Commerce report forecasts strong near-term growth; long-term growth less certain
Ware Myers, Contributing Editor

Over the next three years the worldwide revenues of United States software suppliers are expected to increase 32 percent per year and reach $41 billion in 1987, compared with about $12 billion in 1983, according to a recent report from the US Department of Commerce.*

The prospects for the US industry beyond 1987, however, are less certain, because competition from western Europe, several developing nations, and particularly Japan is expected to become much stronger and because government policies may have adverse effects on US suppliers.

In the near term, sales of packaged software are expected to grow 36 percent annually, remaining the highest growth sector of the software market. The custom software sector, which includes contract programming, will remain second, growing at about half that rate. Integrated systems software will be third.

Because of these different growth rates, the US’s predominance in packaged software—more than 56 percent of its worldwide revenue is in this sector—is a strong competitive advantage. In France, the second largest supplier, a survey of the top 100 computer services firms found that contract programming and consulting are their major activities. In Japan, the third largest supplier, the independent software firms gain more than 90 percent of their revenues from contract programming, apparently because of the preference of users for software tailored to their particular requirements. In the United Kingdom, the fourth largest supplier, more than half the revenue comes from integrated systems software.

*US firms now have 70 percent of the worldwide software market and this share may increase to about 75 percent in the near term. (A Competitive Assessment of the United States Software Industry, Science and Electronics Unit, Office of Computers and Business Equipment, US Department of Commerce, Feb. 1985, 100 pp., available from Government Printing Office, GPO Stock No. 003 009 004365, North Capitol and H St., NW, Washington, DC, $4.50. Also see condensed version in March Computer.)

Emerging competition. Japan will emerge in the long term as the strongest competitor of the United States in the world market, the report speculates. It will focus on products that have established market positions, enhance their features and performance, emphasize quality and reliability, and compete strongly on price, just as it has in the case of other products.

The Japanese face one special obstacle in this field, however. The different structure of the Japanese language makes it more difficult for them to tailor software to speakers of the Western languages and to support software outside their home territory. On the plus side, Japanese programmers are said to be more productive and to make fewer errors than their US counterparts. They appear to be more disciplined, group-oriented, and concerned with quality.

The US is lagging by as much as 10 years in putting its software engineering research to use.

The Japanese have made impressive gains in the development of software tools and have encouraged their widespread use to boost productivity, the report claims. They are also in the process of putting the techniques of software engineering into practical use, leading to the possibility of cost-controlled development of nearly error-free products within a predictable schedule.

In contrast, US personnel appear to be more creative and individualistic, though less disciplined. The country’s entrepreneurial environment encourages the proliferation of innovative firms. It is a leader in software engineering research, but is lagging by as much as 10 years in putting these practices into daily use, according to recent studies. Still, some observers believe that the long US experience in software development has created a corps of managers superior to those of countries that have entered the field more recently.

Government policies. The software industry does not operate in a policy vacuum. The degree to which the governments of the countries interested in competing in this market involve themselves with issues of legal protection and software piracy, export controls, investment incentives or tax credits, import restrictions, and the support of research and development will have a powerful influence on the future distribution of the industry among the countries of the world.

Unlawful copying is said to be reducing industry revenue by several billion dollars a year. Piracy is rampant in some countries of the developing world. Copyright is coming to be the legal basis for software protection, but to be effective, these rights must be enforced by every country. The report recommends a series of efforts to the US government that would have the effect of strengthening the legal protection of software, even to the use of trade sanctions against nations that fail to provide adequate legal protection to US products in their territories. Export controls are an example of a government policy that could diminish the export of software. The present system tries to control too broad a range of products and technology, according to industry sources. These sources claim that the uncertainties in the present licensing procedures lead foreign customers to regard US suppliers as unreliable. The report urges the US government “to strike a balance” between national security and competitive advantage.

A number of countries—France, the United Kingdom, Ireland, Japan, Taiwan, and Singapore—have established investment incentives for their own producers. In the United States these incentives often take the form of tax credits. Unfortunately, those generally available to US industry are largely withheld from software by the Internal Revenue Service’s view that software is an intangible asset. Users may not take an investment tax credit or accelerated depreciation unless the software is purchased with the hardware.

