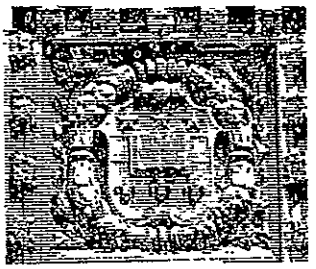

WASHINGTON UNIVERSITY

CENTER FOR DEVELOPMENT TECHNOLOGY

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CONTINUING PROFESSIONAL EDUCATION: STATUS, TRENDS, AND ISSUES RELATED TO ELECTRONIC DELIVERY

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by

DONNA ROTHENBERG

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TABLE OF CONTENTS

Section | Page

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CONTINUING PROFESSIONAL EDUCATION: STATUS, TRENDS, AND ISSUES RELATED TO ELECTRONIC DELIVERY

1. INTRODUCTION AND OVERVIEW

The information explosion places increasingly greater burdens on the working professional to maintain and advance his or her knowledge in order to prevent an atrophy of proficiency. Four professional groups, teachers, doctors, lawyers, and engineers, will be examined in this memorandum to determine if they constitute a potential market for continuing professional education delivered via large-scale electronic technology. For purposes of this discussion, continuing professional education is defined as the participation of working professionals in some kind of formalized learning procedure. Participation may be motivated by a variety of considerations and may, or may not, lead to an advanced degree. This investigation is presented with the full realization that the prospects of any one professional group utilizing telecommunications for continuing education may depend upon a combination of social and economic forces, such as mandatory periodic relicensure, additional course requirements for certification, or the economic health of supporting industry.

In terms of numbers, professionals are not the largest potential audience for large-scale educational telecommunications systems. Teachers and engineers, with an estimated 2,899,000[2]* and 1,000,000 practitioners respectively,[35, 36]* are the largest of the professions studied. These are gross figures, unrepresentative of the specialties within the ranks of each profession. Estimates are for 322,228 practicing doctors[16]* and 322,723 practicing law.[37]* In addition to being relatively small and diverse, as compared with the 10.9 million pre-schoolers in 1970[57] or the 51.3 million elementary and secondary students in 1972,[2] the professional audience has graduated from the educational system and therefore, to a certain extent, must be reached elsewhere.

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*Estimates cited are for the following years: 1971 - teachers, including those engaged in post-secondary institutions and specialized settings; 1970 - lawyers (derived); 1971 - doctors; early 1970's - engineers (rounded).

Generally, professionals may be found clustered around institutions central to their work or practicing in individual offices; configuration varies with the profession. Likely outlets other than campuses are elementary and secondary schools for teachers (many schools currently having radios and televisions, at least), medical centers for doctors (emphasizing concentrations of hospitals and medical schools), courthouses for lawyers, and offices for reaching all professions except teachers. Businesses employing engineers would currently be the most likely offices equipped to receive specialized transmissions. Costs for equipment, participation, and software may well be borne, to some degree, by the engineering employer. The nearest equivalent situation occurs with doctors who may join other health personnel at group viewing stations which seem to be fairly common in hospitals or other medical complexes. Those professions with greater percentages of self-employed practitioners, such as doctors and lawyers, may present a different configuration; practitioners may purchase viewing equipment and materials for individual offices, but the possible existence of group viewing outlets presents another option for participation. Although there is some evidence of a clustering of medical and legal offices within urban areas,[17] telecommunications for continuing education of these groups might place the cost of receiving equipment and software upon the individual practitioner or groups of practitioners. In a "wired" environment, people could be served at home.

The professional audience collectively displays certain characteristics which serve to distinguish it from other educational markets. The elements of time available for participation, motivation, the leadership of professional societies in all aspects of working life, and the ability of many professionals to pay for instruction may all affect the liklihood of electronic delivery being accepted by this market. The professional faces a demanding work day; time available for participation is a premium consideration. Work days are not uniform within this sector, ranging from the "all hours" working demands upon the doctor to the highly-structured days of the school teacher. Released time from work for participation in continuing education is a pattern often seen among engineers while "fringe time broadcasts" (8 AM, noon, or 5 PM) to participating law firms have been tried. Electronic

delivery, to be utilized, will have to provide schedule compatibility and flexibility for each professional market.

Motivation of students is presumably not a problem in this case. Therefore, production values need not be elaborate; "talking heads,"* if sufficiently organized and informative, will do as will taping or broadcast of actual classes. The primary software consideration must then be one of adequate supply for this highly specialized market which is further splintered into sub-specialties within each professional sector. Content quality is very important since the emphasis is upon expanding the practitioner's working knowledge; his or her time should not be wasted. Audiences may well expand should periodic relicensure requirements become common; literature from most of the professions mentions this possibility. However, at present such requirements are virtually non-existent.

Professional societies assume a potentially greater role for serving this market than in other educational sectors. The proclivity of professionals to form and join appropriate work-related organizations places such societies in the position of commanding a distinct membership and quite a few of the specialized information resources. This makes professional organizations desirable partners with established educational institutions for the evolution and distribution of software materials. Two recent examples of this type of interrelationship are in evidence; the "satellite seminar" jointly conducted by the University of Alaska and the National Education Association (national office and state affiliate) relied upon electronic delivery while the Professional Certificate program of the UCLA Extension service in Continuing Education in Engineering and Science and the local chapter of the American Society of Civil Engineers relies upon traditional classroom instruction. A variation on this theme has occurred in Washington, D.C. where the American Law Institute-American Bar Association Committee on Continuing Professional Education, a professional organization, has prepared courses delivered via microwave to participating law offices.

Another feature of the professional market is its ability to pay for instructional materials and generate income for those providing

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*Television parlance for an individual speaking directly to the audience via the television screen.

such materials. This quality makes it attractive to providers of educational services, be they non-profit or commercial in orientation. Indeed, of all the non-traditional markets examined thus far in this series of memoranda,* that of continuing professional education displays the greatest activity on the part of all software providers, whether non-profit institutions or commercial enterprises. Presumably affluent, the working professional either pays for his instruction out of discretionary income (and this may be tax deductible!), or else there is the possibility of passing the cost along to either client or employer.

Much of the instructional activity described herein will be of a non-credit nature, in keeping with the working status of the clientele and the emphasis on expanded competency. This entire area of higher education has, in the past, been difficult to assess due to the informal nature of reporting procedures and the absence of clearly-defined parameters to non-credit instructional experiences. The Continuing Education Unit (CEU) was officially created in 1974; it was the result of six years work by a National Task Force which was formed to create a measure of standardization for non-credit activities to facilitate record keeping and assessment of experiences with continued instruction. Defined as "ten contact hours of participation in an organized continuing education experience under responsible sponsorship, capable direction, and qualified instruction,"[1] the CEU has been accepted by the 600-member Southern Association of Colleges and Schools, and has been favorably received by or adopted by such professional organizations as the National Association of Boards of Pharmacy, several state nursing associations, and the American Nurses Association. While this bespeaks of the CEU's relevance to the topic under discussion, an impression seconded by the presence of engineering organizations and the American Medical Association at Task Force meetings, the guidelines developed for Unit application include the stipulation that "participation in

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*See also D. Rothenberg, "Vocational-Technical and Adult Education: Status, Trends, and Issues Related to Electronic Delivery," "Early Childhood Education: Status, Trends, and Issues Related to Electronic Delivery," and "Education of the Handicapped Child: Status, Trends, and Issues Related to Electronic Delivery." All are memoranda of the Center for Development Technology of Washington University, St. Louis, Mo., and are distributed nationally by ERIC at Stanford University.

programs delivered through the media (e.g., television, radio, newspapers) does not merit the award of CEU unless these presentations are an integral part of an educational program which qualifies under these criteria and guidelines."[1] The proviso would not preclude electronically-delivered instruction; it would mean that reliance upon telecommunications to deliver continuing education must not be at the expense of other administrative and programmatic requirements. The future of the CEU is somewhat conjectural;* should utilization occur on the maximum scale, mention has been made of the creation of a national data bank to store attendance and completion information.

Professionals have another, perhaps more pressing, need that electronic delivery may satisfy; information-on-demand would be of benefit to all professions studied within this memorandum.[17] Two working examples are the MEDLINE system operated by the National Library of Medicine and the LEXIS system providing computer-assisted legal research.

These and other possibilities are explored and detailed in the four subsequent sections comprising this memorandum. The first section looks at the teacher's market for continuing education, where the emphasis is on reaching expanded audiences so that problem areas may be addressed and specialization shortages assuaged. Such is the motivation behind the Appalachian Education Satellite Project now underway on ATS-6, the last in a series of Applied Technology Satellites designed by NASA. 1200 teachers located in 15 sites scattered throughout Appalachia are receiving graduate coursework in career education and reading instruction emanating from the University of Kentucky for distribution via satellite.** This and another instance of regional satellite demonstrations illustrate university-professional society cooperation, the utilization of interstate coordinating agencies, and a willingness on the part of some universities to credit courseware produced elsewhere on subjects they were unable to provide.

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*See "Future Utilization of the Continuing Education Unit," a study conducted for the Southern Association of Colleges and Schools by John A. Rhodes, Jr. Atlanta: Commission on Colleges, Southern Association of Colleges and Schools, 1974.

**The initial phase of the ATS-6 experiment ended in late Spring of 1975 and the satellite was repositioned to be used in India for one year.

The physician's market is examined next. The medical sector has been very active in experimentation with electronic technologies for delivery of continuing professional instruction. A state-wide network in Indiana, reaching resident doctors by ITFS, CATV, or bicycled videotapes, is in operation. Videotape networks criss-cross the country on a formal or an informal basis; an example of the former is the Visual Information Systems' production of electronic journals, and an example of the latter is the videotape duplication-upon-request service of the Brooke Army Medical Center. Medical agencies have maintained a strong interest in mounting demonstration projects on the series of experimental satellites developed by NASA. The December, 1975 launch of the Communications Technology Satellite will complete the schedule of experimental satellites, but the medical community will have been onboard since the first Applied Technology Satellite began functioning in 1971 and will continue with projects on the final satellite in the series. Throughout the decade medical participation has grown in audience size, geographic spread, and programmatic complexity. Programming, which if didactic rather than explicitly clinical (telemedicine), has constantly embraced the concept of the widest possible audience, enabling health personnel other than physicians to participate. Presumably this practice decreases the cost-per-user figure, although cost data generated by these demonstrations is not in great evidence.

Use is made of non-print media for continuing legal education, but not to the extent found in the other professions examined by this study. Section Four details efforts undertaken to bring videotaped instruction to practicing lawyers and the introduction of computer-assisted legal research. Interestingly, the items reported in this section do not represent university involvement; professional organizations were responsible for the videotaped programming, and private enterprise in conjunction with user groups was responsible for the development and marketing of the computerized research system. Although the delivery of video programming by cable and microwave has been abandoned for the present, cost was figured on the basis of tuition divided by instructional hours. When using this method initial hardware investment is neither amortized nor prorated, merely borne by the firm

in whatever manner it chooses. Broadcasts were during "fringe" time, so no billable time was lost from work, nor were travel expenses incurred. The cost-per-student hour was figured at $17.85 (1974). The cost of the one computer-assisted system for legal research now on the market appears to be within the $85 - $100 per hour range, or, on an annual basis, within the $18,000 - $36,000 span, depending upon the amount of time the system is in use. By contractual agreement between user and supplier, the system must be in use for a minimum number of hours each month.

A different method of figuring cost-per-student hour is gaining acceptance within the engineering profession. The examination undertaken in Section Five reveals that use of electronic delivery for continuing education is most widespread among engineers. By 1974, 26 systems at least had begun operation, emanating from universities or university consortia located in most every region of the country. A September, 1973 estimate was that 15,000 engineers were enrolled in 700 courses via electronic delivery of class sessions to off-campus locations. Although delivery mode, credit-granting policies, and tuition may vary, the choice of delivery mode will generally be dictated by the geographical configuration of the target audience and the least-cost method of serving it; delivery modes include videotapes physically delivered to each location, ITFS, or microwave transmissions. Cost analyses are based upon such variables as the number of courses offered (and the number of sections per course), enrollments (both total off-campus and number per location), cost-per-instructional hour, and cost-per-student. When computing cost, capital amortization of "sending" equipment (proration and interest), and operational expenses (overhead and salaries of production personnel, but not faculty) are figured; the price of "receiving" equipment is not included, since this is borne by participating locations. Figures cited by the Task Force of the American Society of Engineering Education indicate a lower per-student-hour instructional cost for off-campus electronic instruction than for similar on-campus instruction. For the Colorado State University system SURGE, figures for the 1972-'73 school year are $4.16 for off-campus education and $6.50 for on-campus instruction. For the Stanford University system comparable figures are $3.26 for off-campus education and an estimated $6.47 for on-campus instruction.

The concluding Section, Six, outlines the main points to emerge from this investigation of the market for continuing professional education via electronic delivery. Topics peculiar to each sub-sector are examined, and topics relating to the entire field, such as the possibility of mandatory periodic relicensure, will be analysed.

2. TEACHERS

2.1 Profile of the Profession

Professional educators are the largest of the groups studied within this memorandum. An estimated 2,296,000 individuals staffed public and non-public elementary and secondary institutions in 1971, of whom 21,000 were placed in the specialized settings of residential schools for the handicapped, federal schools for Indians or military dependents, and university-operated schools. An additional 603,000 people were providing higher education during that year.

