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## India's quest for dual-use technology

Over the last 10 years, India has taken on a significant challenge: become a great power in space-, missile-, and nanotechnology, and do it with the help of a new friend—the United States. But is U.S.-Indian technology-sharing still seen as harmless international engagement?

BY MATTHEW HOEY

**I**N 2008, WHEN FORMER INDIAN PRESIDENT ABDUL KALAM was asked by a student why a peace-loving person such as himself tasked his country's scientists and engineers to build missiles, Kalam replied, "In the 3,000-year history of India, barring 600 years, the country has been ruled by others. If you need development, the country should witness peace, and peace is ensured by strength. Missiles were developed to strengthen the country."<sup>1</sup> The founding father of India's missile defense program, a lead architect of its nuclear and space programs, and the author of *India Vision 2020*—a plan meant to usher India into a new technology age—Kalam appears frequently in any examination of India's technology renaissance. An ardent proponent of the military and scientific communities, he doesn't hesitate to talk about dual-use technology. In *India Vision 2020*, Kalam claimed, "Newly emerging technologies such as robotics or artificial intelligence . . . would have a crucial impact on future defense operations and also on many industrial sectors."<sup>2</sup> There is no doubt that Kalam envisioned long ago what other Indian experts are only beginning to see: Dual-use emerging technologies—space-, missile-, and nanotechnology—would one day become a main driver of military technology for the leading spacefaring nations (e.g., India, the United States, Russia, and China) and that such dual-use technologies would provide the building blocks for larger, more destructive systems.

For its part, the international arms control community only recently began to understand the unprecedented dilemma in the over-

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lap between peaceful commercial technologies and tools of warfare developed through multi-tiered international partnerships. Thus, concerned citizens and policy makers now find themselves unable to object to space technologies that could enable destructive acts of war since objecting to such technologies would be, in many cases, to disagree with the development of technologies that also could benefit humankind. The situation is made worse by countries that facilitate dual-use technology transfers for strategic and economic benefits while ignoring a partner nation's proclivity toward sharing such technologies with questionable nations.

In fact, until about a decade ago, India *had* been considered by the United States to be a major contributor to missile technology proliferation and an unwavering opponent of nearly every major arms control treaty. But after 9/11 this view changed quickly in Washington. As "security" became a subjective term, India promptly learned to take advantage of the U.S. search for Asian allies. At the same time, the country's scientists and military officials stirred domestic and international fears of regional terrorism and Chinese hostilities so they could turn initially peaceful technology transfers between New Delhi and Washington into military research and development efforts. As the U.S.-India relationship grew stronger, New Delhi began to acquire even more advanced knowledge and technology.

Superficially, the U.S.-India partnership resembles a well-intentioned relationship. But a closer look demonstrates India's contradictory—and outright worrisome—pursuit of dual-use technology over the last decade. It also reveals Washington's willingness to choose regional friends and enemies and India's eagerness to gain technology and military prowess from a perceived vulnerable ally. There are obvious questions to be asked: As the U.S.-India partnership developed, why was no one in Washington paying attention to statements and interviews coming out of India's military and scientific communities? And why was there no concern for the repercussions of India's acquisition of dual-use technologies, which could set off a regional arms race?

**Planning begins.** As early as 1988, India planned to develop dual-use technology for peaceful uses. In a government working paper entitled "New Technologies and the Qualitative Arms Race," India explicitly called for "scientific and technological achievement [to] be used solely for peaceful purposes." More specifically, the paper stated, "Progress in science and technology and the changes that it brings about are a part of the historical process and no attempt to halt that process because of the unwelcome nature of some of these changes is likely to succeed. However, dedicated deployment of science and technology for military purposes, irrespective

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of its consequences for humankind, is another matter. It is the latter that is mainly responsible for the new destructive dimensions acquired by the arms race. . . . The pressures of competitive technological armament obstruct further progress in disarmament and even threaten to destroy the limited progress made so far.” The paper

exhibited great foresight, revealing what India saw as a security and nonproliferation future “fraught with risks of staggering proportions,” including “compact and powerful nuclear reactors in space . . . kinetic energy weapons . . . the development of fifth-generation computers and artificial intelligence . . . and the use of [intercontinental ballistic missiles] . . . featuring new types of delivery systems.”

But by the mid-1990s, as India's military modernized, domestic calls for the country's space payloads to include both commercial and military technology became increasingly common. Retired Vice Admiral Raman Puri, who supervised the Integrated Defense Staff and led the coordination of the country's long-range plans and joint doctrines, went so far as to recommend that all “future [space] payloads including civilian space payloads should try to be dual use.”<sup>3</sup>

International objections to Puri's comments and India's pursuit of dual-use technology were uncommon during this time, though some questioned India's “peaceful” use of nuclear technology in the run-up to its 1998 nuclear tests and the subsequent expansion of its nuclear arsenal. Still, domestic supporters openly mocked their few critics, preferring denial when it came to India's rejection of, or lack of adherence to, international arms control treaties. One Indian journalist predicted that the “[Indian] nuclear tests would once again prompt the likes of the Arms Control Association and other nonproliferation groups and activists, not to mention congressmen like [Massachusetts Democrat] Ed Markey and [California Democrat] Howard Berman, to once again attempt to besmirch India's much touted impeccable nonproliferation track record.”<sup>4</sup> At the same time, officials within India's military, scientific, and political communities continued to suggest that trade and export restrictions were used as a tool by the United States and the other permanent members of the U.N. Security Council—Britain, France, China, and Russia—to stifle India's progress.

