Aerospace Student Projects Symposium

INtegrated Flight-Enabled Rover For Natural disaster Observation

Customer: Barbara Streiffert, Jet Propulsion Laboratory Faculty Advisor: Jelliffe Jackson

Adam Archuleta, Devon Campbell, Tess Geiger, Thomas Jeffries, Kevin Mulcair, Nick Peper, Kaley Pinover, Esteben Rodriguez, Johnathan Thompson









PRESENTATION OUTLINE

- Project Purpose and Overview
- INFERNO Design Solution
- Verification and Validation
- Project Achievements



PROJECT CONTEXT





PROJECT MOTIVATION

Design Solution

Wildfires in 2015^[1]

- 68,151 fires
- 10,125,149 acres burned
- Over \$2 billion spent

Human Danger

Project Context

- 2013 Yarnell Hill Fire
 - 19 firefighters killed



[1] National Interagency Fire Center

V&V

Accomplishments



Design and create an **aerial sensor package delivery system** for future integration with a natural disaster observation system





FIRE TRACKER SYSTEM





Project Context

Design Solution

V&V

Accomplishments



SYSTEM FUNCTIONAL REQUIREMENTS

- Aerial Imagery
 - HD Video (1920x1080 pixels at 30 frames per second)
 - Still Photos (8 megapixels)
- Ambient Temperature Data
 - Collected for 60 minutes at 1 second intervals
- Range
 - Child Drone can operate up to 200 meters from Ground Station

V&V

Sensor Package can transmit data up to 200 meters

Design Solution

• Piloting

Project Context

• Land in 1.10 meter by 1.10 meter landing pad

Accomplishments



The CD takes off from the GSMRS using autopilot.





The CD flies to a GPS waypoint up to 200 meters away using autopilot. The CD then maintains its commanded position to 5 meter accuracy.





Using autopilot, the CD lands and deploys the SP which begins collecting and storing 1 hour of data.





The CD returns to hover using autopilot. It may be commanded to capture video and/or still images at any time. This data is transmitted to the GSMRS.





The CD returns to the GSMRS after a 15 minute maximum flight duration using autopilot.





The CD lands on the GSMRS under pilot control and the SP begins transmitting to the GSMRS.



AERIAL SENSOR PACKAGE DELIVERY SYSTEM DESIGN





SYSTEM DESIGN





VERIFICATION AND VALIDATION





CHILD DRONE ENDURANCE TEST

- Verify flight endurance requirements
- Characterize drone thrust-power curves
- Determine mass/power budget





Time (min)
15
18
17.8
22.5

Project Context

Design Solution

V&V

Accomplishments

1/30/2017



SENSOR PACKAGE THERMAL TEST

- Verify SP sensor accuracy
- Verify thermal model

Thermal Chamber Setup



Recorded Data



Sensor Error	Temperature (°C)
Required	< 2.78°C
Mean Measured	1.74
Max Measured	3.48

Project Context

Design Solution

V&V

Accomplishments

1/30/2017



CHILD DRONE LANDING TEST

- Verify piloted landing capability
- Characterize landing pad size



Project Context



Pad Size	Dimensions (cm)
Required	110 x 110 *
Estimated	110 x 110
Measured	79 x 79

* 80% Confidence

Design Solution

V&V

Accomplishments

1/30/2017



PROJECT ACHIEVEMENTS AND SUMMARY





PROJECT ACHIEVEMENTS

Child Drone

Mission Task	Success?
Communications	\checkmark
Takeoff	\checkmark
Deployment	Partial
Target Imaging	\checkmark
Image Transmission	\checkmark
Landing	In Progress

Sensor Package

Mission Task	Success?
Communications	\checkmark
Data Collection	Partial
Data Transmission	\checkmark
Deployment	\checkmark

Successful proof of concept for remote natural disaster observation

Project Context



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Thank You



