

**BUILDING AN INDUSTRY - ACADEMIC ENGINEERING EDUCATION
CONSORTIA: SOME MYTHS AND REALITIES**

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Over the past four years, the three state universities in Arizona (Arizona State University, University of Arizona, Northern Arizona University) and six of the largest, high tech companies (AlliedSignal, Boeing, Hughes Missile Systems, IBM, Intel and Motorola) have completed a Technology Reinvestment Program (NSF Award # 3518) project known initially as JACMET (Joint Arizona Center for Manufacturing Education and Training). It has now been officially established by the universities and industry sponsors as JACME²T (Joint Arizona Consortium - Manufacturing and Engineering Education for Tomorrow).

What is JACME²T?

The Consortium effort began in 1993 as a TRP planning grant (EEC-9310456) and is now a self-supporting group devoted to advancing university - industry interactions - especially in life long learning areas. Overall direction is provided by a Policy Board of top industry, university and public sector leaders. Day to day direction is provided by the Technical Advisory Board, again comprised of industry and university managers. A central office is maintained at ASU and a branch office for Southern Arizona at Hughes Missile Systems in Tucson. Currently, six curriculum development groups composed primarily of industry representatives with two or three academic members are developing/providing advanced level education at the non-credit, certificate and graduate levels in the following areas:

Manufacturing Processes
IPPD
Software
Environmental
Design
Quality

A Marketing Group seeks to expand our organization and participation; a Delivery Systems Group is active in expanding awareness of and delivery of programs via a variety of distance education methods - closed circuit TV, videotape, World Wide Web and others. An Organization Chart is shown in Figure 1.

The Technical Advisory Board meets monthly to review progress of JACME²T to our stated goals, and provide direction where needed. Curriculum groups are reviewed and evaluated with

regard to satisfying customer (Industry) needs for continuous education. These regular meetings also provide opportunities for industry executives and university officials to meet informally and discuss the current state of affairs. These discussions often go beyond the specific business of JACME²T, providing a forum of open dialogue between Industry and the Universities.

As mentioned previously, there are six curriculum areas. The Quality Group has developed six courses providing a basic structure and tools for all skills to use in quality control and improvement. The IPPD Group has recently focused primarily in the project management areas after developing a set of courses providing a fundamental knowledge of integrated product development. Manufacturing Processes has introduced some valuable courses on manufacturing strategies and approaches. They are currently working a program leading to certificate / degree for a Production Engineer, an area where Industry is consolidating its manufacturing support. Software, Environmental and Design are all relatively early in their curriculum developments, but are beginning to provide courses now. A complete list of JACME²T courses that are currently available is provided in Enclosure 2. As of December 1997, JACME²T has offered 125 credit and non-credit courses to approximately 1400 engineers and technical professionals.

JACME²T provides three levels of education, providing Industry with options to choose from depending on their needs. Courses can be offered and taken on an individual course basis, providing focused training in particular skill areas. These courses can also be provided on a "just-in-time" approach when requested by Industry. Certificate Programs are also provided. Certificate Programs fill the gap between individual classes for specific knowledge and full degree programs. The Certificate Programs offer a series of courses which provide the necessary training for the individual to achieve minimum competency levels for job assignments. Certificates usually require an excess of 100 hours of instruction and at least one credit offering. These Certificate Programs offer Industry the opportunities to provide career growth education as well as cross training for a more flexible workforce. Hughes Missile Systems has incorporated certificate programs as part of their employee career development program. University credit courses are also offered through JACME²T. A degree is not currently offered through JACME²T, but existing MS and MBA courses are. There is a proposal to the Arizona Board of Regents (the governing body for the three state universities) to initiate a statewide MS degree encompassing courses from all three schools on the same plan of study. The proposal was a joint effort, originated by the three Universities and supported by Industry. The seed originated in JACME²T. This type cooperation is providing unparalleled education opportunities to the Arizona workforce.

JACME²T is expanding its education role, both in curriculum and membership. Four new Industry members have joined over the original six. We expect the number will increase significantly this year as we broaden the curriculum for learning. The initial focus for JACME²T education was "post graduate engineering." We are expanding this to include business and manufacturing, which should benefit smaller industrial companies as well. As an example, a Fundamentals of Business Finance course was just developed and has gotten very positive reviews. The Boeing Company is offering a short course in "Agility" to aid in their productivity improvements. Manufacturing technician training is also being considered.

All courses are evaluated using standard forms developed by Motorola University. A selected sample is also evaluated by interviewing participants approximately six months after the completion of the course. Credit courses include a variety of regular learning assessment

techniques. This process provides University and Industry leaders with direct and current feedback on the validity, currency, and applicability of our training / education programs.

