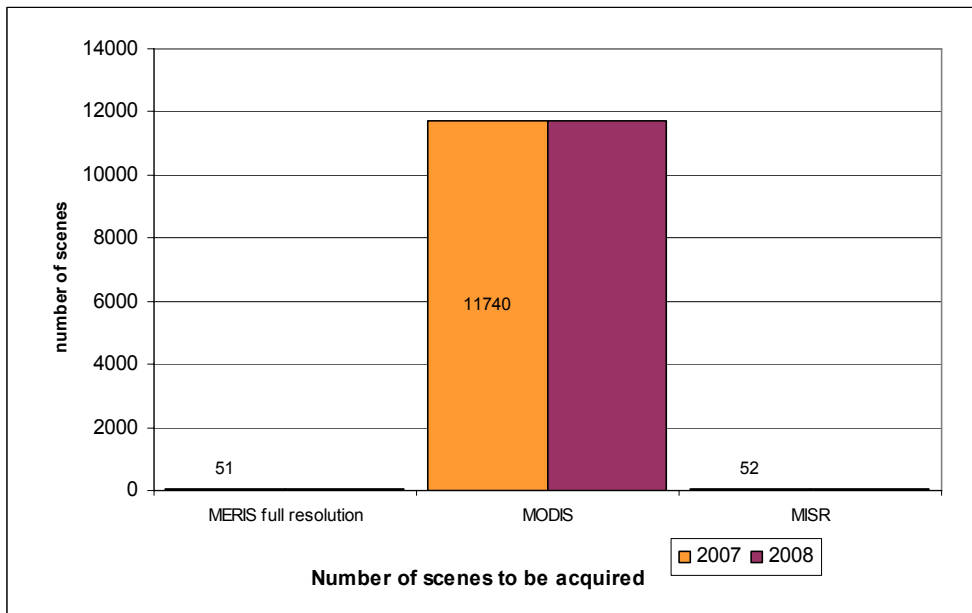
Figure 16: Number of medium resolution scenes to be acquired in 2007 and 2008

There is almost no budget (Figure 17) associated to the acquisition of these data as they are available free of charge from NASA or from ESA under category 1 agreement (Figure 18).
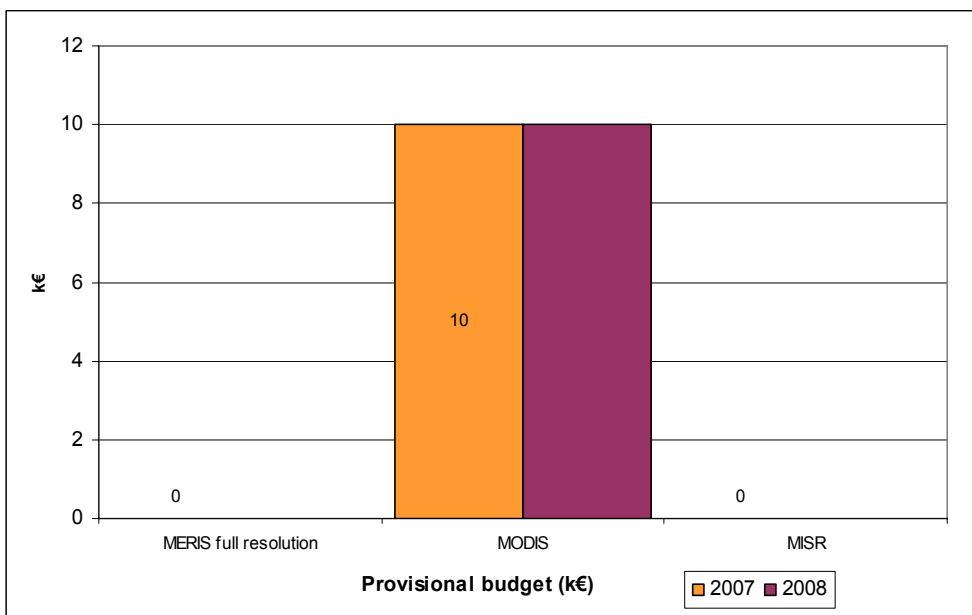
Figure 17: Provisional budget for acquisition of medium resolution data in 2007 and 2008
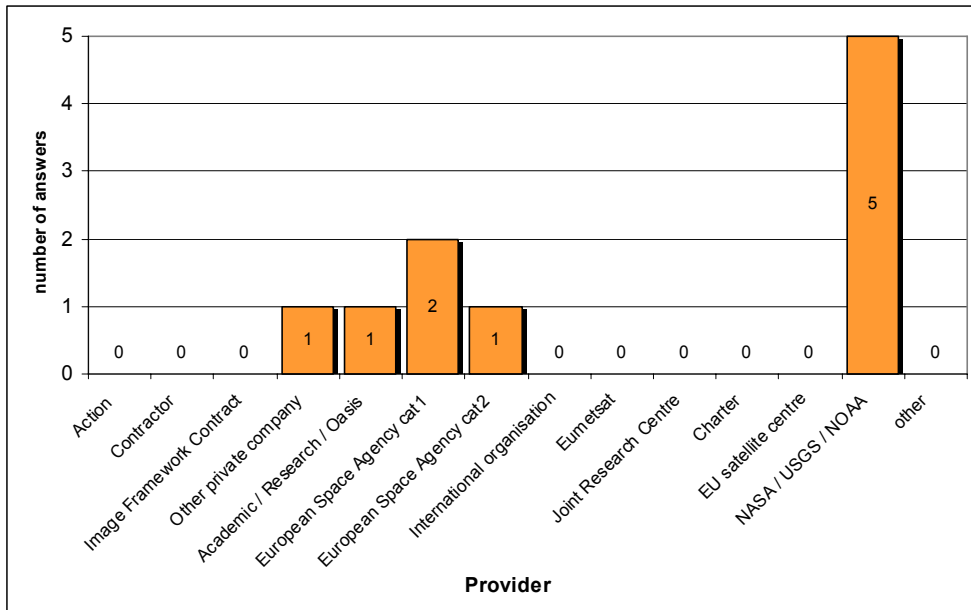
Figure 18: Providers of medium resolution data

3.1.3.3. Geographic coverage

Medium resolution data are mainly acquired over Europe, EU or as world coverage (Figure 19).
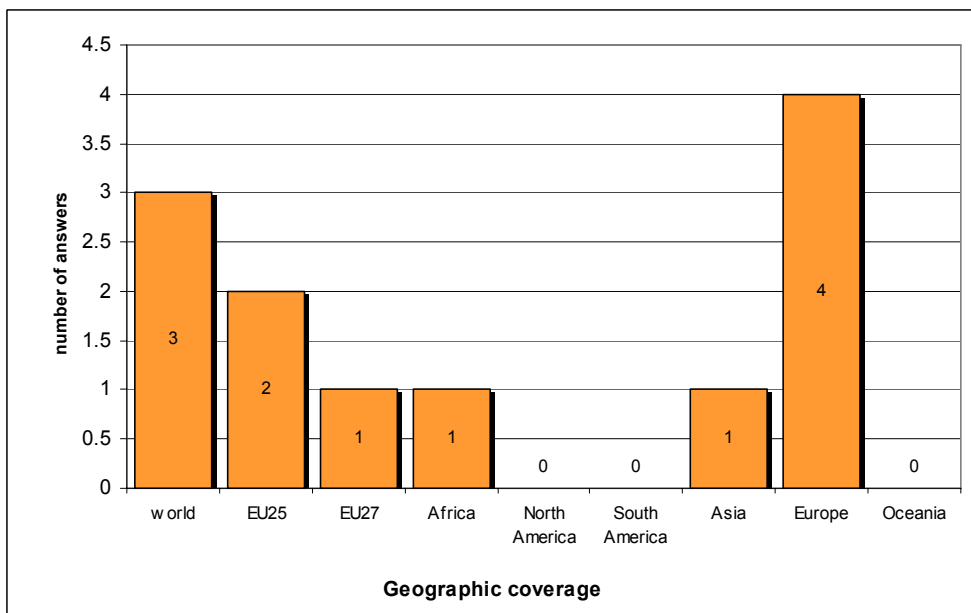
Figure 19: Geographic coverage of medium resolution data

3.1.3.4. Acquisition cycles, time series

Almost all data are acquired regularly (Figure 20) and are used to build time series archives. Most common acquisition cycles are decadal, monthly and seasonal. MODIS and MERIS are acquired with different cycles by the same Actions. Typical acquisition cycles for MODIS are daily and monthly while they are decadal and seasonal for MERIS.

The longest archive of MODIS data available at the JRC starts in January 2001 and the archive of MISR starts in February 2000.
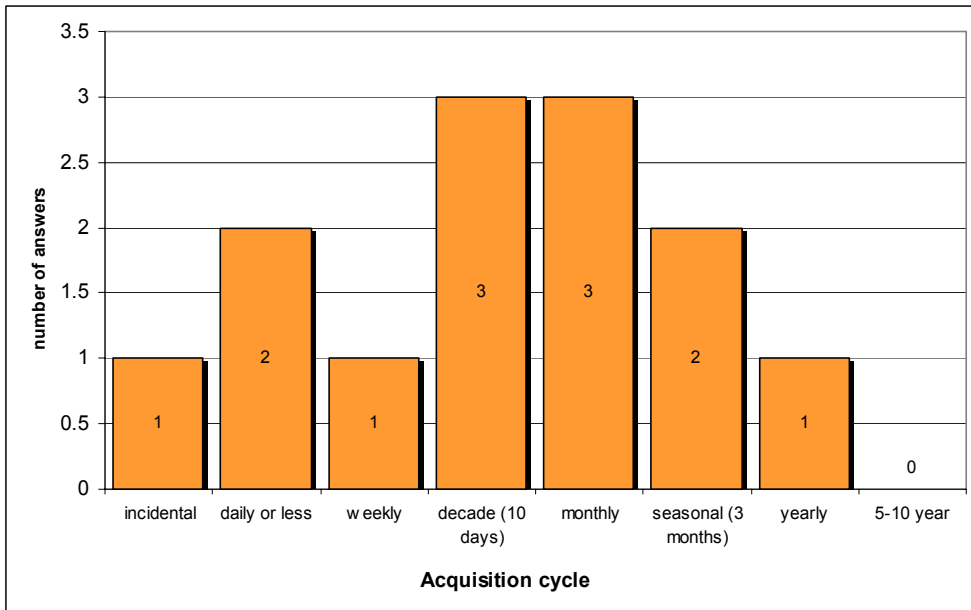
Figure 20: Acquisition cycles of medium resolution data

3.1.3.5. Image characteristics: formats, processing levels, projections

Most of the data are delivered in HDF or flat binary (Figure 21). Most of these data can be read using standard libraries and are using standard projections (Figure 22). Respondents declaring a pre-processing (Figure 23) of their data are usually doing time composites which are typical with the sensors used.
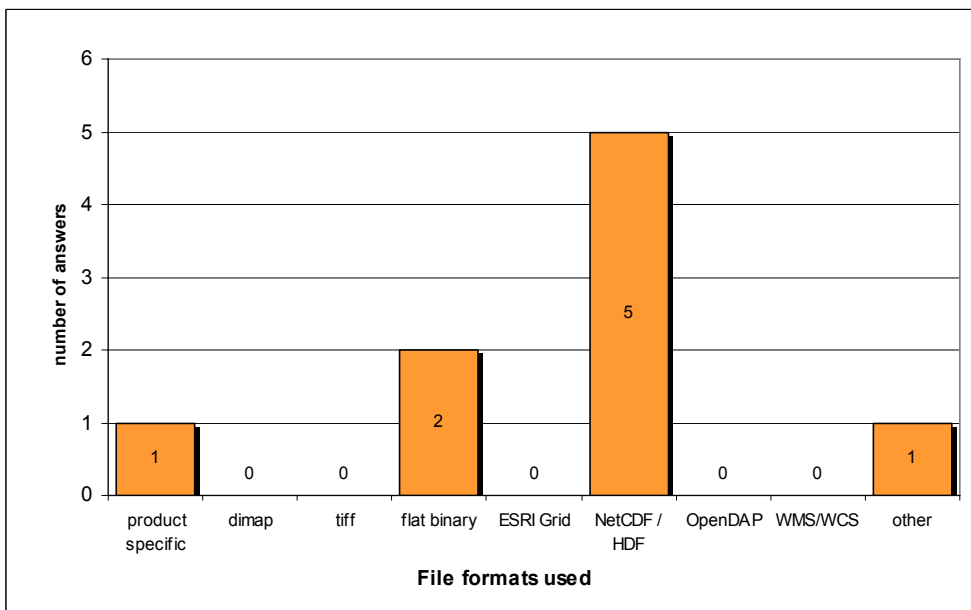
Figure 21: File formats used for medium resolution data
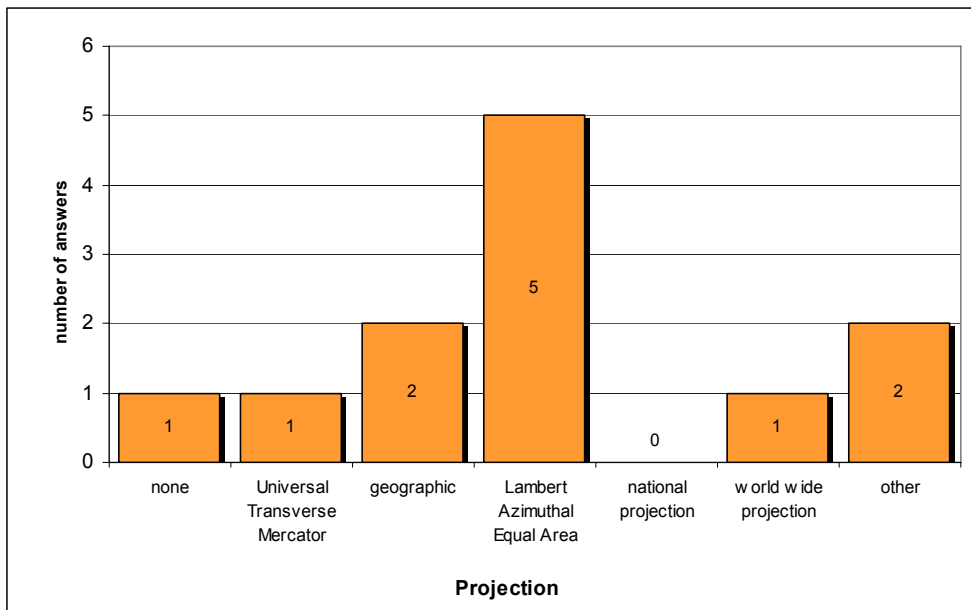
Figure 22: Projections used for medium resolution data
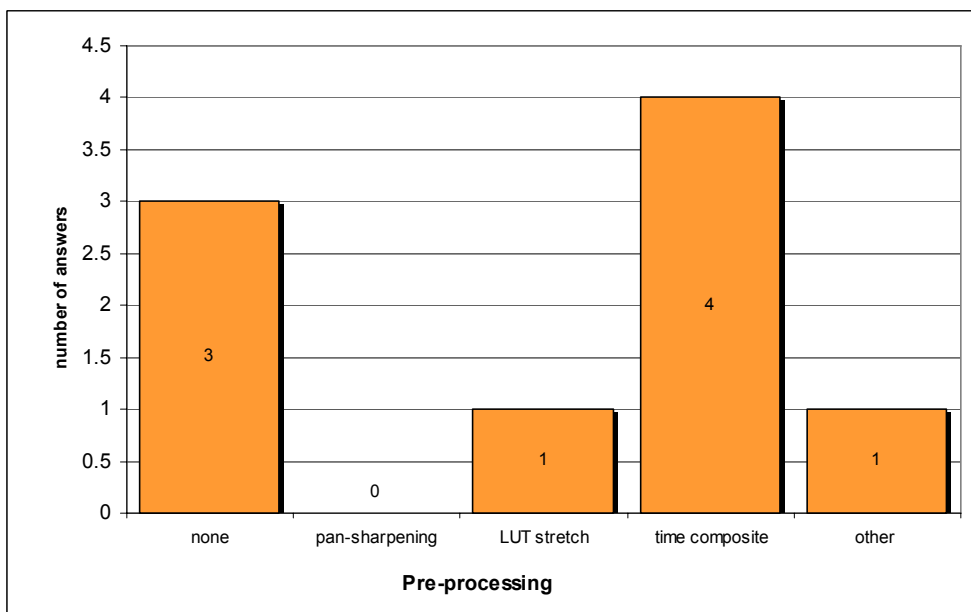
Figure 23: Pre-processing used for medium resolution data

3.1.3.6.   Acquisition characteristics: programming, cloud cover

No programming for acquisition can be done for most of the sensors used to acquire medium resolution data. Cloud cover is not a criterion for 90% of the respondents.

3.1.3.7.   Data Reception: time to receive data, media and delivery services

Actions are usually getting their data in near real time or within two to three days (Figure 24). Long delivery time (one month and more) are usually due to the time needed to create time composites.

> Reception of medium resolution data at JRC is usually done through download from the data providers (Figure 25) which calls for reliable transmission means.
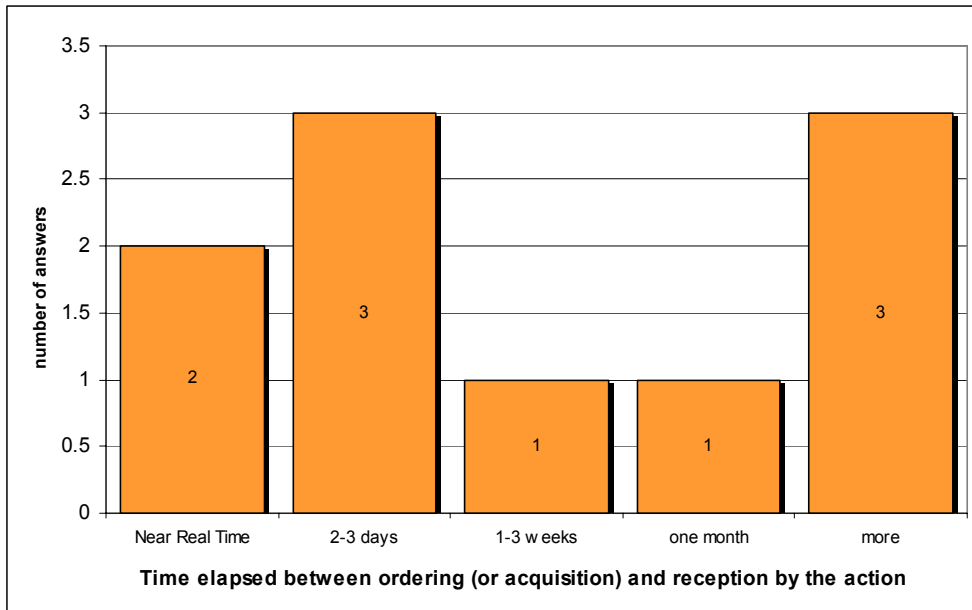
Figure 24: Time elapsed between ordering (or acquisition) and reception of medium resolution data
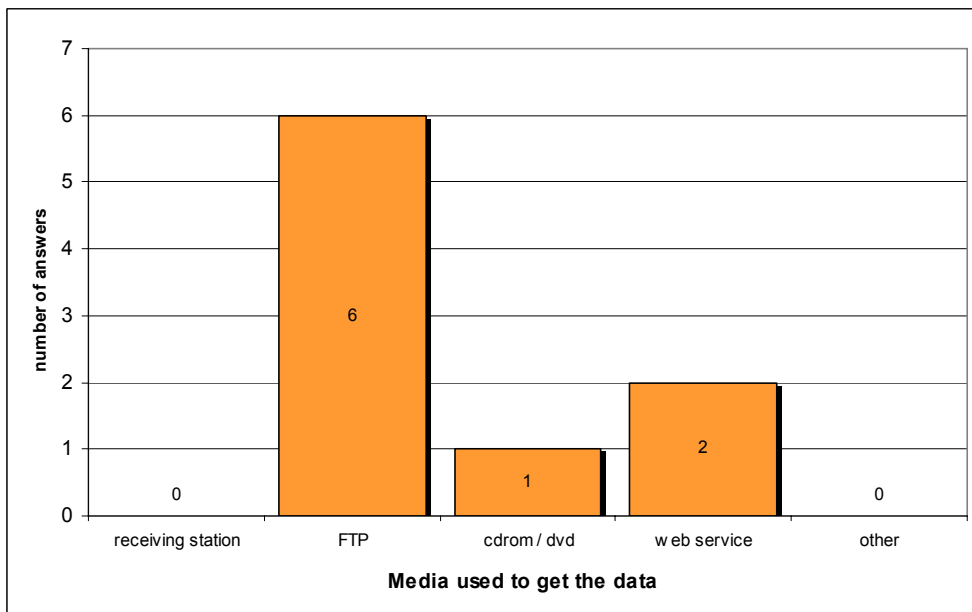
Figure 25: Media used to get medium resolution data

3.1.4. High resolution source data used at the JRC

3.1.4.1. Presentation of the sensors

There follows a short description of the 6 High Resolution (HR) sensors used at the JRC. This data normally has a spatial resolution of 5 – 100 m, and is used by the following JRC Actions: COSIN, ENSURE, FOREST, ISFEREA, MARS-PAC, MONDE, SOIL and TREES-3.

1. LANDSAT 5, 7[13] – The U.S. Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA) support the Landsat Project. NASA developed and launched the spacecrafts. The USGS handles the flight operations, maintenance, and management of all ground data reception, processing, archiving, product generation, and distribution. The Thematic Mapper (TM) is a multispectral scanning radiometer that was carried on board Landsat 4 and still on Landsat 5. The TM sensors have provided nearly continuous coverage since July 1982, with a 16-day repeat cycle. TM image data consists of seven spectral bands with a spatial resolution of 30 m for most bands (1-5 and 7). Spatial resolution for the thermal infrared (band 6) during image acquisition is 120 m. The Enhanced Thematic Mapper Plus (ETM+) was a multispectral scanning radiometer carried on board the Landsat 7 satellite. The sensor provided acquisitions from July 1999, with a 16-day repeat cycle until an instrument malfunction occurred on May 31, 2003. The ETM+ instrument provided image data from eight spectral bands. The spatial resolution was 30 m for the visible and near-infrared (bands 1-5 and 7). Resolution for the panchromatic (band 8) is 15 m, and the thermal infrared (band 6) is 60 m.

2. DMC[14] – the Disaster Monitoring Constellation (DMC) consists of 5 satellites. The standard DMC instrument is the Surrey Linear Imager (SLIM6) built by Surrey Satellite Technology Ltd (SSTL), UK. The SLIM6 consists of 2 banks (Port and Starboard) of 3 channels (Landsat 2, 3, 4 like bands). Combination of the 2 banks provides the total nominal swath width in satellite view of 600km. Resolution 32 m.

3. The IRS[15] 1C/1D/P6 – IRS 1C/1D; LISS-III sensor 23.5 m multispectral, delivered as 3 band products (2=green, 3=red, 4=NIR). Other instruments on board: WiFS 180 m multispectral, PAN 5.8m. IRS P6; LISS-III 23.5 m multispectral 4 band products (2=green, 3=red, 4=NIR, 5=SWIR). Other instruments on board: AWiFS 60 m multispectral, LISS IV PAN 5.8 m.

4. The TERRA/ASTER[16] - The Advanced Spaceborne Thermal Emission and Reflection Radiometer obtains high-resolution (15 to 90 meters) images of the Earth in 14 different wavelengths of the electromagnetic spectrum, ranging from visible to thermal infrared light.

5. The SPOT[17] 1, 2, 4, 5 – SPOTImage SPOT 1, 2 (HRV instruments); 1 PAN 10 m channel, 3 MSP 20 m channel. SPOT 4 (HRVIR instruments); 1 PAN 10 m, 3 MSP 20 m, 1 short-wave IR 20 m. SPOT 5 (HRG instruments); 2 PAN 5 m combined to generate a 2.5 m product, 3 MSP 10 m, 1 short-wave IR 20 m. The swath for all is 60 km.

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[13] http://eros.usgs.gov/products/satellite/tm.html , http://eros.usgs.gov/products/satellite/landsat7.html

[14] http://www.dmcii.com/products_sensor.htm

[15] http://www.euromap.de/site/index.html

[16] http://terra.nasa.gov/About/ASTER/index.php

[17] http://www.spotimage.fr/html/_167_.php

3.1.4.2. Division by sensor, budget, licensing, and data providers
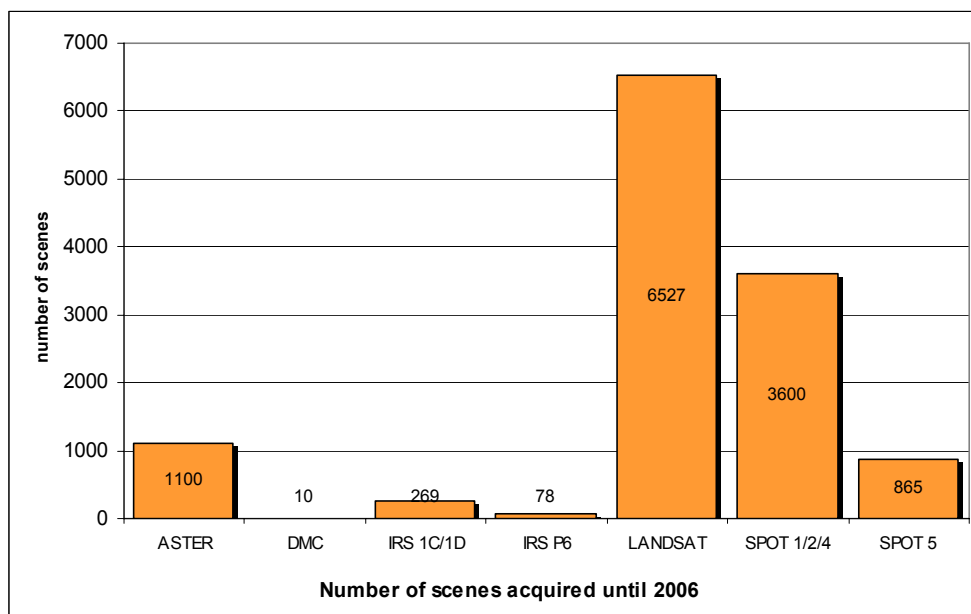
Figure 26: Number of high resolution scenes acquired until 2006

Figure 26 shows the number of scenes at present in archives. The data is to the largest extent stored on network storage. Only two Actions still have parts of data sets on other storage (CD, DVD, tapes, local HD).

> Landsat satellite remote sensing data dominates the JRC HR archives. Large historical archives exist.

SPOT data, especially SPOT 4, show large numbers due to the Image 2006 programme of the COSIN Action. This trend continues also in 2007 (see below). It should be mentioned that SPOT 2 will most probably cease functioning at the end of 2007. The forecasted volumes of Landsat data are optimistic considering Landsat 5's long lifetime (the satellite has been functioning since March 1, 1984), and recent swath misalignment problems (now corrected). However, Actions like FOREST, ISFEREA, and MONDE rely also on archive purchases which will continue.
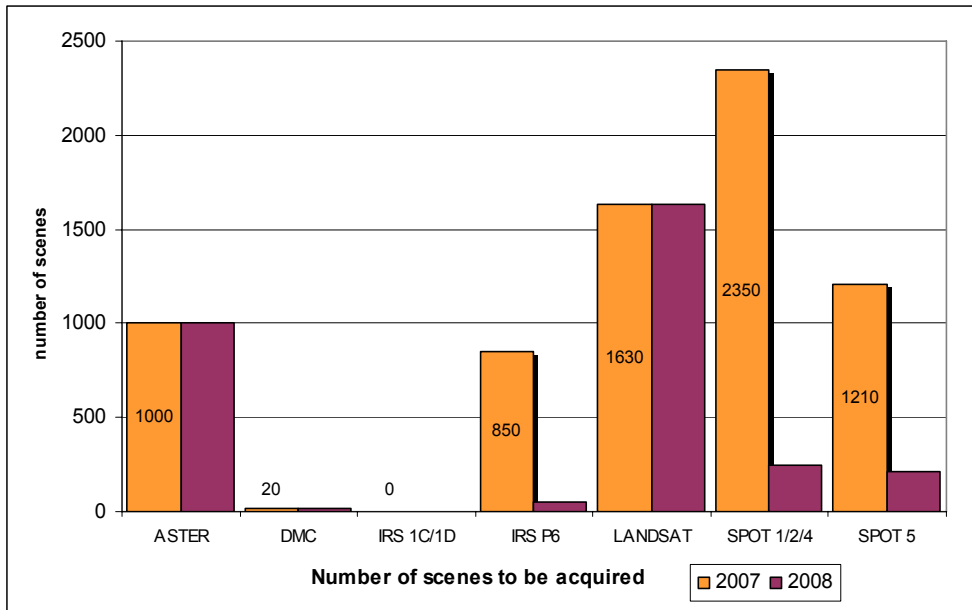
Figure 27: Number of high resolution scenes to be acquired in 2007 and 2008

For most sensor types, imagery is purchased through the EC Framework Contracts (FCs) which are used by 6 Actions.

