Direct Satellite Broadcasting

Eli M. Noam

Columbia Institute for Tele-Information
Graduate School of Business
809 Uris Hall
Columbia University
New York, New York 10027
(212) 854-4222

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Introduction to DBS

One form of broadcasting that threatens to overcome national boundaries is high-powered direct broadcast satellites (DBS). DBS as a concept goes back to 1977, when a World Administrative Radio Conference (WARC), in a contentious meeting pitting the United States against the rest of the world, established the basic framework (Pool, 1991). At the time, European officials saw DBS as imminent. They regarded it as a wide-open field where no country had yet achieved technological dominance and where the potential existed to develop domestic electronic strength. It was also viewed as a way to establish the traditional national broadcast institutions in space, since DBS's large power requirements permitted only a small number of channels, thus causing little disruption to the existing national systems. To achieve high-power beam required a small "footprint" of coverage; thus, the scarcity of channels in the sky would match the scarcity of channels on the ground.

Despite these early hopes, DBS soon ran into problems. Cost estimates rapidly escalated. A typical DBS plan included three satellites of great complexity and expense: two in the sky, one of which served primarily as a standby, and one spare on the ground. Without the redundancy, a small malfunction in a vital component of this expensive technology could cause tens of millions of subscribers to be stranded for a year or more. Thus, the cost estimate for the space segment alone climbed to well above $500 million, and because the life expectancy of a satellite is only about ten years or less, the annual anticipated cost of space hardware was enormous. Launch and insurance costs also mounted, as several telecommunications satellites were lost in highly publicized rocket mishaps. On top of that, there were the considerable expenses of ground stations, program supply, marketing, administration, and subscriber services.

As the projects were considered, technological progress changed the discussion; the need for high-powered satellites was increasingly questioned in favor of medium-powered ones. When DBS was originally conceived in 1977, WARC agreed on a necessary signal power of 230 watts, requiring a receiving antenna of 0.9 meters. To transmit with such power required new and untested technology. (In comparison, regular low-power telecommunications satellites reach around 10 watts of power.)

However, the efficiency of antennas soon improved rapidly. At the 1977

WARC, it was still assumed that antennas would have a so-called merit factor of 6 decibels (per degree Kelvin). By 1985, antennas of 30 db/K were readily available. Since an increase of 3 db/K nearly doubles reception power, many wondered whether high-power transmission was really necessary. Similarly, the attenuation of signals by rain proved to be a much less severe problem than was originally feared. Thus, it became possible to use medium-powered satellites that could provide more program channels and require smaller antennas than had previously been imagined.

In addition to technical dilemmas, the logic behind the use of DBS by established public broadcasting institutions remained unclear. After all, traditional broadcasters typically reach the entire population of their countries through terrestrial broadcasting and have no real ambition to reach the rest of Europe. To add one or two program channels, it would be simpler and much less expensive by using additional terrestrial frequencies, and this would also involve less interference from one country to another. One rationale for public broadcasters' DBS plans was a desire to preempt private entrants; however, the enormous cost of DBS had already created major entry barriers for private firms. There was also the question of whether audiences for Europe-wide programs were large enough. According to one school of thought, there were only two such categories of viewers: adolescents interested in music and managers interested in economic news. Both groups are light television watchers and may not provide an adequate audience base.

Language barriers also undermine pan-European satellite TV. There is less bilingualism than is often believed. Although many viewers claim an "excellent" command of English, actual knowledge is much more modest. Furthermore, dismal foreign-language TV ratings in Europe reveal that even viewers who understand English shy away from English language channels (Evans et al., 1990, p. 76).

Further, the number of products that would permit Europe-wide advertising is not large. The example usually given is Coca-Cola. Even a multinational company such as Unilever, the soap and food giant, has only twenty Europe-wide brand names out of 2000 that are used throughout Europe (McCartney, 1985). Advertising approaches differ greatly in various countries, and a strategy that fits them all may be difficult to find. Most European companies are structured along national lines and their accounts do not have Europe-wide advertising budgets. Of course, many organizational constraints can be changed, but this would take time and in the meantime the infant satellite channels would be in difficulty.

The differing rules on advertising within European countries provide an additional hindrance to pan-European channels. For example, in Italy RAI was prohibited from carrying advertisements for furs, boats, pet foods, automobiles, and newspapers. In Holland, advertising for sweets and correspondence courses was prohibited. In France, margarine, newspapers, real estate, and alcoholic beverages could not be advertised (*Connections*, 1985). This is being changed through the harmonization efforts of the EC Commission and the Council of Europe. Since the early 1970s, there have been experimental DBS ventures, as

well as commercial failures; the U.S. ventures, USCI, failed because of technical problems. Since then, there have been attempts at DBS in India (ATS6), Canada (CTS), USSR (Statsionar 1), France (TDF 1,2), Germany (TV-SAT), Scandinavia (Tele-X), and Luxembourg (Coronet/Astra).

