

## **Fire in the Sky: Community Science with a Network of All-Sky Cameras**

### **Suggested Abstract and Outline for a 50 minute talk with 10 minute Q&A**

Frank Sanders, 15 July 2001

#### **Suggested Abstract**

Fireballs and meteor showers elicit intense interest from the community and are of scientific importance as well. With an increased emphasis being placed by the Museum upon community science in space studies, a network of all-sky cameras across Colorado has been developed. DESS Associate Frank Sanders will show how the planned sky camera network will work, what outputs it will produce, and the broad goals it will achieve. A brief background is provided on small bodies in the solar system and their significance. Fireball and meteor phenomena are briefly described, and the community's reaction to fireballs and meteors is discussed. The Museum's past approaches to studying fireballs and interacting with the community are compared to current and future needs and capabilities that will be met through the use of the Museum's sky camera network. Sky camera outputs for timely (24-48 hr) response to the community via the media are discussed, including fireball tracks and computed orbits. Student projects with sky cameras are described. Community science with sky cameras is shown to be a highly practical method for positively increasing the visibility and relevance of the Museum to the community in the wake of fireball and meteor events.

#### **Suggested Audience**

The ideal audience for this talk is suggested to be as follows: DESS staff; Media Relations staff; DESS Associates; and selected volunteers. Museum staff who might benefit the most would include:

- **Space Odyssey staff** who are involved in Community Science and with general planning for educational and experiential components of the project;
- **Other DESS staff** who are interested in the All Sky Network at the working level;
- **Media Relations staff** who need to know more about how the Museum has handled fireball events in the past and how it may handle them in the future;
- **Selected administrative personnel** who may be interested in learning more about how the planned sky camera network will work organizationally, what outputs it will produce, and what goals it will achieve for the Museum, the Community, and the science of small bodies in the solar system and the Earth's interactions with those bodies.
- **Selected volunteers** who have been involved with the Museum's past efforts to track fireballs and locate meteorites;

#### **Suggested Venue, Schedule and Equipment**

The VIP Room would be appropriate for this talk. A noontime talk would be good, but any time during a weekday, or during an evening would also work. I would be willing to give the talk more than once, if a significant number of people who would like to hear it cannot attend at a particular time on a given date. At present, the most likely dates appear to be sometime in September. I will be available most of that month. A computer projector and an overhead projector would be required for this talk. I can bring a computer projector if the Museum doesn't have any available.

#### **Suggested Length of the Talk**

Each one-line entry in the outline (below) comprises approximately a single slide. This presentation will show approximately 70 slides in 50 minutes, for a typical duration of 42 seconds per slide. The presentation is fast-paced and informative. It is designed to strike a good balance between strong information content, length, and enjoyable presentation.

## Suggested Outline of the Talk

- 1) Introduction: Solar System Billiards (3 minutes);
  - Basic solar system (with asteroid belt and cometary zones);
  - Why asteroid and comet material is important;
  - **Jupiter** as the solar system's heavyweight spoiler;
    - a) Jupiter shoots meteoroids at Earth;
    - b) Jupiter shoots comets at Earth.
  
- 2) Background: Collisions with Earth: Fireballs and Meteors (5 minutes);
  - Sporadic (but not rare);
  - Unpredictable;
  - Approach speeds;
  - Atmospheric physics;
    - a) flight paths;
    - b) light;
    - c) sound;
  - Physical model;
  - Disintegration;
  - Fall to earth.
  
- 3) How the Community Reacts when Fireballs Occur (5 minutes);
  - Bright event in the sky astounds witnesses;
  - Sounds are heard for miles;
  - TV and radio stations are flooded with calls;
  - Museum is flooded with calls;
  - Web sites for reporting fireballs are flooded with reports;
  - **Members of the community want to relate their observations to someone;**
  - **Members of the community are anxious to know more about the event from scientists;**
  - **Community wants timely information (24-48 hrs) on fireball events from the Museum via the media;**
  - **Community wants timely imagery (24-48 hrs), if available, from the Museum via the media.**
  
- 4) Meteor Showers (2 minutes);
  - Regularly occurring, predictable;
  - Known to originate from comets;
  - Good test of systems and methods for observing fireballs;
  - Significant interest from the public.
  
