

ARDC Grant Valley Linking Project

Summary

Create a means to link all Voice of Idaho Amateur Radio Club's mountaintop repeaters into a wide area system covering most of South West Idaho.

Voice of Idaho Amateur Radio Club

PO Box 812, Boise, ID 83701-0812

Grant Director

Dr. Jackson Dunlap, K7MYU

Voice of Idaho Executive Vice President

jmichaeldunlap@gmail.com K7MYU@ARRL.net

Project Director

Jay Van Wormer, W6JVW

Voice of Idaho Technical Director

jvanwormer@socal.rr.com

Project Budget

Valley Floor (HUB)					
<i>Item</i>	<i>Qty</i>	<i>Description</i>	<i>Status</i>	<i>Unit Cost</i>	<i>Extended</i>
Controller	1	RCL Club DlxII	Inventory	\$0.00	\$0.00
UHF Repeating Link	1	TKR-850	Inventory	\$0.00	\$0.00
UHF Duplexer	1		Purchase	\$180.00	\$180.00
Link Antenna	1	Laird Omni	Purchase	\$175.00	\$175.00
ID Filter	1		Purchase	\$25.00	\$25.00
Link Coax	100	1/2" hardline (feet)	Purchase	\$1.50	\$150.00
Antenna Tower (30')	1		Inventory	\$0.00	\$0.00
Antenna Tower Installation	1		Purchase	\$3,000.00	\$3,000.00
			Site Total		\$3,530.00
Shafer Butte					
<i>Item</i>	<i>Qty</i>	<i>Description</i>	<i>Status</i>	<i>Unit Cost</i>	<i>Extended</i>
Controller	1	RC-210	Purchase	\$245.00	\$245.00
VHF Repeater	1	TKR-750	In-place	\$0.00	\$0.00
UHF Repeater	1	TKR-850	In-place	\$0.00	\$0.00
VHF Duplexer	1		In-place	\$0.00	\$0.00
UHF Duplexer	1		In-place	\$0.00	\$0.00
VHF Antenna	1		In-place	\$0.00	\$0.00
UHF Antenna	1		In-place	\$0.00	\$0.00
UHF Link Radios	2	GM-300	Inventory	\$0.00	\$0.00
UHF Link Duplexer	1		Inventory	\$0.00	\$0.00
UHF Link Antenna	1	Laird Y4063	Purchase	\$190.00	\$190.00
ID Filter	1		Purchase	\$25.00	\$25.00
Link Coax	100	1/2" hardline (feet)	Purchase	\$1.50	\$150.00
Remote Cut-off	1		Build	\$130.00	\$130.00
			Site Total		\$740.00

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Squaw Butte					
<i>Item</i>	<i>Qty</i>	<i>Description</i>	<i>Status</i>	<i>Unit Cost</i>	<i>Extended</i>
Controller	1	RC-210	Purchase	\$245.00	\$245.00
VHF Repeater	1	TKR-750	In-place	\$0.00	\$0.00
VHF Duplexer	1		In-place	\$0.00	\$0.00
VHF/UHF Antenna	1		In-place	\$0.00	\$0.00
UHF Link Radios	2	GM-300	Inventory	\$0.00	\$0.00
UHF Link Duplexer	1		Purchase	\$180.00	\$180.00
UHF Link Antenna	1	Laird Y4063	In-place	\$0.00	\$0.00
ID Filter	1		Purchase	\$25.00	\$25.00
Link Coax	100	1/2" hardline (feet)	In-place	\$0.00	\$0.00
Remote Cut-off	1		Build	\$130.00	\$130.00
Site Total					\$580.00

Snow Bank					
<i>Item</i>	<i>Qty</i>	<i>Description</i>	<i>Status</i>	<i>Unit Cost</i>	<i>Extended</i>
Controller	1	RC-210	Purchase	\$245.00	\$245.00
VHF Repeater	1	TKR-750	In-place	\$0.00	\$0.00
VHF Duplexer	1		In-place	\$0.00	\$0.00
VHF Antenna	1	4 Bay Dipole	In-place	\$0.00	\$0.00
UHF Link Radios	2	GM-300	In-place	\$0.00	\$0.00
UHF Link Duplexer	1		In-place	\$0.00	\$0.00
UHF Link Antenna	1	Laird Y4063	In-place	\$0.00	\$0.00
ID Filter	1		Purchase	\$25.00	\$25.00
Link Coax	100	1/2" hardline (feet)	In-place	\$0.00	\$0.00
Remote Cut-off	1		Build	\$130.00	\$130.00
Site Total					\$400.00

