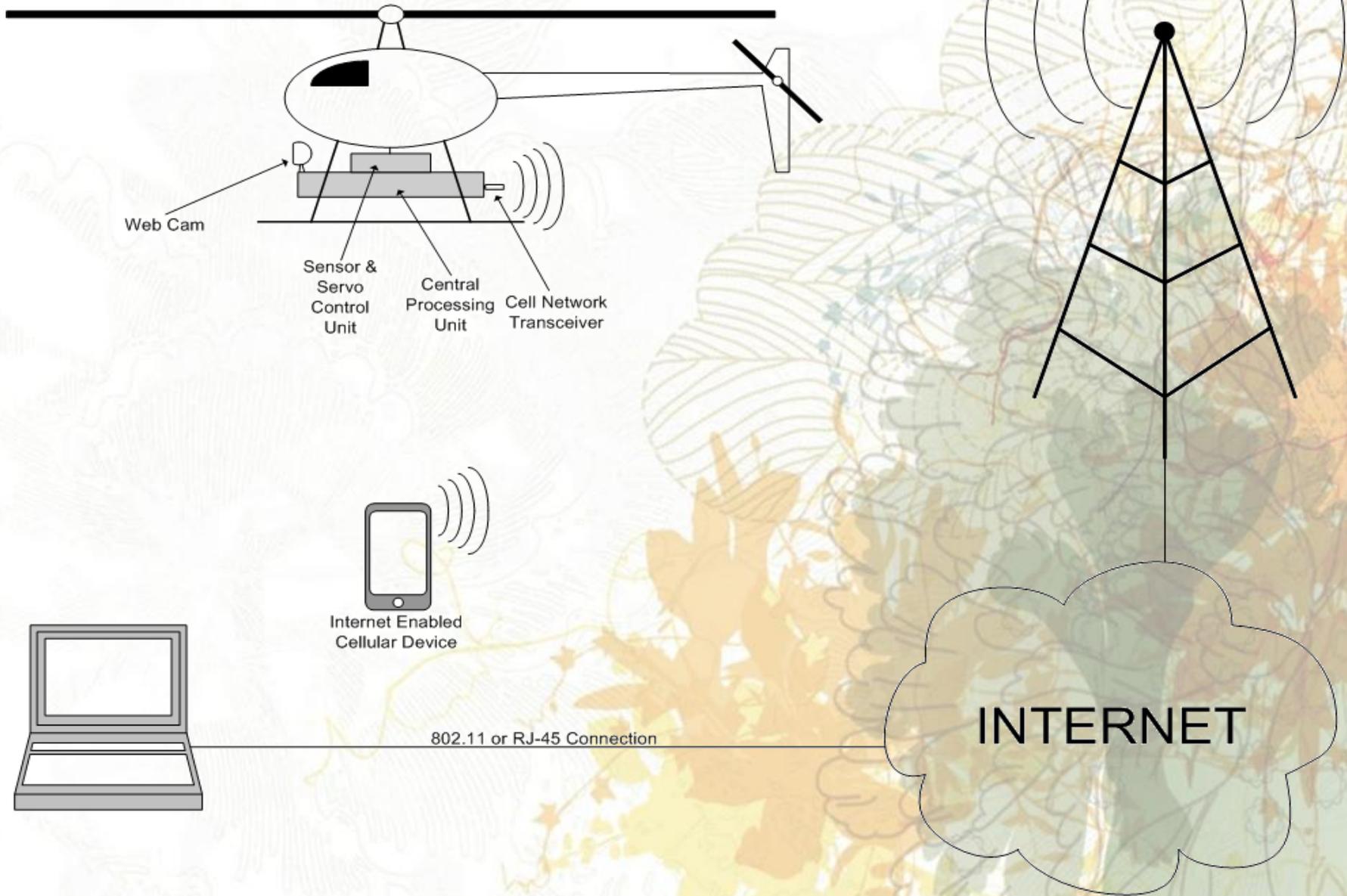


# Cellular Network UAV

Nic McDonald  
Grant Ayers

<http://pisco.flux.utah.edu/uav>





## **ALIGN TREX 600 ESP**

Electric Helicopter

Length: 48"

Flying Weight: 5.4 lbs.

Payload: ~3 lbs.

