TITLE. The Efforts to Repair, Improve, Preserve and Advance Amateur Radio Activities at the University of Michigan

BUDGET. $5026.00

AUTHORS.

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Abstract optional:

The use of "wired" telegraphy, at the University of Michigan, can be traced back to 1858. In its earliest form, telegraphic messages, using cipher codes, were sent from the campus Observatory to Observatory's in New York, Alabama, Massachusetts, New Hampshire, Kentucky, South Carolina and Pennsylvania. Later, time and meteorological data were sent from the Observatory to railway stations and the City of Detroit.

Unknown to many, Samuel Morse, Alfred Vail and Henry Tappan served together as faculty at the University of the City of New York (NYU). Tappan would later become the First President of the University of Michigan. In 1868, Morse's claim to having invented the telegraph was disputed. Tappan would provide his recollections of the events and his use of the telegraph at NYU. (Attachment 1)

In the same year, University Professor Alexander Winchell gave the first classroom lecture on Morse's Telegraph. (Attachment 2) Shortly, thereafter, Professors Augustus Trowbridge and Karl Guethe successfully demonstrated "wireless" telegraphy during a classroom presentation. However, it was not until 1913 when the importance of "wireless" telegraphy became widely publicized. It was the university wireless operator, Benjamin Burglund, who heard the frantic calls from Wapakoneta, Ohio pleading for help. Burglund, using the university's 15 kw transmitter, would ask any stations to respond and to provide assistance to the State of Ohio. The following year, Hiram Percy Maxim and Clarence Tuska would suggest the need for an informal method to relay critical messages. Thus the American Radio Relay League was formed.

To continue this long-standing legacy at the University, the Amateur Radio Club is seeking this ARDC Grant to complete the following 4 projects:

1. **During 1982**, members built a 2M repeater and a single-site 10M cross-band repeater. Both repeaters have existed in Weiser Hall (former Denison Bldg.) since 1982. During

the time from 1997 to 2003, the club became inactive and several items of the crossband repeater, only, were either destroyed by weather, theft and/or lack of maintenance. No attempt was ever made to repair this equipment in part due to the poor band conditions that existed during those years and limited amateur radio participation. Furthermore, in 2017, Weiser Hall was closed for 2 years to undergo extensive building renovations including upgrades on the mechanical floor and roof where the repeaters are housed. (Attachment 3) No damage occurred to the 2M repeater equipment during these years. When the building re-opened in 2019, the cross-band equipment was re-assessed with notation of the damage and missing components.

With an renewed interest and improving band conditions, members would like to make the needed repairs to restore the 10M cross-band repeater as a split-site repeater. The original site will remain in Weiser Hall and the split site be located at the Electrical Engineering and Computer Science Building on north campus; the permanent location for W8UM / W8AXZ. This is the only 10M repeater in the State of Michigan. The 10M (29.640 MHz) and cross-band 70 CM (444.975 MHz) frequencies are presently registered under the W8UM call sign Trustee (WD8DPA).

2. **W8UM was gifted a new Ameritron AL-82 amplifier**. However, our radio room is without a 220 v outlet. Mistakenly, the quote the club obtained was for a 120v 20a outlet rather than the necessary 220v outlet. We do not believe that a 220v estimate will vary significantly than the existing quote.

3. **The History of Telegraphy Project** at the University of Michigan, initiated during 2013, has resulted in 5 articles and 3 formal presentations. Uncovered, at the Bentley Historical Library were writings dating to 1868; the first classroom lecture on Morse's Telegraph and Henry Tappan's letter in defense of Morse's telegraph patent. Additionally, over 200 pages of news article referencing the amateur radio club activities have been photocopied. We would like to digitize these photocopies for preservation. This will be made available to the membership and campus media services for distribution and promotion of amateur radio.

4. **High-Altitude Balloon Tracking Program**. Over the past 2-years, engineering and aerospace students have approached the Amateur Radio Club asking for assistance in FCC Rules interpretation, transmitter power limits, transmitting distances, antenna design, APRS beaconing and band plan interpretation to aid in facilitating their classroom projects. These student projects have involved telemetry data from CubeSats, Mars Rover and high-altitude balloons.

