The JAviator: A High-Payload Quadrotor UAV with High-Level Programming Capabilities

Silviu S. Craciunas, Christoph M. Kirsch,
Harald Röck, and Rainer Trummer

Department of Computer Sciences
University of Salzburg, Austria

Presented by **Rainer Trummer**

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Computational
Systems Group

# The JAviator Project: javiator.cs.uni-salzburg.at

- **Project goals:**
  - Develop high-payload quadrotor model helicopters
  - Develop high-level real-time programming abstractions
  - JAviator helicopters are our software laboratories

- **Real-time programming in Java:**
  - Write-once-run-anywhere also for real time (time portability)
  - Exotasks vs. Java threads (collaboration with IBM Research)

- **Real-time programming in C:**
  - Time-portable software processes (CPU, I/O, Memory)
  - Real-time operating system Tiptoe: tiptoe.cs.uni-salzburg.at

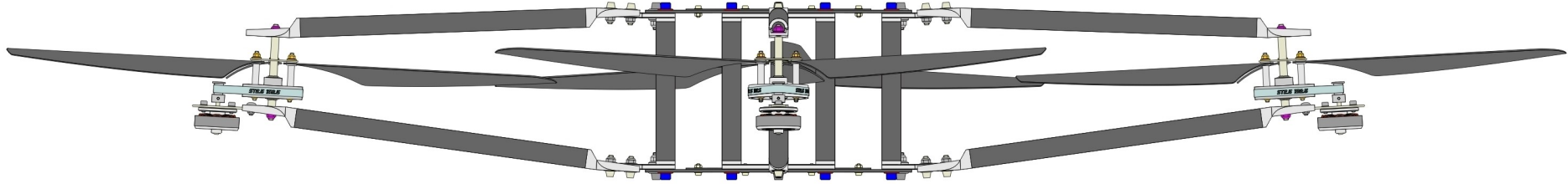# JAviator Design Evolution

- Jan 2006 – Aug 2007: **JAviator V1**
  - Entirely hand-fabricated CF, AL, and TI components
  - Total diameter (over spinning rotors):   1.1 m
  - Empty weight (including all electronics):   1.9 kg

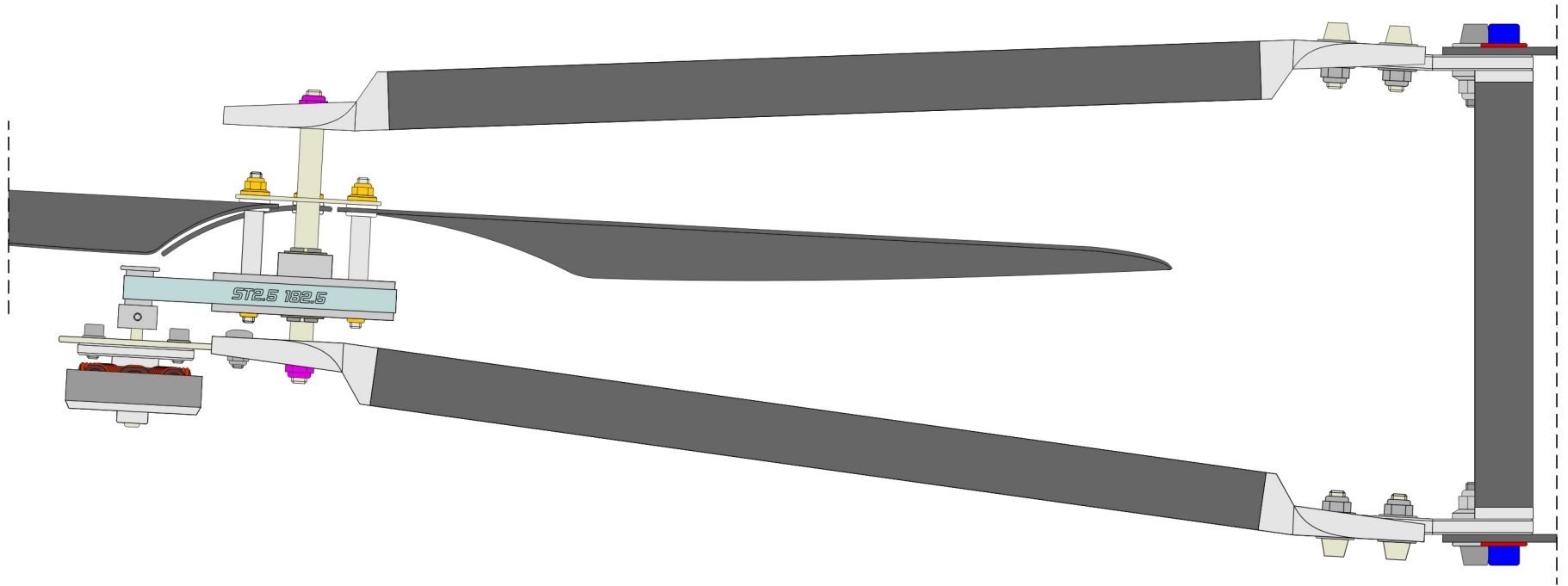# JAviator Design Evolution
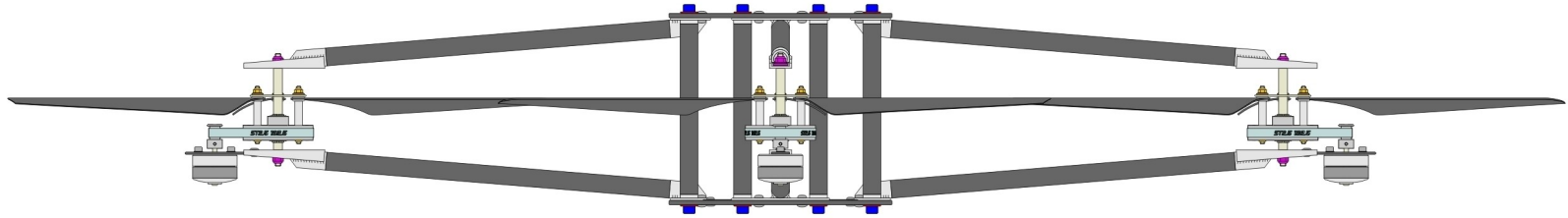
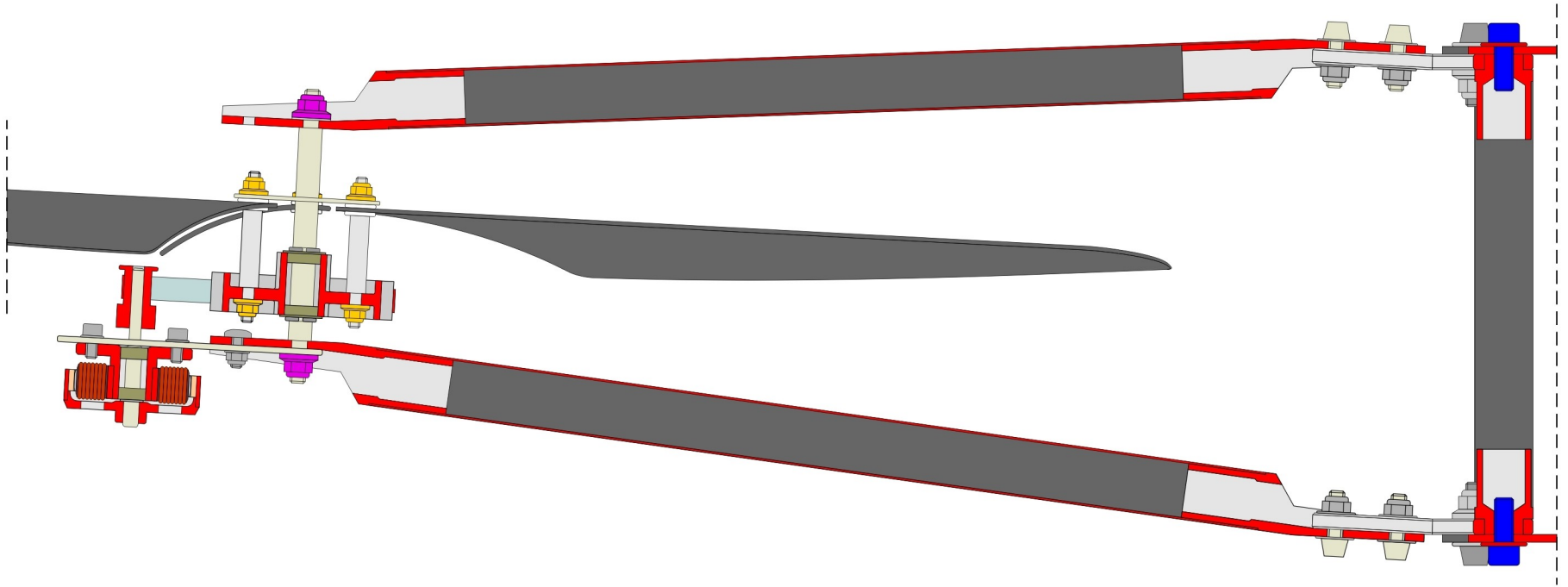# JAviator Design Evolution

