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Monitoring and Evaluation of IACS implementation for the identification of agricultural parcels in Member States of the EU

Base document 2: synthesis of technical alternatives

(working draft)

Contents

Summary

A major aspect of EAGGF's responsibility in the reform of the Common Agricultural Policy is the monitoring of the establishment of an integrated administrative control system - IACS - in the Member States. In order to achieve this effectively, a suitable framework must be devised. This document, intended for internal circulation, is an attempt to support this process.

The framework will consist of three elements:

- a method for the analytical examination of the system (see *Base Document 1: definition of project management objectives and methods*)
- a technical interpretation of the regulations (results anticipated from the SIPGEM study; some contribution also to be made by DGVI including this document, currently in progress)
- dialogues with the Member State administrations; the results of these dialogues will be a series of quarterly reports summarising the technical progress in each Member State.

The implementation of the integrated system by the deadline of 1996 will demand a disciplined approach to the planning, development and execution of realistic strategies by the Member States. In order to ensure the success of this phase, the EAGGF needs to have in place a clear range of options that are considered appropriate.

The main strategies presented can be considered as:

- based upon a cadastre
- based upon geographical entities
- based upon an inventory of geographical entities (hybrid system)

In this document, a broad functional analysis of the system as a whole is made, in order to clearly identify the global issues faced in the development of the system. The principle objectives are detailed, along with functional requirements considered essential to the effective operation of the system. It is considered that these would form the basis of the eventual technical evaluation of the system, as well as acting as indicators for Member States in the meantime.

The main considerations for data management are also discussed. Attention is focused on the implementation of suitable internal control mechanisms, in order to ensure high standards of quality control. The basic management issues concerning of alphanumeric data, geographic data, and historical data are discussed, including use of the main database for an analysis of risk, in order to identify a sample control subset. Ways of speeding up data entry - using, for example, data entry programs supplied to holdings with computers - are presented.

The final section deals with the control and verification of applications using this control dataset. Only an over-view of the control by remote sensing is discussed; these issues are presented in reports elsewhere by VI-G-4. A three-tier approach for the carrying out of field checks is presented, in order to reduce on-the-spot check costs.

1. Introduction

1.1 Background to this document

This document is the second in a series providing a framework for the monitoring and evaluation of the IACS implementation in the twelve Member States. Following the project management framework presented in the first document[1], this report covers the technical alternatives available for components of the integrated system.

1.2 Intended audience

This document is intended primarily for internal use in DGVI-G-4, although may lead to the production of documents informing Member State administrations of the general issues to be addressed in the period leading up to full implementation of the IACS[2]. It is intended as an internal aid to the communication process between the Commission and the Member States, by clarifying the EAGGF's position on a number of technical issues, including the acceptable technical solutions to the diverse range of problems presented by the IACS.

1.3 Aim of this document

Due to the complexity of the system to be developed, as well as the range of technical solutions available, it is difficult - and inadvisable - at this stage to establish a model integrated system to be implemented by the Member States. Instead, the range of options available for each sub-system should be examined and considered in the context of each Member State. The options will be compared to the plans and activities of each Member State, in a series of analyses leading up to the missions to be carried out in the next few months.

This document provides an overview of the options available, beginning with an analysis of the functionality expected of the system and the main strategies that could be adopted (§2); Section 3 looks in more detail at aspects of data management, for both α-numeric and geographic-object based systems. Section 4 considers the special requirements for data management related to the control in the field and by remote sensing.

In this manner the document does not attempt to outline one or more models for an ideal integrated system, nor does it place *a priori* solutions which are expected to be used by the Member States. Instead, it attempts to outline a path by which a system can be objectively and successfully implemented.

This document is a draft version intended to finalise the definition of the technical options available. Note should be made that the technical options refer to the creation of a parcel management and control system, and that no special detailed reference has been made with respect to the animal applications management.

[1] Base document: *Definition of project management objectives and methods*

[2] To be explored, in greater detail, in the report issuing from the SIPGEM study.

2. General Strategy

In this section, the basic functional requirements of the system are outlined (Section 2.1). Issues of distributing the processing load within a Member State are discussed and questions of regionalisation and centralisation raised (Section 2.2 and 2.3). Section 2.4 provides an overview of the three main stratgeies available to the Member State administrations. This basic analysis of the general functions of the integrated system is intended to act as a guide to the more detailed future analysis, country by country, which will occupy the EAGGF over the period up to 1996.

2.1. Functional requirements of the integrated system

A generalised scheme of the integrated system is presented as Figure 2.1. With reference to Regulation 3508/92, Art. 2, it can be seen that the systems comprises:

i. computerised databases (on-line, off-line archives, payment systems, form printing systems)
ii. an α-numeric system for the identification of agricultural parcels (cadastral data, GIS, satellite images, aerial photos etc)
iii. an α-numeric system for the identification of animals (not treated here)
iv. aid applications (pre-printed forms, cadastral parcel information)
v. an integrated control system (RS control, cross-checks in α-numeric database, sanctions calculations)

