



## Motivating Amateur Radio Clubs to Open New Initiatives (MARCONI)

### Program 8: Amateur Radio and Balloon Science

Training Program Director: Ray KC1QLS

## Operational Guidelines

**Statement of Program Purpose:** This project looks to increase awareness of ham radio and its capabilities to those not currently in the field while enhancing knowledge and excitement of the hobby to those already licensed. Balloon launches attract a great deal of attention. This is not about ballooning per se, rather it is an avenue to attract young people to the hobby of amateur radio through STEM activities, as well as offering existing hobbyists a renewed excitement for trying something new.

**Specific Outcomes:** All of the outcomes for this program are centered around education, camaraderie, and fun. More specifically, this program looks to:

- Make young people aware of ham radio through STEM based activities involving balloon tracking, with initial outreaches through organizations like educational institutions and scouting.
- Provide an educational activity to those interested in the hobby as well as those already involved in the hobby.
- Provide new avenues for older amateur radio hobbyists.
- Provide an activity that will bring members, both old and new, together within a club.

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- Grow membership in the Meriden Amateur Radio Club (MARC).
- Provide avenues for joint experiences between MARC and other amateur radio clubs looking to grow and/or reinvigorate their organization.

**Project Vision:** The project vision is to offer a learning experience in amateur radio, specifically low power, long-distance, high-altitude communications. During the first year the project will bring both experienced (older) hams and newer hams together on a shared project, experimenting in areas many hams have not tried, and building a camaraderie within the club.

Moving into the second year and going forward, MARC will develop a community outreach program based around the balloon launches. These launches will come with educational talks regarding all aspects of the project (ballooning, ham radio transmitters, solar cells/panels, atmospheric conditions, launching and tracking). An emphasis will be placed on ham radio, with groups touring the MARC facility and radio room, as well as being introduced to all of the activities the club is involved with, including our work with the town of Wallingford. Our hope is to transition people we impact in our community outreach to our licensing education programs, getting people licensed and active in amateur radio.

**Balloon System Development:** Key to our program is the balloon platform. To achieve the maximum number of balloon launches we need to keep our cost per launch to a minimum.

We have chosen to use the WSPR (Weak Signal Propagation Reporter) protocol, allowing us to transmit at very low power and achieve great distances given the projected height of our balloon. If the balloon travels large distances, our transmissions should be picked up all over the globe on fixed frequencies. All WSPR data is uploaded to a common database ([WSPRnet.org](http://WSPRnet.org)), by anyone spotting our transmissions.

We will use the QRP Labs U4B WSPR board, offering a great deal of features and flexibility at a very reasonable price. The board comes configured to transmit two messages:

- The first message is a standard WSPR message.
- The second message is a telemetry message that sends encoded information using the standard WSPR format.

For our project the data transmitted between these two messages includes the club callsign (W1NRG), Maidenhead Grid Locator, signal strength, GPS data (latitude, longitude, altitude), solar panel power level, and temperature. Power output is about 27 mW.

To achieve a high altitude each of our launches will use a single pico-balloon. These balloons are readily available and relatively inexpensive. Exactness in preparing the balloon, filling it with the correct amount of gas to give it an appropriate amount of lift, and keeping the overall weight of the total balloon system to a minimum are all important factors in our achieving success. A successful flight might last for six or more hours, or possibly last for days as the platform attempts to circumnavigate the globe.

The final design of the balloon system consists of a single pico-balloon with a twenty foot long piece of 5 pound test braided fishing line hanging from it. Attached to the bottom of the fishing line is our platform, made from a foam board. Four pieces of 5 pound test fishing line are attached to each corner of the foam platform and tied together several inches above the surface of the foam board. This is then attached to the bottom of the cord hanging from the balloon.

Mounted on the top of the platform are seven solar cells, with the U4B mounted underneath the platform. A GPS antenna as well as a 20 meter dipole are connected to the U4B. One leg of the dipole attaches to the 20 foot braided cord and runs vertically upwards to the balloon. The second leg of the antenna hangs underneath from the board.

**Balloon Tracking:** Before preparing for any launch we need to make sure we have a good way to monitor our transmissions. When close enough, our transmissions are easily received by radio. The balloon is also easily monitored using [wspnet.org](http://wspnet.org) or [wspnet.rocks](http://wspnet.rocks). These sites work well for monitoring where WSPR transmissions have been spotted around the globe. QRP Labs also provides a means to track the U4B board on their website. As well as displaying data, QRP Labs also tracks the path of the balloon system on a map.

An important part of this project is the development of a club website specifically programmed to track the club balloon launches. This website, [U4B.live](http://U4B.live), was developed by one of our club members, and has become the primary tracking site used by club members and given to people attending our outreach activities.

**Project Outreach:** Key to our program, is its use for outreach to the local community, local educational institutions, and other radio clubs. We know that ballooning raises a lot of interest, and through ballooning we hope to raise a great deal of interest in ham radio. Getting young students and scouts interested should prove to be relatively simple, but being able to get them to a launch early in the morning, especially when they were in school may prove to be a problem.

Our answer is to prepare everything for a launch, and then provide a one hour weekend session where we can present the upcoming launch, and everything that went into its preparation. Part of these presentations will include YouTube videos and pictures from prior launches, as well as screen shots of past tracking data from various websites.

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These presentations will cover a wide range of topics including ballooning, ham radio transmitters, solar cells/panels, atmospheric conditions, launching and tracking. At the end of our presentations there will be a tour of the radio room and antenna farm that will hopefully peak their interest in ham radio as well. Each person would leave with information about the club, ham radio, a club application, and a web link to monitor the our balloon system when it is launched.

When working with other clubs, we will get them involved at a more technical level with our launches, as well as help them to get launches of their own off the ground.

We have met with Steve (K5ATA) the ARRL Education and Learning Manager, and we are planning to work with Steve and his team, sharing our knowledge of balloon launches and what we are doing with WSPR. This activity will allow us to outreach far beyond our local community.

We will also make presentations at the CT Hamfest, several local libraries, and submit one or more articles in hopes of a publication in an ARRL magazine.

**Project Cost:** Our proposed budget totaled \$1686, that included:

- Balloons, Support Hardware, Helium Gas (\$695)
- Solar Cells, Wiring, Mounting (\$211)
- Electronics, Antennas (\$680)
- Outreach (\$100)

**Key Focus:** With everything mentioned above, our focus centers around our three major goals, education, camaraderie, and fun. These goals drive amateur radio as a hobby, and are the cornerstone to this portion of the MARCONI initiative. Inside the MARC this project has found a great deal of interest and excitement within the membership, all focused around our goals of education,

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camaraderie and fun. As we move into the outreach phase of our program, it seems reasonable to expect the same response as we generate new and/or renewed interest in the field of amateur radio.

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### **MARCONI PROGRAM**

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