

Autonomous Aerial Vehicle Midterm Presentation II



Team 6 3/20/14

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Discussion Topics

- Updated Objectives
- Fall 2013 Accomplishments
- Recent Completed Work
- Test Flight
 - Demonstration
 - Autopilot
 - Mechanics
- Image Processing
- Air Drop Simulation
- Future Work
- Budget
- Gantt Chart

Updated Objectives



“Designing for the Future”

- ASME competition showcasing the capstone projects of undergraduate students
- 30-Slide technical PDF
- Finalists featured at the International Design Engineering Technical Conference (IDTEC)

Manual for Future Seniors

- Progress toward competition goals
- Items available in Team 6 portable
- Challenges faced and means of avoidance

Continue Designing and Testing for AUVSI Competition as Originally Planned

- Image Analysis
- Autonomous Flight
- Air-Drop Mechanism
- Target Detection

Fall 2013 Accomplishments

Choice of Competition Objectives

Selection of Competition Vehicle and Components

Selection of Electronics and Software

Purchase of All Necessary Components

Completion of Inherited Senior Telemaster Video Test Flight

Repairs to Inherited Test Airplane

Design and Partial Implementation of Air Drop System



Recent Completed Work

Met With Robin Driscall

- Expert R/C Enthusiast
- Flew our plane for test flight

Mounted GPS, Autopilot, and Batteries Onto Competition Plane

Completed Test Flight

- Actual competition plane was used
- Electric motor, servos, autopilot, and camera system were all tested

Purchased and Cut Target Materials

- 4x8 Rectangle, 4' diameter circle, 2x2 square, 2x2 trapezoid, 4x2 trapezoid, 2x2 triangle, 1.5x4 triangle
- Black, yellow, green, blue, red, white paint



Test Flight

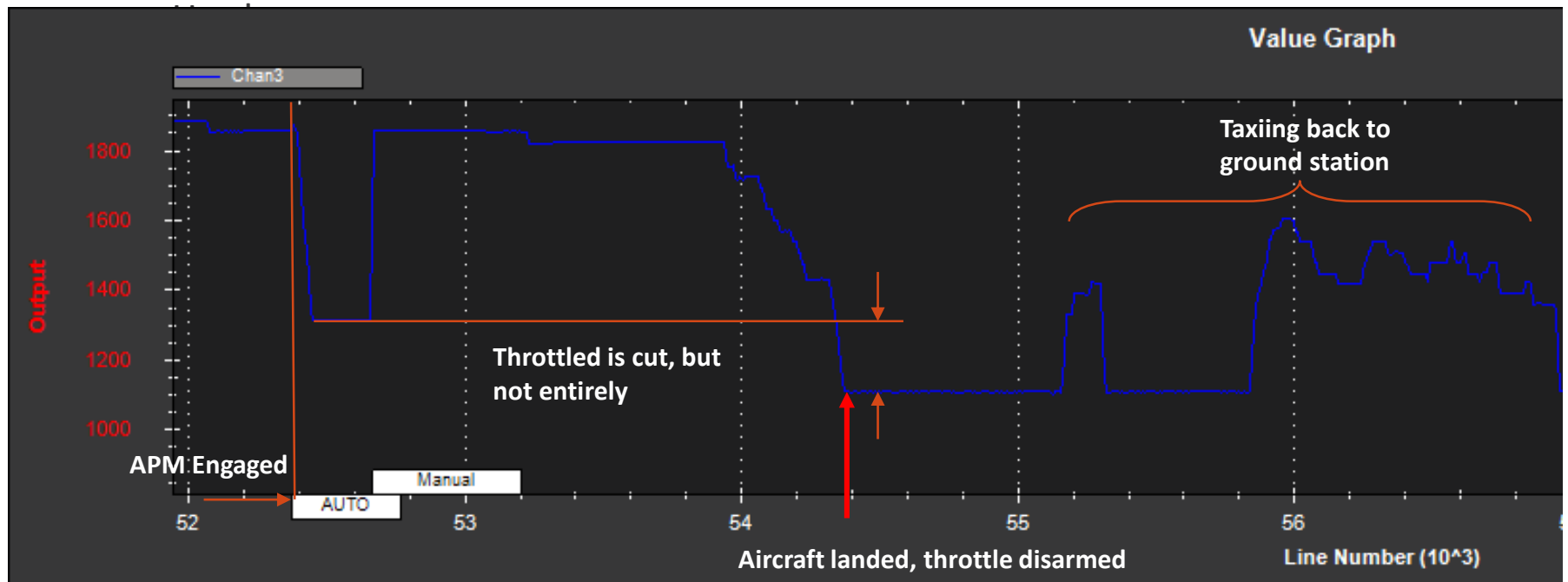
The screenshot displays a flight simulation software interface. At the top, a navigation menu includes options: FLIGHT DATA, FLIGHT PLAN (selected), INITIAL SETUP, CONFIG/TUNING, SIMULATION, TERMINAL, HELP, and DONATE. On the right side of the menu, there is a dropdown menu set to 'COM3' and a 'Link Stats...' button. Below the menu, the main display area shows a satellite map of a rural area with a flight plan overlaid. The flight plan consists of a red star labeled 'Home' and four waypoints labeled 1, 2, 3, and 4, each marked with a green pin and a dashed white circle. Yellow lines connect the waypoints in a sequence: Home to 1, 1 to 2, 2 to 3, 3 to 4, and 4 back to Home. A red line also extends from the Home point towards the top right. In the top left corner of the map area, the following data is displayed: Distance: 0.4622 km, Prev: 322.43 m, and Home: 254.38 m. At the bottom left of the map, there is a small copyright notice: ©2014 Microsoft Corporation. All rights reserved. ©2014 Intel. Images courtesy of NASA.

