ARCAA

UAV Outback Challenge

Lessons Learnt from the Design & Operation of a Search & Rescue UAV

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QUT CSIRO

Presentation Map

- Competition
- Objectives
- Outcomes
- Introduction of SRUAV
- Project Management
- System Architecture
- Team Journey

Competition

Inaugural ARCAA UAV Outback Challenge

www.uavoutbackchallenge.com.au

Search and Rescue

Proof-of-Concept Demonstration

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Categories

- Airborne Delivery Challenge
- Search & Rescue Challenge
- Documentary Challenge

Kingaroy Airport - Queensland
24th -27th September 2007

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Search & Rescue Challenge

University & Hobbyist Category

- Search out a 1.5nm x 1.5nm area for Outback Joe
- Deliver to survivor a small package of sustenance
- ‹150kg FWP & ‹100kg Rotary
- $40k prize money

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Objectives

- Increase awareness in general public
- Work with industry in a UAV education exercise
- Solve some of the technological challenges facing UAVs
- Engage the next generation of UAV developpers

Outcomes

- ✓ 42 Entrants
- ✓ $120k sponsorship
- ✓ 25+ media articles
- ✓ Good industry & government feedback
- ✓ Mueller College won the Airborne Delivery Challenge
- ✓ Dionysius won the Search & Rescue Challenge, but Joe is still waiting
- ✓ 2008 looks good…

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Outback Challenge 07

Meet the Team

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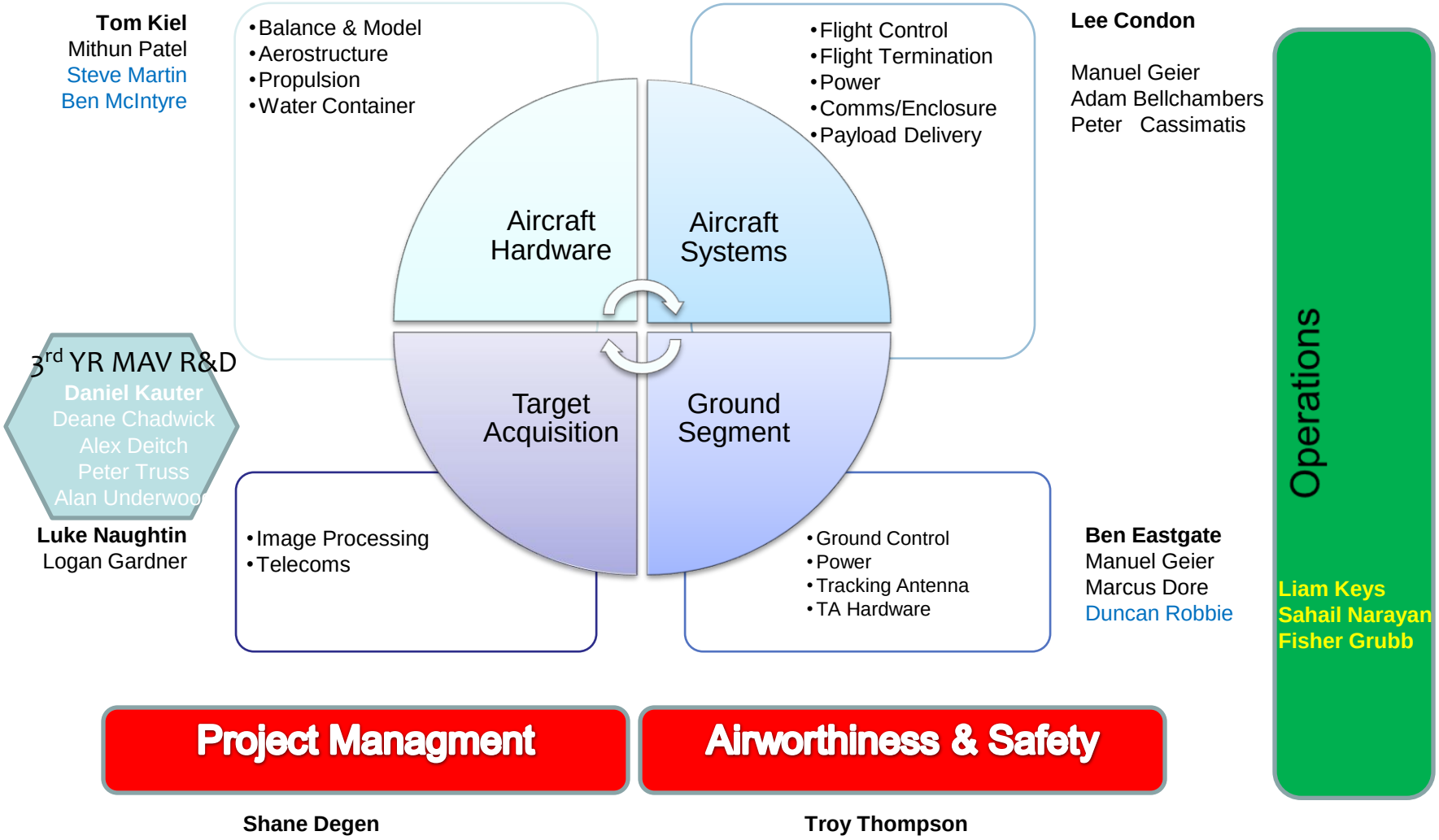
Team Structure



