THE PROBLEM OF SAILPLANE RADIOS

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The installation and operation of radio communication equipment in sailplanes poses unique problems not encountered in general aviation installations. Perhaps the most significant is the lack of the common power source, the engine of a powered plane driving an electrical generator feeding a large capacity battery. Even an air-driven impeller such as used for emergency power in many types of powered planes will not perform satisfactorily at the low speeds encountered in soaring, and would create unacceptable drag. Thus, the elimination of conventional power sources leaves the radio installation designer with only the choice of dry batteries or small, high-capacity lead-acid or nickle-cadmium type batteries. Conservation of battery power can be achieved by using the airborne unit only at times when communication is desired or scheduled, and leaving the auto-battery powered ground station on at all times for reception of calls.

Batteries, either dry-cell, lead-acid, or nickel-cadmium (NiCad) will perform satisfactorily if conservation in use is practiced and radio equipment requiring the least power drain is selected. Dry-cell batteries, of course, only have one life. Lead-acid and nickel-cadmium can be removed from the sailplane and recharged. However, the lead-acid type of battery has the disadvantage of losing voltage as it discharges. This causes a serious loss of transmitter power since almost all of the commercial type equipment is designed to operate at the full-charge voltage or the recharge voltage of the generator. The nickel-cadmium battery does not suffer from this defect; however, a 12-volt battery costs about $100 (the surplus market sometimes offers some less expensive buys).

Next let us consider what frequencies are available for use. Here we have a limited choice. We can use 123.1, 123.3, or 123.5 mcs, frequencies the FCC has assigned for use by aircraft flying schools and flight test stations, in the interest of safety; sometimes referred to as "the glider frequencies." Equipment that is suitable for use on these frequencies must be licensed by the Federal Communications Commission, and its adjustment must be undertaken by a technician possessing an FCC-issued Second Class Rediotelephone Operators (or higher) license. (Refer to Art. 9.314 Part 9 FCC Rules and Regulations.) This requirement makes the use of home-built or kit-form equipment extremely difficult for most soaring pilots. Operation of the equipment, once it has been properly licensed and adjusted, poses no problem since a Restricted Radiotelephone Operator Permit can be secured without difficulty from the FCC. The big advantage to the use of these frequencies is in their proximity to other VHF aircraft frequencies, which through the use of additional crystals, permit communication with FAA weather, tower, and distress facilities.

We might consider the use of Amateur Bands. There is available a wide range of equipment suitable for use in sailplanes employing frequencies in the six and two-meter bands. Transceiver equipment in kit form is available from leading manufacturers of hi-fi and radio kits. Practically all of this type of equipment requires a 6-volt or 12-volt battery as a power source. But the main deterrent to use of ham equipment in sailplanes is the license requirements of the FCC. Both the airborne equipment and a ground station must be operated by radio amateurs who have passed a code test, and written examination on the rules, regulations, and technical matters associated with amateur equipment. This poses a serious problem for family soaring teams unless there were two licensed hams in the family.

Finally, let us examine the use of the Citizens Bands. Currently there are 22 frequencies available in the 27mcs. band for use. Power input is limited to 5 watts except for Class A Stations where inputs of up to 60 watts are authorized. There is lots of Citizens Band equipment on the market, some in kit form. Licensing of the equipment poses no problem and anyone may operate it without license or permit. The problem of utilizing this equipment satisfactorily is one of power and antenna efficiency. For a maximum efficiency one-quarter wave antenna at this frequency a wire of between 5 and 8 feet in length is required. This could be used with fuselages and wings of wooden construction. But in metallic sailplanes these dimensions must be reduced through the use of loading coils and other devices to electrically shorten the antenna. This results in a loss of efficiency, at least for the airborne installation. Some operators have compensated for this decreased performance by operating a relatively high-powered fixed ground station with a relatively high-powered antenna. Such a station should override any interference caused by other low-powered stations within range of the airborne station. However, if cross-country work is anticipated, a mobile-ground station had best be similarly powered.

The subject of antennas should be mentioned at this point. To achieve even a minimum degree of communication reliability with low-powered equipment both airborne and ground antennas should be oriented in the same direction. This is called polarization. A ground antenna that is horizontally polarized will not receive satisfactorily transmissions from a low-powered airborne station whose antenna is vertically polarized. Even with vertically polarized antennas in two sailplanes that are circling in opposite directions, the signals received will vary in strength in large degrees due to their being at times ninety degrees out of polarization. Thus, antennas must be parallel. Practically all amateur and aviation VHF frequency antennas are vertically polarized because their short length and radiation patterns make this desirable. But with Citizens Band equipment, because of the longer antenna lengths, problems arise both in the airborne installation and at the ground station. Vertically polarized antennas must be short in the sailplane, and at the ground station a long mobile whip should be installed.

Considering the costs of the above described equipment, we find that the portable, battery-operated commercially-built equipment for use on the VHF frequencies costs about $300 per station. Amateur radio equipment to operate in the two meter (144 mcs) band can be bought in kit form for as little as $50 and commercially-built equipment from $150 up. Citizens Band equipment can be purchased for as little as $40 in kit form and will run from $100