Above can be viewed in Figure 28 where it also can be seen that other providers include contractors/private companies, ESA, or NASA/USGS/NOAA.
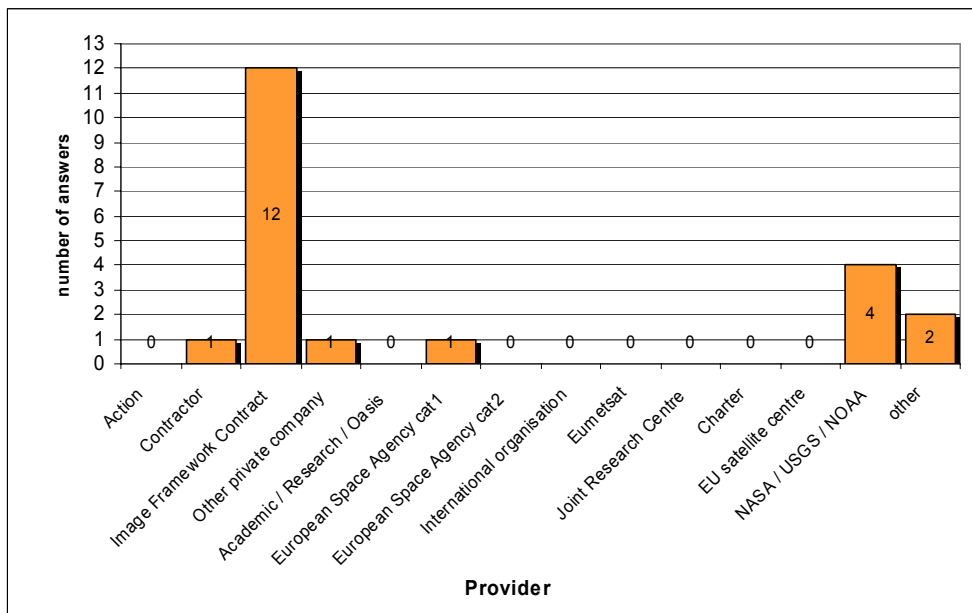
Figure 28: Providers of high resolution data
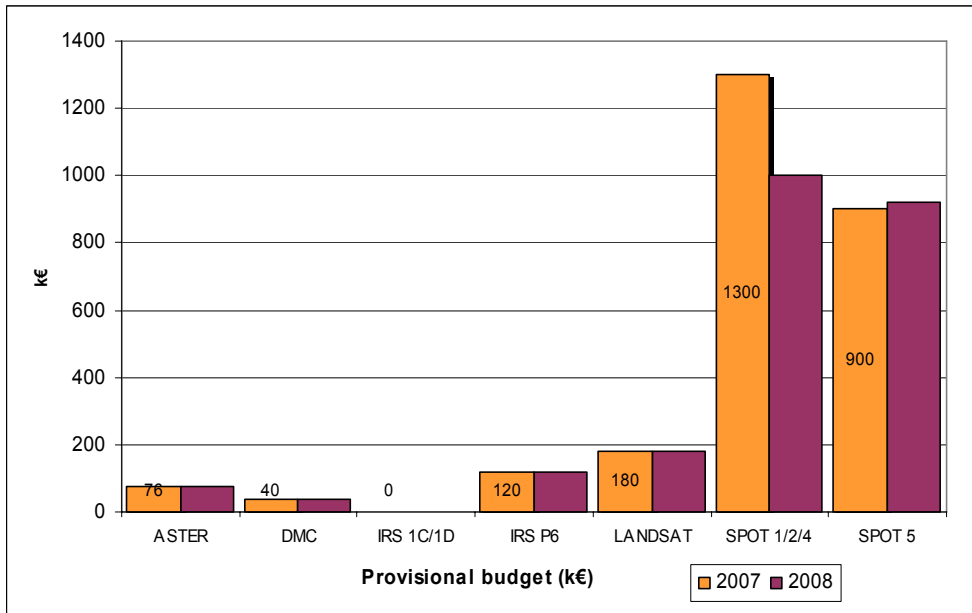
Figure 29: Provisional budget for acquisition of high resolution data in 2007 and 2008

Much of the archive Landsat data is available for free, most expenses go to the SPOT series used by MARS PAC. The largest ongoing programme COSIN Image 2006 does not use the FC (data is purchased by ESA) and licensing follows a derived version of the ESA Category 1 Scheme. The licensing scheme is however not clearly defined yet to the user which leads to an important issue for CID: licensing, and clear data policy.
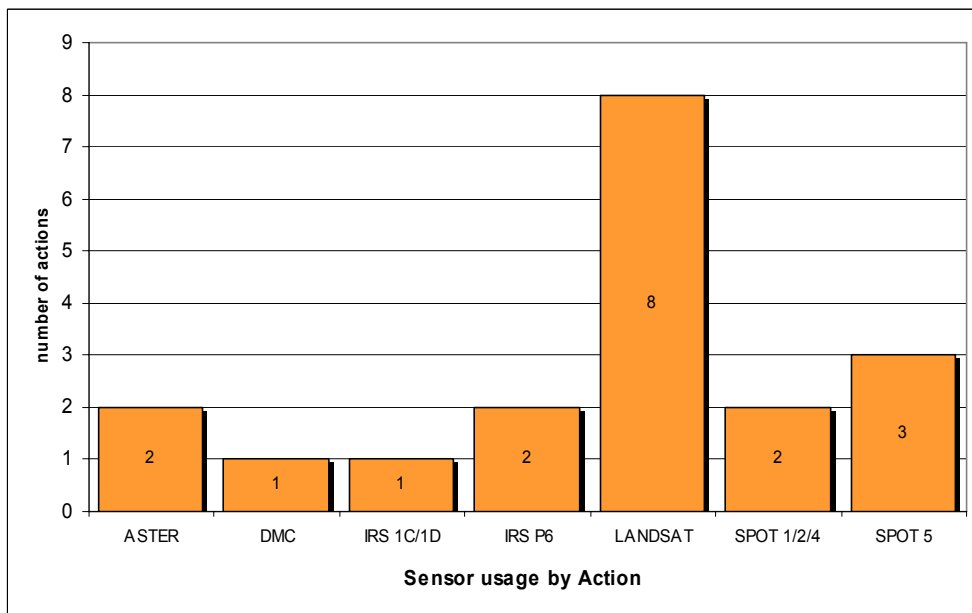
Figure 30: High resolution sensor usage by Action

As mentioned above Landsat is the main HR sensor. In fact it is used by 8 different Actions within the JRC: TREES-3, COSIN, FOREST, SOIL, ISFEREA, MONDE, ENSURE and MARS PAC. A substitute for this satellite will be named in the future – the DMC constellation, a new Landsat (plans for summer 2011…)

3.1.4.3.   Geographic coverage

The area of interest is throughout the world (except North America), with a higher concentration over EU27 and the whole of Europe, where the following actions work; COSIN, FOREST, SOIL, MARS-PAC and

ENSURE. The concentration over Europe is explained by the fact that image coverage is often linked to EU Policy issues. The CID portal should however provide all data efficiently to the user community.
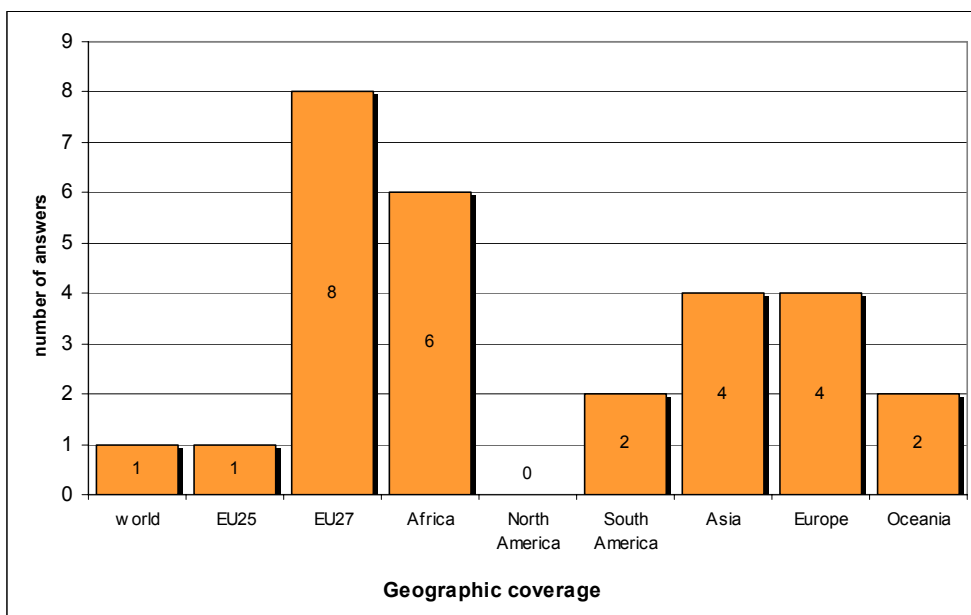
Figure 31: Geographic coverage of high resolution data

3.1.4.4.   Acquisition cycles, time series

Figure 32 shows that most acquisition is incidental, but compared to the VHR cycles there is the 5-10 year repeat cycles of programmes like COSIN (Image 2000, Image 2006 – Corine Land Cover), and Actions TREES-3, FOREST, and SOIL. In fact an interesting comparison can be made between the LR, and MR data acquisition cycles and the HR, VHR cycles; in the former case the acquisition cycles have a steady repeat cycle, while the latter acquisitions become incidental.

Different acquisition cycles require different data management strategies.
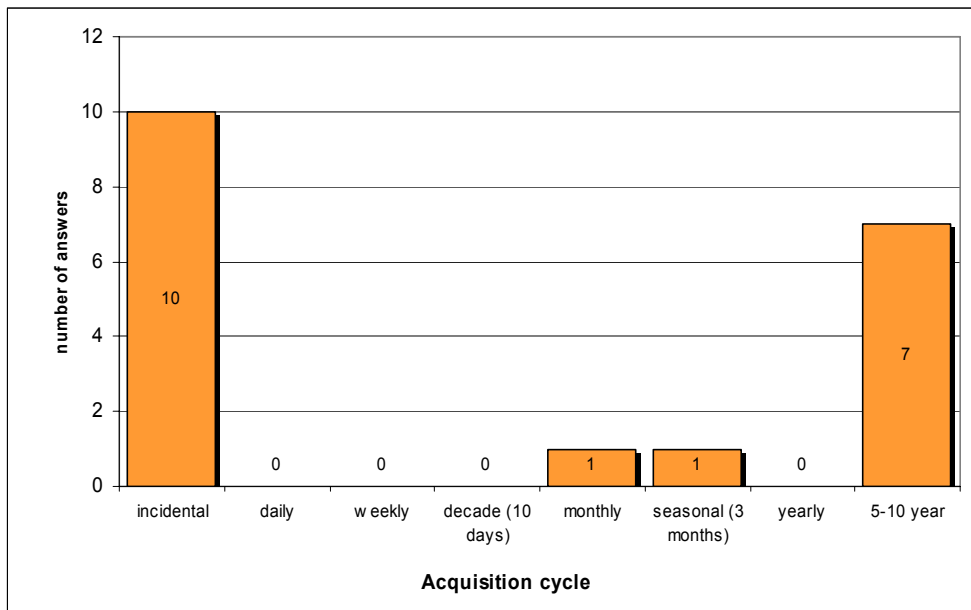
Figure 32: Acquisition cycles of high resolution data

### 3.1.4.5.   Image characteristics: formats, processing levels, projections
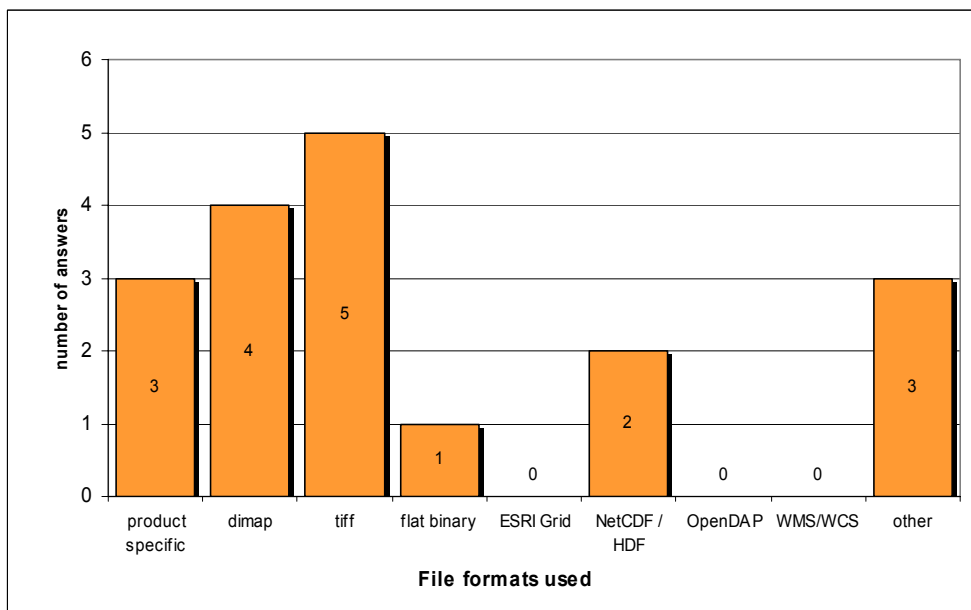
Figure 33: File formats used for high resolution data

As can be seen in Figure 33, the formats are more variable than for the VHR datasets which could imply more work to be served efficiently by the CID portal; but even the specific product, and those declared "other" are well known.
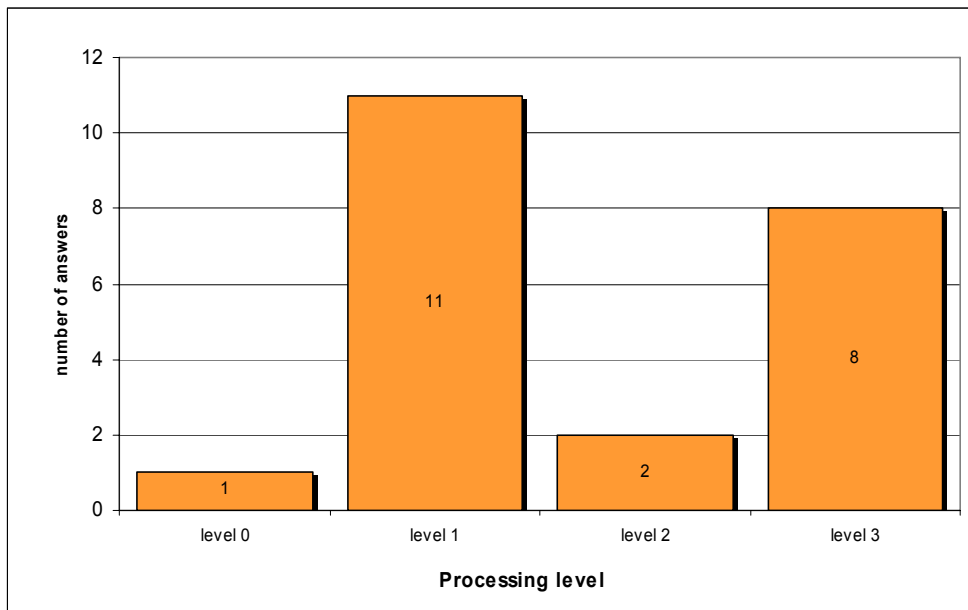
Figure 34: Processing levels used for high resolution data

During the survey the geometric processing levels of data purchased was asked for according to following levels:

    level 0: raw data received from the satellite

    level 1: radiometric correction but no geometric correction

    level 2: radiometric correction and geometric correction

    level 3: radiometric correction and orthorectification

Figure 34 shows that most data is purchased radiometrically corrected, or system corrected, with no pre-processing such as pan-sharpening, LUT stretched, etc. The large amount of answers on level 3 represents mainly Landsat mosaic purchase, and DMC. DMCii, the image provider for DMC, has implemented semi-automatic orthorectification routines.

> It is envisaged that the CID portal will implement semi-automatic orthorectification routines for High Resolution (HR) data; implementation will be a step by step process depending on ease of implementation, most used/required sensors, and most economic gain.

The MARS PAC Control with Remote Sensing programme (where orthorectification is performed by external contractors to the national Member State Administrations) could benefit if imagery from the sensors (SPOT, IRS, Landsat and DMC) included in the programme was available orthorectified from the CID portal to serve the contractors.
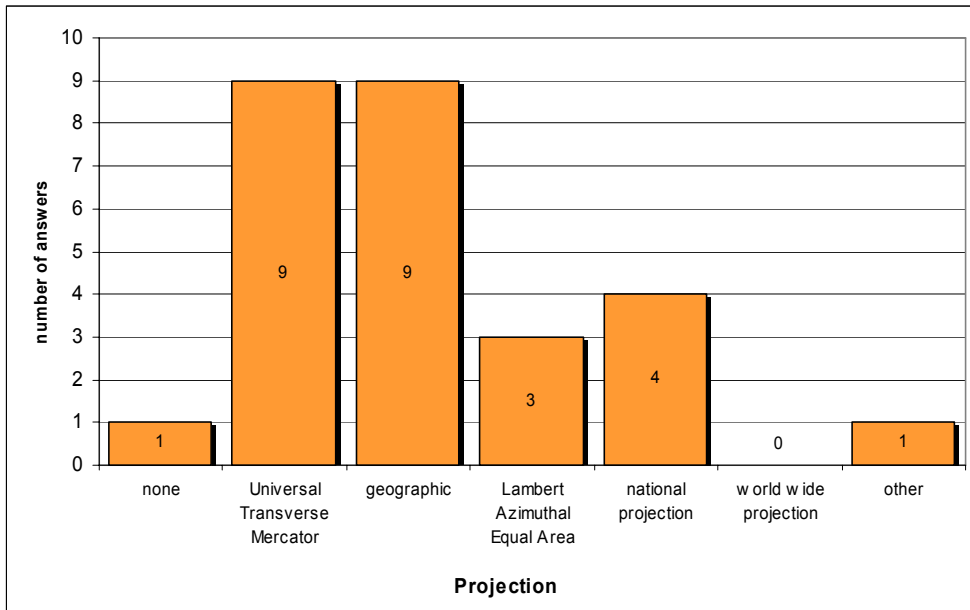
Figure 35: Projections used for high resolution data

Figure 35 shows that the projections used in purchased HR datasets are varying, but normally well known.

3.1.4.6. Acquisition characteristics: programming, cloud cover

Programming of the sensors is standard, except for SPOT where priority (called BLUE & RED) is applied within MARS PAC. The main cloud cover criteria has the threshold < 10% cloud cover within area of interest or image.
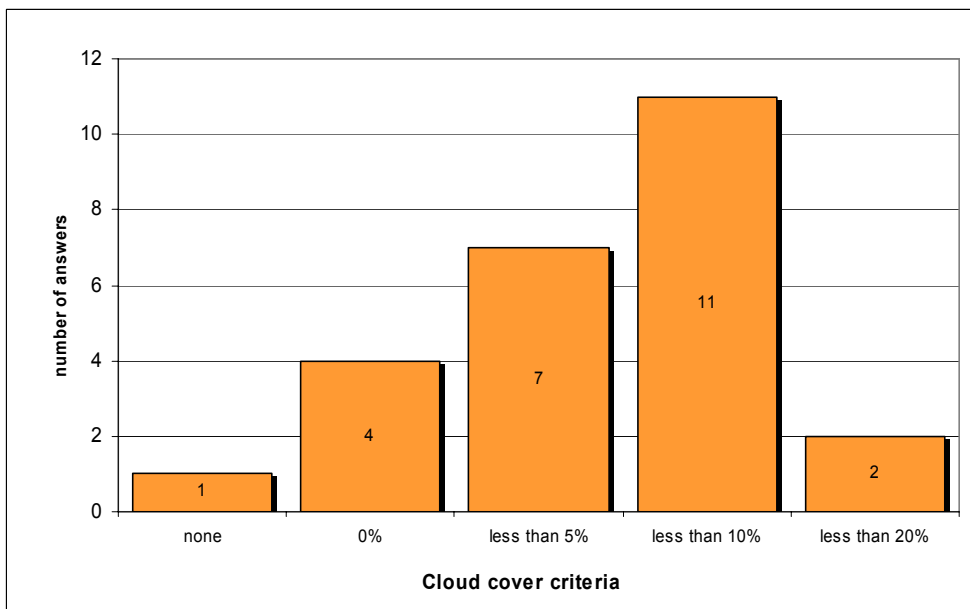
Figure 36: Cloud cover criteria for high resolution data

3.1.4.7. Data Reception: time to receive data, media and delivery services

Data reception time is mainly 2-3 days up to a couple of weeks. FTP or DVD/CDROM is used as main delivery media with an increase of the former.

> Reception of high volumes of data in a short time calls for efficient data transmission means with broad bandwidth.

The Actions acquiring near real time (NRT) is MONDE which downloads data via FTP. The Actions receiving data in more than 1 month are e.g. SOIL often producing time composites, and COSIN producing e.g. mosaics.
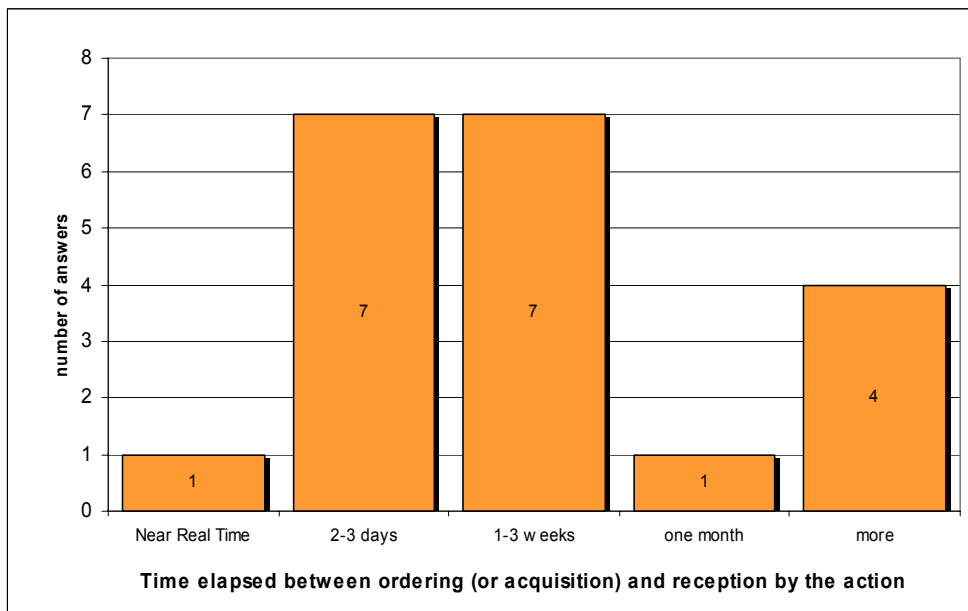
Figure 37: Time elapsed between ordering (or acquisition) and reception of high resolution data

3.1.5. Very high resolution source data used at the JRC

3.1.5.1. Presentation of the sensors

Below follows a short description of the 6 Very High Resolution (VHR) sensors used at the JRC. This data normally has resolution below 5 m and is used by the following JRC Actions; MARS-PAC, FISHREG, ISFEREA, and VERTEC.

1. SPOT 5 supermode - SPOT 5 (HRG instrument); 2 PAN 5 m combined to generate a 2.5 m product. The swath is 60 km (see further SPOT description above under chapter 3.1.4.1).

2. Formosat2[18] - The Formosat2 sensor provides PAN 2 m, and Multispectral 8m resolution data in 4 bands. The swath is 24 km and collection angle ranges from -45º to +45º. With its sun-synchronous, geo-synchronous 14 orbit/day, the Formosat2 sensor has daily revisit capacity, but does not manage to cover the whole globe.

3. EROS A[19] – the EROS A satellite was launched on December 5th 2000. The satellite will be operational until the end of 2010. Basic imagery is PAN with 1.9 meter ground sampling distance (GSD) at nadir; the basic imagery is 14 km x 14 km. A vector image of 14 km x up to about 150 km can be imaged.

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[18] http://www.spotimage.fr/html/_167_.php

[19] http://imagesatintl.com/

4. ORBVIEW3[20] - OrbView-3's imaging instrument provides both one-meter panchromatic imagery and four-meter multispectral imagery with a swath width of 8 km. The satellite revisits each location on Earth in less than three days, collection angle being up to ± 45 degrees

5. IKONOS[21] - 1-meter resolution Panchromatic (black and white), 4 m resolution Multispectral (Blue: 450 - 520 nm, Green: 510 - 600 nm, Red: 630 – 700 nm, Near IR: 760 - 850 nm) and 1 m resolution Pan-sharpened Multispectral imagery. Nominal swath 11 km.

6. QUICKBIRD[22] - 60 cm resolution Panchromatic (black and white), 2.40 m resolution Multispectral (Blue 450 to 520 nm Green 520 to 600nm Red 630 to 690 nm Near IR 760 to 900 nm) and 60 cm resolution Pan-sharpened Multispectral imagery. Nominal swath 16.5 km.

3.1.5.2.   Division by sensor, budget, licensing, and data providers

Three sensors dominate the VHR scenario; Ikonos, Quickbird, and SPOT supermode. All are reliable and the first two have proven to have high success rates in short acquisition windows. By far the largest data volume has and will be placed on the Ikonos sensor being most agile and thus able to acquire data in multiple strips from same orbit. It has approximately 3 times the acquisition capacity of the Quickbird sensor. Main users of the Ikonos sensor are therefore projects which are time critical i.e. MARS PAC, and the ISFEREA which deal with agricultural fraud control or emergency issues.
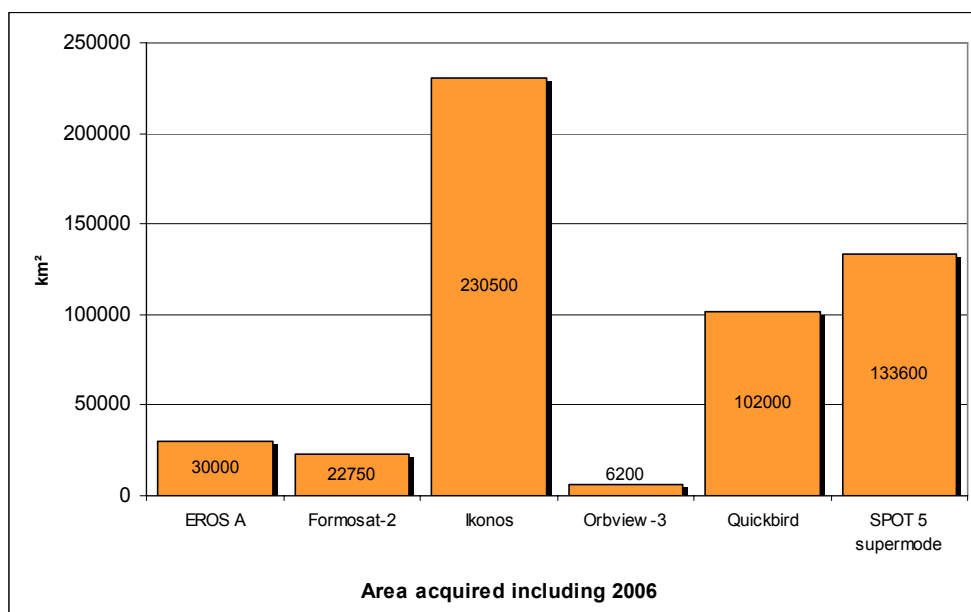
Figure 38: Area of very high resolution imagery acquired including 2006[23]

The majority of VHR data is purchased using the JRC Framework Contracts (FC).

Pricing (see Figure 40), which for VHR datasets is stated in €/km2 since the scene concept does not really apply, follows resolution and reliability; Quickbird is slightly more expensive than Ikonos, justifiable by the higher spatial resolution. Important considerations for the CID portal is the resulting extremely high data vol-

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[20] http://www.geoeye.com/products/imagery/orbview3/default.htm

[21] http://www.euspaceimaging.com/ , http://www.geoeye.com/products/imagery/ikonos/default.htm

[22] http://www.eurimage.com/products/quickbird.html , http://www.digitalglobe.com/product/index.shtml

[23] part of SPOT 5 PAN is included in the SPOT 5 PAN supermode amount (JRC Action FishReg)

umes (very high resolution, and often ordered as a bundled product containing one panchromatic band, and 4 multispectral bands; often several GBytes per dataset).

