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Instructional Television Fixed Service (ITFS) is a band of microwave frequencies set aside for educational and cultural programming. It is a valuable mode of telecommunication for metropolitan universities interested in providing off-campus instruction by television. The article describes a number of possible uses and provides information about costs and the steps to be taken to initiate ITFS programming.

Instructional Television Fixed Service

A Useful Tool for the Metropolitan University

Educators all across the nation realize that the current budget crisis facing them cannot be solved without substantial reform of the educational enterprise. Coupled with this awareness is the growing pressure to provide quality instruction, increase access, and ensure equitable resource distribution. The combined pressures are forcing all of education to consider alternative means of delivering the educational experience. Considerable opportunities are provided by new technologies that have improved traditional modes of distribution of written and oral material and now provide, as well, effective distribution of visual material by means of microwave, cable, and satellite transmission.

The purpose of this article is to focus attention on Instructional Television Fixed Service (ITFS), which refers to a band of microwave frequencies originally set aside by the Federal Communications Commission (FCC) in 1963 exclusively for the transmission of educational and cultural programming. It can be used as a stand-alone method of distribution, or can be combined with others. Its effectiveness has been demonstrated in colleges and universities across the nation, with several institutions having years of successful experience. For example, in the California State University system, sixteen of the twenty campuses have ITFS in operation with over 250 receive sites throughout the state.

In the 1960s, in cooperation with local school districts or community colleges, public television and some commercial stations set out to demonstrate the benefits of "electronic distance learning" for the benefit of urban, suburban, and rural regions of the country. The perceived need for broader access to educational television programming was instrumental in the decision of the Federal Communication Commission in 1963 to designate twenty-eight channels in the 2500–2690 MHz band for transmission of educational or instructional video programming to multiple specially equipped receiving locations. This is the only part of the electromagnetic spectrum reserved for instructional programming. Another unique aspect of ITFS that has significant educational implications is its two-way capability, which permits students to respond to instructional material presented visually and aurally on an aural talk-back channel.

ITFS uses low-power transmitters of about ten watts, although more recent efforts have focused on fifty to one hundred watts. It is a spectrum-efficient service, which enables the sender and receiver to use the electromagnetic spectrum in ways that produce little "spillage" of signal into other adjacent wavelengths. It allows transmission of audio/video/digital signals in a "line of sight" mode from the transmitting antenna to the point of reception. Repeaters and directional equipment are used where necessary to compensate for particular topographic features. Such equipment permits ITFS licensees to serve large areas up to sixty-five miles or more from the ITFS transmitters if there are no terrestrial interferences. For a metropolitan university, the line-of-sight consideration is likely to reduce the range to between fifteen to twenty miles unless the transmitter is located at a high elevation overlooking the area to be served. The limitation is due in great measure to the presence of buildings, potential interference from other signals in the confined geographic location, temperature changes, and several other factors not normally present in rural environments.

Most ITFS systems provide one-way video communication with the possibility of two-way audio interaction. Older systems tend to use the telephone as the format for the talk-back capability, while newer systems are taking advantage of technological breakthroughs and are using the built-in capability within the equipment itself.

ITFS adds an important component to the range of technologies available to universities for distance learning programs. It is particularly suited to the needs of metropolitan universities because it enables locations in a small geographic area equipped with appropriate antennas to receive video and audio signals and to return audio signals as part of a closed-circuit television network. Thus ITFS is very useful when a metropolitan university wishes to deliver distance learning programs to a specific and limited number of sites. For example, ITFS is used to:

- transmit instructional programs to students in public, private, and parochial primary and secondary schools;
- provide college-level courses and degree programs at satellite learning centers for students unable to attend classes on campus;
- provide on-the-job continuing education and graduate training to engineers and scientists working at industrial and defense facilities;

- provide advanced medical training to doctors, nurses, and health professionals while they are working in hospitals; and
- provide instruction to prison inmates.

ITFS can also assist a university in a rural location to provide education to urban residents. California State University, Stanislaus, for example, uses it for a substantial share of the instruction it offers at its Stockton Center almost forty miles away.

Additional ITFS systems are constantly developing with new degree programs and courses being offered to meet the needs of educational institutions, business users, and students. ITFS systems are also being used to provide programming for satellite learning centers and for new commercial office buildings so that building owners may offer instructional programming to prospective tenants. Similarly, transmitting instructional materials to expanding businesses that are currently using ITFS is another use.

