Project Eagle Eye

1. Overview

Project Eagle Eye is a key mission initiated by the New Athens Space Technology and Aerospace Research (NASTAR), aiming to launch a model rocket with the dual objectives of capturing high-resolution aerial photography and videography and reaching an altitude of 1,320 feet (1/4 mile) above the launch site. The mission is tentatively scheduled for the week of the December 26th Founder's Day holiday in New Athens, and will utilize advanced rocketry components and imaging technology to achieve its goals.

2. Mission Objectives

- **Primary Objective**: Capture high-quality aerial photographs and video footage of New Athens territories using an externally mounted Universal Astrocam (model 09166).
- **Secondary Objective**: Achieve a target altitude of 1,320 feet (1/4 mile) above the launch site, with altitude data measured by an internal Jolly Logic Altimeter Two (model 09135).

3. Technical Overview

The technical success of Project Eagle Eye is supported by the careful selection of high-performance components and a well-planned launch sequence. Below is a detailed breakdown of the mission's technical aspects:

3.1 Rocket Components

- **Rocket Model: Rising Star (Model Number 05027)**
    - The **Rising Star** is a skill-level 2 rocket, selected for its ability to carry multiple payloads and reach significant altitudes.
    - **Length**: 39.000" (99.06 cm)
    - **Weight**: 7.100 oz (201.28 g)
    - **Diameter (Max)**: 2.220" (5.64 cm)
    - **Payload Bay Internal Diameter**: 2.15" (5.46 cm)
    - **Payload Bay Internal Length**: 10.1" (25.65 cm)
    - **Manufacturer**: Dynastar
    - **Price**: $52.57
- **Motor Hardware: Cesaroni 24mm 3-Grain Case (Model Number 71002)**
    - The **Cesaroni 24mm 3-Grain Case** is selected for its compatibility with the chosen Cesaroni propellant and its durability in high-power rocketry applications. It offers superior ease of use compared to the AeroTech hardware due to its reloadable design.
    - **Length**: 5.3" (13.46 cm)
    - **Width**: 0.937" (2.38 cm)
    - **Manufacturer**: Cesaroni
    - **Price**: $36.27
- **Propellant: Cesaroni P24-3G Smoky Sam F79 (Model Number 70032)**

    - The **Cesaroni P24-3G Smoky Sam F79** propellant kit is selected for its high thrust-to-weight ratio and characteristic smoky exhaust. It provides the thrust necessary to meet the mission's altitude goals.
    - **Burn Time**: 0.9 seconds
    - **Delay**: 13 seconds
    - **Total Impulse**: 68 Newton-seconds
    - **Max Thrust**: 98.3 Newtons
    - **Manufacturer**: Cesaroni
    - **Price**: $34.70
- **PRO-DAT Tool: Cesaroni PRO-DAT Delay Adjustment Tool (Model 71121)**
    - The **Cesaroni PRO-DAT Delay Adjustment Tool** is used to shorten the delay for motor ejection, ensuring that the parachute is deployed at the optimal time. The delay for the Cesaroni P24-3G Smoky Sam F79 motor is 13 seconds, and this tool will be used to adjust the delay to approximately 7 seconds for this mission.
    - **Price**: $33.12
- **Adapter Ring: Cesaroni 24mm Adapter Ring for 38mm PRO-DAT (Model Number 71105)**
    - To use the **PRO-DAT Tool** with the 24mm motor, the **Cesaroni 24mm Adapter Ring** is required. This adapter ensures proper fitting of the delay adjustment tool with smaller 24mm motors.
    - **Price**: $4.72
- **External Camera: Universal Astrocam (Model Number 09166)**
    - The **Universal Astrocam** is an externally mounted digital camera, specifically designed for model rockets, providing the capability to capture images and video throughout the rocket's flight.
    - **Weight**: 0.43 oz (12.19 g)
    - **Dimensions**: 2.32"L x 1.26"W x 0.67"H (59mm L x 32mm W x 17mm H)
    - **Manufacturer**: Estes
    - **Price**: $74.38
- **Internal Payload: Jolly Logic Altimeter Two (Model Number 09135)**
    - The **Jolly Logic Altimeter Two** is an advanced altimeter designed to accurately measure and record the rocket’s altitude, speed, and flight profile.
    - **Weight**: 0.36 oz (10.21 g)
    - **Dimensions**: 1.93"L x 0.71"W x 0.57"H (49mm L x 18mm W x 14mm H)
    - **Manufacturer**: Jolly Logic
    - **Price**: $93.35
- **Parachute Protection: APOGEE 6IN PARACHUTE PROTECTOR (Model Number 29372)**
    - To protect the parachute from the heat of the ejection charge, an **APOGEE 6IN PARACHUTE PROTECTOR** will be used. This component ensures that the parachute remains intact and fully functional upon deployment, preventing it from being scorched or melted.
    - **Material**: Flame Retardant Fabric
    - **Length/Thickness**: 9" (22.86 cm)

