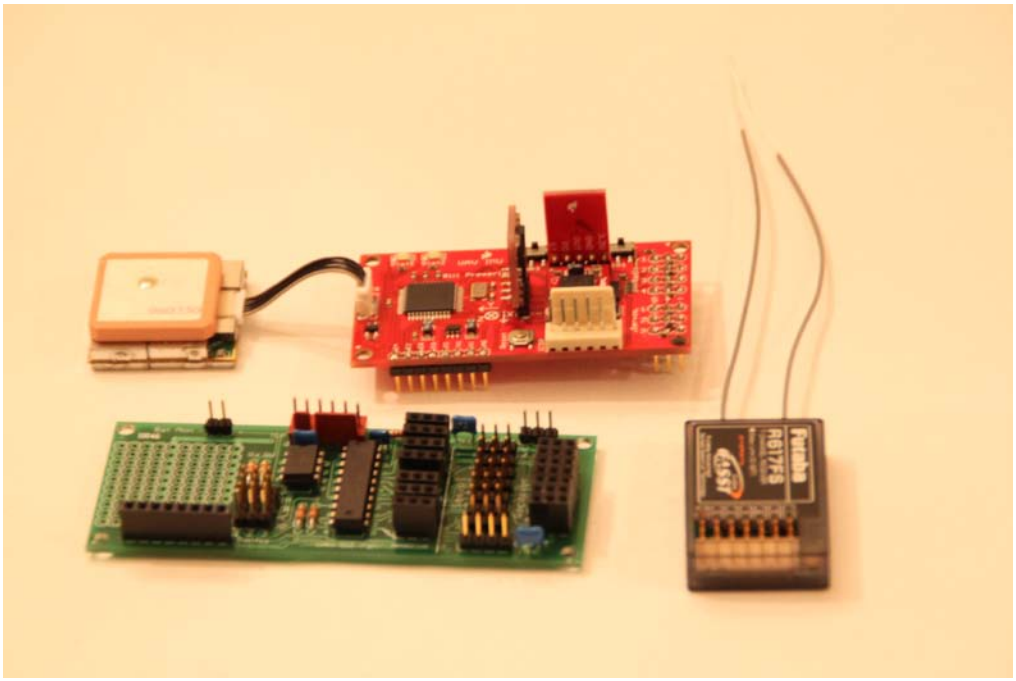


1.0 Purpose

The purpose for an add-on Oil Pan PCB to the UAV Dev Board pioneered by Bill Permerlani (DIYdrones.com) is four-fold:

1. Interface compatibility – The control inputs from the UAV Dev Board are designed for CMOS level outputs from the radio receiver. While this poses no problems in most cases, certain Futaba receivers have been found to output TTL level signals which could cause incorrect operation of the UAV board. The Oil Pan PCB uses a TTL to CMOS level converter for the receiver outputs. No changes to the UAV Dev Board H/W or released F/W are required to use the Oil Pan board for this purpose.

2. Expanded plane configurations – The UAV Dev Board and developed firmware was intended for use with any "3-channel" RC aircraft. Peter Hollands and Ben Levitt devised a way to expand the functionality of the UAV design by utilizing the spare signals that are available on the UAV board. This has extended the range of the UAV board for use with planes requiring 4 or more RC control channels. The Oil Pan PCB incorporates Peter and Ben's design concepts.

3. Added Features – Several other features such as possible battery voltage monitoring (normal/low) and providing an interface for the additional RC channels (6 and 7) to be used as switch outputs instead of the standard PWM format from the receiver. This could be useful for functions such as camera shutter control. A proto bread board area is provided to allow additional circuitry and experimentation.

4. Cable Clean-up – The typical RC plane, especially with UAV control, is usually filled with a maze of wiring and cable harnesses. The Oil Pan PCB is intended to minimize some of the wiring by providing direct connections from the UAV board and the radio receiver. The UAV plugs directly on top of the Oil Pan PCB eliminating cable connections. A standard 7-channel Futaba radio receiver interface is also

provided with plug connectors to tie the receiver and UAV board together. Other receivers may be used if they utilize the same Futaba 0.108" servo output spacing.

2.0 Description

The Oil Pan daughter board provides a physical foundation for mounting the UAV board and radio receiver together. It translates the signals from the receiver to the servos via the UAV board with no changes in functionality the UAV board design. The only wiring cables required are from the assembled module to the aircraft servos.

