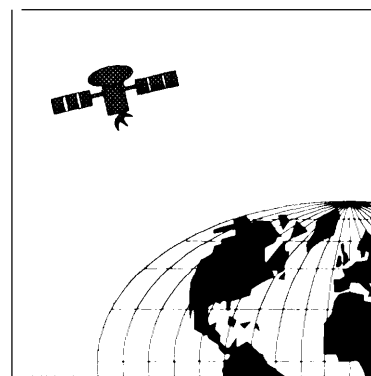
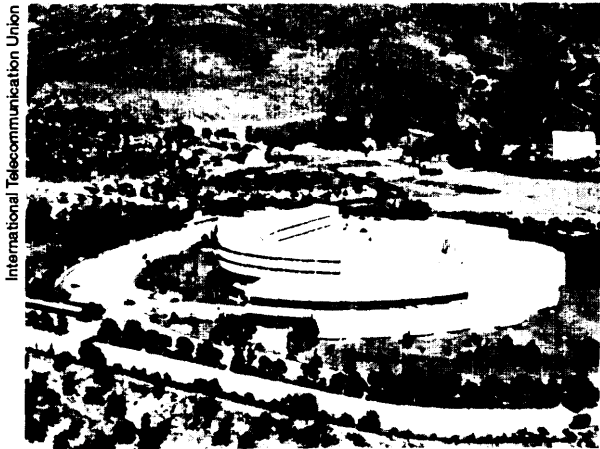


Summary and Findings | 1

For 50 years, radio technologies and services have played an important role in the daily lives of people all over the world. Radio waves carried messages of hope to millions of people caught behind the Iron Curtain. They allowed Americans to see and hear Neil Armstrong's first steps on the Moon. In more recent years, satellite communications have allowed us to witness events from around the globe as they happened—the fall of the Berlin Wall and a lone Chinese student facing an advancing tank in Tiananmen Square. Radio waves also make possible services and technologies considered commonplace today—radio and television programs, cellular telephones, and even microwave ovens, remote garage-door openers, and baby monitors. Advances in radio technology are giving birth to a wide range of new products and services, including pocket-sized telephones that may allow people to make and receive calls anywhere in the world, high-definition television (HDTV) that will provide superior quality pictures and sound, and digital radios that will provide static-free listening.

The process of coordinating the radio frequencies used by different wireless services and systems, and harmonizing radio-communication policies worldwide is an extremely complex task. Procedures must be developed that allow radio services to share sections of the radio frequency spectrum, and international agreements must be negotiated so that systems and equipment in different countries can interconnect and not interfere with each other. The job of harmonizing and regulating telecommunication and radio services on a worldwide basis falls to the International Telecommunication Union (ITU), a specialized agency of the United Nations. In order to allocate radio frequencies for specific radiocommunication services and to negotiate the rules and regulations that govern the use of those services internationally,





For 4 weeks in February 1992, delegates from around the world met in the Palacio de Congresos in Malaga-Torremolinos, Spain for the 1992 World Administrative Radio Conference.

ITU-member countries periodically gather in World Administrative Radio Conference (WARCs). The latest conference, the **1992** World Administrative Radio Conference (WARC-92), took place in Torremolinos, Spain over the month of February 1992. Among other issues, WARC-92 addressed frequency allocations for a wide range of existing and emerging radio services and sought to define the regulations that will govern them.

Despite the growing role wireless services play, the world of international radiocommunication policymaking is largely removed from public view. The institutions and procedures that guide the development and coordination of wireless services worldwide have long been the province of engineers-not politicians or diplomats. Today, however, as the frequencies used for radiocommunication become increasingly congested, the problems of regulating international uses of the radio spectrum are becoming progressively more complex. And as the connections between radiocommunications, international trade and competitiveness, and national security have become

clearer, these problems have begun to draw more high-level attention from American and foreign policymakers.

REQUEST FOR THE STUDY

In November 1991 the Office of Technology Assessment (OTA) released a background paper, *The 1992 World Administrative Radio Conference: Issues for U.S. International Spectrum Policy*.¹ That paper examined the technologies and issues to be considered at WARC-92, discussed the international and domestic context for WARC-92 preparations, and analyzed the U.S. process of conference preparation.

To complete the analysis of WARC-92 begun in that paper, the House Committee on Energy and Commerce and the Senate Committee on Commerce, Science, and Transportation requested that OTA prepare a follow-on study that would examine the outcomes of WARC-92 and their implications for U.S. radiocommunications policy. Noting the importance of international radio frequency allocations to emerging and established radiocommunication services and domestic industries, the Committees requested that OTA assess the relative success of the U.S. proposals to WARC-92 and analyze the potential impacts that the conference's decisions might have on domestic radiocommunication services and policymaking, the international competitiveness of the United States in new radio services, and the ability of the United States to achieve its diplomatic and foreign policy goals.

To answer these questions, OTA focused its analysis in three areas:

1. What decisions were reached at WMC-92? What implications will these decisions have on the development of new radio-based technologies and services in this country? How will the decisions of WARC-92 affect

¹ U.S. Congress, Office of Technology Assessment, *The 1992 World Administrative Radio Conference: Issues for U.S. International Spectrum Policy—Background Paper*, OTA-BP-TCT-76 (Washington DC: U.S. Government Printing Office, November 1991). Hereafter "O'IX, WARC-92."

U.S. international competitiveness in radio-communication applications and services internationally?

2. How successful were U.S. proposals to WARC-92? What were the barriers to greater success? What lessons can be drawn from the WARC-92 experience?
3. How does the current structure of radiocommunication policymaking in the United States contribute to and/or detract from the ability of the country to influence international radiocommunication policymaking? What types of organizational or procedural changes might be needed for the United States to adapt to changes in the international procedures for setting international radiocommunication policy?

This report is divided into three parts. Chapter 1 presents an overview of WARC-92, including an analysis of the themes of the conference and a discussion of the factors that will affect implementation of the final decisions. The chapter also presents options for restructuring the U.S. WARC preparation and radiocommunication policymaking processes to better respond to the challenges of the 21st century. Chapter 2 presents a detailed discussion of the allocation and technology issues that were most important at WARC-92, discusses the issues involved in domestic and international implementation of WARC-92 allocations, and considers the implications for existing and emerging U.S. radio technologies and services. Chapter 3 discusses—in the context of WARC-92 outcomes—the preparation for WARC-92, the management of preparations and conference negotiations, and changes that may be needed in the domestic structures and processes for preparing for and implementing decisions made at future world radiocommunication conferences.

SUMMARY OF FINDINGS

The following section summarizes the conclusions OTA reached as a result of its research. The

underlying bases for these findings are discussed in more detail throughout the report.

Overall, United States proposals enjoyed mixed results at WARC-92. U.S. negotiators achieved some notable successes, but also suffered some defeats. On many of the most important and controversial issues considered by the conference, the broad objectives of the United States were achieved. For example, the United States was successful in preventing changes in spectrum allocations that could have harmed important domestic radiocommunication systems and services. The United States was also successful in persuading the conference to adopt allocations for many important new and existing services, including low-Earth orbiting satellite (LEOS) systems, space research and communications systems, and high-frequency broadcasting (see box 1-A).

However, these successes were often tempered by constraints on how, when, or where the newly-allocated frequencies could be used. It is un-

clear how serious (and permanent) these limitations will be, and it may not be possible to assess their impact on new radio services until systems begin operation. Thus, the ultimate effects of some WARC-92 decisions are still uncertain, and evaluations of the implications of these decisions must remain tentative.

Any evaluation of the outcomes and implications of an international conference will be colored by the perspective one takes. WARC-92 is no exception. Depending on how the goals and objectives of the conference are defined, the results are more or less successful. Taking a narrow perspective, and merely comparing U.S. proposals with the results of the conference may lead to an overly negative assessment of the outcomes of WARC-92. Many analysts prefer a

*United States
proposals
achieved
mixed results
at WARC-92.*

Box 1-A—Radio Technologies and Services Considered at WARC-92

WARC-92 allocated radio frequencies for many different new and existing wireless services. These services, and the technology systems that will provide them, address a wide range of commercial, public safety and information, and government needs. Over the next several years, technical, economic, and political decisions will be made about how to implement these services, and the regulations agreed to at WARC-92 will substantially affect how, when, and where they can be used. Each of these topics is discussed more fully in chapter 2.

Mobile Services—Radio systems that use land-based towers to serve mobile users (in cars, trucks, ships, aircraft, and on foot) are one of the fastest growing segments of the radiocommunication industry. Hundreds of companies around the world have proposed new mobile applications that will deliver a wide variety of new (and old) services, including paging and messaging, telephone, facsimile, data communications, and even imaging and video services. Europe is developing a global system for mobile communications, or GSM, and a future public land mobile telecommunications system (FPLMTS). In the United States, development has centered on personal communication services (PCS).

Mobile-Satellite Service—MSS provides many of the same services as terrestrial mobile systems, but uses satellite to serve larger geographic areas and markets. The additional spectrum allocated at WARC-92 may allow the expansion of services by existing providers and may bring more competitors into the market.

Low-Earth Orbiting Satellites—LEOS systems are a specific kind of MSS that plan to use a network of between 12 and 66 small satellites in low orbits (typically less than 1,000 miles high versus the 22,300 miles altitude of a geosynchronous satellite orbit), to provide a variety of mobile communication services either regionally, or globally. Two types of LEOS systems have been proposed. “Little” LEOS systems plan to provide position location and data communication services that will allow users to send short text messages to and from almost anywhere in the world. The systems would also be able to find lost hikers, stranded motorists, or lost ships or planes. “Big” LEOS systems plan to use their satellite networks to provide global wireless telephone service, in addition to some data and position services, to international travelers, users not served by cellular systems, and those in remote areas with no telephone service.

Broadcasting-Satellite Service-Sound—BSS-Sound refers to the delivery of audio programming (music, news, etc.) from satellites directly to consumer radios. While no BSS-Sound services are operating yet, the systems now being developed would use digital technology to broadcast CD- or near CD-quality programming to listeners, who would receive the programming on radios that would be portable/mobile, low-cost, and able to

broader analysis that recognizes the difficulty of international negotiations and accepts that not all U.S. proposals will be adopted at any given conference. These analysts believe that results are more accurately judged in the context of longer-term negotiating across several conferences and many years. From this perspective, the mixed results of the U.S. proposals at WARC-92 are seen as only the first step in achieving U.S. objectives, and analysts who take this view see WARC-92 as a success for ‘opening the door’ to

new radio services. The limited successes of WARC-92 will serve as the foundation for future proposals as U.S. representatives pursue frequency allocations and regulations favorable to U.S. radiocommunication interests.

Some analysts, however, prefer an assessment that views WARCs and their outcomes in isolation from the larger radiocommunication policy process. From this perspective, to the extent that U.S. proposals were adopted by WARC-92, the conference was a ‘success’ ‘—whatever occurs

receive signals across large geographic areas.¹ Some developers of BSS-Sound systems plan to augment the satellite system with terrestrial transmitters that would improve reception in urban areas (between buildings, in tunnels, etc.). Proponents see many markets for the new digital services, including entertainment, education, paging operations, and navigation and traffic management. In addition to purely domestic services, international broadcasters see BSS-Sound technology as an important new way to eventually transmit their programming—a service that would allow them to reach listeners all over the globe with higher quality than the high-frequency broadcasting they use today.

High-Frequency Broadcasting—HF broadcasting allows international broadcasters such as the Voice of America (VOA) and the British Broadcasting Corporation (BBC), as well as religious broadcasters, to transmit their programming around the world. International broadcasts typically include news and information services and religious programming as well as music. Many countries, including the United States, use HF broadcasting to reach people around the world regardless of political boundaries in order to champion their political, cultural, and economic beliefs. In this role, HF broadcasting is viewed by many nations as an important tool of foreign policy. The United States currently broadcasts more hours of international programming than any other country.

Aeronautical Public Correspondence—APC services allow airline passengers to make (although not receive, yet) telephone calls while in flight. While such services have become relatively common in the United States, WARC-92 designated frequencies that can be used to provide this service around the world.

Broadcasting-Satellite Service/High-Definition Television—WARC-92 also allocated frequencies that will allow programmers to deliver HDTV from satellites. This could provide competition for the traditional cable and broadcast industries in the delivery of the next generation of television programming.

Space Services—Various space services, including communication between space vehicles and space research, received allocations at WARC-92. The need for communications to support space activities by the nations of the world has grown significantly in recent years. Radio frequencies are used in space to communicate with manned spacecraft, to command and control satellites, to relay data from remote-sensing satellites to Earth, and to communicate with astronauts working outside their spacecrafts. The United States, for example, uses these frequencies during shuttle missions, for support of the Hubble Space Telescope, and could need them for the planned operations of Space Station Freedom.

¹ Because existing AM/FM radios use analog technology, they will not be able to receive the new digital BSS-Sound signals. Consumers will have to buy new (digital) radios in order to listen to the new services.

SOURCE: Office of Technology Assessment, 1993.

after the conference should be considered separately. OTA believes this perspective is too restrictive and takes the decisions made at WARC-92 out of context—the goals and objectives for U.S. participation in a WARC should advance the larger radiocommunication goals of the United States. Such a narrow perspective may also obscure flaws that might exist in the policy development and/or preparation process.

Concentrating on the “success” or “failure” of U.S. proposals may oversimplify the

results of WARC-92 and may also obscure the nuances of implementing the frequency allocation decisions made at the conference. Several factors will affect how WARC-92 decisions are implemented and what the implications of those decisions will be. First, WARC-92 does not mark the end of international spectrum negotiations, nor does it represent the final resolution of the issues it addressed. It was only one, albeit important, step in the continuous process of allocating and regulating frequencies internation-

ally. Similarly, the agreements reached at WARC-92 are not cast in stone-future negotiations and world radiocommunication conferences may modify or even reverse some of them. This fact works both for and against those who take a 'long view.' When decisions are subject to review, it is easier to downplay negative outcomes as only a temporary or minor setback that will eventually

Agreements reached at WARC-92 are not cast in stone----future conferences may modify or even reverse some of them.

be overcome through future negotiations. On the other hand, the successes achieved by U.S. negotiators are also subject to review and/or modification. Winning favorable power limits

at WARC-92, for example, does not mean that such limits will not be changed (in ways unfavorable to U.S. interests) based on further studies or operational experiences.²

Second, many of the details involved in implementing the new allocations and services are yet to be worked out. The decisions reached in Spain must now be adopted by each ITU-member country, and any conflicts in implementing WMC-92 allocations and the systems that will use them will have to be resolved in negotiations between countries. In those bands of frequencies where spectrum must be shared, users will have to work out sharing arrangements to prevent harmful interference. In addition, many of the technical details that will affect the future of these services and technologies are still undecided. WARC-92 called on the International Radio Consultative Committee (CCIR) to conduct studies on the technical aspects of many of the allocations adopted.

Third, WARC-92 assigned long transition times to many services before new allocations can be used, making the implications of WARC-92 difficult to foresee. Some WARC-92 allocations cannot come into effect for 10 or 15 years in order to give existing users of the bands adequate time to move to other frequencies. The full force of some of the decisions made at WARC-79, for example, are just beginning to be felt. Likewise, some WARC-92 allocations are not scheduled to come into effect until 2007, and so it will be many years before their effects will be evident. In the meantime, radio technology will continue to advance, and international and domestic regulations will continue to evolve. Because of this, evaluating the outcomes of WARC-92 is, in one sense, premature. Rather, the outcomes of WARC-92 must be examined as one step in a longer process that stretches out for many years before and after.

Finally, the fact that WARC-92 allocated radio frequencies for new and existing radio services does not guarantee that those services-and the individual systems implemented to provide them-will be technically viable or economically successful. In a broad sense, the final assessment of WARC-92 will depend on how successful U.S. systems will be in domestic and world markets. Consumers and foreign regulators will ultimately determine the outcomes of WARC-92.

The preparation and negotiation of proposals for WARC-92 and the outcomes and implications of the conference cannot be divorced from the broader U.S. radiocommunication policy process. From this perspective, lack of integrated, long-term radiocommunication planning by U.S. spectrum managers and policy makers hurt U.S. preparations for WARC-92 and now threatens to undermine

²Commenters have pointed out that this outcome makes WARC-92 a 'success.' However, since the limits agreed to at the conference may be changed, this victory may ultimately prove hollow.

the successes achieved at the conference.³ Driven primarily by advances in technology and a commitment to improving competitiveness, the perspective of both government and industry has been too narrowly focused on merely gaining access to new radio frequencies. As a result of the rush to prepare positions for WARC-92—and now to license services—larger policy issues have been overlooked or neglected, and insufficient consideration is being given to the long-term consequences of implementing new technologies and services. The result has been an often reactive and short-sighted approach to spectrum policy—once frequencies are allocated, other issues can be addressed later. This problem is exacerbated because radiocommunications policy development and spectrum management in the United States is divided between the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA), with input from the Department of State on international issues. No common vision or policy goals currently unite these agencies, and although new leadership may bring more foresight to the process, institutional inertia and personal ambivalence about the prospects of radiocommunication planning among spectrum managers may frustrate the development of new policy directions. Preparations and negotiations for future world radiocommunication conferences will be impaired if radiocommunication policymaking continues to be fragmented and unfocused.

Past approaches to international radiocommunication policy development and negotiations may no longer produce the most successful outcomes for the United States at future conferences. While U.S. technologies and markets still lead the world in many wireless services,

new international competitors will challenge the United States to develop more cooperative strategies that rely less on U.S. market power and more on developing consensus and agreement with new (and old) allies around the world. Several trends evident during the preparations for and negotiations at WARC-92 are challenging traditional U.S. approaches to international policymaking.

