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Pragmatism in the Age of Satellite Imagery

As an intern in the Special Projects Division Nuclear Security Team at the National Consortium for the Study of Terrorism and Responses to Terrorism (START), I worked on the beginning stages of a project for the Domestic Nuclear Detection Office (DNDO) at the U.S. Department of Homeland Security to assess the security of nuclear research and power reactors in Western Europe. The team created a codebook with variables that we hope will capture the factors that will help in determining the security of these facilities and reactors against two types of threats. The first, physical direct attack with the intention of doing damage to the reactor, and the second, theft of material with the intention of acquiring radiological or nuclear (RN) material. The team compiled a list of variables ranging from the basic (location, corruption index, proximity to water, roads, shipping routes etc.) to some more complex, geographic variables (land ruggedness, forest cover, nature of barriers, number of roads, etc.). Detailed information was drawn from the International Atomic Energy Agency (IAEA)'s Power Reactor Information System (PRIS) database. Currently, the project deals only with Western Europe, but the team hopes that the project will expand in the future to include information on nuclear power and research reactors in other regions of the world.

The virtual geographical information program Google Earth provided crucial aid to the Nuclear Security Team for determining and analyzing physical and geographical variables. With a top down image of most nuclear facilities in the Western European region, the team was able to become more acquainted with the layout of each facility or reactor and its position in relation to

the surrounding area. When available, the Street View feature and user taken photos were especially helpful in confirming the security of roads, the nature of protective barriers, and other security features. Additionally, the availability of some 3D models of the sites that the team analyzed brought a greater level of depth to the understanding of those facilities. The open-content add on WikiMapia added further confirmation of physical and geographical features by imposing a layer of outlines for objects in Google Earth labeled by users of the program. In addition to Google Earth, the Nuclear Security Team made use Microsoft's Bing Maps because of its bird's-eye imagery capabilities that capture images from planes at 45°. These images can reveal a wealth of information that would otherwise be hidden from the top-down view of Google Earth in the absence of Street View or 3D Models. Satellite imagery has come a long way since the grainy photographs taken from the basic technology of the late 1950s. However, remarkable developments in satellite imagery have improved intelligence and analysis capabilities for both research and national security purposes, but the risks associated with the clarity and availability of satellite images, especially those made publicly available, could have serious safety and privacy implications as well as issues in international relations.

Context and Implications of Advancement in Satellite Imagery Technology

From the very beginning of satellite technology, concerns regarding national security surfaced due to the sudden vulnerability of locations that major governments would have preferred to keep secret. When the Soviet Union launched Sputnik on 1957, the discourse on satellite reconnaissance sparked up between the major superpowers, each one attempting to leverage the new technology against the other. Surprisingly, President Eisenhower welcomed the launch of Sputnik because of his promotion of an "open skies" policy which would allow the US to do reconnaissance over the Soviet Union and the other way around. This was intended for the

US to observe the military capabilities of the Soviets while at the same time intimidating them with images of American military might. Using satellites to spy quickly became the major purpose and top priority of both the US and the USSR. (Norris, 4) In the following decades, the US and Russia competed with one another to send a great variety and number of satellites, most notably for our purposes, the military positioning satellites that have given rise to the types of commercial satellites of today.

In the past decade, earth surveillance satellite technology reached a turning point with virtual geographical information program Google Earth. Previously called EarthViewer 3D, the Google Earth software was originally developed by Keyhole, Inc. and funded by In-Q-Tel, the private venture capital firm of the Central Intelligence Agency, until its acquisition by Google, Inc. in 2004. The new program made open source satellite imagery mainstream and opened the possibilities of satellite imagery analysis to anybody who cared to explore the free software on their own computers. However, this new availability of surveillance software sparked a great deal of controversy with security and privacy concerns. For example, headlines during the latter years of the Bush Administration reported that then Vice President Dick Cheney requested that his home at the US Naval Observatory grounds near Embassy Row in North West Washington, DC appear as a blur in the satellite images on Google Earth. (Norris, 15) This story not only raised questions about the Vice President himself, but also provoked some discussion on the actual threat to privacy from surveillance satellites in space.

