



Computer-Aided Design Facilities Management System for Geneva International Airport

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Abstract

Geneva International Airport uses a comprehensive GIS to manage spatial referenced data. The Airport GIS, otherwise known as SITAG (Genève International Airport information system), is developed in coordination with all the departments having to manage spatial objects [see **Figure 1**].

The Computer-Aided Design Facilities Management System is called "*GlobalCAD*". Based on *ArcGIS* technology (*ArcSDE*, *ArcView*, *CAD Client ArcSDE*), *Oracle* DBMS, and *AutoCAD*, it is made for managing the Airport's buildings in harmony with both the territorial management and the underground network GIS applications and includes an extension to *Oracle Financial*. Although it belongs to the "building field", the *GlobalCAD* solution rests on a geodatabase and therefore uses all the functionalities that are inherent to spatial referenced models.

THE SITAG PROJECT

Origin, implementation and size of the project

The *SITAG* project originated in a decision of the *GIA* Board. Following an international invitation to tender issued in 1998 and a long evaluation procedure, the project really got under way in January 2000. It is a matter of developing and making operational a set of tools for the management of the *GIA* facilities within the Technical Division, in close collaboration with the Computing Division and taking account of the related needs of the following Divisions: "Finance and Management", "Security", "Operations" and "Environment and Legal Matters".

In the operational stage, in terms of scale and of internal human resources, the *SITAG* project concerns, to use the terminology commonly adopted by English and French speakers, 10 "doers", 15 "users" and, eventually, more than 100 "viewers".

At present, a first stage of graphic information upgrading in a structured and normalised form is in the process of being completed. The collection of attributive and geo-referenced data with *GlobalCAD* began in 2002 with the buildings and will very soon be extended to the underground networks within the framework of the General Water Drainage Plan (GWDP) wanted by the Swiss Confederation and the Canton of Geneva.

Basic principles kept for the choice of management tools for the SITAG project

Strategically, from the beginning of the process of the evaluation of tools for the *SITAG* project, it was decided, so as to ensure longer-lasting information and a greater solution homogeneity, to make use of the same generic

products in the management of the *Surface Equipment and Installations*, in the management of the *Underground Networks* and in the management of the *Buildings*. This fundamental principle led the *GIA* to choose *ESRI* products *ArcSDE* and *ArcGIS*, combining them with *SGBD Oracle*, which had long been acknowledged by the airport.

As for the essential needs regarding Computer-Aided Drafting (*CAD*) for the construction and modification stages of facilities on the airport site, it has been decided to continue the elaboration of construction plans with the assistance of the *AutoCAD* software package. It should be stressed that an airport needs to modernise its facilities and installations to such an extent that work is almost permanently in progress on the site; therefore, *CAD* remains an indispensable tool.