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SRUAV2007

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Competition rules define requirements

Inside mission boundary, within 1hr ,with 500mL being recovered, not touching Joe, within 100m .

SRUAV Baseline Capability

Piloted Take Off/Land

Manual Target Acquisition

Autonomous Navigation

Autonomous Delivery (within 20m)

SRUAV Desired Capability (2008)

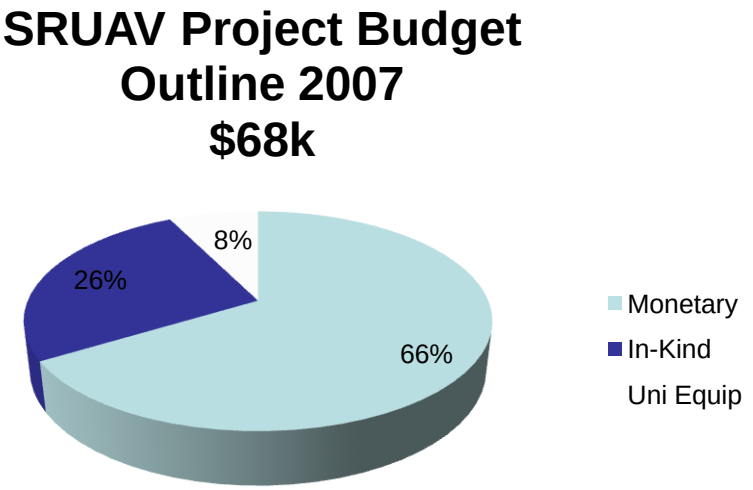
Autonomous Take Off/Landing

Autonomous Target Acquisition

Autonomous Delivery (5m -15m)

Autonomous Start

Budget



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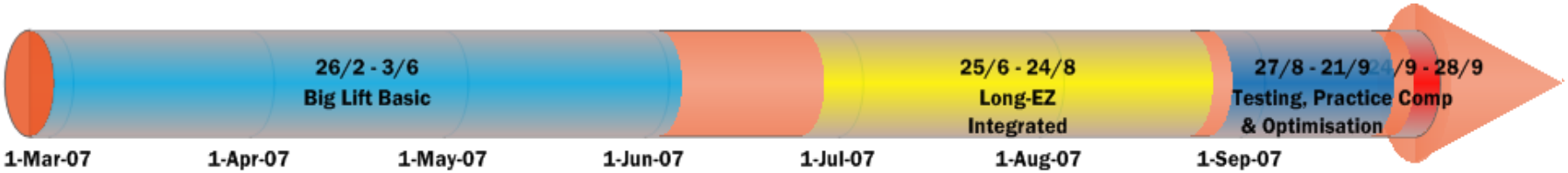
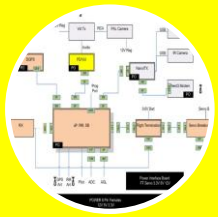
Project Strategy

