Sharing Space: Adapting Military Approaches to Geospatial Analysis for Humanitarian Response and the Documentation of Human Rights Abuses

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Sharing Space: Adapting Military Approaches to Geospatial Analysis for Humanitarian Response and the Documentation of Human Rights Abuses

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The launch of Sputnik by Soviet Russia in 1957 marked the first era of geospatial technology that was largely restricted to governments and their intelligence agencies. The subsequent launch of Explorer I by the United States in 1958 further transformed how nations collect information about other nations. Advancements in how satellite imagery is captured and processed, combined with the increased commercialization of geospatial technologies, have removed some barriers preventing civilians from accessing these capabilities. These innovations are allowing the public sector to utilize this technology for different applications.

A relatively recent civilian application of geospatial technology has been to monitor complex humanitarian disasters and its impact on vulnerable populations through satellite imagery. This application draws on some aspects of the technology's use by governments while simultaneously operating through a humanitarian or human rights lens. It has proved to be an advancement in how timely and accurate information about risks to vulnerable populations can be documented and disseminated to actors on the ground.

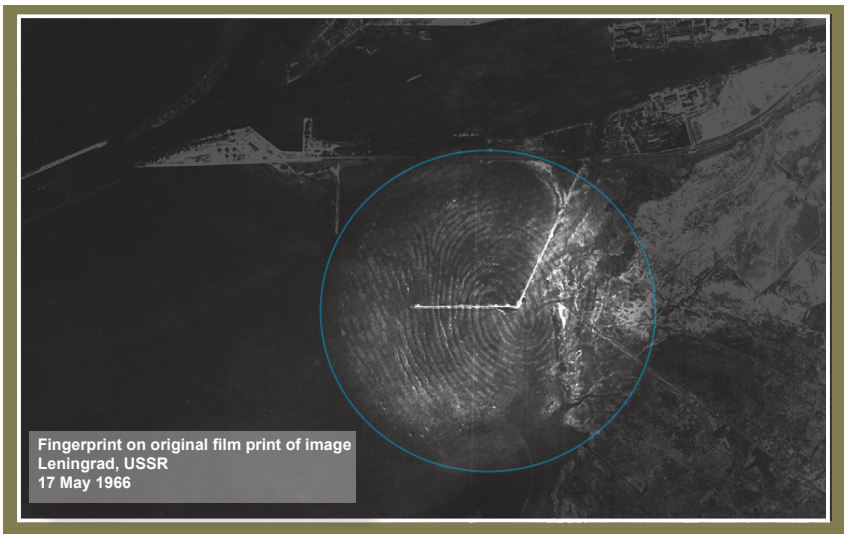
Although their objectives may be different, governments and humanitarian organizations observe similar objects and locations when engaging in satellite monitoring. Since the non-governmental sector has only been using this technology for a few years, this new breed of geospatial analyst will benefit from learning the history of how governments have used geospatial technology as they seek to adapt an initially military tool for humanitarian purposes.

Advancements in Satellite Imagery Technology

In June 1959, the United States Central Intelligence Agency, in conjunction with the United States Air Force, launched the first of 144 satellites as part of a reconnaissance program codenamed "Corona." As 102 of these satellites successfully returned over a million feet of 70 mm film imagery, the Corona satellites ushered in a new and highly productive period of collecting geospatial intelligence (GEOINT) during the Cold War. This analog medium is a stark contrast from today's high-resolution digital satellite images, which can be quickly downloaded to ground stations and transmitted instantly across the Internet.

Beginning with the Corona satellites, governments and intelligence agencies have utilized satellite imagery over the past five decades to gain strategic military information about states and other actors. This has often included information about military movements, deployments of weaponry and nuclear activity. Satellite imagery has also been used in the planning, analysis and execution of military operations.