Four ITFS channels are usually licensed to one operator. Only one antenna is needed by a reception site to pick up signals on all four channels. Hence, the host site is able to broadcast on four different channels simultaneously, enabling receiving sites to receive a variety of programs.

ITFS is used not only as a stand-alone delivery system but also as a way of linking other telecommunication technologies. New and innovative uses of ITFS are being developed at an increasing pace. For example, educational entities have operated satellite networks interconnected with other technologies, and ITFS has been used to distribute programming from the site of the satellite downlink to local schools, hospitals, and other reception locations. ITFS is also increasingly used to link metropolitan universities with cable systems. The accompanying article by M. A. Rahimi describes a particularly successful example of such use, indicating how the effectiveness of ITFS can be maximized by cooperation among educational institutions.

Examples exist as well of partnerships between commercial and educational interests. For instance, the channels available to educational license holders for ITFS and those available to commercial license holders for so-called Multipoint Distribution Systems (MDS) are used jointly in such a way that "wireless cable" for the community becomes a viable option. In such a configuration, educational programming is available during certain agreed-upon hours of the day, and commercial programming the rest of the time. In Corpus Christi, Texas, all thirty-one channels available are shared in this fashion to serve the community.

Costs

Costs for one-way video/two-way audio ITFS systems can vary substantially from one situation to another. For example, an investment of over $1 million was made by one university to put in place a four-channel ITFS system "from scratch," with no financial support for reception locations or programming of the channels. Another university, starting more modestly, invested approximately $40,000 in equipment and a small studio/classroom set-up for the transmission of programming over one ITFS channel.

A distinction must be made between the cost of what is needed for the production of the material to be broadcast and the cost of its transmission. The former depends greatly on the complexity and sophistication of the desired production, ranging from the simplest "talking head" format using a single camera and a minimally adapted space, to multimedia presentations requiring substantially modified classrooms, multiple cameras, and a control room. Architectural modifications and equipment for the more elaborate production facilities can easily add up to $200,000, not counting personnel costs.

The cost of transmission using ITFS will vary slightly depending on how many "bells and whistles" are desired in the system, such as scrambled transmission signals to prevent unauthorized use, as well as power and quality of the transmitted signal. The typical cost for ITFS transmission equipment is between $25,000 and $30,000 per channel as compared to $80,000 to $100,000 for a satellite uplink. To extend the broadcast range, additional repeaters plus receive and transmit antennas will be needed. Ongoing operating costs are low: ITFS has the great advantage that there are no additional costs for air time, whereas the use of a satellite transponder can range from $150 to $500 an hour.

At the receiving end, the cost of the antenna is affected by variables such as the desired quality of the signal and the distance from the transmission site, which affects the necessary size. Commonly used receiving antennas, which can receive all channels simultaneously, can now be purchased for as little as $125 to $150. A satellite receiver can run around $2,000. Further costs depend on whether there already exists a hard wire connection between the antenna and the space to be used for instruction. In most modern school buildings, classrooms are already wired with the capacity to connect a television monitor to receive a distance learning televised program. Further expenses may be incurred if television monitors have to be bought and mounted, telephones installed, and lighting modified.

The following is an average cost projection for a metropolitan university considering investing in an ITFS system. The projection is based on a two-channel system programmed to operate from two modified studio/classrooms to ten reception sites throughout a twenty-five-mile metropolitan area. The estimated costs do not include revenue generated from the activities of the ITFS system in providing educational services to the metropolitan area. The figures for initial investment are as follows:

■ Architectural modification	$ 25,000	–	$ 75,000
■ Originating transmitter	50,000	–	75,000
■ Classroom cameras/audio/monitors	40,000	–	60,000
■ Master control	20,000	–	50,000
■ Receive classroom equipment	30,000	–	50,000
Cost range	$ 165,000	–	$ 310,000

To this must be added annual operating expenses and personnel costs of between $100,000 and $180,000.

Availability of ITFS Channels

For a variety of reasons, ITFS has grown slowly since its inception, and much of the spectrum space allocated to it has not been fully used. The special requirements of ITFS service, and the political and budgetary realities facing most ITFS licensees, have restrained the development process. It is not an indictment of the technology that educational institutions have slowly begun to realize the full potential of ITFS particularly during the last decade. ITFS has steadily expanded and diversified its services in many universities, schools, and communities.

