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21st Century Manufacturing
Enterprise Strategy
Report

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21st Century Manufacturing Enterprise Strategy

An Industry-Led View

ABSTRACT

The 21st Century Manufacturing Enterprise Strategy is a vision and the beginning of an implementation plan, which a core group of industry leaders have developed. This group of 15 executives from 13 companies had the advice and counsel of over 150 people from 77 companies and 11 professional organizations in developing their strategic enterprise plan. The group strongly feels that this strategy will enable the U.S. to once again become the leader in a world marketplace if a significant effort is led by industry with the help of government and academia to implement the strategy and build the infrastructure.

The existing industrial era dominated by mass production manufacturing is drawing to a close. It is giving way to a new era, to be dominated by agile manufacturing enterprises. The Agile Manufacturing Enterprise Forum seeks nothing less than the revival of American competitiveness through the adoption of agile manufacturing strategies. The developers of this strategy believe that U.S. industry does not have an unlimited amount of time to make this transition. We must begin now, today. What happens in the mid-1990's will determine whether or not the U.S. will remain a major manufacturing force, and whether or not the American people can continue to enjoy a high standard of living in the world. Government and academia must join in this extraordinary effort which U.S. industry is leading.

1. Summary

The outcome of this project was the publication of a two-volume report (Attachment A) on the global competitive environment U.S. manufacturing will face, and the infrastructure it will require in order to compete, as we transition over the next 15 years into the 21st century. The developments described in the report present a unique opportunity to capitalize on distinctive U.S. strengths; failure to seize this opportunity will put the standard of living of the American people at profound risk.

The report presents the thinking of leading representatives of industry, government and academe. It represents over 7500 man-hours of work and incorporates ideas culled from many excellent recent reports on U.S. industry. The distinctive value of this particular document lies in its presentation of a comprehensive picture of a new system of manufacturing -agile manufacturing- that has begun to emerge in the industrially advanced nations. Our objective in presenting this picture was to assist in defining a strategy and an action agenda that would enable U.S. industry to make the transition to this new system in a timely and competitively effective manner. Volume one of the report begins with a description of the opportunity for regaining global competitiveness that the transition to agile manufacturing offers American industry. It continues with a non-technical vision of agile manufacturing as a system in which technologies, management structures, and social values are synthesized into a powerful competitive weapon. The opportunity and the vision chapters together provide the backdrop for four industrial scenarios. Each is written from the perspective of a successful agile manufacturing enterprise in the year 2006. Together, the scenarios identify the technological, managerial, and social infrastructures that will have to be put in place if such enterprises are to come into being. Volume two of the report amplifies the technical details implicit in the creation of these infrastructures.

The ultimate objective of this report is to provoke the actions that need to be taken now in order to restore the United States to world leadership in manufacturing. *The fact that all of the world's leading manufacturers have to build a new infrastructure to make the transition from mass production to agile manufacturing provides a unique opportunity for U.S. industry to regain the leadership it lost in the 1970s and '80s.* Only a concerted effort, coordinated by industry, supported by the public, and with the cooperation of governmental and academic institutions can make this happen.

The vision presented here of the infrastructure required for creating agile manufacturing enterprises in the U.S. is, we believe, 80 to 90 percent correct. The key to making the vision come true, however, is not to make the vision 100 percent correct, but to immediately take steps to implement it. Refinement of the vision is best accomplished through the experience of working to make it a reality.

If the U.S. is to return to leadership in manufacturing, industry must take the lead in effecting that return. No single corporation, however, not even the manufacturing sector as a whole, can accomplish that task: it is simply too big a job. Only through inter-firm cooperation, and through cooperative, coordinated, efforts among industry, government and academe can that task be accomplished.

The key finding of this report is that there is a common infrastructure requirement for all agile manufacturing enterprises, regardless of their industrial sector. This common infrastructure will be used in different ways by different industries and different firms within the same industry. Consequently, companies and industries can work together to build the infrastructure, even while competing in the products and services it enables them to provide. The infrastructure will be used to tie production processes together and to integrate those production processes with other parts of the company, and with parts of different companies, into a single system. When the system functions efficiently, it allows companies to easily and quickly meet the needs of a rapidly changing competitive environment. In effect, the infrastructure will enable the formation of agile manufacturing enterprises; capable of responding to the fast-changing market needs and manufacturing demands of a global economy. We believe that competition in the twenty-first century will be dominated by agile enterprises. *Those nations that focus now on speeding the transition to agile manufacturing will become the strongest competitors in the global marketplace.*

We have called our report a "21st Century Manufacturing Strategy". Accordingly, the Summary and Action Agenda sections of this volume lay out steps that need to be taken: by industry; by the DoD, which has a vital stake in the success of industry; by Congress and the Executive Branch, which must act to protect the U.S. standard of living; and by academe, which must assume a more active role as an economic development agent.

Because of our concern that this not be just another report, we strongly recommend forming an Agile Manufacturing Forum. The objectives of this forum will be: to facilitate action; to maintain and build on the momentum generated by this project; and to provide a means for on-going discussion and coordination between all those involved in carrying out the action agendas needed to develop the infrastructure.

After examining this report, we invite you to join us in turning the 21st Century Manufacturing Strategy into reality. The economic well-being and strength of America depends on it.

2. Introduction

2.1. Background. In its Conference Report for the National Defense Authorization Act for Fiscal Year 1991, Congress recognized that identifying a defense manufacturing technology program as an adjunct to the several military Service and Defense Agency industrial preparedness programs will provide the Department of Defense with a mechanism for addressing longer term manufacturing technology programs. The report implies a framework for the Manufacturing Technology Program that promotes a convergence of interests among industry and the Department of Defense. Such a framework should support the acquisition by industry of capabilities essential to satisfying defense requirements while simultaneously creating commercial opportunities and facilitating synergistic cooperation.

The key to developing such a framework was thought to be a mutually defined agenda for encouraging manufacturing innovation. The agenda anticipated would emerge from the vision, architecture and implementation plan being developed for the other Department of Defense programs, such as MANTECH.

In developing its objectives, the Department of Defense recognized that cooperation among all elements of government, industry and society were a key aspect. Such cooperation would underwrite a prodigious benefit for American competitiveness. The following elements have argued loudly and convincingly for a new manufacturing paradigm, one that is characterized by cooperation rather than only competition among industry partners, and which also involves the Department of Defense:

- (1) Congressional interest
- (2) Interest and participation of the Departments of Commerce and Energy, as well as the Department of Defense
- (3) The reality of the Japanese Intelligent Manufacturing Systems programs
- (4) The reality of European Economic Community investments in manufacturing
- (5) The recognition of common economic problems among American companies
- (6) The current Consortia and collaboration experience.

In order to accomplish the goals outlined above, it was judged necessary to structure a means whereby a significant "corporate buy-in" would be achieved. In this manner, companies participating directly in the project as well as those incorporated by other means (workshops, executive briefings, those contracting with the Department of Defense, those connected with the Iacocca Institute) would own a piece of the consensus and would be willing to endorse the final report with that understanding.

2.2. Objectives. With the Congressional mandate that they develop a framework for manufacturing that would promote a convergence of interests among industry and the DoD, the DoD awarded Lehigh University's Iacocca Institute the assignment of creating a vision which would encompass longer term manufacturing goals. These goals and convergence of interests have been used to define the "21st Century Manufacturing Enterprise Strategy".

As facilitator for developing this strategy, the Institute was charged with accomplishing the three objectives stated below:

(1) Identify critical manufacturing goals for defense and industry and use these goals to formulate a joint vision for the future ability of U. S.-based manufacturing to serve the Department of Defense.

