EXPLORER POST 1010
STUDENT LAUNCH
INITIATIVE PROPOSAL

September 17, 2021

Institution: Explorer Post 1010

Mailing Address:
Rockville Science Center
PO Box 1084
Rockville, MD 20849

Email Address:
post1010@gmail.com

General Information

Our team is sponsored by the Rockville Science Center. They help us find qualified adults to mentor our teams and work with the library to provide meeting space. We help the Center with staffing their outreach events which allows our student members to earn Student Service Learning hours. Post families financially support the Center and participate in other Center programs.

We are organized under the national Learning-for-Life Exploring Program (http://exploring.learningforlife.org), and supported by the National Capital Area Council of the Boy Scouts of America.

Explorer Post 1010 ("Post") contact information:

- Meeting Location:
  Rockville Science Center,
  36C Maryland Ave,
  Rockville, MD 20850
- Mailing Address:
  Rockville Science Center,
  PO Box 1084,
  Rockville, MD 20849
- Shipping Address:
  Rockville Science Center,
  524 Carr Ave,
  Rockville, MD 20850
- Email Address: post1010@gmail.com

Mentor contact information:

- Bob Ekman (Post Advisor)
  - bob.ekman@att.net
  - phone: 301-512-1278
- Jonathan Rains (NAR Member)
  - jrains@comcast.net
- Vince Camobreco (parent support)
  - vincent.camobreco@gmail.com

Student Team Leader Name: Jack Sherling

- Email: sherlingjack@gmail.com
- Phone Number: 301-646-1414

Safety Officer: Sam Troost

- Email: samueltroost20816@gmail.com
- Phone Number: 301-310-7351

- Number of Students Committed: 8
    - Jack Sherling
    - Sean Russell
    - Peter Camobreco
    - Sam Troost
    - Jake Hawks
    - Jayden Ku
    - Michael Guardado
    - Ethan Goldberg

Name of the NAR/TRA sections the team is planning to work with:

- NARHAMS, Model Rocket Club, Section 139 - The NARHAMS model rocket club serves Maryland and the Washington Metropolitan Area. The club is an official chapter section of the National Association of Rocketry (NAR).
- Northern Virginia Association of Rocketry (NOVAAR), Section 205 of the National Association of Rocketry (NAR)

Hours Spent on Proposal: 15 hours

Facilities and Equipment

We will be using the Rockville Science Center Storefront (open evenings and Saturdays) and the Rockville Library Makerspace (open 10am-6pm) to design and construct our rocket.

The Explorer Post has had teams in the American Rocketry Challenge (TARC) since 2005. We have had several teams make it into the TARC finals. In 2021, one of our teams came in second nationally. We have institutional experience and equipment that can be put to use in this project.

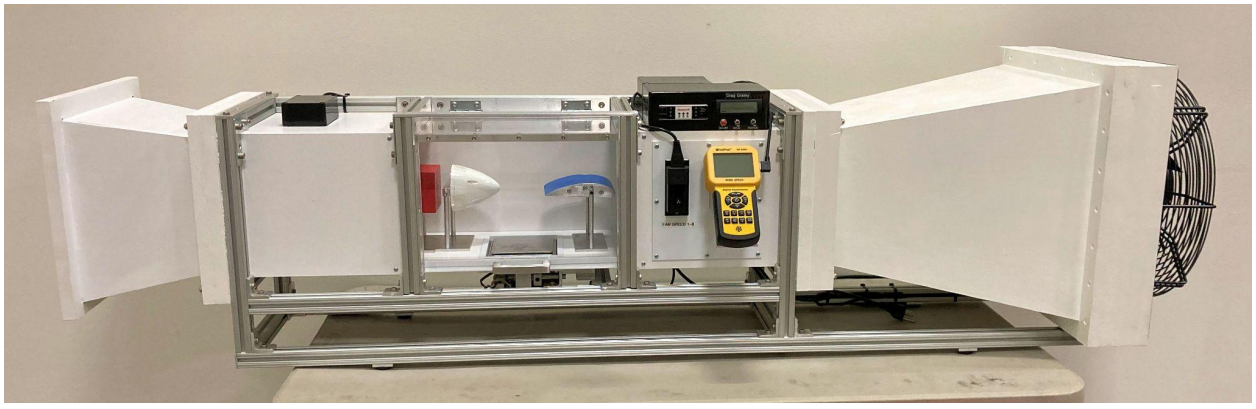
The tools available that we use to build our rocket include a laser cutter, 3D printers, a CNC machine, power tools, and a wind tunnel. There are Center staff available to assist with the use of equipment.

