The United States-India Strategic Partnership:
A Case for Reassessment
Chronology of Events and Analysis
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Twenty five years ago India detonated its first atomic bomb, named Smiling Buddha, in Pokhran, Rajasthan—an event it officially referred to as a "peaceful" nuclear test. India, having long been driven by an unrelenting sense of national pride and the desire to emerge from the shadows of regional rivals such as China, refused to stem the tide of nuclear proliferation in South Asia. Four years earlier, in 1970, The Bulletin of the Atomic Scientists reported on India's atomic ambition. "Atomic energy is a field in which Indians rightly take pride, it is a field in which scientific morale is high," wrote George H. Quester. "For India to lose its momentum in atomic energy now would almost be to violate a sacred trust." Today, as it continues to guard itself against the same "peaceful" nuclear technology it tirelessly pursued decades ago, India is chasing a new technological peril in its race to pursue military space technology and dual-use emerging technologies such as directed energy systems, nanotechnology, robotics, and artificial intelligence.

Evolutions in technology on the scale of the ones that led to Smiling Buddha are already in motion in the abovementioned fields, and, similar to the claims made by Indian scientists and officials in the run-up to India becoming a member of the nuclear club, numerous references to peaceful applications abound. However, in contrast to the claims of the atomic era, many of India's political and military leaders are not shy to openly contradict the dove-like applications of innovations that are the product of what is increasingly being called India's technological renaissance. The country's elaborate push

towards challenging the world's leading military- and commercial- spacefarers is the brain child of former President Dr. Abdul Kalam, who is also the founding father of the Indian missile defense program, and a lead architect of India's nuclear and space programs. With an ever strengthening strategic allegiance to the United States assisting Kalam's dual-use vision, India is likely destined to reach its military space zenith even sooner than previously anticipated.

Kalam's philosophies on war and peace are unique, always consistent, and are frequently expressed. For example in 2008 when he was asked by a student why a peace-loving person such as him built missiles like Prithvi and Agni, 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.[i]" With such sentiments at the heart of India's technology revolution, can India prosper economically and advance scientifically without contributing to the already dangerous security climate in the region? Moreover another essential question that must be asked is: Which India is the United States dealing with today? Is it the India that lambasted Reagan's Strategic Defense Initiative (SDI) in the 1980s and the United States' deployment of ballistic missile defense in 2002, or the India that touts simultaneously its nationally driven effort to now command these same destructive and destabilizing technologies? It is important to note that these questions have become increasingly difficult to address since 2005 when India replaced its 1923 Secrets Act with its Right to Information (RTI) Act—legislation that deliberately through its Section 8 makes transparency related to military technology virtually nonexistent[ii].

In January 2009 India made a formal announcement that it is working toward the eventual deployment of a directed energy-based ballistic missile defense system. Though this announcement represents a very significant strategic divergence from India's occasionally held positions meant to control the proliferation of missile defense technologies, it does not stand alone. Most concerning are the ever increasing inconsistencies and contradictions made by the Indian military and government on space warfare and the weaponization of emerging technologies – a trend the likes of which began decades ago.

A TRACK RECORD OF CONTRADICTIONS

In 1988 India submitted a working paper titled "New Technologies and the Qualitative Arms Race" at the Third Special Session of the United Nations General Assembly devoted to disarmament. The opening paragraph states that "Efforts to that end must include negotiations on the limitation and cessation of the qualitative improvement of armaments, especially weapons of mass destruction and the development of new means of warfare, so that ultimately scientific and technological achievement may be used solely for peaceful purposes." Additionally, and more specifically, the paper states that:

> '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 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. It is the duty of the international community to put a restraint on such an orientation...The history of weapons development in the post-Second World War period is replete with examples of such a self-propelled momentum overtaking whatever meager results "arms control" measures may have achieved. It is thus evident that the prospects for real disarmament will remain bleak so long as this technological arms race is allowed to continue unabated. The pressures of competitive technological armament obstruct further progress in disarmament and even threaten to destroy the limited progress made so far.'

These inspiring words never materialized, but ironically today they serve the arms community well as India's visionary diagnosis of the arms control dilemma is exactly the one to which they are contributing.

Where this working document especially exhibits foresight is in the details. The paper goes on to reveal what India sees as the future threats to international security and non-proliferations efforts in a listing of "new and emerging technologies with far-reaching military applications." The listing includes:

- Compact and powerful nuclear reactors in space, including the powering of beam weapons, battle stations, and supporting satellites

- Kinetic energy weapons

- The development of fifth generation computers and artificial intelligence, with predictions that these techniques are likely to be used in aiding soldiers in handling enormous information in a very short time in a complicated environment, as well as for the later development of autonomous vehicles and automated battle management systems

-The use of ICBMs being contemplated with conventional weapons, featuring new types of delivery systems, such as trans-atmospheric vehicles and space planes that can operate in both atmosphere and space

The paper goes on to say that these technological developments, if allowed to proceed unchecked, would lead to "a highly complex strategic environment fraught with risks of staggering proportions. One consequence that can be predicted confidently is a fresh spiraling of the arms race at a qualitatively different, if not higher, level.[iii]" Sadly as we look back upon the developments from 1988 up to present day, it is undeniable that India has embraced in an almost schizophrenic fashion the polar opposite of nearly every visionary arms control theory exhibited in the working paper.

In the years leading up to the present, India's actions and words have contradicted old intents and reveal at the least the space hopes of a nation that are remarkably and admittedly dual-use on a scale that rivals most nations. This poses an especially significant challenge since it is these dual-use technologies with inherent dual-use applications that pose the greatest hurdles to the arms control community and any potential revisions and improvements to the international space treaty regime. Dual-use technologies are increasingly resulting in heightened obscurity, blurring the line between peaceful commercial and destructive military technologies. It can be observed that the rate of this phenomenon reveals no sign of slowing, thus highlighting the need for the international community to move fast to address dual-usage before peaceful systems become inextricably connected to destructive military space systems.

In 1996 discussions related to India's dual-use space payloads became increasingly common, though what is most interesting is that calls to achieve this level of

technology overlap in relation to commercial- and military- space technology is a strategy that had been discussed time and time again throughout India's military community. One example of this can be found in comments made by Ret. Vice Admiral Raman Puri, who also served as second chief of the Chief of Integrated Service Command (CISC), when he recommended that all "future (space) payloads including civilian space payloads should try to be dual use i.e. civil and military applications." Although Puri's comments were made more than a decade ago, they resonate even more profoundly today as India has come to the point where deploying dual-use satellites as part of both commercial and military space systems in a single launch is commonplace[iv].

Eventually it will be found that among the leading spacefaring nations such as India, the United States, Russia, and China that dual-use emerging technologies will serve as the leading driver of space warfare technology. These dual-use systems are not just limited to satellites and lasers in the macro sense; rather it is the role that dual-use emerging technologies such as nanotechnology, artificial intelligence, and robotics will play by serving as the building blocks for these larger destructive systems. In 1998 India's scientific leader Dr. Abdul Kalam wrote in his monumental Vision 2020 that "newly emerging technologies such as robotics or artificial intelligence…would have a crucial impact on future defense operations and also on many industrial sectors." These technologies are already benefiting India's push towards space dominance, which is manifesting itself via a robust and comprehensive network of remote sensing and imaging and surveillance capabilities to help integrate all branches of the military under the banner of space. This too is inline with the national strategy laid out by Kalam in his statement that:

> ‘Future defense operations are going to be based on multiple networks of Army, Navy, Air Force and space systems. Information technology is going to be used in unprecedented ways, in the planning stages, in various simulation exercises, as well as during actual operations when the need arises. Continual surveillance is going to be another feature in the years to come. This is done through remote sensing, communications and several other means. Continual improvement of systems with higher precision, speed and maneuverability would also be a part of this complex picture. Advances in materials, electronics, advanced sensors; information processing, robotics, and artificial intelligence drive all the critical elements.[v]’

In 2009 Indian military research into these fields is centrally located at the Center for Artificial Intelligence and Robotics (CAIR). Its research focus is in the areas of Artificial Intelligence (AI), Robotics, and Command Control Communication and Intelligence (C3I) systems, to name a few. Currently the facility occupies 15 acres and employs over 300 personnel[vi].

Comments made by Kalam in 1998 reveal the deliberate development of dual-use directed energy applications on the part of India, efforts that are not only taking place in the commercial sector but at India’s military laboratory within DRDO. In his Vision 2020, he praises “The department of Atomic energy, the Indian space research organization and The Defense research & development organization, which have project oriented management for time-bound achievements in high technology, and also their societal application.” Kalam also adds, “Defense Lasers can be used surgically to treat glaucoma or cataract. Atomic energy is used for irradiating, for example, groundnut seeds

for higher productivity; and space research has led to an accurate prediction of the onset of the monsoon.[vii]" India's Bhabha Atomic Research Centre (BARC), which is under the direction of India's department of energy, is also pursuing the development of directed energy technology for military applications[viii]. Indian advancements in directed energy systems are thought to be among the most sophisticated in the world, alongside the United States, Russia, and China. The DRDO's Laser Science and Technology Center was founded in 1950 and was one of the very first military research organizations in India. It was originally known as the Defense Science Laboratory (DSL). The development of military-focused directed energy systems is an area of intense concentration for the DRDO with numerous applications, and it is considered to be one of the most significant force multipliers of the future.

International objections to India's pursuit of dual-use space technology in its quest to share the high ground with the United States were in 1998 very uncommon; even in the present day this is still the case–though criticisms can be expected to increase. Some arguments were being made against India's "peaceful" use of nuclear technology in the lead-up to its defiant nuclear test and subsequent expansion of its nuclear arsenal. In 1998 an Indian journalist predicted that the "Pokhran nuclear tests would once again prompt the likes of the Arms Control Association and other non-proliferation groups and activists, not to mention Congressmen like Ed Markey and Howard Berman, to once again attempt to besmirch India's much touted impeccable non-proliferation track record.[ix]" Commentary such as this is reflective of a disturbingly commonplace sense of denial about India's lack of adherence to international arms control treaties and flat out rejection of others.

At the same time officials within India's military, scientific, and political communities had continued to suggest that trade and export restrictions were tactical in nature and used as a tool by the United States and other P5 nations to stifle India's progress. Kalam makes the observation that:

> 'The technology areas critical for the growth of strategic industries for India...are in the aviation and in propulsion sector, electronics, sensors, space communication and remote sensing, critical materials and processing, robotics and artificial intelligence. Before looking into some of these technologies, it is worth understanding something about the defense technologies and industries as they pertain to India. In India, both the Defense Research & Development Organization and defense industries started experiencing certain restrictions on acquisition of technology and products from the developed countries, particularly from 1985 onwards.[x]'

Kalam's claims cannot be disputed, though there are numerous reasons for such restrictions and deservingly so.