Test Flight - Demonstration



Test Flight - Autopilot

Objectives



Test flight - Mechanics

Set Aileron, Rudder, Elevator , and Flap Throws

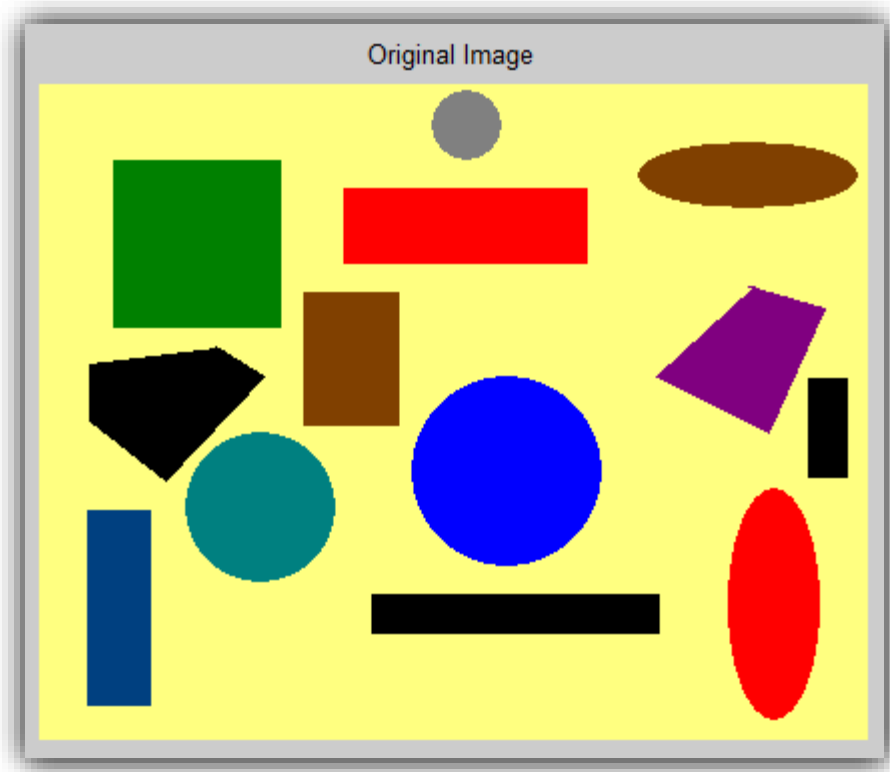
- Ailerons: 25mm
- Elevator: 20mm
- Rudder: 35mm

Adjusted Location of Batteries to Move Center of Gravity to Appropriate Location

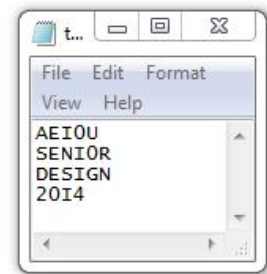
Results:

