EARTH SPACE TRANSPORT SYSTEMS— CONCEPTS, CRITERIA & CONSTRAINTS

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Deregulation is not only the present United States policy for the air transport industry, but also the policy objective for the land and sea transport industries. The National Transportation Policy Study Commission recently completed a study of "National Transportation Policies Through the Year 2000," the purpose of which was a complete investigation of projected transportation needs. All reports on national transportation policy which have been submitted to Congress should have been taken into consideration, as well as the relative merits of all modes of transportation. The Commission fell short of its mandate by omitting the NASA Space Transportation System (STS).

To compensate for this crucial omission, private individuals and organizations are evaluating the Earth Space Transport Systems with the purpose of facilitating cooperative and profitable implementation of national transportation policies through the 21st century. The Earth Space Transportation Systems (ESTS) concept brings commercial space transportation into the discussion as a central issue, going beyond the National Transportation Policy Study to include the potential of space transportation as the focus for a United States leadership role in the global harmonization of policies for all modes of transportation-land, sea, air, and space.

I. STRUCTURING THE INTERNATIONAL SPACE TRANSPORT MARKET

The millenia of human development on Earth have established relatively mature international transport systems. It has now been widely recognized that transportation ultimately takes place from "door-to-door"—that intermodal transfers (using land, sea, and air modes) are usually required. Recent policy initiatives[1] have encouraged competition and allowed greater intermodal integration. Nevertheless, a rather rigid institutional structure still exists for regulat-

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1. NATIONAL TRANSPORTATION POLICY STUDY COMMISSION, NATIONAL TRANSPORTATION POLICIES THROUGH THE YEAR 2000: FINAL REPORT (June 1979) [hereinafter cited as NTPSC].

ing land, sea, and air transport in both domestic and international commerce.

Today, the world is at the threshold of developing another mode of commercial transportation — space transportation. Although many in the United States think of this as synonymous with the impending flight tests[2] of the NASA Space Shuttle Orbiter, the process is in reality a global one not entirely dependent on any U.S. commitment. The 1980's will bring new international competitors, including private firms, into the space transport market and will substantially enlarge the scope of activities in space.

In many ways space transport lags about fifty years behind equivalent stages of air transport development. The problem of structuring the international space transport marketplace can be phrased in terms of an analogy with the development of air commerce. In July 1969, Neil Armstrong, Edwin Aldrin, and Michael Collins made the first manned flight to the Moon, resulting in a successful landing and a safe return to Earth. In May 1927, Charles Lindbergh made the first successful solo crossing of the North Atlantic. Both Lindbergh and the Apollo XI astronauts were pioneers in the sense of being the first men to cross a significant transportation barrier and set foot on another land mass in a triumph of technology and the human spirit. In the air transport field, Juan Trippe was the entrepreneur responsible for the development of Pan American World Airways. Mr. Trippe made substantial contributions to the development of the institutional structures which support today's international air transport industry. If Neil Armstrong was the Charles Lindbergh of space, then who will be the Juan Trippe? The question which soon must be answered involves the entrepreneurial role in space transportation. This question is central to the Earth Space Transport Systems (ESTS) concept.

A backlash reaction to the success of the Apollo program has resulted in the substantial erosion of NASA funds and support since 1969. Despite many favorable economic studies, the benefits of NASA activities have remained obscure to the many voters who view the "space program" as a highly sophisticated and exorbitant boondoggle. Advancement of the astronautical sciences is rarely viewed as a goal of immediate practical value, economic studies notwithstanding.[3] This image problem is a major hindrance to the expansion of permanent

2. Covault, *First Shuttle Launch Again Postponed*, 111 AVIATION WEEK & SPACE TECH., July 2, 1979, at 26.

3. STAFF OF HOUSE SUBCOMM. ON SPACE SCIENCE AND APPLICATIONS OF THE COMM. ON SCIENCE AND TECHNOLOGY, 95TH CONG., 2D SESS., UNITED STATES CIVILIAN SPACE PROGRAMS: AN OVERVIEW 167 (1978).

human activity into space. It is also the reason for the central role of the entrepreneur in space transportation within the ESTS concept.

Recently Good, Robinson, Shakun, and Sudit addressed the problem of maximizing the socio-economic benefits of space industrialization.[4] Symposia held as part of the Annual Meeting of The Institute of Management Sciences and the 30th Congress of the International Astronautical Federation considered the evolution of the space program into space commerce. Areas examined included space industrialization as the process of developing space transport markets and the possible integration of air and space commerce. Factors used to evaluate new commercial space technologies encompassed such important considerations as economic characteristics, relative technological maturity, and the potential size of the commercial market for such technology. Private common carriers were envisioned as possessing the rights and responsibilities for developing various categories of commercial space applications based on these economic and technological considerations. Government, on the other hand, would provide public goods, including research and development for the purpose of increasing the national technology base, regulation of safety and economic activities, and the provision of supportive services such as satellite tracking and aerospace traffic control. The authors concluded that the international marketplace for space transport services could be developed through market segmentation, competitive bidding for operating rights, and protection of emerging common carriers until such protection could reasonably be removed.

