

31-Aug-09

Haven't been able to access Engineering Notes for the past week due to Google Gears errors.

PHASE 1 ORDER

Phase 1 Order is ready to go. Will purchase most Phase 1 components for Remote Control on 4-September. Since most parts for the Test Stand will be purchased locally, will not purchase at the current time.

Developed LabView application to emulate Remote Control by plugging USB cable into computer. Hopefully this will help test the Remote Control.

P1RC1 - Remote Controller PCB Design

Due to Eagle freeware limitations (board size max 3" x 4"), going to have to do everything in PCB Artist. Remade Remote Control Schematic in PCB Artist. Library files are in davidgitz.* in PCB Artist files.

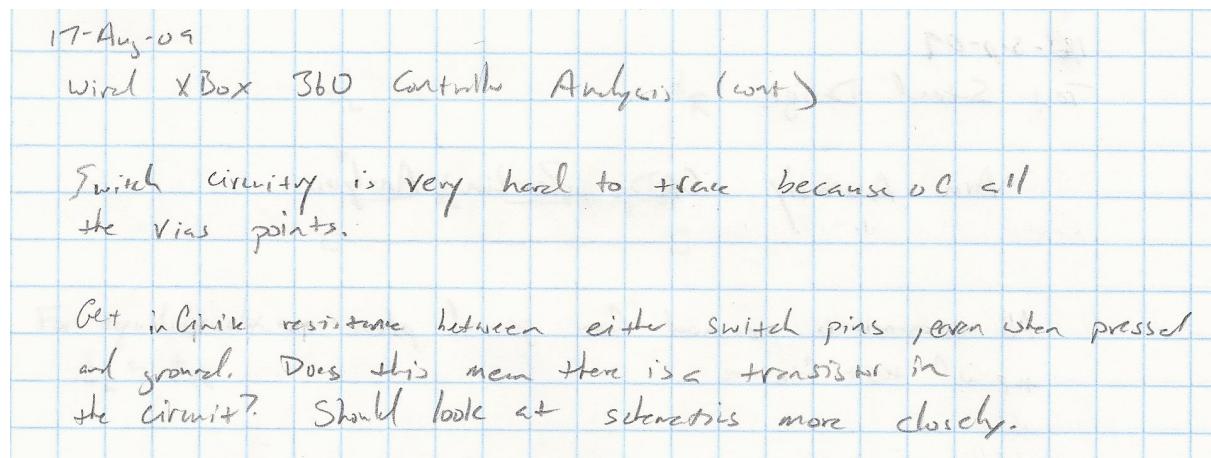
27-Aug-09

P1RC1 - Remote Controller PCB Design

Extensive redesign of power conversion. Sourced MAX608, boost converter that outputs 5V at .5 A. Will need 2 of these plus extra external components but shouldn't have any problems with components. Should investigate what is existing on XBox Wireless Controller though.

17-Aug-09

Hardcopy Engineering Notebook



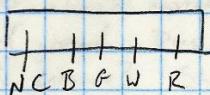
16-Aug-09

Hardcopy Engineering Notebook

16-Aug-09

Wii & XBox 360 Controller Analysis

Power/Data Part



IC List:

ID	Manufacturer	Part Number	Purpose
U1	Microsoft	X803081001, VEO 542 RB	controller
U2	XBox	803121, 64627	Headset?
U3	Un populated		

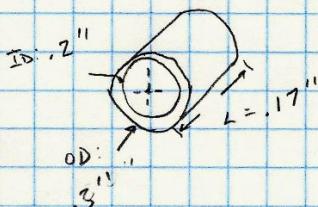


$$\begin{aligned}V_1 &= 5 \text{ V} \\V_2 &: \text{Min} = 0 \text{ V} \\&\text{Neutral} = 1.8 \text{ V} \\M_{\text{ax}} &= 1.60 \text{ V}\end{aligned}$$

) Linear?

5 Tops are easy to get to. blish requires
dismantling. 0 Left Trigger (Left Hand)

Requires removal of Left Trigger. Assembly. This
is facilitated by removing piece of plastic towards outer edge
of controller, and afterwards replacing with a plastic sleeve
or screw.



Unpopulated Sections:

J6, U3,

Notes: All Analog signals have Test Points:

LHOR: TP24

RHOR: TP22

LVER: TP23

RVER: TP21

LTrij: TP37

RTrij: ?

It is logical to assume that the Xbox 360 Wireless is also operating at 5V, which means there must be some kind of DC-DC converters.

I am curious to know what all the transistors are like. Some kind of switch debouncing?