The additional features of the Oil Pan daughter board can be activated by configuring jumpers on the Oil Pan board if desired.

The follow pictures depict the mechanical layout of the system.

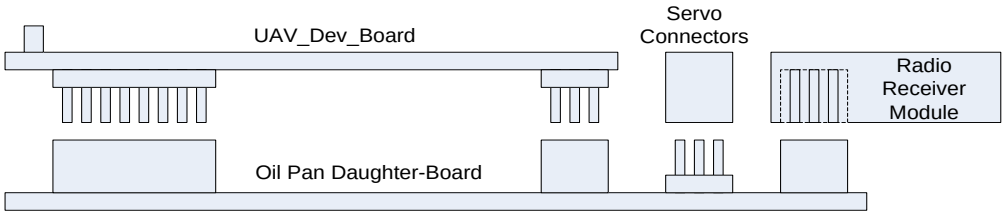


Figure 1: System mounting diagram –side view

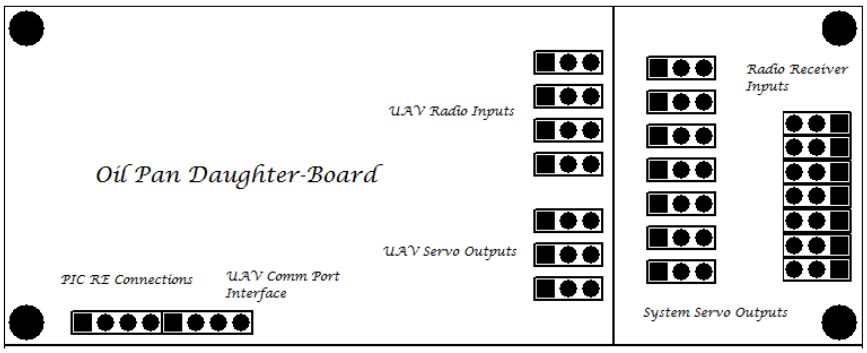


Figure 2: Oil Pan PCB connection diagram

The female header connectors on the Oil Pan PCB are aligned with the UAV board jumpers and radio receiver male connectors for direct easy mounting.

Power for the UAV board / Oil Pan assembly / Receiver assembly is derived from an Electronic Speed Control (ESC) unit which is normally connected to the #3 servo output for throttle control. An additional connector is provided on the Oil Pan PCB if an ESC unit is not used.

A small PIC device (12F683) is used on the Oil Pan board for optionally monitoring the battery voltage and providing PWM to switch decoding. The PIC device can be reprogrammed via an on-board connector to change it's operation. The PIC device may be removed if the functionality beyond that provided by the basic UAV board are not needed.

