

A computer-enhanced photograph taken from space by a reconnaissance satellite. The scene is of a Soviet shipyard building a nuclear-powered aircraft carrier (in two halves).

## Etiquette for the Age of Transparency

### Public access to public monitoring from space

by Kevin Sanders

*In many ways, we're lucky it was the U.S.S.R. that put up the first artificial satellite. If the U.S. had been first, the Soviets might not have been so eager to embrace an "open skies" policy for spacecraft, a policy which allows any and all objects in space to transit their territory. Aircraft certainly can't do that.*

*National sovereignty over the airspace above state territory is a well-established principle of international law. The "open skies" policy for space isn't. It's really just a custom evolving into something like a common-law tradition that may eventually be formalized in a treaty.*

*Until recently, the distinction between aircraft and spacecraft translated into a big difference in the amount of detail that could be gleaned from looking down. The coarser resolution of satellite sensors contributed to the tolerance observed nations have shown toward those viewing them from space. The U.S. has reinforced this tolerance by requiring its civil satellite data be made available to all on a nondiscriminatory basis. As a result, the benefits flowing from "open skies" have been available to all nations, even our potential adversaries.*

*Now that we're entering an era in which just as much detail can be seen from orbit as from an aircraft, will "open skies" prevail? Will easy access to the data continue to neutralize the sovereignty questions? When you are naked to eyes in the sky, what are good manners?*

*Born in Australia, Kevin Sanders has been in the U.S. for about 15 years, working mainly as a television news reporter/producer. He is currently putting together an hour-long video program, tentatively titled "Space 2000," based on a series of reports he did originally for CNN.*

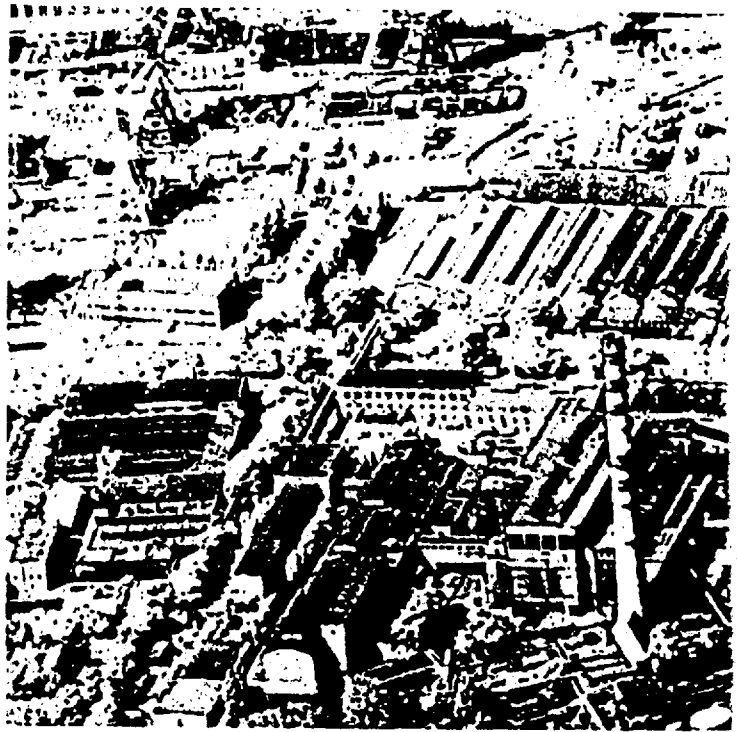
—Robert Horvitz

**T**HE POTENTIAL PEACEKEEPING ROLE of international earth-observation satellites was first reported in "Draft of a Proposed Speech for a President of the United States" by Howard and Harriet Kurtz in *CoEvolution Quarterly* #20, Winter 1978. With the advent of the first civilian high-resolution satellite, such a monitoring system has suddenly become feasible. But there is also talk in the Pentagon of shooting it down.