15-Aug-09

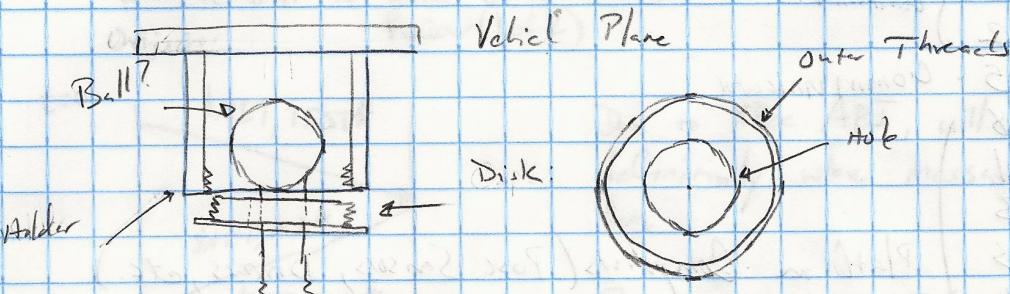
P1TS1 Design Test-Stand

Working on Vehicle Fixture Assembly. Think I have a pretty good idea, it seems simple enough and accomplishes the following goals: Allows the Vehicle to swivel easily, it supports the Vehicle when it isn't powered, limits the range of the travel, is easily disconnect-able, although when engaged ensures it will not release. Will post design when possible.

[Hardcopy Engineering Notebook](#)

15-Aug-09

Test Stand Fixture Assembly



Disk Slides up shaft and screws into Holder.
Holder is narrow enough to allow only a certain pitch when clasp is tightened.

When Vehicle lifts off it is able to swivel due to smooth contact between ball and disk hole.

In fact, if top of Ball is smooth and large enough in diameter Vehicle will rest on it when not powered.

11-Aug-09

JAUS SPIN Stuff:

Finished some initial command codes. Need to investigate "Global Path Segment", only command code I can find that has to do with setting a latitude/longitude, but is only in integers.

Started working on parsing incoming stream.

8-Aug-09

Scanned Hardcopy of Engineering Notebook and inserted into this notebook. Current as of today.

2-Aug-09

Continuing work on JAUS SPIN Object. Started working on Remote Control Rev .1 Package.

1-Aug-09

Started working on JAUS SPIN Object. This will be fun.

31-July-09

Hardcopy Engineering Notebook

31-July

JAUS Messages Relevant to System
IDs

40) common /
32

35 . Communication

38

41

53

43) Platform Components (Pne Sensors, Drivers, etc.)

44

45

46

49) Manipulation (Servos)

51

50 . Range Sensor

36 . Mission Planner

SPIN JAUS Object

PUBLIC

destination

type → driver, sensor, etc.

build message

build

source

priority

PRIVATE

build header

SUPPORT

str. concat

30-July-09

P1RC4 Program Micro-Controller

Finished writing code for XBee API Framework, but since there were very large changes testing will be, interesting. Also, working on a Network Test Mode that should be run upon powerup by any node. See System Documentation for more information.

29-July-09

Need to come up with a Network Initialization/Network Test process, that will test Interface if it is present and still works if it is not.

P1RC4 Program Micro-Controller

Need to implement XBee object as API framework, to be able to address different nodes in a timely fashion. Appropriate object uploaded to SVN.

Hardcopy Engineering Notebook

29 - July

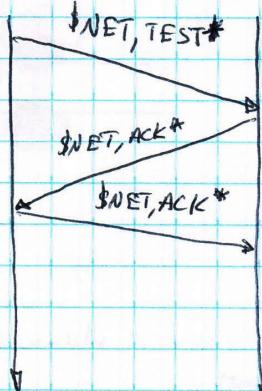
Network Test Mode

- Can be initiated (and should be upon power-up)
by any node.

- Carried out by both other nodes

Originator Review (1 of 2)

t=0



Due to XBee API, will know definitely who message comes from.

Retries 3 times. If no ACK either:

Originator	Receiver
RC	No Vehicle
JN	No Vehicle
VH	No RC or JN

↳ Enter Network Init Mode,
report errors on screen display.

28-July-09

P1TS1 Design Test-Stand

Have preliminary design for Shock Absorber. Need to figure something out for the Vehicle Fixture Assembly. Will post designs when possible.

P1RC6 Implement JAUS on Remote Control

Worked on Architecture Design some more. Still need to dig a lot deeper into the messaging structure. Uploaded a lot of JAUS documentation to SVN.

27-July-09

Fixed up some documentation.

Noted that part of 25-July entry and 26-July entry are gone. Google Doc's offline is imperfect. These entries were unimportant to the project, merely bookkeeping.

25-July-09

Added Bread Board to BOM. Fixed SVN issues, I think. Although Schematics for Vehicle are gone. See if I can recover this off my external drive.

P1RC1 - Remote Controller PCB Design

Instead of using Linear Regulators going to investigate just using 2 Boost Converters, one for 5V and one for 3.3V. Only solution I can find is \$30 just for the individual regulator, although I can get for \$2 if I can do surface mount. Should also investigate what power regulators are already on Controller, I doubt it could power everything off 2 Ni-Mh batteries and not need higher voltages. And might want to look into just adding external batteries.

24-July-09

Added RC Network on all Analog Inputs to provide a LPF on Inputs. LPF Design:

$$f_c = 30 \text{ Hz}$$

$$R = 1k \text{ Ohm}$$

$$f_c = 1/(R*C)$$

$$C = 1/(fc \cdot R)$$
$$C = 33.3 \mu F$$

Fixed program up pretty good. However, unknown if getradiorxbuffer() function is blocking or not.

23-July-09

Circuit Analysis looks good so far on Remote Control, but need to actually source a boost converter that will work. Linear Regulators look like they aren't close to their limits but might want to heat sink anyways.

