by Wolfgang Baur

Spy Satellites in the DARK · MATTER™ Game

ALTERNITY

illustrated by rk post

EYE IN THE SKY

No matter where you go, satellites are watching. In the DARK·MATTER setting, they are also recording your phone calls, directing laser attacks against you—maybe they're even reading your mind.

The use of aerial surveillance to keep tabs on people and armies from a distance has a long history. The use of balloons for aerial observation began during the Civil War in the United States. Orbital satellites are just the logical extension of recon balloons and the U2 and SR-71 spy planes.

In the DARK•MATTER setting, these satellites are more than merely observation platforms; they are weapons to achieve larger and more nefarious goals, including occult activities as well as the detection and suppression of alien species. The existence and deployment of spy satellites makes for a perfect foil for adventures.

Reading Headlines from Orbit

The techniques used by spy satellites have changed drastically since 1960. The Corona satellite took images from a low orbit of about 100 to 125 miles, then ejected a film capsule that literally parachuted back to earth. Specially equipped Air Force planes captured those capsules in midair to prevent them from falling into the wrong hands. The entire program was overseen by the National Reconnaissance Office (NRO), which was so secret that its existence and even its logo were classified. U.S. government officials finally acknowledged it in 1992.

The first-generation Corona satellites were replaced by Argon and Lanyard satellites (and presumably even newer systems whose names remain classified). The first spy camera, the KH-1 or "Keyhole," was progressively replaced by more advanced systems (KH-1 to KH-9). Corona used the KH-9 until the program ended in 1972. The practice of spying from orbit didn't end in 1972; the Corona satellites were simply retired and replaced by the Hexagon satellites.

Hexagon is a redundant digital real-time system. At least two of its satellites are in orbit over any given point on the Earth at any particular time (from roughly 75 degrees North latitude to 75 degrees South). While image resolution has improved steadily over the years from 2 meters for Corona KH-1 to about 10 cm for today's military satellites, the most important breakthrough of all might have been the introduction of the KH-11 camera in 1976. This camera and all subsequent Keyhole cameras use charge-couple devices to digitize images and relay them to earth in real time. The digital imagery can be manipulated to extrapolate data, filling in holes, adding dimensions, or taking out clutter. It can search for particular images, such as a tank silhouette.

Foreign & Corporate Systems

U.S. systems aren't the only ones orbiting the earth, of course. Soviet Zenit spy systems came online not long after the American satellites, in 1962; Soviet space technology looked down at the U.S. naval embargo and the U.S. ICBM silos during the Cuban missile crisis. All the modern Russian civilian satellite systems—most prominently, the Cosmos and Resource systems—are based directly on the 40-year-old Zenit technology. Unlike the Hexagon and Corona systems, the Russian satellites provide photos to the public as well as to the Russian intelligence services.

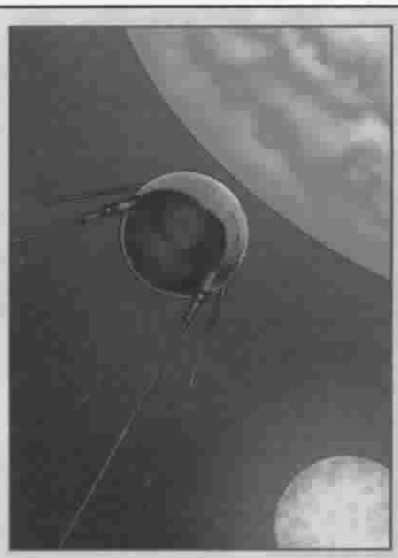
In addition to satellites constructed and operated by foreign governments, the orbital environment has recently become filled with private telecommunications and data relay satellites, as well as devices quietly launched by private organizations like the Bilderbergers for their own purposes. Generally sent up on Russian or Chinese launch vehicles, these satellites are strictly private ventures that are answerable to no one. That they are used in illegal invasions of privacy, in monitoring the status of tracking devices implanted on U.S. citizens, or simply in recording the movements of a few of the world's most important power brokers is a given. Answerable to no civilian authority, the controllers of these satellites can do as they please.

Blueprints & Specifications

Most satellites are purely functional machines, with no consideration for human visits, repair, or habitation. They are typically about 3 meters across, with a wingspan of about 12.5 meters for those satellites using solar power. They have an operational weight of about 1,000 kilograms (1,250 with a full load of hydrazine fuel for maneuvers). Since each satellite is built to order, they vary from model to model, and some are considerably larger or smaller. However, size and weight are not the critical factors once a satellite has reached orbit. A satellite's two most important technical details are its orbit and its resolution.