The aggregate market may be broken down accordingly: 1) educators at the post-secondary level (university and junior college professors), 2) educators at the secondary level (usually subject-matter specialists), and 3) educators at the elementary level (often generalists in charge of a self-contained classroom). There were 1,293,000 elementary school teachers in 1971, including 14,000 employed in the specialized schools noted above. The corresponding figure for secondary staffers is 1,003,000 including the 7,000 employed in other settings.[2]

Professional educators, as recently as the 1960's an occupational growth group, have had a reversal of circumstances during this decade. Projections of demand for professional educators, e.g. new positions, are for continuation of imperceptible growth throughout the '70's, with more noticeable demand by the turn of the decade. Demand projections through mid-decade range from a minimum growth in public school teachers of 40,000 to a maximum growth of 240,000; either extreme is below growth rates of the 1960's.[3, 4] In the vernacular, there is a teacher surplus. A break-down reveals decreasing numbers of elementary teachers through mid-decade while numbers of secondary staffers rise. During the last half of the '70's, the situation will reverse, according to two U.S. Office of Education publications dated 1972 and 1973 (references 3 and 4). Higher, or post-secondary, education will continue to grow ... but at a slower rate than before. Demand for teachers at this level, traditionally staffed by PhDs, ranges from 156,000 to 180,000 full-time instructors.[3, 4]

Demand for teachers is affected by turnover, enrollment growth, decreasing the student-teacher ratio, cutting the drop-out rate, monies

from federal programs for additional staff, and growth of pre-primary education. Of these, the first three figure most prominently. Turnover has been estimated at 8-9% of all public school teachers in any one year, thus usually accounting for most teaching positions available. When enrollment mushrooms, as in the '60's, demand will grow much faster; however, increasing enrollment is not expected to affect demand until 1980. In the meantime, the labor pool of available instructors swells as current graduates, recent graduates unable to find positions, and former teachers willing to resume work all compete for a limited number of spots. The noticeable presence of the "potential re-entrant" is most closely-associated with the teacher's market. National Education Association (NEA) estimates, based upon a calculation of the labor pool of previously-employed teachers made by the U.S. Census Bureau in 1960, indicate 455,700 former teachers of whom 83,400 were ready to re-enter the profession for the 1972-'73 school year. Furthermore, this source of supply is expected to increase during the '70's by an excess of 2,000 each year.(3, 4, 5)

While "potential re-entrants"(3) constitute what may be a specific sub-group within professional ranks, they generally are regarded as one more component of the current oversupply of qualified instructors. Limited evidence indicates that elementary non-specialists (those in "regular instruction"), and secondary instructors in "overcrowded" fields (e.g., social studies, language arts) might also qualify for the distinction. The reverse is apparently true for special educators, other professional personnel such as school librarians, guidance counselors, nurses, and instructors in some of the fields considered vocational education (e.g., distributive education, trades and industry).(4) It appears that demand for those specialists has not diminished.

Although the ranks of the professional educators are large and diverse, they are not amorphous; teaching is an organized profession ... increasingly so in all senses of the word. Most of the nation's teachers are located in public schools which in turn are banded into geographical districts within each state. Schools, districts, and state education agencies represent possible dissemination points for professional material delivered via large-scale telecommunications and

other media. Post-secondary institutions offering graduate work in pedagogy represent another component of a potential delivery system. Finally, national organizations devoted to the various instructional specialties leap-frog geographic barriers in their memberships. Two broadly-based national organizations merit specific mention: 1) the National Education Association (NEA), 1,103,485 members strong, and 2) the American Federation of Teachers (AFT), an AFL-CIO affiliate with 275,000 members as of 1973. Far-flung, with committees, divisions, and councils embracing many areas of interest to American educators including communications and data processing, the NEA is a professional organization with 8949 local chapters and 53 state groups. Administrators and related personnel, e.g., school nurses and counselors, may hold membership. The AFT, a union with a professional membership, has 1,000 locals.(6) The NEA has shown an interest in utilizing telecommunications for continued professional development programming;* whether there is similar interest on the part of the AFT is not known.

2.2 Teachers and Educational Technology

Teachers of teachers have not ignored the opportunities offered by instructional technology. Interest in electronic delivery of appropriate materials appears to remain high on those levels. Generally, current interest seems to center on using technology to reach expanded professional audiences so that problem areas may be addressed and shortages assuaged. Additionally, examples cited produce evidence of institutions of higher education granting graduate credit for coursework delivered to sites off-campus, or coursework produced elsewhere. Another concept to emerge is that of accessibility of a number of locations at any one time to professional education materials. Not every example displays such accessibility in real time or through electronic means. However, glimpses of this principle "in action" are given by the following examples.

2.2.1 The Precursors

Small and large scale technologies have been used to reach and inform the working professional. A 1967 study revealed that 8

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*See page 13.

university extension divisions, or 6% of the total polled, were offering eudcational media courses via open-circuit broadcast television. This approach was concentrated in Oklahoma, Utah, and Hawaii, where it must have emanated from the state level. Combined enrollment was in excess of 1500 teachers. 0 - 1/4 units of credit were awarded.(7)

The small-scale technology of videotape has been used in micro-teaching, a technique to implant or improve specific teaching skills of instructors. Based upon a didactic-clinical application-feedback cycle, video or audio tape is used to record the teachers' instructional technique before a class (clinical application) and to replay the performance for critical appraisal (feedback). Microteaching is packaged in mini-courses, which are distributed by conventional means through the usual channels of extension divisions, state education departments, and individual districts. Each course concentrates upon a specific pedagogical skill area, and subjects covered range from early childhood education to secondary teaching strategies. Each minicourse may be seen as a media package; print workbooks are purchased by each participant, instructional films introduce and explain the skill area, and the tapes encourage self-instruction. Cost, in 1971 dollars, ranged from $1300-$1500 per course, depending upon the existing staff and facilities of the purchasing agency. Cost may be recouped through outside funding or tuition receipts. Graduate credit has been awarded for minicoursework.(8)

2.2.2 The Prototypes

Other technologies used to instruct the working professional include the functioning examples of the Computer Assisted Renewal Education (CARE) program of the Pennsylvania State University and the Spring, '73, "Satellite Seminar" for rural Alaskan teachers conducted over the two-way audio capability of the Applied Technology Satellite-1 (ATS-1).

CARE is computer-assisted instruction to relieve the shortage of special educators by training the pre-primary and primary-grade teacher to spot and accomodate handicapped youngsters within her classroom. During 1973, four courses were available, and two courses were being considered for development. As with the previous examples, graduate credit is awarded (3 units for 3 of the courses, 1 unit for

the remaining course), and distribution is through the usual channels of post-secondary institutions and local districts. Dissemination is via the unusual means of a self-contained mobile computer laboratory housing 16 student terminals with audio-video capabilities and a master IBM 1500 system. When parked at different sites around the country adjacent to the local sponsoring agency, the CARE laboratory provides individualized and branching instruction with the additional interactive component of a telephone line to Penn State curriculum developers. Costs to local institutional participants include $1300 power costs for 7-week course duration (1973 prices), $1200 salary to site proctor, released time for teachers (if possible), plus promotion and coordination expenses including staff time for such activities. Costs per teacher are inversely proportional to the number of teachers participating, for both the institution of higher education and the individual district. The teacher's cost will vary with the tuition of the crediting institution; a $9.25 surcharge, presumably for accompanying text, completes the participant's bill.(9)

Isolated and climatically inimical, Alaska imposes on its teaching corps limited opportunities for professional exchange (in this it resembles many rural teaching situations), and a "culture gap" between students and teacher. To address these problems, the University of Alaska College of Education, Alaska-NEA, a participant's panel representative of the state's rural teachers, and the NEA, co-produced a semester-long radio program beamed to 17 villages. From January-May, 1973, the "satellite seminar" presented an opportunity to broadcast state-wide in real time with a simultaneous tie-in to NEA personnel stationed in Washington, D.C. Interactive audio capability of the ATS-1 satellite allowed point-to-point voice communication from Alaska to Washington, D.C. and from villages to Fairbanks and Juneau (sites of the University of Alaska and Alaska NEA, respectively). Exact enrollment is indeterminate since total attendance varied between sessions; however, 6 teachers took the seminar for 1 unit of credit from the College of Education of the state university. Weekly from 7-8 PM a 50-minute session was broadcast. Topics varied from workable teaching strategies for Eskimo and Indisan students to upcoming legislation affecting rural schools. A question and answer period was a regular concluding feature of the broadcasts.

Cost data is rather sparse. Thanks to "piggybacking" on already extant hardware, expenses for the seminar essentially consisted of staff time and services to plan, coordinate, and participate in the programming. However, lessons were learned about effective program formats (apparently a particularly favorite feature was the satellite's ability to infuse each session with instant two-way communications), enhancing utilization (use accompanying print materials, small-group discussions), and the strong desirability of balancing input from among target audiences (local), program planners (regional and/or national), and liaison individuals or agencies (regional). Secondarily, contact should be maintained between technical staffers and programmers in an attempt to ease the dislocation caused when technical problems arise.(10)

2.3 Applied Technology Satellite-6 (ATS-6) and American Educators

The ATS-6 satellite demonstration has involved selected regions of the country in the use of that large-scale technology to deliver materials needed by working teachers. Alaska has continued onboard and was joined by the eight states of the Rocky Mountain region and the Appalachian counties of eight of the twelve eastern states considered within "Appalachia."* Serviced primarily by ATS-6, and secondarily by ATS-3 over the Atlantic and ATS-1 over the Pacific, the demonstration will generate data about the cost-effectiveness of this means of delivery to isolated student and teacher populations. The demonstration lasted for one year, or three semesters, beginning the summer of '74.

2.3.1 The Appalachian Education Satellite Project

Of the cooperating regions, Appalachia planned the most comprehensive example of use for continuing teacher education ... devoting its entire educational component to this audience. The Appalachian Education Satellite Project** featured television programming developed

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Regional participants by state are: 1) Alaska, to be linked with Washington state for some demonstrations, 2) Rocky Mountain area: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming, and 3) Appalachian area: Alabama, Georgia, Kentucky, Maryland,* New York,* North Carolina,* Ohio, Pennsylvania,* South Carolina, Tennessee,* Virginia,* and West Virginia,* of which the marked states are participating.(11)

**This component is not to be confused with the biomedical communications demonstration conducted under the auspices of the Veteran's Administration which includes 10 VA hospitals scattered throughout the Appalachian region.

at the University of Kentucky dealing with career education and elementary reading and was beamed via ATS-6 to 1,200 teachers meeting at 15 sites throughout the region. The sites are called RESAs (Regional Education Service Agencies). Delivered to sites off-campus without university affiliation, the coursework developed for the demonstration was awarded graduate credit by the developing institution (University of Kentucky) and cooperating universities throughout the coverage area.

Funded by a $2.2 million grant from the National Institute of Education (NIE) and the National Center for Educational Technology (NCET), and coordinated by the Appalachian Regional Commission (ARC) in Washington, D.C., monies were allocated so that approximately $1.5 million went to the University of Kentucky for program development and evaluation and $700,000 went to the ARC and the RESAs for administrative expenses in the ratio of $200,000: $500,000. Special hardware at each site, such as the antennae, facsimile machine, and teletype, were purchased with grant monies provided by the NIE through the Federation of Rocky Mountain States. In addition, each "student" received accompanying materials worth more than $100. It is the hope of all planners that further distribution of materials will result from continued use of videotapes and accessory items by interested parties who may not have been among the original participants.(11)*

Course structure involved the interactive component of live seminars, computerized data searches, electronic feedback for testing and preference polling, and four, one-way audio channels to accommodate related activities and instructional programming. During the seminars, audience questions were relayed to studio panelists via the ATS-3 satellite from the 5 main RESAs with interactive capabilities; input from the 10 ancillary sites came by land line to the nearest "main" RESA. Computer searches of data bases in various locations allowed participants to learn of relevant teaching materials; information requests were via long line, with print-outs returned by mail, teletype, or facsimile. Interconnection was terrestrial. Electronic feedback, available through participant use of audio consoles with selection buttons and response accumulation devices, permitted checks of lesson relevancy and comprehensiveness, and constituted a portion of the follow-up activities for the one-way video programming.(11)

*The reading course is used by Tennessee as a supplement to its Statewide Reading Program for primary grade teachers. Dissemination of the video materials is over the statewide Television Network, and school districts may duplicate programs. Accompanying print materials from the Project may be used by state-trained resource teachers and their aides when working with the classroom instructors.(58)

Class scheduling varied with the change from summertime to school year. During the summer, 12 half-hours of video material plus four seminars featuring audience-panelist interaction per 3 unit course were provided over the 6-week session to 600 teachers equally divided between elementary career-education and reading instruction courses. The school-year schedule called for 16 seminars conducted over a 16 week period each semester; programming was scheduled after school hours. Seminars were always 45 minutes in length. Summertime televised instruction lasted 30 minutes with 15 minutes of related activity (e.g., audio instruction, pre-recorded questions and answers) following. A variety of formats were tried, although school-year programming was less varied. Career education for 300 junior high school teachers was provided during the Fall of 1974, while career education for 300 senior high school teachers was scheduled during the Spring semester of 1975.(11)

2.3.2 Alaska and the Eight State Rocky Mountain Region

Plans of the Alaska and Rocky Mountain regions are to serve a somewhat broader pedagogic audience with their satellite time devoted to education. Alaska hoped to provide in-service training to educational paraprofessionals and professionals.(12) The Rocky Mountain states also planned career education programming which was beamed into schools. Thus, students, teachers, guidance counselors, and administrators were reached in one setting.