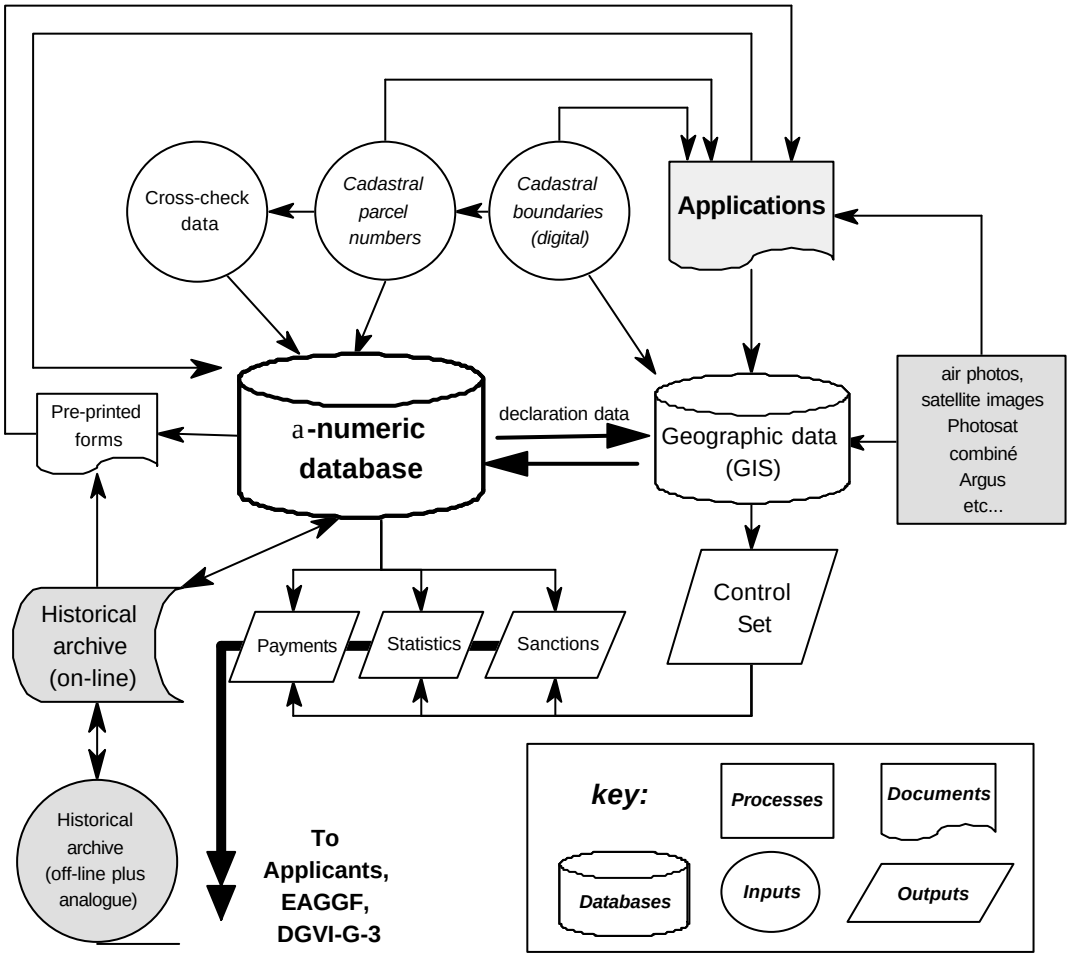

Figure 3.1: Generalised IACS scheme

Not all links shown in the diagram are necessary; this depends upon the inclusion of certain components in the system. The α-numeric database is the central component, around which all other parts of the system are expected to hinge. Note that the sub-systems (i to v above) have overlaps; they are often not fully independent of each other. This has important implications for the project development, since it becomes more difficult to break the system down into sub-projects. Sub-project management must be well coordinated for the final system to work effectively.

2.1.1. Generalised functional requirements

It is important for the EAGGF to ensure that the eventual system strategy chosen by a Member State will be capable of meeting the requirements laid out in the regulations. For this reason the system will be compared with a series of criteria considered essential for the effective operation of the system. At this point, it is worth clarifying three principle features of the system:

- it should be able to ensure a high standard of data quality
- it should be easy to manage and maintain
- that the control mechanism itself is a function of the system integrity.

A preliminary list of criteria that will be examined, bearing in mind these features, is given as follows:

Completeness, accuracy

- interconnects (integrates) spatial data (agricultural parcels) and attribute data (use, area) required for EAGGF claims
- geodetic precision, for area calculation to 1/100th of a hectare
- up-to-date, and continually maintained
- exhaustive/non-overlapping coverage desirable, to uniquely identify land parcels

Suitability

- allows close (preferably perfect) identification of agricultural parcel (geographical boundaries, or identification key such as cadastral parcel number)
- recorded area corresponds to the cultivated area
- load placed upon farmers is limited to an acceptable investment
- system is "sustainable", ie will not require significant financial or technical input, or restructuring, for an acceptable lifetime.

Parcel identification/numbering system, maintenance process

- revision cycle, cost, length
- farmers' access, simplicity
- should preferably allow independent up-dating of parcel numbering system
- high proportion of control for the national EAGGF administration (ie reduced dependency on other bodies)

Utility, effectiveness

- can be used effectively for administrative global control checks (double declaration etc)
- processing load is acceptable
- amalgamation of statistics at national level, regional cross-checks
- historical checks (set-aside rotation)

Implementation

- use of appropriate (informatic) tools
- correct balance of regionalisation/centralisation achieved
- integration with field checking procedure
- degree of synergy with remote sensing control techniques
- data access, security
- budget control

It will be useful for Member States to be aware of these principles and criteria during the period of system development. The more important issues are discussed in §§2.1.2 to 2.1.5 below.

2.1.2. Completeness, accuracy

The quality of the data (completeness, timeliness, accuracy, precision) entered in the system is of great importance in determining the overall system performance. The integration between the spatial data - in the form of raw geographic references or intermediate cadastral references - should be very close, if attribute data is to be accurately matched and processed. A high level of quality control will reduce the requirement of control and correction as determined by a sample dataset, typically carried out as detailed manual verifications or so-called "desk-checks".

Concerning the geodetic precision of the data, the precision required by the regulations is set at 1/100th of a hectare for the area. Boundaries are expected to be identified to a precision of around 1m (depending upon parcel size), although this is not specified in the regulations. For cadastral systems, the numbering scheme should be based on an exhaustive or non-overlapping system, allowing the unique identification of land parcels.

While it is recognised that it is the responsibility of the **individual** farmer or farm manager to furnish data of sufficient quality, it is considered by the EAGGF that it is the responsibility of the administrations to ensure that the farmer is able to collate this information without undue difficulty. The cost to the farmer, in terms of time and resources required, of providing good information must be balanced against the direct benefit in return. It is, therefore, imperative that suitable technical support is in place for farmers, even if this service is to be purchased by them.

In ensuring, therefore, that the highest level of data integrity is maintained in the system, and that farmers are assisted in their provision of correct, accurate and reliable data, the dependence upon sample check controls as a deterrent measure is reduced.

2.1.3. Suitability, and parcel identification system (PIS)

The effectiveness of the system will hinge upon the appropriateness of the system used to identify the **agricultural parcel** (see reg. 3508/92 Art 1 para 4). A number of alternatives exist (see §2.4 below); the eventual solution will depend upon the geographical data sources available (maps, cadastre) and the parcel structure in the member state concerned. Although a direct record of the parcel is not required, if an intermediary record is used (eg a cadastre) then it should be verified that this support is suitable for the identification of parcels, and that this link will be maintained in the foreseeable future.

The maintenance of the numbering system will also be critical for the efficient working of the integrated system. In order to reduce declaration errors, the numbering scheme should reflect changes - creation, elimination, or modification of parcels - as quickly as possible. This revision process should be accessible to farmers, so that they are encouraged to participate in keeping the numbering system up to date. Although such numbering schemes often have multi-users (eg, a cadastral numbering system), a high proportion of control is desirable for the IACS administration, in order to reduce dependency on other bodies and to avoid the integrated system being given low priority concerning up-dating etc.

2.1.4 Utility

The EAGGF is keen to ensure the highest level of internal checks on data. Examples of such quality control processes, to be carried out on the **full** dataset wherever possible, are:

- plausibility check for declaration (existence of farmer/enterprise, etc)
- existence of parcel declared
- check for parcel areas declared against a secondary data source
- internal checks for duplicate parcel declarations
- objective scheme check (areas declared for each crop group meet regulations)
- objective calculation of sanctions or penalties
- pre-printing of declaration forms for subsequent years (not a check, but assists quality control)

It is envisaged that **all** these controls should be capable of being implemented in the IACS α-numeric database, and executed automatically. Some of these controls would take place on a centralised "super" database (§2.3). However, database design should ensure that the processing load is practicable, and may have to incorporate concepts of distributed processing as discussed in §2.2.

2.1.5 Implementation

The system is expected to make use of the most appropriate information management techniques generally available to the Member States, for all aspects of operation:

- applications (pre-printed forms, computer supported declarations (CSD))
- data transfer (electronic data transfer, local and wide area networking)
- data processing (automated checks with other digital databases)

Integration with field checking procedures is of great importance; the database should be used to analyse the risk associated with each application. There should also be close links between the main database and the GIS used for the control by remote sensing; this may include the transfer of digital cadastre boundaries, as well as the attribute data associated with each parcel.

Access to data needs to be restricted in appropriate ways, to ensure that data is not modified without authorisation after entry, and to ensure confidientiality in compliance with European regulations concerning data privacy.

Finally, the type of implementation should realistically reflect the budgetary constraints imposed by the Commission and the Member States. This will demand pragmatic approaches, combined with an effective management strategy.

2.2. Distribution of processing issues (regionalisation)

2.2.1. Regional requirements, existing administrative structures

In many Member States, existing administrative structures will impose upon the structure of the integrated system. Member States where a degree of autonomous regional administration is expected are: Spain, Germany, the United Kingdom.