(2) To develop a framework for pursuing these goals that is responsive to both the respective and common interests of defense and the manufacturing sector, and to allow for cooperation in a natural way on a case-by-case basis.

(3) To articulate a plan for implementing this framework in a way that ensures maintenance of the program vision and partnership mechanisms for the benefit of the Department of Defense.

There was decided emphasis placed on the view that this report not be permitted to become simply an academic exercise. Some attention was dedicated to the history, results and influence of prior vision studies and reports. The assessment yielded the following:

(1) There must be industry participation in the setting of agendas. This project was going to be driven by industry rather than solely by the Department of Defense. In fact, the Department of Defense sponsor was represented on the inner core team by few of its members, and only one full-time member. The steering and agenda setting would be done by the inner core, the principal investigators, and the Department of Defense, working in concert.

(2) Research activities would be centered around searching out the best reports and basing the study therefrom, rather than "starting over"; there would be no attempt to "re-invent the wheel." It was decided at the outset that industry experts would be retained by the inner core team to brief the team on such matters as Japanese vision, American consortia, DoD points of view, etc. Also, research was keyed toward becoming knowledgeable with respect to existing visions, the small business point of view, manufacturing and design engineering, and both successful and failed mechanisms for cooperation between separate and distinct entities, to name a few.

(3) This project was action oriented. A primary focus was on securing a corporate buy-in at the highest levels of industry to the concept of cooperation in a natural way between industry and the Department of Defense. Creating the vision and the mechanisms were in and of themselves, only part of the task.

(4) This was not to be simply a report on a vision. Another primary focus was to advocate and influence the advancement of mutual investment in accordance with appropriate mechanisms and to set a framework that would facilitate this.

3. Approach

Under the leadership of project directors Roger Nagel, Director of Operations, Iacocca Institute, Lehigh University and Rick Dove, President, Paradigm Shift, International, the approach was to create a three-tiered executive vehicle for achieving the objectives of the project. The first tier was an "inner core" team of high-level industry executives together with Department of Defense representatives who would meet in intensive sessions at Lehigh University, and who were supported by university faculty, staff and researchers.

The project strategy was to start with existing visions and other documents to gain the benefit of all prior work and to orient the effort toward reaching rapid consensus among inner core team members with regard to the vision advanced. The inner core would be addressed by an advisory core of selected executives as subject matter experts for briefings as required.

The inner core team would set forth its preliminary draft before an industry consortium-sponsored meeting of industry executives and involve this broader "outer core" of executives in executive briefings/mini-workshops to provide critical review and feedback during the task. The inner core team would then consider, adopt where appropriate and reply to the outer core critique in order to provide both the sense and the fact of participation and ownership of the vision to outer core members.

Acting in concert with inner core team members as well as other participants and non-participants in the project, project team members would then work to obtain CEO endorsement of the vision and framework, as well as commitment to partnering with industry and the Department of Defense. The process would be ongoing, with continuous improvement, and would provide support and encourage the Department of Defense and others to utilize the project results and maintain the momentum of the vision long after the project itself was completed.

3.1. Formation of the Inner Core Team. With the above elements in mind, Principal Investigators Roger Nagel and Rick Dove together with Lehigh University President Peter Likins,

Vice President for Development Mike Bolton and Iacocca Institute Executive, Larry Hecht, formulated a candidate list of companies to be inner core team members. These companies were reviewed by the Department of Defense representatives for suggestions of any additional companies which should be considered. The task of contacting key, high-level executives within these organizations was then initiated. These executives were requested to recommend individuals from their respective companies to serve on the inner core team. Guidelines were presented to the executives regarding the type of member who should be selected. This was to ensure that the inner core team members were individuals who would:

- (1) Understand the corporate perspective and be well acquainted with the needs of the corporation
- (2) Have access to and the confidence of corporate decision makers
- (3) Understand the strategic implications of manufacturing technology for the corporation
- (4) Have a vision of the future competitiveness needs of industry in general and their company in particular
- (5) Be an action, "make it happen" individual
- (6) Have had a line management responsibility during their career
- (7) Have a familiarity with the constraints under which the Department of Defense operates.

Predictably, not everyone contacted was able to contribute an executive given the extremely short notice and the extraordinary time commitment of the individual selected. Those companies who were able to respond and provide a senior-level executive to participate in the project were:

Air Products & Chemicals
AT&T
Boeing Helicopters
Chrysler Motors Corporation
FMC Corporation
General Electric Aircraft Engines
General Motors Technology Center
IBM Corporation
Kingsbury Corporation
Motorola Corporation
Naval Industrial Resources Support Activity Center
Texas Instruments
TRW Space & Defense Sector
Westinghouse Electric Corporation Systems & Technology Center
Westinghouse Electronic Systems Group.

3.2. Inner Core Activities. In view of the constraints imposed by the project time line, the schedule of the inner core activities was, of necessity, rigorous. To meet this time frame, industry representatives met, on average, two to three days per week for two and one-half months. Considerable time was spent in the initial stage in reviewing other reports and presentations. The elements of the vision understood, attention was focused on consideration of various "points of view". Department of Defense, industry consortia, and industry executives provided briefings to the team. These briefings enable the team to understand the various

elements affected by the "vision" as well as enabling them to define a mechanism for cooperation between various commercial entities, the Department of Defense and society as a whole in transferring the vision to reality. A listing of the briefings presented by the advisory core may be found in Appendix A.

The team felt that the best way to present the vision was to devise scenarios of twenty-first century products manufactured with projected processes and management practices rather than writing a standard government report. It was felt that these scenarios would have a much greater impact than the standard format. Accordingly, four corporate entities representing four industries manufacturing four products were selected. **Communitimax**, a multi-enterprise concurrent product whose major contribution is "UltraComm;" **U. S. Motors**, representing Automotive/Heavy Industry, created the three-day car, using current auto industry as a base for a cooperative model of manufacturing; **USASICS**, representing the Semiconductor Industry; and **U. S. Chemicals**, (a chemical plant that is desired by the cities), the Process Industry. The inner core was divided into four teams to work on the original scenarios. All scenarios were reviewed and revised by the entire team as well.

The end result of these scenarios is presented in Volume 1 of the two-volume final report published by the Institute, *21st Century Manufacturing Enterprise Strategy*.

3.3 Industry Input. As stated previously, the project participants recognized the criticality of ensuring that the strategy developed would reflect industry endorsement. To engender this endorsement two sets of industry briefings were held. The first, midway through the development of the strategy, was set to ensure that the premises defined by the inner core team met with those currently held by executives from government and industry. The second set of briefings was held at the conclusion of the two and one-half months to present the refined "vision" and to again ensure that all elements perceived by government and industry were included in the strategy.

Both sets of briefings/workshops were hosted by major government agencies and industry associations. These organizations included:

- Aerospace Industries Association of America, Inc.
- Computer Aided Manufacturing-International (CAM-I)
- Council on Competitiveness
- Defense Science Board Summer Program
- Electronics Industries Association
- IC²-Innovation, Creativity, Capital
- Industrial Research Institute, Inc.
- Manufacturing Studies Board of the National Research Council
- Microelectronics Computer & Technology Corporation
- National Academy of Engineering
- National Center for Manufacturing Sciences
- National Machine Tool Builders Association
- National Security Industrial Association.

