# Team SAR
# Some Assembly Required
# Explorer Post 1010

## *Flight Readiness Review Briefing*

# Introductions and Flight Mission Roles

| | |
|---|---|
| Nathan | Scoring Captain |
| Visesh | Team Captain / Mission Planner Specialist |
| Muhammed | Pilot in Command / Safety Specialist |
| David | Strategic Technician |

# System Overview - Flight Method Strategy and Tasks

1. Fly autonomous objectives
2. Autonomously fly to scoring items
   a. Record coordinates
   b. Drop balloons
   c. Land
3. Hybrid search for further scoring items
4. Autonomous takeoff and landing

# System Overview - Expected Performance

- 3 packages (balloons) on-target
- All 16 waypoints captured
- At least 7 of 8 SAR targets located and classified



- Mission completed within 25-28 minutes flight time
- Autonomous takeoff and landing

# System Overview - Risk Evaluation

| Decision | Risk | Reward |
|---|---|---|
| Autonomous search | GPS malfunctions, unable to immediately pause/resume mission to write down coordinates | Consistent/reliable searching for scoring objects |
| Manual search | Loss of orientation, inconsistent altitude, drift while recording coordinates | Able to recover from GPS issues, potentially faster speed |

# System Overview - Mission Planner Usage

- Monitor aircraft telemetry data
- Program autonomous missions
- Control Balloon Mechanism Servo
- Safety dashboard (arm/disarm, GPS status, flight mode)
- Simulate Missions
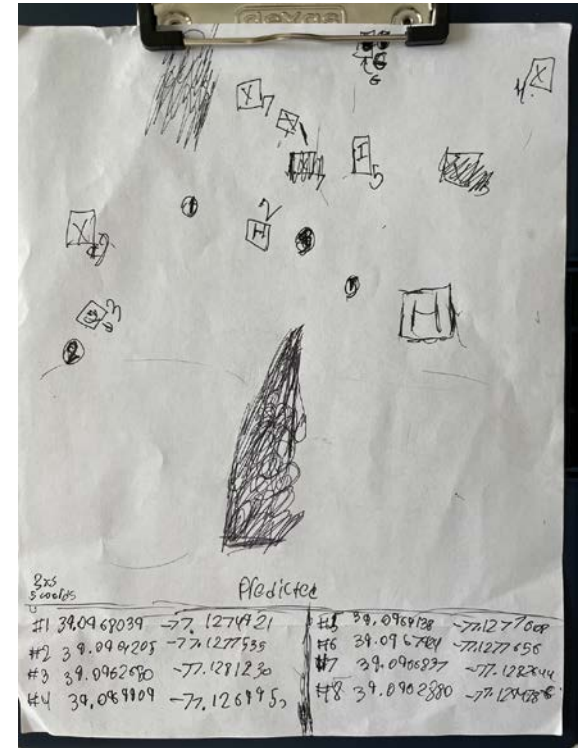- Use flight log to Diagnose Problems

# System Overview - Monitor Usage



Team decisions made based on:

- Latitude/Longitude
- Altitude
- Battery Voltage
- GPS Lock
- GPS Satellite Count
- Flight Mode

# System Overview - Maps

## Consolidation of Data:

- Target location relative to surface features

- Symbol on Target

- Latitude/Longitude

- Possible Obstacles

- Review after flight



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# System Safety - Operational Strategies

ALL flights conducted:
- With supervising adult
- In visual line of sight
- BELOW 400 feet and within FAA regulations

NO flights conducted:
- Without performing pre-flight inspection
- In bad weather or bad visibility
- Over people or buildings

# System Safety - Maintenance and Checklists

- We use checklists to enforce safety
  - Pre-flight
  - Post-flight
- We regularly inspect all aircraft parts
- Repairs are made with consent from all team members

# System Safety - Design Strategies



- 4s batteries for longer flights
- Double balloon drop system
- 3D model of balloon enclosure
- Balloons held in by a rotating plate
- Servo action tab to trigger balloon release (with PWM calibration)
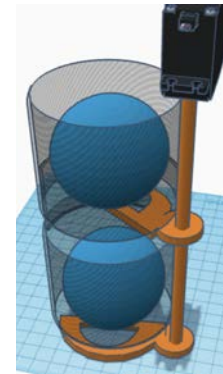


**All Team members contributed to the current design!**

# Developmental Test - Test Planning

1. Prototype Completion
2. Independent System Test (off quad)
3. Integrated Ground Test (mounted on quad)
4. Basic Flight Test (airworthiness)
5. Aerial System Test in open field
6. Mission Performance Test

# Developmental Test - Ground and Mission Performance

- Simulated competition flight experience:
  - Finding scoring items (autonomous map method followed by manual search)
  - Dropping balloons on target
  - Completing autonomous objectives
- Verified updates made to compensate for errors caused by wind

- Detected and fixed balloon wiper issue (screws instead of glue)

# Modifications to Improve Mission Effectiveness

- Different landing gear for stable landings
- New Frame arms and Motor mounts to reduce motor vibrations
- Leg mounts break away in case of a crash
- Multiple balloon drop designs
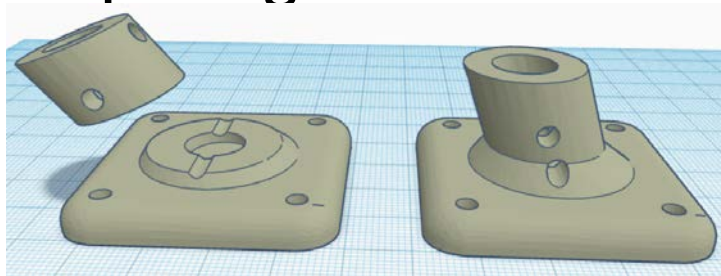
# Evidence of Mission Accomplishments

- >20 successful flights
- Accurately identified coordinates (<15 ft) and content of target objects
- Balloons landed <5 ft from targets
- Safety protocols effectively ensured no damage to persons or property
- Team members effectively executed assigned roles

# Pre-Mission Briefing - Personnel Resourcing & Communications

| Nathan | Scoring Captain |
|--------|-----------------|
| Visesh | Team Captain / Mission Planner Specialist |
| Muhammed | Pilot in Command / Safety Specialist |
| David | Strategic Technician |

# Pre-Mission Briefing - Go/No-Go Criteria



- Discussions and briefings include:

**Before Flight**
- Weather
- Airspace Activity
- Presence of people
- Condition of Quad

**During Flight**
- Aircraft Performance
- Wind Speed
- Battery Condition
- Airspace Activity

# Pre-Mission Briefing - Fall Back Plans

If any risk to Safety is present:



- Return to Land (RTL) Immediately
- Lower or Increase altitude to avoid Obstacle
- Reschedule flight or travel to other fields
- Repair and inspect Quad thoroughly

# Pre-Mission Briefing - Team Comms

Maintaining Communication with Team Roles:

- All non-essential activities are forbidden (sterile cockpit)
- Share essential information
- Each role has specific call outs
- Maintain records of each flight

# Progress during COVID-19

- Working virtually and in-person

- Flying our own drones and Quadzilla

- Community outreach

- Personal projects

# Thank you for your time!

## Questions?