



# Orbit

Journal of the Radio Amateur Space Program

**No. 19**

November/December 1984  
\$2.50 U.S.A./Canada

Published by AMSAT — The Radio Amateur Satellite Corporation



# ICOM IC-471H

## 75 Watt 430-450MHz Base



ICOM presents the IC-471H 430-450MHz base station transceiver with a 75-watt transmitter and high dynamic range, low noise receiver. With FM, CW or SSB modes plus the most advanced 10Hz PLL system, the IC-471H has features which give you maximum UHF operation.

**75 Watts.** With 75 watts of power, the IC-471H provides the power required for simplex or repeater operation. Power is adjustable in all modes from 10 to 75 watts. This enables adjusting the drive level to a linear amplifier for higher power uses such as moonbounce.

**Receiver.** An extremely low-noise, professional-grade receiver and a high signal-to-noise ratio PLL which allows the IC-471's synthesizer to lock to 10Hz, provide receiver performance unparalleled by other UHF receivers. A mast-mounted



Mast-Mounted Preamplifier

preamp is switchable from the front panel and provides an easy-to-use option for weak signal work.

### 32 Full-Function Memories.

Each tunable memory holds frequency, offset, offset direction, mode and subaudible tone. Each parameter is selected by rotating the main tuning knob in conjunction with the other controls on the front panel.

**Subaudible Tones.** Included as a standard feature are 32 built-in subaudible tones which are easily selected by rotating the main tuning knob. PL tones may be stored into memory.

**Size.** Only 11 1/4 inches wide by 4 3/8 inches high, the IC-471H is engineered for ease of operation.



IC-PS30 Power Supply

**Scanning.** The IC-471H can scan its 32 memories sequentially or selectively by mode and by programmed sections of the band. Mode-S scan can be used to scan only memories with a particular mode.

**Fluorescent Display.** ICOM's high-visibility and easy-to-read display gives all the information necessary for logging a contact. Frequency, mode, duplex, offset direction, RIT frequency, memory channel number and PL tone can be displayed.

**Other Standard Features.** To facilitate the operation of the IC-471H, ICOM has incorporated a duplex check switch, all-mode squelch, receive audio tone control, S-meter, center meter, seven-year lithium battery memory backup, accessory connector and microphone.

**Optional Features.** IC-471H options are; AG-35 switchable mast-mounted preamplifier, UT-15 CTCSS encoder/decoder, CT-10 computer interface and EX-310 voice synthesizer. A variety of optional power supplies are available: the

IC-PS30 base station supply, IC-PS15, and the internal IC-PS35.



IC-471H Shown with internal power supply, IC-PS35

**The IC-471A.** The 25-watt IC-471A is also available and has the same outstanding features as the IC-471H, plus an optional IC-PS25 internal power supply for portable operation. Also available to complete your VHF/UHF base station, are its 2-meter companions, the 100-watt IC-271H and 25-watt IC-271A.

See the IC-471H and other ICOM equipment at your local authorized ICOM dealer.



# ICOM

## The World System

ICOM America, Inc., 2112-116th Ave NE, Bellevue, WA 98004 / 3331 Towerwood Drive, Suite 307, Dallas, TX 75234

All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 471H784



November/December 1984  
Volume 5 Number 2

**ORBIT Staff**

Editor: Harold Winard, WB2M  
Contr. Editor/Staff Liaison:  
Vern Riportella, WA2LQQ  
Managing Editor: Bob Myers, W1XT  
Advertising Dir.: Roger Soderman, KW2U

**AMSAT Board of Directors**

John Browning W6SP (Chairman), Tom Clark W3IWI, John Pronko W6XN, Jan King W3GEY, Harry Yoneda JA1ANG, Vern Riportella WA2LQQ, John Henry, VE2VQ

**AMSAT Officers**

President: V. Riportella, WA2LQQ  
Exec. Vice Pres.: J. Champa, K8OCL  
V.P., Engineering: Jan King, W3GEY  
V.P., Operations: J. Champa, K8OCL  
V.P., Special Projects: Bill Brown, K9LF  
V.P., Manned Spacecraft Operations  
William Tynan, W3XO  
Asst. V.P., Eng.: Harold Price, NK6K  
Asst. V.P., Eng.: Phil Karn, KA9Q  
Asst. V.P., Eng.: S. Robinson, W2FPY  
Asst. V.P., Ops.: Jim McKim, W0CY  
Treasurer: Art Feller, KB4ZJ  
Corporate Secretary: Martha Saragovitz