These organizations invited their members to attend a two- to three-hour briefing/workshop presented by Roger Nagel, Rick Dove and other inner core team members as appropriate. Over 100 individuals from industry, academia and government attended these meetings. In order to

ensure that all interested individuals have an opportunity to provide input to the report, it was determined that an open briefing should also be held. An announcement was placed in the Commerce Business Daily indicating a briefing open to the public which would be held at National Institute of Standards & Technology in Gaithersburg, Maryland.

During the process of the outer core workshops, input to the project was overtly solicited. While there were always a number of unique comments, there was in fact a great deal of consensus on the entire range of issues that had been developed by the inner core. Specific input was requested from the groups, however, on the following questions:

- (1) What will be the same/different in 2005 as it relates to manufacturing?
- (2) What are the current Paradigms to bust?
- (3) What conditions make for cooperation in a natural way?

Based on comments received from these briefings, the team's strategy was refined as necessary to reflect appropriate feedback. After further work on the report, these same individuals were invited back to a second round of briefings. Following the second set of meetings, the inner core team prepared the final draft of the "21st Century Manufacturing Enterprise Strategy" report, incorporating these new, additional comments.

4. Summary of Findings and Recommendations

A comprehensive and complete understanding of the findings and recommendations posed by the inner core team may be found in the published report, *21st Century Manufacturing Enterprise Strategy* which is attached. An overview of their findings is present below for the reader.

4.1. The Opportunity & Vision. The industrial era dominated by mass production manufacturing is drawing to a close. It is giving way to a new era, to be dominated by agile manufacturing enterprises.

The emergence of agile manufacturing simultaneously presents U.S. industry with an opportunity to regain world manufacturing leadership and with a threat of dramatic competitive decline if the opportunity is not seized.

With agile manufacturing, competitive advantage will be determined by new criteria of quality and customer satisfaction. Highly competitive firms will develop:

- (1) products that are custom-designed and configured at the time of order
- (2) products that can be reconfigured and upgraded to meet evolving requirements, extending product life and reducing the value of distinct product generations
- (3) long-term relationships with customers who are committed to the evolving products they use, and to the companies that maintain the currency of those products.

Rapid product creation, development and modification in an agile manufacturing enterprise is made possible by:

- (1) the routine formation of inter-disciplinary project teams, able to develop product designs and manufacturing process specifications concurrently
- (2) extending the concept of design to the entire projected life cycle of a product, from initial specifications to its eventual disposal

(3) the availability of scientific knowledge of the manufacturing process, and of computers capable of accurately simulating product performance characteristics, and of modeling the entire manufacturing process

(4) modular, flexible, reconfigurable, affordable production processes and equipment

(5) the ability to obtain relevant information quickly, to share it with project members distributed throughout a firm and in different firms, and to link that information directly to production machinery

(6) modular product design incorporating reconfigurability and upgradability leading to extremely long product lifetimes.

The flexibility, superior process knowledge base, and focus on customer satisfaction of agile manufacturing will require assimilation of social values into the managerial decision-making process. Environmental values, energy efficiency, workplace safety and work force composition concerns, and the social impact of manufacturing enterprises will become part of agile managerial agendas.

The transition to agile manufacturing is inevitable and is already being pursued by industrial rivals of the U.S.

American prosperity is profoundly at risk unless a coordinated effort is made to enable U.S. industry to lead the global transition to the new manufacturing system.

Industry must drive the transition to agile manufacturing, but there are vital roles to be played by government and by academia in enabling, accelerating, and shaping its implementation.

No company or industry is capable of putting into place the infrastructure support systems necessary to effect this transition alone. Industry-led efforts must be supported by appropriate political action and by changes in public attitudes and institutions.

4.1.1. Cooperation as a Strategy for Realizing the Vision. The global economy will be characterized by continuous innovation that will reward rapid product creation and development, and increased speed-to-market. Cooperation is the factor that can dramatically accelerate innovation, product development and market distribution. Cooperation also accelerates a convergence of the respective self-interests of cooperating partners. As a result, cooperation is central to agile manufacturing, whether in the form of cooperative ventures between different firms or different branches of the same firm. The recent IBM-Apple-Motorola agreement illustrates how inter-firm alliances can unite fragmented markets by creating a common technological base for product variation. Cooperation leads to sharing of:

(1) risks and costs, and substitutes sharing variable costs for fixed costs

(2) unique resources, technological as well as human, in the process creating a new resource

(3) distributed, proprietary, knowledge, which in the cooperation process creates new bodies of knowledge.

Cooperation broadens the resource base for attacking problems in parallel or serial order, or both concurrently, as circumstances suggest. It accelerates technology transfer among the cooperating firms and can convert constraining dependencies of firms on one another into mutually reinforcing interactions. Interactions among highly qualified individuals with complementary expertise working on a well-defined problem raise the probability of innovative solutions.

Cooperation between firms must be made an easier option to choose. This requires addressing potential obstacles to cooperation within firms, social obstacles to interfirm cooperation, and the information subsystems necessary to enable easy cooperation.

Anti-trust legislation no longer reflects the competitive realities of a constantly changing domestic marketplace served by global competitors. Instead, American society can benefit from encouraging electronic alliances between competing manufacturing firms.

Interfirm cooperation will be made easier by creating pre-certified, standard models for cooperative ventures, analogous to standard models for wills, trusts, etc.

Cooperation is enhanced:

(1) If the initiative for cooperative ventures can be taken at the operational level

(2) If management combats the not-invented-here syndrome and the cultural prejudice that values lone over team achievement

(3) If management implements measures appropriate to evaluating the benefits of intra- as well as interfirm ventures

(4) If a set of criteria is articulated for rating potential project partners.

Cooperation entails the ability to share complex information electronically. Uniform data exchange standards and broad-band communication channels are the necessary infrastructure for that cooperation to take place.

Information must be available to be utilized. The creation of a national industrial data base of products, facilities, and services along with price, performance characteristics, that is, a Factory America Network (FAN), would be a resource of the first order.

4.2. Building & Maintaining Momentum. The transformation of manufacturing that is underway is a *dynamic process, one that will be shaped in part by unforeseeable developments*. It is also a process that requires a supporting infrastructure that can only be created through a coordinated, cooperative, effort on the parts of industry, government, academe, and society at large. Furthermore, the new manufacturing system that is coming into being is one characterized by routine, intensive collaborations among personnel distributed across, as well as within, firms.

The following action agendas incorporate, in addition to the conclusions of the 21st Century Manufacturing Enterprise Strategy study group, recommendations drawn from the Council on Competitiveness report "Gaining New Ground" and the Center for Strategic and International Studies report "Integrating Commercial and Military Technology for National Strength".

4.2.1. What Should Industry Do? The choice confronting U.S. industry is simple to describe, but difficult to make. Individual companies can pursue the transition to agile manufacturing on their own, or as part of a coordinated national effort, but they must pursue it. The first choice feeds a number of American stereotypes championing self-sufficiency, but, in truth, it is no choice at all. Agile manufacturing as a system is keyed to institutional interdependencies that reward individual initiative in creating new resources out of those very interdependencies. Cooperation in the context of agile manufacturing is much more than a prudent strategy for management to adopt. It is an expression of the distinctive genius of the agile manufacturing system.

The recent increase in the pace of formation of cooperative ventures among traditional competitors, as well as among companies with complementary resources, is symptomatic of the

dynamism of agile manufacturing competition already at work. It is becoming obvious to wider circles of industry executives, policy makers, politicians, and educators that flexible, spontaneous, inter-enterprise cooperation is a formidable competitive weapon. The difficulty of forging that competitive weapon is, however, equally formidable. This is particularly so in the U.S., where the infrastructure requirements for agile manufacturing are only partially developed and where cooperation traditionally is a preferred managerial option only in times of crisis.

