Britain And The S.D.I.
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Dr Gray's current professional interests include studies of strategic defense, nuclear weapons employment policy, and the complex relationships among strategic conflict and conflict on land and at sea ("War as a whole"). His latest book is Nuclear Strategy and National Style. He is currently working on a broad historical study entitled Strategy For Peace and War, scheduled for publication late in 1986.

by

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Adam Smith Institute
1986
THE AUTHOR

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CONTENTS

1. Britain's Hesitant Attitude to Strategic Defence 4
2. The Myths about Strategic Defence 6
3. The Latest Technological Developments 16
4. The Soviet Strategic Defence Effort 18
5. The Political Rewards of Supporting Strategic Defence 19
6. The Case for British Strategic Defence 20

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1. BRITAIN'S HESITANT ATTITUDE TO STRATEGIC DEFENCE

President Reagan's announcement of the new US commitment to strategic defence research was not greeted with unbounded enthusiasm by the British government. Initially at least they seemed to hope that the idea would just go away, that perhaps it was only a passing enthusiasm of the President.

When it became clear that this was not so, official British statements were lukewarm in support, and tinged with a number of reservations. The reasons for this hesitancy are not hard to divine. The government had just fought a long, bitter and tiring campaign in defence of nuclear deterrence, and was not disposed to endorse a new strategic policy which downgraded the role of nuclear weapons. There were also worries that a general shift to a policy of strategic defence and the probable Soviet deployment of new ballistic missile defences would make Britain's own independent nuclear deterrent obsolete, or at least require costly countermeasures.

Further concerns were that America would retreat behind an isolationist space shield, leaving Britain and Europe to the tender mercies of the Soviet Union; that the new weapons wouldn't work anyway; that the arms control process would be damaged; that an eventual elimination of nuclear weapons would require large extra expenditures on conventional forces to meet the Soviet threat.

In addition, existing parts of the defence establishment, already hard pressed for cash, were opposed to any new project which might divert resources away from their own programmes. They were also opposed to new thinking about defence strategy, preferring to rely upon the old ideas and weapons which they thought had served them well. Throughout the ages new weapons and ideas about defence strategy have rarely had a warm welcome.

British policy today is largely limited to support of the research aspects of the SDI programme. The main advantage that is seen for Britain is the prospect of securing some contracts from the US government for British companies. This rather mercenary approach is distinctly short-sighted.

In fact what we may be witnessing is one of those general shifts in strategic and tactical thinking that occur when old weapons become outdated by the new. Britain can no more prevent this probable shift from occurring than King Canute could halt the incoming tide. Most of the British fears and suspicions about the new policy are in fact unfounded. There will be no drastic overnight change, no immediate abandonment of nuclear weapons, but a gradual transfer from the offence to the defence, with new defensive weapons providing enhanced deterrence by protecting offensive weapons.
This paper argues that Britain would be well advised to participate wholeheartedly in these developments, adapting her defence policy to the new circumstances, rather than being stranded with old weapons and old ideas. As the following chapter demonstrates, most of the charges that are leveled against strategic defence are false, misinformed, or misguided. Subsequent sections detail the substantial Soviet effort to develop strategic defences, the rapid technological progress that is being made in the US SDI research programme, and the political popularity of SDI.

The conclusion of this paper is that strategic defence has much to offer Britain, that she has much of the technological know-how required to make it a success, and she should begin to carry out her own research in co-operation with the US with a view to deployment within the next two decades.
2. THE MYTHS ABOUT STRATEGIC DEFENCE

More than two years after President Reagan made the historic announcement of what was to become the Strategic Defence Initiative, there is still confusion and misunderstanding. Although a healthy debate on strategic defence policy has now evolved, misconceptions still cloud thinking even at the highest levels of policy formation. In order to help clarify the debate, analysis of the potential of strategic defence is here organised as answers to 12 charges that are currently being leveled at the SDI.

ISSUE 1: Character and Purpose of SDI

CHARGE: The SDI has been explained in different ways by different US officials. There is a lack of coherence in the policy rationale.