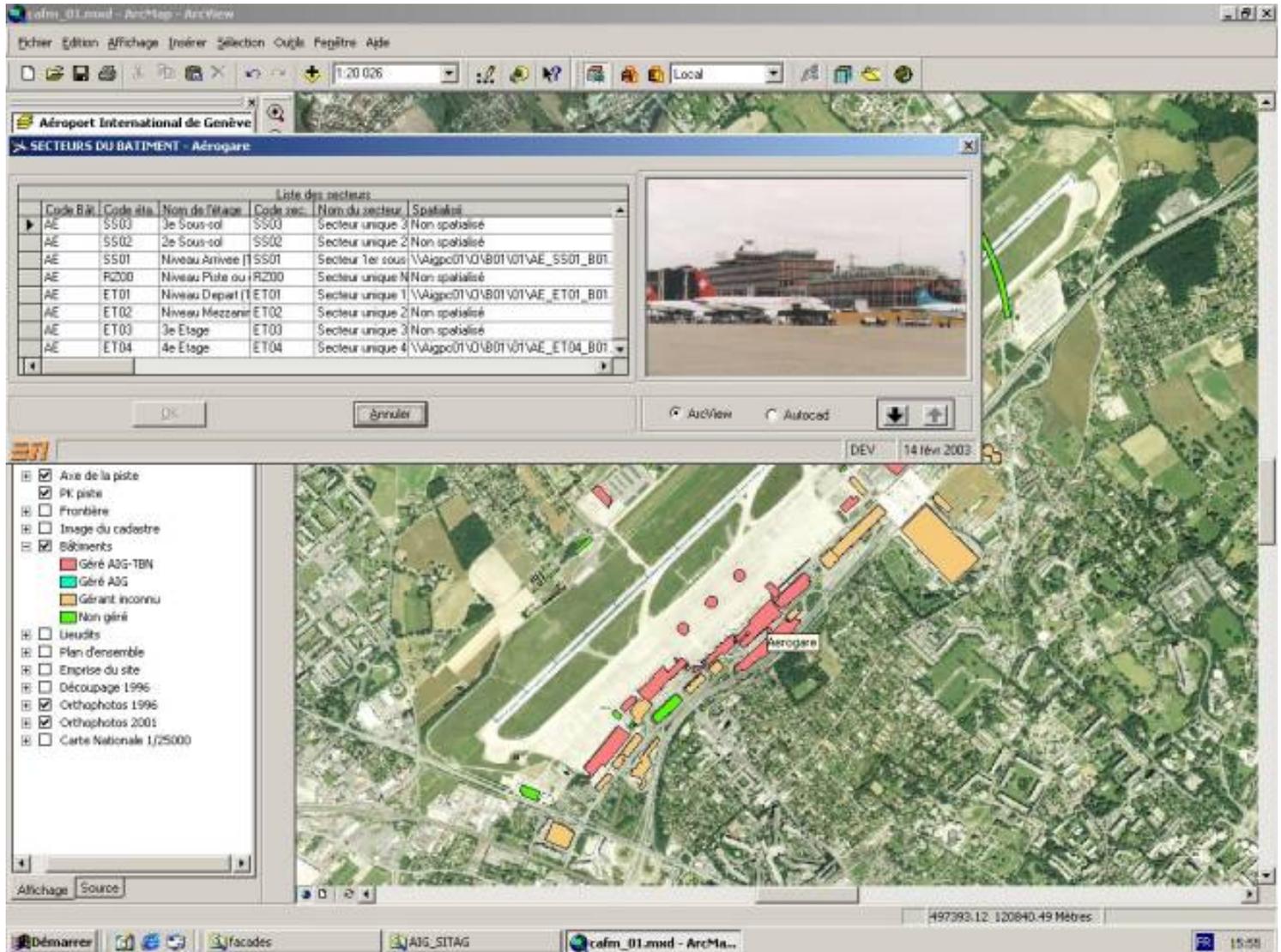


Figure 1: Aerial view (*SITG* orthophotos) of the site of Geneva International Airport (*GIA*)

THE *GlobalCAD* INFORMATION SYSTEM

Within the framework of the *SITAG* project, the *GlobalCAD* information system is conceived so as to satisfy the needs regarding the description, the inventory and the maintenance of the facilities and equipment connected with the buildings. Besides the fact that *GlobalCAD* is based on a spatial-referenced data model, it is characterised by a very strong integration of the *GIS* and *CAD* software tools, so that it ensures a permanent coherence of the graphic information (*ArcSDE layers* and *AutoCAD layers*) and of the attributes (*Oracle Tables*). This latter characteristic results from a global concept that allows the mutation and the sharing of the graphic files of the

AutoCAD software package in a "client server" environment.

Deployment context of the GlobalCAD information system

The essential components on which is based the implementation of the GlobalCAD information system are, on the one hand, the "CAD Norm of the GIA" which defines the use of CAD within the GIA and the technical offices and, on the other hand, the "SITAG guidelines" that define the notion, the list and the characteristics of the themes. It is the identification of the managers' and the users' needs which leads to the notion of "theme"; the themes area management and "Fire Safety" may be mentioned as examples.

It should also be mentioned that the GlobalCAD information system is perfectly integrated in the aforementioned global concept of mutation and sharing of the graphic files, which concept also calls for the use of a software for the Documents Electronic Management (DEM) and a software for the contents management of electronic files (automatic control of the observance of the conditions of CAD Norm and allocation of rights over AutoCAD layers).

Architecture and components of the GlobalCAD information system

In the client-server environment, the GlobalCAD information systems` architecture is built entirely around a spatial data model (Oracle and ArcSDE) permitting the geographic detection of all the chosen facilities objets. For the access and management of graphic and attribute data, the GlobalCAD information system uses the following products: ArcSDE, ArcView and AutoCAD [see Figure 2].