The case of the DBS medium-power project Coronet, pitting broadcast interests in Luxembourg, France, Germany, and the United States against each other illustrates the complex scenario of European direct broadcast satellites.

Luxembourg and the Saga of Coronet

Luxembourg, situated physically and culturally in the heart of Europe, was well placed to host a satellite venture. The country has traditionally benefited from playing the maverick in a number of economic activities, including broadcasting. A first plan was LuxSat. That concept united the West Germans and French in opposition and encouraged the two countries to pursue collaborative development and production of their TDF-1 and TV-SAT satellite projects. In 1983, the French government used its indirect controlling interest in CLT, the parent company of Luxembourg's national broadcasting firm, to block the LuxSat project. Pierre Werner, the prime minister of Luxembourg, therefore sought authorization for another plan, the Coronet project (*Neue Medien*, 1984).

Coronet was the brainchild of the American entrepreneur Clay T. Whitehead, who had formerly headed the Office for Telecommunications Policy (OTP) in the Nixon White House, and later managed the satellite manufacturer Hughes Communications. Whitehead proposed a satellite with intermediate power of about 50 watts located between telecommunications and DBS signal strength. A second part of Whitehead's concept was for the satellite to serve as a transmission facility rather than as a program provider. It would lease its sixteen transponders to interested parties on a common carrier. In 1983, Whitehead convinced Prime Minister Werner of the advantages of the satellite project, which was christened GDL-Coronet (*GDL* for "Grand Duchy of Luxembourg"). Whitehead began recruiting potential investors and users, including the American program provider HBO and the investment bank Salomon Brothers.

The French government opposed the Coronet project because it did not control it as it did CLT. It viewed GDL-Coronet as a threat not only to its own cable and satellite projects but to French sovereignty. France therefore led opposition to the project in Eutelsat, the European telecommunications satellite organization, by pointing to the precedent this project represented: the provision of telecommunications services for hire by a carrier outside of PTT control.

The French government also renewed its commitment to its own TDF-1 project. To ensure usage of that satellite and to draw Luxembourg's CLT into its orbit, it agreed in principle to lease two of the four channels to CLT and offered attractive terms to CLT for commercial television broadcasting in the French language in France, as long as no competitive satellite service was es-

tablished. French pressure on Luxembourg grew massively, and the major French shareholders in CLT, most either owned by or close to the government, threatened not to approve any further investment in CLT if Coronet proceeded.

Meanwhile, the disagreement between CLT and the Luxembourg government quickly escalated into a legal confrontation. CLT claimed a contractual monopoly for Luxembourg broadcasting, while the government of Luxembourg countered that no such monopoly existed because GDL-Coronet was a telecommunications satellite and was providing service for which CLT had no exclusivity.

CLT and the French government relied on the solidarity among the European PTTs against the intruder. Of course, very little encouragement was needed to generate PTT opposition to a potential competitor, especially a private system with American backing. Through their coordinating organizations CEPT and Eutelsat, the PTTs agreed to resist cooperation with Coronet. Eutelsat objected to Coronet's orbital position and frequency use; later, its secretary general Andrea Caruso recommended that member states bar any telecommunication access to Coronet. Eutelsat ignored assurances that Luxembourg would maintain control over Coronet and that American program channels would be prohibited.

By 1984 the GDL-Coronet project became an issue in the Luxembourg parliamentary election, with the Socialist opposition arguing against provoking France. French PTT minister Mexandeau stated, "If the American businessmen attempt to test our abilities to accept their challenge, then we answer them: impossible in a European framework. In any case, we are not willing to let the Coca-Cola satellites undermine our linguistic and cultural identity" (*Neue Medien*, 1984).[1]

The call to European solidarity against the American invasion convinced Germany to join the opposition to the project. In a meeting with Prime Minister Werner of Luxembourg, German Chancellor Kohl made it clear that Germany would give priority to the industrial collaboration with France. In addition, the German Bundespost concluded that a DBS system such as Coronet could threaten its own massive cabling projects and its own TV-SAT DBS project. Consequently, the Dresdner Bank, the venture's main banker replacing the American Salomon Brothers, became cautious about proceeding with the project.

In an attempt to bolster European credibility, Coronet tried to further de-Americanize itself by promising to use the French Ariane rocket for launching, by including many European components in the satellite, and by reducing Clay Whitehead's participation from 20 to 10 percent.

