

# APS releases report on directed-energy weapons

During the APS spring meeting in Crystal City, Virginia, late last month, the APS Council released the long-awaited report of the Study Group on the Science and Technology of Directed Energy Weapons. APS Executive Secretary William W. Havens Jr remarked, "It may be the most important APS study ever done."

Chapter 1 of the report notes: "The combination of lethality, propagation and range requirements determines the brightness required for directed-energy weapons. For defense of the entire nation, including protection of population centers, via boost-phase kill, the brightness requirements exceed by orders of magnitude the present state of the art of various types of lasers, particle-beam devices, optical delivery systems, acquisition platforms, power supplies, etc. This is the main thrust of the detailed conclusions of this study, which are presented in the Executive Summary." (This summary begins on page S3.) On page S15, in a postscript, we describe the announcement of the study and the report of the APS review committee, along with some general remarks from the report's introductory chapter.

The directed-energy weapons study has a long history. In his "Star Wars" television speech on 23 March 1983 President Reagan called on the US science community "to

give us the means of rendering these nuclear weapons impotent and obsolete." At that time he announced he was "directing a comprehensive and intensive effort to define a long-term research and development program to begin to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles. This could pave the way for arms control measures to eliminate the weapons themselves."

That November the APS Council authorized a study on the technology of directed-energy weapons with the hope that the study group would have access to classified information. Originally the council thought that an unclassified report might be produced by the fall of 1985. Encouragement came from Richard DeLauer, then Under

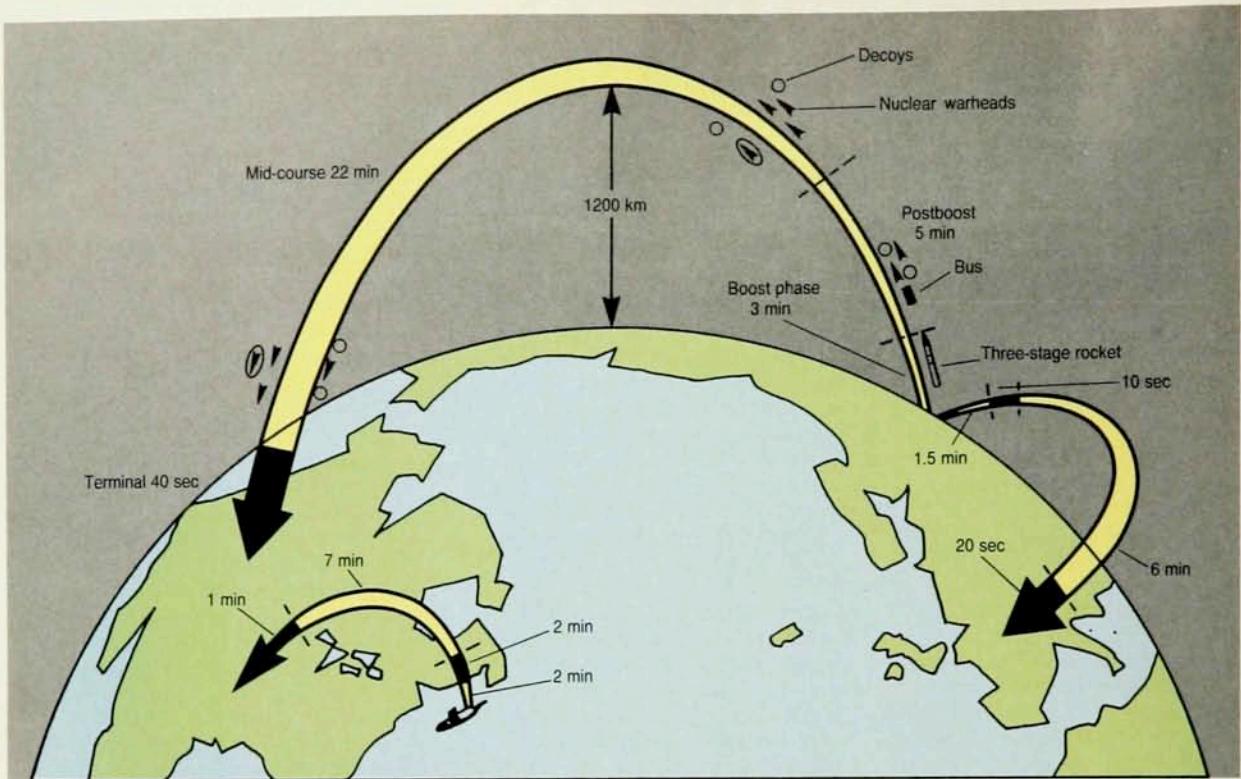
Secretary of Defense for Research and Engineering, in a letter dated 12 December 1983 to Charles Hebel of Xerox, who was then vice chairman of the APS Panel on Public Affairs. DeLauer endorsed an independent and impartial study by "a prestigious professional organization such as The American Physical Society," saying it "could be highly beneficial in coalescing scientific opinion in fulfillment of the President's aims."

