Globeman21 : Enterprise Integration for Global Manufacturing towards the 21st Century

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Abstract

This paper describes the Globeman project, its background and history, its vision, objectives, strategies, organization, work plans and consortium partners. The results are briefly categorized . Industrial scenarios and demonstrators are already available. These serve as specifications, guidelines and training simulators for other partners and projects facilitating technology transfer. Globeman will run through 1999 and the main industrial results and achievements will be published from mid-1997 onwards.

Keywords

IMS, Intelligent Manufacturing System, Globeman, Product Life Cycle, Enterprise Integration, Global Manufacturing, Virtual Enterprise

1 INTRODUCTION

Globeman is a project that operates under the international IMS program. It is a development from the Test Case of the same nature, that has operated since 1993 in the IMS feasibility study. Many of the partners in the present Consortium are continuing from the earlier project.
The Globeman Test Case studied the requirements for manufacturing enterprises to remain competitive in the face of an increasingly demanding and selective marketplace and with rapidly advancing telecommunications and transport technologies. The Test Case took into account the way markets are steadily becoming global, rather than domestic.

J. Goossenaerts et al. (eds.), *Information Infrastructure Systems for Manufacturing*

The Test Case recognized, as many other studies have, that the challenges is to continually improve performance in terms of improved products, reduced costs, decreased product development time, increased flexibility to tailor products to customer needs, and the provision of cleaner products using cleaner processes. The important findings by the Consortium were how the changes in the marketplace and the drive by the new technologies can be used as opportunities for major shifts in the way manufacturing businesses are organized and managed. Three essential features for manufacturing in the future were identified. Firstly, the formation of "Virtual Enterprises", or close collaborations between companies and organizations (usually not bound together by long-term formal arrangements) all over the world, to provide a specific product or outcome. Secondly, the need to integrate the whole life cycle of a product from initial conception through to final disposal was seen as critical, if the needs of the customer and the community are to be fully satisfied. Thirdly, the adoption of Information Technologies in ways that integrate global enterprises, to achieve really close relationships between widely scattered groups and people, was seen as an essential element for the future. Combining all of these findings from the Feasibility Study, Globeman21 is directed at achieving major improvements in the Global Manufacturing Process.

2 BACKGROUND AND HISTORY

We live in a rapidly changing world. International relationships are in continual flux. Manufacturing technologies, business practices and market demands are under constant review. Information technology, is developing at an accelerating rate.

- products can be developed in one country and manufactured at multiple sites anywhere in the world at very low cost,
- vast amounts of information can be stored and retrieved rapidly,
- complex physical situations can be modeled and simulated,
- the operation of flat management structures is made a reality by data access at all levels of an organization,
- virtual enterprises can be created to train on and complete common tasks,
- product information can follow a component or system all its lifetime.

Many of the global developments have left business practitioners puzzled and confused about how best to achieve commercial advantage.
This is the challenge on which Globeman 21 was founded.

Fig.1 shows the history of Globeman 21. In 1993, a International Test Case was conducted by the IMS feasibility study. We learned a lot from this test case. This test case tested advantages and difficulties in cooperation coming from multi-region/multi-national, various industrial sectors, various size of company, diversified interests by partners, different funding system, distributed R&D system and IPR(Intellectual Property Rights).
After that some partners continued Transition Period Project and prepared full scale proposal. In September 1995, our proposal was endorsed by ISC2(2nd International IMS Steering Committee). Kick-off meeting of Globeman21 was held in Sydney, Australia in March, 1996.

