# EMPRESS Embedded RDBMS

# in

# Aerospace, Satellite, Military & Defense

## Highlights

- EMPRESS Embedded RDBMS Functionality
- EMPRESS Users in Aerospace, Satellite, Military & Defense
- EMPRESS Example Applications for Aerospace, Satellite, Military & Defense

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# 1. Introduction

The Empress Embedded Database Management System is powerful, reliable and cost-effective. It is designed for high-performance, mission-critical, maintenance-free embedded applications on Unix, Linux, Real Time and Windows environments. Such applications are typically developed for Aerospace, Military & Defense, Meteorological, Simulator Design, Satellite Imaging, Network Management, Electronic Publishing, Telecommunications and Process Control.

As hardware memory and processors increase in capacity and decrease in cost, intelligent devices with logic and data embedded can be affordably built. Sensor data can be collected and stored in the Empress database. Watermarks can be set and events can be triggered automatically from the database once the watermarks are reached. These intelligent devices can be used in black box systems, vehicle operations and maintenance logging, robotic process control, etc.

The Empress Embedded Database Management System is powerful and cost effective.

The power is shown by its speed, small footprint and adaptability. The cost effectiveness is shown by its portability, ease of use and ease of integration.

The Empress Data Management System design allows for:

- embeddable plug-ins in database applications
- handling any object the computer can store
- processing large volumes of data
- building knowledge-based databases
- distributing database and programming processing
- both disk and in memory database management
- extreme low maintenance


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## 2. EMPRESS Embedded RDBMS Functionality

EMPRESS high performance Embedded RDBMS delivers an unmatched combination of rich features, rich tools and rich data types that are well suited to the Aerospace, Satellite, Military & Defense industry:

**Rich toolset, rich data types and rich functionality for rapid development**

- **TOOLSET API's:**
  - DSQL and ESQL
  - Interactive SQL and Java SQL
  - C and C++
  - JDBC
  - ODBC
  - Report writer
  - Third party product interfaces
- **EMPRESS DATA TYPES:**
  - Character
  - Text
  - National Language Support
  - Byte Stream
  - Date and Time
  - Microsecond Timestamp
  - Decimal
  - Dollar
  - Real
  - Float and Double Precision
  - Integer – short, long, 64-bit
  - Sequence

**Flexible and Configurable for application optimization**

- Stand-alone, client/server and distributed modes
- On-disk and in-memory capability
- Layered architecture accessible at 4 levels allows optimization and rapid prototyping
- Over 170 system variables for configuration, tuning and optimizing
- Customizable product footprint

- **EMPRESS FUNCTIONALITY:**
  - SQL support
  - Kernel level C API
  - Transactions
  - Locking
  - Indexing
  - Time series Indexing
  - Hierarchical Join
  - Cascade Delete
  - Persistent Stored Modules
  - Triggers and Stored Procedures
  - Referential Constraints
  - Range Checks
  - MicroSecond Time Stamp
  - On-Line Backup and Recovery
  - Replication
  - Audit trail Logging
  - Unicode support
  - User Defined Functions
  - Integrity Check
  - Import and Export
  - Shared Memory
  - Batch Commands

**Small footprint for constrained environments**

- Minimum resource consumption for high functionality
- Small disk size that is customizable
- Small memory usage with usage limits

**Predictable performance**

- Fast database engine
- Minimum overhead
- Kernel level control and speed
- Direct access to database structures
- Deterministic response


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**High reliability and consistency of data**

- 24x7 unattended operation
- Data integrity maintained
- Minimum storage/disk fragmentation

**Embeddable as a single unified program that is robust and efficient**

- EMPRESS can be linked with an application in a single address space
- EMPRESS installation is embeddable into application installation procedure

**Easy, straightforward and cost effective runtime licensing**

- Choose from:
  - royalty based
  - one-time fee
  - yearly subscription

**Continuous product development, deployment and life cycle support**

- EMPRESS Software technical support team of knowledgeable database experts deliver high quality, timely support

## 3. EMPRESS Applications in Aerospace, Satellite, Military & Defense

Empress Software's embedded database products and services have earned the trust and reliance of major government organizations and prime contractors including:

Boeing
Fairchild Aerospace and Defense
Federal Aviation and Administration
General Dynamics
GTE Spacenet
Honeywell Flight Systems
Hughes
Jet Propulsion Labs
L-3 Communications
Loral Defense Systems
Lockheed Martin
MIT Lincoln Laboratory
NASA
Northrop Grumman
Raytheon
Swedish Navy
U.S. Air Force
U.S. Army
U.S. Navy

EMPRESS has been successfully embedded into a wide range of successful applications and solutions such as:

Aircraft Design
Aircraft Component Tracking System
Satellite Command and Control Systems
Flight Simulation
Space Flight Systems
Galileo Jupiter Probe Data Management Solution
Data Management for Black Box Applications
Weather Tracking Systems


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# 4. EMPRESS Example Applications in Aerospace, Satellite, Military & Defense

## a. Galileo Project

EMPRESS Embedded RDBMS was used within POINTER (Planetary Observation Instrument Targeting, Encounter Reconnaissance), a subsystem of the Mission Sequence System (MSS) for the Galileo project because of its ability of quickly process huge amounts of bulk data, such as cloud and gas formations, temperatures, and instrumentation readings. The POINTER subsystem has a fundamental role in the collection of remote sensing science data. It provides geometry conditions of spacecraft and celestial bodies in the solar system for instrument science representatives to design remote sensing observations.

From the customer:
"EMPRESS has the ability to quickly process huge amounts of bulk data in a usable format and its direct kernel interface. Any data a computer can store, such as, cloud and gas formations, temperatures, and instrumentation readings, can be stored in the Empress databases. Since much of Galileo's command information will be collected and transmitted at the byte level, EMPRESS' direct kernel interface is ideal for handling instrument positioning."

## b. Ground Telemetry and Command Processor System

A Ground Telemetry and Command Processor System is a software interface which enables ground control staff to command spacecraft and gives analysts the tools to interpret the telemetry information satellites sends to Earth. EMPRESS is used to manage data including spacecraft operational information such as battery voltage, fuel supply,


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rotation, altitude and positioning, as well as telemetry data such as photographic images gathered and transmitted by satellites.

From the customer:
"The system provides the speed and flexibility required by telemetry and command applications by making use of the EMPRESS mr layer, which allows applications to interact directly with the database kernel. Instead of losing performance through additional layers, control over the behavior of data increases with proximity to the kernel."

c. Planetary Observation System

The Motif Integrated Data Application Systems (MIDAS) uses EMPRESS to supply database functions for Star Libraries (Master, IR, Planetary), Object Libraries (Satellite, Objects), and Signature Libraries (Sensor data from various sensors). Star Libraries are accessed by tracking computers to locate stars and planetary bodies. Tracking computers also access Object Libraries by the processing computers to process signature data from sensors located on the telescopes.

From the customer:
"Empress is small and compact. It has ability to store sensor and image data and can be easily set up to interface with various instruments."

d. Satellites Command and Control System

Satellite technology is steadily increasing in sophistication, from local satellites used in mobile communication and digital television services, to more far reaching satellites used to probe outer space and collect high resolutions images of Earth and our solar system. A command and control system used to test


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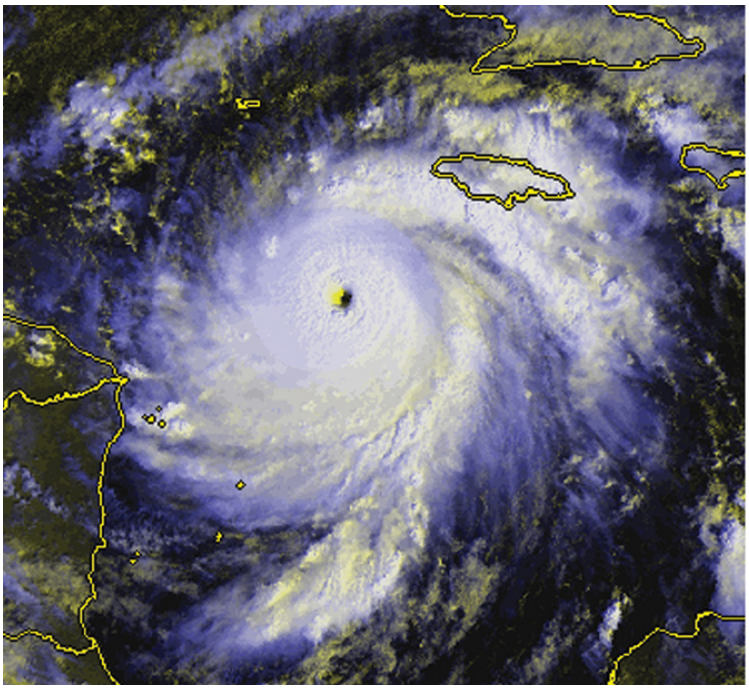
satellite and flight hardware components uses Empress Embedded RDBMS to log, collect and archive all user entries, ground status information and satellite data values for subsequent playback and analysis.