The above analyses, which were based on NASA space industrialization studies,[5] indicated that market organization for space transport services remains the *key issue* in structuring the international marketplace for maximum socio-economic benefits from space industrialization. The optimal structure for the space transport market will yield the maximum benefits from space technology. The very nature of the economic goods provided by space industrialization necessitates the private sector's central role in the development of the space industry.

4. Good, Robinson, Shakun, & Sudit, *Structuring the International Marketplace for Maximum Socio-Economic Benefits from Space Industrialization*, 30th Congress of the International Astronautical Federation (Deutsches Museum, Munich, Germany, September 21, 1979). *See also Future Development of the Aerospace Transport System*, Annual Meeting of the Institute of Management Sciences, Cluster on Policy Sciences, Session on Futurism (Hilton Hawaiian Village, Honolulu, Hawaii, June 22, 1979).

5. ROCKWELL INTERNATIONAL CORP., SPACE INDUSTRIALIZATION (1978); SCIENCE APPLICATIONS, INC., SPACE INDUSTRIALIZATION (1978); NASA JOHNSON SPACE CENTER, SHUTTLE PAYLOAD INTEGRATION AND DEVELOPMENT PROGRAM OFFICE, NASA STS MISSION MODEL PAYLOAD DESCRIPTIONS AND SPACE TRANSPORTATION SYSTEM CARGO MANIFESTS (JSC-13829, Oct. 1977).

The private sector cannot be a mere passive consumer of space transportation services.

Once it had developed space transport technology, the government's principal role would shift to being the primary consumer of space transport services during the market's infancy. The Post Office performed this role in the early days of air commerce. Indeed, NASA, the Department of Defense, and other U.S. Government agencies already consume most NASA space transportation services.

Many alternatives exist for the management and operation of space transportation services. These include the following:

(a) NASA ownership and management of the Space Transportation System (STS);
(b) NASA ownership of the STS with management contracts to private firms;
(c) Joint venture between NASA and private firms for ownership and operation of the Aerospace Transport System (ASTS), but with domestic participants only;
(d) Market organization of the ASTS with the public sector excluded from both ownership and management;
(e) Market organization of the ASTS with the public and private sectors included, but with domestic participants only;
(f) Market organization of the ASTS with the public and private sectors of both domestic and international participants included; and
(g) Market organization of the ESTS with the public and private sectors of both domestic and international participants included with at least nonmarket involvement of less developed countries.

The first STS option is essentially the present U.S. Civil Space Policy as expressed in a recent White House Fact Sheet.[6] This may be in violation of U.S. law once space transportation becomes routine.[7] The second STS option is the concept already proposed in a recent STS Operations Management Study completed for the NASA Johnson Space Center.[8] The NASA Johnson Space Center also recently initiated a study to define its own organizational structure for the operation

6. STAFF OF HOUSE SUBCOMM. ON SPACE SCIENCE AND APPLICATIONS OF THE COMM. ON SCIENCE AND TECHNOLOGY, 95TH CONG., 2D SESS., *supra* note 3, at 179 (Appendix B).

7. Good & Robinson, *The Shuttle: Uncommon, Common Carrier*, 17 ASTRONAUTICS & AERONAUTICS, February, 1979, at 8. *See also Space Transportation System, Hearings on National Space Transportation System Before the Subcomm. on Space Science and Applications of House Comm. on Science and Technology*, 95th Cong., 1st Sess. 611-61 (1977).

8. Covault, *Shuttle Operations Shift Studied*, 108 AVIATION WEEK & SPACE TECH., March 6, 1978, at 12.

of a mature STS.[9] It appears doubtful that either NASA or any NASA contractor will go beyond the first two options due to their underlying goals and values.

The ASTS envisions potential involvement of common carriers from the air transport industry in the development of commercial space transport services. This system implies a close examination and refinement of existing antitrust constraints which might impede collaboration among one or more air transport and/or aerospace manufacturing firms (either domestic or international in the most mature stage). The history of airline regulation and the implications of airline regulatory reform will be examined in the next section. In contrast, ESTS refers to the integration of multinational and multimodal transport services in a deregulated environment. Firms in the communications industry and the energy resources industry could also be integrated into such a multinational corporation. The relationship between ESTS criteria and the recommendations of the National Transportation Policy Study Commission (NTPSC)[10] will be examined in the third section.

