

Wartime imagery from Afghanistan – an analysis

By Professor Gordon Petrie

It was pleasing for both the editor and myself to read and hear the very positive responses to the article on Imaging over Afghanistan that was published in the November issue of GI News. The article was written on 17 and 18 October, not long after the start of the air strikes on targets in Afghanistan and well before the main military action on the ground. So it is interesting now, at the end of November when this new piece is being written, to review the extent to which the matters discussed in the previous article have actually come to pass. Of course, a full assessment can only be made when the military action by the Coalition forces has come to some sort of conclusion and much more information becomes available.

SPACEBORNE IMAGERY

As one would expect, it has been impossible to gain information on the performance of the US National Reconnaissance Office's high-resolution optical (KH-12) and radar (Lacrosse) satellites and imagers. However, at least

some of the images of ground objects hit by air strikes that have been published in the press or have appeared in the daily Pentagon briefings were taken by these imagers (see figure 1), though it is impossible to identify with any certainty which are the spaceborne images. Without doubt, most

of the more detailed images will have been taken from airborne platforms.

Restricting sales of imagery

Much of the information and discussion about spaceborne imagery of Afghanistan has concerned its political aspects. In particular, much discussion has taken place in the press about the moves by Coalition governments to ensure that the images taken by commercial satellites did not reach the Taliban forces and were not published or broadcast by the media. This was mentioned briefly in the previous article, but, since then, the matter has gone much further. The US Department of Defense, via its National Imagery and Mapping Agency (NIMA), bought the exclusive rights to all imagery acquired by Space Imaging's IKONOS satellite over Afghanistan from 7 October for one month at a cost of US\$1.91 million. This was described by a Space Imaging spokesman as a 'wonderful business transaction' for the company. The contract was renewed on 5 November for a further month at the same additional cost and can be renewed monthly.

In practice, this particular action short-circuited the threatened legal challenge by certain parts of the media under the Freedom of Information Act if the US government had invoked the 'shutter control' clause in Space Imaging's operating licence. Notwithstanding this situation, Space Imaging has released a few images to the press, presumably with the consent of the US Department of Defense (see figure 2).

In France, meanwhile, the Ministry of Defence simply instructed SPOT Image – which is part-owned by the French national space agency, CNES – to stop selling images of Afghanistan as of 8 October. The only allowable customer for the imagery

Figure 1: Garmabak Ghar Terrorist Training Camp (a) pre-strike, and (b) post-strike. (Source: US Department of Defense)





Figure 2: Images of Kandahar Airport (a) before, and (b) after the air attacks by US aircraft. The damage to the airport's runway, taxiways and revetments can be clearly seen. The images were acquired by the IKONOS satellite on 23 April and 10 October 2001 respectively. (Source and copyright: Space Imaging)



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from then on was the ministry itself.

EROS-A1

Other images of Afghanistan acquired by the EROS-A1 satellite have been released publicly by ImageSat International and its partners, notably by the Swedish Metria Satellus company. This surprised me quite a lot, especially as I had asserted in the previous article that, since Afghanistan lay outside the range of the main Israeli ground receiving station near Tel Aviv (see figure 3 overleaf), images of Afghanistan could not be acquired by the EROS-A1 satellite! This statement was based on an

article I published on the EROS satellites two years ago in the November 1999 issue of *GeoInformatics* – just before the scheduled launch date of 23 December 1999. The article included the information that, since EROS-A1 had no on-board storage capability, images could only be collected if the satellite was in view of a suitably equipped ground station. This was confirmed by ImageSat International (then called West Indian Space) who vetted the article for its factual correctness prior to its publication.

However, as things turned out, the launch of EROS-A1 from the Svobodny

site in Eastern Siberia using a Russian rocket was first postponed till 24 February 2000 – 'for financial and technical reasons'. Then a new launch date in October 2000 was announced. This was postponed yet again, and finally the launch was carried out successfully on 5 December 2000.

One can only conclude that, during the year that elapsed between the original launch date and the actual launch, the EROS-A1 satellite was modified to incorporate an on-board storage facility. Enquiry of some of the ImageSat partners elicited the response that they were just as uninformed about this development as I was. The Swedish Metria Satellus website (www.satellus.se/eros/imagenet/samples.asp) has quite a number of images of bombed airfields (in Herat, Mazar-a-Sherif and Kandahar) and other targets in Afghanistan (see figure 4 overleaf).

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Figure 3: Diagram of the ground coverage of the Israeli ground station near Tel Aviv for the direct reception of EROS-A1 imagery. (Drawn by Mike Shand)

AIRBORNE IMAGERY

On the airborne side, again it has been quite difficult to find out much about the operational use and performance of the manned reconnaissance aircraft that are acquiring imagery over Afghanistan. The few brief accounts mostly mention the Lockheed U-2 aircraft. According to these reports, there have been no problems with the aircraft's electro-optical and SAR (synthetic aperture radar) imagers.