- The rapid development of new radio technologies and applications, the explosion of demand for wireless communication services, and the consequent increase in congestion of the radio frequency spectrum have put great pressures on the structures and processes for managing radio-based communications both domestically and internationally. Finding space on the airwaves for new technologies and services is becoming increasingly difficult, and many countries, including the United States, have become more protective of their existing uses of the spectrum. Balancing the needs of existing and emerging uses of the radio frequency spectrum will become one of the most critical technological and political problems facing U.S. telecommunications policymakers.
- Economics and politics have begun to play a greater role in the way spectrum is allocated both internationally and domestically as radio services have assumed a greater role in world communications and commerce. The economic stakes involved in the decisions of WARC-92 are huge, and as a result, decisions and proposals regarding spectrum use are often no longer based primarily on technical criteria. In trying to develop domestic radiocommunication policy and prepare for WARC-92, U.S. spectrum managers must often contend with politically powerful users, large invest-

³The Institute of Electrical and Electronics Engineers—United States Activities (IEEE-USA) recently noted the over-concentration on short-term domestic issues to the detriment of long-term planning and accommodation of international concerns. See Comments of the Institute of Electrical and Electronics Engineers before the National Telecommunications and Information Administration, Notice of Inquiry in the matter of *Current and Future Requirements for the Use of Radio Frequencies in the United States*, Docket No. 920532-2132, released June 1, 1992.

ments in equipment, and users with long histories of successful operation and public service. Internationally, maintaining and promoting the competitiveness of U.S. products and services in world radiocommunication markets and protecting vital national (security) communication systems are increasingly important goals of U.S. international spectrum policy.

- In this newly economically-driven context, government and private sector representatives are especially concerned about the rise of regional blocks of countries that are uniting to protect and advance their economic interests in international meetings such as WARC-92. These coalitions can wield significant power in forums such as the ITU, with its one-nation, one-vote process, and could effectively work against U.S. interests at future world radiocommunication conferences. These regional groups also often have enormous technological, manufacturing, and/or market power that could pose a serious threat to U.S. competitive interests in global markets. On the other hand, these new alignments may present the United States with an important opportunity to cultivate support for U.S. positions.
- As telecommunications industries have been deregulated and privatized and as markets have been liberalized around the world, the private sector and radiocommunication user groups have begun to play an increasingly important role in the development of international spectrum policy. This rise may portend important changes in the role of the ITU in international spectrum regulation. Negotiations that previously involved only governments will in the future more directly include a variety of spectrum “special interest groups”—private sector and extra-governmental organizations that represent important international users of radiocommunications—the world aviation community, for example. These international groups were

evident at WARC-92 and worked hard behind the scenes to have their concerns addressed.

The rise of such groups and the increasing involvement of the private sector in international regulatory affairs pose a substantial challenge for U.S. policymakers. The problem is that the interests and goals of transnational companies and organizations will not always match those of the United States. Even those companies based in the United States may have trouble supporting U.S. positions if those positions conflict with their own international interests or with the interests of their industry. In the future, government spectrum managers must be watchful that U.S. companies participating in international conferences support U.S. positions and do not promote their own special interests to the detriment of specific U.S. objectives. A strong policy focus must be maintained if the United States is to be successful in influencing international radiocommunication policymaking.

- Finally, the ITU recently restructured itself and its processes to better meet the challenges presented by these changes. In this new environment, the United States is being forced to reexamine traditional assumptions about how the spectrum is allocated and how radiocommunication policy should be set. Reliance on purely market-based approaches to spectrum policy are likely to be inadequate to protecting and promoting U.S. technological competitiveness and policy leadership in future international policy decisions.

In order to maximize the success of U.S. proposals at future world radiocommunication conferences, the current structure and processes of radiocommunication policymaking in the United States will have to change. Institutional organization, responsibilities, and

procedures for future world radiocommunication conferences must be reexamined. Current levels of funding for WARC preparation and negotiation may be inadequate with future conferences now slated to occur every 2 years. Planning, preparation, and negotiation for these biennial meetings will become continuous activities, replacing the more sporadic efforts for past conferences. Centralizing WARC preparation could streamline decisionmaking and eliminate the funding disparities between agencies that characterized WARC-92. Options for improving WARC preparations and radiocommunication policy in general—are discussed at the end of this chapter.

A critical long-term concern for U.S. spectrum managers and policymakers is balancing important national economic and security interests against the broader goals of international cooperation, integration, and regulatory accord. In some cases, legitimate U.S. radiocommunication requirements may not match global needs. However, U.S. policy makers must be wary of advocating positions that too often conflict with world needs or that run the risk of isolating the United States from the world radiocommunication community. Many analysts believe that an isolationist approach could decrease U.S. effectiveness in international radiocommunication policymaking in the long term. Thorough evaluations must be made of the foreign policy implications of U.S. positions, and international considerations must be weighed carefully in developing U.S. domestic and international spectrum policies. U.S. spectrum managers must also develop better guidelines to balance the needs of new and existing spectrum users. More open and effective procedures are needed to compare and evaluate proposals from competing government agencies and between the government and the private sector.

Cooperation between U.S. Government and private sector interests is generally good during WARC preparations and negotiations. Although each group vigorously pursues its own interests, and conflicts are hard-fought, both sides work together to develop U.S. positions and policies. In large part, this spirit of cooperation is the result of the extensive network of personal relationships that have been built over many years, and the prior experience *many in the* private sector gained while working for the government. The downside of this cooperative process is that

s o m e t i m e s i t i s
unclear who is
in charge of formulating U.S. international spectrum policy—the Federal Government or the private sector and its consultants.

Sometimes it is unclear who is in charge of formulating U.S. 'international spectrum policy—the Government or private sector.

Despite such problems, however, this network of individuals could form a foundation for the future development of aggressive and forward-thinking U.S. radiocommunication policy, if guided by clear and creative guidelines and a focused policy development process.

WARC-92: THE CONFERENCE

WARC-92 began on February 3 and ended March 3, 1992. More than 1,400 delegates attended the conference representing 127 of the ITU's 166 member countries.⁴ The conference was also attended by observers from 31 international and regional organizations (see appendix B). Fifty-three official delegates from the United States participated in the deliberations in Spain,

⁴The number of countries has fluctuated rapidly in recent years as countries have consolidated (East/West Germany and North/South Yemen) and as the member states of the former Soviet Union—the Ukraine and the Republic of Belarus, for example—have sought to enter the ITU as independent members. Delegates from 124 countries attended WARC-92, with 3 (Belize, Latvia, and Liechtenstein) represented by proxy.



More than 1,400 delegates representing 127 countries participated in the deliberations of WARC-92.

representing a wide range of interests from the Federal Government and the private sector (see table 1-1). Jan Witold Baran, a lawyer from Washington, DC, served as head of the U.S. delegation, a position that confers temporary ambassadorial status. A support staff of 18 additional representatives provided technical and administrative assistance to the delegation at the conference, and approximately 30 more U.S. citizens attended all or part of the conference as observers and informal advisers.⁵ During the conference, a “home team” of approximately 40 government and private sector representatives remained in the United States and provided additional technical and policy guidance to the delegation in Spain.

The work of WARC-92 was functionally divided among a variety of committees (see appendix A for a description of the formal seven-committee structure of WARC-92). The most important work, and the majority of formal negotiations, at WARC-92 was conducted in the

meetings of Committee 4 (the Allocations Committee), and Committee 5 (the Regulatory Committee). These committees distributed their work to ad hoc and drafting groups in which small groups of delegates forged agreements on specific topics and developed regulations for implementing changes. The supreme body of WARC-92 was the plenary, which was chaired by the Honorable Jose Barrionuevo Peña of Spain.⁶ It was at the plenary sessions that decisions were formally and finally agreed to—most of the Plenary sessions took place in the last several days of the conference.

The decisions made at WARC-92 resulted from a complex mixture of formal committee meetings and extensive informal discussions outside of the formal meeting structure. These informal discussions, during which much of the real work of the conference—negotiation and persuasion—took place, were held during coffee breaks between sessions, at lunches around town, and at after-hours meetings anywhere there was space. The agreements reached at the conference

Table 1-1—WARC-92 Delegates^a

Department of Commerce	8
Department of Defense^b	5
Department of State	7
Federal Communications Commission	9
Other Government	
National Aeronautics and Space Administration . . .	2
National Science Foundation	1
Coast Guard	1
U.S. Information Agency	2
Federal Aviation Administration	1
Private Sector	35

^a Includes support staff.

^b Includes Army, Navy, and Air Force.

NOTE: Some private sector delegates worked as contractors supporting various government agencies.

SOURCE: Office of Technology Assessment, 1993, based on U.S. Delegation Report.

⁵The United States was the only delegation to send a separate “support staff.” In practice these individuals performed duties that closely resembled those of the formal delegates, although they were not considered delegates by ITU and did not have direct access to working documents, except through fellow delegates.

⁶For conferences held outside Geneva (home base for ITU), the chairman of a WARC is traditionally provided by the country hosting the conference. Five vice-chairs, including Ambassador Jan Baran, the head of the U.S. delegation were selected by the delegates to assist the chair. Delegates from the Russian Federation, Cote d'Ivoire, China, and Norway served as the other vice-chairs.

were based on consensus and compromise, although informal polls were sometimes taken to gauge support and/or opposition to a specific proposal. Although formal voting on issues is provided for in the rules of the ITU, it is usually only used as a last resort, and no formal votes were taken at WARC-92. This was considered a minor victory by some members of the U.S. delegation, since the United States was isolated on some issues and had only tentative support on others. Formal voting on these issues could have been embarrassing for the United States.

As a result of the month-long negotiations, WARC-92 allocated frequencies to a number of emerging radiocommunication services and systems, including low-Earth orbiting satellite (LEOS) systems,⁷ broadcasting-satellite services for audio broadcasting (BSS-Sound), and HDTV. See box 1-A for brief descriptions of these services. The conference also expanded the frequency allocations for the Mobile-Satellite Service (MSS), high-frequency (HF) broadcasting, and a variety of space research and operations services. Box 1-B summarizes the allocations made at WARC-92 and figure 1-1 shows a sample page from the Final Acts of WARC-92. Chapter 2 discusses the allocations in greater detail.

WARC-92 differed from past WARC's in several respects. It was the first WARC in more than 12 years to attempt a broad revision of the international Table of Frequency Allocations. As opposed to the WARC's of the 1980s, which generally concentrated on one service-mobile, high-frequency broadcasting, or space communication services--WARC-92 addressed a wide range of allocation issues covering many segments of the radio spectrum. Compounding the breadth of the conference, the time allotted to WARC-92 was short, both for preparations-less than 2 years-and for the conference itself.



Magellan Systems, Corp.

New radiocommunication services will permit people to communicate to and from almost anywhere in the world.

WARC-92 was limited to only 4 weeks; however, for previous WARC's, the ITU had allotted substantially longer time.

Most analysts believe that WARC-92 was probably the last broad reallocation conference that will be held. At a special plenipotentiary held in December 1992, the ITU adopted a new timetable for future radiocommunication conferences.⁸ According to that schedule, WARC's, renamed "world radiocommunication conferences," would be held every 2 years. Most observers expect these conferences to be narrower in focus than WARC-92--concentrating on one service or area of the spectrum, more like the WARC's of the 1980s. The format and working procedures of future conferences were also changed in order to streamline decisionmaking and reflect the increasing role of the private sector in international telecommunications policymaking. The full impact of these changes will not be felt for several years, however, since some of the agreed-to changes have not yet been imple-

⁷Two types of LEOS systems were considered by WARC-92. "Little" LEOS systems plan to provide data and position-location services and will operate in the VHF/UHF frequencies. "Big" LEOS will provide telephone services in addition to data, and will operate in frequencies above 1 GHz.

⁸See OTA, WARC-92, op. cit., footnote 1 for further discussion of the organization and functioning of the ITU.

Box 1-B—Summary of WARC-92 Allocations

WARC-92 allocated frequencies for a number of new and existing radiocommunication services. The allocations, however, do not tell the whole story of the decisions made at WARC-92. All of the allocations summarized below are subject to limitations and constraints that are described in footnotes to the allocations and in various resolutions and recommendations the conference adopted for each service. These footnotes, resolutions and recommendations are examined in more detail in chapter 2.

High-Frequency (HF) Broadcasting

A total of 790 kHz was allocated to HF broadcasting with 200 kHz located in frequencies below 10 MHz (the most congested portion of the HF bands), and 590 between 11 and 19 MHz. All the newly allocated bands are allocated on a worldwide basis, all are subject to planning, and all must use single sideband (SSB) modulation for transmission.

5900-5950 kHz	3800-13870 kHz
7300-7350 kHz	3570-13600 kHz
9400-9500 kHz	5600-15800 kHz
11600-11650 kHz	7480-17550 kHz
12050-12100 kHz	8900-19020 kHz

Broadcasting-Satellite Service-Sound (BSS-Sound)

1452-1492 MHz	Worldwide, except the United States
2310-2360 MHz	Only in the United States and India
2535-2655 MHz	Various countries in Europe and Asia

All BSS-Sound operations are required to use digital audio broadcasting (DAB) technology.

Broadcasting-Satellite Service-High-Definition Television

17.3-17.8 GHz	ITU Region 2 only
21.4-22.0 GHz	ITU Regions 1 and 3

Terrestrial Mobile Service

1700-2690 MHz	Upgraded to primary status worldwide
1885-2025 MHz &	Intended for Future Public Land Mobile Telecommunica-
2110-2200 MHz	tions Systems (FPLMTS) worldwide. Frequencies for
	a satellite component of FPLMTS were also identified.

Mobile-Satellite Service

MSS allocations are made in pairs—one set of frequencies for transmission from the Earth to satellites (uplinks) and one set for transmissions from satellites to Earth (downlinks).

1492-1525 MHz (downlink)	Region 2 only, not allocated in the United States
1675-1710 MHz (uplink)	Region 2 only
1525-1559 MHz (downlink)	Portions remain allocated specifically to land, mari- time, and aeronautical services, but the United States has allocated almost the entire band to generic MSS. ¹

¹ With the exception of 1545-1555 MHz, which remains allocated to the aeronautical mobile satellite service.

1626.6-1660.5 MHz (uplink)

As above, portions remain allocated to specific (land, maritime, and aeronautical) services, but the United States has allocated the majority of the band to generic MSS.²

1930-1970 MHz (uplink)

On a secondary basis for Region 2 only.

2120-2160 MHz (downlink)

On a secondary basis for Region 2 only.

1980-2010 MHz (uplink)

With an additional 10 MHz allocated at 1970-1980 MHz for Region 2 only.

2170-2200 MHz (downlink)

With an additional 10 MHz allocated at 2160-2170 MHz in Region 2 only.

2500-2520 MHz (downlink)

2670-2690 MHz (uplink)

Low-Earth Orbiting Satellites

Using frequencies above 1 GHz (big LEOS):

1610-1626.5 MHz (uplink)

Upgraded to primary

2483.5-2500 MHz (downlink)

1613.8-1626.5 MHz

Allocated (secondary status) for downlinks in order to permit bidirectional use of the band.

Using Frequencies Below 1 GHz (little LEOS):

137-138 MHz (downlink)

Portions of which are secondary

148-149.9 MHz (uplink)

Secondary in more than 70 countries

400.15-401 MHz (downlink)

Space Services

A number of allocations were made to various space services, including space research, space operations, and Earth exploration satellite services. Frequencies were allocated in the 400-420 MHz bands for space communications and research, in the 2 GHz bands for space research, operations, and Earth-exploration satellite service, and in the bands above 20 GHz for inter-satellite links, Earth-exploration satellite, and (deep) space research services.

Aeronautical Public Correspondence

1670-1675 MHz was allocated worldwide for ground-to-aircraft communications, to be paired with 1800-1805 MHz for aircraft-to-ground transmissions. The United States will maintain its existing system at 849-851 MHz and 894-896 MHz.

Fixed-Satellite Service

A worldwide allocation was made at 13.75-14.0 GHz.

² With the exception of 1646.5-1656.5 MHz, which remains allocated exclusively to aeronautical mobile satellite service.

Figure I-I-Sample Page From Final Acts of WARC-92

		MHz 1613.8 -1626.5			
MOD		Allocation to Services			
		Region 1	Region 2	Region 3	ITU Regions
Frequencies →		1613.8 -1626.6	1613.8 -1626.5	1613.8 -1626.5	Allocations
		AERONAUTICAL RADIONAVIGATION	AERONAUTICAL RADIONAVIGATION	AERONAUTICAL RADIONAVIGATION	Primary services are listed in all capital letters
		MOBILE-SATELLITE (Earth-to-space)	RADIODETERMINATION- SATELLITE (Earth-to-space)	MOBILE-SATELLITE (Earth-to-space)	
		Mobile-Satellite (space-to-Earth)	733A	Radiodetermination-Satellite (Earth-to-space) 733A	Secondary services are listed in Initial capital letters.
			MOBILE-SATELLITE (Earth-to-space)	Mobile-Satellite (space-to-Earth)	
			Mobile-Satellite (space-to-Earth)		
New & existing footnotes		722727730731 731X 731 Y 732733 733A 733B 733E 733F	722 731X 731 Y 732733 733C 733D 733E	722727730731 X 731 Y 732733 733B 733E	
Footnotes that have been removed.		SUP 731A SUP 731B SUP 731C SUP 731D			
Indicates a new footnote that has been added to the table.		ADD 731X	The use of the band 1610.5 MHz by the mobile-satellite service (Earth-to-space) and by the radiodetermination-satellite service (Earth-to-space) is subject to the application of the coordination and notification procedures set forth in Resolution COM5/8. A mobile Earth station operating in either of the services in this band shall not produce an e.i.r.p. density in excess of -15 dBW/4 KHz in the part of the band used by systems operating in accordance with the provisions of No. 732, unless otherwise agreed by the affected administrations. In the part of the band where such systems are not operating, a value of -3 dBW/4 KHz is applicable. Stations of the mobile-satellite service shall not cause harmful interference to, or claim protection from, stations in the aeronautical radionavigation service, stations operating in accordance with the provisions of No. 732 and stations in the fixed service operating in accordance with the provisions of No. 730.		
		ADD 731Y	The use of the band 1613.8 -1626.5 MHz by the mobile-satellite service (space-to-Earth) is subject to the application of the coordination and notification procedures set forth in Resolution COM5/8.		