JAviator Design Evolution

- Since February 2007: **JAviator V2**
  - CNC-fabricated, flow-jet-, and laser-cut components
  - Total diameter (over spinning rotors):   1.3 m
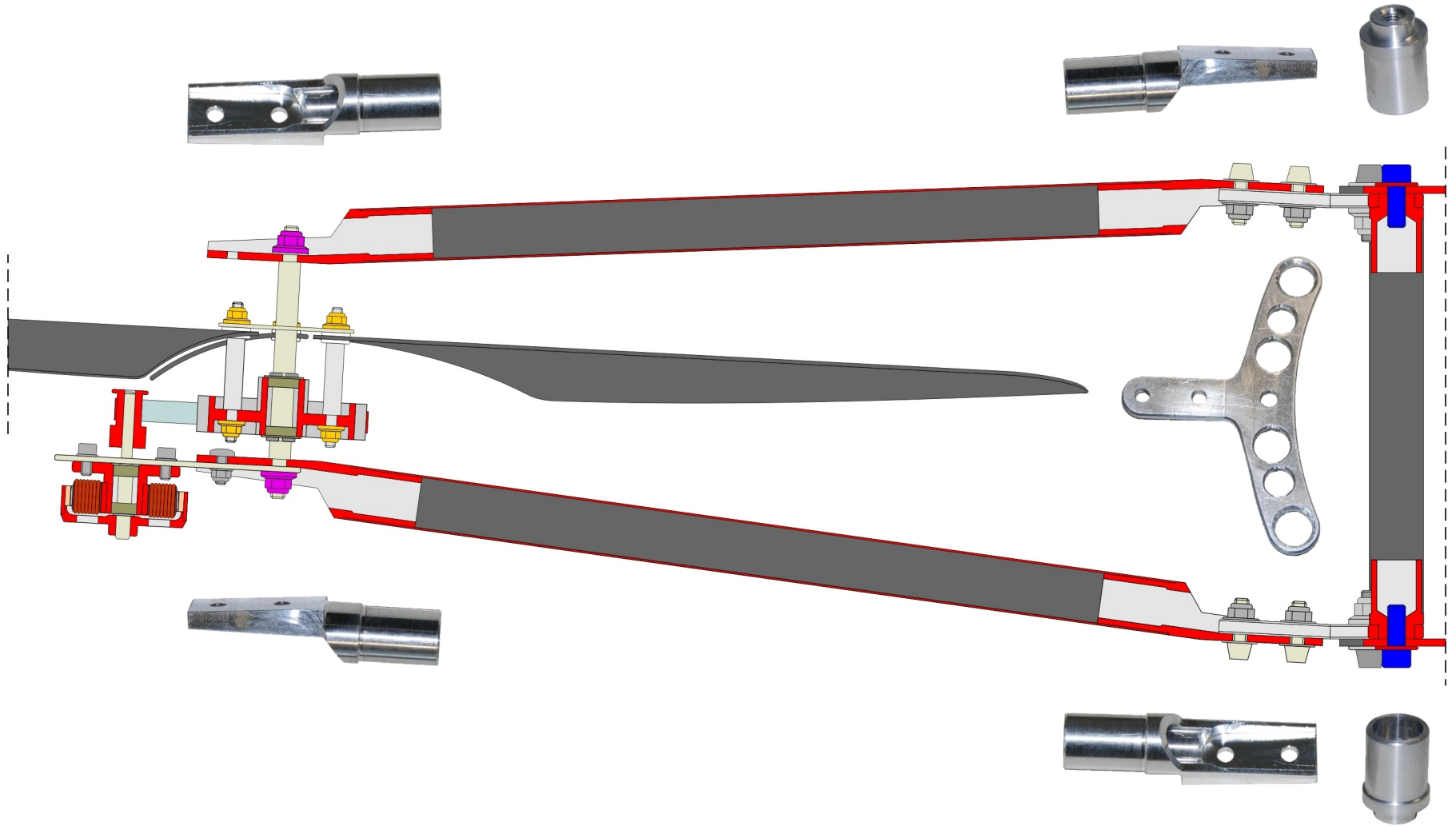 - Empty weight (including all electronics):   2.2 kg
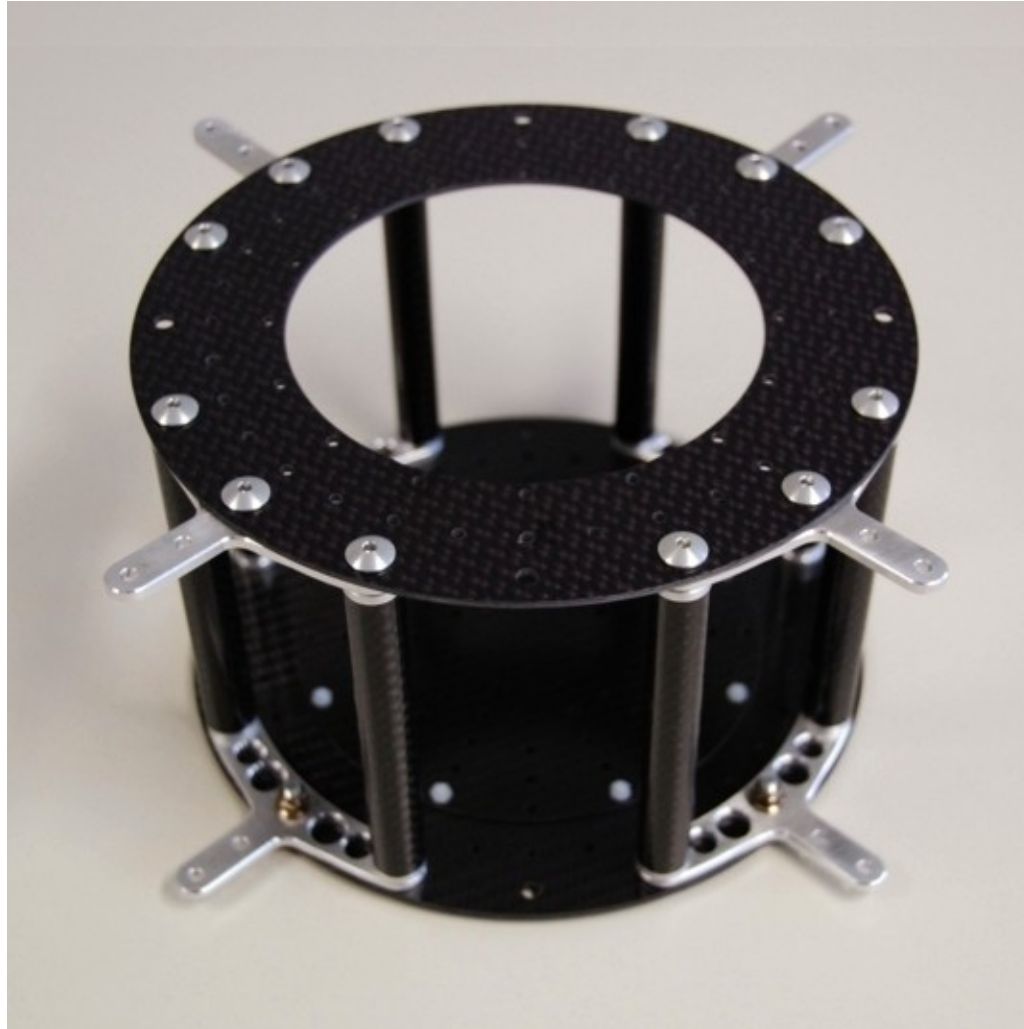
Side-Arm Details