ANSWER: The SDI, as an initiative to explore the potential of defensive technologies, necessarily cannot be tied to the rationale of a single military mission at this time. It is not evidence of policy incoherence to say that there is a long-term possibility that strategic defences may render long-range bombardment by missile and aircraft as obsolete as the cavalry charge, and, in the shorter term, that defences of a technically more modest character could serve exceedingly useful limited purposes.

One would expect US Defence Department officials responsible for the management of the defence effort to emphasize potential near-term benefits of the SDI and President Reagan and his advisors in the White House to place relative emphasis upon the longer-term, broader-gauged aspects. It is entirely consistent to say that:

(a) one day strategic defence may transform the terms of deterrence essentially so as to exclude nuclear threats, and

(b) during a possibly lengthy transition period from today to such a condition of defence, strategic defences could, and indeed should, greatly strengthen the stability of nuclear deterrence as we know it now.

ISSUE 2: Stability in Time of Crisis

CHARGE: The existence of strategic defences will create new incentives to strike first in a crisis.

ANSWER: This is the "mad systems analysts" view of the world. As a matter of narrow defence analysis, it should be true that a first strike would fare better than a second strike against defences. The argument proceeds to claim that the Soviet Union would choose to begin a central war rather than risk being caught by a US first strike and having to retaliate with damaged and unco-ordinated forces against intact Western defences.
This charge neglects to explain:
(a) why the Soviet Union would anticipate any gain from "going first" in a crisis—even if they should do "better" going first rather than second (i.e. why would they expect to do well enough?); and
(b) why Western defences sufficiently serious as, allegedly, to motivate a Soviet first strike, would not also be sufficiently serious as to compromise Soviet expectations of military "success".

The people who level this charge tend to be the same people who claim SDI will be a great technical fiasco. They would have us believe that SDI, at the same time, will be technically incompetent and a major threat to stability.

SDI weaponization, far from imperilling crisis stability, will help strengthen existing disincentives to strike first. Even at an early stage of deployment, SDI weapon architecture cannot help but raise critical new uncertainties in Soviet minds over their ability to strike reliably and in a timely fashion against Western C2I (Command, Control, Communications and Information), assets and strategic retaliatory forces. As the military incentive to strike diminishes— with the prospects for military success—so must the political incentive.

It is important that the Soviet Union not be the first nation to deploy nationwide ballistic missile defence (BMD), in addition to its existing air and civil defence programmes. Soviet official attitudes towards "acceptable" damage may be dangerously different from Western attitudes. The Soviet leadership is inclined only to look after the interests of the small Soviet ruling class, or Nomenklatura, rather than the bulk of the population whose labours it exploits. The tough new Soviet leadership could come to believe that a new BMD addition to their posture would give them a new potential for intimidation. (Too many Western critics of SDI choose to ignore the cultural asymmetries between the USSR and the West).

 Bearing in mind the likely circumstances of an acute international crisis, with both sides' strategic forces in a state of generated alert, a weaponized SDI would provide a very useful hedge against accidental or unauthorized strategic action by any party. The potential for a "mad" dictator such as Colonel Gaddafi of Libya, acting on his own or instigated by the Soviets, to blackmail the West would be greatly diminished.

ISSUE 3: Stability and the Arms Race

CHARGE: The SDI will fuel a more complex defence-offence "spiral" of arms race activity, creating new tensions and not providing any enhancement in security.

ANSWER: There is no technological escape from the arms race. The arms race is on today, substantially—though far from exclusively—in the offence-offence realm. Anything the West
elects to do which challenges the military integrity of Soviet war plans is a candidate for a Soviet response. The Soviet Union will attempt to target SSBNs, mobile ICBMs, superhard silos (if that route is taken by the US), and to detect, track and kill "stealthy" air-breathing forces.

What is so different about threatening the military efficacy of Soviet missiles with active defence, as contrasted with agile mobile deployment, prompt launch on confirmation of attack, or protection by concrete and steel? The problem is the Soviet will have to compete. It is not with the mode (active defence, in this case) of the Western challenge to Soviet strategy.

To claim, sensibly, that the Soviet Union will attempt to "race" with the SDI, offensively and defensively, is a trivially obvious point, although many critics do not understand that. The Soviet Union and the Western alliance are in a dynamic arms competition today. Prominent among the US policy motives behind the SDI is a determination to shift some of the terms of the competition away from the accumulation of evermore lethal offensive forces.