However, the unified opposition proved insurmountable. Coronet suffered a major setback when Werner, its principal governmental supporter, retired after the 1984 election and was replaced by Jacques Santer. The government then decided to form an alternative satellite organization, Société Européenne des Satellites (SES) to replace Coronet. In effect, the American interests were expelled but the business plan and the satellite were kept. SES was partly owned by two Luxembourg government banks, as well as by other firms from Luxembourg, Belgium, Sweden, and Denmark. Later, the British ITV firm Thames Television joined. SES assumed for all practical purposes the GDL-Coronet

position, and Whitehead received some compensation. SES also took over the contract for an RCA 4000 satellite.

Once Coronet had been eliminated, the French government modified the arrangement with CLT. By permitting commercial terrestrial broadcasting within France by two other consortia, the French government eliminated the exclusivity to the French language commercial broadcasting market with which it had lured CLT. It also demanded high rates from CLT for the use of the TDF satellite. When the TDF-1 project developed technical problems and fell far behind schedule, CLT found itself undercut and without a satellite for its own European ambitions.

SES, too, met strong opposition from France and Eutelsat. The Luxembourg government fought with Eutelsat over the question of whether SES was proposing "a public telecommunications service." Ironically, the Luxembourg position was mildly favored by several other countries such as West Germany and France, which otherwise staunchly endorsed PTT exclusivity, but which were establishing their own national satellite systems whose use could be restricted by Intelsat with similar arguments.

In 1988 SES successfully launched its satellite, Astra 1A. Soon, all of its 16 transponders were leased, and served about 15 million European homes. Astra was used for Rupert Murdoch's four Sky Television channels and 12 other primarily English and German stations, including Sat-1, RTL Plus, Screen Sport, Lifestyle, MTV Europe, and The Children's Channel. Astra claimed a third of the British direct-to-home viewing audience (Glenn, 1989a: p. 9). But most of the audience to Astra transmissions are cable subscribers via the head-end of their cable network.

A second Astra satellite was launched in 1990. A third satellite was to follow, all operating from the same orbital positions and offering together 48 channels. According to Astra, 16 million European cable households could receive it. Astra was becoming a huge success.

France

In France the development of both cable television and direct broadcast satellites (DBS) was primarily a hardware-oriented and political question, leaving the programming use of new distribution channels to be determined later. Decisions on program transponder allocation for the DBS satellite project TDF-1, were made almost on the eve of the launch, years after the allocation of investments, and have since changed repeatedly. Similarly, multibillion dollar cable television investment plans were pursued with only vague program planning.

The electronics and space industries and their allied government ministries viewed a DBS project as a promising source of demand for expensive satellites, millions of ground antennas, and upgraded TV sets, while creating much export potential. DBS also presented an opportunity to expand the reach of French broadcasting and culture to other countries. Moreover, it provided a vehicle for

collaboration with West Germany. In 1980 the two countries signed an agreement for a three-satellite system, each with three transponders (later expanded to four and then five) of 250 watts, and costing FFr 1.1 billion. Later, a Nordic consortium headed by Sweden joined in the agreement. The German project, called TV-SAT, was scheduled for launch in April 1985, followed shortly thereafter by the French TDF-1 and a spare satellite. As the French satellite's name implies, it was at the time under the control of the broadcasting administration, TDF, rather than that of its long-standing telecommunications rival, the telecommunications monopoly administration, DGT.

This Eurosatellite consortium included the German firms MBB and AEG-Telefunken, as well as the French companies SNIAS, Thomson, and Aérospatiale (Vedel, 1987). Germany and France agreed on the D2-MAC transmission standard.

The Socialist government, which came to power soon thereafter, scrutinized the project. The DGT, by now actively lobbying for cable, argued that high-powered satellites were unproven as a technology and would be made obsolete as a transmission concept. The TDF-1 satellite had only five broadcast transponders, in contrast to the two dozen or more stations available with cable transmission. The costs inherent in the satellites, including subscriber equipment, antennas, amplifiers, and decoders, as well as environmental limitations (e.g., unsightly antennae, need for a clear southern exposure, and problems in maintaining signal quality in the event of rain or snow) provided strong arguments against DBS. The DGT advocated the use of medium-power satellites with more channels, or, preferably, reliance on the DGT's own low-power telecommunications satellite project together with its terrestrial cable transmission.

In the face of powerful but conflicting interests, the new Socialist government of François Mitterrand compromised by adopting both cable and DBS, declaring them complementary. Ridiculed at the time, this view is nevertheless correct, particularly if it would combine cable with multichannel, medium-power satellites. Cable offers advantages to most urban and suburban viewers, whereas satellites could cover less densely populated regions and feed the cable systems in other areas.