II. History and Status of Air Transport Regulation

Although the Kelly Act of 1928[11] and the Air Mail Act of 1934[12] gave some structure to the infant airline industry, the principal features of airline economic regulation originated in the Civil Aeronautics Act of 1938,[13] which was superseded by the Federal Aviation Act of 1958.[14] The major features of the statutory scheme were:

(a) Control of entry into interstate, territorial, and international air transportation by requiring that entrants obtain certificates of public convenience and necessity unless granted exemption under specific conditions;
(b) Control of rates and fares in such transportation on the basis of a rule of rate-making patterned after previous transportation statutes;
(c) Control of intercarrier relations such as mergers and agreements regarding capacity; and
(d) A provision under which the Civil Aeronautics Board would pay direct subsidies to air carriers.[15]

Such legislated economic regulation was intended to avoid destructive

9. McKinsey & Co., STS Operations Management Study (study in progress under contract with NASA Johnson Space Center).
10. NTPSC, *supra* note 1.
11. Kelly Act (Air Mail Contracts), ch. 603, 45 Stat. 594 (1928).
12. Air Mail Contracts Act, ch. 466, 48 Stat. 933 (1934).
13. Civil Aeronautics Act of 1938, ch. 601, 52 Stat. 973 (1938).
14. Federal Aviation Act of 1958, Pub. L. No. 85-726, 72 Stat. 731 (1958).
15. *Id.*

competition in order to attract greater amounts of private capital. Labor, safety, and national defense issues were considered and analogies were made to public utilities and other modes of transportation. An effort was made to correct the defects in the previously existing system of awarding airmail contracts and to acknowledge the general mistrust of excessive competition which was generally felt during the 1930's.[16]

The administration of economic regulation involved the certification of new trunkline service in particular city-pair markets, as well as the certification of new entrants to the trunkline industry. Along with the protection of controlled competition came the responsibility of restricted exit from city-pair markets. The net economic result was a protected and stable marketplace in which management relinquished some of its flexibility over the control of rates and fares in return for a relatively predictable environment. With the introduction of jet aircraft, rates were adjusted, and a subsidization program was introduced as an experiment in the temporary support of service to small communities.

The present airline industry structure is characterized by substantial economies of scale and significant barriers to market entry even without regulatory restrictions. Substantial capital is required for market entry and there is difficulty in establishing product differentiation. Also, there is considerable variability in costs and operating conditions due to the impact of inclement weather on normal operations. Factor mobility exists for both capital and labor, although the prevalence of seniority systems among contract employees causes substantial transfer costs for labor.

In the effort to bring about the Airline Deregulation Act of 1978,[17] much attention was given to comparisons of economic performance by the regulated trunk airlines and unregulated intrastate airlines. Labor and capital costs were considered along with the costs of regulation, yet several important considerations were overlooked. New constraints on regulatory reform include the regulation of air commerce set forth by state and local governments in the form of curfews, barriers to new service, and noise abatement procedures. Also, airport operating revenues must meet airport financing obligations. Airport congestion restricts the number of new market entrants and inhibits efficiency. Increased fuel consumption due to congestion was not considered, nor was any appreciable decline in safety standards due to the pressure of increased competition.

16. STAFF OF SENATE COMM. ON COMMERCE, SCIENCE, AND TRANSPORTATION, 95TH CONG., 1ST SESS., AMENDING THE FEDERAL AVIATION ACT OF 1958 (1978).

17. Airline Deregulation Act of 1978, Pub. L. No. 95-504, 92 Stat. 1705 (1978) (to be codified in 49 U.S.C. § 1301).

Despite the failure to address the foregoing constraints, the Airline Deregulation Act[18] eliminated protective entry and exit control, as well as public utility regulation using a target return on investment. There have been interim actions (including major statutory changes)[19] expanding and creating less regulated fare zones. Open entry is now allowed for supplemental carriers and charter rules have been liberalized.[20] Cargo price controls have been abandoned.[21] An expansion of the aircraft size limitation applicable to unregulated commuter carriers has been allowed.[22]

One aspect of the airline industry reaction to regulatory reform is the recent proliferation of merger proposals and discussions. The Civil Aeronautics Board (CAB) is in the process of reevaluating its merger policy and the Department of Justice actively opposes airline mergers. Most merger proposals so far have been based on efficiency arguments and promised benefits to the consumer. Southern Airways and North Central Airlines have merged to become Republic Airlines, which now serves 157 cities in the United States — more than any other airline.[23] Lack of CAB approval has so far prevented Continental and Western from merging.[24] Texas International's withdrawal from its courtship of National Airlines left Eastern and Pan American as possible suitors, and the latter's bid recently prevailed.[25] Seaboard World conducted serious talks with Flexi-Van (an intermodal firm), but it appears they will now be acquired by Flying Tigers, the largest scheduled U.S. all-cargo air carrier.[26]

During 1978 airline profits enjoyed record gains,[27] which has prompted some advocates of regulatory reform to claim credit for such an accomplishment. It may well be, however, that 1978's record gains will be followed by record losses in 1979 and 1980. Although air traffic remains strong, great uncertainties persist regarding jet fuel supplies,

18. *Id.*

19. *CAB Readies Route Restriction Removal*, 111 AVIATION WEEK & SPACE TECH., July 2, 1979, at 26.

20. *CAB Moves Toward Eased Charter Rules*, 110 AVIATION WEEK & SPACE TECH., Mar. 19, 1979, at 35.