   As a permanent solution to tracking high-altitude balloons, our members created a Linux based program that automatically controls the azimuth and elevation of the satellite antennas solely on RF signals received directly from the balloons. This allows signal beaconing to occur at any frequency without interfering any on-going APRS data. This also facilitates in balloon recovery for the students. Assistance with this project was aided by WB2OSZ, developer of Dire Wolf. (Attachment 4)

To improve upon this method, the club intends to provide a dedicated VHF receiver for the above. The club does have the necessary antennas, rotor and rotor controller in storage. Lacking is an antenna coax selector and rotor controller wire.

PROJECT WEBSITE. umarc.eecs.umich.edu

Further information on either W8UM or W8AXZ can be found at QRZ.com

CONTACT PHONE. 313-600-0200 cell, John Palmisano

FISCAL SPONSOR. The University of Michigan has 501(c)(3) non-profit tax exempt status

EIN. 38-6006309.

ADDRESS.

W8UM / W8AXZ

Room 4436 Electrical Engineering & Computer Science Bldg.

1301 Beal Avenue

Ann Arbor

MI., 48109

COMPLETION TIME. Approximately 5 months to complete all projects listed

ARDC Grant CATEGORY

X Support & Growth of Amateur Radio

X Education; to assist in the education process / lectures

X Research & Development

X Other Repair and improvements to existing

Who is the Organization and its Mission: The "Wireless Station" at the University was originally formed as a service to rapidly exchange communications between faculty on campus and scientific teams abroad. Since, our mission at the Amateur Radio Club is to make amateur radio resources available to both the

campus and surrounding community by providing the necessary resources to accelerate the many on-going activities involving the education, reception, transmission and experimentation of radio signals.

Our membership encompasses across a broad spectrum including university students, faculty and staff, alums, university retiree's, professionals from the medical center and interested individuals from surrounding communities, all who enjoy amateur radio and the academic lectures and workshops hosted by the amateur radio club. (Attachment 5) The club has an active Radio Repair & Restoration Group, (Attachments 6, 7) a history research group and a high-altitude balloon-tracking program. The individual leading these efforts at W8UM is our club president (Kimberly, KE8QKU). Kim's artwork, "The Train", has recently been selected to travel to the International Space Station in May 2022. (Attachment 8)

Interest in amateur radio saw a resurgence on campus following construction of the Electrical Engineering and Computer Science Building in 2003. The following year, structural engineers completed their assessment and a 40' tower with a SteppIR went on the air. Today, the relatively inexpensive cost to obtain a hand-held radio, increased student interest in designing cubesats, sending and receiving telemetry information, antenna design and theory and RF experimentation can all be accomplished with a Technician level FCC license. Perhaps one difficulty experienced by the Amateur Radio Club is convincing these students to go beyond their required coursework and pursue a high level amateur radio license. Presently, the Amateur Radio Club is viewed, by some, as an adjunct to their required studies. Despite this, the Amateur Radio Club does provide a valuable service and does introduce these students to the field of amateur radio. (Attachment 9)

Why Doing this project: Because of member's interest, the Amateur Radio Club has defined 4 separate projects that could be completed with the financial assistance of ARDC. These projects include;

1. **Repair and improvements to the 10M Cross-Band Repeater**. As described, the 10M, 220 MHz and 440 MHz antennas were not located on the roof and believed to have been damaged and discarded prior to 2017. Following the recent building renovations, the repeater cabinets were re-located and coax is needed to extend to their current location. In addition Combiners and a Controller were also missing from the cabinet.

   Certainly, improving band conditions has renewed Member interest in this repeater. Also, there are Technician Level individuals who view this as their introduction into HF communications. Of particular interest, this is the only 10M Repeater in the State of Michigan.