Also for 2007 and 2008 the same sensors continue to dominate; SPOT supermode is expected to be used more extensively within the FISHREG Action.
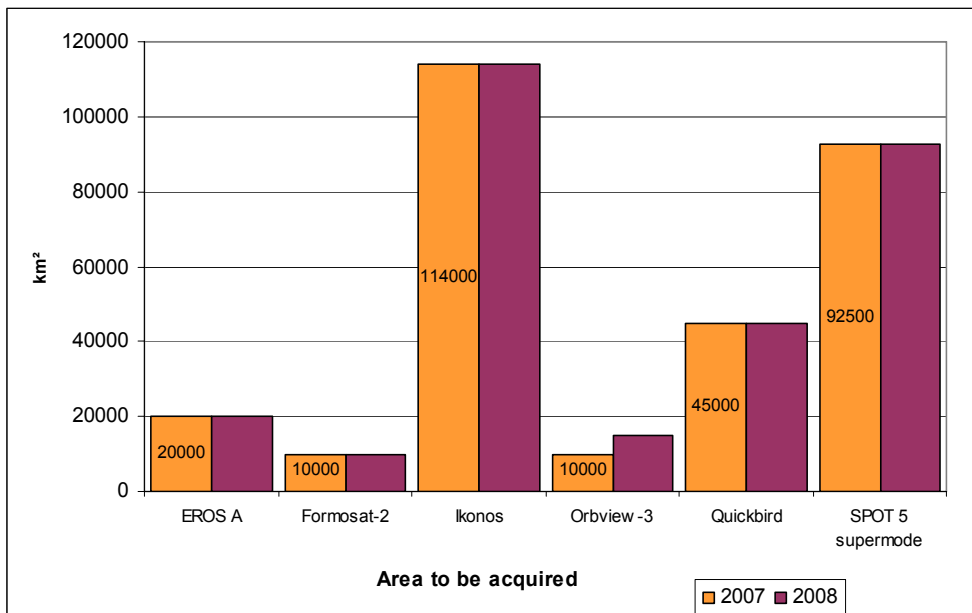
Figure 39: Area of very high resolution imagery to be acquired in 2007 and 2008
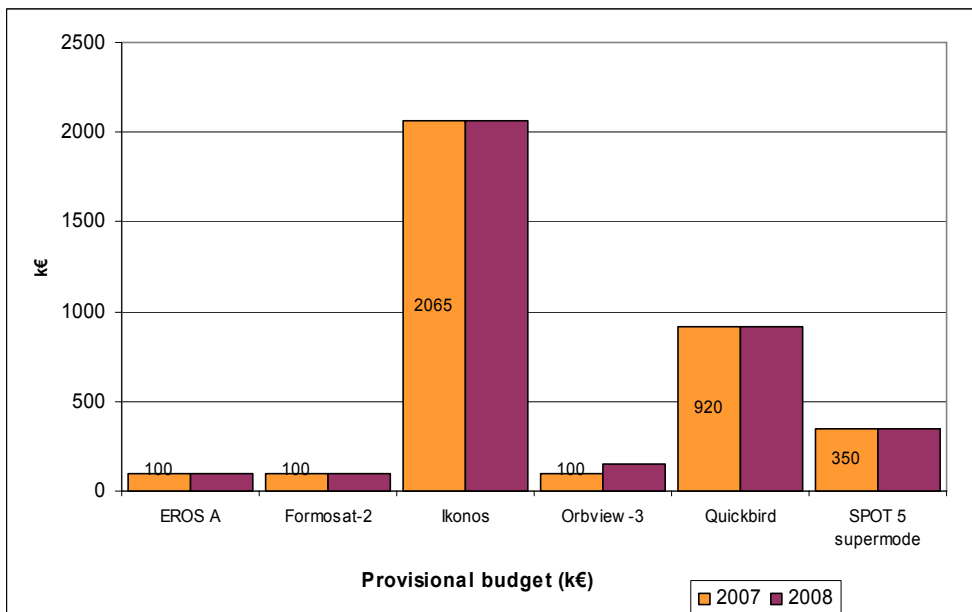
Figure 40: Provisional budget for acquisition of very high resolution data in 2007 and 2008

The largest budget for VHR data is the MARS PAC Control with Remote Sensing programme which has an approximate 3 000 – 3 500 k€ yearly purchase. Since VHR data procurement is rather constant (comment: depending on the CAP Regulations) the volumes are quite easy to forecast, and allows the planning of re-sources.

3.1.5.3. Geographic coverage
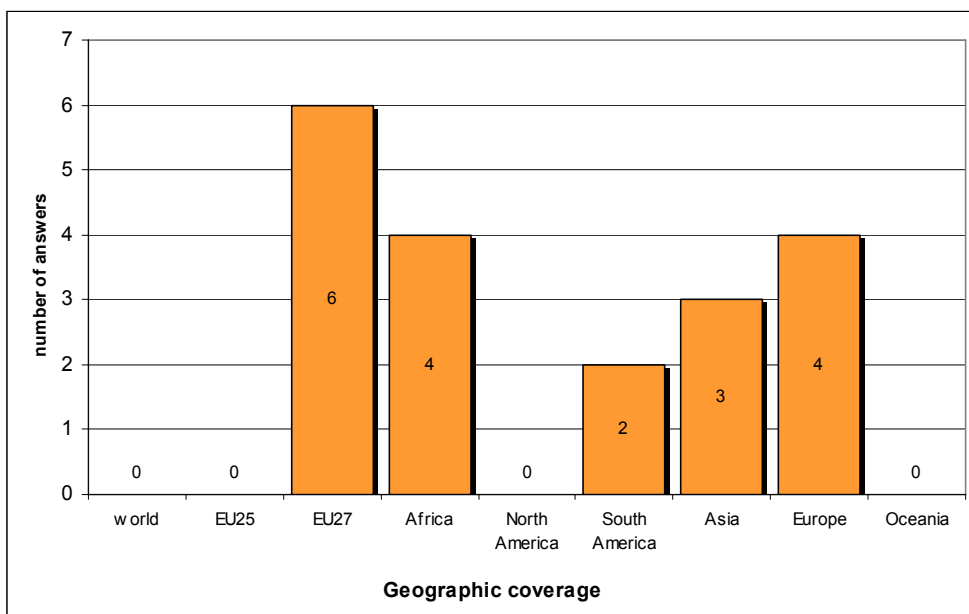
Figure 41: Geographic coverage by very high resolution data

The main data volumes cover the EU 27 countries and remaining Europe; but 3 JRC Actions cover areas in Asia making use of 3 different sensors, 2 Actions cover areas over Africa using 4 types of sensors, and 1 Action covers areas in South America using 2 types of sensors.

> Considerable archives over Europe are being built up; existing 3-400 000 km^2 with an increase of 150 000 km^2 / year not considering the multiple sensor coverage.

3.1.5.4. Acquisition cycles, time series

Very rarely does it happen that acquisition is anything else than incidental since we are dealing with emergency issues, or imagery for agricultural control purposes, both applications requiring imagery quickly at different locations, unless it is to monitor a specific event. The Control with Remote Sensing activity is however a yearly recurring phenomenon over a large set of varying, non-contiguous areas over EU 27.
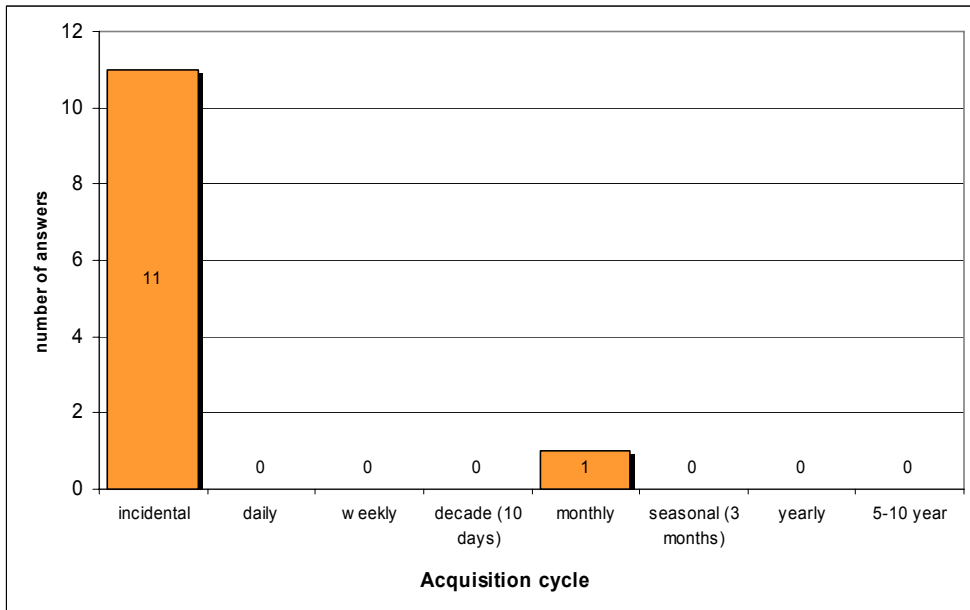
Figure 42: Acquisition cycles of very high resolution data

3.1.5.5. Image characteristics: formats, processing levels, projections

Main formats of the VHR imagery is TIFF (or GeoTIFF). The DIMAP (Digital Image MAP) format is used for Formosat and SPOT supermode. Both of these are well known formats, and for the CID portal do not require additional efforts to incorporate and serve efficiently.
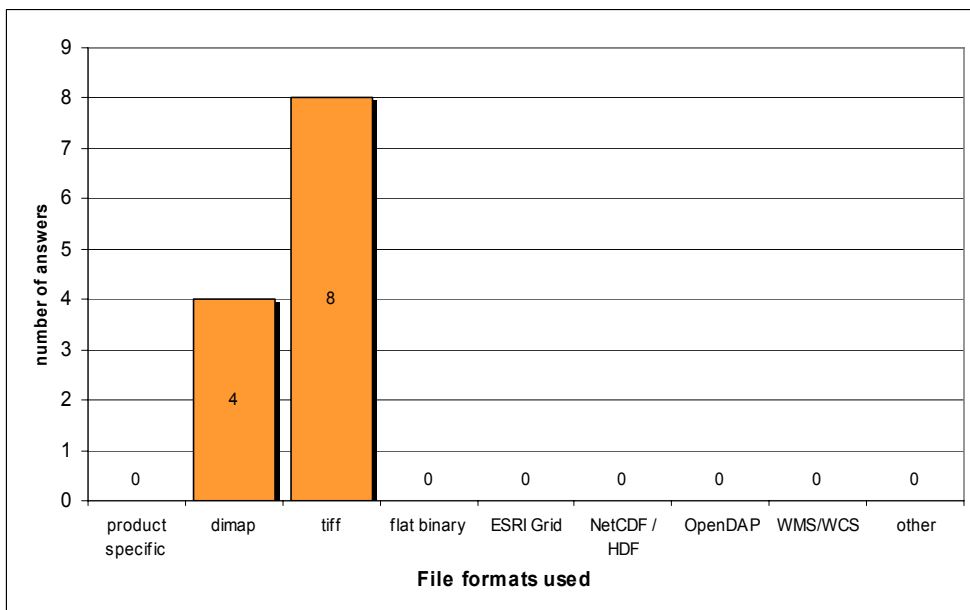
**Figure 43: File formats used for very high resolution data**

During the survey the geometric processing levels of data purchased was asked for according to following levels:

        level 0: raw data received from the satellite

        level 1: radiometric correction but no geometric correction

        level 2: radiometric correction and geometric correction

level 3: radiometric correction and orthorectification

JRC Actions mainly purchase data in level 1 or 2 performing orthocorrection themselves or use external contractors (e.g. in the Control with Remote Sensing the orthocorrection is done by contractors of the National Administrations participating in the programme). This is not done without difficulty.

It is envisaged that the CID portal will implement semi automatic orthorectification of the main VHR sensors.
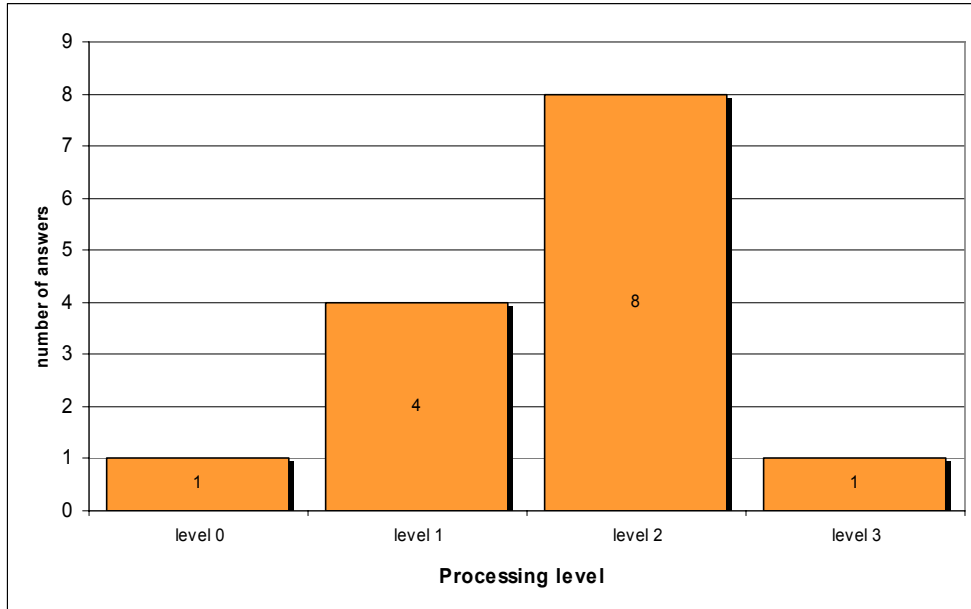
Figure 44: Processing levels used for very high resolution data

The projections used in purchased VHR datasets are normally well known. Within the CID portal there is a need to be able to transform between all requested projections used, and store required metadata according to existing standards.
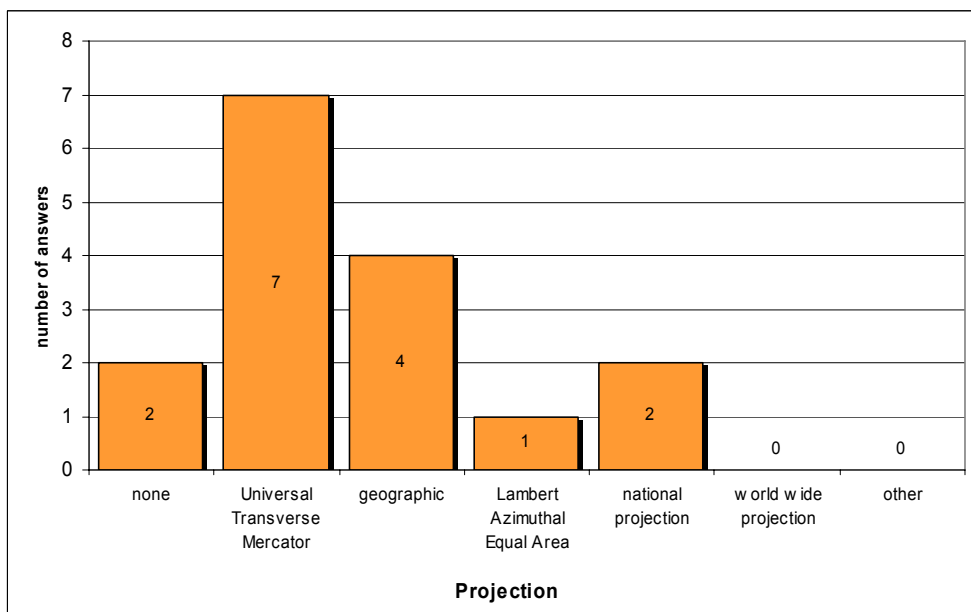
Figure 45: Projections used for very high resolution data

3.1.5.6.   Acquisition characteristics: programming, cloud cover

Priority programming (uplift to standard programming enabling a shorter acquisition window) is used mainly by the MARS PAC Action, while standard or archive by others. Cloud Cover criteria are also stricter for the MARS PAC Action (moving from the standard < 20% CC threshold down to as far as < 5% over the area of interest).
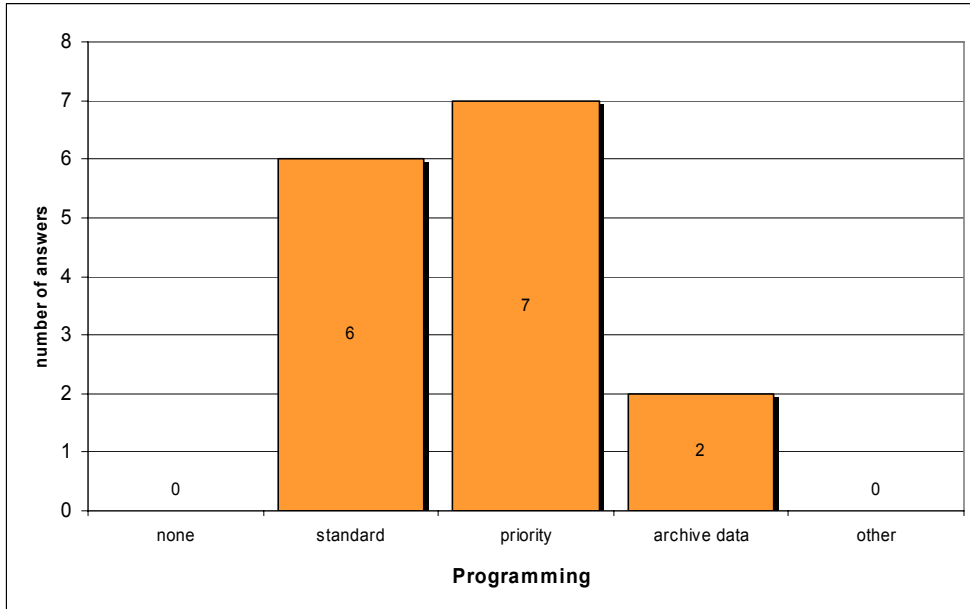
Figure 46: Programming modes used for acquisition of very high resolution data

3.1.5.7.   Data Reception: time to receive data, media and delivery services

Data reception time is most often short (days) considering that the programmes that use VHR data require download of very large volumes in a very short time. FTP or DVD/CDROM are used as delivery media with an increase of the former. This, as mentioned earlier, calls for efficient data transmission with broad band-width, for reception of data. Once data arrives at the JRC, site storage of data is, for all datasets, on network storage. This means that most data is more easily reachable, but not always in common standards (ref. 3.3.1).
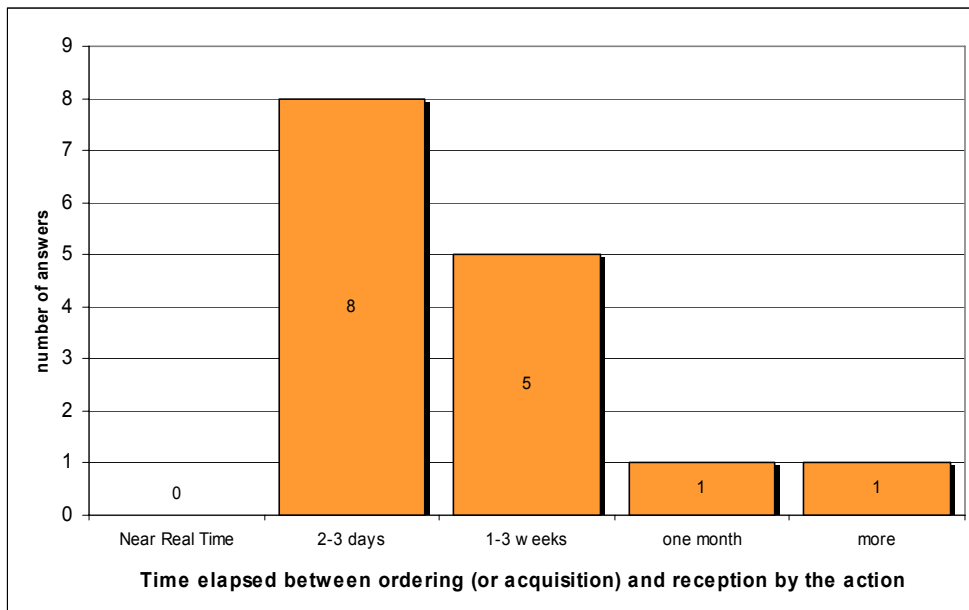
Figure 47: Time elapsed between ordering (or acquisition) and reception of very high resolution data
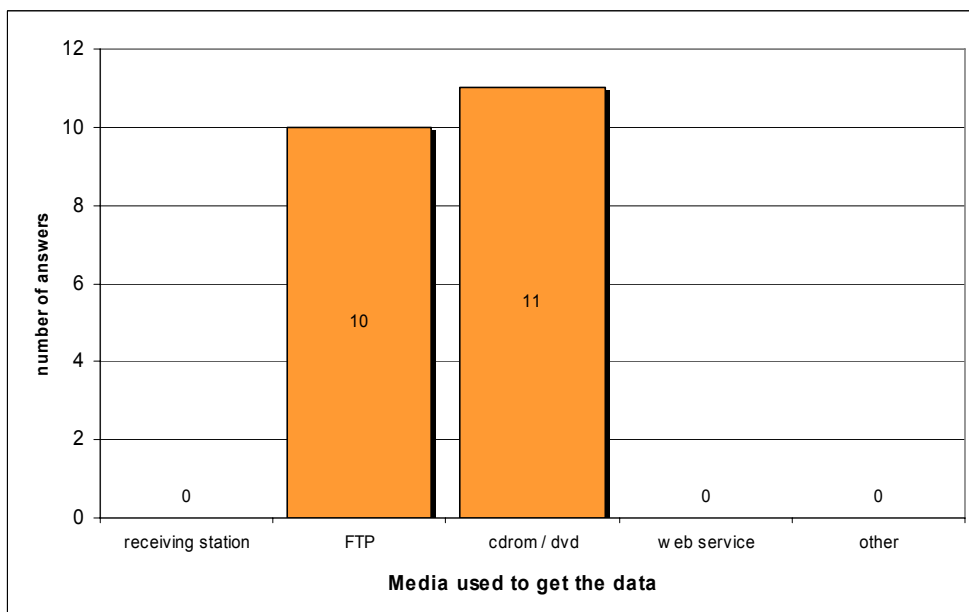
Figure 48: Media used to get very high resolution data

3.1.6. Radar source data used at the JRC

3.1.6.1. Presentation of the sensors

There follows a short description of the 3 radar sensors used at the JRC. This data normally has spatial resolution from less than 10 to 100's of meter depending on imaging modes. The data is used by following JRC Actions: FISHREG, ISFEREA, MARS-PAC, MASURE, and TREES-3.

1. ALOS PALSAR[24] - The Phased Array type L-band Synthetic Aperture Radar (PALSAR) is an active microwave sensor using L-band frequency to achieve cloud-free and day-and-night land observation. It provides higher performance than the JERS-1's synthetic aperture radar (SAR). Fine resolu-

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[24] http://www.eorc.jaxa.jp/ALOS/about/palsar.htm

tion in a conventional mode, but PALSAR will have another advantageous observation mode. ScanSAR, which will acquire a 250 to 350km width of SAR images (depending on the number of scans) at the expense of spatial resolution. This swath is three to five times wider than conventional SAR images. The development of the PALSAR is a joint project between JAXA and the Japan Resources Observation System Organization (JAROS).

2. ENVISAT ASAR[25] - An Advanced Synthetic Aperture Radar (ASAR), operating at C-band, ASAR ensures continuity with the image mode (SAR) and the wave mode of the ERS-1/2 AMI. It features enhanced capability in terms of coverage, range of incidence angles, polarisation, and modes of operation. Radiometric resolution in range; 1.5-3.5 dB, Spatial Resolution; Image, Wave and Alternating Polarisation modes: approx 30m x 30m. Wide Swath mode: approx 150m x 150m. Global Monitoring mode: approx 1000m x 1000m. Swath Width; Image and alternating polarisation modes: up to 100km, Wave mode: 5km, Wide swath and global monitoring modes: 400km or more

3. ERS1/2[26]- European Remote Sensing satellite, ERS-1, launched in 1991, was ESA's first Earth Observation satellite; it carried a comprehensive payload including an imaging Synthetic Aperture Radar (SAR), a radar altimeter and other powerful instruments to measure ocean surface temperature and winds at sea. ERS-2, which overlapped with ERS-1, was launched in 1995 similar to ERS1 but with an additional sensor for atmospheric ozone research. The AMI, i.e. the active microwave instrument consisting of synthetic aperture radar (SAR), mainly used by the JRC Actions, provides two-dimensional spectra of ocean surface waves. In image mode the SAR provides high resolution two-dimensional images with a spatial resolution of 26 m in range (across track) and between 6 and 30 m in azimuth (along track). Image data is acquired for a maximum duration of approximately ten minutes per orbit.

4. The JERS1/OPS27 - JERS1 was launched in Feb 1992 and finalised in Oct 1998 (joint Japanese radar/optical mission with NASDA/JAXA lead). Status: Out of service since 1998. Resolution: 18 m, Swath Width: 75 km Onboard Sensors: OPS (Optical Sensor), and (SAR (JERS-1) (Synthetic Aperture Radar))

5. RADARSAT1[28] – The RADARSAT1 satellite was launched November 4, 1995. It is equipped with a Synthetic Aperture Radar (SAR) that can be steered to collect data over a 1,175 km wide area using 7 beam modes. This provides users with superb flexibility in acquiring images with a range of resolutions, incidence angles, and coverage areas; C-band synthetic aperture radar (SAR), Near-Real Time processing of data, 7 beam modes and 35 beam positions for a wide range of imaging options, varying resolutions (8 - 100 metres; the Fine Beam Mode frequently used by the JRC has a nominal resolution of 8m), swath widths of 50 - 500 km, incidence angles from 10 - 59 degrees. The follower, RADARSAT-2, is scheduled for March 2007

3.1.6.2. Division by sensor, budget, licensing, and data providers

Image products from three satellites are purchased by 4 out of the 5 relevant JRC Actions mentioned above. Radarsat is being used by 4 Actions (Figure 49).

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[25] http://envisat.esa.int/object/index.cfm?fobjectid=3772

[26] http://earth.esa.int/object/index.cfm?fobjectid=3978

[27] http://earth.esa.int/JERS-1/

[28] http://gs.mdacorporation.com/products/sensor/radarsat/radarsat1.asp
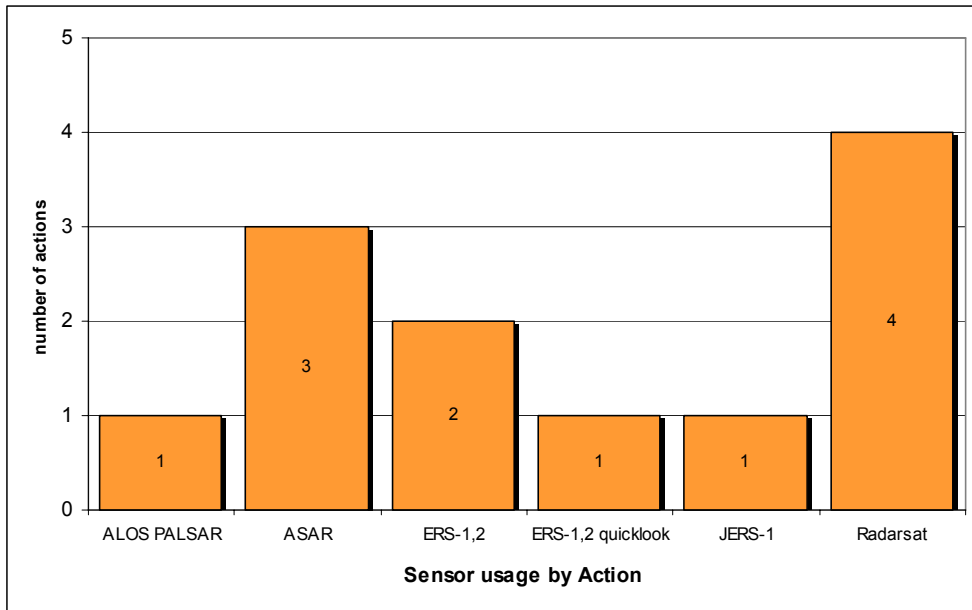
Figure 49: Radar sensor usage by Action

In Figure 50 it can be seen that large archives (since 1999) exist of ERS1, 2 QLs (Action MASURE). A high number of JERS-1 scenes have been acquired by TREES-3 10 years ago. These archives, and all JRC purchased radar data are stored on network storage.
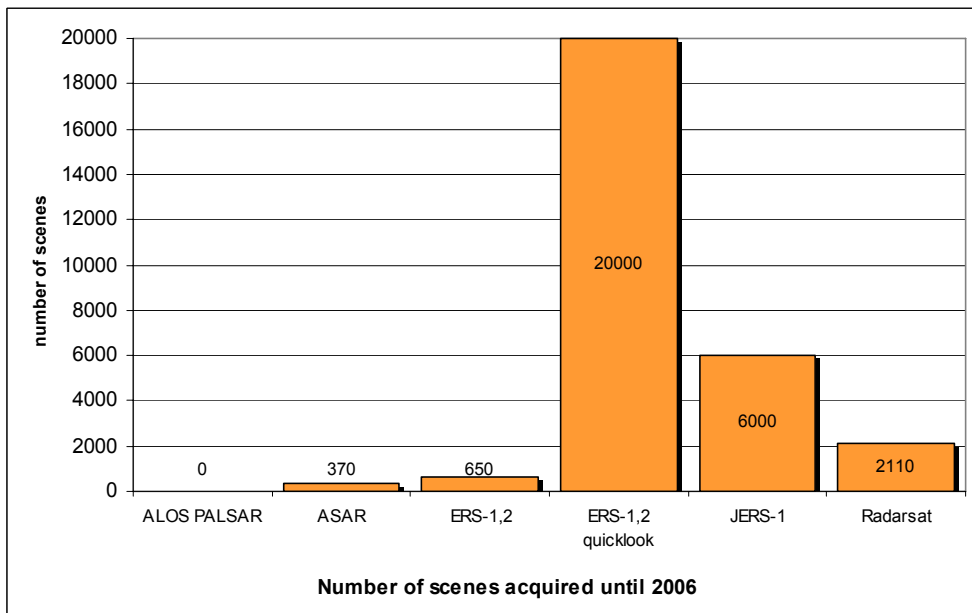
Figure 50: Number of radar scenes acquired until 2006
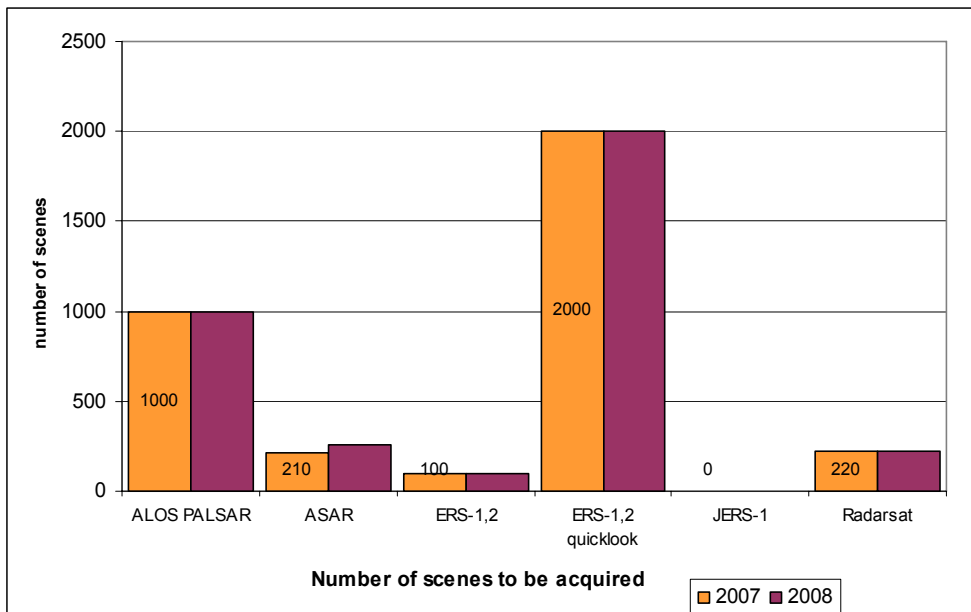
Figure 51: Number of radar scenes to be acquired in 2007 and 2008

The quicklooks will be acquired also for 2007/8 but these do not influence the expenses on radar data since they are obtained at no cost from ESA.