The now declassified imagery from the Corona satellites have been marred by artifacts and accidents that trouble a typical Polaroid or 35 mm home photograph. Fingerprints, smudges, and stains can be seen on the prints. Processing malfunctions have created an intruding blur around the edges of the image. Today's digitally transferred imagery, though vulnerable to its own potential processing malfunctions, such as pixel distortion, benefits significantly from more efficient and economic means of acquisition. Corona satellites dispensed its film by a parachute-equipped canister 100 miles above the Earth's surface, which was then collected


Fingerprint on original film print of image
Leningrad, USSR
17 May 1966

by a C-119 airplane before the satellite crashed into the ground. Now, high resolution satellite imagery is downloaded within minutes from a desktop computer, smartphone or tablet. Imagery is now analyzed more immediately and efficiently, thus leading to faster and more informed decisions.

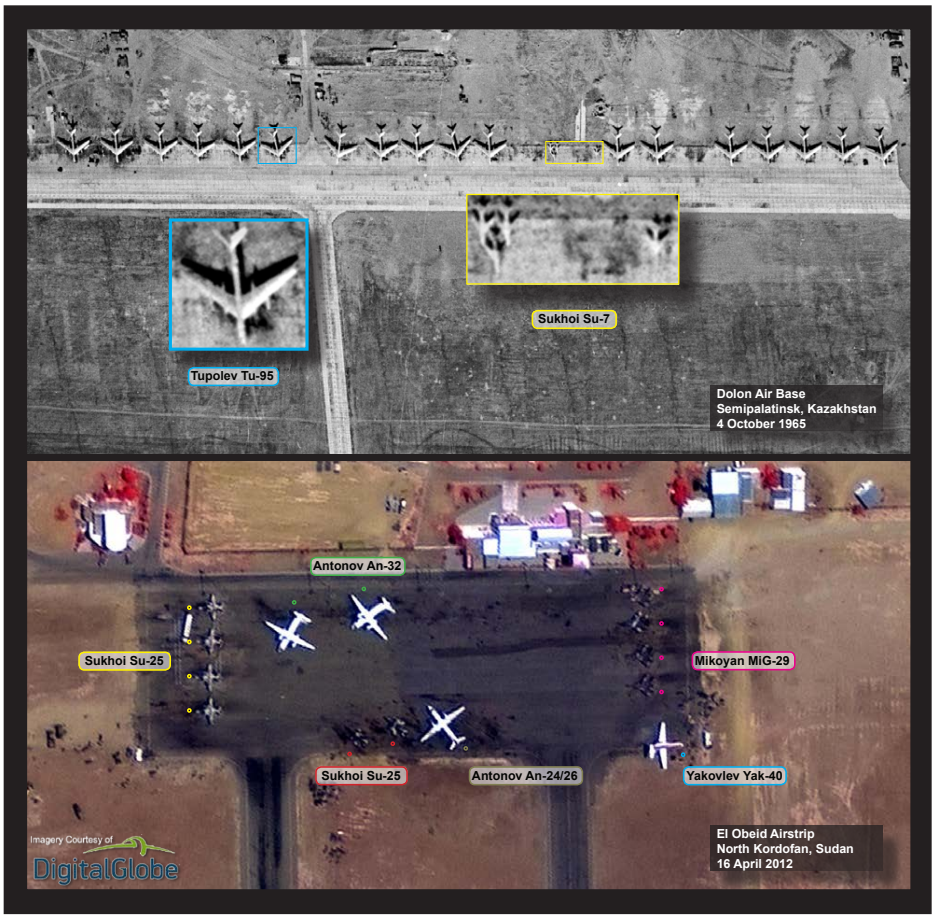
In the 1990's, the Office of Space Commercialization at the United States Department of Commerce led the creation of the US commercial satellite imagery market.[1] Today, satellite imagery technology is no longer exclusive to governments. Private and academic institutions are now able to access satellite imagery as it has become increasingly commercialized. The proliferation of this technology into the private and academic sectors has also changed why this technology is employed. Private and academic institutions are using satellites for research purposes, business applications, and mapping projects.