The only real choice for U.S. industry, then, is to lead a national effort to erect the infrastructure requirements for agile manufacturing on a foundation of systematic cooperation.

The objective of this effort is for *inter-enterprise cooperation* to be as natural and as straightforward as connecting together components for a home audio and video system made by different manufacturers and purchased at different stores. If the U.S. is to achieve leadership in the transition to agile manufacturing, then industry must aggressively pursue that objective. Industry must put into place intra-firm programs consistent with agile manufacturing. Industry must also implement mechanisms, such as the Agile Manufacturing Forum, for making interfirm cooperation natural. Industry must actively promote the necessary supporting contributions from government, society, and academe.

Industry must take the lead; and it can take the following steps on its own.

(1) Adopt methods and procedures to transform the enterprise into an agile manufacturing competitor able to compete in the global marketplace successfully, today and in the future:

- Continuously improve the quality of the enterprise by constantly advancing the criteria by which quality is measured
- Extend and amplify the pull of customer satisfaction throughout the enterprise
- Remove organizational obstacles within companies to the formation of cooperative ventures.
- Pursue *concurrency* within and between enterprises, cooperating with academe on identifying the technological and organizational requirements, and establishing their effectiveness.
- Identify cycle time reduction opportunities for all enterprise activities and actively pursue their development.
- Develop intimate, responsive, supplier - vendor - customer networks, incorporating interactive information exchange systems as appropriate.
- Empower the work force at all levels of the enterprise; and involve the work force in setting company agendas and in exercising initiative to accomplish them.
- Develop metrics that will measure the value of the work force as a corporate asset. Use these metrics to define the need for, and invest in, continuous work force training and education.
- Assimilate into the managerial decision-making process, as an expression of corporate responsibility independent of local laws, public concerns about the environmental and social impacts of manufacturing, energy usage and conservation, workplace safety, and work force constitution.
- Identify the generic technological and organizational requirements for making the transition from flexible to agile manufacturing.
- Identify regulatory and legal barriers to the formation of cooperative ventures and pursue their removal.

- Identify infrastructure requirements that will enhance distributed concurrent product control, development and manufacture.
- Articulate the requirements for comprehensive manufacturing information exchange standards. Draw up specifications for these standards cooperatively with government and expand representation of the U.S. on international standards bodies.
- Define the requirements for a global broad-band communications network, promoting to government and the public its strategic importance to the nation's well-being.
- Identify jointly with academe, the characteristics of a competitive manufacturing work force and develop educational vehicles for achieving it.
- Identify, develop and evaluate the effectiveness of metrics appropriate to the management of agile manufacturing enterprises.

(2) Establish effective interfirm cooperation and partnership mechanisms among U.S. industry groups through the formation of an Agile Manufacturing Forum. Actively promote the necessary supporting contributions to the Forum from government, from industry, society, and academe. The Agile Manufacturing Forum should:

- Be a mechanism to define agile manufacturing infrastructure projects, and to form groups willing to cooperate in each project.
- Use challenge grants and other incentive mechanisms to encourage groups to form, define and develop infrastructure projects.
- Work with existing consortia and other professional groups to promote and develop cooperative mechanisms.
- Conduct meetings, workshops, and briefings around the country to build momentum toward implementing agile manufacturing cooperation mechanisms.
- Serve as a central resource that can coordinate efforts, provide a clearinghouse function, help replicate regional efforts, maintain data bases, and provide other related services to foster the rapid spread and development of infrastructure partnerships and cooperation projects.

Examples of the type of cooperative projects that may be undertaken are defined in the *Infrastructure Volume 2 of the 21st Century Manufacturing Enterprise Strategy* report. Some generic examples of these are listed below:

- (1) Formulate standard models for initiating cooperative ventures
- (2) Develop requirements and metrics for cooperation tools, and sharing the cost of developing cooperation tools, along with government and academe
- (3) Develop environmentally benign manufacturing processes in cooperation with government and academe
- (4) Create jointly with the government a Factory America Network as a high priority agile manufacturing infrastructure element
- (5) Simplify manufacturing-related standards "architectures", making them more reliable and extendable
- (6) Establish practical near-term implementation criteria for cooperative industrial, government and academic R&D in agile manufacturing
- (7) Develop jointly with government and academe, technology deployment measures

(8) Extend distributed concurrency globally, and extend FAN to a World Manufacturing Network, identifying the advantages of this extension to U.S. manufacturers, and criteria for success.

4.2.2. What the Congress Should Do? There are many initiatives which could be undertaken by Congress which will help industry lead and enable the transition to agile manufacturing. Among these are:

(1) Recognize the importance of manufacturing to U.S. industrial competitiveness and to advancing the nation's standard of living

- Promote the excellence of U.S. industry as a national asset and protect the health of the nation's small suppliers.
- Support industry investment in continuous work force training and education.
- Mandate the coordination of existing manufacturing support programs in government agencies.

(2) Create a U.S. economic & regulatory climate that encourages investment in agile manufacturing

- Facilitate the transition to agile manufacturing by removing legislative and regulatory barriers to cooperative R&D, carried through to production floor demonstrations, to multi-enterprise manufacturing ventures, and to the formation of virtual companies.
- Remove any mandated performance-metric requirements that discourage concurrent engineering and agile enterprise management.
- Approve standard legal models for cooperative manufacturing venture formation.
- Adjust anti-trust legislation, and corporate reporting requirements, to reflect current competitive realities and the emergence of agile enterprises.
- Support adoption by industry of environmentally benign manufacturing as a goal by establishing uniform environmental legislation, simplified compliance procedures, and protection from environmentally abusive foreign manufacturers.
- Make the cost of capital for the development of manufacturing technologies competitive with that of America's major competitors.
- Accelerate depreciation schedules and capital cost-recovery programs for manufacturing equipment and facilities so that they are competitive internationally.
- Make an R&D tax credit permanent and amend it to include manufacturing engineering and process R&D.
- Make the federal government a discriminating customer of manufactured products, by comparing and benchmarking against companies, other government agencies and foreign governments.

(3) Invest in the infrastructure and the technology required to speed the transition to agile manufacturing

- Establish a five-year graduated plan to increase federal R&D expenditures for critical infrastructure and manufacturing technologies, if necessary, by restructuring funding schedules for existing programs.
- Increase investment in manufacturing at an earlier point in the R&D cycle, concurrent with the development of new product technologies. Investment in manufacturing should be matched to the collective needs of the industrial base.

- Implement decisions to make sure that the federal laboratories' contribution to agile manufacturing is as high as possible and commensurate with the annual national investment of \$20 billion in the over 700 federal laboratories.

(4) Ensure that America has a world-class manufacturing infrastructure, supported by both physical assets and human resources

- Mandate the creation and full development of a national broad-band communication and information network.
- Recognize the value of FAN and fund a government share in creating it.
- Support the formation of national and international information and communication exchange standards, funding U.S. standards maintenance and representation on international standards councils.

4.2.3. What Should the DoD Do? There are four reasons why the Department of Defense should be an active partner with U.S. industry in accelerating the implementation of an agile manufacturing capability.

(1) The transition to agile manufacturing is already underway in non-defense industry. If DoD is not actively involved in matching its requirements to the character of the new system, it will lose on two counts:

- It will not gain the benefits promised by agile manufacturing
- It will have to support a parallel manufacturing apparatus that lacks effective competitive capabilities.

(2) By accelerating the implementation of agile manufacturing, DoD will reduce the costs of products made for the DoD.