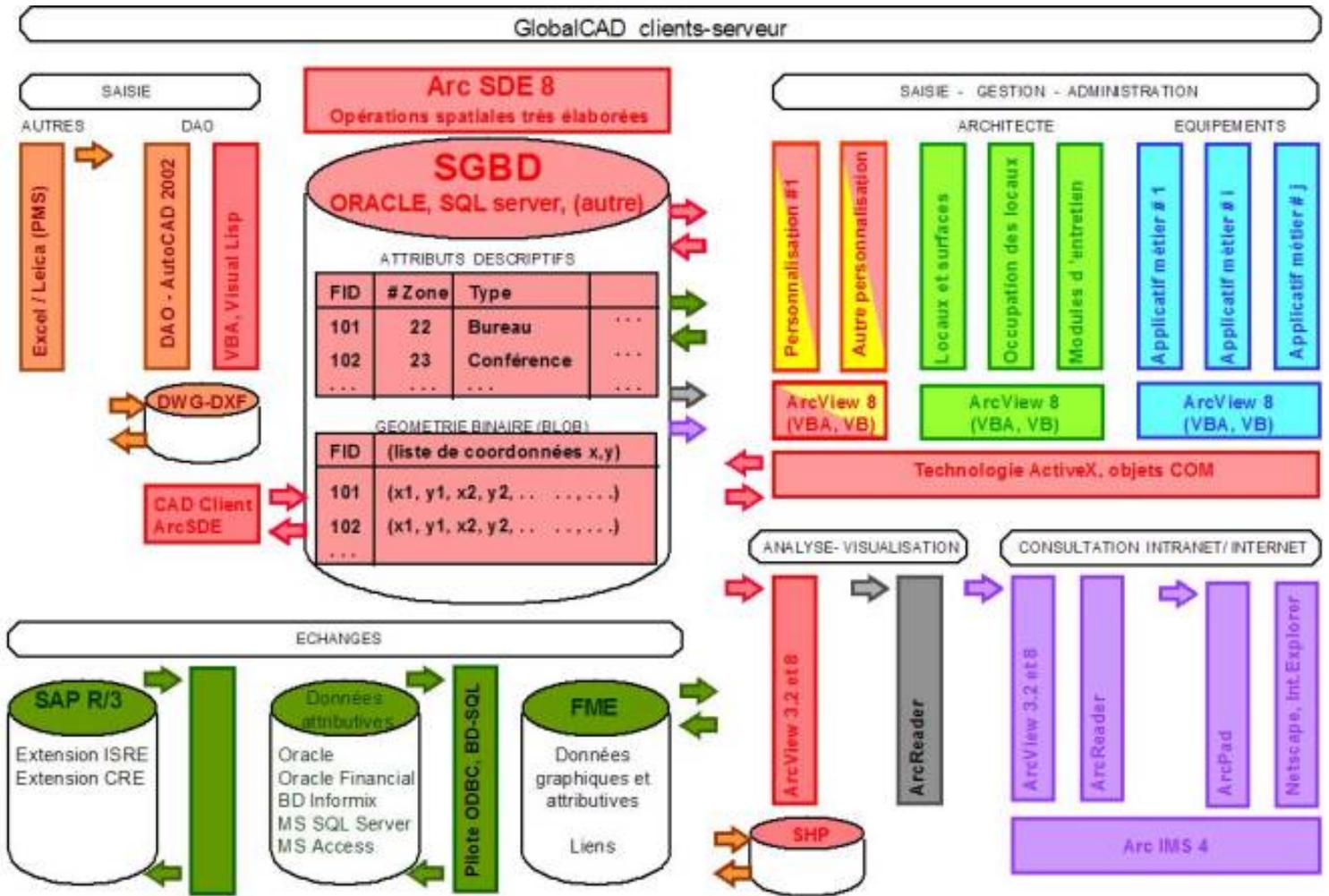


Figure 2 : GlobalCAD information system : architecture and components

The editing of attributive information is carried out indifferently from ArcView and/or AutoCAD by resorting to the

functionalities of the *ODBC* driver. The editing of graphic information is carried out from *AutoCAD* by resorting to the functionalities of the *CAD Client ArcSDE* interface, duly completed in order to ensure the integrity and the coherence of the *ArcSDE* layers and of the *AutoCAD* layers in the interactive-conversational mode [see **Figure 3**].

