



*MiniSShot*  
Progress Report #1

Rev. 2007/07/29

Prepared by: R. Nakka

[1] On indefinite Leave of Absence  
[2] Inactive  
[3] Acting Project Manager  
[4] Acting focal

## **Progress Report #1**

This document outlines progress, to date, of the *MiniSShot* project as a whole, as well as serving to summarize progress of each technical group.

Progress has been very steady and continues to advance at a quickening pace. No significant hurdles have been encountered so far.

## **Project Groupings**

- **Project Support**
- **Systems Engineering**
- **Electronic and Software Systems**
- **Propulsion System**
- **Recovery System**
- **Launch Support**
- **General Engineering Support**
- **General Manufacturing Support**

## **Project Personnel**

Joseph Mahaney (Project Manager) [1]

Andre Alexandre Barbosa

Matt Campbell

Randy Dorman

Alberto Gassol

Chris Hardaker

Joseph Jimmerson [2]

Zachery Kier [2]

Roman Lev

Ed Mallory

Richard Nakka [3]

Cory Posvic

Tom Raithby

Craig Strudwicke

Hans Olaf Toft

Tarun Tuli

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# Project Support

The roles of the group as a whole include:

- document/drawing management
- arrange for launch site, permits, etc.
- develop / distribute marketing and promotional material
- develop fundraising means and assign funding to groups
- develop project goals, plan and budgets
- website enhancement and maintenance
- develop & implement an effective communication strategies between project participants and our public audience
- organizing and finalizing safety, vehicle integration, launch and recovery procedures and checklists

## **Members:**

Joseph Mahaney (focal) [1]

Chris Hardaker

Alberto Gassol

Richard Nakka [4]

Joseph Jimmerson [2]

## **Progress to date**

- Additional CAD support for the project is being actively sought. Some progress made.
- Fundraising has been discussed with a small amount of progress made. Some limited funding is available to the groups.
- In tune with the SS2S program as a whole, support to, and involvement with, high schools and universities is being actively pursued (e.g. piggyback payload, scholarships)
- SS2S website has been updated with news of SS2S reorganization and announcement of MiniSShot project
- *Skype* has been successfully implemented as a primary means of communication between many project members.

# Systems Engineering

The roles of the group as a whole include:

- provide technical direction and facilitate resolution of any technical issues
- ensure successful integration of vehicle and ground system components
- produce project scope document
- produce and maintain project timetable and manage progress
- manage personnel including skills survey and assignment of duties
- definition and technical approval of project objectives and requirements, including associated documents and drawings
- develop mass targets for all vehicle components
- coordinate/perform miscellaneous testing, as requested from other groups
- plan and coordinate in concert with all other groups final integration and on-site test and assembly of vehicle and ground systems

## **Members:**

Joseph Mahaney (focal) [1]

Richard Nakka [4]

## **Progress to date**

- SS2S program scope document has been published with inclusive MiniSShot scope statement
- Timetable has been established with target date for MiniSShot launch. Regular (weekly) “countdown” message sent to all members stating how many weeks remaining until launch. Progress reports have been completed by most members.
- Skills survey successfully completed and used to assign members to appropriate group(s).
- Requirements document is nearing completion.
- Vehicle Mass Statement Iteration #1 has been published with preliminary design data.

# Electronic and Software Systems

The roles of the group as a whole include:

- define payload requirements and electronic and mechanical specifications
- design payload and recovery systems electronics including software as required. If commercially available units are to be used as part or whole of the payload, integrate the units as required to achieve requirements.
- Manufacture payload components and assemblies. Alternatively, produce drawings required for offload of part manufacture to the General Manufacturing group.
- Integration of payload components and systems
- testing of components to ensure proper operation and reliability, including flight testing
- provide applicable support to ground testing
- vehicle-ground communications
- motor ignition systems (ground & in-flight) development
- plan and coordinate in concert with all other groups as needed the integration and on-site test and assembly of all electrical vehicle and ground systems

## **Members:**

Ed Mallory (focal)

Tarun Tuli

Hans Olaf Toft

Craig Strudwicke

Andre Alexandre Barbosa

## **Progress to date**

- Payload (Avionics) largely defined.
- Work is progressing well on Flight computer (FC), GPS, video board & Inertia Measurement Unit (IMU). The latter measures 3-axis acceleration with accelerometer & gyroscope to provide info on attitude with respect to vehicle axis. Integrates acceleration to get velocity and altitude. Integrates roll acceleration to provide roll rate. Flight computer stores all flight data in flash memory. Passes data to chute controllers.
- Design work is progressing well on Chute Controllers (CC). Controller takes altitude data from FC and calculates time to apogee and passes this onto countdown timer. Test cases have been successfully run for Barometric Backup unit.

