EC RESEARCH FUNDING IN ROBOTICS

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INTRODUCTION

ESPRIT, the European Strategic Programme for Research and Development in Information Technology, was launched in 1984 with the overall objectives of:

- providing the European Information Technology (IT) industry with the basic technologies to meet the competitive challenge of the nineties,
- promoting European industrial cooperation in pre-competitive research and development in IT, and
- contributing to the development and implementation of international standards.

The total budget of ESPRIT equals 4.7bn ECU for the first and second phases of 5 years each, one half coming from the European Communities and the other half being provided by the participating organisations. In total 648 projects got off the ground. Of the 1603 organisations involved, 676 were SMEs and 534 were universities or research institutions.

The ESPRIT Workprogramme is currently structured as follows:

1. Microelectronics and Peripheral Technologies
2. Information Processing Systems
3. Office and Business Systems
4. Computer Integrated Manufacturing
5. Basic Research

The majority of projects related to Robotics falls into the domain of ESPRIT/CIM, some further projects dealing with Artificial Intelligence and cognitive science topics are found in ESPRIT/BR.

A specialised Community programme in robotics is the TELEMAN Programme, which addresses the particular requirements of the nuclear industry. The total funding for TELEMAN amounts to 19 MECU.

Outside the Community's Framework Programme, but with the CEC's support and participation, the EUREKA Programme also addresses a number of robotic projects. The total EUREKA funding amounts to about 1 BECU annually.

PROJECTS IN ESPRIT/CIM

The ESPRIT/CIM domain covers five working areas as shown in Figure 1.

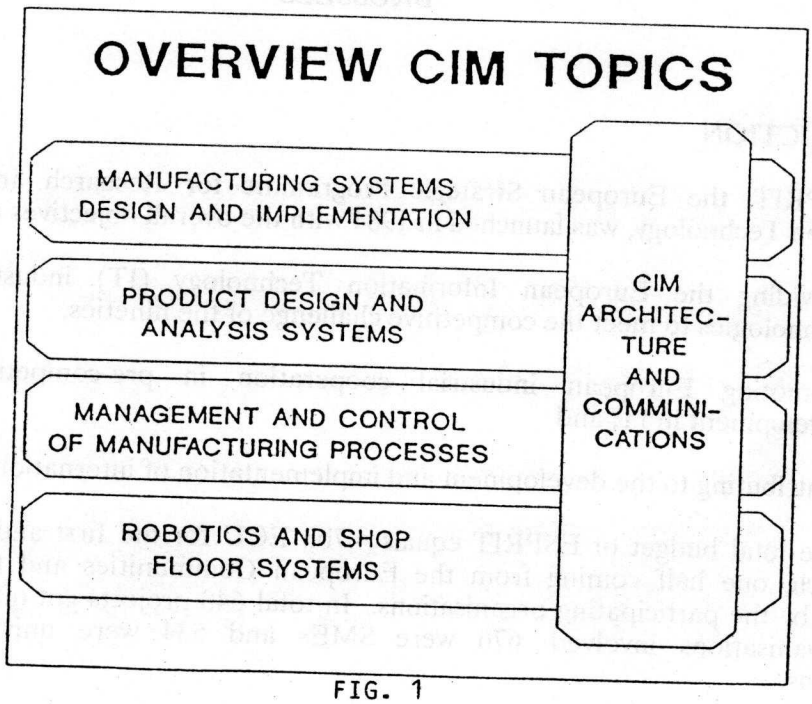


FIG. 1

The work objectives of the "CIM Architecture and Communications" sub-area are to specify, implement, demonstrate and validate architectures and communication protocols to enable interconnection and interworking of CIM systems within a coherent and comprehensive framework, based on the concept of open systems interconnection (OSI). The work in this sub-area contributes to international standardisation and provides the infrastructure for CIM integration. For these reasons this sub-area has a "horizontal" character and the emerging results directly enter and penetrate into the work of the other four CIM sub-areas.

Some of the projects relevant for automation and robotics are, for example, CNMA, FICIM, CAD*I and NIRO.

