



PROJECT REPORT

ERCAMS

EN-ROUTE CONTROL AND MONITORING SYSTEM

powered by CMS/XA

COMSOFT

1998 AUTUMN

ERCAMS KICK-OFF



Contract between NATS and COMSOFT was signed

1998 - 1999

ERCAMS MAIN PHASE

Provision of complete infrastructure for all centres and subcentres

Countrywide redundant CMS-ASTERIX network

Equipment for first site radars

1999 AUTUMN

MAIN PHASE END



Successful FAT and SAT
Interoperability tests between installed sites

2006

ERCAMS II



Modernization

2007/2008

ERCAMS UPGRADE



Reorganization of entire network
Upgrade of centres and radar equipment

YESTERDAYS

In 1998 NATS Ltd. and COMSOFT GmbH first time joined forces to realize a countrywide radar supervision infrastructure in the UK. COMSOFT's CMS/XA, a versatile control and monitoring system, has been configured to monitor 20 en-route radar stations in this project called ERCAMS.

By 2006 the British air navigation service provider intended to upgrade the whole infrastructure and again chose COMSOFT backed by the confidence of their experience of almost a decade. The second phase was called ERCAMS-II.

TODAY

Until 2012, under the NATS RSS (Radar Site Services) programme, 23 radar sites across the United Kingdom will be replaced with new equipment, in its majority Mode S MSSR sensors combined with PSR radars and ancillaries.

The NATS surveillance infrastructure represents billions of investment and has to be operated and maintained at a highest level of performance in order to provide a reliable 24/7 service to the air traffic controllers. Clearly this puts highest demands on the control and monitoring system. Only if the technical management of the infrastructure is complete, reactive and reliable, the required service level can be achieved.

Here is, where the COMSOFT ERCAMS system finds its challenge. Since 2000 the system is installed in the UK, operationally supervising radar sites from the English Channel coast up to the Scottish Hebrides and the Irish Sea. ERCAMS was one of the most successful projects in NATS history. It saved millions of operating and maintenance costs, allowing the air traffic service provider to maintain control over a large heterogeneous set of geographically distributed radars and appertaining infrastructure from one central point in the country.

When the RSS programme began to speed up, it was clear that the COMSOFT system was again one of the major candidates for the open Call for Tender launched by NATS to supply the Control and Monitoring infrastructure for ERCAMS-II. COMSOFT won the contract, based on the satisfaction of NATS with the ERCAMS equipment and its reasonable price, the technological advantages of the COMSOFT proposal and the performance of the company during the previous ERCAMS rollout.

The new programme also made clear the new philosophy under which NATS like most Air Traffic Service Providers today operate: Lowering the operation and support (O&S) costs while maintaining the required service availability. The reduction of the O&S costs involves the use of commercial

off the shelf (COTS) technology and the appreciation of the costs over the complete operating time of a system. COMSOFT could demonstrate with a comprehensive Live Cycle Cost Analysis that their system brings savings not only today but also in the medium and long-term based on reduced maintenance costs.

Sumburgh, Shetland Isles



„I think that we have built a superb relationship between the NATS and COMSOFT teams over the years. This has enabled us to always deliver the system, whatever the technical challenges. I hope that we continue this for many more years.“

Ali Bruce, Senior Radar Engineer,
NATS Ltd.