The indignation would continue in other circles. In the spring of 2000, an alarming report entitled “Military Dimensions in the Future of the Indian Presence in Space” drew little international attention

(probably due to its lack of availability outside of India) but caused waves within official circles. It suggested that India could deploy a directed-energy weapon, such as a particle beam, in space by 2010. At the time, the author, V. Siddhartha, was an officer on special duty in the secretariat of the scientific adviser to the defense minister, and his work demonstrated a clear interest within the Indian military of deploying not only a space-based laser but also a hypersonic suborbital delivery system with a global-strike capability.<sup>5</sup>

By December 2000, the Indian government was issuing regular statements on its development of dual-use technologies. President K. R. Narayanan, speaking at a national laser symposium hosted by the government's Department of Atomic Energy and the military-focused Defense Research and Development Organization (DRDO), stated, "It was very important for India to evolve a national program involving coordination of all available expertise and resources in the missile defense applications of high-power lasers because it could well influence the world power balance equation of the future." He added, "[India] should pursue this critical technology, which enables directing the enormous energy generated by lasers for specific applications with a high degree of commitment to 'self-reliance.'"<sup>6</sup> It was the same threat India had warned the international community about 12 years earlier at a U.N. General Assembly meeting on disarmament.

**A partnership blossoms.** 9/11 redefined U.S.-Indian relations and gave Indian military leaders the international support they needed to continue their research and development. Just 10 days after the attacks, President George W. Bush waived U.S. sanctions against New Delhi that had been in place since its 1998 nuclear tests. Although his motivations appeared to be tactically driven, trade talks with India already had been underway in a limited fashion for some time. Nevertheless, it is safe to say that 9/11 accelerated many U.S. policy modifications regarding India. Subsequently, the number of Indian companies on the Commerce Department's Entity List, the import/export regulations imposed on certain foreign groups or organizations, was reduced from 159 to just 2. Furthermore, the U.S. licensing policy with India for nuclear- and missile-related technology changed from a policy of denial to one of case-by-case review.<sup>7</sup>

In November 2001, Bush and Indian Prime Minister Atal Bihari Vajpayee met in Washington, where they agreed to take steps to transform and stimulate U.S.-Indian relations in the area of high-technology transfers. Soon after, Pakistani terrorists attacked India's parliament building. Now, more than ever before, it appeared as though India and the United States were facing a common threat. As such, U.S. sanctions that had prevented India from enhancing its

nuclear weapons and launch capabilities and developing its military space program were effectively removed.

A year later, Vajpayee and Bush met again. At this meeting, they “pledged to think boldly and creatively about steps that could be taken to further enhance high-technology trade in a way that reflects their countries’ new relationship and common strategic interests.”<sup>8</sup> Meanwhile, U.S. Undersecretary of Commerce Kenneth Juster and Indian Foreign Secretary Kanwal Sibal met concurrently to establish the U.S.-India High Technology Cooperation Group, which sought to “stimulate bilateral high-technology commerce” and strengthen the U.S.-India relationship. Tellingly, India’s external affairs minister, defense minister, minister of space, and national security adviser also took part in the discussion. As follow-up, Juster and

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Sibal later signed the “Statement of Principles on U.S.-India High Technology Cooperation.” Notable among the points, Article VI states, “The two governments understand the importance of enhancing trade between India and the United States in ‘dual-use’ items, including controlled ‘dual-use’ goods and technologies, while protecting the national security and foreign policy interests of both countries.” Equally conspicuous, Article XII states, “For authorized transfers of ‘dual-use’ goods and technologies controlled for missile technology or nuclear proliferation reasons, including exports to entities in civilian space and civilian nuclear energy fields, the Government of India will consider a mutually satisfactory system of assurances regarding end use, diversion, transfers and retransfers within and outside India, re-export, and, where necessary, physical protection and access to the controlled items by third parties.”<sup>9</sup>

Following his visit to Washington, Sibal was asked about critical remarks coming out of the U.S. Congress regarding nuclear, high-tech, and space technology transfers between the United States and India. His answer demonstrated a certain Indian exceptionalism: “[T]he fact is that in the United States, policies are not simply made by the administration, they are also made by Congress. So there is tension within the U.S. system. We are not members of the [Nuclear Non-Proliferation Treaty], and we are not subscribers of [the Missile Technology Control Regime]. Yet, if there is to be nuclear and space cooperation, how does America cooperate with a country like India, even if they see merit in it? Since we are not party to the instruments that exist to deal with nonproliferation or missile technology, there is this conundrum. Our answer is we are what we are.”<sup>10</sup>

