HARMON ROCKET C-GVRL ELECTRICAL SYSTEM DESIGN NOTES

Applies to: Version C1 Schematic

Date: January 1, 2015

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The following design notes should be used in conjunction with the document entitled "*Aircraft Electrical System RV-4/HR II 4325/251 C-GVRL Rev C1*", dated January 1, 2015.

MASTER

The MASTER page represents a conventional single-alternator/single battery primary electrical system. Some additional functions shown on this page are:

- A starter interlock that requires the Master Switch to be in the center (BAT) position and the Avionics Master Switch to be OFF in order to engage the starter.
- The use of a relay in the starter circuit to isolate the stick-grip start switch from the Starter Contactor. This relay reduces the load current carried by the switch and supports the starter interlock function.
- A Sonalert alarm is used to provide an audio indication when the Right ignition (electronic ignition) switch is ON and the Master Switch is OFF. Besides being a safety feature, this prevents the ignition battery from being discharge by accidentally leaving the ignition switch ON. See IGN page for more details.
- A hot wire is connected to the main battery, protected by a 15A fuse. This supports a 12V power jack that may used to externally charge the main battery.
- Two capacitors are used across the alternator to help reduce audible alternator noise.
- A Transzorb is used across the Master Contactor coil to suppress switching spikes. This could also be a 1N5400, similar to the arrangement used on the Starter Contactor.

IGN

The IGN page shows a conventional installation of an Electroair electronic ignition controller. Some additional functions on this page are:

- An ignition hold-over battery is used to prevent low-voltage dropout of the ignition during engine cranking. This prevents accidental kick-back while the starter is engage, which may damage the starter. It is also useful for hand-starting the engine if the main battery is discharged.

- The Bus Isolation Diode allows the Essential Bus Battery to be charged and ignition current to be provided while the engine is running, but isolates the Essential Bus Battery when the Master Bus voltage falls.
- An Advance switch is used to disable the automatic timing advance of the ignition. This is useful for diagnostics and engine break-in. The ignition controller provides a voltage output that is proportional to the amount of timing advance. This timing advance is displayed on the EFIS screen.
- The Advance switch second pole is used to display a mode indicator on the EFIS screen.

SVN

The SVN page shows the architecture of the Dynon SkyView network. Most of the SVN connections are to a Vx Aviation AXIS-9A wiring hub. This hub was the design that inspired the similar Dynon product. Recent (C1) updates show the addition of a Taxi Aid Camera System.

AV

The Avionics page shows the power connections to the primary aircraft avionics. Some of the additional functions on this page are:

- A separate charging port is provided to the SkyView SV-D1000 EFIS. This allows EFIS battery charging without running the engine. The SV-D1000 normally requires the engine to be running in order to charge its battery. This battery must be charged before first flight and after annual capacity testing. This charging port is also useful in powering up the SV-D1000 for configuration and testing.

EFIS

The EFIS page shows the function of the Vx Aviation AXIS-25A. The AXIS-25A interconnects the two SkyView EFIS systems with the rest of the avionics and wiring in the aircraft. Some of the additional functions on this page are:

- The GPS Source switch is used to select either the SkyView or the Garmin Aera for pushing frequencies to the SL-30 Com or SL-40 Nav/com. The Aera position is only required in the event of a dual EFIS failure. Normally the SkyView system will take frequencies from either its internal database or the Aera and automatically push them to the Com.
- There are a pair of jumpers shown that allow an upgrade from the installed SL-40 Com to an SL-30 Nav/Com. Refer to Garmin's installation guides for more information.
- There is a 4-wire audio type jack that provides serial data input and output from the SkyView to external devices. This jack also provides unregulated 12 Volt power. Since the pitch and roll trim systems use the same serial information, care must be taken before changing the EFIS configuration or connecting any devices to this panel jack.

EMS

The EMS page shows a conventional SkyView EMS installation. Some of the additional functions on this page are:

- The Vx Aviation P-TACH device conditions magneto impulses to provide a reliable indication of RPM. Often, it is very difficult to obtain stable RPM readings on the SkyView EMS using the Dynon recommend series resistor.
- The 1N4007 diodes are used on several contact inputs in order to prevent current flow into the EMS when the input voltages exceed 12 Volts. Dynon specifies that this will not damage the EMS inputs, however, if external indication lamps are also connected to the signals being sensed, the lights will glow even when not activated unless the diodes are used.

AP

The Autopilot page shows a modified Dynon SkyView network splitter harness, adapted to supporting two autopilot servos. The regular SkyView network splitter harness cannot handle the power requirements of the servos, so a separate connector with power connection and autopilot disconnect functions is provided.

The pitch servo needs a custom cable with heavier gauge wiring for the power leads as well. Several suppliers sell special servo cable that can support this application.

Other items:

- As a matter of convenience, the servo power is also connected to a spare wire in the right wing. This wire is for future expansion.

FLAPS-TRIM

The Flaps-Trim page shows the pitch (elevator) trim, roll (aileron) trim and electric flaps control. The trim motors are controlled by a Vx Aviation M-PWR-2AT dual auto trim controller (rev C1 schematic). This device also supports stuck switch detection and correction and is capable of extracting airspeed information from an EFIS serial air data stream for switching servo speeds (aka speed scheduling) and two-axis auto-trim control.

A trim switch fault is indicated by the Trim Fault lamp and is corrected using the Trim Fix pushbutton switch mounted near the throttle quadrant. The lamp and switch are also used to program the airspeed threshold for switching between fast and low trim motor speeds. Motor speeds are adjustable for both high speed and low speed settings independently on both channels.