The team has access to soldering equipment, microcontrollers, computers and programming software, wires (male to male, male to female), power supplies (including lithium batteries).

For rocket design and flight simulation, we use OpenRocket. We have used it for many years successfully in TARC.

We will use a programmable drone to either be constructed in-house or purchased and modified, which will be discussed more in our payload section.

The Explorer Post also hosts a drone team. The drone team and their equipment are available to use and help with development. The drone team is registered in the AMA UAS4STEM competition (https://amablog.modelaircraft.org/uas4stem/). In 2021 our team won the national competition held at the annual International AirVenture Aviation Festival.



Safety

Instruction
All members of the Post undergo safety training from qualified makerspace personnel prior to using any of the equipment.

Safety Plan
All construction machinery used will be supervised by at least one other person. A Fire Extinguisher will be accessible during any construction activity There will be adult support when using any construction machinery. Motors will be handled and transported by Jonathan Rains, a NAR member with a L2 certification.

Launch activities
All launch activities will be monitored by NAR officials. All launches are conducted by a range safety officer in compliance with the Safety Code of the National Association of Rocketry as well as NFPA 1127: Code for High Power Rocketry.

For launch sites, we have access to locations previously used for the Tripoli LDRS National event and the National Battle of the Rockets competition.

On the launch pad, only team members, mentors, and NAR officials will be present. We will ensure that no power is on the igniter leads before loading. We will ensure that the rocket is stable on the launch rail after placing it on. We will activate the electronics and drone and ensure that they are working properly with radio signals and LED displays that signify statuses. We will then load up igniters.

Risk Assessment

Risk	Likelihood	Possible Outcomes	Mitigation
Unsafe use of power tools	Medium	Injuries to operator and damage to equipment	The team will only use tools as they were intended, make sure every member of the team is trained to use power tools, inspect tools for damage before use
Improper launch	Low	Unsafe flight and	The rocket will be

preparation		hazard to spectators	thoroughly inspected by the team and the Range Safety Officer
Improper rocket motor handling	Low	Premature ignition of motor, injuries to handler	The team will not allow heat sources or open flames within 25 feet of rocket motors, ignition systems will not be installed until the rocket is at the launch pad or a designated preparation area
Inflight failure of rocket	Low	Injuries to spectators	The team will not fly if any structural or electrical damage is found upon inspection, additionally the rocket will be inspected by the Range Safety Officer

Caution Statements

Caution statements will be used on any potentially hazardous activities and equipment, including instructions on use of personal protective equipment.

NAR Member handling of Rocket Motors and energetics

The team mentor will personally be responsible for all handling of high power rocket motors and energetics.

Compliance with FAA rules and regulations.

The team will exercise extreme caution before launching any rocket. The team will not launch:

1. At any altitude where clouds or obscuring phenomena of more than five tenths coverage prevails;
2. At any altitude where the horizontal visibility is less than five miles;
3. Into any cloud;
4. Between sunset and sunrise without prior authorization from the FAA;

5. Located within 9.26 kilometers (5 nautical miles) of any airport boundary without prior authorization from the
6. In controlled airspace without prior authorization from the FAA;
7. Unless you observe the greater of the following separation distances from any person or property that is not associated with the operations applies:
    - (1) Not less than one quarter the maximum expected altitude;
    - (2) 457 meters (1,500 ft.);
8. Unless a person at least eighteen years old is present, is charged with ensuring the safety of the operation, and has final approval authority for initiating high-power rocket flight; and
9. Unless reasonable precautions are provided to report and control a fire caused by rocket activities.