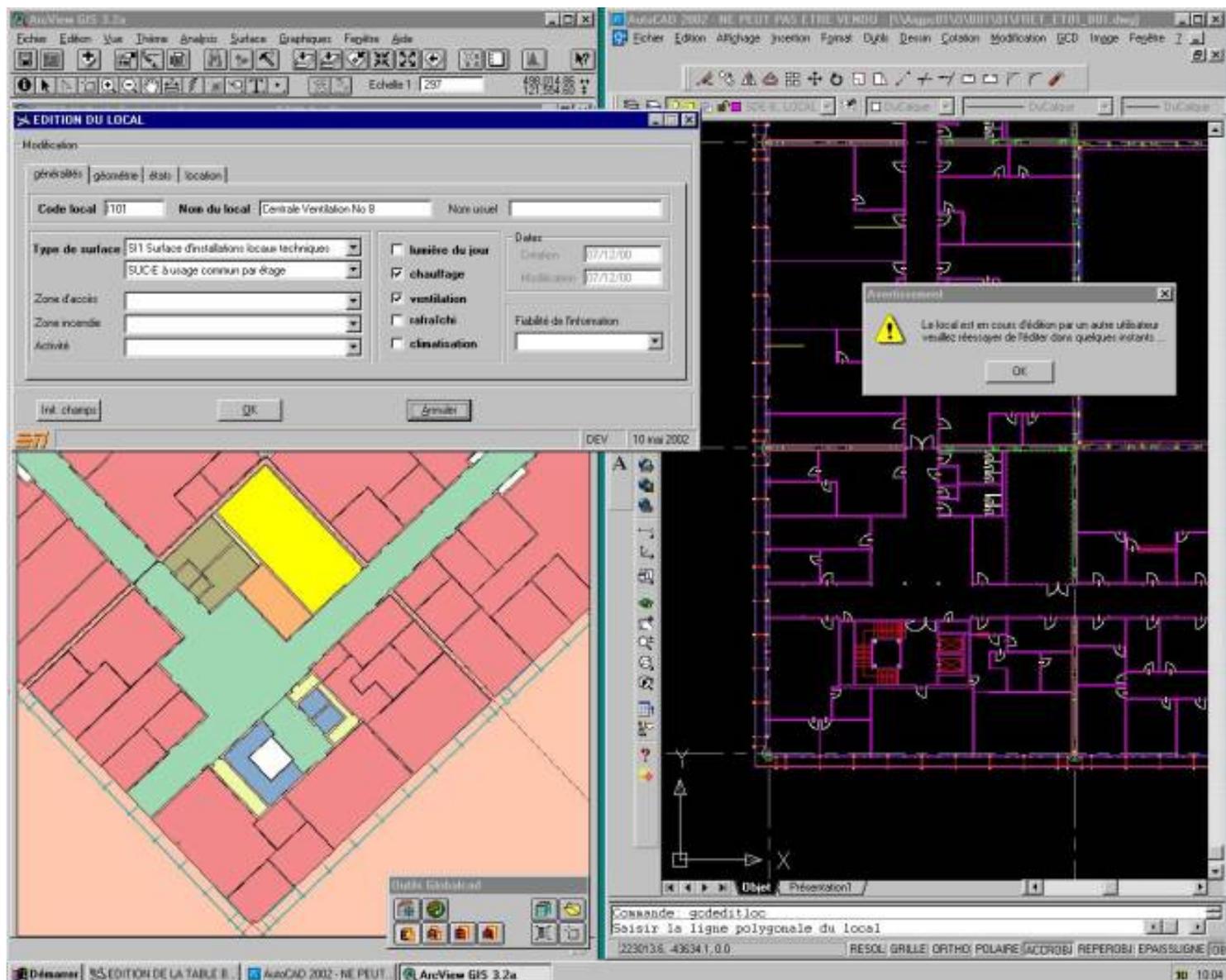


Figure 3 : *ArcView* and *AutoCAD* clients and *ArcSDE* server
Integrity and the coherence of graphic and attributive information

The user environment, created to carry out these manipulations, is common to both client programs. It is adapted to the professional knowledge and to the operators' working methods [see **Figures 4** and **5**].

The development and personalisation work of the *ArcView* and *AutoCAD* software are, as a rule, carried out with the help of the *MS Visual Basic* (software parts common to both programs) and *VBA* languages, so as to take account of the particularities of the *ESRI* and *Autodesk* editors.

The "Buildings" themes of the *SITAG* project and the available *GlobalCAD* modules

In order to satisfy the needs of the aforementioned Divisions of the *GIA* regarding the information system connected with the "Buildings" field, 34 themes have been identified and retained in the *GIATIS* project. In the case of eight of these, it has been decided that a specific task would be undertaken to develop and personalise the basic functionalities of the generic products. To date, the *GlobalCAD* information system permits the treatment of

the following themes:

- buildings inventory
- areas management of premises and other areas; (coding, area, occupant, conditioning);
- volumes management;
- rental of premises, interacting with an application built on *Oracle Financial*;