The orbit determines how often a satellite passes over a particular part of the globe. (Typically, a low Earth orbit satellite passes over a region once per day by following a high-inclination, low altitude polar orbit.) These low orbits are usually only about 1,000 kilometers high, and the satellites orbit the earth every couple hours. Communication satellites, by contrast, usually sit in geosynchronous orbit, 35,700 kilometers above the earth, where they rotate around the earth at the same speed that the earth itself rotates (and thus remain stationary relative to the Earth's surface).

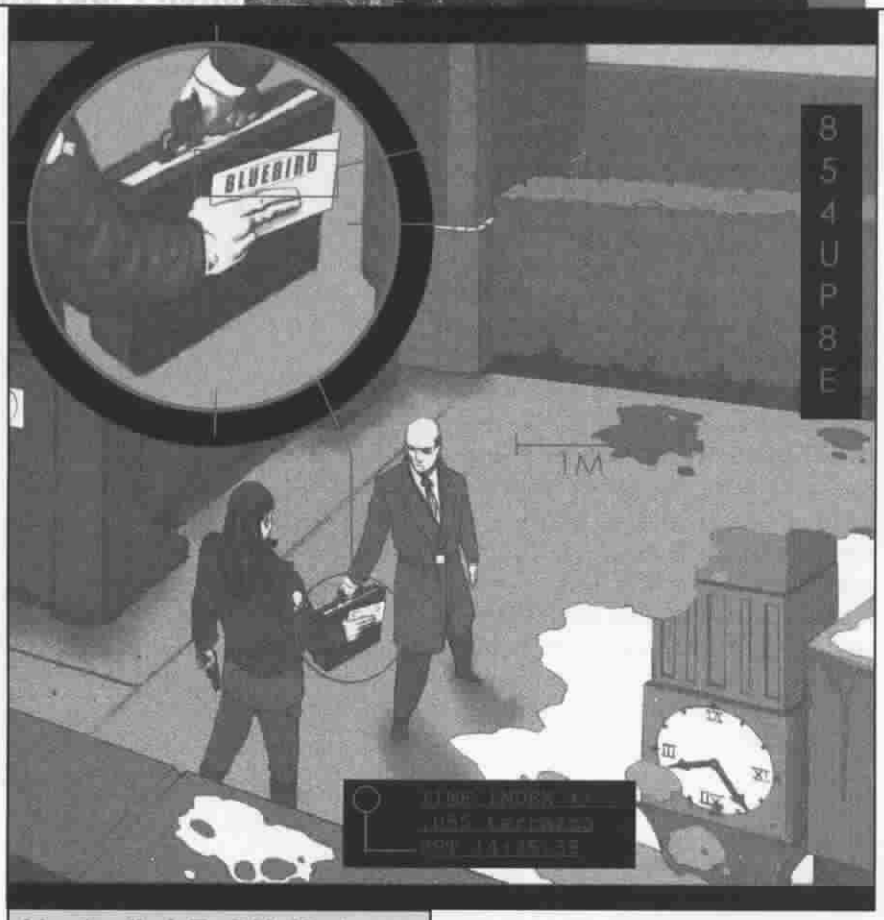
Since the footprint of an imaging satellite can cover thousands of square kilometers, only four or five satellites are needed to provide complete coverage of



Born in the Cold War

The first full-bore spy satellite program, Corona, started in the United States in 1960. Its goal was to generate images of bases deep inside the Soviet Union, and it succeeded even beyond its designer's expectations, offering millions of photographs of bombers, missile silos, and remote military installations that were simply unobtainable through any other means.

Since then, spy satellites have grown more accurate and far more numerous. Most are tightly guarded military systems, with access restricted to national military planners. But a few nations, primarily France and Russia, offer images to anyone willing to pay a modest price, roughly $700 per image ($800 for color). This has made information gathering easier for large and small corporations, for the cash-strapped spy agencies of smaller nations, and for the members of conspiracies and secret societies.



Adventure Hook: The Orbital Pentagram

A private U.S. corporation with links to the Final Church has recently shown great interest in launching a strange network of twenty-six linked satellites. A friendly contact from the Knights of Malta calls the heroes' branch of the Institute with information about these plans, promising to meet them to discuss it. The emailed notes get through, but the friend is discovered ritually murdered and drained of blood.

