

SpaceGAMBIT Proposal

1. Project Title

Central Spark

2. Primary Contact

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3. Project Summary

The goal of Central Spark is to create software that will simplify, automate, and speed up the submission of astronomical sightings and discoveries (such as asteroid sightings made by Slooh telescope observers) to central object databases (such as those maintained by the IAU Minor Planet Center), social media feeds, and “Internet of Things” cloud services.

By doing that, we believe that we can more readily share the excitement of participatory science with people who would otherwise be unaware of the vital role played by amateur scientists in the pursuit of asteroid detection. In addition, by making such data available in real time to experimenters in makerspaces and homes and schools across the world, we expect to spark the development of innovative ways of tracking and displaying astronomical observations and discoveries in real time through the use of microcontroller software and electronics, mobile and wearable computing, and related DIY technologies.

4. Relevance to SpaceGAMBIT Mission

Central Spark is relevant to SpaceGAMBIT's mission on several levels.

First, the project will improve the ability of amateur astronomers with an interest in asteroid detection to use the Slooh remotely-operated telescopes to make observations and rapidly transmit their sightings to centralized databases such as the Minor Planet Center. Another goal of the project is to increase awareness of and participation in asteroid detection activities by

would-be observers, by permitting them to follow the observations and reporting of Slooh asteroid hunters in real time, either through social media or through machine-to-machine (“Internet of Things”) protocols. The end result should be more accurate and timely reporting of observations, as well as raised awareness among amateur astronomers and the general public of the utility of remote observation telescopes in the search for asteroids, leading to an increase in the overall level of asteroid observation and tracking activities by amateurs.

In addition, Central Spark has the potential to enlist the creativity and enthusiasm of the maker movement in designing and building software and/or mechanisms whose function is based on the observational data submitted in real-time by Slooh observers. For example, it might be possible for makers to fashion an augmented planetarium display upon which is overlaid a laser designation of the coordinates of incoming object observations. Or perhaps other makers may choose to create a wearable display that tracks observations in real time, or a tablet-like device that synchronizes incoming observations with a celestial object database showing nearby bright stars, or other creations that may have educational value but which may not be easily imagined ahead of time.

5. Project Description

The Central Spark project will develop software extensions to the Slooh web site to integrate the submission of astronomical sightings to central object databases (such as those maintained by the Minor Planet Center) into the observational program. The software will be incorporated into the Slooh remote telescope user interface, which will simplify and speed up the reporting of scientifically useful object sightings by automating and reducing the number of steps and amount of data entry that is required in order to make a submission to such databases. Automating the submission process should also help to reduce errors.

The initial software development work will be based on the current web user interface to the MPC database, however it is expected that during the project timeframe the MPC will be beta testing new interfaces designed to facilitate automated submissions to the database, which capability will also be incorporated within the Central Spark project. In addition, we will work with other database maintainers such as NASA JPL to ensure that Slooh observers can streamline the submission of observations to those databases.

In addition to enhancements to automate the submission of observations will be work to enable the submission of observation and activity reports to social media such as Twitter. The purpose of using social media feeds to report telescope observations is primarily educational. Social media offer an opportunity to reach out and recruit new observers who might not otherwise discover the fun of amateur astronomy. Twitter messages accompanied by photographs would be particularly effective in capturing the excitement of amateur astronomers making remote observations through professional-quality equipment installed at an exotic site featuring extraordinarily clear skies. The plan is for Central Spark to incorporate social media posting

within the Slooh user interface so that Tweeting of observer activity is painless. Posts can be made to Slooh-maintained Twitter feeds geared to different types of observing - one feed for asteroid observations, another one for planetary observations, another for deep sky objects, and the like. In addition, users will be able to post to their own social media feeds. Twitter is given as an example only - there are other social media sites such as Pinterest and Facebook that would be good venues for posting astronomical observation reports for public consumption.

A third component of the Central Spark project will be enabling Slooh users to submit observations to “Internet of Things” cloud services such as Xively.com and Dweet.io in order to enable machine-to-machine communication of observation coordinates as well as facilitating the creation of archives of observation activities for later analysis. We hope that making this data available will lead to novel ways of visualizing astronomical observation activity and raising awareness of amateur astronomy, by unleashing the creativity of makers, students and amateur scientists who can incorporate the data in projects of their own design. Such projects might involve the use of microcontrollers or single-board computers (such as the Raspberry Pi), or wearable computing, or smartphone and tablet-based interfaces.

Central Spark will also conduct workshops through the Fairfield County Makers’ Guild and the Westport Library MakerSpace to publicize the Asteroid Grand Challenge and amateur astronomy, including creation of projects based on the Slooh asteroid observation data, and a live presentation simulcast over the Internet featuring observations made via the Slooh telescopes in the Canary Islands.