However, there appear to have been problems with the communication links that pass the image data back to the ground stations during bad weather, especially in conditions of heavy rain.

Gnat and Predator UAVs

Most attention has been focused on the unmanned aerial vehicles (UAVs). In the first place, three UAVs have been lost over Afghanistan. The first was a General Atomics Gnat operated by the CIA. This came down in Northern Afghanistan near the border with Uzbekistan on 21 September. Since then, two General Atomics Predators operated by the US Air Force have been lost, the first one during October, the other on 2 November. In each case, the Taliban forces claimed that the UAVs had been shot down, while the American briefings maintained that the losses were due to equipment failure and mechanical problems.

It has since emerged that the harsh cold-weather flying conditions over Afghanistan have indeed caused problems with these UAVs. In particular, icing along

the wings and along the pitot tube that measures the airspeed has resulted in problems controlling the aircraft. Apparently, too, the Predator is difficult to control during landing. Furthermore, as with the U-2, difficulties have been experienced in transmitting the image data to the ground stations during periods of heavy rain. Some of these problems have been experienced elsewhere. Thus, a total of eight Predators have been lost during operations – three over Kosovo and three earlier this year over Iraq, besides the two over Afghanistan.

Add to this number those lost in non-operational accidents due to weather, pilot errors and mechanical failures, and the total lost is 19 of the 60 that have been delivered over the last four or five years out of an original order of 77. Despite these losses, which cost US\$3 million per aircraft, all reports speak highly of the value of the imagery being delivered by the Predators and Gnats. They will continue to be operated intensively, even through the forthcoming Afghan winter.

Global Hawk

At the beginning of November, there were several press reports that the new larger jet-powered Global Hawk UAV had been released for operational service. Shortly afterwards, a very interesting article appeared in *Aviation Week & Space Technology*, written by David Fulghum and based on a briefing by 'a Pentagon official'. According to this, four Global Hawks are now available for possible operational use. All four aircraft are fitted with SAR imagers, but only two with electro-optical/infrared optical imagers. Apparently, so far, two of these four aircraft have been sent to the Afghan theatre of operations. One is fitted with both types of imager; the other has the SAR imager only. Both have redundant satellite communication links. According

Figure 4: Bomb craters and destroyed aircraft on (a) Herat Airfield, and (b) Mazar-a-Sherif Airfield after attacks by US aircraft. The images were acquired by the EROS-A1 satellite on 14 and 11 October 2001 respectively. (Source: Metria Satellus, Sweden. Copyright: ImageSat International)