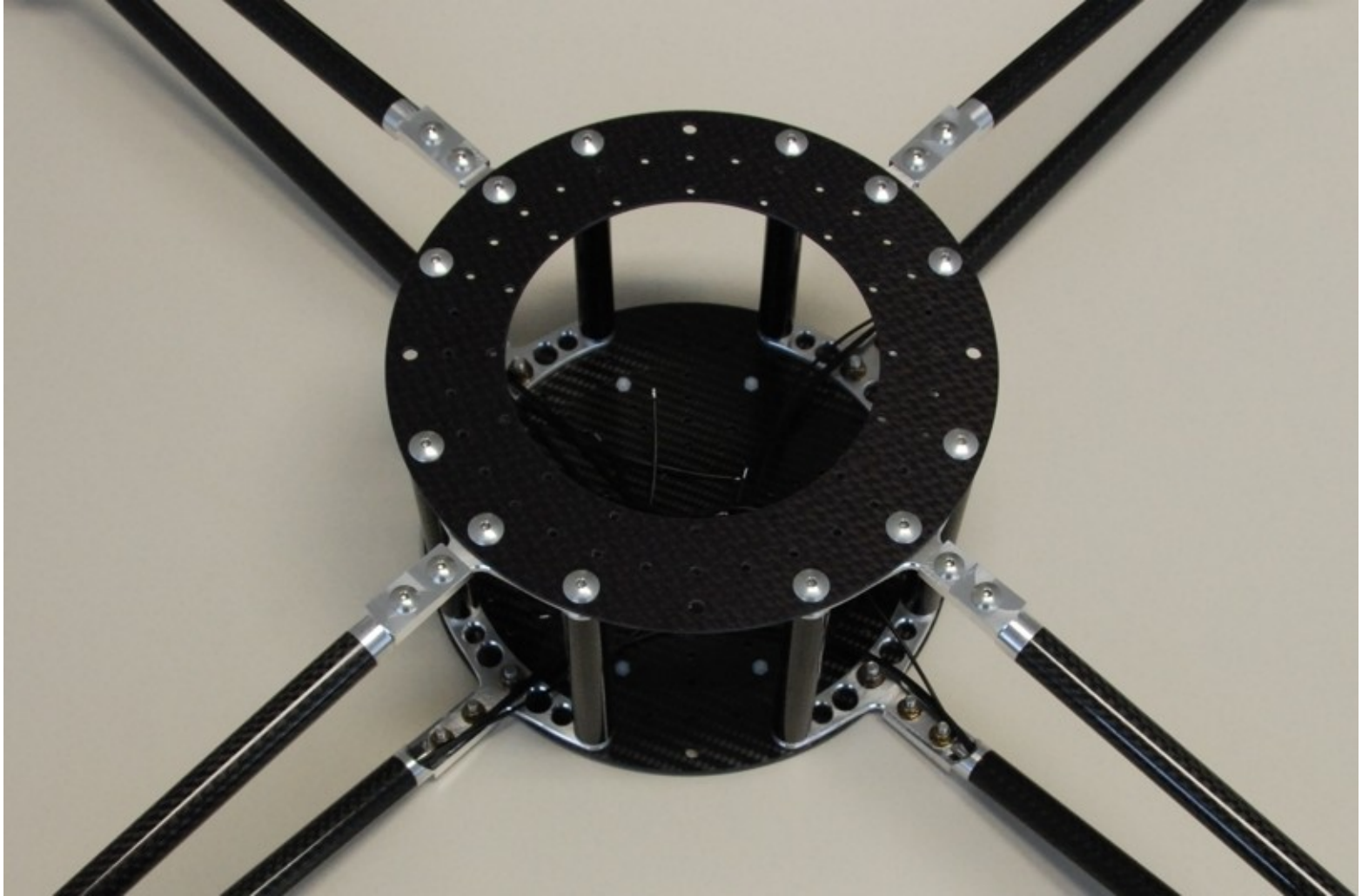# Side-Arm Details

Side-Arm Details

Frame Construction
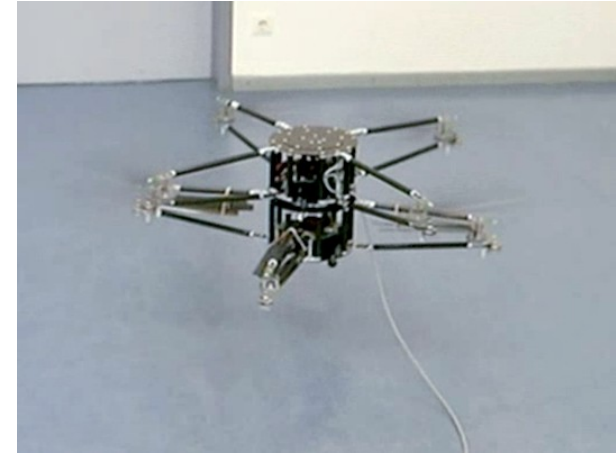
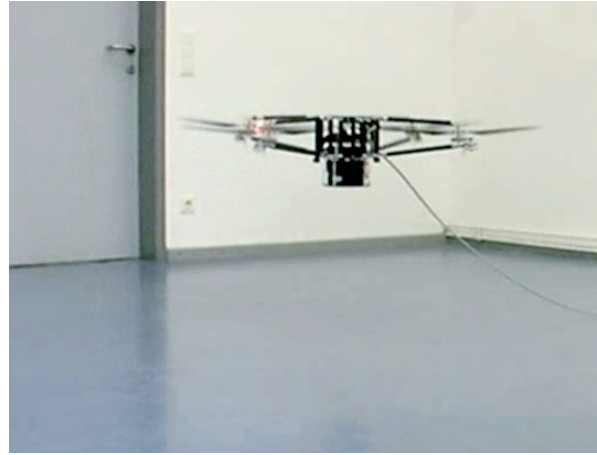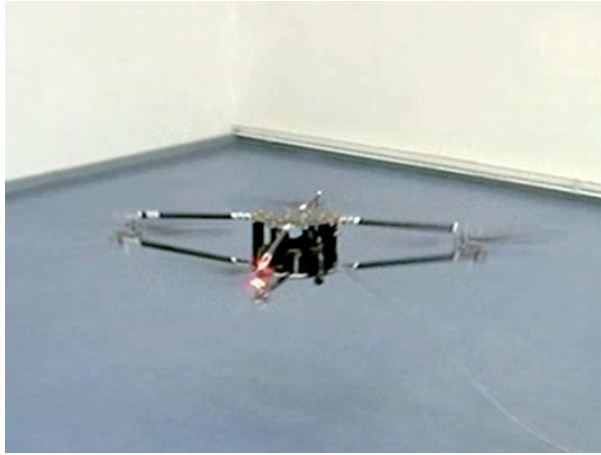# Frame Construction