- Airdrop Servo failed
- Electric motor provided plenty of power
- Throws were too large, need to be adjusted down
- Need switches for power systems so that batteries and connections do not have to be constantly unplugged
- GPS mount came undone during nose dive

Image Processing



A E I O U
SENIOR
DESIGN
2014



Matlab

- Image Processing Toolbox, Image Acquisition Toolbox, Neural Network Toolbox

Air Drop Simulation

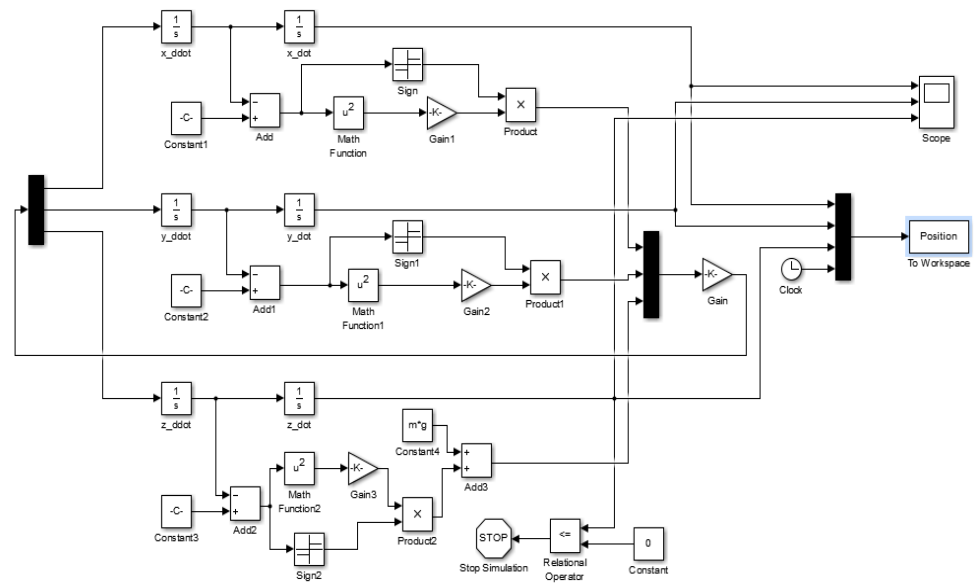
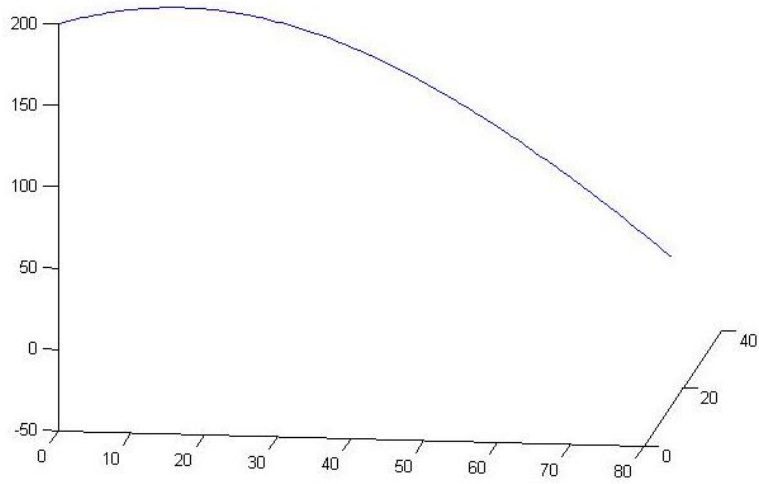
Analysis of care package dropped under given wind conditions performed using Simulink

Factors Considered:

- Plane velocity (initial condition) and Wind speed under free fall
- Projectile mass and geometry