Safety Agreement

All team members understand and will abide to the following safety regulations:

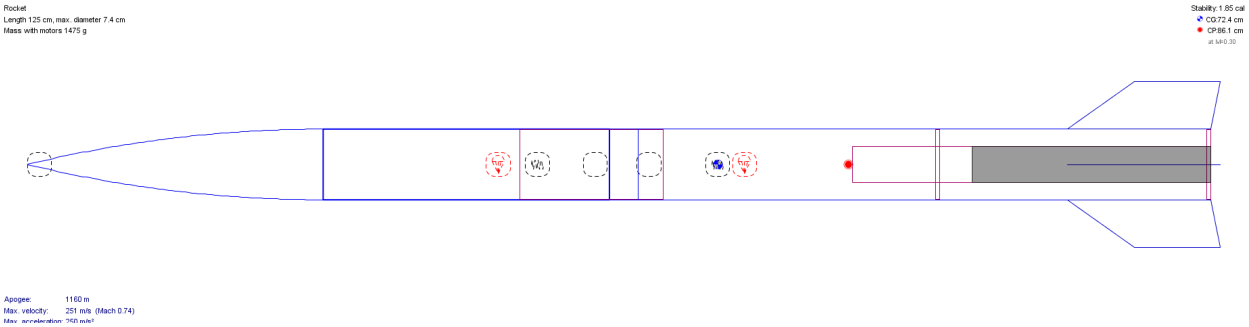
1. Range safety inspections will be conducted on each rocket before it is flown. Each team shall comply with the determination of the safety inspection or may be removed from the program.
2. The Range Safety Officer has the final say on all rocket safety issues. Therefore, the Range Safety Officer has the right to deny the launch of any rocket for safety reasons.
3. The team mentor is ultimately responsible for the safe flight and recovery of the team's rocket. Therefore, a team will not fly a rocket until the mentor has reviewed the design, examined the build and is satisfied the rocket meets established amateur rocketry design and safety guidelines.
4. Any team that does not comply with the safety requirements will not be allowed to launch their rocket.

Technical Design

Vehicle

We plan to make the rocket out of commercial paper tubes because of their mass, cost, and ease of construction. The outer diameter of the rocket is 74mm which is just enough to fit the payload. The projected altitude is 1160m using simulations from OpenRocket, flying on an Aerotech I1285R-14 motor.