Text of footnotes

The text of all new or modified footnotes is presented below the table. Existing unchanged footnotes are listed in the table, but their text is not shown.

SOURCE: Office of Technology Assessment, 1993, with information from International Telecommunication Union, *Final Acts of the World Administrative Radio Conference (WARC-92)*, provisional version, Malaga-Torremolinos, March 1992.

mented. In order to evaluate the implications of these changes for the United States, the Department of State has convened a task force under the auspices of the U.S. national CCIR/International Telegraph and Telephone Consultative Committee (CCITT) committee structure. That group will also study possible improvements in U.S. structures and procedures that could allow the United States to participate more effectively in the new ITU.

THEMES AND TRENDS FROM WARC-92

A number of broad trends complicated the negotiations leading up to and at WARC-92, and several important themes were evident at the conference that will influence the course of future ITU proceedings and meetings. U.S. spectrum policymakers and managers must take account of these trends in order to ensure the success of U.S. negotiating efforts for future world radiocommunication conferences.

■ Spectrum Negotiations Are Becoming Increasingly Difficult

The overarching message to come out of WARC-92 is how difficult it has become to achieve international consensus on spectrum matters. WARC-92 has been described as one of the most difficult international radio conferences in memory. The issues were technically complex and interrelated. New geopolitical realities had redefined who the important players were, and economic concerns drove countries to protect their existing radio services and users with a tenacity rarely seen before.

WARC-92 came very near to failing entirely.⁹ Twenty-four hours before the scheduled end of the conference, several major allocation issues remained unresolved—future public land mobile

telecommunications systems (FPLMTS), MSS, and BSS-Sound—and delegates talked openly about calling a formal halt to the proceedings. If that had occurred, it is possible that no decisions would have been accepted, no new allocations would have been made, and more than 2 years of preparation would have been left unfulfilled.

Several factors made WARC-92 difficult. First, the agenda for the conference changed (and expanded) substantially over time. Originally, WARC-92 was conceived as a limited conference that would resolve issues left over from previous WARC-92s and address a small number of new allocations for space and mobile services. After the initial scope of WARC-92 was set by the 1989 ITU Plenipotentiary Conference, however, it was expanded considerably at the 1990 ITU Administrative Council meeting. At that meeting, the United States added many new items to the agenda, including frequency allocations for ‘little’ LEOS, terrestrial supplements to BSS-Sound, and some new space services. Even after the agenda was finalized in 1990, however, the range of topics to be addressed continued to grow. Companies in the United States unveiled plans in late 1990 for “big” LEOS systems that would provide telephone service in addition to data communications, and that would require a frequency allocation all their own. Because these systems are a type of Mobile-Satellite Service, they were considered at WARC-92 as part of the MSS negotiations. The result of this expansion was that issues became more complex and interrelated, more viewpoints had to be accommodated, and government and private sector resources were stretched very thin. Nonetheless, the broader agenda did force WARC-92 to consider many (new) topics in which the United States had important interests.

⁹In ITU parlance, “fail” seems to have a specific meaning, although there is disagreement over exactly what it is. Some delegates believe that if a conference fails, it is adjourned without any **final** agreements being **signed—even** on those issues where decisions had been reached. Others believe that the conference **could** sign a partial agreement on items that had been agreed to. **No** WARC has ever ended this way, but the threat of “failure” was used at **WARC-92** to push delegates to **compromise**.

■ Technology Issues: Existing Services or New Uses?

The clearest theme governing the negotiations at WARC-92 was the battle between existing and new technologies-how to find room in the spectrum for new technologies and services while accommodating the existing users of the spectrum. The spectrum is already completely allocated from 9 kHz up to 275 GHz (300 GHz in the United States), and many of these frequencies, especially in the bands below 6 GHz are heavily used (see box 1-C for a brief description of radio

Delegates struggled to find spectrum for new technologies while accommodating existing users of the spectrum.

waves and the radiospectrum).¹⁰ And while policy-makers and engineers in the United States continue to propose ways to make more efficient use of the spectrum and accommodate more users, con-

gestion continues to increase.¹¹ Thus, new systems and services trying to gain access to radio frequencies often must contend with entrenched users with long histories of serving public (and private) needs and who have large investments in equipment.

In the U.S. preparation process, the battle over the 1435-1525 MHz band of frequencies illustrates this tension. Proponents of satellite-delivered audio broadcasting wanted to use a portion of this band to deliver BSS-Sound serv-

ices. The band, however, is already used by the Federal Government and aerospace companies to provide aeronautical telemetry (tracking, data relay, etc.) services in support of aircraft testing and missile development.¹² Debate over the U.S. proposal(s) for these frequencies was intense.

At WARC-92, the battle between old and new was clearly evident. On most issues, countries sought to protect their existing services, in which they have often invested millions or billions of dollars, while simultaneously promoting new technologies and services with the potential to provide new or better services where none existed before or that could advance their competitive interests. This battle often separated the developed and developing countries. Developing countries, because of sunk investments and a lack of resources to modernize, often resisted new allocations that could make their existing systems obsolete. Developed countries, on the other hand, which are generally better able to implement new technologies more rapidly, were the major force pushing allocations for new types of radio services. Although resource problems face both developing and developed countries, large-scale changes in systems may be more keenly felt in developing countries, many of which lack the funds and personnel to make such changes. Such countries are likely to need financial and technical help to implement new systems. Recognizing these problems, WARC-92 adopted Resolution 22, which calls on the ITU's Telecommunications Development Bureau (BDT) to provide assistance to countries in need.¹³

¹⁰ OTA, WARC-92, op. cit., footnote 1.

¹¹ Congress, for example, has been considering legislation for several years that would take spectrum from the government and make it available to the private sector. The FCC has put great emphasis on sharing spectrum and competition in its recent proceedings, and has attempted to encourage innovation and Spectrum-efficient applications in its Pioneer's Preference ruling. NTIA has initiated a study looking at the long-range spectrum needs of the country. Scholars, policymakers, and industry analysts alike are debating the value of auctions for assigning spectrum rights. See OTA, WARC-92, op. cit., footnote 1 for further discussion of the technical developments affecting spectrum congestion.

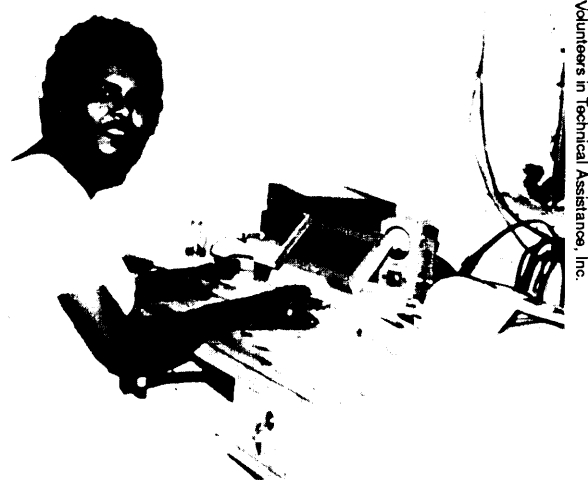
¹² MSS proponents also wanted to use the band for mobile services. For more information on the history of this debate, see OTA, WARC-92, op. cit., footnote 1.

¹³ International Telecommunication Union, *Final Acts of the World Administrative Radio Conference (WARC-92)*, Resolution 22. Hereafter, "ITU, *Final Acts*."

As the spectrum becomes more crowded and congested, convincing existing users in the United States and abroad to share or give up their spectrum will become increasingly difficult. American strategists and policymakers must recognize that convincing incumbents to share spectrum or move will require sustained efforts in political, economic, and technical persuasion. As part of these efforts, the United States may wish to target programs and funding that would help developing countries modernize their (radio) communication services and infrastructures. Such funding, in combination with direct private sector aid to these countries, would make U.S. systems and services more affordable and accessible internationally, and could promote demand for U.S. technology and equipment overseas. Such a strategy may also help counter efforts on the part of other countries, notably Japan and several European countries, to build international markets for their telecommunications equipment.

■ The Rise of Regional Blocks

Another important trend evident at WARC-92 was the linking of countries in groups in order to more forcefully present their positions. WARC-92 was the first WARC held under the banner of the 'new world order.' The USSR had dissolved, and its control over a strong block of Eastern European countries had almost vanished.¹⁴ The historic North-South divisions that separated the developing and developed countries for many years had lessened, replaced on many issues (but not all) by divisions between blocks of countries, each united by common regional and economic concerns. Among these, a unified block of



New satellite technologies will enable people in remote parts of the world to access many kinds of information and receive technical assistance tailored to their specific needs--all at low cost.

European countries, represented by the Conference of European Postal and Telecommunications administrations (CEPT), was the strongest at WARC-92. The developing countries, as a group, exhibited little of the unity and cohesiveness they have shown in the past. However, toward the end of the conference, under the guidance of Mr. Abderrazak Berrada of Morocco, many of the developing countries, especially from Africa and the Middle East, were able to exercise considerable control over debate on many important issues.¹⁵ While other regional blocks did not show the cohesiveness and determination of CEPT, some countries of the Asian Pacific and Latin America were able to cooperate on specific issues—indicating their potential emergence as a force to be reckoned with at future conferences.

¹⁴ The Russian Federation did send a delegation to WARC-92, as did the Ukraine and the Republic of Belarus. The delegates for these new countries were, by and large, the same individuals that had represented the USSR in the past, and they usually acted together in their proposals and negotiations. By most assessments they were an effective, although limited, force at WARC-92.

¹⁵ At past conferences, developing countries often would setup (or threaten) votes on specific issues they knew they had a majority for. In this way, they could more directly control the outcomes of the conferences. At WARC-92 their impact was much more benign, if important—no votes were taken, but the number of potential votes commanded by Mr. Berrada was an important force in making the developing countries voices heard and forcing concessions out of the developed countries.

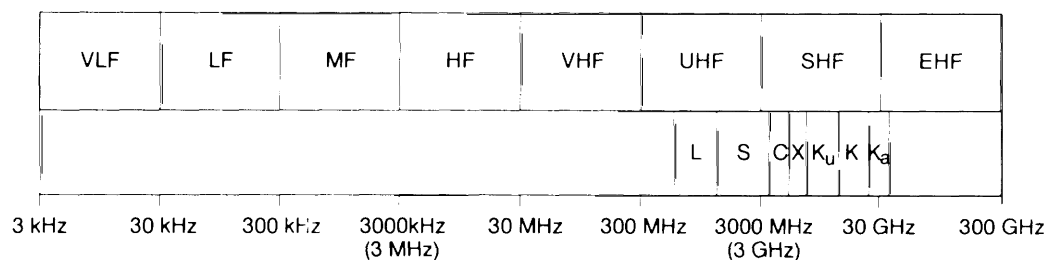
Box 1-C—The Radio Frequency Spectrum

Radiocommunication refers to the process of sending and receiving information that is carried by radio waves. Radio waves have a number of distinguishing characteristics, but they are most often identified by their frequency. The frequency of a radio wave is the number of cycles it completes in 1 second. Radio frequencies are measured in Hertz; 1 Hertz equals 1 cycle per second. Higher frequencies are described as multiples of Hertz:

- 1 kHz (kilohertz) = 1 thousand cycles per second;
- 1 MHz (megahertz) = 1 million cycles per second;
- 1 GHz (gigahertz) = 1 billion cycles per second.

The radio frequency spectrum refers to the total range of frequencies that can be used for communications. Today this range extends from 3 kHz to 300 GHz. Over time, the spectrum has been divided into "bands" that correspond to specific ranges of frequencies. These bands are often referred to by descriptive terms like "high frequency" or "ultrahigh frequency" (see figure 1-C-1). These general terms are listed in table 1-C-1, along with some of the radio services that use the bands. Terms such as "L-band" or "X-band," which are used extensively today, came into use during World War II in order to keep secret the specific frequencies used by radars and other radio devices. Because of their transmission characteristics, some of the most valued and congested frequencies are between 1 and 3 GHz—the L- and S-bands.

Figure 1-C-1—Frequency Band Designations



SOURCE: Office of Technology Assessment, 1993, based on Richard G. Gould, "Allocation of the Radio Frequency Spectrum," OTA contractor report, Aug. 10, 1990.

CONFERENCE OF EUROPEAN POSTAL AND TELECOMMUNICATIONS ADMINISTRATIONS

The most powerful bloc at WARC-92 was CEPT, representing 32 European countries.¹⁶ CEPT members are the telecommunications regulatory authorities from each participating country. For the past several years, CEPT has been gaining the attention of U.S. international spectrum experts as it has become more coordinated and able

to present a more unified front at international meetings. In forums such as WARC-92, where each country has one vote, such a unified group can potentially command a substantial number of votes, and this power gives an enormous amount of leverage in conference negotiations. At WARC-92, CEPT was closely coordinated, presenting common positions on most of the items the conference considered. The tight cohesiveness

¹⁶ Although CEPT is almost unanimously regarded as the most powerful single force at WARC-92, curiously, little mention has been made as to how effective the European bloc was at the conference. While such an evaluation is outside the scope of this report, future studies of the CEPT organization and processes might provide valuable lessons for the United States as it plans for future conferences.

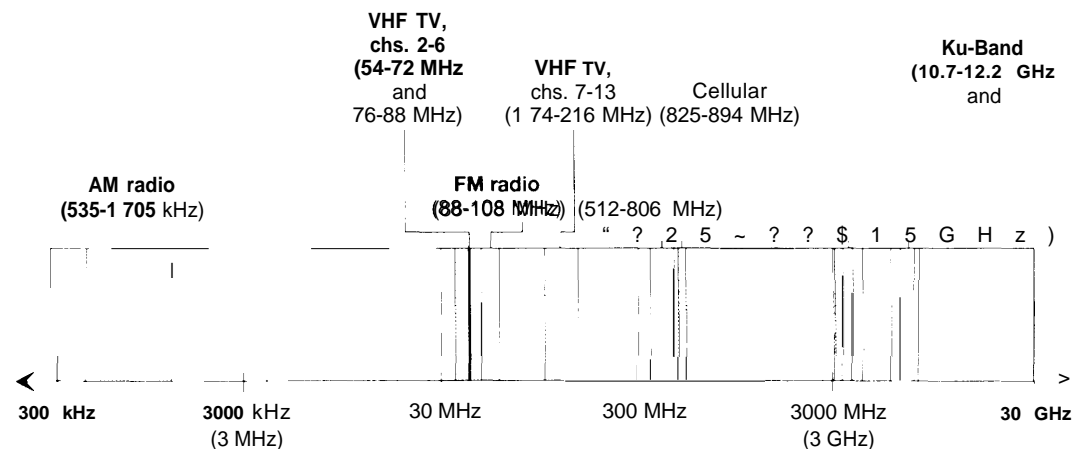
Table I-C-I—Radio Frequency Bands and Uses

NAME	Frequency range	Examples of services
Very low frequency (VLF)	3 to 30 kHz	Marine navigation
Low frequency (LF)	30 to 300 kHz	Marine and aeronautical navigation equipment
Medium frequency (MF)	300 to 3,000 kHz	AM radio broadcast, LORAN maritime navigation, long-distance aeronautical and maritime navigation
High frequency (HF)	3 to 30 MHz	Shortwave broadcast, amateur radio, CB radio
Very high frequency (VHF)	30 to 300 MHz	Private radio land mobile services such as police, fire, and taxi dispatch; TV channels (2 through 13); FM broadcasting; cordless phones; baby monitors
Ultrahigh frequency (UHF)	300 to 3,000 MHz	UHFTV channels; cellular phones; common carrier point-to-point microwave transmission used by long-distance phone companies; satellite mobile services
Superhigh frequency (SHF)	3 to 30 GHz	Radar, point-to-point microwave, and satellite communication
Extremely high frequency (EHF)	Above 30 GHz	Satellite communications and space research

SOURCE: Harry Mileaf (ed.), *Electronics One*, revised 2nd Ed. (Rochelle Park, NJ: Hayden Book Co., Inc., 1976), p. 1014; and John J. Keller, "No Vacancies," *The Wall Street Journal*, Nov. 9, 1990, p. R14.

Individual radiocommunication services use specific bands of frequencies, which are allocated to them at world administrative radio conferences (WARCs). FM radio broadcasting, for example, uses the 88-108 MHz band (see figure 1-C-2). In many cases, however, bands of frequencies are shared by different services. In the lower part of the radio spectrum, for example, frequency bands are often shared by fixed (point-to-point) and mobile radiocommunication services.

Figure I-C-2—Radio Frequency Spectrum and Selected Services



NOTE: This figure uses a logarithmic scale with dashed lines representing breaks in the scale. Shaded areas in different segments of the scale are not proportional. For example, AM radio occupies 1,170 kHz of spectrum, while cellular (which appears smaller visually) actually occupies 69,000 kHz of spectrum.

SOURCE: Office of Technology Assessment, 1993.

and determined approach of the CEPT countries made CEPT a strong, almost immovable force on many issues.¹⁷

In analyzing the performance of CEPT at WARC-92, some observers and delegates tend to see CEPT as a monolithic group that would not compromise on any issue. In large part, this view stems from CEPT's unwillingness to compromise on the high visibility MSS (including big LEOS) issues that were priorities for the United States. Individual European countries were often unwilling to change their positions so as not to break down the unity of the CEPT positions.¹⁸ However, while it is true that CEPT's lack of flexibility made it difficult to negotiate with on several important issues, on other matters CEPT was reportedly more willing to compromise. In the debate over BSS-Sound, for example, internal divisions in CEPT forced a change in its position.

The perceived inflexibility of the CEPT bloc (and the United States' own determination) appears to have had at least one positive outcome. Delegates from both sides agree that such rigidity undermined the ability of Europe and the United States to negotiate before and at WARC-92, and that more flexibility in negotiations might produce better outcomes at future conferences. This realization may lead to more productive discussions and negotiations between the United States and Europe prior to the next world radiocommunication conference.