An Ariane rocket recently blasted off from French Guiana in South America, launching into orbit a new European satellite called SPOT (Système Probatoire d'Observation de la Terre). It is the world's most powerful and versatile civilian earth-observation system, producing pictures of the earth's surface three times more detailed than those of the U.S. Landsat. Under the 1984 Space Commercialization Act, Landsat has recently been transferred from the U.S. government to RCA and Hughes Aircraft, who will operate it commercially under the name EOSAT (Earth Observation Satellite). But among some U.S. officials there is concern that SPOT has already rendered Landsat obsolete. Reports from Europe suggest that SPOT may also mark the beginning of what Daniel Duedney of the Worldwatch Institute has called "The Age of Transparency," in which all nations can see everything all the time. Such a development cuts at an oblique angle across traditional assumptions of nation-state sovereignty and carries important long-term implications for the superpowers' defense and foreign policies.

The Pentagon currently imposes restrictions on Landsat pictures, limiting them to a resolution of 30 meters (one hundred feet). That means Landsat is not allowed to register anything smaller than 100 feet wide. (As a result, the public has access to considerably more detailed satellite pictures of the surface of the moon than of the earth.) SPOT, a joint enterprise by French government and commercial interests — in association with Belgium and Sweden — is not subject to Pentagon restrictions. It has been designed to detect anything more than 33 feet wide. While Landsat pictures cover a larger area — 180 miles square — SPOT will reveal more detail in its pictures, covering an area 36 miles square. Landsat can distinguish blocks of houses; SPOT will distinguish the individual houses.

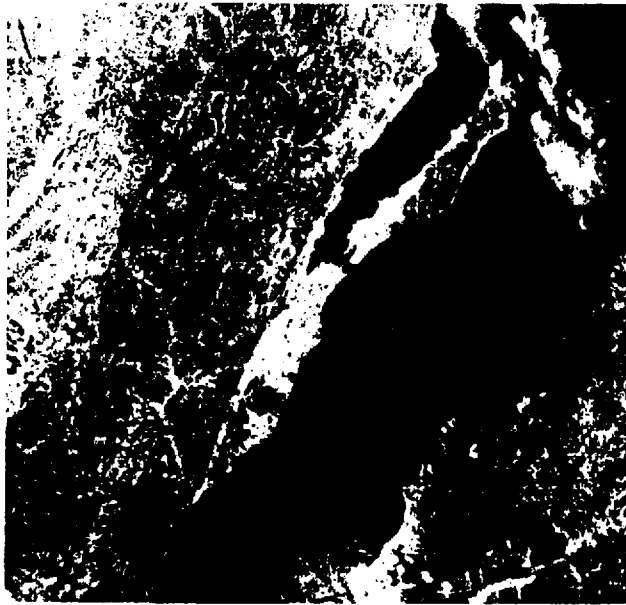
Jim Kukowski, head of NASA's Space Science Information office in Washington, D.C., says, "The impact of SPOT on Landsat's commercial viability will be significant. Landsat cannot be changed; it was built to certain specifications. We in the civilian sector can use our sensing devices to get down to a certain resolution where we have to stop. At that point it comes under the umbrella of the Department of Defense." He also notes that some of the unclassified pictures from the U.S. space shuttle



A portion of another view of the same Soviet shipyard (Nikolaiev, along the Black Sea) showing buildings that house technical staff. In the original photographs taken by U.S. military satellites, objects smaller than people can be discerned. Because of the sideviewing capabilities of the new telemetry satellites (see p. 61), extremely revealing oblique photographs are possible. The two images printed here are xeroxes of photos from British journal "Jane's Defence Weekly," which published them in August 1984, much to the angry surprise of the Pentagon. The degraded fourth-generation resolution of the photographs approximates the clarity of the most advanced commercial satellite imagery that may soon be available to the public.

orbiter's photographic cameras already exceed pentagon restrictions on Landsat. "In some orbiter pictures we can pick up a 747 in flight," he says. As a result of the ten-meter resolution available from SPOT, another NASA official warns, "We have to ask whether we are giving the private sector a dead duck with Landsat."

