Team SAR
Some Assembly Required
Explorer Post 1010

Flight Readiness Review Briefing

Introductions and Flight Mission Roles

Muhammed	Team Captain
David	Primary Pilot in Command
Michael	Strategic Tech/AI Specialist
Jasmine	Mission Planner Specialist
Nathan	Safety Tech/Scoring Captain
Visesh	Air Boss/Mission Planner Lead

System Overview - Flight Method Strategy and Tasks

1. Accomplish autonomous objectives
2. Fly to scoring items
    a. Record coordinates of all targets
    b. Pick up and drop water bottles
3. Hybrid search for further scoring items
4. Autonomous takeoff and landing

System Overview - Expected Performance

- All 10 waypoints captured
- 3 water bottles transferred
- Mission completed within 25-28 minutes flight time
- Autonomous takeoff and landing

System Overview - Risk Evaluation

Decision	Risk	Reward
Manual Bottle Pick Up	Human error in controlling the drone over the target	More adaptable flying patterns, not dependent on technology
AI Based Bottle Pick Up	Extremely rigid, more complex, less adaptable, dependent on several external variables	Advanced capability, faster reactions, reliability and repeatability

System Overview - Risk Evaluation – A.I.

Algorithms	Cons	Pros
Template Matching	- Has difficulty with transformations	- Easy to implement given reference image of target
Feature Matching	- More complicated than Template matching - Single-core CPU bound algorithm	- Higher accuracy - Can handle variations in size and rotation
Convolutional Neural Network Matching	- Most difficult to implement (training)	- Highest accuracy - Lowest inference time (GPU acceleration)

System Overview - Mission Planner Usage

- Monitor aircraft telemetry data
- Safety dashboard (arm/disarm, GPS status, flight mode)
- Program autonomous missions
- Control water bottle grabber servo
- Simulate missions
- Use flight log to diagnose problems

System Overview - Monitor Usage

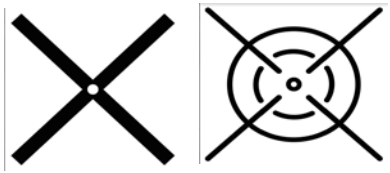
Flight decisions made based on:

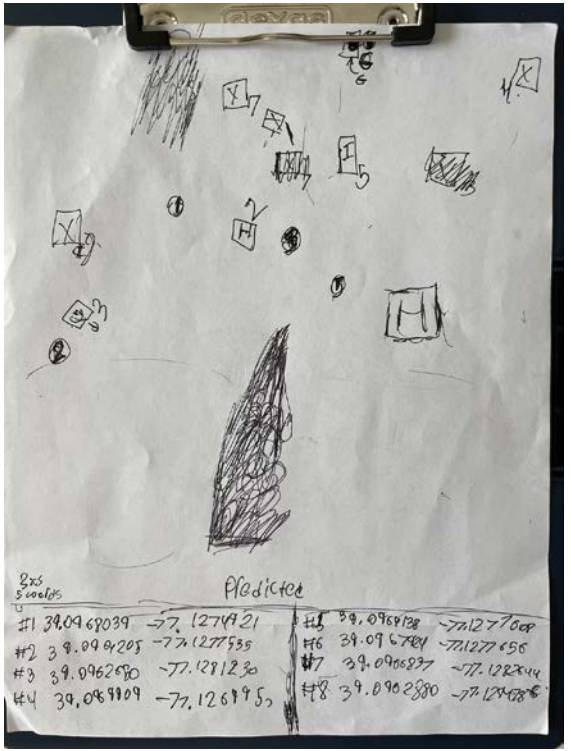
- Latitude/Longitude
- Altitude
- Battery Voltage
- GPS Lock
- GPS Satellite Count
- Flight Mode

System Overview - Maps

Consolidation of Data:

- Target location relative to surface features
- Symbol on Target
- Latitude/Longitude
- Possible Obstacles
- Review after flight





System Safety - Operational Strategies

ALL flights conducted:

- With supervising adult
- In visual line of sight or Visual Observer
- 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 inspect all aircraft parts before each flight
- Repairs are made with consent from all team members

