

diffraction, inescapably associated with the propagation of waves, also depends on the size of the collecting lens.²¹

The most capable American and Soviet photographic reconnaissance satellites use large lenses and long focal lengths, accompanied by high resolution camera film or electro-optical systems capable of transmitting images to the ground without degrading the high resolution²². This represents a degree of high technology not yet matched by other countries, or by observation satellites designed for non-military purposes.²³

The two factors determining resolution are the diameter of the collecting lens and the wavelength of the radiation. The larger the diameter of the lens and the shorter the wavelength, the better will be the resolution. Because infrared wavelengths are longer than those in the visual band, the images produced by infrared sensors cannot match the detail obtainable with visible light. In most other respects, infrared devices have the same

²¹ Resolution, or resolving power, is a term describing the degree of detail that can be observed in an image. Once the detail becomes blurred, further magnification will not allow more to be learned from the image. The resolution can be limited by the grain size of photographic film, or by the number of pixel elements in a television screen, as well as by optical diffraction.

²² George W. Stimson, *Introduction to Airborne Radar*, (El Segundo, California: Hughes Aircraft company, 1983) p. 516. As a general rule, the resolution required to recognize an object is somewhere between 5% and 20% of the major dimension of the object; for example, to recognize a house, a resolution of 2 - 3 metres would be required. Hugh De Santis, *Commercial Observation Satellites and Their Military Implications: A Speculative Assessment*, *The Washington Quarterly*, Summer 1989, p. 192. The author credits some United States systems with the ability to image objects as small as 10 centimetres. Vincent Kiernan, "Book Reveals Bickering Behind Scenes in Spy Satellite Programs," *Space News*, Volume 1, Number 1, 15 - 21 January 1990, p. 16. This author quotes a resolution capability for the American Keyhole or KH 11 photo reconnaissance satellite of six inches (15 centimetres).

²³ Bhupendra Jasani, "Space and Verification of Conventional Arms Reductions," *Brassey's Defence Yearbook*, 1989, p. 250. The best resolution from civil satellites so far is 10 metres, from the French SPOT spacecraft. The American high-resolution KH11 optical reconnaissance satellites are very large, weighing of the order of 14,000 kg.