The M-PWR-2AT also connects to a flaps limit switch as a backup speed control input in the event of an EFIS failure. The flaps limit switch also automatically shuts off the motor when the

flaps are fully in the UP position. The 10A01-T diode allows the flaps to run down even after the limit switch has shut power off on the flap motor.

The flaps are controlled with a relay bridge constructed from a pair of automotive relays. These relays are very robust and can easily handle the flap motor stall currents.

ELEC

The main electrical bus page shows the use of automotive relays for switching power loads in the aircraft. This allows reliable, low current switches to be used for controlling the relay loads and eliminates the need to run heavy gauge wiring to and from the instrument panel.

The commercial seat heating system also has internal relays for temperature control. These are not shown.

The Keylock switch and Accessory Power Jack are used to support main battery charging on the ground and normal electrical loads in flight. A key switch is used to select the 'Hot' or 'Master' bus so that passengers cannot inadvertently change the selection.

LIGHTS1

The first Lights page shows the wiring of the Nav and Strobe lights plus cockpit lighting.

The lights are controlled by power relays. The shielded LED Nav and Strobe wiring is run to a screw terminal block for connection to wing wiring. The lights in each wing tip are run to an Amp Universal Mate-N-Lock power connector, allowing the wing tips to be detached.

LIGHTS2

The second Lights page shows the wiring of the Landing and Taxi lights using power relays. The Vx Aviation WWX-1A device is a wig-wag controller that uses the power relays to flash the Landing and Taxi Lights in an alternating fashion. Logic inside the WWX-1A allows common SP3T switches to be used to provide OFF, FLASH, ON functionality for the lamps.

This switch configuration provides an intuitive switch operation, with up=ON; down=OFF and middle=FLASH.

A 15 pin Dsub connector is used as a Panel Power distribution bus. It is separated into two segments. The segment that drives external loads has secondary over-current protection with a Polyfuse.

LIGHTS3

The third Lights page shows the operation of the main panel dimmer and annunciator lamp controller.

The dimmer drives various loads and is split into two buses. The Left bus provides a variable voltage to lamp loads controlled by the setting of the dimmer control. The right bus is controlled by a section of the Vx Aviation WWX-1A so that during daylight operations, the bus is automatically driven to its maximum intensity, regardless of the dimmer control setting.

The Vx Aviation IL-6A annunciator controller is used to drive panel lamps. It senses active high or active low signals and allows the lamps to be dimmed and tested with an external pushbutton switch. The version of IL-6A illustrated in this design is a prototype, the actual pinout of the production version is different.

AUDIO1

The first Audio page shows a PS Engineering PM3000 intercom, a Garmin SL-40 Com or SL-30 Nav/Com and the Vx Aviation AMX-2A 10-channel audio mixer. The AMX-2A has six fixed-level inputs and four variable-level inputs for those sources that do not have accessible volume controls.

AUDIO2

The second Audio page shows the PM3000 intercom and the audio distribution panel. The audio distribution is built into a removable right side arm rest. The arm rest provides the headset jacks (both conventional and Bose/Lightspeed compatible Lemo) and regulated 10 Volt power, compatible with most ANR headsets. 10 Volts is the maximum allowed for Headsets, Inc. ANR kits and the minimum required for Bose or Lightspeed ANR headsets.

The pilot and copilot PTT switches are built into their respective control sticks. The copilot's stick is removable, so the PTT is attached using a two-pin connector.

AUDIO3

The third audio page shows the connection of stereo audio sources into the music inputs of the PM3000 intercom. It provides a 3.5 mm panel jack for an external music source, a second hidden 3.5 mm jack for a Bluetooth music module, a regulated 5 volt USB power source for the Bluetooth module and the connection to the Garmin Aera GPS.

There are three ways to provide audio entertainment: The Aera's MP-3 music, an external music source connected with a cable, and an external music source connected using Bluetooth.

A smart phone can be directly connected to the 3.5 mm music jack to provide cell phone calls as well as music. Older monophonic phones use a 2.5 mm jack on the phone, so a conversion cable is required that changes the wiring and adapts to the panel jack.

A Bluetooth module that supports both music and hands-free profile can be plugged into the Bluetooth Module interface to provide a complete smart-phone and music function.

AUDIO CABLES

The Audio Cables page provides details on the types of cables required to support various external devices. In general, all tablets, music players and smart phones can use the same 4-wire 3.5 mm cable. Older cell phones need a shop-made 2.5 mm to 3.5 mm adapter cable as shown. The common 3-wire 3.5 mm cable is shown for applications that do not require cell phone operation.

SMOKE

The Smoke page shows the electrical circuits required to support a smoke system in the aircraft. The main Smoke Arm-On switch has two functions: In the middle position, it arms the pilot's stick grip switch so that smoke ON-OFF can be stick controlled. In the up position, it turns the smoke ON. The down position is OFF.

Smoke is controlled with an automotive relay and a 25 amp circuit, capable of supporting the large inrush currents that are common to pump motors. A connector is provided in the baggage compartment for attaching the smoke system assembly.

INFINITY GRIP

The Infinity Grip page provides the pin diagrams for the pilot's stick-grip connector. All of the switches with the exception of the push-to-talk (PTT) switch have a common ground to simplify wiring. This requires the use of relays or trim controllers to support some of the switch functions.

CONNECTORS

The Connectors page summarizes the main panel connectors.

WWX-1A, IL-6A PROTO, AMX-2A, P-TACH and M-PWR-2A

These pages provide the internal details of various Vx Aviation devices used in the aircraft.