In the spring of 2000 an alarming report featured in India's United Service International's (USI) Defence Journal titled "Military Dimensions in the Future of the Indian Presence in Space" surprisingly drew little international attention, probably due to its lack of availability outside of India. The report suggested that a directed energy weapon or weapons could be deployed in space by India, and this could be done as early as 2010. The USI Defence Journal is a publication referred to as the "oldest surviving defence journal in Asia, having first appeared in 1872." The USI journals provide a forum for analyses authored by current and former military officers "in an era," according

to its publishers, "when there is a feeling that free expression of views by Defence personnel is not looked upon kindly by the establishment." The paper's author, Dr. V. Siddhartha, was at the time of its publication an officer on special duty in the secretariat of the scientific adviser to the Defense Minister. The paper is testament to, at the very least, a clear interest within the Indian military of deploying not only a space-based laser, but also a hypersonic sub-orbital delivery system referred to as the Avatar[xi].

It has been suggested that the publication of this paper caused waves within various official circles in India upon its release. The shock factor of the space-based laser comments were complemented by program descriptions such as the "Semi-operational/intimidational space based laser/particle beams." When these words are combined with frequent references to Western hegemony (the United States) and export controls referred to as "technology denial" to India, such claims warrant an additional look. An example of one of Siddhartha's suppositions includes: "Therefore India has, willy-nilly, to co-occupy militarily the hegemon's (United States') last remaining 'High Ground' – space, and establish an active (i.e. not merely reconnaissance) military presence there." Today the paper's author is currently a disarmament expert at the United Nations in New York.

By the year 2000, the positions of diplomats within India's foreign services frequently contradicted the words and actions of the military and scientific communities, as well as some political leaders regarding arms control, non-proliferation, and weapons research and development. This trend only stands to increase as Indian Foreign Service officers dedicate themselves to the possibilities that India can sit along side the P5 and become a global leader economically and scientifically–while the national labs of India,

war planners, and hawkish politicians pursue their own destructive dual-use scientific objectives. For example, in December of 2000 India's then-President K.R. Narayanan, speaking at a national laser symposium hosted by the Department of Atomic Energy (DAE) and the Defense Research and Development Organisation (DRDO), stated that "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." Accordingly, Indian weapons labs continued to outpace flawed international arms control policies and efforts to revise them.

Contradictions ran rampant in 2000 as Kalam's Vision and the pursuits of the DRDO and Atomic Energy Commission clashed with the nation's diplomatic efforts. In 2000 India's government had openly opposed the deployment by the United States of ballistic missile defense. At the same time Kalam, India's scientific leader, stated that "We (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'." In the years leading up to 2009, India has embraced directed-energy ballistic missile defense technologies provided to them from not only by the United States, but from Russia and Israel as well[xii].

The terrorist events that transpired on September 11, 2001 in the United States redefined the U.S.-India relationship. On September 22 of 2001, just 10 days after the terrorist attacks in New York and Washington, then-President George W. Bush waived the sanctions placed on India in 1998 in response to India's nuclear tests. Dianne E. Rennack, Specialist in Foreign Policy Legislation for the Foreign Affairs, Defense, and

Trade Division, reported the president's rationale to Congress, stating "that denying export licenses and assistance was not in the national security interests of the United States." Though the motivations for lifting the sanctions after the United States was attacked by a terrorist organization originating from the region appeared tactically driven in the first days of the United States' war on terror, talks focused on enhancing trade with India had already been underway for some time, though in a more limited fashion. It is safe to say that the 9/11 attacks accelerated many policy modifications regarding India, however it is important to note that Secretary of State Colin Powell held discussions with Pakistan's foreign minister in June of 2001 that focused on terrorism, Afghanistan and the Taliban. Subsequently in 2001 the number of Indian companies on the Commerce Department's Entity List was reduced to just 2 from 159. Additionally, the U.S. licensing policy with India for nuclear- and missile- related technology changed from "policy of denial" to case-by-case review[xiii].

In the aftermath of 9/11, momentum to strengthen strategic and commerce-oriented ties with India accelerated, casting aside its past violations and defiant acts. In November of 2001 then-President Bush and then-Indian Prime Minister Atil Bihari Vajpayee met in Washington, D.C., where they agreed to take steps to transform and stimulate U.S.-India relations in the areas of high technology transfers. Just one month later, on December 13, Pakistani terrorists struck India's Parliament. India and the United States were now more than ever facing a common enemy – and from this point on their relationship would grow even stronger, with all sanctions placed against India in response to its nuclear tests effectively removed. These sanctions had prevented India from enhancing its nuclear weapons and launch capability, though most pertinent to this study

is the impact that removing the sanctions would have on India's ability to expand its military space program and accelerate its already planned weapons systems of the future.

In November 2002, United States' then-Under Secretary of Commerce Kenneth I. Juster and then-Indian Foreign Secretary Kanwal Sibal established the U.S.-India High Technology Cooperation Group (HTCG). Also present was India's External Affairs Minister, the Defense Minister, the Minister of State for Space, and the National Security Advisor. The mission of the HTCG was to "to stimulate bilateral high technology commerce towards realizing their goal of transforming India-U.S. relations." The meeting also served to preserve the commitment between India's Prime Minister Vajpayee and then-President Bush that was detailed during their November 2001 meeting. At that meeting the two sides "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. [xiv]"

Just four months later, in February of 2003, Juster and Sibal signed the Statement of Principles on U.S.-India High Technology Cooperation. Notable among the principles included in the statement was Article 6, which stated that, "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, and intend to take steps to facilitate such trade, which is a component of high technology commerce." Equally conspicuous was Article 12, which stated that "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.[xv]"

In February of 2003, following a visit to the United States, Sibal stated in response to an interviewer's question about the possible transfer of nuclear, high-tech, and space technologies with the U.S.:

> 'A change of policy on the part of the US is required…This would require a change of approach in the US system. And the fact is that in the US policies are not simply made by the administration, they are also made by Congress. So there is tension within the US system. We are not members of the NPT and we are not subscribers of MTCR. Yet if there is to be a 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 exists to deal with non-proliferation or missile technology, there is this conundrum. Our answer is we are what we are. [xvi],

With so many players pushing to ensure technology exchanges and collaboration between India and the United States in fields such as nanotechnology and space systems, it was beginning to look in 2003 as if the development of strategic military concepts would commence.

In June, commentary from a high ranking official within the DRDO's Defense Machinery Design Establishment (DMD) suggested that India already possessed the know-how to develop many advanced systems. U P Thakur, the Director of India's DMD

Establishment, stated that:

> 'We do not need to develop new technology as the Indian scientists are already advanced in the field, all we need is the vision to apply the right technology to aid specific military objectives…India cannot be a mute spectator while major global military powers are aggressively militarising outer space…Wars of the future will be fought and won on the strength of technology and India cannot afford to be oblivious to the external threats it is facing…The Indian history is replete with examples of lost wars and a complete refusal to learn from past mistakes…India has seen several revolutions, but it is yet to witness the much needed military revolution. It will continue to be seen that agreements with the United States on dual-use technology would be a major driving force in facilitating this "military revolution" [xvii].'

In the years subsequent to 2003, help from the United States would not only come in the form of trade agreements or by removing hurdles obstructing India's access to dual-use technology. A global economic realignment was already underway, providing India with a beneficial byproduct that would have direct bearing on India's ability to develop advanced military space technologies. The pending shift of the global economy would serve as a catalyst for a dramatic readjustment of the international space power balance that is in its infancy today.

For nations such as India that will soon possess the relative wealth, infrastructure and knowledge to develop space warfare technologies, their ability to succeed will only require the will to do so. Under Kalam's five-year term as president, beginning in 2002, this resolve to militarize space became undeniable. Today his vision is aided by the fact

that the "brain drain" that hampered the Indian space program in decades' past is beginning to weigh on it less. The stagnancy of foreign economies that resulted in a flood of scientific minds to the United States is slowly ebbing as many are now returning home to profitable jobs in booming defense and space industries. Consequently, not only is the U.S. already voluntarily providing technology to India for commerce and strategically based interests, but soon this process will be catapulted even further along via unauthorized technology transfers from foreign nationals working and studying in the United States and then returning home to work in India's defense industry[xviii].

In July of 2003 the U.S.-India High Technology Cooperation Group (HTCG) convened in Washington, D.C., to discuss impediments to the creation of conditions that are more conducive to a robust trade climate between the United States and India in regard to high technology. Issues discussed surrounded "market access, tariff and non-tariff barriers, and export controls." The forum also included sessions on establishing partnerships related to "information technology, defense technology, life sciences, and nanotechnology sectors." What is most critical to note in regard to tracking the development of military space systems is the transfer of information technologies specifically related advanced computing systems and nanotechnology.

Nanotechnology innovations in the field of lithography and multi-gate processing, such as double- and tri-gate transistors, will enable dramatic increases in processing speed and efficiency when compared to the traditional and increasingly more archaic silicon chip. Additional advances in nanotechnology, specifically pertaining to carbon nanotubes and nanomaterials, will in the coming years begin to radically enhance not only traditional military space systems, but a whole new spectrum of miniaturized

military technologies. New nanomaterials with revolutionary abilities will provide thermal protection, structural integrity improvements, and power-generation abilities to satellites and other critical space assets. Due to the inherent and unique properties of these materials, widespread application to the structural and electronic components of space systems is inevitable.

Nanoscale applications working alone and in concert with A.I. will begin to move from the laboratories of the world into the theaters of war. Just as A.I. systems are in the coming decades being wholly integrated into military decision-making processes such as allowing satellites to deter attacks autonomously, in complementary fashion, nanotechnology will provide the fabric for military space development. Such an observation flies in the face of claims made by both Indian and American officials who stress that by enhancing commerce and technology transfers related to emerging dual-use technologies we can achieve a greater sense of peace and prosperity; that is unless one subscribes to Kalam's vision of a peace that is achieved through military strength.

Evidence of advanced arms racing continued to be common in 2003, such as in October when Air Chief Marshal S. Krishnaswamy, then chief of the Indian Air Force, announced that work had started on an establishing a command structure that could work towards the development a weapons platform in space. Krishnaswamy stated that "Any country on the fringe of space technology like India has to work towards such a command as advanced countries are already moving towards laser weapon platforms in space and killer satellites.[xix]" This might be viewed as a possible reference to unsubstantiated rumors that China was in possession of killer or parasitic microsatellites. Increasingly, rhetoric surrounding China's diabolical space warfare plans was being cited

as a reason for India to take an increased initiative to deploy military space systems[xx]. Krishnaswamy confirmed that India was in fact working to develop space warfare technology when he suggested that such futuristic military space technologies were no longer far from India's reach, stating, "IAF has started work on conceptualising such weapons systems and its operational command system.[xxi]" Within days of making these statements it was reported that India's civilian leaders forced Krishnaswamy to retract his words[xxii]. However, when held in light of the multitude of similar statements made by members of India's military and government, it is difficult to see this act as anything more than merely symbolic.