The government also had to face the task of allocating the transponders. The minister of communications, Georges Fillioud, discarded the original allocation in favor of new channels. He assigned one channel to the French public broadcasters, and a second to a French-language European channel, and he dangled a third and fourth channel before Luxembourg's CLT to lure it away from pursuing its own LuxSat. CLT could contribute its popularity as a program provider, and because various French state companies owned large blocks of its shares, it was viewed as controllable by the French government.

An agreement was reached for two CLT channels on TDF-1, one each in French and German, for FFr 90 million per transponder per year (Vedel, 1987). But after Luxembourg ended its Coronet involvement, CLT was dropped. In the meantime, TDF-1 launching dates fell behind schedule, disputes over transmission standards erupted, and costs rose to over FFr 3.5 billion. Despite the

setbacks and rising costs, the largest threat to the project was the introduction of commercial terrestrial television, which undermined the market for DBS and made the main argument for the costly satellite concept, the absence of suitable terrestrial television frequencies, seem disingenuous. The negotiations unraveled: CLT now wanted one of the two terrestrial channels, while terrestrial applicants wanted also to be carried on TDF-1 to increase their reach.

Télévision par Satellites, a company that had foreign participation, was established to operate the satellite; the French government held 34 percent, and together with other government-linked French companies such as Aérospatiale and the bank Crédit Agricole, it had majority ownership. Foreign participants included Robert Maxwell, the British media mogul (then-owner of the Mirror newspaper group and of the largest British cable system, who held 20 percent), Luxembourg financial institutions (17 percent), Berlusconi (8 percent), and the Dutch company Philips (5 percent).

When a conservative French government assumed power in 1986, it questioned the concept, and even more the transponder assignments. Both the terrestrial stations awarded to La Cinq and M6 and their transponders on TDF-1 were at first rescinded. CNCL, the new media regulatory agency, reassigned the transponders, one to the modified La Cinq group of Berlusconi, Seydoux, and Hersant, and the other to the new holders of M6, CLT and Lyonnaise des Eaux. By that time, project cost had risen to FFr 2 billion for one satellite, almost six times the original cost, not counting inflation, and the project. But the industry interests lobbied furiously to save the project, using scare scenarios about British, Japanese, Luxembourgeois, and other satellite projects relegating France to the role of a second-rate power. Meanwhile, corresponding interests in other countries were lobbying their own governments, using similar arguments.

TDF-1 was launched in April 1988, shortly after its German counterpart, TV-Sat, was unsuccessfully put into orbit. TDF-2 followed in 1990.

The French satellite has been hampered by various technical difficulties, including the permanent breakdown of several of its channels. Because TDF-1 was the first satellite to use the D2-MAC transmission standard, consumers had to purchase new reception devices that were in short supply and expensive. Luxembourg's Astra satellite which uses the PAL also proved to be a formidable competitor.

In 1990, the new French–German public channel La Sept was the only unencrypted television broadcaster operating on TDF-1 that could reach all French homes, and it was neither well known nor popular. The other transponders are allocated to the pay-TV channel Canal Plus which has no full terrestrial coverage, Sports 2/3, Canal Enfants (a children's channel in which Canal Plus holds a stake), and Euromusique. Three radio stations—Hector, Victor, and Radio France Internationale—were also using the satellite. Few French were willing to invest in a satellite dish for so few DBS program channels, while terrestrial broadcast options (Graham, 1990: p. 4). To give the program channels on TDF a boost, the French regulatory agency CSA decided in 1990 that all cable networks must carry these channels.

Germany

German involvement with satellite broadcasting began in the late 1960s when the Ministry for Research and Technology ordered two competing private consortia to develop and analyze the feasibility of direct satellite broadcasting. West Germany later joined the European Space Agency (ESA) and assumed a share of the cost of the agency's European Communications Satellite (ECS) project. The two countries agreed in 1979 to develop and produce the nearly identical German TV-SAT and the French TDF-1 satellites, with 54 percent of production costs assumed by Germany and 46 percent by France (Scherer, 1985). In 1982, the German states declared that they wanted to play a part in the decisions concerning satellite use (Bullinger, 1985). Several years and many debates later, the states' prime ministers decided to allot two of TV-SAT's five transponders to the established public broadcast institutions ARD and ZDF for their satellite channels 1-Plus and 3-Sat and to allocate the three other transponders to private program providers. Two of the private channels would be SAT-1 and RTL-Plus, both preferred in states dominated by the Christian Democratic Party, and the third private channel was left to the discretion of states dominated by the Social Democratic Party (Müller-Romer, 1988).