During the early 1980s, the FCC undertook proceedings to consider amendments to its rules and regulations governing ITFS. One change from the original intent was the reallocation of a portion of the ITFS spectrum to Multipoint Distribution Systems (MDS), e.g., business and for-profit entities using the same technology as educational users, and permitting ITFS licensees to use channel time for non-ITFS purposes. The reallocation decision by the FCC forced many schools and universities to halt or redevelop their ITFS plans. The decision to authorize the use of ITFS channel time for non-ITFS purposes drastically changed the environment in which educational institutions must operate.

In a subsequent clarification of earlier policy pronouncements, the FCC belatedly recognized that it had opened up a Pandora's box by allowing ITFS licensees to use excess channel capacity for non-ITFS uses. The commission's good intentions—to enhance efficient spectrum use and stimulate the growth of ITFS by a marriage with private enterprise—have not come to pass with any degree of success. Instead, the FCC's decisions resulted in a furious rush for unused frequencies, fueled in large part by MDS operators who intended to provide lowest-common-denominator ITFS service while leasing as much time as possible for highly lucrative MDS programming. Without the adoption of stringent controls, this FCC policy had the practical impact of stunting the further development of ITFS. It became necessary for many universities and schools to use limited financial resources to counter the continuing intervention of the FCC rather than to develop the ITFS systems and their educational programming.

One university expended over $100,000 for legal services provided in an effort to protect ITFS frequencies licensed to it by the FCC. This situation was created when the FCC awarded the same frequencies in the same geographical area to commercial interest. The award was based on a lottery conducted under the auspices of the FCC.

To suggest that the FCC is not aware of the issues would be misleading. That body continues to be buffeted by the winds of change in the telecommunications arena and the interest groups calling for increased business opportunity for themselves. Caught between supply and demand, or services and who will benefit, the FCC must balance public good with private interests, e.g., the cable industry, public utilities/regulatory policies.

Application Prospects

For the metropolitan university considering a move into the ITFS arena, it would be wise to first ascertain the availability of ITFS channels in the local area. Most metropolitan areas have a local FCC office that could be responsive to any questions pertaining to the ITFS situation. Another option would be to contact a local college or university, school district, or ITFS user to obtain as much information as possible on the current local use of ITFS. And finally, some parts of the country have a local informal FCC coordinating body where the total electromagnetic spectrum use is coordinated by all users, e.g., Southern California FCC Coordinating Council, from an engineering standpoint of resolving and anticipating issues of signal transmission and reception.

Even if all of the local ITFS channels are currently committed, the interested metropolitan university may be able to enter into a cooperative or collaborative arrangement with a license holder. The arrangements can be worked out depending on the interest and goodwill of all parties.

Assuming that ITFS channels are available and a decision is made to apply for them, the normal procedure is to obtain an appropriate form from the local FCC office, complete it, and then submit it to the FCC in Washington, D.C. Another process often followed by educational institutions is to engage a consultant familiar with the FCC procedures and local ITFS environment to work with the institution and submit the required paperwork to the FCC. Another alternative is to retain legal counsel with expertise in the areas of ITFS, telecommunications, and FCC, and familiarity with the issues surrounding ITFS and its use.

For the metropolitan university seriously considering entering the world of ITFS, or, for that matter, any form of telecommunications associated with distance learning, the most prudent advice would be to engage in a feasibility study *and* a realistic business plan before submitting an application to the FCC. Such a planning effort will better enable the institution to complete the requested information from the FCC and will serve to better inform the stakeholders in the institution of the issues and opportunities available through the use of ITFS for distance learning opportunities.

Absent staff expertise at the metropolitan university, external assistance is best sought to offer advice and counsel. The expenditure of such funds up front will enable the university to be better informed early in the process rather than after the fact.

Faculty Resistance

ITFS shares with other modes of distance learning a considerable amount of faculty resistance to the use of telecommunications. If educational applications of various technologies are to continue to affect more and more aspects of university operations, the small and capable cadre of faculty will no longer be sufficient to ensure the academic quality of programming available via telecommunications.

Many educators, including faculty, regard educational applications of telecommunications technologies as unconventional and question their academic quality. Whether it be in association with the promotional practices of a given institution, or the traditional versus nontraditional teaching methodologies under review, for many professors the use of technology has been seen as detrimental to professional advancement.