Boost Converter requirement (Worst Case, Regulators fully loaded):

Vin: 2.0 - 2.6V

Vout: >7V

I: 4.1 A

Boost Converter requirement (Following Design):

Vin: 2.0 - 2.6V

Vout: > 7V

I: .6 A

Fixed pin numbers in Program and Encoder calculation.

22-July-09

Worked on Remote Control Schematic. Looks pretty good. Need to perform analysis on it to make sure current, voltage and power requirements/constraints are met.

21-July-09

Tasks:

Design Shock Absorber and Vehicle Fixture.

16:4 Encoder for Vehicle is hard to find. Need to implement as 8:3 priority encoders in circuit design.

Phase 1 Order (P1RC1) is ready to go, with an estimated budget of \$460.61 This includes 3 XBee Radio's and 3 USB Dev Board, to make sure Comm Link Test (P1RCT1) is successful.

Continuing to have problems with Tortoise SVN. I have successfully removed the problematic directory from the Server but the files that were part of it, even when moving to a different location locally still act like they are version controlled and when I put them back in the correct folder there are conflicts.

20-July-09

Test-Stand Arm Assembly and Base are designed.

19-July-09

Working on some Project Management stuff for Project. Splitting up tasks into phases and prioritizing work. See Project Management file on Google Doc's for more info.

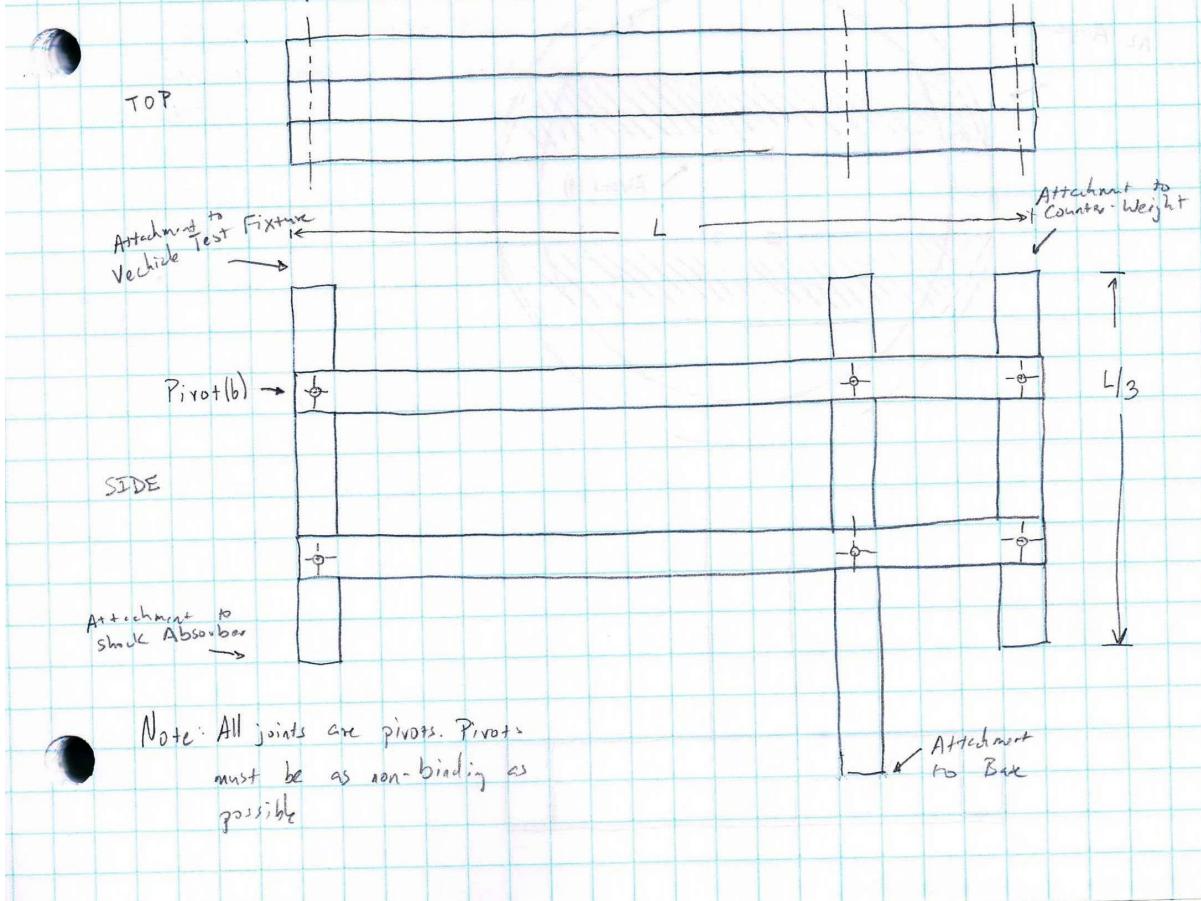
[Hardcopy Engineering Notebook](#)

19-July-09

Test Stand Design: # P I T S I

Parts List: 1" Aluminum Square Tube $5L + \frac{2}{3}L$ Length

Arm Assembly



10-July-09

Started working on some PID stuff for SOM Board Program.