21. Ott, *Uncertainty Marks Cargo Deregulation*, 110 AVIATION WEEK & SPACE TECH., Mar. 19, 1979, at 35.

22. *Id.*

23. *North Central, Southern Agree on Merger*, 109 AVIATION WEEK & SPACE TECH., July 17, 1978, at 28.

24. *Continental Drops Western Merger Effort*, 111 AVIATION WEEK & SPACE TECH., Aug. 13, 1979, at 24.

25. *Pan Am Gets National Majority*, 111 AVIATION WEEK & SPACE TECH., July 30, 1979, at 22.

26. Feazel, *Flexi-Van Plans Seaboard Buy*, 110 AVIATION WEEK & SPACE TECH., May 28, 1979, at 29.

27. Wetmore, *U.S. Carriers Report Record Earnings*, 109 AVIATION WEEK & SPACE TECH., July 24, 1978, at 34.

especially since preference has been given in the allocation process to home heating oil and diesel fuel production. Aging aircraft, noisier and less fuel-efficient, must be replaced in the near future. Inflation brings increased demands for higher wages from highly organized unions within the airline industry, and the stockholders demand higher returns on their investments in order to make up for the erosion of capital caused by inflation. In addition, under current U.S. tax laws and procurement regulations, depreciation accounting practices are most often based on historical purchase prices (the original cost of the equipment) rather than on the current acquisition cost (the capital required to replace the same capital stock in an inflated marketplace).[28] As a consequence, profits are overstated and depreciation is understated, leading to the payment of excess amounts of income tax. Since inflation affects the aircraft manufacturers as well as the airlines, its negative impact on the airline industry's ability to raise capital is probably even greater than that caused by the uncertainty of regulatory reform. In failing to account for inflationary factors, the U.S. tax policy adversely affects the productivity of the entire U.S. economy; thus, the air transport industry would do well to work together with other capital-intensive U.S. industries in order to accomplish immediate reform of this tax principle. This is especially important in an era of persistent inflation.

In developing the ESTS concept, seemingly endless difficulties and uncertainties facing the airline industry are considered together with the lack of common carrier authority for NASA. Although the connection has not yet become obvious to airline executives busily fighting for corporate survival, the interrelationship of air and space transport development is the most significant indicator of the natural evolution of global transport systems. The analysis summarized in the previous section attempted to evaluate the development of an adaptive purposeful system to optimize the socio-economic benefits from space transportation. The result of the analysis emphasized that the ESTS concept would be the optimal long-range system. Once the ESTS concept is developed in greater detail, it will be an additional option available to transport executives concerned with strategic decision-making.

Due to the less structured environment after regulatory reform and the close relationship between air and space technology, airline executives need to be particularly familiar with the ESTS concept. Just as air transport naturally replaced the land and sea modes in intercity and international passenger transport markets, so will communications

28. K. HEISS, AEROSPACE CAPITAL FORMATION: IMPACT OF INFLATION AND DEPRECIATION (1976).

satellites launched and maintained by the STS replace some functions now accomplished by the air transport industry and the automobile. This is known as the telecommunications-transportation tradeoff, which will become increasingly important in an era of rising energy costs. Two prime examples are electronic mail and teleconferencing. The former transmits information electronically (by satellite) and reproduces it for delivery at the destination. The latter is a way of holding business meetings without the need to travel to a common location. Communications satellite technology becomes increasingly competitive for this purpose as the cost of fuel continues to rise and a growing number of organizations learn by experience of the increased efficiency possible through teleconferencing.

The development of the ESTS concept is one means of analyzing the natural evolution of global transport systems, and is based on technology, economics, and present legal and institutional constraints, assuming the existence of an adequate market for commercial space transport services. The latter assumption is based on exhaustive NASA studies of space industrialization and a careful review of NASA Space Transportation System pricing policy and theory.[29] The challenge presented by the ESTS concept is the development of a new transport mode in the private sector, while remaining within the guidelines of National Transportation Policies which do not address directly the question of policy for the STS. Although a major study of organizational alternatives for U.S. space transportation was completed for NASA by the National Academy of Public Administration in 1977, no attempt was made to structure the international marketplace for space transportation services.[30] The initiative for such efforts must come from those private transport firms able to sense a nexus between regulatory reform and the development of commercial space transportation.

III. NATIONAL TRANSPORTATION POLICIES THROUGH THE YEAR 2000

In June 1979 the NTPSC completed a $5 million study of national transportation policies.[31] The Commission's charter was mandated by

29. ROCKWELL INTERNATIONAL CORP., SPACE INDUSTRIALIZATION (1978); SCIENCE APPLICATIONS, INC., SPACE INDUSTRIALIZATION (1978); NASA JOHNSON SPACE CENTER, SHUTTLE PAYLOAD INTEGRATION AND DEVELOPMENT PROGRAM OFFICE, NASA STS MISSION MODEL PAYLOAD DESCRIPTIONS AND SPACE TRANSPORTATION SYSTEM CARGO MANIFESTS (JSC-13829, Oct. 1977).