CNMA stands for Communication Networks for Manufacturing Applications. The project focusses on developments of protocols and services at the application layer, more specifically MMS (Manufacturing Message Specification) and network management, which is of increasing importance. FICIM aims at instituting standards for a fieldbus. On the other hand, the projects CAD*I and NIRO have been and are developing neutral interfaces and neutral data formats for the exchange of geometrical, technological and programming functions and data between CAD, robot planning and robot control.

The projects in the CIM sub-area "Robotics and Shop Floor Systems" embrace work on manufacturing equipment and robotic cells, autonomous robotic vehicles, vision systems, and sensors and actuators. The work is based on fundamental principles such as open control architectures, modularity and compliance with standards. Figure 2 provides an overview over major projects in this sub-area. The upper figure shows the so-called A-Type projects, i.e. major projects whose objectives are defined in detail in the respective workprogramme. Four projects deal with advanced manipulators, there are three projects addressing vision systems

for industrial automation, two mobile robot projects and one which deals with a modular open control architecture for robots and shop floor systems.

The lower part of the Figure gives an overview over thirteen smaller so-called B-Type projects. Vision and inspection for manufacturing automation are addressed by EP 1572, 2017, 2640, 5194; robotic welding technologies by EP 595, 5220, 5272, 5369; and other production automation by 179, 2656, 5114, 5338. Projects EP 2172, 2192 and 2617 deal with the important issue of advanced sensor systems, including validation, predictive maintenance and data management.

Both together, the A- and B-type projects, represent a well-balanced and strategically placed approach to the field of automation and robotics.

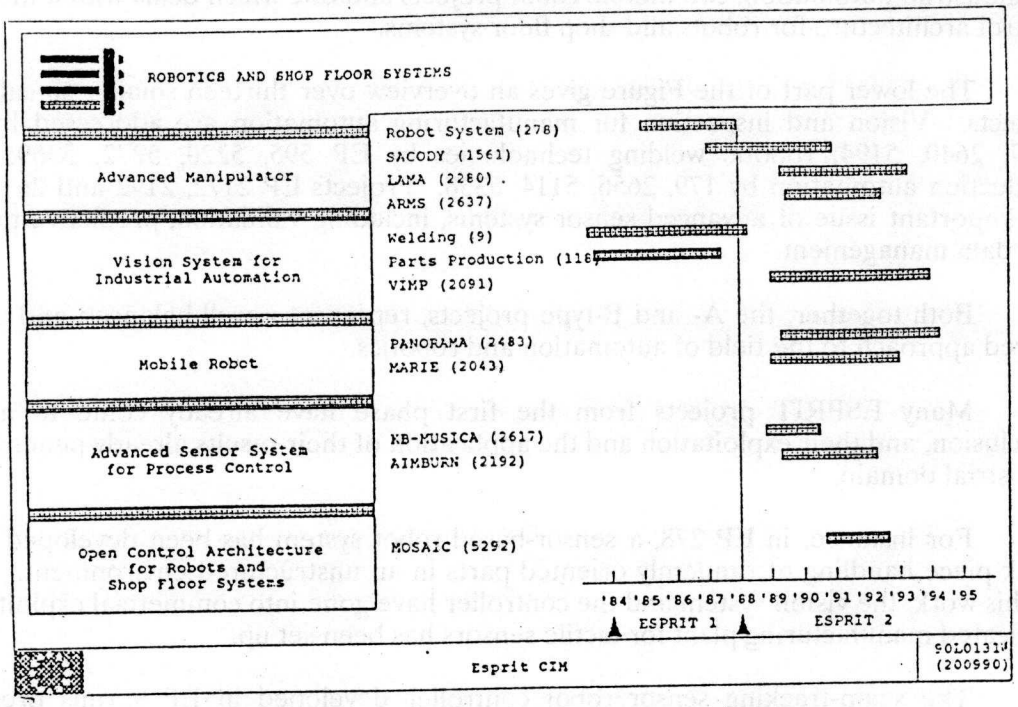
Many ESPRIT projects from the first phase have already come to a successful conclusion, and their exploitation and the application of their results already penetrate into the industrial domain.

For instance, in EP 278, a sensor-based robot system has been developed for flexible work piece handling of randomly oriented parts in an unstructured environment. As a result of this work, the vision system and the controller have gone into commercial exploitation and a dedicated manufacturing plant for tactile sensors has been set up.