Congressman George Brown (D-California), who has long advocated civilian access to high-resolution pictures of Earth from space, predicts, "The U.S. probably will not be able to compete with SPOT, either in the quality of its pictures or the international marketing of the service." But Gilbert Weill, President of SPOT Image



An off-the-shelf Landsat satellite view of Lake Baikal in southern Soviet Siberia, not far from the Mongolian border. The resolution is about 80 meters (85 yards), which means objects smaller than 80 meters in area are not distinguishable. New satellites will resolve below 5 meters (16 feet).

(the corporation that owns and operates the satellite), stresses that SPOT pictures can be used in cooperation with Landsat. "SPOT is a logical complement to Landsat," he says. "We offer detailed images that can work in tandem with their more broad-scale product."

At the National Oceanic and Atmospheric Administration (NOAA) in Washington, D.C., an official who asked not to be identified, acknowledged that U.S. reaction to SPOT is schizophrenic. "Even though SPOT will be competition for Landsat, cooperation makes sense; the two satellites gather somewhat different kinds of data serving different needs. Also, we don't know if the present Landsat will continue working until we get the next one in orbit." The next in the series, Landsat 7, is scheduled for launch by the U.S. government in 1988 and will be operated on a commercial basis by a consortium of private space-technology companies. An NOAA official reported that future Landsats have been cleared by the Pentagon to go down to a resolution of 15 meters. SPOT will still be well below state-of-the-art for earth observation from space. Already some of the approximately 100 U.S. and Soviet spy satellites now in orbit are believed to have a resolution of one meter or even less. Anecdotal reports claim that some can see any weapon larger than a rifle, and that on a clear day they can detect the magazine you are holding. Soldiers working on secret projects in the field are ordered not to shine their shoes; the glare from polished shoes marching in step is said to show

up in military satellite pictures. General Daniel Graham (ret.), who heads the Washington, D.C.-based Heritage Foundation's High Frontier proposal for a space-based weapons system, boasts, "From space we can tell on which side a man's hair is parted."

Over the years the superpowers have learned to coexist under each other's scrutiny from space. Both concede that spy satellites have helped stabilize relations and reduce tensions. The advent of SPOT, however, undermines the superpowers' monopoly on high-resolution pictures from space, and there are now plans under consideration in Europe to experiment with SPOT data to monitor crisis areas, military activities, and arms control agreements.

International satellite monitoring of peace agreements was first proposed in the early sixties by a Washington, D.C.-based group called War Control Planners, headed by airline executive Howard Kurtz and his late wife, Harriet, a theologian. Edward Teller, a developer of the hydrogen bomb, was an early supporter. "Everything that can be seen from space should be shown in the United Nations," Teller said. The idea finally emerged in 1978 as a French U.N. proposal from an International Satellite Monitoring Agency (ISMA), after being picked up by assistant secretary general of the U.N., Robert Muller.

After a four-year, 12-nation study, the U.N. issued a report in 1982 concluding that an ISMA was "feasible and desirable." According to the U.N. report, each year an ISMA would cost the international community "well under one percent of the total annual expenditure on armaments" and could be operated "with or without the support of the superpowers."

Although the U.S.S.R. voted against the ISMA, and the U.S. abstained, 126 nations voted in support. In 1983, the Parliamentary Assembly of the Council of Europe — a 23-nation body including the Vatican — offered to cooperate with the U.N. through the European Space Agency (ESA), to establish a rudimentary ISMA. They would use data routinely available from U.S. and U.S.S.R. civilian satellites, together with more detailed pictures available from SPOT. The project is currently under further study by a Parliamentary Assembly committee on science and technology. According to John Pike, a space-science researcher at Federation of American Scientists in Washington, D.C., the Europeans are eager to get involved with an ISMA to reduce their dependence on earth observation material they currently get from the U.S. military in exchange for other "intelligence" information. "A lot of European governments would like to get out of that deal," Pike says.