The SDI is likely to dampen the race in offensive strategic arms if and only if defensive technologies render offensive forces increasingly unreliable military instruments. The SDI offers the only path to a transformation in the technical and strategic terms of the arms competition away from weapons lethal to people. This is what the SDI is all about.

ISSUE 4: Arms Control and the ABM Treaty

CHARGE: SDI poses a potentially fatal complication for the arms control process today, while in the medium term it places at risk the integrity of the ABM treaty.

ANSWER: There is no denying that SDI is providing an important set of complications for the design of arms control policy. However, those "complications" could better be stated as opportunities. SDI critics tend to forget that the SALT/START/INF process either "failed" or was in acute "crisis" long before President Reagan made his SDI speech on March 23, 1983.

The "problem" of the SDI for arms control today does not reside with the West. SDI has simply moved the Soviet Union to try to discourage the West from pursuing this new approach to stability. Far from being incompatible with arms control, SDI is the only instrument capable of triggering a disarmament regime of substantial benefit to stability.

"Deep" reductions in nuclear arms are of little relevance to peace and security if the forces permitted can be lethal against military targets, and those forces are still very large in absolute terms. SDI could defend retaliatory forces and essential C3I, discourage further accumulation and improvement of offensive forces, and "police" a truly deep-reductions regime (by
neutralizing the military and political value of treaty non-compliance - even on a large scale).

If the Soviet Union should come to fear a combination of effective Western offensive and defensive forces, it should discern a most pressing set of reasons to negotiate sharp cutbacks in offensive arsenals.

ISSUE 5: Alternatives to the SDI

CHARGE: SDI is unnecessary.

ANSWER: No one is suggesting that, somehow, the nuclear age can be repealed. But if one believes that it may be possible to effect reductions on such a scale in the size - or effectiveness - in action - of nuclear arsenals that Western society no longer need be at terminal risk, then it is difficult to discern any plausible alternatives to strategic defence.

To sustain the charge that SDI is unnecessary one needs to argue that "there is a better way". It should not be forgotten that SDI looks both to strengthen deterrence and, if need be, to provide physical protection. Since there are no paths available, at present, towards the transformation of the basic character of world politics, this charge has to rest upon the proposition that an offence-dominated deterrence will never fail or become irrelevant.

The case for SDI, in the context of this charge, is: (a) it should lead to a more effective deterrent of war, and (b) it would be the only reliable way in which war damage could be limited drastically. SDI carries the promise of strengthening the pre-launch survivability of offensive forces during the early stages of a "defensive transition", all the while providing more persuasive reasons for the Soviet Union to restructure its strategic forces away from offensive elements (because they will not "work") over the long run.

There are problems with strategic stability in an offence-dominated world - and strategic defence looks to be a cost-effective solution to many of these problems. While in the longer term, although SDI cannot alter the basic character of Soviet-Western security relations, it certainly may be able to alter the burden of risk to society, indeed to the entire planet, that is inseparable from "the balance of terror".

ISSUE 6: The Technical Feasibility Of SDI

CHARGE: Whether or not strategic defence is desirable is beside the point; SDI simply will not work.

ANSWER: The technical feasibility of SDI remains to be demonstrated. No one is making extravagant claims - save on the negative side. Military history is replete with examples of whole classes of weapons being rendered obsolete (or having their roles
changed dramatically) by new technologies. There is no reason in principle why the long-range ballistic missile might not cease to be a useful weapon of war.

The technical infeasibility charge needs to be interrogated closely as to its details. What is it that a weaponized SDI, allegedly, will be unable to do? Protect retaliatory forces? Provide vital minutes (at least) of survival time for C3I assets? Keep all nuclear weapons away from Western society?

Some SDI critics are arguing that the offence can always restore a relation of advantage over the defence. This is poor military history. It is true that there has been a permanent dialectic between offence and defence—meaning one could just as well argue that an SDI ascendency over offensive missiles need not be permanent, though history (and common sense) suggests that two societies locked in a long-term competition probably will find new, or revive old, ways to hurt each other.

If one seeks ways to end the arms competition, one must look to political factors, not to technology. SDI may protect the West for a period long enough to see a change in the Soviet Union, away from the Soviet hostility towards other forms of political organization on the rest of the planet, and towards a more pluralist, democratic society.

