What's this business about getting an Amateur Radio license?
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Why do we use Amateur (ham) Radio in ballooning?
We all have a strong incentive to track our balloons and recover our payloads (so we can fly them again). Optical tracking is next to impossible, and accurate optical tracking would require triangulation, and even then the odds of being accurate enough to find a downed payload in anything but flat, treeless terrain are not good. Radio tracking can provide a beacon, that specialized direction finding equipment can be used to point the way. Even better, with the advent of the Global Positioning System (GPS) our package can report its position directly to us at all times. With the proper equipment it can broadcast its latitude, longitude and altitude (and other cool things like velocity and direction of travel!) using a system called Automatic Position Reporting System (APRS). The most convenient approach for communications from the balloon is to utilize ham radio, which requires an operator's license.

Ham radios are a consumer product, that means they are mass-produced, and consequently are reliable, relatively inexpensive, and easy to use. What's more, they can be equipped with (or come with) a data modem that allows them to transmit the GPS information via the APRS system. Battery operated portable transceivers, called HTs (HandiTalkies), are small enough to fit in the palm of your hand and weigh only a few ounces, making them ideal for the command capsule.

In addition to providing telemetry from the balloon, Ham radios find another very practical use in ballooning, communications between people in remote and disparate places. Balloonists use Ham radio to stay in contact with their team, during launch preparation, during flight, and especially during recovery when the team may be located at several different locations.

Not just anyone can talk on the frequency bands designated for Ham Radio. One has to have an Amateur Radio license to transmit on these frequencies, and your use of the amateur service has to be for a legitimate purpose.

Why do I need a license?
It's the law. The FCC requires it. The Ham community is very proud of the standards that they have evolved for the proper use of the Ham bands, and they want to be sure that everyone using Ham radios adhere to the simple but necessary protocols. Licensing provides a way for all users to learn "the-rules-of-the-road". Fortunately an amateur radio license is not difficult to obtain.

What is an Amateur (ham) Radio License?
There are actually three different types of Ham Radio licenses in the United States called "license classes": Technician class, General class, and Extra class. The type of license one has determines which frequencies can be used, what methods of transmission (e.g. voice, code, single side band, etc) and how much power one can radiate. The most popular class for
beginners, and the easiest license class to get, is the Technician class License. NO MORSE CODE IS REQUIRED. Fortunately, the technician license is all anyone needs to carry out the communications aspect of ballooning. The Technician class license allows one operate on all amateur frequency bands greater than 30 MHz, including the use of popular "FM" two-way radios and repeaters on the VHF and UHF bands. You can also send computer data, television signals or use Amateur Radio orbiting spacecraft with the Tech license. The license is granted by the Federal Communications Commission and is good for 10-years, and may be renewed.

Don't I have to be a real geek and know all kinds of technical stuff including Morse Code?

No! Virtually anyone can get their "ticket". The previous requirement to learn Morse Code in order to obtain any kind of ham radio license was dropped several years ago. While a little basic familiarity with electronics and radios helps in understanding the material to pass the exam, it is not at all a prerequisite. All of the material needed to become a competent ham operator can be learned in a few evenings of study before taking the exam. The material needed is covered exhaustively in a manual put together by the national association for Amateur Radio, the American Radio Relay League (ARRL). More about this later.

So what are the steps to getting a license?

Getting a Technician's license requires passing a written examination. The exam is a 35 question multiple choice test. The questions on any particular exam come from a universe of pre-established questions. Those questions, and the correct answers are readily available form a multitude of sources, including the study guide published by ARRL. One great source of study material is the internet, where one can take sample examinations with the exact questions taken from the official question pool.

By far the best way to get introduced to Amateur radio and prepare for the exam is through a local Amateur radio club. The license examinations are administered by ham radio volunteers. Best of all, one doesn’t have to study alone. Many local ham radio clubs offer FREE training courses, often augmented by video training material, to assist you in learning ham radio. Such a course can be very useful because it puts you in direct contact with enthusiastic hams who can answer questions and guide your learning. Typically, a club might offer a number of training sessions over the course of a few weeks, followed by a club-sponsored examination administered by a team of three or more Volunteer Examiners. The Examiners handle all of the paperwork and submit it to the FCC who issues the license directly to you.

An excellent starting place for learning about amateur radio, for getting study guides, and for locating an amateur radio club in your area is to visit the ARRL web site at:

http://www.arrl.org/hamradio.html
If you want to begin your studies without the assistance of a local ham club you can purchase the illustrated and easy-to-read study manual (pictured at the right) through the ARRL website. The manual's title is *Now You're Talking! All You Need For Your First Amateur Radio License*, 5th edition © 2003 #8810--$19.95, available through the ARRL.

**Recommended Steps:**

1) Find a local club near you and determine if one of these clubs is offering a training course. A directory of ham radio clubs can be found at:

   http://www.arrl.org/FandES/field/club/clubsearch.html

2) Find a testing site (and date) near you:

   http://www.arrl.org/arrlvec/examsearch.html

3) Study independently, or through the club's help.

4) Practice taking the examination by working through the study guide, *Now You're Talking! All You Need For Your First Amateur Radio License*

   or

   Practice taking the examination on the internet* from such sites as:

   http://www.aa9pw.com/radio/
   (left hand column, check "Technician" and click on "Take Exam")

   http://www.eham.net/exams/
   * Note Effective July 1, 2003 the exam pool questions may change, so some of the internet sites offering practice exams might not be up-to-date. The complete list of exam pool questions is available from ARRL at:

   http://www.arrl.org/arrlvec/pools.html

5) Take the examination under the supervision of the ARRL Volunteer Examiners. A passing score is 26 or more correct answers. CONGRATULATIONS!

6) Getting impatient? After about 10 days, look on the internet to see if the FCC has issued your license yet and find out what your call sign is (You will receive your license in the mail.)

   http://www.arrl.org/fcc/fcclook.php3
7) Start talking on the air. There are far too many variables to offer advice on equipment in this limited space. Talk to our new friends in the local club.

**What are the costs of getting a license?**

The cost of the examination is $12.00 (There is no additional charge from the FCC for the license)

**Got your license? Conduct a "Fox Hunt" with your team.**

Here's a fun little field exercise to apply your new knowledge and practice the skills needed for flight tracking and recovering your downed payload at the conclusion of its flight. Have one of your team members (a licensed ham) place a ham transmitter ("the Fox") in a hidden location. Set it up to transmit a periodic signal containing the GPS coordinates of its position. Separate the rest of the team into a few groups of two to three individuals, and send each team out to find the "Fox". The team that locates the hidden transmitter in the shortest time wins bragging rights.

There is a significantly more challenging version of the fox hunt that doesn't permit the use of GPS, but instead relies entirely on radio direction finding (RDF). Suppose the balloon GPS system fails to report its position, and the only information you have is the radio beacon. RDF provides a means for tracking down your payload using directional receiving antennas. The basic concept is that the radio waves are emanating from a point source. Using highly directional antennas on your receiver, it is possible to determine the direction that the radio signal is coming from. Successively monitoring this direction as you move about should lead you right to the hidden transmitter. This project will require you to build a direction finding (DF) antenna, an excellent way to learn some new amateur radio skills. Such an antenna can be built for less than $10.00.

One simple DF antenna design is available at [http://home.att.net/~jleggio/projects/rdf/tape_bm.htm](http://home.att.net/~jleggio/projects/rdf/tape_bm.htm).

The photo above shows a variant built by the Montana State University BOREALIS team. Hidden transmitter hunts are a popular pastime of amateur radio enthusiasts so there is a vast amount of information available on the internet.