DARPA and Hilbert

In August last year, a document called *23 Mathematical Challenges* appeared on the website of the Defense Advanced Research Projects Agency. DARPA, which operates under the U.S. Department of Defense, funds high-risk research and development projects that could eventually lead to technology of use to the military. The document consists of one- or two-sentence summaries of 23 problems that fall within the field of mathematics or that could require mathematics for their solution. On the final page, Benjamin Mann, a mathematician and DARPA program manager, states that he is "fully responsible for the selection and statement of these challenges" and thanks a few other mathematicians for their help.

The background color of the document suggests parchment, and the whole appearance conveys an aura of the classic and the hallowed. Given that there are exactly 23 problems listed, the document seems intended to evoke David Hilbert's famous list of 23 problems presented at the International Congress of Mathematicians in Paris in 1900.

But DARPA is offering something Hilbert wasn't: money. On the same webpage there is a link to a description of a new program called *DARPA Mathematical Challenges*, which will support work on the 23 problems. This is not DARPA's first foray into funding pure mathematics. Over the past few years, for example, it has funded work on the geometric Langlands program.

Exactly how much money DARPA will devote to its *Challenges* is not specified in the program announcement. According to reports in the *Notices* by AMS Washington Office director Samuel M. Rankin III, over the past several years the DARPA mathematics budget has hovered around US$16 million per year. According to a report in the August 2007 *Notices*, the requested budget for the current fiscal year of 2008 is 50% higher than for 2007, up from an estimated US$18.0 million to a requested US$27 million.

Issuing a list of problems to be solved is quite an unusual way for a government agency to organize a proposal solicitation in mathematics. Some reactions to it can be found on Internet blogs, such as the n-Category Café (`http://golem.ph.utexas.edu/category/`). There, in addition to simple perplexity, one finds a range of reactions. For example, one contributor complained that the problems are "poorly phrased or extremely speculative"; another, noting the limited funding for mathematics research, called the program "a serious attempt" to widen funding possibilities.

The new DARPA program makes me wonder whether the U.S. mathematical community is becoming more receptive to military funding than it was, say, twenty years ago. Back in the mid-1980s, a group of mathematics organizations, including the AMS, began to collaborate on strategies for increasing government funding for research. This effort triggered a searching debate within the Society about whether it is ethical for mathematicians to take research grants from the military. One of the main advocates against military funding was Fields Medalist William Thurston, who during the 1980s served as an AMS vice president. Panel discussions were held at the Joint Meetings, and the *Notices* established a special section to air debate on the topic.

The climax was a referendum put before the AMS membership in January 1988. One of the motions in the referendum stated:

> The AMS is concerned about the large proportion of military funding of mathematics research. There is a tendency to distribute this support through narrowly focused (mission-oriented) programs and to circumvent peer review procedures. This situation may skew and ultimately injure mathematics in the United States. Therefore those representing the AMS are requested to direct their efforts towards increasing the fraction of non-military funding for mathematics research, as well as towards increasing total research support.

With a turnout of voters much larger than for any other AMS election or ballot issue, the referendum passed by a wide margin. (The full text of all five motions in the referendum appeared in the November 1987 *Notices*, page 1014.)

The AMS membership was not unanimously against military funding for mathematics, however. Many thought the Society had no business telling mathematicians who they should and should not take funding from. I remember a heated Council debate in which William Browder, then AMS president, expressed his strong opposition to blanket condemnations of research grants from the military. He likened such condemnations to a "witch hunt" against those who opted to take such grants. (Browder, whose father Earl was persecuted because of his leadership of the American Communist Party, is not one to use the term "witch hunt" lightly.)

Will the AMS Council or other venues within the mathematical community renew debate over military funding for mathematics? A mathematical generation later, it seems unlikely. But that doesn't mean the question raised in the 1980s—do mathematicians have a responsibility to try to influence how their work is used?—has lost validity.

—Allyn Jackson

[1] *Available at* `http://www.darpa.mil/dso/personnel/mann.htm`*; the PDF file is 1.7MB.*