MIKE - Can you start looking at some of the code I've written? I'm sure a lot of it is garbage, I haven't done C++ in a while. Let me know what you think though. If you have any questions with the stuff look at the Documentation.txt file and hopefully that will answer any questions.

8-July-09

Tasks:

DONE-Enter and Tx Manual mode from Remote

STARTED -PID on Vehicle SOM

DONE-Remote LCD stuff

DONE-Source LCD, RGB LED

DONE-UART differentiation on Vehicle Prop.

Also put in code for Error Code Generation and multi-uart on Remote Control.

5-July-09

Wrote code for Encoder and Ultrasonic stuff on Vehicle Propellor. Added accelerometer class in Vehicle SOM Board. Made some modifications to Non-JAUS Protocol for Ultrasonic and Encoder support. Worked on some more sensor stuff for SOM Board.

Started working on Error Code Generation and Definitions, listed in Documentation.txt

3-July-09

Started working on mode algorithms for SOM Controller board. Sourced better Electronic Speed Controller.

1-July-09

IEEE Paper sent to D for upload.

30-June-09

DONE - Check motor Encoder rpm rating against Dragan Flyer drive motor.

BaneBots Speed Controller: 18A Peak, 5A Continuous, 6-24V DC, Brushed motor controller

Motor Encoder: 14,400 rpm max

Motor: 4.5 - 9V (7.2V best), up to 16,500 rpm, up to 9A stall (1.3A best), Carbon Brush.

ISSUES -

Current enough for BaneBots speed controller?

DC-DC Converter for Motor?

Encoder good enough?

[Hardcopy Engineering Notebook](#)

29-June-09

pitch, yaw, throttle, roll

0: full reverse

127: neutral

255: full forward

①

④

②

③

$$\text{motor_1} = 0 \# (\text{pitch} - 127) + (\text{yaw} - 127) + \text{throttle} + \text{bias} \# 255$$

$$\text{motor_2} = 0 \# (\text{roll} - 127) + (127 - \text{yaw}) + \text{throttle} + \text{bias} \# 255$$

$$\text{motor_3} = 0 \# (127 - \text{pitch}) + (\text{yaw} - 127) + \text{throttle} + \text{bias} \# 255$$

$$\text{motor_4} = 0 \# (127 - \text{roll}) + (127 - \text{yaw}) + \text{throttle} + \text{bias} \# 255$$

PITCH	ROLL	YAW	THROTTLE	①	②	③	④
127	127	127	127	127	127	127	127
255	127	127	127	255	127	0	127
127	127	127	255	255	255	255	255
127	255	127	127	127	255	127	0
127	127	255	127	255	0	255	0
* 255	127	127	255	255	127	127	127
127	255	255	127	255	127	255	127

$$\left(\frac{\text{pitch} + 127}{2} \right) - 127 = \frac{\text{pitch} + 127}{2} - \frac{255}{2} = \frac{\text{pitch} - 127}{2}$$

$$\text{Motor-1} = \frac{(\text{pitch} - 127)}{2} + \frac{(\text{yaw} - 127)}{2} + \frac{(\text{throttle} + 127)}{2}$$

$$\text{Motor-2} = \frac{(\text{roll} - 127)}{2} + \frac{(127 - \text{yaw})}{2} + \frac{(\text{throttle} + 127)}{2}$$

$$\text{Motor-3} = \frac{(127 - \text{pitch})}{2} + \frac{(\text{yaw} - 127)}{2} + \frac{(\text{throttle} + 127)}{2}$$

$$\text{Motor-4} = \frac{(127 - \text{roll})}{2} + \frac{(127 - \text{yaw})}{2} + \frac{(\text{throttle} + 127)}{2}$$