Frame Construction

Frame Construction

Frame Construction

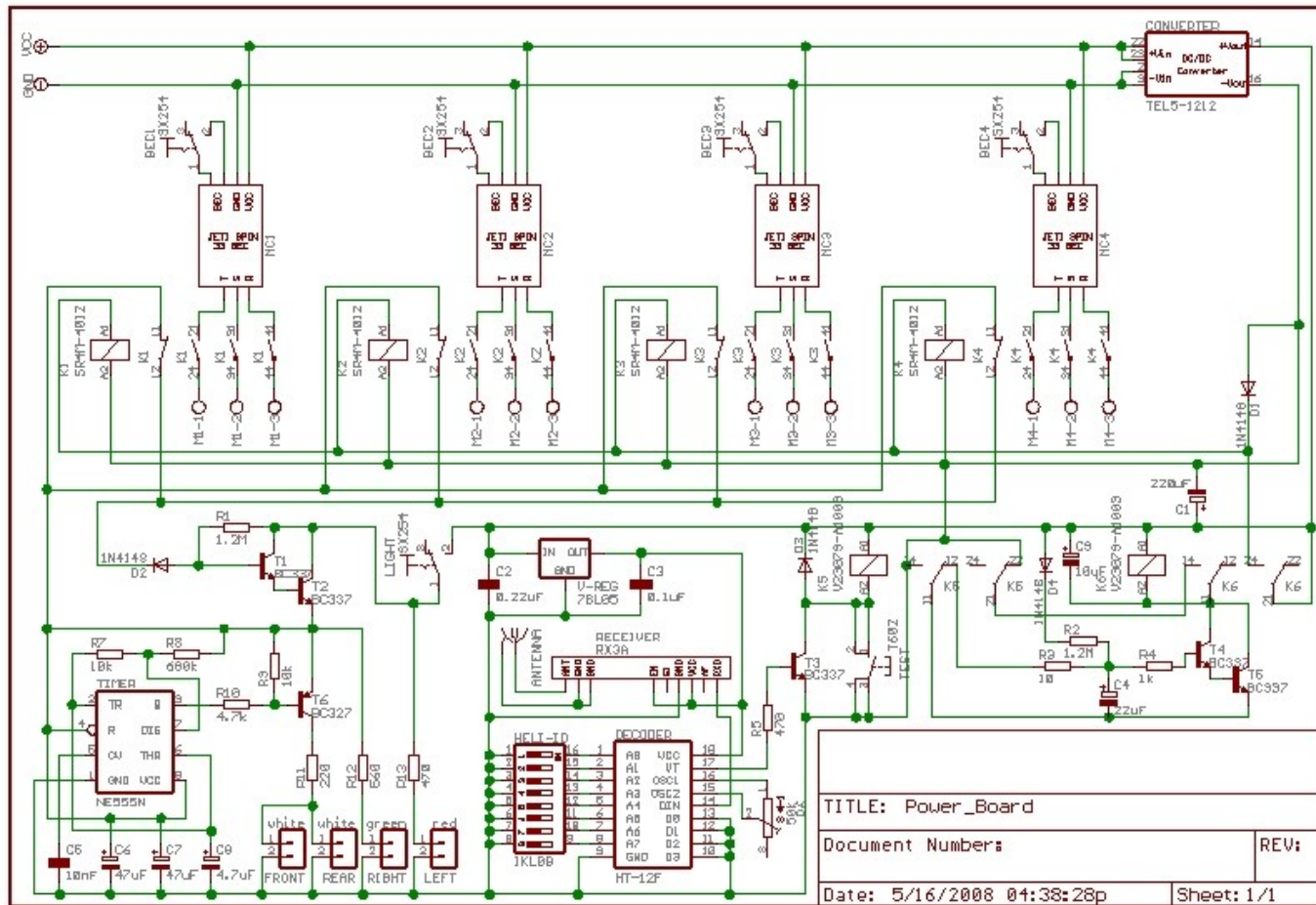# Propulsion Capacity

- Maximum lift capacity: 5.4 kg
  - 2.2 kg empty weight + 3.2 kg maximum payload

- Maximum flight time: 40 min
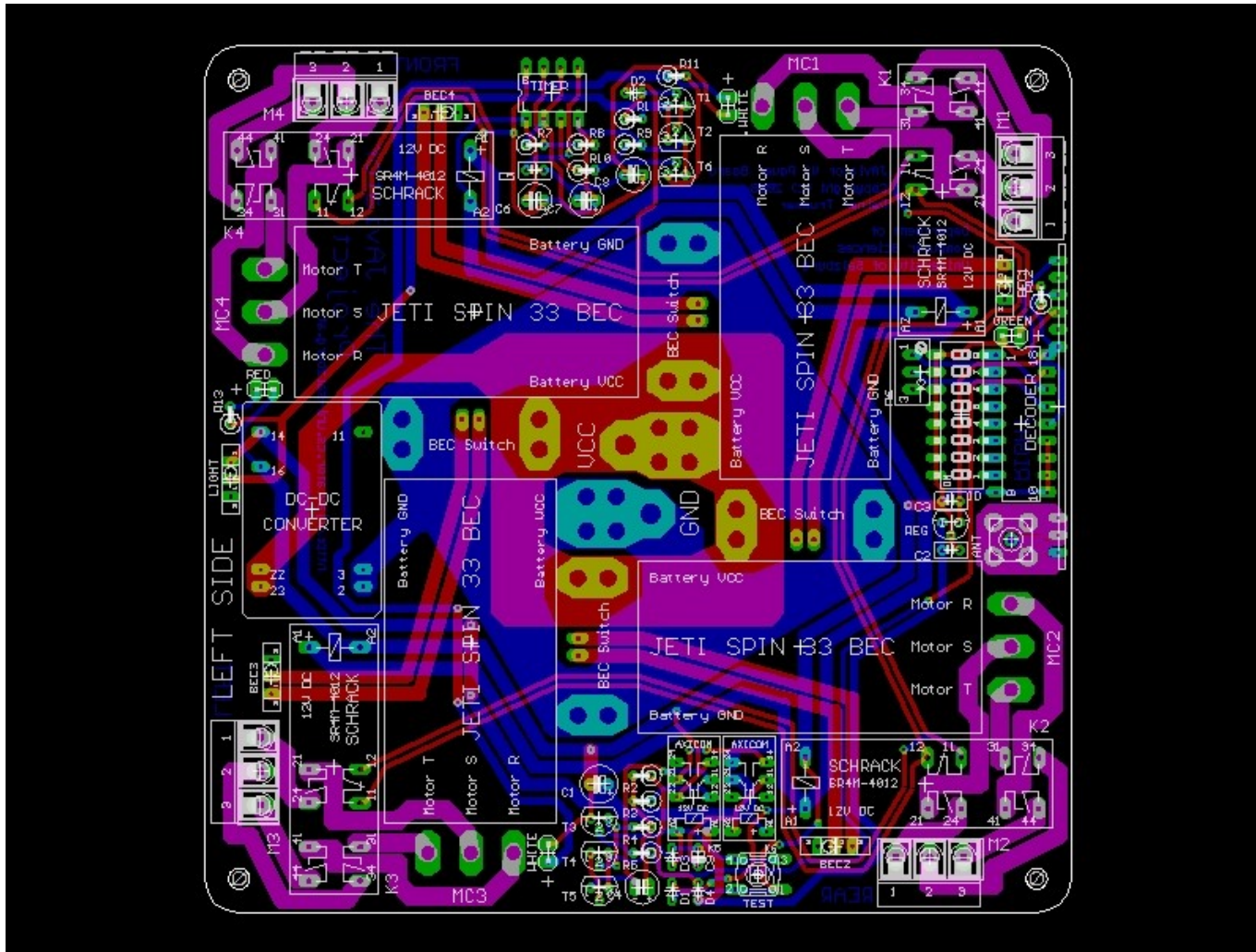 - 40 min without payload down to 8 min with 3.2 kg