In conducting this project we have encountered several challenges. Our extensive dialogues and mutual efforts have exposed a variety of important myths and related realities. They are presented here in the spirit of perhaps assisting other such groups in fulfilling their potential in their local service areas - while fully recognizing that with the explosion in telecommunications - there will truly to be no such "local service area" in many respects.

Myth	Reality
Industry wants too much control over universities	There may be a very small percent of industry leaders, who fall in this category but <u>most</u> only want more cooperation and realistic responses from universities - and not the same old same old!
Industry wants <u>training</u> and not education	While many may not understand or articulate the difference - <u>most</u> realize universities are primarily in the education business.
Industry is too proprietary and competitive to work together	Semitech, JACME ² T, the Lean Manufacturing Initiative and many other examples solidly refute this.
Intellectual Property rights are impossible to equitably address	While still a major stumbling block, new and fresh thoughts on this offer some positive solutions.
Distance Learning is not really supported by industry	While some sites may not operationally support distance learning as well as they should/could, the <u>access</u> and <u>flexibility</u> distance education allows is well supported by our management and participating engineers. If anything they want more, not less.
Universities are only interested in credit programs.	Of course most universities are still primarily directed toward credit and degree production - after all, it is the one niche they still have - many professors and schools increasingly recognize their responsibility in providing lifelong learning and that will mostly be in non-credit areas.
Most engineers today have too little time to devote to continuing their education	Many companies require - and monitor - a “40 hours per year minimum” of education and training. However, this is still the number one stumbling block reported by practicing engineers.
Industry knows exactly what it needs in CEE.	This is seldom the case. They are not in the “education business” for the most part and still need to work on this major weakness in all operations.

Partnerships are joinings of equals. One side cannot dominate the other. In JACME²T we have achieved through extensive dialogues and working together pretty well the maximum extent possible in this regard. Companies do not have to belong – it is voluntary and universities have to maintain their academic standards. Fortunately, none of our top level company supporters have a problem with this but occasionally you do encounter it at lower levels in some organizations. Industries belong because they obtain influence on programs and courses tailored to their needs, lower costs, faster response times and a host of other gains from working with universities.

The ASU Center for Professional Development began operation in 1982. Many other universities have been at it a lot longer than that. Partnering with industry and other employers is definitely the most productive approach. Just being another "provider," even a "preferred" one is not likely to sustain major programmatic efforts over the long term - in both good economic times as well as bad. In Arizona, we are convinced that an expanding JACME²T is the best way for us to maximize value while minimizing costs for all parties involved. The core to productivity improvement is a highly skilled workforce. We feel JACME²T is a significant contributor to achieving that goal.

ALBERT WINN, joined McDonnell Douglas in 1984, was named to his current position in 1997. Prior to that he was vice president, Production Engineering and Operations (1996); vice president, Integrated Product Definition (1994); vice president, Engineering (1992); director, Longbow Apache Engineering (1991); manager LHX Technology, Flight Technology, Advanced Configuration Design, and AH-64 Product Definition (1984-1991).

Before joining MDHS, Mr. Winn held several engineering and executive positions within the U.S. Army Aviation Research and Development Command and the U.S. Army Aviation Systems Command. He was responsible for engineering support of integration, design, and airworthiness qualification during the aircraft development cycle of major Army helicopter systems, including the AH-64 Apache and the UH-60 Blackhawk.

Mr. Winn received his B.S. in aerospace engineering from California State Polytechnic University in 1968 and his M.S. in aerospace engineering from the University of Southern California in 1974.

Born in Los Angeles, Calif., Winn is the father of one son and two daughters.

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Figure 2

Quality Curriculum Area

- The two-day Statistician: An Introduction to Statistical Quality Control
- An Introduction to Quality Function Deployment (QFD)
- An Introduction to Robust Design of Experiments (DOE)
- Problem Solving with TQM ToolSchool™
- Quality Engineering and Management (credit)
- Reliability

Integrated Product and Process Development (IPPD) Curriculum Area

- Integrated Product Development (self-study)
- Tools for Integrated Product and Process Development (credit)
- IPPD Project Management (credit)
- The Effects of Economics of New Product Markets (credit)
- Strategic Product Development (credit)
- New Product Strategy (credit)
- A.G.I.L.E. – “Individuals”
- A.G.I.L.E. – “Train the Trainer”
- Lessons Learned
- Cycle Time Management
- Decision Tools
- Risk Management
- Technical Leadership
- Introduction to Agility (WWW)

Environmental Curriculum Area

- Brief Introduction to DFE
- ISO 14000 Update
- Environmental Overview
- Design for the Environment (credit)
- Environmental Auditing and ISO 14001
- Business Case for DFE
- Environmentability (self-study) – (WWW)

Manufacturing Processes Curriculum Area

- Control of Manufacturing Processes (credit)
- Design for Assembly
- Manufacturing Strategy (credit)
- Continuous Flow Manufacturing Fundamentals – Part 1