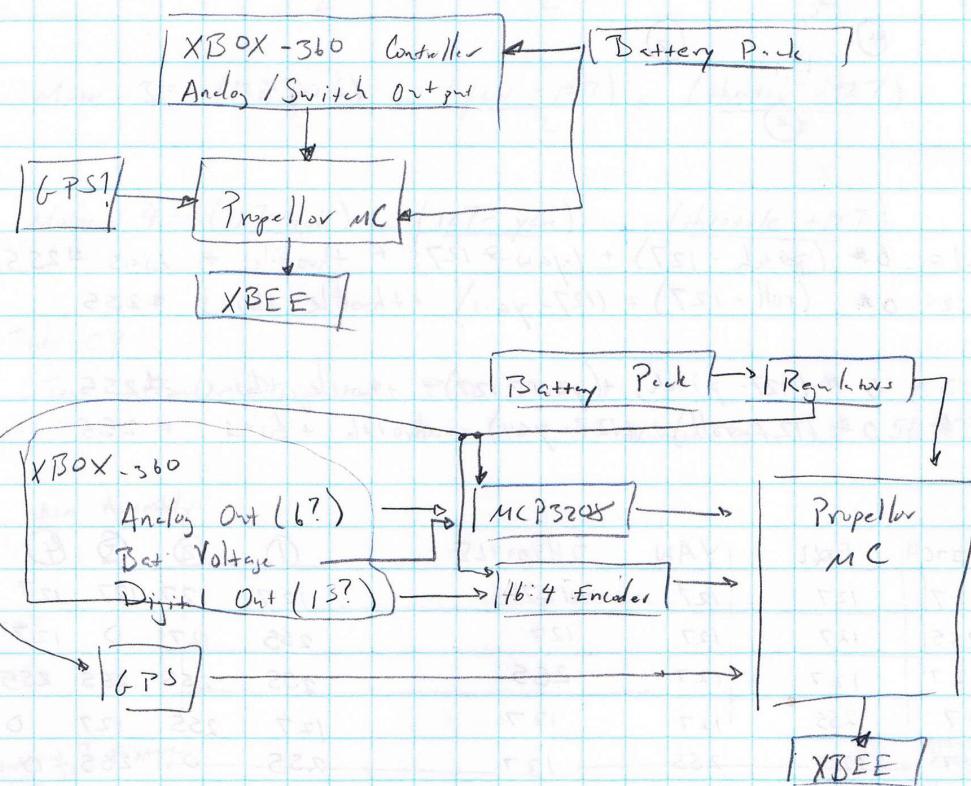
28-June-09

Need to start working on a Remote Control Unit. Decided to use an XBox 360 wireless controller, hooked up to a Propellor uC to acquire inputs and encapsulate into a messaging protocol to be transmitted by an XBee. Messaging Protocol will be derived from Senior Design project, for now, until JAUS has been implemented.

[Hardcopy Engineering Notebook](#)

28-June-09

Need to come up with a Remote Control Unit for Quad-Rotor.
Use XBOX-360 controller.



23-June-09

Started working on Pseudo-Code for Navigation, located on SVN.

16-June-09

Finished Filtering equations in MatLab and verified with u-Controller implementation,

pretty good correspondence but of course will have to check with actual sensors. Of course Code is available on SVN.

Received motor spec's. At Max Efficiency, motor voltage is 7.2V @ 1.73A, at Stall current is 8.77 Amps. Motor will operate on voltages from 4.5V-9.6V
Because of this, can go down one level for speed controllers. Updated BOM.

Hardcopy Engineering Notebook

16-June-09

$$y(n) = \sum_{i=0}^k x(n-i)b(i) - \sum_{i=1}^K y(n-i)a(i)$$

for $i=1:n$

$$y(n) = b_1 x(n-1) + b_2 x(n-2) + b_3 x(n-3) + \dots - [a_1 y(n-1) + a_2 y(n-2) + a_3 y(n-3) + \dots]$$

Test Stand Design

Vehicle Fixture Design

15-June-09

Working on some Control Algorithm stuff.

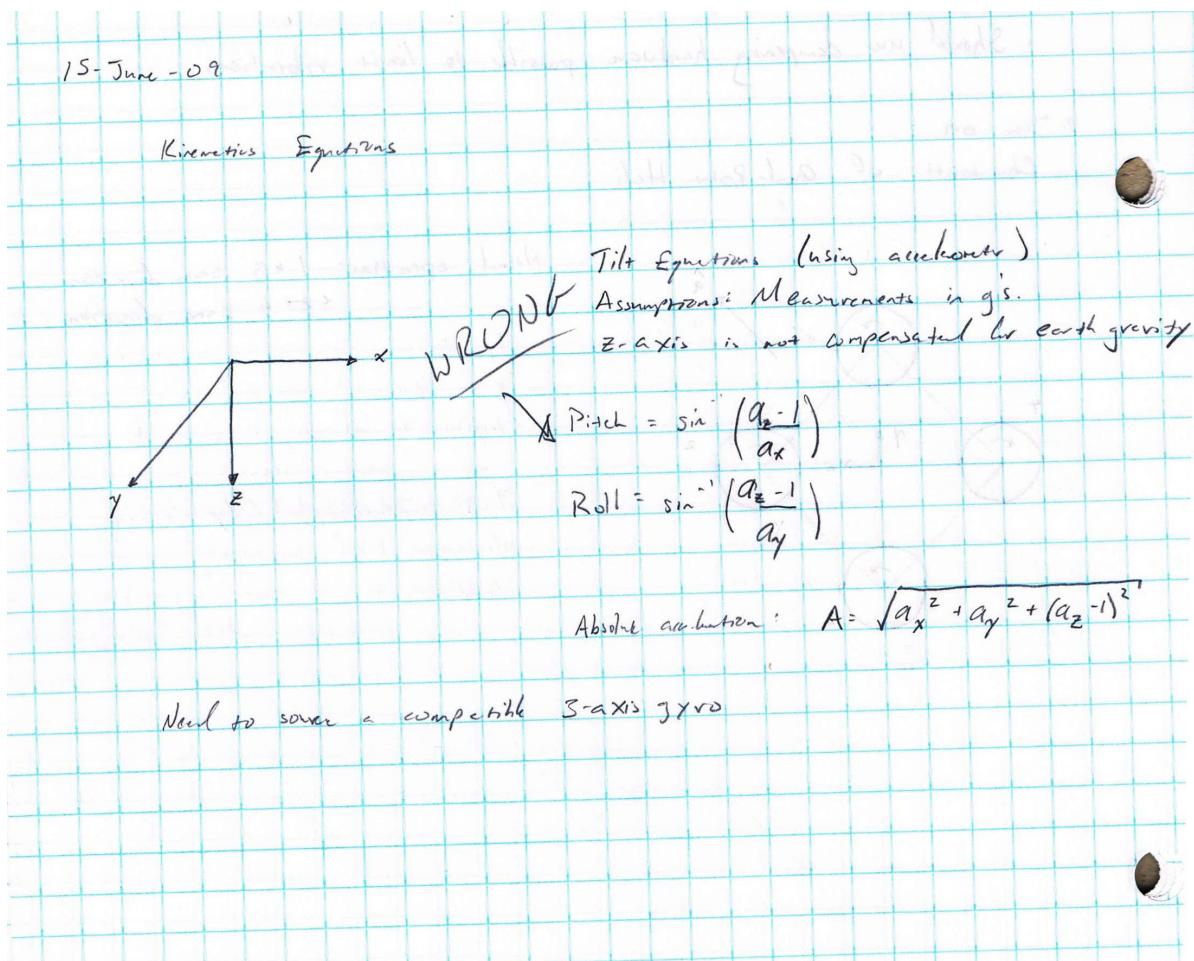
MIKE - Can you access this and email to me? <http://ieeexplore.ieee.org/Xplore/login.jsp?url=http%3A%2F%2Fieeexplore.ieee.org%2Fiel5%2F4339287%2F4339288%2F04339333.pdf>

