

DRONE MISSION PLANNING SOFTWARE

TAYLOR TRABUN

DAVID KLINGENBERG

EMETH THOMPSON

JOE HIGLEY

UNIVERSITY OF IDAHO – MOSCOW, ID

OVERVIEW

- PROBLEM DEFINITION
- PROJECT STATUS
- GOALS & PLANS
- HARDWARE
- COMMUNICATIONS
- GUI
- DEMO
- Q & A

PROBLEM DEFINITION

THE GOAL OF THIS PROJECT IS TO DESIGN AND DEVELOP A GRAPHICAL USER INTERFACE (GUI) FOR DRONE MISSION PLANNING.

REQUIREMENTS:

- USER FRIENDLY INTERFACE
- ALLOW 3D MISSION PLANNING
- UPLOAD THE FLIGHT PLAN USING XAPI AND XBEE
- ALLOW MANUAL OVERRIDE DURING FLIGHT
- IMPLEMENT DRONE HARDWARE FOR FLIGHT CONTROL

PROJECT DELIVERABLES

- ALPHA VERSION OF GRAPHICAL USER INTERFACE (GUI)
- INTEGRATED PROTOTYPE INSTRUMENT PANEL INTO GUI (CODE BY GUILLAUME CHOUTEAU)
- ARDUINO FIRMWARE FOR HOME AND DRONE WITH XAPI AND DRONE SERVICES
- BASIC COMMUNICATIONS INTEGRATED WITH DRONE AND GUI
- FULLY CONFIGURED DRONE HARDWARE
 - INITIAL DRONE PROTOTYPE FIRMWARE

HARDWARE

Technical drawing of a Speed Controller Bin. The drawing includes a top view showing four circular cutouts, a side view showing the bin's profile, and a perspective view showing the bin's depth and mounting points. The drawing is on a grid with columns A-H and rows 1-4.

DESIGNED BY: David Klingenberg	Speed Controller Bin			C	---
DATE: 1/27/2015	V4			H	---
DRAWN BY:				G	---
				F	---
				E	---
SIZE: A3				D	---
SCALE	WEIGHT	PRICE	NUMBER	C	---
				B	---
This drawing is the property of ARV. It may be reproduced or distributed without our written permission.				A	---

Technical drawing of a Battery Mount. The drawing includes a perspective view showing the battery cells and internal wiring, a top view showing the battery layout, and a side view showing the mounting structure. The drawing is on a grid with columns A-H and rows 1-4.

DESIGNED BY: David Klingenberg	Battery Mount			C	---
DATE: 2/17/2015	V5			H	---
DRAWN BY:				G	---
				F	---
				E	---
SIZE: A3				D	---
SCALE	WEIGHT	PRICE	NUMBER	C	---
				B	---
This drawing is the property of ARV. It may be reproduced or distributed without our written permission.				A	---

Technical drawing of an ARDUINO PLATFORM. The drawing includes a top view showing the board layout and a side view showing the board's profile. The drawing is on a grid with columns A-H and rows 1-4.

DESIGNED BY: David Klingenberg	ARDUINO PLATFORM			C	---
DATE: 3/3/2015	V7			H	---
DRAWN BY:				G	---
				F	---
				E	---
SIZE: A3				D	---
SCALE	WEIGHT	PRICE	NUMBER	C	---
				B	---
This drawing is the property of ARV. It may be reproduced or distributed without our written permission.				A	---