The role of CEPT in future international spectrum negotiations is somewhat unclear due to continuing reorganization of its structure and functions. Prior to 1987, CEPT was composed of telecommunications regulators, systems operators, and telecommunications services providers. In that year, the role of CEPT was redefined and

the scope of its power diminished by transferring standards development activities to the European Telecommunications Standards Institute (ETSI). In September 1992, CEPT reorganized again, and now consists solely of telecommunications regulators, with system operators and services providers forming a separate group.¹⁹ Within CEPT, the focal point of radiocommunication policymaking is the European Radiocommunications Office (ERO), which evaluates spectrum use and development, manages spectrum interests, and develops long-term spectrum policy.

As a result of these restructurings, CEPT activities have become increasingly focused on regional and international radiocommunications policymaking—with the goal of promoting greater harmonization of European policies. This concentration, and the slowly increasing political and economic unification of Europe, may eventually strengthen CEPT as an organization and bring it to the forefront of European radiocommunication policy development. However, at the end of 1992, the various European organizations (including CEPT, ETSI, and the European Community (EC)) had not settled all the jurisdictional and procedural battles over radiocommunication policy. It is still too early to tell if restructuring will make the European process more or less effective, and what impact these efforts will have on European performance at future world radiocommunication conferences.

Aside from its new focus on radiocommunications policy, regional changes could bolster Europe's and CEPT's position. Driven by economic concerns, for example, the nations of Europe are becoming increasingly united on trade and competitiveness issues—a trend that may

¹⁷ The behavior of CEPT at WARC-92 has been likened to a battleship—large and powerful, but slow to maneuver.

¹⁸ In addition to the CEPT group, the European Community had its own representatives at WARC-92. Some U.S. delegates to WARC-92 believe that this group was present to enforce the solidarity of the European countries at the conference. Several observers, however, note that such pressures were resisted by CEPT members, especially those not belonging to the EC, and that the relationship between the EC and CEPT representatives was strained at best.

¹⁹ Andreas Evagora, "cEn: Radio Interference," *Communications Week International*, July 20, 1992, p. 4.

foreshadow greater cooperation on radiocommunication policy development in order to support common economic goals. With the dissolution of the USSR, the newly independent countries of Eastern Europe have been seeking alliances with Western Europe, including joining CEPT or the EC (see figure 1-2). CEPT's numbers (and hence the number of potential votes CEPT would represent) will likely swell in the next several years. A larger CEPT representing more countries at future conferences could pose a substantial challenge to U.S. negotiators and policymakers.

INTER-AMERICAN TELECOMMUNICATIONS CONFERENCE (CITEL)

The countries of the Western Hemisphere have their own forum for coordinating telecommunication policies, CITEL.²⁰ However, in the past, CITEL has served little more than a discussion function for its members; it has not been an effective force for coordinating regional radio- or telecommunication policies. In preparation for WARC-92, many of the countries in the Western Hemisphere, including the United States, made a concerted effort to build regional cooperation-at least in part in response to the perceived power of the CEPT alliance-in order to present a stronger, more united front at the conference. Two formal meetings were held in an attempt to work out common positions, and working groups were set up to develop common views that could be used by all CITEL members to form the basis for their own national proposals.²¹ Despite recognition of the importance of such activities and extensive discussions between countries, no formal common proposals/positions were adopted.

During the conference, CITEL had little more success in building a stronger presence and

promoting regional views. A schedule of meetings had not been set up in advance of WARC-92 and formal discussions were held only in the last 2 weeks of the conference. Ambassador Baran hosted a luncheon for CITEL members, but only a few countries attended. The CEPT countries, on the other hand, met daily to update members on late-breaking news and to develop negotiation strategies and responses. In the end, the CITEL effort was ineffective because members could not agree on common views.

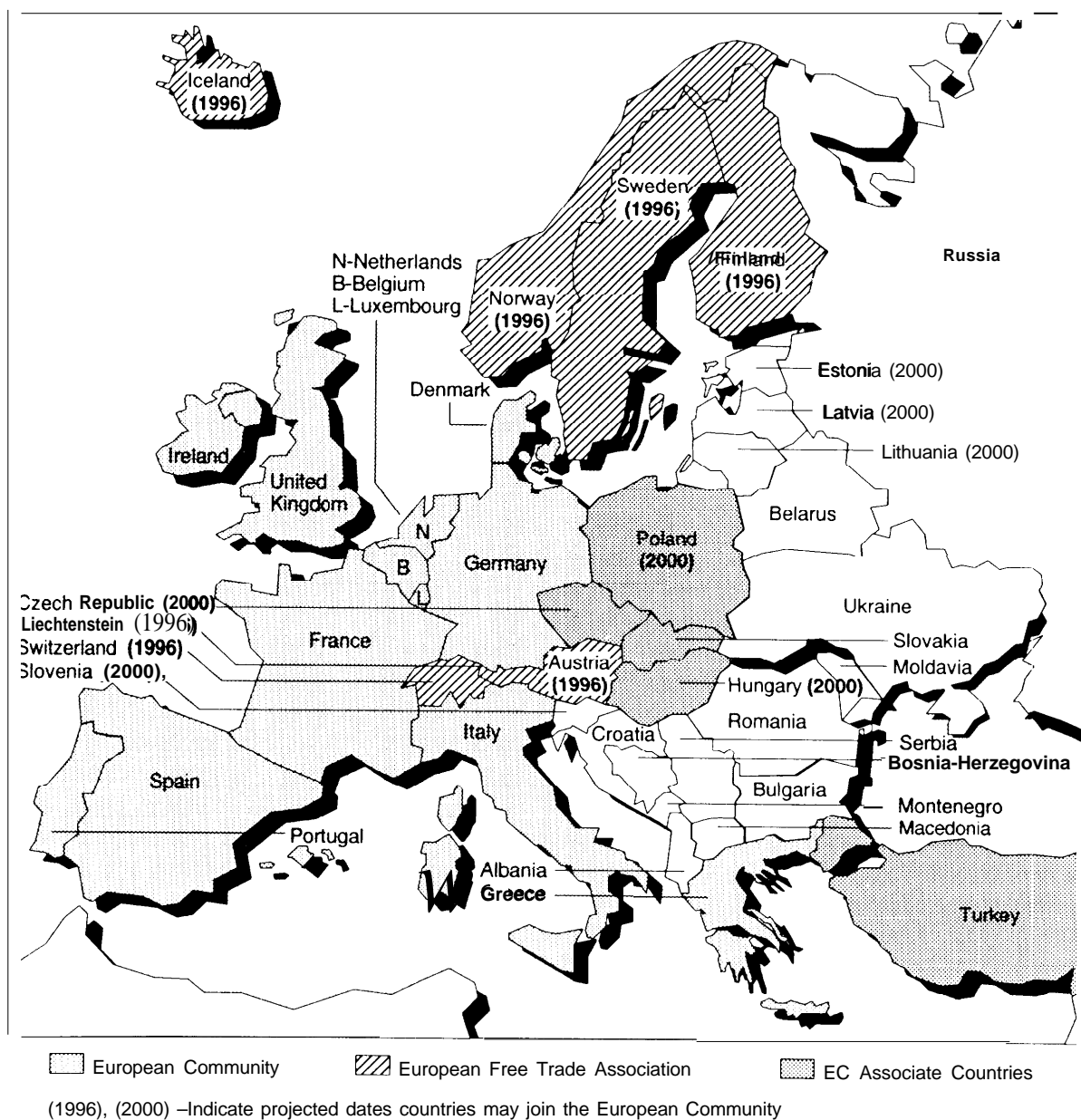
The ineffectiveness of CITEL at WARC-92 is the result of several factors. There is little historical tradition of cooperation between the countries in the Western Hemisphere on telecommunication matters. CITEL has been underfunded by the Organization of American States, its parent organization, for many years. Perhaps most importantly, the countries that participate in CITEL are a more heterogeneous group-politically, economically, and culturally-than the countries that belong to CEPT. There are fewer natural and historical linkages that can be used to promote cooperation.

However, the failure of CITEL'S efforts at WARC-92 should not be considered a systemic failure of CITEL as a coordination mechanism. Rather, its ineffectiveness illustrates the need for better regional cooperation, both in conference preparation and at the conferences, and indicates that further work must be done if CITEL is to more forcefully represent the interests of its members. Most analysts do not believe, however, that the goal of efforts to improve CITEL should be to mirror the kind of organization represented by CEPT--namely, development and strict adherence to common regional proposals by all members. "Common proposals" carry with them

²⁰ CITEL is an ongoing conference convened under the auspices of the Organization of American States. See OTA, WARC-92, op. cit., footnote 1 for a more in-depth discussion of CITEL, its historical development, and its WARC-92 preparations.

²¹ This approach differs from that of CEPT, which actually submitted "European Common Proposals for the Work Of the Conference." In contrast, the idea behind CITEL WARC-92 preparations was not for the CITEL countries to actually submit "common proposals" to which each country would adhere, but to develop common positions from which each country would develop and submit its own formal, individual proposals for WARC-92. See International Telecommunication Union, "European Common Proposals for the Work of the Conference, Parts I and II," Document 20-E, Oct. 7, 1991.

Figure 1-2--Current and Projected European Community Membership



SOURCE: Office of Technology Assessment, 1993.

the potential loss of national sovereignty and could lead to the type of inflexibility many observers attributed to CEPT. Maintaining national flexibility in a framework of regional cooperation seems to be the consensus goal of those involved.

Continued improvement in CITEL's effectiveness will require the cooperative efforts of the U.S. private sector and the Federal Government, as well as the other member countries of CITEL. Representatives from all these groups recognize the need for better coordination, and individuals from several CITEL countries approached U.S. delegation members and observers to talk about ways to improve future efforts. A long-term commitment must be made to the CITEL process if the region is to effectively work together at future world radiocommunication conferences.

OTHER REGIONAL BLOCKS

In addition to CEPT and CITEL, some delegates reported that the French- and English-speaking countries of Africa were more united than they had been at past conferences. They also showed a willingness to follow the leadership of Morocco on several issues, making Africa a powerful force in later stages of the conference. As further evidence of the increasing unity of the African continent, observers point to the development of a regional satellite system-RASCOM. Some analysts believe that the unifying force of a common satellite communications system may lead to a more coherent approach to meeting the communications needs of the continent, and could form the basis for future cooperative efforts among the countries of Africa in telecommunications development and policymaking.

This coalescence could present the United States with an opportunity to improve relations with African nations and strengthen its negotiating positions internationally. Africa is part of the same ITU region (Region 1, see figure 1-3) as

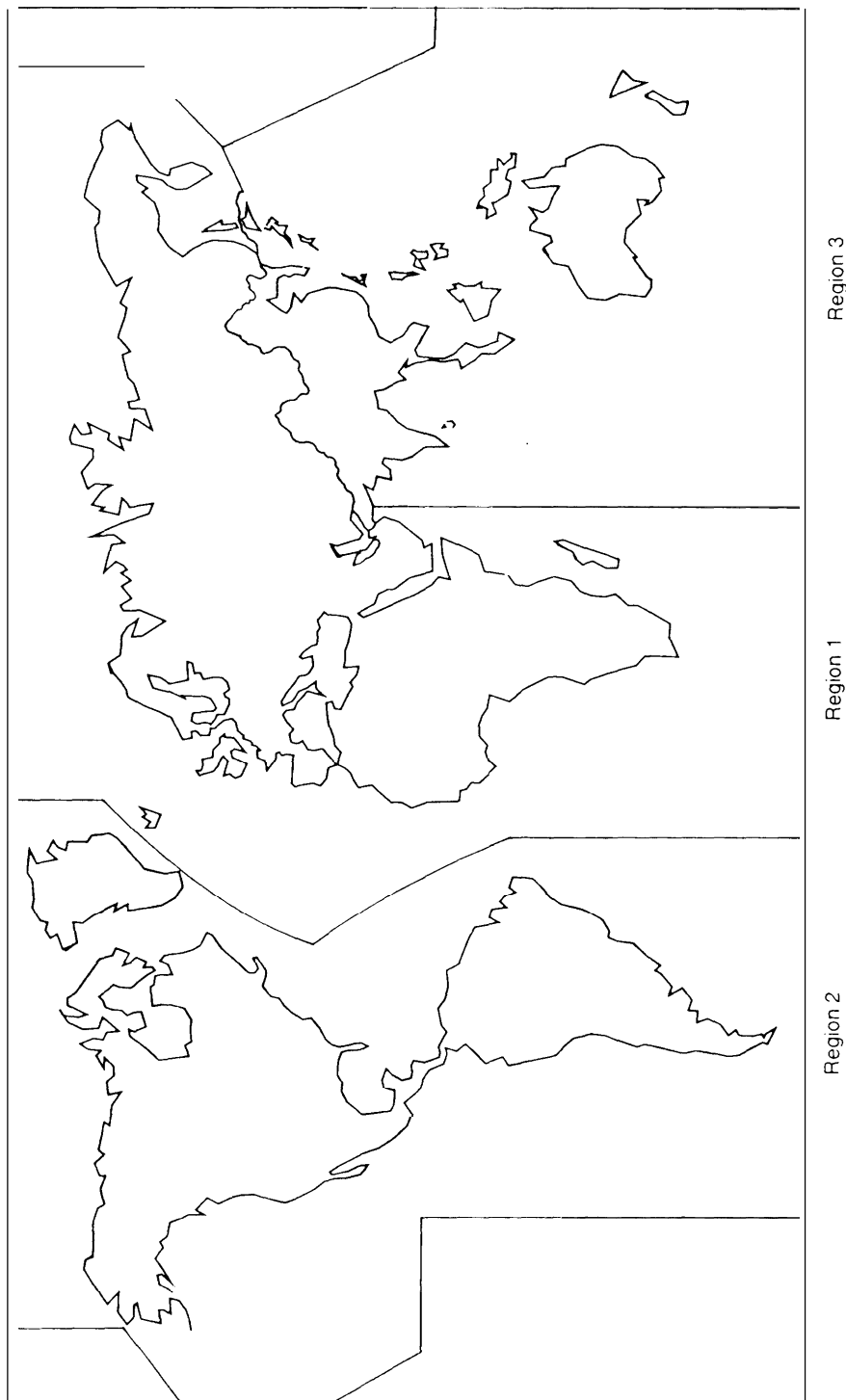
Europe. Improved ties and cooperation with Africa could provide leverage for U.S.-supported proposals. Other observers point out, however, that the African nations are still disorganized—they have nothing approaching the CEPT or even CITEL organizations, and are not yet a major market for telecommunications products or services.

The countries of the Asian Pacific represent another region of the world that is becoming increasingly important. While the region does not have an organization comparable to CEPT, the six countries of the Association of South East Asian Nations (ASEAN) have cooperated on trade issues in the past and have announced the formation of a free trade area that would include 320 million People.** And while not a member of ASEAN, Australia has been an active force at past conferences, including WARC-92. Japan has been quiet at past conferences, but has economic power that could come into play in the future. Although uniting all these countries in a single trading block is unlikely in the short term, they represent a huge market for U.S. goods and services, and could become powerful representatives of regional interests in ITU activities.

Because of these political/economic realignments and differences in the ways countries use spectrum, the United States has lost many important allies and some of the historical influence it has wielded in international radiocommunication policymaking. At past conferences, the United States had usually been able to count on the industrialized world and even, to a certain extent, on the USSR for support. By 1992, however, many of these historical ties had dissolved, and new ones were still being developed. As a result, at different points in the conference, the United States found itself isolated on several important issues. The Europeans, for example, opposed the United States on many items, including some of the most important issues of the conference-

²² ASEAN members include: Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore, and Thailand. The ASEAN Free Trade Area (AFTA) is expected to begin Jan. 1, 1993. Paul Blustein, "Southeast Asia Joins the Bloc Party," *The Washington Post*, Nov. 10, 1992, p. B1.

Figure 1-3—International Telecommunication Union Regions of the World



SOURCE: U.S. Department of Commerce, National Telecommunications and Information Administration, *Tables of Frequency Allocations and Other Extracts From: Manual of Regulations and Procedures for Federal Radio Frequency Management*, September 1989 ed., p. 4-30.

future terrestrial mobile services, MSS, and BSS-Sound. The United States was also not able to develop significant worldwide support for its proposals on aeronautical public correspondence (APC) and HDTV.²³ The United States can no longer rely solely on its market power and technological preeminence to influence the outcomes of international radiocommunications conferences.

The rise of regional blocks of countries acting in concert at ITU forums presents the United States with both threats and opportunities. The threats stem from the possibility that U.S. proposals and positions could be overpowered in future WARC's. Conversely, the fluid state of alliances presents the United States with an important opportunity to encourage the formation of other blocks of countries, either on a regional basis or perhaps based on a particular special interest, that could support U.S. positions. The United States would not necessarily have to be an official member of such alternative alliances for them to prove useful. The development of alternate, competing power centers could be used to balance each other at future conferences. At the same time, the United States should cultivate alliances, both with members of the Western Hemisphere and with individual countries or other regional or international organizations that share U.S. concerns, in order to promote U.S. interests.

■ The Economics and Politics of WARC-92

Economics and, as a consequence, politics are playing increasingly pivotal roles in the allocation of spectrum both internationally and domestically. In the past, international spectrum allocation was largely the province of government engineers, spectrum managers, and representatives from a few large (U. S.) telecommunications companies. Today, as the world's telecommunications industries and service providers are in-

creasingly turned over to private ownership and as markets are opened to competition around the world, the economic stakes associated with spectrum policy are growing. Decisions that were once based primarily on technical considerations are now decided on the basis of economics (investments, revenues, and competitiveness) and politics as well as technology. As countries (or blocks of countries) have sought to advance their economic interests in radiocommunications, spectrum allocations have become a weapon in the battle for global economic supremacy, and WARC's, which decide how frequencies are to be divided between services, have become anew focus in the intense global struggle for competitive advantage in radiocommunication technologies and services. Countries seek to protect the interests and investments of their existing domestic users, and try to gain an advantage for their manufacturers and service providers in order to promote competitiveness.

