Hybrid energy module for environmental science experiments and studies

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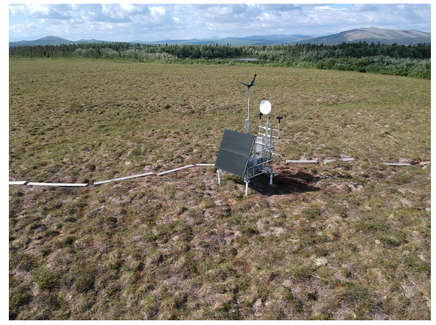
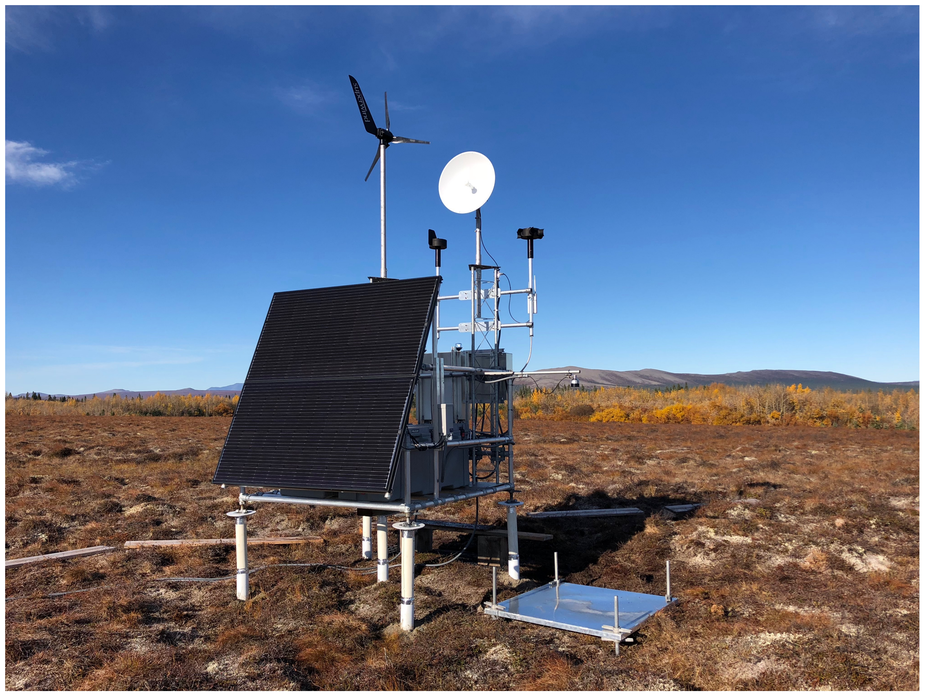
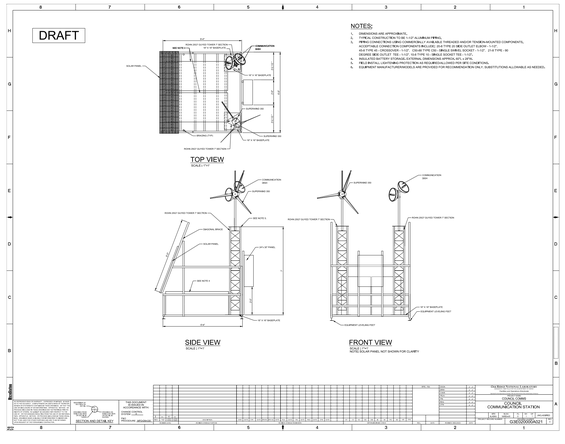


Increased concerns about regional and global climate change in recent decades has led to a significant expansion of monitoring, observational, and experimental sites in remote areas of the world. During this same time, advances in technology and availability of low-power equipment, have allowed increasingly sophisticated measurements with an increasingly wide variety of instruments. However, the deployment and use of these technologies in remote locations is restricted not only by harsh environmental conditions, but by the availability of electrical power and communication options. In some cases, research stations and military installations can provide power for scientific equipment, data acquisition, storage, and transmission. Clustering of research sites near existing infrastructure has the unintended consequence of limiting our spatial understanding of large geographic regions. Fortunately, the modern market offers many different power and communications solutions, but most of them are oriented towards large industrial applications. Use of those solutions to power a research site and associated experiment is very limited due to their cost and necessity of significant modification for the specific research applications. Each study has its own unique goal, agenda, need for proper instrumentation, and unique power requirement. A one size fits-all power and communication solution that could be used for a vast majority of implementations with or without modification would be incredibly beneficial.

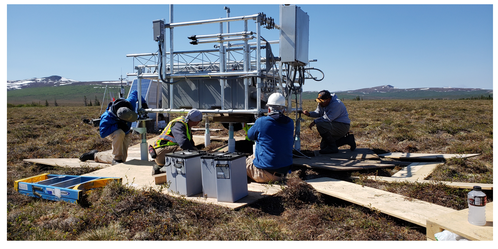
Council Experimental Site Power and Communication Module

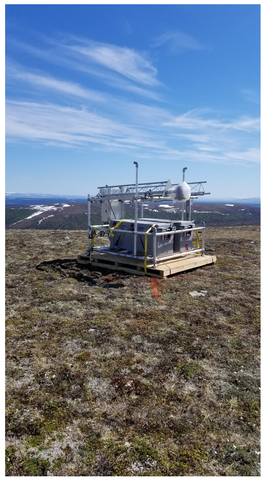
- The system was designed with scalability in mind; it is possible to scale the power and communications capabilities up or down depending on application and adapt it to different power needs
- Power sources (solar panels and wind turbines) can be easily mounted in different ways and quantities to obtain the power necessary for a given application
- Strong, rigid construction deployable in a harsh environment that will withstand winter and icing conditions, plus be strong enough for deployment using a helicopter
- Instrumentation can be mounted on the module itself; for medium and large stations, it is possible to add standard towers for instruments and sensors
- No need to use specially fabricated parts. All parts are available off the shelf and offered in different sizes which simplifies scalability of the whole system
- The frame-based design allows to use different materials for different environments and module sizes. For milder locations and small modules, the aluminum pipes used in this case can be substituted by PVC pipes, for example.
- Small and medium size stations can be setup easily and the entire module is transportable, albeit larger units may require additional design criteria focusing on weight
- All components (e.g., solar panels, regulators, batteries) are co-located. It significantly reduces and simplifies wiring and maintenance. Also, it takes less space at the experimental site.

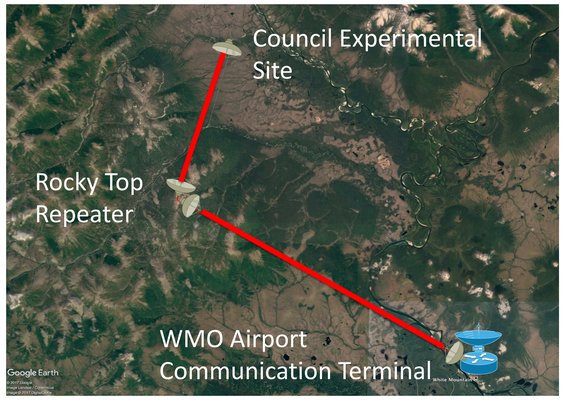




- Two 340W solar panels
- Superwind 350 wind generator
- Eight 405Ah AGM batteries
- Able to power ~40W of instruments
- ~10 days of autonomy
- Provides solar and wind power for instruments and sensors
- Serves as a central data collection station via wired or Wi-Fi connections
- Allows remote access and monitoring instruments
- Collects basic meteorological data







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