In analyzing the changing tenor of relations between the U.S. and India, it is critical to note the sense of competition and insecurity that is felt by India as a result of advancements by regional rivals such as Pakistan and China. As with other technologies that serve to undermine China's economic ascent, dual-use nanotechnology, for example, is one that the United States is tremendously eager to share with India, particularly through broad collaborations between military scientists and universities. China's focus on the vast, multidisciplinary field of nanotechnology is equally ambitious. It was reported in October of 2003 that patent application cases concerning nanotechnology have grown rapidly in China over recent years, with the total number following the United States and Japan to take the world's third place. It was also reported that the Chinese Ministry of Science and Technology (MST) in the entire decade prior to 2001 filed less than 1,000 applications for nanotechnology patents. By 2004 China had become the owner of 12 percent of the world's total nanotechnology patents, holding a total of more than 2,400[xxiii].

In September of 2004 the United States Department of Commerce's Bureau of Industry and Commerce continued its pursuit to involve India as much as possible in collaborations with the U.S. in order to facilitate increased trade in dual-use technology by forming the U.S.-India Next Steps in Strategic Partnership (NSSP). This venture would herald significant and heated debates between the arms control community, democratic leaders, and the Bush Administration. The Mission of the NSSP was to put forward "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 bullet points within the document included: "Removing the Indian Space Research Organization (ISRO) Headquarters, Bangalore from the Department of Commerce Entity List, which will permit many dual-use items to be exported to ISRO Headquarters without an export license. The removal of ISRO Headquarters from the Entity List will facilitate U.S. exports to India's civilian space program and encourage U.S. investment in the peaceful uses of space." This was just another in what is a long running series of U.S. Commerce Department references to "peaceful" technology applications – references that would be continuously and almost simultaneously contradicted by numerous officials within India's defense establishment.

It was also stated within the announcement the U.S. intent to:

'remove licensing requirements for low-level dual-use items (known as EAR99 and XX999 items) exported to ISRO subordinate entities that are on the Entity List. This change in licensing policy is expected to reduce the number of applications submitted for exports to ISRO subordinate entities by approximately 75-85 percent and reduce the total number of applications for all dual-use exports

to India by approximately 20-25 percent. This would be done as a complement to efforts such as applying a 'presumption of approval' policy for all dual-use items not controlled by the Nuclear Suppliers Group (NSG), if intended for export to the "balance-of-plant" portion of an Indian nuclear facility subject to International Atomic Energy Agency (IAEA) safeguards. Permitting the export of all U.S.-origin items not controlled by the NSG to the "balance of plant" portion of safeguarded facilities will expand the scope of civilian nuclear cooperation between the United States and India.[xxiv]'

Such evidence of a rapid leap by the west to embrace India was ubiquitous in 2004. On one single day in October, the Indian Embassy released a thread of news articles on their web site, The India Digest, indicating this trend. For example, in an article titled "Europe opens doors to Indian researchers," it is stated that, "faced with an acute shortage of research scholars in pure and applied sciences, European countries are increasingly looking to India, with one of the largest pools of scientists in the world, to fill the gap." In reverse of the trend on European work permits that followed India's multiple nuclear tests, the article reveals that "Britain, Italy and the Netherlands have already indicated they are throwing open their doors to Indian researchers by dropping the requirement of work permits. Germany is expected to follow." The Indian Embassy added that "Demographic reasons apart, the emphasis on business and economy in the European Union countries has resulted in a steep dwindling of scholars engaged in pure and applied research." An emphasis within this article is placed upon nanotechnology[xxv].

In an article titled "Lifting of U.S. curbs will triple imports: ISRO," the Indian Embassy announced that the lifting of sanctions by the U.S. "would enable it (The Indian

Space Research Organisation) to double or triple the import of critical equipment from American firms."[xxvi] Should these technologies strictly be used for peaceful space programs this would be good news for the entire nation of India and its international collaborators, as rising tides would undoubtedly raise all boats. ISRO chairman G. Madhavan Nair was quoted in the piece as saying that "We welcome the U.S. decision to lift sanctions against all the remaining ISRO units. This will make us import hi-tech equipment required for our space projects, including applications from American firms, with greater vigour." This quote is followed by the Embassy adding that "The U.S. department decided to take ISRO units and the Department of Atomic Energy off the entities list on the eve of Prime Minister Manmohan Singh's visit to New York to take forward the Next Steps in Strategic Partnership (NSSP) between the two countries. The U.S. sanctions were imposed following India's nuclear tests in May 1998. This led to the ban on imports of hi-tech equipment by Indian space and defence establishments." Disturbingly, also on the Embassy's news thread that day was an article titled "Time not right to sign NPT: Manmohan Singh."

Further down the thread is an article that mentions the meeting between India and U.S. on October 11 that reviewed "the progress of their growing relations in high-technology cooperation, including in the field of nuclear and space programmes," while also reporting that "the exports of 'dual-use technology' equipment had risen from $26 million in 2002 to $90 million as of July 31 in 2004." Later in the article, then-President Kalam makes references to India's dual-use efforts related to nanotechnology, stating that "The advancements made in material science and technology gave the impetus for both nuclear and biological ages to flourish. We are today at the convergence of nano, bio and

information technologies." He goes on to say that India must continue to acquire technologies related to space and missiles[xxvii].

In February 2005, former Air Chief Marshal of India's Air Force Yashwant Tipnis outlined his vision for the IAF in an analysis titled "Indian Air Force 2020 Perspective Planning - An Essential Requirement." In it Tipnis states that "In both its acquisition and denial forms, space will have a determining influence on the battlefields of land, sea, air and space. [xxviii]" In 2005, as many nations were more openly coming to this realization, the arms control community was beginning to also see an unprecedented dilemma on the horizon in the overlap between peaceful commercial technologies and tools of warfare developed via multi-tiered partnerships. Whether this was the strategy of warplanners or merely a coincidence delivered via technological evolution, it presented to the concerned citizen and policy maker an inability to object to space technologies that could facilitate destructive acts of war. This was because the act of objecting to these emerging technologies that support space warfare applications would be, in many cases, to disagree with the development of technologies that could benefit mankind. This will continue to be the case at least as long as we do not have treaties and an international legal regime in place that differentiates between commercial and military space technology. Such a dynamic is worsened by nations racing forward to facilitate dual-use technology transfers for strategic and economic benefits, while ignoring a partner nation's proclivity towards sharing technologies with questionable nations—such as in the case of India, which has lent its support to Iran on multiple occasions.

In April of 2005 the Acting Under Secretary Peter Lichtenbaum of the Department of Commerce at the 8th National Forum on Export Controls stated:

‘As much as we favor expanding trade with China, we will not knowingly approve any export that will help China modernize its military capabilities. We continue to support the arms embargo and have urged our European allies to do likewise. We will also require a license for all exports that an exporter knows could materially assist the Chinese military. We will review any application that supports the advancement of Chinese military capabilities under a general policy of denial. We will encourage our allies to adopt similar positions. We also 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. [xxix]’

The ratcheting up of accusations that China poses the greatest threat to the space assets of India and the United States would grow with the release of a number of U.S. military- sponsored analyses citing the threat posed by the Chinese military space program. Lictenbaum added that:

‘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. We consider India our partner for most endeavors in the international arena and we are seeking to expand trade relations by a wide variety of means in a wide variety of commodities and technologies, including defense trade. Toward

this end, we have been working diligently with India to narrow the scope of our disagreements and expand areas of mutual cooperation.'

At the same time India also began to voice fears that China could hypothetically attack a constellation of high-resolution satellites that had been under development for tactical military applications since 1999 when security loopholes had failed to prevent the entry of Pakistani terrorists into India during the Kargil attacks. When fully deployed, this constellation would serve a multitude of vital purposes including surveillance of potential threats originating in the region of Kashmir, as well as applications for disaster management and other civil uses.

India cited this proposed threat to their satellites as the reason to pursue technologies to defend their space assets based both in space and terrestrially. The recommendation for this constellation was included in a 2000 report by K. Subrahmanyam, who was previously a member of India's National Security Council. Two of these satellites would be built by the Indian Space Research Organisation (ISRO) India's civilian space organization. The first satellite named Cartosat-1, which was launched in May of 2005, has a resolution of 2.5 meters. The next satellite in the series would be named the Cartosat-2 which would deliver 1-meter-resolution. Another surveillance satellite named the Risat microwave remote sensing satellite would also in the coming years be deployed and was described as having an ability to capture images through dust and darkness[xxx]. What is also noteworthy about the constellation is that the United States intelligence service would later lease imaging capabilities from the Cartosat-2 in order to provide the United States with complementary and overlapping

intelligence gathering abilities in the region in support of its war on terror and in response to other regional threats.

In the summer of 2005 India's then-Minister of Defence Pranab Mukherjee and then-U.S. Secretary of Defense Donald Rumsfeld met in Washington, DC, to discuss the New Framework for The U.S.-India Defense Relationship. The overall mission of this initiative was to transform the India/U.S relationship to reflect both nations' common principles and shared national interests. In keeping with the military and defense oriented theme, various bullet points throughout the paper suggested the improbability that discussions about transfer of technology would be limited those surrounding peaceful commercial applications, such as for India's space program. For example, Article 3 stated that: "The U.S.-India defense relationship derives from a common belief in freedom, democracy, and the rule of law, and 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." Obvious contradictions arise when India's claimed interest in promoting stability, preventing terrorism, and combating proliferation is viewed within the context that India even in 2009 has yet to sign onto the Proliferation Security Initiative to combat the proliferation of weapons of mass destruction, nor the Non-Proliferation Treaty, while at the same time India is pursuing weapons technologies that are certain to lead to arms racing with regional rival China, thus undermining regional stability[xxxi].

In July of 2005, as news about China's military space program was growing in frequency and increasingly being seen as an instigator for the military space efforts of the United States and India, the U.S. Department of Defense released its Annual Report to Congress on The Military Power of the People's Republic of China. This report by the DoD referred to China's pursuit of Anti-Satellite Weapons (ASATs) stating that:

> 'China is working on, and plans to field, ASAT systems. Beijing has and will continue to enhance its satellite tracking and identification network – the first step in establishing a credible ASAT 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, and consequences from use of nuclear weapons. China is also conducting research to develop ground-based laser ASAT weapons. 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.'

Such reports would continue to be cited by India as evidence of a threat to its national security and safety of its commercial and military space assets[xxxii]. The Report also mentions, though briefly, that some "People Liberation Army theorists are aware of the electromagnetic effects of using a high-altitude nuclear burst to generate high-altitude electromagnetic pulse (HEMP), and might consider using HEMP as an unconventional attack, believing the United States and other nations would not interpret it as a use of force and as crossing the nuclear threshold." As a follow up to the Report of the Commission to Assess the Threat from EMP[xxxiii] released in 2004, many nations such as the United States and India were designing satellites with the EMP threat—probable or

not—in mind. India in particular would in the coming years begin to explore advanced nanomaterials as a means to shield against the effects of EMP and electromagnetic interference (EMI).