In 1984 France and Germany began the development of a new 130 watt broadcast satellite generation with ten transponders, to be operated jointly by the two countries.[2] Germany developed a purely national telecommunications satellite project called DFS-1 Kopernikus which serves as a backup for TV-SAT-2 in reaching cable head-ends.[3]

TV-SAT-1 was launched into orbit in late 1987. However, a defective solar panel immediately made the project a failure. TV-SAT-2, launched two years later, utilizes the D2-MAC transmission standard. It experienced problems in acceptance: Terrestial broadcasters preferred improved and compatible PAL standard (e.g., Super-PAL), reception equipment was slow to reach the market and very expensive, and consumers chose to view channels on Kopernikus (with low-power transmission) or the medium power Astra, both of which use PAL (*Funkschau*, 1990, pp. 24–26).

Scandinavia

In the early 1970s the Scandinavian countries began negotiating for NORDSAT, a joint high-power satellite program intended to carry the national channels of all five Nordic countries on seven TV and eleven radio transponders, thus giving each country access to the others' programs. However, the participant countries soon fell to bickering about the financial burden and the adjustment of different national regulations. For example, since Finnish television carries advertisements, Sweden argued that its firms would be at a disadvantage if Finnish programs were freely available in Sweden. The NORDSAT project was eventually shelved, but Swedish high-technology firms sought to rescue

their project through the creation of an alternative government-supported satellite program, and in 1982 proposed the less ambitious Tele-X project.

Tele-X is associated with the joint French–German TDF-1/TV-Sat project. Ericsson supplies the antennae and communications modules and is the primary contractor for the earth station. Saab-Scania provides high-powered television and transponders.

The Tele-X satellite itself cost about $88 million, and total system costs reached over $200 million. Of these costs, more than 80 percent were borne by Sweden, with Norway and Finland accounting for the remainder. Work on Tele-X's is managed by the Swedish Board of Space activities. The Swedish and Norwegian telecommunication administrations set up the Nordic Telecommunication Satellite Corporation (Notelsat) to be responsible for Tele-X experiments and operation of broadcasting and commercial services, but Finland and Denmark, withdrew from Notelsat, and Norway reduced its role.

Tele-X faces several difficulties. The satellite's orbital slot is not a good one, and its capacity is limited to five transponders. It faces competition from established satellites of Eutelsat, Intelsat, and Astra, and from proposed projects that include the Eutelsat II generation. In 1990, TV-4—Sweden's first commercial network—became the first television channel to use the Tele-X satellite (Nicholson, 1990, p. 28).

United Kingdom

The British aerospace and electronic industries were the initial driving forces behind DBS in the United Kingdom. The Home Office let it be known that the government would not provide financial support for the establishment of DBS. The BBC was interested and wanted to assure its presence in new technology. The ITV companies, however, were not supportive because they did not want competition with their monopoly over television commercials. In 1982, Home Secretary William Whitelaw announced the beginning of a DBS project. The BBC would be licensed to lease two transponders on a planned high-power satellite Unisat, which would be built by a private consortium that included British Aerospace, British Telecom, GEC-Marconi, and the Rothschild Bank. The two BBC DBS channels would carry pay TV and BBC highlights from past years, together with quality international television.

In its preference for British development, the government demonstrated the tension between aspirations for high technology and for media liberalization. As in cable television, the government backed a British high-tech solution, thereby jeopardizing the development of a new medium.

The BBC negotiated with the consortium for British design and construction of the satellite. When it became evident that costs would be substantial, the BBC received governmental authority to go beyond its borrowing limits, though there was no increase in the license fee to finance this. Furthermore, the government also proposed including two ITV channels in order to decrease the BBC's financial burden. The remaining shares would go to other firms. These

were Thorn-EMI, Granada, Virgin (a record, film, and airline firm), S. Pearson (a conglomerate with publishing and entertainment interests), and Consolidated Satellite Broadcasting (an entity with a complicated structure involving the Luxembourg CLT and British independent producers).

In 1984, the consortium faced new cost projections that went far beyond what the participants were willing to bear. For several months the consortium explored the possibility of dropping the expensive British satellite and going with a cheaper American one that would cost only half as much ($46.8 million a year for five RCA transponders versus $96 million a year for three Unisat transponders). This, however, would have run counter to the government's aim of launching a British-made satellite.

The situation became even more complicated when the BBC engaged in negotiations with the government to link its license fee increases with its contribution to the DBS venture. In the end, the government approved rates of only £58, significantly below the rate for which the BBC applied. This made the fate of the DBS venture dependent on an unobtainable major government subsidy and led to the BBC's withdrawal and the shelving of the Unisat project.

But the demise of Unisat did not put DBS to rest. For a while British Telecom (BT), the telephone near-monopolist, considered launching its own satellite system. But it decided to join with the other public PTTs and to bet on their Eutelsat II satellite generation, with the request that the satellites be modified to provide for eight transponders of 50- to 60-watt strength, which BT would lease.