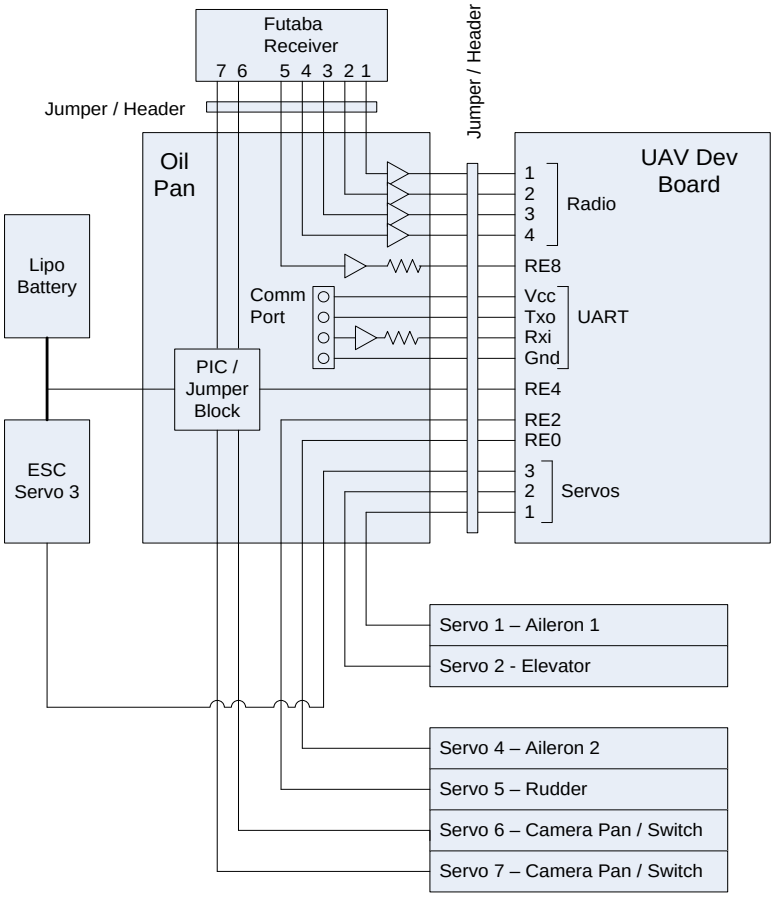
3.0 Logic Flow

The following block diagram depicts the basic interconnections between the UAV board, Oil Pan board, radio receiver, and the aircraft control signals in the assembly's full configuration. The features and functions added by the Oil Pan board are selected by four on-board jumper blocks.

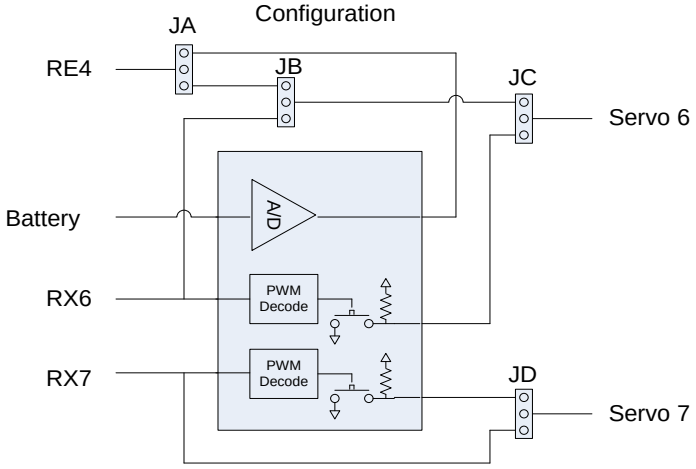
Note: In the base configuration, the configuration jumper blocks should be open and the PIC device may be removed.

Block Diagram

UAV Dev Board
w/ Oil Pan Daughter Board



PIC / Jumper Configuration



3.0 Oil Pan Configuration Jumpers

The following table describes the possible functions available with the Oil Pan board along with the appropriate configuration jumper settings.

Configuration	Description	JA	JB	JC	JD
Monitor Battery	RE4 is input from PIC A/D	2-3	1-2	1-2	-
Servo #6	RE4 Drives Servo #6 (PWM)	1-2	-	-	-
	Receiver #6 drives Servo #6 (PWM)	-	2-3	1-2	-
	Receiver #6 drives Servo #6 (Switch)	-	2-3	2-3	-
Servo #7	Receiver #7 drives Servo #7 (PWM)	-	-	-	1-2
	Receiver #7 drives Servo #7 (Switch)	-	-	-	2-3
Note: RE4 cannot drive Servo #6 and monitor battery status simultaneously					

3.1 Battery Monitor

A simple Good/Low battery monitor signal may be sent back to the UAV DSPic controller to denote the status of the battery. The good/low threshold of the battery voltage level is determined by values of the Ra and Rb resistor values on the Oil Pan PCB. These resistors may be changed to match the type and operating voltage level o the battery source.

If the battery monitor function is activated, control of the #6 Servo channel is tied directly to the radio receiver #6 servo's output channel.

3.2 Servo #4 and #5 Control

When using the UAV Dev Board, the #4 radio channel is reserved for controlling the UAV mode of operation. Please refer to the UAV Dev Board documentation for further information about this.

With the Oil Pan PCB, servo output channels #4 and #5 may be driven directly from the UAV board and not the radio receiver. This requires optional F/W to be loaded into the UAV board and is compatible for planes requiring more than three servos for control.

3.3 Servo #6

Servo #6 may be configured by the Oil Pan PCB to provide several optional functions:

1. Driven directly from the radio transmitter/receiver #6 channel. If this mode is selected, the battery monitor function of the Oil Pan board may be used.

2. Driven directly from the UAV Dev Board. Optional F/W is required if this mode is used. The batter monitor function is NOT available in this configuration.