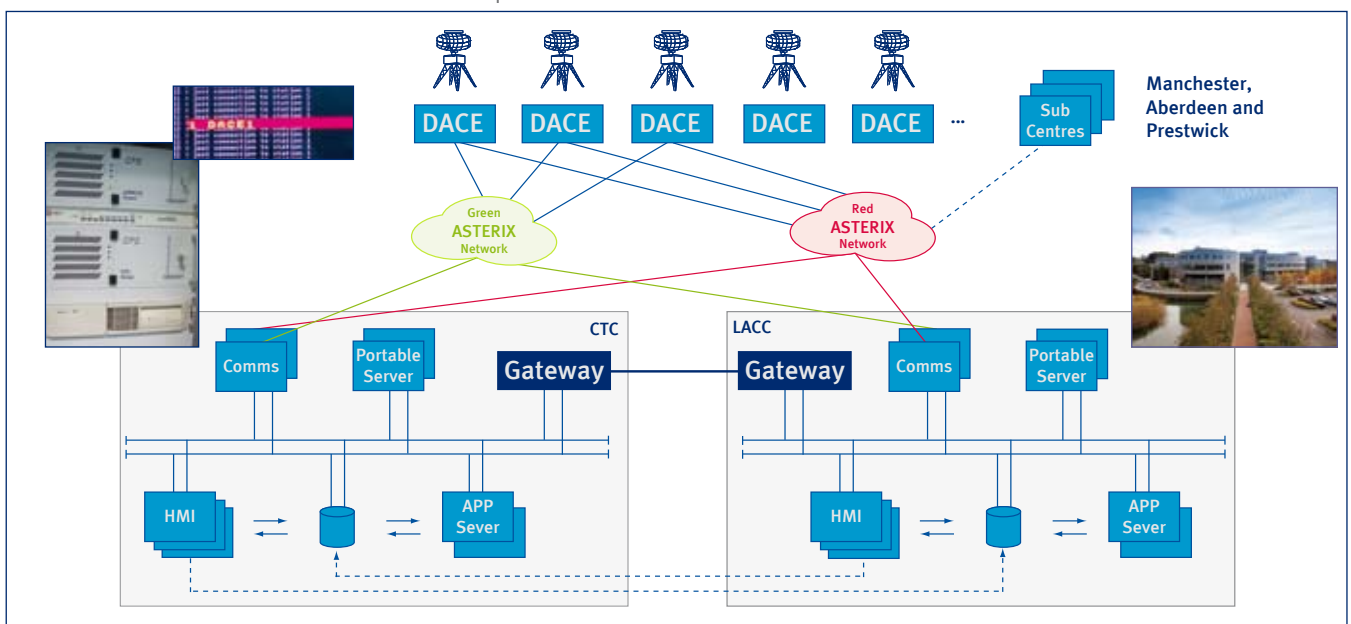
DACE

ARCHITECTURE

ERCAMS-II is based on the COMSOFT CMS/XA architecture, standing for a new generation of Control and Monitoring Systems. It is an integrated architecture covering on-site data acquisition technology, remote communications as well as centrally based processing and visualization.

- The Data Acquisition and Control Equipment (DACE) is located at the individual ERCAMS-II radar sites. It is based on standardized field bus technology and allows both central and distributed installation of acquisition and control entities. Particular emphasis is put on catering for a diversity of discrete and analogue signal types as well as serial interfacing towards control and monitoring subsystems, including SNMP supervision.
- The Control Centre Equipment (CCE), the central component of the architecture, coordinates all the remote sites from a NATS Service Management Centre. The CCE provides sophisticated rule-based data processing, filtering and visualization technology, gathering all the information an operator requires, in the form of graphical support elements, triggers, alarms and historical databases. For ERCAMS-II the main centre is mirrored at a contingency site, both sites interconnected via a high-speed link.
- A surveillance network connects all of the components using the standardized ASTERIX format as its application-level protocol. The ERCAMS-II network is based on the COMSOFT RMCDS - Radar Message Conversion and Distribution System - technology, used in many countries for the exchange of surveillance-related data in real time. For ERCAMS-II the network was restructured and updated with the latest version of the software. ERCAMS-II comprises two mirrored and independent network segments, a „green“ and a „red“ network.

CMS/XA in its ERCAMS Architecture



Today, as part of NATS' relocation from the Gatwick Service Management Centre, the NATS Swanwick Centre (LACC) hosts the ERCAMS-II Control Centre Equipment, while the Corporate & Technical Centre (CTC) at Whitley acts as a backup site.