   The costs and individuals items necessary to complete this project include;

1.	Antennas $1120.00		Cost ($)
	a. Hygain SPT 500	29 MHz - 5/8 wave antenna	250.00
	b. Hygain SPT 500	29 MHz - 5/8 wave antenna	250.00
	c. M² 222-5SS	220 MHz antenna	190.00
	d. M² 222-5SS	220 MHz antenna	190.00
	e. Diamond F-718A	440 MHz - ½ wave antenna	200.00
	f. Miscellaneous Mounting Hardware		40.00
2.	Combiner $120.00		
	a. Comet CF-4160J		59.00
	b. Comet CF-4160J		59.00

3. Duplexers $85.00
    a. MFJ 916BC 440 MHz Duplexer 85.00

4. Controller $290.00
    a. Controller for 440 Repeater – 28 MHz Transmitter $290.00

5. Coax $690.00
    a. 100' RG8/U Coax (Belden 8214) ($2.31/ft) $231.00
    b. 120' LMR 600 Coax (Davis RF) $280.00
    c. 330' of LMR 400 Coax (Talley) $410.00

6. Miscellaneous Antenna Mounting Hardware $40.00

Total $2574.00

2. **W8UM was gifted a new Ameritron AL-82 amplifier**. Mistakenly, the quote the club obtained was for a 120v 20a outlet rather than the necessary 220v outlet. Regardless, financial support from the ARDC would be used to install a 220v outlet. This is not a high-priority problem but would allow members to use a full legal limit power amplifier. The attached quote from the Architecture, Engineering and Construction Services is for $1900.00 (Attachment 10)

3. **The History of Telegraphy Project was entirely accidental**. It began with organizing the thousands of QSL cards received over the years. This led to the organization of meeting notes and agendas. Among these papers, names like Albert Kahn, John Kraus, Jack Burchfield, The Greater Rockford and the Untin Bowler were found. This led to further research at our Bentley Historical Library where additional information was uncovered.

   Presently, there are 14 binders containing these documents. One collection is entirely from the campus newspaper, The Michigan Daily. This binder alone contains over 200 photocopied pages that chronicle the development of telegraphy and club activities dating back to 1868. The club would like to digitally preserve these for our Members and distribute to the news and media services at the University. This would be a valuable asset in bringing attention to amateur radio and its many contributions.

   The cost to digitize each page is $0.49 / page. The club estimates the time to complete this would be 5 hours at $15/hour. The total amount to complete this process would be $174.00.

4. **The Amateur Radio Club has provided assistance to many students** who participate in classwork offered in aerospace, communications and telemetry. Support is primarily in the form of providing FCC Rules interpretation, fox-hunting skills, novel methods to track high-altitude balloons or improving communications between multiple users and vehicles.

One recent project involved using RF signals from 5, high-altitude balloons to automatically control the UHF/VHF satellite antennas. This, along with assistance of Dire Wolf, allowed non-APRS signals to be displayed on APRS.fi without interfering with current APRS activity. This program, written by amateur club members, will be made available to campus aerospace students and any organization looking to improve their balloon tracking and retrieval.

A secondary use for this same equipment is also being implemented. Recently the amateur station has began tracking radiosondes from National Weather Service Balloons. Additionally, the club is also preparing to participate in the MOTUS Wildlife Tracking Program.

W8UM has a second pair of UHF/VHF antennas and a rotator dedicated entirely to high-altitude balloons. To make this fully operational, both an antenna selector switch and rotator control wire are needed. The total amount would be $378.00.

1.	RCS-8VL Remote Coax selector	$295.00
2.	8-conductor #5971 rotor wire, 120' ($0.69/ft)	$ 83.00

1. The most complex project entails repairs to the 10M Cross-Band Repeater. While not difficult, this will be a split-site repeater and does require a fair amount of planning. Fortunately, the Weiser Hall site is partially intact; some coax remains, electrical service is in place and the radios are secured in a lock cabinet. Since this will be a split-site, cavity tuning and the like will not be necessary.

   The outdoor work will include the building of the vertical antennas and tuning to the correct frequency. The antenna location, along the building walls are available and without any obstruction. Members will need obtain wall mounting hardware to secure the antennas.