The largest budget expenditure on Radarsat imagery is by the MARS-PAC and FISHREG Actions , purchasing approximately 100 scenes per year for their programmes.
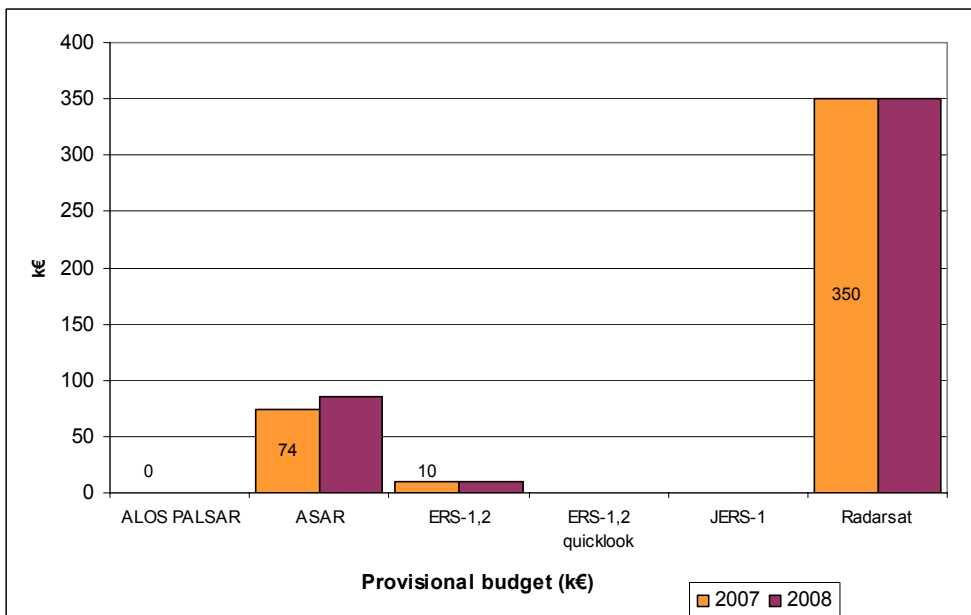
Figure 52: Provisional budget for acquisition of radar data in 2007 and 2008
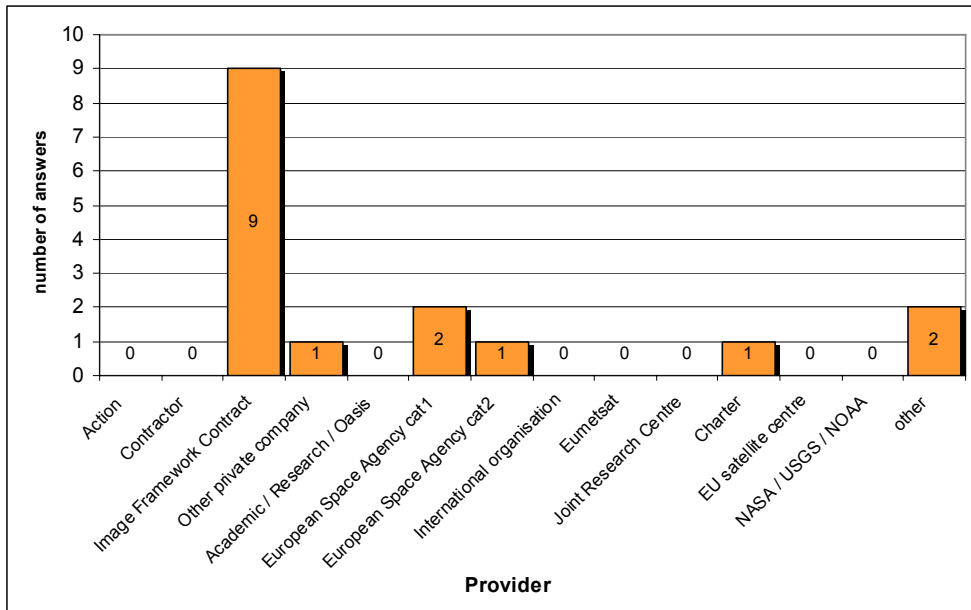
Figure 53: Providers of radar data

Figure 53 above shows that most data is purchased through the FC agreements, otherwise ESA or JAXA or in the case of the Prestige incident through charter.

3.1.6.3. Geographic coverage
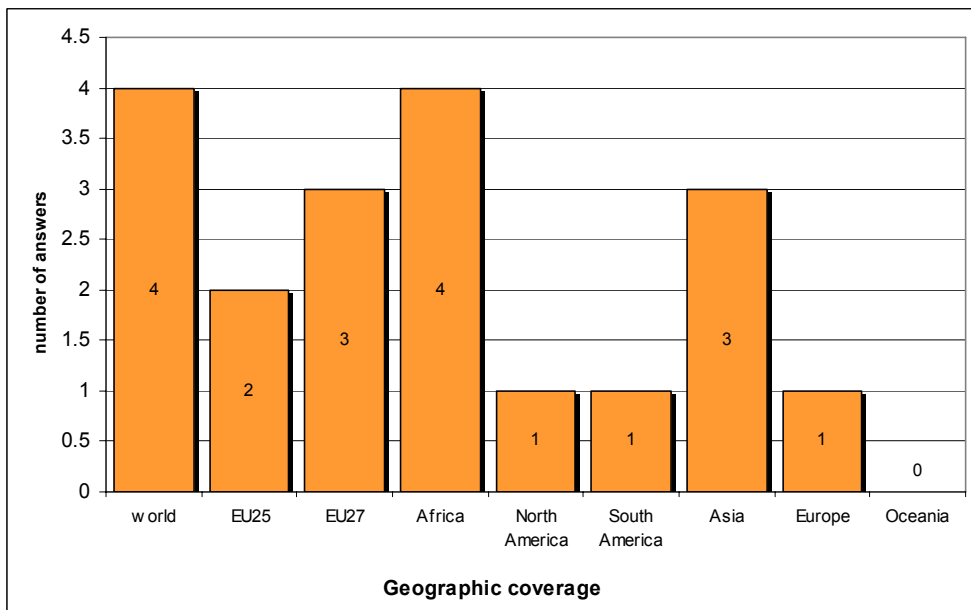
Figure 54: Geographic coverage of radar data

Data are covering different parts of the world indicating that areas of interest are widespread (Figure 54). A significant number of the scenes are acquired over the sea (without considering the 20 000 ERS quick-looks).

3.1.6.4. Acquisition cycles, time series
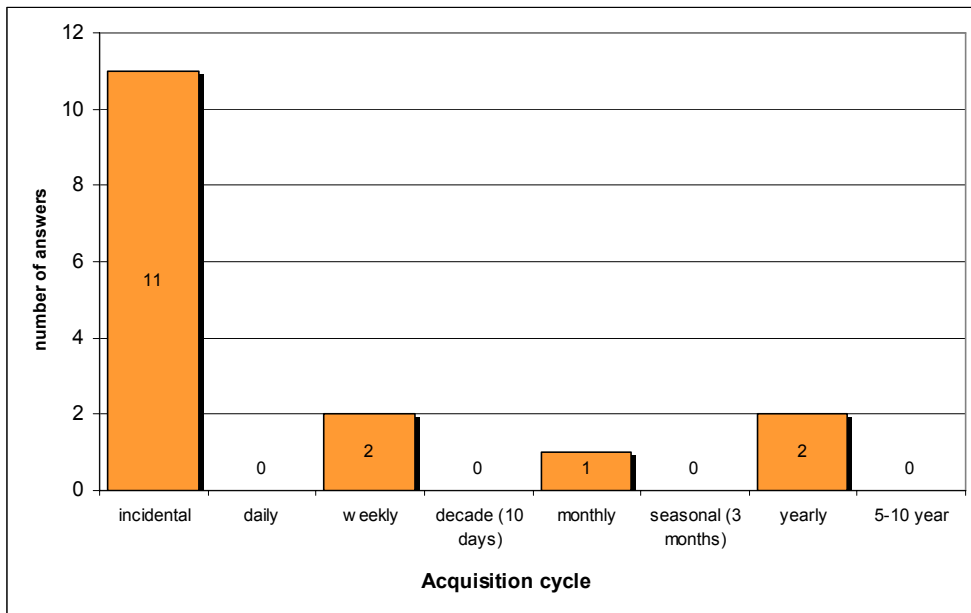
Figure 55: Acquisition cycles of radar data

Acquisition cycles (Figure 55) are in majority incidental but repeat cycles occur in FISHREG, TREES-3 (yearly) and MASURE (weekly).

3.1.6.5. Image characteristics: formats, processing levels, projections

Radar data are typically acquired in product specific formats with none or product dependent pre-processing. The processing levels chosen are equally 0, 1 and 2.

3.1.6.6. Acquisition characteristics: programming, cloud cover
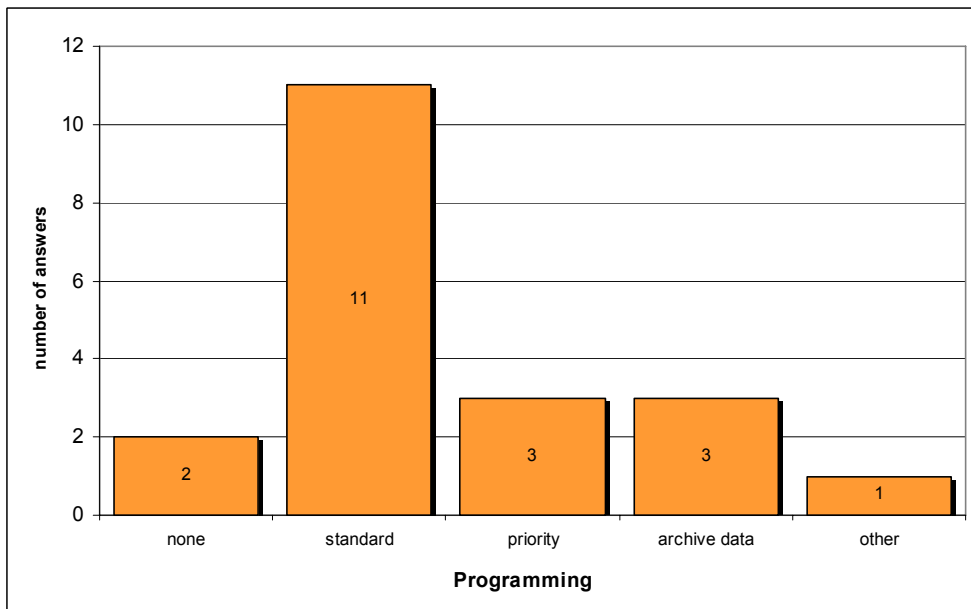
Figure 56: Programming modes used for acquisition of radar data

Main programming (Figure 56) is standard programming. Any Cloud Cover (CC) criteria are not relevant for radar sensors since they operate in the microwave region of the spectrum.

3.1.6.7. Data Reception: time to receive data, media and delivery services
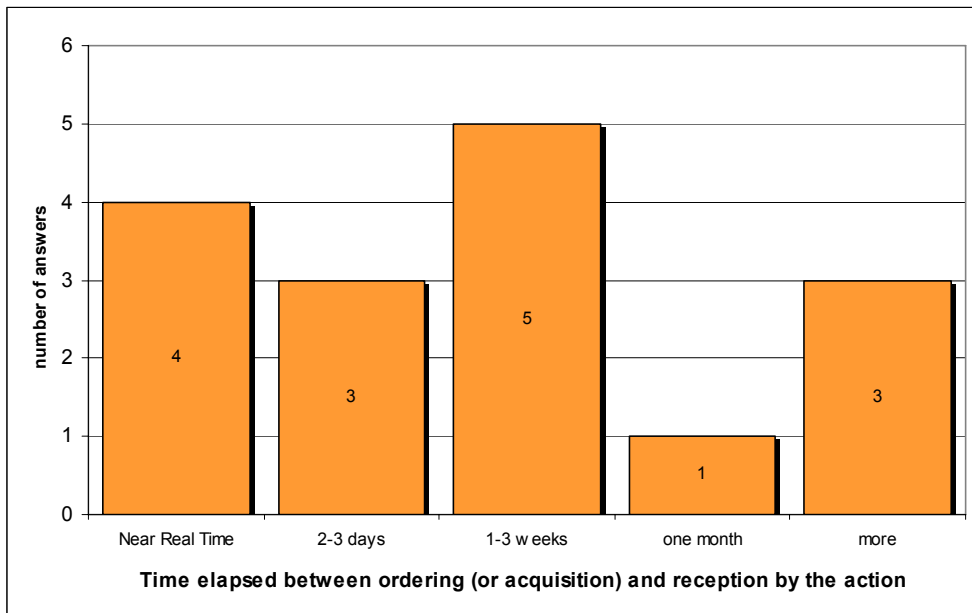
Figure 57: Time elapsed between ordering (or acquisition) and reception of radar data

Near Real Time (NRT) delivery is used substantially by FISHREG, and MASURE dealing with Fisheries Policy and vessel detection. The MARS-PAC agricultural controls receive data within days, while other programmes rely on longer delivery.

> The main delivery media for radar is reception through FTP, calling for secure quality, and reliable service in transmission of data especially for the programmes requiring NRT delivery of data.
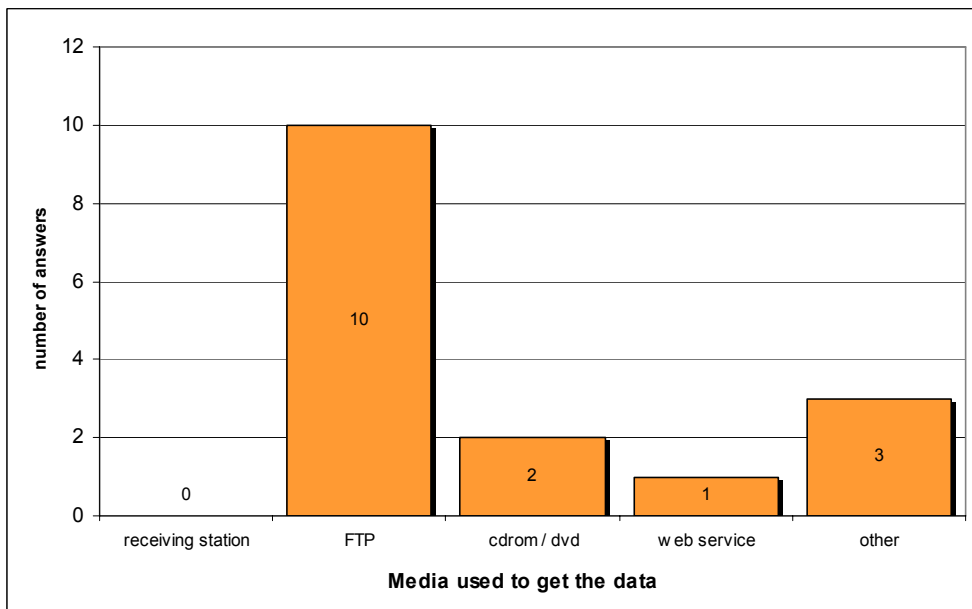
Figure 58: Media used to get radar data

3.2.   Derived Products Generated by the JRC Actions

In order to get an overview of the types of products generated, the respondents were asked to assign the products their Action creates from source data inventoried during this survey to predefined categories. The results are found in Table 3.

Product	LR	MR	HR	VHR	Radar
Classification	6.25%	28.57%	25.00%	0.00%	43.48%
Change detection	9.38%	35.71%	22.73%	15.79%	17.39%
Digital Elevation Model	0.00%	0.00%	0.00%	10.53%	0.00%
Lookup table stretch	3.13%	0.00%	2.27%	0.00%	0.00%
Meteorological product	12.50%	0.00%	0.00%	0.00%	0.00%
Ortho and LUT stretched	0.00%	0.00%	20.45%	36.84%	4.35%
Ortho image	0.00%	0.00%	13.64%	21.05%	8.70%
Phenological data	12.50%	0.00%	0.00%	0.00%	0.00%
Preview (small image for fast pre-view)	12.50%	7.14%	4.55%	15.79%	0.00%
Vegetation indices	21.88%	14.29%	0.00%	0.00%	0.00%
Other	21.88%	14.29%	11.36%	0.00%	26.09%

Table 3: Products generated according to the type of source data

> The main products produced are classifications, change detections and orthocor-rected images.

Some Actions generating products on a daily to monthly basis stressed the fact that source data and products should be available through the same service.

3.3.   Storage and Dissemination of Data

The questions in the fourth section of the questionnaire were designed to give an overview about the way imagery data are currently archived and how data are disseminated or planned to be disseminated. These results give an important indication for prioritization of objectives for the CID Action when establishing the Image Portal.

3.3.1. Data storage systems and capacity

Image data from satellites belong to the kind of data sources with probably one of the highest requirements regarding available storage capacity. Large archives of imagery – often collected over years and decades – are usually a challenge for even modern and the most up-to-date storage appliances.

The way data are stored and organized has an important impact on potential data access strategies. In most cases image data in the JRC are stored on network-based disk storage devices (NAS[29]/SAN[30]) as seen in

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[29] **NAS** Network-attached storage is the name given to dedicated data storage technology that can be connected directly to a computer network to provide centralized data access and storage to heterogeneous network clients

[30] **SAN** Storage area network is a network designed to attach computer storage devices such as disk array controllers and tape libraries to servers

Figure 59. This situation will facilitate the online access to data and/or reference them in a catalogue without the requirements to first copy them from tapes or CD-ROM/DVD.
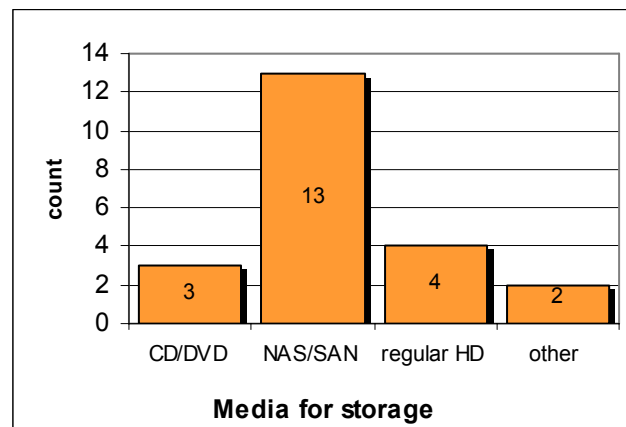
Figure 59: Media used for data storage

The *storage location* in 75% of all Actions is inside the JRC corporate network, only 25% are directly available in the DMZ[31]. This complicates data dissemination via data services towards the Internet. Due to security policy, data inside the corporate network is usually not accessible from the Internet. Even in cases when this kind of access is possible, the data access will have to go through firewall routing. This will decrease the data transfer speed greatly which has an important impact on the data services given the generally large size of image data.

The *data storage required* to cover the needs of all actions for the years 2006 to 2008 is displayed in Figure 60.

> The total amount of imagery is expected to increase from 55 TeraByte (TB) in 2006 to more than 100 TB by 2008. This means an increase of more than 80% within two years.

The dashed line shows the storage capacity currently in place (110 TB). In principle, the necessary storage quantity is covered by the existing capacity. Since storage is typically only used inside one Action or Unit and not shared between them, a shortage in one action is in most cases not compensated by existing storage in another Action or Unit.

> One solution to the issue of fragmented storage is the sharing of a central storage service.

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[31] **DMZ** Demilitarized zone is a network area that sits between an organization's internal network and an external network available from outside, usually the Internet.
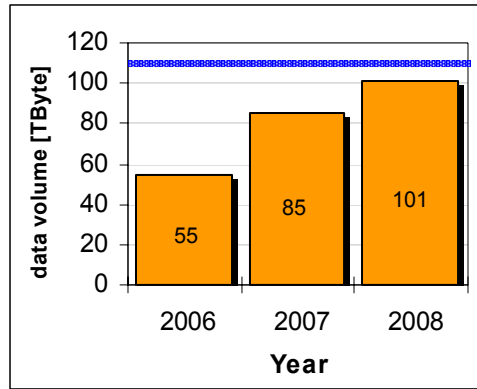
Figure 60: Required data storage for all actions

Figure 61 shows the rough amount of data currently stored for each sensor category. More than 80% of the data volume is occupied by low and high resolution data.
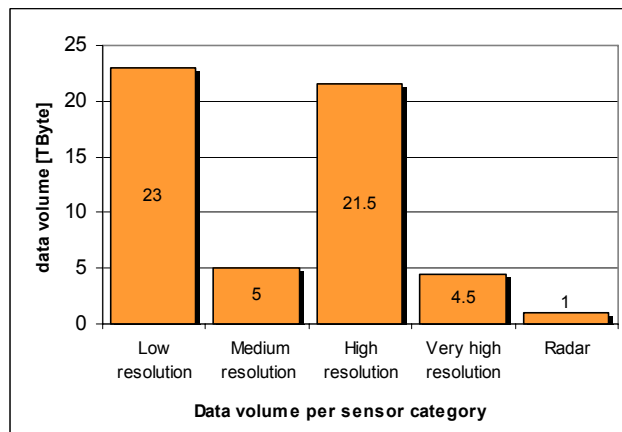
Figure 61: Data volume per sensor category

Figure 62 shows the *total storage capacity deficit* for all the 16 Actions showing interest in a centralized storage facility. It is calculated by the difference of currently existing and required storage capacity per Action.

> Already in 2007 the required disk storage capacity is expected to be 11 TB higher than the available one inside the respective action, increasing to a shortage of 20 TB in 2008.
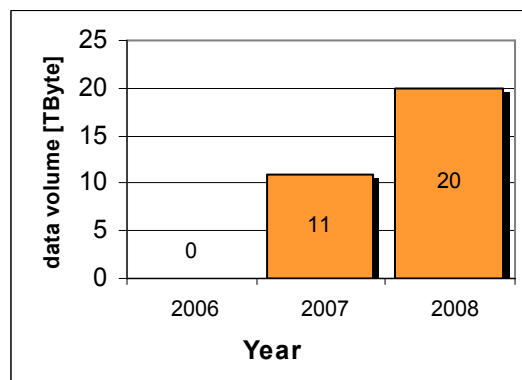
Figure 62: Deficit in data storage for Actions interested in centralized storage

3.3.2. Media types used for data reception and project deliverables

Imagery data used at JRC is received and disseminated in various types of media. The main media used for receiving image data are transmission via FTP[32] and shipping via CD-ROM/DVD. All other types are marginal. Figure 63 shows the total number of mentioned data transmission types per sensor for all actions.

> The domination of FTP for data reception emphasises the need for sufficient and reliable Internet bandwidth to ensure smooth data transmission.

This is confirmed by additional comments of respondents preferring imagery to be delivered on DVD/hard disks because of too low Internet bandwidth.
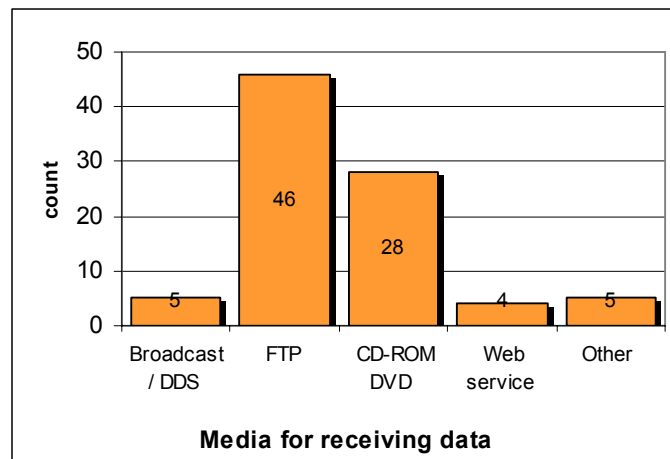
Figure 63: Media used for data reception

In contrast to data reception, the media used for *project deliverables* are more heterogeneous as displayed in Figure 64. Dynamic and static Web sites are widely used, as well as printouts and FTP. The use of Web services for data dissemination is currently only in place for a few sensors in some Actions.
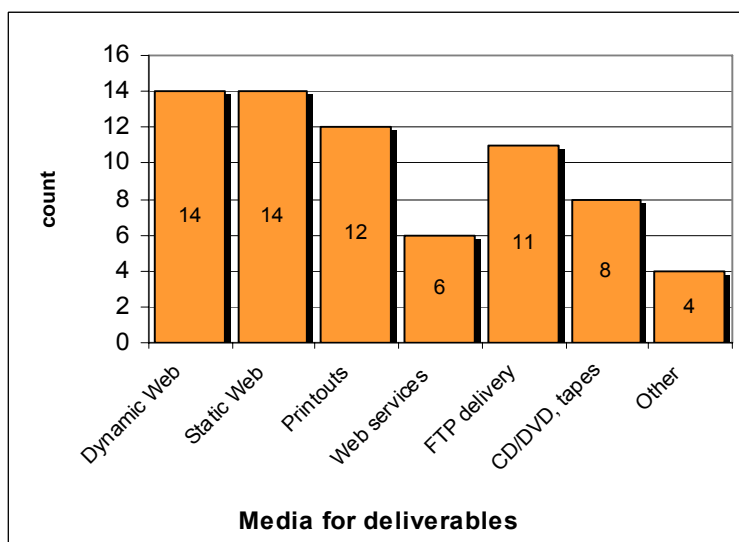
Figure 64: Media used for dissemination of project deliverables

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[32] **FTP** File Transfer Protocol is a commonly used protocol for exchanging files over any network that supports the TCP/IP protocol (such as the Internet or an intranet). It is mainly used for file downloads from an FTP server.

3.3.3. Data backup strategies

Data backups are an important task in order to restore data in case of hardware failure of disk storage solutions. Even though modern network storage appliances provide reliable and failsafe solutions, they cannot replace backups of valuable data that will require big monetary or human resources for recovery in case of unexpected incidents.

The three figures below give an overview of the **backup strategies** of all Actions currently storing imagery data. The backup frequency for all Actions is displayed in Figure 65. More than 40% do not perform any backup at all. Regular daily to monthly backups are just executed in a few cases. The most common applied backup strategy is on an occasional basis. This is understandable with regard to the total amount of data to be backed up and the usually more static character of the image archives.
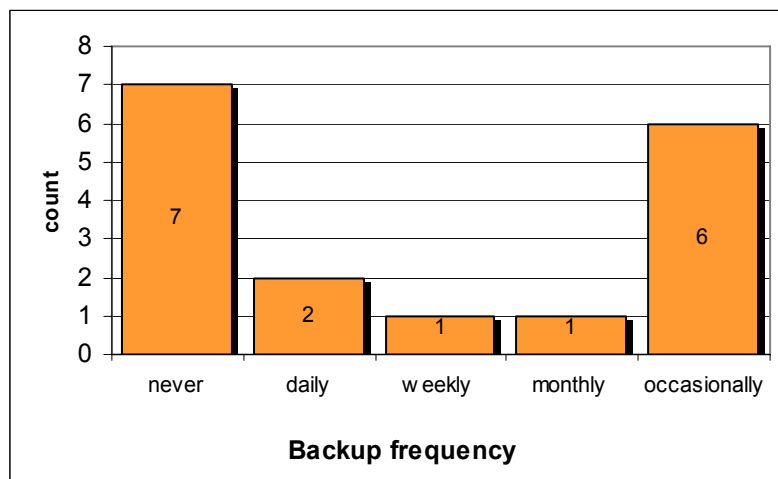
Figure 65: Backup frequency for all Actions

Figure 66 gives an overview about the possible **data included in the backups**. The chart shows only the values for Actions interested in a centralized storage for which a backup could be provided by INLU and CID. The estimated data volume for backups in Actions currently applying backups at all will increase from about 17 TB in 2006 to more than 30 TB in 2008. The amount of data for Actions currently not performing any backup is even higher.
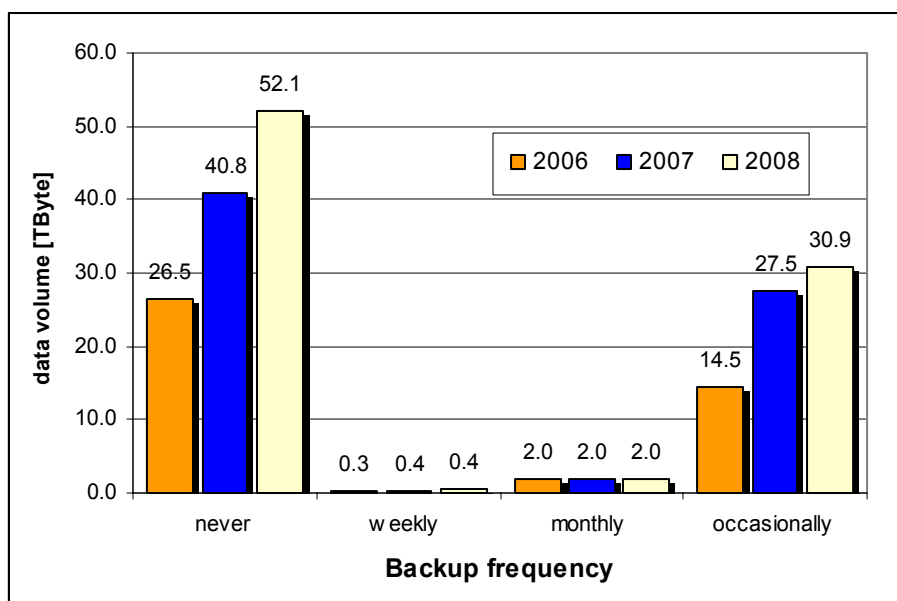
Figure 66: Backup volume for Actions interested in centralized storage

Most of the currently performed backups are using tape devices as shown in Figure 67. It is possible that some of the Actions at present without backup may decide to set up a backup strategy as well.