The more the heroes investigate, the stranger the satellites seem: They are armed with lasers and jamming equipment, are inscribed inside and out with occult symbols, and are capable of bouncing those lasers among each other to create a huge reflected web of light around the earth. Is the Final Church hoping to attack its enemies from space? Or does it hope to create a vast pentagram of orbital laser light, turning earth itself into a sacrifice to infernal powers? Are the satellites meant to exert mind control, or is that just disinformation and paranoia to conceal their true purpose? The adventure comes to a head when sunspot activity on the surface of the Sun flares up enormously. This could be a blessing that disables the entire infernal network, turning the satellites into space junk—or it could be just the result that the satellites were intended to achieve, bringing Luciferans through a doorway to visit the cultists who summoned them.

90% of the earth's surface. Doubling that number provides a reserve for each area in the event of failure (something that real-world agencies usually provide for but James-Bond-style villains often neglect).

The satellite's resolution determines what it can see. A 10–meter resolution can see buildings, large planes, and other objects 10 meters long or larger. Today's best satellites are believed to have a resolution in the 10 centimeter range, but those are strictly for the best-equipped National Reconnaissance Office surveillance missions and are not available to the public. The best civilian satellites are in the 1-meter range, able to see cars, people, back yards, crops, dogs, and so on, as if their pictures were taken from a low-flying plane. To see sample images (or to buy a satellite photo of a particular place), take a look at the images at <www.terraserver.com>.

A satellite view is completely vertical; anything not visible from the top is invisible to the satellite. In addition, most satellites images are limited by prevailing conditions. Cloud cover exists over about 40% of the world at any given time, eliminating a satellite's ability to see a target. Likewise, nightfall or even a forest canopy can hide a target from view. And satellite images can be fooled; spray painting a long black strip on a desert landscape and plunking plywood roofs onto the ground can make it appear as if an air base has been constructed virtually overnight. Likewise, dummy aircraft or tanks—stripped of engines, weapons, and armor—can fool observers overhead. Even when the pictures are legitimate, a trained photorecon interpreter is often required to determine what's what; images reveal more information to a trained observer than someone without experience. (See the "Satellite Mechanics" sidebar for details.)

Beginning in 1987, a few specialized satellites were launched that used an active form of observation rather than passive photography. These synthetic aperture radar (SAR) satellites can look through clouds and through the dark of night—even through small layers of sand or camouflage netting. Surprisingly, today the French government sells such images to civilians. However, even this technology has its limits. At the moment, no satellite can see through a steel or concrete hangar or building.

Similarly, tracking a quickly-moving target, such as a plane or even a car, can be difficult. This is because the cameras are so distant and so sensitive; maintaining a series of turns and corrections to follow a car moving and stopping in city traffic is quite a feat from 1,000 kilometers up. For all of these reasons, spy satellites are best used to take pictures of stationary objects over time, such as airfields, missile silos, and bunkers.

Tapping Your Phone, Your Radar ... Your SAM Battery

While most people think of spy satellites as cameras first and foremost, just as many are SIGINT (Signal Intelligence) satellites as are involved in photo reconnaissance. These satellites intercept radio and TV broadcasts, phone conversations, faxes, and even wireless airplane and cell phone communications.

The first of these communications-tapping satellites sent aloft by the U.S. were called Rhyolite (launched in 1970). Its successors were Aquacade, Chalet, Magnum,

and now Orion. They are parked much higher above the earth than photo recon satellites; SIGINT satellites travel in geosynchronous orbits, about 35,700 kilometers above the Earth, and listen in with 22-meter-wide antenna. They can monitor thousands of phone calls simultaneously and can intercept car phones, walkie talkies, radar stations, and missile telemetry. In the U.S., these intercepts are monitored by the NSA at Fort Meade, Maryland.

Just as famous as the satellites themselves is the data-integration system that the NSA uses to make sense of the incredible tower of babble that is modern telecommunications. The NSA system is called Echelon, and it is run jointly by the United Kingdom, Canada, Australia, New Zealand, and the United States to track primarily civilian rather than military communications. (The armed forces have their own systems for monitoring foreign military communications.) The Echelon system depends on both satellites and undersea cable taps to intercept all important world communications, though primarily those in Europe, North America, and the Pacific. It uses incredibly sophisticated computation power to analyze the millions upon millions of emails, phone calls, and other messages every day. Echelon does this by searching for a preset group of key words defined by its internal "dictionary." These key words or search strings might be phone numbers, the name of a dictator, drug lord, or conspiracy leader, calls made in a particular language or by a particular individual, or words such as "atomic" or "alien" or "drugs," depending on the nation's security interests of the moment. While the system is not foolproof, it generally can find most of what it seeks—if the NSA knows where to look. Technically, the NSA is forbidden from using the system against U.S. citizens, but in practice no one exercises any day-to-day oversight, and abuses of the system are easy for people with the right government connections.