Determination of impact coordinates

- Used to create offset from drop position



Future Work

Autopilot Testing

- Troubleshoot autopilot failure
- Use radio to switch autopilot modes

Issues discovered in test flight

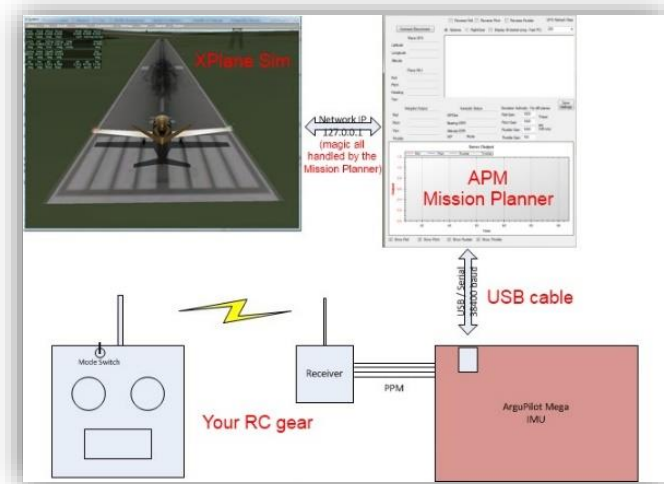
- Repair servo for Air Drop
- Install main power and throttle switches

Image Processing and Ground Station Software

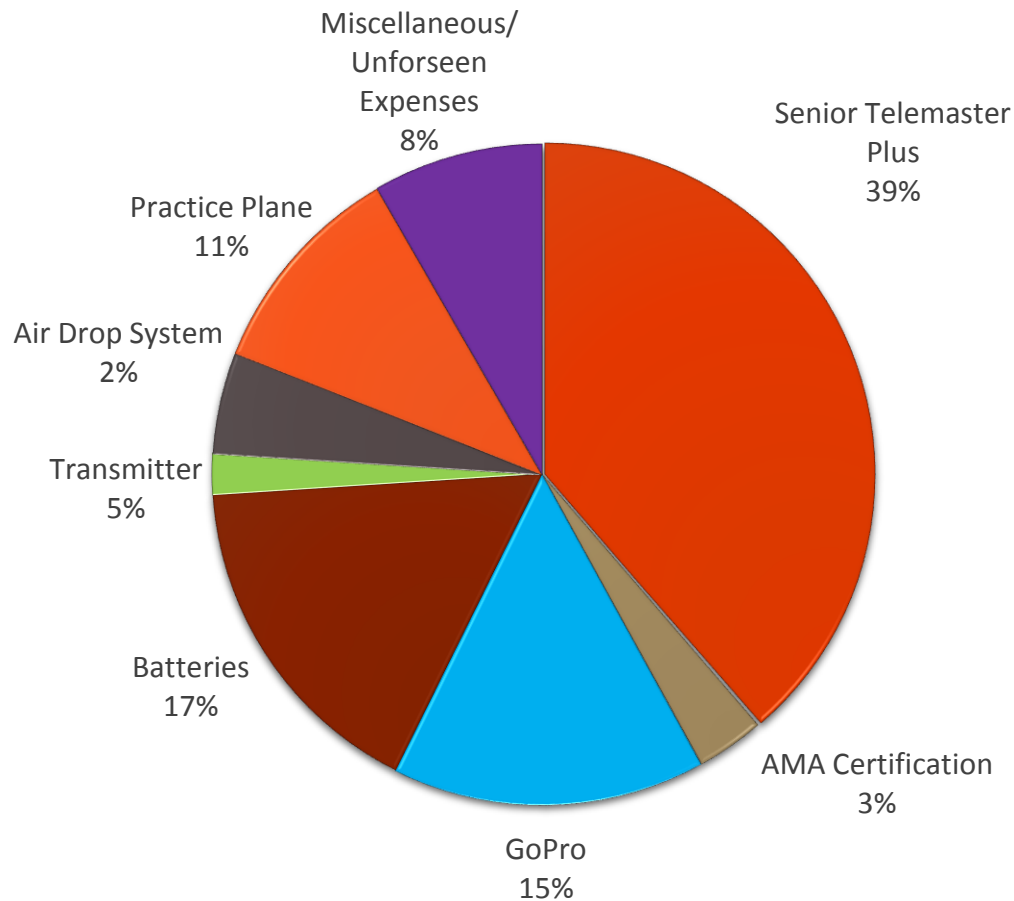
- Implement scaling and rotation for shapes/alphanumeric characters