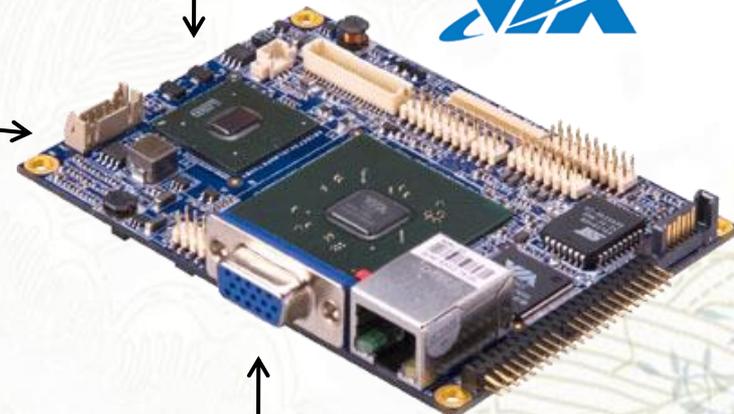
Sponsored by:



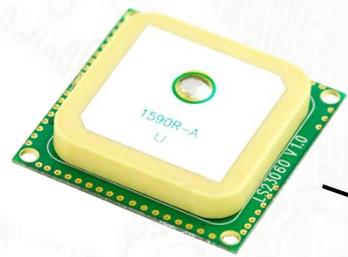
Sponsored by:



USB

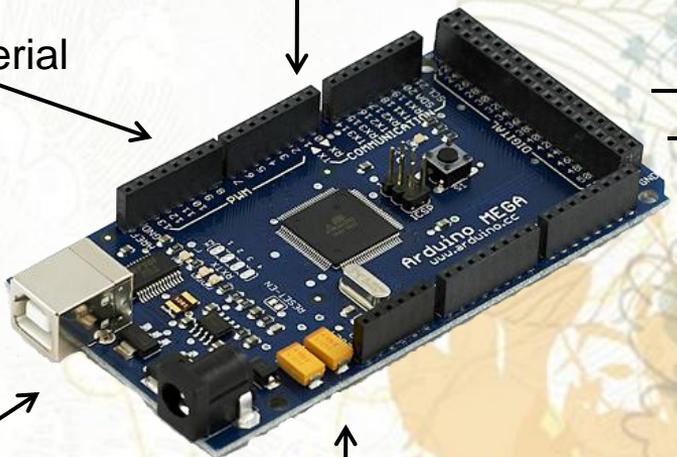


USB

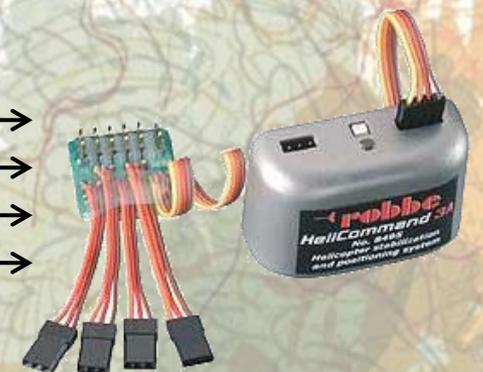


Serial

Serial



PWM



Analog



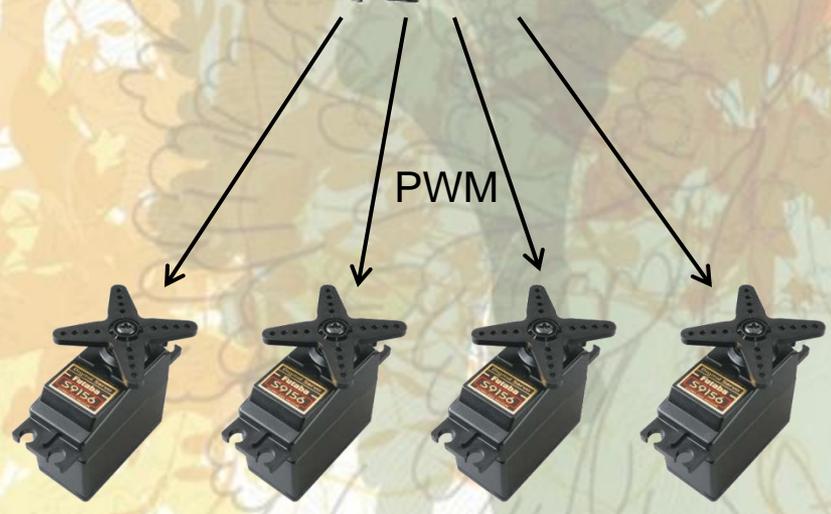
I<sup>2</sup>C



I<sup>2</sup>C



Serial



PWM

## Private Ground Station:



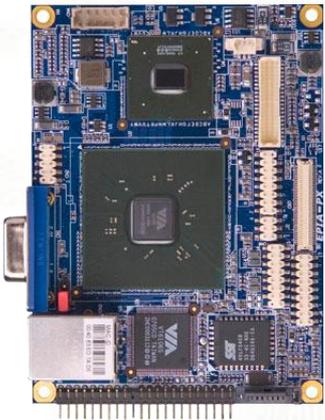
- TCP/IP command & status link.
- Manual flight control.
- Autonomous flight control.