Evidence of the increasingly political aspect of the process is abundant. In the United States, companies or government agencies fighting for spectrum often raise the battles to the political level—pitting Congress against the FCC, and the Defense Department against the private sector. Congress, for example, got involved in the FCC's spectrum reserve proceeding in order to protect the interests of the incumbent users of frequencies the FCC proposed to reallocate. FCC commissioners have noted the political pressures and rumors surrounding the pioneer's preference pro-

***E**conomics and politics are playing increasingly pivotal roles in spectrum allocation—internationally and domestically.*

²³ In the case of APC, the United States held to its original position, protecting the systems already being used in the United States, Canada, and Mexico. However, in the case of HDTV, the United States went along with a compromise supported by other members of Region 2, the Western Hemisphere.

ceedings for LEOS services.²⁴ Motorola wrote then Vice-President Dan Quayle, seeking help in preventing the International Maritime Satellite Organization (Inmarsat) from entering the big LEOS arena (see chapter 2).

The consequences of this focus on economics and the consequential politicalization of WARCS have a number of effects clearly seen at W-92. First, despite the general belief that global allocations are the most advantageous in terms of market size, consequential lower equipment costs, and reduction of interference—allocations were often made on a regional or even country-specific basis. Many countries, the United States included, inserted footnotes into the international Table of Frequency Allocations that prohibit services from operating in their country or allocate services that will operate only in their country.²⁵ Although such footnotes are sometimes necessary to protect important national services, fictionalization of the allocation table in this way makes it harder to share spectrum and coordinate services, and may lead to an increase in interference between different services operating in the same band in different countries. Divided allocations may also reduce the potential market for new services, increase equipment costs, and may even make some services (technically and/or economically) infeasible. The negative impacts of regionalization should not be overestimated, however. The large size of some regional markets may mean that a worldwide system or service would not convey any further significant economies of scale or size.

Second, in order to protect existing services, technical limitations were put on many of the new

allocations. These include sharing requirements, power limitations, and stringent coordination procedures. Such limitations could severely limit the ability of a new service to operate and could preclude it altogether in some circumstances. At best, such limitations make the process of developing and introducing a new international radio-communication service more difficult and subject to failure if countries cannot agree.

Third, long transition times were attached to some new services. In many cases, these services cannot come into operation for 10 or 15 years. These long transitions are designed to protect investments in equipment—allowing time for companies and countries to recover their investments before the systems are replaced. However, in an era of rapid technological change, when generations of technology are measured not in years, but in months, such a practice can also be used to allow lagging countries to “catch up” to their competitors in the development of new technologies. In this role, long transition times are sometimes perceived as protectionist mechanisms of foreign trade policy.

For the future, the role of politics and economics must be clearly recognized and explicitly included in preparations and negotiation strategies. As the traditional role and power of foreign postal, telegraph, and telephone administrations (PTTs) erode, the locus of power will likely shift to private companies and government telecommunication ministries. The experience of WARC-92 showed the effectiveness of making direct contacts with high government officials in other countries. It is at these higher levels that political and economic pressures will be understood and acted on. Closer

²⁴ Comments of Commissioner Ervin S. Duggan, “FCC Tentatively Chooses Non-profit Organization Proposing LEO Satellite Service to Aid Developing Country Volunteer Programs to Receive First Pioneer’s Licensing Preference,” *Telecommunications Reports*, Jan. 20, 1992. Comments of Commissioner James Quello at the August 5, 1992 meeting of the Federal Communications Commission.

²⁵ Footnotes to the international Table of Frequency Allocations, just like the footnote you are reading, further describe or limit the allocations listed in the table. They are designated by number and letter-731X (see figure 1-1, which shows a sample page from the international Table of Frequency Allocations, including how footnotes are presented). Footnotes are used for a variety of purposes, including to specify power levels, reference relevant resolutions, and allocate additional services. As noted, footnotes are also used by a country (or countries) to preserve some measure of national sovereignty when they disagree with the allocations that were made internationally. These country footnotes can make alternative or additional allocations or can limit operations within those countries.

cooperation with high-ranking foreign government officials may enhance the ability to achieve compromises acceptable to all sides.

■ The Rise of the Private Sector

INTERNATIONAL AND WARC ISSUES

As the forces of privatization and liberalization sweep through the world's telecommunication and radiocommunication industries, the number and influence of private sector interests and user groups are growing. This rise has the potential to alter the ways in which radiocommunication policies are determined internationally by bringing telecommunications system operators, manufacturers, and users more directly into the process. However, the increasing role of the private sector in international telecommunications regulation and negotiations may pose a threat to international structures and institutions such as the ITU. Historically, the ITU has been primarily an intergovernmental organization, bringing together the nations of the world in order to harmonize telecommunication and radiocommunication policies and coordinate international usage. With the rise of transnational telecommunication firms, however, and the demise of the government-controlled PTTs, control of the world's tele- and radiocommunications networks and policies is increasingly being influenced by the private sector.

As a result, the focus of world telecommunication and radiocommunication policymaking could shift. The structures and processes that were set up to accommodate intergovernmental negotiations may prove inadequate for private sector needs. Recognizing this, the ITU is attempting to open its activities more to the private sector. If its efforts succeed, it may survive as a new, more industry-oriented ITU. However, if its processes and structures begin to be seen by the private

sector as too slow, or too political, or even irrelevant, some or all of the ITU's functions could increasingly be bypassed.

The rise of the transnational corporation poses challenges to both domestic and international WARC preparations and negotiations, although the extent to which this is a serious problem is still unclear. Often such companies have branches or subsidiaries in many countries. In the preparations for world radiocommunication conferences, it is possible that representatives of these companies will pursue proposals that favor their home country or their company over best interests of the country in which they work. In the United States, with its open (FCC) preparation process, this is a serious concern. Foreign-based or foreign-owned companies doing business in the United States may seek to influence U.S. spectrum policy through their U.S. subsidiaries or partners in ways that favor *them* or their countries.²⁶

The private sector's rising influence is creating new threats and opportunities for United States spectrum policymakers.

The multinational character of these companies is felt at the WARC's as well. In recent years, as the international trend to privatization and liberalization has advanced, more and more members of private companies have been serving on other nations' WARC delegations. This trend continued at WARC-92, and promises to accelerate in the future as ITU activities are increasingly opened to private sector participation. Some companies, in fact, may actually have representatives on several different delegations²⁷—raising

²⁶In WARC-92 preparations, questions of foreign ownership and the influence that it might have on U.S. policymaking were raised in connection with two LEOS firms—Starsys, Inc., which has ties to the French Government, and I-oral, which is 49 percent owned by foreign companies (see chapter 2).

²⁷Motorola, for example, had representatives on several delegations, including the United States, Canada, France, and Australia.

the possibility at least that in international fora such as ITU conferences and meetings, these companies may (surreptitiously) choose to pursue strategies that protect or promote the company's best interests, but do not support and may actually undercut the efforts of the governments on whose delegations they serve.

DOMESTIC ISSUES

The ramifications of this rise internationally are far-reaching, but the United States, with its active private sector and more democratic policy processes, could be affected more than other countries.²⁸ The role of the U.S. private sector in international telecommunication matters is unique in a foreign policy setting. Due to the historical development of the telecommunication industry in this country (private, not government-owned), and the high degree of expertise private sector representatives have developed in international radiocommunication matters, they play a much more active and involved role in foreign (telecommunication) policy than companies in other industries.²⁹

During the preparations for WARC-92 and at the conference, for example, private sector representatives were very active in the development of U.S. proposals and in lobbying for U.S. positions at the conference. Generally, government and industry delegates believe these efforts were important in achieving positive outcomes for the United States. In the case of big and little LEOS, several delegates credited much of the success of the U.S. proposals to the work of the LEOS private sector proponents supported by the government. Ambassador Baran encouraged the wide

participation of the U.S. private sector in order to demonstrate to foreign delegates that the United States was serious about its various proposals and that the proposals enjoyed broad industry backing.

The private sector will also be intimately involved in implementing the decisions of WARC-92. U.S. companies planning to operate in foreign countries, for example, will have to develop a knowledge base of the various stakeholders and regulations in those countries in order to negotiate for foreign licenses. The knowledge gained in this process could form an important foundation for planning and strategy as the United States prepares for future conferences.

The extensive involvement of the U.S. private sector in international radiocommunication policymaking has benefits and disadvantages. The primary benefits flow from the expertise industry representatives have developed. In many cases this experience was gained from previous service in the Federal Government. This relation fosters a closer sense of collegiality among Government and nongovernment representatives that promotes greater cooperation and better decision-making. In this way, the private sector supplements the government's own expertise, enabling the best and brightest of American radiocommunication experts to contribute to developing policies and positions.

The downside of this involvement is that private sector individuals represent the interests of their company, and in some cases, these interests may conflict with the greater interests of the United States.³⁰ On an individual level it is

²⁸ Recognizing the importance of this restructuring for American companies, the State Department organized a private sector ITU Task Force to develop recommendations on how the United States should approach the special plenipotentiary. The final recommendations of this group were submitted to the State Department in December 1992.

²⁹ In Europe especially, the telecommunications service providers have historically been public institutions—PTTs. In effect there were no private sector service providers, although manufacturers of equipment have been privately owned.

³⁰ This is one reason conflict of interest disclosures were required from all U.S. delegates.

often difficult to balance the two. For official WARC delegates, this tension can be especially trying because delegates formally represent the United States, and they may have to support U.S. positions that they and their companies do not endorse and actively argued against in the past. Several delegates to WARC-92 reported feeling torn on various issues. In cases such as these, a danger exists that an individual may work more for his/her own interests and not support (or actually undermine) official U.S. positions. Isolated instances have occurred in past conferences, and infighting between the big LEOS proponents was evident at WARC-92, but, by and large, government representatives and delegation leaders report that the private sector delegates were relatively well-behaved at WARC-92.

More problematic is unofficial private sector involvement at the conferences. Past practice has allowed governments to let individuals from both the government and industry participate in the work of the conferences as “observers” or “support staff. At WARC-92, such designations were granted to a large number of people from the U.S. private sector. Again this practice has both good and bad effects. The primary advantage is that more people increases lobbying strength to support U.S. positions, gauge foreign delegates reactions, and simply get work done. WARC observers from both the government and the private sector credit a strong industry presence with helping U.S. positions get adopted. However, some delegates to WARC-92 (both U.S. and foreign) and others who attended WARC-92 have charged that lobbying was sometimes too aggressive or heavy-handed. Motorola, for example, had a contingent of representatives in Torremolinos estimated at over 30 people (all but one of whom was not part of the official delegation). Too large a group of “observers” can easily become overbearing and make foreign delegates feel dominated. In some cases, these industry repre-

sentatives, who are not formal delegates and are less subject to formal control by the delegation leadership, can be overzealous-becoming, as one observer put it, “their own worst enemy.” Perhaps more than in the past, setting rules of conduct early in the process and maintaining tight control over the number and (to the extent possible) the actions of unofficial delegates will be important.

Participation by private sector companies also leads to questions of equity. Large corporations can afford to send sizable groups of their employees to international meetings such as a WARC. Smaller companies, however, have no such option. In many cases, they hire an outside consultant/lawyer to represent them in the preparation work and at the conference. Disproportionate representation such as this may give an unfair advantage to those companies well-heeled enough to participate,

Finally, the direct and critical involvement of the private sector in sensitive international negotiations raises a number of important questions for U.S. policymakers. Fundamentally, who’s in charge? At what point does the U.S. Government lose control of foreign policy? How much latitude should private sector delegates have at conferences? Should private companies take such an aggressive role? In such an environment, companies may feel free to cut “deals” with foreign countries in order to advance their own interests. In some cases, such arrangements may help further the policy objectives of the United States, but should such actions be condoned? In an era of translational corporations that owe less and less allegiance to any national government, there is no guarantee that private interests will always match U.S. public policy or foreign policy objectives. Aside from questions of legality, such actions could undercut the sovereign power of the U.S. Government to negotiate international agreements.

IMPLICATIONS FOR U.S. POLICY AND TECHNOLOGY DEVELOPMENT

The lessons of WARC-92 and the implementation of its outcomes cannot be analyzed in isolation from the larger context of U.S. radiocommunication policymaking. That context is characterized by a divided government structure, a strong and involved private sector, and a philosophical commitment to market-driven policy development. The proposals that the United

The lessons of WARC-92 cannot be analyzed in isolation from the larger context of U. S. radiocommunication policymaking.

States adopted for WARC-92, and the manner in which the decisions made at the conference will be implemented domestically, are a product of these forces.

OTA has previously analyzed the divided structure of U.S. radiocommunication policymaking and the problems that it causes in the WARC preparation process.³¹ That analysis led to the conclusion that the fragmentation of U.S. radiocommunication policymaking, lacking clear long-term policy guidelines or vision, led to radiocommunication policies that were often reactive and lacking focus. And while this structure may have worked adequately for isolated issues or specifically-defined topics such as WARC-92, it works less well for developing long-term and/or broader radiocommunication policy initiatives.

Looking beyond WARC-92, although senior policymakers increasingly recognize the importance of the international dimensions to radiocommunication policy and more effective plan-

ning, it is possible that philosophical, structural, procedural, and institutional inertia may inhibit creative policy development and prevent the United States from aggressively moving ahead in radio technology policy development. Even with a change in Administrations, which may bring more focused direction and leadership to U.S. radiocommunication policy development, structural and procedural problems will continue to exist, and ideological changes at the top levels of the government may take some time to falter down to career spectrum managers. Established institutional cultures and beliefs, and uncertainty over how much the spectrum can and should be planned, could make the implementation of any new vision difficult.

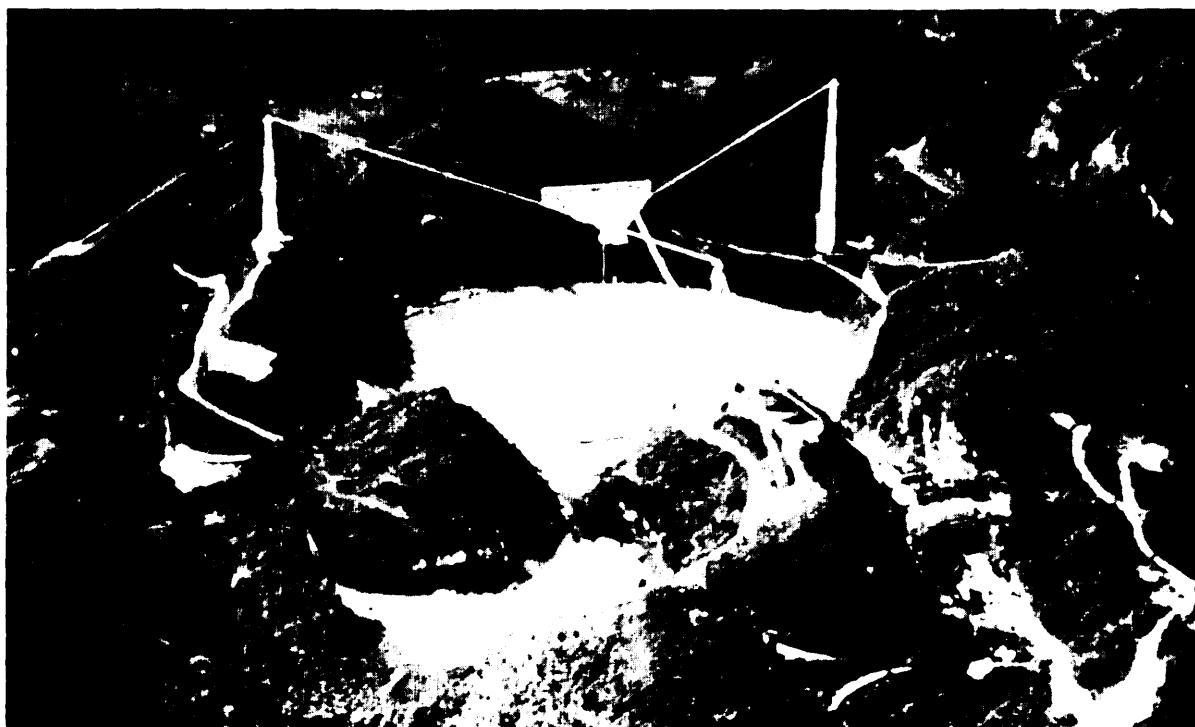
■ Refining the Market Approach to Spectrum Policy

In place of focused forward-looking policy leadership by the Federal Government, the United States has relied almost solely on market forces to guide the development of radiocommunication services and technologies in this country.³² And while market mechanisms do have advantages in technology development, there are dangers in relying too heavily on such an approach. Overreliance on market mechanisms, combined with the divided nature of U.S. radio spectrum management and a lack of forward-looking action on the part of Federal policymakers, has led to a drift in international radiocommunication policy that could consign the United States to being a second-rate radiocommunication power.

Historically, the United States has based its approach to telecommunication development on a philosophical/ideological model that identifies “the market” as the best driver of technological

³¹ OTA, WARC-92, op. cit., footnote 1.

³² NTIA, op. cit., footnote 3.



National Science Foundation

Radio astronomers use large dish-shaped antennas, such as this one in Puerto Rico, to help them explore the Universe. These antennas must often be several hundred feet in diameter in order to pull in the faintest radio waves from distant galaxies.

progress.^{33 34} According to this approach, market mechanisms provide maximum flexibility to industry to develop and sell products and services that meet consumer/user demands. Similarly, government spectrum managers believe that *a priori* planning of radiocommunication services would lead to inefficient use of the spectrum by committing frequencies to technologies and services that may not succeed in the long-run. Proponents of a market approach point to U.S. leadership in many areas of radiocommunication technology and the highly developed state of U.S. radiocommunication systems (compared with other countries) as proof that the market-based ap-

proach should be the preferred model for technology development.