Humanitarian and Human Rights Remote Sensing

One of the most cutting-edge applications of this technology is to document conflicts, humanitarian crises and their impacts on vulnerable populations. The analysis of satellite imagery has provided a new tool for humanitarian and human rights professionals. This tool allows organizations to analyze both ongoing and retrospective conflicts and alleged human rights violations, particularly those occurring in non-permissive environments. For example, the Signal Program on Human Security and Technology (Signal Program) at the Harvard Humanitarian Initiative (HHI) recently released *Sudan: Anatomy of a Conflict*, which is the first geospatially-based history of a conflict.[2] Other organizations, such as Human Rights Watch, have recently employed satellite imagery analysis to document violence in areas such as Burma[3] and Nigeria.[4] These efforts, in addition to others, showcase how conflicts and their impacts on vulnerable populations are increasingly captured through remote sensing.

Although their objectives may be different, satellite monitoring conducted by governments and humanitarian organizations involves the observation of similar object types and locations. What governments and militaries may monitor to gain intelligence about an opponent and their military capacity, such as airstrips, bridges, military bases and infrastructure, humanitarian organizations may also monitor to understand how a conflict's progression affects vulnerable populations or humanitarian operations.

One example of these parallels is found in declassified imagery from the US Government's KH-7 "Gambit" satellite, which was made publicly available in 2011. Imagery captured in 1965 of the Dolon air base in Kazakhstan reveals the presence of 40 Tupolev Tu-95 strategic bombers, four Sukhoi Su-7 jet fighters and two Antonov An-22 transport planes.[5] This air base was a major Soviet strategic bomber base during the Cold War. Analysts at HHI have used largely identical measurement and analysis techniques to document similar aircraft in Sudan. These aircraft included Antonov An-24/26 transport planes, Mikoyan MiG-29 jet fighters and Sukhoi Su-25 jet fighters that were reportedly used by the Government of Sudan to conduct harassment bombardment and aerial attacks against civilian populations and rebel groups.[6]



Despite the increasing deployment of these civilian conflict-monitoring programs, there are no standard methodologies for humanitarian and human rights analysis of remote sensing data. Unlike governments, who developed doctrine and protocols for the use of this technology over decades, the humanitarian sector has had less than ten years experience with these approaches. Three examples of methods ostensibly developed and used by governments being adapted for humanitarian and human rights purposes are vehicle identification, vegetation analysis and infrastructure analysis.

1. **Vehicle Identification**

One major use of high resolution satellite imagery by militaries is to identify, or "type," vehicles and equipment deployed by armed actors. This method of analysis has been facilitated by advancements in remote sensing software that make the counting and measuring of objects faster, with greater visual enhancements. Typing deployed vehicles enables analysts to conduct threat assessments based, in part, on the vehicles' operational range and weapons capability. This analysis may also determine the command and control structure responsible for the vehicle's operational deployment, an essential prerequisite to assessing the prospective threat it poses. As evidenced in the declassified KH-7 imagery from 1965, the Tu-95 bomber was identifiable due to its size, shape, and location at the Dolon air base. The now declassified US satellite imagery show that strategic military locations, like the Dolon air base, were repeatedly imaged over decades to detect change in the capacity and activity present at that site.

Vehicle identification and analysis for humanitarian or human rights documentation purposes focuses on the same factors and parameters. This traditionally military approach may help non-governmental organizations deduce what actor is deploying a certain type of vehicle, what they are using it for, and how far it may travel. The Signal Program used this method to identify vehicles used by actors allegedly committing gross human rights abuses. Satellite imagery revealed white Toyota Land Cruisers at the state police headquarters in Kadugli, South Kordofan, Sudan in June 2011. These Land Cruisers are consistent with those later seen present during apparent house-to-house searches and extrajudicial executions that reportedly occurred throughout the town at the time.[7]

2. **Vegetation Analysis**

Analysis of vegetation in multispectral satellite imagery has proven an effective tool for law enforcement agencies trying to determine the location of illegal narcotic crops both domestically and abroad. Concealed cannabis farms and opium poppy fields, otherwise indiscernible from surrounding vegetation, can be singled out and accurately identified

through the isolation of color bands within a multispectral image. Additionally, persistent satellite monitoring of these locations over an extended period of time can determine the rate at which these crops are being cultivated.

