

Homework #1
Assigned Jan. 26, 2018
Due Friday Feb. 2, 2018
Geology 4113 (Remote Sensing)

In the following show the equations you use and the algebra.

1) **Wavelengths and frequencies (10 points)**

- a) What is the wavelength in centimeters for a radar system operating at 15 GHz.
- b) What is the frequency in gigahertz of a system operating at a wavelength of 10 cm?

2) **Spatial resolution (10 points)**

Assume that your eyes have the normal resolving power of 0.2 milliradians, and that you are on an aircraft at an altitude of 20 km. For objects on the ground with a high contrast, what is the minimum separation (in meters) at which you can resolve these targets?

3) **LROC Narrow Angle cameras. (20 Points)**

a) (10 points) The Lunar Reconnaissance Orbiter Camera (LROC) now in lunar orbit consists of several components including two Narrow Angle Cameras which are "along-track" or "pushbroom" instrument like the ones discussed in class, using the spacecraft motion for the forward scanning. At an altitude of 50 km it obtains images with a resolution of 0.5 m. It orbits at a velocity of approximately 1.6 km/second. Find the instantaneous field of view (IFOV) of a detector needed to obtain this resolution, and also the "dwell time" for the sensor to advance one line of pixels. Finally, if the physical size of the detector pixels is 7 μm , what focal length telescope would be required to produce the above IFOV? Show the equations you use and your algebra.

b) (10 points) Once you've obtained your own answers, examine the LROC web site at <http://lroc.sese.asu.edu/> to see what instrument parameters they quote, and how well those agree with your estimates. You won't find all of your values there, but will find some. You may also want to examine some of their lunar images.