Trying to get Complimentary Filter algorithm working for Accelerometer and Gyroscope Data, using experimental data taken from Senior Design and <http://spritesmods.com/?art=rocketlogger&page=5>

See svn'd doc's on Control Algorithms for more information. High Pass Filter for

Gyroscope isn't high enough, think the LPF is close. See svn'd MatLab code for more information.

Hardcopy Engineering Notebook



$$\theta = \int (\text{angular rate}) dt \rightarrow \boxed{\text{HPF}} \quad \frac{\gamma s}{\gamma s + 1}$$

$$\theta = \sin^{-1} \left(\frac{\text{accel.outpt}}{g} \right) \rightarrow \boxed{\text{LPF}} \quad \frac{1}{\gamma s + 1}$$

High-Pass Filter implementation

$$y[i] = a_1 y[i-1] + a_2 y[i-2] + \dots + b_1 x[i] - b_2 x[i-1] + \dots$$

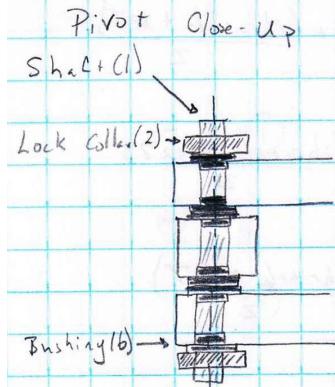
Using gyro data from Senior Design Project

Low-Pass Filter implementation

$$y[i] = a_1 x[i] + (1-a_1) \cdot y[i-1]$$

Found some test data for a 3-axis accelerometer

$$a_x \cdot \frac{bg}{65536} - 3$$



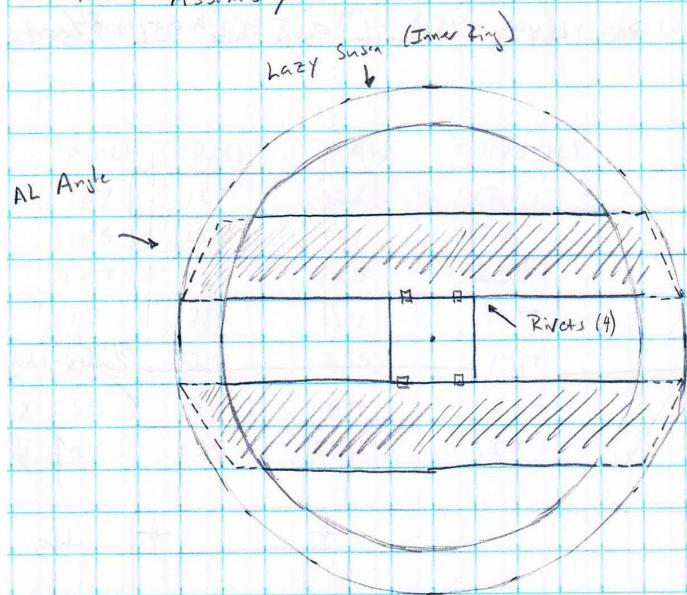
Parts List x 6 For Assembly

Aluminum Shaft $3/8''$ OD 6" Long

Bushing $3/8''$ ID x 6

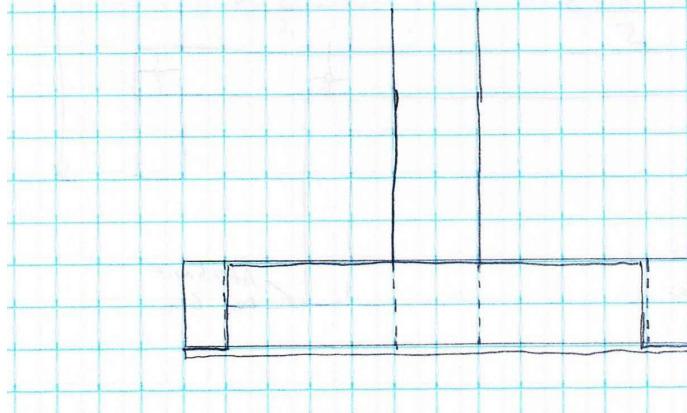
Lock Collar $3/8''$ ID x 2

Base Assembly



Still need more vertical stability.