From the customer:
"A compact, low-cost, efficient and flexible system, EMPRESS proved to be amazingly fast when seeking data from data-tables containing millions of records."

e. Automated Weather Distribution System



In the Satellite and Radar Data Ingest for the Automated Weather Distribution System, weather satellite image data and radar summary data are gathered at Air Force Global Weather Center at the Offutt AFB, Nebraska. The weather satellites include the U.S. Air Force's Defense Meteorological Satellite Program, U.S. Department of Commerce's NOAA/NESDIS polar orbiters (TIROS), Japan's Geostationary Meteorological Satellite, European Space Agency's METEOSAT, and the NOAA/NESDIS Geostationary Satellites (GOES). In addition, National Radar Summaries are received from the U.S. National Weather Service/FAA/Air Force radars (NEXRAD.) All this image data is stored in mapped image databases using the EMPRESS RDBMS. Based on both schedules and data arrival events, map projection images for any part of the world are created and sent to Department of Defense sites spread around the world. The time between data arrival at Offutt Air Force Base and product arrival at the customer site is 10 minutes or less. A combination of terrestrial and satellite links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(including satellite based File Broadcast System links) ship thousand of images per day to bases all around the world.

From the customer:
"The exceptional speed of the EMPRESS RDBMS in handling bulk image data makes it possible to perform all of these operations on only two, single processor. The computers and the mass storage array occupy a single equipment rack. The EMPRESS RDBMS is the engine that makes our system work."

## f. War Game Simulation

Advanced Battlefield Computer System (ABACUS), a war game simulation, uses EMPRESS Embedded RDBMS to store thousands of pieces of information from weapon system ranges, to weather conditions, to vehicle loading time. A team of less than 6 military officers and maintenance engineers form the central command post, creating scenarios and running exercises for up to 170 stations and 2000 people. These exercises can run 24 x 7 for up to two weeks fueled by up to the minute, real time data. ABACUS is an internationally NATO used training application that can be tailored to meet the specific demands of a variety of organizations, both military and civilian.

From the customer:
"Since integrating EMPRESS in ABACUS five years ago, we have had little or no need for technical support. The product simply operates as desired and does it with no trouble."


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## 5. SUMMARY

EMPRESS high performance Embedded RDBMS delivers an unmatched combination of rich features, rich tools and rich data types that are well suited to the Aerospace, Satellite, Military & Defense industry.

- High reliability and consistency of data
- Rich toolset, data types and functionality for rapid development
- Flexible and configurable for application optimization
- Small footprint ideal for size constrained environments
- Predictable performance
- Embeddable as a single unified program that is robust and efficient
- Easy, straightforward and cost effective runtime licensing
- Continuous product development, deployment and life cycle support

EMPRESS has the following product characteristics:

1. Compact, low-cost and flexible system
2. Low resource consumption
3. Fast data ingest speed
4. Can store large volumes of binary data
5. Able to process huge amounts of data
6. Stores any data the computer can store
7. Zero maintenance
8. Can run in the same address space as the application
9. Configurable as standalone or client/server as needed
10. Kernel level interface for best performance, speed and flexibility

Most of all, over the past 25 years, Empress Software has developed a high degree of database management expertise in the Aerospace, Satellite, Military & Defense industries. Empress Software's technical support team of knowledgeable database experts delivers high quality, timely support.


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