Background and Script to Supplement the Live Stream Footage of the Balloon Solar Eclipse Project

LOCATION OF FEED FOR PROJECTION:

The Live Feed is on YouTube, and you can find it by going to YouTube.Com and on the search bar key in our channel: @EclipseUpClose. Once on our channel, select the "Live" tab.

Or, you can go directly to the Live feed page via this link: (1) Eclipse Up Close - YouTube

The project also has a (1) Facebook channel: EclipseUpClose where we will post any latest updates.

The project website contains more background on the project and can be found at www.eclipseplus.ca

Background

- The Balloon Solar Eclipse Project has been in development and planning for the past three years to provide an opportunity for audiences to view dramatic video footage and images of the Sun, Moon, Earth, clouds and horizon throughout the various Eclipse stages in real time.
- This is a volunteer, not for profit, community-based initiative, involving volunteers from various backgrounds and expertise.
- The overall goal of the project is to engage the public in a unique way to experience the total eclipse free of charge. (It is expected that audiences in the viewing centres will have a mix of local residents, students and tourists who have travelled to participate in the planned eclipse activities from regions that would not be within the path of totality, or from more local regions that are in the path of totality.)
- This is the first time this region has had a total solar eclipse since the year 932.
- There are a total of 8 public viewing centres in Florenceville-Bristol, Hartland, Woodstock, Perth-Andover, Plaster Rock, Grand Falls and also Houlton Maine.

The Payload

- The payload is housed in a hexagonal enclosure about 200 cm (6 1/2 feet) in height and 50 cm (1 2/3 feet) in width.
- The entire payload weighs about 8 kg (17 1/2 lbs).
- It contains several mechanical and electronic components needed to ensure the safe flight of the payload, a transponder for air-traffic identification, RF devices for air-ground communication, GPS, pressure/temperature sensor and multiple computers for image gathering, control and storage.
- It contains a total of 8 cameras.
- The payload is attached to a high-altitude, unmanned, helium-filled balloon.
- The payload has no directional control abilities and its flight path is completely dependent on the wind direction and velocity.
- The balloon is designed to self destruct at around 28,000 metres (or 93,000 feet), however, if the upper-level winds are strong, the payload will be programmed to go to a lesser height by means of “cutdown” unit that can be programmed to initiate destruction after a specific time lapse or by command issued from the ground station.
- The pressure inside the balloon is just slightly greater than the outside atmospheric pressure. So, on the ground the balloon pressure is just a little bit above the outside ground atmospheric pressure.
- The little extra pressure inside the ballon is needed to work against the force of the latex trying to squeeze the balloon inwards. Think about how hard it can be to blow up a balloon. That's the extra force needed.
- As the balloon rises the outside atmospheric pressure decreases. That means the balloon expands because the inward force on the balloon from the atmosphere has decreased.
- This process continues as the balloon rises and the atmospheric pressure decreases.
- The balloon gets bigger and bigger until finally it can't stretch anymore and it shatters and blows up.
- The balloon diameter on the ground after inflation is about 7 feet, but at maximum altitude it will grow to about 35 feet in diameter.

- The payload is launched from the grounds of the Amsterdam Inn in Florenceville-Bristol, under close cooperation and only upon approval from the air traffic control units in both Moncton and Boston.
- The payload contains an aircraft transponder that allows its location to be fully tracked and monitored by the ground station crew, as well as the air traffic control units and any airplanes within the vicinity.
- In addition to the transponder, we are also able to track the location of the payload via a SPOT trace device that transmits the GPS data, and an Automatic Packet Reporting System Device (APRS). There is also an independent SpotTrace unit in the cutdown unit. Thus, we have four independent methods for tracking the location of our payload.
- The balloon will rise at a speed of 5 metres/second. The balloon will either self destruct when it reaches its maximum altitude of 28,000 metres (93,000 feet) OR due to activation of a cut-down mechanism mentioned previously.
- Once the balloon flight is terminated, the payload descends towards ground in freefall until a parachute unfurls slowing the descent rate to a terminal velocity of 5 metres/second at touch down.
- The project team has a Recovery Team that tracks the location of the payload during flight and travels to the estimated landing site to recover the payload and contents.

Cameras

- There are a total of 8 cameras on the flight, 6 of which transmit images in real-time to the ground station.
- One camera that takes continuous video from a horizontal view out the side of the payload
- Four cameras that each take still image pictures at a rate of every 60 seconds: -one with a downward view from the payload

  -two on opposite sides of the payload taking horizontal views

  -one upward looking camera on the cutdown unit
- One camera that is dedicated to taking still image pictures of the Sun at a rate of every 10 seconds. This camera is centred above a mirror that will reflect the Sun image. The mirror is attached to a sophisticated mechanism referred to as the Agile Eye, that has a dual axis gimbal mechanism that will adjust the mirror dynamically based on the Sun's position relative to the payload. The Agile Eye

reacts to data on the Sun's position based on an IMU (Inertial Measurement Unit).

