gis europe

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spotlight on defence

ready for take off

Ready for take off

When war breaks out, airfields are often the first targets, and quick repairs are needed to get the planes back into the air. In Denmark, the air force has developed a new GIS application that helps ground crews manage an airfield's infrastructure and respond promptly to emergencies—not only in the event of war, but in peacetime as well. JENS H. HANSEN and SAMUEL SAMOUELIAN report.

Entrance to the headquarters of the Royal Danish Air Force Air Materiel Command (FlyveMaterielKommandoen or FMK), north of Copenhagen, Denmark

The Danish armed forces use GIS to provide pilots with geographic information for mission planning, to design safe flight routes and calculate radar coverage for emergency operations. But they must also ensure that their planes can get into the air in the first place, so they require precise and detailed records of each airfield's infrastructure for analysing damage and making swift repairs if an attack takes place. To that end, the Royal Danish Air Force Air Materiel Command has developed a GIS application called Canmas, which stands for 'computer-assisted network management system'. This system comprises modules for analysing telecoms and utilities networks and airfield damage, and is designed to manage an airbase's complete infrastructure (see figure 1).

Clever mapping

The system is used to create and label basemaps with 'intelligent' items, that is, items with database records attached to them. These provide information on an airbase's assets such as its buildings, trenches, ducts, roads and runways. It also enables operators to define their own SQL queries by means of pop-up menus, and to select specific layers for plotting on the basemap.

At the core of the GIS is Enghouse's GeoNet, run under Windows NT and linked to an Oracle relational database management system. The Canmas application was developed over ten months by N2S, a French software services firm. The system was built according to Nato quality standards, with technical support from Enghouse France. Bull a/s acted as a global project integrator.

The system's telephone module is used for standard network design tasks and, most importantly, for analysing data. It enables operators to place distribution frames, cables, terminals and splices, to perform 'patching operations', which

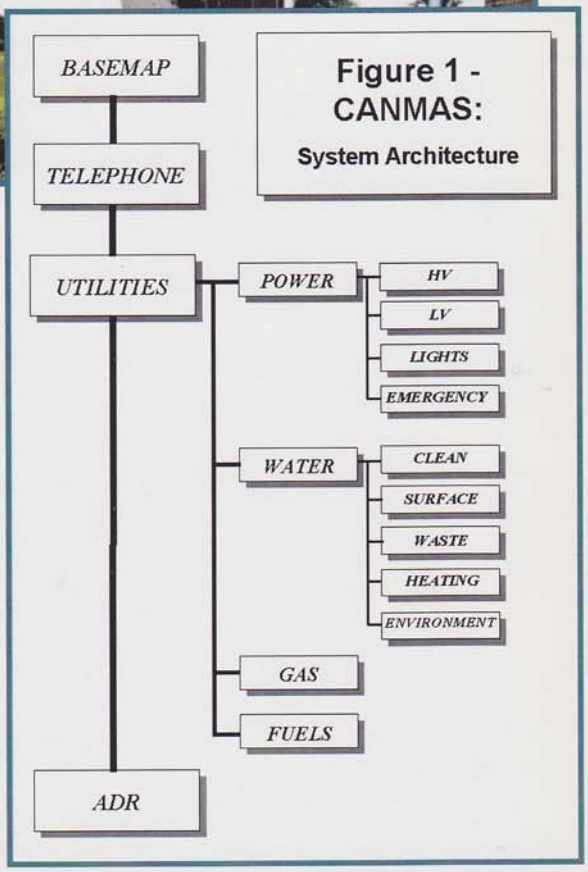


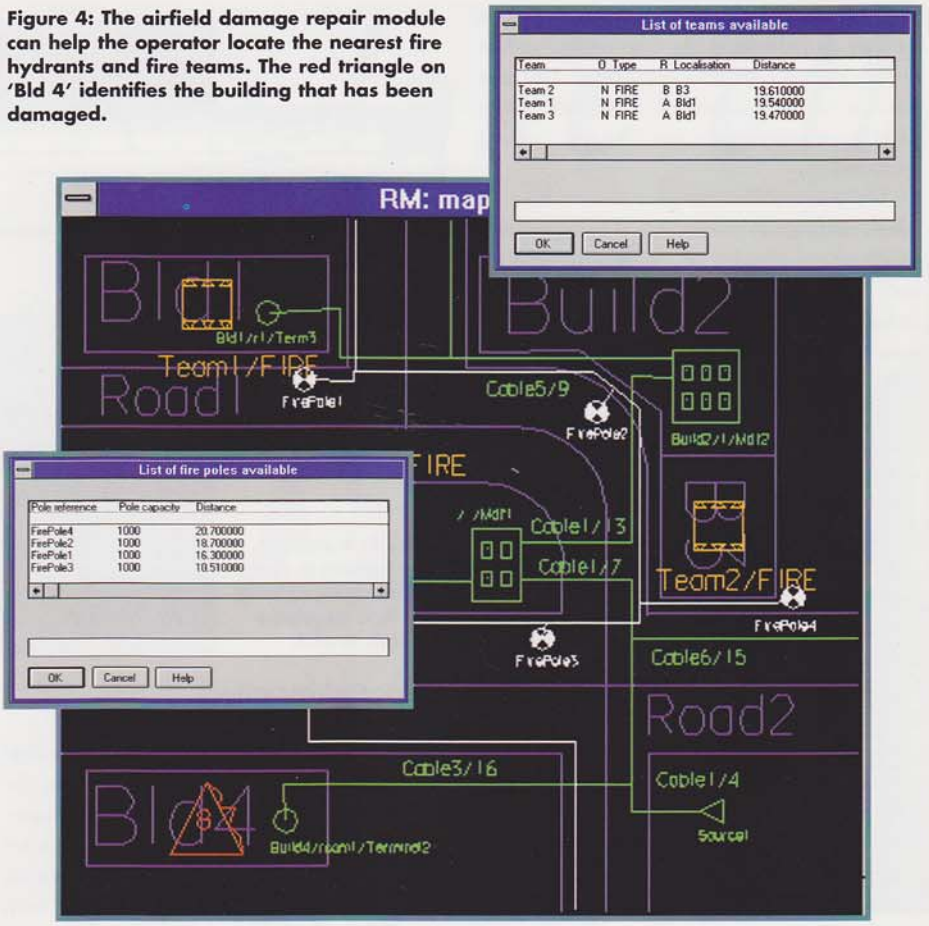
Figure 1: The Canmas system's global architecture. Users can create, delete and update their own networks (telephone, utilities or airfield damage repair), but are given view-only access to other modules.