War eagle					
<i>Item</i>	<i>Qty</i>	<i>Description</i>	<i>Status</i>	<i>Unit Cost</i>	<i>Extended</i>
Controller	1	RC-210	Purchase	\$245.00	\$245.00
VHF Repeater	1	TKR-750	In-place	\$0.00	\$0.00
VHF Duplexer	1		In-place	\$0.00	\$0.00
VHF Antenna	1	4 Bay Dipole	In-place	\$0.00	\$0.00
UHF Link Radios	2	GM-300	Inventory	\$0.00	\$0.00
UHF Link Duplexer	1		Inventory	\$0.00	\$0.00
UHF Link Antenna	1	Laird Y4063	Purchase	\$190.00	\$190.00
ID Filter	1		Purchase	\$25.00	\$25.00
Link Coax	100	1/2" hardline (feet)	Purchase	\$1.50	\$150.00
Remote Cut-off	1		In-place	\$0.00	\$0.00
Site Total					\$610.00

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Bench					
<i>Item</i>	<i>Qty</i>	<i>Description</i>	<i>Status</i>	<i>Unit Cost</i>	<i>Extended</i>
Controller	1	RC-210	Purchase	\$245.00	\$245.00
VHF Repeater	1	TKR-750	In-place	\$0.00	\$0.00
VHF Duplexer	1		In-place	\$0.00	\$0.00
VHF/UHF Antenna	1		In-place	\$0.00	\$0.00
UHF Link Radios	2	GM-300	Inventory	\$0.00	\$0.00
UHF Link Duplexer	1		Purchase	\$180.00	\$180.00
UHF Link Antenna	1	Laird Y4063	Purchase	\$190.00	\$190.00
ID Filter	1		Purchase	\$25.00	\$25.00
Link Coax	100	1/2" hardline (feet)	Purchase	\$1.50	\$150.00
Remote Cut-off	1		In-place	\$0.00	\$0.00
			Site Total		\$790.00
Spare Equipment					
<i>Item</i>	<i>Qty</i>	<i>Description</i>	<i>Status</i>	<i>Unit Cost</i>	<i>Extended</i>
Controller	1	RC-210	Purchase	\$245.00	\$245.00
VHF Repeater	1	TKR-750 or equivalent	Purchase	\$900.00	\$900.00
			Spares Total		\$2,300.00
			Linking Project Total		\$8,950.00

Who are we?

The Voice of Idaho Amateur Radio club is a 501c3 nonprofit corporation. It is one of the largest amateur radio clubs in the Pacific Northwest. The VOI has been an ARRL affiliated club for over 45 years and is recognized as an ARRL Special Service club. <https://voiceofidaho.org/>

The VOI business plan states the following:

Our purpose is to further the exchange of information and cooperation between members, to promote radio knowledge, fraternalism, and individual operating efficiency in all aspects of amateur radio, and to so conduct club programs and activities as to advance the general interest and welfare of amateur radio in the community.

Specific Goals include the following:

- Member development
- Repeaters
- Learning
- Communication
- amateur radio Community

The VOI maintains five mountaintop repeater systems that, when combined, cover Southwest Idaho, a small portion of Southeast Washington, a large segment of Eastern Oregon, and Northern Nevada. The footprint ranges from Baker City, Oregon on the West, to Twin Falls, Idaho on the East. The footprint

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extends from McCall, Idaho on the north to Northern Nevada on the south. The VOI repeater system is a key tool for those engaging the Southern Idaho backcountry.

The repeater system is in regular use and carefully maintained. It is a key tool for local emergency communications and heavily used for outdoor activities, such as the Jet Boat Races, organized hikes, marathon runs, bicycle races, and car rallies.



Why do you want to do this project?

What are you trying to achieve with this grant, or - said another way - what is the problem you are trying to solve and how would the grant help you solve it? Why are these funds needed? Who will your project impact? Limit this field to 10000 words

The VOI is creating a means to link all Voice of Idaho Amateur Radio Club's repeaters into a wide area system covering most of South West Idaho.

