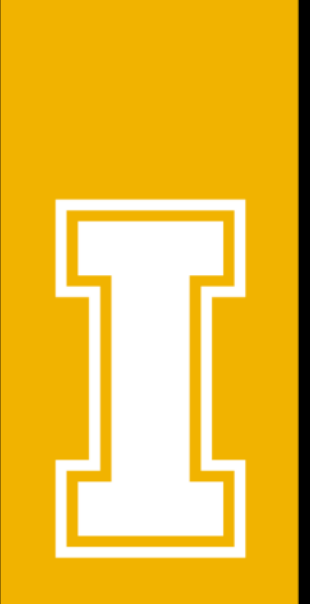


EXPO Space Communication Utilizing Backbone Existing Networks

SCUBEE

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While the barriers to space flight have been reduced due to the privatization of launch vehicles, two large hurdles remain for those seeking to conduct research in space: **orbit-to-ground communication, and reentry recovery.** Our work seeks to reduce these barriers through research in these areas.

Iridium Core 9523:

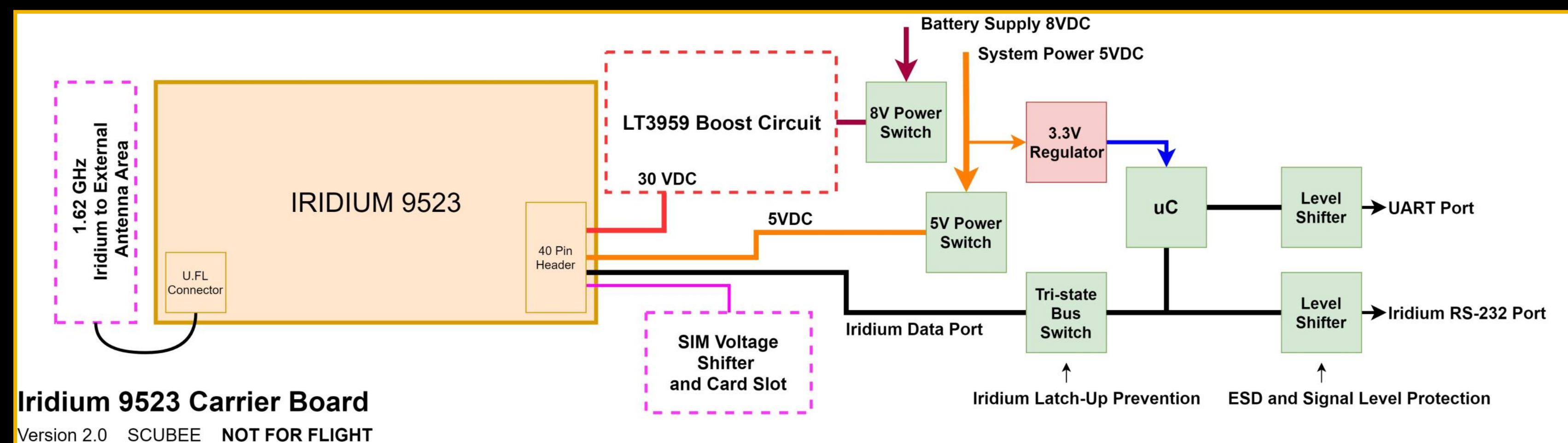
The most advanced consumer satellite communication modem on the market, the Core 9523 communicates with the Iridium satellite constellation and is able to establish a full internet connection to a ground network. Our project looked develop a carrier board for the Core 9523 so it can be integrated into a cube satellite, eliminating the need for researchers to use regulated frequency bands and equipment.