(represented by the red triangular symbol on Bld 4). It is possible for the operator first to fill in a preliminary damage report, then to locate the closest fire hydrants and the closest available fire teams. Another possible use of ADR during peacetime operations is for analysing the existing underground utilities infrastructure before a new building is constructed on an airbase. The operator can site the building on the basemap, knowing that necessary cables and equipment are already in place. A feature of the ADR is that several users can access the database at the same time, but the system is able to differentiate the data entry workstations from those of the decision-makers.

Canmas is used to keep track of all of the airbase's communication and utilities assets. The system's decision-making features enable airbase staff to evaluate the state of the airbase's infrastructure, so they can repair damage quickly and keep the base operational at all times.

JENS H. HANSEN *is the project manager in charge of the implementation of Canmas at the Air Materiel Command. He can be contacted on Tel: +45 44 78 22 55 ext. 2336; Fax: +45 44 68 02 55*
SAMUEL SAMOUELIAN *is operations manager at N2S. He can be contacted on Tel/Fax: +33 4 74 57 72 31 Enghouse France can be contacted on Tel: +33 4 72 15 29 60; Fax: +33 4 72 15 29 69*

Figure 4: The airfield damage repair module can help the operator locate the nearest fire hydrants and fire teams. The red triangle on 'Bld 4' identifies the building that has been damaged.



involve switching currents from one wire to another and patching the connection, and to display planned network expansions. It is also possible to flag sections of a network which need modifying or have been corrected.

The user is able to generate reports showing which items are in the process of being created, which are out of order, which are being repaired and which have been repaired. The system includes an option to highlight the shortest, most workable paths between two points in the cable network. If some equipment is out of use, the operator can use this feature to re-route telephone lines through another part of the network.

When creating a new telephone network, the user can list all the pieces of equipment that a particular cable passes through, using an upstream or downstream trace option (see figure 2). Each item traced can also be highlighted on screen so the operator can see clearly its location in relation to the rest of the network. By clicking on an item of equipment, the user can access the relevant alphanumeric database records—which give technical information such as its capacity, cable type and reference number. When a new piece of equipment is plugged into the network, it is assigned a code and then added to an inventory of the equipment used.

The operator can also assign telephone numbers by clicking on the starting point of the network. Users' names can be entered and lists of users edited.

Distributing power

The utilities module operates in the same way as the telephone module but manages infrastructures distributing power, water, gas and fuels. The operator can create, update and locate specific items on the network, and also access technical information for analysis and maintenance purposes. The module can highlight all equipment located upstream or downstream of a selected point on a utilities network, so the user can trace a 'zone of influence'. For example, the user can assess which parts of a network will be safe to work on if a particular fuse is removed. By activating options for 'opening' or 'closing' parts of the network, the operator can also simulate the flow of liquids.

This module is useful for monitoring environmental changes. For example, groundwater pollution levels can be monitored by studying data from samples collected across an airbase. Also, sewer drainage capacities can be assessed. As Canmas provides a full record of the cables, pipes, valves and pumps featured on the networks, technical and economic factors related to maintaining networks can also be analysed.

