

Space Shuttle: Studies Open Cost-Benefit Conflict

In its pitch to Congress for a multibillion dollar space shuttle project, the National Aeronautics and Space Administration (NASA) has consistently advertised the shuttle's economy as its major selling point. Besides offering the versatility and convenience of a reusable rocket, NASA officials have said, the shuttle would cut by 90 percent the cost of putting payloads in orbit and thus save billions of dollars more than its cost of development.

But it was never very clear how the shuttle would pay its own way—at a cost estimated by NASA earlier this year at \$6 billion—without greatly expanding civilian and military space programs (*Science*, 12 March 1971). During the past 2 weeks, the cost-and-benefit case for the shuttle has grown even murkier with the emergence into public view of two sharply conflicting analyses of the shuttle's economics.

One analysis, an October 1970 Rand Corporation study commissioned by the Air Force, concludes that the shuttle's savings over the cost of conventional, expendable launch rockets would at best amount to a "marginal" \$2.8 billion over 15 years. At worst, the Rand report says, the shuttle might cost \$5 billion more than conventional space transportation between 1975 and 1990. In sharp contradiction, a March 1971 report prepared by Mathematica, Inc., of Princeton, N.J., under a NASA contract optimistically concludes that the shuttle would be an "economical investment" at a price ranging anywhere between \$13 billion and \$22 billion, depending on civilian and military space activity in the 1980's.

Senator Walter Mondale (D-Minn.), a persistent critic of the shuttle, gave the Rand study its first wide publicity by inserting it in the *Congressional Record* of 26 May. He termed its conclusions "devastating" to the project, and indeed they seemed to be. The analysis pointedly noted that "although such a vehicle has been recommended for development by the President's Space

Task Group, that development is not easy to justify."

Comparison of the two studies is complicated by differences in key assumptions made by their authors, particularly concerning the ambitiousness of future U.S. activities in space. Rand analysts settled on the most conservative program recommended by the Space Task Group in September 1969. They calculated shuttle costs and benefits for that program, taking it as a "base case," then did the same for seven alternative programs which assumed a variety of delays and cancellations in the base case. The Rand analysts found that "in only the base case, plan 1, does the shuttle demonstrate a net monetary gain by 1990, and even under this plan the savings seem to be marginal." Cost overruns or "significant delay" of the shuttle's operation beyond 1977 (the date has already slipped to mid-1979) might erase even these savings, the report said. Rand estimated that military and civilian expenditures for this "base case" would add up to \$140 billion between 1975 and 1990.

By contrast, Mathematica took as its "baseline" case a program that would spend a modest \$200 million a year for manned space flights (\$1.2 billion less than in 1971) and \$900 million for unmanned activities (\$330 million more than in 1971). If the shuttle and a "space tug" for use in earth orbit were to begin operating before 1980, the shuttle-and-tug project could cost \$14 billion to \$18 billion and still save enough to pay its way, Mathematica said.

NASA officials, at the invitation of Senate space committee chairman Clinton P. Anderson (D-N.M.), swiftly responded to discrepancies between the two reports by blaming them on the Rand document. George Low, the deputy administrator of NASA, said Rand's work was "based primarily on data that are 2 years old" and does not take account of recent technical and economic studies of the shuttle.

Outdated as it may be, however, the Rand report raises some points of at least historical interest. For one, it stated, and presumably with some authority, that the cost of putting the shuttle into operation would be \$9 billion. But as recently as last March, NASA was publicly estimating this cost at a far more attractive \$6 billion. Since then NASA's estimate has crept up to \$8 billion, but it seems worth wondering whether this figure, too, is not more conservative than it might be.

It is also worth noting that the cost of a combined shuttle-and-tug system is estimated by Mathematica at \$12.7 billion. Critics point out that even if these saved a liberal \$16 billion, the difference would amount to little more than \$3 billion over 15 years, a figure Rand considered marginal.

Whether all these uncertainties affect shuttle funding for 1972 remains to be seen. The space authorization bill, including an extra \$25 million for the shuttle, sailed through the House on 2 June by a vote of 302 to 64. Congressional observers see little chance for Senate shuttle opponents to fare any better this month when their turn arrives. Three previous Senate contests over the shuttle have turned out no more than about 30 opponents, and there is as yet no visible new groundswell against the project—R.G.