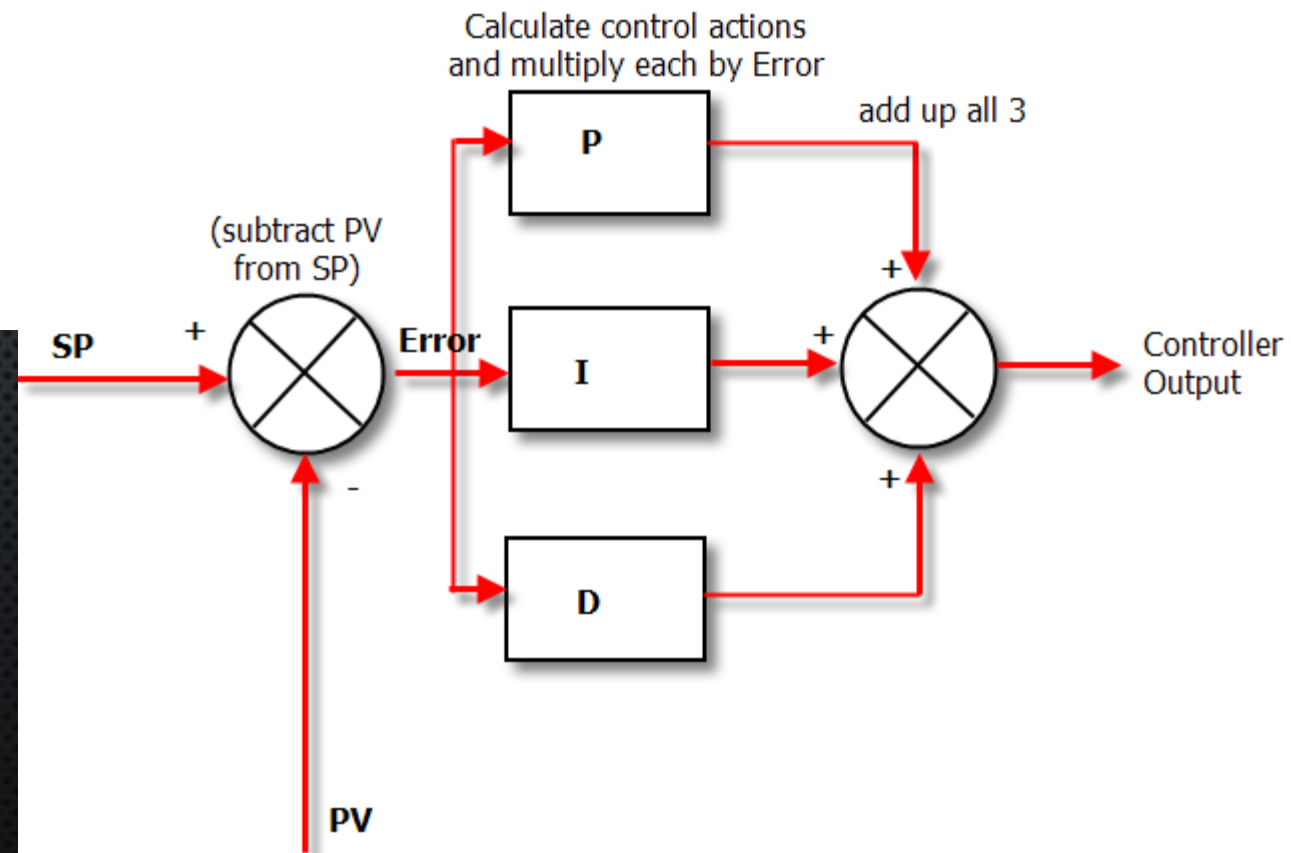
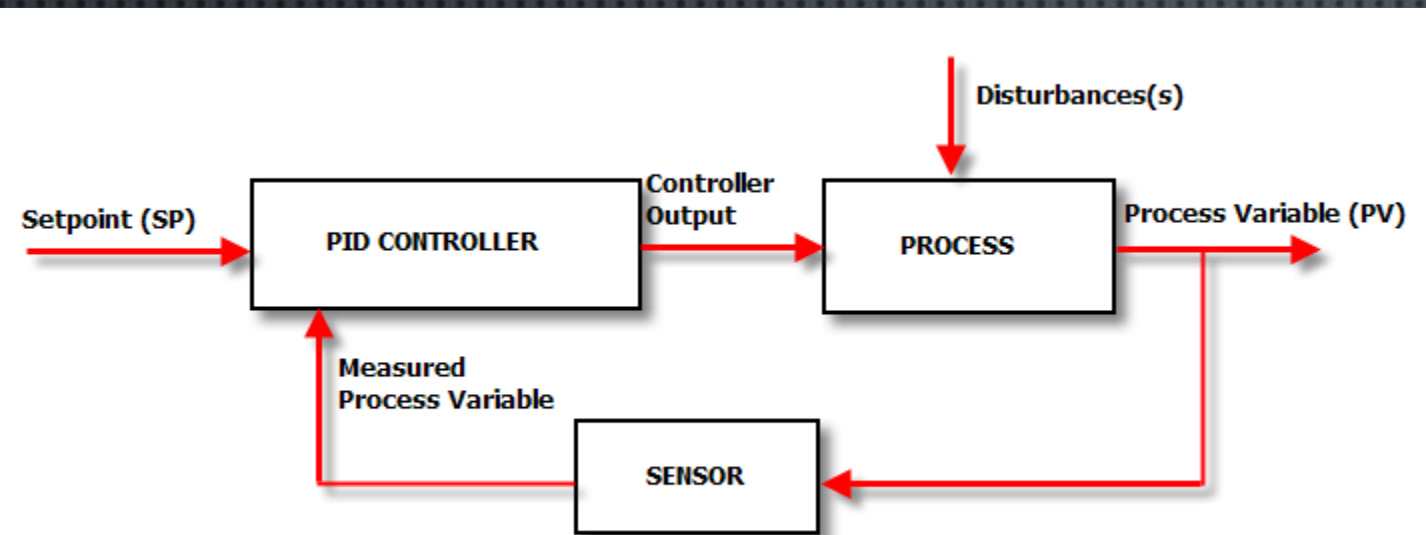
HARDWARE



