

# Sdmay22-30: 5G and Beyond Prototyping

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Website: <https://sdmay22-30.sd.ece.iastate.edu/docs.html>

## Problem

- ARA- Agriculture and rural communities
- Provide an experimental infrastructure for wireless applications
- Rural wireless broadband for agricultural uses
- Need a way to deploy all this equipment in an easy manner to many different users
- Solution should be generalized so it can fit many use cases

## Design Requirements

- Functional:
  - Enclosure should have ethernet ports and be waterproof
  - All components should fit inside the enclosure
  - Algorithms should perform better than default
- Nonfunctional:
  - Enclosure should be portable
  - Enclosure should be easy to manufacture
  - Easy to deploy
  - Algorithms should work as designed
- Constraints:
  - Completed in two semesters
- Operating Environment:
  - Multiple outdoor deployments across Iowa
- Standards:
  - IEEE 802- networking standard
  - IEEE 1914.1- radio protocol standard

## Design Approach

Enclosure design:

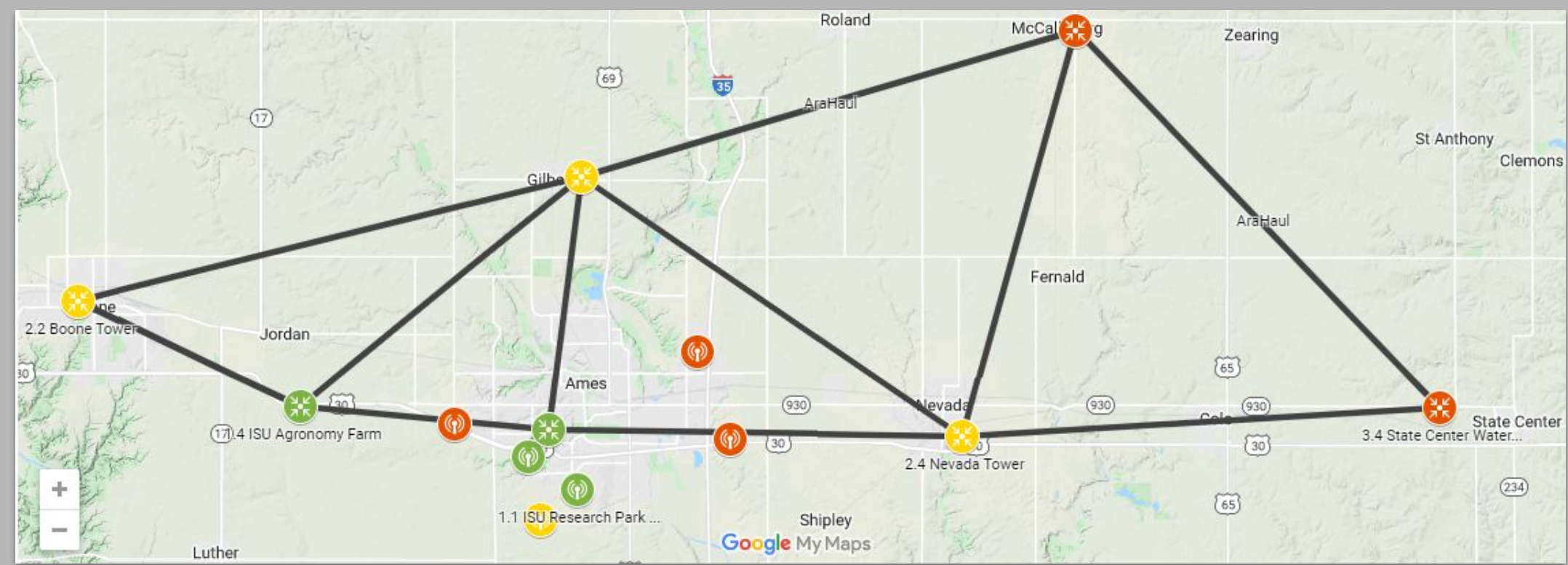
- CAD 3D design model
- 3D printing prototype
- DPH-28712 enclosure design (pictured right)
- Cut acrylic panels with waterjet for mounting hardware

Software design:

- Researching SDR algorithms
- Creating a testbed
- Running implementation of algorithms

## Solution

- Create an enclosure to store the necessary components
- Simplify manufacturing process of the enclosure
- Experiment with software to increase performance metrics of software defined radios



## Intended Users and Uses

Users

- Universities
- Farmers
- Rural communities
- The city of Ames

Uses

- Provide connectivity for wireless networks
- Cloud computing
- Plant phenotyping
- Remote monitoring
- Tele-operation of agricultural vehicles



## Technical Details

Hardware (pictured left):

- Components in the UE
  - B210 SDR
  - Skylark mMIMO SDR
  - B205 SDR
  - 8 port network switch
  - LN amplifier
  - Management and compute computer