(3) Agile manufacturing is keyed to customized production. There is no added cost for satisfying customers with special requirements.

(4) Changing mission requirements can be met by rapid reconfiguration of existing equipment, conferring significant logistical and battlefield advantages.

Reconfigurability and upgradability are generic features of agile manufacturing products. If DoD requirements can be satisfied by products whose specifications lie within the range of configurability of commercial production facilities, substantial savings can be realized. In addition, the modular and scalable architecture of agile manufacturing facilities provides the kind of surge capacity that will reduce the need for special DoD manufacturing, or remanufacturing, facilities. Agile manufacturing products have extended lifetimes through designed-in reconfigurability and upgradability.

This is an invaluable asset in an era of rapidly changing, diverse, DoD missions. For DoD to reap the benefits of agile manufacturing, two conditions must be met:

- (1) Agile manufacturing must be the norm for commercial products
- (2) DoD must be a cooperating customer, familiar with, and involved in, agile manufacturing design and production practices.

Cooperation permits the creation of new resources by synthesizing them out of existing inputs from varied sources, no one of which could, or could rapidly and cost-effectively, create that resource. Utilizing a national industrial data base and the device of "virtual" companies, for example, the expertise and the facilities necessary to design, test, and manufacture new, or

improved, products can be assembled quickly. The need for constructing new production facilities is minimized.

The prospect of rapidly developed defense products, of extensive configuration options, simplified reconfiguration and upgrade capabilities, and much lower costs for satisfying special DoD requirements, makes a compelling case for a DoD stake in the implementation of agile manufacturing. *To protect and to advance its interests, the Department of Defense should create incentives for the commercial implementation of agile manufacturing.*

The DoD should:

(1) Take appropriate steps to encourage the widespread use of cooperation and partnership mechanisms by industry in working with DoD

(2) Take strong steps to eliminate the perception and or reality of an adversarial relationship between industry and the DoD

(3) Establish an expectation of partnership relationships between DoD and industry by giving preference to project contracts with shared risks, burdens, and benefits

(4) Fund multi-enterprise (virtual company) projects

(5) Establish mechanisms within DoD that promote cooperative venture DoD contracts, leveraging DoD resources.

The DoD should follow the practices of agile manufacturing in its own operations, by adopting industry practices and commercial standards where ever possible. The use of special military standards and specifications should be minimized.

- Emulate the close relationship between manufacturers and suppliers in agile manufacturing by strengthening DoD links with its tier of suppliers.
- Cooperate with industry in the development of the agile manufacturing infrastructure, and ensure that developments are compatible with DoD needs.
- Require uniform product description standards for DoD contracts, thereby supporting information infrastructure systems such as CALS, PDES, et cetera.
- Support the formulation and implementation of universal data/information exchange standards.
- Drastically reduce the number of non-commercial standards used in DoD manufacturing operations.

Impediments to the transition to, and practice of, agile manufacturing in DOD operations, regulations and practices should be removed.

- Remove barriers to the integration of commercial and military manufacturing, especially:
 - cost accounting requirements
 - military specifications/standards
 - intellectual rights in technical data
 - unique contract requirements.
- Give industry leeway to alter procedures and set performance metrics in accordance with the evolving character of the new manufacturing system, adapting DoD requirements appropriately.
- Remove barriers to the adoption by industry of accounting and management metrics appropriate to agile manufacturing. For example, remove barriers to company investment in work force training and education.

- Increase and extend manufacturing development funding to include pilot production runs and manufacturing process technologies, as well as the required infrastructure.

In addition, the DoD should promote and invest in the transition to agile manufacturing with industry to ensure appropriate benefits for DoD.

- The DoD should accelerate the commercial implementation of agile manufacturing supporting the creation of the Agile Manufacturing Forum, and participating with industry in Forum activities.
- Use the Agile Manufacturing Forum as a means of immediately establishing a challenge grant program for industry-proposed projects for the transition to agile manufacturing that would leverage DoD funding by at least two to one.
- Promote distributed enterprise integration by defense contractors.
- Support research to identify the system elements of distributed concurrent engineering and promote their maturation.
- Share in the creation of Factory America Network (FAN) and in the installation of the broad-band communications channels required by FAN.
- Accelerate industry's adoption of the goal of environmentally benign manufacturing by sharing in the development of the technologies required for its accomplishment.
- Use defense production projects as vehicles for continuing to identify the core elements of agile manufacturing and then supporting research into these jointly with industry and academe.

4.2.4. What Should the Executive Branch Do? Apart from the Department of Defense, various Executive branch agencies have important contributions to make in realizing the vision of an agile U.S. manufacturing apparatus.

(1) Take the lead in establishing the competitiveness of the manufacturing sector as a national priority because of the dependence of the standard of living on its wealth generation capability.

- Communicate to the public the importance to U.S. competitiveness of the transition to agile manufacturing and its relationship to the national standard of living. Involve key policy makers more closely in these issues.
- Highlight the priority of manufacturing technology in the annual State of the Union message.
- Make research on generic industrial technologies a national R&D priority.
- Identify the skill base of the work force as the nation's most valuable asset.
- Expand the focus of the National Security Council to include issues related to manufacturing and industrial competitiveness.

(2) Develop policies and programs to ensure that America has a world class agile manufacturing infrastructure.

- Support the extension of national and international broad-band communication networks.
- Promote public education and provide incentives to make technical education and careers in manufacturing more attractive to the brightest young people.
- Create incentives for industry investment in continuous work force training and education.
- Support the creation of a national industrial information network, Factory America Network (FAN).

- Create an award, or awards, similar to the Malcolm Baldrige Award to recognize manufacturing companies that assimilate social concerns such as the environment into their managerial agendas.
- Support removal of legislative and regulatory barriers to the routine formation of virtual companies.
- Take steps to accelerate the pace of technology transfer.

4.2.6. What Should Academe Do? The speed and effectiveness of the transition to agile manufacturing will be dependent on significant action by the academic community at all levels. There are three driving factors behind this dependence. In what follows we identify the driving factor and what academe should do.

(1) In response to the dependence of agile manufacturing on the skill base of the work force, academe should:

- Help identify metrics and methods of utilizing human resources to maximum competitive advantage
- Develop, cooperatively with industry, appropriate life long training and education curricula
- Develop and provide educational vehicles for delivering life-long, continuous, work force training and education
- Institute continuous curriculum review and reform in science and engineering education, and in business and management education, in support of agile manufacturing
- Develop or significantly strengthen undergraduate curriculum leading to careers in manufacturing
- Work aggressively with industry to ensure that science and engineering curricula reflect the interdisciplinary requirements of agile manufacturing enterprises

(2) Provide traditional academic research and collaboration on agile manufacturing. For example, conduct research in the following areas:

- Design and maintenance of information exchange standards
- Articulate the requirements for:
 - implementing concurrent engineering, along with mechanisms and metrics for evaluating their effectiveness
 - enterprise integration implementation
 - cooperative mechanisms within and between firms and measures for evaluating their effectiveness
 - forming virtual companies
 - operational level work force empowerment
- Environmentally benign manufacturing practices
- Design of broad-band communication networks
- Distributed data bases
- Design and support of cooperation tools.

In addition to the more traditional roles above, academe has an important new role to play in facilitating the creation of agile manufacturing enterprises. Academe must:

(1) Act as a facilitator for, and partner in, government and industry cooperation in the Agile Manufacturing Forum, helping to speed the development, and assessing the progress of agile manufacturing in the United States.