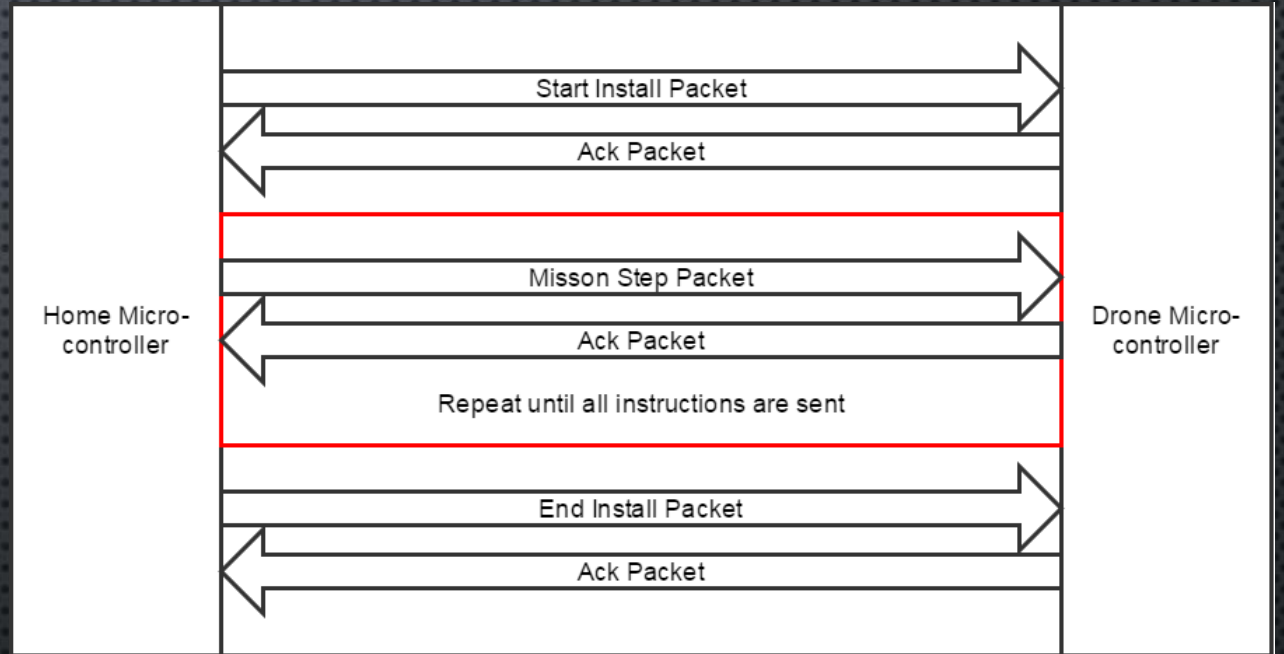
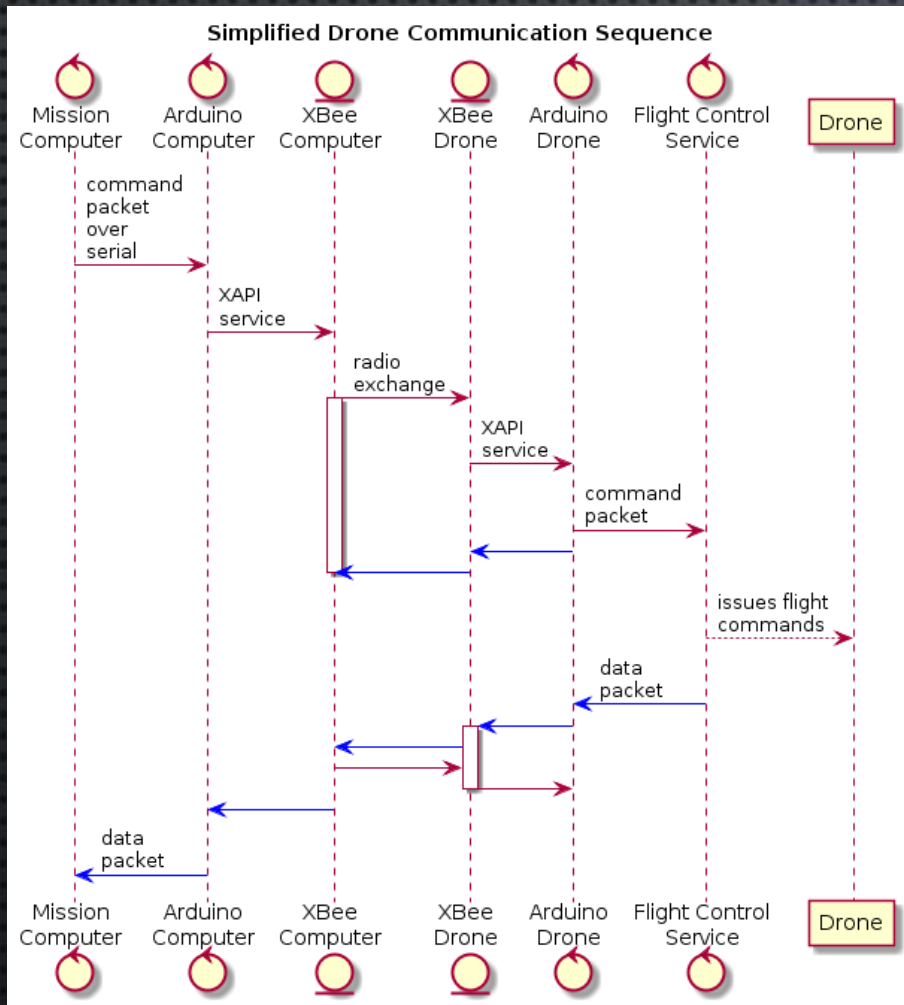
FIRMWARE