> The total data volume for backups might go up to 80 TB.

This will have an important influence of backup strategies to apply and backup devices to select since volumes of these dimensions may not be handled with currently implemented solutions.
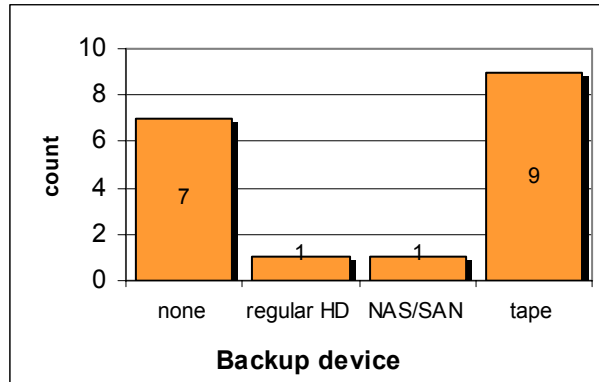
Figure 67: Devices used for backups

3.3.4. Image metadata

Metadata are an essential element of image archives. Systematic **collection** and consistent structures and standards **of metadata** are needed to ensure the usability of an archive. Figure 68 shows the way metadata are collected and available at the Actions dealing with image data. In only half of the Actions metadata are collected in a systematic way; 35% are collecting metadata unsystematically and 15% do not collect metadata at all.
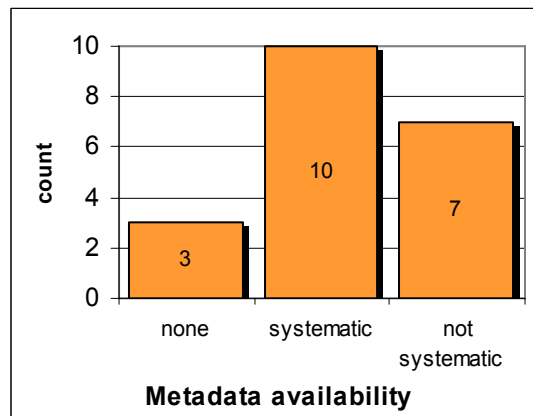
Figure 68: Availability of metadata

Metadata can be defined and collected following various types of **standards**. In 25% of the cases the Actions follow open standards like ISO or Dublin Core, another 25% use the metadata defined and delivered by the image provider. The approach followed most frequently is to define and apply a proprietary metadata profile that suits particular needs of the project.

> Due to the variation of standards, a detailed analysis of all the different metadata for inclusion or referencing imagery data in an Image Portal catalogue is required.

Figure 69: Metadata standards followed

The **metadata** are **stored** in databases or are using file system methods (Figure 70) with various Actions applying both methods. File system-based metadata storage can be either a metadata file per image or the directory structure and filenames following a certain nomenclature that provides the meta-information.
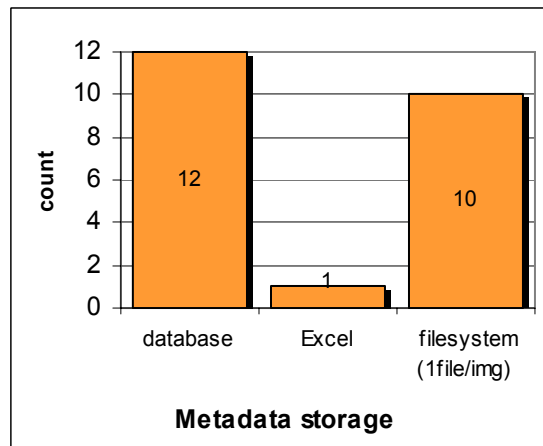
Figure 70: Metadata storage

3.3.5. Data users and access policy

The image data types in use at JRC level are very diverse as laid out in chapter "Source Data". In the same way license agreements and usage restrictions differ very much from one image type to another. They can be from freely available data to the application of very restrictive license policies. This has an impact on the way imagery can be accessed by users.

As shown in Figure 71, in most cases image data access is not open to the public. There are various types of **access restrictions** in place, ranging from distribution means to image resolution and specific agreements of Actions with image providers. This situation has an impact on the way data can be disseminated and requires an access and authentication management solution to address these issues.
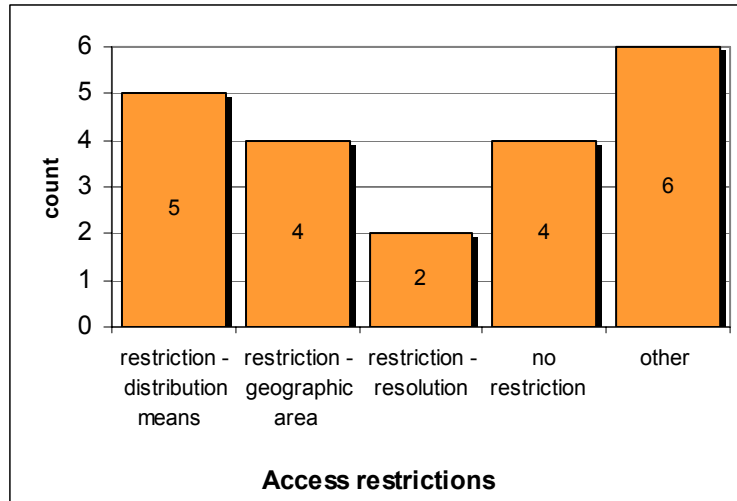
Figure 71: User access policy

The main ***users of the image data*** are clearly directly inside the respective Actions. A second big group are users in the EC context, ranging from Unit to full EC level. International and academic organizations as well as national administrations are using the JRC image data for more than half of the Actions. Access by private sector or the public (under 'other'), however, is comparatively low.
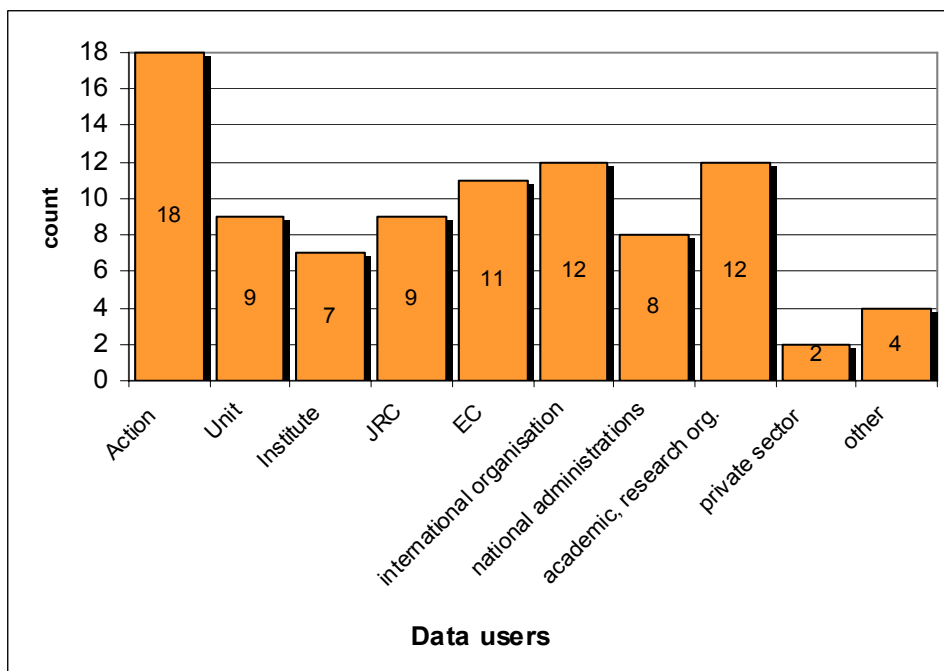
Figure 72: Users of image data

3.3.6. Data dissemination

Dissemination of data requires the possibility to identify the data someone is interested in and appropriate mechanisms and services to provide the requesting user with the selected data. In most cases an online system that allows searching the archive applying search restrictions is the solution of choice. The ***availability of online search*** capabilities is displayed in Figure 73. Nearly half of the Actions have some kind of

search functionality on their intranet or on the Internet implemented[33]. 5 actions have no such system running but would be interested to implement it in the future.
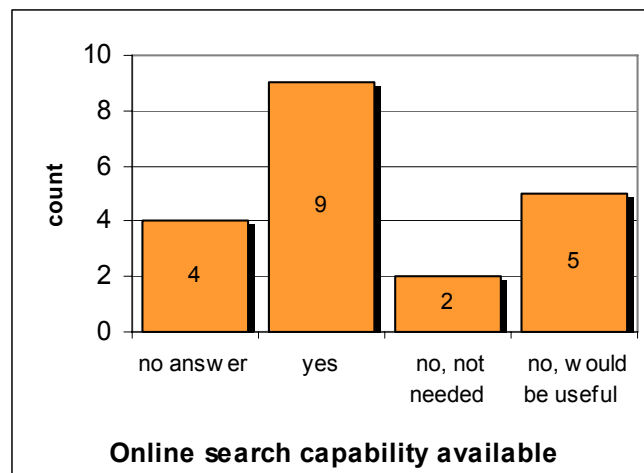
Figure 73: Availability of online search capabilities

The various means of data dissemination currently in place and the ones wanted in the future are shown in Figure 74 and Figure 75. Currently the most used method of data dissemination is file transfer via FTP. The number of actions that want to supply this dissemination in the future remains nearly the same. Sufficient network bandwidth is a requisite to provide smooth performance of this dissemination method.
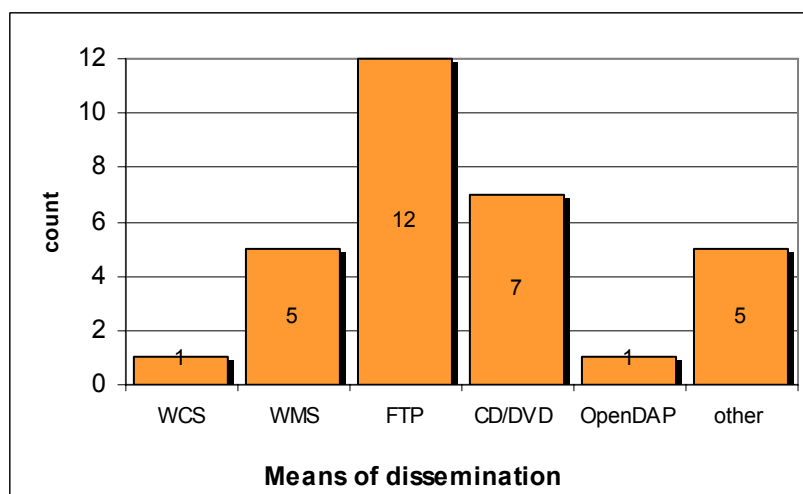
Figure 74: Current means of data dissemination

In contrast to this are the data services designed for geo-data, Web Coverage Service (WCS) and Web Map Service (WMS) [34]. A WCS is currently only implemented in one Action, WMS provided by five Actions. The interest in providing these data service types in the future is very high and gives clear indications on neces-

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[33] An online search capability is typically an interactive Web application and should not be confused with a Catalogue system that provides a standardized data discovery service (see below).

[34] **Web Coverage Service** (WCS) and **Web Map Service** (WMS) are standards specified by the Open Geospatial Consortium (OGC, http://www.opengeospatial.org). WMS supports the creation and display of registered and superimposed map-like views of information that come simultaneously from multiple remote and heterogeneous sources. The map returned is not the data itself. WMS-produced maps are generally rendered in a pictorial format such as PNG, GIF or JPEG. In contrast to this, WCS provides remote access to the raster data in their original resolution and their full information contents.

sary services for data included in the Image Portal. Dissemination via CD/DVD is used by one third of the actions and will remain like that in the future.
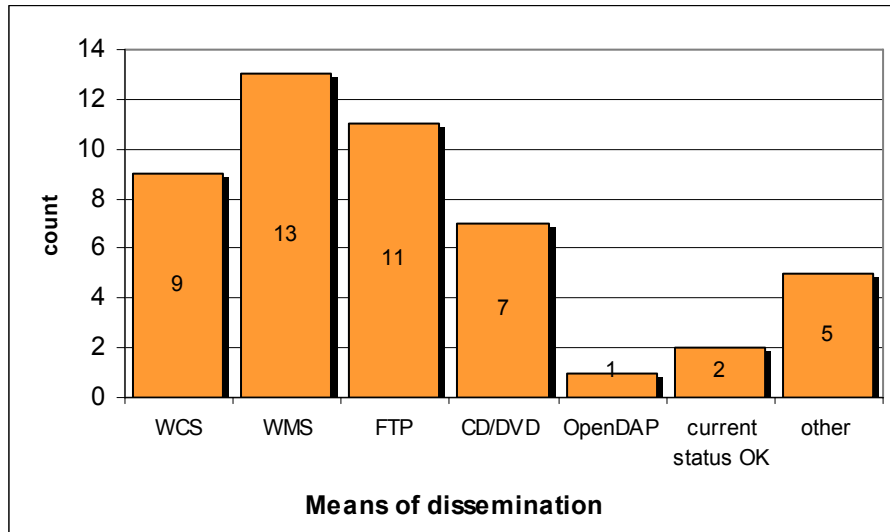
Figure 75: Future means of data dissemination wanted

3.3.7. Future needs in services

The results of the services needed by the Actions in the future as seen in Figure 76 give a clear indication about the prioritization of services requested from CID Action. Nearly all Actions were interested in a catalogue service for their image archive. 75% of all Actions were also interested in image acquisition coordination and centralized storage facility. Half of the actions expressed needs for data acquisition or a helpdesk.
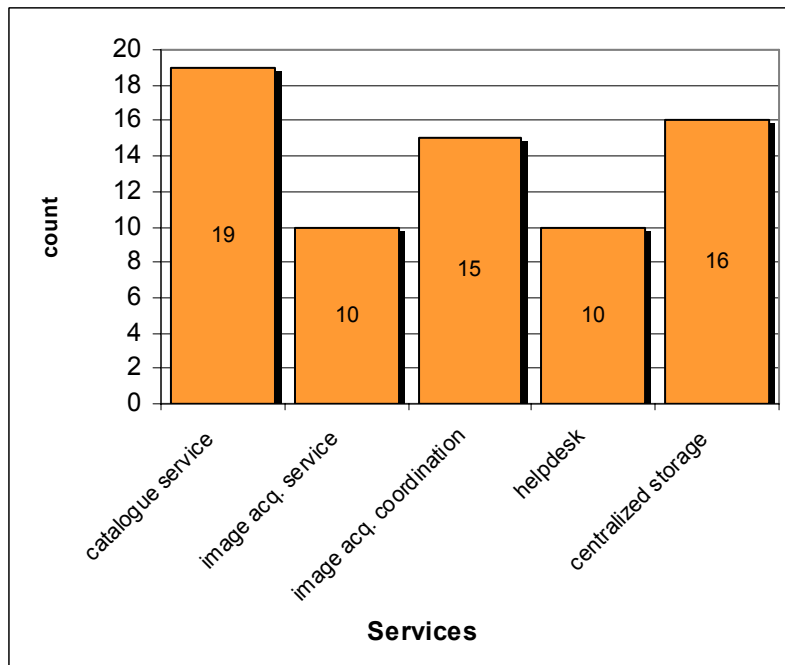
Figure 76: Future needs in services

3.4.   Comments Received

The general idea of CID was welcomed by a majority of Actions, more than half of them emphasized the importance of a searchable archive of satellite data and products. The most important issues mentioned were accessibility, advanced searchability, interoperability (with other archives), completeness, alert service and robustness in handling different projections, processing levels and file formats.

There is interest for improvement and simplification of licensing arrangements and help with purchases to ensure that the right products are procured with the most open licensing conditions.

A number of actions have stated interest in a central storage service. It was explained in some comments that a larger storage is needed to work more thoroughly with satellite data. This would allow reprocessing and significant improvement of the products.

The service offered by CID must be at least as efficient as data archiving systems currently in place, particularly in terms of accessibility and data transfer rate.

The CID project must be coordinated internally with Actions such as COSIN and INSPIRE and externally with the European Space Agencies, European Satellite Centre, etc.

4.   Conclusions

4.1.   Resources for Image Acquisition and Data Management

Image acquisition is an important task for 2 Actions at the JRC for which it requires the allocation of considerable budget and human resources. For most of the other Actions the data acquisition is a minor element of their daily work. This situation is slightly different for the image data management. In total for all Actions nearly 9 person years are allocated to data management. This time does not include resources needed for data processing, data services and application development. CID could stimulate synergy between Actions by creating a coordinated approach to image acquisition and management.

> − Annual expenditure on satellite remote sensing data at JRC: 7.2 M€
>
> − Annual human resources used for data acquisition at JRC: 6 person-years
>
> − Annual human resources used for image data management (excluding resources for data processing): 9 person-years

4.2.   Source Data

Large archives of satellite remote sensing data from various spatial resolutions and archives of radar data are spread over 20 Actions within the JRC. More than 700 000 low resolution, 50 000 medium resolution and 10 000 high resolution images are currently in the different archives. In addition to these, a few Actions have acquired more than 500 000 km^2 of very high resolution imagery and a few thousand radar scenes. The growth rate is stable for all sensors over 2007 and 2008 (without considering data for the Image2006 project). Currently the archives consist of several millions of files with a total size of **55 TB**. These figures have to be taken into account at all stages of the design of the CID IT system architecture and also while planning and implementing the services to be provided by CID.

A variety of **coordinate reference systems** are used. Most of them can be identified using their EPSG[35] code. Geo-location parameters used for level 0 data are specific to the spacecraft carrying the sensor and it might be impossible for CID to work with them.

Low and medium resolution data are typically covering the whole **globe or entire continents** such as Europe or Africa. They almost always consist of **time series** (the longest starting in 1981) over the same area with acquisition rates ranging from sub-daily to seasonal while **radar, high resolution and very high resolution** data are more often **acquired incidentally** over Europe or Africa. This reflects the JRC's involvement in EU policies as well as in global issues such as environment. These differences between, on the one hand low and medium resolution data, and on the other hand radar, high and very high resolution data, call for different interfaces to the services CID will provide.

Remote sensing data are stored in a wide variety of **file formats**. Those used for low and medium resolution data which can be read by CID without involving extraordinary work are flat binary and some implementations of netCDF and HDF (to be analysed on a case by case basis). The formats used for high and very high resolution are well known by CID and most of them can be read using commonly available tools. The ability to read source data in its original format is extremely important as it gives the possibility to extract at least some basic **metadata** useful for a Catalogue Service: scene corner coordinates, acquisition date, projection used, parameters specific to the sensor, etc. Depending on the sensor, the format used and the metadata available, it might also be possible to do some of the automatic processing of the data requested by the users: generation of preview, extraction of look-up tables, assignment of colour maps, re-projection, rescaling, orthorectification, etc.

Some Actions generate **daily or weekly products** derived from source data acquired daily or more frequently. Assuming that their source data will be available from CID services, they would benefit from using CID services for storing and serving their products. Some survey respondents stressed that they want to have their source data and the products in one place.

A decision on the boundary between **image products** (e.g. orthoimage, DEM) and **thematic product** needs to be defined (e.g. classification result). The latter should be stored within the Action COSIN. An issue of importance will be interoperability between both portals.

Data licensing is a very complex issue of the highest importance. Low resolution, medium resolution and part of high resolution data are available free of charge for scientific use but the usage rights vary a lot. Some data can be used freely (freedom to use and redistribute data and derived products) and some others carry very restrictive rights (authorizations are granted by the image provider for specific projects only). Most of purchases of radar, high resolution and very high resolution data are done through a Framework Contract (ref.. licensing terms in chapter 6.3). Where there is an overlap between a single image provider's licensing and the terms in the Framework Contract, the European Commission licensing is adopted. This was a basic criterion when signing the Framework Contracts. At present there is a series of issues linked to what services the CID portal can provide that are being discussed with the image providers. The starting point is that CID is working towards a definition of user rights for services in accordance with agreed licensing policy. This brings us to a discussion on permission to deliver the actual source pixel or not and to whom. The services considered are: catalogue service (CSW), web mapping, WMS, WCS and FTP.

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[35] **EPSG** European Petroleum Survey Group, absorbed in 2005 by the OGP Surveying and Positioning Committee (http://www.epsg.org). The EPSG Geodetic Parameter Dataset is a database of coordinate reference systems (CRS). It is the main source for CRS definitions and most of the worldwide used CRS can be identified by their 4 or 5 digit EPSG code.

At present the FC allows image distribution of satellite remote sensing data purchased by the EC Services (<u>the actual source pixel value</u>):

– to European Institutions and all bodies established on the basis of the EC and EU Treaties

– to third parties working under EC instructions and responsibility to derive value added information that serve Commission requirements (EC subcontractors, MS Administrations or their contractors...)

– to parallel domain end users (Min. Agriculture, Min. Environment...)

– to parallel domain research end users (upon agreement with image providers).

What is being discussed is image distribution (<u>transferring up to the actual source pixel value</u>):

– to non parallel domain end users

– to International Organisations (UN, FAO, NGO...)

– to Universities, Research Organisations

– to EU citizens i.e. to anybody.

– More than 700 000 low (LR) and 50 000 medium resolution (MR) images.

– Time series starting as far back as 1981 for low resolution data.

– More than 10 000 high resolution images and over 500 000 km^2 of VHR images.

– Cyclic global or continental coverage with low and medium resolution data.

– Very large number of HR and VHR scenes over Europe.

– Expected data purchases in the future are well known and this enables good planning of CID activities in advance.

– All purchases of very high resolution data and most of the high resolution data are procured through Framework Contracts.

– Many types of licenses govern data usage

– A wide variety of file formats, projections and processing levels are used.

4.3. Storage and Dissemination of Data

4.3.1. Data storage, transfer and backup

The majority of satellite imagery at JRC is already stored on **network-based disk devices** which will facilitate the task of referencing images in a central catalogue. Also, all data services that need to access the imagery directly for dissemination benefit from that. A factor that hampers access to the imagery via the Internet, however, is the **location of the storage**, which is mainly inside the corporate network and not accessible from the Internet. A proposed solution to this type of problem is a **dedicated network zone** with a high speed connection from the corporate network and also accessible from the Internet.

Various Actions have already invested in large network **storage capacities** that are adequate for the storage of their data for the next few years. Nevertheless, **shortage of disk storage** capacity could be identified for some Actions which will require the purchase of additional capacity already in 2007. Given the fact that

these Actions showed interest in a centralized storage, this is a clear starting point for a service provided by CID and INLU.

The domination of *FTP* for *data reception* emphasises the needs for sufficient and reliable Internet band-width to ensure correct data transmission. Especially for automated data management and transfer and the usually large sizes of image data, a fast and *reliable Internet connection* is a pre-requisite for providing the needed services.

The large amount of data that could be included in a centralized storage facility – this might in the future go far beyond 50 TB – will require a thorough definition and design of a *backup solution and strategy*. It has to be investigated if classical backup solutions like tape libraries are feasible to handle this amount of data.

> − Total volume of image data amounts to 55 TB, with an expected increase of 80% in 2 years
>
> − Most image data is stored on internal network storage; accessible from JRC, but more difficult to access from Internet
>
> − Deficit in storage could be identified
>
> − FTP data transfer requires reliable and fast Internet transfer bandwidth
>
> − High total volumes for backup requires thorough definition of backup strategy

4.3.2. Data dissemination and provided services

Most of the satellite image data available at JRC have some kind of *access restrictions*. At the same time the user groups are very heterogeneous and will have different access rights to the archive data. This situa-tion requires an access and *authentication management solution* to manage user and group roles with flexible definitions of access permissions and constraints.

Image metadata are a central component of an image archive and the basis for data search and retrieval. The currently set up solutions of image metadata collection and management at JRC requires a detailed *analysis of all the different metadata standards* for inclusion or referencing imagery data in an Image Data Portal catalogue.

The interests and *services needs* expressed by the Actions give clear indications of prioritization of future tasks and objectives of CID. The implementation of a *Catalogue Service*[36] has to be regarded as the ser-vice with the highest interest of all Actions. One problem that has to be faced in this context is the different (and not interoperable) implementations of *metadata profiles* and the not yet finalized definition of a profile suitable for the specific needs of Earth Observation data. Since CID is also involved in the GMES coordina-tion, a catalogue service needs to be compliant with the solution set up by the HMA[37] project of ESA as the central interface for requesting and accessing data in the context of GMES.

The strong interest for a *centralized storage* (all Actions but COSIN and FOREST are interested) facility will have to be addressed in close collaboration by CID and INLU to provide appropriate storage capacity.

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[36] **Catalogue services** support the ability to publish and search collections of descriptive information (metadata) for data, services, and related information objects. Metadata in catalogues describe resource characteristics that can be queried and presented for evaluation and further processing by both humans and software.

[37] **HMA** Heterogeneous Missions Accessibility is a project launched by the European Space Agency (ESA) which will define the neces-sary interfaces and a generic, service-oriented architecture to ensure interoperability within the GMES Space component comprising a constellation of satellites together with its Ground Segment and the interfaces to the other components of GMES .

The storage facility that is currently under construction as collaborative activity of INLU and CID will allow the extension to include additional image archives from other Actions. The inclusion and hosting of image data from various Actions require a clear definition and implementation of **workflow for data and metadata management**. This management will have to deal on the one hand with different data structures of the single Actions and on the other hand provide harmonized data structures to all users.

The various methods of **data dissemination** will undergo some changes in the future. Data transfer via FTP will continue to play an important role and emphasises again the need for sufficient connection bandwidth to Internet. In addition, open and standardized services for geo-data, like **Web Coverage Service** (WCS) and **Web Map Service** (WMS), will play an important role as medium of choice for access, display and transfer of imagery data. The CID Action will need to provide these services as integral component of an Image Portal to interested Actions using the centralized storage facility.

Additionally, **coordination of image acquisition** is also regarded as an important service and support activity expected from CID Action. This service will help to identify other projects with similar needs and help to avoid multiple purchases of image data.

Direct support in image acquisition and a **helpdesk service** are regarded as useful, but with lower priorities than the services mentioned above. With regard to limited resources these services will have to be considered as second stage objectives.

> − User structure and access restrictions require flexible authentication mechanisms
>
> − Detailed analysis of all metadata standards needed
>
> − Needs expressed for Catalogue service and centralized storage
>
> − Services to implement for data hosted on central storage: WCS, WMS, file system access

4.4.   Implementation of the <u>C</u>ommunity <u>I</u>mage <u>D</u>ata portal (CID) Services

4.4.1. Proposal for services provided by CID

The results of the survey gave a very good overview of the existing satellite image data stored at JRC and the activities based on them. The imagery archives in the various Actions are characterized by a large diversity of the data with regard to data collection cycles, image types and resolution, data formats and services related to them.

During the analysis of these results some major areas could be identified as a base for **common services** provided to interested Actions (all Actions interviewed are interested in at least one service):

> − Provision of a centralized data storage facility with file serving functionality, including authentication service
>
> − Image catalogue services
>
> − Data visualization and dissemination services

Specialized data services that require highly customized functionality with respect to certain properties of the different image types will usually remain in the sole *responsibility of the respective Actions*.

An *orthorectification service* for semi-automated orthorectification of HR and VHR data will be provided to selected Actions as part of system testing and in the context of the data workflow implementation.

4.4.1.1.   Centralized data storage facility

The very high volumes of remote sensing imagery data require appropriate and reliable solutions for their storage and backup. Actions could benefit from a storage facility that provides all the required functionality to them, thus reducing data management tasks. INLU and CID have started a close collaboration for the implementation of a *flexible and extendible storage architecture* that can provide the following services:

> − Robust, reliable and highly available enterprise storage
>
> − File access via standard network file protocols CIFS[38] (SMB) and NFS[39]
>
> − High speed access to the storage from JRC scientific network
>
> − Back-up solutions based on user requirements and feasibility analysis

The imagery data from various Actions will differ in their internal structure and organization. A centralized storage will need to both provide a single Action with its custom file structure and to all other Actions a harmonized and standardized data structure for direct file access. This will be a challenging task for the implementation and requires a thorough *definition of data workflow and management*.