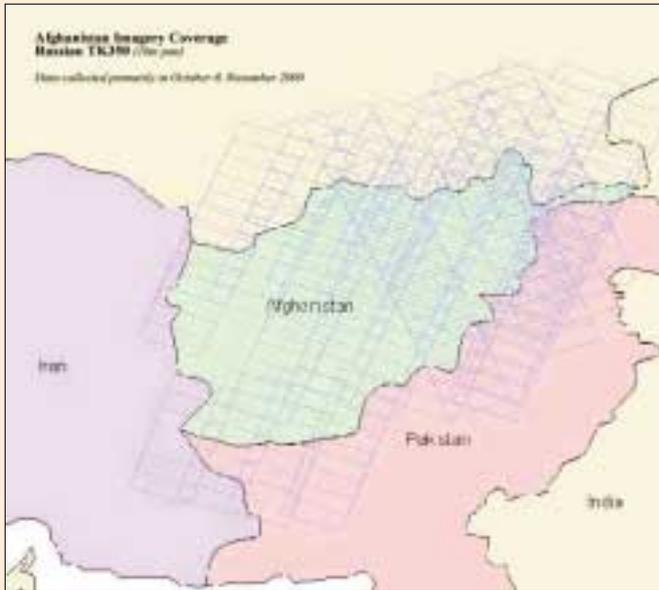
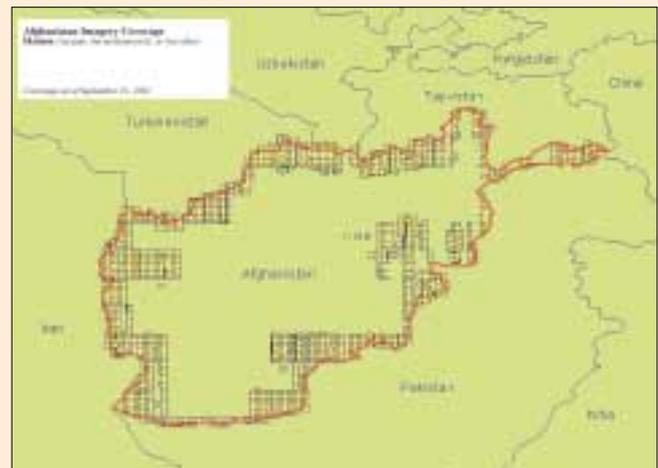
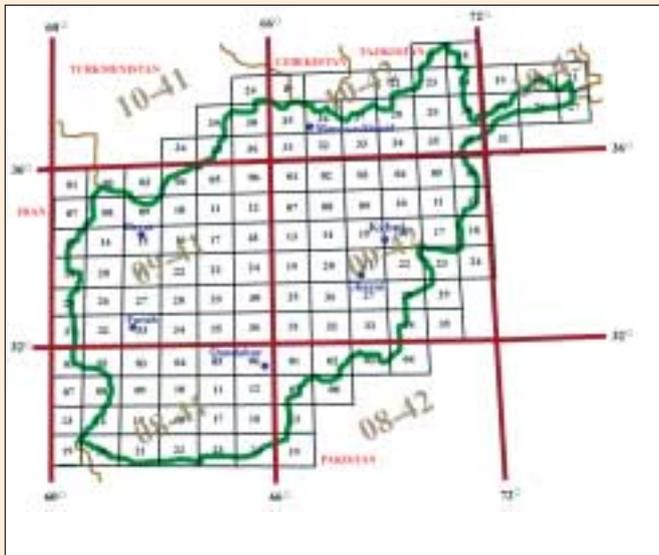
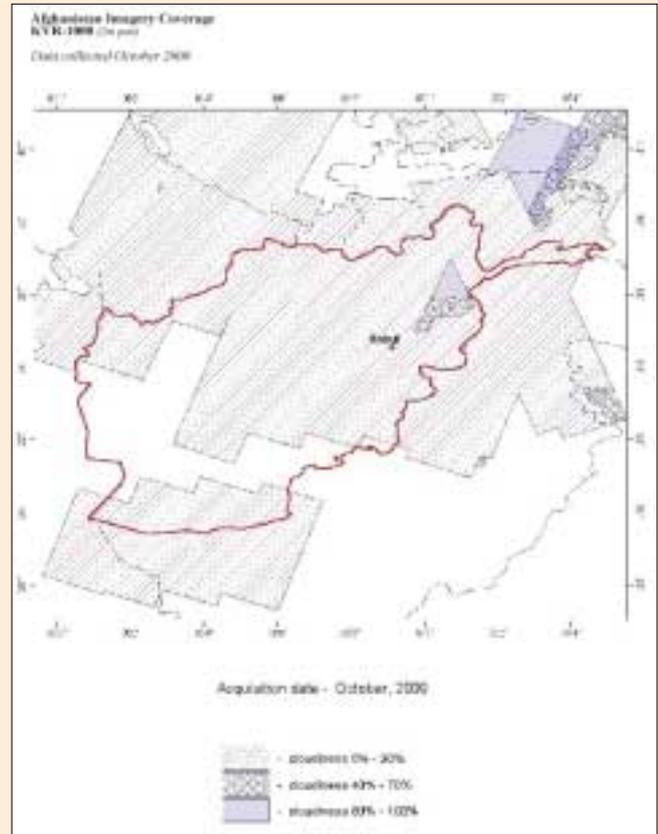


Figure 5: A (above left) - TK-350 coverage of Afghanistan; data collected primarily in October and November 2000.

B (above right) - KVR-1000 coverage of Afghanistan; data collected in October 2000.

C (below left) - Index of the Russian 1:200,000 scale topographic map series of Afghanistan. (Source: Land Info)

D (below right) - IKONOS coverage of Afghanistan as of 21 September 2001.



to the latest press reports, the Global Hawk flew its first operational sortie over Afghanistan at the end of November.

RUSSIAN IMAGERY AND MAPS

One correspondent wrote and asked me what lay behind my previous remarks that 'it is an open question as to whether Russian film or digital imagery is being used by Coalition forces over Afghanistan'. Well, in my personal opinion, this does seem quite likely. If, for example, one looks at the coverage diagrams (see figure 5) displayed on the website (www.landinfo.com) of the Land Info company based in Englewood, Colorado – which sells Russian images and maps – one can see that the Russian coverage of Afghanistan is comprehensive.

Thus, for example, there is complete coverage of the country taken by TK-350 large-format metric film cameras, whose images are thought to be the main source for the Russian military mapping of Afghanistan. The higher-resolution KVR-1000 reconnaissance film cameras have also been used to acquire a lot of coverage recently.

By contrast, the IKONOS coverage of the country had been relatively small before the NIMA contract, mostly covering the border areas of Afghanistan. It is also quite noticeable that, when media correspondents appear on television holding maps of Afghanistan, they appear to be from the Russian 1:200,000 (or occasionally from the 1:100,000 or 1:50,000) scale Russian military map series. Given the long Russian involvement

in Afghanistan, it is not too surprising that they have produced such a comprehensive space image and topographic map coverage of the country.

CONCLUSION

It will be most interesting to see how this whole matter of acquiring high-resolution imagery and producing maps of Afghanistan for use by the Coalition forces will develop.

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