Power Board Design

- Need for central board containing ...
  - four AC motor controllers
  - R/C emergency shutdown
  - high-current circuit breaker
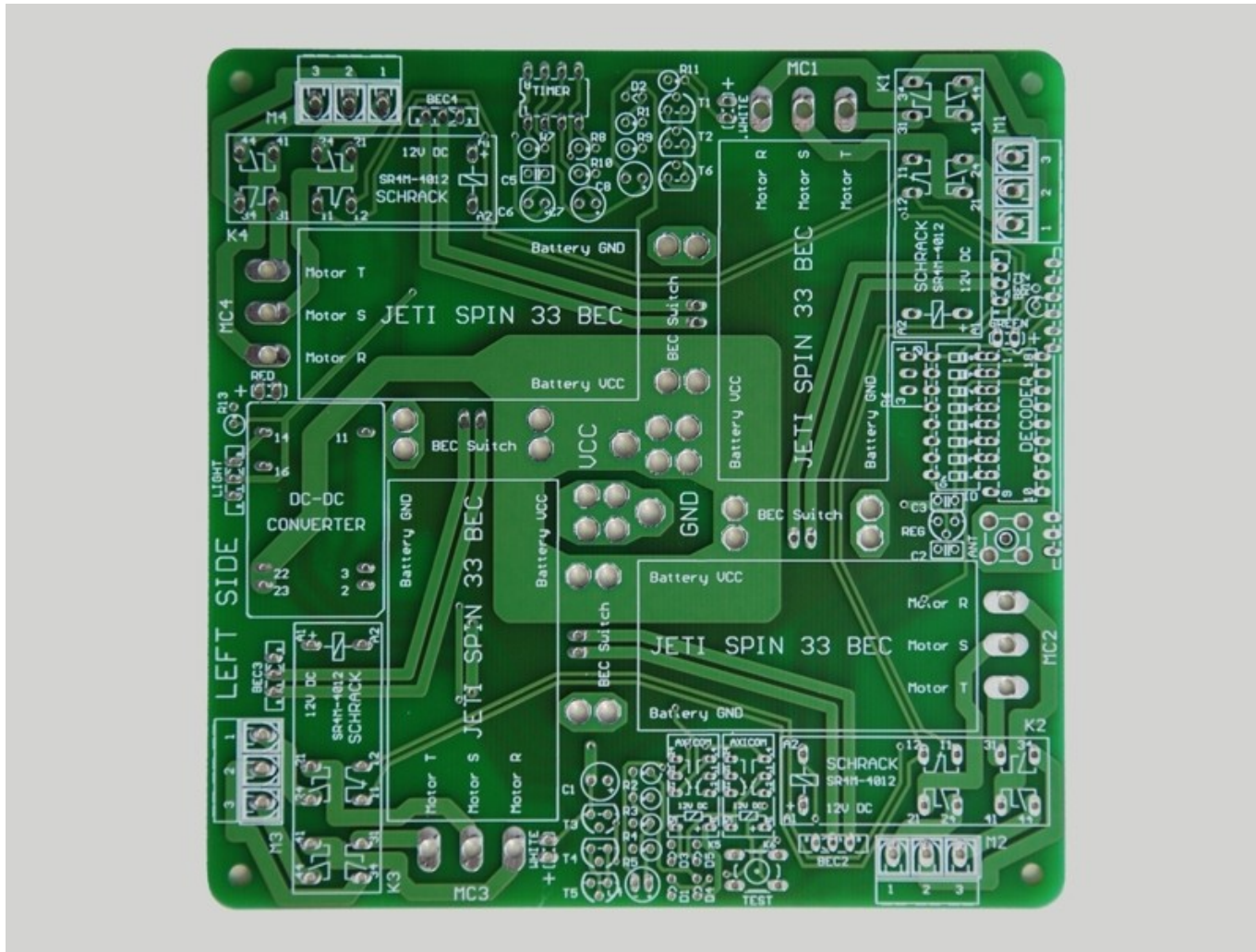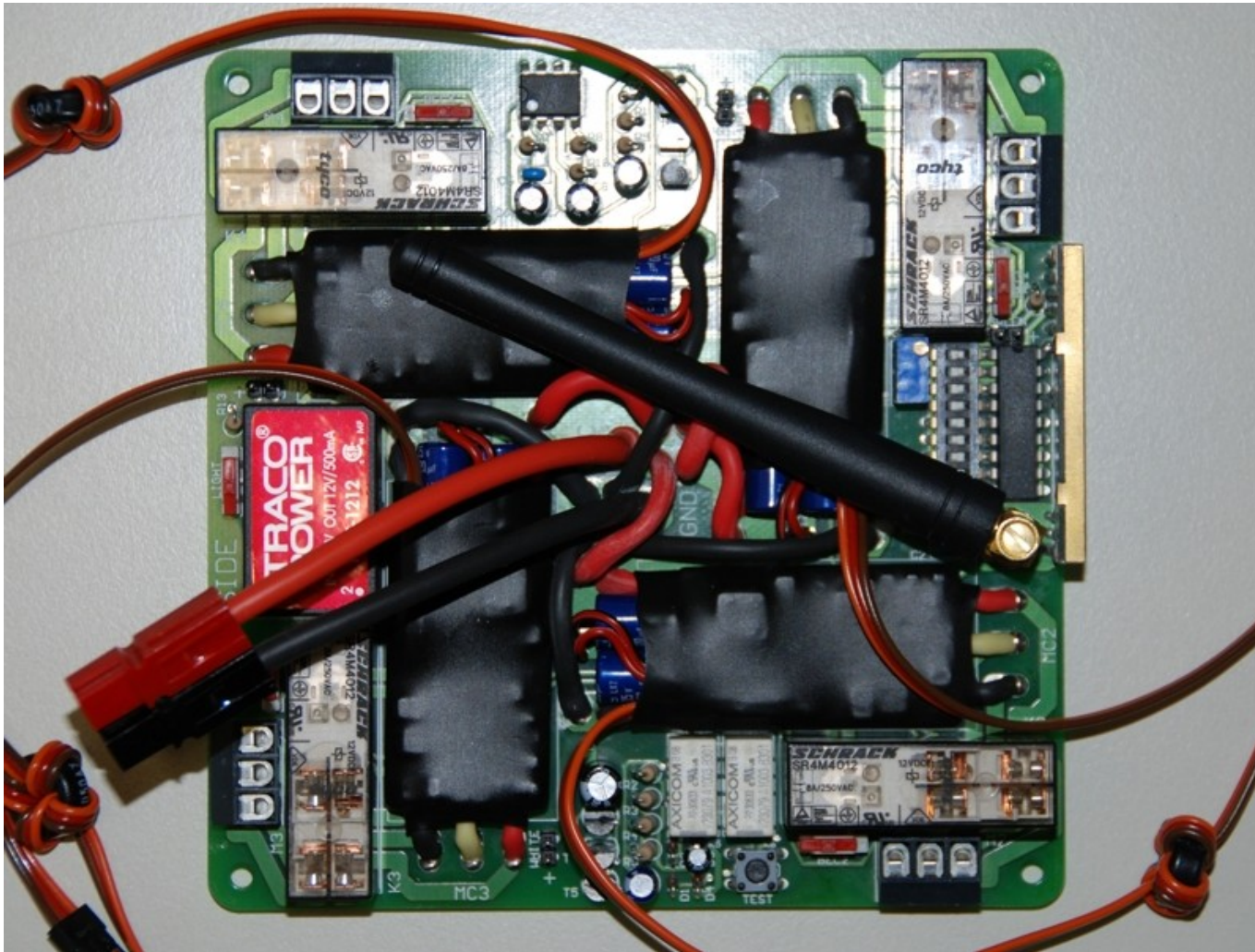 - signal-lights mechanism
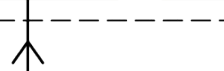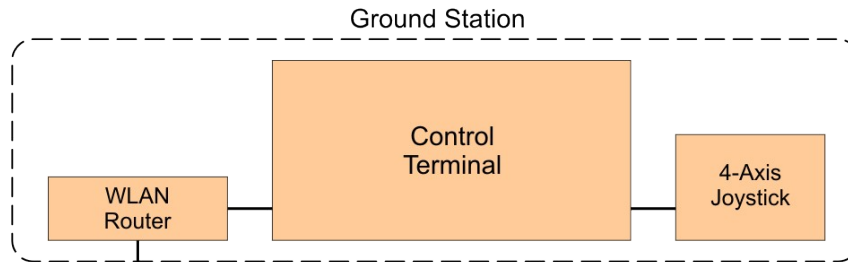 - low-voltage power supply

