

Proposal to build a Wideband Cryogenic Front-End For the Arecibo Observatory 12m Antenna

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This proposal identifies the tasks, the deliverables and a timeline required to complete the project. The proposed work is performed in 7 phases over a 21-week period following the timeline outlined below.

Over the course of the project, CryoElec LLC will be responsible for the following tasks:

- Hardware Design and Analysis
- Hardware Procurement using funds from Arecibo Observatory
- Hardware Assembly
- Hardware Testing
- Generate documentation
- Sending progress reports and updates regularly
- Attending meetings and design reviews(online)
- Responding to reviews and making revisions if needed
- Reporting problems or issues affecting: schedule, budget or performance

Phase1A: On antenna testing of the QRFH feed

During this Phase, the following tasks are performed:

- Installation of the QRFH and room temperature LNAs feed on the 12m antenna
- Measurement of the noise temperature of the system on antenna at different elevation angle
- Measurement of the aperture efficiency using radio sources

Phase 1A duration: ~ 2 weeks @ full time

Phase1B: Cryogenic Design, Analysis and Procurement

During this Phase, the following tasks are performed:

- Cryogenic System Design: Mechanical, thermal and Electrical design
- Parts and Key components are selected
- Design Review
- Design Revision if needed
- Procurement of parts and Materials after design acceptance

Phase 1B duration: ~ 1 Month @ full time

Phase2A: Solar Filter and Warm air Blower Design

During this Phase, the following tasks are performed:

- Solar Filter: Mechanical design
- Solar Filter: Control Electronics Design
- Dry air blower: Mechanical design
- Dry air blower: Control Electronics Design
- Design Review
- Design Revision if needed
- Procurement of parts and Materials after design acceptance

Phase 2A duration: ~ 1 Month @ full time

Phase2B: M&C System Design

During this Phase, the following tasks are performed:

- M&C System Design: Electronic Design
- Parts and Key components are selected
- Design Review
- Design Revision if needed
- Procurement of parts and Materials after design acceptance

Phase 2B duration: ~ 1 Month @ full time

Phase3: System Assembly

During this Phase, the following tasks are performed:

- Mechanical Assembly of the Vacuum Chamber / Cryogenic system
- Installation of electronic components
- RF Cabling installation
- DC Wiring
- Connection to M&C system

Phase 3 duration: ~ 1 Month @ full time

Phase4: System Testing

During this Phase, the following tasks are performed:

- Vacuum test of the cryostat
- Cryogenic test: Heat load on the cryogenic cooler test
- Electronics components testing
- M&C system Testing
- Vacuum Window Test
- RF Tests: Noise temperature Measurements of the Front end

Phase 4 duration: ~ 1 Month @ full time

Phase5: Integration with Room Temperature Electronics and Testing

During this Phase, the following tasks are performed:

- Integrating the Cryogenic front end package with the room temperature electronics.
- Testing of the full system

Phase 5 duration: ~ 2 Weeks @ full time

Phase6: Documentation

During this Phase, the following tasks are performed:

- Gathering and combining all design files + Drawings + Test data in one User/Maintenance Manual
- Writing a Standard Operating Procedure (SOP)

Phase 6 duration: ~ 2 Weeks @ full time

Phase7: Field Deployment and on-Antenna Testing

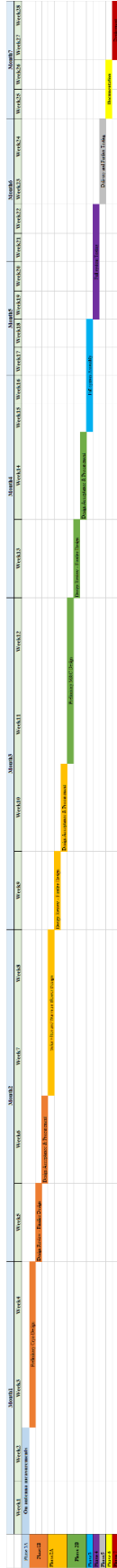
During this Phase, the following tasks are performed

- Installation of the system on customer site
- Conducting On-site on-antenna testing
- Training customer personnel on operating the system

Phase 7 duration: ~ 2Weeks @ full time

Total Duration: 28 Weeks

Deliverable: Cryogenic Front-end system with room temperature and M&C electronics and documentation and including on-site customer training



Project Timeline

Materials, Parts and Tools used for the Design/Assembly and testing:

(Provided by Hamdi Mani/CryoElec LLC and used for the project but not delivered)

- Mechanical CAD software License
- Alcatel Vacuum Pump + Vacuum hose
- CTI SC compressor for driving the CTI-350 1 phase cold head (Provided by Arecibo)
- Fasteners: Stainless steel screws, bolts, nuts, washers...
- Vacuum grease: for the vacuum chamber O-rings
- RF test equipment used for components testing and Receiver testing (Yfactor/Noise, Stability, linearity...): VNA, Spectrum Analyzer (R&S 26.5GHz), power meter / Signal generator
- Power Supplies + Voltmeters + Labjack DAQ
- Miscellaneous RF components used for testing: Amplifiers, Attenuators, cables, connectors, adapters...
- Miscellaneous Materials and Laboratory consumables: Soldering, electronics cleaning tools and solutions...
- Electrical power: 220V @15A used to run the vacuum pump + cryogenics