Reflected in the timeline



Big Lift Basic

- Flight Control
- Flight Term Ph1
- Power



Long EZ Integrated

- Flight Term Ph2
- Payload Delivery
- Video Link
- Tracking Antenna

Mission Simulation

- Test
- Best Case Simulation
- Worst Case Simulation
- Mission Practice

Competition

- Practice Day
- Competition

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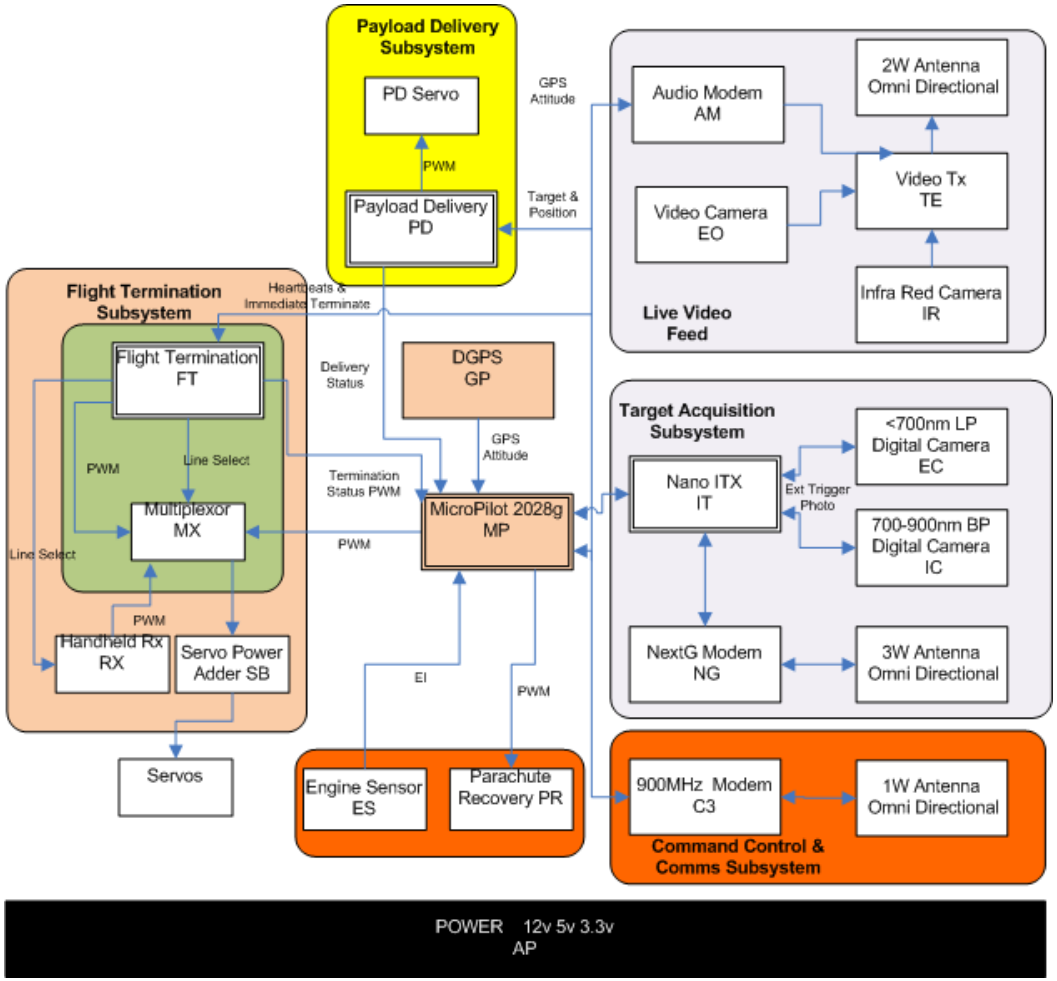
Airborne Architecture