The different access restrictions and user roles require a flexible *authentication solution* for file access based on state-of-the-art technologies like LDAP[40] to handle all file system protocols efficiently.

The access to large volumes of image data on network storage requires high *network transfer speed* as a pre-condition for efficient data processing. The outlined system architecture agreed by INLU and CID described in Section 6.4 is therefore situated in a *dedicated network zone* and fulfils the requirements with respect to network security and speed. This zone is reachable with high bandwidth of up to 10 Gbit/s[41] from the internal network while at the same time allows services in that zone to be accessible via the Internet (see also Section 4.4.1.3).

4.4.1.2.   Catalogue services

Catalogue services are an essential element in an Image Portal to discover and identify images based on standard data properties. A catalogue service was also considered by nearly all Actions as an important service needed. The CID Action will set up an OGC[42] compliant *Catalogue System for the Web* (CSW) as fu-

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[38] **CIFS** Common Internet File System (also known as **SMB**, Server Message Block) is an application-level network protocol mainly applied to shared access to files, printers, and miscellaneous communications between nodes on a network. It provides an authenticated Inter-process communication mechanism. It is mainly used by *Microsoft Windows* equipped computers.

[39] **NFS** Network File System is a network file system protocol for *UNIX* operating systems allowing a user on a client computer to access files over a network as easily as if the network devices were attached to its local disks.

[40] **LDAP** Lightweight Directory Access Protocol is a networking protocol for querying and modifying directory services running over computer networks.

[41] **Gbit** gigabit is a unit of information or computer storage, 1 gigabit = 10^9 bits, equal to 125 decimal mega*bytes*. Gbits/s is a dimension of data transfer speed e.g. over a network

[42] **OGC**: Open Geospatial Consortium (http://www.opengeospatial.org) is a non-profit, international, voluntary consensus standards organization that is leading the development of standards for geospatial and location based services.

ture entry point for remote sensing data discovery at JRC level. In addition to a service-based catalogue, CID will also implement a Web based *application for interactive image data discovery* that will be based on the same metadata catalogue.

The way metadata from the various Actions can be included and referenced in a catalogue system differs from the way data are located:

All *data hosted on a centralized storage* mentioned above will have to be automatically referenced with the necessary metadata in the catalogue. This requires the definition and implementation of routines for metadata extraction and import in close collaboration between CID and the respective Actions.

Image *data hosted on storage at Action or Unit level* should be referenced as well in a Catalogue service of the CID portal in order to facilitate data discovery by third parties like other Actions. This could be implemented by harvest functions of the CID catalogue system and would require the respective archive to provide an OGC compliant CSW that can be harvested via standardized protocols. Another solution would be the implementation of metadata import routines for these Actions as well as mentioned above. This has to be discussed in detail with the respective Actions.

4.4.1.3. Data visualization and dissemination services

Data visualization and dissemination services will be integrated into the portal architecture and will be based on the metadata catalogue. With regard to usage restrictions and varying IPR, data visualization and dissemination services will have to support *authentication and access constraints*. This is not always directly supported by some access protocols and will require additional efforts for the implementation.

Main services provided for data hosted on the central storage area will be:

> – Preview and visualization via Web mapping application
>
> – FTP download
>
> – Data access via WMS and extraction via WCS
>
> – Data access for single images via ECWP[43] or KML[44]

The *Web mapping application* will be integrated into the application for interactive image data discovery mentioned at 4.4.1.2. This application will be the main entry point for interactive discovery and preview of image data. It is complemented by *image data services* like WMS, WCS, and ECWP. KML support might be added in a second step. These data services allow the access to image data via the Internet into desktop applications or middleware services. ECWP directly supports authentication and access constraints mechanisms. For the other mentioned services this will have to be added on top of the current protocol. A flexible solution for access via FTP shall be set up for direct download of single or multiple images.

The dissemination services will have to take into account *special requirements* of the source data, like time series, spatial filters, image mosaics, etc. This implementation can take place only after the base system has been set up and its scope will depend on available resources.

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[43] **ECWP** Enhanced Compressed Wavelet Protocol is an HTTP based streaming protocol that provides fast access to ECW compressed images via the Internet. The ECWP protocol transfers compressed blocks from the server to the client, providing real time roam and zoom functionality on image updates.

[44] **KML** Keyhole Markup Language is an XML-based language for managing three-dimensional geospatial data in the program Google Earth and Google Maps.

4.4.2. Priorities and Implementation Schedule

The requested and planned services mentioned above require a prioritization and implementation schedule due to the limited human and financial resources of CID. The Action has currently 2.5 persons in 2007 allocated for the Image Portal implementation.

A preliminary implementation schedule for 2007 is outlined as following:

- Set up of server architecture and image storage as base for Image Portal

- Setup up of authentication system

- Implementation of Catalogue service

- Development of Image Portal Web mapping and search application

- Set up, testing and management of the orthorectification system

- Specification of data workflow and implementation of image data management system

- Migration of imagery data from two or three Actions to the new Community Image Data portal system.

This survey could be extended to GMES Fast Track and Future Services (Core, Downstream) to determine GMES service requirements if DG Enterprise so requests.

5.   Glossary

Catalogue service supports the ability to publish and search collections of descriptive information (meta-data) for data, services, and related information objects. Metadata in catalogues describe resource characteristics that can be queried and presented for evaluation and further processing by both humans and software. The main implementations of Catalogue services are the **OGC** compliant Catalogue Service for the Web (**CSW**) is meant which provides a standardized interface and protocol for metadata discovery.

CIFS Common Internet File System (also known as **SMB**, Server Message Block) is an application-level network protocol mainly applied to shared access to files, printers, and miscellaneous communications between nodes on a network. It provides an authenticated Inter-process communication mechanism. It is mainly used by *Microsoft Windows* equipped computers.

CSW see Catalogue service

DDS Data Dissemination System allows rapid dissemination of the ENVISAT data products to users across Europe. The system uses a commercial satellite-based network, which is based on the Digital Video Broadcasting (DBV) standard and is integrated into the Internet. It accommodates low-cost user stations and allows for cost-effective use of satellite bandwidth.

DMZ demilitarized zone is a network area that is situated between an organization's internal network and an external network, usually the Internet.

ECWP Enhanced Compressed Wavelet Protocol is an HTTP based streaming protocol that provides fast access to ECW compressed images via the Internet. The ECWP protocol transfers compressed blocks from the server to the client, providing real time roam and zoom functionality on image updates.

EPSG European Petroleum Survey Group, converted in 2005 to OGP Surveying and Positioning Committee (http://www.epsg.org). The EPSG Geodetic Parameter Dataset is a database of coordinate reference systems (CRS). It is the main source for CRS definitions and most of the world-wide used CRS can be identified by their 4 or 5 digit EPSG code.

ESA European Space Agency is Europe's gateway to space. Its mission is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe.

FC Framework Contract

FTP File Transfer Protocol is a commonly used protocol for exchanging files over any network that supports the TCP/IP protocol (such as the Internet or an intranet). It is mainly used for file downloads from an FTP server.

GigaByte [see TeraByte].

GMES Global Monitoring for Environment and Security is a European initiative for the implementation of information services dealing with environment and security. GMES will be based on observation data received from Earth Observation satellites and ground based information. These data will be coordinated, analysed and prepared for end-users.

HMA Heterogeneous Missions Accessibility is a project launched by the European Space Agency (ESA) which will define the necessary interfaces and a generic, service-oriented architecture to ensure interoperability within the GMES Space component comprising a constellation of satellites together with its Ground Segment and the interfaces to the other components of GMES.

HR High Resolution satellite sensors have a spatial resolution of 5 – 100 m

IPR Intellectual property rights cover two main areas: industrial property, covering inventions, trade marks, industrial designs, and protected designations of origin; copyright, represented by literary, musical, artistic, photographic, and audio-visual works.

KML Keyhole Markup Language is an XML-based language for managing three-dimensional geospatial data in the program Google Earth and Google Maps.

LDAP Lightweight Directory Access Protocol is a networking protocol for querying and modifying directory services running over computer networks.

LR Low Resolution satellite sensors have a spatial resolution in the range of 1 or more km

LUT Look-up table is a data structure, usually an array or associative array, used to replace a runtime computation with a simpler lookup operation. In the context of image data processing LUT's are usually calculated by applying histogram stretching algorithms. This information is stored and can be re-used to stretch the available spectral information of an image (or an image band).

MR Medium Resolution satellite sensors have a spatial resolution in the range of several 100 m

NAS Network-attached storage is the name given to dedicated data storage technology that can be connected directly to a computer network to provide centralized data access and storage to heterogeneous network clients

NFS Network File System is a network file system protocol for *UNIX* operating systems allowing a user on a client computer to access files over a network as easily as if the network devices were attached to its local disks.

NRT Near Real Time

OGC Open Geospatial Consortium (http://www.opengeospatial.org) is a non-profit, international, voluntary consensus standards organization that is leading the development of standards for geospatial and location based services.

SAN storage area network is a network designed to attach computer storage devices such as disk array controllers and tape libraries to servers

TeraByte also terabyte, TByte, TB: is a measurement unit for data storage capacity equal to 1 000 gigabytes, i.e. 10^{12} bytes. Corresponding units are

> kilobyte (kB) 10^{3} Byte
> megabyte (MB) 10^{6} Byte
> gigabyte (GB) 10^{9} Byte

VHR Very High Resolution satellite sensors provide spatial resolutions below 5 m per pixel

WCS Web Coverage Service, **WMS** Web Map Service are standards specified by the Open Geospatial Consortium (OGC, http://www.opengeospatial.org). WMS supports the creation and display of registered and superimposed map-like views of information that come simultaneously from multiple remote and heterogeneous sources. The map returned is not the data itself. WMS-produced maps are generally rendered in a pictorial format such as PNG, GIF or JPEG. In contrast to this, WCS provides remote access to the raster data in their original resolution and their full information contents.

Web mapping The term Web mapping describes Web-based applications that allow interactive visualization, mapping and querying of geo-data using standard Internet browsers.

WMS [see WCS].

6.   **Annexes**

6.1.   **Key to the Actions Interviewed**

The Actions are sorted by Institute code (e.g. G), then by Unit number (e.g. 03) and finally by Action number (e.g. 21102). The content of subsections of the current chapter has been extracted from the Science Knowledge Management website[45] and the JRC intranet on 08 February 2007.

6.1.1. INLU (C05)

Unit Head: Marc Wilikens

INLU's mission is to provide state-of-the-art ICT tools and services for supporting JRC's research and business processes. Firstly as any research organisation but reinforced by its European remit, it needs efficient access to data processing and communications facilities for accessing scientific information, for sharing knowledge internally as well as for facilitating cooperation with the global research community. Second, JRC's deliverables towards its customers in the Commission and in the Member State increasingly consist of critical information products, whether databases or in the form of operational information services, and applications. This requires ICT infrastructure that ensures business continuity and security. Third, as a Commission institution, the JRC's ICT infrastructure and information systems architectures need to comply with Commission IT guidelines and governance principles while respecting the diverse needs of its research institutes which is reflected by the distributed organisation of its informatics.

The unit develops and deploys in partnership with the JRC Institutes and corporate directorates a set of common ICT tools and services:

- A reliable and high performance ICT infrastructure including the Ispra campus and JRC inter-site IP communications networks, Internet connectivity and messaging services, data centre services;

- Application development and software engineering in support of JRC corporate processes and scientific activities;

- Desktop and mobile IT platforms for corporate users;

- Management of ICT Framework Contracts for the JRC wide acquisition of ICT equipment and support services;

- Management of the JRC scientific publications and the Ispra Central Library including for both the development and deployment of eServices;

- Coordination of the JRC wide participation in the Commission ICT governance structure and provision of guidance for the JRC ICT strategy.

6.1.2. ISFEREA (G02, Action 41002)

Unit Head: Delilah Al Khudhairy

Action Leader: Daniele Ehrlich

The general aim of the action is to support all EU external policies (security and global stability, development, humanitarian, neighbourhood, pre-accession) and to provide specific support to crisis response and monitoring for security. The focus will be on support to emergency response as well as to post crisis rehabilitation and reconstruction, situation assessments in conflict areas, the analysis of root causes of conflict and

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[45] http://skm.jrc.it

conflict resources (e.g. diamonds) in support to conflict risk assessment, the analysis of built up areas and assessments in order to understand linkages between migration and development as well as between environment and security.

The main sources used are high resolution (HR) and very high resolution (VHR)latest generation satellite-derived data both in the optical and radar spectrum, existing cartography and GIS layers, web-based open sources, and direct field surveys for building the interpretation keys and for validation of the interpretation models and analysis. In security-related applications, satellite-derived data play an essential role as a synoptic, independent and objective source, especially in case of international controversy, anti-fraud and conflict related assessments. The complexity of these data and the operational constraints related to security applications, require special methodological emphasis on newly-defined morphological and textural image feature recognition and automatic discrimination, volumetric estimation from stereo images using improved automatic image matching procedures, and newly- defined fuzzy spatial inferential engines for integrating different partially non-consistent geo-information sources in the final assessment.

The action supports External Relations DG's as well as other DG's dealing with security issues or external aspects of internal Community policies (DG ENV – Monitoring Information Centre, JLS, OLAF). The action will also continue to provide strategic geo-spatial information to the European Council and bodies of the European Union outside the European Commission including EU Member States. Some of the information is also delivered to UN agencies and NGO's addressing humanitarian aid and civilian crisis response.

6.1.3. MARS-PAC (G03, Action 21102)

Unit Head: Jacques Delincé

Action Leader: Simon Kay

This Action, valorising the acquis and experience in the 6th MAFWP, addresses new information needs for European Policies related to Agriculture and Regional Development, such as Cross Compliance, Farm Advisory System, food quality and product origin traceability (unique parcel identifier). The reform of the CAP will be further supported by the definition, development and testing of extensive, standardized and sustainable control methods in a variety of agriculture-related areas. The Action will follow-up future development in Geomatics techniques, and support land administration (cadastre) and multipurpose large scale mapping approaches; common specifications, standard measurement and data management tools, and validated methods will be studied to reinforce the consistency of land parcel identification and measurement across the Union and in Candidate Countries. Research will be undertaken towards the development of a European-wide geo- data base, and the testing and implementation of INSPIRE principles, in support of Rural Development.

In order to achieve these goals, the action will be divided into three teams: Geo-Information Management (WP1), focused on the support to the main need of organising and making available data to respond to various policy needs; Development of Control Methods (WP2), addressing the technical and scientific evolutions linked to area-based payments; and Agricultural Policy Instruments (WP3), which will cover the analysis of new instruments introduced into the CAP (Cross Compliance, quality, traceability & certification, issues related to Rural Development) and promote best practice approaches for the management and control of data, and prepare recommendations for stakeholders.

WP1 will address the underlying requirements of geo-information management for rural areas, either through the extension of IACS data (implementing INSPIRE principles) or through the integration of existing data (e.g. cadastre) and helping to ensure the successful implementation of these key data sets.

WP2 will continue its role in supporting stakeholders with the highly operational control activity carried out by member states. This demands a coordinating role, with a high degree of contact with stakeholders, visits and technical exchanges. It will also be the key reference point for defining DG AGRI's financing program of the CwRS image purchase.

WP3 will focus on: the optimisation of the definition of GAECs through exchange of best practices; the support given to the exchange of information or access to geographical database between the competent Control Bodies involved in the Cross-Compliance, or through the establishment of the Farm Advisory System (FAS); the assessment of the permanent grassland ratio maintenance; the development and promotion of methods using traceability, quality and certification at farm/parcel level.

6.1.4. MARS-STAT (G03, Action 21103)

Unit Head: Jacques Delincé

Action Leader: Giampiero Genovese

The MARS (Monitoring Agriculture with Remote Sensing)-Stat action contributes to improve the Community's statistical tool for managing and monitoring the Common Agriculture Policy. MARS-Stat has been developing and operationally running a Crop Forecasting System since 1993 in order to provide timely crop production forecasts at European level. This system is able to monitor crop vegetation growth and include the short-term effects of meteorological events on crop productions and to provide yearly forecasts on European crop predictions. The MARS-Stat system is made of remote sensing and meteorological observations, agro-meteorological modeling (Crop Growth Monitoring System, CGMS) and statistical analysis tools. Besides, MARS-Stat is the depositary of techniques developed using remote sensing and area frame sampling at European level to estimate crop areas. In 2007 MARS-Stat will ensure the continuation of the operational activities as covered by Council Decision 1445/2000 (and its extension untill 2007) and will continue the development of new improvements for the Crop Yield Forecasting and Area Estimate System. This action will also participate in the Crop Growth Monitoring System Scientific Network and continue the Agro-Phenological pan-European Network. The enlargement to new crops and areas of the current Crop Yield Forecasting System will continue over the Candidate Countries and the neighbouring countries of the EU. The new acivity on crop world estimate will start with pilot regions including Black Sea area and Russia. The Agrometeorological system will be adapted in order to run on climatic forecasts at different levels (from 10 days to 100 years) in order to improve the crop yield forecasts but also to generate climate change impact scenario on farming systems. In order to improve the communication and the results of the action, existing MARS-Stat web sites (e.g. MARS-OP) will be regularly maintained, data improved and training with stakeholders made. As part of the system capabilities and mission of MARS stat, the client DGs will receive a support in improving statistical-related activities such as the Agromet system and Lucas survey. In 2007 MARS STAT will continue the support and participation to the implementation of the LUCAS survey. In 2007 MARS STAT will continue to participate to IP: develop within the ENSEMBLES project impact of climate change on EU agriculture; contribute with DB to the SEAMLESS project. In 2007 agriculture insurance studies will be developped in support of DG-AGRI request.

6.1.5. FISHREG (G03, Action 21201)

Unit Head: Jqaues Delincé

Action Leader: Thomas Barbas

The action will continue to provide scientific and technological support to DG Fisheries & Maritime affairs, in particular, its directorates dealing with Conservation Policy, with Control and Enforcement, and the Maritime Policy Task Force. At the same time JRC intends to strengthen its working relationship with ICES (International Council for the Exploration of the Sea).

Work in control and enforcement will include:

– user requirements and further specification of technology to monitor fishing vessel movements and effort based on VMS, satellite and other sensor data; goals include higher performance, reliability assessment, better coordination with authorities, wider acceptance of the technology;

- planning and execution of a number of fisheries monitoring and control campaigns in selected regions;

- assessments of new technological and organizational options for more efficient fisheries monitoring, control and surveillance;

- analyses to couple input and output data to provide better enforcement and better management of the resources;

- analyses to derive effective warning signs for quota uptakes;

- databases and tools for improved accessibility and use of genetic information on fish and fish products; applications for stock origin identification purposes using genetic and other information;

- monitoring of tuna fishing and farming activities in the Mediterranean;

- analysis of fish trade data and aspects of fish transport.

Work in conservation of the resource base will include:

- contribution to EC's scientific advice process through administration of the Scientific, Technical and Economic Committee for Fisheries (STECF) and its Subgroups;

- collection, validation, consolidation and management of data made available to the advice process on behalf of DG FISH through DG FISH regular calls for data in the framework of the Data Collection Regulation (DCR);

- support of the move towards a new DCR with increased attention to overfishing, ecosystem approach, regional dimension and best use of data;

- analysis for specific aspects of aquaculture;

- enlargement and integration-specific support related to the Black Sea.

Work for the Maritime Policy Task Force is expected to include contribution to a specific project on integration and convergence of ocean-related data and other support work for the Task Force. Institutional work will be complemented with applied research in the form of contributions to externally financed projects and JRC exploratory research. Of these, CAFE explores the relationship between catch, effort and fishing mortality, CEVIS examines the cost-effectiveness of innovative fisheries management schemes, COBECOS focuses on cost-benefit analyses of control schemes, CEDER looks into technologies to provide more accurate and timely data on catches, effort, landings, discards and quotas, TANGO explores the possibilities for real-time monitoring outside EU waters, and MARUSE looks at what Galileo and EGNOS could bring to VMS.

6.1.6. MASURE (G03, Action 21202)

Unit Head: Jacques Delincé

Action Leader: Guido Ferraro

This Action will examine scientific and technical issues related to maritime safety and security, specifically with respect to maritime surveillance.

The action is conceived from amalgamating parts of existing actions, and therefore it has a strong starting position with regard to expert knowledge and contacts and collaborations already established with regional and national competent authorities in the field. JRC has a leading position in satellite ship surveillance and oil spill detection; this knowledge (algorithms, software, systems) will be further developed, for (a) performance improvement and (b) to incorporate more data sources (such as newly launched satellites).

A central theme of this action is to address the maritime surveillance with an integrated approach. The action will look into the desirability and feasibility of an integrated plan for EU-wide maritime surveillance, as

tabled by the Green Paper, taking into account the many actors and their remits. Technically, this means MASURE will explore systems which can provide a complete picture of the vessel traffic. This picture can only be obtained by integration of vessel traffic information from many sources. The action aims to develop the tools for such data fusion and integration.

Subsequently, the integrated maritime surveillance tools developed by the action will be used for risk assessment studies related to existing and potential maritime threats and infringements: illegal immigration patterns, dangerous traffic routes (such as oil tankers routes), illegal fishing, and pollution from ships. The risk analysis will be supported by combining activity patterns with boundaries of sovereignty and regulatory areas in a GIS approach, taking into account current SDI (Spatial Data Infrastructure) initiatives (ref. INSPIRE).

Moreover, addressing the G of GMES, also maritime surveillance of areas far from the European coasts will be studied with a view to identify traffic patterns, compliance with international legislation and threats to supply lines. Collaboration with non-EU States (such as Russia and Ukraine) is envisaged.

Another longer-term activity foreseen in the action is the exploration of the use of new sensors for maritime surveillance, in particular UAVs (Unmanned air Vehicles) and USVs (Unmanned Surface Vehicles) which will be needed to perform monitoring tasks essential for the detection of transient events (basically, illegal activities and terrorist threats).

Since some operational tasks related to maritime surveillance have become the remit of EU Agencies, notably EMSA, FRONTEX, CFCA and EUSC, the action will concentrate on R&D support for these customers. Technology transfer to the Agencies is aimed for.

6.1.7. MARS-FOOD (G03, Action 42002)

Unit Head: Jacques Delincé

Action Leader: Olivier Léo

The main aim of MARS FOOD action is to support the Food Security and Food Aid Policy of the European Union: Directorates General AIDCO DEV, ECHO (in Brussels) and RELEX (in Delegations) are the direct customers for this work in the Commission.

The activity potentially covers the entire world. However, in the frame of the ACP Observatory for Sustainable Development, a particular emphasis will be given to Africa, where food insecurity problems are chronically widespread.

The main expertise relates to an improved monitoring/assessment of the crop status in regions/countries stricken by food shortage problems. This accurate and timely information on crop status is needed to properly calibrate and direct European Food Aid, in order to prevent food shortages and consequent human famine, or to avoid possible market disturbances due to excessive food aid distribution.

The Action provides technical support related to food access and need assessments in the 3 following areas:

– Technical advice, monitoring and evaluation is given to EC projects and programmes in food security implemented by the United Nations agencies FAO and WFP;

– Participation in the process of improvement of the UN Crop and Food Supply Assessment Missions (CFSAMs) and Emergency Need Assessments (ENA) as member of the technical panel on methodologies and procedures and as EC observer in the CFSAMs;

– A specific support in vulnerability assessment and participation to ENAs in the Horn of Africa is another requirement established by the Administrative Arrangement.

Following the pre-operational phase of MARS FOOD (2005- 2006), 2007 will be a strategic year to:

– Establish geographic priorities and define a comprehensive pluri-annual work plan including possible operational reinforcement, geographic deployment or transfer;

– Validate the general MARS FOOD methods by the scientific community and identify relevant results of R&D projects, new agro-meteorological data or products for further development or consolidation;

– Address the interest of integrating more accurate land use information and define a R&D program on the agriculture area / crop area estimates as a component/complement of production forecasts;

– Consolidate the technical support to client DGs in food security matters not related with crop monitoring and continue to contribute to the strategic dialogue with UN agencies in this field;

– Identify with the client DGs, taking into account the specific context of the Food Security Thematic Strategy, the medium term and wider requests which could be taken into consideration for the evolution of the MARS FOOD activities during the 7Th FWP;

– Define the future GMES related services.

These different points will be addressed in the context of the ACP Observatory for Sustainable Development and in close collaboration with the Food and Agriculture Organization (FAO), the World Food Programme (WFP) of the of the United Nations, the European Space Agency (ESA/ESRIN) and the GMES component on Food Security (cf. Fast Track on global Land).

6.1.8. VERTEC (G08, Action 53105)

Unit Head: Willem Janssens

Action Leader: Joao Goncalves

VERTEC designs, develops and integrates novel Information and Communication Technologies and processes to cope with present and emerging challenges in the evolving scenarios of Nuclear Safeguards and Additional Protocol. Together with ESARDA focus group on audit, the action supports DG-TREN in the design, test and implementation of a novel audit-based approach to Nuclear Material Accountancy systems, including training activities and trial audits. VERTEC will assist the validation of authentication technologies currently under consideration by DG-TREN. This is most relevant for future C/S 'Safeguards-by-design' concepts where inspectors and operators might share equipment and measurements. It will continue to develop tools to assist inspectors in (i) 'recurrent-type' of data reviews (based on plant's historical data, previous reviews and machine learning technologies), (ii) 'integrated' reviews (e.g., by correlating nucleonic and image data) and (iii) extending to 'one-off' reviews by new data summarisation techniques. 3D technologies will be applied for Continuity of knowledge starting with two areas of work: (i) to identify nuclear containers by unique surface maps and (ii) to augment traditional 2D cameras with depth measurements for robust and accurate surveillance, including in-front-of-lens authentication. Unattended remote monitoring systems aim at increased timeliness and reduction of costs whilst guaranteeing an equivalent level of security: VERTEC foresees the development of autonomous or computer assisted remote systems with tele- presence capabilities as well as Safeguards-specific design and simulation tools. To support to the Additional Protocol, 3D laser technologies will be extended and consolidated in the novel Outdoor Verification System, which will integrate vehicle-borne laser, satellite and airborne data. The use of Unmanned Aerial Vehicle acquisition systems will be investigated. Building on experience with Secure Information Retrieval, novel tools will be designed for the "investigative inspector" to enhance his/her observation skills and securely retrieve local, just-in-time information. This envisages connection to headquarters' back-office, on-line services, wireless data transfer to and from hand-held devices facilitating measurements, voice recordings, digital annotations, photos. Augmented reality tools are foreseen to present the inspector with real-time documentation on devices, sites, and procedures. VERTEC will support in 2007 established secure communication links includ-

ing those with DG-TREN, IAEA and Sandia Labs. In 2007, for the verification of treaty compliance, VERTEC continues previous activity on the development of tools for the efficient presentation and analysis of information across multiple time-frames of a wide variety of data types and sources, including sensory, textual, satellite imagery, geographical.

6.1.9. PROCAS (H03, Action 21203)

Unit Head: Alan Belward

Action Leader: Wolfram Schrimpf

The Action PROCAS is dedicated to the building of a comprehensive knowledge base to help the implementation of the Marine Strategy and the development of the Maritime Policy. To this end, it will rely on the analysis of remote sensing data, the application of numerical hydrodynamic and bio-geochemical models, the definition of eco-regions and on standard techniques for monitoring the functioning of marine ecosystems.

The information from the Action PROCAS also constitutes a basis to compare and harmonise guidelines for the assessment of the ecological quality of coastal and marine waters at European scale and to develop means of implementing integrated strategies for the sustainable management of marine resources (fisheries). 'Intelligence' support (scientific and technical advice and consultancy work) for DG Environment and the regional marine conventions will constitute an important part of the Action's activities.

In FP7 specific increased efforts are dedicated to the Mediterranean Sea / United Nations Environment Programme - Mediterranean Action Plan in the context of the EU Environment Strategy for the Mediterranean (Horizon 2020) and the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic (on request from DG Environment). The support for the Baltic Marine Environment Protection Commission (HELCOM) and the Black Sea Commission (Bucharest Convention) will be continued and fostered on request from DG Environment. Collaboration and support for the regional marine conventions is forming a key element in the coming years since these inter- governmental organisations are playing a central role for the implementation of the Marine Strategy on the regional sea level.

The Action will make a continuous effort to disseminate spatial marine information developed through its own research in order to make it available for marine assessments of regional seas and at European level. In this context, the Action will synchronise its own activities with the relevant WISE (Water Information System for Europe) activities.

The Action will seek to strengthen and deepen its collaboration with the International Council for the Exploration of the Seas (ICES) in view of exploiting the synergies between relevant activities, including issues related to fisheries. In addition, the work of the Action will be strengthened through targeted participation in new indirect actions. Finally, there is a fundamental linkage between PROCAS and other JRC Actions, specifically SOLO and MONDE. These working collaborations will guarantee the provision of quality controlled satellite data for the PROCAS Action and enable the interoperability of information systems.

6.1.10. SOLO (H03, Action 24004)

Unit Head: Alan Belward

Action Leader: Mark Dowell

This Action will address these concerns by supporting the upcoming climate and space policies through the GMES and GEOSS processes. Research and Development activities will be conducted to take advantage of the data acquired by satellite sensors and generate, in collaboration with the Space Agencies, land and ocean climate as well as environmental products, including their time- dependent changes, in the context of the Global Climate Observing System (GCOS). Quality, reliability and accuracy of satellite products will be assessed through laboratory and in situ benchmarking activities; new algorithms will be developed to in-

crease their relevance as physical parameters in climate studies and international networks supported to ensure global acceptability of products.