The same month that the DoD released its report on Chinese military space efforts, India and the United States also again held talks on enhancing bilateral high-technology trade with the word "peace" serving as a constant. For example, a joint statement by both countries reiterated the partnership's call for "enhanced U.S.-India cooperation on the peaceful uses of space technology." It also called for "closer ties in space exploration, satellite navigation and launch, and in the commercial space arena." However, collaboration in space technology, specifically launch technology, warrants a second look when one also considers reports to Congress in 2006 that "India's space-launch vehicle technology was obtained largely from foreign sources, including the United States, and forms the basis of its medium-range Agni ballistic missile booster, as well as its suspected Surya intercontinental ballistic missile program.[xxxiv]"

On August 5 then-President Dr APJ Abdul Kalam, inaugurated the Advanced Simulation Centre at Research Centre Imarat (RCI) in Hyderabad. The RCI is a DRDO research laboratory with the aim to "be the leader in the development of guided Missile Systems for [India's] Armed Forces by developing the frontier Technologies, multi-disciplinary competence and Avant-garde Infrastructure leading to self-reliance." It is stated in RCI's brief mission statement that this vision would be achieved with the help of "collaboration with Academic Institutions & industry.[xxxv]" Kalam, in his ribbon-cutting speech, also placed emphasis upon the important role of MEMS and nanotechnology in the design and development of missile systems[xxxvi]

It was reported later on August 31 that the United States had removed six Indian space and nuclear facilities from the Department of Commerce's Entity List. The entities included:

> 'Department of Atomic Energy facilities at Tarapur, Rajasthan, and Kudankulam. Tarapur and Rajasthan are under International Atomic Energy Agency (IAEA) safeguards. Kudankulam 1 & 2 is under construction and will be placed under safeguards when completed. The Government of India and the IAEA have agreed that this facility will be subject to IAEA safeguards upon completion. The other three entities are Indian Space Research Organization (ISRO) subordinate entities, specifically, the ISRO Telemetry, Tracking and Command Network (ISTRAC), the ISRO Inertial Systems Unit (IISU), Thiruvananthapuram, and the Space Applications Center (SAC), Ahmedabad.'

It was suggested by USA Centers for Global Commercial & Investment Relations that Indian American community efforts had influenced then-President Bush and members of Congress to accelerate the removal of the above mentioned companies from the list. This action complemented one made just a day earlier by Matthew S. Borman, the Deputy Assistant Secretary for Export Administration of the Department of Commerce that authorized "the removal of license requirements for exports and re-exports of items controlled unilaterally by the United States for nuclear non-proliferation.[xxxvii]"

In October of 2005 the Indian Parliament enacted the Right to Information Act, created to address the demand of the Indian people for greater access to records of the Central Government and State Governments. However, various secrecy provisions were

built into the law. For example, in its Section 8, the government reaffirmed its lack of obligation to disclose to any citizen:

> 'information, disclosure of which would prejudicially affect the sovereignty and integrity of India, the security, strategic, scientific or economic interests of the State, relation with foreign State or lead to incitement of an offence… information including commercial confidence, trade secrets or intellectual property, the disclosure of which would harm the competitive position of a third party, unless the competent authority is satisfied that larger public interest warrants the disclosure of such information;'

Prior to the RTI Act, the first line of protection to Indian secrets and its technology was the Secrets Act of 1923, though the Secret Acts was more tailored towards spying. The chilling effect of the RTI can be seen anecdotally while researching India's military technologies in that openness in relation to scientific developments was effectively reduced through its role as an additional layer of bureaucracy. Take for instance this question posed to an Indian official who is involved in the RTI program at the government's National Informatics Centre: "Do you believe that the RTI in comparison to the Secrets Act more so prevents scientists from sharing information related to dual-use technology and military technology with other scientists internationally?" The answer provided was as follows: "Queries cannot be answered as per the provisions of the RTI Act."

Another contact who was a former military official in the IAF was able to explain the RTI in a more nuanced light when he wrote in an email:

‘To me, the RTI Act doesn't dilute the 1923 Act; nor does it supersede any previous legislation. The RTI Act merely fills a long-standing vacuum by providing a legislative lever for accessing information that the government cannot justify suppressing on the grounds of the national interest or national security. In the past, the government has not needed to cite the Official Secrets Act in order to deny access to information; it has merely ignored inconvenient requests for information. Now, the RTI does not allow it to ignore such requests. Information that would damage the national interest or national security by its release would still be covered by the Official Secrets Act; the RTI Act does not provide access to that. But now those seeking the release of such information can challenge, before the Information Commissioners, the government's decision to deny them such information. And the government will have to justify its decision. That having been said, Section 8 provides an easy excuse for the government.’

In its stricter and more comprehensive language, the RTI Act certainly seemed to breathe new life into the immunity the DRDO maintains in withholding information. This is hardly surprising when one considers the combination of circumstances that surrounds the work of the DRDO. On the one hand, they are dealing in frontier technologies and trying to mask the fact that they have so far achieved only limited success in developing those technologies. At the same time, they are fishing the international market for dual-use technologies that they can use to bridge many knowledge gaps.

Over the following years and into the open-ended future, the Chinese military space threat would be repeated again and again in the media and in one U.S. government-sponsored threat assessment after another. This anxiety over China gained momentum

with the publication of the Cox Report in 1999 and would be perpetuated with such releases as the National Intelligence Council Report entitled "Mapping the Global Future" (2004), the National Defense Strategy (2005), the Quadrennial Defense Review Report (2006) and the National Security Strategy (2006). These fears would effectively work to accelerate collaboration between India's peaceful space division ISRO and the military DRDO. At the same time, Indian security policy concerns were reprioritized placing the future threat to India's space systems from China nearly on par with the threat posed to India by terrorism.

This trend to fend itself against satellite attacks would only continue as India's financial and human investment in dual-use space technology would exponentially increase year after year up to the present day. Space programs such as the Cartosat series would frequently be considered sitting ducks to such an attack in the minds of Indian military officials. The Cartosat series of satellites play a valuable military role for not only India, but also for international customers such as the United States who would later rely on imaging derived from the satellite system to provide supplemental and overlapping coverage in support of military operations and the global war on terrorism. Business deals involving the marketing of ISRO's products are handled by Antrix Corporation Limited, thus revealing that a commercial space agency is selling imagery to militaries and intelligence services of foreign governments – essentially blurring the lines between commercial and military space systems. The Cartosat series of satellites are state the art "commercial" imaging satellites that provide imaging at a steep discount in comparison to the cost of traditional imaging options provided by other space imaging providers, such as the Ikonos. The Cartosat 2-A would be launched in April of 2008

aboard the PSLV in what would be a monumental accomplishment for ISRO as it placed 10 satellites into space in a single launch vehicle with the help of an ESPA ring-like stage. The Cartosat 2-A, unlike its two predecessors, is a dedicated military satellite and is the thirteenth satellite in the Indian Remote Sensing (IRS) satellite series. A fourth Cartosat, the Cartosat-3, is scheduled to be launched sometime in 2009.

While other nations in the years to come would consider retaliatory options such as the use of nuclear weapons as part of the range of possible deterrents and responses to a space systems attack, India does not officially have such an option due to a no first-use nuclear policy. Realizing that full-scale attacks on space systems could deliver catastrophic effects upon economies, societal functions, and military operations that would take decades to recover from, satellites and ground-based defensive options would increasingly become India's pursuit. The implication that these technologies might be utilized even within a limited act of space warfare opens up the potential for rapid conflict breakout and light-speed escalation scenarios–and even a spasm nuclear exchange within the fog of a military crisis in space.

However some in India would find a way to capitalize on the looming military space threat. Antrex, it has been noted, was making serious headway in 2006 especially regarding its constantly improving imaging quality and novel ability to deliver affordable imaging services. When such a business model is married to a launch services capability such as India's, it should be anticipated that there would be monetary aspirations. In January of 2006, ISRO chairman Madhavan Nair stated, "It will be a great opportunity for us if we can capture at least 10 percent of the launch business, worth $2 billion in the international market.[xxxviii]".It can be expected that revenues generated from such services

coupled with steady evolutions in Indian space vehicles could translate into improvements for the Indian ballistic missile fleet.

At this time ISRO's near full-spectrum partnership with the DRDO seemed to be indisputable. For example on January 24 ISRO Chairman G Madhavan Nair reportedly stated that the organization was planning to attach advanced hypersonic engines to its space launch vehicles to reduce the cost of placing payloads into orbit. Nair made the comments at an event titled "Technological Challenges in Hypersonic Systems and Reusable Launch Vehicles" organized by the DRDO. Nair also announced that ISRO and the DRDO would work together in the future to develop new technology in the field of space[xxxix]. Given the fact that various military pursuits incorporate hypersonic technology, dual-use questions beg to be asked.

That same month the US-India Business Council arranged for the most influential and largest defense-oriented delegation to travel to India to discuss the further advancement of dual-use technology dealing and to continue brokering the strategic partnership between the two nations. The delegation was headed by General (Rtd) Paul J Kern, who was at the time a senior counselor with former U.S. Defense Secretary William Cohen's Cohen Group. He was joined by four-star Admiral (Rtd) Walter Doran, then-vice president of Navy Accounts for Business Development at Raytheon, and former NASA astronaut Andrew Allen, then-vice president of International Fixed Wing Aircraft at Honeywell Defense & Space. The 31-member delegation represented 22 of the leading defense manufacturers in the U.S., and included besides Raytheon and Honeywell, Boeing, Lockheed, General Electric, Northrop Grumman, Pratt & Whitney, United Technologies Corporation, Bell Helicopter Textron, General Dynamics, MIC Industries,

BAE Systems Inc, L-3 Communications, ITT Defense International, Sikorsky Aircraft Corporation, Motorola Inc, and Emergent Bio-Solutions.[xl] Virtually all of the parties listed stood to benefit from the changes in export policies and the removal of sanctions that have resulted in billions of dollars in dual-use defense opportunities. Furthermore despite these activities thus far in 2006 many Indian diplomats were still claiming that their space program was peaceful. Accordingly, the U.S. Commerce Department would reiterate such claims regarding dual-use technology transfers, while continuing to remove even more hurdles that once prevented India from acquiring such technologies.

In early February of 2006 India's leading Defense Scientist M Natrajan referenced what was described in Indian press reports as "India's acute shortage of design engineers" that was "putting hurdles in the way of developing futuristic weapon platforms in the country." M Natrajan who was then lead Scientific Advisor to the Defense Minister stated that "As against the need for a minimum over [100,000] design engineers, we are making do with just 6,000 of them in the Defense Research and Development Organisation and this will come in the way of development of future missile and space weapons." Natrajan also reportedly noted that design engineers are critical to producing state-of-the-art weapons like submarines, electronic warfare systems, setting up networking of armed forces, and for forays into the frontiers of space and missile technology. Natrajan added: "There is no dearth of talent in India as our engineering institutions are churning out experts. But what the need is to orient the courses to roll out more design engineers, as this expertise is a must to forge ahead in warship, submarine, aircraft and space and satellite program." Natrajan's comments were made during a conference with the media at the Defense Expo '06, in New Delhi. Though

Natrajan acknowledged that DRDO, like other critical agencies, was facing a 10 percent exodus of scientists and engineers every year, he remarked that “this is not a brain-drain, as these engineers are moving to better pastures within the country," he added[xli].