- **Manufacturer**: Apogee
- **Price**: $8.14

3.2 Launch Configuration

- **Launch Pad**: PRO SERIES II LAUNCH PAD (Model Number 07708)
    1. The PRO SERIES II LAUNCH PAD is selected for its stability and reliability, providing a secure base for the rocket during lift-off.
    2. **Rod Size**: 1/4" x 5ft long
    3. **Manufacturer**: Estes
    4. **Price**: $99.98
- **Launch Controller**: ESTES PRO SERIES II LAUNCH CONTROLLER (Model Number 07707)
    1. The ESTES PRO SERIES II LAUNCH CONTROLLER will be used to safely initiate the rocket's launch. This controller is known for its reliability and safety features, making it an ideal choice for precision launches.
    2. **Manufacturer**: Estes
    3. **Price**: $47.07
- **Flight Sequence**:
    1. **Ignition**: The CESARONI 24MM 3-GRAIN CASE MOTOR HARDWARE, loaded with the P24-3G Smoky Sam (F79) propellant, will ignite, delivering a powerful thrust to propel the rocket upward.
    2. **Ascent**: The rocket will rapidly gain altitude, driven by the motor's high thrust-to-weight ratio. The ascent phase will be captured in real-time by the externally mounted Universal Astrocam.
    3. **Apogee**: The rocket is expected to reach an altitude of 1,397 feet above ground level, where the delay charge will activate the parachute ejection system.
    4. **Parachute Deployment**: The parachute will deploy after an 8-second delay, initiating the descent phase. The APOGEE 6IN PARACHUTE PROTECTOR will ensure the parachute remains intact and fully functional during this critical phase.
    5. **Recovery**: The rocket will descend slowly under the parachute, allowing for safe retrieval and recovery of both the rocket and its payload.

3.3 Data Collection and Analysis

- **Imaging Data**: The Universal Astrocam will capture continuous video and still images throughout the flight, documenting the rocket's ascent, peak altitude, and descent. The visual data will provide valuable insights into the geography and layout of New Athens territories.
- **Altitude Data**: The Jolly Logic Altimeter Two will record detailed flight data, including the maximum altitude reached, total flight duration, and the rocket's speed profile. This data will be crucial for verifying the success of the mission in achieving its altitude goal.

4. Project Timeline

- **Preparation Phase (September - October 2024)**:
    - Procurement of all necessary components from Apogee Components.
    - Assembly of the Rising Star rocket, including the installation of the camera, altimeter, parachute protector, motor hardware, and propellant.
    - Ground tests to verify system functionality, particularly the operation of the launch controller, camera, altimeter, and parachute protector.
- **Pre-Launch Phase (November 2024)**:
    - Final system checks to ensure all components are operating correctly.
    - Weather monitoring to select the optimal launch day within the week of Founder's Day, 2024.
    - Coordination with airspace authorities to ensure a safe and secure launch environment.
- **Launch Day (Week of Founder's Day 2024)**:
    - Final assembly and setup at the launch site, including motor loading, camera activation, and parachute packing.
    - Safety briefing and initiation of the launch sequence.
    - Rocket launch with real-time monitoring of altitude, imaging, and descent.
- **Post-Launch Phase (Launch Day - December 2024)**:
    - Retrieval of the rocket and extraction of the imaging and altitude data.
    - Analysis of flight data to evaluate the success in achieving both the primary and secondary objectives.
    - Compilation and assessment of the captured images and video for quality and utility.
    - Preparation of a detailed mission report documenting the outcomes and insights gained from Project Eagle Eye.