In most cases, this regionalisation will complement the strategy; the Member States listed above have large numbers of potential applicants and millions of parcels to control. Indeed, a degree of decentralisation should be considered by all Member States in order to distribute processing workloads. However, the different regional administrations must be carefully coordinated for the integrated system to work. The Commission will look, therefore, at the cooperative work that takes place between the regional administrations. Such topics which may be examined are:

technical criteria:

- formats of application forms
- explanation booklets
- database structures
- uniform application of regulations, control tolerances etc

administrative criteria:

- report structures
- frequency of national meetings
- frequency of central administration visits to regions
- bi-regional exchanges (sharing of systems development, solutions, etc)

2.2.2. Maintaining regional centres

Many parts of the data processing path are best handled in regional centres. These could be:

- data collection
- information dissemination
- data entry
- data correction (returned forms etc)

Many checks are most easily carried out at local level; for example, using a hierarchical structure for numbering could ensure that i) parcels declared all fall in the legitimate parish for that catchment area, and ii) all parcels inside that parish are checked for double declaration. However, this demands a certain degree of decentralised processing capability (e.g. a PC-based local system) or access to a central server over a wide area network (WAN).

2.3. Homogeneity and coherency issues (centralisation)

2.3.1. Effective administrative checks, database

There are, however, significant checks that are best carried out at a national level. This is to ensure that declarations straddling several administrative regions (for example) are able to be verified together.

For this reason, it is a specific requirement of the regulations that any decentralised databases created by an administration (or sub-divisions thereof) shall be conceived in a homogeneous manner, and be compatible between each other (3508/92 Art 3, para 2). Compliance with this regulation is considered to be of great importance. However, cross-database compatibility should not be confused with the an overall homogeneous systems application. It is not the aim of the EAGGF to force identical implementation of the system across all regions. Instead, it is only necessary that the data collected and processed should be interchangeable, and the regulations applied in consistent manner. In this respect, system strategies should be *coherent* between regions, if not identical.

2.3.2. Production of national statistics

The national administrations are required to report statistics concerning areas applied for under the CAP in the last quarter of each year. In order to achieve this, the integrated system must be able to collate the data managed in each regional centre, and ensure that the basis of calculation follows the same procedure. This is a second reason for compliance with regulation 3508/92 Art 3, para 2, and the ability of the Member State to produce reliable statistics in the time-frame available will be examined by the EAGGF.

2.4. Main strategies for developing the integrated system

It is apparent that only a certain number of choices are available to the Member States in developing their systems. These can be summarised as:

- systems based upon cadastral inventories, using alphanumeric databases (such as in Bayern, Germany)
- systems based upon geographic entities using a GIS approach (such as in Belgium)
- hybrid systems, where geographic entities are inventoried (such as in England, UK)

Each of these systems tracks land usage in a different way. In regulation 3508/92, Art. 1 para. 4, the spatial unit required to be tracked is the **agricultural parcel**, interpreted as a continuous portion of

land, cultivated as a single crop by a single farmer/holding. In reality, few administration systems[3] already contain reference(s) to this unit. The three alternatives above all present ways of linking the reality in the field to a remote management system, in some cases using intermediary spatial definitions, such as a fiscal cadastre.

2.4.1. Cadastre-based systems

A cadastre-based system uses an existing fiscal or property cadastre as the basis for parcel identification. A cadastre contains a description of the **geographical characteristics** of the **cadastral parcel**[4]; usually this is presented as a plan, of large scale (1:500 to 1:5,000 is common) Each parcel is numbered, usually with a hierarchical system allowing the geographical localisation of the parcel (for example, province, commune, plan). Complete, up-to-date, accurate cadastres have great utility - but only if they are each of these things. An out-of-date cadastre has little use; if a parcel has been split or two parcels merged, it must be reflected in the cadastre. It is only by being assured of the quality of the geographical data management that it is possible to pass to the abstract - but highly practicable - concept of using numbers to manage parcels.

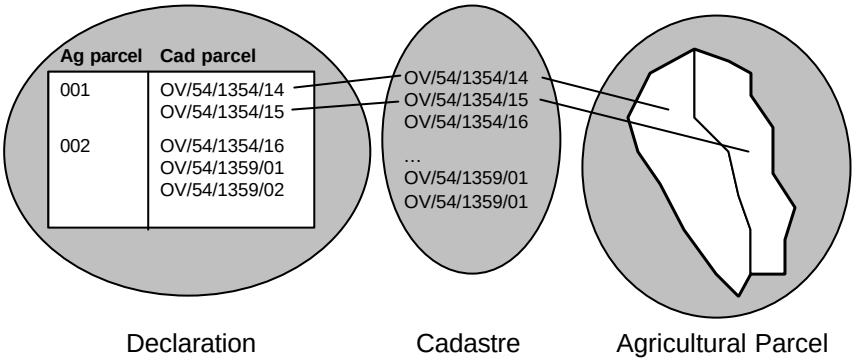

Figure 2.2: Use of cadastral database as an intermediary reference for the agricultural parcel

It is of great importance to note that a cadastre is merely an effective and useful tool for dealing with geographic data. The actual use by an administration of the cadastral α-numeric database does not eliminate the need to recognise that the fundemental data type being treated is geographic; it is just more useful to deal with the cadastre than with parcel boundary definitions. For this approach to work, however, the links between the agricultural parcel and the cadastral register must be excellent (manageable), and they must be maintainable[5]. Given that the cadastre is a record of geographic entities (parcels, classified by one attribute or another), this maintenance process is a classic **geographic data** management problem. Therefore, even if an administration chooses to use an existing cadastre as the basis for its integrated system, the maintenance of this geographic database is of hyper-critical importance to the continued effectiveness of the system as a whole. The fact that this maintenance task is usually executed by a external body, whose funding sources are often not linked to those of the IACS administration, only serves to enhance the sensitivity of this issue.

2.4.2. Systems based on geographic entities

A second approach is to confront the management of the agricultural parcel characteristics directly, by capturing, editing, and maintaining a database of **geographic data**. In its favour, this method limits some of the assumptions external to the cadastre-based approach; a direct relation between the database and reality can be applied (a cadastre acts as an intermediate relation). However, the main reason for the existence of cadastres should not be forgotten: the management of large amounts of geographic data -

[3] Other than those already existing on the holding - farmers are well used to this management unit.

[4] Which may bear little or no resemblence to the agricultural parcel.

[5] It is unlikely that the administration responsible for the IACS will execute this management; cadastres are generally multi-purpose, and have several users.

either digital or analogue - imposes extreme overheads by comparison with the α-numeric cadastre database.

A geographic database will store a description of the agricultural parcel directly, most probably as a **vector** description or a list of coordinates decribing the boundary. This storage could take place on paper, in the form of a map, but is more likely now to be stored in digital format. A digital mapping system is able to manage and manipulate such data on a computer.

When the parcel has information associated with it - **attribute data** - the software used to manage this ensemble of information is called a Geographic Information System, or GIS. The attribute date could be a parcel number specific to IACS, the owner's name, the area, the crop cultivated, or any other permanent or temporary feature of that parcel.

Digital data management makes possible spatial data analysis that would be impracticable using analogue (paper-based) systems. New technology, in particular GIS and digital mapping software, has increased the potential for the management of large geographic databases. For example, it can be verified that parcels do not overlap, or that they fall inside particular administrative zones (yields zones, for example). While these analyses can be executed automatically, they still impose serious overheads on computer time, since the geographic data processing is far more complicated than α-numeric data processing.

