

Current plans for missile defence

John PIKE and Peter VOTH

The development of anti-missile systems began simultaneously with the advent of long-range missiles. Although thousands of nuclear-tipped missiles were deployed during the Cold War, neither the United States nor the Soviet Union invested substantially in anti-missile defences. The end of the Cold War has changed many things, not least of which is American interest in anti-missile technology. While the rest of the world remains largely disinterested in missile defence, the question is increasingly not whether the United States will deploy missile defence, but rather what types of defence when.

The United States

NATIONAL MISSILE DEFENSE

The American National Missile Defense (NMD) programme is intended to defend the entire territory of the United States against a small number of ballistic missiles — whether from an attack by one of the “states of concern” or from an accidental or unauthorized launch by an established nuclear power. Although plans for sea-based NMD are floated from time to time, the main thrust of American NMD efforts are directed toward the development of a land-based system. Current American deployment plans call for a system able to defend against five warheads to be fielded by 2005 (although President Clinton’s announcement that he would leave the decision to his successor will most likely push this timetable back further) to as many as fifteen warheads by 2015.

The American NMD system is conceived as a land-based, non-nuclear missile defence system employing silo-based, hit-to-kill interceptors and incorporating both orbiting and terrestrial early warning and battle management systems. In the event of a missile attack against the United States, the first notification of a missile launch would come from the network of early warning satellites. In the initial stages of NMD deployment, this capability would be provided by the Defense Support Program satellites, which have been in place since 1970. This system, however, is scheduled to be

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phased out over an eleven-year period beginning in 2001 by the Space Based Infrared System (SBIRS), which is being developed independently of NMD.

The SBIRS programme will be made up of satellites in high altitude (SBIRS High) and low altitude (SBIRS Low) orbits. SBIRS High will consist of four satellites in geosynchronous Earth orbit and two satellites in a highly elliptical orbit. The number of SBIRS Low platforms has not yet been determined, but they will employ two sensors — one acquisition and one tracking sensor — operating in a variety of wavebands including short-wave infrared, medium-wave infrared, long-wave infrared and visible. SBIRS High would be responsible for launch detection and over-the-horizon tracking, providing the earliest trajectory estimate to command and control systems.

SBIRS Low would provide mid-course tracking and discrimination capability in conjunction with the ground-based early warning radars currently operated by the United States. These radars, located at Flyingdales Moor in England, Thule Air Station in Greenland, Beale Air Force Base in California, Cape Cod Air Force Station in Massachusetts, and, after its completion in early 2001, Clear Air Force Station in Alaska, would receive both hardware and software upgrades as part of their new mission. The hardware modifications would involve the replacement of computers, graphic displays, communication equipment and the radar receiver, while the software would be rewritten to allow the acquisition, tracking and classification of small objects near the horizon. There would be no change in power, radar antenna patterns or operating frequencies as part of the NMD programme.

Once the re-entry vehicles have separated from the missile, the X-Band Radar (XBR) would act as the primary fire control radar guiding the interceptor to the target. Receiving cues from SBIRS Low and the early warning radars, it would employ a narrow radar beam that can detect a typical warhead at a range of 4,000 km, and is likely able to detect a reduced-signature target 2,000 km away. At smaller distances, it is said to be capable of discriminating between warheads, decoys and other debris. The first XBR site is slated to be built at Shemya, Alaska and current plans are to build a total of nine sites in a variety of locations around the world by 2015.

At this point the Ground-Based Interceptor (GBI) would be launched. The GBI is a fixed, land-based missile intended to approach an incoming warhead outside the Earth's atmosphere and release

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its payload, the Exoatmospheric Kill Vehicle (EKV), which will steer itself to and impact with its target. Although the EKV would be able to discriminate between warheads, decoys and debris, it would receive mid-flight updates on the target from the ground-based radar and satellite sensors to increase the likelihood of a successful intercept. Initial plans are to base twenty interceptors in Alaska (although not at the same site as the XBR), but the system will ultimately consist of 250 interceptors both at the Alaska site and at Grand Forks Air Force Base in North Dakota.