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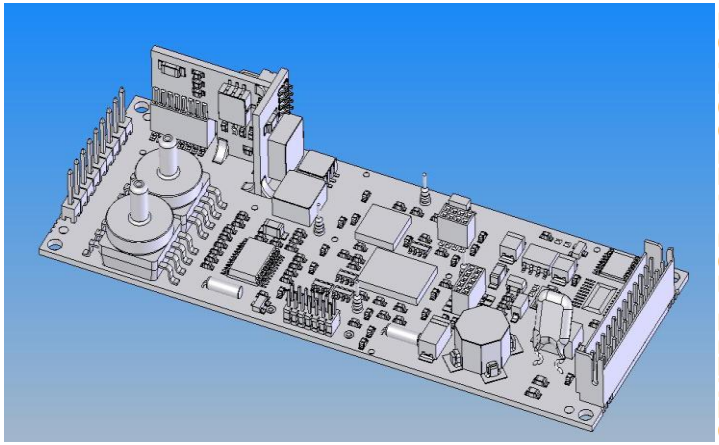
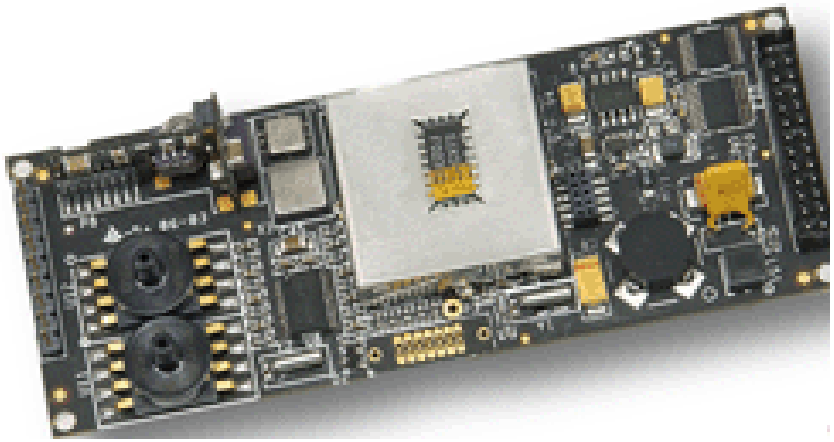
MicroPilot 2028g



Features

- Autonomous Takeoff and Recovery
- Waypoint Navigation, Attitude Hold
-
-
-



Sensors

- Pitch, Roll and Yaw Rate Gyros
- Accelerometers
- Airspeed Sensor
- Altitude Sensor
- Ultrasonic Sensor
- Magnetometer
- GPS going to DGPS

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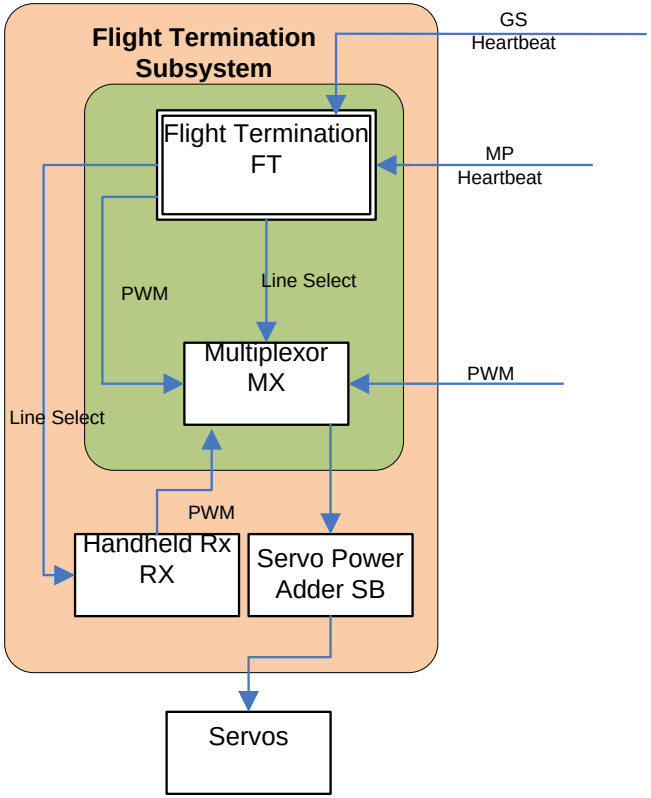
Flight Termination