Howard Kurtz, who sees an ISMA as the first step to what he calls a "global information cooperative," regards the advent of SPOT — and its possible value to an ISMA — as most encouraging. Kurtz is also urging support for a congressional resolution to guarantee limited civilian access to NAVSTAR, the Pentagon's multibillion dollar, 20-satellite, global navigation and tracking system due in place in 1988. "As part of an ISMA, it (NAVSTAR) could be used for global and local security, earth resource management and crisis and disaster relief," Kurtz says. "Back when Harriet and I first proposed these ideas, everyone said we were 25 years ahead of our time," he recalls. "Well, it's been 25 years and the time seems right!" (Kurtz has been nominated for the Nobel Peace Prize for his work.)

In a 1982 address to the U.N., British science writer, Arthur C. Clarke — who has dubbed the ISMA "the peacesat" — said it was an idea whose time has come. "Most of its elements are already present in existing or planned systems. The French SPOT with a ten-meter resolution has been mentioned. Whether the superpowers wish it or not, the facilities for an

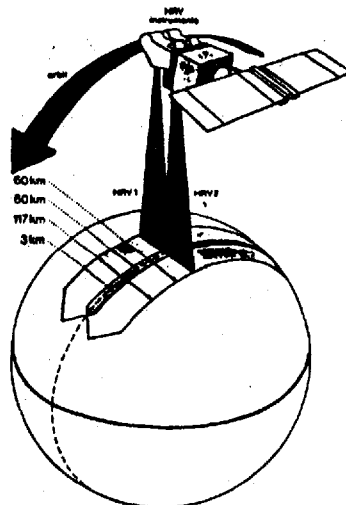
embryo peacesat will soon be available. May I remind my Russian and American friends that it is wise to cooperate with the inevitable."

Despite the current controversy over the Reagan Star Wars proposal — Canada, the Netherlands, France, Norway, Denmark, Sweden, China, Australia and New Zealand refuse to cooperate in research — the degree of international peaceful cooperation in space is, by contrast, already considerable and growing. Given the inherently global nature of space, many believe such cooperation is inevitable. All nations already cooperate in the space-based telecommunications system, Intelsat. The European Spacelab — involving all 12 nations of ESA and Canada — flies on the U.S. shuttle. Australian tracking facilities will follow the European Halley's probe. France, Canada, the U.S. and the U.S.S.R. are involved in the Search and Rescue Satellite system (SARSAT). Like the international postal service and civilian air traffic controls, satellite-based systems for communication, meteorology, astronomy and earth observation require a high degree of international cooperation to function efficiently. For example, the SPOT scanning programs are directed from mission control in

## THE GIANT EYES OF SPOT

Using the latest microchip technology — a pair of "pointable" electronic scanners, each with 6000 sensors aligned on CCDs (charge-coupled devices) — SPOT will provide stereoscopic, color-enhanced pictures of the Earth's surface. Circling the planet every 70 minutes at an altitude of 520 miles, in what is called a "near-polar" orbit, SPOT will systematically observe the entire earth except the tips of the polar caps. It will cross over any given area of the planet every 26 days. But since the computer-controlled scanners — the eyes of the satellite — can be maneuvered to either side to "pre-visit" or "revisit" any specified location, observations of the same area will be possible on a near-daily basis, thus providing "sequence" pictures of rapidly evolving events such as storms and floods. In addition, SPOT will be able to scan back and forth along the ground tracks, which together with the "side-ways look" capacity will provide for the first time in a civilian satellite the information to construct stereoscopic pictures of the Earth's surface "texture."