One should always be wary of scientists who insist that particular technological tasks are impossible. A few examples are instructive:

"Rail travel at high speed is not possible because passengers, unable to breathe, would die of asphyxia."

Dr Dionysus Lardner (1793-1859)
Professor of Natural Philosophy and Astronomy at University College, London.

"Heavier-than-air flying machines are impossible."

Lord Kelvin
British mathematician, physicist, and President of the Royal Society. c. 1895

"The people who have been writing these things that annoy me, have been talking about a 3,000 mile high-angle rocket shot from one continent to another, carrying an atomic bomb and so directed as to be a precise weapon which would land directly on a certain target, such as a city."

"I say technically, I don't think anyone in the world knows how to do such a thing, and I feel confident that it will not be done for a long time to come....I think we can leave it out of our thinking. I wish the American people would leave it out of their thinking."

10
Dr Vannevar Bush  
Former Dean of Engineering at the  
Massachusetts Institute of Technology  
and President of the Carnegie Institution of Washington, 1945.

Recent technological breakthroughs make the speedy deployment of strategic defence weapons much more possible than had previously been thought, even by the idea's most ardent proponents. (See section 3, 'The Latest Technological Developments').

ISSUE 7: The Cost of SDI

CHARGE: SDI is not affordable and the US will drop the project.

ANSWER: It is difficult to conduct cost-effectiveness analysis when the cost of SDI weaponization is not yet known. However that cost is most unlikely to be in any way unbearable.

SDI critics hover in their cost preferences in the range "several hundred" billion to $1 trillion for SDI, R,D,T,E, and procurement. These numbers are worthless, except they have a contemporary political impact not easy to counter. The proper starting point for analysis, if we grant the critics' premise of a multi-tiered (four or five) architecture of defence, is to say that for "X dollars" we should be buying the functional equivalent of (and perhaps the event itself) near-total nuclear disarmament of the Soviet Union. For "X dollars", Americans and their allies would have bought effective immunity of their societies from terminal (though certainly not all) nuclear danger. No other category of weapon can protect our society in this way. A weaponized SDI, multi-tiered, offers a unique quality and quantity of physical protection. What should we be prepared to pay for that?

If, for the sake of argument, (and only for the sake of argument), we take a figure of $500 billion as the full-up R,D,T,E, and procurement cost of a multi-tiered weaponized SDI, elementary arithmetic shows that the cost would be 8 per cent of the defence budget for the next 20 years, assuming a constant defence budget level of $300 billion per annum. If a defensive transition is phased over 30 years, the burden is reduced, of course. No critic of SDI is going to win a political argument claiming the protection of Western society is not "worth" 8 percent of the US defence budget for 20 years.

ISSUE 8: SDI and "Fortress America"

CHARGE: A protected America would retreat upon itself and the current structure of international security would collapse.

ANSWER: The logic in this charge is as bizarre as the claim is popular in Europe. It may be true that if US strategic defences trigger new Soviet strategic defences, the Western Alliance will need to reconsider its strategy (as the terms of deterrence
alter), but the connection between SDI weaponization and American isolationism is so elusive as to be analytically invisible.

A modest scale and character of SDI deployment in the 1990s would strengthen the contemporary terms of offence-dominated deterrence - and thereby would help bolster the last line of NATO-European defence. More capable strategic defences, designed to keep the vast majority of Soviet nuclear weapons away from Western "targets" of any kind, logically must help strengthen the long-standing US role as principal security guardian of distant friends and allies. After all, it has been the vulnerability of North America to Soviet attack that has caused European leaders and theorists since the 1950s to question American reliability as a security guarantor. (Would the US risk New York for Hamburg or Birmingham?).

If America returns to isolationism, it will be because it discerns an unwillingness on the part of allies to help in their own defence to an appropriate degree, not because the US is newly defended by a weaponized SDI.

ISSUE 9: The Soviet Response to SDI

CHARGE: The Soviet Union is able and willing to offset US strategic defence with new quantities and qualities of offensive forces.

