

CBO TESTIMONY

**Statement of
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Director**

**Economic and Budgetary Issues with
Cash Prizes to Achieve NASA's Objectives**

**before the
Subcommittee on Space and Aeronautics
Committee on Science
U.S. House of Representatives**

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Mr. Chairman, Congressman Lampson, and Members of the Subcommittee, thank you for this opportunity to present the Congressional Budget Office's views on the basic economics and budgetary treatment of cash prizes, or inducement prizes, like those that would be included in the Administration's Centennial Challenge prize program proposed in the 2005 budget for the National Aeronautics and Space Administration (NASA). In my remarks today, I would like to make four points:

- In some circumstances, inducement prizes are an effective means of acquiring technologies that the government deems desirable but that are unlikely to be provided by private markets. But there is no free lunch. Innovators and researchers must be paid for what they do. Inducement prizes have to be very large if the objectives sought are risky and expensive.
- Prizes can be most useful when the government seeks participation in research efforts by people or firms that might not participate in the traditional procurement process. Contests offer the advantage of lowering the barriers to entry typically posed by the government's procurement procedures.
- The rules and structure of contests can make a difference in the level of effort put forth by participants and in the payoff to the government.
- Inducement prizes entitle successful competitors to a future payment. To fulfill that type of commitment, the sponsoring agency needs to have sufficient budget authority to cover the potential payment before offering the prize. As a general rule, money needs to be appropriated up front for the full cost of the prize.

No Free Lunch

An inducement prize is one among many means that the government can use to spur the development of innovative technologies. Like direct production, contracting for specific systems, and research grants, cash prizes have characteristics that make them a more or less effective way to do business depending on the circumstances. But prize competitions do not change the underlying factors that determine risks and rewards. An individual or business choosing to participate in a government-sponsored contest will address those risks and their cost in deciding whether to enter and, once entered, in deciding how much effort to undertake. Large and expensive technical risks will require large prizes if they are to induce effort.

Charles Lindberg won a \$25,000 prize when he succeeded in flying from New York City to Paris in 1927. Inflated to 2005 dollars, that prize amounts to a little over \$260,000—a very small amount measured against the scale of NASA’s major programs. Advocates suggest that inducement prizes are more likely than traditional contracting to produce revolutionary technical changes that reduce costs because they bring new players and new ideas to the playing field. That may be the case, but the point remains that the large scale of the projects that dominate NASA’s programs—for example, the Crew Exploration Vehicle is currently estimated to require development expenditures of over \$12 billion (in 2005 dollars)—would probably require prizes of the same order magnitude as the current cost estimates, if they were to produce the desired results.

Prizes are not new; there are examples from the United States and abroad currently in effect and stretching back to the 18th century.¹ Before Lindberg won his prize, Glenn Curtis won

1. See Steering Committee for the Workshop to Assess the Potential for Promoting Technological Advance Through Government-Sponsored Inducement Prizes in Engineering and Science, *Concerning Federally Sponsored Inducement Prizes in Engineering and Science* (Washington, D.C.: National Academy of Engineering, November 1999), Appendix A.

prizes of \$2,500 in 1908 and \$10,000 in 1909 for achieving a set of firsts in wheeled takeoffs and flight distances.² In the early 1700s, the British Parliament offered a substantial prize to the developer of a means to gauge longitude at sea. As this Subcommittee is well aware, the privately funded Ansari X Prize offers \$10 million to the first team able to fly a vehicle carrying one person, but capable of carrying three, to an altitude of 62 miles above the Earth and return safely, twice within a 14-day period. And in 2004, the Defense Advanced Research Projects Agency's (DARPA's) Grand Challenge offered a prize to the first developer of a robotic rover capable of completing a challenging desert obstacle course.³ Although no contestant succeeded this year, the competition will again be run in October 2005.

Prizes and Participation

What is different about prizes, and what advantages may they offer? Experience from both the Ansari X and DARPA prize contests suggests that inducement prizes will draw untraditional participants and ideas that the usual contracting procedures will not. Thus, the prize mechanism may be most valuable when the government is seeking to achieve a specified objective but has little idea of how to do so, and therefore wants to encourage a wide variety of approaches.

Probably the main reason that prize competitions induce wider participation than other lures the government can use is that they impose few contracting and accounting requirements. Such requirements pose significant barriers to entry by newcomers, especially small firms, in traditional competitions for government contracts.

2. U.S. Centennial of Flight Commission, "Glenn H. Curtiss," available at www.centennialofflight.gov/essay/Explorers_Record_Setters_and_Daredevils/Curtiss/EX3.htm.

3. The DARPA Grand Challenge is described at www.darpa.mil/grandchallenge.

A second factor that might play a role in inducing wider participation is the prestige associated with winning an open competition. Relatively unknown entrants might find a well-publicized competition more attractive than an equivalent procurement contract if winning would provide a larger boost to their credibility in the marketplace. They might also value the resulting prestige more than established firms would and therefore be more inclined to participate.

Rules and Structure

The rules and structure of a contest matter and are likely to be critical to the government's getting its money's worth for the prize offered. My testimony touches on only a few of the major points from the substantial body of literature on the subject.

Most important, the contest's rules must be adhered to. Awarding a prize for performance that falls short of the designated finish line establishes a precedent that contestants may use in future competitions to claim rewards for less than complete success. To successfully make repeated use of contests, the government must establish a reputation for following the rules that it establishes.

Clarity in the rules is also essential. Unclear or unenforceable rules are an invitation to conflict, and the government will bear a cost of adjudication when disputes arise. Conflicts over rules in the Federal Communications Commission's auctions of licences to use the radio spectrum and in its Pioneer's Preference policy (which granted spectrum license rights to the developers of innovative technologies or approaches to using the radio spectrum) are relevant illustrations. In both cases, unclear rules led to prolonged and expensive legal disputes between the government and private parties.