At SPOT Image headquarters in Reston, Virginia, the administrative manager, Nadine Binger, explained that pictures of whatever kind — black and white (at ten-meters resolution) or



color (at 20-meters resolution), flat or 3-D, single-picture or time-sequence — will be available for sale to anyone, including government agencies, corporations, universities, media and private individuals. "It's just like selling toothpaste," she says. "Customers will be those who want the information for agriculture, forestry, meteorology, oil and mineral exploration, mapping, oceanography, and environmental, urban and regional planning."

Unlike Landsat and the Large Format Camera, which were research programs designed to find out what the

technology was capable of detecting, SPOT was conceived from the start as a business venture. That should mean faster and easier access to the data, and more customer control over data acquisition. In terms of service, their most intriguing innovation is that you won't have to settle for just what's in stock. You'll be able to ask them to shoot the exact location you want, in black and white or false color. Scene requests will be radioed up to the satellite every day. Up to 60,000 scenes are expected to be acquired for general inventory next year.

The data will be available on computer-compatible tapes, photographic film (positive or negative) and on photographic paper. Each scene will cover 60 km x 60-85 km.

A rough ball-park range of prices: a photographic print or transparency will cost between \$300 and \$1,500, averaging \$500 each depending on requirements. Geometric correction (adjusting the distortion due to side-viewing) increases the average price to \$800 per photo. Digital tapes for image manipulation will raise the cost to over \$1,000 per scene.

Exact figures and ordering information will be available from SPOT Image, 1897 Preston White Drive, Reston, VA 22091-4326; 703/620-2200.

Toulouse, France, yet the digital data from which the pictures are reconstructed will be collected through a network of receiving stations in 12 countries, with more soon to be involved. Already 48 nations have ordered test pictures.

At a meeting in Washington, D.C., last year, Dr. Caesar Voute, chief of the Netherlands-based International Institute for Aerial Survey and Earth Sciences, predicted that, as such cooperation expands, "Interdependence will take the place of detente and coexistence." Dr. Voute regards the ISMA as an opportunity for all nations to work together for common global security. "We are at an historic turning point," he said, "But it will require a new approach by mankind to reap the benefits of space."

Ironically, President Reagan's proposal to share Star Wars technology with the world would entail the greatest international cooperative endeavor ever undertaken. Armand Hammer, president of Occidental Petroleum and friend of both President Reagan and Secretary Gorbachev, has challenged President Reagan to offer an immediate exchange of space weapons technology. But historian William Irwin Thompson has mocked what he regards as the inherent absurdity of the idea,

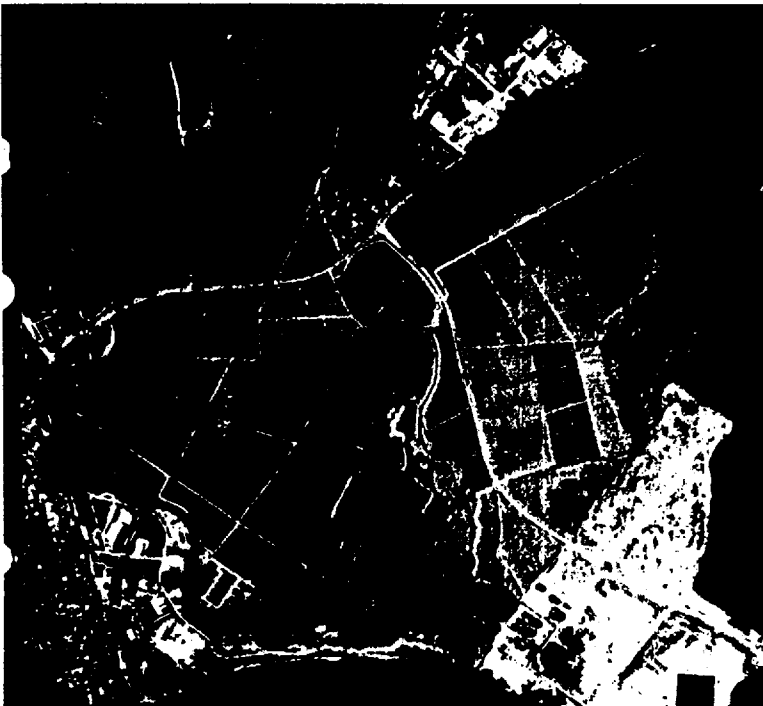
arguing that, paradoxically, it would also require such a massive level of trust in the exchange of nuclear, space and computer technologies "with Rockwell subcontracting space weapons construction to the Russians" that a situation would soon be reached in which it would be easier, cheaper and safer simply to disarm the bombs on earth and secure space for peaceful purposes.

