Documenting border conflicts from afar

Civilian researchers find early signs of cross-border violence in satellite images

By **Ginger Pinholster**

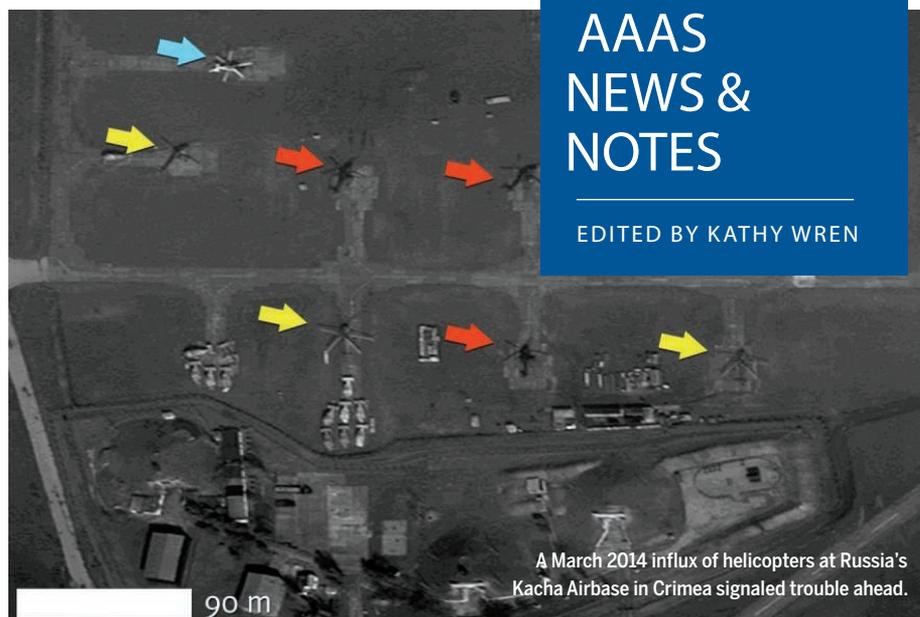A March 2014 influx of helicopters at Russia's Kacha Airbase in Crimea signaled trouble ahead.

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By early April 2014, despite denials by Russian government officials, signs of a coordinated Russian military campaign to annex Ukraine's Crimean Peninsula were falling into place. On 10 April, NATO released commercial satellite images showing a buildup of Russian forces at Novocherkassk and other towns along the border with Ukraine. A Russian military official claimed that the photos showed military drills from August 2013, but AAAS analysis of satellite images from the same time period and locations reinforced NATO's case.

Several weeks earlier, that AAAS research effort had also confirmed reports of military activity in the Ukrainian port city of Sevastopol. The satellite imagery showed, for example, military vehicles parked in depots throughout the area and a tugboat towing a floating chain to control access to the entrance of Sevastopol Bay.

Civilian researchers have long used satellite images to investigate threats to human rights and the environment, but the AAAS study, which was part of a broader effort to document cross-border conflicts, represents a new direction for this type of analysis, said Susan Wolfinbarger, director of the AAAS Geospatial Technologies Project. In addition to revealing destruction to cultural sites or natural resources, satellite images can help "pierce the fog of war" by confirming or overturning reports about what is happening on the ground during conflicts, said Jonathan Drake, a AAAS senior program associate.

This research is "hitting at a huge and very important question," said Noel Dickover, senior program officer at the PeaceTech Lab, which is affiliated with the United States Institute of Peace (USIP): "What if peace-builders had access to geospatial information in near-real time to look at incidents of violent conflicts before they arise? How would that change our world?"

Wolfinbarger and her colleagues spoke at an 11 March event at USIP, which funded seven cross-border conflict studies by AAAS. The researchers compared images from before and during the escalation of the conflicts, which took place in regions roiled by the end of colonialism in Africa and South/Southeast Asia, and by the fall of the Soviet Union. Together, these images revealed key warning signs of impending war: the movement of materials and troops, as well as the appearance of new infrastructure and military camps.

Evidence of troop movements could be seen in satellite images from the majority of the conflicts studied, said AAAS Program Associate Eric Ashcroft. In Africa, for example, a new road with access to the disputed border between Djibouti and Eritrea seemed to signal the buildup of military activity before a 2008 conflict. Military mobilization of troops was more directly visible before the 2001–02 conflict between India and Pakistan. The sudden emergence of new infrastructure also marked the start of a conflict at the Cambodia-Thailand border in 2008. And, shortly after a 2011 referendum made South Sudan an independent state, "you could see a large amount of materiel moving through the space, presumably to the front lines" at the Sudanese border, Ashcroft said.

For now, the high-resolution satellite images needed for this type of analysis aren't easily available. The first commercial satellite was launched in 1999, and now there are eight offering image resolutions of one meter or less. Costs can be prohibitive, however: a single, small image can cost $250 or more, and to analyze each location requires (at minimum) an image captured before and after a conflict or event of interest. Commercial satellites also do not acquire images of the whole globe continuously.

In the future, the emergence of smaller "microsatellites" that continuously scan the planet may potentially support more automated analysis of regions over time, Ashcroft noted. Those images are consistently captured from a 90-degree angle, he explained, and so they can be precisely aligned on top of each other.

As more images become available for civilian analysis, said Dickover, "you can envision scenarios in the very near future where ad hoc groups would have the ability to crowd-fund the cost of the imagery, and you already see in the humanitarian space where they are doing the analysis themselves. Imagine if that happens to the peace-building world...the implications are fairly vast."

The AAAS Geospatial Technologies Project has posted its seven case studies and other instructional documents for researchers who want to leverage satellite-image analysis, at http://aaas.org/geotech/borders. The group has also published an ethics statement about satellite imaging in cultural sites of conflict. ∎

AAAS launches new Public Engagement Institute

The newly announced Alan I. Leshner Leadership Institute for Public Engagement will empower cohorts of scientists and engineers to communicate effectively about key issues at the intersection of science and society. As of 10 April 2015, more than 130 gifts and pledges had been committed, exceeding the initial goal of $500,000 to fund the Institute in its first 5 years. The first class of fellows, planned to convene in 2016, will focus on climate change, with subsequent topics to be determined by a AAAS advisory committee. Give online at www.supportaaas.org/AlanLeshnerFund.

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