

they'd be doing America a favor by participating."

R. V. Jones, a leading British expert on air-defense systems, supports the idea of defenses against ballistic missiles, but he feels that US Defense

officials engaged in an "awfully hard sell." Jones felt that the British government should have raised tough questions about the feasibility of certain missile-defense systems in the negotiations with US officials; his

views about SDI are summarized in the box below.

The campaign to win European support for SDI would appear in a dim light if it were to end up costing the supporters their jobs. That could hap-

Jones, British air-defense expert, discusses SDI outlook

R. V. Jones, a leading British expert on air defenses since the mid-1930s, is consulted frequently by governments on defense issues. He supports SDI "as a vigorous effort to explore what can be done to counter nuclear missiles" but is "very skeptical about the application of directed-energy weapons at long range."

Background. Educated at the University of Oxford, Jones took up the study of infrared detectors at the Clarendon Laboratory in the mid-1930s, which brought him into contact with the closely related radar technologies. When the war broke out, Jones was quick to emerge as a leading figure in efforts to counter the German Luftwaffe. His first major accomplishment was to figure out that the Germans were using systems of intersecting radio beams to guide their nighttime bombers. After winning the so-called "battle of the beams," Jones went on to conduct studies of German radar systems, the V-1, the V-2 and other major technological programs. A few months before D-day, Jones was able to convince Deputy Allied Commander Arthur W. Tedder of the crucial importance of locating and knocking out Germany's coastal radar. An anti-radar effort was authorized, and on the eve of the invasion the Allied forces succeeded in knocking out all but six or so of Germany's 47 radar stations on the Channel coast.

Jones has been on the faculty at the University of Aberdeen since 1946, except for the years 1952-53, when Winston Churchill brought him back into government to serve as the chief of scientific intelligence in the consolidated defense ministry. Jones has described his wartime activities in *Most Secret War* (1978), which appeared in the United States as *The Wizard War*, a phrase Churchill coined to describe the operations Jones and his colleagues conducted. In an interview conducted on 1 April, Jones discussed his views about SDI with PHYSICS TODAY.

Radar vs. directed energy. In his book, Jones notes that the British first began to think about radar when a committee on air defenses was set up in 1935 and immediately took up the question of "death rays"—"the idea being the creation of a sufficiently strong beam of electromagnetic waves which would heat up anything in their path." It was quickly calculated that the power needed was far beyond contemporary technology, but having brought up electromagnetic waves, the committee got to thinking about radar. By the time the war broke out, it was apparent to specialists such as Jones that development of effective radar would depend on finding means of getting wavelengths down into the centimeter and millimeter regions and of increasing output power. Now, with directed-energy weapons, we are back to

death rays, with the key problems being to increase the power and to focus the beams.

Jones sticks to the very skeptical assessment of directed-energy weapons at long range that he outlined in an article published in June 1985 by the Centre for Policy Studies in London. Jones believes that any directed-energy device placed in geostationary orbit would have to have a precision at least ten times better than the space telescope's, which he does not consider achievable in the foreseeable future.

Low-orbit lasers. Turning to laser or particle-beam weapons put on patrol in low orbits, Jones considers the technical possibilities somewhat more interesting. He thinks it might be possible to use a laser beam as its own optical radar by sending out a broad beam and then using the reflected light to focus the beam sharply on a region of the enemy booster. He is especially interested in recent work on phase-conjugation techniques. Jones reports that Lieutenant General James Abrahamson, head of the SDI Organization, is trying to get top security clearances for him so that he can be briefed about the latest advances in methods of overcoming atmospheric distortion and of switching beams from target to target without having to move or refocus mirrors.

Jones remains worried that a laser of plausible specifications would have to be able to make a beam "dwell on a spot of just under 1 meter diameter on a booster at a range of 3000 kilometers for seven seconds in order to produce sufficient disruption." Overall, he wrote last year, "it is hard to differ from the opinion of Edward Teller, who, although he supports SDI, is quoted in *Commentary* for March 1985 as saying, 'Lasers in space won't fill the bill—they must be deployed in great numbers at

terrible cost, and could be destroyed in advance of an attack.'"

Jones himself supports the SDI research program on the simple moral ground that if there is any possibility at all of defending populations against the danger of nuclear extermination, then one must explore that possibility. But he is inclined to think that it would or will probably take until the middle of the next century to develop and deploy an ABM system that would require us to change the doctrine of mutually assured destruction.

Rocket interceptors. Looking to the decades immediately ahead, the technology that makes sense to Jones is the type of infrared homing interceptor being developed as an anti-satellite weapon by the Air Force and as an ABM system by SDI. "This is the part of the program I would support," Jones told PHYSICS TODAY. It might be worth deploying such a system to defend missile silos, as permitted by the ABM Treaty, Jones said, but "whether or not it is worth it has to be thought through by the policymakers." He said that "in a way you already went through this with Sentinel and maybe it would go the same way again."

Asked about his "feel" for the types of inventions that would be required to make directed-energy weapons work, as compared with his feel in 1938-39 about the inventions that would be needed to make radar work, Jones became cautious and self-deprecating. He was "much closer to the front line then," he said, and "I couldn't guarantee my grasp on the current situation as I could then."

Pressed, he conceded that when he wrote a report in 1937 saying that it would be necessary to find ways of shortening radar wavelengths drastically and boosting power substantially, he felt very confident that the required inventions would be made. He does not feel the same way about directed-energy weapons at long ranges today.

"Of course the big difference between those days and now is that if you knocked out 10% of the enemy bombers, offensive operations became unsustainable and damage could be managed. Now you have to come up with such a fantastically effective defense, and you know how many things can fail once you are committed to operations," Jones said.

He went on to say he felt it was unfortunate that President Reagan couched the SDI research program in such dramatic terms. He felt that this had "interrupted the smooth course of ABM research and polarized scientists so that now you get people on both sides saying silly things, for example, the Union of Concerned Scientists statement that SDI is 'morally repugnant.'"

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