

The Power to See

The first Group (GR1)

Sponsor: Scott Faulkner

Lockheed Martin

<http://www.lockheedmartin.com/>

Project lead/Low Power Engineer: Catherine Donoso

High Power Engineer: Diego Rocha

Data System Engineer: Keith Weston

Objective:

To design and analyze a prototype of a Radar Interface Control and Power Supply (RICPS) for a transceiver.

Narrative:

Our task is to design timing, control, and power supply for a Joint Air to Ground Missile (JAGM). The topology has limiting factors in that the area is relatively small and odd shaped form factor. Thermal and Electromagnetic radiation and interference (EMI) must be kept to a minimum to insure optimal performance of missile guidance and tracking systems. The power supply needs to be clean, contiguous, and responsive. Voltages and currents from Power Architecture will be monitored and reported through a data bus which is EMI resistant. The radar transceiver will accept commands, convert them into timing and control signals which will direct the RICPS to correct voltages as well as monitor and report internal status. Timing signals are expected to be highly accurate and reliable.

Specifications:

Power Architecture

To operate the radar transceiver must accept external power and convert it into the power it needs.

The decision has been made to send +32 V to the gimbal to minimize the current and therefore wire gauges going to the gimbal.

Input Power: +32 VDC @ Amps(TBD) Regulation (TBD) Noise (TBD)

Output Power:

Unit

- 6XMIT 6 VDC @ 11 Amps 3% Regulation 1 mV noise
- 9XCVR +9 VDC @ 100 mA 3% Regulation 100 uV noise
- 6XCVR +6 VDC @ 1000 mA 3% Regulation 100 uV noise
- 4XCVR -4 VDC @ 250 mA 3% Regulation 100 uV noise

Special Load Characteristics:

6XMIT

- Used to drive transmitter
- Load applied for durations of 1 to 100 uS but shall not exceed 50 % duty cycle
- Pulse Repetition Rates from 1 to 100 KHz
- Other Voltages
- Continuous loads

Power Sequencing:

- Power UP: -4 then +6 then +9 then high current +6
- Power Down: Opposite Order
- Voltage Failure: Upon detection use Power Down Sequence

Other:

- Current Sense resistor and amplifier must be added inline with 6XMIT to permit the measurement of its current.
- Current Sense resistor and amplifier must be added inline with 6XCVR to permit the measurement of its current.
- All voltages must be routed to Timing & Control for monitoring.

Thermal:

- The radar transceiver is mounted on gimbal with only convection cooling (~ 3 watts) and heat sink available to control temperature. The heat sink is aluminum with 5 inch diameter and 0.35 inch thickness. The heat generated in the conversion of +32 V to other voltages must be minimized to maximize the operation time of the radar transceiver ! The goal in 7 minutes of operation time between power downs for cool off.
- The high efficient of on gimbal power conversion requires DC to DC Convertors.

Timing & Control Architecture

To function, the radar transceiver must accept commands, convert them into timing/control signals, translates to correct voltage and monitor/report its internal status. Timing signals are expected accurate to 5 nS (i.e. 1/200 MHz). Voltages and currents from Power Architecture will be monitored.

Timing & Control Interfaces:

Inputs

- Command Bus

- All voltages
- Current monitor for 6XMIT and 6 XCVR
- AD590 Temperature sensor

Outputs

- Status Bus
- Timing Signals (14) – Voltage translators will be needed to drive GaAs MMICs

Functions

- Accept Command Bus inputs
- Translate commands into timing/control signals
- Digitize Analog inputs
- Turn power ON and OFF
- Assist in Power Sequencing if necessary
- Report Status