Ideas: Steel Cable? like A
Cell Phone Tower



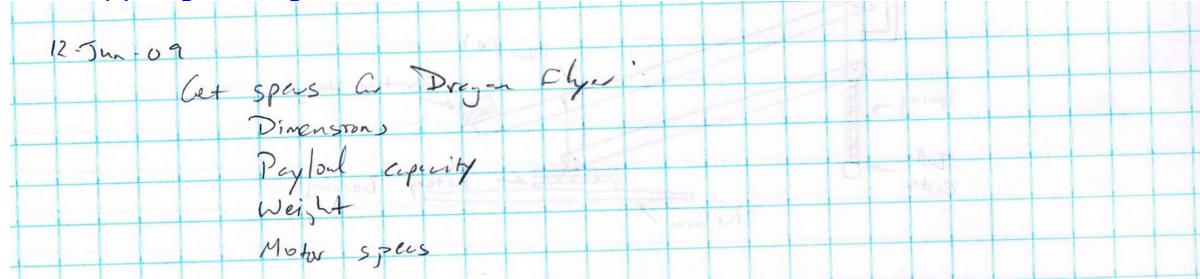
14-June-09
Added Compass to BOM.

Started Tasks Document.

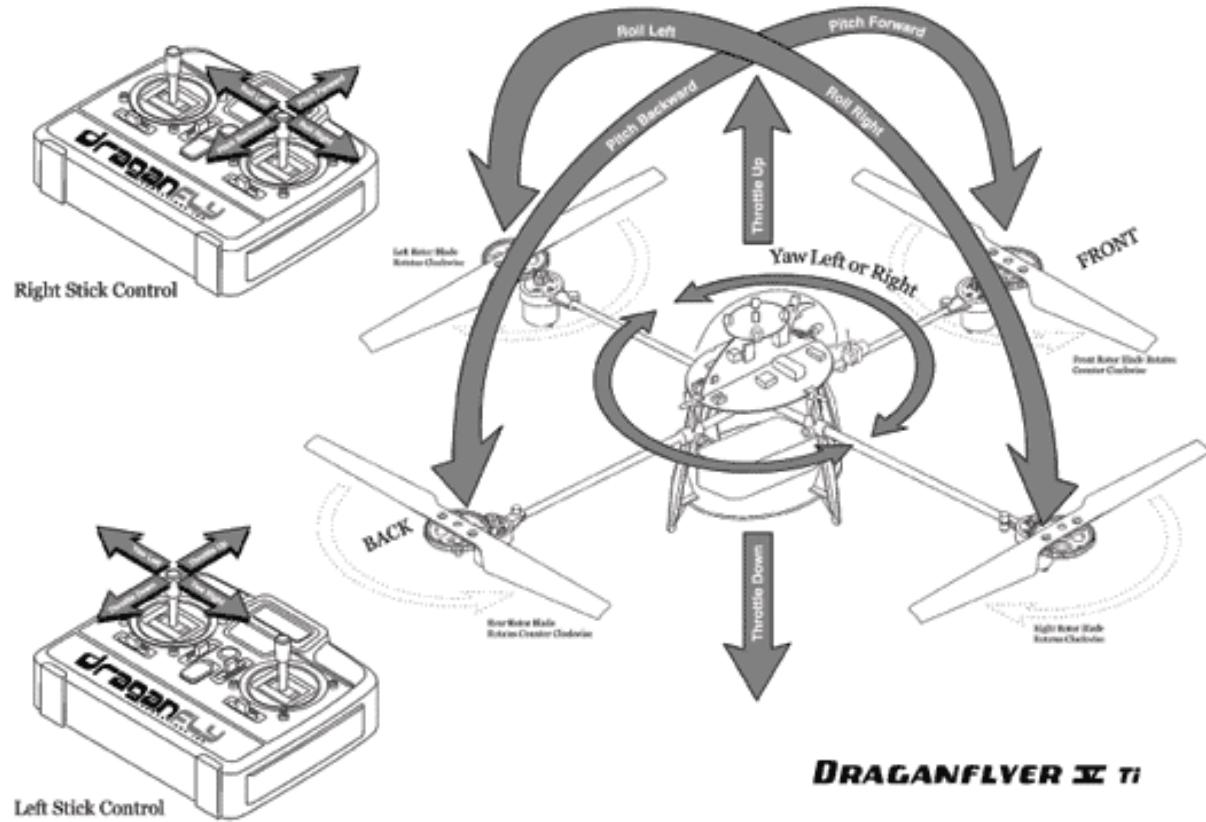
12-June-09

Emailed Dragan Flyer Tech Support for more detailed spec's. Worked on BOM some more.

Hardcopy Engineering Notebook



10-June-09



6-June-09

David

Would like to look at a quad-rotor helicopter vehicle more closer, from what I've read it should be easier to fly and cheaper, but I don't know about the payload capacity. I actually might be able to get one from Brehm for free.