5. Expected Outcomes

- **Successful Aerial Photography and Videography**: The mission aims to capture high-quality images and video of New Athens territories, fulfilling the primary objective.
- **Achieving Target Altitude**: The Jolly Logic Altimeter Two will provide accurate data on whether the rocket reached the target altitude of 1,320 feet (1/4 mile) above the launch site, meeting the secondary objective.
- **Comprehensive Data Collection**: The mission will generate valuable visual and flight data, contributing to future aerospace projects by NASTAR.

6. Legal and Insurance Information

King Tyler Mullins is a registered member of the National Association of Rocketry, which provides insurance coverage to members for rocket activities adhering to the NAR Model Rocket Safety Code.

- **What activities does NAR individual insurance cover?**
  NAR insurance is a general liability coverage policy that the NAR purchases and is included as part of your membership benefits. NAR insurance helps protect the NAR member from liabilities arising out of NAR sport rocketry activities, including both model and high-power

rockets in the event a member's rocket causes damage or injury to the person or property of another. NAR insurance provides primary coverage for your rocket activities.

- **What are the coverage limits of the insurance?**
  The NAR policy limit is $5 million per occurrence.

- **What are the deductibles for the insurance?**
  The NAR policy has a $5,000 deductible per Bodily Injury and/or Property Damage Claim. Members are personally responsible for payment of the first $1,000 of the deductible. If a member is responsible for more than one claim in any NAR policy period (typically April 1 to March 31), they will be responsible for the entire amount of the NAR deductible in the subsequent claims after the first one. In the event of a claim filing, failure to pay the deductible may be cause for the loss of membership benefits.

- **When do NAR insurance benefits kick in on a claim?**
  NAR individual insurance applies for all your rocketry activities covered under the NAR Safety Code.

7. Conclusion

Project Eagle Eye is a critical mission for NASTAR, integrating advanced rocketry with practical applications in aerial imaging and data collection. The planned launch during the week of Founder's Day 2024 is anticipated to be a milestone in New Athens' aerospace endeavors, showcasing the technical prowess and innovative spirit of NASTAR.

The successful execution of this mission will provide valuable visual data of New Athens territories and set the foundation for future projects that further advance New Athens' technological capabilities in aerospace.

8. Links

- **Rocket Model: Rising Star Model 05027**
  https://www.apogeerockets.com/Rocket-Kits/Skill-Level-2-Model-Rocket-Kits/Rising-Star
- **Motor Hardware: Cesaroni 24mm 3-Grain Case (Model Number 71002)**
  https://www.apogeerockets.com/Rocket_Motors/Cesaroni_Casings/24mm_Casings/Cesaroni_24mm_3-Grain_Case
- **Cesaroni P24-3G Smoky Sam F79 (Model Number 70032)**
  https://www.apogeerockets.com/Rocket_Motors/Cesaroni_Propellant_Kits/24mm_Motors/3-Grain_Motors/Cesaroni_P24-3G_Smoky_Sam_F79
- **PRO-DAT Tool: Cesaroni PRO-DAT Delay Adjustment Tool (Model 71121)**
  https://www.apogeerockets.com/Rocket_Motors/Cesaroni_Accessories/Pro-38_Delay_Adjustment_Tool

- **Adapter Ring: Cesaroni 24mm Adapter Ring for 38mm PRO-DAT (Model Number 71105)**
  https://www.apogeerockets.com/Rocket_Motors/Cesaroni_Accessories/24mm_Adapter_Ring_for_38mm_Pro-DAT
- **External Camera: Universal Astrocam (Model Number 09166)**
  https://www.apogeerockets.com/Electronics-Payloads/Cameras/Universal-Astrocam
- **Internal Payload: Jolly Logic Altimeter Two (Model Number 09135)**
  https://www.apogeerockets.com/Electronics-Payloads/Altimeters/Jolly-Logic-AltimeterTwo
- **Parachute Protection: APOGEE 9IN PARACHUTE PROTECTOR (Model Number 29372)**
  https://www.apogeerockets.com/Building-Supplies/Parachute-Protection/Cloth/Apogee-9in-Parachute-Protector
- **Launch Pad: PRO SERIES II LAUNCH PAD (Model Number 07708)**
  https://www.apogeerockets.com/Launch_Accessories/Launch_Pads/Pro_Series_II_Launch_Pad
- **Launch Controller: ESTES PRO SERIES II LAUNCH CONTROLLER (Model Number 07707)**
  https://www.apogeerockets.com/Launch-Accessories/Launch-Controllers/Pro-Series-II-Launch-Controller