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A primary goal is to improve amateur operator to amateur operator VHF/UHF communication across the region. Infrequent use of some machines in the region reduces operator-to-operator communications and often leaves newcomers with no one to talk to. Some of these leave the hobby behind.

Another goal is to be better able to control the repeater system from a single location that is close to Boise, Idaho. Since repeater sites are only physically accessible for short windows each year, the VOI needs a central location to be able to control the repeater system. By linking the machines, and controlling them from an accessible location, it becomes possible to generate and manage a wide area repeater network. The vision is that anyone with a hand held radio will be able to access the entire repeater network. The primary mode is to link all machines. Individual machines can be unlinked to fulfill special tasks and needs.

An important goal is to enhance emergency communications in the region. There are at least three major aspects to this goal. Many Idahoans take advantage of the wild and unpopulated areas of the state, where cell-phone access is not available. This activity includes hunting, whitewater sports, hiking, camping, snowmobiling, and cross-country skiing. Often, these individuals are only able to access one local repeater with limited emergency support. By linking the machines, access extends across the region and extends the ability to reach emergency services, when needed.

Current use of Voice of Idaho Amateur Radio Club repeaters indicates that there is a deep need for linking repeaters. The general view is that all of these machines should be linked full-time in normal operation, with on-demand changes as needed for local events, such as Ride Idaho and the Jet Boat races on the Snake River. Current linking is spotty and unreliable. The goal is to bring the system to a full and robust state that is easily and effectively managed in a winter accessible location (The Treasure Valley floor).

A second aspect is extended, reliable, communications for local government agencies and hospitals in an emergency.

A third aspect is In the event of a major seduction zone emergency in Oregon and Washington (expected and planned for by FEMA) Boise is designated as a major staging area for goods, equipment, and personnel. This linking project creates a footprint that covers the entire Boise area and provides wide-area communication to support the staging operations.

Considerable club resources are included in this request. The VOI relies on donations and dues to maintain a large system of machines. The expertise and much of the equipment for this project is supplied by the VOI. We seek a partner to provide funds to complete the project.

What is your project plan?

Share your plan for carrying out the grant. What steps will you take? When and how will you do the work? How will you know if you were successful? Share your plans in as detailed terms as you can. More expensive and complex projects should be supported by more detailed plans. Limit this field to 10000 words.

0) Establish a permanent valley floor linking site

Two sites are being considered that have direct access to all five VOI repeater sites as well as two additional planned sites.

The linking site has to be accessible 24/7 all days of the year.

1) Downlink Transmitter ID

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There is a problem with generating ID on the link downlink transmitters. It is not desirable to have this ID go through the Controller and back up the link to the repeater transmitter. In addition, generating an automatic downlink ID in accordance with Part 97 requirements is difficult. We plan to program a micro-controller to monitor the PTT line to the downlink transmitter, and generate a Morse Code ID under the two following conditions –

- a) 15 seconds after the last transmission in a sequence of transmissions lasting less than 10 minutes, and
- b) Every 10 minutes into a sequence of transmissions lasting longer than 10 minutes.

Note that the a) condition assumes that, in a sequence of transmissions in a normal QSO, the intervening pauses would be less than 15 seconds, and that a b) event would cancel an upcoming a) event. It is also necessary to prevent downlink IDs sent under condition a) from being repeated by the Controller, and to prevent IDs generated under condition b) from being heard through the Controller along with the repeated voice.

A Voice Detector circuit and some COS logic at the Downlink Receiver can prevent the a) condition ID from triggering the Controller. If voice is not present when the ID occurs, downlink COS would be blocked from the Controller.

For the b) condition ID, a narrow-band Notch Filter in the received audio from the Downlink Receiver would prevent the ID tones from being heard, without affecting the repeated voice.

2) Security from hackers

Legitimate repeater users who send touch-tones to activate commands will first key up, announce their call and intention, and then send the tones. Hackers just key up and send tones without any ID.

A circuit which monitors the receiver audio to detect both voice energy and touch tones can be set to disallow the receiver COS from reaching the Controller if the tones come without preceding voice ID.

With this circuit, a touchtone hacker would not gain access to the Controller to activate any command. A monitor at the downlink receiver would also guard against hackers on the downlink frequencies.