Developers, to qualify for the R&D tax credit, must establish that software is a completely new or significantly im-
proved program "whose operational feasibility was seriously in doubt." The IRS denies credit to software developed by means of "standard programming techniques." The report urges that these tax benefits be extended to all software.

Other nations are developing methods to restrict the import of software to encourage their own suppliers. For example, setting a customs value on a package based on the basis of its intellectual content results in high import duties. Non-tariff barriers include mandatory licensing of software (at relatively low fees), reservation of markets to local suppliers, setting standards that favor them, treating them preferentially in government procurement, and limiting subsidies and incentives to local suppliers.

The report recommends that the US government work to lower barriers to free trade; it should seek to encourage high technology in developing countries without damaging US suppliers. Influenced by the example of the Japanese Fifth Generation Computer Project, the western Europeans are now supporting several broad-gauge R&D programs with software aspects, such as the European Community's Esprit and England's Alvey. In addition, industry groups, both in the US and Europe, are supporting cooperative R&D efforts. In the US, much of the R&D in software is being supported through military or space appropriations, but these efforts will not lead directly to commercial products. The governments of at least eight nations, both developed and developing, have now recognized the importance of software as an industry capable of providing substantial employment and revenues and are making efforts to promote it. In the United States, where market forces are expected to drive the industry to compete more effectively, the government does have a responsibility to clear the way for fair competition.

Center offers computing fellowships to PhD candidates

The Center for Advanced Computer Studies at the University of Southwestern Louisiana is offering tax-free fellowships of up to $12,500 per year for students pursuing a PhD in computer science with a concentration in any of the university’s software areas. The fellowships are awarded for one year and provide support for as many as four years. Applicants should contact Terry M. Walker, Director, Center for Advanced Computer Studies, University of Southwestern Louisiana, PO Box 44330, Lafayette, LA 70504; (318) 231-6339.

Department of Defense establishes Software Engineering Institute at Carnegie-Mellon University

Ware Myers, Contributing Editor

Finding promising software tools and methods, and then developing them to the prototype stage, is the purpose of the Software Engineering Institute. The Department of Defense recently established the institute at Carnegie-Mellon University. A.N. Habermann, its acting director, described the institute at Compcon Spring 85 February 28.

The institute will demonstrate the usefulness of these practices to DoD units and contractors. It will not produce finished products and is not being staffed for that purpose. Rather, the institute and DoD will encourage contractors to take over the prototypes and turn them into products.

The institute does not plan to write telephone book-sized documents on program metrics, say, or other aspects of software development, Habermann indicated. It will encourage the building of tools in the environment in which the software development takes place. It will concern itself more with the technological support of software project management than with management methodologies as such.

During the negotiations between DoD and CMU, the parties agreed that some tasks—perhaps 20 percent of the total—will be assigned to the institute by DoD and that the rest will be initiated by the institute.

States of the art. Habermann distinguished three stages of the state of the software art. First, there is the state of the practice, referring to the tools and methods that have evolved from experience in building software systems and are now in widespread use in most industrial and defense organizations.

Second, there is the state of the art, consisting of techniques developed in universities and research laboratories. Some of these techniques are being introduced in production environments, but others have seen little practical use. In fact, many organizations are 10 to 15 years behind this state of the art.

Finally, there is the future state of the art. Because research in software engineering is proceeding at a fast pace, there will certainly be many new tools and methods in the future. “But we can only speculate on their exact form,” Habermann noted.

Finding the ideas. In establishing the Software Engineering Institute, DoD is trying to accelerate the transition of good techniques from the concept stage to practice, Habermann said. One of the first tasks of the institute, therefore, is to identify good ideas. To this end, it gathered together several top workers in the software engineering field and asked them to develop a list of areas to work on. The institute staff will amplify this list and make it the basis of discussions next fall by a larger group of experts, perhaps 35 to 40. The results of that discussion will be published and will lead to a still larger conference in the spring of 1985.