ANSWER: There is no question that the Soviet Union is strongly motivated to discourage the West from pursuing open-ended, all-purpose, strategic defence R&D, wheresoever it might proceed. Similarly, there can be no doubt that the Soviet Union is able to produce more offensive forces and upgrade the quality of new offensive weapons. However, Soviet defence planners can be trusted to be sensible in their allocation of scarce economic assets. A highly cost-effective SDI deployment, the only kind the West would field, will not be met by an endless proliferation of Soviet offensive assets. Facing an exponential rise in the price of access to Western "targets", Soviet defence planners will have to recommend a fundamental change in policy. This happened before. Until 1968-69, the Soviet Union favoured heavy constraints on offensive forces and permitting defences to run free.

Furthermore, a point frequently neglected, the Soviet Union's difficulties with the effectiveness of its offensive forces do not reside solely in the realm of potential problems with SDI. Whether or not the US SDI matures into a period of weaponization, Soviet planners have to be anxious that the days of confidence in offensive counterforce success may be passing swiftly. Western C3I modernisation means a much reduced prospect for a decapitation strike. Prompt launch out, under or after attack, of MX and Minuteman means that these may not be usefully targetable, and Ohio class SSBNs pose an intractable ASW problem. All of these concerns, and more, should point to the conclusion (already tentatively signaled by Marshal Ogarkov) that defensive
counterforce is a more reliable means of limiting damage than is offensive counterforce. This is not suggesting that the Soviet Union would choose one or the other exclusively.

When the Soviet Union comes to believe that the West truly will stay the course with SDI, its tactics should change towards arms race management. It is more likely than not that the Soviet Union will seek to negotiate a new strategic defensive arms treaty which permits deployment in technical areas wherein Soviet competitive potential is good (terminal and late mid-course), and precludes deployment of a kind not reliably attainable by Soviet science-based industry (boost, post-boost and perhaps mid-course defences).

ISSUE 10: SDI and a "Technological Peace"

CHARGE: Peace can only be political. SDI is a futile attempt to provide an inappropriate technological solution to a political problem.

ANSWER: Peace is indeed political rather than technological. But the military expression of an essentially political incentive to compete, or even fight, is no less essentially technological. The basic security problem for the West is the assumed political incentive Soviet leaders might have some day to use their weapons. Until the nature of the Soviet regime changes, we have no choice other than to minimize those dangers to our security that can be minimized.

Soviet long-range missiles pose a technological threat to Western survival. It is entirely appropriate that, pending the political evolution in a benign direction of the relations between the West and the countries which comprise the Soviet bloc, a technological answer be sought to that technological danger.

SDI should enable us to deter war more reliably and even, if need be, survive a breakdown in the deterrence system. No responsible person is claiming that SDI itself effectively resolves political problems. But SDI should enable us to live more safely with the political problems that continue to evade effective political treatment.

ISSUE 11: Offence and Defence in Transition

CHARGE: A period of "defensive transition" would be uniquely dangerous for deterrence.

ANSWER: The proper relationship between the offensive deterrent that the West has today and the defensive deterrent that it may have tomorrow is indeed a challenge to sensible policy-making.

The key to maintaining stable deterrence is to ensure that at no point Soviet military planners have a plausible theory of military victory. It is close to a certainty that both sides
will want to maintain a substantial offensive arsenal, if and when they proceed to deploy new BMD weapons: (a) to "backstop" defensive deterrence; (b) to deter third parties; (c) "just in case....". However, as the US government says today, a point should come when deterrent duties vis a vis the USSR can be shifted from offensive to new defensive force elements.

It is important that there be no premature transfer of duties, from a deterrent that "is", to a deterrent that "may be". Furthermore, the SDI would be assisted very considerably if the Soviets agreed to a negotiated deep reductions regime in offensive nuclear arms. For the Soviet Union to be persuaded sooner rather than later to join in a co-operative - or at least partially co-operative - defensive transition, it is important not only that they give great technical credit to Western defences, but also be anxious concerning the ability of US offensive forces to penetrate their defences.

As President Reagan has stated, it is not the US intention to achieve a first-strike advantage. But, if a very useful disarmament regime is to be negotiable, it is probably essential that the Soviet Union anticipate an evolving future strategic balance increasingly to their military disadvantage. It will always be a unilateral possibility for the West to downgrade the quantity, and even restrict the quality, of its offensive forces - to moderate Soviet anxieties - but Soviet anxieties, unfortunately, really are the engine of arms control progress.