- Initiates termination manoeuvre if:
  - Ground station communications lost
  - Mission boundary breached
  - On request from ground station

- Incorporates warning signals to establish communications recovery procedures



Payload Delivery

Autonomous Delivery

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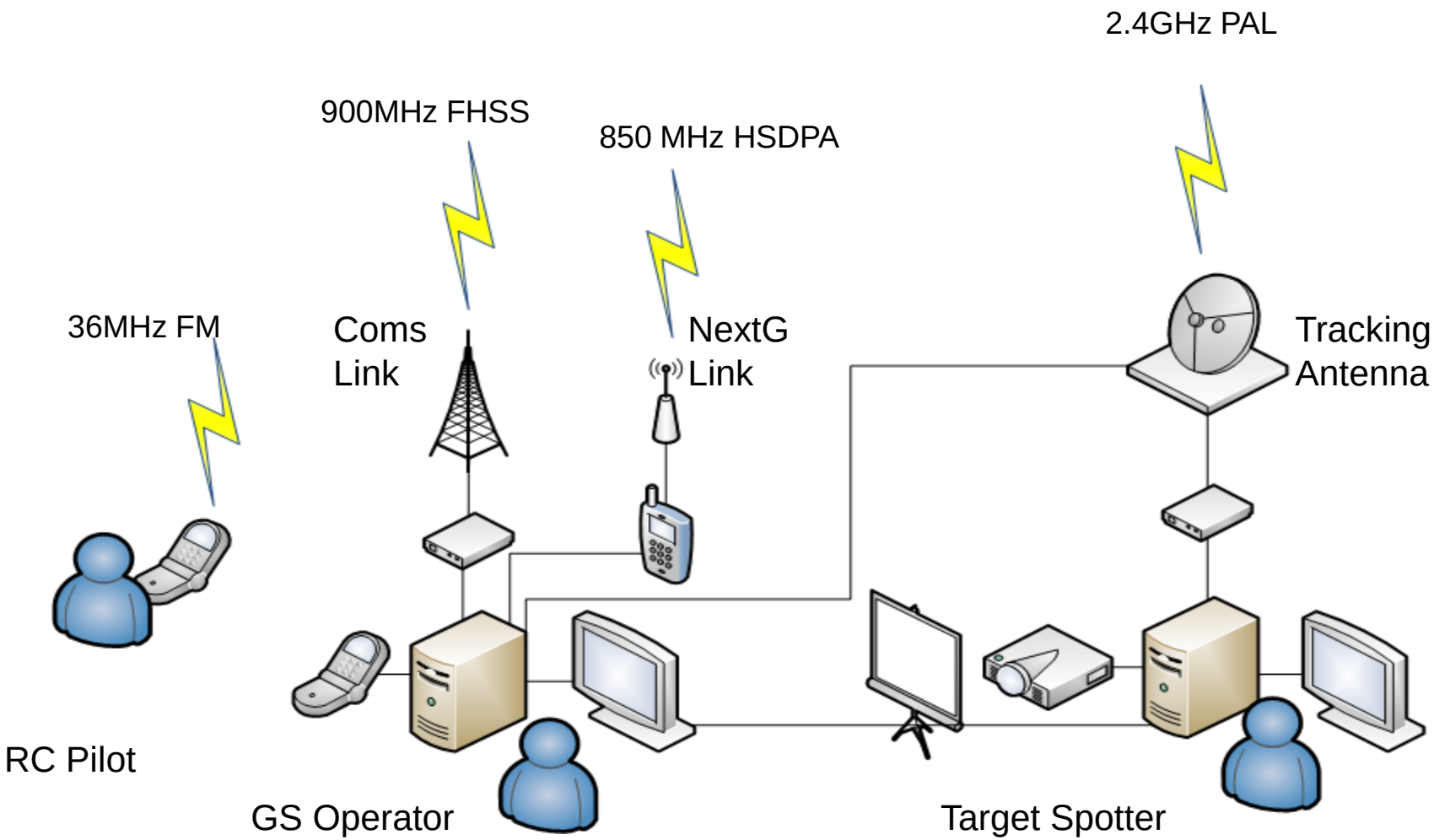
Ground Segment Overview



