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Commercial Space Policy: Theory and Practice

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NASA's commercial space policy is designed to encourage private involvement in commercial endeavors in space. The policy introduces approaches and incentives to reduce technical, financial, and institutional risks inherent in commercial space ventures to levels competitive with conventional investments. The policy is implemented through such special initiatives as joint endeavor agreements. An application of this type of agreement is described as it pertains to facilitating the birth of a new multibillion dollar communications industry. This is made possible by the development of mobile communications by satellite. This unique capability is expected to provide two-way voice, data, paging, and position location services to mobile users primarily in nonurban areas on a nationwide or regional basis. Thin route inexpensive fixed service telephony may also be possible. This is the culmination of almost ten years of regulatory, technical, experimental, financial, and institutional studies.

SUMMARY OF SPACE COMMUNICATION POLICY: GOALS AND PRINCIPLES

The primary goal of NASA's commercial space policy is to encourage and stimulate free enterprise in space.[1] Implementation of this policy is guided by five principles:

1. *The government should reach out to and establish new links with the private sector.* NASA will broaden its traditional links with the aerospace industry and the science community to include relationships with major non-aerospace firms, new entrepreneurial ventures, as well as the financial and academic communities.

2. *Regardless of the government's view of a project's feasibility, it should not impede private efforts to undertake commercial space ventures.* If the private sector is willing to make the necessary investment, the project's feasibility should be allowed to be determined by the marketplace and the creativity of the entrepreneur rather than the government's opinion of its viability.

3. *If the private sector can operate a space venture more efficiently than the government, then such commercialization should be encouraged.* When developing new public space programs, the government should actively consider the view of, and the potential effect on, private venture.

4. *The government should invest in high-leverage research and space facilities which encourage private investment. However, the government should not expend tax dollars for endeavors the private sector is willing to underwrite.* This will provide at least two benefits. First, it will enable NASA to concentrate a greater percentage of its resources on advancing the technological state-of-the-art in areas where the investment is too great for the private sector. Second, it will engage the private sector's applications and marketing skills for getting space benefits to the people.

5. *When a significant government contribution to a commercial endeavor is requested, two requirements must be met. First, the private sector must have significant capital at risk, and second, there must be significant potential benefits for the nation.* In appraising the potential benefits from and determining appropriate government contributions to commercial space proposals, NASA will use an equitable, consistent review process.

A possible exception to these principles would be a commercial venture intended to replace a service or displace a NASA R&D program and/or technology development program of paramount public importance now provided by the government. In that case, the government might require additional prerequisites before commercialization.

IMPLEMENTATION

In implementing this policy, NASA will take an active role in supporting commercial space ventures in the following categories, listed in order of importance:

- new commercial high-technology ventures
- new commercial applications of existing space technology
- commercial ventures resulting from the transfer of existing space programs to the private sector.

NASA will implement initiatives to reduce the technical, financial and institutional risks associated with doing business in space.

- To reduce technical risks, NASA will support research aimed at commercial applications; ease access to NASA experimental facilities; establish scheduled flight opportunities for commercial payloads; expand the availability of space technology information of commercial interest, and support the development of facilities necessary for commercial uses of space.
- To reduce financial risks, NASA will continue to offer reduced-rate space transportation for high-technology space endeavors; assist in integrating commercial equipment with the shuttle; provide seed-funding to stimulate commercial space ventures; and, under certain circumstances, purchase commercial space products and services and offer some exclusivity.

- To reduce institutional risks, NASA will speed integration of commercial payloads into the Orbiter; shorten proposal evaluation time for NASA/private sector joint endeavor proposals; establish procedures to encourage development of space hardware and services with private capital instead of government funds; and introduce new institutional approaches for strengthening NASA's support of private investment in space.

A high-level Commercial Space Office has been formed within NASA as a focal point for commercial space matters. This office is responsible for implementing the NASA policy to stimulate space commerce and has sufficient authority and resources to fully carry out this assignment.

MOBILE COMMUNICATIONS VIA SATELLITE —A NASA INITIATIVE

A satellite-relayed communications system can provide voice and data communications services to mobile users throughout the western hemisphere.[2] Its operation would be similar to that of terrestrial-based land mobile communications systems in which vehicles within line-of-sight of a 50–400 foot ground-based relay tower can communicate with one another. The lines-of-sight of these terrestrial-based systems range only from 3–40 miles. A satellite in geostationary orbit acts as a 22,000 mile high "relay tower," extending the communications system lines-of-sight over almost all of the western hemisphere. Using this height advantage to provide line-of-sight to remote and/or thinly populated areas, mobile communications via satellite can augment and extend terrestrial based mobile communications systems which primarily serve urban areas.

The proposed new service would help the United States achieve affordable nationwide mobile communications by extending existing and planned mobile telephone and private mobile radio services into rural areas not currently served.