Education professionals involved will be the staffs of the 56 rural junior high schools throughout the Rocky Mountain region which are equipped with the requisite rooftop antennae to receive transmissions. This audience averaged 600 and received pre-service instruction during the late summer of '74 plus 2 semesters (32 weeks) of in-service training during the 1974-'75 school year. Instruction largely rested with 16, 55-minute, originally-produced broadcasts to concentrate upon the relationship of career education with the more traditional secondary school subject matter areas. Each broadcast was regularly scheduled for replay the week following its premiere. An interactive component was available to the staffs of the 24 institutions equipped with "intensive," or two-way, terminals; two-way audio capabilities permitted requests to Denver (demonstration headquarters)

for additional film or videotape materials from the project library to be shown, recorded at the school, and replayed when needed. Transmission of requested items was reserved to one hour every-other-week. Available time could be expanded to a maximum of 31 hours should off-peak time periods be used.

Funds for this, the largest regional component, came from the NIE and are channeled through the Federation of Rocky Mountain States (FRMS), the Denver-based consortium handling planning and operations. Total expenditures for this regional component may be estimated at $10.5 million.[13]

Distribution of materials was also open-circuit via PBS stations equipped with receive-only terminals; these stations, 12 in all, are located in the region's major cities. Local junior high school students and staffs, as well as the general community, could receive demonstration programming. However, faculties in these locations did not receive pre-service or in-service instruction. This design also affects the head count of the professional audience, thereby making cost-per-participant difficult to gauge.[12, 13]*

2.4 Future Plans

It may surmised that regions participating in the ATS-6 satellite demonstration would be interested in continued participation aboard upcoming experimental demonstration satellites. With the December, 1975 launch of the Communications Technology Satellite (CTS), the last in the currently scheduled series of NASA experimental satellites for communication purposes will be at hand. Although CTS will differ in many technical respects from ATS-6, among these footprint and frequency which in turn affects receiving devices, equipment conversion is possible.**

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*Evaluation of the Rocky Mountain and Appalachian education components on ATS-6 is being carried out by the Syracuse University Research Corporatio under National Institute of Education sponsorship. Practical Concepts, Inc. is carrying out the evaluation of the Alaskan satellite education demonstration, also under NIE sponsorship.

**ATS-6 will not be available for use after June, 1975, since it will be repositioned over India as per prior agreement. ATS-6 will again cover the United States in the late summer of 1976. CTS will be available for two years.

As of this writing (April, 1975), the Appalachian area is interested in converting to CTS equipment and continuing with teacher in-service training during it's satellite time. A proposed new demonstration designed for debut on CTS includes yet another teacher in-service application. While smaller in scale, tying two California school districts, the emphasis in this one appears to be on the utilization of media for individualized instructional systems, with satellite transmission to cable TV, ITFS, or VHF terrestrial distribution apparatus.(14, 15, 60)

2.5 A Final Word ...

Examples of telecommunications serving the continuing professional needs of educators are not rare. Technologies promising wider coverage if not initially lower costs, such as satellite television and either computer-based instruction, or computerized research assistance, are now attracting thoughtful attention. Recognition of technological potential by pedagogical planners is not at issue. Teachers represent an audience that may well be there already, willing to pay, and sufficiently motivated to complete the instructional schedule.

To be bullish about the "teacher's market" is to take those factors into account plus "ample hints" of changes now underway in the teaching corps which may prove a boone to participation in on-going study: improved preparation of new teachers, the corollary of rising qualifications for replacement staffing, and tightening job market conditions and their adverse affect upon occupational mobility may all augur well for the need for specialized pedagogical instruction delivered to select but geographically diverse audiences. Increasing unionization may play a benign role if continued professional preparation and the new institutional arrangements necessary to amass the sizeable audiences needed for electronic delivery do not become bones of contention during contractual negotiating sessions. The reserve of previously certified teachers who may need additional coursework to qualify for current staffing consideration should not be ignored when assessing the breadth of the market.

New demonstrations, notably the Appalachian Education Satellite Project, provide evidence of institutions of higher education cooperating to form a crediting consortium for post-graduate courseware originating elsewhere and delivered electronically. Thus seemingly one crippling

problem, that of institutional cooperation, may be on the road to elimination. Prior to relegating that consideration to the role of an anachronism, one must determine which university division usually awards credit for completed coursework: cursory analysis seems to indicate that extension divisions have traditionally been cooperative in that regard, whereas graduate departments of pedagogy may not. Nonetheless, although the "teacher's market" would seem to be shrinking in sheer size, it still affords one of the likelier prospects for large-scale electronic delivery of continuing professional education as the needs to upgrade specific skills and assuage specialization shortages remain.

3. DOCTORS

3.1 Profile of the Profession

As of 1971, there were 322, 228 active MDs serving the continental U.S. and outlying territories. There are some important derivatives from that total. 52,840 individuals were interns and residents in civilian and federal hospitals, still completing their training, and thus outside the thrust of this report which tries to concentrate upon practitioners, or those theoretically eligible to receive continuing professional instruction. Most physicians are in private practice. Almost 200,000 (197,764) practice in an office setting, a style overwhelmingly seen among non-federal doctors. Hospital-based practice involved 36,644* physicians, rather evenly divided between federal and non-federal practitioners. Most clinicians are specialists; nearly 150,000 (142,003) in the non-federal sector and perhaps 17,000 plus in the federal ranks (counting full-time hospital staff members) practice a specialty. Fully 55,000 doctors (55,137) are general practitioners, and 30,000 plus (31,451) do not care for patients but serve as administrators, teachers, and researchers.(16)

There is also a geographical maldistribution of doctors, with rural areas and urban ghettos particularly underserved. One imbalance compounds the other; specialists tend to congregate around urban medical centers thereby appearing inaccessible to both patients and doctors in outlying areas. Assuming that most of the 36,644 hospital-based physicians** and the 31,451 active doctors not in private practice are connected to some extent with medical teaching centers, a further concentration occurs. The Institute for Public Policy Analysis at Stanford University has noted that urban physicians locate together, making certain neighborhoods medical clusters. Furthermore, entire office buildings may be filled by medical suites. While it is not known how many doctors maintain a solo or group (two or more) practice, a logical conclusion is that some hardware installation (e.g., miles of cable, rooftop antennae) will be necessary to reach the majority of MDs.

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*exlcuding interns and residents

**This figure may be closer to 20,361, which is the number of non-federal MDs employed full-time as hospital staff members.

Costs might well be manageably-borne by colleagues within the same building (for satellite reception) or office suite (for cable drop). Isolated practitioners would be very costly to connect.(17)

The medical profession supports a well-developed infrastructure both in professional organizations and institutions which would serve as suppliers and outlets for courseware materials. Organizationally, there are state and territorial medical associations plus national medical specialty societies with their regional and local affiliates. The American Medical Association (AMA) alone has 55 state and territorial affiliates and 1966 county medical societies with a broad span of clinical specialists in the membership ranks.(6) There should be overlapping membership between geographical and specialty associations; this could be the basis for cooperation, software production included. What may retrospectively be viewed as a precedent is the example of one state association working with a specialty society to develop continuing education materials for its clinically-diverse membership regarding the current state of the art within that specialty.

The institutional infrastructure includes medical schools, hospitals, and libraries. Data from 1971 indicated 103 medical schools in the U.S. and Puerto Rico of which 97 were 4-year institutions. There were an estimated 7,733 hospitals including the 6,630 general-care facilities. Almost 1,600 institutions (1,589) had a 25-49 bed capacity. 1800 (1824) had a capacity range from 200-1,000 plus beds; of this total, 1438 were general hospitals. Naturally, there is some overlap between library facilities and the educational and clinical settings detailed above. Statistics from a 1969 health sciences library* survey revealed approximately 2,000 hospital libraries, 470 in educational institutions (plus another 140 in 2-year schools), 155 in organizational settings (including foundations), 250 in industrial and research situations, and 140 libraries in "other" locations.(16)

During 1971-'72, 2,354 continuing physician education courses were given by 292 separate organizations; 38% were given by medical schools, 26% by hospitals, and presumably the lion's share of the remainder were given by professional organizations. Professional societies reported

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*serving physicians and other health personnel.

1,610 courses given at annual meetings (year unreported). Formal documentation of enrollment, e.g., certificates, is still in the discussion stage and a set pattern has yet to emerge.[18]

3.2 Physicians and Information Technology

3.2.1 MEDLINE, Computer Network for Medical Research

Wide-range dissemination systems serving this profession include Medline, a service of the National Library of Medicine and one of a number of services performed by a globe-spanning computer network. Medline uses this network for interactive computer searches and retrieval of most of the biomedical journals cited in Index Medicus. Master data bases are at Bethesda, Md., and Albany, New York with more than 200 user terminals in 47 states (including Alaska and Hawaii), 8 Canadian provinces, and 4 foreign countries (England, France, Sweden and Brazil). Telephone lines or transoceanic cable routinely provide the interconnection. Other data bases may be accessed, including plans to catalogue audio-visual materials relevant to medical education. Additional services include CAI courseware emanating from Massachusetts General Hospital, the University of Illinois, and Ohio State Univeristy.[19]

Individual users are accommodated by becoming part of a remote computing network operated by Tymshare, Inc., for the National Library of Medicine. Through the provision of access nodes scattered throughout the area served, including one in Paris, France, users are given toll-free access to the master computer. As of July, 1973, the Tymshare network consisted of more than 40 nodes, affording toll-free access from more than 30 United States cities. Supplementary and back-up coverage is provided by some dedicated, leased telephone lines, a vestige of an earlier phase of the network. The NLM decided to expand the network by scattering toll-free access nodes to diminish the distance between master computer and remote users, based upon calculations which indicated that most of the total cost to users stemmed from communication expenses. McCarn and Leiter cite an unpublished report prepared for the NLM which addressed this problem; indications were that the computer search could be performed for approximately $3.00, but that access via direct dial long distance would in itself cost more than $6.00 (1971 prices inferred). Relying upon a dedicated network featuring scattered access points, such as the one provided on a commercial basis

by Tymshare, Inc., was the least expensive alternative, given the options of an inbound-only WATS line, leased multiplexors either in a six city network configuration or along the west coast, or the Western Union Datacom service. Tymshare proved the cheapest with a total monthly cost of $51,600.00, of which $38,400.00 is borne by the user (1971 prices inferred). Components of the user cost figure include the acquisition of a terminal, staff salaries, telephone charges incurred when reaching the nearest toll-free access node, computer time actually used, and the number of citations printed out. 1974 literature from the NLM explains that an "ordinary search" may maximally cost $7.50. Nationally, the network is divided into 11 regions for the Regional Medical Library Program. This provides a variety of more localized services for participants, such as the facilitation of inter-library loans.(19)

3.2.2 Video Systems

Other distribution systems exist. Among them is the Brooke Army Medical Center (Texas) which will duplicate requested items from its audio-visual collection of more than 200 titles pertaining to continuing medical education. Non-profit civilian health institutions are eligible for this free service upon request and provision of a videotape.(21) Visual Information Systems, Inc., claims to be the leader in the new and expanding field of electronic publishing. Penetration of the medical and scientific markets is the most advanced, according to comments made by company president Jay E. Reuben appearing in a United Press International wire service article. Reuben feels that the engineering, legal, business, and pedagogical professions will be the next areas of expansion for this concept. VIS now produces closed-circuit or videocassette "journals" for health personnel. With subscription rates approximately $600 annually, the usual procedure is for an hour-long edition of the journal to reach hospital, university, or institutional subscribers on a regular basis, e.g., bi-weekly. At the moment, Visual Information Systems distributes materials in 14 different formats with the videocassette the most popular. Originally, VIS was a service of Roche Laboratories, a pharmaceutical house; now it is a subsidiary of Republic Corp. Other pharmaceutical houses, for instance Smith, Kline, and French, have also provided similar services.(34)

A state-wide medical network is operating in Indiana. The Medical Education Television Network (WAT-21) is part of the Indiana Medical Educational Resources Program (MERP) operated by the state university medical school. The network reaches 7 campuses, 26 hospitals, and physician's private homes. There are also 62 in-state hospitals comprising the Medical Videotape Mailing Network. WAT-21 emanates from hospital-based production studios in Indianapolis, and utilizes a channel of the Indiana Higher Education Telecommunications System to transmit signals to IHETS receiving terminals at various locations. From there, transmissions are relayed to area hospitals and private homes* either by cable or microwave. Indianapolis hospitals are served by an ITFS installation; in Lafayette and Kokomo homes must purchase a special converter to receive programs over CATV. An array of medical programming, much of which is of a continuing professional education nature, is broadcast in color during a 40-hour week.(22) A survey conducted by the network during May of 1974, revealed that approximately one-third of the responding physicians watched the special channel on the regular basis of at least once every two weeks. The second largest percentage of physician respondents (30%) viewed only when a special program was offered. The majority of those replying watched at hospital viewing centers. The survey results were based upon a 9.7% return rate among doctors who did not constitute the total sample, sharing that distinction with nurses and other health personnel.(22, 24)

Dedicated programming over a wider geographic area has been, and will continue to be, distributed in real time via satellite. "Recent Advances in Psychotherapeutic Drugs" was the topic of a closed-circuit television seminar in January, 1973. Linking New York City and London with ten American cities, satellite distribution made possible interactive communications between New York and London-based panelists and doctors gathered at hotel auditoria in the other ten cities. Under the aegis of the Royal College of Psychiatrists and the American Psychiatric Association, the session was produced by Comtact Seminars under a grant from the pharmaceutical house of E. R. Squibb & Sons.(23) This seminar is noteworthy not only because of its "commercial sponsorship," which

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*There is the potential for broadcasting into physician's offices, but specific instances of this were not cited.

is not unusual in the potentially lucrative market that physicians represent to many medical suppliers, but also because it appears to be an example of satellite programming geared exclusively to physicians ... and specialists at that! To date, most examples of satellite-based delivery of continuing medical education are beamed to doctors and other health personnel, be they professional or paraprofessional. This is one way of amassing the sizeable audiences needed to make the exercise cost-effective.