This Action will address the following broad objectives:

- Generate and deliver products and services in support of policy making and other applications to specific customers such as the Directorates-General of the European Commission, the European Environment Agency, Space Agencies, as well as international organizations and the broader scientific community.

- Carry out the laboratory, field and research activities required to guarantee the quality, reliability and accuracy of these products and services, thereby contribute to the reduction in uncertainties required by the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.

- Conduct the scientific R&D necessary to formulate new or improved value-added products and services to address existing and emerging needs.

- Undertake temporal and spatial analyses of the core Essential Climate Variables and value added products to fill gaps in the state-of-the-art knowledge of biogeochemical processes and climate variability.

6.1.11. MONDE (H03, Action 42001)

Unit Head: Alan Belward

Action Leader: Philippe Mayaux

The Action will establish dedicated monitoring techniques for promoting the sustainable management of natural resources in African, Caribbean and Pacific (ACP) countries. Particular attention will be paid to land cover and land use dynamics, fresh water availability (in dry areas), land degradation and desertification, forest resources (deforestation, illegal logging), coastal zone management (degradation), marine resources, threats to biodiversity (in protected areas and in specific ecosystems) and the urban ecological footprint. Tools combining satellite data, advanced geospatial analysis and socio-economic models will be shared with Commission services and ACP countries in charge of sustainable management of natural resources and environmental protection.

Country and region specific environmental diagnostics will be produced, as well as reports for the Multilateral Environmental Agreements (UNFCCC, UNCCD, CBD) and contributions to international organisations (UNEP, FAO). The scope of the Action lies on the ACP countries, with a special focus on Africa. It will constitute a major element of the ACP Observatory for Sustainable Development, being developed by the JRC.

6.1.12. TREES-3 (H03, Action 42003)

Unit Head: Alan Belward

Action Leader Frédéric Achard

The TREES-3 Action provides quantitative measurements and mapping of changes in forest resources for the EU policies related to global environmental and forestry issues, with a focus on Eurasian boreal forests and tropical forests, including the Caribbean and Pacific regions. Forest cover and cover change issues related to EU commitments to Multilateral Environmental Agreements, especially to UN conventions such as the UNFCCC, UNCCD and UNCBD, and the UN Forest Forum, as well as Action Plans such as on Forest Law Enforcement Governance and Trade (FLEGT) will also be addressed.

The Action is proposed to take a fresh look at deforestation issues in a global perspective. The work will generate regional forest maps, track areas of rapid forest change and produce statistically valid estimates of cover change for the current and previous decades (from the mid 1970's up to 2005- 2010). The drivers of

deforestation will be identified at the regional levels, with a focus on Eurasian boreal forests and tropical forests. The TREES-3 products will be used as inputs in future climate change impact scenarios and, through close co-operation with DG Environment, will provide a basis for developing non-annex 1 country input into the Kyoto Protocol process. The regional forest maps and estimates of cover change will be shared with Commission services, EU Delegations, International Organisations (in particular the Food and Agricultural Organization FAO), and partner countries. Biomass maps and carbon emission/storage estimates will be produced for selected forest ecosystems. Due to persistent cloud in the tropics and poor illumination in winter months in the boreal ecosystems, the TREES-3 Action will develop forest monitoring techniques which also include the use of radar technologies, as these have good cloud penetration properties and operate without sunlight.

6.1.13. ENSURE (H05, Action 22005)

Unit Head: Giovanni Bidoglio

Action Leader: David Pennington

Action ENSURE provides essential guidance, indicators, approaches, and data for the development of knowledge-based policies on resources, products, and the related management of wastes. This Action will develop and apply conventional environmental impact assessment methods related to end-of-life waste management and contaminated site risk assessment.

Action ENSURE complements the conventional methods for resource management with the development of recommended approaches, indicators, reference data, and case studies to facilitate life cycle thinking in business and public administrations. The focus is on increased awareness and acceptance through scientific robustness and consensus building. For example, the European Platform on Life Cycle Assessment will develop the European Reference Life Cycle Data System (ELCD) and recommended Handbooks on Life Cycle Assessment. This European Platform is being realised by working closely with other Commission services and Member State representatives, as well as the European Data Centres, European business associations, the United Nations Environment Programme, and other stakeholders.

The Action addresses three overarching objectives:

- Life Cycle Thinking in Resource Management Policies
- Knowledge Base for Waste and Resources Management
- Support to Enlargement and Integration

6.1.14. COSIN (H06, Action 11601)

Unit Head: Alessandro Annoni

Action Leader: Stephen Peedell

This Action will support and help in coordinating the work across different JRC Units to create a JRC Spatial Data Infrastructure according to INSPIRE principles and specifications. It will focus on streamlining the flow of spatial data in the JRC, implement common standards and methods for the creation, management and analysis of these data, so that they are more accessible and usable across the organization to support its mission. The Action will support the development of the European Environmental Data Centres hosted by the JRC in collaboration with the Actions FOREST and SOIL and the setting up of a common architecture for all data centres in collaboration with the so-called "Group of Four" (JRC, DG Environment, DG Eurostat and the European Environment Agency), in the context of the European Shared Environmental Information System (SEIS). The Action will also support the establishment of INSPIRE within the relevant Community Institutions and bodies providing technical advice and guidelines. The Action will develop and test new protocols, standards, methods and tools for data integration and analysis and will ensure interoperability of data and services, and new information gathering activities. Together with the Action INSPIRE, the research under-

taken in this context will reinforce the JRC role as a recognised reference centre for geospatial information systems and science.

6.1.15. INSPIRE (H06, Action 11602)

Unit Head: Alessandro Annoni

Action Leader: Paul Smits

This Action will assume the scientific and technical co-ordination of the INSPIRE Directive. It will conduct a wide range of activities as foreseen in the various agreements relating to INSPIRE. This includes the preparation of implementing rules for metadata, harmonised data specifications, and network services. This work will be done in close cooperation with DG Environment, Eurostat, the European Environment Agency (EEA), and the INSPIRE Spatial Data Interest Communities and Legally Mandated Organizations in the Member States. This Action will also develop the EU Community Geoportal, a one-stop facility to discover and access geographic information and INSPIRE-compliant services at the European level. The Action will develop and test the contribution of in- situ data acquisition and monitoring infrastructures and integrate them into the INSPIRE framework. Through this Action, JRC will also participate in architectural and data management aspects of SEIS, GMES and GEOSS and will liaise with international organizations active in developing a Global Spatial Data Infrastructure. Moreover, JRC will continue to monitor and participate in the work of European and international geo-spatial standardization bodies. A strong research component will underpin these activities leading to the definition and the development of the next generation of Spatial Data Infrastructures. Together with the Action COSIN-JRC, this Action aims to reaffirm JRC as recognized reference centre for spatial data infrastructure research. The objectives of the INSPIRE Action are structured in such a manner that together they develop, share, evaluate and apply the knowledge required to implement and further develop the spatial information infrastructure envisioned by INSPIRE and required by SEIS and GMES.

In collaboration with the Action COSIN-JRC, this Action aims to reaffirm JRC as the internationally recognized reference centre for spatial data infrastructure research.

6.1.16. FOREST (H07, Action 22003)

Unit Head: Guido Scmuck

Action Leader: Jesus San-Miguel-Ayanz

EU policy relevant information, from initial field data collection all the way to final reporting will be managed by the FOREST Action. This will be achieved by the development and implementation of the European Forest Data Centre (EFDAC) as a focal point for information on forest resources and their condition at the European level following the INSPIRE guidelines. The Action FOREST will contribute decisively to the implementation of the EU Forest Action plan, the follow-up of the European Commission's Communication "Halting the Loss of Biodiversity to 2010 – and beyond" and to the future forest monitoring under the LIFE+ programme. Advanced modelling techniques and scenario analyses will be used to provide the information needed to understand the status and trends of European forests (species distribution, forest area, and biomass, forest condition), the interactions between forests and biodiversity, those between forests and climate change and the protective function of forests. The European Forest Fire Information System will be further enhanced by additional modules. The work on the production of spatial information on forest resources (forest mapping) and forest damage assessment will contribute to the Global Monitoring for Environment and Security (GMES) initiative.

The Action will focus on the following high level objectives:

– The establishment of the European Forest Data Centre (EFDAC) as focal point for forest data and information in Europe (in collaboration with the Actions SOIL, INSPIRE and COSIN-JRC)

– Running and thematic extension of the European Forest Fire Information System (in collaboration with the Actions SOIL and NAHA)

- Research and development of advanced modelling techniques, indicators and scenario analysis in relation to forest and forest biomass mapping, biodiversity and climate change (in collaboration with the Actions NAHA, BioF, TREES-3, and GHG-AFOLU)

- Follow-up of Forest Focus and support to the future monitoring of forest under the LIFE + programme (in collaboration with the Actions SOIL and GHG-AFOLU)

- Finalisation of the European Forest Information and Communication Platform (EFICP) (in collaboration with the Actions INSPIRE and COSIN-JRC)

- Support to the EU Enlargement and Integration Programme and the European Neighbourhood Policy (in collaboration with the Actions NAHA, SOIL, INSPIRE, COSIN-JRC, and TREES-3)

- Exploratory research

6.1.17. SOIL (H07, Action 22004)

Unit Head: Guido Scmuck

Action Leader: Luca Montanarella

EU policy relevant soil information, from initial field data collection all the way to final reporting will be managed by this Action. This will be achieved by using the European Soil Data Centre (ESDAC) as the single soil information focal point. It will serve the Commission's needs in negotiating through the EU Institutions the new Thematic Strategy for Soil Protection (COM (2006)231) and the Soil Framework Directive (COM(2006)232) as well as their subsequent implementation in Member States. Advanced modelling techniques and scenario analyses will be used to provide soil information to end users in relation to the major threats to soil identified in the Thematic Strategy for Soil Protection (erosion, decline of organic matter, compaction, salinisation, landslides, sealing, contamination and loss of soil biodiversity). A strong scientific and technical support to the United Nations Convention to Combat Desertification (UNCCD) will be provided by promoting the reform of the Committee of Science and Technology (CST) of the UNCCD and by the development of an operational Global Soil Information System (GLOSIS) for the regular assessment of global soil degradation processes.

This Action will provide a coherent approach to soil data collection and distribution for all different policy areas and initiatives relevant to the EU, while assuring high scientific quality, policy relevance and technical support as needed.

The Action will focus on the following overarching objectives:

- The establishment of the European Soil Data Centre (ESDAC) as a single focal point for all soil data and information in Europe.

- The development of procedures and methods for data collection, quality assessment and control, data management and storage, data distribution to Commission and external users, fully complying with INSPIRE principles for spatial data infrastructures.

- Research and development of advanced modeling techniques, indicators and scenario analyses in relation to the major threats to soil (erosion, decline of organic matter, compaction, salinisation, landslides, sealing, contamination, and loss of soil biodiversity), as identified in the Thematic Strategy for Soil Protection.

- Supporting the other Commission's services with soil information and scientific as well as technical assistance in negotiating the Thematic Strategy for Soil Protection and the proposal for a Soil Framework Directive through the EU Institutions and their subsequent implementation at Community and Member State level.

    – Extension of the coverage of the European Soil Information System (EUSIS) towards a fully operational Global Soil Information System (GLOSIS), providing relevant soil information for the implementation of multilateral environmental agreements, like UNFCCC, CBD and UNCCD, and contributing to the ground segment of the Global Monitoring for Environment and Security (GMES).

6.1.18. NAHA (H07, Action 32001)

Unit Head: Guido Shmuck

Action Leader: Ad de Roo

The Action will focus on the development of a better capacity for early warning, monitoring and damage assessment systems for weather-driven natural hazards, as well as for tools for assessing climate change effects, land use change effects, risk mapping and adaptation (prevention and reduction) to extreme events driven by the current climate and expected changes in climate. Modelling is given specific attention with respect to the occurrence of natural events such as floods and droughts, for example in support of the Flood Action Programme. The Action items are geared towards the provision of direct support to the Community civil protection mechanisms and to interventions by the Solidarity Fund. They are also linked to the development of the Global Monitoring for Environment and Security (GMES) services. Synergies with Agendas 2.2 (Natural Resources) and 2.4 (Climate Change) of the JRC's Multi-Annual Work Programme will be developed.

The aim is to complement Member States' activities towards weather-driven natural hazards by developing harmonized EU-wide methodologies and information systems towards the prevention and prediction of weather-driven events (floods and droughts). Furthermore, the activities will support the European Spatial Development Perspective and new EU Regional Policy regulations by developing tools for the impact assessment of regional developments on weather-driven hazards and vice versa, as well as risk mapping. In addition, the JRC will provide advice towards the definition of future priorities at EU level by evaluating the impact of medium- and long-term scenarios linked to changing climate conditions and to socio-economic processes in Europe. Furthermore, research activities will be carried out to understand the underlying dynamics and interrelationship between technological and natural hazards.

The Action will focus on the following high level objectives:

    – Pre-operational testing, finalization and transfer of the European Flood Alert System (EFAS)

    – New development and testing of a European Drought Observatory (EDO)

    – Development and testing of a Flood and Drought Watch System for Europe (including a flood rapid response service)

    – Multi Natural Risk Mapping (floods, droughts and forest fires), including support to the Flood Directive

    – European urban and regional land use scenarios effects on weather- driven natural hazards

    – Assessment of climate change effects on weather-driven natural hazards in Europe

    – Enlargement and Integration

    – Exploratory Research

6.1.19. SOLAREC (H08, Action 13106)

Unit Head: Heinz Ossenbrink

Action Leader: Ewan Dunlop

The Action will focus on:

– The implementation of the traceability chain from SI units to the verification of the power and energy generation of photovoltaic devices through development of international standards, and the dissemination of such methods to the research community and application for industry and end users.

– The development of means to determine the ageing and acceleration factors in the end-of-life of photovoltaic modules. By sequential accelerated stress testing and stress doubling approaches, the activation energies and critical stress factors in the life-time of photovoltaic components, in particular thin film materials, will be investigated. This will be introduced in the international community as input to international standards.

– The establishment of an integrated method for the energy output of new generation photovoltaic modules, particularly thin film technologies. A systematic study of the generality of material performance characteristic in operational conditions, to establish energy rating will be made. This will enable comparison of performance within module families, as well as evaluation and comparison between different technologies. The study of system / performance evaluation including quantitative determination of the critical losses will feed into international standards and norms.

– The Photovoltaic Geographic Information System (PVGIS) will translate experimental knowledge into real-world conditions. To improve the geographic understanding of solar technology, PVGIS will develop high resolution databases. The GIS analysis will provide the platform to integrate traceability, energy rating and life-time assessment and to develop standards in a single integrated system. The core data layers will be developed from Meteosat images (in collaboration with Action EXPO-Tools). Supplementary data on temperature will allow the assessment of performance degradation. The impacts of large scale deployment on existing European electricity grids will be analysed. PVGIS will address new transmission, stability and load/supply issues in electricity grids in Southern regions with higher density of solar photovoltaic systems, including the analysis of short-term intermittency, and real-time energy flows.

– Exploratory Research will address new material concepts from electronic properties and conversion mechanisms by application of spectroscopy techniques. The focus shall be on innovative photon absorption process such as selective emitters, photon up/down converters and polymer based approaches. New experimental apparatus for the characterisation of high efficiency multi- junction solar cells and indoor characterisation of concentrator cells will be developed. These studies feed back to the research community as measurement methods for future generation solar cells. Collaboration will be targeted on the new Member States.

6.1.20. EXPO-TOOLS (I05, Action 23003)

Unit Head: Dimitrios Kotzias

Action Leader: Dimitrios Kotzias

The Action will investigate human exposure from a holistic approach. The assessment and modelling of exposure to chemicals released from products and articles (e.g. volatile organic compounds-VOCs, biocides, dyes, etc.) will form the basis for the development and implementation of consumer exposure models, exposure assessment procedures and information tools. Fundamental source models for consumer products and for different source classes will be developed and validated in collaboration with Action 23002. A consumer exposure modelling framework (standalone or accessible via the Web) will be designed and built a modular

approach that will allow a multitude of models, both simple and complex to be added in a dynamic fashion at any time.

The European Exposure Assessment Toolbox designed and developed within FP 6 (EIS-CHEMRISKS/CHEM-TEST projects) will be further refined and completed to support the development of a structured stakeholder dialogue towards harmonised exposure assessment in the EU.

The mission of the unit is to develop and implement state-of-the-art Information and Communication Services that enable:

– the JRC scientific activities to effectively and securely access knowledge and ICT resources and share information with their partners and customers;

– the JRC staff to efficiently access corporate information

6.2.   CID work programme

Policy Theme: **1** - Prosperity in a Knowledge intensive society
Agenda No & Title: **1.1** - Competitiveness and innovation
Sub-agenda No & Title: **1.1.6 - Data harmonization**
Action Leader: AASTRAND,PAER
Web site address (URL): http://agrifish.jrc.it/marspac/CwRS/ or http://imageportal.jrc.it/
Customer/users (outside the European Commission):

- Member State paying agencies
- Member States Research organizations
- Ministries of Agriculture
- ESA-ESRIN
- Citizens
- Research Institutions and Universities

Customer DGs (inside the European Commission):

- Agriculture and Rural Development
- Enterprise and Industry
- Research
- Environment
- External Relations
- Development
- Regional Policy

Keywords:

Global Monitoring for Environment and Security (GMES), Satellite Remote Sensing (SRS) data, ae-
rial photography, image portal, image acquisition management, image access, harmonized-, stan-
dardized-, interoperable-data, image property rights, INSPIRE, web service, map server, front end,
back end, orthorectification, Quality Assurance (QA), EU Policies, Control with Remote Sensing
(CwRS), High Resolution (HR), Very High Resolution (VHR), MS Administrations, Framework Con-
tract (FC).

Rationale:

The competitiveness of the European economy benefits from increased access to harmonised in-
formation and interoperable services related to items of community policy relevance. Innovation in a
knowledge intensive society includes making this information available in an efficient way and stor-
ing it in a secure manner. The CID (Community Image Data portal) Action relates to the acquisition,
access and storage of Satellite (and aerial) Remote Sensing data in the context of the JRC and
Commission services needs. This includes the procurement of data sets for a broad range of uses
including data and information management for GMES. The Action is a result of the long term ex-
perience in image data management and in image data applications built up at the JRC. The experi-
ence will serve to: - coordinate efficient image procurement, quality access, preparation and storage
for the JRC and defined EU organisations. - Give input to an efficient collaboration with external
partners in the field (ESA, industry and image providers). - serve EU organisations and the EU citi-
zen with satellite image products, and data services in a harmonized, standardized, interoperable
way. - ensure a better use of imagery, more efficient re-use and encourage the use in new areas.
Particular attention will be given to further development of an Image Portal; favouring in respect of
property rights, the sharing of images between Commission services, other stakeholders, as well as
providing some viewing services for European citizens. The Image Portal will reside with the main
Satellite Remote Sensing (SRS) data user of the EC (IPSC) but builds on a combination of efforts
from other Institutes to achieve the best interoperability and security; some 25 Actions within the

JRC presently deal with and/or have repositories of SRS data. In addition to development activities linked to the satellite data service, the action will provide support to the coordination of the JRC inputs to the GMES initiative including support to the identification of data needs and user requirements, to the implementation of improved responses and new approaches associated with EU Policies, and to the long-term access to space data.

Summary of the project:

The Action aims to place itself as the centre of gravity of satellite and aerial remote sensing (SRS) data management within the JRC and defined EU organisations. It will create an Image Portal consisting of a front/back end providing suitable access and preparation/storage of imagery. This will be done following rules for data harmonisation, metadata, and data specifications defined by, amongst others, INSPIRE standards.

The Action will manage image acquisition and service requests for any project within the JRC and upon request other EC projects. It will benchmark new satellite sensors, and finally also identify user needs and requirements, and provide support to the coordination of the JRC inputs towards GMES. The Action will be divided into 3 Work Packages:

1.Image Portal, which will manage the front end (image access) and the back end (image preparation and production, image and image metadata storage). This means detailing an authentication system, and a catalogue service to allow selective, secure access to data in the portal. It will deal with licensing issues involved in viewing, browsing, other types of image access, and in image download. The WP will make assessment of data existing at the JRC, and assess the future needs of repositories, data, and services. It will also specify and implement suitable means of image serving to customers.

2.Image Acquisition, which will manage image acquisition as requested by JRC or defined EC programmes (e.g. MARS PAC Control with Remote Sensing). This means efficient management of feasibility studies, planning, programming, acquisition and ordering through to delivery and invoicing. Further it means to produce statistics to evaluate the efficiency of the workflow and to identify possible bottlenecks. The WP will provide details for the adaptation of the current acquisition/ordering system to fit management of other projects, produce image acquisition specifications, perform benchmarking of new satellite sensors when launched.

3.Support to the GMES Initiative, which will manage relations between the JRC, DG ENTR and the GMES Bureau. The activity will participate in relations with ESA, and industry; responsibility will be at three levels: in GMES user contacts, in GMES image provider contacts, and in archiving/distribution of acquired data. In general the WP will strive to enlarge the CID image acquisition management to serve further defined EU organisations, will work towards the implementation of improved responses and new approaches associated with EU Policies and in issues relating to long-term access to space data.

Objectives for 2007 :

- 01.1 To make an inventory of JRC data archives (image data and image products). This is done to identify who, at the JRC, are storing image data, of which type and quantities, which data should be made accessible from the portal, and finally to take decision on storage capacities required in the near future and best means of dissemination. The inventory will provide a basis for assessment of the requirements of the CID to the responsible Unit; AgriFish and to decide whether the storage should be centralized at INLU.

- 01.2 To manage the development of the 1st release of the Image Portal including suitable authentication, and cataloguing within the system. This is part of the development of the portal and performed in order to allow selective secure access to data.

- 01.3 To implement semi automatic orthorectification routines for the CwRS programme, including QA routines. This is required, as part of the back end of the image portal (data preparation), to enable best means of image serving to the user.

- 02.1 To manage the CwRS VHR and HR image acquisition programme 2007. This includes feasibility, planning, programming, acquisition, ordering, delivery and invoicing satellite data to be used by the MS Administrations (and their contractors) in the CwRS operation. Approximately 6 M euro is managed on subdelegation from DG AGRI per year.

- 02.2 To manage the well functioning and extensions of the Framework Contracts (FCs) with all EC image providers. New FCs valid for the EC services for a maximum ceiling of yearly 9 M euro have been prepared in 2006 with 1 + 3 years validity. These require yearly extensions, and a constant service to the EC users.

- 02.3 To perform benchmark on new satellite sensors. New sensors are constantly launched and need to be tested for efficiency, and accuracy. The main client is the CwRS programme which yearly splits required HR acquisitions between 4+ sensors (approx. 700 images), and VHR acquisitions between 6+ sensors (approx. 140 000 km2).

- 03.1 To be the link and coordinator between the JRC and the GMES Bureau, which means to be able to detect and understand long term policies of access to space data. Also, the WP will be a driving force for DG JRC image data archiving, access, and distribution for the GMES initiative. This is vital since already within the JRC (and for selected EC programmes) the image portal will serve large amounts of data; a natural expansion of this, and a step towards maintaining a high profile for the JRC within the GMES initiative, is to serve the future data that will be purchased for the GMES projects to the users.

Deliverables :

- 1.1 Report on JRC SRS (and aerial) data archives and needs of services (**30/06/2007**)

- 1.2 Deliver the 1st release of the Image Portal with suitable authentication and cataloguing services (**30/06/2007**)

- 1.3 Report on test of automatic orthorectification service for a set of contractors within the CwRS programme 2007 (**30/12/2007**)

- 2.1 Deliver image acquisition specifications for the 2007 CwRS Campaign (**30/06/2007**)

- 2.2 Deliver final report on the image acquisition for the CwRS VHR/HR Campaign 2007 to DG AGRI (**30/12/2007**)

- 2.3 Deliver report on the efficiency of any new sensors introduced in the CwRS programme (or any other EC programme) (**30/12/2007**)

- 3.1 Deliver reporting on all GMES coordination meetings, and a major report on the GMES image acquisition clarifying the role of JRC in image distribution, and archiving mechanisms. (**30/12/2007**)

6.3. EC Satellite Remote Sensing Data Framework Contract Licensing Terms

ARTICLE I.9 – OTHER SPECIAL CONDITIONS

I.9.1   Image Licensing.

With regards to the use of SRS data products purchased by the EC Services the following shall apply:

- The license granted by the image provider to the EC will apply to its ongoing scientific research programmes requiring use of this type of data. Once any EC Service has purchased imagery any programme can benefit from it. This license shall include the European Institutions, (see Art. 7, 8, 9 and 21 of the EC Treaty) and all bodies established on the basis of the EC and EU Treaties.

- The licence will also cover the case imagery, purchased by the EC Services, is treated by third parties under EC instructions and responsibility to derive value added information that serve Commission requirements. These third parties are exclusively EC subcontractors, MS Administrations or their contractors located in the specific Member State or Accession Countries, or the Candidate Countries (EU 25 + 4) and officially selected for this specific purpose. This last situation applies in the Control with Remote Sensing programme, where imagery is transferred directly to technical contractors in the EU Member States which possess technical capacities MS do not possess. These contractors exclusively access the imagery in their operational control tasks, or in the domain of the Common Agricultural

  Policy (CAP) Integrated Administration and Control System (IACS), in order to ship back the data to the EC Services on completion of the work.

- The licence will also allow MS Administrations to use the imagery in a parallel research operation in the same domain as above.

  - This is, for instance, when imagery is used by the Ministry of Agriculture itself for the above mentioned control operation in the domain of the CAP IACS, and for updating of their geographic information systems requested by the IACS, or yet another Ministry for e.g. Environmental legislative checks.

  - The EC Services will give full name and details of user and the purpose of the data usage, to the image provider, before using the data. Such parallel domain users are in general not expected to be more than 2.

- EC will inform the image providers of any order, not falling in the above categories, involving EC Services working together with third parties, allowing the image provider to confirm the absence of any restrictions applicable to the third party, or the data usage (eg. military, exclusivity agreement, etc.).

- The above licence will NOT apply if any one of the contractors used by the EC or a MS wishes to use the data for any other purpose than that of the contracts signed with them. In such case commercial negotiations between the image provider and the contractor needs to take place in order to arrange for the necessary contractual arrangements for such "data usage".

6.4.   Draft Implementation of the CID IT Architecture

> The content of this chapter is adapted from the document *CID related IT require-ments and infrastructure* ref. JRC IPSC/G03/P/PHA/pha D(2006)(6660) which can be re-quested from the Agrifish Unit.

An overview of the CID IT architecture taking into account all the functionalities described in chapter 4.4.1 is available at Figure 77. To ensure a high availability of the services, every node mentioned in Figure 77 is in fact a cluster designed for failover and in a few cases also for load balancing.
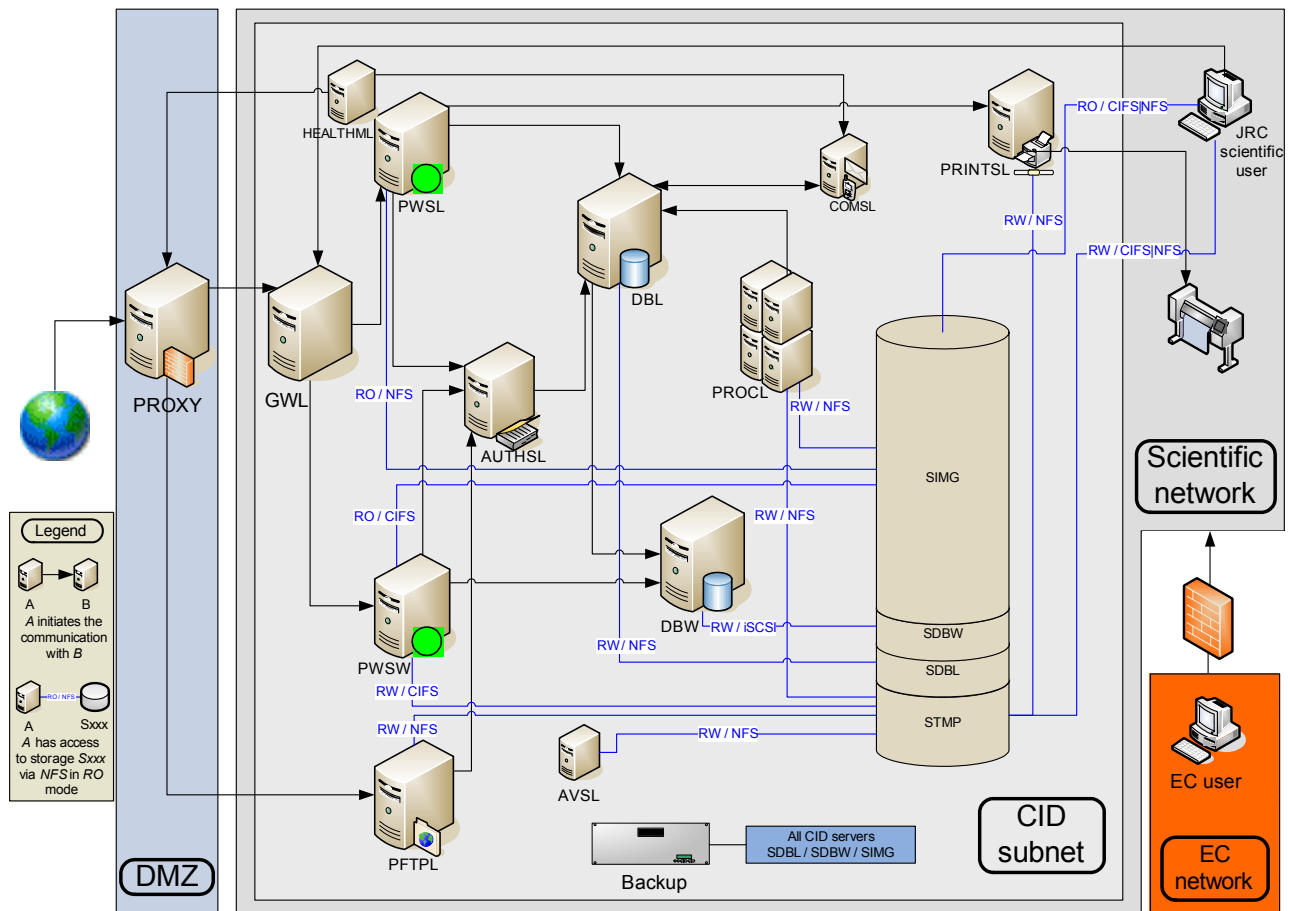

Figure 77: Architecture overview

6.4.1. Services

AUTHSL (Authentication Service on Linux): This cluster will host an LDAP server and the backend of the authentication system developed by Spacemetric. This LDAP server will be used to authenticate all ac-cesses to web servers and ftp servers (PWSL, PWSW, PFTPL). It will also be used to authenticate file based access (NFS, CIFS) to SIMG and STMP.