User Equipment Would Be Simple, Affordable, Reliable, Small

The intent is ultimately to use the same mobile communications equipment for terrestrial and space systems.[3] Space system users would be able to access terrestrial networks and vice versa. The cost of satellite-compatible mobile communications equipment would be similar to the price of existing terrestrial mobile communications equipment ($500–$2,500). Applicable user charges are expected to be comparable to terrestrial telephone services or private networks.

There Is a National Need

Rural or non-Metropolitan Statistical Areas (MSA) represent 85 percent of the geographical area of the United States, 25 percent of the population (60 million people) and 20 percent (15 million workers) of the nation's commercial/industrial activity. The characteristics of commercial and local government activities and employment are essentially the same within and outside the MSA's. Nationwide, 27 percent of local government activity is located outside the MSA's (e.g., fire, police, school bus, emergency).

There is a recognized need for mobile communications in rural areas. However, terrestrial cellular systems are not expected to expand significantly into rural areas, and terrestrial private radio networks may be economically and/or geographically impractical in many rural areas. Since satellites are well suited for wide area, dispersed population coverage mobile communications via satellite augmenting terrestrial services may be much better able to serve widely dispersed and rural users.

Unique wide area coverage and reliability requirements of many Federal, state, and local agencies, and other public safety organizations can be met only through use of a space service that has a mobile communications capability. The Congress has recently imposed a requirement for nationwide continuity of mobile communications for public safety purposes. There are similar needs in the private sector. Only mobile communications via satellite augmenting (not competing with) terrestrial mobile communications can provide nationwide coverage. And finally, the results of ten years of user experiments and studies involving

industries with widely diverse and rural operations (e.g., trucking, oil and gas, electric power utilities, rural telephone, and emergency medical services) demonstrate the need.[4]

It Is Technically Feasible

The present state-of-the-art is adequate for a first generation system. NASA's experimental ATS-6, in 1974, demonstrated the ability of a 10-meter satellite antenna to support terrestrial mobile units using modified off-the-shelf mobile communications equipment with small omni-directional and medium gain antennas. Canada plans to develop and provide mobile communications via satellite in 1988.[5] U.S. corporations have filed with the FCC for licenses to build satellites and to operate similar systems in the late 1980s.

By the 1990s, a later generation medium to high capacity satellite may use a 20–55-meter antenna with 10–100 spot beams ensuring spectrum conservation through frequency reuse.

It Is Economically Viable

The nonurban market for mobile communications units is estimated to range between 640,000 and 2,445,000 by 1995. Annual revenues to a system operator of between $0.5 and $1.0 billion are projected and internal rates of return of 20 percent to 40 percent are considered realizable.[6] Venture capital has been raised and commercial applications have been filed with the FCC for authority to build and launch satellites for mobile communications and to offer mobile communications via those satellites.

WHERE DO WE GO FROM HERE?

For the United States to begin commercialization, provide for growth, and continue with high risk technology development, adequate frequency spectrum must be allocated by the FCC. This issue is the subject of a current FCC Rulemaking Proceeding, RM-84-1234, which is in response to NASA's November 1982 Petition for Rulemaking.[7]

NASA's Goal And Role

NASA's goal is to facilitate and encourage the commercialization of its technology. This process involves minimizing technology, regulatory, and financial risks. NASA is now at the threshold of culminating nearly ten years of effort toward achieving this goal with respect to mobile communications.[8] Large technology and financial risks have been reduced, leaving the regulatory risk as the primary obstacle in the path of commercialization. In many ways the regulatory process has served to "protect" established institutions but at a heavy cost. This process has suppressed or slowed down the development and the commercialization of new communications technology. Potential new communication services or new technological advances are almost always perceived as a competitive threat to the nonsponsors. New services and technical innovation also represent impending change. The prospect of change—any kind—is always uncomfortable and more often than not somewhat frightening to existing institutions. For years, large well-established U.S. entities opposed the introduction of domestic satellite services back in the sixties. Costly years of regulatory proceedings and lobbying finally cleared the way for U.S. commercial services, but not before Canada charged ahead and obtained three choice geostationary orbit positions at the expense of U.S. national interests. The same process took place for more than ten years with respect to broadcast satellite services. Twelve years of costly proceedings transpired before terrestrial cellular mobile communications became a reality. Proceedings for a Land Mobile Satellite Service actually began in the mid '70s during U.S. preparations for the 1979 World Administrative Radio Conference (WARC). Proposals for enabling the satellite service were introduced by NASA during eight FCC Notices of Inquiry in the 1970s.[9] This persistence, supported by many years of study and experiments and technology development, culminated in a U.S. position advocating primary allocations in the 800 MHz band shared with terrestrial Land Mobile Services. The 1979 WARC approved these proposals.[10] Now, ten years after the initial proposals, these efforts are about to bear fruit domestically.

The Federal Communications Commission released a

Notice of Proposed Rulemaking on January 28, 1985 (General Docket no. 84-1234), in response to NASA's November 1982 Petition for the Establishment of a Land Mobile Satellite Service (RM 4247). Key provisions include:

- A strong statement that the Mobile Satellite Service is needed;
- A proposed primary allocation of 821–825 MHz;
- A statement of intent to allocate additional bandwidth in the 1500/1600 MHz band ("L" band)
- A recognition that communication services other than mobile (e.g., fixed, broadcast, data, paging) through the mobile should be permitted provided that mobile is the primary use
- Applications for MSS systems will be accepted in parallel with the rulemaking proceeding.