The seam-tracking sensor/robot controller developed in EP 9 runs presently as a prototype product version in three different industrial testbeds and, if successful, will be marketed by one of the partners of the consortium.

Another project, very successful in terms of exploitation, is Operational Control for Robot System Integration into CIM (EP 623). The results of the project have led to ten different systems on the market, and have been exploited in seven different systems internally and in about forty consultancy tasks. They have been the subject of a hundred technical publications and been included in forty university courses. The project participated in twenty-eight fairs.

The impressive success of the concluded projects with respect to exploitation sets high expectations for the projects currently under way.


ROBOTICS AND SHOP FLOOR SYSTEMS
Advanced Manipulator
Vision System for Industrial Automation
Mobile Robot
Advanced Sensor System for Process Control
Open Control Architecture for Robots and Shop Floor Systems
Robot System (278)
SACODY (1561)
LAMA (2280)
ARMS (2637)
Welding (9)
Parts Production (118)
VIMP (2091)
PANORAMA (2483)
MARIE (2043)
KB-MUSICA (2617)
AIMBURN (2192)
MOSAIC (5292)
'84 '85 '86 '87 '88 '89 '90 '91 '92 '93 '94 '95
ESPRIT 1
ESPRIT 2
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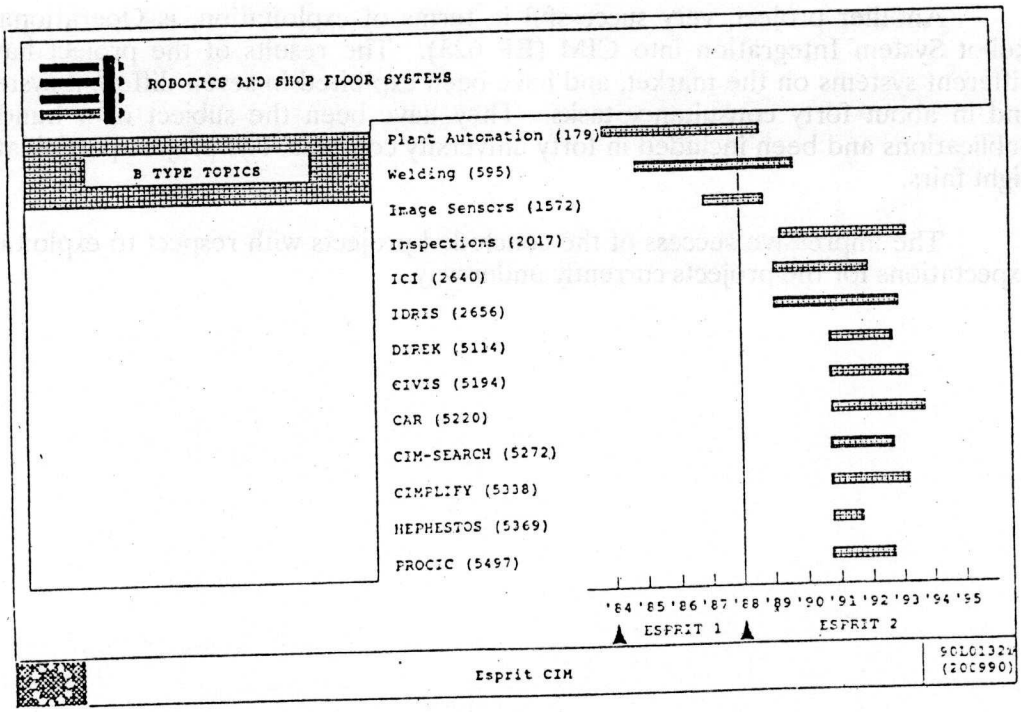
ROBOTICS AND SHOP FLOOR SYSTEMS
B TYPE TOPICS
Plant Automation (179)
Welding (595)
Image Sensors (1572)
Inspections (2017)
ICI (2640)
IDRIS (2656)
DIREK (5114)
CIVIS (5194)
CAR (5220)
CIM-SEARCH (5272)
CIMPLIFY (5338)
HEPHESTOS (5369)
PROCIC (5497)
'84 '85 '86 '87 '88 '89 '90 '91 '92 '93 '94 '95
ESPRIT 1
ESPRIT 2
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FIG. 2