Assessing these new ideas is the responsibility of the Basic Research and Education Division, one of the institute's four divisions. The research component of this division plans to invite people with interesting ideas to work at the institute for extended periods of time and to support them with the resources necessary to develop their ideas. The institute is not going to limit itself to a particular technology or a technique that may have been developed at CMU, Habermann insisted. Rather, it is going to search the country for good ideas.

Divisional organization. Once a concept has been developed to a certain level, it becomes the responsibility of the Projects Division. A project is expected to consist of a project investigator, project administrator, and 10 to 15 professionals. All work is to be done in-house. The Software Engineering Institute is not permitted to contract out to other organizations nor will it take contracts itself. It will not develop software at the applications program level.

The third division, Technology Transition and Training, will demonstrate the prototypes developed by the Projects Division to the defense community and will train personnel to use them. In addition, it will be in a position to assess ideas differently from the Research Division—its role in transmitting software methodologies to users should make it especially aware of the current needs of applications under consideration. The fourth division provides administrative and technical support to the other divisions.

Educational effort. The institute will conduct three levels of education, Habermann explained. One is training in
the use of prototype tools and methods. The second level will be tutorials on specific topics, while the third will offer semester courses leading to the masters degree in software engineering. The institute plans to work with the Wang Institute and universities that have explored this area, involving them in the design of the curriculum.

Institute relationships. Each of the four divisions will be led by an associate director. Above the divisions are three officers: the director, chief scientist, and DoD control officer. These seven make up a review board responsible for the selection of topics and projects. The institute will build up to about 80 staff members in 1985 and to about 250 within five years.

The institute director reports to the university provost, giving it the same academic status as other institutes of the university. A board of visitors, drawn from industry, other universities, and DoD, will advise the director. In addition, DoD is setting up an advisory group with members drawn from the three services. An executive committee of this group, composed of technical and administrative personnel, is the focal point for DoD relationships with the institute. Officially, the institute is the responsibility of a vice commander of the Air Force.

Entirely financed by DoD, the institute’s primary function is to advance the defense community’s software engineering capabilities. To serve other communities, Habermann added, the institute proposes to establish two affiliates programs, one for academia and one for industry. Affiliates may send someone to interact with an institute program on a regular basis. Affiliates may carry on parallel development, though not on contract with the institute. Habermann hopes that affiliates will in some instances carry on development of a project beyond the prototype stage. They will be free to market the resulting product on commercial terms.

Academic publication. The institute’s research and development work will be in the public domain and its results published, Habermann said, responding to a question from the floor. The institute will give DoD copies of papers 30 days in advance of publication, not so much for security reasons as for patent purposes, he said. Since many defense application programs are classified, the institute’s transition personnel, who will be working with these programs, will require security clearances. The transition teams will screen out classified information so that the projects at the institute itself can be nonclassified.

DEC gives $330,000 for editing software project

With a $330,000 grant from Digital Equipment Corp., the University of Pittsburgh will develop programs to teach writers to locate and correct mistakes in their compositions. The university’s English Department will use the funds to buy a VAX 11/750 minicomputer, 12 DEC Professional 350 microcomputers, an Ethernet local area network, and a text-to-speech system.

A team of experts in computing, linguistics, and artificial intelligence is researching human language processing so it can then develop computer programs that are not only detect errors but also help students learn to correct those mistakes.

The university expects the research to be useful for computer-assisted instruction in many fields, not only in languages, said Mary Louise Briscoe, chairperson of the English Department.

Publications describe vertical market, decision support

A new study, The Vertical Market Reference Book, examines 75 industry sectors and details the levels of computer automation in each. The survey shows several marketing opportunities for vendors of information-processing products and services. For more information, contact the Market Information Center, 100 Pennsylvania Ave., Ste. 350, Framingham, MA 01701; (617) 879-2273.

A new journal, Decision Support Systems, monitors ongoing research in decision support, with the aim of bridging the gap between computer science and management science. The journal draws from a range of disciplines, including operations research, management science, computer science, cognitive psychology, and organizational behavior. For more information, contact North-Holland, c/o Elsevier Publishing Co., PO Box 1663, Grand Central Station, New York, NY 10163.