3.3 Satellites and the Health Sector

Throughout the 1970's experimentation with satellite delivery of health care and professional health education has been conducted. Inaugurated in 1971 on the first Applied Technology Satellite, ATS-1, real-time consultations between Alaskan physicians and paraprofessional aides administering to the health needs of remote villages were made possible and used by target personnel. Other health-related demonstrations were carried out, but only a few of them would be classified as continuing professional instruction. Among these would be the three month course on coronary care offered to 22 village-based nurses.[26] With the May, 1974 advent of ATS-6, the final "bird" in the ATS series, satellite-based health-related activities continued on an expanded scale, both in programmatic and geographic terms.

The ATS-6 satellite demonstration illustrates two phases of contemporary medical practice: 1) the evolving concept of telemedicine, defined herein as "the use of telecommunications in the practice of medicine. Although telemedicine is excluded from this discussion, the distinction between it and continuing medical education is not always precise,"[27] and 2) provisions of continuing professional education. Two of the three regions of the country participating in the satellite demonstration have a health-related component. Health activities onboard are coordinated by the Lister Hill National Center for Biomedical Communication;[28] individual experiments in the participating regions are generally not administered by the same agency in charge of the education component.

3.3.1 ATS-6 and the Pacific Northwest Connection: Alaska to the State of Washington

Medically-related demonstrations in the Pacific northwest and the state of Alaska involve both telemedicine and undergraduate medical education (e.g., medical school). Activities conducted under the auspices of the Veteran's Administration are based upon the provision of information services to ten Appalachian VA hospitals, and may broadly be considered an example of continuing professional education.

To highlight the confusion which may result from trying to make too fine a distinction between these two applications, consider the opportunity provided by ATS-6 when linking the University of Washington Medical Center at Seattle with the outstate town of Omak. Upper-division medical students from the Center are "apprenticed" to practicing physicians in Omak under the WAMI program* to receive a portion of their clinical training. While contact must, of course, be maintained with instructors in Seattle, the two-way audio-video terminals installed at each site provide an opportunity for the outstate clinicians to consult with Center-based specialists. While communications among practitioners may range from the formal to the informal, the electronic tie may be considered a form of continuing education for all medical personnel involved.(26)

3.3.2 ATS-6 and the Continental U.S. Connection: Veteran's Administration Hospitals throughout Appalachia to Denver, Colorado

The design of the Veteran's Administration component is more obviously instructional in nature. Ten VA hospitals scattered throughout the Appalachian footprint area are linked via ATS-6 with the television studio used by the University of Colorado Medical Center

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*"WAMI" is the acronym given to the Washington-Alaska-Montana-Idaho physician training program in which qualified students from the latter three states are admitted to the University of Washington medical school, but trained at campuses and cooperating clinical locations throughout the four state area.(61) This arrangement was worked out because Alaska, Montana, and Idaho lack medical schools. For further detail see p. 31 of this memorandum, and Albert Feiner, "Health Care and Education on the Threshold of space" (Reference 26).

at Denver for continuing professional programming. Video presentation formats, as distinct from the computer-assisted instruction mode, vary among seminars, grand rounds, and teleconsultations. Interactive capabilities, when required, are provided by telephone line between participating hospital and Denver production facilities. Formalized presentations, such as seminars, are accompanied by print materials developed by project coordinators at the Foundation for Applied Communications Technology (FACT), the Denver, Colorado - Westwood, California based organization chosen by the Veteran's Administration to conduct its ATS-6 demonstration. Subject matter was determined by participant choice as stated in questionnaires distributed prior to the demonstration. This component boasts an elaborate administrative scheme, replete with hospital staff members in charge of related activities such as taking attendance and collection of post-viewing questionnaires; however, two sub-contractors of particular interest are David Grieve and Associates, in charge of pre-taped video and film production, and Applied Communications Research,* in charge of evaluation.(28)

The VA component is designed to be evaluated along many parameters. Among these are engineering considerations (of which the CAI demonstration is a part), programmatic conception and effectiveness, and cost-per-user hour.(29) Hard data generated by the demonstration are somewhat scarce to date, including data on the critical cost factor. The amount of funding necessary to plan and operate the excercise has not been cited in available literature. There is evidence that this component is the result of efforts by other federal health-related agencies in league with those of the Veteran's Administration. The National Library of Medicine has taken a helpful stance, donating editing and production equipment through its National Medical Audio-visual Center. However, the Veteran's Administration appears to have provided much, if not all, of the requisite funding, including the monies for evaluation. The VA's interest in a project of this nature is a result of the "Exchange of Medical Information Program."(28)

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*Applied Communications Research (ACT), formerly known as Paisley-Mick is a Palo Alto, California organization specializing in communications data research and evaluation.

3.3.2.1 Details of Demonstration Design and Operation

Although determining cost-per-user-hour will not be a simplistic matter,* there currently exists some insight into audience size and composition which may well become important determinants of that variable. Data compiled by Applied Communications Research pertaining to the July 10 - September 4, 1974, operational period indicate that programs were beamed to audiences composed of a variety of health personnel, and although some broadcasts were specifically marked for physicians or nurses, the viewing base was broadened by the inclusion of non-doctors. A minimum total of 3317 viewers attended 13 broadcasts. ACR suggests that total and various sub-totals derived from it may be increased by 25%, assuming a questionnaire response to actual attendance ratio of 3 to 4. On the average, physicians composed 16% of an audience, nurses 57%, while the remaining 27% was almost-completely composed of "other" health personnel ranging from technicians to those providing auxiliary services such as social workers. The most-attended program was one entitled "POMR" which attracted 416 viewers. Interestingly, the two programs specifically labeled for the physician attracted the greatest number of doctors, 132 and 88, respectively.(30)

While it is also interesting to note that the American Dietitians Association and "...some state nursing associations" have granted continuing education accreditation to the VA/ATS-6 programming,(28) its professional educative value to physicians has yet to be formalized. Broadcasts deal with specific medical topics; however, because of the broadly-based nature of the audience it must be assumed that the complexity of the material is geared accordingly. This arrangement is apparently not uncommon to hospitals having viewing areas available to all health personnel. The arrangement undoubtedly deflates the cost-per-user figure and maximizes the economic attractiveness of hardware and software purchase without addressing a basic dilemma: how is a production entity to provide materials of sufficient caliber and quality for the proportionately small number of users in each occupational specialty category?

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*For further details see Paisley-Mick Associates report dated March, 1974 (reference 29).

The other horn of the dilemma concerns the willingness of health personnel to utilize electronic media for their continuing education or information needs. Preliminary findings by Applied Communications Research from a pre-operational questionnaire distributed to future participants in the VA satellite demonstration indicate that print media, primarily journals and books in that order, are both the most important and most used sources of information for working health personnel. According to ACR, "the next six sources were conferences, lectures, seminars, informal discussion, consultations, and rounds -- all face-to-face sources providing some form of oral feedback," although the ranked order of the six changed when the criterion changed from importance to actual use.(31) Yet another interesting finding to emerge from this study was that the information need considered most important by the respondents was that of continuing education. The data is based upon 2500 distributed questionnaires which allowed for indication of more than one need. There were 547 responses, of which 135 came from physicians. How the doctors generally rated the need for continuing education as opposed to information provided for "current awareness, ... problem solving, ... or staff coordination," has apparently not been determined since the analysis was made according to total response to each informational function rather than by occupational response to each listed need.(31)

3.3.2.2 A Trial Run of Computer-Assisted Instruction (CAI)

A final word on the VA/ATS demonstration. A computer-assisted instruction mode was included during the December, 1974 - April, 1975 period. While interest existed in the appropriateness and helpfulness of the software, much interest was centered on the engineering question of satellite interconnection of data base with distant terminal. The mini demonstration was designed so that CAI courseware emanating from both the Latter Day Saints and Veterans Administration Hospitals in Salt Lake City, Utah could be provided to three Appalachian VA hospitals in Fayetteville, North Carolina, Altoona, Pennsylvania, and Salisbury, North Carolina. Although the target student population was not the practicing physician, the general findings released thus far are of interest here.

To establish a basis of comparison, a long-line interconnection was established linking Fayetteville and Salt Lake; for the December to mid-January period CAI courseware in admitting room history-taking procedure was provided to interested nurses. The software was well received, and linkage quality and reliability was apparently adequate to good. On January 15, 1975 the Altoona VA began a largely satellite interconnection with Salt Lake for delivery of the same material while Fayetteville continued with terrestrial linkage. The newer connection was facilitated by ATS-6, Salt Lake to Altoona, and ATS-3 plus some telephone lines for the return communication. Additionally, the Salisbury and Salt Lake VAs (the psychiatric unit of the latter) were linked by ATS-3 so that a CAI program training psychiatric patients in self-assessment could be delivered. At last report, the Salisbury link continued in operation until its scheduled termination in April, delivering what was regarded as valuable materials. The service to Altoona was discontinued after early March due in part to satellite-related technical difficulties which included the transmitting unreliability of ATS-3 (which operates on the same frequency level as commercial radio), and the very limited amount of time allocated for simultaneous use of ATS 6 and 3.[32, 33] Partially due to such engineering considerations, the April, 1975 issue of "Uplink," the VA Demonstration newsletter, capsulated the experience as follows: "The two types of computer-assisted experiments conducted via ATS-6, and the lower-powered satellite, ATS-3, have indicated that computer communications via satellite are possible but not always reliable."[33]

3.4 Future Plans Onboard CTS

Organized entities within the American medical community have made extensive use of the NASA Applied Technology Satellite series, especially when their activities are compared with those of other professional sectors. Experimentation was begun on ATS-1 and has continued on the two other functioning ATS birds, growing in complexity and participation. The stage has been uniquely set for building upon the experience gained to date by continued experimentation onboard CTS. Currently on the drawing-boards are plans for four medically related demonstrations on CTS, most of which may be considered to contain a continuing professional education application. Two of the proposed demonstrations

would involve participants from ATS-6. The precise nature of the demonstrations and their exact configurations are being determined; pending still are other considerations such as funding. Therefore, any descriptions must be considered tentative as of April, 1975.

3.4.1 Continuation of the Washington - Alaska Link

To begin with an ongoing experiment given sparing mention thus far, the WAMI program now plans to continue and expand when it transfers to a CTS slot. Operating from the University of Washington Medical Center in Seattle, WAMI is an acronym for the instructional program conducted by that university in conjunction with the neighboring states of Alaska, Montana, and Idaho. Lacking medical schools, those states have an arrangement with the Washington institution to provide medical training on a regional basis to qualified students from the participating states.[61] A further ramification of this program is an attempt to give as much of the clinical portion of the training as possible in an outstate environment, since evidence indicates that where physicians train they tend to practice. This approach represents the other avenue currently being tried to redress the geographical maldistribution of practicing physicians.* Now in operation by WAMI is the Seattle-Omak, Washington two-way video link (see p. 26).[26] It appears that expansion will occur by site and by number of component experiments. Site expansion will be facilitated by a mobile van. Component experiments will expand; they will be designed according to selected medical specialties in addition to provision of the undergraduate medical curriculum. While there may also be experiments in dental and nursing education, it does not appear that there will be an experimental component specifically geared towards continuing physician education, unless the outstate practitioner-Seattle specialist contact that will surely result is considered an example of such.[14, 15]

3.4.2 Other Possible Demonstrations

Lest that area go unaddressed, other CTS proposed demonstrations will be devoted in large part to continuing professional education.

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*Another approach to this problem is telemedicine (p. 25). Further details on WAMI may be gleaned from the Feiner article (reference 26).