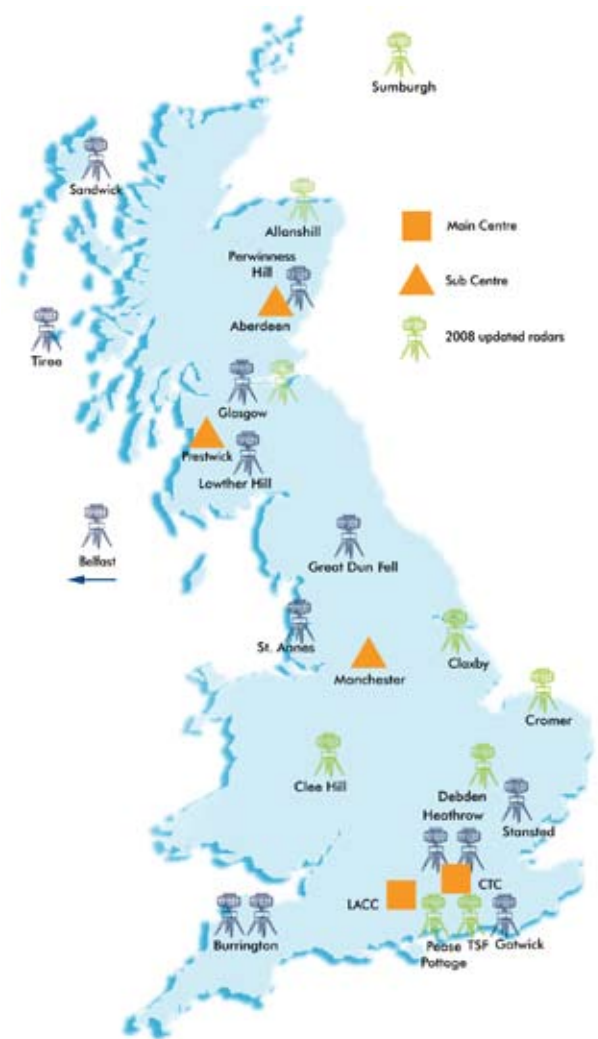
ERCAMS-II also connects 3 sub-centres equipped with so-called MCEs (Monitoring Centre Equipment). They are located at Manchester, Aberdeen and Prestwick. Each MCE receives individually filtered monitoring data from the two main centres, representing a tailored view of the radar monitoring information which is of interest for the specific site. The MCEs follow the same basic architecture as a CCE and share a limited set of control commands with the main centres. Like all other sites, the MCEs are connected to the countrywide ERCAMS-II network.

THE CMS/XA PLATFORM

CMS/XA is a COTS product that can be adapted in a very flexible form to arbitrary infrastructure requirements without changes to the software. A huge tool box of configuration-level adaptation possibilities is at hand. A rule language permits to specify alarm conditions, logging prerequisites, or the specific way that subsystem states contribute to higher levels of control. The customisations for ERCAMS and ERCAMS-II rollout sites have over and over again brought to light the resulting unmatched high flexibility of the system.

The CMS/XA system is based on open and state-of-the-art COTS technology. This includes the use of an ORACLE relational database, PROFIBUS field bus acquisition technology, a LabVIEW graphical user interface builder, and OSI Layer 1-7 network technology, including ASTERIX as data exchange format. Scalability, reliability and openness to future extensions can be seen as an almost automatic side effect.

The CMS/XA COTS family is scaleable - from a local, single-PC based configuration, to a countrywide distributed, integrated control and monitoring system with a large range of data acquisition sites, multiple (peered) main control centres and a hierarchy of sub-centres. Connectivity scales from the use of a few dedicated serial lines to a country-spanning wide-area network and an intra-centre LAN topology.



ERCAMS sites in the UK

Performance Highlights

- Response time
 - < 3sec (end-to-end)
 - < 5 sec for simultaneous burst of all radar sites
- Number of acquisition sites: max. 1000
- Number of signals per site: 3000 analogue/digital
- Number of control centres: 2 main (redundant); 5-10 remote
- Number of information propagation layers: 10-20
- Number of customizable graphical user interfaces: 1000-5000



Dirk Hotz (COMSOFT), Ali Bruce (NATS)

