FREQUENTLY ASKED QUESTIONS ABOUT LUNAR METEOROID IMPACT MONITORING

1) *What kind of telescope and camera do I need?*

The "Minimum System Requirements" document describes what we believe to be the minimum hardware required to provide useful data. It also describes the system we use at NASA's Marshall Space Flight Center. In general, you need a big enough aperture to collect the light from the relatively faint flashes and you want a large enough field of view to see a significant portion of the dark part of the moon. The more surface you can see the more impacts you will see. This drives you to a relatively "fast" optical system with short effective focal length. This can be accomplished using a focal reducer if your telescope is f/8 or greater. Our initial work was with a 10 inch f/4.7 and we are now using two 14 inch f/8 telescopes with 0.33 magnification focal reducers and a 20 inch f/8.1 with a focal reducer adjusted to 0.25 magnification to give the same field of view as the 14 inch telescopes. A sensitive black and white video camera is essential. Camcorders and webcams are not sensitive enough, but "astronomical" video cameras have the required sensitivity. A video frame rate is vital in order to detect the short flashes. Integration with a CCD camera will not work. Full exposure at frame rates of 30 per second (NTSC) or 25 per second (PAL) is necessary. The exposure time should equal the frame rate. In other words, there should be no dead time between exposures since a flash can appear at any time.

2) *When should I make my observations?*

Observations should be made when the moon is between about 10% and 50% illuminated on any clear night. This is a crescent phase to quarter phase. This includes both the waxing (evening observations) and waning (morning observations) phases. Between quarter and full phases the sunlit portion of the moon is too large and its glare reduces visibility of impact flashes. Phases less than 10% illuminated are so close to the sun that the moon sets too soon after sunset or rises too close to sunrise to provide much useful data. Also, the elevation of the moon is so low that atmospheric extinction reduces the detection of faint flashes. Meteor showers occurring when the viewing geometry is correct give a greater probability of seeing an impact, but we are interested in the sporadic background meteors. See FAQ #6 below for more information.

3) *What kind of electronics do I need?*

The "Minimum System Requirements" document describes a system which we are using. Other hardware may work but the key goal is to generate video data which is compatible with the LunarScan software. Since timing is so important, either WWV audio should be recorded with the video or a GPS time stamp should be included at the start and end of the video. Carefully setting the time on a video recorder is important but usually is not adequate.

4) *What kind of software do I need?*

The "Minimum System Requirements" document lists the software we use. In general you need software to record your video to your hard drive and you need a copy of LunarScan (available as a zip file from http://www.gvarros.com/lunarscan.zip) to search the video for the impact flashes. It is possible to detect the brighter, longer lasting flashes by visually reviewing the video but it is very tedious and you are likely to miss many short flashes.

5) ***How do I know I have detected an impact?***
The best way to know if you have detected an impact is correlation with another observer, hence the need for accurate timing information. There are many phenomena which can look like an impact: cosmic ray impacts on the CCD detector, electronic noise (especially if using analog video tape recording), satellite and orbital debris sunlight glints, and "point meteors" – those coming straight at you. If another observer more than about 10 kilometers away sees a flash on the same spot on the moon at the same time, we can safely say it is none of the above phenomena and is probably an impact. Also, if the flash is bright, persists for more than a couple of video frames, shows the right kind of "light curve" (bright followed by exponential fading), and is obviously not moving, it is most likely an impact.

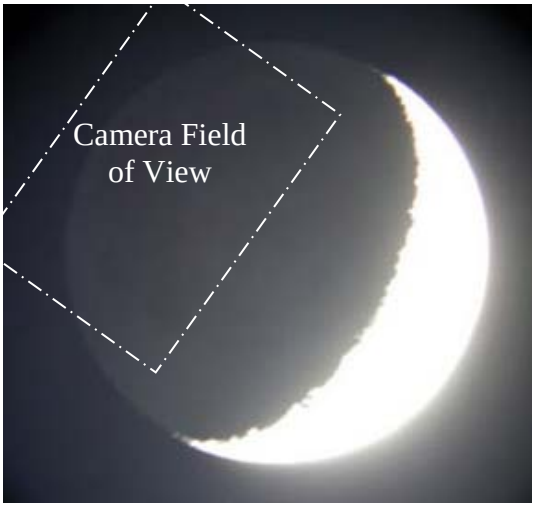
6) ***Who is interested in my data and what will it be used for?***
The NASA Meteoroid Environment Office at Marshall Space Flight Center is responsible for defining the meteoroid environment so that spacecraft designers can add adequate protection for their vehicles and any crew it may contain. It is important to understand the flux, size, and speed distributions of large (few centimeter) meteoroids impacting the moon and the resulting ejecta sprayed from the impact. Your data will help determine the flux.

7) ***How do I report my results?***
Please provide impact flash observations that include the date, time, location of observatory, and location of the impact on the moon to NASA's Meteoroid Environment Office at the email address listed under "Contact Us" at the website
http://www.nasa.gov/centers/marshall/news/lunar/index.html

In general, we will need a few frames of video data around the time of the flash with an accurate (approximately 0.1 second) time determination. In order to photometrically calibrate the flash we will also need a few frames of video of a star (with its identification) near the moon, recorded within a few tens of minutes of the flash.

8) ***Will LunarScan run under another operating system?***
No. It is for Windows only. There are no plans to port to other operating systems.

9) ***What should my field of view look like?***
You want to maximize the un-illuminated area of the moon seen in your field of view without including any of the sunlit portion. It's best if you stay away from the terminator. See the diagrams below.



We rotate our camera to put the terminator in the bottom of the field of view as in drawing below. We make sure that the horizontal axis of the camera is parallel to the terminator. The polar cusps of the moon can be used to establish this line if necessary. The GPS time code is only recorded for a few minutes at the start and end of the observations.