PROCESSES OF MARKET-BASED POLICYMAKING

In practice, the market model affects the development of radiocommunication policy on at least two levels. At the broadest level, the market is called on to determine what technologies and services should be developed, how much spectrum should be allocated to them, and in what bands. This approach to policymaking and spectrum allocation suffers from several flaws. First, the market can only sort effectively and effi-

³³ For one view of the difference between market-driven and technology-driven approaches to telecommunications, see Barbara J. Farrah and D. Mike Maxwell, "Market-Based Public Policy," *Telephony*, June 15, 1992 p. 80.

³⁴ Notwithstanding efforts by the FCC in the early 1970s to create spectrum reserves for land mobile technologies. For a brief history of these actions, see Federal Communications Commission, *In the Matter of Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, 7 FCC Rcd No. 4, Feb. 7, 1992.

ciently between competing commercial uses, or uses that can be reduced to dollar figures. It cannot adequately judge between a commercial system, for example, and a radiocommunication service that serves larger social goods or goals, such as public diplomacy or radio astronomy—where few or no direct monetary benefits may accrue. In cases such as these, public policy must step in to fill the void left by a market approach. Policymakers must decide how to strike the balance between the important social functions filled by radiocommunications—public safety, defense, diplomacy, and scientific research—and (new) commercial systems that could potentially improve U.S. competitiveness in radiocommunications, create jobs, and improve our balance of trade.

Determining the “public good” in this new era of wireless communication will be increasingly difficult. Many different players in the government and industry need the radio spectrum to carry out their missions and provide services to the public. Domestic policy battles over spectrum use will intensify as the Nation’s airwaves become increasingly congested—pitting the private sector against the government, different domestic radio industries against each other, and various Federal Government users against each other. For example, the use of radio frequencies to provide safety and navigation services to maritime and aeronautical users is a vital public interest use of the spectrum, but it is not particularly glamorous. The importance of such uses can sometimes get lost in the enthusiasm for new consumer technologies. In these battles, the legitimate interests of the existing users of the spectrum must be balanced against the potential benefits to consumers and advantages to international competitiveness that new technologies

could bring. Too often, as policy is determined now, such evaluations—based on a comprehensive assessment of the benefits and disadvantages of each competing user—are not made.

Second, what is “the market” and who defines it? Presumably the market is perceived user demand for a product or service. Unfortunately, this demand is usually measured and reported on by the very companies that wish to serve it—they have an obvious motive in making the proposed service seem as popular and desirable as possible. As a result, the marketing projections made by these potential providers may be overestimated. The widely varying estimates of the market for satellite-delivered phone services indicate the subjective nature of this approach. Allowing the private sector to dictate radiocommunication policy through its definition of market demand may skew the policy development process in ways that benefit companies at the expense of consumers or the long-term development of a coherent radiocommunication policy designed to serve public needs.³⁵

Because of the difficulties in identifying “successful” technologies, opponents of greater Federal Government involvement in technology development (industrial policy) believe that the government should not be put in the position of picking specific technology winners and losers. Rather, they argue that the government should support any and all radio-based technologies that contribute to an agreed-upon framework of policy goals for radiocommunications development. Such policy goals and objectives, however, like the concept of universal service in telephony, cannot be set or achieved by market forces alone.

Furthermore, some analysts, in fact, argue that the U.S. approach to telecommunication technol-

³⁵ Some analysts are more blunt: “The public has been largely shut out of the communications policy process. Although the Communications Act of 1934 mandates that all actions implementing it be based on determinations that they are in ‘the public interest,’ the FCC has viewed the public as nothing more than customers. It has let those who sell services to the public decide what is best for them.” Nolan Bowie, Angela J. Campbell, and Andrew Jay Schwartzman, “Telecommunications,” in Mark Green, (ed.), *Changing America: Blueprints for the New Administration* (New York: Newmarket Press, 1993), pp. 604-615.

ogy development is often not market-, but technology-driven. "If you build it they will come" still seems to be the dominant theme in U.S. telecommunications technology development.

Although the current [industry] language suggests a market model, the actions continue to focus on a technological one. This confusion has brought the industry to its present impasse. More than anything else, this impasse is characterized by effort after effort to develop "market-driven" products, only to have the products repeatedly fail in market trials.

Why is this happening? The industry has carefully identified products customers could use. . . . The answer lies in understanding how paradigms affect actions. . . if their [companies'] vision is limited by a focus on technology, if their insight is bounded by a commitment to specific products, they may see only what technology can do for customers rather than learning what customers need technology to do for them.³⁶

The reason for this continued reliance on technology has been attributed to the fact that "all too often, the people who invent and design new technologies are not the ones who debate and think through their social, economic, and policy implications.³⁷ In other words, technology is often developed by engineers who concentrate on solving technical problems, but give less thought to how (or even if) the technology systems they have developed will really be used. Given this historical focus, letting the market decide, when the market is defined by the companies trying to serve it, is not necessarily a sound basis for determining public policy or the public good. More specifically, in the development of WARC proposals, the dictates of an as-yet-unspecified market demand should not be uncritically accepted or given undue weight in the preparation process. Noncommercial systems that serve im-

portant public (safety) communication needs must be fairly considered and equally strongly advocated. Government regulators and analysts must play this role.

Some analysts have likened the change that needs to occur in telecommunications policy with the change in paradigm from an industrial economy to an information economy—with a change in focus from industry to public interest needs. Congress has an important role to play in moving U.S. telecommunication policymaking into the 21st century. Today, legislation is often

. . . designed from an industrial age perspective to protect industrial age players. They represent sellouts to special interest groups rather than the responsible leadership needed in these economically turbulent times.³⁸

More forward-looking leadership from the Congress could push U.S. spectrum managers to consider more carefully the long-range impacts of their decisions on all of **American** society, and take a broader, more comprehensive approach to evaluating the public good.

The dominant theme in U.S. telecommunications technology development still seems to be "if you build it they will come."

The second means by which the market controls radiocommunication policy is just as important. Once a market decision has been made regarding which services are most needed, the market is then called on to sort out competing systems, standards, and companies. Unfortunately, the market is fickle, and acts according to

³⁶ Barbara J. Farrah and D. Mike Maxwell, "Rethinking the Telecom Field of Dreams," *Telephony*, Mar. 9, 1992, p. 50.

³⁷ D. Linda Garcia, remarks before the Annual Conference of the Public Radio Program Directors Association, Philadelphia, PA, Sept. 17, 1992.

³⁸ Barbara J. Farrah and D. Mike Maxwell, op. cit., footnote 36.

economics—it does not necessarily take into account important social or political goals.

Finally, the market does not always work. In the standards-setting arena, there are many examples when market forces have failed, including AM stereo and digital cellular telephone.³⁹ In these cases, the failure of the market to quickly converge on a standard held up the development and deployment of the most advanced technologies. In an era of rapid technology developments,

Relying solely on the market undermines effective strategic planning.

waiting for the market to set standards and sort out winners and losers could leave the United States behind its international competitors in advanced wireless applications.⁴⁰ During

the preparations for WARC-92, for example, private sector stakeholders often complained about the lack of government leadership and guidance in developing positions.

EFFECTS OF A MARKET-BASED APPROACH

From a policymaking perspective, U.S. reliance on market forces at both levels has several undesirable effects. First, there is a philosophical commitment in this country to the democratic ideal where proponents and opponents come together in a neutral forum to debate the merits of an idea and arrive at a reasoned conclusion or decision. This is a forum where information flows

freely, and the technical merits of a technology should decide its fate—win or lose. However, in reality, the picture is more complicated. In cases where the economic stakes reach into the billions of dollars, companies will look for any means to discredit their competitors and politics often enters the equation (witness the political overtones to almost every major decision the FCC makes). If the market were a level playing field, all rivals could compete evenly. However, in this debate, all parties are not equal. Larger companies, with more resources and better political connections and clout, can often gain an ‘unfair’ advantage. As a result, the market is not allowed to function normally. It becomes hostage to the various political and legal machinations industries use to either protect themselves (as in the case of personal communication services) or to promote themselves (as in the case of LEOS). The market sometimes has less to do with deciding outcomes than the political considerations that have come to the fore with the rise of the (economic stakes of these) new technologies.

Relying solely on market forces to determine spectrum policy also undermines effective strategic planning and could decrease the long-term competitiveness of the United States in new radiocommunication services. Indicative of the lack of strategic focus in radiocommunication policymaking, no effective governmentwide mechanism exists for comparing and evaluating radio technologies and services as a basis for public policy decisions. The FCC, through its public comment processes, does try to make these kinds of analyses, but it only controls the private sector

³⁹ The FCC has now been mandated to set a standard for AM stereo. Telecommunications Authorization Act of 1992, Public Law 102-538, Oct. 27, 1992.

⁴⁰ A nagging question from the WARC-92 preparations process, and one that tiers debate in the standards-setting arena for new technologies, is at what point should positions (and standards) be set. By waiting for the market to decide (determine a standard) the United States could lose any competitive advantage it might have. Waiting also makes it very difficult to push U.S. proposals and policies abroad, when they have not been set. Such disputes were highly evident in the preparation for the The Inter-American Telecommunications Conference (CITEL) WARC-92 preparation meeting held in Washington DC. Would the United States be better served by adopting a decision early and getting a potential jump on the competition? On the other hand, locking in a position too early could jeopardize effective negotiation—if U.S. representatives did not have the flexibility to modify their stances—just as setting a standard too early can lock in technology that is not the optimum. For a more complete discussion of the policy issues surrounding standards setting, see U.S. Congress, Office of Technology Assessment, *Global Standards: Building Blocks for the Future, TCT-512* (Washington, DC: U.S. Government Printing Office, March 1992).

use of the spectrum. There is no open, effective way to compare government and nongovernment spectrum use. WARC-92 was, in large part, a struggle for spectrum between emerging wireless technologies and services and established radio frequency users. For several reasons—lack of objective sources, lack of FCC staff resources, pressures imposed by the shortness of WARC-92 preparation time, secrecy of government data, lack of experience and data on new services—open evaluations of the public interest benefits and/or disadvantages of competing radio services were never made.

The foremost example of this lack of process was the competition for the coveted frequencies in the L-band. The Federal Government and major aircraft manufacturers use the lower portion of this band (1435-1525 MHz) for aircraft and weapons testing. Because these activities are classified, however, the FCC claims it was unable to determine exactly how the government and its contractors use the band—i. e., what frequencies, what times of day, what geographic locations. The government was never forced to fully explain its use of the band.⁴¹ The private sector, because of the favorable transmission characteristics of the band, wanted to use this spectrum for mobile satellite services or digital audio broadcasting satellite services. While a comparison was apparently made between the existing uses of the band and the potential revenues, technological gains, and competitive benefits that could be realized by reallocating the band for BSS-Sound, it is unknown what factors were used in the comparison or how they were valued.

Finally, the reliance on private industry to identify future spectrum needs obscures the second-order effects of new systems and services. Assuming frequencies are granted, what real benefits will the United States realize? Many of the new systems and services tout their benefits to American competitiveness. Such claims need to

be examined closely. Will the equipment needed for these new services be produced in the United States? Indications are that some will not be. Little LEOS service providers, for example, report being disappointed with the response of U.S. manufacturers to this potentially lucrative new area. More importantly, for a system to succeed globally, it will need to attract support (and funding) from a variety of foreign sources, both government and private sector—global systems will require global partners to succeed. Launches may not be on American rockets, and much of the other equipment for the systems may not be produced in American factories. The real benefits to American competitiveness may come only in enhancing the U.S. reputation as the world's premier provider of satellite services, and laying the foundation for future advances in global satellite markets.

Overall, relying on the power of the U.S. radiocommunication market alone would be a mistake. The emerging markets of Europe and Asia will challenge U.S. claims to being the world's preeminent technology developer and consumer. Crea-

tive and aggressive policymaking, taking advantage of market forces, is needed to ensure the competitiveness and leadership of the United States in world radiocommunication markets. Without

such leadership, the United States will continue to rely on its private sector to set the direction for U.S. radiocommunication policy. Industry, however, needs the guidance and partnership of

Creative and aggressive policymaking is needed to ensure United States competitiveness in world radiocommunication markets.

⁴¹Governments spectrum managers dispute this view. They contend that they made all necessary information available to the FCC for review. However, what information was actually provided, its accuracy and completeness, is unclear.

government planners to make the United States a strong, coherent presence in international radio-communication policymaking and markets. A more aggressive policy process is needed to bring leadership, direction, and coherence to U.S. international radiocommunication policymaking.

■ Improvements in Long-Range Planning

As a result of the historical reliance on market forces and the lack of Federal Government leadership in spectrum policy development, long-term planning for future uses of the radio frequency spectrum and coordination of spectrum policy (including priority-setting) are inadequate. For example, although U.S. proposals for WARC-92 were developed in a timely fashion, it is less clear how well, if at all, these proposals (and the policy directions

Long-term radio frequency spectrum planning and coordination of spectrum policies are inadequate.

they imply) fit into long-range policy goals or even if such long-range goals have been considered. Preparing WARC proposals and positions is not equivalent to de-

veloping long-term policy (even if WARC negotiating strategies are carried out over long periods of time), and it is unclear if such an essentially ad hoc approach can meet long-term needs. A more regular ITU schedule for future conferences will increase pressures to develop more coherent U.S. policymaking initiatives, and force both the government and the private sector to consider

long-term goals in a more clearly defined and focused way.⁴²

OTA has argued in the past that a reliance on market forces and a lack of government and private sector foresight in planning for future radiocommunication services will hurt the U.S. ability to compete internationally.⁴³ OTA continues to believe that between a purely market-based approach to spectrum management and an overly centralized approach to planning, there is a middle ground of creative, aggressive planning and policymaking that will enable the United States to compete more effectively in the new technologies and services that are being developed.⁴⁴

However, developing a practical approach to spectrum planning will be challenging. A number of analysts in both the government and the private sector have noted the difficulties in planning spectrum. First, planning for needs and technologies that do not yet exist is nearly impossible, and would not necessarily lead to efficient use of the spectrum. The tradeoffs between encouraging efficiency and promoting the development of new technologies must be carefully weighed as a part of determining future radiocommunication policy. It may be possible to craft policies and regulatory efforts that encourage both, but it will be necessary to carefully balance the needs for efficiency with the demand for new technologies and services. Second, even if spectrum is more concretely planned, this does not guarantee that a market for the planned service will actually develop or that the services/systems planned will become economically viable. The 12-GHz band of frequencies, for example, has been planned for several years to provide direct broadcast televi-

⁴² NTIA has taken steps in this direction with its proceeding on future spectrum requirements, as has the State Department with its task force on U.S. reactions to changes in ITU. See U.S. Department of Commerce, National Telecommunications and Information Administration, "Current and Future Requirements for the Use of Radio Frequencies in the United States," Notice of Inquiry, Docket 920532-2132, June 1, 1992.

⁴³ OTA, WARC-92, op. cit., footnote 1.

⁴⁴ A similar concept has been called a "progressive" approach to telecommunications regulation. See Steven R. Rivkin and Jeremy D. Rosner, "Shortcut to the Information Superhighway: A Progressive Plan to Speed the Telecommunications Revolution" *Future Choices*, August 1992.

sion services from satellites. Despite the fact that such services were first proposed in the early 1980s, they are only now beginning to be implemented, and their eventual success is far from certain.

One of the fundamental reasons for the lack of a clearly defined vision/framework to guide U.S. radiocommunication policy development is the divided responsibility for policymaking in the United States. The FCC and NTIA have not worked cooperatively to build such a view or framework. Recognizing these problems and the importance of radiocommunications, in recent years U.S. policymakers at higher levels have begun to pay greater attention to spectrum policymaking.

The executive branch has taken the lead in revitalizing spectrum planning. NTIA recently issued a Notice of Inquiry requesting comments and information on "Current and Future Requirements for the Use of Radio Frequencies in the United States,"⁴⁵ In the Notice, NTIA notes clearly the importance of improved planning of the spectrum resource:

... planning helps ensure that adequate spectrum will continue to be available for public safety needs, other non-commercial uses such as amateur radio and scientific research, and local, state, and federal government uses. Moreover, improved planning is essential for the U.S. government to represent effectively the interests of all U.S. spectrum users in international spectrum negotiations. Such planning is especially important to permit the presentation of consistent policies in such forums as the new series of biennial World Administrative Radio Conferences recommended by the High Level Commit-

tee of the International Telecommunication Union (ITU).

In its comments on NTIA's proceeding, Motorola notes further that "this explosive growth of new mobile communications services, driven by technological advances and consumer demand, will lead to a serious shortage of spectrum absent sound spectrum planning."⁴⁶

Unfortunately, these efforts have not yet been matched by the FCC. Critics accuse the Commission of doing little more than reacting to technology developments. It responds to applications and petitions, but has shown a notable lack of aggressiveness or foresight in helping to advance the development of radio technologies. Numerous observers have commented that the FCC will not act until someone forces it to by filing a petition for change. Despite a historical lack of planning at the FCC, however, there are signs that things could be different. The FCC has taken an aggressive (ironically, some say too aggressive) approach to developing standards and an implementation schedule for HDTV. The FCC's Office of Plans and Policies has written studies on the future of fiber optics and the broadcasting industry.⁴⁷ In early 1992, the FCC proposed the creation of a "spectrum reserve in order to promote the development of new radiocommunication technologies and services."⁴⁸ Aside from the political problems encountered by the plan, the FCC's efforts at least represent an effort to spur future development.

In terms of international spectrum planning and policymaking, the National Aeronautics and Space Administration (NASA) and the international Space Frequency Coordination Group (SFCG)

⁴⁵ NTIA, *op. cit.*, footnote 3.

⁴⁶ Comments of Motorola, Inc., in the matter of "Current and Future Requirements for the Use of Radio Frequencies in the United States, X," *op. cit.*, footnote 34, p. 4.