ISSUE 12: Ethics and SDI

CHARGE: There is no ethical case for SDI.

ANSWER: SDI is the most ethical response to the dilemmas of nuclear weaponry. Moral philosophy distinguishes between two kinds of argument, the absolute or deontological and the consequentialist. The case for SDI may be made with both kinds of argument.

In terms of the ethics of consequences, SDI should provide a more robust deterrent against war, and - should deterrence fail nonetheless - should ensure the least possible damage is suffered. In absolute terms, SDI defends what and who can be defended. It can be argued that Western governments have an absolute duty to provide protection to their citizens. In addition, one can argue that to deter by threatening to defeat enemy weapons is absolutely morally superior to deterrence by the threat to damage enemy society. ("Killing people is wrong, and threatening to kill people is wrong", particularly if there is a better way available).

Western society finds all aspects of nuclear weaponry morally repugnant. Moreover, there can be no offensive nuclear strategy "with a human face". Western deterrence strategy today, with its quite heavy reliance upon latent nuclear threat, is an affront to
the values of our culture. It is probably not too strong to say that Western uneasiness with, and distaste for, the means of nuclear deterrence, dangerously undermines the goals of our policy.

Research breakthroughs have come so quickly that deployment may be possible much earlier than predicted. These breakthroughs have occurred in the following areas:

* The Rubber Mirror

Development of this device will now permit lasers to be stationed on the ground instead of in space. The rubber mirror is a reflecting device that changes its shape many times a second in order to correct for the attenuating effect of the earth's atmosphere on a laser beam, thus sharpening its focus. It is not actually made of rubber but of many individual surfaces which can be independently and rapidly moved to correct the beam. The mirror was tested successfully in September 1982, and could lead to the deployment of a ground-based laser defence ten years earlier than had been thought possible. It is now clear that hundreds of strong rubber mirrors can be placed in space, far more than would actually be needed, in order to thwart possible Soviet countermeasures. This will obviate the need to station lasers in space, which would have been much more difficult and expensive, given the high cost of lifting heavy lasers and their fuel and power supplies into space.

* The Free Electron Laser

This laser uses electrical energy to generate a beam of high intensity. Very rapid progress has been made with the testing programmes at the Los Alamos National Laboratory in New Mexico and the Lawrence Livermore National Laboratory in California. Scientists at Livermore have generated a free electron laser beam at a peak power of 1 billion watts, a power far greater than the 20 million watt level deemed necessary for an effective laser defence against Soviet missiles. These free electron lasers could be an important component of a weaponized SDI as they are exceptionally lethal against targets, energy efficient, and less vulnerable to countermeasures than most other lasers.

* The Chemical Laser

This is a high-energy beam of concentrated light derived from a chemical reaction of the compound hydrogen fluoride. Its development is at an advanced stage, and once deployed it could be used to intercept Soviet missiles in boost-phase, post-boost phase, and mid-course. On September 5th 1985 the US Navy's mid-infrared advanced chemical laser (JIRACL) reached full operational status. It was tested at a power level of several million watts and demonstrated a ground-based Titan I missile casing pressurized and loaded to simulate flight conditions of
3. **THE LATEST TECHNOLOGICAL DEVELOPMENTS**

Rapid progress is being made towards achieving the technical goals of SDI. In 1984 the Defense Technologies Study Team, the so-called Fletcher Commission, concluded that strategic defence was indeed feasible, and projected demonstration of key technologies in the early 1990s and possible deployment in the first part of the 21st Century. This timetable now seems to have been much too conservative.

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16
operational Soviet missiles. Such tests have determined that SDI officials had previously over-estimated the amount of power a laser would have to deliver to a missile in order to destroy it. Ballistic missiles are less sturdy than was thought in the past. Another chemical laser, the multipurpose chemical laser (MPCL), is being developed by the US Army and is expected to require lower power and costs to achieve the same effect as the MIRACL.

* The Railgun

This "gun" uses electromagnetic energy to fire a "smart bullet" at very high speeds towards an enemy warhead. Tests have proceeded so well that it is now possible to fire many bullets in rapid succession—five every half second—whereas a year ago only one shot could be fired every two or three days.