The GBI has proved to be the most technologically troublesome aspect of the system through the testing process, scoring only one hit out of three attempts. The first failure occurred on 18 January 2000 when a cooling line on the EKV malfunctioned, causing its infrared homing sensors to malfunction. The second, coming on 7 July 2000, was due to a problem in the booster itself. Including the successful intercept, the EKV has demonstrated its ability to track objects in space on three separate occasions. The battle management communications systems and XBR have also functioned well. Ironically, proof of the XBR's functionality came in part when it indicated that the decoy balloon failed to inflate during the 7 July test.

THEATER MISSILE DEFENSE

Attacks against the American homeland are not the only concern driving missile defence efforts. The proliferation of medium- and short-range ballistic missiles has increased the vulnerability of military facilities and other American interests and has prompted Washington to spend much time and effort (not to mention money) researching Theater Missile Defense (TMD) to counter these regional threats.

The only TMD systems currently fielded by American forces, the Hawk and the Patriot, are basically upgraded versions of existing land-mobile, surface-to-air missile systems. New design concepts rely on a two-tiered architecture consisting of upper-tier systems that attempt to intercept an incoming missile either above or just within the Earth's atmosphere and lower-tier systems that engage the missile at much closer ranges.

The Army's upper-tier system will be the Theater High Altitude Area Defense (THAAD) system. It is intended to provide extended coverage, engaging incoming missiles at a range of up to 200 km horizontally and 150 km vertically. This hit-to-kill interceptor would initially engage its target above the Earth's atmosphere, providing the opportunity for a second shot in the event of a miss, either by the THAAD battery or by the lower-tier system. The second chance could turn out to be important — the THAAD testing programme has been plagued by technical failures from a variety of different sources, and has scored only two successful intercepts out of eight attempts.

The lower-tier system working in conjunction with THAAD would be the Patriot Advanced Capability-3 (PAC-3), the end result of several major revisions to correct problems with the PAC-2 identified during the Gulf War. Since that time, work has been continuing on the PAC-3, which, far from being a mere augmentation of the original Patriot, is an entirely new missile. Whereas the PAC-2 uses a proximity fuse to detonate its warhead near enough to the target to destroy it, the PAC-3 uses a hit-to-kill strategy. As a result, the PAC-3 is able to use a smaller warhead and a smaller booster (the ERINT booster, developed in the 1980s for the Strategic Defense Initiative or SDI programme), reducing the size of the weapon and increasing the number of missiles able to fit on a launcher. Tests of the PAC-3 have generally met with success.

The Navy's upper- and lower-tier systems, respectively, the Navy Theater-Wide (NTW) and Navy Area Defense (NAD) systems, will, in essence, simply be upgrades to the air defences on Ticonderoga-class cruisers and Arleigh Burke-class destroyers that enable the AEGIS radar system and Standard Missile-2 Block IVA interceptors to track and destroy incoming ballistic missiles. NAD scored its second hit in as many tries in a test on 25 August 2000, and initial operational capability for NAD is planned for 2001 with flight testing for NTW to begin the same year.

OTHER SYSTEMS

The United States has been working on a number of other anti-missile systems as well. Most recently, the Tactical High Energy Laser, developed in co-operation with Israel, successfully shot down its target in a test on 6 June 2000. This system uses a deuterium fluoride chemical laser to shoot down medium- to short-range missiles at a range of up to 5 km.

Also employing directed energy technology is the United States Airborne Laser, a high-energy, chemical oxygen iodine laser mounted on a modified 747-400F aircraft which will shoot down theater ballistic missiles in their boost phase while in friendly airspace, hundreds of miles from the

launch site. A test aircraft is currently under construction, and a test against a Scud-type missile is set for 2003. If all goes as planned, a fleet of seven Airborne Lasers will be operational by 2008.