- The four still image cameras are programmed to take an image every 60 seconds each, but they are staggered in time such that a new image from one of the cameras is sent to the ground station every 15 seconds.
- The video camera will record non-stop and the feed will be sent to the ground station in continuous, real-time.
- All of the images and video are transmitted from the payload computers to the ground station via the 70 cm (440 MHz) downlink band at a speed of 500 kbps.
- Once the images and video feed are received at the ground station, the feed is formatted and uploaded to YouTube and the feed is then projected on screens at the viewing centres.

What will you see displayed on the Projection?

- The feed will be divided into four quadrants,
- The two quadrants on the left-hand side of the screen will display the most recently downloaded images from the five still image cameras. These two images will alternate updating and refreshing with new images.
- The top right-side quadrant will display the continuous video feed from the video camera.
- The bottom right-side quadrant will contain the logos for our sponsors as well as the following telemetary data about the payload: the current latitude and longitude position of the balloon, the current altitude of the balloon, the horizontal distance from our launch site, a countdown to launch (T-X) as well as a countdown to totality (T-X).

Why does a Solar Eclipse Happen?

- As the Moon goes around the Earth it follows an orbit which is elliptical, appearing very slightly smaller when further out and larger at the closer point.
- While it is not possible to detect this difference in size without accurate instruments, when the moon is at its closest point it is large enough to completely obscure the disk of the Sun, and the closer it is the longer the duration of the eclipse.

- A total solar eclipse is when the moon blocks out the Sun entirely, a partial eclipse is when it blocks out a portion of the Sun, and an annular eclipse is when the moon is at its furthest point in orbit.
- The next total solar eclipse in Canada will not be until August 2044.

Eclipse Phases

- Partial eclipse begins (1st contact): The Moon becomes visible over the Sun's disk. It looks like the Moon has taken a bite out of the Sun.
- Total eclipse begins (2nd contact): The Moon covers the entire disk of the Sun. Observers in the Moon's umbral path may be able to see the diamond ring effect and Baily's beads just before totality.
- Totality and maximum eclipse: The Moon completely covers the disk of the Sun. Only the Sun's corona is visible. This is the most dramatic stage of a total solar eclipse. At this time, the sky goes dark, temperatures can fall, and birds and animals often go quiet. The midpoint of time of totality is known as the maximum point of the eclipse.
- Total eclipse ends (3rd contact): The Moon starts moving away, and the Sun reappears. Those fortunate enough to be in the Moon's umbral can see Baily's beads and the diamond ring effect just after totality ends.
- Partial eclipse ends (4th contact): The eclipse ends as the Moon leaves the Sun's disk.

Events of Interest

- The **Baily's beads, diamond ring or more rarely double diamond ring** effects are features of total solar eclipses. Although caused by the same phenomenon, they are distinct events during these types of solar eclipses. As the Moon covers the Sun during a solar eclipse, the rugged topography of the lunar limb allows beads of sunlight to shine through in some places while not in others. They are named for Francis Baily, who explained the effects in 1836. The diamond ring effects are seen when only one or two beads are left, appearing as shining "diamonds" set in a bright ring around the lunar silhouette. It is common for Eclipse watchers to propose marriage at the precise moment when the diamond ring effect occurs.
- **The Corona** During a total solar eclipse, the corona briefly comes into view as the Moon blocks out the light from the solar surface. The corona is wispy, white

streamers of plasma (charged gas) that radiate out from the surface of the Sun. It constantly changes shape and size.

- Light filtering through leaves on trees casts crescent shadows as totality approaches.
- During an eclipse, local animals and birds often prepare for sleep or behave confusedly. Local temperatures often drop near totality.

Timing of Event (based on New Brunswick local time)

- Live feed will begin at 1515h
- Balloon Launch 1530h
- Partial Phase begins 1522h
- Totality 1632h 19 sec to 1635h 38 sec
- Totality duration 3 minutes 19 seconds
- Live feed ends at 1645h

Safety *The following bullets have been provided by the New Brunswick Optometrist Association*

- Do not look directly at the sun unless you are wearing proper, certified eclipse glasses to protect your eyes.
- Solar eclipse glasses must be certified with certification identification: ISO 12312-2. Regular sunglasses DO NOT provide enough protection.