Power Board Design

Power Board Design

Power Board Design

Power Board Design

Computer System

Ground Station

Control Terminal

WLAN Router

4-Axis Joystick

JAviator Quadrotor

WLAN Module

Gumstix
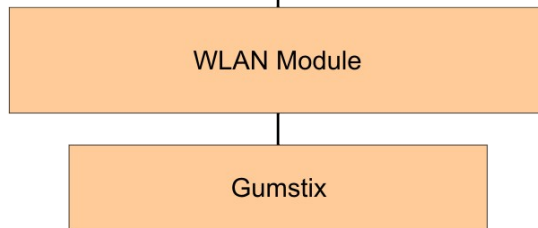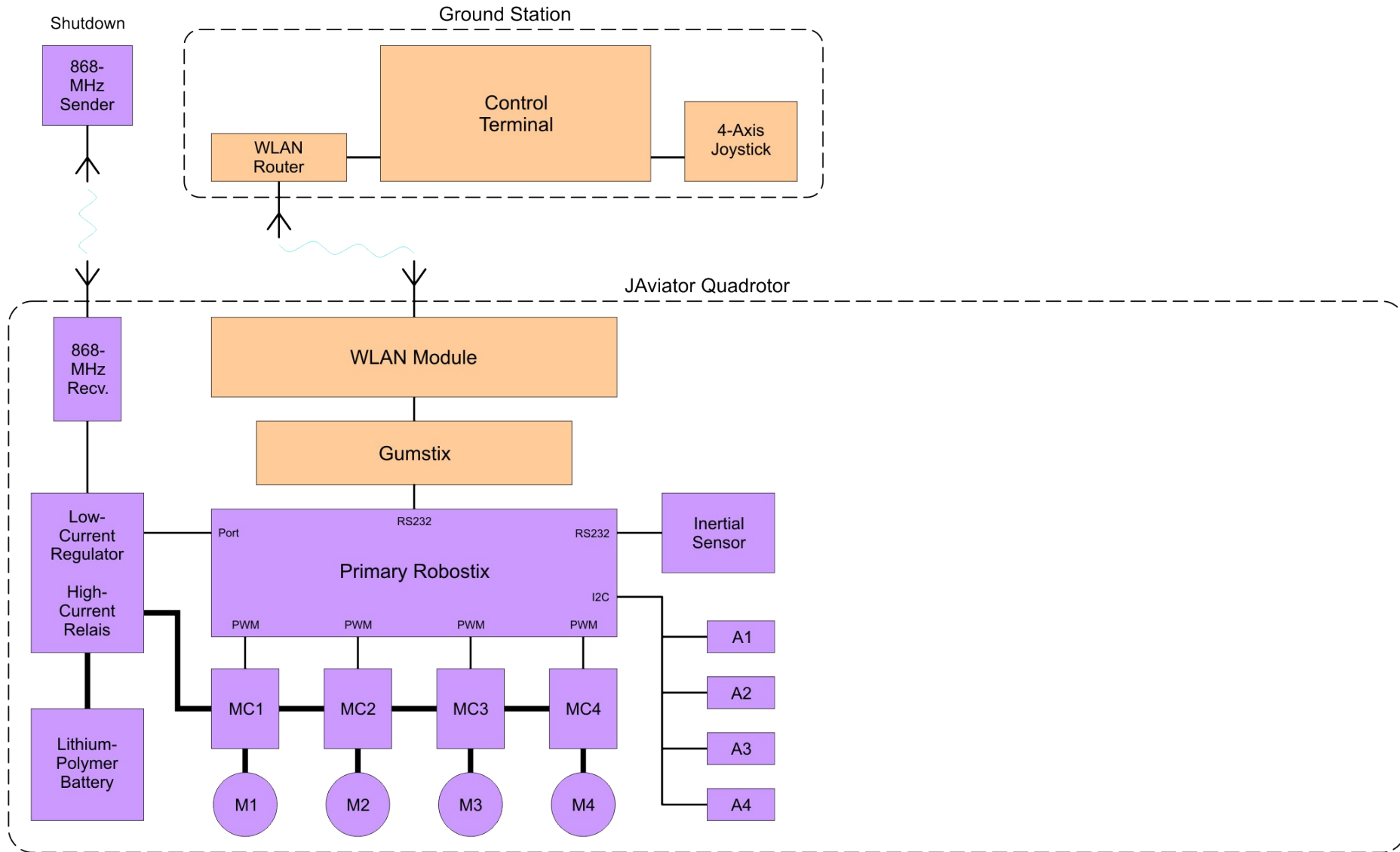
Computer System