3. Regardless of the selection for driving servo #6 (transmitter or UAV), the output of the channel to the servo is configurable between a standard RC PWM output or as an electronic switch.

3.4 Servo #7

The servo #7 may only be controlled by the RC Transmitter. However, the output of this channel may also be configured to operate as a normal RC PWM or optional electronic switch.

Jumper Settings			
JA	**JB**	**JC**	**JD**
Open	Open	Open	Open

Option A: Battery Monitor active and Servo #7 directly from Transmitter if available.

4.0 Common Configuration Settings

While many configurations and modes of operation are possible with the Oil Pan PCB system, the following two are the most common configurations and are supported either by the released code provided by Bill Premerlani or the extended operation code available from Ben Levitt and others (see http:code.google.com/p/gentlenav).

4.1 Base Configuration

Uses the standard released code for the UAV Board without requiring modifications and is intended for use with 3-channel RC aircraft. This mode only provides Futaba and UAV Board signal compatibility.

Oil Pan Jumper Settings – Base Configuration			
JA	**JB**	**JC**	**JD**
Open	Open	Open	Open

Radio Channel	Control
1	Aileron or Rudder
2	Elevator
3	Throttle (ESC)
4	UAV Mode Function

4.2 Extended Operation Configuration

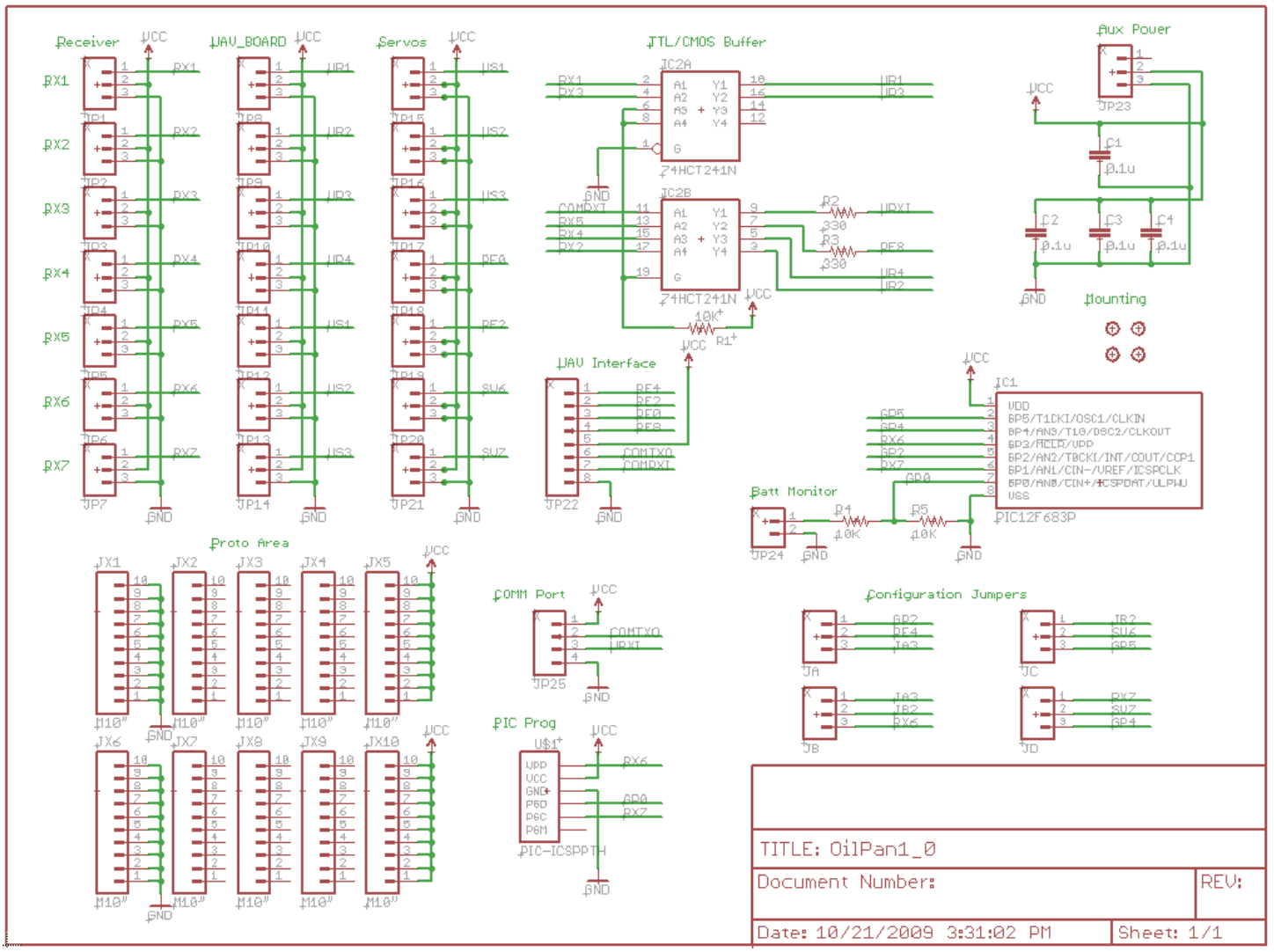
Requires the extended operation firmware to be loaded into the UAV Board DSPic controller device.