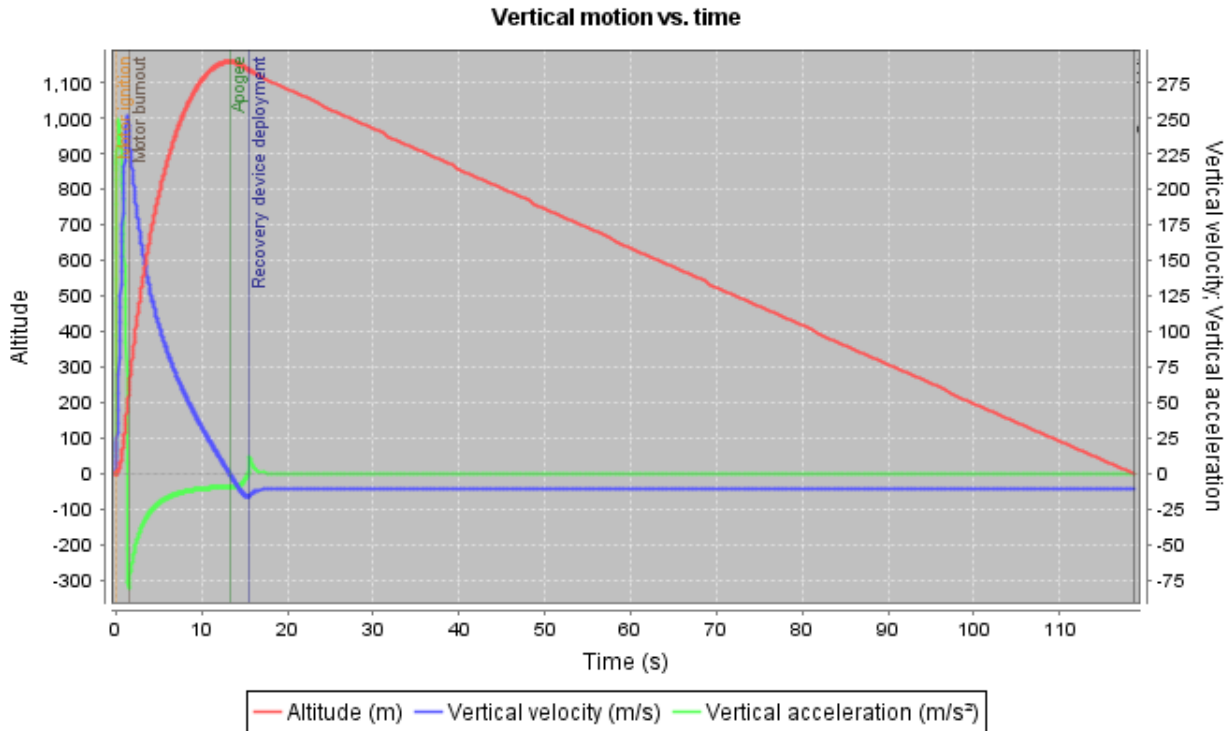
Design



Components

- Nose cone
  - Unspecified
- Tube 1
  - Main Parachute
  - Main Shock Cord
- Electronics Bay
  - Tube coupler
  - Electronics
  - Drone
- Tube 2
  - Drogue Parachute
  - Shock cord
  - Trapezoidal fin set
  - Centering ring
  - Centering ring
  - Engine

Simulation



Recovery

Our rocket is recovered via parachute. At apogee, the rocket will send charges from the electronics bay to open the drogue chute. At 900m, the rocket will send charges out to open the main chute. The rocket will be sending GPS location data from the GPS unit via radio transmission, so it can be retrieved after a safe landing.

Safety

The team will adhere to all rules and regulations outlined by the National Association of Rocketry and the FAA at all times. See Safety section above. For redundancy, our rocket will contain two altimeters in case one fails. If neither fails, the average altitude between the altimeters is used.

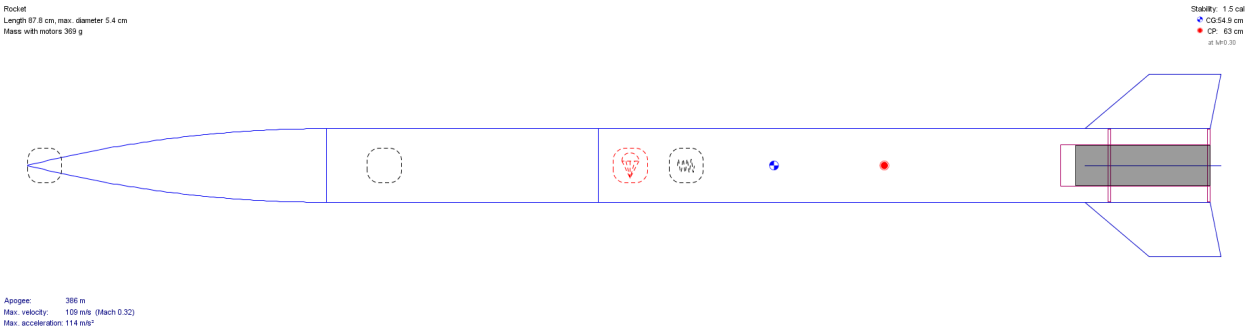
Payload

The payload will be a small drone (45mm x 45mm) designed to be deployed upon remote confirmation from RSO after main parachute deployment. Once deployed, the drone will start recording video from the bottom camera. It will receive location data from the rocket's integrated GPS and altimeters. The drone will orbit the descending rocket and remain at a distance of 20 feet. When the rocket lands, the drone will return to the launch pad for retrieval.