**Knowledge and technology growth.** In June 2003, a DRDO official suggested that India possessed the know-how to develop advanced systems and technologies such as nanotechnology, information technology, communications satellites, artificial intelligence, robotics, and unmanned systems along with nanoweapons and bioweapons. He stated, “[India does] not need to develop new technology, as Indian scientists are already advanced in the field; all we need is the vision to apply the right technology to aid specific military objectives.”<sup>11</sup> At the same time, he underscored the importance of gaining and developing this technology through cooperation and sharing.<sup>12</sup>

Incidentally, global economic shifts were working in India’s favor. So the DRDO official was correct: Knowledge would not be a problem for India’s technological development programs. The “brain drain” that previously had hampered the Indian space program was beginning to wane. Stagnant foreign economies meant that many Indians were returning home to profitable jobs in booming domestic defense and space industries. Consequently, not only was the United States providing technology to India for commercially and strategically based interests, but Indian students and professionals in the United States were coming home—bringing with them unofficial technical knowledge that would benefit New Delhi’s military and scientific development.<sup>13</sup>

As these well-trained specialists returned to India, the High Technology Cooperation Group convened in Washington in July 2003 to discuss impediments to robust high-technology trade between the United States and India, particularly “market access, tariff and non-tariff barriers, and export controls.” The forum also included sessions on establishing partnerships in information and defense technologies, the life sciences, and nanotechnology. Discussions of information-technology transfers specifically related to advanced computing systems and nanotechnology were undoubtedly important to India’s continued military space development programs since nanotech innovations would enable dramatic increases in processing speed and efficiency. In a little under a year, the benefits of this group were revealing themselves with “almost 200 more license applications than the previous year [granted to India] . . . [meaning] that, in fiscal year 2003, [the United States] approved 90 percent of all dual-use licensing applications for India, with the value of such approvals more than doubling to \$57 million.”<sup>14</sup>

Evidence of advanced arms and technology development continued to mount, primarily via the public statements of high-ranking Indian officials. For instance, in October 2003, S. Krishnaswamy, chief of the Indian Air Force, announced that work had started on space-warfare technology and a command structure that could

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aid the development of a weapons platform in space: "Any country on the fringe of space technology like India has to work toward such a command as advanced countries are already moving toward laser weapon platforms in space and killer satellites."<sup>15</sup> His use of the term "advanced countries" might have been a reference to un-

substantiated rumors that China is developing offensive space-warfare technologies. True or not, the claim is a key reason for India's increased initiative in military space systems.<sup>16</sup> Within days of his statement, India's civilian leaders forced Krishnaswamy to retract his comments, though the multitude of similar statements made by other members of New Delhi's military and government suggested this retraction was merely symbolic.<sup>17</sup>

**The Chinese threat.** China's technological advances and its specific focus on the vast, multidisciplinary field of nanotechnology foster a sense of competition and insecurity in India, where dual-use technology research and development garners a sense of great pride. This insecurity is not misplaced. An October 2003 news report stated China ranked third in the world in the number of patent application cases concerning nanotechnology, trailing only the United States and Japan. A year later, China owned 12 percent of the world's total nanotechnology patents.<sup>18</sup> These facts only motivated India to pursue dual-use technology more vigorously.

The United States in particular has been willing to undermine China's economic ascent by aiding India in its pursuit of dual-use technology. In fact, as news of China's military technology program spread, the U.S. Defense Department released its annual report to Congress entitled "The Military Power of the People's Republic of China." It stated, "Beijing has and will continue to enhance its satellite tracking and identification network—the first step in establishing a credible [anti-satellite weapon] capability. China can currently destroy or disable satellites only by launching a ballistic missile or space-launch vehicle armed with a nuclear weapon. However, there are many risks associated with this method. . . . Based on the level of Chinese interest in this field, the Defense Intelligence Agency believes Beijing eventually could develop a laser weapon capable of damaging or destroying satellites."<sup>19</sup> India would cite this and other reports as a threat to the safety of its commercial and military space assets.

Meanwhile, Washington has made a concerted effort to keep dual-use technology away from China. Commerce Department Act-

ing Undersecretary Peter Lichtenbaum reiterated the U.S. position against sharing military modernization technologies with China in an April 2005 speech: “[We] deny all items controlled for missile technology reasons that enhance China’s space launch capabilities. Since civil space launch and military space launch technology is virtually identical, we do not have adequate assurances that our exports will only be used for peaceful applications.” At the same time, Lichtenbaum defended the U.S.-India partnership. “We have a strong national interest in promoting expanded trade relations with the world’s largest democracy and an ally in the war on terrorism. Although we have significant disagreements with India over their nuclear and missile technology programs, there are more common interests that unite us than differences that divide us. . . . Toward this end, we have been working diligently with India to narrow the scope of our disagreements and expand areas of mutual cooperation.”<sup>20</sup>

India buttressed the U.S. position by expressing fear that China could (hypothetically) attack a constellation of high-resolution Indian satellites, which, when fully deployed, would serve a multitude of vital purposes, including surveillance of Kashmir and disaster-management assistance.<sup>21</sup> New Delhi cited this potential threat as the reason to pursue both space- and terrestrial-based technologies to defend its space assets. Notably, India’s intelligence community later would lease imaging capabilities from some of these satellites to provide Washington with complementary intelligence-gathering abilities in the region.