On February 16 it was reported that the United States would be entering into a significant space agreement with India in a matter of weeks. This agreement would manifest itself during President Bush’s visit to New Delhi for talks that included the lifting of a ban on the sharing of space technology. On the prospect of the two countries signing a space cooperation deal that would allow India to launch commercial satellites that incorporate U.S. components, ISRO Chairman G. Madhavan stated, “From one satellite a year, if we could launch 2-3 satellites every year it would mean substantial growth.” He added, “We expect revenues from satellite launches and transponder services to at least double in two years.” The report also suggested that the deal would have a negative effect on China’s space exploration plans[xlii]. An increase in such opportunities for India’s dual-use space program was not solely being provided by the United States. Four days later it was announced that India and France had signed nine agreements related to technology transfers. Indian Prime Minister Manmohan Singh revealed that the agreements focused on defense-related issues such as cooperation in the fields of space, science, and nuclear technology[xliii].

On March 2 the India Foreign Ministry announced that the U.S. had decided to consider the removal of the remaining ISRO entities from the U.S. Department of Commerce’s Entity List. This would follow actions in 2004 and 2005 that included the removal of ISRO headquarters and three other ISRO subsidiaries from the US Department of Commerce Entity List. The stated purpose of this shift in policy was to

expand bilateral cooperation in the civil space[xliv]. The following day, at an event in New Delhi, then-President Bush stated that, "For many years, the United States and India were kept apart by the rivalries that divided the world. That's changed. Our two great democracies are now united by opportunities that can lift our people, and by threats that can bring down all our progress. 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.[xlv]" These rapid and sweeping amendments being made to U.S. Commerce Laws in the name of shared strategic interests followed many years of trade sanctions with India. Prior to this sudden revision, India had been a nation regarded as a major contributor to the proliferation of missile technology, as well as an unwavering rejecter of nearly every major arms control treaty ever known.

On March 20 it was announced that military officials appointed by the Indian military would be given liaison posts at the U.S. Strategic Command (Stratcom). The purpose of this move was to establish a more efficient and collaborative relationship between Stratcom and India's Strategic Forces Command (SFC). Stratcom oversees the U.S. missile defense system, military space assets, and nuclear forces, while the SFC is responsible for India's nuclear weapons. This concept was introduced nine months earlier in talks between then-U.S. Secretary for Defense Donald Rumsfeld and his Indian counterpart Pranab Mukherjee upon the signing of the new Indo-US defense framework. The plans for Indo-US defense cooperation came amidst American pressure on its European allies not to lift the arms embargo against China. [xlvi]"

In the summer of 2006 Indian Air Force Group Captain A.S. Bahal, in an analysis titled "Satellite Reconnaissance, ISR and Countermeasures," seemed to contradict

reactions about earlier reports, from authors such as Dr. V Siddhartha, that India's interest in space-based directed energy weapons was merely conceptual. Bahal actually recommended that "the development of the KALI (kinetic attack loitering interceptor) and DURGA (Directionally unrestricted ray gun) should be progressed to their logical conclusion." Bahal also suggested that "the growing technical competence of commercial space technology has bridged the gap between military and civilian space capabilities." His statements are testament to the fact that India's peaceful commercial directed energy technology research within its national laboratories effectively can and will serve as the destructive military technologies of the future. In regard to this point it is important to note that the many hurdles faced by directed energy weapons such as those relative to atmospheric challenges and adaptive optics do not exist in the vacuum of space. It is this ideal environment that could welcome the near-term deployment of a space-based laser should a spacefaring nation choose to do so—possibly inciting a global trend that would likely never be reversed.[xlvii]

There are many events that seem to defy a simple explanation regarding how a nation with a track record such as India's has managed to access dual-use technologies with destructive potential; perhaps most alarming of these technologies is nanotechnology. Even in 2009 the United Nations has yet to address in a serious fashion the oversight of nanotechnology, a multidisciplinary field of science about which environmental effects are relatively unknown, and through which there is the potential for innovations in military space and nuclear weapons technology. This brings us to what could be the most serious arms control dilemma facing the international community today: that the evolutionary nature and pace of emerging technologies have the potential

to render archaic bureaucratic institutions such as the United Nations if these technologies are not addressed effectively and immediately.

One does not have to dig deep to realize that some in the Indian military community had been considering the military applications of nanotechnology since at least 2006. In the Spring, while the U.S. Commerce Department was busy removing the barriers that prevented India's industries from access to these technologies, a report titled "Impact of Nanotechnology on Nuclear Weapons" was released in India's USI journal. Authored by Commodore S Kulshrestha , who was at the time of publication the Principal Director of India's Naval Armament Inspection, the article highlights the significant lead time that China possesses over India in the field of military-focused nanotechnology. The introduction states:

> 'In the middle of 1980s, the Chinese Academy of Sciences (CAS) and National Natural Science Foundation of China (NSFC) initiated support on the development of scanning probe microscopy (SPM) and other scientific issues at the nanometre scale (1987-1995). The Ministry of Science and Technology of China approved the "Climbing up" project and supported nanomaterial science for ten successive years from 1990 to 1999. Over 3,000 researchers contribute to the field…To date, more than 50 universities, 20 institutes of CAS and 300 enterprises are engaged in the research and development of nanoscience and nanotechnology. Several centres for research and development of nanoscience and technology have been established in CAS, Tsinghua University, Peking University, Nanjing University, East China University of Science and Technology, and others.'

The prospect of a regional rival devoting such a broad national focus on an area of science with relative success and the potential for military application would once more lay bare India's insecurities. Kulshrestha gave words to this ever-looming mindset when he commented that "considering the potential for military force multiplication offered by advanced nanotechnology, the dangerously unstable nature of a nano arms race and the foreseeable temptation to make a preemptive first strike, the emergence of China as a major player in the field should be a cause for concern." Kulshrestha follows up this statement with 12 paragraphs describing the potential for nanotechnology to deliver fourth-generation nuclear weapons, going into detail about the type of weapons that could be developed and their applications. Finally, the Commodore concludes:

> 'A thorough discussion of the potential of nanotechnology and microelectromechanical engineering in relation to the emergence of fourth-generation nuclear weapons, is, therefore, of utmost importance. It is likely that this discussion will be difficult, not just because of secrecy and other restrictions, but mainly because the military usefulness and usability of these weapons is likely to remain very high as long as precision-guided delivery systems dominate the battlefield. It is, therefore, important to realise that the technological hurdles that have to be overcome for laboratory scale thermonuclear explosions to be turned into weapons may be the only remaining significant barrier against the introduction and proliferation of fourth-generation nuclear weapons.'

From the Atoms for Peace program to the Pokhran Nuclear tests, to every other subsequent military space example, India's track record of taking peaceful technologies

and weaponizing them seemed in 2006 undeniable and unlikely to stop[xlviii].

In mid-July India's Prime Minister Manmohan Singh held talks with then Russian President Vladimir Putin, after the conclusion of the G-8 meeting. On the agenda were issues related to strengthening bi-lateral ties between the two nations with emphasis placed upon enhancing cooperation in the "fields of defence, space, atomic energy, oil and gas.[xlix]" Two days later the former chief of a Hindu nationalist organization articulated what had been a mounting assessment of Western motives for many actions in the region, noting for example U.S. fears that missiles capable of striking targets 12,000 kms away were in China's possession. "We must understand this game and not become a tool to be used against China," K S Sudarshan of the Rashtriya Swayamsevak Sangh (RSS) stated in an Indian media interview, adding that the best way for the U.S. to counter China would be to "control the entire geo-political space around India."[l] By 2006 many media reports coming out of India reflected an attitude that was attune to theories on U.S. intentions in the region that fall outside the sphere of anti-terrorism efforts. Also, it has been suggested by sources within India that not only are India's government and military leaders keen to this dynamic, but that there is a belief that its leaders are clever enough to prevent such exploitation from happening while India takes advantage of its newfound access to U.S. technologies. When the U.S.-India partnership is viewed from this perspective, the notion of a relationship built on genuine motives with common bonds and claims of democratic ideals seems merely a facade for what is no more than a trawling of each other's resources in pursuit of strategic interests.

Another potential Trojan horse might be found in the three-way partnership between the U.S., India, and Russia in pursuit of a manned moon mission combined with

precursor efforts to map and study the moon's geology. With each nation—and the world for that matter—facing a growing energy crisis, a race for the moon is underway not for the sake of exploration alone, but in pursuit of energy. In the years leading up to 2006, mentions of India's pursuit of the lunar Helium-03 Isotope, the holy grail of energy, had grown louder and more frequent within India's space community. Interestingly enough there are very few areas of India's emerging space technologies that are not in one way or another relative to this pursuit. On July 17 A. Sivathanu Pillai, Distinguished Scientist and Chief Controller (Research and Development) for the DRDO, supported this theory in a lecture titled "Setting new trends in aerospace" at the Park College of Engineering and Technology. Said Pillai: "We are now in the knowledge era but the nanotechnology age is coming. It will be a 'nano-bio-info' revolution." He then referred to future advancements that would be made in the field of super computing, materials sciences, and in aerospace. Pillai said that the aircraft of the future would be able to "fly like birds" using "morphing airframes". In the same breath, he predicted that space tourism would become common and unmanned combat aerial vehicles would enhance India's defenses—yet another reflection of the inherent dual-usage of nanotechnology. He went on to state that India is on its way to becoming a leading space power along with the United States, Russia, and China and others. In the course of the speech, Pillai also made mention of the Chandrayaan-1, India's moon mission that focuses on reaping the benefits of resources in space. He even went as far as describing a factory on the Moon that could manufacture hydrogen and helium for energy[li].

On January 11 China shot down its own Fengyun 1-C satellite, and, as alarming as it was, it would once and for all settle the ongoing arguments over whether China's

PLA was working toward the development and deployment of space weapons. Casting aside the frequently debated question of if the China space weaponization efforts were true, parties within the intelligence, military and defense industries in India and the United States seized upon the moment to justify their own military space pursuits. The fact that anyone was surprised that China could accomplish such a feat is unusual since this was a capability that China and other nations had possessed for many years. This was due to widespread technology exchanges pertaining to space launch systems and the proliferation of long-range ballistic missile technology, coupled with the widespread availability of commercial launch services and further exacerbated by the abundance of open-source information related to satellite orbits and locations.