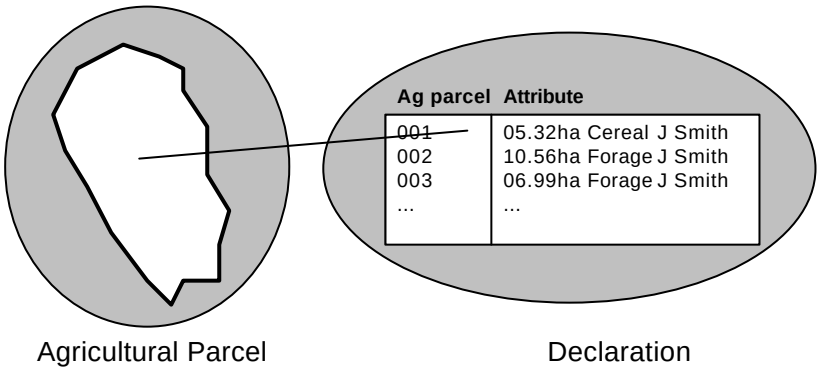

Figure 2.3: Use of a geographic database for parcel information management

The task of implementing a national parcel management system remains enormous, and the investment required can only be realistically envisaged when shared between several users. National mapping agencies and cadastral services in Europe have already begun to manage geographic data in this way. For the IACS administrations to do so can only be, at this stage, termed ambitious, but in some cases few viable alternatives may exist - the existing map base or cadastre may present more problems.

A further argument for facing up to this approach is that the IACS administrations will inevitably have to face large scale geographic data management problems. A primary case in point is the control by remote sensing of parcel declarations. The mainstream method used for this is to overlay satellite imagery with vector descriptions of parcel boundaries. While a digital cadastre could be used as the data source for this process, this action raises a number of important questions:

- what is the best way to collect the geographic data? Do all farmers have to refer to maps?
- when an error in the geographic data is found, is the correction fed back into the cadastral database?
- if 5% of the applications are to be treated each year in this way, can we expect over a twenty year period that all parcels will be digitised once? Is this not already a significant job?
- by the same reckoning, in any five year period 25% of parcels will be captured and stored in digital form. Is it much more difficult to manage 100%?

The answers to these questions are not immediately obvious, and much experience will be gained in the course of implementing the integrated system.

2.4.3. Hybrid systems

A number of variants on the two "pure" methods presented above are under development in member states. These can be loosely classified as "geographic inventories", where geographic entities are registered in a multi-purpose database[6].

A suitable example of such a system is the basic parcel identification system chosen in the UK (there are in fact several systems used, to cope with differing map resources and parcel structures). For areas mapped at 1:2,500 scale in the UK, all geographical parcels - ie units of land surrounded by physically identifiable limts, such as walls, hedges, roads - are numbered and given an area, in hectares. The numbering system - based upon the mapsheet number and a four figure grid reference for the parcel centroid - gives a unique number for every field. There is (supposedly) a high correspondence between the mapped and cultivated parcels, and therefore the system is considered to be very practical.

The system can be termed "hybrid" since it possesses some of the features of both a cadastre and a geographic database. It can also, however, present disadvantages from both systems. For example, the numbering system is not necessarily exhaustive, as in a cadastre based system; the existence of a number does not eliminate the possibility of overlaps without the careful control of the authorisation of modifications, which must be done by the national mapping agency. For re-numbering to be effective, the mapping agency responsible must be able to react quickly, to transmit information from local offices to national level. And while the identification of more permanent parcels is useful, a direct link with the agricultural parcel is not made, as in a GIS approach.

In the Netherlands, it is proposed that a similar scheme will be set up which will number permanent parcels, allowing farmers to make *ilôt* type declarations within them. Ireland also has plans to scan topographic maps and produce a parcel inventory, but at this stage it is less clear exactly how they will achieve this.

Table 2.1 below summarises the main three strategies to be used in the IACS implementations. Example logical framework matrices for each of these components (creation of a geographical database, use of cadastral data) are then presented in Tables 2.2, 2.3 and 2.4.

[6]Note that a classic cadastre need not be a register of geographic entities; the limits of a parcel defining ownership need have no physical form, such as a fence, wall etc - only the coordinates of the parcel are recorded.

Table 2.1: Summary of the options available

System type / ***Feature***	**Cadastral inventory based**	**Geographic entity based**	**Geographic inventories**
Resources required	Existing α-numeric cadastre Effective cadastral up-dating mechnism Administration must possess aptitude to adapt cadastre for IACS	Availability of mapping materials, or RS data (aerial photos, satellite images) For GIS, considerable input of sophisticated IT material	Pre-numbered geographic objects, on map base α-numeric listing of parcel numbers
Workload[7]	High for farmer Low computer processing overheads	High for administration Requires technical expertise to fully implement (GIS) Digitial declaration would be easier for farmers[8]	Can be low for Administration Can be high for farmer New numbers could be generated (eventually) by digital implementation
Advantages	Can be very quick to implement Exhaustive coverage Early work is seen as investment for later 100% cross checks very rigorous Stable system, in some cases	Geographic form of declaration support (overlays on airphotos etc) seems clear to farmers In areas where no cadastre exists, no other option Probably all admini-strations must deal with geographic data (control etc) - this approach means better integration	Stable system Can be exhaustive coverage, in some cases Makes good use of existing resources Easy to understand Parcels easy to locate Integration with geographic data is relatively simple
Disadvantages	High initial workload for farmers Dependence upon external bodies for maintenance of cadastre Integration with geographic data (eg control by RS) is limited	Difficult to carry out spatial checks, due to high computing overheads Non-exhaustive coverage Demands "state of art" GIS techniques	Numbering scheme not flexible - administration cannot create new numbers easily Numbers must be available on maps - otherwise best created from digital geographic database
Implemented in	I, F, E, P, D, Dk, L	B, G(?), P	UK, NL, Ire

[7] Workload refers to parcel numbering management; takes into account updating system for new/modified parcels.

[8] Currently under trial in some Member States.

3. Data management

In this section, the main considerations for the management of data will be presented. Two forms of system are expected to be used by all Member States; these will handle α-numeric data and geographic data. The weight of these two systems in each Member State will be dependent upon the overall strategy chosen (see § 2 above). However, it should be noted that all systems are expected to have to incorporate the handling of geographic data, probably using some kind of Geographic Information System (GIS)[9].

Section 3.1 will deal with the main aspects of α-numeric data management, applicable in all circumstances. Many of the points raised are also relevant to the workings of a geographic data management system, discussed in more detail in § 3.2. Both sections look to the possibilities of increasing automisation of data entry by using informatic support for declarations.

Section 3.3 examines the requirements of historical data archiving, and discusses the difficulties likely to be faced in developing an operational system that requires systematic checks upon previous declarations. § 3.4 outlines the need for the use of the existing database (alphanumeric, geographic, historical) to conduct an analysis of risk for the selection of a control sample set (the use of which is discussed in § 4 below).

3.1. Alphanumeric data management

It is stipulated in the regulations that a component of the integrated system in each Member State will be a computerised database (3508/92 Art 2, para a), incorporating an α-numeric parcel identification system (PIS)[10]. The main reasons for this use of computerised technology are:

- the large amount of data to be handled, in a short period of time
- the need to have objective procedures for treating data (calculating sanctions etc)
- the need for automation of many procedures (e.g. pre-printing forms for consecutive years)
- the connection to other existing databases as required (e.g. cadastral, fiscal, other claim schemes)

There are no defined structures for implementing the database. Within the scope of the regulations, the Member States are at liberty to define appropriate informatic approaches to handle the data collected. It is anticipated (Mar 1994) that most administrations will have commissioned analytical studies, to be conducted by external consultants or internal informatics divisions of the administrations, to outline a strategy for development. These studies are of interest to the EAGGF, since they can present the path chosen by the administration in a clear and concise manner. For this reason, copies will be requested by the Commission when available.