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**Universities, Air Force create AI consortium**

Eight universities—seven from New York state and one from Massachusetts—have entered into a five-year, $8 million contract with the Air Force's Rome Air Development Center in upstate New York to study artificial intelligence.

"The project is aimed at establishing a major research force in artificial intelligence in the Northeast," said Fred Diamond, chief scientist at Griffiss Air Force Base in Rome, New York, where the development center is located.

The consortium has four main goals: improving the Air Force's technical AI abilities, improving training of Air Force personnel and expanding the general base of AI expertise, stimulating business involvement in AI research and development, and establishing a cooperative relationship among institutions in the field.

Syracuse University will be the prime contractor for the consortium, developing logic programming and special-purpose hardware. The university will subcontract other research to the remaining colleges in their respective areas of expertise.

The University of Rochester will handle problem solving and temporal relationships and reasoning problems. The Rochester Institute of Technology will work on speech-understanding systems. The State University of New York at Buffalo will develop versatile expert maintenance systems.

Rensselaer Polytechnic Institute will undertake research on image-understanding systems and on aerial and satellite imagery. Clarkson University will work on distributed problem solving, while Colgate University will develop natural language processing and plan recognition. The University of Massachusetts will explore intelligent user interfaces, natural language generation and understanding, and distributed artificial intelligence/expert system coordination.

The Air Force Institute of Technology will also contribute to the consortium, but on a nonfunded basis.

**DPMA model legislation combats computer crime**

Computer crime is growing at a rapid pace, according to Data Processing Management Association research. A fifth of the respondents to a DPMA survey said their businesses had suffered computer crime losses ranging as high as $300,000.

The problem is more acute for software developers. In fact, there are estimated to be at least as many pirated versions of business software in the United States as there are legal copies, a study by Future Computing Inc. found.

The estimated loss to the business software industry was $1.3 billion between 1981 and 1984, Future Computing said. Had a quarter of the pirated programs been purchased, the industry would have gained another $800,000 in revenues.

Copy protection appears to be no protection, the firm said. Copy-protected software is pirated as often as unprotected programs, the survey revealed.

At the workplace, unauthorized employee use is the leading category of computer crimes, the DPMA survey found, followed closely by software theft and copying and by hardware theft.

**Model legislation.** In an effort to combat the rise in computer crime, the DPMA is drafting model legislation aimed at curbing fraud and abuse. Existing laws cover the use of computers for theft and fraud. But most laws do not cover the copying and abuse of computerized information.

"The computer itself has generated items of property that never existed before; such as information and software, which are not covered by common law," said Richard Cashion, chairman of the DPMA's Computer Crime Subcommittee. "Information in computers is a primary resource. If you lose control of information, you lose a primary resource—you lose your business."

The laws that do exist now vary from state to state. While it is recognized that abuse of resources, stealing computer time to run a business on the side, and stealing information are unauthorized acts, the statutory definition of "unauthorized" differs across state lines. "We need uniformity across the nation," Cashion said.

The DPMA's model law includes the following felony categories of computer fraud and abuse: unauthorized use of computing resources with the intent to defraud, unauthorized use of computing resources for the purpose of experimentation, unauthorized release of computing resources for the purpose of experimentation with a loss to the victim of under $1000, unauthorized release of computing resources for the purpose of experimentation with a loss to the victim of over $1000, unauthorized modification of computing resources with the intent to defraud, and unauthorized modification of computer resources for the purpose of experimentation with a loss to the victim of more than $1000.

The DPMA also hopes to make the failure to report a computer felony a misdemeanor violation. Surveys show that only half the computer fraud detected is reported to law enforcement officials.

**US publishes guide to microcomputer security problems**

The federal government recently published a guide that discusses security problems in using personal computers. Security of Personal Computer Systems, written by the National Bureau of Standards, identifies the areas of vulnerability that microcomputer use brings.

These include physical and environmental protection, system and data access control, integrity of software and data, backup and contingency planning, and communications protection.