It's worth mentioning that communication satellites are more susceptible to disruption than photorecon satellites. In 2002, the Earth is near the peak of a sunspot cycle, and satellite communications do suffer accordingly during these outbreaks. The vagaries of satellite jamming are kept hidden from the general public, but attempts by many industrial nations to disrupt their enemies' communications do occur when small wars grow serious. In some cases, however, such as the border wars between India and Pakistan, neither side has anything to gain from disrupting the regional satellite: They both depend on the same hardware for their own messages. Disruption at the communication satellite dishes on the ground is more effective in these cases.

Agricultural & Archaeological Techniques

Some satellite reconnaissance involves using radar-based SAR methods to find things kept hidden from ordinary photoreconnaisance. These unusual targets include archaeologists searching for buried or underground structures, farmers and agricultural ministers tracking crops and fallow fields from space, and even police and customs officials pinpointing drug fields, laboratories, smuggling, and interdiction.

For instance, the European Union uses a pale blue, flowering plant to ensure that fields that aren't supposed to be planted are, in fact, fallow. The plant's blossoms reflect a particular spectrum of light back into space, a spectrum that is quite distinct from that reflected by wheat or maize or barley. Any farmer who doesn't plant what he claims in this satellite-monitored field can be sure to receive a visit from the Ministry of Agriculture.

The detection of coca plants, cannabis, and poppies from orbit is just as easy, making detecting drug-producing fields easier for law enforcement. Although few people will discuss it, these same techniques also track human populations, poachers, dark matter concentrations, and possibly even the movement of alien species. In particular, the Center for Xenological Studies (CXS) in Washington, DC, uses multispectrum analysis to find and track invasive alien species that appear within regions monitored by the AFT.

Shutter Control

While anyone can buy a picture of an area from SPOT—the French civilian recon company—or from private U.S. vendors like terraserver.com, not just any picture is freely available to the public. Only "friendly" governments and citizens can obtain access to certain photos, and some areas of French and allied security is simply unavailable. For instance, Groom Lake photos are not released to the public, nor are photos of the French nuclear testing sites in the South Pacific, Russian gulags in Siberia, and certain particularly benighted portions of Texas.

The nation owning a satellite can exert "shutter control," allowing that nation to turn off the stream of images from a satellite during military maneuvers, weapon testing, or especially during a war. Because of this, nations like Japan, China, India, Israel, and South Africa

Satellite Mechanics

Commandeering someone else's satellite requires sending the proper radio signals and interpreting a returning stream of data. In game terms, this requires a successful System Operation–*communications* roll, though most satellite commands are so routine they do not require a skill check. For unusually difficult tasks (such as tracking a moving object or finding targets hidden under partial cover), a complex skill check might be required.

Heroes might try to gain access to satellite resources that don't belong to them. This requires a successful System Operation–*communications* roll to establish a radio link, then a Computer Science–*hacking* complex skill check to break in. The level of difficulty depends on the satellite's age and security measures: An old bird might require only 2 successes, while a modern military satellite might require 6 to 9.

Not every satellite understands commands given in English, adding yet another layer of difficulty to commandeering foreign satellites. Hijacking these devices requires fluency in the appropriate foreign language, or at least a skilled translator able to perform simultaneous translation of technical jargon. These foreign satellites expect their instructions to be delivered in Chinese or Korean, pictograms, Cyrillic letters, or Japanese kanji.

Once in control of a satellite, the heroes have access to its stream of data but not its core guidance system. Seizing control of a satellite guidance system requires an Amazing difficulty complex skill check. If they succeed, the heroes can use Vehicle Operation–*space vehicle* to maneuver the satellite to view any target.

Interpreting the full results from satellite observation requires training, but in most cases, a hero can interpret the basic structures at a site with a successful Knowledge–*deduce* roll. For a more detailed interpretation, a System Operation–*sensors* roll is required.

Adventure Hook: The Breeder

An electromagnetic life form has infected an orbiting satellite deep in space and now plans to take it on a joy ride. In fact, the creature has learned to manipulate electrical signals inside the command-and-control circuits to force the satellite into a decaying orbit. Once it has gone through re-entry, the creature promptly infects a member of the satellite recovery team sent out to retrieve it.

Infecting a human host requires a few hours of adjustment, but then the host is under the creature's control and begins exhibiting strange behavior, including a sudden obsession with electronics of all kinds. When the host's actions draw attention, the creature jumps out of its host and into the phone system, crossing the wires as a "pure" electrical signal, perhaps shutting down the local phone system for a few hours until the irregular burst of power is repaired.