The circuit can easily be created on a printed circuit board, which will allow easy implementation at any desired location.

3) Mountaintop Transmitter Remote Disable

A UHF receiver with DPL decode, set to an odd frequency outside the UHF repeater band, along with a touch-tone decoder, can be used to remotely disable both the main repeater and downlink transmitters.

The UHF receiver could be one of the inexpensive Baofeng handheld radios.

4) Audio Delays

Because of the key-up delays and decode delays in the sequence of transmitters and receivers in the system, it is recommended that audio delay circuits be inserted in the RX audio line at each receiver.

A universal audio delay board can be easily made, using the PT2399 Audio Delay IC, which can produce audio delays from 40 to 350 ms, with 0.5% audio distortion. Fifteen of these delays would be required.

6) Integration of functions

The Downlink Receivers will have a number of special functions included in their RX audio chains – Audio Delay Hacker Touch-Tone blocking of COS Blocking of COS when ID with no voice ID tone filtering.

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Each mountaintop system will also have a number of special functions – Audio delay for both main and link receivers transmitter enable/disable for both main.

Describe your outreach plan.

For example, how will you recruit people to participate, volunteer with you, or collaborate with you? How will you share the results of your work? Limit this field to 10000 words.

The planning for this project was initiated by the VOI board of directors. The project was assigned to the VOI Technical Committee with support by the VOI board and the VOI Marketing Team.

The VOI Technical Committee formed a team that has conducted extensive planning. This team has the expertise and capability to complete the project. The team and Technical Committee has a number of experienced electronic engineers, some retired, and others still working for high-tech companies.

The availability of the linked system will be made known on the VOI repeater nets and advertised across the ARRL section using allidahohams@gmail.com. Frankly, much of the local ham community is aware of this project and anxious for it to go into operation.

How does your project align with ARDC's mission and granting goals?

For more information, visit mission and grant making goals. Limit this field to 10000 words.

Category:

- **Support and growth of amateur radio.** Extends repeater infrastructure, improves emergency communications projects, expands interest and access to amateur radio (particularly to Technician Class operators).

ARDC Goals:

- **Broad reach.** The project is a benefit to the entire Southwest Idaho amateur community as all VOI machines are open machines with access tones made public.
- **Social over commercial benefit.** The project is beneficial to society through maintenance of reliable communications systems when needed in emergencies. This is a benefit to government, hospitals, and the general amateur community.
 - The VOI portion of the project is funded by gifts, donations, and club dues. There is no commercial resource involved.
- **Empowerment of individuals, and distribution rather than centralization.** The current and future VOI repeater systems are available to entire amateur community. These systems provide, and this project extends, safety in the backcountry through access to resources not always available through each repeater. All VOI repeaters are general use repeaters for all amateur operations. Hopefully, the linked machines will engage more local Technicians and help to extend their Aculturalization to the hobby.

Who will carry out your project?

Please share who will carry out the project, and briefly tell us about the skills they have to do the work. Limit this field to 10000 words.

Primary: Valley-wide Linking Project Team. VOI Technical Committee.

Supporting: VOI Marketing Team. VOI Board of Directors.

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How does your project fulfill ARDC's open access goal?

For more information, visit grant making goals. Limit this field to 10000 words.

ARDC Open Access Requirement.

- All VOI repeaters are open. VOI welcomes groups who need to use our machines for various activities. VOI welcomes responsible non-VOI nets. VOI repeaters are routinely available to groups for various activities, such as the Idaho Rally, Ride Idaho, and Jet Boat Races.

Supporting information

Supporting information (text field). Limit this field to 10000 words.

Background

The Voice of Idaho Amateur Radio Club maintains a number of VHF, UHF, and digital repeaters. These machines were initially linked and independently provided communication that when combined extended from Northern Nevada to McCall, Idaho and into portions of Eastern Oregon and Southeast Washington. The east-west footprint ranged from Baker City, Oregon to Twin Falls, Idaho. Overall, this network covered the vast majority of Idaho's population, as well as Idaho's capitol city. Over time, this system has deteriorated and needs to have its linking systems restored and upgraded. A major problem is limited access to repeater sites. Another problem has been the ability to access and control the repeaters from a single, remote location.

