# NeCST

## Networked Control Systems Tolerant to faults

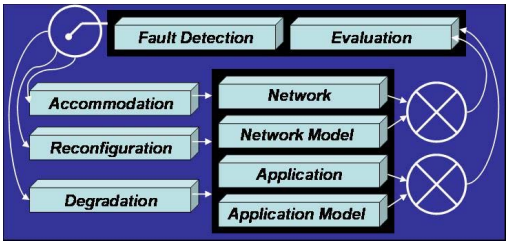
**KEYWORDS:** Embedded Systems, Networked Systems, Distributed Control, Fault Tolerance, Diagnosis, Quality of Service

### Introduction

Nowadays there is a strong demand by industry for the implementation of multi-level, plant-wide networking systems that address safety-critical issues. Multilevel communication architectures enable new requirements such as modularity, control decentralisation and/or distribution, integrated diagnostics, computing redundancy, quick and easy maintenance etc, to be met. The networked control system (NeCS) concept can provide many advantages that will contribute to meet these requirements.

### Objectives

The aim of the project is to explore research opportunities in the direction of distributed control systems in order to enhance the performance of diagnostics and fault tolerant control systems. This will lead to an improvement in the intensive use of NeCS technologies for the reactivity, autonomy and monitoring of large scale systems. The systems under consideration in the framework of this project can be considered as a distributed network of nodes operating under highly decentralised control, but unified in accomplishing complex system-wide goals. One of the key factors in designing such a complex system is that both the physical subsystem and the control part have to be designed together in an integrated manner.



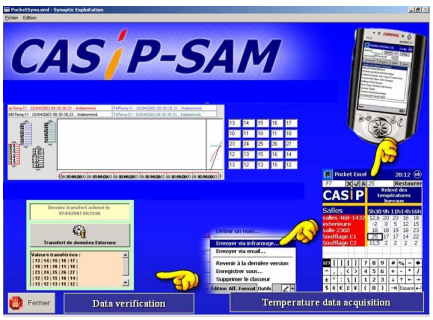

The systems developed in this project will be modular, adaptive, able to operate autonomously, and also possibly be reconfigurable. The implementation of these concepts is achieved by using the technologies of wireless networks, embedded systems, nomad components, electronics tags, etc…

Another the main contribution of the NeCST project is to propose different means of improving the embedded component safety. For this purpose, algorithms and procedures will be developed that are able to detect, at an early stage, anomalies (variances or irregularities in the embedded networks and in the embedded equipments) and to switch to the fault tolerant control strategy and/or providing predictive and real-time maintenance.

### Expected Results

An integrated solution offering a synergy between communications, and computation and control, represents a new area of study for fault diagnosis and fault tolerant control.

Conventional Fault Detection and Isolation (FDI) / Fault Tolerant Control (FTC) and Autonomy theories, with their ideal assumptions such as synchronised control, non delayed sensing and actuation, must be adapted to the new paradigm of NeCS. In particular, no significant theory in fault management and autonomous operating conditions exists, and only a few tools are available. Considerable efforts are still needed to make the range of theoretical results or methods in the control field applicable to networked systems.

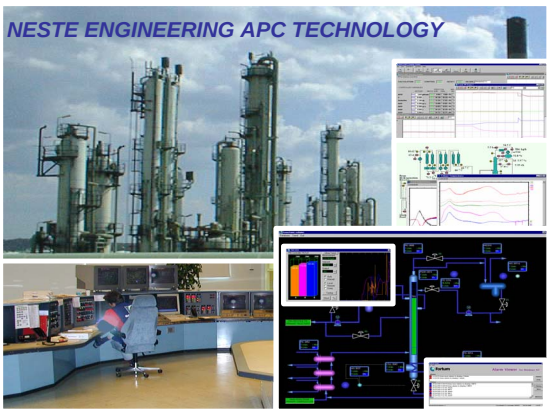


A toolkit of software modules will be developed to provide the monitoring, diagnostic and action planning functions of a fault-tolerant system. Application Tools and Methods will be provided to cover feasibility studies, investment justification, system installation, operation and enhancement etc.
A networked interface for use as intelligent advisor to human operators in production processes; Integration Methods will be defined which will be compatible with users' current and future control systems. Software Platform will include advanced distributed control methods that can fully exploit the advantages allowed for by NeCS technologies in continuous, as well as discrete, control processes and Hybrid systems. Implementation of the novel decision-support facilities that can fully exploit the advantages allowed by NeCS technologies will assist human operators in supervising industrial plants from local and remote workplaces.

It is planned to implement one technical prototype within plants operated by the industrial partner, incorporating the tools and methods appropriate to fault-tolerant control concepts. This will result in tested and validated project prototypes embedding the distributed control methods and the advanced decision support facilities within the different applications provided as project test-beds by the end-user partner.

## Partners and their role

The consortium is a composition of four academic groups University Henri-Poincaré, Nancy 1 (CRAN/UHP/CNRS), University of Duisburg – Essen, Helsinski University of Technology and University of Hull, and three industrial companies: NESTE JACOBS OY (Finland), PREDICT (France) and SAE AUTOMATION (Slovakia).




The role of the four universities is to integrate their experience and competence in the design of advanced FDI-FTC control systems for networked applications. The objective of PREDICT and SAE AUTOMATION is to develop a generic software platform implementing all the NeCST concepts. NESTE JACOBS OY should instantiate the software platform in a specific application of a Petroleum Oil Refinery Process.

## NeCST

**CONTRACT NUMBER**
IST – 004303

**FULL NAME**
Networked Control Systems Tolerant to faults

**TYPE OF PROJECT**
Strategic targeted research project

**PROJECT PARTICIPANTS**
University Henri-Poincaré, Nancy 1 (France)
University of Duisburg – Essen (Germany)
Helsinski University of Technology (Finland)
University of Hull (United Kingdom)
NESTE JACOBS OY (Finland)
PREDICT (France)
SAE AUTOMATION (Slovakia)

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**PROJECT WEBSITE**
www.strep-necst.org

**BUDGET**
Total cost: 2 M€
Funding: 1.2 M€

**TIMETABLE**
Starting date: 1. August 2004
Duration: 36 months

**This project is part of the portfolio of the**

**Embedded Systems Unit – C3**
**Directorate General Information Society**

**For more information please check:**

**http://www.cordis.lu/ist/directorate_c/ems/**