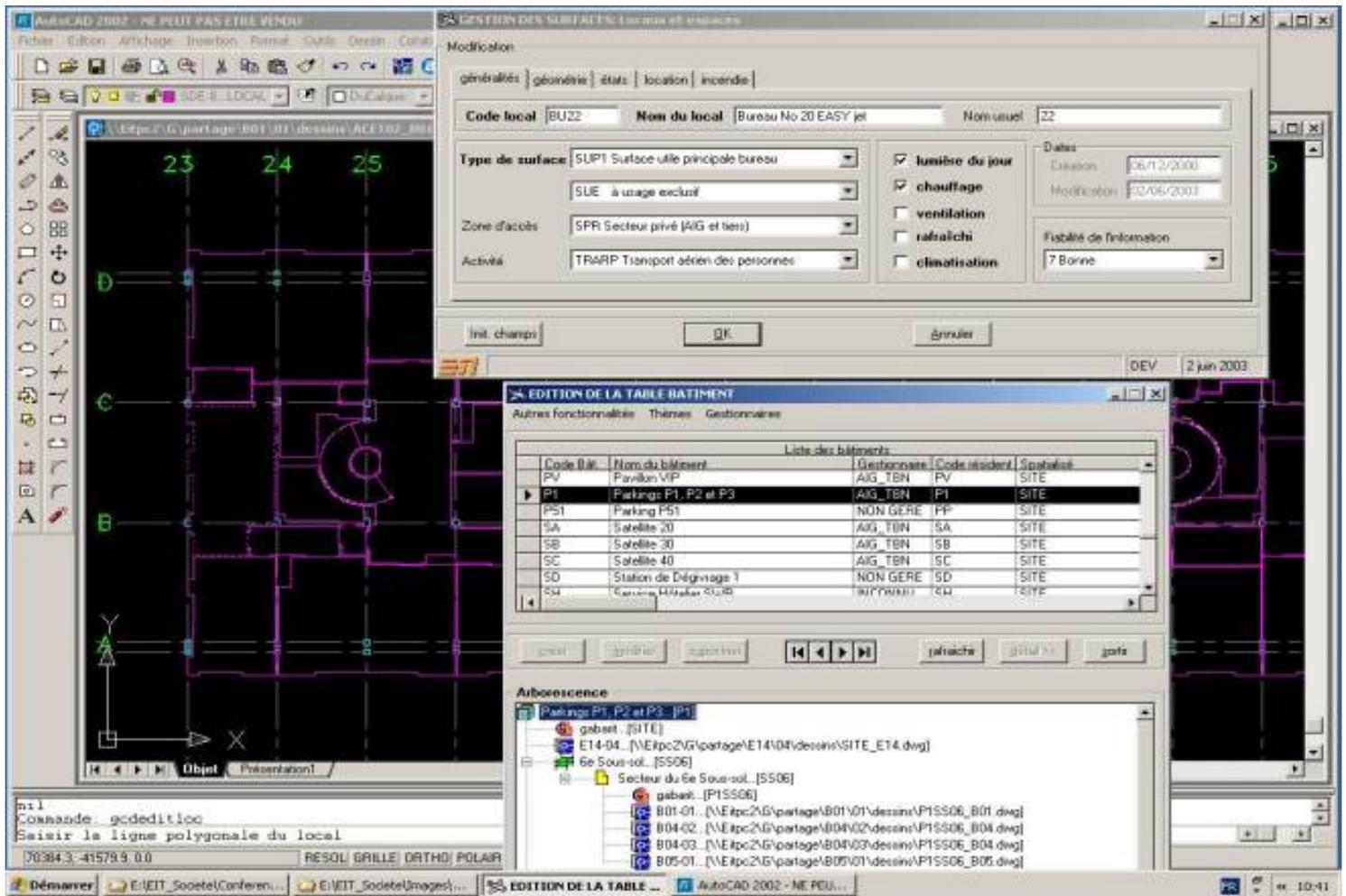


Figure 4 : GlobalCAD information system: user environment of AutoCAD operators

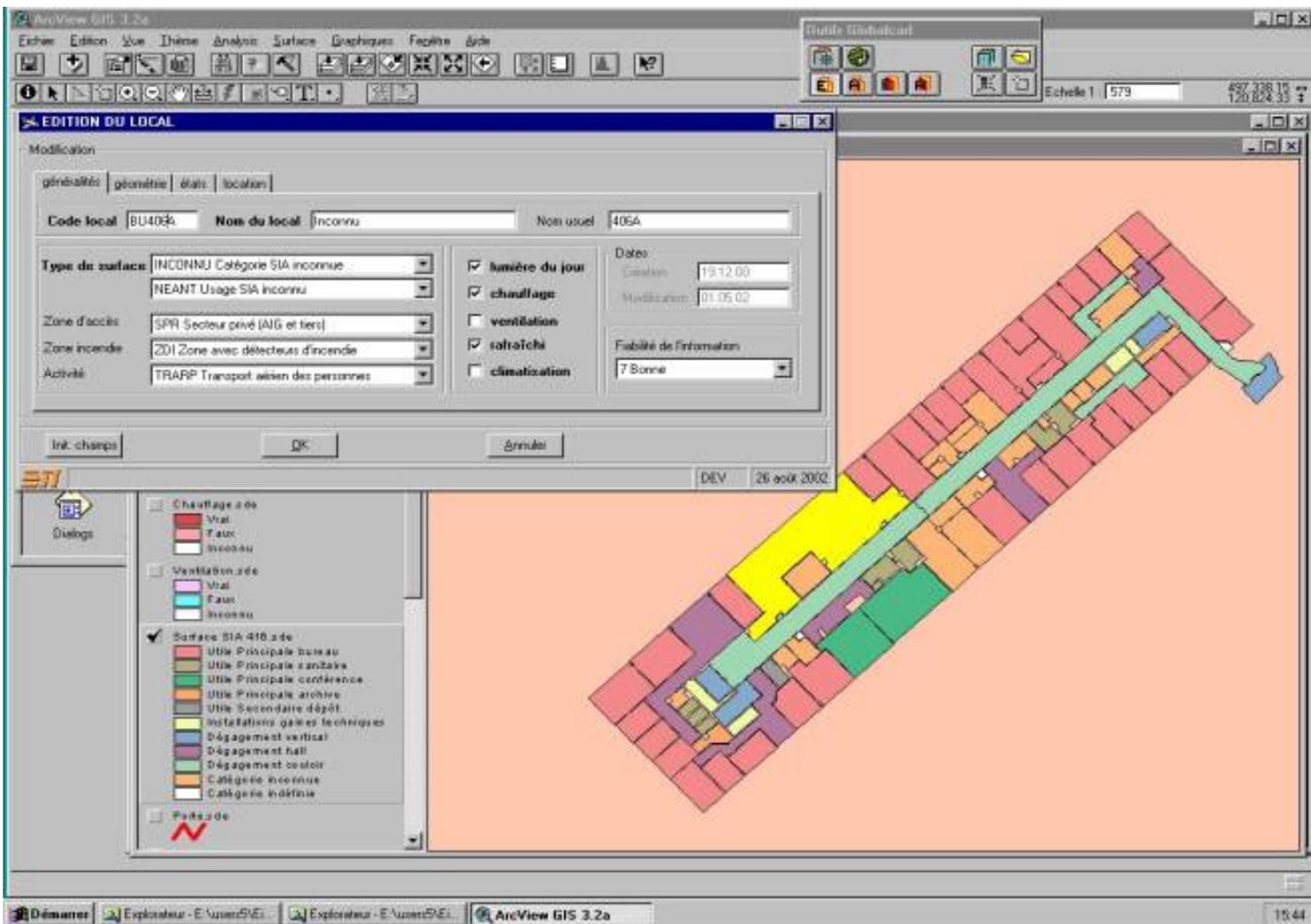


Figure 5 : Global/CAD information system: user environment of ArcView operators

- access management (management of doors, keys and access card system);
- management of Fire Safety equipment (safety areas, detection and alarm equipment, extinction equipment, ventilation equipment) [see **Figure 6**].