## Public Ground Station:



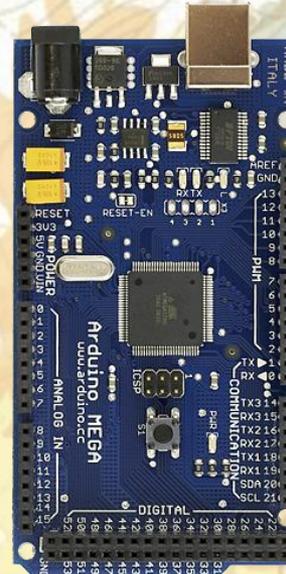
- Aircraft webcam video viewer.
- Aircraft and flight statistics viewer.

## Central Processing Unit:



- TCP/IP server for command & status link.
- TCP/IP server for webcam link.
- Main flight control system.
- Serial interface to SPU.
- USB interface to webcam.

## Sensor & Servo Processing Unit:



- Command & status decoding & encoding.
- Sensor data reporting and retrieval.
- Management of sensor control (power, sensitivity, etc.).
- Generation of pulse width modulation (PWM) for servo positioning.

# Controlling a Helicopter

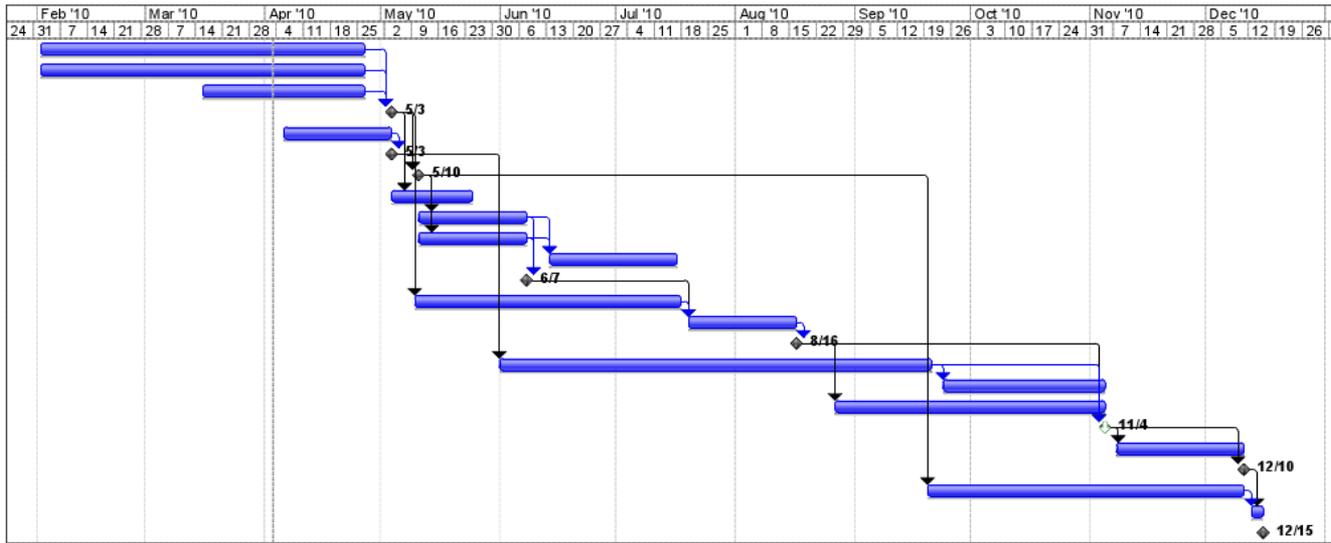
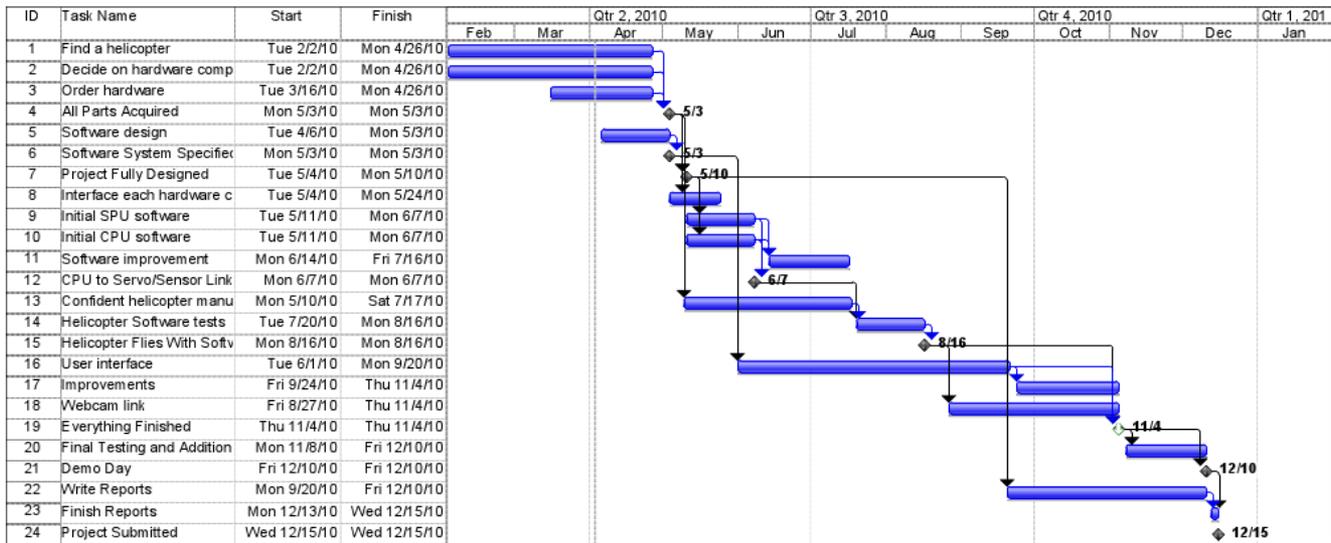