The 68-page guide (USGPO stock number 003 003 02627 1) costs $3 and can be ordered from Dept. 36-LR, Superintendent of Documents, Washington, DC 20402.

**High growth predicted for software service, support**

Revenues to service firms from systems software maintenance and support will increase by 33 percent each year between 1984 and 1989, moving software from nine percent of total service revenue in 1984 to 22 percent in 1989, according to a new report by the market research firm Input.

In that same period, hardware maintenance will decrease from 83 percent to 63 percent of total service revenues. Hardware service prices are expected to continue the decrease begun in 1982. Professional services will increase to nine percent, while educational services will rise to six percent, the firm predicted.

The total large-systems customer service business will grow from $3.4 billion to $5.7 billion, giving it an annual growth rate of 11 percent.
DPMA publishes computer education curriculum

The Data Processing Management Association has designed a business-oriented course of study on computing for high school students. The goal of the curriculum, which took two years to develop, is to increase computer literacy, teach marketable computer-related skills in occupational programs, and boost knowledge about computer information systems to help students meet more stringent college-entrance requirements.

"All citizens in an information society require a solid background in computers," said Carroll L. Lewis, president of the DPMA. "Virtually all people will have to react with computers, even if they are not computer professionals."

However, the curriculum purposely avoids two areas of study—computer engineering and systems and software design—that the DPMA judged too specialized for the curriculum's focus on business applications.

Four levels. The course of study is divided into four levels. The first is an introductory, one-semester course in basic computer literacy called "Computers and Information Technology." Depending on a school's resources, it could include some hands-on use of simple microcomputer applications. The first level is aimed at students in grades seven through nine.

The second level stresses career-oriented computer applications. "Computer Information Systems and Programs" includes instruction on simple programming for business needs. The course is meant for students in grades eight through 10.

Level three is intended to be an honors course for college-bound students, particularly those interested in business and related fields. The "Computers in Modern Life" program covers the same material now studied in many introductory courses taken by college freshmen. It is suggested as a 12th grade elective.

Fourth-level courses are single-semester, practical training modules for grades 11 and 12. The 15 modules are grouped into four areas: business computing programming, business computer operations, microcomputers in business, and keyboarding.

The first texts and supplementary materials should be available for the fall semester, while all core courses and several of the occupational skills classes will be supported by fall 1987. The DPMA intends to provide 30 hours of curriculum instruction to interested teachers.

Interested educators should contact the DPMA at 505 Busse Hwy., Park Ridge, IL 60068; (312) 825-8124.

IEEE offers three packages

The IEEE has published three individual learning packages as part of its independent professional program in emerging high technology. The packages cover digital signal processing, spread spectrum signals and systems, and advanced microprocessors.

Developed under the guidance of the IEEE Educational Activities Board, the packages include a text book or course, a study guide, an audiotape, and a final examination. The program offers Continuing Education Achievement Units and an IEEE-EAB Certificate of Achievement.

"Digital Signal Processing" (ILP HS0047-1, $179) is an advanced three-semester postgraduate program (400 hours) designed for the electronics or computer engineer familiar with linear and sample-data systems who requires intensive state-of-the-art knowledge in the digital signal-processing field. The program has two options: the ILS-IEEE Simulation Software System (HS0048-9, $150), an electronic study partner on IBM PC-compatible 5¼" floppy disks, and Programs for Digital Signal Processing, 29 advanced Fortran programs on a half-inch mainframe tape in either 800 or 1600 bpi in EBCDIC format (PT05004 or PT05017, $63).

"Spread Spectrum Signals and Systems" (ILP HS0046-3, $179) introduces the concepts of spread spectrum systems through eight learning sessions (80 hours) from basic spread spectrum theories and techniques to design and analysis for complex spread spectrum system design.

"Advanced Microprocessors" (ILP HS0045-5, available in the fall) introduces in nine learning sessions (80 hours) the theories and design processes in single-chip technology. Major emphasis is placed on 16- and 32-bit microprocessor units.

The packages can be ordered from the IEEE Service Center, 445 Hoes Ln., Piscataway, NJ 08854. Add $8.50 shipping and handling for each package ordered.