Some of the major uses of satellite imagery today with regards to national security include military purposes and observation of nuclear development. In the realm of military uses, the United Nations has analyzed images taken from space to help make assessments on peace-keeping missions in complex crises involving irregular warfare and civil violence (Shannon,

179-180) For nuclear development, Frank Pabian highlights a study illustrating the utility of commercial satellite imagery with Google Earth verifying open source information on an alleged clandestine nuclear facility in Iran. This study shows the wide range of creative software and analysis possibilities using open source information. By simply adding a Google Earth image overlay, researchers were able to view images of very high resolutions. They also used measuring tools on Google Earth to measure distances between entrances and to detect subtle changes over time. (Pabian, in Doyle, 238-240) This illustrates not only the usefulness of Google Earth, but also the issues surrounding its precision, detail, and openness with regards to national security and diplomatic relations with respect to nuclear security and national privacy.

Literature Review

Discussion about the implications and risks of the growing trend of satellite surveillance became more and more relevant as the technologies improved during the Cold War. A sizeable body of literature exists on the consequences and possibilities of satellite imagery between the US and the USSR from the tail end of that period of tension. For example, a chapter in *Commercial Observation Satellites and International Security* details some results and conclusions regarding a photographic analysis of Soviet space photography and the magnitude of detail. The study concludes that Soviet satellite imagery could detect facilities, but was not sufficient in recognition or identification of objects and equipment. (Reborchick, Cox, and Biache, in Krepon, Zimmerman, Spector, and Umberger, 229) Of course, technological capabilities have transformed drastically since the end of the Cold War, but this study reflects the goal of studies during the Cold War; one centered almost exclusively on possible recommendations for courses of military action that could be taken in deterrence of the USSR.

Today, the focus has shifted somewhat from the more geopolitical concerns of the Cold War to the possibilities that arise may arise from the amazing technological advances in satellite imagery that have occurred since and also its increased availability. In terms of international diplomacy, Larry K. Grundhauser highlights one of the major shifts brought about by satellite imagery in general, but also specifically for open source types, namely, a new trend of improved transparency. He notes that "many advocates for loosening restrictions on commercial satellite imagery have since joined the chorus of those who believe that improved transparency provided by commercial imagery will actually lessen the prospects for conflict." (Grundhauser) He reasons that if superpowers lose their domination over satellite imagery surveillance, checks from foreign governments and even NGOs and IGOs may discourage them from pursuing armed conflict.

Space and software industries insider Pat Norris argues in his book *Spies in the Sky: Surveillance Satellites in War and Peace*, that surveillance satellites had the greatest impact on human history of any form of space activity in the past 50 years. (Norris, 16) Certainly, many events since then have involved surveillance satellite technology; the Cuban Missile Crisis in the 1960s and the monitoring of Iranian nuclear development come to mind. In his subsequent book, *Watching Earth From Space: How Surveilance Helps Us—And Harms Us*, Norris argues that "by and large Earth-watching satellites are a good thing." (Norris, Author's Preface) This optimistic perspective on the advantages and drawbacks of satellite imagery appears in almost all literature on the subject. Some, however, see areas that need reinforcement as the technology improves and use increases. Journalist John M. Diamond's article in *Strategic Intelligence: Windows Into a Secret World* lists a handful of issues in the US government that he believes must be resolved in the future. These include the lack of a clear path forward within the

intelligence community and congressional overseers, the lack of imagery intelligence to demonstrate an ability to contribute decisively to the fight against terrorism and weapons proliferation, the sluggish shift from Cold War strategic missions to real-time roles, the slow shift in the technology itself, and the rapid development of denial and deception skills by adversaries in relation to advancement in the intelligence community's data collection capabilities. (Diamond, in Johnson and Wirtz, 56-57) Diamond comes to the conclusion that strategically and financially important decisions lie ahead and that the American government has not prepared to make them. This article constitutes a less optimistic view on the future of satellite imagery intelligence, but still holds optimism in the application of information gained from the technology.