30. National Academy of Public Administration, *U.S. Space Transportation in the 1980's: Organizational Alternatives*, Washington, D.C. (1977).

31. NTPSC, *supra* note 1.

Public Law 94-280, Section 154,[32] which required: ". . . a full and complete investigation and study of the transportation needs and of the resources, requirements, and policies of the United States to meet such expected needs."[33] The Commission published a Final Report and nine special reports on current issues and problems. Disappointingly, none of the special reports nor the Final Report dealt with the development of the Space Transportation System, although other NASA programs were included (such as the development of more efficient aircraft). One of the special reports dealt with the tradeoff between transportation and telecommunications technology, but minimized the considerable impact of space transport in accelerating the growth of telecommunications.

In general, the Final Report of the NTPSC is exhaustive, detailed, and very well documented. The most disturbing aspects of the study are the omission of commercial space transportation and the use of several questionable or obsolete assumptions. These include an underestimation of the rate of increase in fuel prices, underestimation of inflation in general, and a possibly self-fulfilling assumption that government spending would continue to increase from 34% to as much as 50% of the gross national product by the year 2000.[34] Evidently some of the Commissioners forgot that the American Revolution was fought in response to excessive taxation.

The NTPSC was intended to "take into consideration all reports on national transportation policy which have been submitted to the Congress. . .,"[35] "evaluate the relative merits of all modes of transportation in meeting our transportation needs,"[36] and "recommend those policies which are most likely to insure that adequate transportation systems are in place which will meet the needs for safe and efficient movement of goods and people."[37] In its Final Report, the NTPSC was requested to include its findings and recommendations with respect to:

(a) The Nation's transportation needs, both national and regional, through the year 2000;
(b) The ability of our current transportation systems to meet the projected needs;

32. Federal-Aid Highway Act of 1976, Pub. L. No. 94-280, § 154, 90 Stat. 448 (codified at 23 U.S.C. § 101 note (1976)).
33. *Id.* at § 154(a)(2), 90 Stat. 449.
34. NTPSC, *supra* note 1, at 90.
35. Federal-Aid Highway Act of 1976, *supra* note 32.
36. *Id.*
37. *Id.*

(c) The proper mix of highway, rail, waterway, pipeline, and air transportation systems to meet anticipated needs;
(d) The energy requirements and availability of energy to meet anticipated needs;
(e) The existing policies and programs of the government which affect the development of our national transportation systems; and
(f) The new policies required to develop balanced national transportation systems to meet projected needs.[38]

The NTPSC study generally satisfied the objectives set forth in its mandate. The third item above (regarding the optimal intermodal mix) has never before been confronted in U.S. transport policies, and the related discussion in the report included a variety of issues. Toward what mix of systems is present policy directing the U.S.? What are the consequences of that future mix? Is there an optimal mix of systems which policies might endeavor to achieve? What policies might achieve that optimal mix? How effective and efficient are such policies? Are there conflicts between measures that seek to achieve an optimal modal distribution and other values regarding freedom of choice and action?

The NTPSC found that an appropriate mix of systems is best achieved through promoting an environment of free choice, by consumers and suppliers of service, where prices fully reflect the monetary and non-monetary costs of that choice.[39] It is important to note that free choice is advocated for suppliers of transport services as well as for consumers, implying that capital is allowed to be mobile between modes. There have been recent attempts to limit the ability of energy resource firms to involve themselves in different forms of energy production (*e.g.*, oil companies investing in coal). The proposed Kennedy-Metzenbaum bill goes considerably beyond antitrust arguments in an attempt to restrict the mobility of oil company capital which otherwise might flow into other investments.[40] Previously transport firms were restricted to a single mode since different modes were viewed as competing with one another, and the involvement of one regulated mode in the business of another could be conceived of as a restraint of trade.[41]

Several basic themes emerged from the investigation of transportation issues by the NTPSC, including the importance of the pricing mechanisms in competitive markets to determine transportation serv-

38. NTPSC, *supra* note 1, at xxv.
39. *Id.* at 265.
40. *Proposed Amendments to the Clayton Acts: Hearings on S. 1246 Before the Subcomm. on Antitrust, Monopoly, and Business Rights of the Senate Comm. on Judiciary*, 96th Cong., 1st Sess. (1979).
41. R. BORK, THE ANTITRUST PARADOX: A POLICY AT WAR WITH ITSELF 198-224 (1978); D. WALDMAN, ANTITRUST ACTION AND MARKET STRUCTURE 126-27 (1978).

ices required by the U.S. economy, and the importance of neither distorting transport markets nor destroying the role of private enterprise when transportation is used as a tool for achieving national objectives.