Subscale Rocket Design

Using OpenRocket we will scale down our design and build a subscale model. We will scale down the weight and weight distribution. We will match the simulations to the full scale design simulations.

We will also scale down the propulsion motors and get some experience flying our design. We will be able to fly locally with our TARC teams. We will fly a version of the electronics to experiment with dual deployment recovery.



STEM Engagement

See @Post1010 on Twitter and our website, http://post1010.org/, for social media presence. Post1010 and the Rockville Science Center also have Facebook sites where the team can post information about the NASA Student Launch.

We will use the Rockville Science Center as a hub for our in-person STEM Engagement activities. We will also do video conferencing. Some of the topics that will be focused on include programming, aerospace engineering, and mathematics.

We visit local schools and run exhibits on rocketry in their STEM festivals.

We help with rocket building and launches at the annual Rockville Science Day held at the Rockville campus of Montgomery College. NARHAMS runs an exhibit at the annual event and we support their exhibit. They work with 36 elementary students to build Alpha III rockets and launch them in the late afternoon on the athletic field.

Project Plan

Timeline

Date(s)	Description
Aug. 15-Sep. 19	Develop Preliminary Design and Proposal
Sep. 19	Submit Proposal
Mid Oct.	STEM Engagement Event 1
Late Oct.	Submit Preliminary Design Review
Oct.-Nov.	Build Sub-scale Rocket
Nov.	STEM Engagement Event 2
Dec. 2021-Jan. 2022	Launch Sub-scale Rocket
Jan.	Submit Critical Design Review
Feb.	Finish Build Final Rocket (“Rocket”) and Payload
Feb.	Flight Test 1 (Vehicle Demonstration)
Feb.	STEM Engagement Event 3
Mar.	Flight Test 2 (Payload Demonstration)
Mar.	STEM Engagement Event 4
Apr. 20	Huntsville Launch Week
May	Post-Launch Assessment

Budget

Item	**Description (if applicable)**	**Cost (USD)**
Team Travel	Round-trip plane tickets for each team member from D.C. to Huntsville	1400
I Class Rocket Motors	5 motors	450
Rocket Body Tubes	Four 7.4cm Diameter Cardboard Rocket Tubes	25
Subscale Rocket Body Tubes	Two 5.4cm Diameter Cardboard Rocket Tubes	21
Drone	Payload	150
Parachutes	Main & Drogue	50
GPS Unit	Recover rocket and send data to drone	40
Electronics	Wires, microcontrollers, ejection charges, etc.	300
Altimeter	2 Altimeters	150
Nose Cone	Inexpensive plastic nose cone	25
Subscale Rocket Nose Cone	Inexpensive plastic nose cone	22
Maintenance Costs	General costs for repairs	200
Other	Building supplies, tools, etc.	100
TOTAL	**TOTAL**	2933

Funding Plan:

- Earnings from American Rocketry Challenge 2nd Place Finish: $1000
- Membership Fees: $1600 ($200/member)
- Donations and contributions ~$400

Sustainability

- **Recruitment**
    - The Post enrolls about 40 teens every fall and runs the program through the next summer. Most members are involved for three or four years. This Post has been active since 1997. We were at Lockheed Martin for 17 years, then spent five years at Johns Hopkins University in Montgomery County, and recently moved to the Rockville Memorial Library and the Science Center storefront. We have had over 500 students participate through the years.
    - Meetings and open-houses
    - School word-of-mouth marketing
    - We utilize the Storefront's location to spread the word to foot traffic
- **Funding**
    - Membership fees from new members
    - Grants, donations and contributions
    - Some travel costs may be covered by members and their families
    - Fundraising activities as needed
- **STEM Engagement**
    - The Post supports the Science Center with their camps and classes to foster STEM engagement. We will support and continue these programs.