There are several advantages to intercepting missiles during their boost phase. At that time, a missile is a relatively large and vulnerable target; it does not manoeuvre and its exhaust is very obvious to infrared sensors. In addition, the destruction of the missile, with the attendant dispersion of debris and hazardous substances, occurs over enemy territory. As a result, the United States is working on other schemes to shoot down missiles in the boost phase with missiles either launched from ships, manned aircraft or unmanned aerial vehicles. However, these ideas all suffer from the same flaw — the weapon must be within range of the launch site at the time of the launch to be effective. As a result, either a fleet of these weapons would need to be on station continually, all over the world, or advance warning of several hours or days would be needed before an attack — an unreliable assumption on which to base the nation's defence.

Russia

Russia remains the only country with a currently operational strategic anti-missile system. In service with various upgrades over the past three decades, the Moscow anti-missile system is permitted

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by the ABM Treaty. It is capable of covering only a limited region centred on Moscow — unlike the American NMD system, which is intended to protect the entire national territory of the United States. The most recent upgrade to the system, designated the A-135, became fully operational in 1989, but was designed in the late 1970s. It operates as a two-tiered system, using the nuclear-tipped SH-08 Gazelle and the SH-11 Gorgon as its short- and long-range interceptors.

Russia has also developed a number of surface-to-air missiles capable of missions against medium- to short-range missiles. The mainstay of the Russian ABM arsenal is the S-300 series (SA-10, SA-12 and SA-12b), land-mobile interceptors with a proximity fuse conventional explosive warheads and ranges between 75–200 km.

Russia is very keen to export the SA-12, marketing it as a system comparable to the Patriot. A number of countries have expressed interest in purchasing the system, including India, South Korea, Egypt and the United Arab Emirates. China has imported 100–200 SA-10 systems, which are deployed around Beijing, and has expressed interest in producing the SA-10 under license as well. In addition, it has been reported that China's HQ-18 missile is a copy of the Russian SA-12, although this cannot be confirmed. Nevertheless, it is presumed to have an anti-missile capability.

The S-400 Triumf (SA-20) is the latest addition to Russia's arsenal. While details of the system are not readily available, the anti-missile variant of the Triumf appears to have a range of 120 km, and can engage targets at altitudes as high as 35 km. At last report, the first launcher was due in the field in late 2000, although it will be loaded with older S-300 missiles.

The more capable S-500 system is reported to be able to engage target missiles with ranges of up to 3,500 km. However, it appears that Russia has not undertaken actual development of the S-500 due to a lack of funding, and has consequently proposed joint development of the system with the United States.

East Asia

The United States considers the participation of Japan, South Korea and Taiwan as vital to the ultimate success of TMD. All three nations have expressed concerns about North Korean and/or Chinese missile programmes, and all have expressed various degrees of interest in American TMD. South Korea has also considered purchasing the Russian S-300 to counter the North Korean threat.

Taiwan regards the Chinese missile threat as serious and, as a result, is interested in participating in missile defence. Taiwan currently fields up to 200 PAC-2 missiles to counter Chinese offensive missiles and has plans to purchase the PAC-3. In addition, the indigenously developed Sky Bow II has demonstrated an anti-missile capability. Taiwan has sought to purchase AEGIS-class destroyers from the United States, which would almost certainly be equipped with theater missile defence interceptors, although to date the American government has declined to authorize such sales. In early 2000 the Clinton Administration did authorize the installation of a large phased array early warning radar in Taiwan (probably the PAVE PAWS radar formerly installed at Warner Robins Air Force Base in Georgia), though details remain to be negotiated. The American Congress has also introduced legislation proposing strengthened United States-Taiwan TMD co-operation, which has been welcomed by the government of Taiwan. These moves have raised considerable concern on the mainland, particularly the increased co-operation between Taiwan and the United States.