Iridium Core 9523

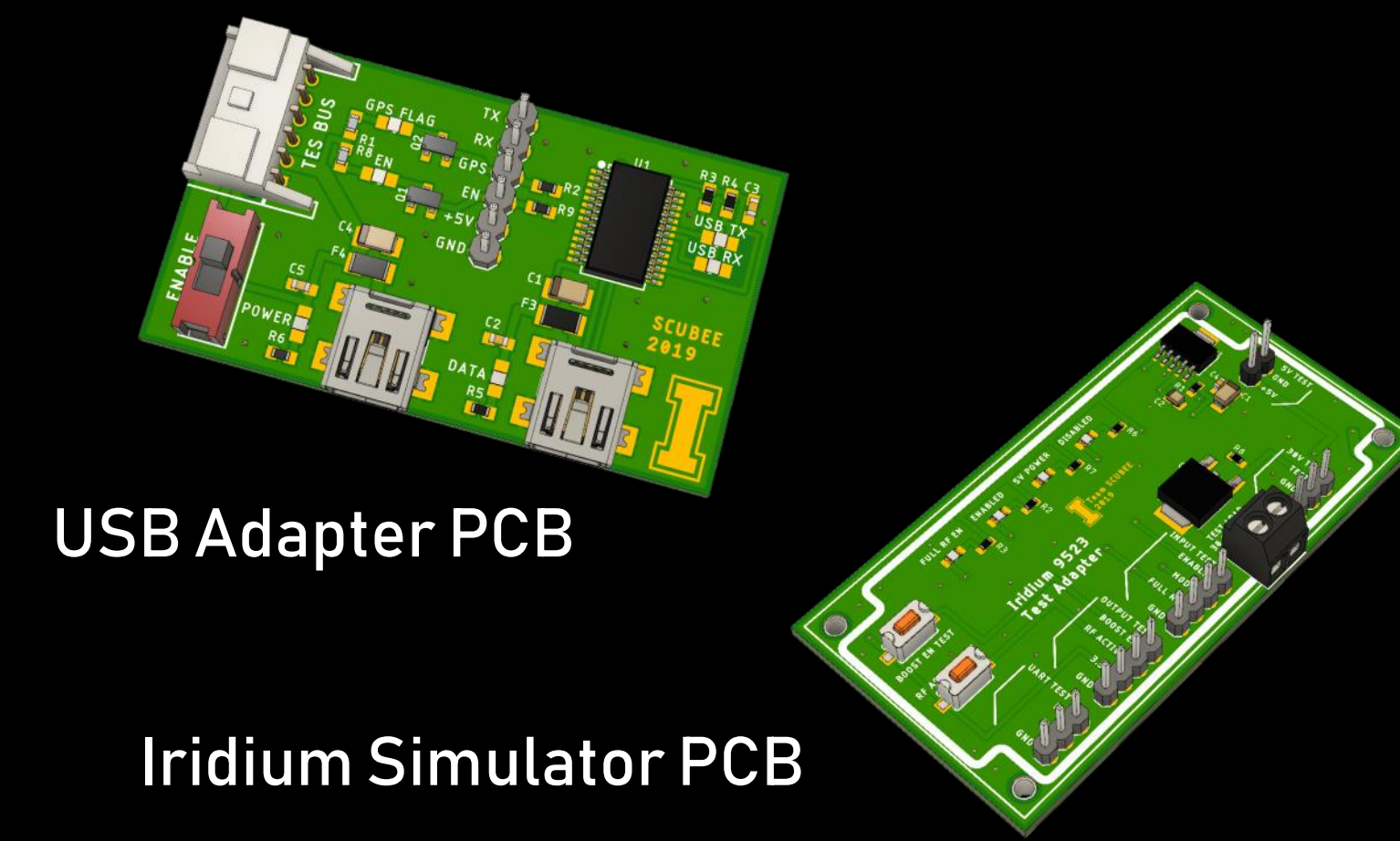
Electrical Design:

The Core 9523 requires two power inputs, one to power its logic, and another to power its radio. A 30-watt boost converter had to be designed to supply the instantaneous power needed by the Iridium Core when transmitting, in addition to an onboard microcontroller to interface the Iridium to the satellite motherboard.