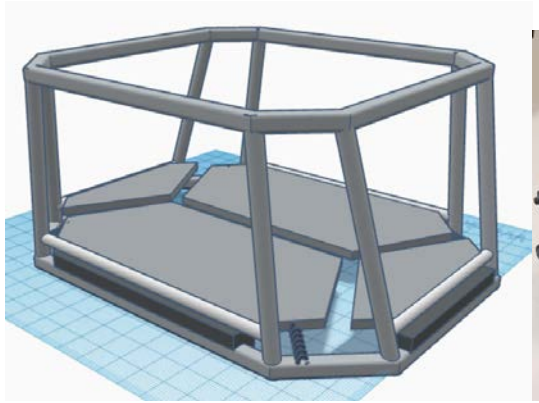
Some Assembly Required Checklists

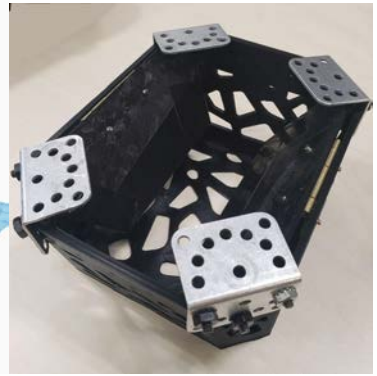
Start of Flight Ops / Location Change

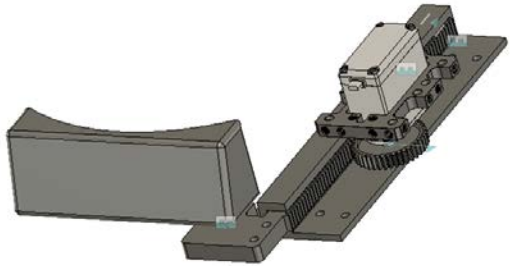
- Weather check – METAR, 800.WxBrief
- Crew Briefing (roles and goals)
- Safety inspect aircraft (AC)
- Power on GS computer and verify computer battery charge
- Start mission planner and verify maps are perfected / download maps
- Verify voice prompts are enabled - ConfigTunig | Planner
- Power on TX and verify battery charge
- Power up AC
- Connect MP to AC
- Verify video signal is good at the location (distance check). Select new channel if needed.
- Perform compass and IMU calibration if required
- Set Failsafe – Battery (10.4V)
- Set Failsafe – Radio loss link to RTL
- Set Geofence and upload to AC
- Set minimum Altitude and verify voice warning is on
- Power off AC

System Safety - Design Strategies

- 4s batteries for longer flights
- 3D model of bottle grabber
- Reverse trap door drop system
- Bottle held in by a “trap door” plate
- Servo action tab to trigger bottle release (with PWM calibration)







All Team members contributed to the current design!

Developmental Test - Test Planning

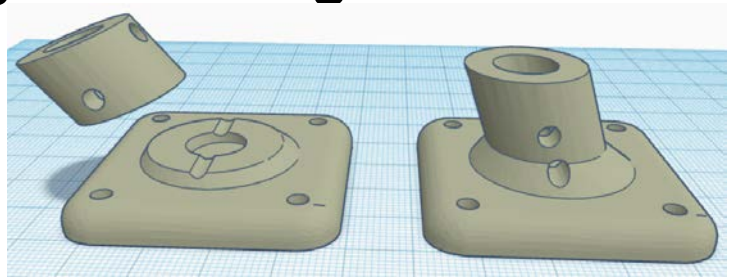
1. Prototype Completion
2. Independent System Test (off quad)
3. Integrated Ground Test (on quad)
4. Basic Flight Test (airworthiness)
5. Aerial System Test in open field
6. Mission Performance Test

Developmental Test - Ground and Mission Performance

- Plan to simulate competition flight experience:
  - Find scoring items (autonomous map method followed by manual search)
  - Transfer water bottles
  - Complete autonomous objectives

Modifications to Improve Mission Effectiveness

- Different landing gear for stable landings
- Non-round frame arms and matching motor mounts to reduce motor vibrations
- Leg mounts break away in case of a crash
- Multiple bottle grabber designs



Further Modifications to Improve Mission Effectiveness

ATMOS Camera Stabilization System

- Custom motorized gimbal for camera
- Reduces visual inaccuracies
- Consistent visual observations
- Multiple gimbal designs

ATMOS Mk1

Mk I Mk II Mk III

Evidence of Mission Accomplishments

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

Pre-Mission Briefing - Personnel Resourcing

Muhammed	Team Captain
David	Primary Pilot in Command
Michael	Strategic Tech/AI Specialist
Jasmine	Mission Planner Specialist
Nathan	Safety Tech/Scoring Captain
Visesh	Air Boss/Mission Planner Lead

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
- Adjust 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

Social Outreach

- Local science day presentation
  - Introduce community to drones/ explorer post
- Personal projects

Thank you for your time!

Questions?