Similar techniques were employed in 2011 by the Satellite Sentinel Project to identify an alleged mass grave in Kadugli, Sudan.[8] Using the Harvard Humanitarian Initiative's Ground Reporting through Imagery Delivery (GRID) methodology, a hybrid of maps and imagery specially designed to transmit geospatial data confidentially to and from sources on the ground, analysts were able to identify the location of an alleged mass grave reported by a witness. Although no visible indication of an apparent grave site was seen in recently collected imagery, the adjustments of color bands within multispectral imagery revealed an area of disturbed earth in the exact location identified by the eyewitness using GRID. Imagery taken a short time before the witness reported seeing the grave shows that the earth had not yet been disturbed in that location.

3. **Infrastructure Analysis**

Since the first reconnaissance satellites were launched over 50 years ago, a primary objective was the locating, analyzing and monitoring of military infrastructure. Declassified imagery from the Corona program, as well as the KH-7 and KH-9 satellites, reveals multiple Soviet military installations likely of great interest to the US during the Cold War. Surface-to-air missile sites, fortified armories, strategic air bases, and submarine ports are visible within in the images, offering broader and more consistent coverage and collection of intelligence than what was available in past conflicts.

Imagery analysis of military infrastructure is also a key component of humanitarian of conflict areas, especially non-permissive environments. Satellite imagery can provide evidence of military build-up near vulnerable populations. Imagery enables humanitarian analysts to identify if bases, encampments and fighting positions are being constructed or enhanced. These indicators allow humanitarian organizations to evaluate potential threats to vulnerable populations, including a potential escalation in violence between armed groups. One example is the case of the Government of Sudan's Central Reserve Police (CRP) in Kadugli, Sudan. Through imagery analysis, HHI analysts were able to document the build-up of a CRP encampment adjacent to the United Nations Mission in Sudan (UNMIS) compound in Kadugli where thousands of civilians were massing along the security perimeter. These forces reportedly targeted, killed, harassed and threatened the internally displaced persons (IDP) there. The presence of these forces in close proximity to the IDP population directly and negatively impacted the security of those people.[9]

Old Methods, New Patterns

Remote sensing now allows non-governmental organizations to understand patterns of how conflicts unfold and affect populations in ways that are otherwise unavailable. Remotely understanding how human security is affected by conflict comes from an integrated analysis of the fields of physical geography and human geography, which includes "socio-cultural, economic, political, health, urban, and other types of research. Together, this research can identify groups of people, their leaders, and their interaction with other groups, which are the seeds of potential conflict."[10] As part of this research, satellite imagery provides otherwise unattainable information about events happening on the ground. Ever increasing access to recently collected and archival satellite imagery will enable humanitarian analysts to more effectively analyze how conflict affects human security.

The information resulting from more timely and improved analysis will likely directly affect human security situations as they are unfolding. As this trend continues, standard methodologies within the humanitarian and human rights sector for satellite imagery and relating data are urgently needed. The creation of a basic doctrine for this new field of remote sensing must come from the rich legacy of military use that has preceded it in order to incorporate tested analytic systems that have evolved in this industry over time.

Endnotes

1 U.S. Department of Commerce, "Commercial Remote Sensing," accessed June 6, 2012, http://www.space.commerce.gov/remotesensing/

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4 Human Rights Watch, "Nigeria: Massive Destruction, Deaths From Military Raid," May 1, 2013, accessed June 5, 2013, "http://www.hrw.org/news/2013/05/01/nigeria-massive-destruction-deaths-military-raid

5 "U.S. Department of the Interior, U.S. Geological Survey," accessed June 5, 2013, http://earthexplorer.usgs.gov

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8 Satellite Sentinel Project, "Cover-Up: New Evidence of Three Mass Graves in South Kordofan," August 17, 2011, accessed June 5, 2013, http://satsentinel.org/report/cover-new-evidence-three-mass-graves-south-kordofan

9 "Sudan: Anatomy of a Conflict"

10 Jim Hodges, "Success Left of Zero," Trajectory Magazine, Winter 2012, accessed June 5, 2013, http://trajectorymagazine.com/defense-inteligence/item/1351-success-left-of-zero.html

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