The Biomedical Communications Experiment put forward by the Lister Hill National Center for Biomedical Communications will have as a major objective the establishment of an elemental network linking National Institutes of Health personnel with formalized educational presentations originating elsewhere; most probably, "remote" sites will be medical schools or research-oriented entities. The motivating concept is the heightened knowledge flow between the NIH and the medical community. An interactive mode with video capability has been chosen as the means of achieving this interchange. The experimental design features a mobile van equipped with two-way capability which presumably will roam a good portion of the adjacent 48 states to increase site participation. Another intended component of this experiment is the transfer of audiovisual materials by electronic means, e.g., satellite, instead of the currently-employed mailing system. In both instances, an important variable will be the cost-effectiveness of the operation.(14, 15)

The Health Education Experiment for CTS proposed by the Association of Western Hospitals seeks to link outstate and urban medical practitioners with programs of medical educational institutions that are of an instructional or consultative nature. Another component of this demonstration would use the electronic links forged between the satellite and existing terrestrial redistribution schemes, e.g., ITFS or cable television, with those of satellite reception antennae to promote resource and data sharing helpful for administrative and clinical purposes. In this instance receive-only video transmissions are envisioned to be complemented by an interactive audio component.(14)

The exact status of plans by the Veteran's Administration for continuation aboard CTS is unclear. Serious thought is being given to the possibility. If consideration results in implementation, the exact dimensions of the plan ... other than its expanded basis ... are currently not well defined.(14, 15, 28)

3.4.3 Analysis of Experience to Date with Satellite Delivery

Writing at this juncture, with the tentative nature of CTS planning a very real factor, some analytical points are faintly emerging. Participation by medical entities situated on the west coast seems to be increasing. Geographic overlap between on-going and proposed experiments, namely an expanded WAMI component and the proposed Western

Hospital Association plan, could be a possibility. Use of mobile vans and existing terrestrial specialized audio-visual distribution systems are intended to increase experimental coverage throughout this area. Coupled with plans of the Lister Hill National Center for some semblance of a biomedical network serving the contiguous United States, plus the possibility of continued VA participation, the culmination of efforts that commenced with the launch of ATS-1 and its limited medical component may be glimpsed.

Medical components appear to have built upon experience while experimenting with new combinations of technology and participating sites. The technology employed, both in orbit and on the ground, appears to be increasingly complex and .... it may be presumed ... increasingly expensive. A constant appears to be a programming concept that assumes the "average" audience will be composed of a range of medical personnel. The presumed utility of this concept for cost-derivation has previously been mentioned (pp. 25, 28). A new dimension to delivery by telecommunications of continuing medical education may be provided should the electronic audiovisual transfer component of the Lister Hill experiment produce favorable results in cost-efficient and cost-benefit terms. In that event, the efficacy of electronic, rapid transfer of the product of small-scale technology would be on the road to establishment. Videotapes may be considered an example of such a technology that would have potentially great application to this market. Carried to its logical conclusion, this might permit the transmission of materials designed for the smaller, specialized audiences that actually compose the total mass of viewers attending any one presentation. To match the promise of electronic delivery with the reality of the highly fragmented medical market it may be necessary to mesh the best efforts of large-scale and small-scale electronic technology. In that way, a merger between rapidly available information and material of sufficient complexity may be achieved. Such a merger appears to be what is needed to best provide the working professional with appropriate knowledge.

3.5 A Final Word ...

Inspite of this activity, inducements to engage in continuing professional education are, to date, largely resisted.*[18] Participation in programs is generally not required for either relicensure or recertification. As of 1974, laws requiring attendance for license renewal are on the books in New Mexico, Maryland, and Kansas; action on this clause is underway in New Mexico and Maryland, in limbo in Kansas. Recertification, or the renewal of specialist status by the board for that particular specialty, is not common; one specialty board requires it. Nor is membership in state medical assoications or national specialty societies incumbent upon ongoing education. Two specialty societies are known to require this, seven to encourage it. Seven state medical associations have made continuing medical education mandatory for continued membership. The degree of enforcement and compliance with both mandatory and voluntary programs is not uniform. Furthermore, there is no known correlation between educational programs and reductions in malpractice premiums, although some professional societies have tried to use the former to implement the latter. To date, this is not seen as a motivational factor for continuing education.[18]

On the other side of the coin are a host of factors. There are some hints that spending for continuing medical education might be on the upswing. Within the four years 1968-'72, eleven state societies and nine specialty associations increased dues to finance continuing medical education. This leads to another interesting point: medical society resolutions concerning study or activation plans for a continuing medical education component (compulsory or voluntary) have shown increased frequency in the past four years. While the American Academy of

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*The following information is drawn from the AMA's Department of Continuing Medical Education's "Survey of Medical Education Activities. State Medical and Medical Specialty Societies, 1972." The report was updated as of January, 1974. The scope of the survey includes 35 national specialty societies and 53 state and territorial medical associations. Responses were obtained from 34 national associations and 51 geographic societies. However, not all responding groups answered each questionnaire item, so figures cited may not be representative of the total sample.

Family Physicians has required participation since 1947, three of the remaining five specialty organizations and twenty-two of the state associations responding to the AMA survey, (see footnote p. 34) have investigated this since 1970.

In 1974 a bill was introduced in the Senate which would require periodic relicensure of doctors, and national licensure standards for both physicians and dentists. The bill would also seek to redress the geographical and specialty distribution of MDs, affecting the former by a mandatory service period in areas under-served by available health manpower.[20] That this proposed legislation was even introduced during the last Congressional session is viewed as significant because of the two provisions previously cited and their possible effects upon the demand for continuing medical education and electronic delivery of same. Thus far into the current session the House has ordered a health manpower bill reported out of Committee, and six different versions of legislation on the same topic are pending in the Senate.[25]

Usually the continuing education requirements of a professional organization are for coursework, a prescribed number of credit hours over a specified number of years. Among state organizations, the most favored format is to require a minimum of 90 credit hours over a three year period with 150 credit hours most common. Among specialty organizations a pattern is less discernible; the same requirements may be used, or a five year period substituted with or without a rise in required hours; the range is from 55 credit hours over 5 years to 200 credit hours within 5 years.[18]

Prospects for the emergence of a physician's market for continuing professional education via telecommunications may be assessed in terms of delivery mechanisms and utilization. A well-developed professional organizational and institutional infrastructure is already yielding software production and outlets. Experimentation with satellite technology has proceeded for some time, constantly expanding in geographic, programmatic, and technological complexity. Future plans are for continued and expanded experimentation that will link orbiting transmissions to more kinds of terrestrial distribution systems, thus providing greater national coverage. Of great interest will be that portion of the CTS demonstration proposed by the Lister Hill National Center for Biomedical Communications which will test the feasibility of

electronic transfer of audiovisual materials. Favorable results might well signal the merger of the benefits of large-scale with those of small-scale technology, producing a fortuitous combination for effectively serving a market composed of so many occupational specialty groups. However, in the final analysis the degree of utilization by practicing doctors of electronic delivery of continuing education materials may be dependent upon external forces such as relicensure requirements and professional society membership demands.

4. LAWYERS

4.1 Profile of the Profession

Estimates vary on the number of practicing lawyers in the U.S. during the early 1970's. Low figures are in the 270,000 - 280,000 range, with a high figure of 322,723. All sources agree that approximately three-fourths of the working lawyers were in private practice; aproximately one-half of those were solo practitioners. Other employment arrangements include partnerships (92,442 individuals out of the high total estimate),* or salaried positions (24,680 in law firms, 86,638 in governmental, judicial, or corporate situations). Generally, individual or partnership arrangements are more prevalent in cities of less than one-half million, while associate status with a law firm is more prevalent in larger cities of more than 500,000 population.(35, 36, 37)

Further refinements are that one-half of the lawyers in government service work on the federal level (18,710), while most of the attorneys employed by the judicial branch work at the state level. Federal departments employing higher proportions of lawyers are Justice, Treasury, and Defense ... plus the Veteran's Administration.(36) Geographical distribution corresponds to population, i.e., states with larger populations have more lawyers. Not surprisingly, Washington, D.C. has the highest proportion of lawyers to the general population. Surprisingly, there are more attorneys in places of less than 250,000 people than in areas of more than 500,000 inhabitants. As of 1970, 159,291 lawyers practiced in areas of 250,000 people or less while 128,116 attorneys practiced in cities of 500,000 or more. Cities with one-quarter to one-half million people attracted 37,411 practicing lawyers.(37) A hypothetical explanation is that larger cities have suburbs of less than 250,000 people, while cities in the intermediate range are separate in location and generate a smaller volume of business. This explanation presupposes that lawyers, like doctors, concentrate in urban areas.

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*The following figures are also derivatives of the high total estimate, or that of the Statistical Abstract of the United States: 1973.

Within cities attorneys, again like physicians, appear to cluster their offices in particular neighborhoods. Working from rough data, the Institute for Public Policy Analysis concluded that most lawyers could be reached by concentrated equipment installations although the relatively few practicing in decentralized locations would be more costly to reach.[17]

Legal educational institutions apparently do not involve as many professionals as do medical education centers. The number of law schools have been variously cited as 167 or 173; those approved by the American Bar Association are given as either 138 or 148. As of 1970, 3,732 lawyers were employed by educational institutions, presumably as professors in law schools.[35, 36, 37] Interestingly, the study of law attracts a fair proportion of part-time students as reflected in night school enrollments which constitute approximately one-fourth of all law students.[35, 36] Unlike the other professions sutdied in this chapter, law students usually do not specialize while training; generally, specialization comes with placement and experience. To those individuals working in this field, research is an integral part of the practice of law.

4.2 A Brief Case Study of Computer-Assisted Legal Research: LEXIS vs. West?

Considered a "natural" by many for the use of technology, legal research is beginning to lose its time consuming voluminous image with the introduction of an interactive, full-text computer system that operates with key words selected by the user to trigger data base searches. LEXIS is now the only computerized legal research system on the national market, a position it has enjoyed since its nation-wide debut in May, 1973. The system is currently in use in four states with imminent expansion to five; utilization settings are either law schools, judicial chambers, courthouses, private firms (usually the larger ones), or public agencies dealing with matters of legal precedent (e.g., the Justice Department, the Internal Revenue Service). Also, LEXIS represents an interesting counterpoint to other examples cited in that the financing for the development and marketing of the system has been in the hands of private enterprise with substantive guidance from groups representing potential users.

By all accounts,[42, 43]* the impetus behind computerized legal research came from segments within the legal profession itself. In 1966, the New York State Board of Regents formed the Lawyer's Center for Electronic Legal Research, a non-profit corporation to promote speedier research as a means of improving the judicial process. By 1967, the Ohio State Bar had formed the Ohio Bar Automated Research Corporation, a non-profit affiliate devoted to much the same goals. In 1971, the New York group evolved into the National Center for Automated Information Retrieval which features the expanded professional participation of certified public accountants. Both organizations have developed important and on-going relationships with Mead Data Central, the Ohio-based subsidiary of Mead Paper Company which is the business organization behind the development of LEXIS. It was the Ohio group that originally approached Data Corporation, now Mead Data Central, with the concept; the New York group is paid a retainer by Mead to advise that organization on what federal law should be stored in the data base and also to promote expanded use of the LEXIS system. Venture capital for system development was more plentiful after merger with the larger Mead Paper Company: the presumably substantial sums involved have lead Mead to a highly proprietary stance regarding application of its system; e.g., with the exception of Missouri, all states using LEXIS do not own the data base storing their appelate court decisions, and any any state adopting it must contractually agree to use it exclusively for a specified number of years.

LEXIS' track record and future are generally considered good ... although debatable. The system consists of a master data base in Dayton, Ohio storing selected aspects of federal law, such as the United States Code, decisions of federal courts at all levels, and rulings compiling the Federal Tax and Federal Securities Libraries; participating states have access to this and appelate court decisions of each member state. Communication is handled via longline. The user employs a keyboard terminal; commands and feedback are displayed

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*Most of the following information pertaining to LEXIS comes from the Singular article (reference 42) or the Harrington article (reference 43).

on a CRT screen with printouts provided by an accompanying unit. Market penetration during two years of availability has proceeded from Ohio to New York, Texas, Missouri, and will soon include Kansas;[44] Illinois has been variously reported as a user or on the threshold of adoption. The precise number of outlets is unclear, although the variety of utilization settings has already been detailed (see p. 38). Sources cited by Stephen Singular estimate thirty private law firms in seven cities use LEXIS, with definite figures given for the Justice Department, 22 terminals, and the IRS, 18.[42] Harrington notes that IRS terminals are scattered among Washington, D.C., Cincinnati, and New York offices.[43]

Most indications of annual cost converge on a figure in the $18,000 - $36,000 range, with amount of time in use being the crucial variable. In basic agreement with that estimate is the report that LEXIS will cost $3,000 per month.[42] Or one may note the $18,000 basic annual fee entitling the client to a specified number of hours use each month within a 9 A.M. to midnight "day"; use in excess of the pre-agreed maximum is charged at the rate of $85 an hour.[42] Harrington, who serves as a consultant for Mead Data, writes of the stipulation that clients agree to a minimum number of hours use each month, and that the agreement "...is for a substantial number of hours monthly."[43] Another clue to the "going rate" for LEXIS service is the charge by the Ohio Bar Association of $100 per hour for phone-in or walk-in search requests to the Association's publicly-available terminals in three Ohio cities. Telephoned requests are accepted from lawyers located anywhere in the country; three-quarters of all queries are received over the phone.[42] Another cost component is the $2,500 charge made for installation and client training.[42] Thus far marketing has been aimed at the larger law firms, state bar associations, or appropriate public agencies ... those parties, critics claim, able to afford a fee steep enough to keep many out of the market. Placement in many public or non-profit settings, e.g., law schools, has taken place courtesy of funds distributed under the Law Enforcement Assistance Administration (LEAA). Established under the Safe Streets Act of 1973, LEAA monies are made available on a predominently discretionary basis to either decrease crime or to improve the criminal justice system. Operating within the second proviso, LEAA funds have been

used to place LEXIS terminals in some New York law schools, courts with a heavy criminal case load, and public defenders' offices, and in selected courthouses and public attorney's offices and all law schools in the state of Missouri.[42, 44, 45]

The existence of the LEXIS system raises a number of issues. Among the most pressing is the question of accessibility; is the "little man," be he counsel or client, frozen out of the benefits of computer-assisted legal research by the cost of LEXIS and the marketing strategy of Mead? Does a computer system present cost savings which are in turn passed on to the client? What is the legal status of the monopoly enjoyed by the LEXIS/Mead system, particularly with regard to those exclusivity provisions attached by Mead to user contracts?