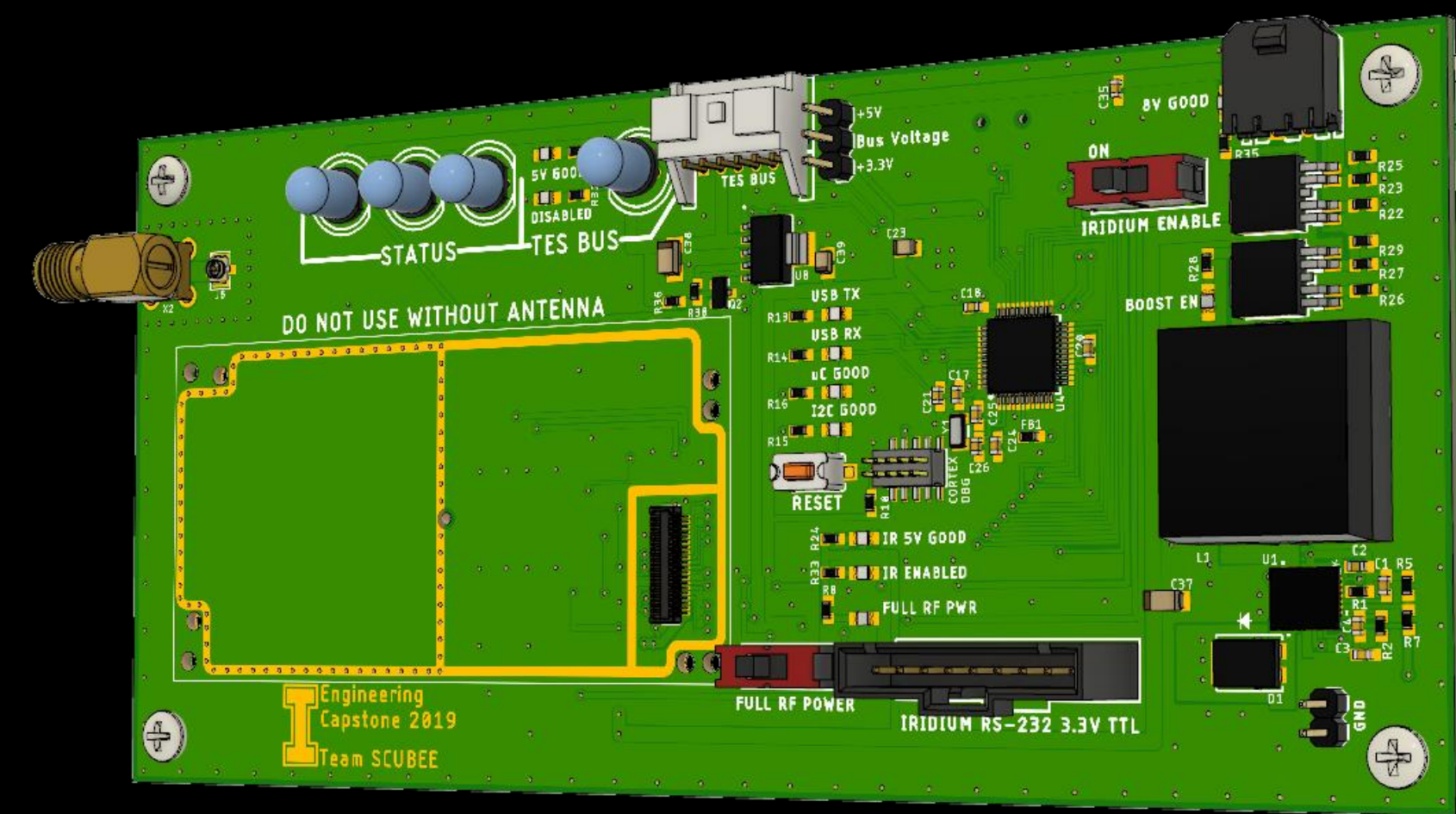
Circuit Board Design:

The Iridium carrier board is a two-layer PCB designed for testing the Core 9523 in the lab or as a high-altitude payload. Two additional PCBs were designed, one to simulate the Iridium modem to aid with testing, and one to provide a link between the satellite data port on the carrier PCB and a computer to help with software development.