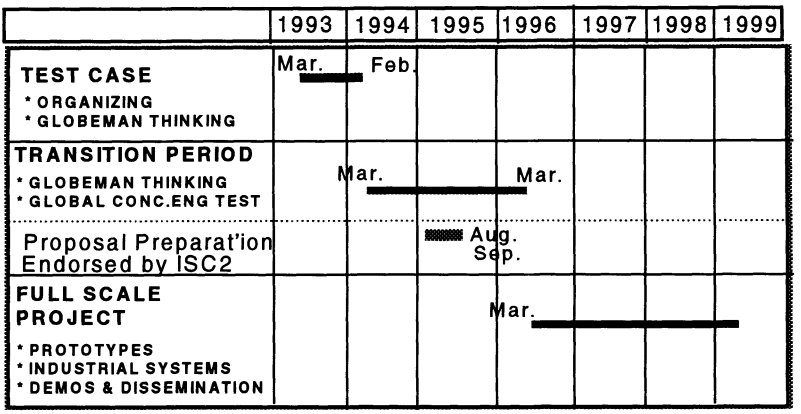

Figure 1 History and schedule of Globeman

3 PROJECT OVERVIEW

3.1 Vision

The Future will see Manufacturing Globally Integrated across Time and Space.
Globeman21 is an international research consortium building a cooperative team of the world's best industrial and research organizations to develop and sustain collaborative networks.
It is drawing on the specialized strengths and knowledge available in many organizations, to build the business practices, the management techniques, the information infrastructure, the simulation systems and the modeling tools for integrating the elements of an enterprise across geographic, cultural and time barriers.

3.2 Objectives

Objectives of Globeman project are:

1. To create the business processes; the methods, models and technologies, for the emerging global manufacturing environment. Global life-cycle management will be included as a key element. The new approaches, models, methods and technologies will be integrated by managing the processes in global enterprises.

2. To improve the quality and professionalism of manufacturing by performing several industrial Demonstrators.

3. To present clearly the findings of GM 21 so that the participants and other companies can radically improve their business processes and environments based on new business models and supporting tools.

3.3 Strategy

To achieve Globeman objectives, we concentrate on 2 business processes and 4 technology areas.

Business Process Groups(PGs):

Global Product Life Cycle Management

Global Manufacturing Management

Technology Groups(TGs):

Modeling Technologies

Technologies for Information Access and Control

Technologies for Scheduling and Coordination

Technologies for Business Process Analysis and Design

The interactions between process groups and technology groups are illustrated in Fig.2.

Process groups are intended to apply and test methods and technologies that enhance the performance of the business processes related to their areas of concern. These groups will configure existing technologies such that they can be applied in manufacturing business practice. If it is considered that no appropriate technologies exists, the technology groups will suggest and recommend new technologies which they have been studying, or they will seek to develop new technologies.

On the other hand, the technology groups have the possibility to propose the process innovation to the process groups by applying advanced technologies.

In these research and development activities, we can share the background intellectual property rights and produce foreground information and rights. These interactions will be spiraling and in the final stage of Globeman activities, Globeman demonstration throughout the business life cycle are anticipated.

Because of the wide scope of these groups, it is necessary to form smaller cooperating units to undertake the detailed studies, industrial trials and research. The Work Packages are the operating units which will have clearly defined mandates and specific task areas for each partner to perform.

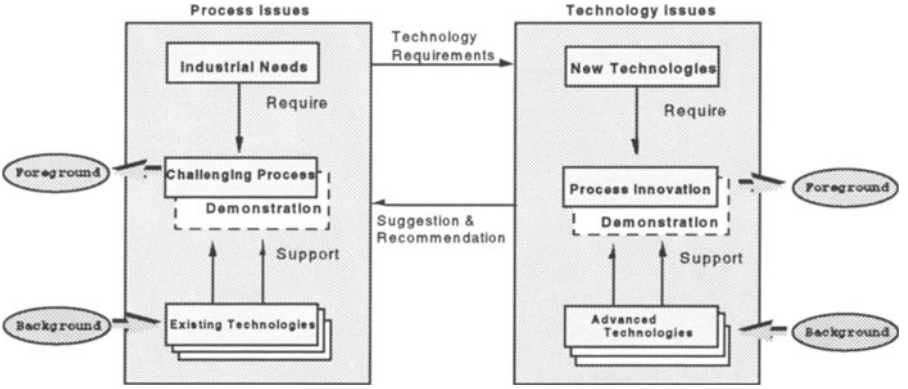

Figure 2 Business process & Technology collaboration

3.4 Management Structure

Management is very important in such a large consortium. Fig.3 shows Globeman management structure. Board which consists of regional coordinators shall be responsible for political & managerial matters such as ensuring the efficient performance of the consortium, interfacing with ISC, IRS, maintaining the vision and mission of the project. IPR support committee shall be responsible for addressing all legal aspects of the projects. Executive Director shall be responsible for ensuring efficient performance of the project, timely reporting the results to ISC, partners and funding agencies, resolving disputes between partners. Technical Committee shall be responsible to the Executive Director for ensuring the work of the Process Groups and the Technology Groups converge towards the project vision.