Market penetration may be affected by the possible introduction of a competing computer-assisted search system marketed by West Publishing Company of St. Paul, Minnesota, a well-established legal publishing firm. The West system is called QUIC/LAW and was developed in Canada by IBM Canada, Queen's University, and the Canadian Department of Justice. It is not full-text but is interactive, allowing the user to conduct his business in the English vernacular or "legalese" via a typed dialogue with the computer. Apparently, West would provide the entire system to buyers, including hardware. Perceived advantages of this system include its massive data base containing "...the last eight years of all state and federal opinions,"[42] and the retention of the West legal numbering system so familiar to lawyers. QUIC/LAW will be field tested during 1975 at various locations in the twin cities, including the Minnesota Supreme Court and some of the larger law firms in Minneapolis; additionally, a head-to-head comparison with LEXIS will be conducted at the Federal Judicial Center in Washington, D.C. Should West decide to proceed with a commercial venture offering computer-assisted legal research, it will mark the second time that that service will have been commercially offered to the legal community and another instance of private capital developing and marketing an information service for a specific professional group.[42]

4.3 Other Formats, Other Organizations, and Other Media

Coursework formats could be delivered to the same outlets. However, when considering sources of software production, the "dual tier" structure

of the market should be recognized. A good percentage of American law is local or state statute, although national audiences can be assembled in specialty fields or areas of substantive research. There are roughly 34 national organizations devoted to specific law fields (some overlapping), about 19 foundations/centers/institutes devoted to researching particular aspects of law, and there are many others of either a clearinghouse function or at the apex of functional channels, e.g., the National Conference of Court Administrative Officers.* Broadly-based professional organizations include the American Bar Association (ABA) with its Section on Science and Technology,[43] and at least two groups dedicated to continuing legal education. Additionally, there is a Bar Association in every state. The American Bar Association counts 158,205 members; the ABA has joined with the American Law Institute (ALI) to found their Joint Committee of Continuing Legal Education.** The Practicing Law Institute (PLI), 25,000 members strong, is an organization dedicated to continuing legal education and has been for the past 41 years.[6] Special mention should be made of those sections, committees, or sub-groups within larger organizations which are devoted to technological matters. Examples include the ABA's Section on Science and Technology, and the Legal Information Systems Group within the Justice Department.[42]

Recent efforts to use non-print media for continuing professional education include courses produced by the PLI and Joint Committee.** For instance, the PLI has created a videotape cassette course on the problems confronting counsel for a company going public. Issues covered within this 15-hour program entitled "Writing a Prospectus" include underwriting considerations, presentation to the SEC, and accounting practices. The video material ranges from dramatized situation to narrative summary, and written materials accompany the 16 cassettes. Whether the program is ultimately presented as a concentrated workshop

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*Based upon a perusal of Encyclopedia of Associations, Volume 1. (Reference 6).

**1975 literature and letterheads from this organization now refer to it as the American Law Institute - American Bar Association Committee on Continuing Professional Education.

(it has been presented as a three-day session), or a course geared around group discussions or supplementary lecture, are decisions for the sponsoring institution. Availability of the videotaped package was announced at the meeting of the Association of American Law Schools.(38)*

4.3.1 A Brief Case Study: The Video Courseware of the ALI-ABA Committee on Continuing Professional Education

The Joint Committee of the ALI-ABA has mounted three series of continuing legal education programs during the Spring 1974, which were available to practitioners within a 20-mile radius of the transmitting station in northwestern Washington, D.C. Each series corresponded to a 14-session course on a particular topic, and uses lecture format with occasional guest speakers. Distribution was by microwave (2150 Megahertz) via Microband National Systems, Inc.(40) Reception was possible on a regular television set located in a building equipped with a special rooftop antenna. Distribution of the signal within a building was either by master antenna system already in place or by direct cable. With the exception of the specialized rooftop antenna, additional equipment and distribution costs (including television sets) were borne by the subscribers.

The market for this continuing legal education programming was law firms; for $250.00 per course, any number of attorneys per firm may enroll. Participation requires an hour each week for the 14-week duration; scheduling is during off hours (noon, 5 PM, and 8 PM) so that office time is not lost. A cost-benefit breakdown prepared by the Joint Committee indicates a cost of $17.85 per student per hour, or the quotient of tuition divided by instructional hours. Essentially these are the only costs seen by the Joint Committee, since there are no travel expenses or loss of billable working time. Based upon this procedure, the cost to the firm would decline as more employees enrolled. This situation is contrasted with the normal off-site workshop method of continuing legal education where expenses increase as more lawyers per firm enroll. The traditional method requires

*The California Continuing Education of the Bar (CEB), formed by agreement of the State Bar Association and the University of California through its Extension Division, uses electronic means to reach expanded audiences. Audio and video cassettes with accompanying print materials are available for purchase or rental. Audio tapes may cost from $5.30 to $53 depending upon length; likewise, videotape rental ranges from $6 to $27 per person. Closed circuit television and nine city simulcasts have also been used.(59)

travel expenses and loss of billable working time, which should be added to tuition when figuring cost for each participant. Three series were scheduled for the Spring of '74: "Federal Taxation," "United States Supreme Court Issues and Trends," and "Modern Real Estate Transactions." Literature explaining the programming gave the impression that participants need not be specialists; instead, the survey approach is taken to inform as wide an audience as possible.(40)

Originally, plans for Spring, 1975 called for another set of electronically delivered courses to an expanded market of participating law firms in Washington, D.C. and New York City. Enrollment was so tiny that the plans became unworkable. Reasons for the poor response are conjectural: costliness and unfamiliarity with non-print media for learning are often cited. The Joint Committee retains an interest in electronic delivery of continuing legal education, and in fact is maintaining a rental library of filmed and videotaped sessions and accompanying print materials that it has produced. Rental fees vary; generally, a price-per-viewer is quoted, with a minimum total stipulated. No minimum cited in literature detailing 1975 offerings is below $100.(46) Distribution of this material will be by more conventional means, such as mailing or parcel post, pending more inroads by electronic media into legal study and practice and the concommitant increased availability of the requisite hardware. A recent user was the Alaska State Bar Association, which flew the materials to four urban locations within the state for maximal exposure. For the moment, however, plans of the Joint Committee to rely increasingly upon telecommunications for delivery or wide distribution of instructional materials seem to have been shelved due to market response.(41)

4.4 A Final Word ....

Lawyers, long known for their reverence for the traditional, appear to be among the more cautious of the professions in their acceptance of electronic delivery of continuing education. At first glance the scorecard is mixed: computer-assisted legal research is gaining a foothold while electronically delivered coursework has had limited success at best. The limited scope of the market served by the ALI-ABA Committee's venture into real-time mediated courseware favors highly tentative conclusions, if any, about the potential acceptance

of the concept. Participation was open to cooperating law firms in two eastern urban locations, Washington, D.C. and New York City. Involvement was voluntary and in practical terms meant full financing of the requisite reception equipment plus participation fees. Reasons put forward to explain the lack of response are conjectural, but would include the uncertain economic climate and the sizeable capital investment needed for participation. Law offices are apparently unlike schools or selected corporate settings (e.g., science-based industries likely to employ engineers) where the requisite reception technology is more likely to be found.

Nonetheless, it is difficult to generalize about this market which seems to display many characteristics atypical of the other professions studied. Relevant examples of legal instructional or research activities have taken place in well populated areas of the country. This is unlike the pattern which has developed in the medical and pedagogic professions where large-scale technology has been used to reach geographically isolated practitioners. Relatively little of the capital costs or operating expenses of those entities either developing or electronically delivering pertinent educational materials have been borne by public monies; this situation, too, is somewhat analagous to the engineering market. However, the analogy must be drawn carefully, for the engineering sector supports a far more prevalent utilization pattern (see Section 5) and has been far more successful in recruiting support from private sources, as shown by the greater number of firms employing engineers that participate in electronic delivery systems.

A third distinctive consideration is that legal societies have unabashedly been in the vanguard of development and utilization of the new electronic technologies for professional purposes. This leadership could be a decisive factor affecting the ultimate extent and speed of adoption, assuming that membership is now indifferent rather than hostile.

In any event, a final conclusion regarding this market is elusive, except to say that the legal profession will apparently take a different road than the other professions towards coming to grips with the potentialities of continued instructional and research services via electronic technology.

5. ENGINEERS

5.1 Profile of the Profession

Engineering, among the more technically-oriented of the professions studied thus far, is composed of a variety of specialists practicing in diverse settings. Somewhat like law, professional advancement may require the acquisition of new skills; business management is often helpful to engineers as they are promoted into supervisory positions. There is also the practitioner's need for updated technical knowledge, leading to an active market in additional education for post-graduate degrees, similar to that found for teachers. Another resemblance to the teaching profession lies in size, with engineers numbering somewhat more than 1 million as of the early 1970's. Prominent engineering specialties are electrical (230-235,000 practitioners), mechanical (215-220,000), civil (180-185,000), and industrial (120-125,000), although 25 specialties are recognized including such less-common ones as ceramic and agricultural engineering. Biomedical engineering, a newer and less prevalent specialty as of this writing, is expected to be a growth area.[35, 36]

This professional variety is reflected in possible places of employment and work roles. Engineers may be employed by private industry of many kinds, e.g., the service or construction sectors or institutions of higher education. Engineers may serve in technical capacities or consultative or administrative roles. The Occupational Outlook Handbook indicates that 600,000 engineers of various specialties were working in the manufacturing sector as of 1970, 300,000 in services and construction, and 40,000 in educational institutions as teachers and researchers. Many of these positions have counterparts in public agencies; the Occupational Outlook Handbook reports that governments of all levels employed 150,000 engineers in 1970, mostly concentrated at the federal level within the Department of Defense, Agriculture, Interior, Transportation, and NASA.[36] The Encyclopedia of Careers and Vocational Guidance reports approximately one-third of the practicing engineers are in "administrative or management positions."[35] This statement is supported by Alden who cites the NSF Postcensal Survey showing 400,000 engineers in related capacities; 152,000 in "Managerial and Other Engineering Related," and 248,000 in "Other." Alden uses

data from that survey to point out that of the 1,242,600 individuals employed in engineering capacities, a slight majority are not graduate engineers; fully 476,500 lack a bachelor's degree while 180,900 have earned their highest degree in a non-engineering field.(47) This point should be kept in mind when planning programming delivered to place of employment; it is possible that an audience could be found for courses leading to the first professional degree or for general updating of technical skills that are not part of a degree curriculum.* Candidates for advanced engineering degrees have risen from 10% to more than 33% of graduating classes over the past 25 years; about one-half of the Master's degrees awarded are to part-time students, according to Baldwin.(48) Annual enrollment statistics compiled for Fall, 1972, by the Engineering Manpower Commission and cited by Alden reflect the size of that segment of the student body when they indicate that approximately one-third of all engineering graduate students were part-time.(47)

5.2 Electronic Delivery of Graduate Study in Engineering

Graduate programs have long been available to meet the needs of this professional audience, and particular attention has been paid to the sizeable part-time enrollment. There are many examples of course-work delivered to remote locations via electronic means. Baldwin has

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*Baldwin discusses the latter possibility with respect to the findings of a survey conducted by Colorado State University among 385 engineering employees (approximately 10%) of an in-state aerospace engineering firm. Limited responses revealed "...a need for specially designed courseware for the older engineers which the graduate curriculum does not satisfy." Baldwin comments that the inhibiting factor is funding for suitable course design and production, or software, since presentations of this nature would not be similar to any courses currently offered by the engineering school.(48)

Since making those comments in 1973, Dr. Baldwin has served as a Co-Director of a Workshop on Continuing Education for Engineers at Midcareer held in Dallas/Fort Worth during late August of 1974. Addressing many of the same issues, the Workshop recommended continued application to the problem in the form of four tasks to be completed, ranging from improved data on the magnitude and complexity of the situation to design of an optimum software marketing strategy, presumably to be carried out by working committees of attendees. For further details see the proceedings of the Workshop on Continuing Education for Engineers at Midcareer (reference 55).

estimated 15,000 students in 700 courses each year; this estimate was made in September, 1973, with the full realization that every year more universities expand with off-campus electronically delivered graduate engineering programs.(48) Curricula of this nature are conducted by universities throughout the country. The coverage area of these systems will vary; some programs reach students in other states, others exist within an intrastate region, and a few programs are strictly local.* All systems employ a range of technology from live or videotaped television via open circuit (e.g., broadcast), or dedicated distribution (e.g., ITFS or "bicycled" videotapes) usually complemented by audio response capability, to two-way audio with wire transmission of graphic material.(50, 52) Usually they utilize some form of accompanying written material, e.g., class notes or diagrams, and schedule professorial site visits so that instruction is not totally left to electronic means. Programming consists of transmitting courses which are a regular part of the graduate curriculum; students may attend for credit, pursue attendance for a degree, or audit.(49)

5.2.1 Technologies Used in Operating Programs

Examples of programs in operation may arbitrarily be grouped by type of technology used. Audio-based systems, including use of an electrowriter,**

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*For a complete listing of known systems as of Spring, 1974, see Mike D. Wong, "The Role of Technology in Non-Traditional Higher Education" (reference 52). Although Mr. Wong's categories will not correspond to geographic coverage, the reader will be able to determine how the systems described could be classified according to that criterion.