- (2) Recognize its impact as an economic development agent.
- (3) Clarify the impact of standards and/or the lack of standards on the transition to agile manufacturing.
- (4) Provide support for the development of dynamic standards able to evolve over time as requirements change.
- (5) Participate in the creation of Factory America Network and its underlying technological and organizational infrastructure.
- (6) Help shorten the time for technology transfer.
- (7) Enhance vocational-technical secondary school, and two-year college, business and technical education.
- (8) Contribute significant resources to improve primary school education and to develop measures of improvement.
- (9) Conduct strategic planning by educational institutions at all levels in conjunction with industrial partners.
- (10) Highlight career opportunities in agile manufacturing. Take steps to excite young people at the formative stages of career planning. Provide teachers and other community members with support in explaining the importance and excitement of a career in an agile manufacturing enterprise.

5. Creation of the Agile Manufacturing Enterprise Forum (AMEF)

To accomplish the transition to agile manufacturing effectively, and to aid the above groups in building and maintaining momentum, a mechanism is needed that will, on a continuing basis:

- (1) measure the value of decisions taken against the evolution of manufacturing from mass production to agile production
- (2) promote a national consensus on the need for a competitive manufacturing apparatus and coordinate identification of the infrastructure requirements for an agile manufacturing system
- (3) facilitate routine collaborations among manufacturing enterprise personnel as a means of achieving agility.

All of these activities come within the purview of an Agile Manufacturing Enterprise Forum whose formation is an outcome of the 21st Century Manufacturing Enterprise Strategy effort. The broad objectives of the Forum are to organize an agile manufacturing constituency, to build momentum on behalf of a common national vision of agile manufacturing, and to translate this momentum into action in order to accelerate the realization of that vision in the U.S.

The Agile Manufacturing Enterprise Forum will not supplant existing organizations concerned with manufacturing. Its operational mission is to coordinate the focusing of relevant resources of those organizations on the successful accomplishment of agile manufacturing initiatives. By not having direct responsibility for projects it will maintain an independent and unbiased overview of progress towards agile manufacturing. Its structure will take the form of a centrally coordinated network of regional forums with membership open, and accessible, to small- and medium-sized enterprises, as well as to large ones. Because of the benefits to the Department of Defense of a mature, U.S.-based agile manufacturing system, the active involvement of the

DoD in creating the Forum, in partnership with industry, supporting it through its formative phase, and in participating in its projects is especially important.

The Forum has been established, and is currently working with industry, government and academia. Appendix B provides a listing of the more significant AMEF activities since its formation in December, 1991. One of the key issues the Forum is undertaking is the development of a "Benchmarking Agility: A Self Assessment Tool" which will help industries and the DoD assess their transition to an agile enterprise. Other focus groups are working to define additional elements of the infrastructure laid out in the *21st Century Manufacturing Enterprise Strategy* report. It is with such steps as these that we are working to make the recommendations in this report a reality. We invite the reader to contact us and join with us in this important movement.

Appendix A

Advisory Core Briefings Presented By:

- Steven V. Balint, Assistant Deputy Chief of Staff for Weapons Systems Production Management, U. S. Army
- Steve Bomba, Vice President, Technology, Johnson Controls
- David W. Cheney, Senior Associate, Council on Competitiveness
- Philip Francis, Vice President, Corporate Technology Center, Square D
- Robert W. Hall, Editor-in-Chief, Target
- Richard H. F. Jackson, Deputy Director, Manufacturing Engineering Laboratory, National Institute of Standards and Technology
- Ben Kaminski, President, CAM - I
- Michael J. Kelly, Director, Defense Manufacturing Office, Defense Advanced Research Projects Agency
- Charles Kimzey, Assistant for Manufacturing Technology, Office of the Secretary of Defense
- George Kuper, President, Industrial Technology Institute
- David Lando, Vice President, AT&T
- Mark S. Lang, Executive Director, Ben Franklin Advanced Technology Center
- Peter W. Likins, President, Lehigh University
- Steven M. Linder, Director of Production Assessment Division, Office of the Assistant Secretary of the Navy
- James Ling, President, Ling Technologies, Inc.
- Thomas Mahoney, Acting Executive Director, Manufacturing Studies Board
- Lt. Col. Erik Mettala, Program Manager, Defense Advanced Research Projects Agency
- William S. Safier, Director, Naval Industrial Resources Support Activity, United States Navy
- Charles L. Strecker, Manufacturing Technology Directorate, Electronics Division, Wright Laboratory, United States Air Force
- Barry Whalen, Vice President, MCC

Selected Advisory Core Topics:

- Air Force Microelectronics Manufacturing Science and Technology (MMST)
- ATP Program as Mechanism
- Business of Paradigms, The: Discovering the Future (video tape)
- Council on Competitiveness Report, Gaining New Ground: Technology Priorities for America's Future:
- Defense Advanced Research Projects Agency: Manufacturing and Design Engineering in Ultra Reliable Systems Acquisition for Devices on Demand; and "Micro Tech 2000".
- Department of Defense MANTECH Program
- IMS as a Possible Framework Model
- ITI Experience with Mechanisms
- LINC as a Concept for a Mechanism
- Manufacturing Studies Board Reports
- Manufacturing 21 Report
- MCC as a Mechanism
- NCMS as a Mechanism
- Power of Vision, The: Discovering the Future (video tape)
- U. S. Memories as a Case Study
- White House Office of Scientific and Technology Programs Critical Technologies Report

Appendix B

Agile Manufacturing Enterprise Forum Activities

November, 1991

Report with industry recommendation to form Agile Manufacturing Enterprise Forum (AMEF) is released.

Inner Core asks Iacocca Institute to launch the Agile Manufacturing Enterprise Forum (AMEF).

Inner Core selects Focus Group topics for first year of AMEF.

December

4 First meeting -Simulation & Modeling Focus Group. The first Focus Group to meet. Monthly meetings follow.

5 Corporate Communications Committee inaugural meeting
* Agreement reached to serve as a voluntary advisory group.
* Development of strategies to communication the agility message.
* Initial discussion on communications requirements.

12 & 13 First Annual Agile Manufacturing Enterprise Conference in Orlando, Florida
* Attended by 170 participants from industry, government and academia.
* This was the first opportunity to make the public aware of the report and the "agile" vision.

16 Business Week article on "21st Century Manufacturing Enterprise Strategy" by Otis Port

January, 1992

30 First meeting - Environmental Enhancement Focus Group, monthly meetings follow.
31 First meeting - Supplier Management Systems Focus Group, monthly meetings follow.

February, 1992

12 First "Wake Up America" meeting for CEOs and Senior Executives held at FMC in Chicago
* Meeting called to discuss agility with executives from 22 organizations.
* Invitations extended to AMEF to brief executives of participating organizations.
* Meeting is chaired by J. Puth Chairman and President of J.W. Puth Associates.

19 Second "Wake Up America" meeting for CEOs and Senior Executives held at Chrysler in NYC.
* Meeting called to discuss agility with executives from 25 organizations.
* Invitations extended to AMEF to brief executives of participating organizations.
* Potential Leadership Steering Committee members identified.
* Industry will lead AMEF decision is made.
* Meeting is chaired by W. Williams, Chairman, President and CEO of Bethlehem Steel.