The alphanumeric part of the integrated system will be based upon a numbering system, whereby every applicant and parcel can be uniquely identified. While this numbering system is an essential development for any kind of system, for a configuration that uses an external geographical register (such as one based upon a cadastre or land register) the number in the integrated system database may be the one used in the register. This will allow the carrying out of a number of checks as described in section 3.1.3. Note that the numbering system must be carefully designed to ensure that duplicates of numbers do not exist and that maintenance of the register can be achieved easily.

[9] Note that a GIS always incorporates an alphanumeric database for attribute data storage.

[10] All references to databases in this report assume some level of IT/Informatics support, unless otherwise specified.

The fundamental tasks required to be managed by the system are: handling of applications, including computer supported declaration (CSD) systems; administrative controls; calculation of payments or sanctions. These are dealt with in sections 3.1.1 to 3.1.6 below.

3.1.1. System integrity; objectiveness of implementation

It is a fundamental requirement that the system operates in an objective and integral manner. It is expected that manual intervention will be kept to a minimum; that access to the system is restricted and the data secure; and that changes or choices made after operator intervention are recorded and logged automatically, so as to ensure a line of responsibility. It is expected that certain tasks, such as payments and sanctions calculations, are executed automatically, so as to ensure a clear and objective procedure.

Administrations are expected to be rigorous in their protection of the data, including the prevention of unauthorised distribution of personal records. Sufficient security mechanisms should be built into the system; particular attention should be paid to questions of accessibility to or from remote stations over wide area networks.

These requirements are all in line with ensuring the overall integrity of the system. A good database design will account for many of these principles and the implementation of such a system should not present a problem to experienced developers.

3.1.2. Application handling requirements

Since every Member State has now made a start with some form of integrated system, the greatest requirement of the system for handling applications is the pre-printing of application forms for subsequent years. Important considerations in form design are therefore:

- simplicity
- replicability
- clarity
- ease of use; good instructions
- pre-filled with last year's data
- emphasis on reducing bureaucracy (e.g. needless repetition of account numbers, holding numbers etc on multiple pages)

Applications need to be handled effectively upon receipt by the administrations; the Commission expects that appropriate techniques for automating (or partly automating) the data entry process will be explored. As well as the pre-printing of forms, to allow farmers to declare only changes, such techniques could include: use of barcodes, character readers, provision of data entry applications for personal computers (discussed below, to be used directly by farm administrations).

3.1.3. Administrative controls; receipt of applications

Administrative controls are intended to check the "paper work"[11] accompanying an application. In all cases, and as stipulated in Reg. 3887/92 Art 4, para 1, an application is expected to be made up of:

- the identity of the applicant
- particulars permitting the identification of all agricultural parcels on the holding (for example, a list of cadastral parcels or a map)
- the area, use and aid scheme concerned for the agricultural parcels
- documents relating specifically to set-aside (indication of set-aside parcels, for reference to rotational patterns; in some cases maps locating all parcels)
- a (signed) statement by the applicant declaring knowledge of the requirements pertaining to the aids in question

[11] Trials using applications made using some kind of informatic support should be carried out in Belgium and Germany this year (1994).

Although the regulations do not specifically mention checks to be made on 100% of the data, some controls are intended to take place on large amounts of the data stored in the alphanumeric database. Reg 3887/92, Art 6, Para 2 notes that the administrative checks should include cross-checks on "parcels and animals declared in order to ensure that aid is not granted twice in respect of the same calendar year". This objective is, in principle, extended to cover other checks, included in 4.1.5 below, that are not technically complex to carry out on computerised alphanumeric databases.

3.1.3.1. Signature

The administrative procedure should check that the applicant has signed a copy of the application. One copy of the form should remain with the farmer, and show the receipt of the application by the administration.

The exchange of this document should be seen as contractual in nature; in this respect, administrations should not place unfair burden on farmers by not accepting liability in the case of lost forms or data. A mechanism should be enacted to ensure that applicants are notified of the receipt of forms; and farmers encouraged to submit applications before the deadline.

3.1.3.2. Pre-registration of the applicant

Schemes to enforce a certain degree of eligibility upon aid applications are acceptable, provided that it can be shown that these do not favour or disqualify particular groups of farmers. These schemes should be designed to allow the identification of attempts to circumvent certain aspects of the regulations, such as the splitting of holdings to avoid set-aside. The development of holdings registers and the use of other data sources to determine eligibility is to be encouraged

3.1.3.3. Documents present

The administrative check should ensure that all necessary documents are present, and that they are valid (correct map numbers etc). This should be conducted at a local level to ensure the rapid return of applications that are considered to be missing data.

3.1.4. Data entry and digital declaration support

A further consideration expected to be made is the assurance that data-entry is accurately accomplished. For manually entered data, the standard procedure of double entry is one possibility to ensure data integrity. This may also take the form of the entry of the main data (at parcel level), followed by an entry of summary data (at group-crop level), both sets of information being derived from the application form. The summary data entered is then compared with a summary set calculated from the parcel level data already entered.

An alternative approach is to return a (printed) copy of the declaration to the farmer for approval. In any case, administrations (or their contractors) should demonstrate the level of quality control implemented for this highly important aspect of the system's operation. In practice, this could present serious administrative bottle-necks, except perhaps in the use of computerised declarations (see below).

In some cases, the use of an informatic support - a database application, entry computer located at local level administrative headquarters - may be a feasible method of reducing data-entry work loads for regional administrations. Such a technique has the double advantage of increasing data reliability, by carrying out checks before the data enters the main database, and by possibly passing on the data entry load to the applicant. Declarations made with an informatic support can be done in two ways:

- by providing a small data entry application to the holding or enterprise, should a computer be available
- requesting the delivery of the declaration data in a pre-described file format (ASCII, database, spreadsheet etc.)

The first option is probably only practicable for regions which have farms already using computers for management (accounts, administration), which may allow the national administration to provide a computer database-type application in place of the standard paper form; the *land* of Mecklenburg-Vorpommern will probably be conducting a trial of this method in 1994. Farm managers already using computers are unlikely to consider the use of a database application as increasing their work load - much of their data may already be in digital form (although using it directly may be difficult). The second option is to be adopted in Belgium in 1994, where at least six associations are known to have optimisation programs for calculating applications; around 10,000 declarations are expected on diskette.

A further option may be critical for regions where the declaration process is complicated, perhaps because the geographical data support (maps, cadastral system) is weak; Belgium will also conduct a trial using PC's displaying scanned aerial photographs, upon which farmers will identify their fields, with assistance from technicians from the administration (see the discussion of geographic data below).

All the approaches above can help to reduce time spent by an administration in entering and checking data, since in both cases the data can be passed through an automatic preliminary check. This reduces the number of cases where an application is returned to a farmer for clarification of correction, often because of a small trivial detail and not because of any fraudulent act.

3.1.5. Cross checks on full dataset

3.1.5.1. Checking existence of parcels; cadastral and hybrid systems,

A preliminary administrative check should be made to evaluate the existence of each parcel against a record of registered parcel numbers. This can be carried out automatically using a digital database (which must be acquired from the national service responsible) recording the numbers. Member States will be expected to demonstrate that such checks will be possible before the 1996 use of the system.

3.1.5.2. Checking of cadastral areas

A further check expected to be carried out on all parcels is the verification of the declared area in a cadastral system. The simplest manner of carrying this out is to use a digital external database listing areas for each of the cadastral parcels, again to be maintained by the national service responsible. Member States will be expected to demonstrate that such checks will be possible before the 1996 use of the system.