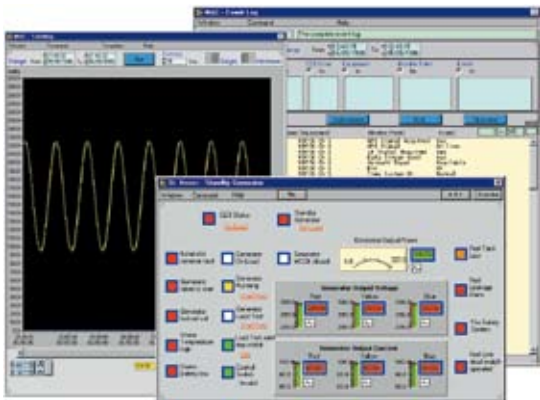
RELIABILITY

The reliability requirements for ERCAMS and ERCAMS-II were a particular challenge of the project. NATS requires a total system MTBF of 10^6 hours, i.e. the equivalent of more than 100 years without total system failures. Designed particularly for ATC applications, CMS/XA includes redundancy concepts for its components at hardware, software and networking level, capable to fulfil these stringent availability requirements.

All critical components of the system are replicated. In addition, a two-segment network and a dual-centre architecture were the fundamental ingredients, implementing a dual feed approach from the radars down to the individual graphical front-ends.

As part of the NATS ERCAMS-II project the FDDI-based LAN of ERCAMS was replaced by redundant Gigabit Ethernet technology using interface bonding.

Based on the ERCAMS-II architecture, each of the NATS operator working positions can be transparently switched between alternative feeds, including the derived system states, alarm conditions and historical databases. This renders the extreme availability values required by NATS and verified as part of the ERCAMS acceptance procedures.



Customized HMIs



Customized CMS/XA HMI as used for ERCAMS

ADAPTABILITY

Perhaps one of the most distinguishing features of the CMS/XA system is its outstanding ability to be customized to different environments.

This capability was already a prerequisite for ERCAMS. With its 20 different radars, hundreds of different signal types and thousands of individual monitoring points, it was a precondition that it should be an easy task to make adaptations to the configuration.

Also for ERCAMS-II this flexibility was essential. All site-dependent adaptations are handled in CMS/XA via configuration rather than code. Configuration changes by the end-user are not a complex and error-prone process involving proprietary system details. The architecture makes it as easy as editing a field of an underlying relational database, to include a new sensor or to modify an alarm condition.

In the same way, designing a screen for data presentation does not require use of more than a graphics editor to „drag & drop“ respective symbols from a template bar.

OUTLOOK

The first ERCAMS-II sites are operational since 2006, mainly in the Southern part of the country serving in particular the busy London area. Then the ERCAMS-II centre upgrade was successfully completed in 2008. ERCAMS-II has been moving North now, also in preparation for the New Scottish Centre at Prestwick. Radar sites at Allanshill, Lowther Hill, Stornoway (Sandwick) and Belfast belong to this rollout.

The ERCAMS team at COMSOFT follows a challenging schedule, facing a new rollout almost every 2 months, each with its own Factory Acceptance and strict Site Acceptance activities. At the end of the programme close to 25.000 individual radar elements will be monitored and controlled from the service centre.

ERCAMS clearly shows: the world of control and monitoring is changing in air traffic control. The pressure of cost-efficiency today is promoting architectures with a high degree of centralization. At the same time, vendor-specific, proprietary control and monitoring systems are replaced by open integrated solutions with a uniform and flexible handling of a range of systems.

Flexible, distributed availability of monitoring data, powerful event-processing and expressive data presentation techniques are the essentials of tomorrow. This is what made the COMSOFT CMS/XA system succeed in the ERCAMS projects. Therefore NATS is already prepared for the future, using a flexible platform to fully meet the existing and upcoming control and monitoring needs.



Sumburgh, Shetland Isles



Gerhard Kremer (COMSOFT) - NATS Radar Station, Allanshil



NATS Radar Station - Lowther Hill



Members of the original ERCAMS team from 1998 today left to right:

Andreas Sprenger, Gerhard Kremer, Robert Clauss (all COMSOFT), Ali Bruce (NATS), Alexander Tilichi (COMSOFT), Colin Smith (NATS), Dirk Hotz, Alfred Schneider, Klaus-Dieter Leyher (all COMSOFT)

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