- ARDUINO FIRMWARE USES XAPI TO MANAGE SERVICES THAT CONTROL DIFFERENT ASPECTS OF COMMUNICATION
- HOME FIRMWARE FOR ARDUINO CONNECTED TO WINDOWS PC RUNNING MISSION CONTROL SOFTWARE
 - RELAYS PACKETS, OVER A SERIAL CONNECTION, TO THE ARDUINO THEN OVER XBEE MODULES TO DRONE ARDUINO
- DRONE FIRMWARE FOR DRIVING FLIGHT COMPUTER
 - ENABLES AUTOMATIC OR MANUAL CONTROL
 - AUTO PILOT MANIPULATION VIA XAPI SERVICES WE DEVELOPED

FIRMWARE



COMMUNICATION DESIGNS



COMMUNICATION PACKET TYPES

TUN Type Key Internal/External	Payload	Use
0x50/0x51	Altitude	Take off and maintain specific altitude
0x52/0x53	N/A	Land
0x54/0x55	X,Y,Altitude	Go to specific coordinate
0x56/0x57	MoveDirection,Amount,Metric	Carry out specific move (Forward/Back/Left/Right/Rotate)
0x58/0x59	N/A	Start mission plan upload
0x60/0x61	X,Y,Altitude	Mission instruction - go to specific coordinate
0x62/0x63	MoveDirection,Amount,Metric	Mission instruction - carry out specific move (Forward/Back/Left/Right/Rotate)
0x6A/0x6B		Instruction - Land
0x6C/0x6D	Altitude	Instruction - Take off and maintain specific altitude
0x64/0x65	ChecksumValue	End install and check checksum to validate success
0x66/0x67	N/A	Stop current mission plan and activate manual control (maintain altitude)
0x68/0x69	N/A	Stop current mission plan and activate manual control (no longer autonomous)
0x70/0x71	N/A	Acknowledgment (ACK)
0x72/0x73	N/A	Acknowledgment of issue (NACK)
0x74/0x75	InstrumentData	Heartbeat that contains the drone's current state
0x76/0x77	Altitude	Set altitude
0x78/0x79	Speed	Set the never exceed speed
0x80/0x81	Speed	Set never exceed fall speed
0x82/0x83	Throttle	Set throttle
0x90/0x91	On/Off	Set drone armed status
0x92/0x93	Heading	Set drone heading for auto pilot
0x94/0x95	HoldAltitude	Set drone to hold altitude (true/false)
0x96/0x97	HoldHeading	Set drone to hold heading (latitude/longitude)