USB Adapter PCB

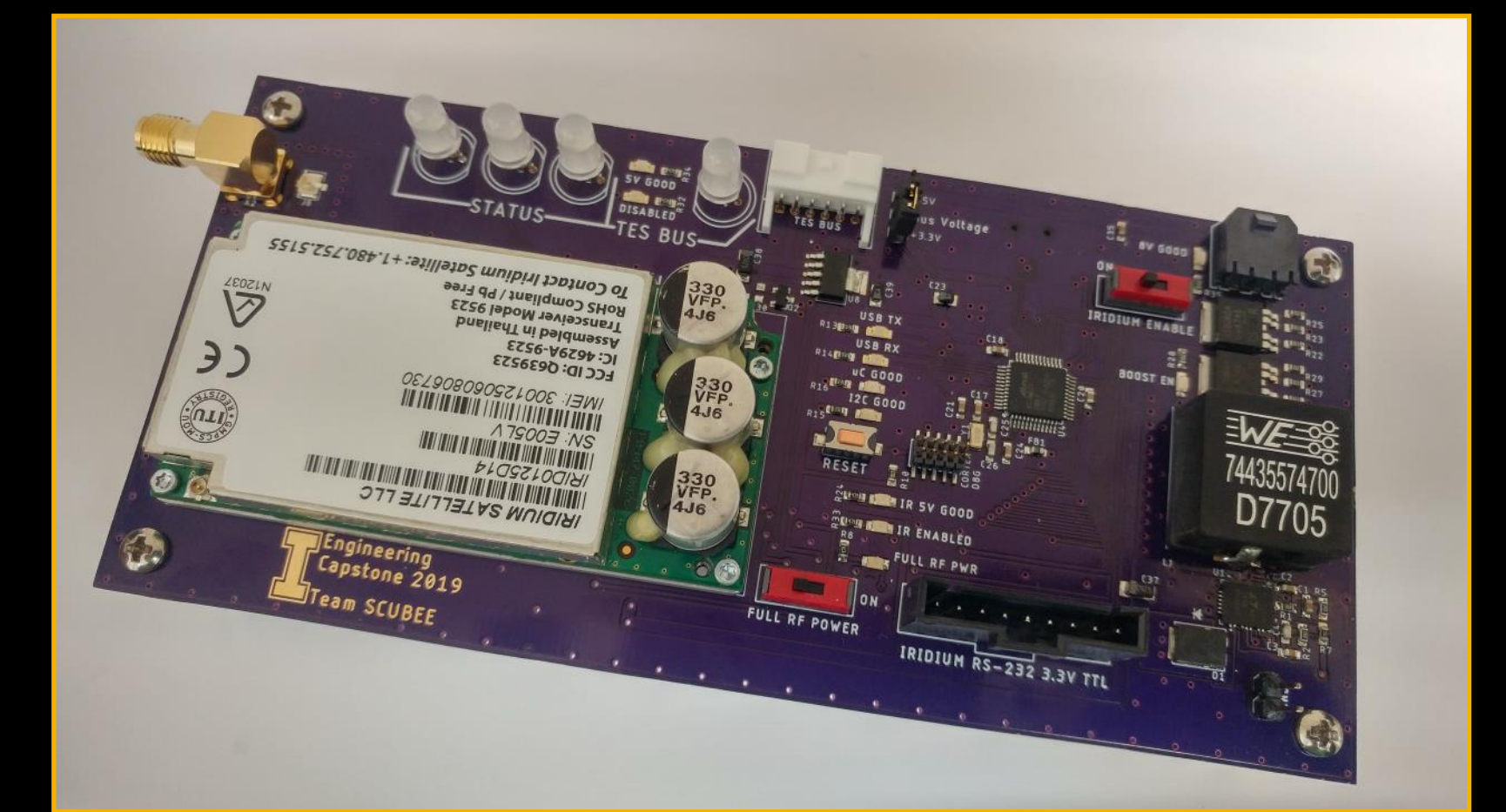
Iridium Simulator PCB



Iridium Carrier PCB CAD model

Carrier Specifications:

- Fully Arduino compatible for ease of use
- SAMD21 ARM Cortex-M0+ microcontroller
- Active power monitoring and management
- Full 2kV ESD protection on all ports
- Configurable serial data bus for easy integration with existing hardware