In addition to professional recognition for practices involving the use of telecommunications, curriculum development is a related faculty issue of high concern. The need exists to develop educational software capable of more fully utilizing the capacity of various technologies. Although ITFS provides a live, interactive capability for teacher and learner, the fact is that many faculty see the instructional programming as a "packaged" teaching tool that offers the opportunity for others, e.g., instructional designers and content specialists, to impact what is taught. Substantial improvement in policies and practices associated with overcoming faculty resistance to the use of technology is occurring, but much more needs to be done.

Faculty need to be involved and engaged in the planning processes associated with the use of technology. Special training opportunities, faculty development opportunities, and increased familiarity with the technologies available are required so they can develop their ability to teach via telecommunications. Such a recognized need implies a partnership among communications specialists, instructional designers, and faculty.

Many faculty, after an initial period of reticence or concern, become very excited about their use of technology in the teaching/learning process. Nevertheless, the bottom line is that the eventual success of the course or program delivered to the students is inextricably related to the quality of the faculty member and that faculty member's commitment to effectively use the technology.

The technological applications that are most likely to persist are those that pose the least threat to the traditional role of faculty. Yet, more and more faculty are engaged in pushing the line forward, enabling innovative uses of the technology to occur without fear or resistance to the seemingly insurmountable barriers placed in their path.

Institutional Actions

The metropolitan university using ITFS and other technologies to advance its institutional mission is doing so as a result of the persistence of individuals at various levels of the institution. Typically, the use of technology has evolved over time without a coherent plan of action or an integration with the ongoing institutional processes. ITFS is often seen as an add-on rather than an integrated part of the institutional effort to fulfill its mission.

The following actions are suggested for a metropolitan university committed to the use of ITFS and other technologies in order to address the urban milieu that is a key element of its educational mission:

Support from the central administration is essential if the use and application of ITFS and other technologies are to succeed. Unless the campus administration clearly commits itself to the concept by establishing policies and procedures supportive of the desired changes, the use of the technology will have a limited chance of meeting with success. Budgeting special funds, reallocating or redistributing existing resources, facilitating external fund raising earmarked for the use of technology, and planning for the technologies as a part of the institutional fabric—all contribute to making instructional technology resources integral to the institution.

The American Assembly of Collegiate Schools of Business (AACSB) addressed this point in 1989 when it made the following observation:

> An important prerequisite for success of distance learning programs is a total cooperative university effort. It is vital that support come from the top administrative units of a university. This support must encompass both financial as well as philosophical support over the course of planning and implementation, recognizing that any such effort will be difficult and organizational learning will take place over several years.

Policy endorsement by the governing board establishes the framework for the development of the appropriate technologies. Policy statements from the governing board emphasizing that current institutional operations and future planning should incorporate technology to improve service, the teaching/learning process, and reduce operating costs will serve to reinforce the institutional commitment to incorporate technology into the "cost of doing business." Without policy endorsement, the institution will have a very difficult time in making decisions regarding how best to proceed.

Proposals for change advanced through the planning process should be within a context understood by the institution. A picture of the institution's desired future needs to be developed, recognizing foreseeable conditions. While not a blueprint for tomorrow, the forecast will provide a vantage point for assessing where the institution should be headed. It will suggest some key points for the integration of technology into the life of the institution. It also will provide a master plan for technology use by which the institution can continuously assess its progress in reaching the desired future.

Essential ingredients for successful implementation of ITFS and other technologies at the metropolitan university are visible advocates and an infrastructure of good human resources. This point cannot be stated strongly enough. Without a dedicated group of people working individually and collectively, even the best plan will not be realized. The institution needs to recognize the contributions made by the staff—financially and through other tangible forms of recognition.

The metropolitan university should engage in collaboration with the private sector and other educational entities in the use of technology, both to enhance the quality of education in the classroom and to expand the delivery of educational services to the off-campus locations, including the work site. The concept envisions the metropolitan university and the community it serves as a wired city, linked by electronic highways by which the panorama of institutional clients access the informational resources available to them. The intended end is curriculum enhancement through the increased communication capability of schools, colleges, and universities providing the opportunity for institutions to receive varied types of supplementary educational programs. Additionally, the educational enterprise can conduct exchanges with business, industry, and government; participate in live lectures and conferences on special topics; and increase cooperation and communication among educational institutions.