**Headquarters Office Staff**

General Manager/Exec. Director:  
William Lazzaro, N2CF  
Office Manager: Martha Saragovitz

**Editorial Office:** P.O. Box 575,  
Wharton, NJ 07885

**AMSAT:** P.O. Box 27, Wash., DC 20044.  
Telephone: 301 589-6062  
Telex: 248-566

Second Class postage paid at Waterbury, Conn. by ORBIT, 221 Long Swamp Road, Wolcott, Connecticut 06716.

ORBIT (USPS 041-850) is published six times per year for \$15. (inseparable from membership dues of \$24).

Copyright © 1984 by ORBIT. Contents may be reproduced without specific permission provided proper credit is given, unless otherwise stated and copies are sent both to AMSAT and to the author. Opinion expressed is not necessarily that of AMSAT.

# CONTENTS

**Technical Features:**

- 5 **Using Water as a Primary Method of Propulsion for Spacecraft Modifying Standard STS Orbits**  
By Jan A. King, W3GEY  
*A common substance, found around the home, may power future OSCAR satellites into higher and more useful orbits.*

- 13 **Phase III Spacecraft Thermal Design**  
By Dick Jansson, WD4FAB  
*Designing satellites for the perils of space is crucial for successful missions. A thermal engineer tells how AMSAT-OSCAR 10 was readied for the hot and cold of its elliptical orbit.*

**Informational Topics:**

- 9 **Orbitalker: An OSCAR Information Center**  
By Stewart Beal, VE3MWM  
*What do you get when you team a computer and a voice synthesizer? A talking computer, of course, and one that tells you where the satellites are.*

- 18 **AMSAT Board Stakes out Major Goals; Names New Officers**

**Departments:**

- 3 **Ellipsis...** By Harold Winard, KB2M  
*The View From The Turning Point*
- 20 **Worldwide Satellite Activity** By Pat Gowen, G3IOR
- 24 **Orbital Predictions** By Phil Karn, KA9Q
- 25 **Orbit Sponsor Donations**
- 26 **AMSAT News**

**COMETS**

*ARRL Northwestern Division Convention, page 11*  
*Mirage Donates Amplifier, page 23*

---

**Our Cover:** The satellite station at OE1VKW includes an impressive array of antennas. Shown are a 9-element crossed Yagi for 145 MHz, four 21-element Yagis for 435 MHz, and an unusual 25-turn helicone antenna for 1.269 GHz.

# LET'S TALK OSCAR



DATA IS DERIVED FROM OBSERVATIONS BY PROJECT OSCAR. REPRODUCTION, AUTOMATICALLY STAMPED ENVELOPE, OSCAR P.O. BOX 1136 LOS ALTOS, CA 94024 OF THE LATEST AVAILABLE DATA.

SUPPORT THE AMATEUR SATELLITE PROGRAM. AMSAT P.O. BOX 27, WASHINGTON, DC 20044

COMPILED AND COORDINATED BY JOHN PRONKO - W6XN, RANDY COLE - KN6W AND JACK SOMERS - WA6VGS

PRINTED BY Henry Radio

**AT HENRY RADIO  
WE'RE DEDICATED TO EVERY  
ASPECT OF AMATEUR RADIO  
...FROM THE EXCITING AND SOPHISTICATED  
TECHNOLOGY OF TODAY TO HELPING THE  
YOUNG NOVICE GET HIS FIRST SIGNAL ON THE AIR.**

**AND OUR OSCAR 8 & 9 ORBITAL DATA  
SHEETS AREN'T ALL WE HAVE TO OFFER**

★ **"HAM IN SPACE" TEE SHIRTS**

★ **ORBIT MAGAZINE**

★ **L & R POLARIZED ANTENNAS**

★ **OSL CARDS**

★ **AMSAT BADGES**

★ **LINEAR AMPS**

★ **TRANSCEIVERS FOR OSCAR  
MODES A, B & J**

★ **RECEIVING PRE-AMPS**

★ **ORBIT PLOTTERS**

- ICOM
- KENWOOD
- YAESU

★ **ASTRON POWER SUPPLIES**

★ **AZMUTH & ELEVATION ROTORS**

★ **ORBIT CALENDARS**

**IN FACT, WE HAVE IT ALL...WE ARE OSCAR SPECIALISTS!**

**HENRY RADIO leads the way. Let us answer your questions and help you with your needs. Give us a call— at the L.A. store ask for Jack (WA6VGS)**



## Henry Radio

2050 S. Bundy Dr., Los Angeles, CA 90025 (213) 820-1234  
931 N. Euclid, Anaheim, CA 92801 (714) 772-9200

TOLL FREE ORDER NUMBER: (800) 421-6631  
For all states except California.  
Calif. residents please call collect on our regular numbers.