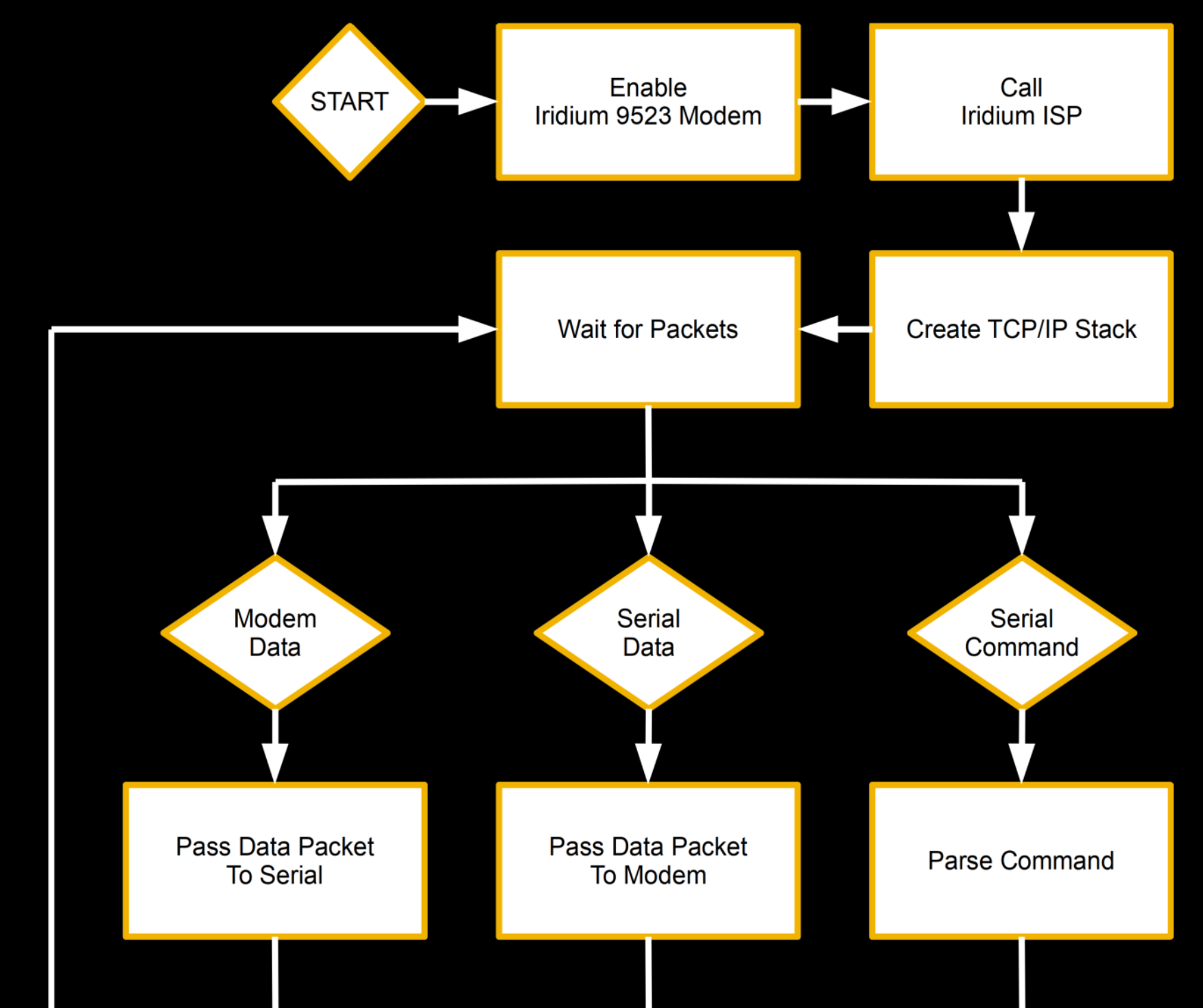


Fully Functional Assembled Iridium Carrier

Software:

A software library was designed to use the Core 9523 to establish an internet connection to the Iridium internet service provider, in addition to providing direct access to advanced configuration options for the 9523.

Two versions of the library were created. The first version is designed for use on a microcontroller and is optimized to use as little memory as possible. The second version is designed to run on a computer and provides debugging information to assist future software development.



Basic Software Behavior Flowchart