* The Scramjet

The biggest cost associated with SDI will be that of actually putting objects in space. The cost of an effective strategic defence system must be less than the cost of adding more offence or countermeasures. Currently rockets must be used to take everything into space, which is expensive. "A more revolutionary approach...may be possible by the development of a fully reusable, air breathing launch vehicle capable of horizontal take-off and landing", announced Brig. General Robert R. Rankine Jr., the US Air Force's special assistant for SDI to a seminar of the American Society of Engineers in December 1985. "Such a vehicle is called the aerospace plane". This plane is based on the concept of a new kind of engine called the Scramjet, a cross between a rocket and a jet engine, which has recently undergone successful laboratory tests. The engine's design is based on elaborate calculations by Cray computers that would have been impossible ten years ago.

The scramjet, once operational, will be able to reduce the costs of putting heavy items into orbit from thousands of dollars a pound (current shuttle prices) to tens of dollars a pound. Such a decrease in the costs of orbiting payloads by a factor of 100 may be the most important achievement to date, because it will strongly tilt the ratio of costs of space-based defence in favour of the defence.
4. THE SOVIET STRATEGIC DEFENCE EFFORT

The Soviet Union's attitude to strategic defence can be summed up by the fact that its main spokesmen decrying the SDI are actually some of the top scientists engaged on the Soviet's own strategic defence programme. For example, the so-called "Committee of Soviet Scientists in Defence of Peace and Against Nuclear War", which has issued the most widely publicised Soviet report attacking SDI, is headed by Yevgeny P. Velikov, the most prominent Soviet anti-SDI spokesman. However Mr Velikov is also a central figure in the development of Soviet high-energy laser weapons, and was formerly director of the Institute of Atomic Energy laboratories at Troitsk, where lasers for strategic military application are being developed.

It is clear that the Soviets are pushing ahead with a powerful research and development programme in this field, while simultaneously trying to frustrate similar Western efforts. In fact they are probably ahead of the West in a number of areas, such as phased-array lasers and particle beam generators. The phased-array laser is a Soviet invention which uses many small, closely co-ordinated lasers, arranged in a pattern known as an "array", to build one large, powerful laser beam. US scientists are now trying to copy the same technique.

Similarly, in the field of particle beam generators, two Soviet inventions - the "ion induction linear accelerator" and the "radio frequency quadrupole" - are central to current US designs. A CIA staff paper written in March 1985 concluded that "Soviet research and development of those technologies that could support a particle beam weapon have been impressive. Work on ion sources has been spectacular". According to a 1985 Pentagon report on Soviet military power, prepared by the Defense Intelligence Agency, the Soviets have over 10,000 scientists and engineers working on laser weapons alone.

In the last four years the Soviet Union has more than doubled its annual expenditures on space activities. Almost all of the Soviet space programme is military - 90 per cent of Soviet satellites have military missions. If the present trend continues, ten years from now the Soviets will be spending as much on space as they now spend on their army or their navy. Soviet ground-based lasers are already in a position to destroy US and NATO satellites in low earth orbit. Soviet preparations to develop a ballistic missile defence system are already well advanced. Not to respond to this challenge would be irresponsible, and would leave the West open to grave dangers.
5. THE POLITICAL REWARDS OF SUPPORTING STRATEGIC DEFENCE

British politicians are missing a golden opportunity by not being more active in supporting strategic defence. All the evidence shows that once the strategy is explained to them, voters favour it enthusiastically. Voters have understood the concept of mutually assured destruction, and the vast majority have supported it as the least bad policy out of a set of bad options. However, they are uneasy with it, and unilateral disarmers have fed on this uneasiness. But the voters have been quick to transfer their support to SDI which they see as more soundly based morally, and more likely to offer them real protection.

Support for the nuclear freeze and other unilateralist positions has dropped dramatically in America. Speak to nuclear freeze advocates and you will find that they are profoundly depressed. The same change in public opinion could happen in Britain. The first political party to take up the advocacy of strategic defence could be richly rewarded at the polls. In the US the Democrats regret that they allowed President Reagan to steal a march on them with this issue.

