

Open Skies Sensor Suite

At the present time the treaty permits two different kinds of sensor packages: 1) the Initial Operational Configuration (IOC) capability, which allows the use of only the visible-light sensors (i.e., standard framing cameras and color videotape) and 2) the Final Operational Configuration (FOC) capability, which consists of the IOC capability plus the addition of a thermal Infra-red Line Scanning device and a Synthetic Aperture Radar (SAR).⁵ The IOC is the sensor set allowed for the first three years after the treaty has entered into force; the FOC capability becomes the mandatory Open Skies imaging set after the initial period has passed in January 2006. The full sensor set will then ensure an all-weather, day-and-night observational capability.

The treaty limits the allowable sensor configuration not only to the four types of sensors but also in terms of the maximum allowable ground resolution⁶ of these sensors. Adherence to this limitation is assured through a rigorous process of sensor calibration. Only aircraft and sensor set that meet the treaty's technical limitations can be "certified" to be treaty-compliant and only certified aircraft are allowed to fly operational Open Skies Missions. The treaty requirement states the best allowable spatial resolution for the optical, infra-red and radar instrument to be as follows:

1. In case of optical panoramic and framing cameras, a ground resolution no better than 30 centimeters. Fair weather and day-light dependent sensor. Offers ability to identify and map man-made and natural features larger than 30 cm and to identify precisely their characteristics. With respect to the environmental data,⁷ this type of sensor would perform best in the following areas of application:
 - Civil cartography: landscape topography data; map generation and updating; creation of highly-accurate digital elevation models/maps (DEMs);
 - Urban management: identification/quantification of urban growth; transportation/industry infrastructure development monitoring; post-conflict/disaster urban damage assessment;
 - Land cover mapping: land-use classification/change detection; delineation of land and water boundaries.
2. In case of video cameras with real-time display, a ground resolution no better than 30 centimeters. As above.
3. In case of infra-red line scanning devices, a ground resolution no better than 50 centimeters. Weather and light independent sensor. Thermal IR detectors respond to the thermal radiation that each body emits. This sensor therefore allows viewing in poor-light conditions and, thanks to its ability to detect changes in ambient heat levels it can be used to profile temperature gradients. In terms of environmental data collection, thermal IR images obtained of the underlying surface could be useful for:
 - Studies of volcanic and geothermal areas;
 - Forest and underground coal seam fire⁸ detection and monitoring;
 - Thermal pollution monitoring in urban areas;
 - Assessments of the state of water areas, irrigation and reclamation problems.

⁵ Mark David Gabriele, "Capabilities of the Open Skies Sensor Suite," ch. 2 in: *The Treaty on Open Skies and Its Practical Applications and Implications for the United States*. Santa Monica, CA.: RAND Graduate School, Ph.D. Dissertation, 1998, pp. 7-24.

⁶ Ground resolution is defined as the minimum distance on the ground between two closely-located objects distinguishable as separate objects.

⁷ It seems also possible for the Open Skies cameras to be able to capture images from select parts of the electromagnetic spectrum by using various combinations of filters and films. The types of imagery that could result, apart from panchromatic (B/W), would include natural color, false-color infrared, and black-and-white infrared photography. This capability may have significant application for vegetation monitoring. See Britting and Spitzer, "The Open Skies," p. 236.

⁸ Wild coal seam fires are burning hundreds of millions of tons of coal every year, pumping huge quantities of carbon dioxide and pollutants into the atmosphere, and thus are contributing to climate change and damaging human health. See Jonathan Amos, "Coal Fires Are 'Global Catastrophe'." A *BBC News service Story* (February 14, 2003), pp. 1-3; "Wild Coal Fires Are a 'Global Catastrophe'." A *New Scientist News Service Story* (February 14, 2003), pp. 1-2, and; Harvey Black, "Feature: Coal Fires Threaten Environment." A *UPI News Service Feature Report* (March 6, 2003), pp. 1-2.