sound, according to Keyworth, but irrelevant: "I don't think [they] will be an important component of an eventual strategic defense. That's based on their limited potential for boost-phase intercept." In addition, he finds them politically undesirable because "defensive nuclear weapons are still nuclear weapons," and the President wants none of them. A more challenging question, Keyworth thinks, is whether a space defense can be deployed cheaply enough to discourage an attempt to overwhelm it with offensive weapons. "Good question," he says; "that's what the reasearch is for."

While Keyworth thinks that the aims of SDI are feasible, he says that even if he had doubts, he has been in a position where "political contiguousness" with the President is "mandatory." He adds: "If I choose to go out and criticize steps that the President has taken publicly I should do so in some other function than as his science adviser." Thus, his view of his role as a kind of mobilizer of technology does not seem very different from the role played by the Joint Chiefs as a mobilizer of troops.

The staffing of Keyworth's OSTP reflects the boss's interests and priorities. After two major waves of staff turnover in 1983 and 1985, the office is heavily peopled today with military, physics, and aerospace experts. In spatial proximity, the closest to Keyworth is Navy Captain Peter Graef, an assistant for military affairs, with an office near Keyworth's in the Old Executive Office Building. Across Pennsylvania Avenue in the New Executive Office Building is Deputy Director John McTague, a physical chemist on loan from the Brookhaven National Laboratory. He has been at OSTP since late 1983 and seems well liked on Capitol Hill.

There was, briefly, a second deputy director, physician Bernadine Healy, also well liked on the Hill. Her arrival in 1984 ended the complaint that OSTP was neglecting biomedicine. But her service lasted just a little over a year. She left in August 1985, married, and became Vice President for Research at the Cleveland Clinic. The life sciences are being handled now by Marvin Cassman, on loan from NIH, Robert Rabin, borrowed from NSF, and Air Force toxicologist Alvin Young.

The rapid pace of staff turnover at OSTP in recent years has more to do with the nature of the office than with its director. It has become a place where staffers "on loan" from other places can add prestigious White House service to their résumés. But it does not offer great visibility or administrative clout. OSTP can recruit able people, but it does not always keep them. In addition, Keyworth said he does not expect staffers to stay long, adding that "you get worn out here." Press aide Bruce Abell nodded; he was scheduled to write seven speeches in 5 days.

Almost exactly a year ago, there was a strong rumor in Washington that Keyworth and the OSTP were going to be removed from the White House. Edwin Meese III, then the President's chief of staff and a friend of Keyworth's, was about to depart from the Executive Office and move to the Justice Department. As a former OSTP staffer says, the OSTP had become "an island in the White House," and Keyworth's "only bridge to the President was SDI."

OSTP did not get the ax. Instead, Keyworth says, the President personally asked him to stay on as science adviser, and "the whole issue was to stay on to work on SDI." Keyworth agrees with an estimate that he may have spent 85 percent of his time on SDI this fall. But he prefers to say that in the past 2 years he has spent 50 percent of his time on it.

Keyworth by all accounts has been a strong leader of OSTP and has defined the office's role clearly as one that is to support policy handed down from above. The mold he has established will almost certainly last out this Administration.

—ELIOT MARSHALL

British Cabinet Split on SDI Agreement

Concern about technology transfer and diversion of talent from civilian programs have stalled agreement to participate in "Star Wars" research

Paris. An agreement between the American and British governments on the involvement of British scientists in the research phase of the Strategic Defense Initiative (SDI) has hit a snag. It is being held up by continuing concerns in London that such a move could drain scarce talent from other top-priority research programs, particularly those concerned with civilian applications of advanced computing techniques.

At a meeting in Brussels at the end of October, British Defense Minister Michael Heseltine and U.S. Defense Secretary Caspar Weinberger reached provisional agreement on the terms under which British companies and research institutes could accept SDI research contracts. At the time, it was hoped that final agreement would be reached before the Geneva summit meeting.

When the terms were put before the British cabinet, however, they were reported to have come under fierce criticism from Leon Brittan, trade and industry minister. Brittan apparently expressed the views of officials in his department that the draft agreement provided insufficient guarantees that the U.S. government would not apply excessive constraints on the use for non-SDI purposes of results obtained by British scientists under SDI research contracts.

The same officials have also expressed fears that British scientists might be wooed by the offer of generous SDI funding away from working on research projects considered vital to the future health of Britain's own high-technology industry, in particular those funded through the $500-million Alvey program on microelectronics research (*Science*, 20 May 1983, p. 799). "The use of a limited amount of top-quality manpower must be a major consideration in any SDI agreement," said Brian Oakley, the head of the Department of Trade and Industry's Alvey Directorate, in a telephone interview with *Science*.

The split within the government has brought to a head political tensions over the implications of accepting SDI research contracts that have been growing steadily in Britain—as in other European countries—ever since the invitation to participate was issued by Weinberger in March.

Several British companies and university research groups have already agreed in principle to undertake specific research projects. For example, Ferranti Instruments has reached a draft agreement for research into optical computing

techniques, to be carried out in conjunction with scientists at the Heriot-Watt University in Edinburgh and the University of Dayton, Dayton, Ohio.

At the request of the British government, however, no firm contracts are being signed before a broad framework agreement has been reached with the United States on the general conditions that should govern the participation of British scientists and technologists in SDI research.