But even purely civilian spacecraft present ambiguities of conflict and cooperation. Considerable international confusion exists over the military implications of satellites. Earlier last year, just before he left for Geneva to begin the first round of arms negotiations with the U.S.S.R., U.S. chief negotiator Max Kampelman astonished a group of space-cooperation activists by telling them, "There are already thousands of weapons in space." After some enquiries he modified the number to "hundreds." A few days later, after being challenged further on the statement, Kampelman explained that he was referring to the military observation and communication satellites. A similar confusion seems possible over SPOT, since its data could also be used to identify military movements and installations. Would this make it a "weapon?" Are there circumstances in which the U.S. would consider using antisatellite weapons against SPOT or other components of an ISMA?

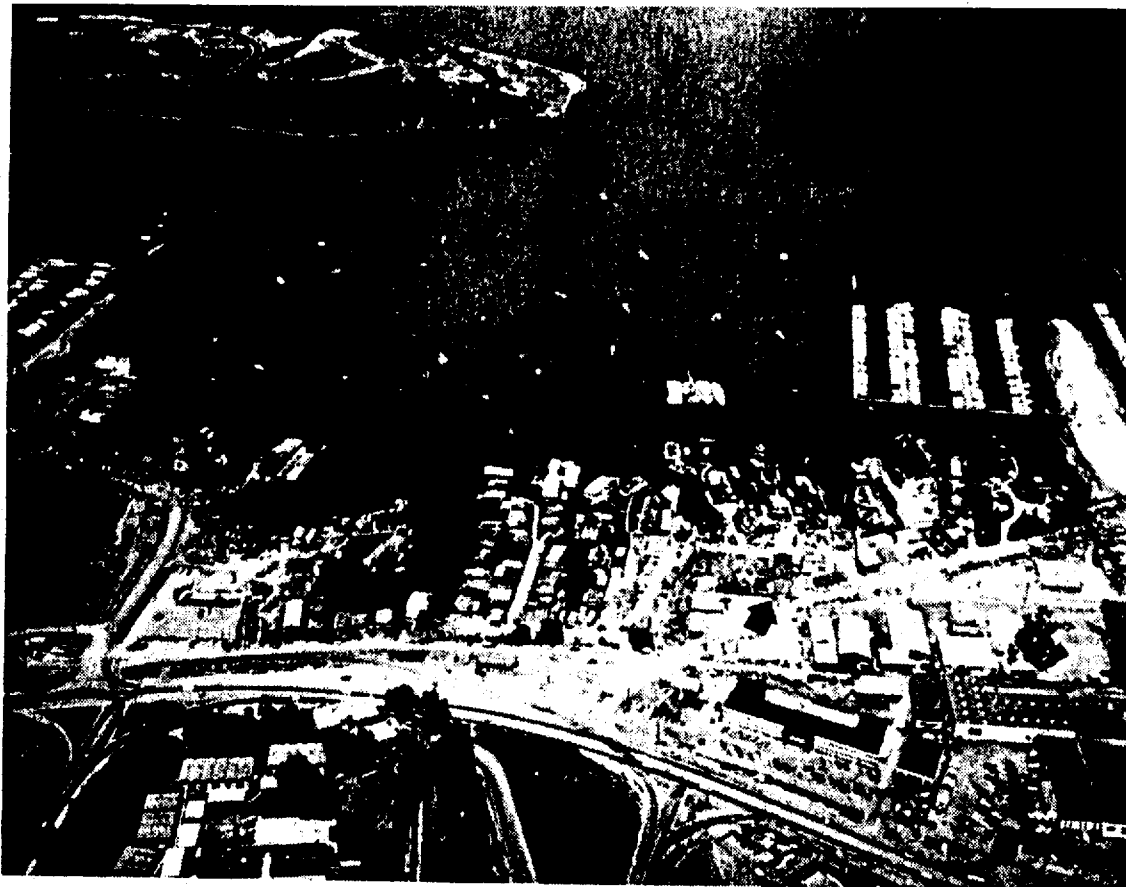
The Pentagon is reluctant to discuss the issues. "We don't want to reveal the range of our ASATs (antisatellite weapons)," said U.S. Air Force information officer Ron Rand. But Jonathan Weiner, aide to Senator John Kerry (D-Massachusetts), who opposes ASAT testing, says, "SPOT is clearly vulnerable, particularly if nations develop laser weapons." A Pentagon official acknowledged that if SPOT were to reveal military activities the U.S. wanted to keep secret, and if France refused to withhold the pictures, "It would be a perfectly logical scenario that SPOT could be targeted." David Julian, SPOT Image vice president, says the billion-dollar SPOT system carries no defense, and adds, "The possibility of an ASAT attack has not been discussed." He speculates it would be, "unlikely, since existing military satellites can already see much more." But Congressman George Brown claims, "The development of ASATs will inevitably pose a mortal threat to the whole international civilian space enterprise." (Currently congress has ordered a halt to U.S. ASAT weapons testing unless the Soviets resume their program.)