Software (pictured bottom left):

- srsRAN source code
- Algorithm Implemented in srsUE
  - Implemented Unified Cellular Scheduler (UCS) algorithms
  - local-deadline partition (LDP) algorithms
  - Weighted Fair Queuing(WFQ) algorithms
  - Device-to-Device (D2D) algorithms

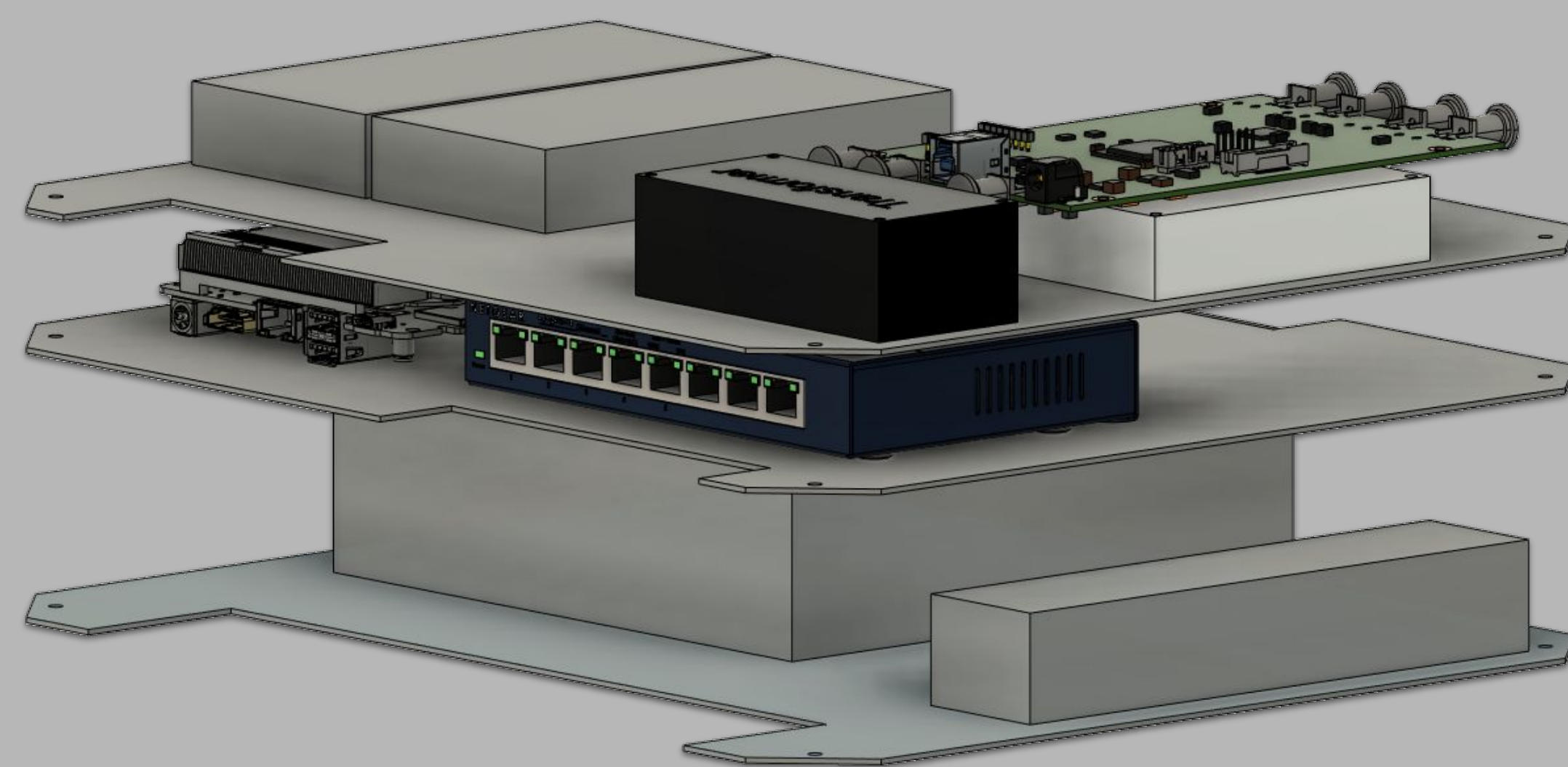
## Testing

Hardware:

- Run script on management computer to start srsRAN
- Attach camera via ethernet ports on enclosure
- Use srsRAN to connect to base station
- Transfer camera data to base station
- Verify you can see camera feed on base station

Software:

- Testbed with server and client systems
- Running test scripts



## Project Resources

ARA Partners:

- Partners at universities (Kansas State, Ohio State, ...)
- Industries (Mediacom, John Deere, ...)
- Communities (NSF, FFA, ...)
- Government agencies (NIFA, City of Ames, ...)

All of these entities want to address the challenge of rural broadband internet.