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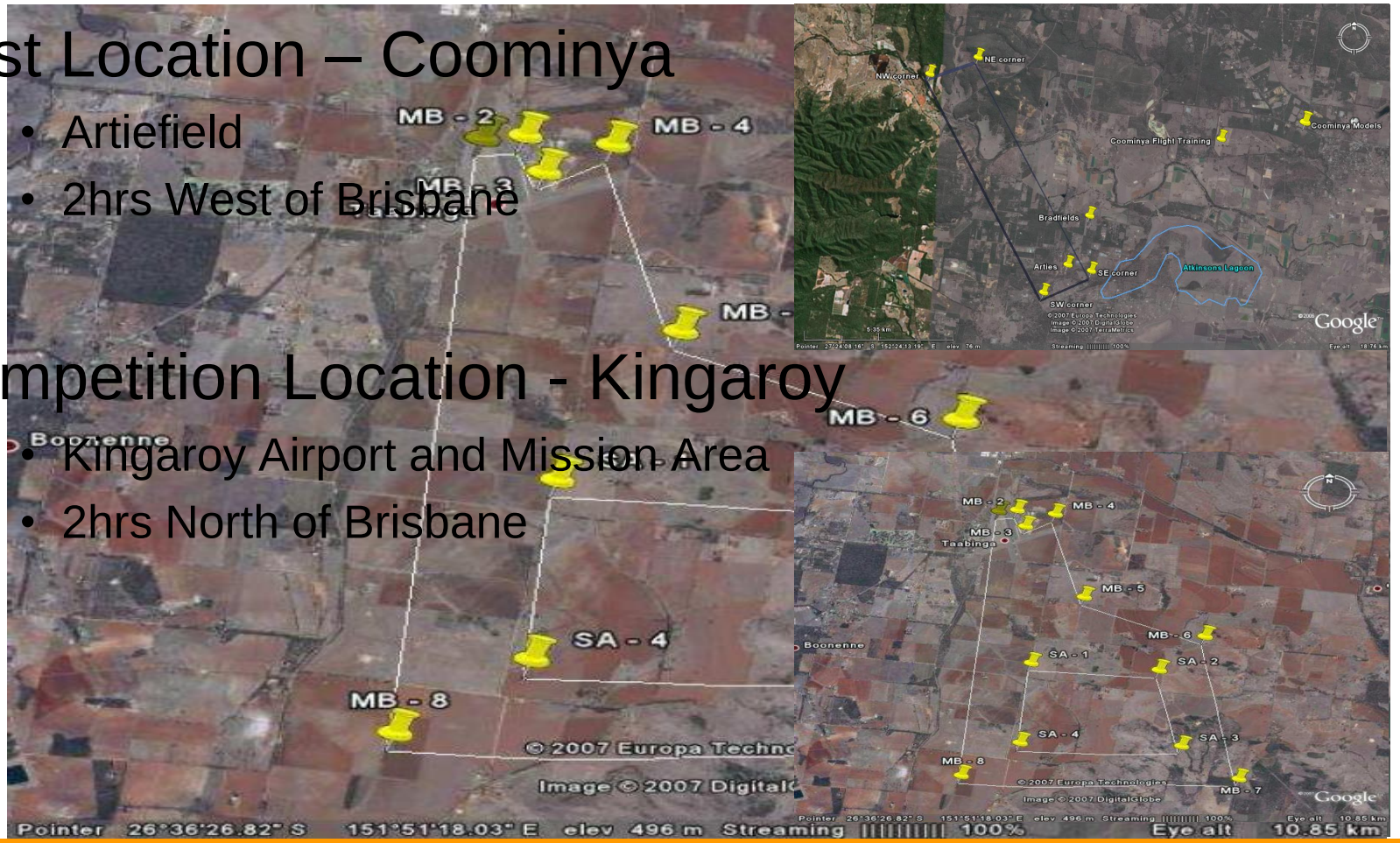
Operational Areas