Possibly in anticipation of such tensions, French President Mitterand has proposed an independent European space station be used to

NASA



Crops can be monitored via satellites. Those with access to this information will often know more about the overall harvest of an area before its own farmers or local government. The dark patches in this low-altitude image of Jamaican fields indicate lush vegetation.



Above San Francisco

Gate Five Road, our backyard. We fuzzed an aerial photo of the Sausalito waterfront where our offices are (we're in the box the arrow points to) to simulate the quality of a 2-meter satellite shot. (Two-meter resolution means that objects smaller in size than 2 meters aren't discernible.) The technology to gather images of this quality from any back yard on earth already exists.

"observe, transmit and counter any eventual menace." He suggested recently that the French-built civilian science and technology platform, Eureka, which is due to be launched in two years, could be adapted for European space defense. Some observers believe the French statements merely reflect European resentment of President Reagan's failure to consult other nations prior to his public announcement of the Star Wars project.

However that may be, other nations are developing an increasing stake in space, and a growing concern for its security. Four more SPOT satellites will be launched in the next ten years, and West Germany, Japan and ESA also have earth observation satellites in the works for later this decade — some with picture quality and resolution even better than SPOT's. Charles Sheffield, vice president of the privately owned, Washington D.C.-based Earth Satellite Corporation, predicts the trend will continue. "By the year 2000 it is hard to imagine that there will be any limits on resolution of spaceborne sensors, other than those imposed by the technical state-of-the-art of the future optical systems," he says.

Eventually a network of such satellites — perhaps in the form of an ISMA — may become what science writer Ben Bova calls "a Swiss guard in space." Some believe such a system could pose an international counterforce to the growing threat of the weaponization of space. It could herald an age of international governance with a third force in orbit to triangulate the political dynamics of space with the superpowers.

The coming age of transparency is likely to require a new international etiquette and will raise a number of questions that have, as yet, been little considered: Will governments respond with greater civility or greater stealth? Will national and even personal privacy yield to the requirements of world security or have they already? Will orbital space become a superpower battlefield or a global commons? These are but a few of the issues the superpowers may have to consider now that the giant eyes of SPOT are in orbit, sending back from space the best pictures we have ever been allowed to see of our planet. They are available from SPOT without restriction for about a dollar an acre. Extra for 3-D. ■

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