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- Work has been undertaken on DTMF unit, which incorporates a UHF receiver to pick up one-way signals from ground. Intended use is to “save the bacon” as a last ditch effort in case FC & CC’s fail. Can also send signal to prematurely fire 2nd phase to destroy vehicle in case of 1st phase burn anomaly. Based on Amateur radio 440 MHz band.
- Work is progressing well on design of RF link, utilizing 3 radio systems (Amateur Radio band). Receives data over a Wi-Fi link to maintain contact with vehicle to receive flight data, such as GPS coordinates. Intended as a 2 way link.
- Work is progressing well on design of analogue data acquisition. A UART data I/O could be used for diagnostics and/or as a direct link to the telemetry radio. Proposed system would have 8 analogue inputs with 10-bit A/D resolution. A thermistor based circuit to measure vehicle or nosecone internal temperature (0-60 deg.Celsius range) has been designed.
- Beacon transmitter to send out amateur radio call sign, GPS coordinates, status, as part of vehicle tracking system to aid recovery has been proposed. One beacon located in each section (booster, payload).

# Propulsion System

The roles of the group as a whole include:

- define propulsion and static testing requirements including technical specification document
- rocket motor detail design
- produce sketches or informal CAD drawings of rocket motor components and assembly
- fabricate (or coordinate fabrication of) rocket motor components
- propellant casting
- perform motor static testing
- plan and coordinate in concert with all other groups the integration and on-site test and assembly of vehicle propulsion and propulsion ground support systems

## **Members:**

Randy Dormans (focal)

Richard Nakka

Matt Campbell

## **Progress to date**

- Technical Specification Document for the ProtoSShot-M Mark I motor has been completed and published. The ProtoSShot-M Mark I motor is, in essence, the projected MiniSShot motor.
- Detail design of the ProtoSShot-M Mark I motor has been largely completed.
- Composite joint design for the nozzle and bulkheads has been substantiated by successful hydro-static testing.
- Thermal ablative testing well underway with a number of suitable candidates identified.
- Thermal insulation for the motor casings has been identified.
- Significant fabrication has been completed on the casing, nozzle, upper and mid bulkheads.
- Preliminary Finite Element (FE) analysis has been started on the Delay Plug design.

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# Recovery System

The roles of the group as a whole include:

- define recovery system requirements
- design and manufacture of recovery system components (excluding electronics)
- ground and flight testing to verify design concept and reliability
- plan and coordinate tracking and recovery of vehicle
- plan and coordinate in concert with all other groups the integration and on-site test and assembly of vehicle recovery system elements

## **Members:**

Matt Campbell (focal)

Tom Raithby

## **Progress to date**

- Basic key parameters have been identified (such as mass and volume targets) in order to meet project requirements.
- Clarified recovery system requirements and recovery profile. Safety aspects incorporated to protect against inflicting damage on the ground, but also to meet mission requirements (redundancy, etc).
- Opened discussion with Carl Denzell (rage@rocktrage.com) on recovery strategies.
- Preliminary detail design of recovery system ready to commence.

## **Launch Support**

The roles of the group working in concert with all other project groups include:

- coordinate ground support systems
- coordinate on-site assembly and testing, launch, tracking and recovery of vehicle

### **Members:**

Members will consist of volunteers from all other groups within the project that can be on-site to assist in launch and recovery efforts. The members are to be selected 3 months prior to launch attempt.

# General Engineering Support

The roles of the group as a whole include:

- define overall design of the vehicle
- provide technical support and direction to all other groups (including role as a clearinghouse for technical queries from all other groups)
- provide mechanical and thermal part simulations
- perform flight trajectory simulations and studies
- define vehicle stability requirements
- produce (or assign tasks regarding) CAD models and drawings based on sketches or informal CAD drawing from all groups
- perform brief part or assembly optimization

## **Members:**

Zachery Kier (focal) [2]

Cory Posvic

Hans Olaf Toft

Roman Lev

Richard Nakka (consultant) [4]

## **Progress to date**

- A Vehicle Configuration Study has been completed which studied viability of MiniSShot (and other SS2S projects) with regard to achieving altitude goals. Included comprehensive sensitivity study with regard to parameters that affect altitude.
- Basic MiniSShot vehicle design has been undertaken and progress has been solid.
- Thermal analysis is currently being undertaken to study ablative protection of the rocket nozzle.
- Technical support has been coordinated between groups.
- Design concepts and manufacturing means for nosecone is well underway.
- Detail fin design has commenced with background research into stability requirements and how this inter-relates to fin design. *FinSim* software has been purchased to aid in fin design.
- Iteration #1 of MiniSShot flight simulations has begun.
- CAD (SolidWorks) modeling of motor nozzle, bulkhead and mid bulkhead has been nearly completed. Engineering drawings have also been produced for these components.

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# General Manufacturing Support

The roles of the group as a whole include:

- provide manufacturing support for the project, including off-load work from other groups
- provide technical support regarding manufacturing methods to all groups
- provide access to manufacturing facilities or materials

## **Members:**

Richard Nakka (focal)

Tom Raithby

Roman Lev

Zachery Kier [2]

Matt Campbell

Randy Dormans

Joseph Mahaney [1]

## **Progress to date**

- Components for the ProtoSShot-M Mark I motor have been manufactured (or are in the manufacturing stage). Existing pyrogen unit from BEM will be used, removing manufacturing requirement for that component.
- Nosecone and Payload Fairing manufacturing has been assigned.