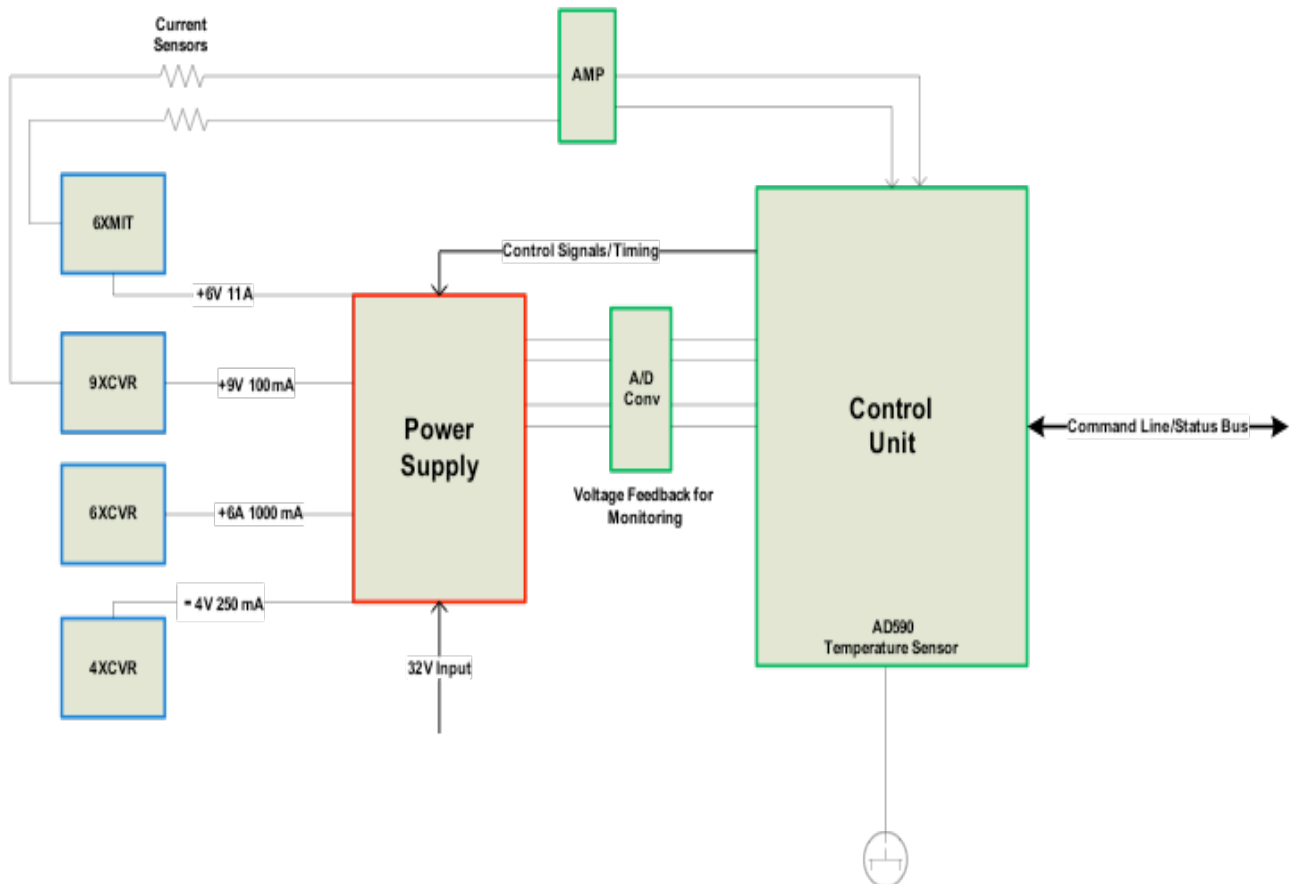


Fig. 1 Block diagram describing RICPS

* Power supply and control unit blocks are at “Research” status.

**Blue blocks are signals that have been designated by the customer.

Areas of Responsibility:

- Power Supply
 - Catherine Donoso
 - Diego Rocha
- Control Unit:
 - Keith Weston

Financing and Budgeting:

The financial source of the project is Lockheed Martin Missiles and Fire Control, Orlando, FL in which Scott Faulkner, the project sponsor and mentor, will approve monetary transactions.

<u>Item</u>	<u>Price</u>
Printed circuit board	50.00
DC-DC converter	30.00
FPGA	85.00
Heat sink	10.00
Test box	100.00
Temperature sensors	15.00

Power module	70.00
Resistors	5.00
Capacitors	40.00
Connectors (serial or parallel bus)	30.00
EMI filter	20.00
Total:	455