After 2005, the Chinese military space threat would be cited again and again in the media and in U.S. government-sponsored threat assessments.<sup>22</sup> As fear grew, collaboration between India’s civilian and military research groups accelerated. At the same time, Indian security concerns were reprioritized, placing the potential threat to India’s space systems from China nearly on par with the threat of terrorism.

**The benefits of collaboration.** In September 2004, the U.S. Commerce Department’s Bureau of Industry and Commerce formed the U.S.-India Next Steps in Strategic Partnership. The partnership’s mission: propose “specific modifications to U.S. licensing policies designed to expand U.S.-India civil space and civil nuclear cooperation and enhance bilateral high-technology trade.” Key points within the agreement included removing the Indian Space Research Organization (ISRO) headquarters in Bangalore from Commerce’s Entity List in order to allow it to import dual-use items without a license and to aid India’s civilian space program.

Whereas Commerce highlighted the partnership’s peaceful technology applications, Indian defense officials continuously, and almost simultaneously, contradicted this position. Nevertheless, the

Next Steps Partnership later announced that license requirements for “low-level, dual-use items” would be removed and that U.S.-origin nuclear technologies not controlled by the Nuclear Suppliers Group would be exported in order to “expand the scope of civilian nuclear cooperation between the United States and India.”<sup>23</sup>

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This “expanded cooperation” has been a boon to India’s financial commitment to dual-use technology, with New Delhi’s investment increasing exponentially every year since 2005. As a result, the technology contracting companies have been quick to capitalize. For example, Antrix Corporation Limited, the commercial arm of India’s Department of Space, was making serious headway in 2006, particularly in improving satellite imaging quality and its ability to deliver affordable imaging services. Antrix began providing services to the United

States and other commercial, governmental, and military space entities worldwide and growth was “roughly about 25 percent” over 2005. (In 2005, 75 percent of Antrix’s revenue came from abroad.<sup>24</sup>) ISRO Chairman G. Madhavan Nair recognized an opportunity, suggesting that ISRO could capture at least 10 percent of the \$2-billion global space-launch business, which could in part benefit the further development of the Indian ballistic missile fleet.<sup>25</sup>

That same month, the U.S.-India Business Council arranged for the largest, most influential defense-oriented U.S. delegation to travel to India. The delegation was headed by retired Gen. Paul Kern, who at the time was a senior counselor at former Defense Secretary William Cohen’s consulting firm. He was joined by retired Admiral Walter Doran, vice president of navy accounts for business development at Raytheon, and former NASA astronaut Andrew Allen, a vice president at Honeywell Aerospace. In total, the 31-member delegation represented 22 of the leading defense manufacturers in the United States.<sup>26</sup> Virtually all of the parties stood to benefit from the changes in export policies. Overall, the removal of sanctions has resulted in billions of dollars in dual-use defense opportunities.

Nor were the financial gains limited to the private sector. India’s scientific community benefited as well. By 2006, ISRO’s near full-spectrum DRDO partnership was solidified, with Chairman Nair announcing that ISRO and DRDO would work together to develop new space technology, thus locking down significant contracts and ensuring that hefty profits would come out of streamlined dual-use collaborations.<sup>27</sup> By 2009, commercial revenues from India’s space pro-

gram saw a sixfold increase over four years, brought about in part by the development and sale of technologies to foreign buyers.<sup>28</sup>

**Washington lifts more regulations.** Although India would go on to strike lesser deals with France, Israel, and Russia, the United States continued to be its main source for both military and civilian technology. In the summer of 2005, Indian Minister of Defense Pranab Mukherjee and U.S. Defense Secretary Donald Rumsfeld met in Washington to discuss the New Framework for the U.S.-India Defense Relationship, an initiative intended to outline a 10-year plan for the U.S.-India defense relationship.

The meeting's report suggested that technology transfer would not be limited to peaceful commercial applications: "The U.S.-India defense relationship . . . seeks to advance shared security interests. These interests include: maintaining security and stability; defeating terrorism and violent religious extremism; preventing the spread of weapons of mass destruction and associated materials, data, and technologies; and protecting the free flow of commerce via land, air, and sea lanes."<sup>29</sup>

Soon after the Mukherjee-Rumsfeld meeting, India and the United States held talks on enhancing bilateral high-technology trade. The "peaceful" theme was constant throughout. A joint statement by both countries even reiterated the partnership's call for "enhanced U.S.-India cooperation on the peaceful uses of space technology."