Computer System

Software System
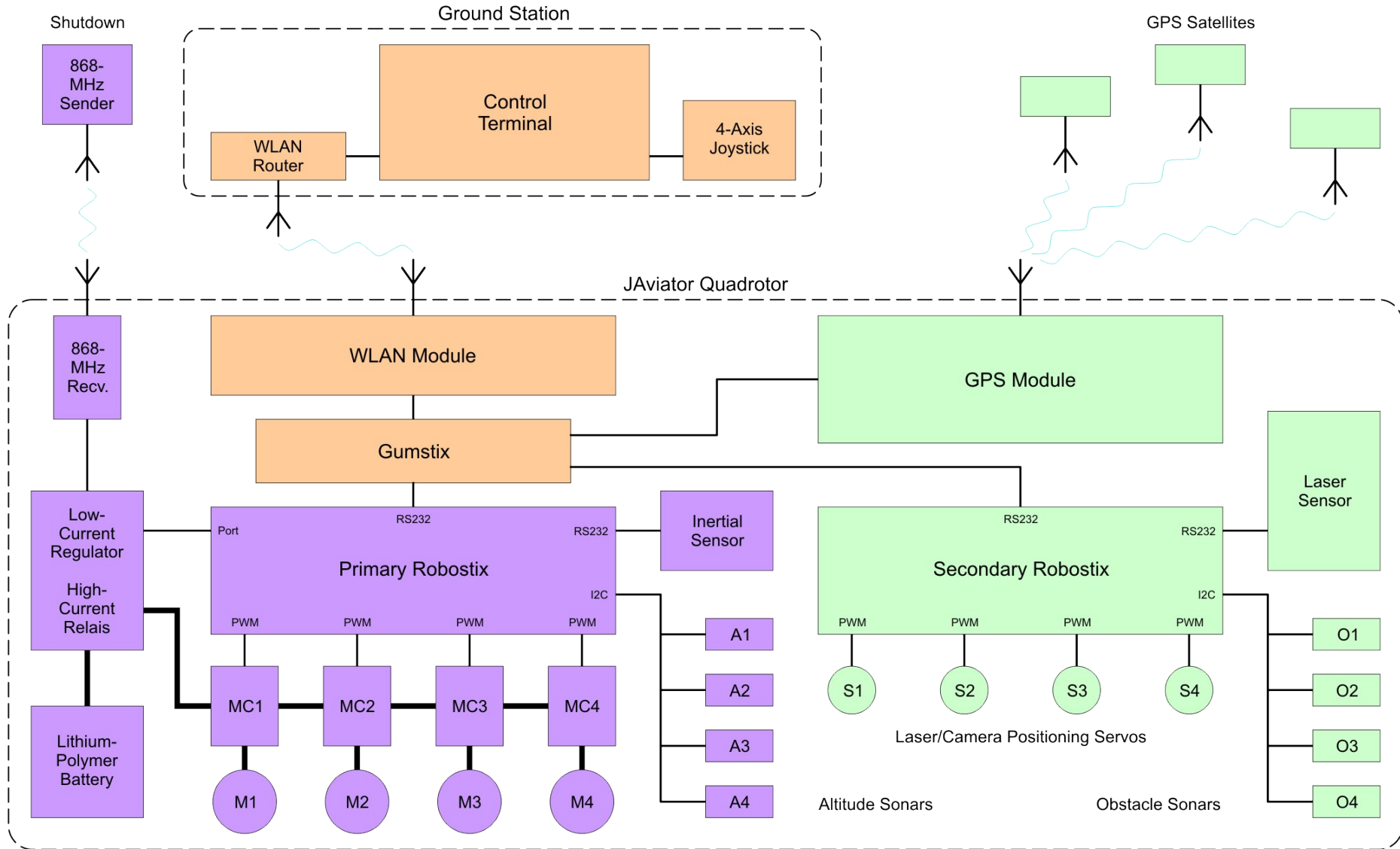
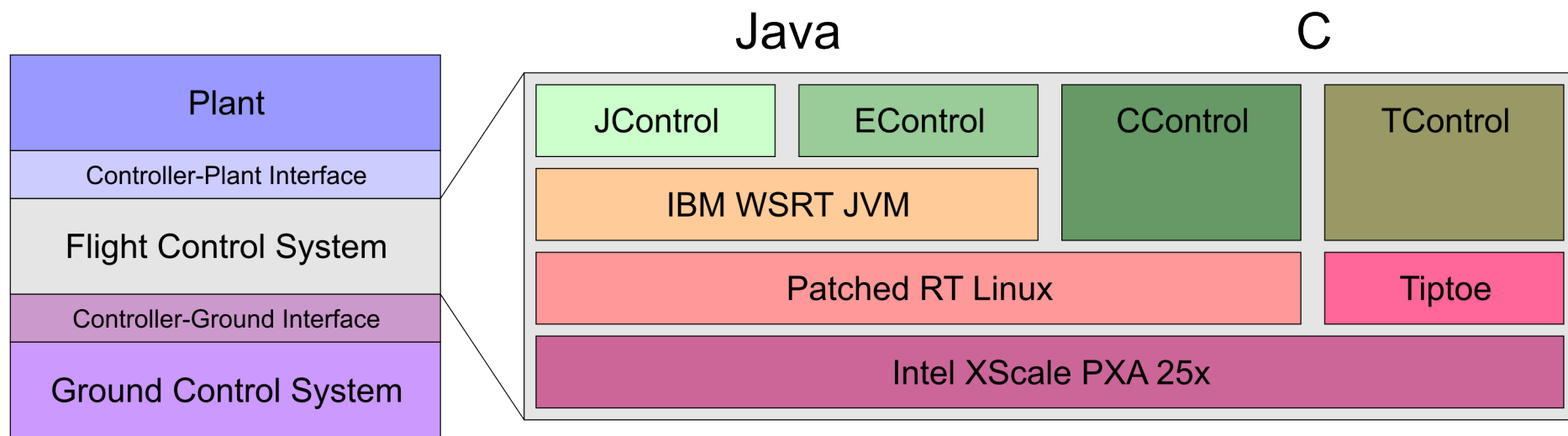| |
|---|
| Plant |
| Controller-Plant Interface |
| Flight Control System |
| Controller-Ground Interface |
| Ground Control System |
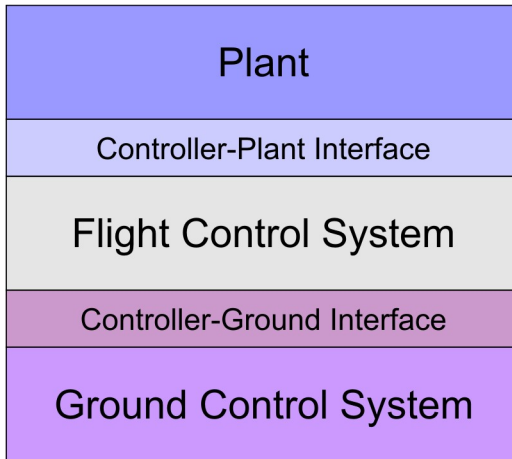
- Real JAviator or MockJAviator