Comments are due by April 22, 1985, and replies by May 22, 1985. Mobile satellite applications for licenses are due April 30, 1985. Since the extent to which Mobile Satellite Services will be implemented and prove useful is very much a function of the public's involvement in the regulatory process, NASA is bringing an awareness of this proceeding to the public.

- NASA's role and interest in this FCC rule-making proceeding is based upon long-standing precedent. NASA developed critical technology and helped define parameters and frequency allocations for the Fixed, Broadcast, and Earth Resource Satellite Services (among others) well in advance of the definition of institutional roles and responsibilities for these services.
- The spectrum allocation is an essential step for commercial activity to begin. Without the assurance of a primary frequency allocation and adequate bandwidth, commercial mobile communications via satellite would never become a reality. Clearly, it is also not desirable for NASA to invest large sums of R&D dollars in high risk communications technology if

this technology cannot ultimately be exploited by the private and public sectors.

- NASA is prepared to enter into a joint agreement with U.S. industry to facilitate commercialization, develop the technology needed for growth, and to conduct experiments. On February 25, 1985, NASA issued an Opportunity Notice for a Mobile Satellite Agreement in parallel with the FCC rule-making proceeding on MSS allocations. NASA intends to offer the U.S. firm licensed by the FCC to provide Mobile Satellite Services specified standard shuttle launch services in return for a specified amount of satellite channel capacity on the first commercial mobile satellite system. NASA and other government agencies will use this capacity for a period of two years to conduct experiments. Details of this arrangement are described in the referenced document.
- NASA is working with Federal and state government organizations to develop communications experiments using the first U.S. commercial satellite for mobile communications.
- Canada's Department of Communications and NASA have signed an agreement (November 1983) to cooperate toward the establishment of commercial mobile communications via satellite.

SUMMARY

Too often, the process of commercializing new communication satellite technology has been excessively long and costly. Regulatory, institutional, and economic barriers have been key factors in causing this delay. NASA has initiated a focused effort to facilitate the commercialization of space technology through technical, financial, and institutional initiatives. As a result of these efforts a new Land Mobile Satellite Service has been developed and is expected to be in commercial operation by the late 1980s.

This service, which is expected to spawn a new multibillion dollar industry, will help the United States achieve affordable nationwide mobile communication by extending existing and planned mobile telephone and private mobile radio services into rural areas not currently served.

NOTES

1. NASA, Commercial Use of Space Policy, NASA Headquarters Code I, October 29, 1984.

2. NASA, Mobile Communications Via Satellite—The Land Mobile Satellite Service, NASA Headquarters Code EC, December 1984.

3. NASA, Petition for Rulemaking, Amendment of Parts 2, 22, and 25 of the Commission's Rules Relative to Satellite Augmentation of Terrestrial Cellular and Non-Cellular Mobile Communications Systems through Establishment of a Mobile Satellite Service, RM 4247, November 24, 1982. NASA Headquarters Code EC.

4. J. Freibaum, NASA, "Need for, and Financial Feasibility of, Satellite-Aided Land Mobile Communications," IEEE International Conference on Communications, Philadelphia, Pa., Conference Record volume 2 of 3, ref. 7H.1 P.A. Castruccio, ECO systems; C. S. Marantz, Citibank, N.A., J. Freibaum, NASA, June 1982.

5. Canada, DOC, Proposed Spectrum Utilization Policy, Government of Canada, Department of Communications, June 1984.

6. Citibank, NA, "Financial Study for a Satellite Land Mobile Communications System," Combined—Phase A—Industry Analysis Report, and Phase B—Financial Structures Report, Corporate Finance Division, Merchant Banking Group, JPL Purchase Order Number BP-73664 for NASA, December 16, 1981.

7. FCC, Notice of Proposed Rulemaking, Amendment of Parts 2, 22, and 25 of the Commission's Rules to Allocate Spectrum for, and to Establish Other Rules and Policies Pertaining to, the Use of Radio Frequencies in a Land Mobile Satellite Service for the Provision of Various Common Carrier Services, General Docket No. 84-1234, RM-4247, adopted November 21, 1984, released January 8, 1985.

8. NASA, Opportunity Notice for a Mobile Satellite Agreement—NASA Headquarters Code EC, February 25, 1985.

9. NASA, "Petition for Reconsideration" before the Federal Communications Commission. "An Inquiry Into the Use of the Bands 825–845 MHz and 870–890 MHz for Cellular Communications Systems," FCC Docket No. 79-318 and Other NASA Filings Under This Docket and Dockets 79-112, 79-113, 80-10 and 80-739, June 22, 1981.

10. International Telecommunication Union, "Final Acts of the World Administrative Radio Conference, Geneva, 1979" (WARC-79). A general revision of the International Radio Regulations.