By the end of August, there were reports that Washington had removed six Indian space and nuclear facilities from the Commerce Department's Entity List.<sup>30</sup> By March 2006, the United States declared it would consider removing the remaining ISRO subsidiaries from the Entity List, a shift in policy that would expand bilateral cooperation in civilian projects.<sup>31</sup> Soon thereafter, at an event in New Delhi, Bush declared a renewed unity between the two countries: "The United States and India, separated by half the globe, are closer than ever before, and the partnership between our free nations has the power to transform the world."<sup>32</sup>

But a July analysis by Indian Air Force Group Captain A. S. Bahal hinted that India's interest in space-based directed-energy weapons wasn't merely "peaceful" and suggested it was more than just conceptual. Bahal stated that "the development of the [kinetic attack loitering interceptor] and [directionally unrestricted ray gun] should be progressed to their logical conclusion" and that "the growing technical competence of commercial space technology has bridged the gap between military and civilian space capabilities." His statements suggested that India's peaceful commercially directed-energy technology research within its national laboratories effectively could, and would, serve as the destructive military technologies of the future.<sup>33</sup>

The U.S.-India relationship did suffer a setback in April 2007 when the Justice Department released an indictment that charged agencies within the Indian government of conspiring to circumvent U.S. export regulations.

**India continues to watch China.** On January 11, 2007, China shot down its own Fengyun 1-C satellite—an event that reignited the debate about whether China was working toward the development and deployment of space weapons. Ignoring the frequently debated question of whether China’s space-weaponization efforts

were true, some within the intelligence and military communities and defense industries in India and the United States seized upon the moment to justify their own military space pursuits. For instance, Air Chief Marshall Tyagi stated that India would establish an aerospace command “to protect the country’s space-based assets.”<sup>34</sup> That same month the scientific adviser to India’s defense minister stated that he was concerned that missiles could “disable” satellites, specifically those with commercial and dual-use applications such as GPS, nav-

igation, and military functions.<sup>35</sup>

India has suggested on many occasions that it is considering—and even working toward—developing the means to protect its satellites. One way to do so is with missiles. But less conspicuous methods such as rendezvous and interdiction activities, which draw a fine line between offensive and defensive functions, also exist. In many cases, these advanced systems are complemented by elaborate countermeasures that can be employed to defend against attack or, in an offensive capacity, impose the five “Ds” of counter-space operations—deception, disruption, denial, degradation, and destruction—of a rival satellite.<sup>36</sup> As U.S.-Indian military collaborations continue to evolve and their strategic interests become more closely aligned, the perception that China poses a threat to each nation’s space systems will certainly increase.

**Who is holding back?** By 2007, Commerce Deputy Secretary David Sampson was boasting, “The average [strategic trade] license processing time for India is now in line with other key allies, including the United Kingdom, Israel, and France. These advances were the result [of] a new atmosphere of trust and confidence that has allowed sweeping export control changes over the past five years.”<sup>37</sup> Nevertheless, some officials, including Kalam, who was nearing the end of his presidential term, suspected that the United States and its allies were holding out on India. He argued that after Washington and its allies—separating out the Russians whom he referred to as “the Soviet Bloc”—stockpiled nuclear, chemical, and biological weapons for themselves, they used international conventions and treaties to control their supply. According to Kalam, the motive was

to control the market forces and maintain domination. He went on to reiterate his belief that the major protection against nuclear attacks would be antiballistic missile defense systems followed by space systems and strategic military satellites—exactly the technologies India is pursuing.

Disturbingly, there was no indication that the Commerce Department noticed Kalam's blatant indifference to nonproliferation.<sup>38</sup> But the relationship did suffer a minor setback in April 2007 when the Justice Department released an indictment that charged agencies within the Indian government of conspiring to circumvent U.S. export regulations. These violations were based on efforts to obtain what reports described as “secret weapons technology” from U.S. companies over several years. Suggesting that the Indian military was clearly involved, the indictment also charged private companies that were serving as agents for the Indian government.<sup>39</sup> Nevertheless, the Bush administration continued advocating for increased openness with New Delhi. One Commerce official stated, “As we build ever-closer ties with India, our export controls will continue to be adjusted to reflect new, post-Cold War realities. In 1999 . . . almost 25 percent of all U.S. exports to that country required some sort of license from the Commerce Department. Today, as a result of the new strategic partnership, less than 1 percent of U.S. exports are subject to individual license requirements.”<sup>40</sup>

India's behavior has been comparable to other defiant nuclear states, but few have U.S. support. The difference? India has the potential to be a proxy rival against China and, to a lesser degree, in the war on terror. Taking into account the fact that India does not take part in the Proliferation Security Initiative and never supported the Iraq War, it is worth asking: Is the U.S.-India relationship merely the embodiment of the adage “my enemy's enemy is my friend”?

Beijing's influence on New Delhi's defense policy decisions cannot be underestimated. China—as well as the United States and Russia—has been at the forefront of conducting military research into lasers. Accordingly, India has been doing the same for decades with DRDO, which delineates its work by breaking it into three categories: (1) technologies that it will develop in-house; (2) technologies that it will develop in partnership with academic institutions; and (3) technologies that it will develop with foreign partners.<sup>41</sup> As with other Indian technology development, these three strategies have received support from the United States.