- Test Location – Coominya
  - Artiefield
  - 2hrs West of Brisbane
- Competition Location - Kingaroy
  - Kingaroy Airport and Mission Area
  - 2hrs North of Brisbane



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Testbed - EMIGO

Specifications

- 2.4m Wingspan
- Trainer Style
- 50cc Boxer 2-Stroke
- 18x18 prop
- Standard Config + Flaps

Completed
Multiplex
Big Lift II

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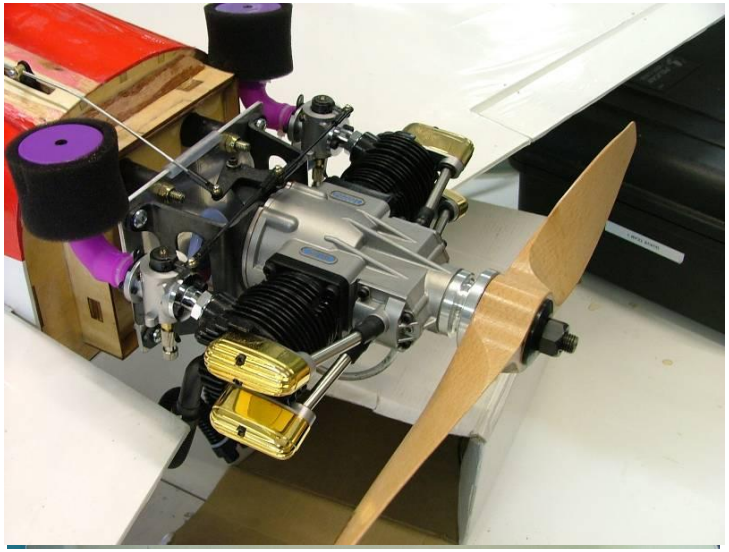
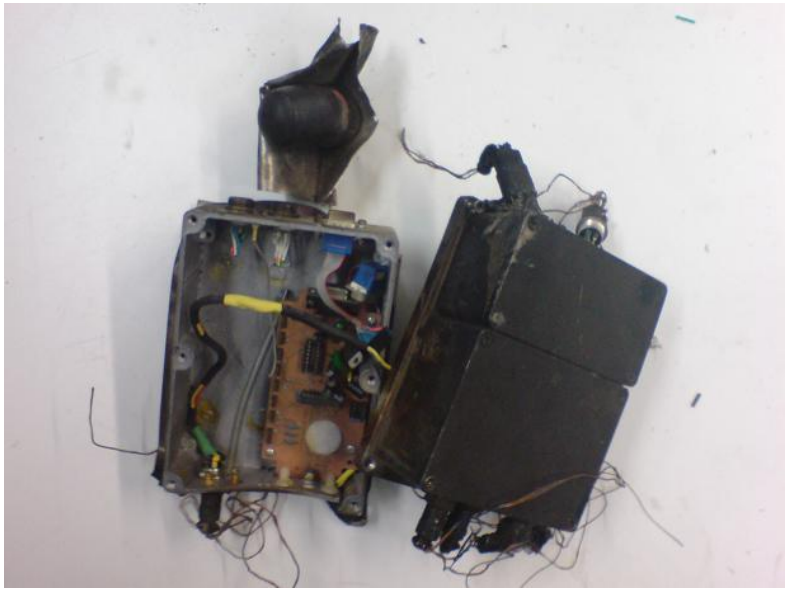
First Setback

- EMI Issues
  - Vero board System
  - Pure PCB System
- Aluminium System Enclosures
  - Power Distribution
  - Micro Pilot & Radio Modem
  - Flight Termination & Servo Board
- In the End
  - Get rid of the source – DZY48cc
  - Implement SAITO 300TDP
  - Reliability not an issue with
    - Redundant Plugs/Carbs/Cylinders
    - Onboard Glow