   This same process will occur at the Electrical Engineering & Computer Science Building following completion of the above. Similarly, the radios are housed in the W8UM/W8AXZ room. In this 4th floor room, there exists two coax chutes to the roof. This will provide access for the additional feed lines to the roof. There is ample roof space to secure the vertical antenna. Additionally, there is space on the 40' tower to attach the link antenna.

   The club has 2 active members who are each Certified Tower Climbers who can complete the necessary tower work without any cost.

2. Installation of a 220v outlet will be completed by a licensed electrician at the University. A work order will be completed and work will be commence once a date has been determined.

3. The digitizing of club documents will be time consuming and requires patience. Given that each paper is already in a transparent protective sheet, each page will need to be digitized individually. We expect this process will not occur until the students return to campus in the Fall 2022 and may take 3-4 weeks to complete.

4. The high-altitude balloon tracking program is in a temporary form. The goal is to establish a permanent system for the students. W8UM has the major components and is lacking only the rotator control wire and an antenna coax switch. Work will be completed by the 3 individuals who are providing assistance to the aerospace students. The time estimated to complete should be less than 4 hours.

HOW DOES THE PROJECT ALIGN WITH ARDC MISSION

The mission of the University of Michigan is to apply, disseminate and preserve knowledge by providing its students and faculty with the values to create leaders. Similarly, the mission of Amateur Radio Digital Communications is to support and promote amateur radio in its broadest forms.

During the recent 20-years, the amateur radio club has been a "location" where students with an amateur license or those having an interest in amateur radio can use the station equipment at their pleasure. However, with microcircuitry, and relatively inexpensive components, students and faculty are finding new ways to use radio waves in their coursework. As a result, the amateur radio club is now seen as a resource to students in engineering, physics and ornithology studies.

In addition to the assistance performed on campus, members make themselves available to other amateur radio operators with limited mobility and / or surviving spouses with the installation or removal of antennas and such items as needed. Members also volunteer by providing radio support to the Program to Educate All Cyclists, a bicycling event that empowers individuals with disabilities.

WHO WILL CARRY OUT THIS PROJECT.

1. The purchase and installation of the needed items for the Cross-Band Repeater will be completed by our Radio Repair and Restoration Group. These individuals all hold FCC Extra-Class License's and include a Senior Engineering in Engineering (KB5AW), an Emeritus Professor (K8EV), a Professor in Electrical Engineering (AC8YB), a Ph.D. student in Mathematics (KE8SWM), a Radio Service Engineer (W2PUT), an Automotive Engineer (KB8RCO) an Electrical Engineer and Club Trustee (WD8DPA) and an Engineer/Physician (N4IYL). All work will be performed under the guidance of the Station Manager (KB8OIS) and the Engineering Faculty Advisor (AC8YB). This would be completed over a 3-week time period.

2. The installation of the 220 v electrical outlet will be completed by the Architecture, Engineering and Construction Services at the University of Michigan. This process will only take 1-day but will depend upon their scheduling.

3. The digitizing of the historical W8UM articles will be offered to a student member as their contribution to club activities. Due to the volume of pages, this would be completed over a 3-5 weeks.

4. The installation of a remote antenna switch and cables for the high-altitude balloon project will be completed by KB8RCO, KE8AQW and KB8OIS; author and contributors of the attached high-altitude balloon article. This would be a 1-day project to complete. Cable pulling could be completed simultaneously with the 10M Cross-Band or at any time before or after, The antennas and rotator are currently on-site, in storage, and the coax chutes and roof access are readily accessible.

HOW DOES THIS PROJECT FULFILL ARDC OPEN ACCESS GOAL

1. Support and growth of amateur radio
2. Education
3. Technological innovatio
4. Social benefit academic and community interest in amateur radio, supporting community events
5. Inclusion many members are foreign student of students with disabilities who enjoy communicating using amateur radio
6. Promote amateur radio
7. expand the infrasctucture
8. Broad reach
9.

Attachments:

DATE SUBMITTED. 04/25/2022