But the greatest U.S. support of Indian development efforts came in October 2008, when Washington and New Delhi signed the Agreement for Cooperation for Civilian Nuclear Technology, often referred to as the U.S.-India nuclear deal. The agreement was unprecedented, demonstrating how broad the U.S.-India partnership

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could be. Furthermore, DRDO and ISRO scientists welcomed the Nuclear Suppliers Group waiver, promoted by the United States and approved by the 45 member states, aimed to promote the fundamental principles and safeguards for nuclear transfers, which would not only “address the country’s energy needs but also help in get-

ting critical technologies in diverse areas which have been denied for decades.”

DRDO’s Chief Controller of Research and Development W. Selvamurthy said the strategic partnership would lead Washington to share technologies with India that were made unavailable for nearly three decades, thus having a ripple effect in other sectors—including space, defense, and general science.<sup>42</sup>

**What’s next?** Defense contractors and investors continue to flock to India, and New Delhi appears unwilling to change its rhetoric or actions when it comes to dual-use technology research and development—despite changing priorities and shifting regional threats. In fact, it seems the military has been even more outspoken since the Bush era ended. One official recently suggested that efforts were well underway to make use of India’s space assets for a variety of passive and active combat roles.<sup>43</sup>

However, some in Washington are starting to pay attention to the possible ramifications of India’s activities. In April, after the chief executive and three Indian employees of a U.S. electronics supply company were charged with shipping closely guarded U.S. computer technology to India for use in missiles and other weapon systems, Massachusetts Democratic Cong. Edward Markey issued a stern warning: “If the Indian government has attempted to circumvent U.S. export controls over sensitive missile technology, as is alleged in the indictment, then it has violated its explicit agreements to become a responsible international actor in the context of nonproliferation. . . . India has also long touted its strong military and space-launch cooperation with Iran, which raises the possibility that the sensitive U.S. missile technologies India has misappropriated may wind up benefiting Tehran. . . . This would be absolutely unacceptable, and it would be treated as such by Congress.”<sup>44</sup>

Is it too late to change the course of the U.S.-India partnership? Probably not. While India’s race for dual-use technologies—especially space-based ones—will undoubtedly contribute to a deteriorating security environment in Asia, the United States does have the power to redefine its partnership and rein New Delhi in. Should India’s technological pursuits continue unabated, it is only because

the Obama administration failed to learn from the Bush administration's mistakes. Secretary of State Hillary Clinton seemed to conduct business as usual during the administration's first visit to India in July—Clinton and her counterpart agreed to allow U.S. firms to sell civilian nuclear reactors to India—but President Barack Obama will have an opportunity to chart a new course on his scheduled visit to India in November.

To make the necessary changes, the Obama administration should consider dual-use technology in the context of two other issues: (1) India's support of defense technology over social programs for its impoverished citizens; and (2) the country's unreliable and disorganized internal security apparatus. It is worth noting that despite India's claims of a hostile China, New Delhi's greatest security threats originate from regional or domestic terrorist groups; to wit, in recent years India has experienced more casualties from acts of internal terrorism—such as the November 2008 Mumbai attacks—than from conventional military conflicts with other countries.

So with a new administration comes a new opportunity to redefine the relationship. Technology and knowledge cannot be taken away, nor can defense contractors legitimately be prevented from engaging India's government and military. But laws and trade can be implemented or reconstituted, statements can be considered more than rhetoric, and narrow bilateral relations can be viewed in tandem with their regional consequences. After all, redefinition has to begin somewhere. ■

*Matthew Hoey is a former senior research associate at the Institute for Defense and Disarmament Studies, where he researched and forecasted missile defense and space weaponization technologies. In 2009, he launched the Boston-based Military Space Transparency Project. Hoey's current research focuses on the impact of emerging technologies such as artificial intelligence, robotics, and nanotechnology on military and commercial space technology.*

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## NOTES

1. "Kalam Defends Chandrayaan," *The Hindu*, January 20, 2008. Available at <http://www.thehindu.com/2008/01/20/stories/2008012058410900.htm>.

2. Abdul Kalam, *India Vision 2020*. Information available at <http://www.indiavision2020.org/>.

3. Raman Puri, "Space Assets and Their Integration with Land, Air, and Maritime Warfare for Enabling National Security Strategy Part-II," *USI of India* (October/December 2006). Available at [http://www.usiofindia.org/article\\_Oct\\_Deco6\\_9.htm](http://www.usiofindia.org/article_Oct_Deco6_9.htm).

4. "Sentencing of Indian Businessman won't Affect N-Deal," *Rediff News*, June 21, 2008. Available at <http://in.rediff.com/news/2008/jun/21ndeal1.htm>.