3.1.5.3. Double declaration

One of the most critical checks expected to be carried out is the verification that no surface is subject to two applications for aid (reg. 3887/92, Art. 6, para. 2, concept established by reg. 3508/92, Art. 8, para 1, concerning the implementation of administrative checks). The exact manner in which this is to be achieved will vary according to the general strategy chosen, but effectively depends upon the geographical limits for any piece of land being defined either internally in the system (for example, where it is based on geographical entities, using a GIS, discussed below) or externally (as in the case of cadastral based alphanumeric systems).

The principle to be followed is that the identification of land parcels is exhaustive, whereby no two pieces of land can have the same reference (α-numeric or geographical). A check on parcels can be simple and effective, and is generally most easily implemented in a cadastral type system. However, it does depend upon the existence of an existing digital record of cadastral parcel numbers, which may have to be supplied - and maintained - by a service external to the administration responsible for the IACS, such as a topographic or cadastral institute. (For methods referring to geographic data alone, see Section 3.2.5 below)

3.1.6. Payment and sanctions calculations

The applications having been entered into the database, the system should be capable of producing reports on a variety of different aspects of the data. These reports can effectively be summed up as a

verification of the eligibility of the application (conformation with regulations), and the calculation of the payment due, or the sanction/penalty that should be applied, or other action to be taken (eg, control in the field). Both the Italian and the Belgian administrations have, to date, provided explanation of how such systems are applied in their data processing.

In effect, the requirement is for a modest expert-system to define action based upon the outcome of the analysis of each application. Due to the number of applications that must be handled, the minimum number of manual interactions is desirable. Any manual intervention must incorporate thorough tracking procedures, in order to ensure database integrity. Although the number of applications for which sanctions calculations are required is more limited, these too should be done automatically to ensure systematic treatment of declarations.

A final requirement is the printing of reports notifying applicants of the outcome of their application. Payments should be executed before the end of the calendar year in which the application is made.

3.2. Geographic data management

Geographic data is the information detailing the actual geographical limits of parcels, in this case stored in vector format. It is not a requirement of the regulations that digital data concerning the definition of parcel boundaries is handled. Instead, it is assumed that most administrations will implement systems that will work from a parcel numbering system and a land register. In some Member States (notably Belgium), where suitable land registers do not exist, it may be decided to develop an entire "agricultural PIS", including the management of geographic entities.

As in the case for alphanumeric databases, there are no defined structures for implementing the geographic database. Member States are at liberty to define appropriate informatic approaches, and it is anticipated that most administrations will commission analytical studies, to be conducted by external consultants or internal informatics divisions of the administrations, to outline a strategy for development.

However, all systems that use remote sensing for their control will also require geographical data management for at least a partial dataset. While only a few (non-cadastral) systems will require the input, storage, analysis and manipulation of these data for the entire set of declarations[12], most systems will need to generate and manage vector data for a subset. This subset of information, at present usually managed by a contractor in a proprietary system, must also link closely to the main database for full integration. Probable future requirements - yet to be clearly identified - will include the transfer of parcel numbers and boundary definitions (from the main database or a digital cadastre) to the control data subset (see Fig. 2.1 above).

The fundamental tasks required to be handled by the system are as for the alphanumeric database, and so only those particular to geographic data will be discussed below. These are: receipt and digitisation of map data; storage and processing of digitised map data; set-aside map data; administrative control of geographic objects (area calculations, overlap etc.). These are dealt with in sections 3.2.1 to 3.2.5.

3.2.1. Application handling requirements

As with α-numeric-based systems, the Commission is interested in seeing support systems that can operate at a local level, ie that can be used to conduct a plausibility check to verify an application before entry into the main database. These support systems should not be confused with the full implementation of a distributed GIS - only a small proportion of the functions of the full system would be required[13].

[12] Indeed it must be considered by the administration whether full data entry is essential.

[13] Conversely, a high degree of regionalisation may be a workable strategy with regards to the implementation of a geographic database.

In Section 4.1.4 above one strategy for allowing the entry by the applicant of α-numeric data in a database application is discussed. It is not anticipated by the Commission that similar approaches would be feasible with geographic data; instead, an alternative approach to handling applications is to make available an encoding station available to the applicant. One method being tested is to locate a PC in a community centre allowing data entry (as on trial in Belgium, including on-screen location of agricultural parcels on a photographic base). The main emphasis here, however, is the elimination of effort in digitising large volumes of parcel boundary data. It is also expected that administrations will carry out trials to establish the most efficient method of capturing boundaries sketched onto maps.

In extreme cases, an administration may argue that it is not necessary to capture all map data provided, instead carrying out checks on a sample dataset. This will render the most important administrative controls (area, duplicate declaration) completely inoperable. It is therefore considered that, despite the high work overhead associated with the capture and processing of geographic data, these checks should be carried out. Instead, it is up to the Member State administrations to devise a strategy making the best use of the resources at their disposal, which conforms to the regulations.

3.2.2. Receipt of map data, general

It is not mandatory for administrations to request *map* data localising agricultural parcels. Instead, the regulations (1765/92, Art 10, para 3; 3508/92, Art 4; 3887/92, Art 4) stipulate that *satisfactory* documentation must accompany the applications. For purely cadastral based systems, a list of valid parcel numbers may be sufficient (depending on the degree of parcel fragmentation).

However, in certain cases, it is considered by the Commission that the integrated system will have difficulty in functioning without maps. These are:

- where the system is based upon the registration of geographic entities (as in Belgium)
- where no unique numbering system is currently in place (Scotland, UK)
- where the parcel inventory system is likely to lead to an agricultural parcel being declared as a fragment (or collection of fragments) of the base parcel (some areas in Spain, Italy, and Germany)
- where the agricultural parcel system is in a state of flux, or traditionally unstable (New *Lander* in Germany, Belgium, the Netherlands?)
- in all cases, for the location of set-aside parcels

In such cases, administrations are strongly advised (or obliged) to collect map data from farmers indicating the locations and areas of the parcels declared. In all other cases, administrations will be required to demonstrate why the collection of map data is not required.

3.2.3. Storage and processing of digitised map data

If map data is collected, the administration must devise suitable guidelines for the handling and storage of the documents, taking note of the stipulation in the regulations for storing data for three years after collection. Documents indicating the location of set-aside will, however, be required for 5 years, in order to control rotational set-aside.

Likewise, a suitable approach should be devised for the use of the data, for example how the map data is to be digitised for remote sensing control purposes, stored, systems to be used for management, quality control procedures, etc.

If digital cadastral data sources are to be used instead, then the administration must show how, in operational terms, it can effectively use the cadastral data for this control. Of significance is how any modifications identified by the farmer - but not yet reflected in the cadastral database - or introduced by the control procedure, can be used to update the cadastral database; for example a part-parcel declaration by a farmer which modifies the boundaries existing in the cadastral database.

For geographic based systems, the GIS must be able to handle the extra dimension imposed by historical data, and keep access to previous versions of parcels open. It is the view of the EAGGF that up until now, little attention has been paid to the problem of maintaining the spatial component of the

databases - usually estimated at being 80% of the total cost of a GIS over its lifetime. This has important implications concerning the historical use of the data; see Section 3.3 below.

3.2.4. Receipt of map data, set-aside

Unfortunately, the regulations do not clearly state that the set-aside declared shall be clearly identified on a map, available to the administration. In the case of a set-aside agricultural parcel being composed of clearly identifiable sub-parcels (for example, in a cadastral reference system), a map shall not be determined to be required for verification of compliance with the regulations concerning rotation of the set-aside (true? false????). However, where the parcel set-aside is a subdivision of the parcel declared (ilôt, schlag) then the application will be expected to be accompanied by a map, identifying with sufficient precision, the location and area of the parcel set-aside. This is a consequence of regulation 1765/92 Art 10 para 3, stating that information concerning set-aside will be declared as a separate entity in the application.