In response to China's ASAT test, India's Air Chief Marshall S. P. Tyagi stated that India was planning to establish an aerospace command "to protect the country's space-based assets."[lii]. That same month on January 21 M. Natarajan, scientific advisor to India's defense minister stated that it was an area of concern that missiles could "disable" satellites, specifically those with commercial and dual-use applications such as GPS/navigation and military functions. Natarajan added that "We are looking into it. We will make our own assessment (to see) what steps we need to initiate in this direction." The Press Trust of India also quoted Natarajan telling reporters in Bangalore that the test is "definitely a concern for all countries with satellite capabilities…Satellites, after all, form an important part of communications, command, control and intelligence systems.[liii],,

Though India has suggested on many occasions that it is considering and even working towards developing the means to protect its satellites, it is important to note that

satellites with such a capability have an inherent ability to perform dual-use functions that at times overlap with offensive anti-satellite functions. Missiles are not the only method to disable a satellite or prevent an attack. Less conspicuous methods exist, such as rendezvous and interdiction activities that draw a fine line between offensive, defensive, and peaceful commercial functions. These advanced systems are in many cases complemented by elaborate suites of countermeasures including: 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 DE systems, jamming devices, electronic warfare (EW), high-powered microwave (HPM), RF, EMP, and electromagnetic interference (EMI), and various other methods to duplicate natural phenomenon. Countermeasure options also include thermal effects, foils, lures, methods to compromise sensors, crosslink/uplink/downlink transmission sabotage or interference, and, lastly, defense by an accompanying host/surrogate satellite or an independent escort/defense satellite. Such countermeasures could be employed to defend against attack or, in an offensive capacity, impose the 5Ds upon a rival satellite.

On January 26 India's Prime Minister Manmohan Singh and Russian President Vladimir Putin stated publicly in a joint press conference that their respective nations were against the weaponization of space. Singh declared that "our position is similar in that we are not in favor of the weaponisation of outer space." Putin stated that "What's more, in military circles in the US, we hear plans about attempting to militarise outer space. We should not let the genie out of the bottle. This is our position." He also added that, China was "not the first country to hold such tests.[liv]"

These comments were in stark contrast to the statements being made at the same time by various scientists in the military laboratories and military officials in India. For example, the Indian Air Force (IAF) chief Shashi Tyagi stated on January 25. "As the reach of our air force is expanding, it has become extremely important that we exploit space, and for it you need space assets." Tyagi reiterated the call for India to establish a military space presence and even took the topic one step further by explaining the process by which India had been establishing an aerospace defense command "to exploit outer space." This was confirmed by the Press Trust of India (PTI) when Tyagi told reporters: "As the reach of our air force is expanding, it has become extremely important that we exploit space, and for it you need space assets…We are an aerospace power having trans-oceanic reach and we have started training a core group of people for the aerospace command." Lending further credence to reports that the Indian military might be collaborating with the peaceful and commercial ISRO, Tyagi said that the IAF would seek civilian help for the military space asset project. He added, "We will take help of ISRO (Indian Space Research Organisation) for the aerospace command but it will have distinct features as it is a military command.[lv]"

On February 5 India then cautioned that space could become the battleground for a new arms race. The comments were made by Defence Minister A.K Antony, who also called for ideas and concepts for an international non-proliferation regime – despite the fact that India has yet to even sign the nonproliferation treaty. Antony also acknowledged claims of obscured dual-usage when he noted that "It may be difficult to demarcate distinctly between peaceful and military uses. However, we have always advocated peaceful use of technology. Thus, we are of the view that weaponisation of space must be

discouraged." That same day Chairman of Indian Space Research Organisation G Madhavan Nair committed to the use of outer space for peaceful purposes only. Asked if India has the capability to conduct such a test, he said: "Why not? Any of our rockets can reach that altitude without any problem.[lvi], [lvii]," But he was also sure to categorically deny that India has any intention of undertaking such an exercise. A week later, in an attempt to reassure the international community and regional rival India, China's Foreign Minister Li Zhaoxing testified to External Affairs Minister Pranab Mukherjee that the January 11 ASAT test was not directed against any country, but rather it was a technological and scientific enterprise[lviii].

Meanwhile efforts were still underway to relax U.S. commerce laws regarding India. In February Secretary of Commerce Carlos Gutierrez promoted its "Trusted Customer" program by stating that "it will greatly facilitate high-tech trade. For some controlled dual-use high-tech products, no export licenses will be required. Customers who qualify for this program will have access to U.S. high technology products in a faster, more efficient, and more transparent manner.[lix]" That same day it was reported on the Commerce Department website that U .S. Commerce Deputy Secretary David A. Sampson stated in a speech at the Fifth U.S.-India High Technology Cooperation Group, that "First, it is focused on key industries that have been hurt by tariff and non-tariff barriers (including export controls) that limit innovation and hinder trade." Referring to the NSSP Sampson, went on:

> 'Thanks to the work of the HTCG, and the Next Steps in Strategic Partnership, India has had far greater access to U.S. technology as we have been able to change export controls on certain dual-use items. The results have been striking.

> In 1999, 24 percent of total U.S. exports to India required a Commerce license. Today, that number has plummeted to less than one percent. The average 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 a new atmosphere of trust and confidence that has allowed sweeping export control changes over the past five years.[lx],

Despite all of these efforts, some leading Indian officials such as then-President Kalam were still expressing that the United States and their allies were holding India back through efforts such as the NPT. Two days after the U.S. Department of Commerce expressed further loosening of export and commerce laws, Kalam declared that the nuclear non-proliferation treaty was discriminatory. This statement was made at the Defence Service Staff College. Kalam said that after the U.S. and its allies—separating out the Russians whom he referred to as "the Soviet Bloc"—had stockpiled nuclear, chemical and biological weapons, they then utilized international conventions and treaties in order to control their hoard. According to Kalam, the motive behind so-called technology denial and NPT and MCTR was to control the market forces and maintain domination. He even downplayed the potential for global nuclear disarmament when he said that "Despite the noise made against nuclear proliferation, the developed countries were not likely to reach the state of zero nuclear weapon under the NPT." Furthermore, Kalam reportedly predicted that in the next two decades, the major forces to guard against nuclear weapons attacks would be antiballistic missile defense systems followed by space systems and strategic military satellites. As far as technology control regimes were concerned, the only defense was through self-reliance in the critical technology

area.

Perhaps most disturbing in 2007 about the Indian president's blatant indifference to nonproliferation is that there was no indication that the Commerce department had even referred to Kalam's statements on the topic in its decision to grant India increased access to defense, space, and dual-use technologies[lxi]. On March 7 the Islamic Republic News Agency reported that "the supreme commander of the Indian armed forces visualized the IAF of 2025 to be based on scientific and technological competence in development of communication satellites, high precision resource mapping satellites, missile systems, unmanned supersonic aerial vehicles and electronic and communication systems." Kalam reportedly added that "this capability will enable the air force to succeed in electronically controlled warfare in the midst of space encounters, deep sea encounters and ballistic missiles encounters.[lxii]" On April 3, despite U.S. and Indian efforts to build a mutual trust, 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 American companies over several years. Suggesting that the Indian military was clearly involved in the conspiracy, the indictment also charges numerous private companies that were serving as agents for the Indian government to acquire weapons technology[lxiii].

Still in April the Bush Administration was again advocating for increased openness with India. Before the Computer & Communications Industry Association, Assistant Secretary of Commerce for Export Administration Christopher Padilla stated that:

'Another area where export controls must keep pace with change is India. President Bush has worked to transform America's relationship with the world's most populous democracy, creating a strategic partnership covering both political and economic exchanges. 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, after India tested a nuclear device, almost 25% 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% of U.S. exports are subject to individual license requirements.[lxiv]'

His remarks also highlighted a clear contrast between U.S. trade policies for China and India: on one hand a policy that supports a nation's strategic objective, while on the other one meant to hinder a nation's progress. In the same talk, Padilla told the audience:

'There are other aspects of China's growth that cause concerns, both in the United States and other countries. China is modernizing its nuclear forces, rapidly expanding its navy, deploying precision-strike weapons, developing sophisticated command and control networks, and recently tested an anti-satellite capability in space. It has reported double-digit real increases in defense spending for more than a decade, and its actual level of defense spending may be much higher. The United States sees more organized efforts to obtain and illegally export controlled U.S. technology to China than to any other country. The lack of transparency about this buildup heightens international anxieties about China's military intentions and capabilities. Consequently, America's export controls must support

our longstanding arms embargo and not allow exports that would make a direct and significant contribution to China's military.'

The seeming dichotomy that the U.S. had created for the two countries through its trade policies was called into question in June when Indian Prime Minister Manmohan Singh was prompted to express to Chinese President Hu Jintao at the G-8 in Germany that the United States, India, Japan, and Austrailia were in no way a military alliance against China. "We are not ganging up against anybody," Singh said, "there is enough space for everybody to coexist.[lxv]" His remarks were regarding the newly formed Quadrilateral Strategic Forum. However Hu Jintao's complaints over the U.S. variance in policy between the two nations seems to at least warrant consideration when held in light of the fact that India has violated the will of the international community with its nuclear tests, refused to sign onto various UN treaties, while simultaneously being one of the largest arms purchasers in the world.

Take for instance Atomic Energy Commission (AEC) Chairman Anil Kakodkar's statement on August 17 when he declared that no country, including the United States, can stop India from pursuing its independent nuclear program—strategic or civilian. These comments were made when speaking to reporters after inaugurating India's new Centre for Fundamental Research for Applicable Mathematics. Reports also cited Kakodkar's statement that "there was no clause banning any new nuclear test by India in the civil nuclear agreement between the country and the US." Such comments are comparable to any other defiant nuclear power in the world; the most significant difference seems to be that 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 PSI and never supported the U.S. in the war against Iraq, Kakodkar's remarks beg the question: What type of ally is India truly? Is our relationship merely the embodiment of the adage 'my enemy's enemy is my friend'? Kakodkar also spoke in a manner the likes of which would be expected from Ahmadinejad's Iran or Kim Jung Il's North Korea in stating the following: "India will not entertain any hindrance to its independent nuclear program. We are able to carry out our autonomous strategic nuclear program.[lxvi]" India's strategic nuclear policy, much like during the Pokhran nuclear tests, will yield for no one. This was true in 1998 and remains true to this day.