All polls in the US have demonstrated strong public support for SDI. In a Sindlinger poll conducted in May 1985 62% of respondents thought SDI was feasible, and 73.1% thought it would make the US more secure. In the same poll 84.4% said they would support SDI if it could destroy all incoming missiles, and 61.5% said they would support it if it could only defend US retaliatory missiles. In a February 1984 Arthur Finkelstein poll 61.4% supported the US developing a non-nuclear defence system in space; in a Penn & Schoen April 1984 poll 75% supported a space-based defence system. Other polls show similar high percentages of the population in support.

In view of the evident popularit y of strategic defence it seems strange that British politicians have been so slow to do much to support it, and that others are actually campaigning against it.

A more sophisticated European space defence system could be deployed by the space shuttle or equivalent vehicle at a relatively low altitude of about 300 miles. Space-based lasers and particle beam weapons would provide a very effective defence of both military sites and population centres.

With even a partial European defence system in place, an attack would look much less promising to the Soviet Union. A limited number, perhaps 50 SS20 missiles, could in fact destroy the whole NATO military structure whilst causing relatively limited damage to cities. With a limited defence the entire SS20 force would be required to accomplish the same task, and even then might not succeed. Thus a partial missile defence would greatly increase the threshold for nuclear attack.
6. THE CASE FOR BRITISH STRATEGIC DEFENCE

New strategic defence weapons could play a very important role in defending British military installations and population centres from attack. The intention of the SDI is not to cover the US in an impenetrable astrodome, leaving Europe out in the cold, but to develop new defensive weapons with a potential for deployment to protect both military installations and people in Europe and America.

In fact there is much greater potential for near-term deployment in Europe than in America. A space defence against nuclear attack could be established first in Europe at a fraction of the cost of a full global system. A defence against intermediate-range nuclear missiles in Europe could be a practical first step in the construction of a larger global strategic defence programme.

Contrary to the statements of some European spokesmen, Soviet SS-20 missiles aimed at Europe are actually easier to defend against than intercontinental missiles. They travel more slowly, and are smaller missiles with fewer warheads and decoys, all of which lessens the burden on the defence.

These missiles are visible to fairly simple tracking radars and would be vulnerable to a relatively unsophisticated defensive system consisting of airborne infrared detectors, computer-assisted ground-based radars, and batteries of non-nuclear air defence missiles. Defences against Soviet cruise missiles could include surface-to-air missiles; electronic countermeasures to confuse cruise missile flight computers; air-to-air missiles launched from interceptor aircraft with look-down/shoot down radar; ground-based laser weapons; and space sensor directed weapons. Thus, existing technology is already capable of protection of military sites such airfields, missile sites, and communications centres, and also of significant population defence, given the density of population and small area to be defended.

A more sophisticated European space defence system could be deployed by the space shuttle or equivalent vehicle at a relatively low altitude of about 200 miles. Space-based lasers and particle beam weapons would provide a very effective defence of both military sites and population centres.

With even a partial European defence system in place, an attack would look much less promising to the Soviet Union. Today a limited number, perhaps 50 SS20 missiles, could in fact destroy the whole NATO military structure whilst causing relatively limited damage to cities. With a limited defence the entire SS20 force would be required to accomplish the same task, and even then might not succeed. Thus a partial missile defence would greatly increase the threshold for nuclear attack.
The Soviet intention would not be to reduce the whole of Europe to a smoking ruin, but to exercise a swift surgical attack on limited military targets, counting on a US reluctance to retaliate and put US cities at risk. The more effective a European strategic defence system the less the likelihood of such an attack.

Britain has a lot to contribute to an effective European strategic defence, both technologically and by providing political leadership. The planned British aerospace plane, which British Aerospace and Rolls Royce hope to be operational by 1997, would be an ideal vehicle to place strategic defence weapons in space. Named the 'Hotol' and similar to the US 'scramjet', it may be operational before the US plane. It should a vital part of a European strategic defence programme.

The British government should commit itself to achieving a transition from sole reliance on offensive weapons to greater reliance on strategic defence. It should take steps to explain the new policy and its benefits to the British people.

The British government should initiate its own strategic defence research project aimed at facilitating an early deployment of strategic defence weapons in Europe. The proper British and European role should be to co-operate with the US SDI with a view to deploying the first phase of a global strategic defence system in and above Europe at the earliest opportunity.