Under normal conditions, these machines are entirely supported and maintained by the Voice of Idaho Amateur Radio Club from private, personal donations in tiny amounts. This process will continue into the future as it has for over 30 years.

Recently, the Bureau of Land Management made decisions to refurbish their Cinnabar Mountain Site – a site used by VOI for at least 20 years. The Voice of Idaho Amateur Radio Club was required to remove its equipment until basic infrastructure could be rebuilt by BLM. Due to the slowness of BLM in making the necessary changes, the Voice of Idaho Amateur Radio Club abandoned this site. A year or so later, a gift of an unused telecommunications site on War Eagle Mountain was provided to the Voice of Idaho Amateur Radio Club. This site is now owned by the Voice of Idaho Amateur Radio Club, and the land leased from BLM. This site has over 90% of the range of Cinnabar Mountain. All power is generated on site by solar panels. The Voice of Idaho Amateur Radio Club has plans and has allocated funds to upgrade this site to be the flagship repeater of the Voice of Idaho Amateur Radio Club network. The site is in regular use with power, building, and antenna upgrades planned for the summer of 2024.

The second key site is Snowbank Mountain, near Cascade, Idaho. This site is managed by the United States Forest Service. Significant refit of the site is scheduled to meet current and future needs. This site covers much of the internal recreational areas of southwest Idaho.

The most important site is on a peak at the Bogus Basin ski resort, north of Boise, Idaho. This site provides access to the majority of Boise, Idaho. Access to the site is severely limited by winter snow and ice. Accessibility is limited to a few months a year. The club plans restoration of this facility the summer of 2024. At that time, we plan an extension of the digital communication resources at this site.

Recently, the Voice of Idaho Amateur Radio Club was granted access to a site on Squaw Butte outside of Emmett, Idaho. This site is difficult to access due to deep canyons that retain snow. The benefit is that this site opens communication into Boise and Valley counties, which are prime recreational areas. (The city Boise is in Ada County. Boise County is a rural county north of Boise.) Another benefit is that this

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site has commercial power and internet access. The Voice of Idaho Amateur Radio Club plans to extend the capability of this site over the summer of 2024.

The fifth site is a downtown Boise repeater located on the Boise Bench. This provides coverage of areas of the capitol city that are shaded from the Shaffer Butte machine.

It is clear that with the significant maintenance needed, and planned upgrades, the Voice of Idaho Amateur Radio Club resources are strained. At the same time, there is a genuine need for assistance in the valley-floor linking project. The valley-floor linking project is a high priority and is critical to a fully built out, repeater based, emergency communications system. Among the items listed in the Business Plan Development, the valley-floor linking project was number one among Voice of Idaho Amateur Radio Club contributors. It has been widely discussed and is the major topic considered in technical committee meetings.

Each of these sites is designed to have a 144 MHz repeater, a 440 MHz repeater, an Automatic Packet Reporting System digi-peter, a D-Star repeater, and linking transceivers. The linking transceivers ensure that any operator that can reach one of the repeaters, can link through to any of the other repeaters. (In emergencies, all the links are brought up so there is one monolithic network.)

In summary: Under normal conditions, this expanding network has been maintained and operated for over 30 years. Challenges in refurbishing sites to meet government desires, replacement of equipment, and expansion exceed the ability of the local amateur radio operators to fund the changes.

What Are We Contributing?

First, our technical team, some of whom are electrical engineers, provide the all of the technical expertise to make these changes. A standing committee of technically expert Club members meets regularly to discuss and implement technical items. A sub-committee is focused only on the Valley-Floor Linking project.

Second, the Voice of Idaho Amateur Radio Club yearly allocates essential funds for maintenance. In addition, a surprising number of individuals have donated funds specifically designated for this project. The Voice of Idaho Amateur Radio Club technical committee has the expertise to design, install, and maintain this equipment.

How Is This Equipment Currently Used?

- General amateur radio use.
- Public Service. Support of public events including bicycle races, Idaho Rally, and special events.
- Training and maintenance of a cadre of trained operators, as well as operators with net control skills.
- Support of local emergency networks, including ARES and support to Idaho Emergency Management.
- Support to government agencies and hospitals in times of limited communications and emergencies.
- Communication between and among regional amateur radio operators.
- Support to citizens traveling through the region who possess amateur radio licenses and equipment.