5. V. Siddhartha, "Military Dimensions in the Future of the Indian Presence in Space," *USI of India* (April/June 2000), pp. 243–258.
6. "Tap High-Power Lasers for Missile Defence: President," *Business Line*, December 13, 2004. Available at <http://www.hindu.com/businessline/2000/12/14/stories/141467rq.htm>.
7. Dianne E. Rennack, "India and Pakistan: Current U.S. Economic Sanctions," Congressional Research Service, October 12, 2001. Available at <http://fpc.state.gov/documents/organization/6202.pdf>.
8. U.S. Department of Commerce, "U.S.-India Joint Statement on High Technology Commerce," November 13, 2002. Available at <http://www.bis.doc.gov/news/2002/kijointstatementindia.htm>.
9. U.S. Department of Commerce, "Statement of Principles for U.S.-India High Technology Commerce," February 5, 2003. Available at <http://www.bis.doc.gov/internationalprograms/statementprinciplesindia.htm>.
10. "The Rediff Interview: Kanwal Sibal," *Rediff News*, February 19, 2003. Available at <http://in.rediff.com/news/2003/feb/19inter.htm>.
11. "India Cannot Be Smug over War Technology," *The Times of India*, June 28, 2003. Available at <http://timesofindia.indiatimes.com/articleshow/48015.cms>.
12. U. P. Thakur and Narasimba Rao, "Conceptualizing Security for India in the 21st Century," *Conceptualizing Security for India in the 21st Century*, ed. Gautam Sen (New Delhi: Atlantic Publishers, 2005), pp. 1–22.
13. Matthew Hoey, "The Proliferation of Space Warfare Technology," *Bulletin of the Atomic Scientists*, December 11, 2008. Available at <http://www.thebulletin.org/web-edition/features/the-proliferation-of-space-warfare-technology>.
14. Kenneth I. Juster, "Unleashing the Potential of U.S.-India Civil Space Cooperation" (keynote remarks, Bangalore, India, June 22, 2004). Available at [http://www.bis.doc.gov/news/2004/bangaloreindia6\\_22.htm](http://www.bis.doc.gov/news/2004/bangaloreindia6_22.htm).
15. Bradley Graham, "Some Question Report on Chinese Space Arms," *Washington Post*, August 14, 2004. Available at <http://www.washingtonpost.com/wp-dyn/articles/A63706-2004Aug13.html>.
16. Ibid.
17. David Rohde, "India's Lofty Ambitions in Space Meet Earthly Realities," *New York Times*, January 24, 2004. Available at <http://www.nytimes.com/2004/01/24/international/asia/24SPAC.html?pagewanted=1>.
18. "China's Nanotechnology Patent Applications Rank Third in World," *InvestorIdeas.com*, October 3, 2003. Available at <http://www.investorideas.com/Companies/Nanotechnology/Articles/China%27sNanotechnology1003,03.asp>.
19. U.S. Defense Department, "The Military Power of the People's Republic of China 2005." Available at <http://www.defenselink.mil/news/Jul2005/d20050719china.pdf>.
20. Acting Undersecretary Peter Lichtenbaum, Commerce Department (speech, 8th National Forum on Export Controls, April 28, 2005). Available at <http://www.bis.doc.gov/news/2005/usnationalforum.htm>.
21. "Indian Aerospace Command to Operate Military Satellites," *Space News Business Report*, April 4, 2005. Available at [http://www.space.com/spacenews/archive05/Milspace\\_040405.html](http://www.space.com/spacenews/archive05/Milspace_040405.html).
22. Among the other publications: the 2004 National Intelligence Council report, "Mapping the Global Future"; the 2005 National Defense Strategy; the 2006 Quadrennial Defense Review Report; and the 2006 National Security Strategy.
23. U.S. Department of Commerce, "Announcement on U.S.-India Next Steps in Strategic Partnership," September 2004. Available at <http://www.bis.doc.gov/news/2004/us-indianextstep.htm>.
24. "Antrix Revenues at Rs 400 Crore," *Economic Times*, December 17, 2006. Available at <http://economictimes.indiatimes.com/articleshow/826792.cms>.