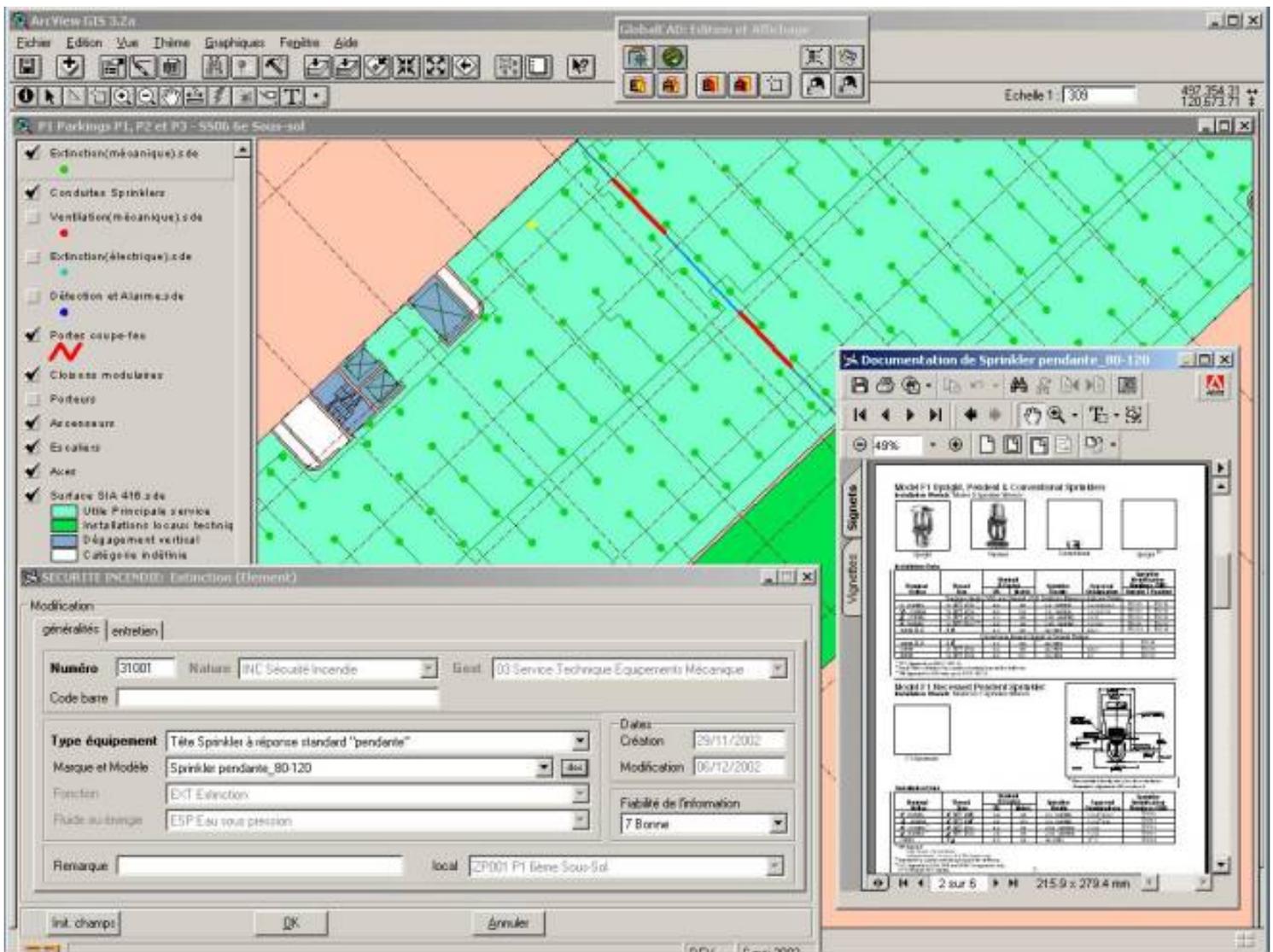


Figure 6 : GlobalCAD, "Fire Safety" module
 Extinction system; spatial location, attributes and documentation of a sprinkler

Solution positioning and analysis of the spatial detection of objects

It is interesting to place the *GlobalCAD* information system in the context of the present market for software products devoted to Computer-Aided Facilities Management (CAFM) and thus shed new light on the search for ever more efficient solutions for satisfying the building professionals' needs.

The existing solutions may roughly be classified into three categories:

- information systems based on an alphanumeric data model (Facility Management); they belong to the field of "classic" financial management and are often based on management systems for relational databases, or even on models such as those proposed by *SAP*;
- information systems combining an attributive model and schematics. The identification of the components of the facilities and installations is carried out through schemes that comprise attribute links and the "lightened" graphic representation lends itself to the diffusion of information. These systems are frequently implemented for the management of technical installations;
- information systems combining the resources of *Facility Management* and *CAD*. They are often referred to as "*CAFM* systems". These systems are usually built on the basis of an architecture that resembles that of the geographical information systems (GIS) resorted to in the last 10 or 15 years, which architecture is often considered obsolete nowadays.

Within the framework of the *SITAG* project, as mentioned above, the management system intended for the "Building Field" should be based on a data model and an architecture as close as possible - ideally identical - to those of the information systems reserved for the "Exterior Field" and for the management of the underground networks. It seemed, therefore, natural to build the *GlobalCAD* solution with the same technology as the one adopted for the *GIS* tools and thus to resort to the mentioned generic products.

This initial strategic criterion relating to the homogeneity of the means used was strengthened by the awareness of all the advantages naturally derived from the availability of the intrinsic functionalities of "spatial reference" data. The *GlobalCAD* solution may, therefore, be designated and characterised by the expression "*CAFM-spatial system*".

Illustration of the advantages of the spatial detection of objects

In the field of facilities management, the advantages of the spatial detection of components or objects are similar to those generally identified in the *GIS*. With a view to briefly illustrating this point, we present the following non-exhaustive series of examples with relation to the reciprocal spatial detection of the said objects:

- a room (polygon) belongs to a floor (polygon), itself contained in the outline (polygon) of a building; this approach should be compared to the room identification obtained with the help of a primary key resulting from the concatenation of the "building-floor-room" codes;
- the removal of a piece of furniture (polygon, line or point) from one place to another located at another address comes down to, for the operator, a mere "*copy-paste*" operation; this approach should be compared to the manipulations that would be entailed by the same removal if an attributive-data model were used;
- when the geometry of adjoining rooms is modified, the elements contained in these rooms (fixed lights, fire detectors, sprinklers, etc) are automatically assigned to the new geometry with its unchanged alphanumeric attributes and with no intervention on the part of the user;
- more specifically, a door (line) equipped with a lock and the cylinder associated with it separates two rooms (polygons). By identifying the access card or the key in a protected list, it is possible to identify the rooms the card gives access to [see **Figure 7**].

Multi-user and single-user solutions

All the modules of the *GlobalCAD* information system exist for the single- and multi-user environments.

The multi-user version is based on *ArcSDE 8*, *Oracle 8i*, *ArcView 3.2a* and *8.2*, and *AutoCAD 2002*. At present, it is functioning in the "New Buildings", "Finance and Administration" and "Mechanical Maintenance" departments in an initial stage of mass data collection. The installed functionalities are dependent on the activities carried out by the users and access to information is regulated through the usual means implemented by the *SGBDs*.

The single-user version uses a personal geodatabase and functions with *ArcView 8.2* combined with *Access 2000* or superior. At the *GIA*, this version is essentially reserved for on-site capture operations; it permits the edition of graphic and attribute information. The functionalities are identical with those of the client modules of the multi-user version, without the need of *AutoCAD* for the edition of the geometric attributes.

EVOLUTION OF THE *GlobalCAD* INFORMATION SYSTEM

Development and personalisation work

A permanent multi-disciplinary team works on the improvement of the functionalities of the solution and at the creation of new modules, in close collaboration with the various facilities and furniture specialists.