⁴⁷ Robert M. Pepper, *Through the Looking Glass: Integrated Broadband Networks, Regulatory Policy and Institutional Change* (Washington DC: Federal Communications Commission, November 1988); Florence Setzer and Jonathan Levy, *Broadcast Television in a Multichannel Marketplace* (Washington, DC: Federal Communications Commission, April 1991).

⁴⁸ Federal Communications Commission, "Re-evaluation of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies," *Notice of Proposed Rulemaking*, ET Docket 92-9, 7 FCC Rcd No. 4, Feb. 7, 1992.

may provide a model of planning for future spectrum needs. The SFCG (see chapter 2) is composed of space agencies from all over the world. This group identifies the future needs of space operations and research, and develops consensus among member countries, on a continual basis, on how best to meet those needs. Because of the long lead times to get large-scale space operations and missions into space, this

Despite the increasing importance of telecommunications in world and domestic economies, no action has been taken to unify United States telecommunications policy.

group has to think of their spectrum requirements in the long term and then develop international agreements to get what they need. In the United States, for example, NASA was a strong driver pushing the United States to become more involved with and to support what turned out to be

WARC-92. As a result of the extensive pre-negotiation done in the SFCG prior to WARC-92, new allocations for space services were relatively easy to agree to at the conference.

■ The Future: Protecting US. Technological and Policy Leadership

As the United States moves into the 21st century and wireless technologies and services become an increasingly important part of the overall telecommunications infrastructure of this

country, the timely development of appropriate radiocommunication policies, both domestic and international, becomes imperative. Many analysts have identified the general problems and shortcomings of the presently divided structure of U.S. telecommunications policymaking.⁴⁹ As a subset of overall telecommunications policy, spectrum planning and management suffers from the same problems. It is important to note, however, that despite the increasing importance of telecommunications in world and domestic economies and the strategic and competitive benefits a strong telecommunications policy represents, no action has been taken to unify U.S. telecommunications policy, although some efforts have been made to improve long-term spectrum management.

The large number of radiocommunication technologies and services now being developed, and the corresponding increase in the number and influence of private sector interests, will place increased emphasis on government and private sector cooperation to prepare for future world radiocommunication conferences, to carry out cooperatively developed strategies at the conferences, and to implement new domestic radiocommunication rules and regulations. There is a significant amount of expertise in both the government and the private sector that must be tapped in creative ways to bring the benefits of new technologies and services to American consumers and to promote the competitive interests of U.S. radiocommunication firms overseas.

Unfortunately, the United States has had no vision or policy framework that could guide spectrum development and that would ensure that the spectrum resource is utilized in the public interest and for the benefit of the Nation. Overall,

⁴⁹ For a discussion of such issues, see Henry Geller, *The Federal Structure for Telecommunications Policy* (Washington, DC: The Benton Foundation 1989); U.S. Congress, Office of Technology Assessment, *Critical Connections: Communications for the Future*, OTA-CIT-407 (Washington DC: U.S. Government Printing Office, January 1990); U.S. Congress, Office of Technology Assessment, *The 1992 World Administrative Radio Conference: Issues for U.S. International Spectrum Policy*, OTA-BP-TCT-76 (Washington, DC: U.S. Government Printing Office, November 1991); Michael F. Starr and David J. Atkin, "The Department of Communications: A Plan and Policy for the Abolition of the Federal Communications Commission," *Hastings Communications and Entertainment Law Journal*, vol. 12, No. 2, titer 1989; and U.S. Department of Commerce, National Telecommunications and Information Administration, *U.S. Spectrum Management Policy: Agenda for the Future*, NTIA Special Publication 91-23 (Washington, DC: U.S. Government Printing Office, February 1991).

the process of developing coordinated domestic and international radiocommunication policy in the United States is seriously lacking. Decisions and policies are often reactive and not based on long-term considerations. This situation is compounded by the fact that there has not been one decisionmaking authority that effectively arbitrated policy disputes between Federal agencies in a timely manner; that made policy-level decisions among competing agency missions and requirements.⁵⁰ The recent change in Administrations may bring more focus and vision to U.S. spectrum policy, but in any case, it is too soon to gauge the impact anew perspective could have on improving U.S. radiocommunication policymaking, or the effectiveness of such an approach in the face of stubborn institutional and structural barriers.

The trends examined above and the issues and implications outlined in chapter 2 demonstrate the need for a comprehensive approach to spectrum management in this country, and the potential consequences to services and competitiveness if such a policy framework is not adopted. Unless institutional and structural changes are made, this lack of policy guidance and planning will, in the long term, reduce the U.S. leadership role in international radiocommunication policymaking and could erode the U.S. competitive position in radio-based technologies and services.

OPTIONS FOR IMPROVING U.S. POLICYMAKING

The choices for improving domestic and international U.S. radiocommunications policymaking cover a broad range of approaches and options. Many of the options discussed include reorganizing the institutions and processes by which international spectrum policy is made. Any successful reorganization, however, must be based on *specific* public policy goals that the reorganization is designed to achieve.⁵¹ A careful analysis must also be made of the tradeoffs of reorganization, including those between efficiency, equity, and political and public accountability.⁵² Reorganizations based on well-meaning, but elusive concepts—such as improved economy, efficiency, or public responsiveness—are not likely to be successful in the absence of clearly defined goals.

At the broadest level of policy development, presidential leadership may be effective for set-

N*o single decisionmaking authority has effectively arbitrated policy disputes between Federal agencies in a timely manner.*

m The director of the Office of Management and Budget (OMB) is authorized to resolve appeals between agencies over specific Federal Government frequency assignments, but this authority does not appear to extend to policy decisions or give OMB the right to decide matters of policy such as which agency mission(s) should take precedence over others in matters of frequency allocation.

51 In a 1977 report to the Congress, the Congressional Research Service noted that: "Reorganization itself cannot be a 'value.' It receives its normative content by absorption. A reorganization is 'good' or 'bad' depending upon the purposes the reorganization is designed to achieve. Presumably, in the hierarchy of purposes, a reorganization should be justified on the grounds that it is facilitating the achievement of a 'higher purpose' than that which is the purpose of the current organizational structure. It is the task of President Carter, as it was of his predecessors and will be of his successors, to develop a hierarchy of values so that the process of reorganization will be neither random nor counterproductive, but will serve a purpose which is both consistent and visible. Ronald C. Moe, *Executive Branch Reorganization: An Overview*, prepared by the Congressional Research Service for the Committee on Governmental Affairs, U.S. Senate, committee print, March 1978, p. CRS-72. The relationship of goals to institutional organization is also discussed in U.S. Congress, Office of Technology Assessment, *Critical Connections; Communication for the Future*, OTA-CIT-407 (Washington, DC: U.S. Government Printing Office, January 1990).

52 Craig Thomas, "Reorganizing Public Organizations: Alternatives, Objectives, and Evidence," paper prepared for the Secretary of Energy Advisory Board, U.S. Department of Energy, August 1992. This paper also notes the necessity of choosing between goals ("values") "when deciding whether and how to reorganize a public organization," and notes the "profoundly political" nature of such decisions, p. 51.

ting the general goals and policy framework that will guide future radiocommunication policy. Likewise, Administration initiatives may also be able to improve specific aspects of the U.S. radiocommunication policy process—through executive orders, for example. However, forceful congressional action may also be needed to help focus attention on the broad problems facing U.S. spectrum managers and to develop priorities for resolving those problems. The approaches and options presented below give Congress a number of ways to work with the Administration in order to bring about desired improvements or to exercise more prominent leadership if the Administration fails to act quickly and decisively in improving U.S. radiocommunication policy structures and processes.

Depending on congressional interest and involvement, three basic approaches are available to reform the international radiocommunication policy process, within which specific options are presented. The three approaches represent a progression from least to most complicated—from short term solutions that could be implemented in less than a year, through solutions that could be developed over a 1 to 2 year span, and finally to more long-term, systemic solutions, which could take many years to enact. Each approach has its own benefits and disadvantages as outlined below. The options presented are not meant to be exhaustive or exclusive, and many different combinations of options are possible. Figure 1-4 summarizes these approaches and options, and figure 1-5 puts them in the context of Congressional decisionmaking.

■ Approach 1

Improvements in the U.S. policymaking process must be made immediately to allow the United States to most effectively respond and

adapt to rapid changes in radio technology and the recent restructuring of the ITU. Over the course of the next year, Congress could take several steps to improve the U.S. radiocommunication policy process in general and the WARC preparation process specifically. Congressional action, by targeting funding and focusing attention on key aspects of the U.S. spectrum policymaking process, would demonstrate commitment to and leadership of U.S. radiocommunication policy, and could encourage the development of more focused policies by the agencies involved. Such efforts could be made in concert with executive branch efforts or in place of them if insufficient interest or attention is forthcoming from the White House. Implementation of these options may also serve as a stimulus for further presidential action.

The first general approach would leave the existing three-part radiocommunication policy structure and procedures intact, and allow the FCC, NTIA, and State Department, as well as the individual Federal agencies, to build on improvements they have already instituted. The FCC, for example, established the Office of International Communications (OIC) in January 1990 to coordinate international policies. Driven by the increasing importance of international concerns in the FCC's daily work, and supported by former Chairman Alfred Sikes, OIC has evolved into an important center of policy coordination in the FCC. Most of the experienced international staff, however, still remain scattered among the FCC's various bureaus. As noted above, the State Department has convened a task force to examine changes in ITU structure and possible U.S. responses. NTIA is engaged in a long-term effort to improve its spectrum management procedures vis-a-vis the private sector,⁵³

⁵³ The blueprint for these activities was first outlined by NTIA in early 1991, and many of the changes they identified have been put into place. U.S. Department of Commerce, National Telecommunications and Information Administration, *U.S. Spectrum Management Policy: An Agenda for the Future*, NTIA Special Publication 91-23 (Washington DC: U.S. Government Printing Office, February 1991).

and has begun a broad assessment of the long-term spectrum needs of the United States.⁵⁴

OPTION 1. *Take no action, but closely monitor the efforts noted above and the overall direction and development of U.S. international radiocommunication policy.*

OPTION 2. *Increase funding for existing agencies and programs and tie it to improvements in the radiocommunication policymaking process and/or WARC preparation activities.*

Targeted financial support for WARC preparation and spectrum policy planning activities could encourage more forward-looking policies and enable more thorough policy planning and technical preparation for future radiocommunication conferences.

OPTION 3. *Mandate the formulation of a long-range spectrum plan.*

If Congress believes that the executive branch is not making sufficient progress toward developing a more comprehensive and focused approach to international spectrum management, it could also require long-range and strategic planning on the part of all Federal agencies. This would force the executive branch to develop priorities for radiocommunication policy, and would also contribute to the development of a broader spectrum policy framework that would guide future policymaking efforts.

As the focal point of this effort, the FCC and NTIA could be required to cooperate on developing a long-range plan that would address the Nation's spectrum needs, with revisions to the plan submitted at regular intervals. In 1978, Executive Order 12,046 required that such a plan be developed, and although NTIA has produced a series of long-range plans beginning in 1986,

these plans have largely been developed without the cooperation of the FCC (as required) and even at times without the participation of the Interdepartment Radio Advisory Committee (IRAC).⁵⁵ In the recent legislation statutorily authorizing NTIA, such a plan was listed as a function of NTIA, but was not mandated.⁵⁷ Making the development of such a plan a required responsibility of NTIA, subject to congressional review, could hasten the development of more focused policy.

This option would build on NTIA's current efforts to identify long-range spectrum needs, and expand this activity to serve as the basis for the development of a future integrated national spectrum plan. In order to bring the FCC more directly into the process (and meeting the original language of Executive Order 12,046), legislative language could be inserted in FCC appropriations to mandate formal FCC cooperation with the NTIA effort. The effort could also be further expanded to include all Federal Government agencies with radio operations. In some cases, such efforts may require the commitment of additional resources, but such increases could be minimal.

In order to accommodate the concerns of the private sector, another possible vehicle for improving the development of radiocommunication policy and new radiocommunication technologies and services is to fund (jointly with industry, perhaps) a radiocommunication equivalent of Sematech. In that case, the Federal Government funds a consortium of computer chipmakers to promote research and development of chips and promote U.S. competitiveness in the chip industry. A similar arrangement for radiocommunication could have a variety of missions. It could serve as a focal point for the development of radio

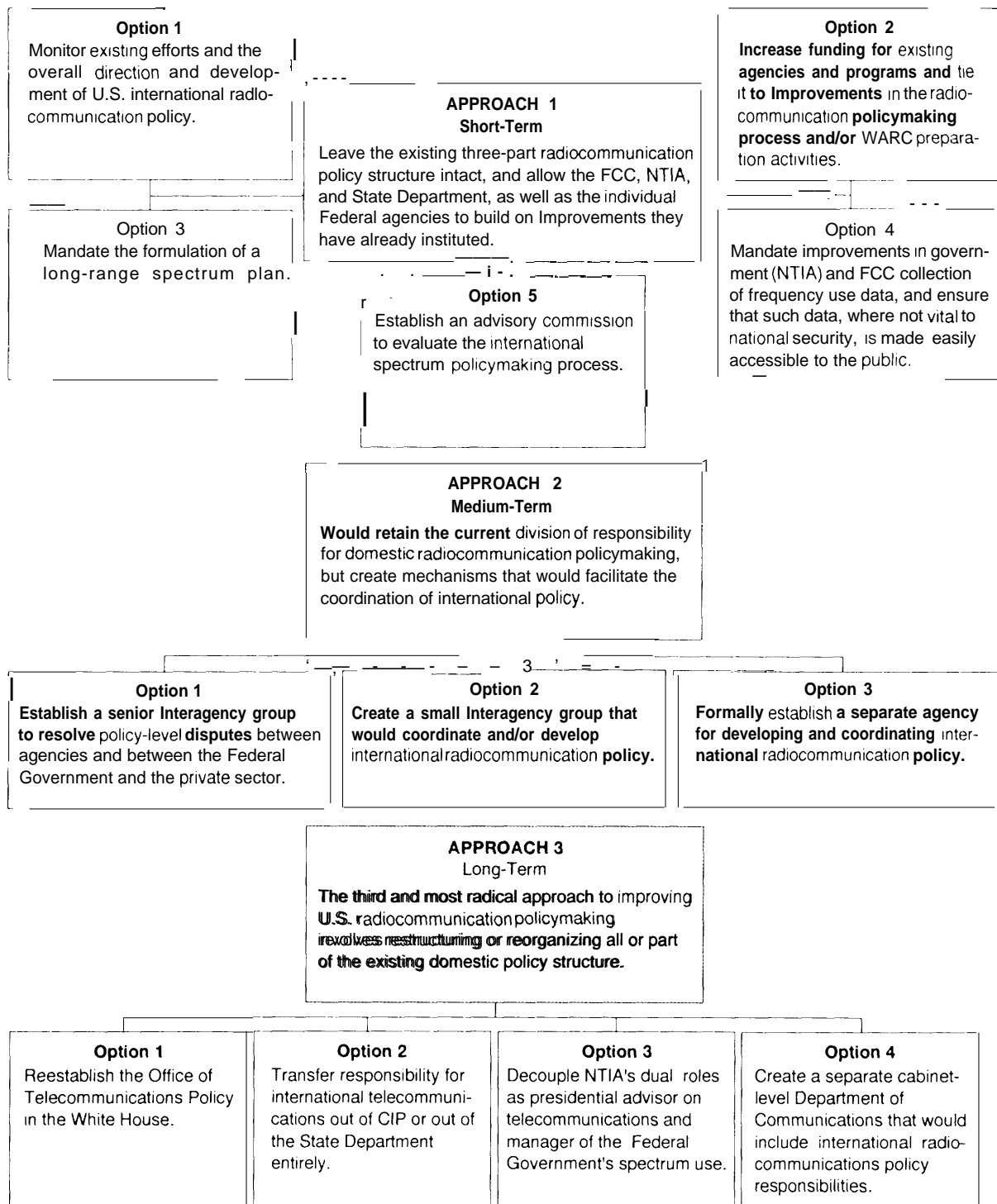
⁵⁴ NTIA, op. cit., footnote 3.

⁵⁵ Executive order No. 12,046, reprinted in 1978 U.S. Code Congressional & Administrative News, 9685-9692.

⁵⁶ NTIA, op. cit., footnote 53, p.176.

⁵⁷ Public Law 102-538, Oct. 27, 1992.

