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TECHNICAL REPORT

Pricing Strategies for NASA Wind-Tunnel Facilities

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Summary

Evaluating Approaches for Pricing NASA Test Facilities

The National Aeronautics and Space Administration (NASA) maintains a large array of national-class aeronautics test capabilities. With the maturation of aerospace technology over the past century, the end of the Cold War, and the growing capability of computational fluid dynamics, there has been an overall downward trend in the use of NASA's wind-tunnel test facilities. At the same time, fiscal pressures have increased incentives at NASA to cut costs and create additional sources of revenue to sustain and modernize the test capabilities the organization offers.

The RAND Corporation was asked to explore the trade-offs among alternative approaches for charging users of NASA's wind-tunnel test facilities. The RAND team analyzed the following six strategies for pricing a notional test facility:

- **Marginal cost pricing (MC).** Each user is charged an hourly fee equal to the test facility's marginal operating cost.
- **Two-part pricing with full cost recovery (TPP).** Each user is charged both a fixed fee and a variable fee. The fixed fee (i.e., an annual subscription fee or test setup fee) is set to approximately balance the facility's annual budget; the variable fee equals the facility's marginal operating cost. (One could think of this approach as MC with a subscription fee.)
- **Two-part pricing with partial subsidization (TPPS).** As in TPP, each user is charged both a fixed fee and a variable fee. However, the fixed fee is set to recover only some of the facility's annual budget; NASA is expected to subsidize the rest.
- **Average cost pricing (AC).** Each user is charged a variable rate, determined annually, that is set to approximately recover all of the facility's costs.
- **Average cost pricing with partial subsidization (ACS).** As in AC, each user is charged a variable rate. However, the revenues collected cover marginal operating costs and a portion—but not all—of the facility's annual budget; NASA is expected to subsidize the rest.
- **No charge for use (NC).** Each user is granted access to the facility at no cost beyond the direct pass-through consumable costs, such as for electricity.

The team evaluated each of these approaches for pricing wind-tunnel use in terms of their ability to (1) promote efficient use of test facilities as defined by economists (i.e., efficiency), (2) generate revenue to offset costs (i.e., fiscal impact), and (3) produce a fair allocation of costs between beneficiaries (i.e., fairness). Details regarding how these metrics are defined and evalu-

ated are documented in the report's complete economic analysis, which compares cost, benefit, and utilization levels.

The performance of each pricing approach is summarized in Table S.1. Although no strategy performs well across all three criteria, the no-charge policy stands out for performing poorly across all three criteria. Specifically, a no-charge policy would lead to overutilization of facilities from an efficiency perspective, would result in the largest budget shortfall of any of the pricing strategies we reviewed, and would perform poorly in terms of fairness because NASA would be forced to pay all costs even though users outside the agency would benefit from using NASA's test facilities.

In selecting between pricing alternatives, NASA will be forced to make trade-offs:

- Marginal cost pricing and both forms of two-part pricing perform well in terms of efficiency. The no-charge policy and both forms of average cost pricing perform moderately or poorly, but for different reasons: Both forms of average cost pricing would lead to underutilization of test facilities, and a no-charge approach would lead to overuse.
- In terms of making facilities financially self-sustaining through user charges, two-part pricing with full cost recovery and average cost pricing perform well, producing revenues in line with total costs. These pricing strategies are likely to be viewed as more attractive if the budgetary environment at NASA becomes more constrained. On the other hand, a no-charge approach not only means that NASA has to cover all costs but also that it is more likely to lead to overuse and therefore drive up costs.
- In terms of fairness, two-part pricing with subsidization and average cost pricing with subsidization are likely to be viewed as attractive options. Both forms of full cost recovery—two-part pricing and average cost pricing—perform poorly in terms of fairness because users must pay for all of a facility's fixed costs, even though a facility's availability is dictated by strategic national security considerations that are not tied to any particular user. A no-charge system performs poorly in terms of fairness because it forces NASA to pay all costs.

Table S.1
The Performance of Alternative Pricing Approaches Against the Three Criteria

Pricing Approach	Efficiency	Fiscal Impact	Fairness
Marginal cost pricing	Good	Poor	Moderate
Two-part pricing with full cost recovery	Good[a]	Good	Poor
Two-part pricing with partial subsidization	Good[a]	Moderate	Good
Average cost pricing	Moderate to poor[b]	Good	Poor
Average cost pricing with partial subsidization	Moderate	Moderate	Good
No charge	Moderate to poor[b]	Very poor	Poor

[a] The model outlined here assumes that the fixed fees imposed under a two-part pricing scheme will not discourage any potential users from participating in NASA's test facility user base. This means that both two-part pricing schemes—TPP and TPPS—perform well in terms of efficiency. This assumption may be questionable, however, and, if a two-part pricing system is pursued, it merits additional research.

[b] AC and NC policies can be less efficient than ACS because they can result in a price that is further from the marginal cost when both fixed and marginal costs are substantial. However, facilities with marginal costs approaching zero would find NC to be more efficient than ACS unless the subsidy approaches 100 percent of fixed costs. Similarly, facilities with fixed costs approaching zero would find AC to be more efficient than ACS unless the subsidy approaches zero.