In 1986, the Independent Broadcasting Authority (IBA) rekindled an interest in a British DBS project, but this time without requiring a British-built satellite. It invited programmers' bids for DBS transmission of three television channels. It permitted the participation of existing ITV companies, but limited them to holdings of 15 percent in order to bring in new interests. The government again established its position that it would not provide financial support for the project.

After some vigorous jockeying, a fifteen-year franchise for British DBS was awarded in 1986 to the consortium BSB (British Satellite Broadcasting), whose initial partners were Anglia, Amstrad, Granada, Pearson, and Virgin. These participants were later joined by Bond, Chargeurs, Invest International, and London Merchant Securities; others dropped out. After a six-month delay, the BSB satellite, built by Hughes Communications, a subsidiary of General Motors, was launched and began broadcasts in April 1990. A month after its launch, 25,000 receivers had been sold. Its dish receiver kit sold for almost $600 and rented for $36 a month. In 1990 BSB began marketing a squarial—a flat antenna. Although the size has been increased from 25 to 40 cm, the squarial is still small enough to hang out a window. The receiver package, which includes the antenna, decoder, and remote controller, sold for $540 (*EBU Review*, 1989). BSB's biggest advantage, however, may be its fifteen-year official franchise, which also gave it a must-carry status on British cable systems. Unlike most European DBS projects, BSB was more than a satellite hardware project serv-

ing other providers, since it provided its own program channels, offering movies (Screen), sports and news (Now), children's programs (Zig Zag), and general entertainment (Galaxy) (Glenn, 1990a, p. 8) and rock music (Power Station). The service had access to $2.4 billion in capital and has spent $500 million on program libraries and film rights.

BSB's main competitor was Rupert Murdoch's Sky Television, which uses transponders on Luxembourg's Astra satellite. Half of Sky viewers received all four channels via home dish, sold for £200 or for rent, and others got one or more channels over cable systems. Sky Movies used scrambled signals and was available for $16 a month. To speed the growth of Sky, Murdoch began to offer satellite dishes bundled with a weekly subscription fee of £4.49 ($8) (Glenn, 1989b, p. 18).

In the early phases of the competition, Sky Channel pulled ahead of BSB, despite the latter's higher signal power. BSB had incurred the high cost of its two satellites ($1.5 billion), whereas Murdoch was only leasing his on a sixteen-transponder satellite. BSB also experienced problems with program cost and with the reception of its D2-MAC signal, a problem Sky, which used the PAL standard, did not have.

In November 1990, BSB and Sky Television, having lost, respectively, $900 million and $600 million decided to merge rather than compete. The joint company's operated with the trade name BSKyB. Murdoch, whose service was much more successful with one million subscribers (vs. only 120,000 for BSB) received a substantial cash payment which helped his $8–9 billion indebtedness. The merged system used at first both satellite systems and all channels, but progressed towards a single system (Astra), standard (PAL) and five channels.

Meanwhile, across the Irish Sea, in the Republic of Ireland, the government granted a DBS franchise to Atlantic Satellites, owned by Hughes Communication and James Stafford, an Irish shipping entrepreneur. Atlantic Satellites aimed also at the UK, France, the Netherlands, and parts of Scandinavia (Logica, 1987, p. 219).

Pan European and International Satellites

The international telecommunication satellite organization, Intelsat, is an umbrella organization with over 100 member countries, headquartered in Washington, D.C. It holds exclusive rights for civilian international telecommunications satellite service, although in the 1980s its monopoly began to be challenged by would-be entrants such as Orion and PanAm Sat.

In 1989, five low-power Intelsat satellites were transmitting video signals throughout Europe. The services on Intelsat satellites included Children's Channel, CNN, MTV Europe, Premiere, TV3, BBC-TV Europe, BR3, Pro7, Tele. 5, and SVT 1 and 2 (Swann, 1989, p. 56).

A second international body is the European Telecommunications Satellite

Organization (Eutelsat), founded in 1977 by twenty-six European PTTs. Its original purpose was to provide trans-European communications. However, its low-power satellites 1F4 and 1F5 are used primarily for cable and television distribution.[4] By 1987, 75 percent of Eutelsat's revenues were derived from cable (Logica, 1987, p. 157). A more advanced generation of satellites, Eutelsat II, was launched in the medium-power range. These offerings, in addition to Astra, Intelsat, and various national satellite systems, were expected to create a large supply of more than 200 transponders after 1993, half of them on the six Eutelsat IIs. Eutelsat was hampered by a need to give priority to its PTTs sponsors, by lack of managerial autonomy, and by an inability to group transponders together at convenient orbital positions.