- 5) What the Museum has Historically Done When Fireballs Occur (4 minutes);
  - Take reports on the telephone;
  - Interview selected eyewitnesses at their locations;
  - Reduce eyewitness reports to flight paths (manually, no computers, low accuracy);
  - Place notes in files;
  - Occasionally conduct ground searches in possible fall areas.

- 6) What the Museum has NOT been able to do historically for fireballs or meteor showers (5 minutes):
- Have not produced fast data collection (data have usually taken months to acquire);
  - Have not been able to provide quick (ie., 24-48 hr turnaround) info to public on fireballs;
  - Have not been able to provide imagery of fireballs;
  - Have not usually provided imagery of predicted meteor showers in real-time;
  - Have not been able to provide rapid feed-back to the community on big fireballs.
- 7) What the Museum has Done More Recently to Analyze Fireballs (5 minutes):
- Take reports from Web sites;
  - Use newly developed software (by Sanders) to quickly correlate witness data;
  - Use Web reports and software to produce approximate flight paths overnight;
  - Obtain acoustic data from NOAA and correlate with eyewitness information;
  - Prototype sky camera designed, developed and tested by Sanders.
- 8) What the Museum will do with a Network of Sky Cameras (10 minutes):
- Basic sky camera design (with model);
  - Obtain imagery of fireballs for scientific and community-science purposes;
  - Use sky camera imagery to compute 3-dimensional trajectories overnight w. Sanders software;
  - Use sky camera information to compute more accurate 3-trajectories;
  - Use overlapping sky camera imagery (if available) to compute **orbits** with Sanders software;
  - Use data from just one camera plus Web reports to compute approximate **orbits**;
  - Use data to quickly compute approximate fall locations;
  - Eyewitness interviews are mostly **eliminated**;
  - **Collaborative relationship** with Sandia National Laboratory allows data sharing with New Mexico network, and collaborative data analysis between DMNH and SNL;
  - **Information can be released via news media to the community in a timely manner (within 24-48 hours):**
    - a) Imagery;
    - b) 3-D tracks;
    - c) Orbits (showing where the objects have come from);
  - Scientific outputs will be produced in the form of journal papers on fireballs and the camera network. Likely collaboration with Sandia on these papers;
  - **Real-time imagery of predicted meteor showers** may be provided via the media to the community.
- 9) What Students will do with a Network of Sky Cameras (4 minutes):
- Allow students to share data between schools (one fireball or meteor on one camera goes out to all schools, even those without cameras);
  - Students compute trajectories and possible orbits;
  - Students compute approximate fall locations;
  - Students take observations on regular meteor showers and share those data between schools;
  - Students compute meteor orbits and compare them to known cometary orbits;
  - Students are motivated to further understand meteors, meteorites, comets (small bodies in the solar system);
  - Students have a tool to observe and study atmospheric phenomena on a long-term basis.

- 10) Highest-Level Benefits to the Museum and the Community (3 minutes);
- Museum interacts directly with the Community on many levels (educational, scientific, and informational);
  - Existence of Sky Camera Network raises the Museum's visibility in the Community in a positive sense;
  - Timely (24-48 hr) informational feedback from the Museum to the Community in the wake of fireball events raises the Museum's visibility in a positive sense;
  - Students who gather and share fireball and meteor data perform science on a multi-level basis.
- 11) Example Case history: May 26, 2000 fireball (4 minutes);
- Observer's data;
  - Correlation to obtain 3-D flightline;
  - Reduction to orbital elements.
- 12) Question-and-answer session (10 minutes).