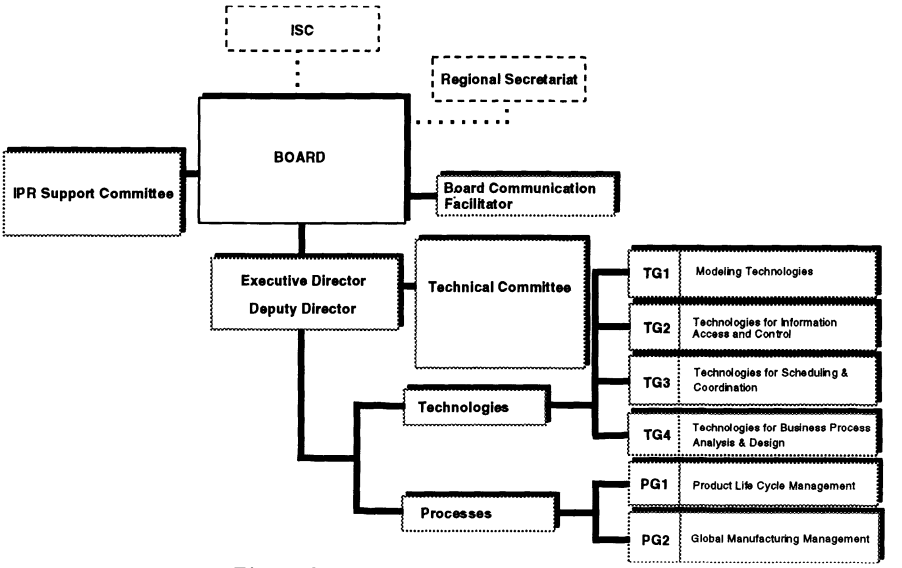

Figure 3 Management structure of Globeman

3.5 Expected Benefits

Expected Benefits from Globeman activities will be:

- Increased understanding of the key processes in manufacturing, considering an integrated dynamic cooperation between enterprises, and taking account of cultural issues in different regions.
- New management capabilities to operate in a world of global virtual enterprises - i.e. an "enterprise" composed of cooperating companies (not formally incorporated) working together for a specific production task.
- New technologies and new applications in fields such as: modeling, simulation, control, artificial intelligence, team leadership and human organization issues; and the

integration of elements from all of these and other disciplines.

- Architectures for more efficient, high quality, production in all domains of manufacture, but particularly in small batch or one-off production. The emphasis will be on a framework of new processes and technologies to provide improved products, more directly focused on customer needs and satisfaction, and with reduced time and cost for product development.

The World Manufacturing Community will benefit, in the long-term, from publication of results and from demonstrations which ensure that Globeman21 influences manufacturing management and business practices throughout the world.

Industrial Partners can gain immediate benefits by becoming part of the developing practices and technologies with shared access to information between leading industrial enterprises and some of the world's best researchers. Participation in Demonstrators ensures very early benefit and enhances the in-house capabilities for future company developments.

Participating Universities and Research Establishments are given scope for expanding their research activities and undertaking industrial research in association with world class scholars and leading manufacturing companies. Generic results are publishable, while Demonstrators ensure industrial relevance and a global reputation in the real world of manufacturing

4 PROJECT WORKPLAN

Process Group 1(PG1) - Global Product Life Cycle Management - is aimed at improving the business processes to manage the life cycle of the product. The work of the Group includes description from the conception of the product, all the way to planning and re-use or re-cycling of the product and its materials. Critical to life cycle management is the flow of information through all phases of the product's life and the seamless transfer of data and knowledge between different companies in all of the phases. Thus, the Work Packages in PG1 include topics such as, defining the life cycle itself, communications within the life cycle and the extended manufacturing enterprise, production and recycling, integration of engineering and production, managing maintenance and renewal of the product/process, and integration of the findings of the whole Process Group into a generic solution that can be applied in manufacturing practice.