6. Methods and Implementation Plan

a. Objectives

1. Develop software extensions to Slooh to enable automated observation submission to astronomical databases, social media, and Internet of Things cloud services
2. Involve makerspaces in publicizing NASA’s Asteroid Grand Challenge, Central Spark project, and amateur astronomy

b. Tasks

1. Review Slooh software internals and proposed extensions with Slooh software engineers
2. Select specific external services for interfacing: astronomical databases, social media, and Internet of Things cloud services
3. Document the software interfaces for each external service to be supported
4. Create a detailed design spec for all of the Slooh software extensions and interfaces to be implemented
5. Obtain IT equipment and hosting services
6. Develop software extensions to Slooh using development and test servers

7. Test usability and functionality of software extensions
8. Deploy the Central Spark software updates to the Slooh production servers
9. Work with makerspaces to launch workshops

c. Time allocation

- design and documentation process: three to four weeks
- development and testing: six to eight weeks
- makerspace workshop development: one week

d. Milestones and Deadlines

- review of proposed software extensions with Slooh software engineers - one week after project approval
- selection of external services, with documented interfaces - two weeks after project approval
- completion of design spec - four weeks after project approval
- alpha test of astronomical database interface software - seven weeks after project approval
- alpha test of social media interface software - nine weeks after project approval
- alpha test of Internet of Things interface software - ten weeks after project approval
- beta test of all new software functionality - eleven weeks after project approval
- release to production of new software - depending on successful completion of beta test and Slooh development/release schedule
- present makerspace workshops - ten weeks after project approval

7. Team, Hosting and Partner Organizations

Taking the lead role in this project will be Ed Kalin, a graduate of MIT with an interest in amateur astronomy and experience as both a technical marketing professional and a tech startup executive, a computer hardware and software engineer, a consultant, a researcher, a solitary entrepreneur, a technical writer, an inventor, and a registered patent agent. Ed will also manage the involvement in the project of other local makerspace members who have an interest in hands-on science and a background in computer software development and/or DIY electronics.

Ed is affiliated with two Connecticut makerspaces, both of which will participate in the Central Spark project:

FCMG - Ed was one of the co-founders of the Fairfield County Makers' Guild (<http://makersguildfc.com/>), a Norwalk, Connecticut-based makerspace that offers a wide variety of hands-on maker classes, sponsors weekly meetups devoted to topics such as microcontrollers, 3D printing, multicopters, and robotics, and provides a community workshop equipped with maker tools, technology, and expertise in their use. FCMG members will create one or more projects that will interact with Central Spark based on inexpensive and accessible platforms such as the Raspberry Pi educational computer board and the Arduino microcontroller, and will develop and present public classes or workshops based on those projects. FCMG will handle bookkeeping for Central Spark through the makerspace's own accountant, Marie DeLeo.

Westport Library (CT) MakerSpace - The Westport Library (<http://westportlibrary.org>) has been a pioneer in the emerging library-based makerspace movement. The Westport Library operates its MakerSpace (<http://westportlibrary.org/services/maker-space>), located right in the heart of the Library's "great hall", as a center for public participation in creation, collaboration, innovation and entrepreneurship. Ed was selected by the Library to be its "Maker in Residence" for the month of March, 2014, during which time he worked on his project, "Developing an Experimental All-Sky Camera Based on the Raspberry Pi Computer Board", which included members of the public in the design discussions for the project. In conjunction with that project, Ed has been actively blogging on two sites (<http://allskycamera.wordpress.com/> and <http://www.element14.com/community/people/doorknob/blog>), and he will also be blogging about the Central Spark project. Ed will be working with Bill Derry, Assistant Director for Innovation and User Experience for the Westport Library, to set up public presentations and/or workshops to highlight the activities of NASA's Asteroid Grand Challenge, SpaceGAMBIT, and Central Spark.

Slooh - Slooh (<http://www.slooh.com/>) has connected telescopes to the Internet for access by the public. Slooh members have participated in numerous discoveries with leading astronomical institutions. Ed will be working closely with the staff of Slooh to develop the Central Spark project software.

8. Budget

The estimated budget for Central Spark is approximately \$14,600, most of which is allocated to labor for software development. The remaining budget line items include administration, materials for use in makerspace projects, and IT equipment and hosting.

See the attached budget spreadsheet for a detailed breakdown.

9. Project Deliverables

Software to interface between Slooh users making asteroid observations and centralized object databases such as that maintained by the IAU Minor Planet Center

Software to automate the posting of Slooh users' asteroid observations to social media such as Twitter

Software to automate the submission of Slooh users' asteroid observations to Internet of Things cloud services such as Xively.com and Dweet.io

CC licensed project documentation

Workshops presented to the public by Fairfield County Makers' Guild and the Westport Library MakerSpace