LUNAR-BASED SOLAR UV SPECTROMETER RESEARCH PROGRAM

EXECUTIVE SUMMARY

It is proposed that a solar UV spectrometer research program be performed as a part of lunar exploration. The goal would be to produce a new generation of solar UV spectrometers capable of true autonomous operation.

BACKGROUND

The solar UV spectral irradiance (SUSI, 120-400 nm) plays a crucial role in the structure of the Earth's atmosphere. Solar UV radiation is absorbed by ozone and other constituents provide heating for the stratosphere. It is also believed that variations in solar UV irradiance affect terrestrial climate. Because a large part of this radiation is absorbed or scattered by the Earth's atmosphere, measurements of SUSI must be made from space.

Since the 1970s, wavelength-dependent SUSI measurements have been made from rockets, satellites, and the space shuttle. Different from other scientific disciplines where the job is complete once a quantity is measured, we must continue to measure SUSI as it changes over time. This is because future solar behavior is fundamentally unpredictable and may have important consequences for humanity. This is amply demonstrated by the continuing scientific interest in sunspot numbers and estimates of solar irradiance during the Maunder Minimum and their possible connection to the "Little Ice Age" in Europe. Accordingly, accurate long-term SUSI time series will provide one of the basis measurements used to monitor and understand the evolution of Earth's atmosphere and climate. These will continue and improve a long-term database to be consulted for generations to come. Such a time series is absolutely required for climate studies.

PROPOSAL

An implicit goal of current research programs is to bring SUSI measurements to an operational, monitoring regimen. The problem is that the needed instrument science has not yet advanced to the level that provides accurate and precise measurements over the long term. In particular, calibrating the instruments' wavelength-dependent responsivity has been difficult and problematic. It is proposed here to utilize the moon as a unique platform to test and validate new SUSI instruments and concepts to allow for future accurate long-term autonomous operation aboard satellites. Because of their importance to the terrestrial system, SUSI measurements provided by foreign participants have been planned for the Space Station.

There are several advantages afforded by this program.

1. We expect that the environment on the moon will be cleaner and easier to control than that of the Space Station. Further, this program provides a real and substantial scientific benefit the lack of which was a perceived weakness in the Space Station program.

2. The lunar platform uniquely allows for the flexibility of human intervention in the various experiments, not shared by autonomous satellite experiments. Given the termination of the Space Station, the lunar surface is the most viable location for this research.

3. The search for a viable approach could be opened up to competition (both public and private) with several experimental concepts being tested at once. This would leverage America's pioneering and innovative spirit to solve this important problem.

4. This program would continue only until a solution to the fundamental measurement problem is found and transferred to an ongoing solar UV irradiance monitoring program, probably by another agency, e. g. NPOESS or NOAA.