Although British Prime Minister Margaret Thatcher has already given her political support to the SDI research program, both she and her cabinet members are particularly concerned that Britain's participation should result in a genuine "two-way street" in technology transfer, not merely a drain of scientific ideas and talents into the U.S. project, with minimal technical return to Europe.

"The issue of intellectual property rights must be decided in a way which allows the people collaborating in this work to use the results for other purposes, either for the defense of Europe, or for civilian usage," says Oakley. Earlier this year, Oakley voiced public skepticism about whether SDI was likely to have significant commercial spin-offs, describing it as a "conjectured military system" and suggesting that computing scientists would be "better employed in a commercial project."

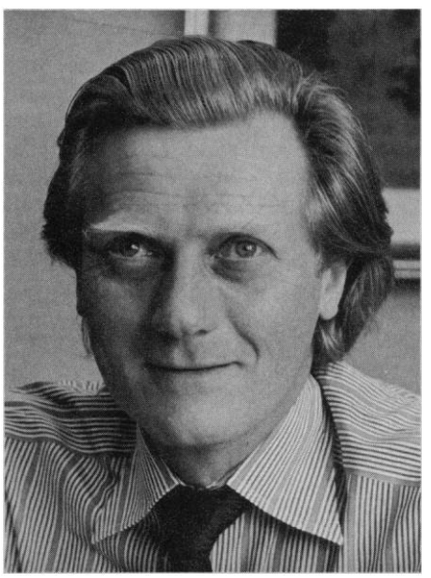
Given the sensitivity of current interdepartmental negotiations in London, Oakley is reluctant to comment further. However, a growing number of university scientists, many directly involved in the Alvey program, have no hesitation about expressing very similar objections.

Earlier this year, for example, a group of computer scientists from the University of Edinburgh sent a letter to U.S. Vice President George Bush criticizing the whole concept of SDI. A similar letter was sent last month by five computing professors from Imperial College in London to Thatcher, arguing that SDI was unlikely to work in the form currently being proposed by the U.S. Administration, and that Britain's participation was threatening to divert scarce intellectual resources from more pressing industrial problems.

"Most of the senior respected computer scientists in this country have more than enough work to do in pursuit of things which have a clear, positive social benefit; to participate in SDI research would mean that they would have to stop doing other things," says Henry Thompson, lecturer in Edinburgh University's Department of Artificial Intelligence and principal organizer of the first letter.

Given such growing criticism in universities, it seems inevitable that any academic scientist who does sign up for SDI research can expect fierce attack from both academic colleagues and students. Already, for example, 70 lecturers from Imperial College have written to a national newspaper disassociating themselves from the activities of one computing professor who acts as a software consultant to Science Applications, Inc., one of the five companies awarded major SDI contracts in the United States.

Although the government is keen to see British industry benefit to the maximum extent from collaboration on SDI research, it is aware that the benefits of past collaboration have not always been as high as hoped. Partly to avoid similar disappointment over SDI, and partly in an attempt to obtain a reward for its political support, the British government surprised Pentagon officials in July by demanding a firm commitment that British companies would receive contracts worth at least $1.5 billion out of the total proposed 5-year research program of $26 billion.



Michael Heseltine

Asked for a $1.5-billion commitment.

After several months of negotiation, this proposal has now been rejected by the United States. Washington argues that congressional procedures make it impossible to agree to such a commitment in advance. British Defense Minister Heseltine conceded at the Brussels meeting with Weinberger that he was not going to get the commitment he had been asking for, and subsequently claimed that the figure of $1.5 billion had been put forward merely "to indicate the ambitions which we had in mind."

Although details of the draft memorandum of understanding reached between Heseltine and Weinberger have not been published, these are said to describe a "work package" in each of 18 research areas where British scientists and high-technology companies are felt to have experience and expertise to offer SDI.* The total value of these packages, for which British research groups would be able to bid for contracts on the same basis as U.S. competitors, is said to total about $1.5 billion.

A similar compromise was reached in Brussels over the second issue which had been holding up the intergovernmental agreement, namely the extent to which U.S. export control regulations would be applied to the results of SDI R&D programs carried out in Britain (for example, in preventing the incorporation of these results in technological products destined for export markets).

Heseltine and Ministry of Defense officials, who emphasized in their discussions with Pentagon representatives that Britain also applied strict controls on its technological exports, claim to have been convinced that the terms of the draft agreement are not excessive. But the delay in obtaining cabinet endorsement indicates that their judgment has not obtained immediate support from officials in the Department of Trade and Industry.

Observers in London agree that the cabinet split is unlikely to scuttle the SDI agreement. The government remains keen to see the agreement signed, if possible within the next few weeks, aware of the pressure from various companies and research groups who are threatening to proceed unilaterally with their own contracts if the government fails to act soon.

Nevertheless, the dispute in Britain (which has been mirrored in different ways in virtually every other Western European country invited to participate in SDI research) confirms the judgment issued earlier this year by the London-based International Institute of Strategic Studies in its 1985 report, "Strategic Studies," that "the strong feelings that appear to be developing on both sides of the Atlantic suggest that 1984's comparative calm in inter-Alliance relations may not survive 1985."—**DAVID DICKSON**

*The 18 research areas covered in the draft agreement are: optical computers and components; advanced thyratrons; electronic sensors; radar; interceptor technology; electromagnetic guns; ion sources; space experiments; the vulnerability of lasers and particle beams; laser radar and imaging; countermeasures; software security; phase conjugation; electronic materials; nonelectronic materials; command, control and communication systems for ballistic missiles; signal processing; and general architecture studies for the European arena.