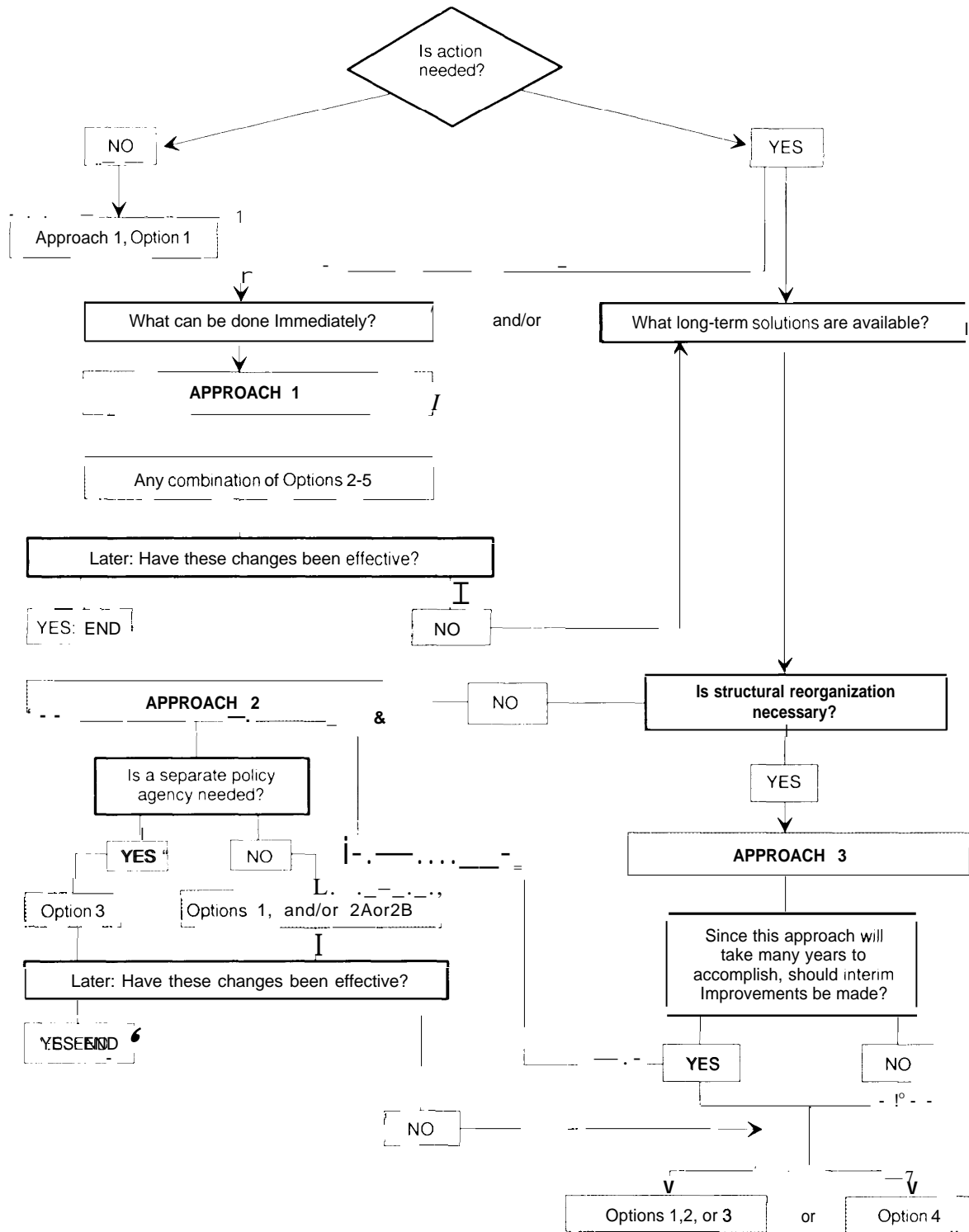
Figure 1-4—Approaches and Options for Improving U.S. Radiocommunications Policy



KEY: CIP = Bureau of International Communications and Information Policy; FCC = Federal Communications Commission; NTIA = National Telecommunications and Information Administration.

SOURCE: Office of Technology Assessment, 1993.

Figure 1-5-Decisions to Improve U.S. Spectrum Policymaking



SOURCE: Office of Technology Assessment, 1993.

technologies, focus private sector input into the radiocommunication policy process, and provide a forum for cooperative industry/government policy development. Such an organization could also serve as a clearinghouse for future world radiocommunication conference preparations.

OPTION 4. *Mandate improvements in government and FCC collection of frequency use data, and ensure that such data, where not vital to national security, are made easily accessible to the public.*⁵⁸

Additionally, such data should be required to be shared with relevant policymaking authorities in order to reach informed decisions about future WARC proposals and spectrum requirements. In several cases during the preparation for WARC-92, private sector and even some government interests complained that they could not assess some uses of particular spectrum bands because the data either did not exist or were withheld.

OPTION 5. *Establish an advisory commission to evaluate the international spectrum policymaking process.*

Such a commission could be mandated to identify any problems with the current U.S. policy structure, recognizing the current state of flux in the world's telecommunications community, and to recommend specific improvements (if needed) in the structure and/or processes of U.S. international spectrum policymaking. Such a commission could be established in a number of different ways. Congress, for example, could pass legislation to establish such a committee, with membership to include individuals chosen by the President and assuring adequate representation for

Congress.⁵⁹ The principle advantage of such a commission would be to focus more high-level attention on the processes of radiocommunication policymaking and encourage greater congressional and Administration (oversight of and) involvement in goal-setting for U.S. international spectrum policy. Another recent suggestion calls on the president to establish a commission to review overall U.S. communications policy and make recommendations for updating it.⁶⁰

The advantages and disadvantages of essentially preserving the status quo mean continued reliance on market mechanisms to make broad policy decisions. This approach maintains an ideological commitment to market-based decisionmaking and ensures that the private sector has maximum flexibility to quickly respond to both new consumer demands and advances in technology. However, as noted previously, too much reliance on market forces reduces the amount and quality of strategic planning that can be accomplished. In the face of increasingly fierce competition in global radiocommunications systems and services from both Europe and Japan, such a policy may inhibit U.S. ability to compete effectively in world markets.

■ Approach 2

Although the options presented above could contribute to the short-term improvement of the development of U.S. international spectrum policy, more substantial changes may be required to ensure that U.S. policies adequately reflect the technological, economic, and political changes now taking place in global radiocommunications policymaking. Over the next year or two, Con-

58 NTIA discusses options to improve access to frequency data in NTIA, *U.S. Spectrum Management Policy*, op. cit., footnote 53.

59 In 1966, for example, Congress passed the "Marine Resources and Engineering Development Act," which directed the President to establish a Commission on Marine Science, Engineering, and Resources. That commission had 15 members, limited to 5 from the Federal Government, and with four members of Congress serving as advisors. The legislation specified the duties of the commission and provided for funding of its efforts. "The committee was part of a broader legislative approach to develop a 'comprehensive, long-range, and coordinated program in marine science. . . ." Public Law 89-454, June 17, 1966.

60 "Breaux Awaiting Reaction to Suggestion of Presidential Commission On Communications," *Telecommunications Reports*, Dec. 14, 1992.

gress may want to consider additional procedural and/or structural improvements that could improve U.S. WARC preparations and the overall policy development process. These medium-term options represent the next step in a broader evaluation of the efficacy of current U.S. methods for determining international spectrum policy.

The context and timing of these changes is crucially important. With world radiocommunication conferences scheduled to take place biennially, the distinctions between general policy development and WARC preparation will become increasingly blurred and will, in fact, begin to converge. A single focal point for integrating these trends would help the United States to develop and maintain a clear policy direction throughout all its international radio negotiations and meetings. NTIA, for example, proposed a Joint Strategic Planning Council, which would bring together the FCC and NTIA to coordinate domestic spectrum management policies.⁶¹ An important factor in forming such a group is to get high-level support for its activities, and to ensure the active and effective participation of private sector interests.

The second approach to improving radiocommunication policy development would retain the current division of responsibility for domestic radiocommunication policymaking, but create mechanisms that would facilitate the coordination and/or development of international policy. Under this general approach, several options for improving the coordination and quality of radiocommunication policy exist.

OPTION 1. *Establish a senior interagency group that could resolve policy-level disputes between agencies and between the Federal Government and the private sector.*

A possible model is the Senior Interagency Group for telecommunications that was dis-

banded for budgetary reasons in the mid-1980s.⁶² This group would have the power to review the spectrum uses of the various Federal agencies and prioritize the agencies' missions and future spectrum requirements. The group would also settle disputes between industry and the Federal Government regarding conflicting proposals for spectrum use. In order to fairly represent all interests, private sector membership in this group, as observers at least, maybe required. Efforts would have to be made to ensure the widest possible participation from industry—not just the largest or most well-established players.

OPTION 2. *Create a small interagency group that would coordinate WARC and/or international radiocommunication policy.*

This group could effectively complement the Senior Interagency Group noted in Option 1, and could probably be put together with a minimum of additional funds, although this would require further study. This solution was suggested by a number of delegates and observers, and took several different forms.

Option 2A. In its least complicated form such a group would coordinate, but not subsume, the activities of the FCC, NTIA, and the State Department in preparation for world radiocommunication conferences. This group would focus only on WARC preparation.

Option 2B. In order to ensure that WARC proposals effectively reflect broader U.S. international spectrum goals, the mandate of the group discussed in Option 2A could be broadened to include coordination not only of WARC positions and proposals, but also the coordination of all of international radiocommunication policy and integrating WARC preparations within an overall policy framework.

Legislation, for example, could create (reestablish) the Joint Long-Range Planning commit-

⁶¹ NTIA, *op. cit.*, footnote 53.

⁶² For further discussion of past efforts to integrate spectrum policy, see OTA, *WARC-92*.

tee, composed of representatives of both the FCC and NTIA, that would meet on a regular basis, and produce a report to Congress every year or two years. This legislation would force the United States to specifically develop goals and plans for developing the radio spectrum resource and radiocommunication systems, and could provide a vehicle for Congress to participate in the goal-setting for radiocommunications and to closely monitor progress toward those goals.

OPTION 3. *Formally establish a separate agency for developing and coordinating international radiocommunication policy.*

Essentially, the international radiocommunication functions and staff of the FCC, NTIA and Bureau of International Communications and Information Policy (CIP) would be merged in one agency.⁶³ Domestic functions could be left intact. Such an agency would combine technical and policy expertise and, proponents believe, would effectively unify U.S. international radiocommunications policymaking and streamline both the development of policy and the WARC preparation process. Such a singular focal point for international radio policy could also improve the conduct of radiocommunications negotiations internationally. For example, foreign spectrum managers would no longer be confused by the three-part division of responsibility in this country and could no longer take advantage of this split to further their own positions. However, such a centralized approach faces opposition by many

analysts and would be difficult to institute both institutionally and politically.⁶⁴

The most difficult question regarding the establishment of such an agency is where to locate it in the structure of the U.S. Government. Care would have to be taken to establish it at a high enough level to give it the authority to set priorities and policies, while at the same time avoiding the ability of one group or groups to dominate the agency's work. Clear lines of responsibility and coordination between this agency and the FCC, NTIA, and State Department would have to be established.

Along these lines, some have suggested the creation of an office similar to the U.S. Trade Representative (USTR) for international telecommunications (or just radiocommunications) policy. In 1962, Congress created a position in the White House for a special representative for trade negotiations, changed as the chief representative of the United States in all trade agreements negotiations, and chair of an interagency organization, established by the President, to assist with the implementation of trade and tariff agreements.⁶⁵ Paralleling the language describing the mission of NTIA, the USTR is designated as the President's "principal advisor" on international trade policy. The USTR also coordinates interagency preparation for and participation in multilateral trade talks, and supervises a network of private sector advisory groups.

The advantage of this option is that it would raise the level of international telecommunica-

⁶³ For example, the agency would combine the FCC's Office of International Communications, NTIA's Office of International Affairs, and the State Department's CIP.

⁶⁴ The idea of centralizing telecommunications and radiocommunications policy in the United States has been discussed extensively elsewhere. For a brief review of the arguments for and against such an approach, see OTA, WARC-92.

⁶⁵ The office supporting the USTR was created by executive order in 1963. For a fuller discussion of the USTR, see Stephen D. Cohen, *The Making of United States International Economic Policy*, 3rd Ed. (New York: Praeger, 1988). Cohen reports that the creation of the office was precipitated by Congressional doubts about 'the State Department's ability to drive a hard bargain and bring home the most advantageous trade agreement. . . .' (p. 66). Similar concerns have been raised about the ability and will of the State Department to negotiate international telecommunication agreements—some believe that they are more concerned with keeping foreign governments happy than anything else. The 1974 Trade Act elevated the position to cabinet-level status. In 1980, under Reorganization Plan No. 3, the office was renamed the Office of the USTR and received a broader mandate that effectively made the office "the lead agency in all aspects of policy formulation in the trade and investment sectors. Reorganization Plan No. 3 (as submitted to Congress by the President) says that the USTR 'shall have primary responsibility' for 'developing and for coordinating the implementation of U.S. international trade policy.'" Ibid, p. 67.

tions to the political level, enabling/forcing policy decisions to be made about goals, priorities, and strategies. The status of such an agency would offer high prestige and political leverage to formulate policy, and could offer a place for policymakers to coherently think about international telecommunications policy, rather than responding to the wishes and whims of private sector and Federal agency interests.

The main disadvantage to such an agency is the very real threat that the office could become too political—a charge often leveled at the USTR. Rather than aggressively formulating policy and pursuing long-term negotiation strategies, this new agency could be “captured” by U.S. industry or the administration in power. It would be extremely important to build in openness and public accountability into the procedures of such an agency.

■ Approach 3

In the long term, the changes needed in the U.S. radiocommunication policy development process may be realized only as part of a more sweeping reordering of the Nation’s entire telecommunication policymaking structure. Sustained congressional efforts would be required to make these changes. As noted in chapter 3, each of the agencies involved in the management (and/or regulation) of spectrum resources has its own problems and limitations that constrain its effective participation in the policymaking process. The FCC is critically short of funds to do its job, and this has caused it to take a primarily reactive approach to policymaking. NTIA is hampered by its sometimes conflicting roles as presidential telecommunications advisor and Federal Government spectrum manager. And the role of the State Department needs clarification and perhaps redefinition. See chapter 3 for further elaboration of these issues and options.

The third and most radical approach to improving U.S. radiocommunication policymaking involves restructuring or reorganizing all or part of the existing domestic policy structure. This approach would take many years to debate, build support for, and enact.

Some analysts believe that as long as the current structures (FCC, NTIA, and State Department) and divisions in authority (Federal Government vs. private sector and State/local government) continue to exist, there is little chance that a coherent international radiocommunication policy can be articulated and maintained in the long term. These analysts believe that policy development for both government and nongovernment spectrum use must be combined in order to achieve a focused approach to both policy and international negotiation.

From this perspective, many observers view the disbanding of the Office of Telecommunications Policy (OTP) in 1978 as a mistake.⁶⁶ They believe that a high-level (White House) focus is needed once again for U.S. telecommunications policy. Still others believe that a cabinet-level position is needed—a Department of Communications. Disagreements over the form of this restructuring reflect the lack of consensus over the importance of telecommunications policy and what the best format for developing that policy is.

While presidential leadership, or at least support, would be necessary for any of these options to come into being, Congress has an important role to play in considering the implementation and implications of these proposals. Long-term congressional leadership in the development and articulation of U.S. radiocommunication policy could be the vehicle through which such changes are enacted, and the creation of such an agency or department may help to solidify the congressional role in the future development of U.S. radio- and telecommunications policies. Efforts to restructure the process would also demonstrate the

⁶⁶ OTP functions were transferred to NTIA.

importance Congress places on the issues of telecommunication policy in this country.

OPTION 1. *Reestablish the Office of Telecommunications Policy in the White House.*

This office would be responsible for developing all domestic and international telecommunications (including radio) policy for the executive branch. Similar to the establishment of a USTR-type position noted above, such an agency would confer needed high-level attention to the problems of telecommunications and would offer a mechanism for more effectively coordinating long-term policy development and resolving policy level disputes between agencies. The creation of such an office would entail moving responsibilities for radio- and telecommunications as outlined in the options below. Changes could be accomplished through executive order.

OPTION 2. *Transfer responsibility for international telecommunications out of CIP or out of the State Department entirely.*

If Congress decided that CIP was no longer necessary in a restructured international telecommunication procedure, CIP's functions could be transferred to another bureau of the State Department.⁶⁷ This action would likely require Congressional action since CIP was established by Congressional mandate.⁶⁸ This could result in either effectively burying CIP, and presumably effectiveness, or conversely, if CIP's functions were taken over by a strong division of the State Department, or if CIP continued to exist within a strong division of State, the effectiveness of the office could be enhanced. Alternatively, CIP's functions, and the responsibility of the State Department for international telecommunications representation, could be transferred to NTIA, a

newly created international radiocommunications agency, or a new OTP.

OPTION 3. *Decouple NTIA's dual roles as presidential advisor on telecommunications matters and manager of the Federal Government's spectrum use.*

As argued in chapter 3, the two roles can conflict and give the appearance of being incompatible in many instances-WARC preparations, for example. Two choices are possible. First, transfer IRAC duties and support out of NTIA. IRAC existed before NTIA, and could be made into a separate organization with a separate budget. This would sever the now direct policy development lines from IRAC to NTIA and give NTIA more autonomy to make policy decisions in the public interest and with less influence from IRAC. Under this option, the question of whether to leave NTIA as the manager of Federal Government spectrum is problematic. Some could argue that separating IRAC from NTIA would sufficiently protect the public's interest by decreasing the power of IRAC over NTIA policymaking. However, the ties between the two agencies could continue to be too close to permit truly independent policy development. IRAC might have to assume a broader role as the Federal Government spectrum manager, an option that would seriously reduce the role and staff of NTIA.

An alternative choice is to leave IRAC in NTIA, but separate out the role of presidential telecommunications advisor from NTIA and put it in the White House. One possible place to vest this authority is the Office of Science and Technology Policy or a new OTP. Another possibility would be to transfer it to a special telecommunications representative, like USTR, noted above. This action would leave NTIA free

⁶⁷ The State Department recently restructured its operations, revoking CIP's bureau status and placing it under the Bureau of Economic and Business Affairs. This could affect both CIP's stature and its ability to carry out its statutory responsibilities.

⁶⁸ In early 1990, for example, Representative Edward Markey considered proposing legislation that would have removed authority for international HDTV negotiations from the State Department and placed it in the Department of Commerce.

to concentrate on its responsibilities as Federal Government spectrum manager.

OPTION 4. *Create a separate cabinet-level agency, a Department of Communications that would include an international radiocommunications junction.*

This option would abolish the FCC, NTIA and CIP, and transfer their functions to one integrated department that would have overall responsibility for developing and implementing national telecommunications policy, and negotiating at international meetings.

The advantages and disadvantages are similar to those for Approach 2 above: international telecommunications policy would gain a more solid political base from which to settle disputes and set goals and priorities. However, the department could become another pawn in political

battles, or be captured by industry. There is little discernible support for this idea among members of Congress.

The most far-reaching changes would be accomplished through the establishment of a central telecommunications agency combined with a major commitment to an industrial policy for the telecommunications industries. Such a commitment would require the most active and long-term congressional involvement. This approach could be accomplished through existing structures or through a centralized telecommunications agency. The benefits of such an approach would be to raise the level of policymaking to a higher level, and to focus greater attention, and hopefully resources, on telecommunications policy issues. The disadvantages include the effects of poor planning **and** decisionmaking **and a** danger of even greater politicalization of the issues.