United States

The DBS situation in the United States will be briefly reviewed here for the sake of completeness and comparison. The United States has several advantages over most other industrialized countries with respect to DBS power requirements. Its 525-line NTSC transmission format needs a bandwidth of only 4.2 MHz, in contrast to the 5.5 MHz of a European 625-line. This corresponds to a further gain of 2.5 dB/W, although at the expense of a lesser definition of pictures. Furthermore, Americans have fewer political problems than Europeans in accepting a lower-quality DBS signal at the edges of the footprint. The quality of the American television picture varies widely, partly because of a policy of localism in broadcasting, which leads to hundreds of different stations with limited signal strength. There was also greater willingness if not eagerness in the United States to add as many transponders as possible—which favored medium over high power—because the forces opposing a multichannel television environment were much weaker than those in Europe.

For these reasons, the United States moved toward medium-power satellites. This trend was complemented by a convergence from both directions of the power scale. "Pure" DBS projects scaled down their power demands and found mediumpower technically adequate and economically superior. Equally important, cable television program networks, previously users of low-power satellite signals (10–20 watts), grew interested in using medium-power transmission signals (around 50 watts) that could be marketed to households as "satellite-direct" where cable television was unavailable.

Although the FCC granted ten conditional construction licenses for high-power DBS to private interests, none have operated. Only one medium-power DBS system actually operated in the United States: USCI, a consortium of Prudential Insurance, General Instruments, and the Galesi investor group, initiated service in late 1983. One and a half years later, the company ceased operations, having gained only 10,000 subscribers. Even with a considerable tax-loss carry-forward, it was unable to attract a buyer.

Another major DBS project was promoted by Comsat, the U.S. designated

satellite carrier in Intelsat. Initially it envisioned four satellites covering the United States with some overlap. Each satellite was to have three transponders of 230-watt strength, and the project's cost was expected to be over $1 billion, comparing poorly with rival delivery systems. Whereas the high-power Comsat system required a $75 capital investment per household reached and program channel supplied, other technologies were considerably cheaper: cable television was $17, microwave Multipoint Distribution Service was $15, and Satellite Master Antenna TV was $12 (Henry, 1985). In the face of this market pressure, the project was first scaled down and then completely abandoned in 1984.

Many observers of USCI's dismal failure and Comsat's troubles concluded that DBS was dead in the United States. But with equal justification, one can say that DBS is alive and well, and gaining the interest of a new and promising set of major media firms.

This seeming contradiction resulted from the development of DBS in ways not anticipated by the original governmental and corporate planners. Such "supply-side" television, similar in approach to that taken by Western European governments, missed the market because it generally underestimated the difficulties of the technology itself as well as those of subscription marketing and program acquisition. Yet although major corporations foundered in "real" DBS, a demand for "quasi"-DBS emerged virtually spontaneously from the consumer end all across the United States. Spearheaded by do-it-yourselfers and promoted by small entrepreneurial businesses, hundreds of thousands of people set up satellite antennas in their backyards and farms, and the home "dish" antennas soon numbered more than 2 million.

The key impetus for the expansion on the ground is the equally rapid expansion in the sky. Fueled by the expansion of cable television and the drop in satellite transponder costs, a large number of program suppliers emerged to fill the multichannel cable medium with a variety of program wares ranging from the Eternal World Television Network to the Pleasure Channel. All these programs could be received via satellite without any payment to the program providers. In fact, until 1985 an antenna owner *willing* to pay a fee to a program supplier had no mechanism to do so.

When there was only a small number of private backyard satellite receivers, the cable television operators and their program providers shrugged off the matter as transitory and as a reflection of a demand that was caused by the often tortuous process of awarding municipal cable franchises. They responded negatively only when programs were resold to third parties without permission or royalty payment. (In several Caribbean countries, American program suppliers are largely powerless to inhibit unauthorized commercial distribution.) With the growing numbers of TV receive-only (TVRO) owners, however, it became evident that quasi-DBS reception was not transitory but permanent in the following areas: low-density areas that were not likely to be reached by cable; cabled urban and suburban settings where viewers sought to avoid payment of the often substantial cable subscription fees or where they sought added

(5)

diversity: and apartment house settings, where landlords were setting up unregulated Satellite Master Antenna Television (SMATV) distribution. The potential and real revenue losses galvanized the cable industry into legislative, judicial, and organizational action. The losses also led the industry to begin recognizing the potential of the market and to view it as a natural extension of its activities and an opportunity rather than a rival.

There were several approaches to the prevention of backyard satellite reception. Some municipalities banned TVROs, partly for aesthetic reasons. Antenna vendors were challenged in court for knowingly selling equipment to be used for the reception of unauthorized signals. A much more effective approach, however, involved reaching the source of program supply. For cable operators to be protected from "free" DBS, the key condition of excludability needed to be fulfilled. At a substantial cost, the market leader HBO thus introduced the scrambling of satellite signals.