Manual for future seniors

Prepare target test



Budget



- \$1500 Total Budget
- \$1325 Spent
- \$175 For Unforeseen Expenses

AUVSI Project Plan

Period Highlight: 27

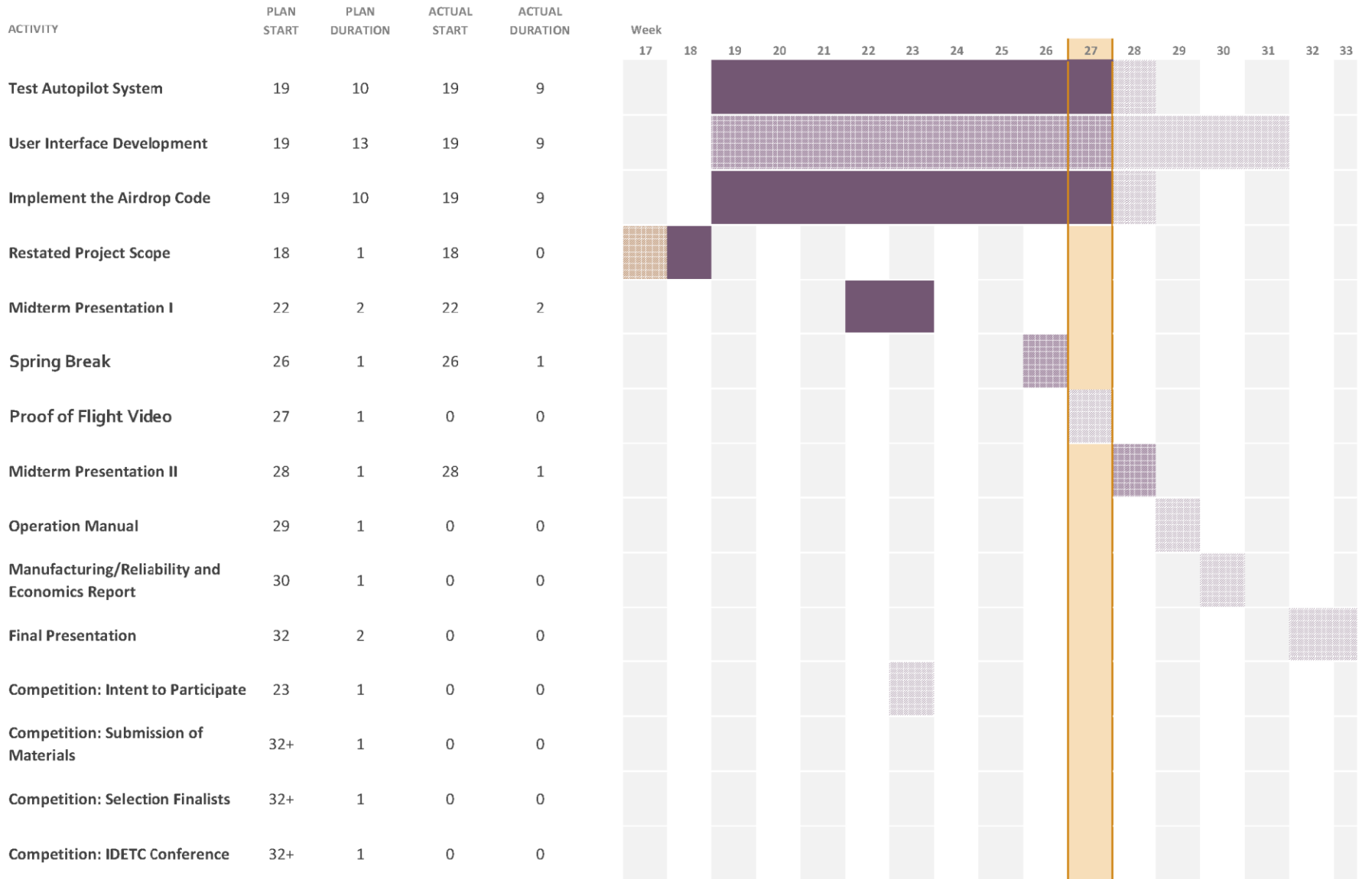
Plan

Actual

% Complete

Actual (beyond plan)

% Complete (beyond plan)



References

1. (<http://www.fas.org/sgp/crs/natsec/R42136.pdf>)
2. (<http://www.fas.org/sgp/crs/natsec/R42938.pdf>)
3. http://www.auvsi-seafarer.org/documents/2014Documents/2014_AUVSI_SUAS_Rules_Rev_0.2a_DRAFT_13-0930-1.pdf
4. <http://airfoiltools.com/airfoil/details?airfoil=spicasm-i>
5. <http://www.pprune.org/tech-log/434511-aerodynamics-flap-question.html>
6. <http://plane.ardupilot.com/wiki/xplane-3/>

Questions?