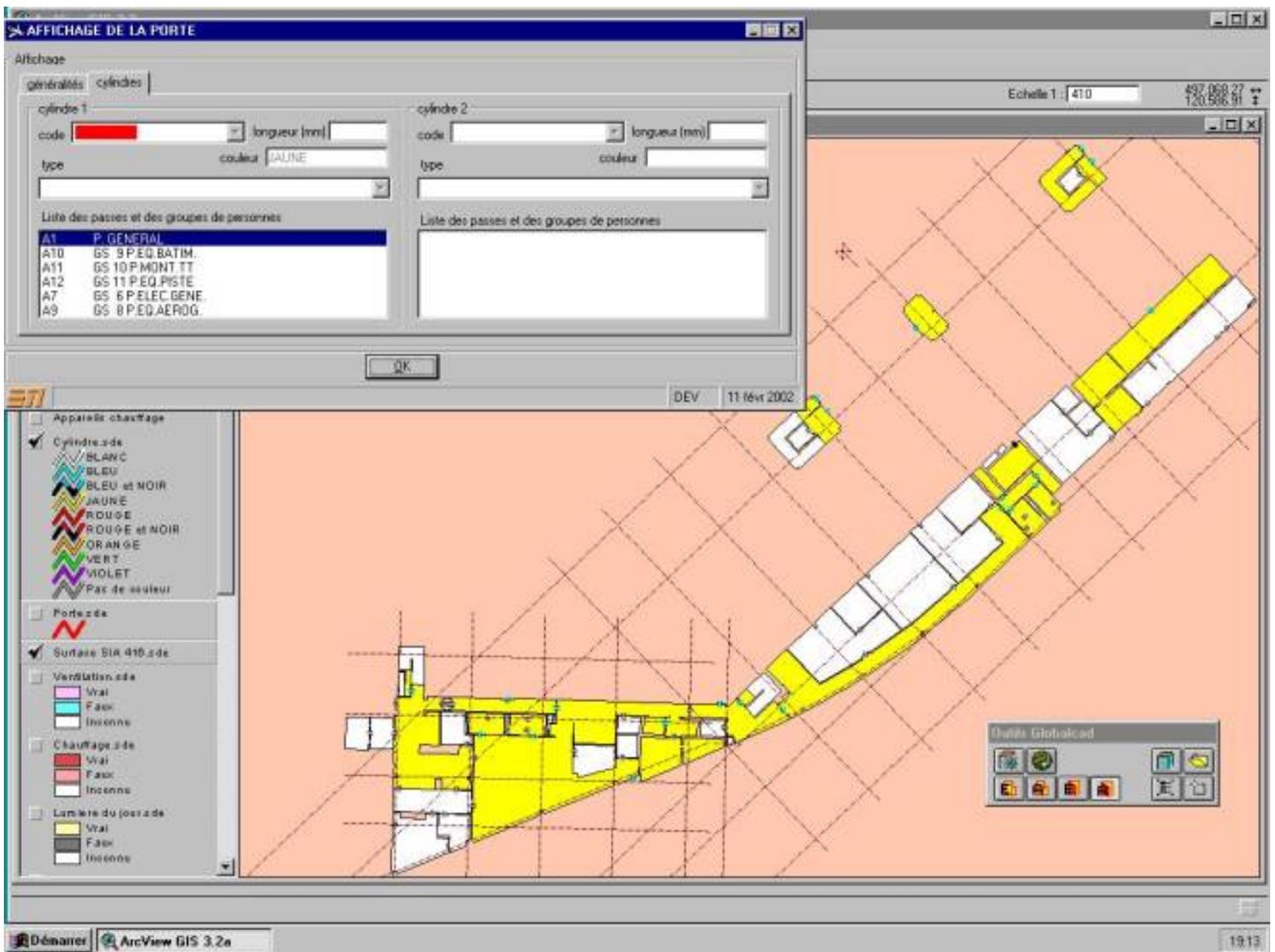


Figure 7: GlobalCAD, "Access-card System" module
 Rooms accessible with the help of an access card granted to a group of people

The next step after the completion of the "Fire Safety" theme, one of the most complex in the *SITAG* project, and of a request generator used for list editing, will be the creation of a theme relating to the ventilation installations.

As for the aspects connected with actual data processing developments, the fact that several CAD users may be involved in the same theme and that several *AutoCAD* files may be opened simultaneously (see **Figure 4**), led to completing the behaviour of the *CAD Client ArcSDE/AutoCAD* interface so as to get round the "File Locking" problem inherent in the use of *AutoCAD*.

Additional functionalities

Additional functionalities are also being worked on or will be developed before the end of 2003.

Thus, following a request from the swiss State of Tessin Cantonal Administration, an interface of the *GlobalCAD* information system with the *SAP/R3* module for surface management is being developed.

Moreover, for the benefit of the "viewers", it has been decided to allow a first diffusion of the graphic and attributive information of the *SITAG* project on *GIA's Intranet* with the help of the *ArcIMS* functionalities.

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