COMSL (Communication services on Linux): This system will manage the preparation of emails and SMS to be sent to users and system administrators and will rely on JRC email service (ie. it is not foreseen to set up a SMTP server).

DBL (Database on Linux): This cluster will host the PostgreSQL + PostGIS database used by all CID ser-vices which do not rely on SQL Server.

DBW (Database on Windows): This cluster will host the SQL Server database used by the data ordering application and the server part of the image loading application.

HEALTHML (Health Monitoring on Linux): This cluster will host Jmeter and the scripts used to check the availability of CID services. It will also have the possibility to send emails and sms (not shown here).

PFTPL (Public File Transfer Protocol on Linux): This cluster will host an FTP server used to download data to be incorporated in the archive and to serve data when requested.

PRINTSL (Print Service on Linux): This cluster will host the poster printing service and be connected to a plotter.

PROCL (Processing on Linux): This cluster will host the image processing and archiving services of CID.

PWSL (Public Web Services on Linux): This cluster will host the web portal, all OGC web services (WMS, WFS, WCS, CSW) and the front-end of the authentication system.

PWSW (Public Web Services on Windows): This cluster will host the data ordering, the server part of the data loading and the ECWP and ArcXML dissemination services.

6.4.2. Storage

SDBL (Storage for Databases on Linux): PostgreSQL database will be stored in a dedicated volume of the storage area and accessed via NFS from DBL cluster.

SDBW (Storage for Databases on Windows): SQL server database will be stored in a dedicated volume of the storage area and accessed via iSCSI from DBW cluster.

SIMG (Storage for Images): This volume will be the main data repository. It will contain all images (source and processed) and a single file will be accessible at the same time via NFS and CIFS from different computers. Only PROCL and CID management will have direct write access to this volume.

STMP (Storage for Temporary files): This volume will contain the images to be processed and be used as a temporary directory while the processing takes place. Access to data will be possible through NFS and CIFS.

6.4.3. Backup

A backup facility must be set up for all CID servers as well as all storage but STMP.

6.5.   Complete list of questions in the survey

CID Communities Image Data Portal

CID survey Part I: Project overview

A) Project details

* **q1: JRC institute**

Please choose **only one** of the following:

☐ IE
☐ IES
☐ IHCP
☐ IPSC
☐ IPTS
☐ IRMM
☐ Ispra Site directorate
☐ ITU

---

* **q2: JRC unit name**

Please choose **only one** of the following:

☐ D02 Reference materials
☐ D03 Infrastructure et Gestion du site
☐ D04 Isotope measurements
☐ D05 Neutron physics
☐ D06 Informatics and electronics
☐ D07 Institute development and programme management
☐ D08 Food safety and quality
☐ E02 Hot cell technology
☐ E03 Materials research
☐ E04 Nuclear fuels
☐ E05 Nuclear chemistry
☐ E06 Actinides research
☐ E07 Nuclear safety and infrastructure
☐ E08 Applied safeguards laboratory
☐ F02 Clean energies
☐ F03 High-flux reactor
☐ F04 Nuclear safety
☐ F05 Technical and scientific support to Tacis and Phare
☐ F06 Scientific and technical support
☐ G02 Support to external security
☐ G03 Agriculture and fisheries
☐ G04 Hazard assessment
☐ G05 European Laboratory for Structural Assessment
☐ G06 Sensors, radar technologies and cybersecurity
☐ G07 Traceability and vulnerability assessment
☐ G08 Nuclear safeguards
☐ G09 Econometrics and statistical support to Antifraud
☐ H02 Climate Change
☐ H03 Global Environment Monitoring
☐ H04 Transport and Air Quality
☐ H05 Rural, Water and Ecosystem Resources
☐ H06 Spatial Data Infrastructures
☐ H07 Land Management and Natural Hazards
☐ H08 Renewable energies

☐ I02 Validation of biomedical testing methods
☐ I03 Toxicology and chemical substances
☐ I04 Biomedical materials and systems
☐ I05 Physical and Chemical Exposures
☐ I06 Biotechnology and GMOs
☐ J02 Sustainability in industry energy and transport
☐ J03 Support to the European research area
☐ J04 Technologies for information and communication
☐ J05 Sustainability in agriculture, food and health

---

* q3: JRC action number as available from SKM

http://skm.jrc.it	Please write your answer here:

---

q3a: Action acronym

Please write your answer here:

---

q4: JRC action tasks / work packages (one per line)

Name of the work package (or task) inside the action	Please write your answer here:

---

q5: Unit head name (Surname Firstname)

Please write your answer here:

---

q6: Unit head email

Please write your answer here:

B) Contact person

q7: Surname Name

Please write your answer here:

---

q8: Email

Please write your answer here:

[   ]

---

q9: Phone

Please write your answer here:

[   ]

---

q10: Function

Please write your answer here:

[   ]

C) Project description

q12: JRC typology category (GMES)

Please choose **all** that apply:

☐ CAT 1: services are delivered to operators who are otherwise financed for implementation – examples are found in real time monitoring illegal discharge from ships where negotiations are in progress to prepare for an action by the Maritime safety agency.

☐ CAT 2: services are kept inside the Commission because they fulfil a specific requirement for internal operations (this is the case for antifraud work; EFFIS fire risk is currently in the Forest Focus directive and temporarily maintained in this category; MARS STAT etc).

☐ CAT 3: services are operated by outside operators but products and results are evaluated and translated by JRC in the name of a client DG (ex: Greenhouse Gas reporting in the context of the UNFCC; technical work on INSPIRE, etc).

☐ CAT 4: R&D in new services as requested by DGs (ex: the Africa Observatory which is to serve spatial information requirements of policy DGs involved in development aid).

---

q13: Main organisation financing the image data procurement

Please choose **only one** of the following:

☐ European Commission (not JRC)
☐ Joint Research Centre
☐ Competitive
☐ Other [   ]

---

q14: Main data sources for the project

Please choose **all** that apply:

☐ Satellite images
☐ Aerial photography
☐ Derived products
☐ Field / Ground data
Other: [   ]

---

q15: Deliverables of the project

Please choose **all** that apply:

☐ Products to be printed with a spatial component (maps, sat images...)
☐ Georeferenced data
☐ Statistics
☐ Reports
Other: [   ]

---

q16: Media used for deliverables

Please choose **all** that apply:

- ☐ Dynamic web (search facilites, webmapping...)
- ☐ Static web (i.e. equivalent to a paper printout)
- ☐ Printouts
- ☐ Web services (WMS/WCS/WFS/OpenDAP/kml...)
- ☐ FTP delivery
- ☐ CD/DVD, tapes...

Other: [   ]

---

q18: Image based service websites

Please write your answer here:

[   ]

---

q19: Annual budget for acquisition and processing of aerial and satellite data (K€)

Please write your answer here:

[   ]

---

q19a: Are you partially or fully subcontracting the acquisition and/or processing of these data?

Please choose **only one** of the following:

- ☐ Yes
- ☐ No

---

q20: Human resources working with acquisition of satellite data. (person-months)

Please write your answer here:

[   ]

---

q21: Human resources working with management of image data and associated IT infrastructure. (person-months)

Please write your answer here:

[   ]

Submit Your Survey.
Thank you for completing this survey. Please fax your completed survey to: +39 0332 78 51 62.

CID Source data acquired

CID survey Part II: Source data (aerial / satellite) acquired

D) Sensor specific parameters

* q30: JRC action number as available from SKM

| http://skm.jrc.it | Please write your answer here: |

* q31: Sensor name

Please choose **only one** of the following:

- ☐ ads40
- ☐ aerial analog photography
- ☐ alos
- ☐ aster
- ☐ Cartosat-1
- ☐ dmc
- ☐ ENVISAT AATSR
- ☐ ENVISAT ASAR
- ☐ ENVISAT GOMOS
- ☐ ENVISAT MERIS full res
- ☐ ENVISAT MERIS low res
- ☐ ENVISAT MIPAS
- ☐ ENVISAT MWR
- ☐ ENVISAT RA-2
- ☐ ENVISAT SCIAMACHY
- ☐ eros A
- ☐ eros B
- ☐ ERS 1,2 ATSR
- ☐ ERS 1,2 GOME
- ☐ ERS 1,2 MWR
- ☐ ERS 1,2 RA
- ☐ ERS 1,2 SAR
- ☐ ERS 1,2 WS
- ☐ formosat-2
- ☐ grace
- ☐ ikonos
- ☐ IRS 1C/1D PAN/LISS
- ☐ IRS 1C/1D WIFS
- ☐ IRS P6 AWIFS (ResourceSat-1)
- ☐ IRS P6 PAN/LISS (ResourceSat-1)
- ☐ jason
- ☐ JERS-1
- ☐ kompsat-2
- ☐ landsat
- ☐ Meteosat 1st generation
- ☐ Meteosat 2nd generation
- ☐ MetOp AMSU-A
- ☐ MetOp ASCAT
- ☐ MetOp AVHRR
- ☐ MetOp GOME
- ☐ MetOp GRAS
- ☐ MetOp HIRS
- ☐ MetOp IASI
- ☐ MetOp MHS
- ☐ MetOp SEM
- ☐ modis terra/acqua
- ☐ Nimbus-7 CZCS
- ☐ NOAA AMSU
- ☐ NOAA AVHRR
- ☐ NOAA HIRS
- ☐ NOAA SARP-2
- ☐ NOAA SBUV
- ☐ Orbview-2 Seawifs
- ☐ orbview-3
- ☐ proba
- ☐ quickbird
- ☐ QuickSCAT
- ☐ radarsat-1,2
- ☐ Scisat-1 ACE
- ☐ SEM-2
- ☐ spot 5

☐ spot 5 supermode
☐ spot vegetation
☐ spot-1,2,4
☐ topex-poseidon
☐ ultracam
☐ MISR
☐ Other [   ]

q32: Vehicle (to be filled in only if answer to q31 is "Other")

Please choose **only one** of the following:
☐ aerial
☐ satellite
☐ shuttle

q33: Type (to be filled in only if answer to q31 is "Other")

Please choose **only one** of the following:
☐ optical VHR
☐ optical HR
☐ optical MR
☐ optical LR
☐ radar
☐ Other [   ]

q35: Resolutions (metre) (to be filled in only if answer to q31 is "Other")

Please write your answer(s) here:
Resolution 1 (XS if relevant): [   ]
Resolution 2 (PAN if relevant): [   ]
Resolution 3: [   ]

q36: File format

Please choose **only one** of the following:
☐ product specific
☐ dimap
☐ tiff
☐ flat binary (BSQ/BIL/BIP)
☐ ESRI Grid
☐ NetCDF / HDF
☐ OpenDAP
☐ WxS (WMS/WCS)
☐ Other [   ]

E) Characteristics of acquired data
Fill in this questionnaire for every type of aerial or satellite data acquired

* q37: Processing level

Please choose **all** that apply:
☐ Level 0 (raw data received from the satellite)
☐ Level 1 (radiometric correction but no georeferencement)
☐ Level 2 (radiometric correction and georeferencement)
☐ Level 3 (radiometric correction and orthorectification)

* q38: Pre-processing

Please choose **all** that apply:
☐ none
☐ pan-sharpening
☐ LUT stretch
☐ time composite
Other: [   ]

* q39: Projection

Please choose **all** that apply:
☐ none
☐ Universal Transverse Mercator
☐ Geographic
☐ Lambert Azimuthal Equal Area
☐ National projection
☐ World wide projection
Other: [   ]

* q40: Geographic coverage (where images are mainly located)

Please choose **all** that apply:
- ☐ world
- ☐ EU25
- ☐ EU27
- ☐ Africa
- ☐ North America
- ☐ South America
- ☐ Asia
- ☐ Europe
- ☐ Oceania

---

q41: Total surface covered until now [2006] (km2) if data procurement is surface based
NB: If an area of 15 km2 has been acquired twice, count it as 30 km2. (i.e. for multitemporal coverage, count every coverage)

Please write your answer here:

[   ]

---

q42: Number of scenes acquired until now [2006] (if data procurement is per image)

Please write your answer here:

[   ]

---

q43: Surface (to be) covered in: (km2/year)

Please write your answer(s) here:

2006: [   ]

2007: [   ]

2008: [   ]

---

q44: Number of scenes / images (to be) acquired in:

Please write your answer(s) here:

2006: [   ]

2007: [   ]

2008: [   ]

---

q45: Intellectual Property Rights Get a copy of the license agreement

Please write your answer here:

[   ]

---

* q46: Acquisition cycle

Please choose **all** that apply:
- ☐ incidental
- ☐ daily
- ☐ weekly
- ☐ decade (10 days)
- ☐ monthly
- ☐ seasonal (3 months)
- ☐ yearly
- ☐ 5-10 year

---

q47: For time series, enter a start date [YYYY-MM-DD]:

Please enter a date:

[/ /   ]

---

* q48: Provider

Please choose **all** that apply:
- ☐ Action
- ☐ Contractor
- ☐ Image Framework Contract (FC)

☐ Other private company
☐ Academic / Research / Oasis
☐ European Space Agency cat1 (free access to data)
☐ European Space Agency cat2
☐ International organisation
☐ Eumetsat
☐ Joint Research Centre
☐ Charter
☐ EU satellite centre
☐ NASA / USGS / NOAA
Other: [_____]

---

q49: Programming

Please choose all that apply and provide a comment:

☐ none [_____]

☐ standard [_____]

☐ priority [_____]

☐ archive data [_____]

---

q50: Cloud cover criteria

Please choose **all** that apply:

☐ none
☐ 0%
☐ less than 5%
☐ less than 10%
☐ less than 20%

---

q51: How long does it take you to receive your data?

Please choose **all** that apply:

☐ Near Real Time
☐ 2-3 days
☐ 1-3 weeks
☐ one month
☐ more

---

* q52: How do you get your data (media used)?

Please choose **all** that apply:

☐ broadcast / DDS
☐ FTP
☐ cdrom / dvd
☐ web service
Other: [_____]

---

q54: About the current storage Indicate percentage of both

Please write your answer(s) here:

network storage: [_____]

other (CD, DVD, tapes, local HD): [_____]

---

q55: Multi annual budget for data procurement (k€)

Please write your answer(s) here:

Budget for 2006: [_____]

Budget for 2007: [_____]

Budget for 2008: [_____]

F) Products derived entirely from the data source considered

q56: Which products are derived entirely from the data source considered?
For each of them, specify if available on network storage or not.

Ask for a copy of the license agreement for each product.

Please choose the appropriate response for each item:

	yes	no	Not Available
Classification	☐	☐	☐
Change detection	☐	☐	☐
Digital Elevation Model	☐	☐	☐
Lookup table stretch	☐	☐	☐
Meteorological product	☐	☐	☐
Ortho and LUT stretched	☐	☐	☐
Ortho image	☐	☐	☐

Phenological data	☐	☐	☐
Preview (small image for fast preview)	☐	☐	☐
Probability analysis	☐	☐	☐
Sea Level Anomaly (and msla)	☐	☐	☐
Sea Surface Temperature	☐	☐	☐
Vegetation indices	☐	☐	☐
Others	☐	☐	☐

q57: For each product derived entirely from the data source considered, please indicate the provider.

<u>Please choose the appropriate response for each item:</u>

	Action	Image FC	Other priv. company	Aca / Res / Oasis	ESA cat1 (free)	ESA cat2	Int. org.	Eumetsat	JRC	Charter	EU sat. centre	NASA...	Other
Classification	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Change detection	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Digital Elevation Model	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lookup table stretch	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Meteorological product	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Ortho and LUT stretched	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Ortho image	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Phenological data	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Preview (small image for fast preview)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Probability analysis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sea Level Anomaly (and msla)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sea Surface Temperature	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Vegetation indices	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Others	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Submit Your Survey.
Thank you for completing this survey. Please fax your completed survey to: +39 0332 78 51 62.

CID Derived products
CID survey Part III: Derived products purchased or generated from several source data

G) Product specific parameters

* q60: JRC action number as available from SKM

http://skm.jrc.it | Please write your answer here:

---

* q61: Product name

Please choose **only one** of the following:

☐ Classification
☐ Change detection
☐ Digital Elevation Model
☐ Lookup table stretch
☐ Meteorological product
☐ Ortho and LUT stretched
☐ Ortho image
☐ Others
☐ Phenological data
☐ Preview (small image for fast preview)
☐ Probability analysis
☐ Sea Level Anomaly (and msla)
☐ Sea Surface Temperature
☐ Vegetation indices
☐ Other

---

q62: coding

Please choose **only one** of the following:

☐ 8 bits
☐ 16 bits
☐ 24 bits
☐ 32 bits
☐ Other

---

q63: Resolutions (metre)

Please write your answer(s) here:

Resolution 1 (XS if relevant):

Resolution 2 (PAN if relevant):

Resolution 3:

---

q64: File format

Please choose **only one** of the following:

☐ product specific
☐ dimap
☐ tiff
☐ flat binary (BSQ/BIL/BIP)
☐ ESRI Grid
☐ NetCDF / HDF

☐ OpenDAP
☐ WxS (WMS/WCS)
☐ Other [_____]

H) Characteristics of acquired/generated products
Fill in this questionnaire for every type of aerial or satellite data acquired

* **q65: Projection**

Please choose **all** that apply:

☐ none
☐ Universal Transverse Mercator
☐ Geographic
☐ Lambert Azimuthal Equal Area
☐ National projection
☐ World wide projection
Other: [_____]

---

* **q66: Geographic coverage (where products are mainly located)**

Please choose **all** that apply:

☐ world
☐ EU25
☐ EU27
☐ Africa
☐ North America
☐ South America
☐ Asia
☐ Europe
☐ Oceania

---

q69: Intellectual Property Rights Get a copy of the license agreement

Please write your answer here:

[_____]

---

* **q70: Acquisition / Production cycle**

Please choose **all** that apply:
☐ incidental
☐ daily

- ☐ weekly
- ☐ decade (10 days)
- ☐ monthly
- ☐ seasonal (3 months)
- ☐ yearly
- ☐ 5-10 year

---

q71: For time series, enter a start date [YYYY-MM-DD]:

Please enter a date:

| / / |

---

* q72: Provider

Please choose **all** that apply:
- ☐ Action
- ☐ Image Framework Contract (FC)
- ☐ Other private company
- ☐ Academic / Research / Oasis
- ☐ European Space Agency cat1 (free access to data)
- ☐ European Space Agency cat2
- ☐ International organisation
- ☐ Eumetsat
- ☐ Joint Research Centre
- ☐ Charter
- ☐ EU satellite centre
- ☐ NASA / USGS / NOAA

Other: [   ]

---

q73: Delivery time
(for derived products purchased or generated by the action)

Please choose **all** that apply:
- ☐ Near Real Time
- ☐ 2-3 days
- ☐ 1-3 weeks
- ☐ one month
- ☐ more

---

* q74: Delivery media
(for derived products purchased or generated by the action)

Please choose **all** that apply:
- ☐ broadcast / DDS
- ☐ FTP
- ☐ cdrom / dvd
- ☐ web service

Other: [   ]

---

q75: Are you interested in an online delivery system in future?

Please choose **only one** of the following:
- ☐ Yes
- ☐ No

---

q76: About the current storage Indicate percentage of both

Please write your answer(s) here:

network storage: [   ]

other (CD, DVD, tapes, local HD):
[   ]

I) Source data used to generate the product

* q77: Sensor name

Please choose **all** that apply:

- ☐ ads40
- ☐ aerial analog photography
- ☐ alos
- ☐ aster
- ☐ Cartosat-1
- ☐ dmc
- ☐ ENVISAT AATSR
- ☐ ENVISAT ASAR
- ☐ ENVISAT GOMOS
- ☐ ENVISAT MERIS full res
- ☐ ENVISAT MERIS low res
- ☐ ENVISAT MIPAS
- ☐ ENVISAT MWR
- ☐ ENVISAT RA-2
- ☐ ENVISAT SCIAMACHY
- ☐ eros A
- ☐ eros B
- ☐ ERS 1,2 ATSR
- ☐ ERS 1,2 GOME
- ☐ ERS 1,2 MWR
- ☐ ERS 1,2 RA
- ☐ ERS 1,2 SAR
- ☐ ERS 1,2 WS
- ☐ formosat-2
- ☐ grace
- ☐ ikonos
- ☐ IRS 1C/1D PAN/LISS
- ☐ IRS 1C/1D WIFS
- ☐ IRS P6 AWIFS (ResourceSat-1)
- ☐ IRS P6 PAN/LISS (ResourceSat-1)
- ☐ jason
- ☐ JERS-1
- ☐ kompsat-2
- ☐ landsat
- ☐ Meteosat 1st generation
- ☐ Meteosat 2nd generation
- ☐ MetOp AMSU-A
- ☐ MetOp ASCAT
- ☐ MetOp AVHRR
- ☐ MetOp GOME
- ☐ MetOp GRAS
- ☐ MetOp HIRS
- ☐ MetOp IASI

☐ MetOp MHS
☐ MetOp SEM
☐ modis terra/acqua
☐ Nimbus-7 CZCS
☐ NOAA AMSU
☐ NOAA AVHRR
☐ NOAA HIRS
☐ NOAA SARP-2
☐ NOAA SBUV
☐ Orbview-2 Seawifs
☐ orbview-3
☐ proba
☐ quickbird
☐ QuickSCAT
☐ radarsat-1,2
☐ Scisat-1 ACE
☐ SEM-2
☐ spot 5
☐ spot 5 supermode
☐ spot vegetation
☐ spot-1,2,4
☐ topex-poseidon
☐ ultracam
Other: [   ]

q78: Source data providers /
Derived products provider

Please choose **all** that apply:

☐ Action
☐ Contractor
☐ Image Framework Contract (FC)
☐ Other private company
☐ Academic / Research / Oasis
☐ European Space Agency cat1 (free access to data)
☐ European Space Agency cat2
☐ International organisation
☐ Eumetsat
☐ Joint Research Centre
☐ Charter
☐ EU satellite centre
☐ NASA / USGS / NOAA
Other: [   ]

Submit Your Survey.
Thank you for completing this survey. Please fax your completed survey to: +39 0332 78 51 62.

CID storage and dissemination

CID survey Part IV: Storage and dissemination

J) Storage issues

* q80: JRC action number as available from SKM

| http://skm.jrc.it |

Please write your answer here:

---

q81: Current size of the archive (GB)

Please write your answer here:

---

q83: Foreseen data volume (GB) in:

Please write your answer(s) here:

2006:

2007:

2008:

---

q84: Storage media used

Please choose **all** that apply:

☐ CD/DVD

☐ NAS/SAN

☐ regular HD

Other:

---

q85: Size of disk storage currently in place (GB)

Please write your answer here:

---

q86: Manufacturer and type of storage

Please write your answer here:

---

q87: Network on which the storage (if any) is located

Please choose **all** that apply:

☐ internal

☐ DMZ

☐ external

---

q88: Backup frequency

Please choose **only one** of the following:

☐ never

☐ daily

☐ weekly

☐ monthly

☐ occasionally

q89: Backup device

Please choose **all** that apply:

☐ none
☐ regular HD
☐ NAS/SAN
☐ tape
☐ DVD

K) metadata

q90: Availability

Please choose **only one** of the following:

☐ none
☐ systematic
☐ not systematic

q91: Standard followed (name, reference)

Please write your answer here:

q92: Get some sample metadata files if available

q93: metadata storage

Please choose **all** that apply:

☐ database
☐ excel
☐ filesystem (1 file/image)
☐ paper
Other:

q94: Is there an online search capability available?

Please choose **only one** of the following:

☐ yes
☐ no, not needed
☐ no, would be useful

L) users

q95: users

Please choose **all** that apply:

☐ action
☐ unit
☐ institute
☐ JRC
☐ EC
☐ international organisation
☐ National Administrations
☐ academic, research organisations
☐ private sector
Other:

q96: current means of dissemination

Please choose **all** that apply:

☐ Web Coverage Service

☐ Web Mapping Service

☐ FTP

☐ CD/DVD

☐ OpenDAP

☐ Filesystem (netbios/NFS)

Other: [＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿]

---

q97: future means of dissemination wished

Please choose **all** that apply:

☐ Web Coverage Service

☐ Web Mapping Service

☐ FTP

☐ CD/DVD

☐ OpenDAP

☐ Filesystem (netbios/NFS)

☐ Happy with current status

Other: [＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿]

---

q98: user access policy

Please choose **all** that apply:

☐ restriction based on the distribution mean (WxS, CD...)

☐ restriction based on the geographic area

☐ restriction based on the resolution

☐ no restriction (public access to data in any format)

Other: [＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿]

M) Miscellaneous

q99: Future needs in services

Please choose **all** that apply:

☐ Catalogue service (data identification and preview)

☐ Image acquisition service (planning, purchase)

☐ Image acquisition coordination between different programmes

☐ Helpdesk (on CID, on satellite sensors)

☐ centralized storage facility

Other: [＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿]

---

q100: Do you have plans for using networks for data transfer which could impact the requirements to network infrastructure on campus or externally (ref. GEANT)?

Please write your answer here:

---

q102: General comments or observations

Please write your answer here:

Submit Your Survey.
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European Commission

EUR 22768 EN – DG Joint Research Centre, Institute for the protection and the Security of the Citizens

Title: CID Survey Report

Authors: Pär-Johan Åstrand, Armin Burger, Paul Hasenohr, Per Loekkemyhr

Luxembourg: Office for Official Publications of the European Communities

2007 – 114 pp. – 21 x 29 cm

Abstract

The Agriculture and Fisheries Unit (IPSC) together with the Informatics, Networks and Library Unit (ISD) has performed this inventory called the Community Image Data portal Survey (the CID Survey); 20 Actions from 4 different Institutes (ISD, IPSC, IES, and IHCP) were interviewed.

The objectives of the survey were to make an inventory of existing satellite data and future requirements; to obtain an overview of how data is acquired, used and stored; to quantify human and financial resources engaged in this process; to quantify storage needs and to query the staff involved in image acquisition and management on their needs and ideas for improvements in view of defining a single JRC portal through which imaging requests could be addressed.

The global expenditure on satellite remote sensing data through the JRC in 2006 was 7.2 M€. This fits within the ceilings placed for the 14 Image Framework Contracts (FCs) currently in place at a yearly 8.8 M Euro (35 M€ over 4 years). The annual human resources used for data acquisition management at JRC are 6 person-years, and the annual human resources used for image data management (excluding resources for data processing) are 9 person-years. This means that at the JRC an annual 15 person-years total are placed on image acquisition and data management.

Within the JRC there are (including 2006) more than 700 000 low resolution (LR) and 50 000 medium resolution (MR) images, with time series as far back as 1981 for the LR data. There are more than 10 000 high resolution (HR) images and over 500 000 km2 of very high resolution (VHR) images. For the LR and MR data, cyclic global or continental coverage dominates, while the majority of HR and VHR data is acquired over Europe. The expected data purchase in the future (2007, 2008) known which enables good planning. Most purchases of VHR and HR data are made using the established FCs with common licensing terms. Otherwise multiple types of licensing govern data usage which emphasizes the need for CID to establish adequate means of data access.

The total amount of image data stored (2006 inclusive) is 55 TB, with an expected increase of 80% in 2 years. Most of the image data is stored on internal network storage inside the corporate network which implies that the data is accessible from JRC, but difficulties arise when access is to be made by external users via Internet. In principle current storage capacity in the JRC could be enough, but available space is fragmented between Actions which therefore implies that a deficit in storage could arise. One solution to this issue is the sharing of a central storage service. Data reception is dominated by FTP data transfer which therefore requires reliable and fast Internet transfer bandwidth. High total volume for backup requires thorough definition of backup strategy.

The user groups at JRC are heterogeneous which places requirements on CID to provide flexible authentication mechanisms. There is a requirement for a detailed analysis of all metadata standards needed for reference in a catalogue. There is a priority interest for such Catalogue Service and also for a centralized storage. The services to implement for data hosted on central storage should be WCS, WMS, file system access.

During the analysis of the results mentioned above, some major areas could be identified as a base for common services to be provided to interested Actions, such as: provision of a centralized data storage facility with file serving functionality including authentication service, image catalogue services, data visualization and dissemination services. Specialized data services that require highly customized functionality with respect to certain properties of the different image types will usually remain the sole responsibility of the individual Actions. An orthorectification service for semi-automated orthorectification of HR and VHR data will be provided to certain Actions.

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The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.