On the nuclear security side of the discussion, many believe that improved satellite imagery technology has been and will continue to be useful to safety. In their article *Development of Geospatial Technology for Nuclear Information Management*, C. Vincent Tao and Q.S. Truong hold the view that better geospatial technologies would not only be useful, but essential in order to abide by the Additional Protocol adopted by the IAEA Board of Governors in 1997 which strengthened safeguards by placing high priority on increased access to information and increased access to facilities. Tao finds the current reporting system for the Canadian Nuclear Safety Commission (CNSC) unsuitable for managing and archiving the information required to meet the requirements of the Additional Protocol and that about 70 percent of the data required is related to geography. Some of these requirements include up-to-date maps of sites and fuel related information. (Tao and Truong, in Keeley and Huebert, 69-70) Furthermore, in a chapter in *Nuclear Safeguards, Security, and Nonproliferation: Achieving Security with Technology and Policy*, Pabian writes that specifically open source commercial

satellite imagery can be used by multinational organizations, nongovernmental organizations, the news media, academics, and even plain individual parties or hobbyists interested in nuclear security with some computer access to view, identify, and monitor nuclear facilities and their associated activities in the framework of international peace and security that may otherwise remain clandestine. (Pabian, in Doyle, 221) However, despite the detail and clarity that can be achieved by satellite imagery today, Pabian also makes sure to recognize the current limitations on this type of information and reminds us that analysts should not rely solely on this means of detection, but should use satellite imagery as an auxiliary to other available geographic information. (Pabian, in Doyle, 248) David Shim highlights another problem in using satellite imagery intelligence: the interpretation of photographs. He makes note of the effects of preconceptions have on interpretation and warns of the dangers of governments, organizations, groups, and individuals seeing what they want to see or believing what they want to believe and supporting their beliefs on their interpretation of remote sensing data. (Shim, 20) Thus, a necessity of developing a better understanding of interpretation, uses, and functions of satellite imagery must also be pursued.

Gaps in Literature

Most of the current authors on the subject of satellite imagery seem content with the state of affairs as it pertains to security and privacy. The photographs and applications show places on earth at a level of detail that provides a wealth of information for analysts, but not enough detail that would warrant using satellite imagery information on its own. At the present, Google Earth's projection of the planet with its Street View and 3D models seems state of the art. Norris points out instances in which these technologies can be used to violate privacy or even do physical harm, but he still sees the benefits of satellite imagery outweighing the costs. However, the

current literature does not speculate on the possibilities that may arise from a point in technology where privacy and security may become seriously threatened by governments, groups, or even individuals who seek to exploit the precision of crystal clear images of the earth from space. The literature does not consider a point of technological competency where widely available and unquestionably accurate satellite imagery becomes a very dangerous concern. Lieutenant Colonel Stephen Latchford of the US Air Force shows concern for the use of commercial satellite imagery by adversaries of the US from a military perspective, but concludes that the US should develop technologies like co-orbital jammers, on-orbit disablers, and low-power lasers from surface to air to pursue aggressive action as the only viable solutions to the problem. (Latchford, 29) Though creative and likely effective on the operational level of an armed conflict, this type of reaction to the advances in satellite imagery technology represents an attitude of short-sighted solutions to serve as quick fixes to the pesky satellite problem during times of hostilities. Developing counter-satellite technologies may be helpful in some instances, but not unless the US can foresee a major impending conflict with a developed country. Discourse should explore how to protect against satellite imagery instead of coming up with strategies to attack the technology itself to 'defeat' it.