Tracking the creature down is a challenge; destroying or capturing it is even more difficult. Perhaps the heroes can trick it onto a specially insulated satellite about to be shot right into orbit, or perhaps they can't capture it without arcane FX.

have launched their own satellites to gain a better view of targets and threats that might surround them. The United Arab Emirates and the Ukraine are acquiring satellites as quickly as possible.

Attack Satellites

To counter all this orbital activity, the U.S. has developed special weapon systems with a single purpose, the so-called satellite killers. These kinetic energy weapons are satellites that work by first finding and then smashing into other satellites, destroying them both. No nation has admitted to deploying any such weapon; their real strength and real numbers will only be acknowledged after they have been used to cripple a hostile power's communications relays or its surveillance satellites.

The principles behind these weapons are straightforward. Kinetic attack satellites are often parked in variable orbit to allow them maximum flexibility in choosing targets. These elliptical orbits have a perigee of just 2,000 kilometers above the Earth and an apogee of 20,000 kilometers. Each weapon is launched into orbit on a rocket and then releases "kill vehicles," each of which is slightly bigger than a fire hydrant.

Once in orbit, the kill vehicles maneuver to a target using reaction thrusters and destroy their target by smashing into it. The real trick is to destroy the satellite without creating so much space junk that the satellite destroys some of its neighbors as well. In ALTERNITY game terms, they are guided High Impact weapons with –1 accuracy and Good damage that inflicts d6+1s/d6+1w/d6+3w. The first of these anti-satellite systems flew in 1997, funded by a small research program that operated quietly under the Bush and Clinton administrations. Estimates are that up to ten such weapons might be in place by the year 2000, to assert U.S. control of space in the case of emergency.

The US has also developed weapons that strike from orbit against targets within the Earth's atmosphere. The newest generation of U.S. attack satellites is the SBL, or "space-based laser" series launched in the early 00s. Putatively designed as part of an anti-ballistic missile defense during the 1980s and 1990s, they use hydrogen fluoride lasers combined with 10-meter wide concentrating mirrors to destroy missiles shortly after launch, destroying roughly one missile per second and up to several hundred targets each. Weighing roughly 77,000 pounds, these gigantic weapons are capable of destroying several hundred targets before running out of energy. Currently, four of these satellites are deployed in a LEO about 1,300 kilometers above the Earth; the plan is to deploy a full twenty such weapons by 2010. However, their enormous weight has made launching them difficult; their incredible military value means that none of these satellites can be trusted to a Chinese, European, or Russian launch vehicle.

However, the system is not perfect. For one, the SBLs cannot hit ground-based targets; the water vapor in the atmosphere absorbs their energy before they reach the surface. This limits them to destroying ballistic missiles (the job they were designed for), plus destroying other satellites, military aircraft, and even commercial aircraft flying more than 4 kilometers up (roughly 13,000 feet). U.S. Department of Defense scientists and Israeli scientists are cooperating to produce new SBLs with wavelengths that can penetrate clouds and other sources of water vapor, to be able to attack ground targets. When attacking vehicles, these lasers inflict Good firepower energy damage. They damage vehicular targets for d6w/d8w/d4+1m, with –1 accuracy. It is capable of autofire and has a range of roughly 4,000/6,000/8,000 kilometers.

Adventure Hook: Loss of Shutter Control

When a border war flares up in the Golden Triangle between the Shan and a U.S. proxy government, the U.S. watches the action through one of its many Hexagon satellites. Unfortunately, someone has compromised the control codes, and the satellite is turned against the U.S. The heroes must find out who has taken control and how: Perhaps telekinetic abilities are being used, or perhaps it was taken over by Bilderberger or Knights of Malta operatives who feel their need for its information is greater.

Regardless of the source, the heroes must fight their way into the new ground control station and re-establish control of the satellite before its telemetry is used to coordinate a missile attack, pinpoint U.S. troops, or otherwise harm the government's efforts to contain the Shan.

Paranormal and Highly Classified

On occasion, the Hoffmann Institute acquires information or tips regarding a class of oddball satellites. These aberrant satellites are often mentioned but never detailed in the fringe press. They include devices devoted to obscure and classified projects in experimental physics, laser satellites that blind individual targets, kinetic energy weapons that strike from orbit with the force of a tactical nuclear weapon, and even mind control satellites.

Though no nation admits to owning, deploying, or even researching such satellites, the multi-billion dollar black budgets of the space-going industrialized nations have plenty of room for such schemes. Proof of their existence is sketchy, however, and generally limited to witness statements or the reports of supposed weapons-research insiders. Typically, their stories are impossible to verify.

Wolfgang Baur is the designer of the DARK•MATTER Campaign Setting. In his spare time, he struggles to master arcane computer codes, reads volumes of esoteric technical data, and tinkers with his mind control lasers.