Scrambling originated as a defensive move to terminate piracy. It immediately gained commercial potential, however, since it enabled program providers, including HBO, to sell their programs *retail* to satellite viewers, instead of *wholesale* through cable operators. In the landmark Cable Communications Policy Act of 1984, Senator Barry Goldwater, the conservative champion of high-tech individualism—and owner of his own satellite dish antenna—successfully sponsored a provision that guaranteed the right to receive for private viewing any satellite channel without payment obligation, unless the supplier encrypted the signal and had operational marketing mechanisms to supply these programs. The legislation created an incentive for the more popular satellite channels to set up a DBS retailing system, at least in noncabled areas. A cable program supplier's desire to set up such a direct marketing system must be distinguished from its ability to maintain it in a competitive environment. In effect, HBO was asking TVRO owners to pay $400 for unscrambling equipment (which would be incompatible with many of the TVROs, and would thus require further costly modifications) and a monthly fee of $13 thereafter. A backyard pirate has no reason to consent to such domestication. Although HBO is the most popular pay channel, there are substitutes for it. To succeed in signing up satellite viewers, HBO would have to be joined by other channel suppliers in adopting scrambling. Given the often high cost of doing this, it is not surprising that program suppliers did not initially join HBO in offering a "scrambled package."

The other possibility for creating an economic foundation for hybrid DBS was for program suppliers to follow the traditional pattern of commercial broadcasting and become advertiser supported. More specifically, the satellite signal could have advertising messages inserted into programs for "satellite-direct" viewing. Receiving the same programs for retransmission to households via cable, the cable operator could either retain the commercials and benefit from their revenue or excise them. Several minutes of lag would accumulate periodically, but on a majority of programs realtime is not important.

To succeed in scrambling, the major program suppliers would have to be-

have oligopolistically, since they would have to agree on and enforce joint action. In the past they had not been able to do so, given competition. Therefore, the involvement of the cable operators, as distinguished from the program providers, became significant. In effect, major cable operators could organize a "scrambling cartel" by insisting on carrying only those channels that had been scrambled by their program providers. It makes perfect business sense for the cable operator to insist on a program provider's scrambling, since free satellite reception of unscrambled signals diverts some of its customers. It also facilitates the entry into redistribution DBS as local agents of program suppliers, protecting them from competition with their own program suppliers.

Given these realities on the ground, the space segment adjusted. Since 1986, HBO has offered "satellite-direct" service. Other cable channels followed suit. In 1989, there were thirty-one scrambled services available to home dish owners (*Cable and Station Coverage Atlas*, 1989). Viewers may subscribe directly from HBO, or, in areas where cable franchises operate, from cable operators acting as service agents.

Thus, direct satellite reception is alive in the United States as a supplement to cable distribution, especially in areas where cable is unavailable or expensive. Recognizing this market niche, in 1990 several major consortia announced DBS plans. One was to launch the four-satellite, 108-channel Sky Cable service that brought together NBC (one of the three major commercial networks), Hughes Communications (the satellite firm owned by General Motors), Cablevision (a major cable distribution and program packaging firm), and News Corp. (Rupert Murdoch's U.S. holding, which would benefit from his European DBS). Another system included AT&T, using its communication satellites and providing billing and subscription information via the telephone network's signaling channel (*Satellite Week*, 1990, p. 5).

Conclusion

DBS has been both a failure and a success. Defined as a high-powered satellite, it turned out to be, at least during the 1980s, an obsolete concept that kept going, even after being recognized as such, from sheer momentum, absence of analysis, and political and economic muscle. There are very few subscribers to such a type of DBS. Though the numbers of viewers reached by DBS that are published appear large [e.g., 10 million in the Netherlands, 6 million in Belgium (Glenn, 1989a)], in reality they are virtually all regular cable television viewers who receive the program via their cable head-end, which could almost as well receive them from a vastly cheaper low-power telecommunications satellite. On the other hand, DBS is a sensible way to go if it is based on more economical medium-power, multitransponder satellites such as Luxembourg Astra, the Eutelsat II generation, or the Sky Cable project planned for the United States. The target audience of direct reception, instead of encompassing the entire population as planned in the past, is becoming those for whom cable

transmission is uneconomical or as yet not available. The latter is especially the case in countries only partially cabled: France, the United Kingdom, Italy, Spain, Portugal, and Greece. (In several of these countries, however, cabling is steadily progressing, thus reducing the market for direct cable reception). Medium-power satellites hence appear to be a sensible compromise that permits an economic reach of both cable head-ends and households.