The question of security against satellite imagery technology speaks a great deal to the threat of terrorism. Given that most writers believe that governments will become increasingly cautious and possibly even discouraged from resorting to military options due to the increased sophistication of eyes watching their actions from space, we can move past military and diplomatic concerns in that regard at the level of grand strategy. At the tactical level, we already see its possible uses by insurgents in southern Iraq in determining targets for mortar attacks. (Harding) However, the issue with terrorism and improved satellite imagery may become a

major concern. If the Pakistani extremists who carried out bombings in Mumbai in 2008 could use Google Earth to get better acquainted with their target location, what could the possibilities be for a terrorist group or an individual if open source satellite imagery could show the finest details, have meticulously photographed Street View images, or even stream images over time or in real time? Naturally, this point will not be reached until sometime in the future, but policymakers may want to consider thinking about these possibilities as satellite imagery becomes more and more advanced. For instance, terrorists planning attacks would find a great deal of useful information from clearer and more up-to-date images on their targets. In the event that real-time or near-real-time satellite imaging becomes possible, terrorists would have strong tactical awareness capabilities currently available only to sophisticated militaries. What kind of policy should be put in place to counter these types of capabilities that might come into play in the future? What kind of research should be pursued to begin discourse on these issues concerning a growing availability and intrusiveness of this technology? These types of questions must be resolved in order to keep pace with the scientific advances as they develop, independent from the world's reactions and awareness of their implications.

Conclusion

Despite the enthusiasm expressed by writers on the subject of surveillance satellite imagery technology, security and privacy concerns must not be dismissed as inevitable and necessary evils for the sake of technological progress. The threats to national security and personal privacy that exist today only in sparse instances of creativity or in pure speculation must be taken into consideration as a possibility that could occur in reality. As the Mumbai terrorist attacks of 2008 and the difficulties faced by British forces at Basra from insurgent mortars show, widely available satellite imagery intelligence has already aided in the execution of violence.

Although these threats may create reservations about expanding capabilities of surveillance satellite imagery intelligence, we should not lose sight of the utility of this technology. Satellite imagery from space has, since the 1950s, been a dynamic technology that has kept the nations of the world alert to the security of their countries especially in terms of military and nuclear concerns. Countries must develop policies and safeguards as precautions against possible breaches in security or privacy rather than advocating for the limitation or retardation of the development side itself. Norris notes that camouflaging sensitive locations from overhead surveillance has been a staple in maintaining security and privacy since the beginning of overhead observation. He states that if people fail to protect their clandestine interests, they "can hardly blame Google Earth." (Norris, 16) So, in terms of security and privacy, governments, groups, and individuals should remain mindful, plan accordingly, and remain resilient for the possibility that somebody may be watching.

Furthermore, governments especially should invest in strengthening their satellite imagery intelligence because as it stands currently, they have insufficient information. As Diamond suggests, the US government stands at a disconnect between the intelligence community's abilities to effectively use satellite technology and America's adversaries' abilities to keep things secret. Additionally, the government lacks a clear path and goal for development of the technologies and analysis skills required for a post-Cold War and post-9/11 security environment. With regards to nuclear security, the current safeguards, requirements, and regulations must be updated and reformed to take the type of information that can be acquired from satellite imagery intelligence into consideration for evaluating the security against adversaries and to plan reinforcement to strengthen facilities and reactors against threats.

In short, after the revolutionary developments in the technology, the current capabilities of satellite imagery intelligence gives states, organizations, groups, and individuals the opportunity to browse sensitive locations in the world while putting into question the dimensions of national security and privacy. However, the technology continues to improve and provide clearer, more accurate, and more intrusive photographs of places where some would prefer to keep hidden from view. International organizations and governments should not impede the development of satellite imagery technology, but instead pursue research and policy that addresses the issues that a growing availability of surveillance technology will bring and how to deal with these issues in order to strike a balance between technological progress and global security.