Provides extended servo control for aircraft requiring four or more control servos. Utilizes servos #6 and #7 directly from the RC radio receiver as PWM control outputs to the servo devices.

Oil Pan Jumper Settings – Extended Configuration			
JA	**JB**	**JC**	**JD**
Open	2-3	1-2	1-2

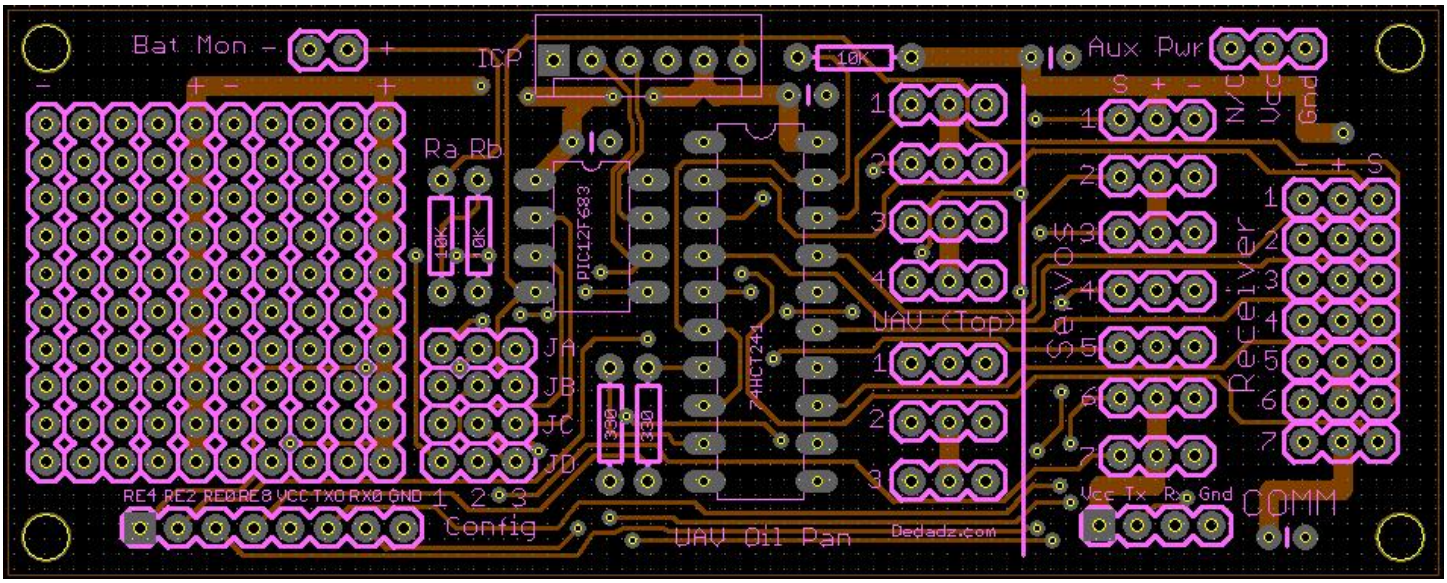
Radio Channel	Control
1	Aileron 1
2	Elevator
3	Throttle (ESC)
4	UAV Mode Function
5	Rudder
6	Aileron 2
7	User Defined

4.0 Schematic



5.0 PCB Layout

5.1 Component Side (Top)



5.3 Solder Side (Bottom)