SERVICES (FULLY IMPLEMENTED)

- ALTITUDEHOLD SERVICE
- ARM SERVICE
- DOMOVE SERVICE
- HEADING SERVICE
- HEADINGHOLD SERVICE
- LAND SERVICE
- UPDATED SERIAL SERVICE
- TAKEOFF SERVICE

FUTURE SERVICES REQUIRED

- HEARTBEAT SERVICE (IN PROGRESS)
- MISSIONPLANINSTRUCTION SERVICE
- MISSIONPLAN SERVICE
- MOVE TO COORDINATE SERVICE
- DRONESETTINGS SERVICE

MISSION CONTROL SOFTWARE

FLIGHT PLAN PANEL

- ABLE TO CREATE AND SUBMIT FLIGHT PLANS WITH MANY INSTRUCTIONS.
- INSTRUCTIONS IMPLEMENTED:
 - MOVE: FORWARD, LEFT, RIGHT AND BACK
 - ROTATE: LEFT RIGHT
- INSTRUCTIONS CAN BE ADDED AND SUBTRACTED BEFORE BEING RESUBMITTED.
- EMERGENCY BUTTONS FOR PAUSING FLIGHT AND FORCING A LANDING ARE CLEARLY INDICATED.

The screenshot displays the 'Flight Planning System' interface. It features a title bar with a '+' icon. Below the title bar, there are four instruction rows, each with a 'Move' dropdown, a direction dropdown, a numerical value in a spinner box, a unit label, and a '-' button. The instructions are: 1) Move Forward 4 meter, 2) Rotate Left 20 degrees, 3) Move Left 4 meter, and 4) Move Back 5 meter. At the bottom of the panel, there are three buttons: 'Hold Position' (red), 'Submit Flight Plan' (blue), and 'Emergency Land' (red).

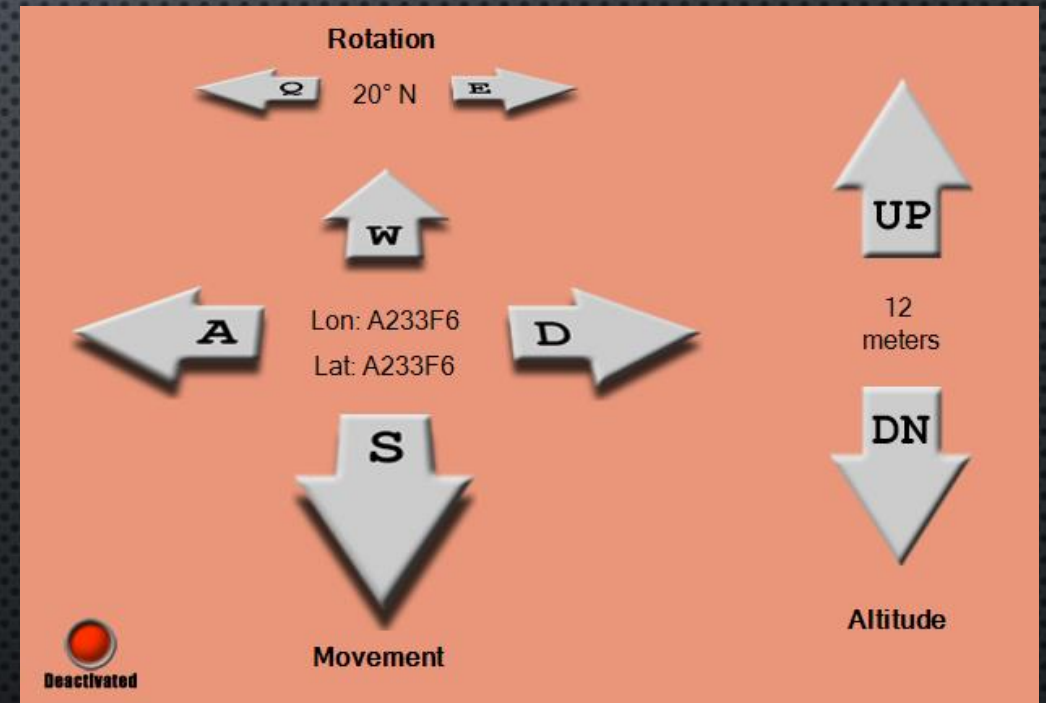
Instruction	Direction	Value	Unit	Action
Move	Forward	4	meter	-
Rotate	Left	20	degrees	-
Move	Left	4	meter	-
Move	Back	5	meter	-