- 27 R. Nagel testifies before the House of Representatives, Committee on Science, Space and Technology, Subcommittee on Technology and Competitiveness.
- * Introduced major concepts of agility to Congress.
 - * Discussed governments role in facilitating changes required for agility transition.
 - * Introduced *The 21st Century Manufacturing Enterprise Strategy Report* to Congress.
- March *The 21st Century Manufacturing Enterprise Strategy Report* is released to Congress by a bi-cameral, bi-partisan group.
- 11 R. Nagel testifies before the Senate, Committee on Armed Services, Subcommittee on Defense Industry and Technology.
- * Discussed major concepts of agility
 - * Discussed governments role in facilitating changes required for agile transition.
 - * Discussed major findings of *The 21st Century Manufacturing Enterprise Strategy Report*.
- 25 First meeting - Empowering Individuals & Teams/Continuous Learning & Training Focus Groups.
- April, 1992
- 10 AMEF testifies before the Democratic Caucus on Economic Conditions.
- 22 First meeting - Agile Production Focus Group, monthly meetings follow.
- 28 First meeting - Evolving Standards Focus Group, monthly meetings follow.
- 30 First meeting - Continuous Learning and Training Focus Group, monthly meetings follow.
- May
- 8 First meeting - Enterprise Integration Focus Group, monthly meetings follow.
- 15 First meeting - Benchmarking Agility: A Self Assessment Tool Strategy (BASAT) Group. Bi-monthly meetings begin.
- 20 Corporate Communications Committee meeting - NYC
- * Identified requirement for press kit.
 - * Identified need for "rollout" strategy.
 - * Identified need for spokesperson.
- 26 Environmental Enhancement Focus Group meeting held at FMC in Philadelphia
- June
- 4 AMEF testifies before the Republican Caucus on Agile Manufacturing.
- 12 "Wake Up America" meeting for CEOs and Senior Executives held at General Motors in NYC.
- * Meeting is hosted by D. Runkle, V.P., Advanced Engineering of General Motors.
 - * Agreed that an industry led movement was essential.
 - * Agreed to provide resources, access and expertise.
 - * Identified potential candidates for Leadership Steering Committee.
 - * Broadened participation in the AMEF.
- 16 "Wake Up America" meeting for CEOs and Senior Executives held at Texas Instruments in Dallas.
- * Meeting is chaired by H. Hayes, President, Defense Systems & Electronic Group of Texas Instruments.
 - * Established opportunity for outreach to West Coast.
 - * Identified potential candidates for Leadership Steering Committee.

- * Broadened participation in the AMEF.

July

22

First meeting - Leadership Steering Committee.

- * Meeting co-convened and hosted by J. Junkins, Chairman and CEO of Texas Instruments, T. Murrin, Dean of Business at Duquense University and D. Roderick, retired Chairman of USX.
- * Four Leadership Cabinets established.
- * Members agreed to be spokespersons for agility.
- * Members agreed to establish policy and procedures for AMEF.
- * Members agreed to expand Leadership Steering Committee from 14 current members to 30 members.

28

"Wake Up America" meeting for CEOs and Senior Executives held in Portland, OR

- * Established opportunity for outreach to North West.
- * Identified potential candidates for Leadership Steering Committee.

August

11

AMEF Integration Meeting for Coordination, Integrating and Sharing of Information and Experiences between Focus Groups.

- * All Focus and Strategy Groups made presentations discussing progress made, information obtained and future group direction.
- * AMEF growth requirements and current problems were discussed.
- * Plans for the 2nd Annual AMEF Conference/Workshop were discussed by both Focus Groups and Strategy Groups.

October

2

Corporate Communications Committee meeting in Washington.

8

R. Nagel scheduled to speak in Venice, Ottawa and Toronto, first speeches concerning agility outside U.S.

November

19

2nd CEO Leadership Steering Committee scheduled.

December

15 - 18

Second Annual AMEF Conference/Workshop, scheduled in Orlando, FL

- * All Focus and Strategy Groups will either present findings or conduct workshops.
- * Industry Leaders will speak on Agility implications.
- * Agile Initiatives will be offered in many new areas of concern.
- * Industry presentations on different aspects of Agility will be held.
- * Planning sessions will be held to discuss future AMEF activities.

AGILITY FORUM

FALL 1992

The AMEF is industry led and facilitated by the Iacocca Institute at Lehigh University

WELCOME TO AGILITY

WELCOME TO THE FIRST ISSUE OF THE AGILITY FORUM.

For many of you this issue of The Agility Forum is your first contact with the Agile Manufacturing Enterprise Forum (AMEF). Permit us to introduce you to the AMEF and by this column invite you and your organization to participate in its activities.

The AMEF was created as a unique organization to focus on speeding and enhancing the transition of U.S. based industry to "agile competition". The creation of the AMEF was recommended in the congressionally inspired, DoD funded, industry led report "The 21st Century Manufacturing Enterprise Strategy Report".

The AMEF belongs to those individuals and organizations which participate in it. The AMEF was organized to enable and empower the hundreds of organizations working to increase U.S. based competitiveness. It does this by providing a common vision and understanding of the requirements

for success in the agile competitive era we have entered.

Success for the AMEF will be measured by its sponsors in impact on their bottom line and by the nation in impact on the standard of living.

INDUSTRY HAS HEARD THE MESSAGE OF AGILITY AND IN THIS DIFFICULT CURRENT ECONOMIC ENVIRONMENT COMPANIES SUCH AS TEXAS INSTRUMENTS, ALCATEL, WESTINGHOUSE, CHRYSLER, GENERAL MOTORS AND IBM HAVE ALREADY COMMITTED SIGNIFICANT RESOURCES TO ASSIST IN THE OPERATION OF THE AMEF. THE DOD AND DOE, THROUGH ITS SANDIA LABORATORIES, AND THE NCMS HAVE ALSO ACTIVELY SUPPORTED THE AMEF. MORE THAN 100 ORGANIZATIONS ARE CURRENTLY INVOLVED.

The AMEF has set three objectives for its operation:

- To spread the word, get people involved and provide a place to discuss the transition to agility and its implications;
- To deepen and broaden our understanding of agile competition;
- To be industry led with appropriate participation by government and academe.

The task of spreading the word and getting people to think about how agility will impact their organizations is an important part of the AMEF mission. **A workshop in December (see article on page 3) which will be an in-depth learning opportunity,** along with this newsletter and the facilities at Lehigh University where AMEF is housed are a part of AMEF activities.

The best method, however, is person to person. If each person reading this newsletter would talk to two of their associates, this would represent a significant step towards broadening the ever widening circle of friends we can touch. Your involvement in understanding the impact of Agility, and your excitement toward your involvement, will make others want to know more about Agility and the AMEF.

If you are interested in joining the AMEF, if you want more information about Agility or if you have participated in the AMEF and wish to increase your involvement, call us. We will work to enhance your move to Agile competition.

Again, welcome to the first issue of The Agility Forum. We are excited. We are committed to making the Agile Enterprise conversion in America a success and we encourage you to become a participant in the AMEF.

CEO's LAUNCH AMEF LEADERSHIP STEERING COMMITTEE

As a result of a series of meetings among Chief Executive Officers, corporate chairmen, and senior level executives representing over 70 of the top companies in America, 14

...IT WAS DECIDED THAT THE AMEF'S MISSION WAS SO IMPORTANT THAT THE STEERING COMMITTEE WILL MEET AGAIN ON NOVEMBER 19...

CEOs and presidents agreed to participate in the first meeting of the Agile Manufacturing Enterprise Forum (AMEF) Leadership Steering Committee. The establishment of this committee represents a major step towards speeding the transition to Agile competition in the United States. This commitment of senior executives is both essential and consistent with the AMEF concept that industry must provide the leadership.

The first meeting was co-convened and hosted by Jerry Junkins, Chairman and CEO of Texas Instruments, Thomas Murrin, who was a division president of Westinghouse, the deputy secretary for Science and Technology in the Commerce Department, and is currently the Dean of Business at Duquense University, and David Roderick, retired Chairman of USX.