Reflecting a clear progression in India's success in acquiring foreign space and defense technology, France joined the United States by agreeing to provide India access to dual-use systems. It was reported on January 25 that although the two nations were in agreement on signing such an agreement, they were planning to wait for IAEA approval before moving forward with civilian nuclear cooperation activities. The announcement was made after talks were held between French President Nicolas Sarkozy and Prime Minister Manmohan Singh. India's Prime Minister stated that, "In the area of defence cooperation, we have agreed to go beyond a buyer-seller relationship." Adding that, "We will increasingly focus on joint R&D projects, transfer of technology, and greater military exchanges." Singh also stated that, "We have agreed to consolidate our multi-faceted cooperation in the areas of trade and investment, technology transfer, space, defence, civil nuclear energy, culture and education. The initiatives that we have taken reflect our mutual strengths and the growing potential of our countries to contribute to each other's development and national priorities.[lxvii]"

Much like India's relationship with other leading trading partners such as Israel, Russia, and the United States, defense-related trade with France represents a significant portion of the overall trade revenues. For instance in 2006-07 imports from France to India were worth $4.21 billion—twice that of Indian exports at $2.1 billion. The report stated that French exports to India such as aircraft and space industry products accounted for over half of the total exports at $2.3 billion. It was also reported that "India and France plan to double their 2006 trade figures in three years. With bilateral trade in 2006-07 recorded at $6.3 billion, it is expected that this target will be crossed easily.[lxviii]"

Space would continue to be a primary focus of India as well as a leading focal point of national pride. What would also continue are contradictions in statements made by the Indian Government and military regarding the relationship between the DRDO and ISRO. For example, on January 31 ISRO's Chairman G Madhavan Nair stated that, "For military purposes, there is the Defence Research and Development Organisation (DRDO), with which ISRO has no commonalities." Reports stated that Nair was previously, "Brushing off a question from the audience about military programmes.[lxix]"

In 2008 the attention placed upon military application of nanotechnology would continue to increase. DRDO chief controller Dr. W Selvamurthy stated in an interview on February 21 that DRDO "thrust areas include nanotechnology-based biosensors, laser-based detection for chemical clouds, self-contained inflatable NBC shelters and a 'model' hospital to handle NBC victims." He also referred to other applications as well such as "smart vests, impregnated with silver nano particles, for decontamination of biological agents and monitoring of vital signs." Also, "NBC suits, with thermo-electric cooling.[lxx]" The pursuit of such applications is not a cause for alarm in and of itself and is

representative of the numerous military and commercial uses of this multidisciplinary field; standing in stark contrast, however, are nanotechnology-based warfare applications such as enhancements to nuclear weapons. Additionally, micro-electro-mechanical systems (MEMS) and micro-opto-electro-mechanical systems (MOEMS) will in the years ahead lead to further improvements in sensors, such as Attitude Determination and Control (ADCS) and other components, such as actuators.

More ominous was a statement made by former President Kalam on February 23 that India was capable of intercepting and destroying any foreign object that posed a threat to the nation at an altitude up to 200km. He said this capability was helped in part by "very high" technological advances in the fields of guidance, computer processing, and avionics–all areas where nanotechnology will have a significant impact in the coming years. These comments were made at conference on avionics systems that was held in India. Kalam made clear India's asset defense capability when he added that, "We definitely have the capability of intercepting foreign objects in defensive action." There can be little doubt that such a capability to destroy a threat to a space asset at 200km also has the potential to serve as an ASAT capability. Kalam cited India's successful tests of its missile defense system and Akash systems in exo and endo-atmospheric configurations in proving that "we have reliable technology and capability of interceptor missiles." References were also made by Kalam to India's progress in the areas of guidance systems, electronic countermeasures, and miniaturization of missiles. Emphasis was placed upon miniaturization for easy carriage of missiles aboard aircraft. India's capability was further confirmed by V.K. Saraswat, DRDO Chief Controller of Research and Development on Missiles and Strategic Systems, when he noted that the country had

the technology to detect the "coming and dangerous" objects. Said Saraswat: "We have the technological strength to obstruct and destroy them.[lxxi],[lxxii]"

On February 29 the U.S. and India decided to address enhancing cooperation between the two countries in the areas of "nanotechnology, biotechnology and information technology through enhanced transfers." The Indian delegation was headed up by Foreign Secretary Shiv Shankar Menon while the U.S delegation was lead by then-Under Secretary of Commerce Mario Mancuso. In a joint statement issued after the meeting it was stated that "in the area of defence, the two nations agreed on an ambitious plan to give an impetus to high technology transfers and trade that would address all issues related to licensing." Furthermore the statement said that "The plan would also address issues related to implementation of India's defence offsets policy, encouraging collaborations at all levels, including small and medium enterprises.[lxxiii]"

On March 16 A. Sivathanu Pillai, Chief Executive Officer and Managing Director of Brahmos Aerospace in New Delhi, in delivering the convocation address at the Karpagam College of Engineering, spoke enthusiastically about how the convergence of information and communication technology with nanotechnology had given rise to new concepts such as integrated silicon electronics and photonics. He also noted that "Intelligent Bioscience" was yet another emerging area. Elaborating on nanotechnology and its impact on human life, Pillai said it could offer solutions to problems in healthcare, energy, water, and defense. He also predicted the country would see the emergence of micro-electromechanical systems (MEMS), and that the combination of nanosystems, nanoelectronics, and nanomaterials would lead to a revolution in nanotechnology[lxxiv].

During the Anniversary of the Pokhran-II nuclear test on May 13, Prime Minister

Singh told DRDO scientists that they must focus harder on emerging technologies such as hypersonic propulsion, robotics, stealth, smart materials, nanotechnology and unmanned air, land and underwater vehicles[lxxv]. Actions such as the development of underwater vehicles may once again suggest that India's military research and development efforts are driven by a supposed need to counter threatening military developments by China, such as the reported development of an underground submarine base in the area of Hainan Island[lxxvi]. This is seen as a threat by India's military as it signals efforts by China to move in closer to India's backyard. Naval Chief Admiral Sureesh Mehta had admitted that the development of an underground submarine base was a "cause for security concerns'' in an Indian media report on May 6. The Economic Times offered the following analysis: "The Indian establishment has always publicly sought to downplay the China threat, so this admission by the Navy chief himself indicates that China's military expansionist plans have struck a deep chord of unease in the security and military establishment." The Indian head of the Navy was also quoted as saying, "It is not the nuclear submarine bases that matter, we are concerned over the number of nuclear submarines that are being built in our neighbourhood." Though he added that the nuclear sub base was not the only concern, "Underground or overground nuclear submarines bases don't matter. What is of concern is the number of nuclear submarines that are being built.[lxxvii]"

Like the United States, Russia, and China, India has been conducting military research into lasers for decades. In the case of India, this research has been ongoing since 1950 in the Laser Science and Technology Centre (LASTEC) at DRDO. Another DRDO research center focusing its attention on lasers is the Raja Ramana Centre for Advanced

Technology (RRCAT). Today LASTEC's primary focus is to deliver directed energy weapons systems to the military. LASTEC is under the leadership of Dr. Anil Kumar, who delivered a prominent talk on laser weapons at DRDO's Golden Jubilee in 2008.[lxxviii] The transformational warfighting advantage provided by directed energy weapons is just one component of an overarching military technology portfolio designed to lead India's fighting forces into the future. On May 29 India's Business Standard reported that the DRDO and India's Integrated Defence Staff divided the 100 most important technologies they need into three different categories:

> -Category 1. Technologies that the DRDO will develop in-house. These are strategic technologies and systems, such as missiles, hypersonics, and unmanned fighter aircraft, which no country usually provides to another.
> -Category 2. Technologies that the DRDO will develop in partnership with academic institutions. The CSIR, IITs, and universities will assist the DRDO with fundamental research, to overcome the DRDO's shortages of manpower and facilities.
> -Category 3. Technologies that the DRDO will develop with foreign partners, since they are beyond the capabilities of the country's existing scientific base[lxxix].

Many of these technologies mentioned above have received increased attention as a result of perceived military space threats by China. On June 17 Geeta Varadan, ISRO's Programme Director, suggested at an event that focused on India's military applications in space that India was preparing a response to China's anti-satellite missile. Varadan stated that, "The first is a geo-stationary satellite that we are trying to put up (to keep a

lookout for probable missiles) and we are also setting up a ground station to monitor any object coming close to our satellites so that we can move our satellites out of harm's way." In contrast to Varadan's claims of stopping short at militarization efforts in space, IDS chief Lt General Hardev Lidder, who attended that same meeting, stated that "we may get sucked into the inevitable military race of space-based applications in warfare and protection of space assets.[lxxx]"

Speaking about the current and future state of U.S.-Indian trade, U.S. Consul General Michael Owen explained in Mumbai on July 3 to reporters that there has been success between India and the U.S. and that their trade partnership was not being undermined by China. Owen stated that there is "no doubt Sino-Indian trade is growing fast. Nonetheless Indo-US trade has more than doubled from $20 billion to $42 billion in the last three years…Our next target is to take to $100 billion." Owen cited defense trade between the two nations as an influence upon this trend. This is reflective of India's partnerships with Russia, France, and Israel, whose defense-heavy trade relationships are having similar results[lxxxi].

Despite so many efforts by the U.S. to remove barriers to India's ability to acquire technologies, Indian officials continued in 2008 to refer to the U.S. as a stifling force to its military and economic progress. On September 10 it was reported that scientists at the DRDO and ISRO expressed their belief that the "Nuclear Suppliers Group waiver will not only address the country's energy needs but also help in getting critical technologies in diverse areas which have been denied for decades." The report stated that India believes the nuclear energy waiver granted to them would result in an increased flow of emerging and advanced dual-use technologies with military and commercial applications.

DRDO's Chief Controller of Research and Development W Selvamurthy said the strategic partnership with the United States would lead to the U.S. sharing with India technologies that were for nearly three decades made unavailable to India. Selvamurthy stated, "I think the strategic partnership with the US will result in an environment which will encourage them to share with us critical technologies whether they are in the civilian or military domain." He added, "when the denial regime is lifted in one sector it will have ripple effect in other sectors." Minister of State for Defense M M Pallam Raju remarked, "Access to dual use technology will definitely accelerate all the programs in space, defense and other scientific areas. Even the private sector will benefit from it."[lxxxii]" Raju's comments echoed a point made a few weeks earlier in a keynote address to the IAF by Indian Air Force Chief Marshal FH Major in which he stated: "India has an increasing role in world affairs, and in keeping with that, the Indian Air Force is in the midst of an exciting transformation. No nation can be a major power without a high level of technological capability and a capacity to meet basic needs indigenously." He added, "the coming decades are full of challenges. The IAF seeks to statement exploit space, handle smart weapons, use information management tools and other cautionary technology.[lxxxiii]"

India's success in strengthening foreign collaborations on critical technologies continued into December when India and Russia together signed an agreement on civil nuclear cooperation. The pact also included defense, space, and some civilian areas and was described as an effort to take the nations' strategic partnership to a higher level. India's Prime Minister Singh and Russian President Dmitry Medvedev signed the agreement in New Delhi. Singh stated that "The signing of the agreement on civil nuclear

cooperation with Russia marks a new milestone in the history of our cooperation with Russia in the field of nuclear energy." In 2008 India continued to be a source of profit for nations through arms deals. Russia is a leading supplier of arms to India with representing about 70 percent of Indian military equipment and technology coming from Russia[lxxxiv].

Further evidence of a shift in the DRDO's threat perception away from terrorism is represented well on January 15 when it announced that it would have new missiles deployed as part of its BMD system. As part of its layered BMD system, Indian officials reported that Phase-I missiles would be capable of intercepting 2,000-km range missiles and would reportedly be ready for deployment by 2011 or 2012. Phase-II will look to thwart threats from missiles with ranges of up to 5,000 km. Asia Times Online also reported that given "DRDO's dubious achievements and delayed delivery record, observers agree that the involvement of international expertise would speed things up." This is not an uncommon scenario. India has historically supplemented its indigenous military technology capabilities with materials and know-how acquired from other nations, namely the United States, and this case would be no different. This system in particular reaped the benefits of U.S.-provided "computer simulations of at least two live missile launches." The news report also included the analysis that, "In the context of emerging threats from Pakistan and the changing strategic relations between India and the US, New Delhi has been looking to Washington to hasten its military achievements and capabilities. As part of its global efforts against terror, Washington has sought to involve India to strengthen its nuclear defense abilities and effectively neutralize threats from volatile states in the sub-continent, apart from the obvious business generated from such

big collaborations." A US Embassy official was also quoted as saying[lxxxv], "India is a partner of ours, and we want to provide it with whatever it needs to protect itself. This fits into the overall strategic partnership we are building."