Buttons: Hold Position, Submit Flight Plan, Emergency Land

MISSION CONTROL SOFTWARE

MANUAL CONTROL PANEL

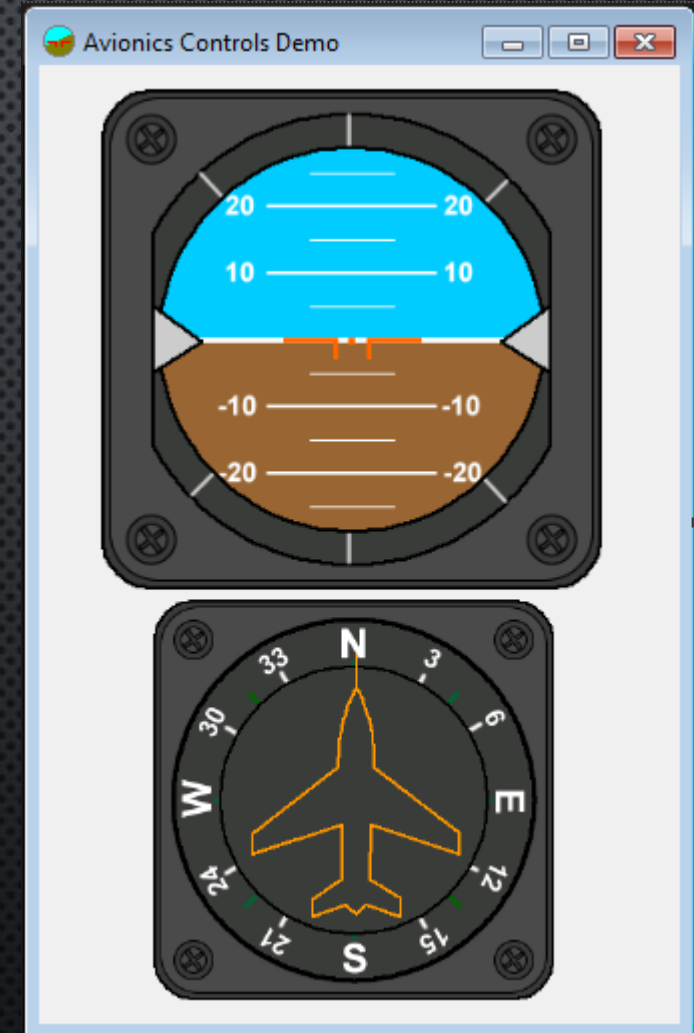
- CONTROLS CAN BE ACTIVATED OR DEACTIVATED
- CONTROLS CAN USE EITHER KEYBOARD KEYS OR MOUSE CLICKS.
- FUTURE IMPROVEMENTS:
 - DATA DISPLAYS NEED TO BE UPDATED FROM THE DRONE PACKET.
 - RESTRICT KEY SELECT TO ONLY ONE KEY AT A TIME.



MISSION CONTROL SOFTWARE

INSTRUMENT PANEL

- LIBRARY COURTESY OF GUILLAUME CHOUTEAU
- CURRENTLY MONITORS THE PITCH, ROLL AND YAW OF THE DRONE'S ARDUNIO
- STRING PARSING EXTRAPOLATES THE DATA AND THEN TRANSLATES TO A FORMAT READABLE BY THE INSTRUMENT PANEL LIBRARY.



TESTING (AUTO PILOT)



THANK YOU

QUESTIONS?