---

# Ellipsis...

An Editorial by Harold Winard, KB2M

---

## The View From The Turning Point

The present is often not the best place to view the future from but, like it or not, it's the only place we have. Yet despite the handicap and the uncertainties that result, prognosticators have long had a very enthusiastic audience for their seemingly magical glimpses into the dark future.

Why have people been fascinated by every seer from Nostradamus to Jean Dixon and probably quite a bit before that? Probably a fear of the unknown and a desire to assure themselves of the assumed certainty of their future existence.

But not all things in the future are so vague or cloaked with mystery that the less clairvoyant among us can't uncover their meaning. As any academician will tell you, the past is a true guide to the future and a surprisingly accurate one. There is little indeed that has happened to humanity in the last several million years that is not going to happen, in one form or another, in the future. With the exception of some atomic particles that may have been truly synthesized by man, there is probably nothing new under our sun.

Armed with an outline of the past, those of us in the present daring enough to venture forth can develop some very plausible and probably accurate assessments on our future fate.

Undoubtedly now is the best time for all of us in the amateur radio community to make a considered judgement about the future of amateur satellite activity. The first OSCAR went into orbit some 23 years ago. By current reckoning in the electronics and space science world that's a very long time indeed, but one filled with a variety of valuable experiences from which we can do some surveying into the future.

To start with, let's look backwards to the early days of the amateur satellite program when a handful of skilled engineers fabricated a tiny package in their own homes and offered it as a replacement for the ballast that would have been fitted to a U.S. launch vehicle. OSCAR-1 answered Don Stoner's challenge, but only partially for it would take others, in years to come, to build repeaters in space that demonstrated the perseverance of amateurs in general and the skill of a widening group of technicians, engineers, scientists, and researchers.

Succeeding OSCAR satellites did more than just announce their presence. From a single repeater channel and

limited life spans, the amateur community evolved sophisticated rf packages that provided predictable communications performance, albeit for just 15 to 20 minutes at a time. Soon the weeks and months that earlier satellites spent in useful life became years, in some cases years beyond design forecasts.

Last year the scientists, technicians, engineers, researchers, planners, writers, and administrators held their collective breaths as the flight control officer at the European Space Agency's Kourou launch facility recounted the flight events as the Ariane rocket pierced through the atmosphere and hurled Phase IIIB into a transfer orbit. Yes . . . OSCAR-10 had made it and the world of amateur radio had its first practical communications satellite.

The now widening circle of experts didn't let the grass grow under their feet nor did they rest on the laurels of their past achievements. In the past year UoSAT-OSCAR-11 sprung to life high over the earth carrying a sophisticated scientific payload and a future-oriented digital communications experiment. Even in the agony of its premature silence, Hams marshalled the forces of accomplished amateur radio operators around the world to mount an intensive campaign to listen for the minuscule signals emanating from the crippled satellite. Yet another group of experts had been added to the growing family of upward looking communicators.

OSCAR-11 is safe now, working by virtue of the persistence of the ground crew at the University of Surrey, the dedicated Hams within the California-based SRI International research facility, and the clever circuit design that allowed substitution of one controller for another to restore command functions within the bird.

That brings us to the present and a very important time it is. Would we to ride through the time machine to the next century, I am sure that 1984-1985 would be seen as the turning point in the amateur space program. The handful of pioneers tinkering in their basements has grown to an accomplished force of many with diversified fields of expertise. The simple packages are now very complex combinations of digital and analog circuitry. Even the flight hardware, such as the propulsion systems and their controllers, are many orders of magnitude more elaborate than anything hams have flown and controlled before. And it will become even more complex. So complex, in fact, that homebrewing will be out of the ques-

*Continued on page 8*