On the basis of the emerging issues and the carefully developed forecasts (overlooking the few marginal assumptions and the major omission of space transportation), the NTPSC recommended new policies required to develop balanced national transportation systems.[42] Based on these themes, many NTPSC policies (as contrasted with status quo policies) were recommended in the functional areas of transportation: (1) regulation; (2) ownership and operation; (3) finance, pricing, and taxation; (4) planning and information; and (5) government organization.[43] The basic policy is to encourage Federal actions, in concert with the private sector and other levels of government, which are more consistent, flexible and cost-effective. These policies are designed to improve upon what is today a reasonably effective U.S. transportation system in order to meet the challenges of the 21st century.

Despite the previously mentioned flaws in the NTPSC assumptions, the ESTS concept is basically in harmony with the results and recommendations of the NTPSC Final Report. Since there are sixty-six NTPSC policy recommendations,[44] further research is necessary to relate each recommendation to the ESTS concept. Three specific NTPSC recommendations involving intermodalism, mergers and foreign ownership relate directly to the ESTS concept.

The first recommendation is the elimination of Federal impediments to common ownership and intermodal coordination and cooperation, and the promotion of effective joint rates and through service within and among modes. Some restraint on common ownership may be necessarily continued where the result is strongly anticompetitive. However, where such benefits as probable energy savings resulting from common ownership are high, energy considerations should be weighed against any anticompetitive effects. A common definition of "through bill of lading" should be adopted by Federal agencies, and

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42. NTPSC, *supra* note 1, at 372-73. The six major policy themes are:

(1) National transportation policy should be uniform;
(2) Overall Federal involvement should be reduced;
(3) Intended Federal actions should be economically analyzed;
(4) Transportation systems used to pursue social goals should be cost-effective;
(5) Federal involvement (including financial assistance) in transportation safety and research is required; and
(6) Those benefiting from Federal actions should pay.

Id.

43. NTPSC, *supra* note 1, at 247.
44. *Id.* at 252-59, 262-64, 266-67.

differences between ICC, CAB, and FMC regulations affecting through rates should be eliminated. Cargo liability laws should be further standardized. The United States should seek to write into law through international treaty and other means simpler, more uniform international documentation and liability requirements. These improved procedures might include pre-clearance (using satellites) which, if adopted on a multilateral basis, should improve service.[45]

As stated in the first section of this article, the ESTS concept involves the integration of multinational and multimodal transport services in a deregulated environment. The ability to provide "door-to-door" intermodal service for intercity and international freight and passenger traffic is a primary objective of the ESTS concept. Opportunities for profitable service within urban and rural markets are also being continually investigated.

The second NTPSC recommendation that is of strategic concern to the ESTS concept is that the Federal Government should permit mergers, consolidations, and transfers between carriers and among modes (including nontransportation firms), as long as such actions do not substantially lessen competition and are treated in a timely manner subject to antitrust laws.[46]

Since the driving force behind the ESTS concept (other than the profit motive and overall social responsibility) is the desire to achieve a commercial space transportation capability, the ability to enlarge the capital base and expand intermodal services through the consolidation of transport firms operating in different modes is an important prerequisite for the ESTS concept's success. As was mentioned earlier, most pending airline mergers have been proposed on the basis of efficiency arguments. The major exception involves a sympathy or justice argument. These proposals are judged using anticompetitive criteria. The ESTS concept involves mergers between transport firms in the same or different modes, as well as mergers with energy or communications firms, in order to achieve a balance sheet condition which will allow an ESTS firm to enter the space transport market in competition with an existing NASA monopoly or other restricted market structure for space transportation.

Since NASA considers itself (and is generally considered by others) to be the most elite and achievement-oriented agency in the Federal Government, the concept of competing with NASA is one of the most attractive aspects of the ESTS concept. It offers the boldest and most effective defense against any possible misguided or overzeal-

45. *Id.* at 255.
46. *Id.*

ous interference from the Antitrust Division of the Department of Justice. Although the sentiment against big business is still politically attractive today, there is a growing segment of the U.S. population which believes that today's "robber bureaucrats" are the modern equivalent of earlier robber barons. The success of California's Proposition 13[47] and many other tax reduction initiatives are visible evidence of this trend.

The ESTS concept does not intend to alienate, intimidate, or embarrass politicians or bureaucrats in present or future administrations. It is only worth noting that the concept has potential political attractiveness as long as faith in a private enterprise system continues. During times when major U.S. institutions are coming under increasingly critical scrutiny, the objective of the ESTS concept is to work together with government to implement transportation policy and assure progress in the technology of transportation, telecommunications, and energy in order to assure the sustainable growth of peaceful and democratic activities on Earth and throughout Outer Space.

Finally, a third NTPSC recommendation suggests that the Federal Government should not permit ownership restrictions to unduly inhibit foreign investment in U.S. transportation facilities.[48] The current policy for U.S. airlines is that 75 percent of the voting interest of CAB-certified U.S. air carriers must be owned or controlled by U.S. citizens. Two-thirds of the directors must be U.S. citizens. Other restrictions exist for other modes of transportation. The ESTS concept includes both domestic and international participants with at least a nonmarket involvement of less developed countries. In order to develop a multinational corporation along the lines of the ESTS concept, U.S. policies are required which will not unduly inhibit foreign investment in U.S. transportation. In order to structure the international marketplace for maximum socio-economic benefits from space industrialization, the investment in ESTS stock should be open to citizens of all nation-states, either as individuals or through their governments.