Reference:

<http://en.wikipedia.org/wiki/Quadrotor>

<http://www.rchelicopter.com/category/rc-helicopter-construction-design/rc-helicopter-quad-rotor-design/>

Would like to add an ultrasonic sensor to the vehicle for close proximity measurement when landing.

All sensors on BOM are 3.3V compatible except for 3-Axis Accelerometer. I still have 2 Level-Shifter boards (2 channel each) from Spark Fun would this be better to use than doing our own?

Reference:

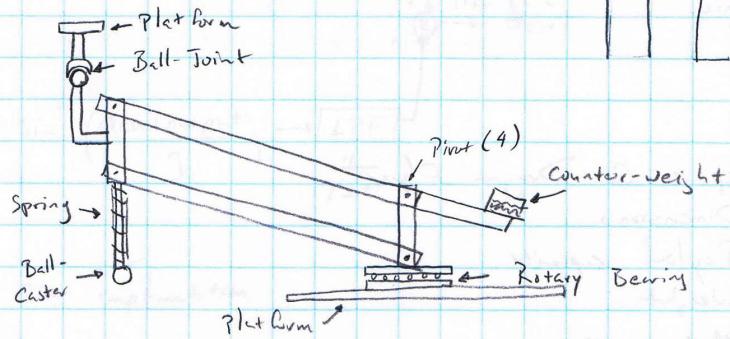
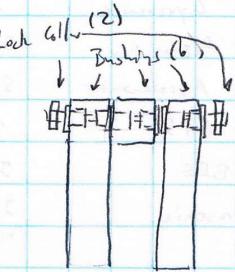
http://www.sparkfun.com/commerce/product_info.php?products_id=8745

http://www.nxp.com/acrobat_download/applicationnotes/AN10441_1.pdf

[Hardcopy Engineering Notebook](#)

6-June-09

Helicopter Test Stand

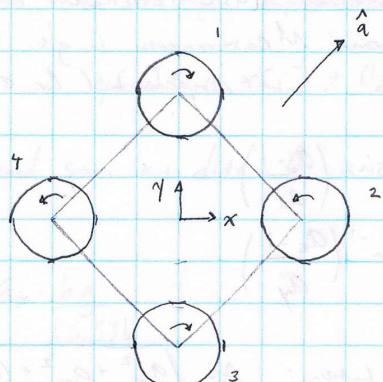


- Should use damping hardware possible to limit vibrations

7-June-09

Characteristics of Quad-Rotor Heli

Normal operation: 1 & 3 same direction
2 & 4 same direction



2-Axis Gyroscope	3.3V All
Altimeter	3.3V All
3-Axis Accelerometer	5V power & signal
GPS	3.3V All
XBEE	3.3V All
Ultrasonic	3.3V All

27-May-09

Mike

Here is a company that works only on UAV control. There are some papers posted there that may be helpful.

<http://guidedsystems.aero>

Reference designators starting with L on a schematic typically stand for inductors. They are used as RF/common mode chokes I believe.

The LMS1587-3.3 should be suitable for our application. They are cheap and could provide 3.3V to other subsystems besides the SOM.

26-May-09

David

Tasks:

Update BOM with individual small components.

Design power subsystem. What power source and specifications?

MIKE - What are "L" components on SOM-150 schematic, on serial connector? Instead of LMS1587-3.3 Linear Voltage Regulator, should we use a 3.3V DC-DC converter instead? Although the LMS1587 has an output of 3A, hard to find an inexpensive dc-dc converter that is capable of minimum power requirements (300 mA)

25-May-09

David

Working on hardware schematic and figuring out control board specifications.

Issues:

MIKE - Altimeter and Accelerometer together use both SPI ports, if using SD Card won't be able to do it easily? Also, is ARM Board 5V tolerant? I assume yes.

Tasks:

Would like to investigate if memory wires would be an option.

Mike

The altimeter and accelerometer chips will be on the same SPI channel with different chip selects. The SD Card can be placed on the MMC/SD four wire interface. The SOM is not 5V tolerant.

The memory interface can be used for a memory mapped I/O interface.

The datasheets for the SOM-9260M, SOM-9G20M, SOM-150ES added to svn. The schematic for the SOM-150ES was added. Email me for PDF password.

24-May-09

David

Tasks:

DONE - Setup SVN Server

DONE - Website

Preliminary LabView stuff - Human Controller and Mapping

Issues:

DONE - Calibration between Screen Location and Lat/Long conversion is off.

Hardware Design:

Reverse voltage protection

Overcurrent protection

Power regulation

23-May-09

David

Carrier Board Requirements

Idea size: 2.66" x 1.5"

Power Protection and Regulation

Sensor Interfacing

Actuator Interfacing

Serial Port interface

Program Port interface

22-May-2009

David

Ideas:

-Adherence to JAUS Standard for communications between Helicopter and User Interface

-Port User Interface developed from Senior Design to this project

-Actuation of Rudder and Blade Pitch using Memory Wire to decrease physical space requirements

-Power Protection on power supply

-Surface mount stuff

Actuation Requirements:

2 Servo's for Swash Plate