- Four interchangeable controllers

- Java-based Control Terminal
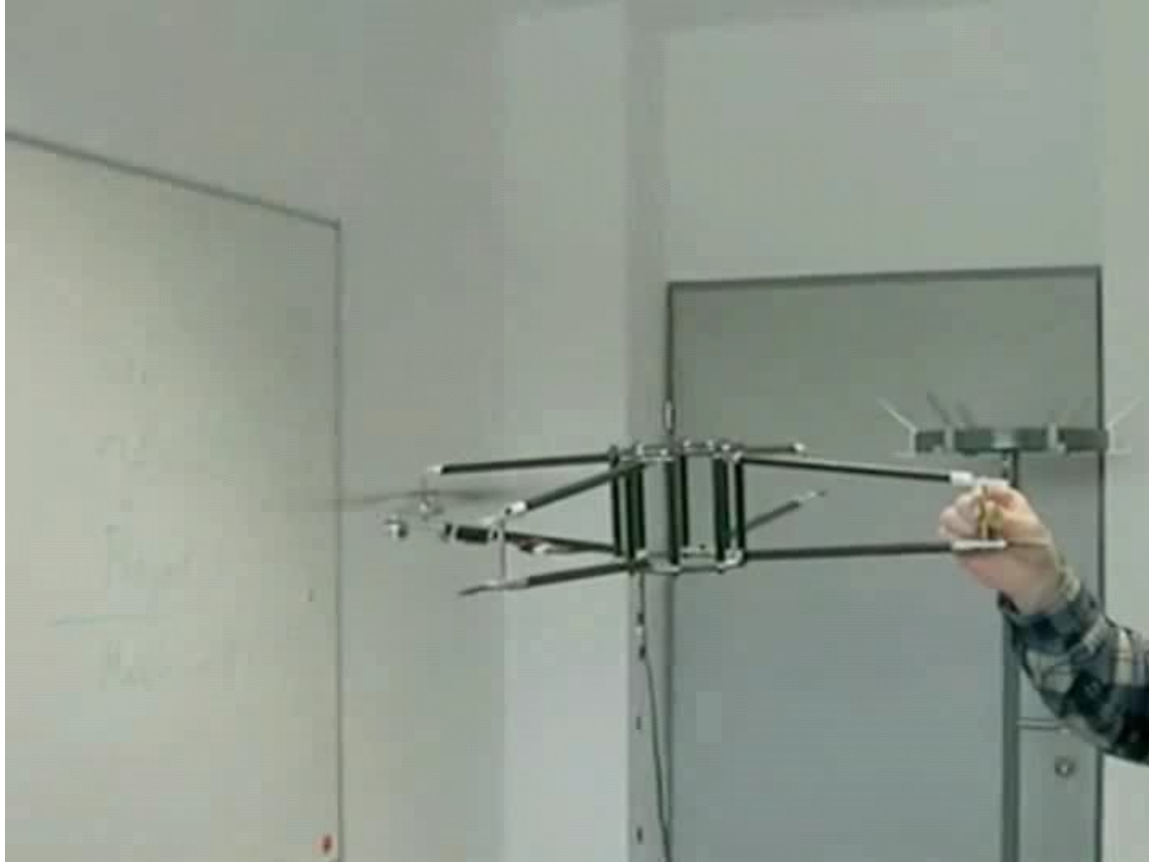
Software System

- JControl: Thread-based Java controller (runs on top of any JVM)

- EControl: Exotask-based Java controller (runs on IBM's WSRT JVM)

- CControl: Linux-based C controller (runs as single-threaded process)

- TControl: Tiptoe-based C controller (runs bare-metal on Gumstix)

Software System
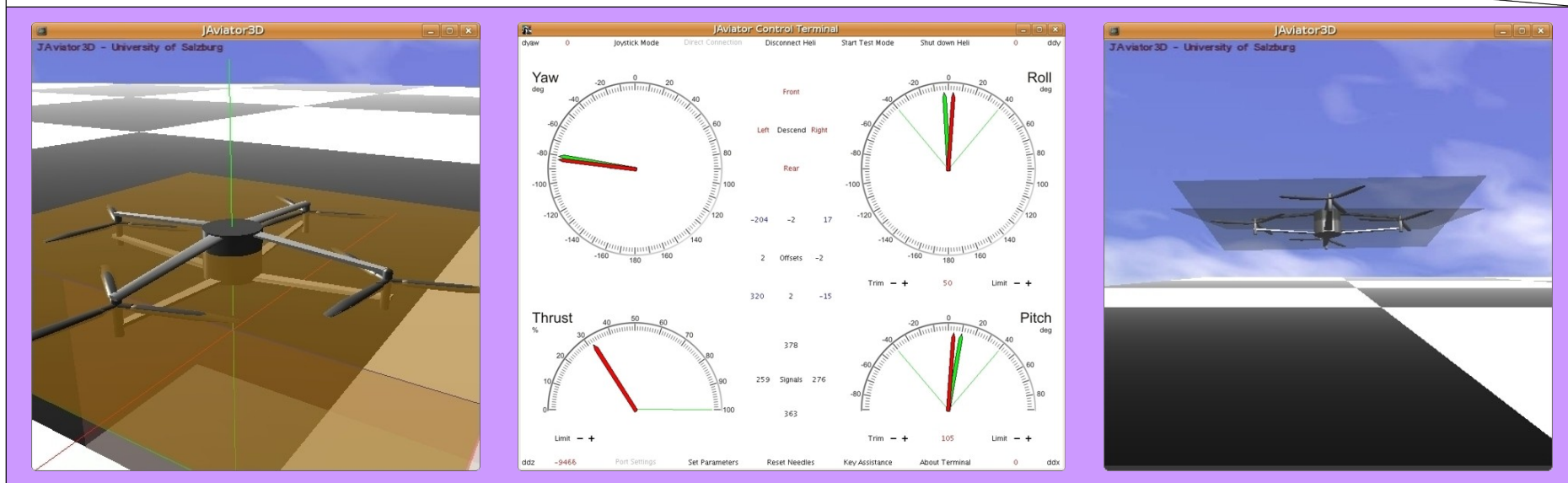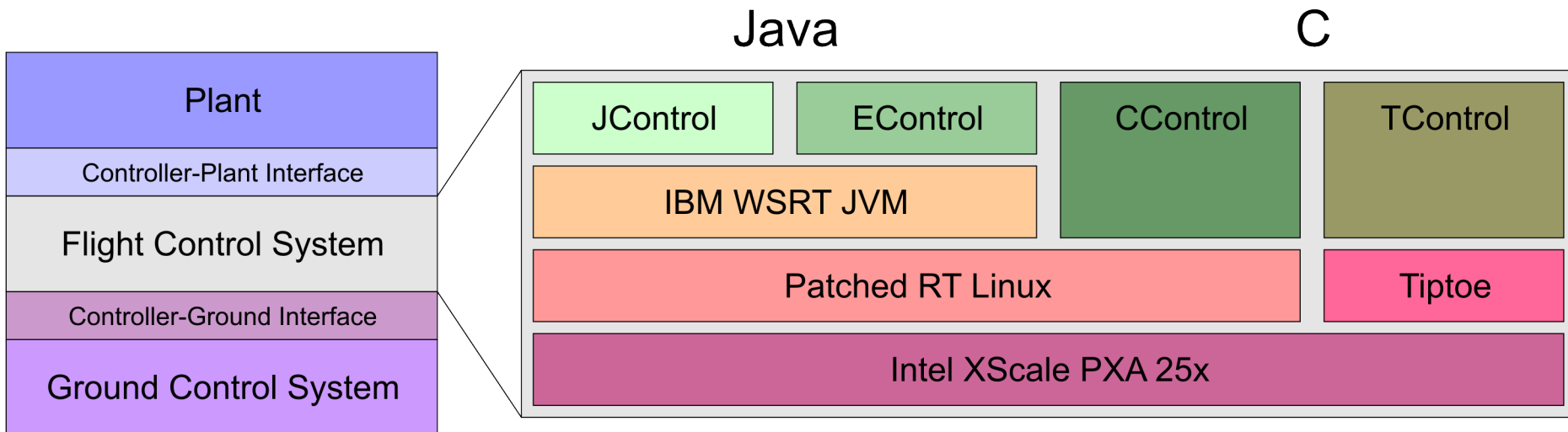
JAviator Impressions

Thank You!

Questions?