Interest in TMD has been tempered by concerns over technical feasibility. Skeptics have noted the poor performance of the PAC-2 against the relatively uncomplicated Scud during the Gulf War, the amount of damage caused by the Patriots when they were launched against the Scuds during the same conflict, and the numerous failures in the THAAD flight-testing programme. In particular, Japan has expressed concern about not only the financial but also the political costs of the system. In addition, Japan still harbours bad memories of the last time the two nations entered a joint military development agreement — the FSX fighter project (Congress, dismayed over what it thought was an unfavourable flow of technology to Japan, forced the renegotiation of the agreement a few months after it came into force). Nevertheless, North Korea's August 1998 missile test spurred Japan to action, and in early 1999 it signed an agreement with the United States to formally begin a joint theater missile defence development programme based on the NTW scheme.

Israel

In order to meet its requirement for an interceptor to defend military targets and population centres against medium- and short-range ballistic missile attacks, Israel undertook in 1986 the development of a missile defence system in conjunction with the United States. In addition to assuring the security of a regional ally, the United States wanted to develop a new, advanced anti-tactical ballistic missile that could be incorporated into its own TMD systems.

The result was the Arrow 2, a TMD system that can detect and track up to fourteen incoming missiles as far away as 500 km and can intercept missiles 50–90 km away (although the range may be as little as 16–48km). The interceptor uses a terminally-guided, proximity fuse, high-explosive warhead to destroy targets at an altitude of 10–40 km. Initial Israeli plans were to deploy two Arrow 2 batteries, but in 1998 this was increased to three batteries. The first battery was declared operational in the second half of 2000.

The United States has financed two-thirds of the estimated \$1.6 billion cost of developing the Arrow programme, and put another \$45 million toward construction of the third battery. In order to provide this assistance, the United States made an exception to its general policy of denying technology transfers to missile programmes defined as Category I by the Missile Technology Control Regime guidelines.

India

India has been pursuing a system to counter Pakistan's missile threat for a number of years. It would prefer to develop an indigenous capability to produce such a system, whether by modifying one of its existing surface-to-air systems, producing one under license, or simply purchasing a system off-the-shelf. India has expressed particular interest in the Israeli Arrow 2 or the Russian S-300. Recently, unconfirmed reports have suggested that India may have entered into a covert arrangement with Israel to obtain technology related to the Arrow 2.

Arms control and international relations

American deployment of NMD would evidently require revision or abandonment of the ABM Treaty. Most fundamentally, a NMD would be inconsistent with the explicit prohibition against nation-

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wide missile defence systems in Article I. As the remaining provisions of the treaty are simply an elaboration of the interlocking measures associated with the implementation of this premise, a revised treaty regime would unavoidably alter the security environment codified by the treaty. The original construction of the treaty was in essence a predictability measure — to ensure that the deployment of large nation-wide systems would require more time than would be required to deploy offsetting offensive forces, and thus to reduce incentives for

deployment of such forces. Many of the revisions to the treaty required to accommodate even a modest NMD deployment would lay the base for much larger anti-missile deployments, thereby increasing incentives for offensive force build-ups as a hedge against uncertainty.

The various space-based satellite sensor systems would contravene Article V's ban on space-based system components. The use of the early warning radars would contravene both Article VI's prohibition of the modification of non-ABM radars to work as part of an ABM system and Article IX's ban on the deployment of system components in other nations. The resulting global sensor network would appear to be capable of supporting far more than the few hundred interceptors contemplated as the initial tranche of NMD.

In addition, the placement of the XBR at Shemya would be inconsistent with Article III, which specifies that all radars must be co-located with the interceptors. Furthermore, the deployment of interceptors in Alaska would require modification of existing treaty provisions that interceptors can be located no more than 150 km from the national capitol or a specific ICBM site selected for defence. And plans for as many as 250 interceptors at two sites would require revision of the 1974 amendments that reduced permitted deployments to 100 interceptors at one site (in isolation perhaps a modest change from the initial limit of 200 interceptors at two sites).