The ESTS concept also supports efforts to establish additional equatorial launch sites which are free trade zones. In order to make the benefits of space industrialization available to more citizens of Earth, and provide a more flexible transport system, additional launch and recovery sites with compatible ground facilities are needed. Having from eight to twelve alternative landing sites (one every thirty to forty-five degrees of longitude) would provide a substantially greater margin of safety for response to emergencies requiring an immediate return to

47. CAL. CONST. art. 13A.
48. NTPSC, *supra* note 1, at 259.

Earth. Having active launch sites at these landing sites will shorten the Earth transportation distance required to send people and payloads into Outer Space. Economic and industrial development will naturally sprout around each of these sites, which could also ultimately be used for hypersonic transportation via suborbital trajectories between such sites for Earth-to-Earth high priority passengers and freight.

The proceedings of the recent meeting in Cuba of nonaligned nations provides additional evidence of the importance of considering the aspirations of less developed countries in the analysis of global strategic options. The inclusion of Cuban, East European, and other cosmonauts in the Soviet space program is another indication that the Soviet Union continues to recognize and deal with the international political implications of Outer Space activities. Although the Space Shuttle will soon fly with Europeans and others aboard as payload specialists (on the European Space Administration Spacelab) and in other roles, an ESTS suggestion that highly qualified airline pilots from various international airlines be considered for possible selection as pilot astronauts or mission specialist astronauts has not been taken seriously by NASA. Such an approach would fit in with the ESTS concept since it would reduce the military emphasis within the STS and accentuate the international commercial aspects.

Since the move toward airline deregulation, U.S. policy has become less sensitive to the international transport community. This is most evident in the rate-making function of the International Air Transport Association (IATA), and it has even extended to the safety and navigation function of the International Civil Aviation Organization (ICAO) within the United Nations.

Neither a safe and efficient hypersonic ASTS nor a comprehensive and viable ESTS can be developed without credible world leadership and a cooperative effort on the part of all nations. The ESTS concept is being designed to provide a guide for that leadership. A reduction in the restrictions which would inhibit ownership in an ESTS firm will be a prerequisite for credible leadership in the world community; however, the opening of other commercially oriented national space programs could be sought as a *quid pro quo* before removing ownership restrictions affecting space transportation. Other concessions or restrictions may be required in order to inhibit free technology transfers or to comply with other U.S. policies.

IV. Conclusions: Further Research, Constraints, Options, and Implementation

A frequent first reaction to the ESTS concept is the statement that

it is "mind-boggling," and some people familiar with ESTS development to date even doubt its relevance during the next fifty years. Surprisingly, this reaction is common among many active participants in the commercial air transport industry who should have a much greater awareness of the commercial implications of space technology in contrast to individuals working in any other transport mode. The problems which lie in the path of the development of the ESTS concept nevertheless exist today and must be dealt with.

The NTPSC has noted that many transport mergers are possible in the immediate future and recommends that they be allowed wherever feasible.[49] The major obstacle remains the argument of efficiency versus anticompetitiveness. The latter constraint evaporates if it can be shown that the merger is for the purpose of entering new markets or competing with an existing monopoly such as the NASA Space Transportation System. During the development of the ESTS concept, the NASA monopoly budget for space transportation and supporting services has been carefully investigated. An attempt has been made to determine the balance sheet constraints which must be met by a private firm before entering the space transport market under well-defined terms. The preliminary guidelines, which need to be further refined once the Space Shuttle begins its reimbursable flights, are as follows (in 1975 U.S. dollars):[50]

(a) $10 billion cash flow;
(b) $5 billion total assets;
(c) $5 billion total equity;
(d) Return on investment currently in line with the parent industries;
(e) Ten percent maximum exposure of total cash flow of the parent firm in the new space transport market; and
(f) Strategic advantages to the parent firm resulting from entering the space transport market.

All of the above criteria need to be met by June 30, 1985 in order to enter the space transport market in a timely manner.

In the air transport industry no new trunk airlines have entered the market in the last forty years. This is changing under deregulation, but an entire generation passed once the original participants were determined. There is no reason to believe that opportunities to enter the

49. *Id.* at 255.

50. These guidelines are based on analysis of the following: STAFF OF SENATE COMM. ON COMMERCE, SCIENCE, AND TRANSPORTATION, 95TH CONG., 2D SESS., NASA AUTHORIZATION FOR FISCAL YEAR 1980 (1978); STAFF OF HOUSE SUBCOMM. ON SPACE SCIENCE AND APPLICATIONS OF THE COMM. ON SCIENCE AND TECHNOLOGY, 95TH CONG., 2D SESS., 1980 NASA AUTHORIZATION (PROGRAM REVIEW) (1978).

space transport market will be continuously available. As was the case with the domestic U.S. airline industry, too many participants initially could impede industry growth. Market entry must be controlled until the institutional structures are established. Once new entrants are allowed, the incumbents normally have a strategic advantage as long as they are willing to continuously evaluate and develop technological improvements in their markets.