The study group was formed by November 1984 and had its first meeting at the UN Plaza Hotel in New York during Washington's Birthday weekend of 1985. At that time the group thought its report might be released the following April during the APS Washington meeting. The group's co-chairmen were Nicolaas Bloembergen of Harvard, who had shared with Arthur Schawlow the 1981 Nobel Prize in Physics "for their contribution to the development of laser spectroscopy," and Kumar Patel (now executive director, materials

science, engineering and academic affairs division at AT&T Bell Laboratories), who is best known for his invention of the carbon dioxide laser. To advise the APS Council about the study, a review committee was formed, headed by George Pake, then vice president for research at Xerox. (For the complete list of study group and review committee members, see the boxes on



**The Strategic Defense Initiative** envisions a multilayer defense. Shown here are ground-based lasers whose beams are directed by space-based mirrors against offensive missiles.



**Phases** of ballistic missile trajectories for ICBMs, submarine-launched missiles and intermediate-range missiles, showing the boost, post-boost, midcourse and terminal phases for each. Also shown are the times spent in each phase. Decoys can be deployed by reentry vehicles in the post-boost phase.

pages S3 and S16.) DEW study members committed themselves to spending a large portion of their time on the study, which in the end lasted a year and a half.

The DEW study group was specifically chartered to examine the status and requirements of directed-energy weapon technologies (see the box on page S4). Accordingly the group studied several DEW technologies and estimated the parameters needed to accomplish a ballistic missile defense.

By June 1985 George A. Keyworth II, then Presidential science adviser, and Lieutenant General James Abrahamson, director of the Strategic Defense Initiative Organization, had offered encouragement and assured the DEW study group of their cooperation. The study group had access to classified information and received extensive assistance from many government agencies, national laboratories and contractors.

Last June the group finished a draft report and submitted it to the review committee, which urged the group to produce a report closer to a finished product before submitting it for security classification review. On 25 September the DEW study group submitted what the group considered an unclassified report to Abrahamson. The

report was over 800 double-spaced typed pages, including over 100 figures and tables. But the SDI organization told the group in December that it considered roughly half the report classified. At a meeting just before Christmas the group met with SDI officials and went over the report paragraph by paragraph to identify offending items. The group members were each assigned sections to modify, in many cases supplying their own calculations or references to the open literature.

Once the report was suitably modified it was returned to SDIO. At the end of January, Louis Marquet of SDIO announced during the AAPT-APS meeting in San Francisco that the report was about to be released, probably a couple of weeks later. Instead it was read by lawyers and classification officials at SDIO, the State Department, DOE, the three military services (which took at least a month to clear it) and the Office of the Secretary of Defense, including the DOD public information office. In explaining part of the lengthy delay, one study group member remarked to us: "It took a long time to make the rounds. After all, who wants to read an 800-page report? To get it out, some SDIO staff people had to push

the bureaucracy pretty hard."

On 21 March Patel received an ex-purgated version of the report from SDIO, which he and the others considered unacceptable. The study group and the review committee felt that the portions deleted were crucial to the integrity of the report. After negotiations among Patel, OSD and SDIO some of the deleted material was restored. On 10 April Patel was asked to make a few last-minute changes and deletions and then the SDIO directed-energy office gave the go-ahead for final release of the OSD-approved version. The amended report, still over 800 pages long, was rushed to AIP's Woodbury, Long Island, facility, where a crash effort was launched to compose, typeset, print and distribute it. A similar effort was launched at the PHYSICS TODAY offices. Meanwhile photocopies were shipped to the Pake committee for a final review and to the APS Council for its final OK. The report was officially released in the midst of the APS Crystal City meeting, on 23 April.

In the following pages we present the exact text of the executive summary and conclusions from the DEW study. For the table of contents of the complete study see page S8.

—GLORIA B. LUBKIN □