**The electrowriter permits transmission of still video material, graphic, diagram, or digital, via leased telephone lines. By writing on paper with a special transmitting instrument, written material is sent to a receiver in the remote classroom which projects it onto a screen for class viewing. Simultaneously, audio transmission is carried over telephone lines, combining to effectuate a lecture session with blackboard notations. Both processes are reversible simply by placing microphones and electrowriters in remote classrooms, although most users simply allow for return audio to facilitate class discussions. Considered effective with minor restrictions, e.g., written material once shown cannot be reshown but must be rewritten, this approach is less costly than video-based delivery. Kriegel cites equipment costs, including classroom refurbishment, in the range of $2,500.00.(49) The major operational cost is the telephone lines, a factor mitigated by blanket arrangements many schools may have with the local system operator and off-peak use when the lines are used for evening

(FOOTNOTE CONTINUED ON FOLLOWING PAGE)

are employed by ... among others ... the Universities of Illinois, Wisconsin, New Mexico, and Missouri (at St. Louis). Other schools, such as Virginia Polytechnic Institute and State University, use audio-based media for some courses and video-based media (e.g., videotape) for others, while the University of Tennessee at Knoxville combines the two so that videotaped instruction is followed by an interactive question and answer session over the electrowriter system. Video-based systems, including videotape, ITFS, and microwave relay, are employed by the Universities of California at Davis, Rhode Island, Ohio State, Iowa State, Oklahoma, Michigan, Colorado State, and Stanford, Southern Methodist, and the University of Southern California ... among others.[48, 49, 50] Here again any one system may use a combination of technologies; however, classification will be made according to predominant means of distribution.

The video technology is selected on the basis of many considerations, including available funding and anticipated audience configuration. The prevailing feeling seems to be that "bicycled" videotapes will serve a geographically scattered audience of relatively few individuals at each site, ITFS is practical for many locations within a concentrated area, and microwave is useful when serving an audience widely-scattered over such an extensive area that repeater facilities may be required.[48] The Oklahoma system is state-wide, servicing educational and industrial sites by microwave relay to area ITFS systems, apparently similar to the Indiana Higher Education Telecommunications System. Regional consortia may back a system, such as TAGER serving northern Texas institutions and industry; the schools are primarily Dallas-based with SMU an active participant, although state university campuses are also aboard. Locally-oriented ITFS systems reaching education and industry

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(FOOTNOTE CONTINUED FROM PREVIOUS PAGE)
school instruction. Technological variations of this method include dual-track audio tape, FM signals, and satellite transmissions in lieu of telephone lines. Discussion potential is preserved with tape by having students record questions which the instructor answers upon receipt of their tape. While not live interaction, still video is preserved by writing with a special instrument which records on the second track of the tape.[49]

are operated by Stanford* and USC. Videotape operations are run by Colorado State and Iowa State Universities.[48, 49] While ITFS and microwave relay allows real-time delivery, videotape delay need not amount to more than a few days so course progress is not impeded. Talk-back capabilities may or may not be a feature of any system; however, it appears that most systems have interactive audio capabilities via telephone lines.[52]

5.3 Cost Data on Electronic Systems and Assumptions Made In Computation

There are a number of variables used to figure the cost of these programs, while a number of assumptions are made to underlie orderly calculations. As Baldwin points out, assuming that hardware costs are amortized and that the selected technology represents the most appropriate delivery mode for the envisioned audience (p. 49, paragraph 2), the major cost component will be program production and support.[48] Admittedly, this approach pivots on regularly-scheduled courses being routinely recorded or transmitted with consequent imperceptible charges for production values and no incremental salary for instructors. Proceeding on the assumption that distribution is not a major cost factor given the appropriateness of the delivery mode and production

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*This may also be viewed as a regional consortium composed of industrial and institutional members from the San Francisco Bay Area and coordinated by the Association for Continuing Education (ACE) which was created to act as the administrative side of the delivery system. Cooperative efforts revolve around Stanford's four-channel ITFS network which is used to carry that university's instructional programming during the business day; ACE contracts for use of the facilities during the "fringe time" hours of 7 to 8 AM, noon, and 5-7 PM so that televised coursework, seminars, or special productions of interest may be transmitted to those assembled at member firms. Televised materials may be presented under the auspices of other schools; the MBA program of Golden Gate University is an example of a degree oriented program, while courses in Cybernetics Systems of San Jose State University exemplify a study sequence that did not, as of August, 1974, lead to a degree. ACE is self-supporting; revenues from tuition receipts and firm memberships, its sole source of income, are sufficient to maintain its operations which were on the scale of 73 televised offerings reaching 3200 enrollees at the end of the 1974 academic year. Of that enrollment, 2450 participated in the live television - interactive audio mode, and 750 participated via the videotape option.(54)

and staffing considerations, off-campus class size may be rather small and the system will still be justified in cost terms. For instance, Colorado State will service 2 to 3 off-campus students, Iowa State 5, SMU 4, and the University of Rhode Island, 1.[48, 52] Moreover, this approach represents cost to the institution, since the student may still be paying as much tuition as if he attended classes on campus plus a possible surcharge ... although incidental expenses such as travel and parking are eliminated. The cooperating employer will be overtly paying for monitors and other receiving equipment, less-obviously paying through released time for instruction and provision of classroom space, and may be paying a blanket participation fee. There are possibilities for tie-ins with company tuition refund plans.[48, 49, 50]

Even with these presumptions, costs bear further examination. In a 1973 article Kriegel cites lump-sum capital costs of more $1 million for ITV systems with talk-back capabilities, plus approximately $30.00/channel/hour in operating expenditures. He also notes that the Oklahoma service, microwave relay to area ITFS distribution, represents in toto a $1.7 million capital outlay.[49] While these citations are loose examples of direct comparisons between technologies, other figures represent a more functional cost accounting among technologies. Baldwin cites the work of Loomis and Brandt in comparing the costs of the UC Davis (point-to-point microwave), Colorado State (videotape), and Stanford (ITFS) systems. Based upon the cost "...per TV classroom lecture hour...", Loomis and Brandt found the biggest item to be "production and program management" (coordinating and technical staff), with equipping sending and receiving classrooms a distant second. $20-$30/hour could be spent on software, while hardware spending ranged from $4-$7/hour. Equipment spending will be upped for any delivery mode if talk-back capability is included. This will amount to an additional $1-$7/hour, marking response capability as a more expensive hardware component.[48] Available data does not indicate if, or by how much, audio response capacity will vary with each type of distribution system.

5.3.1 Cost Analysis of the Colorado State University System (SURGE)

A more detailed pricing of an individual system's component costs has been presented by Baldwin of the Colorado State University program.

State University Resources for Graduate Education (SURGE) utilizes commercial delivery of videotapes and accompanying print materials. As of Spring, 1973, SURGE reached 29 participating locations representing business, military, educational, and governmental organizations in four states and the Canal Zone. Inspection reveals that other variables affecting cost include: number of courses offered, number of sections/course, number of off-campus students/section, total off-campus enrollment,* and what might broadly be termed incremental expenses, e.g., graduate assistance for the increased paperwork resulting from off-campus enrollment, travel expenses for professorial site visits, handling of each tape distributed, and the amortization of facilities (hardware, rent, and tape). Dollar values for each item are used to help calculate** the three component expenses of the program: 1) amortization of facilities, 2) operating expenses, and 3) additional instructional costs associated with the off-campus enrollment. In 1971-'72 dollars, $32.25 was spent for each recorded hour ($7.10 in amortization; $25.15 for media support staff), and $4.75 + $1.30S (where S = "average student enrollment in each off-campus section") for each delivered tape. It is interesting to note that CSU figures $2.50 round trip for tape distribution by commercial carrier plus 50¢ handling charge. Further inspection reveals that cost of off-campus graduate instruction may be less than that imparted on-campus, thereby lowering the cost when figures for both student groups are averaged.[48] It may be inferred that this gives increased viability to graduate-level programs.

Carrying this approach one step further, the Task Force of the American Society of Engineering Education examining the cost-effectiveness of televised instruction found that during the 1972-'73 academic year SURGE delivered off-campus education for $4.16 per student each instructional hour while similar on-campus learning was $6.50 per student each instructional hour. Comparable figures for Stanford, an ITFS installation, were $3.26 per student each instructional hour for

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*All of which may fluctuate from quarter to quarter, and upon which final values are dependent.

**Other components, mentioned previously, include production and support services.

off-campus education, and $6.46 per student per instructional hour for on-campus education (estimated).

5.4 New Thrusts in Engineering Education

An issue when conducting classes for the post-graduate student body has been raised by Baldwin (see footnote, p. 47); continuing course-work, particularly that carried to working students, has usually been part of a graduate program leading to an advanced degree...although this may not fill the needs of many engineers, leaving a portion of the continuing education market untapped. Study programs have been devised to rectify this dilemma. The two following examples are approaches that do not, as far as can be determined, rely upon telecommunications to any significant extent. However, each example merits further scrutiny insofar as it represents an approach to this problem. Both examples are university-centered as opposed to corporate programs; credentials are awarded by the school's Extension Division upon completion, although a widely recognized degree such as the M.S. in Engineering is not the end result. Professional societies and employers assume roles of varying significance in each program, although the emphasis is intended to be on student needs with some semblance of programmatic flexibility to best match instructional offerings with individual demands.

5.4.1 The University of Wisconsin's Professional Development Degree

Cited by Baldwin as the prototype for continuing engineering education of the midcareer professional is the program of the University of Wisconsin at Madison. Culminating in the Professional Development Degree, the sequence consists of approximately 25 undergraduate semester credits, or 1200 study hours, encompassing any approved learning format with the possible exception of correspondence work: formal university courses, seminars, workshops, or corporate evening classes ... to name but a few. Fully one-half of the approved activities may be transferred from other schools. Baldwin feels that the distinguishing feature of this program is the quadripartite curriculum core into which all credited activity must fit. Designed so that working engineers will refresh technical skills, update technical proficiency, broaden professional options through courses in business and the social sciences, and further

expand career horizons through elected subjects of individual interest (one requirement is that an independent study be done), the P.D. Program is an attempt to mesh instructional basics with personal choice. As of 1970, 140 students had enrolled in the program during its initial four years of operation, and two had been awarded the P.D. Degree.(56)

5.4.2 UCLA's Professional Certificate

A sequential program leading to a "Professional Certificate" designed to meet the needs of the middle-level management engineer in a specific working environment has been inaugurated by UCLA in conjunction with local chapters of the appropriate professional societies. Uniting an academic institution with professional organizations in the construction and implementation of interdisciplinary coursework has lead to an allocation of responsibilities which may emerge as a protype for expanding coverage of continuing professional education to a highly defined market.(51)

The UCLA program serves off-campus students through conventional means, e.g., weekly attendance at evening classes conducted for two academic years. Roughly, the school furnishes facilities, academic certification, and coordination ... both of an academic and clerical nature. Ingersoll remarks that perhaps the greatest function performed by professional societies is aiding student recruitment; free space in association newsletters matches program publicity with target audience. Societies may also be of help in an academic role, providing guest lecturers and having sitting representatives on the Executive Coordinating Committee. Employers may provide encouragement and tuition, which is higher for this program than for coursework leading to an advanced degree, and are represented on the ECC. Students, ranging from PhDs to engineers without state registration working in engineering-management capacities, clearly are a varied lot who are willing to make time and money commitments for an academic sequence they feel will have true job relevance. In writing of the program, Ingersoll notes that participants found the face-to-face interaction with each other and guest speakers most helpful, while Gonzales remarks that the social science components of the management training given result in financial remuneration for certicate holders although the program cannot be applied to a master's degree.(51) The UCLA Professional Certificate

program is a functioning example of unviersity-professional association cooperation, a combination posed so often in this section. However, it is important to point out that the professional organizations made minimal financial contributions.