25. Siddharth Srivastava, "One Small Step. . .," *Asia Times Online*, May 16, 2006. Available at [http://www.atimes.com/atimes/South\\_Asia/HE16Df02.html](http://www.atimes.com/atimes/South_Asia/HE16Df02.html).
26. Among those represented: Boeing, Lockheed Martin, General Electric, Northrop Grumman, Pratt & Whitney, United Technologies, Bell Helicopter Textron, General Dynamics, MIC Industries, BAE Systems, L-3 Communications, ITT Defense International, Sikorsky Aircraft, Motorola, and Emergent Bio-Solutions. See "High-Powered U.S. Defence Team for India," *Rediff News*, January 31, 2006. Available at <http://www.rediff.com/news/2006/jan/31us.htm>.
27. "ISRO to Attach Hypersonic Engines to Rockets," *Defence India*, January 24, 2006. Available at [http://www.defenceindia.com/company\\_news/news141.html](http://www.defenceindia.com/company_news/news141.html).
28. "Space Programme Wins European Commercial Boost," AFP, September 30, 2007. Available at <http://www.livemint.com/2007/09/30144826/Space-programme-wins-European.html?d=1>.
29. "New Framework for the U.S.-India Defense Relationship," signed by Pranab Mukherjee and Donald Rumsfeld, June 28, 2005. Available at [http://merln.ndu.edu/merln/mipal/reports/US\\_India\\_Defense\\_Framework.doc](http://merln.ndu.edu/merln/mipal/reports/US_India_Defense_Framework.doc).
30. "Removing Six Nuclear Facilities," USA Centers, August 31, 2005. Available at <http://www.usacenters.com/resixnufa.html>.
31. Government of India, Ministry of External Affairs, "India-U.S. Space Cooperation—Fact Sheet," March 2, 2006. Available at [http://pib.nic.in/release/rel\\_print\\_page1.asp?relid=16135](http://pib.nic.in/release/rel_print_page1.asp?relid=16135).
32. The White House, Office of the Press Secretary, "President Discusses Strong U.S.-India Partnership in New Delhi, India," press release, March 3, 2006. Available at <http://merln.ndu.edu/archivepdf/india/WH/20060303-5.pdf>.
33. A. S. Bahal, "Satellite Reconnaissance, ISR, and Countermeasures," *Air Power* 3, No. 2 (Summer 2006), pp. 85–101. Available at <http://www.aerospaceindia.org/Journals/Summer%202006/Bahal-%20AP.pdf>.
34. "Special Report: Chinese Anti-Satellite Weapon Test—The Shot Heard 'round the World," *WMD Insights*, March 2007. Available at [http://www.wmdinsights.com/I13/I13\\_EA1\\_SP\\_III\\_IndiaChinaASAT.htm](http://www.wmdinsights.com/I13/I13_EA1_SP_III_IndiaChinaASAT.htm).
35. "U.S. Using India against China, Says Sudarshan," *Times of India*, July 15, 2006. Available at <http://www.news.com.au/heraldsun/story/0,21985,21094067-5005961,00.html>.
36. Countermeasures may include aerosols, decoys, lasers, chemical munitions, high- and low-energy lasers, power-sapping methods, adhesives, adhesive materials, corrosives, destructive enzymes, charged projectiles, kinetic objects, kinetic collisions, cryogenically frozen micro-meteors, compact directed energy systems, jamming devices, electronic warfare, high-powered microwaves, radio frequency, electromagnetic pulse, electromagnetic interference, and other methods to duplicate natural phenomenon, as well as thermal effects, foils, lures, methods to compromise sensors, crosslink/uplink/downlink transmission sabotage or interference, and defense by an accompanying host/surrogate satellite or an independent escort/defense satellite.
37. Deputy Secretary of Commerce David Sampson, "U.S.-India High Technology Cooperation Group Industry Day" (speech, February 22, 2007). Available at [http://www.commerce.gov/NewsRoom/DeputySecretarySpeeches/PRODO1\\_002802](http://www.commerce.gov/NewsRoom/DeputySecretarySpeeches/PRODO1_002802).
38. "Nuclear Non-Proliferation Treaty was Discriminatory," *DNA India*, February 24, 2007. Available at [http://www.dnaindia.com/india/report\\_nuclear-non-proliferation-treaty-was-discriminatory\\_1081813](http://www.dnaindia.com/india/report_nuclear-non-proliferation-treaty-was-discriminatory_1081813).
39. Mark Mazzetti and Neil A. Lewis, "U.S. Cites Indian Government Agencies in Weapons Conspiracy," *New York Times*, April 3, 2007. Available at <http://query.nytimes.com/gst/fullpage.html?res=9901EEDE1F30F930A35757CoA9619C8B63>.
40. Assistant Secretary Christopher Padilla, "Computer & Communications Industry Association 34th Annual Washington Caucus" (remarks, April 17, 2007).

Available at <http://www.bis.doc.gov/news/2007/padillao4172007.htm>.

41. "A New Engagement with Military," *Business Standard*, May 29, 2008. Available at <http://www.business-standard.com/india/storypage.php?autono=324378>.

42. "Nuke Deal Will Bring in Restricted Technologies, Says Top Scientist," *Rediff News*, September 10, 2008. Available at <http://www.rediff.com/cms/print.jsp?docpath=/news/2008/sep/10ndea13.htm>.

43. Radha Krishna Rao, "Chinese Threat to Indian Space Assets," *Domain-b.com*, January 29, 2009. Available at [http://www.domain-b.com/acro/20090129\\_indian\\_space.html](http://www.domain-b.com/acro/20090129_indian_space.html).

44. "Missile Cuffs on Indian: Glare on Delhi for Violating U.S. Export Laws," *Telegraph*, April 3, 2009. Available at [http://www.telegraphindia.com/1070404/asp/nation/story\\_7604980.asp](http://www.telegraphindia.com/1070404/asp/nation/story_7604980.asp).

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