



March 24<sup>th</sup> | 14

# Progress Report for SkySeed

Panalloon Systems

## Prepared for

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## Introduction

SkySeed is a real-time outdoor surveillance system that is attached to a helium weather balloon tethered at an elevation of 20-30 meters. Through a graphical user interface, the operator at a base station can observe and change the area of interest of the video feed.

This document describes the details of Panalloon Systems' progress toward the completion of the SkySeed proof-of-concept; progress is described by addressing hardware and software development cycles. Furthermore, the document analyzes expenditures and provides an outline of the remaining tasks. Via parallel development, SkySeed is currently in the final stages of development and integration. During our balloon testing phase, we encountered an unforeseen weight issue which will require minor design changes to be made in order to meet the weight constraint. This leads to consideration of remediation schemes to get SkySeed back on track. However, in retrospect to Panalloon's original project plan, SkySeed is now on schedule and close to completion.

## Schedule

SkySeed's original schedule was carried out without any deadline deviation up until the first hardware implementation milestone. Hardware development was delayed approximately 1.5 weeks due to complications that have arisen thus sometime was allocated to remediate.

Members of Panalloon are now meeting only once a week to update one another on SkySeed's development progress. Once the integration phase begins on April 1<sup>st</sup> members will meet more frequently to carry out team involved testing procedures. As of now, Panalloon will proceed with the following schedule outline:

*March 24<sup>th</sup> –to- April 1<sup>st</sup>:* Focus on weight reduction, reliability testing

*April 1<sup>st</sup>- to – April 7<sup>th</sup>:* Hardware and software feature enchantments

*April 7<sup>th</sup>-to- April 10<sup>th</sup>:* Modular integration of whole system

*April 10<sup>th</sup> –to- April 17<sup>th</sup>:* Integration testing and demo preparation

## Finances

Panalloon Systems has financially gone over the estimated cost of \$962.50 with a total expenditure of \$1018.20 until today. Initial budget was coined at \$1250, which comprises of ESSEF Project Funding and each member's personal contribution. Currently, accounts have \$231.80 remaining from initial budget in case of component failures.

## Progress

### Hardware Progress

As of today, Panalloon's hardware development team has completed the critical path of SkySeed's design. The completion marked a 1.5 week delay with respect to the original schedule deadline March 4<sup>th</sup>. Below are completed tasks and remaining tasks to solve realized problems and enhance features.

#### Completed tasks

Critical path of the motion system and power system:

- Power is now desirably safe and successfully distributed to SkySeed's electronics
- Motion system is fully functional and wirelessly controllable from base station

#### Remaining tasks

Aerial System:

- Balloon failed to lift at nominal helium lift capability, weight reduction of SkySeed is now in scope of re-designing.
- Parachute in a re-design phase due to SkySeed weight adjustments
- Material re-selection to improve balloon and enclosure alignment

Motion System

- Add camera stability enhancement via turbulence feedback using an onboard gyro-scope
- Re-designing of camera exoskeleton to reduce onboard weight
- Weight reduction of wooden bracket for camera

### Software Progress

Panalloon Systems' software is comprised of the user interface on the client side and the microcontroller programming on the server side. Based on the original schedule, the deadline for completion of all software tasks is the week of March 2nd. However, Panalloon's software team managed to clear this milestone ahead of schedule, allowing more time for feature enchantments.

Currently, work is being done on the UI to make it more reliable. For example, allowing user to exit gracefully upon system errors. A great amount of effort is also being spent to provide the user with useful system status. Along with reliability concerns, Panalloon is able to implement two bonus features to augment robustness and usability. The first feature, under construction will provide the user with a choice of camera rotation speeds. The second feature, which has been successfully added, is the ability for the user to record up to 5 minutes of video.

### Completed tasks:

- Basic User Interface: main functions such as displaying video stream and sending commands to the Arduino server
- Microcontroller programming: receive and process client commands by moving servos
- Video Record: option to record current video stream in clips of up to 5 minutes

### Remaining Tasks:

- System status: recording status and connection status
- Speed control: user will choose from three speed options
- Reliability and Robustness:
  - Graceful exit in all situations
  - Quick recovery and reconnection when network issues occur
  - Usability of UI elements such as buttons and radio buttons

## Remediation

SkySeed has yet to deviate from the original proof-of-concept design. However, development progress is now at halt in the Aerial System department. This is due to the helium balloon failing to lift at nominal lift capability of 1.6 kg (the balloon at hand is only capable of lifting 0.9 kg).

Addressing this constraint is first in priority, as helium lift is the aerial system's key attribute.

Fortunately, SkySeed has adopted a very modular development etiquette in order to mitigate delays due to inter-component dependency. Members of Panalloon System are now going back to make minor and iterative design changes to reduce net body weight of SkySeed. *As a plan-B Panalloon Systems has decided to add a second balloon to lift the 1.56 kg SkySeed to a desired height.*

## Conclusion

Panalloon Systems has dedicated many hours to the completion of SkySeed. As a result, the overall progress of SkySeed has been faster than our initial perceived schedule. At the moment, the product state is at 90% completion. The software and hardware aspects of SkySeed are completed and general enhancements are being added. Although the project has required consideration in minor remediation, the modifications will not affect the proposed completion date. Initially, we planned to demo the project on April 1, 2014; however, we were able to pick a later demo date of April 17 which allowed time for extra enhancements and testing.