5.4.3 The Instructional Activities of Corporations: "In House" Electronic Delivery

It is important to point out that universities, either by themselves or in conjunction with professional societies, are not the only repositories of continuing professional education. Another source, perhaps the most accessible one to potential students, would be the programs offered by corporations to their employees. Euphemistically known as "in house" programs because they are offered within the confines of a company, this service is largely the preserve of larger corporations. As of 1972, 42% of those concerns with net receipts in excess of $1 billion annually offered in-house continuing education programs. In contrast, 6% of those concerns with net receipts up to $10 million a year offered similar services. This data was compiled by the American Chemical Society and quoted by the Workshop on Continuing Education for Engineers at Midcareer, and thus may reflect to a greater extent data from firms in science-based industries.(55)

Proceedings of the Workshop list in some detail educational activities provided by a few of the major corporations. It is difficult to say precisely, but Bell Telephone Laboratories appears to be the firm most heavily involved in providing in-house continuing professional education, claiming 2,500 enrollees or about one-third of its technical work force. DuPont maintains 25% of its technical personnel are enrolled at any given time, while Kodak reached 4,000 employees of all occupational classifications during 1973. Direct comparison with coursework provided by an academic institution may be tenuous, since many corporate offerings may be of the short course, or refresher, variety or single presentation symposia, designed as it is to fill an occupational need rather than a degree requirement. However, there is evidence that not all corporate courseware is disseminated in the traditional classroom way, as electronic delivery systems and workbooks in the programmed instruction format are in evidence.

Leadership in this field is again difficult to pinpoint, but Texas Instruments must surely emerge as one of the top candidates. T. I. maintained, as of 1973, an in-house video production component for videotape courseware and was instituting three courses delivered via computer-assisted instruction. It has been the company's experience that an individual's progress and resultant courseware modifications can be effectively monitored and made via CAI so that a 50% saving in training time may result. Interestingly, experience has been that training via videotape results in greater time savings. It is also of interest that Texas Instruments will sell their videotaped instructional materials to industrial buyers; five courseware packages complete with accompanying printed material, four of them on the graduate level, are available for $3,500 per course. In concluding their remarks on the company program, the Workshop on Continuing Education for Engineers at Midcareer has noted that "these electronic methods as used by Texas Instruments have shown themselves to be cost effective instructional techniques -- though not so cost effective as books -- as well as efficient techniques for presenting tutorial information to large numbers of people."(55)

5.5 Benefactors to Non-Traditional Delivery Systems, and Optimization of System Performance

The more traditional academic programs delivered in non-traditional ways generally have funding from a few sources. Wong has noted that "...with the exception of in-house funds, grants (often from corporate donors), and student fees, other sources of support are infrequent and scattered. Although when support does occur it may not be of an insignificant level."(52) Start-up costs are usually financed primarily by the institutions themselves; 64% of the funding in 55% of the cases. Operational costs are usually borne by a combination of university funds and student tuition; 64% of the sampled institutions reported in-house funds as the primary support, while 30% of the respondents cited student fees as the basic source of revenue.* Other

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*Respondents listed "Other" as a slightly larger source of operating funds over student fees; however, lack of distinction between government or corporate funds within that category precludes it from being cited as the second greatest source of support.(52)

potential sources of funds include the state and federal governments, and private and corporate gifts. Wong's statistical sampling is limited, based upon 20 responding institutions out of 27 queried, and represents institutions selected on the basis of utilization of non-traditional delivery modes ... thereby including more than those engaged in providing post-graduate engineering study via technology-based means. Wong also cautions that most systems of the type discussed within his work are relatively new within the last 5 years; therefore, operational funds may still include start-up monies which are not anticipated to be in perpetuity. Operational monies in subsequent years may reflect revenue sources in different proportions.(52)

A Task Force of the American Society of Engineering Education was formed in January, 1973, and charged with investigating the cost-effectiveness of televised graduate instruction. This survey encompassed 26 installations and produced 14 responses. In addition to generally corroborating the highly advantageous cost data shown by the SURGE experience, major findings were that one pioneering system had been discontinued, one was making money (a surplus of tuition receipts over cost), and new ones had constantly been created since the first system 12 years ago.(53)

The Task Force also noted the use of existing systems for delivery of other kinds of coursework or presentations, e.g., symposia. A frequent example would be the business administration courses "piggy-backed" over a number of systems including SURGE, Stanford, and MERGE (the Michigan Expanded Resources for Graduate Education Network of the University of Michigan). The University of Rhode Island system has been used for graduate studies in pedagogy.(52, 53) This practice would appear to enhance any system's cost effectiveness, the amount of use would increase permitting capital cost proration over an expanded audience while increased operating expenses are met by more user fees. Underlying this scenario is the assumption that the cost of additional facilities for expanded off-campus reception will be borne by the newcomers through their institutional participation.

5.6 A Final Word ...

In the final analysis, the engineering subsector looks most promising as a market for electronic delivery of continuing professional

education. At last count, 26 such systems* had been constructed to serve this market. Programming varied from sequential coursework culminating in a degree to individual presentations of special interest, and attention is being given to the distinctive needs of midcareer professionals. Clearly, the field is in a state of evolution and currently is somewhat amorphous as new systems appear and new programs are developed. Keeping this in mind, some generalizations may still be made. One is that electronic delivery systems tend to be regional in scope, meaning that they bring educational services to an area emcompassing more than one locality. While that may seem obvious on economic grounds alone, it indirectly leads to a second generalization: universities have apparently taken the lead in pioneering this field.

The literature perused when researching this section has dealt almost exclusively with university-based electronic delivery systems. Although corporate systems certainly do exist, universities may still be viewed as the organizations most uniquely equipped to serve the market. Aside from their primary qualification as educational institutions, universities are "neutral" organizations within a region, able to gain electronic entrance to, and disseminate information among, many corporations and thus precipitate an information flow which otherwise might not exist among competitors. Evidence indicates that universities are willing to form consortia to program for these networks, presumably because the economics of regional operation demand it. The evidence also shows that that is about the only form of programming cooperation among schools, as individual systems rarely exchange materials;[53] it also appears that only M.I.T. has produced mediated instructional materials for marketing on a national scale.[49, 55]

However, when adopting this stance toward the role of the university there should be some rethinking of the conventional wisdom. Universities have never claimed a monopoly on intellectual expertise, yet it may be overlooked that authorities exist in other settings. Tapping into the human resources outside the university, such as

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*Using the data of the American Society of Engineering Education Task Force, or Morris Committee, Report (reference 53); this counts university-based, dedicated electronic systems.

commercial operations or government agencies, may be facilitated by production input from other sources in much the same fashion that professional societies contributed to UCLA's Professional Certificate Program.

The nature of the university-industry-professional society interdependence with regard to an engineer's decision to participate in continued education must be reassessed. The incongruity of employer encouragement and contributions to programs for continued professional education (whether delivered traditionally or electronically) with little apparent correlation to job promotion or other work evaluation[55] forces one to question how the various parties perceive the utility of such endeavors. While this concern will probably never be resolved with either absolute certainty or total satisfaction, both the continued viability of these programs and the universities' role may depend to a substantial extent upon the balance finally struck. Affecting any balance of interests will be the issue of licensure or certification. Referred to as registration within the profession, currently less than one-third of the engineers in the U.S. are registered. The crux of this issue seems to be its voluntary nature, although the Workshop for Continuing Educatinon for Engineers at Midcareer has noted that many companies encourage it and laws requiring testing for registration renewal seem to be increasing.[55]

It might also be wise to reexamine what is now thought of as the thorny matter of an effective marketing strategy. Like the two other issues raised for reconsideration, this also involves the concept of snags in the cooperative relations among all interested parties. It is possible that the national markets to first take shape will be those for in-house programs offered by large corporations to their personnel in many locations. Such programming may have application beyond its initial outlets, given suitable modification including readjustments for proprietary material. Although program interchange to date has not been particularly widespread, it is important to recognize the potentially national scope of corporate instructional activities so that one production and distribution prototype may be identified ... and perhaps ... built upon. While a final agreement cannot be visualized, other parties to any cooperative effort could be such "neutral"

organizations as universities or professional societies. In this way, visionary as it may now seem, those organizations with a genuine interest and capability to serve the engineering market could perhaps develop a working relationship to do so. A highly dependent variable would be the satisfactory resolution of the "preeminence" issue; under whose auspices would any programming be produced and distributed? The matter may well be open for reflection and discussion, assuming that the future of continuing engineering education is becoming increasingly linked with electronic delivery of such services.

6. CONCLUSION

Continuing professional education is the most paradoxical of all the non-traditional educational markets examined thus far in this series of memoranda.* While numerically small and occupationally fragmented, the market for this instructional service is simultaneously the most active. Plausible explanations for this lie in the distinctive nature of the professional sector itself; the presumption of student motivation, obviating the necessity of elaborate or entertaining productions, and the ability of participants, both individually and collectively through professional societies, to pay for instructional services.

Efforts have been made and funds expended by both public and private entities to serve this market; these efforts are numerous and include many examples delivered by electronic means. Public undertakings include the MEDLINE computer-assisted research service of the National Library of Medicine, the WAT-21 Medical Television Network covering the state of Indiana, and relevant demonstrations on NASA's Applied Technology Satellite series. Efforts representative of private enterprise include the LEXIS computer-assisted legal research system developed and marketed by Mead Data Central, and the electronic journals "published" on videocassette by Visual Information Service, Inc. for hospital subscription. The videotaped programs produced by the American Law Institute - American Bar Association Committee on Continuing Legal Education and distributed by microwave and cable television systems represent another form of private involvement, that of private funds available through professional organization membership dues.

Thus, many precedents exist for public and private service. Providers may represent a fusion of financing; the university-based networks so prominent in the engineering sector are primarily constructed from university funds (some, like Stanford, are private), but corporations support the effort by providing classroom space, individual tuition or a company participation fee, and purchasing their own receiving hardware, all of which may be considered a form of private donation. Another model for the combination of public and private monies stems from the LEXIS experience; LEAA funds are being secured for the installation of LEXIS terminals and service in public or quasi-public settings. Whether this funding is essentially to introduce the

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*See footnote p. 4.

innovation, and whether it will be maintained for an indefinite period of time, is not known. Expansion of other services, e.g., MEDLINE, was publicly underwritten for a while; cutbacks to date have been manifest in restrictions on those people who may use it without surcharge.

While many models of cooperation between public and private entities are operating, no trend has surfaced to date regarding the relative success of one type of supplier over the other in meeting the needs of the professional market for continuing instruction. What does seem apparent is that to introduce less commonplace hardware to prospective users than that which they would normally have, e.g., low-cost satellite reception terminals, requires the infusion of venture capital on a scale beyond what must be available from routine commercial sources. In many cases these are the instances in which public money is used to purchase equipment and increase its availability; requisite ground equipment for participation on the ATS-6 satellite, and installation of MEDLINE computer terminals are but two examples. Equipment purchase of a more routine nature, such as the television monitors needed to receive the Stanford ITFS network, will usually be borne by the participants themselves. Diffusion of requisite technology is not an "either, or" situation, but one involving the proverbial large gray area. With limited exceptions, what is considered an "esoteric" new technology depends upon the setting. When the MEDLINE system was originating, for any library ... much less a medical library ... to have a keyboard terminal providing interactive communication with a distant data bank might have been considered visionary. A current case in point concerns the private law firm sub-sector of the legal profession. Planned expansion during 1975 of videotaped programs distributed electronically was shelved due to lack of response. One possible explanation was the reluctance of many firms to incur the expense of equipment installation. Simultaneously, it appears that a computer-assisted legal research system is making headway within the same market sub-sector.

The phoenix to rise from the ashes of conflicting evidence is that professionals will accept electronic delivery of continuing instruction or other information services if it meets their needs as dictated by their working conditions. Thus far the available evidence would seem to indicate a more favorable reception for the information-on-demand

services provided by the computer-assisted research systems. Nonetheless, factors such as convenience, programming propriety, and the specter of mandatory periodic relicensure appear to be on the cutting edge of increasing adoption of electronically-delivered instructional services.

The matter of convenience is important. Proximity often acts as an inducement; its role in promoting technological utilization is no exception, particularly when the prospective users are working professionals with eclectic time constraints. As the necessary technology becomes more commonplace to the point of ready availability, its use by busy professionals should increase. Working days are not uniform within this sector; the doctor on call will have a schedule drawn along different concepts than the highly-structured day of the school teacher. Hence the attractiveness of convenient scheduling. This feature may help to explain the growing acceptance of the computer-assisted research systems introduced thus far.

Programming distributed over any technological system should be of sufficient complexity and timeliness so that the groups of specialists and sub-specialists which compose any professional audience will find the software suitable and not a waste of their time. The emphasis of any programming or information service will be to expand and enhance the practitioner's competence. Just as programming must be tailored to its audience, for maximum effectiveness it must also be delivered to a group clearly defined along interest or specialty lines. Such groups, however, may be small and geographically diverse. A demonstration proposed by the Lister Hill National Center for Biomedical Communications for execution on the upcoming Communications Technology Satellite will hopefully provide useful data for resolving this dilemma. Plans to use CTS for electronic transfer of requested materials, e.g., videotapes, may aid in giving professionals access to an array of suitably specialized non-print materials; resultant data should be analyzed for promise of cost-effectiveness and attitudinal acceptance.

The possibility of mandatory periodic relicensure or recertification of practicing professionals will provide a third force for increasing acceptance of electronic distribution of continuing instruction. This eventuality will prompt more ongoing educational activity; should other factors conducive to improved technological distribution

occur, the convergence would be potent for the prospects of continuing professional education via telecommunications.

All of the professions studied in this memorandum are in varying stages of commitment to, and experimentation with, electronic delivery systems for continuing education. While this bespeaks of an interest in market prospects, actual adoption may hinge upon factors such as relicensure and recertification requirements, cost-effectiveness and configuration of the technology, and the degree of affluence of supporting entities and individual practitioners.

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