- Elevator (cyclic pitch)
- Aileron (cyclic roll)
- Collective (rotor pitch)
  - Also on tail
- Rotational velocity (RPM)
  - Tail velocity is proportional to the main rotor



## Helicommmand 3A Stabilization:

- Attempts to level the helicopter when the controls are 'neutral'.



Project: UAV Date: Sat 4/3/10	Task	[Blue Bar]	Milestone	◆	External Tasks	[Grey Bar]
	Split	[Dotted Line]	Summary	[Arrow]	External Milestone	◆
	Progress	[Black Bar]	Project Summary	[Arrow]	Deadline	⬇

Page 1

# Bill of Materials

Item	Description/Notes	Status	Vendor	Cost	Totals	
<b>Vehicle:</b>						
Align Trex 600	Electric helicopter & Etc.	Got it	L-3 Sponsored	\$2,000		
Helicommand 3A	Stabilization system	Got it	L-3 Sponsored	\$500		
					\$2,500	
<b>Central Processing Unit:</b>						
VIA ARTiGO A1000	Mini x86 System	Got it	VIA Sponsored	\$250		
1GB SO-DIMM RAM	x86 Memory	Got it	VIA	\$45		
2.5" 80GB SATA	x86 Hard drive	Got it	Newegg	\$40		
					\$335	
<b>Sensor &amp; Servo Processing Unit:</b>						
Atmega1280	Arduino Mega	Got it	Sparkfun	\$65		
					\$65	
<b>Peripherals:</b>						
Cell Network Modem	USB	Borrowing it	Friend	\$100		
Logitech C200 Webcam	USB		Amazon	\$30		
Locosys LS20031 GPS	Serial		Sparkfun	\$60		
Ultrasonic Range Finder	Serial, Analog, PWM	Got it	Sparkfun	\$30		
3-Axis Accelerometer	Analog	Got it	Sparkfun	\$20		
HMC6352 Compass	I2C		Sparkfun	\$35		
Temperature Sensor	I2C		Sparkfun	\$6		
					\$281	
<b>On Board Power:</b>						
14.8v Battery	Lithium Polymer (4-Cell)		Hobby-Lobby	\$32		
Battery Charger	1-4 Cell LiPo Charger		Hobby-Lobby	\$30		
					\$62	
						<b>\$3,243</b>

# Risks

Crash

Loss of link and high latency

Interface to helicopter is only theoretically known.

# Prevention

Progressive build process. Testing, testing, testing!

Design aircraft software for autonomous flight. Use fail safes (timed hover and land) for complete link loss.

Get the hardware figured out early. Testing the interface thoroughly before flight.