Second Setback

Fatal crash of EMIGO
(Big Lift)
on July 17



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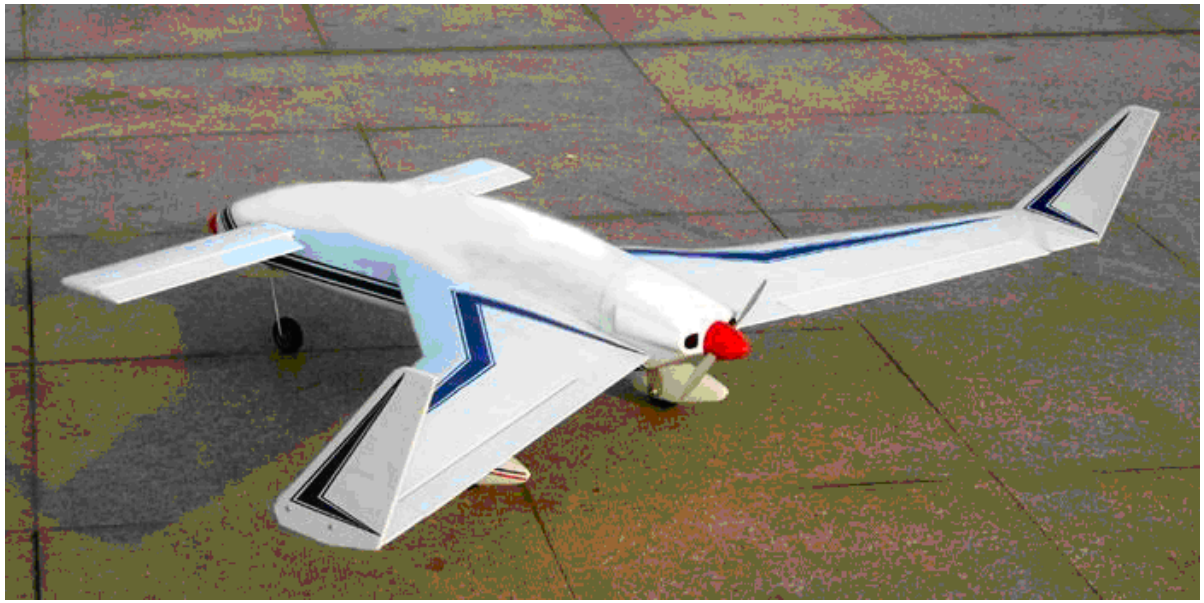
Final Platform - PHOENIX

Burt Rutan LONG-EZ

- Wing Span – 2.4m
- Length – 1.5m
- Wing Loading – 150g/dm^2
- Wing Area – 80.5dm^2
- Engine – Saito FA300TDP
  50cc 4-Stroke Glow
  Twin Carb – Opposed Boxer



Rutan LongEZ under testing

Phoenix Crash

- 11 days to go
- Flipped on take off

Katana

Specifications

- 2m Wingspan
- Aerobatic Style
- 50cc Boxer Glow
- 18x12 prop
- Traditional Config

Katana

- 3 Days to Go
- Loss of Control

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Overall Achievements

Competition

- Came 3rd
- Winner got unstable autonomy for a few seconds only.

Documentary

- Came 2nd (extremely close)

Lessons Learnt

LESSONS LEARNT - EMI

- DON'T APPLY BANDAID SOLUTION

LESSONS LEARNT – Big Lift

- STATIC WING LOAD TEST

LESSONS LEARNT - LongEZ

- DON'T ABANDON STRATEGIES FOR TIMELINE PRESSURES
- KEEP IT SIMPLE STUPID

LESSONS LEARNT - Katana

- HAVE SPARE PLATFORMS EASILY ACCESSIBLE
- DON'T USE 36MHz (use SS technology)

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turning ideas into reality

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ANY QUESTIONS?

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