Process Group 2(PG2) - Global Manufacturing Management - is directed to the business processes required to manage a globally integrated manufacturing business. It assumes an extended enterprise comprising traditional manufacturing establishments and also including suppliers and customers as part of the involved manufacturing enterprise. Thus suppliers, customers and many other companies are necessarily linked into the total business process. The Work Packages in PG2 include a review of methods to improve the business system in a global operation, development and testing of prototype models for new business processes in repetitive manufacturing and in one-of-a-kind production, consideration of methods for maintaining and using data between diverse groups and a group that will integrate the results of the complete Process Group to achieve a generic demonstrator that can be applied by companies in the consortium and by other companies engaged in global operations.

While the two Process Groups are directed towards different ends - PG1 at the product life cycle and PG2 at the manufacturing enterprise - both assume a global manufacturing interaction, with effective information infrastructure to support the whole operation. There will

be commonality in many of the new technologies required by each process groups. For this reason, the Technology Groups that have been established will link into both PG1 and PG2. There will also be some sharing of tasks and results between PG1 and PG2. So far as possible, the TGs will adapt existing technology to suit the requirements of the Groups. New technology will only be developed when no other suitable technology exists.
Demonstrations are a key feature of Globeman. They will exemplify the complete operation of some major element of Globeman. So far as possible, the demonstrations will be real situations and the resulting conclusions will provide an actual improvement in the operation of the company members.

Table 1 Work packages of Process Groups

	Title	Leader
PG1	**Global Product Life Cycle Management**	Ahlstrom, Finland
WP1	Product Life Cycle Process	IPK, Germany
WP2	Communications Management	TEC, Japan
WP3	Product Model Management	FhG-IPA, Germany
WP4	Integration of Engineering and Production	TEC, Japan
WP5	Operations Support and Maintenance Management	VTT, Finland
WP6	Management of Renewals	JSPMI, Japan
WP7	Management by Visual Methods	HUT, Finland
WP8	Integration of PG1 Results	Ahlstrom/IPA
PG2	**Global Manufacturing Management**	BHP, Australia
WP1	Business System Analysis and (Re)Design	HUT, Finland
WP2	Management of Repetitive Manufacturing	BHP, Australia
WP3	Managing One-of-a-Kind Manufacturing	Ahlstrom, Finland
WP4	Global Data Warehousing	TBA
WP5	Integration of PG2 Results	BHP, Australia

Table 2 Work packages of Technology Groups

	Title	Leader
TG1	**Modelling Technologies**	Toyota, Japan
WP1	Modelling Infrastructure	IPK-IWF, Germany
WP2	Global Product Models	U. Tokyo, Japan
WP3	Global Business Process Models	RIT, Sweden
WP4	Tools for Simulation	FhG-IPA, Germany
TG2	**Technologies for Information Access and Control**	TEC, Japan
WP1	Data Communication & Sharing Infrastructure	TEC, Japan
WP2	Knowledge Sharing Infrastructure	TEC, Japan
WP3	Tool Integration	Yokogawa, Japan
TG3	**Technologies for Scheduling and Coordination**	CMU, USA
WP1	Constraint-Based Scheduling	CMU, USA
WP2	Coordination Methods	CMU, USA
WP3	Generic Agent Shell	U. Toronto, Canada
WP4	Workflow Management	U. Toronto, Canada
TG4	**Technologies for Business Process Analysis and Design**	CSIRO, Australia
WP1a	Methodology for Business Process Analysis and Design	Griffith U., Australia
WP1b	Tools for Business Process Analysis and Design	Griffith U., Australia
WP2	Business Process Analysis and Manufacturing Strategy Formulation	CSIRO, Australia
WP3	Alternative Approaches for Business Process Analysis and Design	TBA
WP4	Visualizing Business Process	TBA

5 RESULTS AND ACHIEVEMENTS

The results of the project fall within the following items:

1. Partner requirements
2. Industrial scenarios
3. Demonstrators
4. New products
5. New processes
6. New competence and skills
7. New IT systems and tools
8. New methodologies
9. International collaboration

6 CONSORTIUM PARTNERS

Currently 46 partners signed Consortium Corporation Agreement from all regions.
The people resources applied to Globeman over the next 3 years will be order of 4500 person-months. This is actually 40 million US$ project for 3 years.