In cases of doubt, administrations are strongly urged to request maps of such a nature from farmers, to be lodged along with applications for the duration of the rotational cycle (five years). They must also make provision for the access and use of these data, as noted in sections 4.2.3 and 4.3.

3.2.5. Storage, control of geographic objects

3.2.5.1. Area calculations

In a system which makes reference to geographic entities or objects (i.e., describes the parcels as a series of vectors), the calculation of areas should be made according to the established mapping conventions of the Member State. It should be noted that orthogonally projected areas[14] - not "true" areas uncorrected for slope - are considered by the Commission to be the areas acceptable for declarations.

3.2.5.2. Locations

A system storing geographic objects is well placed to allow analysis based upon location of a parcel. However, just how the objects are stored will have significant consequences upon the efficiency of such a system.

3.2.5.3. Parcel overlap

The system should ensure the easy verification of multiple declaration of parcels (or parts of parcels). Depending upon the system implementation, this can be a very computationally intensive task. While manual solutions are possible, they are not exhaustive and do not provide an objective approach to database management. It is therefore necessary that the administration demonstrates a suitable technique for automating this task. A number of strategies are possible for tackling this problem, however, it is not the purpose of this report to discuss them in further detail.

3.3. Handling of temporal data

An important part of the functional requirement of the integrated system is the handling of historical data in the database. The regulations (No 3887/92 Art. 16 para 7) state that data should be kept for a period of three years; however, to enforce set-aside regulations, data must be kept for five seasons (including the current season).

[14] An orthogonally projected area can be considered to be that calculated by a GIS in a national projection system, and takes into account the major distortions due to slope. Other differences - altitude, projection type, datum - are minimal, and introduce differences which are not significant for this application. In this manner, an applicant can be expected to i) measure a parcel from a (projected) map, or ii) request a surveyor to undertake the work.

In either case, there is a requirement to build into the system the capacity to make historical checks, certainly requiring the access to data from several years previously. For α-numeric systems based upon stable cadastral structures, this presents a minor problem; but for rapidly evolving field structures, and certainly for systems managing geographic entities, the tracking of land use could become progressively complex.

A number of techniques can be used to handle this problem, and their application will depend upon the general strategy chosen by the administration. As with other cross-checks, systems using simple, exhaustive numbering schemes with externally defined geographical limits will be the simplest to implement. Geographically based systems, with new annual definitions of parcel boundaries will be the most complex, requiring large amounts of polygon overlay, and could be un-workable. If the majority of parcels do not change, then those that have been modifies can be separated (for example, by comparing areas from one year to the next) and then controlled.

It should be noted that these kinds of checks demand a solid, coherent and systematic numbering system to be implemented nationally.

3.4. Risk analysis

A major use of the database is to generate a list of declarations to be verified in more detail, by visits from inspectors and by field measurements. The declarations selected should be the result of an objective strategy - indeed, an analysis of risk - which uses the information in the databases to determine whether a check should be carried out. Regulation 3887/92 Art 6 para 4 defines the broad objective of this task. Among the criteria expected to be used are:

- historical; period since last check, changes since last declaration, changes since last check
- geographical; location, parcel structure
- statistical; size, mix of use, difference from mode declaration, amount of aid involved

Each Member State is expected to present to the Commission its plans for using risk analysis in the annual report presented in January of each year.

4. Control and verification of applications

An important requirement of the regulations is the verification, for a sample of the applications, of the areas and use declared for each parcel and each crop group. This control is distinct from the cross-checks carried out on the full dataset.

This section opens the discussion with a note on the measurement tolerance expected (§ 4.1) and then discusses some of the techniques available to the Member States (remote sensing including aerial photography, and a range of equipment for ground measurements). A brief discussion of possible strategies for field controls concludes the section; the choice will, as ever, be a function of local conditions and resources.

Again, it is worth making the remark that a good, organised system for the declaration process and the provision of internal system cross-checks will reduce the dependency on "deterrent" sample checks such as described here. While the balance to be made is based on the relative cost of implementing checks, it should be noted that many of the internal cross-checks are considered to be less expensive and less technically demanding than direct control in the field.

4.1. Tolerance

The Commission aims to achieve a tolerance of control of 2% (as used for the basis of sanctions calculations in regulation No. 3887/92 Art. 9). The choice of technique used for field control should therefore reflect this tolerance.

The Commission does not seek to impose one method of ground area measurement upon the Member States; instead, it proposes the use of the most appropriate method given local constraints. It is up to the Member State administration to specify which techniques are to be used under which circumstances; however, the EAGGF will seek to ensure that the methods used are appropriate, and may require evidence that the technique produces results equal to those elsewhere and that meet the tolerance criteria specified in the regulations.

4.2. Control by remote sensing

The Commission encourages Member States to use the most appropriate and advanced techniques available for the control of aid applications. With particular reference to the verification of declarations concerning land use and area, it is expected that the majority of Member States will see the application of remote sensing technology - either satellite- or aircraft-borne - as a suitable strategy for at least part of the control. The EAGGF supports this approach with its direct commitment to the European-wide purchase of satellite imagery for the use by Member States.

While this stance is currently one of flexibility in the period leading up to the full implementation of the system, it will be required of each administration to justify the use of remote sensing technology - as indeed any other strategy - in terms of cost, accuracy, timeliness, and benefit. For this reason it is not anticipated that the application of remote sensing technology across Europe will be homogeneous. Indeed, it is probable that many forms of remote sensing - plane and ortho-rectified aerial photographs, optical remote sensing, Radar - will be applied according to local conditions. The major constraints anticipated are:

- parcel structure, size, stability, use, boundary definition
- cropping patterns, crop phonology, inter- and double cropping
- weather conditions, particularly cloud-free days

A limiting aspect of remote sensing control is the logistical requirement for grouped sample declarations. For reasons of economy, a limited number of sites are chosen in each country, which are examined intensively. The requirement for location of these sites to remain confidential - even after the control period - is of great importance. This means that in all cases, remote sensing must be combined with a certain level of ground control, in order to create “background noise’ across the whole region, diverting attention from sites controlled by remote sensing and ensuring a certain degree of "randomness" in the otherwise highly selective control programme. The Commission will seek to verify that the strategy adopted by the administrations is compatible with these aims.

4.3. Ground control

In all cases it is expected that measurements will need to be carried out in the field, in order to:

- take up cases identified by remote sensing as doubtful or reject
- to ensure a level of activity - so-called “background noise” - to conceal the remote sensing control sites

This control will demand the use of particular techniques and relatively specialised teams of inspectors, familiar with the regulations concerned and the techniques available to them to check on areas declared.

4.3.1. Equipment

The Commission, in general, expects the use of modern, accurate and efficient techniques in the execution of field control. To this end it has organised workshops to introduce many of these to Member State administrations.

The exact choice of equipment will be determined by the national administrations, as a function of the parcel structure to be measured, as well as other factors such as staff training levels, parcel registration system, etc. The type of equipment envisaged includes total stations, GPS survey, as well as the appropriate "non-accurate" techniques (tape, chain).

4.3.2. Training

In the case of an administration opting to carry out field controls themselves, the Commission will wish to see evidence of how the teams with the responsibility for the field work have been trained. The use of contractual teams (for example, specialised surveyors or topographers) presents no difficulties, providing they meet nationally recognised standards for carrying out such measurements.