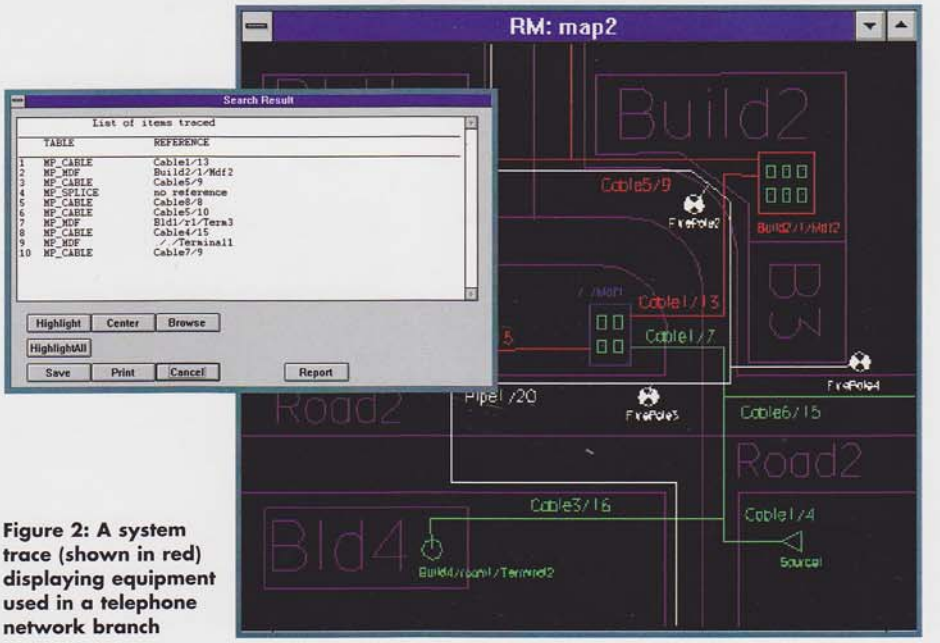


Figure 2: A system trace (shown in red) displaying equipment used in a telephone network branch

Prepared for attack

The airfield damage repair (ADR) module enables staff to carry out quick repairs to the airbase's infrastructure. This is used in conjunction with the previous two modules, which act as data suppliers. The ADR module is crucial, as it provides geographic data associated with damage types on network. For example, it can show whether buildings or runways have been hit, and the type of bomb involved, such as chemical or atomic.

When war breaks out, the first infrastructure likely to come under attack is the airfield, because if aircraft cannot take off or land, they are rendered useless. Canmas's ADR module can be used as a simulation tool to calculate a 'minimum operating strip' for take-off and landing purposes. This means that the airbase can still function, even with a shorter runway (see figure 3).

The program can also be used by airbase officials to assess the consequences of exploding a bomb. It does this by calculating specific, context-dependent security perimeters. This means that if there is a bomb on an airbase, staff can set safety perimeters at, for example, 30 metres or 50 metres depending on the type of ordnance. For this, ADR operators use the analysis functions of the telephone and utilities modules. After they have examined the different layers in the network mapping system, the system can calculate the amount of any damage and the time needed to carry out repairs.

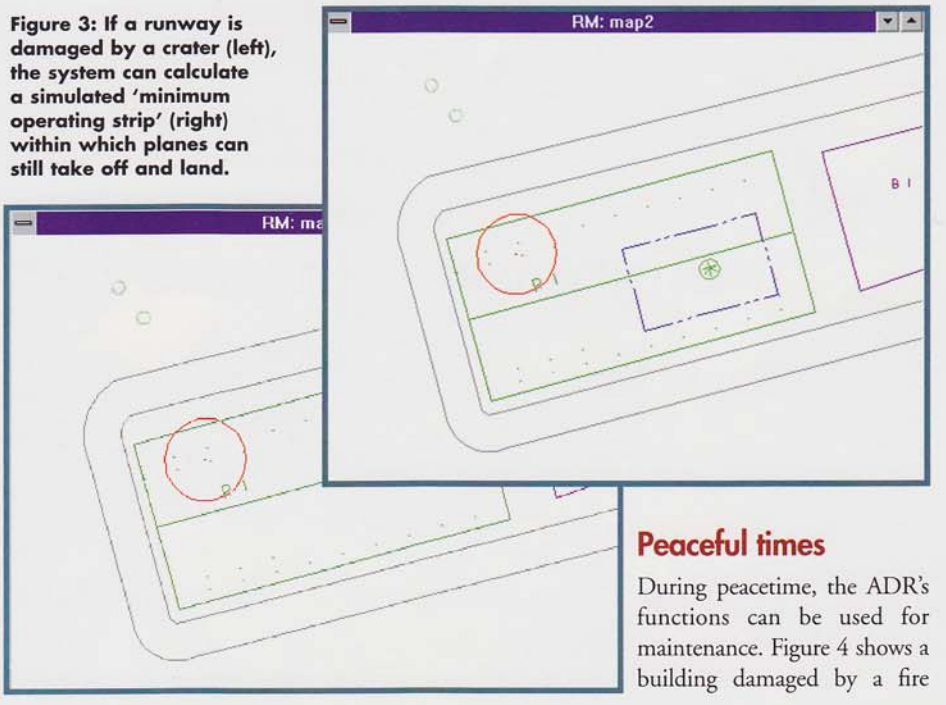


Figure 3: If a runway is damaged by a crater (left), the system can calculate a simulated 'minimum operating strip' (right) within which planes can still take off and land.

Peaceful times

During peacetime, the ADR's functions can be used for maintenance. Figure 4 shows a building damaged by a fire