At this meeting it was decided that the AMEF's mission was so vital that the Steering Committee will meet again on November 19, immediately following the presidential election to discuss strategy objectives.

The Leadership Steering Committee's mission is to serve as the catalyst for ensuring that through the AMEF industry leads the transition to Agile competition in the United States. Four Leadership Cabinets were established and populated to carry out

the Leadership activities for the committee:

Policy Cabinet: Members establish the rules and regulations as well as activity priorities of the Agile Manufacturing Enterprise Forum (AMEF).

Campaign Cabinet: This group serves as the fundraising arm for AMEF activities. Resources include loaned executives who represent the interest of industry, guide the AMEF and provide expertise and advice. The loaned executives ensure that funds raised by the AMEF are allocated to maximize benefits to the AMEF sponsors.

Governmental Interaction Cabinet: Members are asked to utilize their influence in Washington with legislative representatives to maximize AMEF influence to get legislation passed which will enable and empower industry to change rapidly into Agile Competition. This cabinet also will provide a group of executives to meet with Congress to discuss Agility and the factors influencing competitiveness.

Communications Cabinet: Members will help spread the word for the Agile Manufacturing Enterprise Forum (AMEF) movement.

The commitment of time, energy and resources which these senior executives and their organizations have made to the AMEF is truly remarkable. To broaden this commitment of resources the AMEF needs a similar commitment from other executives and organizations. Interested CEO's or senior level executives should contact the AMEF at (215) 758-5510.



Congress asks about Agility...Roger Nagel, Leo Reddy, President of NACFAM, Ed Miller, President NCMS, R. Wayne Sayer, Executive Director, CIMS testifying before the Senate Armed Services Committee. Congress and the Executive Branch have begun to hear the Agility message. AMEF executives have been asked to testify five times before Congress, in both the Senate and House of Representatives, and at both Democratic and Republican caucuses.

Benchmarking AGILITY

One of the most critical areas in the move to Agility is the development of benchmarks to measure the Agility of an enterprise. A Strategy Group with the title Benchmarking Agility: A Self Assessment Tool (BASAT) has begun to develop tools and methods to measure progress toward Agility. "This Strategy Group combines government, private sector, large companies, small companies and universities into a cooperative effort to determine how to measure an

...A METHOD WHICH WILL ENABLE AN ORGANIZATION TO IDENTIFY STRATEGIC GOALS FOR ITS PATH TO AGILITY...

Agile Enterprise," states Len Allgaier of General Motors, the group's Industry Chairman. The group currently contains representatives from General Motors, IBM, the U.S. Navy, Air Products, FMC, AT&T, Texas Instruments, ComputerAid, Paradigm Shift International, Wayne State University, Sandia National Laboratories, Target AME, NCMS, and Westinghouse.

The BASAT Strategy Group has begun the process of developing a method which will enable an organization to identify strategic goals for its path to Agility, assess their organizations' progress toward these goals, identify infrastructure needs and constraints, and assess their organizations' progress toward Agility. Use of this methodology on a periodic basis also would allow an organization to measure ongoing progress toward Agility.

(continued page 4)

AGILITY WORKSHOP/CONFERENCE SCHEDULED

The second annual Agile Manufacturing Enterprise Workshop/Conference will be December 15-18, 1992 at the Swan Hotel in Orlando, Florida. This annual conference offers a chance for people and organizations already involved with Agility to increase their knowledge and also serves to introduce newcomers to the concepts of Agile Enterprise.

"The purpose of the conference is to have a place where people working in Agility can exchange views, share developments and discover what other people and organizations are doing. We plan on presenting and distributing new publications from AMEF Strategy and Focus Groups. Many of these groups will issue and present a report at the conference," explains Roger N. Nagel, a principal organizer of the AMEF. "It is also a place for people who want to find out about Agility to meet, discuss these concepts, and hear reports of current activities concerning Agility."

Groups planning to report and get feedback include: Enterprise Integration, Evolving Standards, Agile Production, Simulation & Modeling, Environmental Enhancement, Empowering Individuals & Teams, Continuous Learning, Supplier Management Systems, and Benchmarking Agility: A Self Assessment Tool.

"One of the things we are seeking is organizations willing to share examples of their Agility with the rest of the group," notes Rusty Patterson, the Advanced Technology Operations Manager of Texas Instruments. All individuals and companies with an interest in Agility are invited and encouraged to attend. The aim of the conference is to explore ways that agility can meet the needs of your organization, whether you are a small, medium or large sized concern.

WE PLAN ON PRESENTING AND DISTRIBUTING NEW PUBLICATIONS FROM AMEF STRATEGY AND FOCUS GROUPS. MANY OF THESE GROUPS WILL ISSUE AND PRESENT A REPORT AT THE CONFERENCE.

"We hope to have broad based participation by people in the Agile movement and people who have been intuitively moving towards Agility on their own. We will use this as a major event in the mission of the Forum, which is to spread the word and get people involved," Dr. Nagel stated.

The registration fee is \$595 for this important workshop/conference. For more information and registration materials, call the AMEF at 215-758-5510.

21st Century Report Available

We are pleased to report that *The 21st Century Manufacturing Enterprise Strategy Report* is once again available. This report which sold out its first printing of 10,000 copies is an excellent introduction into the world of Agility. This popular report, which has also been distributed to all members of Congress, is a great way to learn about Agility. To obtain copies contact the AMEF office at (215) 758-5510. The report is contained in a 2-volume set and each volume is priced at \$25.

Benchmarking...

(continued from page 3)

Guiding the development are several important concepts:

1. An organization can't benchmark its progress towards Agility unless it has defined why it is becoming Agile. The organization needs to identify specific strategic benefits it hopes to gain in order to measure progress.
2. Agility is not a prescription. It is a menu from which each organization must chose its own transition path.

The BASAT Strategy Group has an additional objective of developing a method of comparing one organization with another. When an organization compares itself with another organization the measures utilized must be interpreted in the same way. The BASAT Strategy Group will begin the process of developing an approach to this difficult problem.

Strategy and Focus Groups...The AMEF continues to meet its objective of deepening and broadening the understanding of Agility through the creation of Strategy and Focus Groups. This issue contains an article on the Benchmarking Strategy Group (see page 3). There are currently eight Focus Groups working on Agility related topics. Each group meets approximately once a month for two days. More than one hundred organizations are currently participating in one or more Focus Groups. The next issue of The Agility Forum will feature articles on Focus Group activity and how to participate.

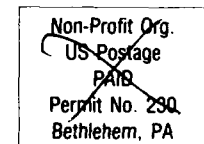
Upon identification of a satisfactory plan, it will be tested by a set of organizations who will be asked to evaluate this process in two of their P&L operations. This should allow the BASAT Strategy Group to compare across operations within an organization and across several organizations. When this process is completed it will be evaluated and refined before release for broader use.

The BASAT Strategy Group is working closely with the National Center for Manufacturing Sciences (NCMS) to develop for the longer

term an integrated benchmarking tool which will combine the resources of the NCMS and the AMEF into a single tool that the NCMS will implement for broad based application.

In addition, the AMEF will continue to develop concepts through its BASAT Strategy Group toward the goal of providing methods for on line benchmarking systems. There are currently 15 organizations which have committed their interest and resources to this important effort. If your organization wishes to participate it is not to late to call the AMEF.

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Appendix C

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References noted with an asterisk (*) were reviewed and discussed by the Inner Core Team in plenary session.

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