

# Product Development Specification

Team 05

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## Customer requirements

The Portland State Aerospace Society (PSAS) needs a device that can be used for command, control, communications between a **CubeSat** and a **ground station**. A **CubeSat** is a miniature satellite that can be used for scientific research in space. It has a volume of one liter (10cm cube), and has a mass of no more than 1.33kg. A **ground station** is a radio station located on earth that is designed for communication with spacecraft. Development of such a device is not trivial as it will need to eventually be "space ready" (for example being able to operate in -30C to 150C temperature ranges and withstand ionizing radiation from space environment) and will require multiple phases of development.

The first phase of development will involve finding and de-risking a microcontroller that is capable of handling command, control, and communications. Therefore, the device will be a communications module "breakout board" that will allow easy access to the features of the microcontroller like UART, I2C, SPI, GPIO, ADCs/DACs, etc. Access to these features will rely on miscellaneous connectors such as .1 inch pin headers, USB, 6-pin JTAG, etc. Furthermore, as a project that is sponsored by PSAS it should adhere to their open source standards, while obeying governmental regulations.

## Requirements

### Must

- Have a transceiver for RF communications
- Have an antenna capable of 435 - 438MHz frequency band transmission
- Have visible indication of communication (*such as LEDs*)
- Have a bidirectional amplifier for RF communication
- Be able to fit within the CubeSat form factor  
(*no bigger than 10cm x 10cm x 10cm*)
- Be a breakout board
- Have access to UART
- Have access to I2C
- Have access to SPI
- Have access to GPIO
- Have access to ADCs/DACs

### Should

- Use USB for interfacing
- Be able to send/receive data packets via RF communication
- Be capable of RF communication at a distances greater than 6 feet
- Be battery powered (as opposed to using lab power supplies)
- If battery powered, utilize USB for recharging
- Comply with European Telecommunications Standard Institute(ETSI) and Federal Communications Commission (FCC) regulatory requirements
- Use a GNU GPL v3 license for all design work and software

### May

- Be capable of long distance communication (*250m-500m for example*)
- Be capable of sending/receiving data packets
- Be capable of operation in space temperature range (*-30C to 60C* )
- Comply with Federal Aviation Administration (FAA) regulatory requirements