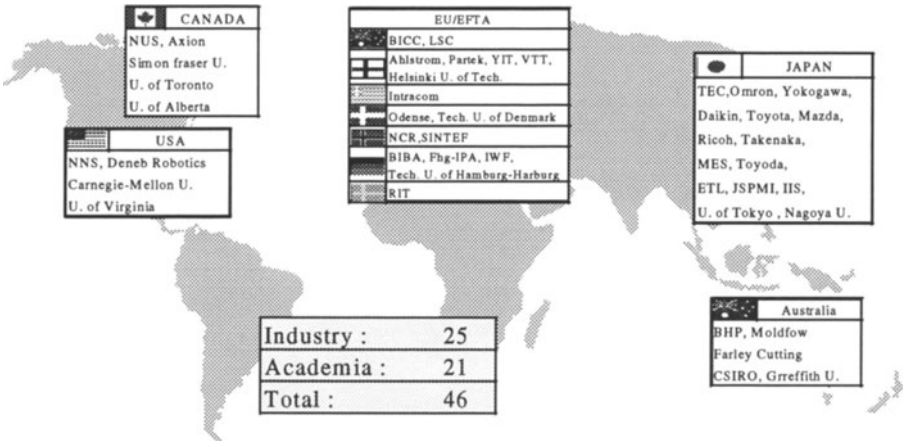

Figure 4 Globeman Partners

International Coordinating Partner:
Newport News Shipbuilding

Regional Consortium Partners:

Japan Region

Coordination Partner: Toyo Engineering Corporation

Industrial Partners: Toyo Engineering Corporation , Omron Corporation , YokogawaElectric Corporation , Daikin Industries Ltd , Toyota Motor Corporation, Mazda Motor

	Corporation , Ricoh Company Ltd , Takenaka Corporation , Mitsui Engineering & Shipbuilding C.Ltd., Toyoda Machine Works
Academic Partners:	Electrotechnical Laboratory, Japan Society for the Promotion of Machine Industry, Institute of Industrial Science, University of Tokyo, Nagoya University,

European Union(EU) /EFTA Region

Coordination Partner:	A. Ahlstrom Corporation, BICC
Industrial Partners:	A. Ahlstrom Corporation, BICC, Logistics Support Consultants , Intracom SA, Odense, Partek , YIT, NCR Norge AS
Academic Partners:	Bremen Institute of Industrial Technology, FhG-IPA, IWF, VTT, IIA-Research Centre Helsinki University of Technology , Royal Institute of Technology, Technical University of Denmark, SINTEF, Technical University of Hamburg-Harburg .

Australia Region

Coordination Partner:	BHP Pty Co.
Industrial Partners:	BHP Pty Co., Farley Cutting Systems Pty Ltd. , Moldflow Pty Ltd.
Academic Partners:	Commonwealth Scientific and Industrial Research Organization, Griffith University

CANADA Region

Coordination Partner:	University of Toronto
Industrial Partners:	Northern Underwater Systems, Axion Spatial Imaging
Academic Partners:	Simon Fraser University , University of Toronto, University of Alberta

USA Region

Coordination Partner:	Newport News Shipbuilding
Industrial Partners:	Newport News Shipbuilding , Deneb Robotics
Academic Partners:	Carnegie-Mellon University, University of Virginia

6 CONCLUSIONS

Globeman has so far successfully integrated industrial and academic people from 4 continents. This is achieved by developing common IT infrastructures, objectives, methodologies and approaches.

The efficiency of this size of project has surpassed our expectations. Cultural and other differences among partners do not seem to prohibit creative collaboration as long as we share common vision, concepts, infrastructures and pattern of behaviors.

The importance of global cooperation and collaboration can not be overemphasized. Most governments contribute to programs to give aid to the underdeveloped countries. Globeman is developing technologies that will open opportunities to improve the way this aid can be provided. Sharing knowledge, competence and skills and transferring results and values can be achieved without cultural and human interference and with simultaneous interaction.

The Globeman partners are satisfied with the project and have great expectations to the results being continuously developed and deployed.