Notably just one day later, former President Kalam stated that the DRDO needs to "specialize in what others can't give"[lxxxvi]. Fortunately for Kalam, today it seems there is no shortage of those who want to give, and India's appetite—and its relatively stable economy—shows no signs of waning. One has took look no further than the migratory patterns of leading defense contractors such as Lockheed Martin, General Dynamic, and others who are racing to India in order to reap war profits, while contributing to the destabilization of the region through the facilitation of advanced arms racing. On January 16 Kalam reportedly told an interviewer in a discussion on "increasing defense budgets and international conflicts" that "strength respects strength." He elaborated: "Some nations find nuclear power to be very important. And while it is all well to speak of diplomacy, we must develop our economic and defense strengths because they are the two key parameters that are respected in the international community. We are getting there." Kalam also stressed that "The key challenge ahead of the DRDO and other labs across the country is to stay ahead of time."

On January 23 DRDO Air Defense program Director V K Saraswat said that, "The building blocks of BMD such as the surveillance, tracking and battlefield management systems have been developed." He added that the DRDO has developed a very robust command and control system that can "survive and deliver" in any environment. "Our command, control and communication system can work in a networked form and survive and deliver even in a high electronic warfare (EW)

environment," he said. Saraswat provided evidence that India is striving for an indigenous development capability for missile defense system when it was reported that he said India was always open for cooperation in developing technologies for the program with friendly foreign countries, but said the country would "not buy" any ready-made BMD systems from any country[lxxxvii].

This increase in military projects that appear to be in response to a proposed threat by China, combined with the focus on terrorism seeming to take a back seat, begs the question: What were the original pretenses for the aforementioned dual-use technological trade agreements being signed with India in the first place? Had U.S. officials known back in 2001 that its approval of loosened trade practices would lead India to the potential initiation of an arms race with China, would the U.S. have allowed its longstanding export practices to be altered? While it is true that no one could have foreseen China's satellite shoot down years later, now that it has happened, has anyone within the U.S. government called for a reassessment of the U.S.-India dual-use trade agreements?

On January 29 it was reported that Indian Air Force chief Air Marshal FH Major definitively stated that efforts were well under way to make use of India's space assets for a variety of passive and active combat roles. The article stated that the IAF was fully conscious of the threat faced from "space and cyberspace." Around the same time, Indian Defense Minister AK Antony was frank in his reference to the threat faced against "Indian space assets" from increasing Chinese efforts in the field of "space militarization." Antony also questioned how long India can "remain committed to the policy of non-weaponization of space even as counter space systems are emerging in our

neighborhood" – again referring to China. At this same event Antony announced the formation of a new space division that would work with the Integrated Services Headquarters, serving to assist the Indian Defense Forces with a constellation of satellites that are operated by the Indian Space Research Organization (ISRO). This collaboration would also represent the first phase in the development of the long awaited aerospace command[lxxxviii].

The momentum being witnessed within India's government regarding an arms build up, increasing rhetoric about China being a military threat, and increases in military spending was only rivaled by the attention the U.S. defense contractors were beginning to pay to India. In a span of just three news days, examples of this profiteering abounded. On February 9 General Dynamics announced that it had opened a liaison office in New Delhi. Areas of focus included among numerous others, weapon systems, special-mission aircraft, and commercial space-related systems[lxxxix]. On February 10 the Wall Street Journal reported that Honeywell announced that it expected "annual revenue from India to almost double to $1 billion in the next three years.[xc]" Then on February 11 it was reported that India's Secretary for Defense Production Pradeep Kumar stated that the global economic downturn would not inhibit India's military enhancements. He reassured the global aerospace industry of the tremendous potential of India's capital, citing India's plans to purchase up to Rs1.4 trillion ($30 billion) on military hardware over the next five years[xci]. Six days later it was reported that the Indian government had made provisions that would result in a 35 percent increase in defense spending over the previous year. It was reported that the "substantial increase in allocation to the Defense sector spells good news for companies that provide products and services to the sector.[xcii]"

With booming profits and minimal oversight working in tandem, an increase in corruption and lobbying is also inevitable. On February 26 the Associated Press reported that Aerospace Industries Association of America Inc., which represents aviation and defense companies, spent $138,441 to lobby in the fourth quarter on funding for space programs, missile defense and other issues. The Arlington, Va.-based group, whose members include Boeing Co. and Lockheed Martin Corp., also lobbied on NASA funding, U.S.-China space exploration, aeronautics research and development, export controls, and helping India develop nuclear power.

Not everyone in Washington is turning a blind eye to the possible ramifications of India's activities. In April, after the chief executive of a U.S. electronics supply company and three other Indians employed in the firm were charged with shipping closely guarded U.S. computer technology to India for use in missiles and other weapon systems, Congressman Edward Markey signaled a stern warning in an official statement:

> 'If the Indian government has attempted to circumvent US 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 non-proliferation…India has also long touted its strong military and space-launch co-operation with Iran, which raises the possibility that the sensitive US missile technologies India has misappropriated may wind up benefiting Tehran…This would be absolutely unacceptable, and it would be treated as such by Congress.'[xciii]

We will continue to witness in the weeks and months ahead, the current U.S.-India strategic relationship was based on a short sighted strategy made by the failed Bush

Administration. These left-over policies will continue to contribute to the further deterioration of the security environment in Asia by increasing regional hostilities and fueling exponential growth in arms trading. Should these trends be allowed to continue by the Obama administration it will only be because we failed to learn from the lessons of the past recognize the dilemmas that stand clearly before us.

Many questions must be asked before this relationship is allowed to continue in its current form. Questions such as, are we again experiencing a nearly identical scenario to what took place with the Atoms for Peace project that began in 1953? The program that began with a peaceful atomic technology exchange agreement, which was terminated, though not before India used the peaceful technology provided to them by a trusting global community to develop its first atomic bomb?

We must ask ourselves: What has India done in the 35 years since its first nuclear test to earn the trust of the international community once again? Even more so, what has it done to earn the trust of the international community since sanctions were placed upon it again in 1998 for even more nuclear tests? When we analyze the lifting of sanctions against India and the loosening of export and commerce laws against it, can we trust that what we experienced with the Atoms for Peace Program will not repeat itself? In order to do so is to ignore many events that have taken place historically. At the same time, one must believe that the separate terrorist events that both nations suffered from are sufficient enough a cause to forget the past.

Additionally when these critical decisions are combined with a decreased transparency provided by the Indian military research organization, DRDO, which operates almost autonomously and without restriction, we have to wonder where our

technology will end up. Will America technology be used to promote piece, or will it end up on the battlefield to the detriment of citizens in the region? Compounding the negative effect of increased obscurity in the Indian military research complex is that progress within India's weapons technology industry is outpacing proliferation efforts, and is all too often contradicting the words coming from India's foreign services. This reflects the great divide between diplomats and the DRDO.

Despite claims by India's former President and scientific leader Dr. A.P.J Abdul Kalam that rising technological tides will lift all boats and will lead to better lives for all Indians, there can be no doubt that this argument is flawed. In an India rife with poverty and an archaic caste system, where only 1 percent of Indians work in high technology, the question must be asked: How do investments in military technology improve the common person's life? At the current pace, long before poverty is relieved, a dangerous arms race between China and India will begin. India is ultimately investing in a process that will contribute to the undermining its region's and its people's security, while ignoring the fundamental needs of its citizens.

India's arms trade is exploding year after year with international defense companies racing to exploit markets to the benefit of shareholders and the detriment of all Indians. This arms build-up is taking place in parallel to rampant poverty, substandard healthcare, increases in diseases such as HIV/AIDS, numerous environmental dilemmas, substandard sanitation, and dwindling natural resources. The peddlers of these dual-use technologies, such as the United States, are exploiting this situation. At the same time India is a state that is policed by an unreliable and disorganized internal security apparatus that has been neglected for far too long. It is noteworthy that India's security

threats do not come from China and do not require missile defense systems with a 5,000km range; India's greatest security threats originate from within and from regional terrorists groups. In recent years, India has experienced more casualties from acts of internal terrorism and insurgencies than from military conflicts with nation states. One does not have to look far into the past to find numerous examples of internal security failures such as those witnessed during the Mumbai attacks.

Moreover, at a time when India refuses to allow any foreign involvement in its internal and national security affairs, one cannot help but wonder if India is even a willing listener to its few critics on issues such as arms control and non-proliferation. Combine this with the recent nature of India's words and actions and India's historically and frequently blemished record on issues related to proliferation, transparency, and treaty abidance. When India's defiant positions toward international treaty regimes is added to the equation, India's access to dual-use technology demands an immediate reassessment. India has not signed onto the Proliferation Security Initiative (PSI), the Nuclear Non-Proliferation Treaty (NPT), the Comprehensive Test Ban Treaty (CTBT), the Fissile Materials Control Regime (FMCR), or the Missile Technology Control Regime (MTCR).

A U.S.-India relationship based upon a philosophy of "my enemy's enemy is my friend" is not enough reason to ignore the perils and pitfalls of this questionable partnership and its practices—a partnership crafted by and left over from the Bush Administration.

When considering the threat posed by emerging technologies and the future weapons of war, one might recall Harry Truman's words spoken in 1945 that "the release

of Atomic energy constitutes a new force too revolutionary to consider in the framework of old ideas." In the case of India, this quote could not be more evocative, and one has to go no further than India's own words before the United National Disarmament Commission in 1988 when it submitted its document titled "New Technologies and the Qualitative Arms Race" at the Third Special Session of the United Nations General Assembly devoted to disarmament. In it was stated:

> 'Reliable information on what is happening on the other side can remove a major reason for persisting with the qualitative refinement of arsenals on a unilateral basis-namely, the fear of being caught by surprise by technological breakthroughs by the adversary. Conversely, lack of such knowledge frequently leads to exaggerated productions based on 'worst case' assumptions and creates pressure for undertaking whatever the adversary might be presumed, at worst, to be doing.
>
> 'The Conference on Disarmament should also impress upon all member Governments that, whenever an emerging technology appears to have the potentiality of leading to the development of new weapons and new means of waging war, the details of such technologies should be given wide publicity.
>
> 'Unit in the Department for Disarmament Affairs: A unit should be established in the Department of Disarmament Affairs to monitor and study the implications of new technologies with potential military applications.
>
> 'Banning of technological missions clearly designed for developing new weapons.'

Perhaps India should take its own advice on these matters.

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