A cash award contest could be structured as a tournament or race, each of which offers advantages and disadvantages. A tournament, which specifies an objective and a time limit, guarantees an award to the party that has made the most progress toward meeting the objective. It encourages participation—parties with substantial uncertainty may enter on the basis of partial insights—but can impose high costs on the government for evaluating many participants' relative progress toward the goal. In contrast, a race specifies a goal and may or may not specify a time period, but an award is made only if a party achieves the goal. Participation may be less than if partial success is rewarded, but the government pays only for meeting the specified objective and is likely to incur lower evaluation costs because unequivocal success is more easily judged than progress toward the goal.

Rules governing entry and elimination, if the contest has phases, are also important. A competitor for a cash prize makes decisions about whether to enter and how much effort to expend mindful of the odds both of achieving the goal and of achieving it before competitors do. More entrants worsen the odds of being first and lead to decreased effort. Fewer entrants, however, may deny the government the benefits of capturing a wide array of novel approaches—one of the main reasons for choosing a contest over other forms of acquisition.

The designers of a government-sponsored contest face the problem of structuring the competition so that rewards are sufficient to offer a good prospect of success but take account of the subsequent benefits of spreading technological innovation to the larger economy. A competition that limits the patent rights of a successful winner will attract fewer entrants and less effort but at the same time allow for the rapid diffusion of technology. In some cases, offering a larger prize to attract more entrants and greater effort in exchange for intellectual property rights may make sense for the government.

In many circumstances, cash awards may be outstanding for a number of years. For example, the \$10 million Ansari X Prize was first offered in 1996. To provide the same inducement today, the prize would have to have grown to over \$12 million. Government-sponsored competitions could maintain a constant level of real incentives by indexing the value of prizes to the rate of inflation. Also, in the interest of matching rewards and effort, contest rules could specify increasing rewards at the government's discretion. For example, DARPA is increasing its challenge award from the \$1 million offered in 2004, when no competitor completed the course, to \$2 million for the 2005 race. Elimination rounds could also be used to intensify the competitive effort. As the number of competitors decreases, their improved prospects of finishing first increase the expected value of the prize and prompt greater effort.

Financing and Federal Budgetary Treatment

Policymakers have several alternatives for the financing of prize money. To best encourage successful competition for advancement in space travel and exploration, however, the government would have to make clear that the funds to reward the winners were available and were not contingent on future legislative actions. That approach would mean providing the budget authority up front—appropriated by the Congress and accounted for in the federal budget. Were funds to be appropriated later, a degree of uncertainty would probably limit participation.

Practices in the private sector also suggest that a sponsor may tailor its financing to the nature of the prize. For example, recipients of performance awards like the Nobel Prize have no fixed expectation of receiving the prize, so the sponsor has no obligation to fund a specific number or size of awards. In contrast, individuals or businesses vying for an inducement prize are opting to compete on the basis of a promise of a specified payment. As a result, the sponsor must guarantee that it will be able to pay the amount promised at

the time promised. The Ansari X Prize Foundation is being funded by private donations, but the amount and timing of the payment are backed by an insurance policy, making it clear to competitors that the funds will be there for a successful entrant.

Most existing federal prizes are used to recognize past performance—for instance, the Malcolm Baldrige National Quality Award and the Vannevar Bush award for public service activities in science and technology. Such awards typically are in the form of medals and other noncash compensation, but agencies still need funding to cover the cost of the prizes and the programs. Such programs are funded by annual appropriations, so the level of funding can fluctuate from year to year depending on federal priorities.

DARPA's 2004 competition illustrates the approach of appropriating the full cost up front. The budget authority for the \$1 million prize was included as part of the agency's \$2.8 billion appropriation for 2004. When DARPA announced the competition, it reserved the \$1 million needed to cover the potential payment. Once the competition ended without a winner, DARPA released those funds and was able to use the money for other authorized purposes. Had there been a winner, the agency would have incurred an outlay when it paid the prize.

Very large cash prizes may require additional measures to secure a future federal payment. Given the amount and short time horizon of the DARPA prize, competitors may be confident that the agency will be able to pay the \$1 million. Competitors may have less confidence, however, if the promise to pay extends several years into the future, especially if the prize represents a much larger share of an agency's budget. Funds appropriated for a payment that is in the future but have yet to be obligated can be rescinded or otherwise limited by subsequent legislative action, especially if federal policies toward the program's objectives change.

Proponents of prizes valued at hundreds of millions or billions of dollars must consider ways to balance contestants' need for assurance about the funding with the cost of ensuring payment. As mentioned, the sponsors of the X Prize purchased an insurance policy to guarantee the prize money. Alternatively, federal funds could be put in a private escrow account, but such a transaction would involve making the payment—that is, a budget outlay—at the time the money was put in the escrow fund; if there was no winner, unclaimed funds would be returned to the government, but that receipt would not occur until after the competition was over.

The budgetary impact of any award program ultimately depends on policymakers' choices about the terms. Specifying the amounts authorized to be appropriated is the key element of Congressional control, but other terms are important as well. NASA has requested authority for a permanent award program, not a pilot program. Individual awards would be limited to \$10 million (although the Administrator or his or her designee could increase that sum), and any appropriated funds would be available indefinitely (as so-called no-year money). That approach would give the agency latitude in setting the duration of competitions without risk that the authority would lapse, and it would allow the agency to reuse any unclaimed (and therefore unobligated) funds for other competitions.