The present NASA budget and previous expenditures are available to anyone through public records. Analysis by potential investors may lead to slightly different balance sheet constraints. This will be affected by the success of the first ten Space Shuttle missions and the changing perceptions of the size and risk of the space transport market as June 30, 1985 approaches. Although arguments could be cited for increasing or decreasing some of the above constraints, it is most useful to look at the general size of the resulting firm in relation to other U.S. industries. The above balance sheet conditions would place an ESTS firm about twentieth in the 1978 Forbes Sales 500 ranking. Considering the June 30, 1985 target date, an ESTS firm would not necessarily outrank United Technologies, Rockwell International, Boeing, or United Airlines.[51]

The NTPSC Final Report indicates that new legislation may be required to implement its policy recommendations. Further research is necessary in order to determine a list of policy priorities for an ESTS firm to use in supporting U.S. policy implementation. The NTPSC suggestions for implementation need to be continuously analyzed in light of changing political environments and shifting national priorities. Most importantly, an effort needs to be made to insert space transportation into the national transportation policy from the perspective of the ESTS concept.

There are other important and immediate issues which must be evaluated in relation to the ESTS concept. The most urgent of these involve strategies for gracefully putting a corporate nose in the NASA tent. Although much effort has been expended to create a corporate structure for a private commercial Landsat system, roadblocks still remain. These efforts, together with the history of the Communications Satellite Act of 1962,[52] are being studied for the purpose of developing a Space Transportation Act proposal which would serve as enabling legislation for private capital to become involved in financing and eventual operation of Space Shuttle Orbiters and other future aerospace vehicles.

51. FORBES, May 14, 1979, at 234-38.
52. Communications Satellite Act of 1962, 47 U.S.C. § 701 (1976).

Over two hundred questions have been identified for further research. These issues deal with constraints, options, and implementation of commercial space transportation. They must be answered before private capital may be invested in such enterprises. There are too many to list in this article, but public discussion will certainly be required before enabling legislation can be passed and institutional structures created. External constraints such as the rate of development of the NASA Space Transportation System indicate that much of this discussion will take place during the Second Session of the Ninety-Sixth Congress in 1980.

Similar questions were asked fifty years ago at the birth of air commerce. It is still true that all of aerospace technology has both military and commercial implications. The advent of nuclear weapons has resulted in an emphasis on the military aspects of the space transportation mode. When aircraft first started flying on a reimbursable basis, the weight of an airmail payload was light in comparison with the weight of destructive weapons. Nuclear weapons changed that by achieving greater destruction with less mass. Both air and space vehicles have enabled man to attain the advantage of height for better strategic observation of the Earth. In outer space, however, the human eye has been replaced by expanded technologies such as Landsat and military reconnaissance satellites.

The general question of the role of Juan Trippe with regard to space transportation becomes clearer by considering the court-martial of General Billy Mitchell (1879-1936). Prior to World War II the strategic importance of air power was not widely recognized. Only a few leaders such as Billy Mitchell and Charles Lindbergh really understood its implications. Since Billy Mitchell found it difficult to restrain himself from expressing a rather visionary point of view within the military services he was eventually court-martialed. He was not opposed to the use of aviation technology for commercial air transports. Instead, Mitchell thought that military applications were underemphasized and not widely recognized. Similarly, the catalyst required for commercial space transport development is the reverse of a Billy Mitchell. Commercial space transportation may presently seem like an absurd concept to many, but its implications for U.S. economic survival may well be as great as the implications of air power on U.S. military survival in World War II. Moreover, the ESTS concept is designed to have an impact on U.S. economic productivity beyond the sphere of aerospace technology through the pursuit of general U.S. tax reforms and improved economic policies.

Although the entrepreneur of space transportation needs to be

aware of his "Billy Mitchell" role, to be successful he must avoid being fired (*i.e.*, court-martialed). Such an individual will need to be firmly established in the private sector and well-versed in the sciences. It would also be helpful to have the support of organized labor through the AFL-CIO.

The ESTS concept is designed to yield short-range survival benefits from early participation in a long-range commercial space transport enterprise. It was not sufficiently well-formulated to apply to Frank Borman's bid for Eastern to take over National Airlines. During the next two to three years the concept will be exposed to the world's major transport firms and then will stand the ultimate test of the marketplace. Meanwhile the Space Shuttle should begin to look like a real system rather than just something to talk and write about.

It should also be remembered that the air transport industry was formed during the Great Depression. The seemingly unstable and unpredictable course of the present economy therefore does not necessarily detract from the viability of the ESTS concept. On the contrary, the United States Congress should closely investigate the Earth Space Transport Systems concept as it continues to review the appropriate levels of NASA funding for future space initiatives.