Russia, America's partner in the ABM Treaty, has maintained its objections to such substantial alterations to the treaty. According to a Russian Foreign Ministry news briefing on 20 October 1999: "Russia is not engaged in any bargaining over this treaty. We are not conducting any negotiations on any amendments to the ABM Treaty, especially amendments that would alter its key provision banning any deployment of national ABM defenses or creating any basis for such defenses." More recently, Russian President Vladimir Putin told the Russian Parliament on 14 April 2000 that Russia would withdraw from all arms control agreements if the United States forced changes to the ABM Treaty, saying that "I want to stress that, in this case, we will have the chance and we will withdraw not only from the START II Treaty, but from the whole system of treaties on the limitation and control of strategic and conventional weapons."

Russia is joined in its objections by China, which sees American deployment of NMD as directed against its nuclear force as well. China's small ICBM force (perhaps twenty missiles currently capable of reaching the United States) is precisely the size force that the American NMD system is designed to counter in the mid-term, by 2010. Recalling American nuclear threats during the era before China got the bomb, Chinese security planners would be remiss in not drawing the necessary conclusions. In the early 1980s China embarked on a programme to replace its existing large liquid-propellant missiles with smaller solid propellant missiles. This rather leisurely programme is finally bearing fruit. On 2 August 1999, it tested the DF-31, a two-stage solid-fuel missile capable of reaching the west coast of the United States, which will form the basis for a longer range three-stage version called the DF-41. Both of these missiles, along with a sea-based variant of the DF-31 designated the JL-2, will probably enter service by 2010. Eventual Chinese force level goals are uncertain, but would almost certainly be predicated on a requirement to offset foreseeable American NMD plans. Reportedly, the United States intelligence community has concluded that China may eventually deploy as many as 200 warheads on these missiles, a ten-fold increase over current capabilities.

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On 18 July 2000, Russia and China issued a joint statement that called the ABM Treaty "the cornerstone of global strategic stability and international security". The United States drive for NMD has, according to the statement "aroused grave concern" on the part of China and Russia, who hold that the programme is aimed at "seeking unilateral military and security superiority" and state that "to amend the text of the ABM Treaty is tantamount to an act of undermining the ABM Treaty".

These protests have had practical consequences, stalling negotiations on the Fissile Material Cut-off Treaty (FMCT). Although China is not a party to the ABM Treaty and associated strategic arms agreements, it has long been a beneficiary of the fact of the existence of the ABM Treaty. It is not difficult to understand a Chinese calculation that it would be unwise to agree to FMCT caps of its weapons stockpile, when a rather substantial augmentation of that stockpile might be needed to compensate for an American NMD deployment.

Because of geographical proximity, theater missile defence systems are in many respects "strategic" for regional powers like China, India and even Israel. Consequently they have the same potential as NMD in the context of the United States and the Soviet Union — a potentially destabilizing force in a regional arms race. Between India and Pakistan, for example, the same logic may hold true as did for the authors of the ABM Treaty almost three decades ago. A drive by India or Pakistan to negate the other's offensive missile force by deploying an anti-missile defence could provoke offsetting missile build-ups.

Developments in the anti-missile arena may impact regional stability indirectly as well. Neither Pakistan nor India has appeared overly interested in acquiring anti-missile systems. But India's nuclear

aspirations are in part a response to China's nuclear status, just as Pakistan's nuclear programme reflects that of India. Should China choose to embark in a substantial nuclear build-up to offset prospective American NMD deployment, India would surely take China's force levels into account in its own planning, as would Pakistan in turn. And in the worst case, the nuclear domino effect might extend beyond China, India and Pakistan, encouraging other countries to join the nuclear club.

One saving grace is the rather sedate pace at which American missile defence programmes are likely to proceed. Ronald Reagan's SDI was initially cast as a five-year programme, yet after nearly two decades an operational capability remains at least five years in the future. The impact of NMD and TMD deployment is a function not simply of the direction in which the security environment is moving, but also the pace at which it is changing. While many actors may be concerned by the prospect of radical change, they may at least take comfort in the possibility that the future may be long delayed.