4.4. Strategy

In order to streamline the process, it is considered that all parcels on a site should be checked, particularly for applications selected that are not subject to a previous indication of doubt or rejection (e.g., as a result of a check by remote sensing). However, see the discussion below concerning full and partial checks.

Field checks are expensive and time-consuming. A three-tier approach is considered appropriate in order to reduce overheads and target high accuracy measurement teams effectively.

4.4.1. Site visit

When an application is selected as a result of a “doubtful” status or a minor administrative problem - either as a result of the risk analysis, application processing, or from the remote sensing control - then a simple visit by an inspector may be sufficient to clarify any problem. At the request of an inspector, a full or partial check on areas may be carried out.

4.4.2. Full check

A full check of all parcels in a declaration is required on a number of applications, depending upon the overall control strategy chosen:

- in the case of remote sensing control not being used, on a full 5% or more of the applications, selected using risk analysis
- in the case of remote sensing control being used for a partial control, full checks are required for the fraction of 5% not subject to control by remote sensing.
- in the case of remote sensing control being fully utilised, a number of full ground checks will be carried out to ensure a widespread distribution of checks, as well as to ensure a level of activity in the communities themselves. Other partial checks will be carried out as a function of declarations identified by remote sensing control.

In a full check, all parcels in a declaration will be measured systematically using the same (or most appropriate) technique. Sanctions will be applied at a group culture level, as outlined in regulation 3887/92 Art 9.

4.4.3. Partial check

A partial check is the measurement of a subset of the parcels making up a declaration. Each of the parcels, however, is measured with the same level of accuracy as proposed for the full check.

Where possible, partial checks should be carried out on groups of cultures, in place of full checks on entire declarations. For example, where remote sensing control has identified that an application is doubtful or reject, then field control should begin with the parcel(s) so identified to be the major cause of the problem. Field control should stop when the problem is confirmed or resolved; there is little point in continuing to check fields already confirmed as acceptable by remote sensing.

5. Conclusions

The implementation of the integrated system by the deadline of 1996 will demand a disciplined approach to the planning, development and execution of realistic strategies by the Member States. In order to ensure the success of this phase, the EAGGF needs to have in place a clear range of options that are considered appropriate.

The main strategies presented can be considered as:

- based upon a cadastre
- based upon geographical entities
- based upon an inventory of geographical entities (hybrid system)

A broad functional analysis of the system as a whole is made, in order to clearly identify the global issues faced in the development of the system. The principle objectives are detailed, along with functional requirements considered essential to the effective operation of the system. It is considered that these would form the basis of the eventual technical evaluation of the system, as well as acting as indicators for Member States in the meantime. The eventual configuration of any system is acknowledged to be a function of local conditions and resources available to each administration.

The main considerations for data management are also discussed. Attention is focused on the implementation of suitable internal control mechanisms, in order to ensure high standards of quality control. The basic management issues concerning of alphanumeric data, geographic data, and historical data are discussed, including use of the main database for an analysis of risk, in order to identify a sample control subset. Ways of speeding up data entry - using, for example, data entry programs supplied to holdings with computers - are presented. Administrative controls are shown to be a way of enforce quality control on the database, as well as reducing the importance of the field control execution. The handling of map data is discussed, and some issues concerning the maintenance of historical spatial archives raised, particularly with reference to enforcing the verification of rotational set-aside.

The final section deals with the control and verification of applications using this control dataset. Only an over-view of the control by remote sensing is discussed; these issues are presented in reports elsewhere by VI-G-4. A three-tier approach for the carrying out of field checks is presented, in order to reduce on-the-spot check costs.

Index

Glossary

Agricultural parcel	defined as unit of land cultivated with one crop, by one farmer. In many cases this corresponds directly with the more colloquial term field.
Alphanumeric database	a database containing only alphanumeric data (eg parcel numbers, names addresses, text from declaration forms) without storing information referring to geographic data (parcel boundaries).
Applicant	the person making an application for aid.
Application (1)	an application for aid based upon a declaration of cropped areas.
Application (2)	a computer application, for example the integrated system.
ARGUS	Automated field boundary capture system, based on scanned aerial photos and a GIS, developed by Agrar- und System Technik GmbH, Germany
Carte combiné	A remote sensing product used in France, combining satellite imagery (SPOT) with digitised map information, to produce an orthoimagemap, upon which farmers can base their declarations.
Crop group	crops subject to the same aid regime.
Declaration	the information contained in an application concerning cropped areas, set-aside etc.
Digital terrain model	a computer-compatible representation of a terrain surface, usually in the form of a matrix determining altitude (and possibly slope and aspect) at point locations (DTM).
EAGGF	European Agricultural Guaranty and ??? Fund.
Entity, geographical	a basic unit that could be considered to build a feature in a geographical vector database; for example, the vector defining a polygon, or more likely the segments defining the vector (which in turn defines a polygon).
Evaluation	measures designed to establish the results of an activity in relation to the stated objectives and the expected impact.
Exhaustive coverage	the complete coverage of (for example) a cadastral numbering system, allowing the unique identification and referencing of a surface by just the number and cross reference to a geographical database (possibly external to the integrated system).
Geographic database	a database storing information referring to (among other data) parcel boundaries. This kind of database is usually refereed to as a Geographic Information System (GIS), and is linked to an alphanumeric database storing data on attributes of the geographic entities stored.
Historical checks	checks on declarations making reference to previous uses of agricultural parcels, in order to establish their eligibility for various aid schemes.
Holding	the land declared under one single application; usually one farm or enterprise.
IACS	Integrated Administrative Control System.
Ilôt	term used in France to describe the grouping of agricultural parcels on the basis of a declaration made by a farmer. The parcels within the *ilôt* are not always separated by permanent geographical features (walls, fences etc.).

Image map	a map product created from a remotely sensed image (including aerial photos, also known as orthophotomaps) rectified to eliminate geometric distortions.
IT	Information Technology, ie the use of informatics in data management.
Logical Framework Approach	A matrix based tool for presenting the underlying logic of project design, particularly how certain inputs should produce stated outputs in order to help meet objectives contributing to wider goals.
Monitoring	the periodic oversight of the physical implementation of a project to ensure that inputs, external factors, and outputs are proceeding according to plan and to consider whether planned impact remains valid or whether plans should be changed.
MS(s)	Member State(s).
Object, geographical	see entity, geographical .
Orthophoto	an aerial photograph geometrically rectified to take account of distortion to tilt of the aircraft, and terrain. This is achieved either by using stereo pairs of photographs, or by using a single photograph and a digital terrain model (DTM).
Parish	administrative unit, UK, equivalent to commune (France), kreis (Germany).
Photosat	A remote sensing product used in Italy, combining satellite imagery (for spectral information) with aerial photography (for spatial information).
Reference area	allowable cropped area determined for each country (region).
Risk analysis	the use of existing databases to model high risk applications based upon various criteria, in order to increase the effectiveness of remote sensing and ground control schemes.
Sanctions, penalties	a fine or punishment (eg disqualification from the scheme for a period of time) applied as a result of the farmer not declaring as required by the regulations.
Schlag	term used in Germany to describe the agricultural parcel, or in some areas multiple agricultural parcels grouped together as in an *ilôt*.
SIPGEM	study contract to be pursued in the first half of 1994; Système d'Identification des Parcelles et de leur Gestion Graphique dans les Etats Membres.
Wide area network	a computer network linked together using (usually) advanced telecommunications (ISDN, X25) to transfer data. In the integrated system, this is typically characterised by regional offices transferring data to a centralised database, and then access those data (or other processed data) for taking action (control, payments etc.). (WAN)