

The enthusiastic young radio amateur looked inquiringly in the open door of the Oscar HQ. "Is this where the Oscar tracking operation will take place?", he asked eagerly. "I'd like to help track a satellite!"

The weary Oscar worker brushed his hair from his eyes with a grimy hand and replied, "Well, fine! You can start by taking this broom and sweeping the floor. Then, we have a 1500-foot roll of cable to be sorted and laced, and these heavy desks have to be carried upstairs. After that, you can help carry that five-hundred-pound roll of coaxial cable up the hill to the tower. After that . . ." The young amateur gulped, and looked unhappily about him at the chaos. "Sure, sure," he replied. "I'll be happy to help. I'll try to get back next week." And he disappeared forever.

Oscar III and W6EE

BY WILLIAM I. ORR,* W6SAI

THE air inside the garage was frigid and the cement floor was *very* cold. Don Norgaard, W6VMH, stamped his feet in a vain attempt to restore circulation. He looked grimly at the tiny electric heater in the corner of the cluttered work room. It was totally ineffective in removing the night chill and had lost the battle of holding the room at a reasonable temperature. Above Don's head, gently swinging at the end of a frayed section of rope hung the strange, silvery, rectangular object that had been the center of his attention for months. A casual observer could have guessed the device was some kind of electronic apparatus by the meters on the top side, by the ganglia of cables that protruded from it, and unflinching, by the four spike antennas that were mounted to its surfaces. It seemed devoid of life in the cold air.

On the workbench in front of W6VMH reposed a battered v.h.f. signal generator amid a miscellaneous gathering of wires, cables, small

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parts, batteries, defunct transistors and tools. The floor at his feet was littered with small parts and bits of solder. To Don's right was a brace of 2-meter receivers, operating, but balanced precariously on top of other electronic test equipment. The washing machine and clothes dryer at the rear of the work area were nearly hidden by other v.h.f. equipment. A field-strength meter sat atop the Volkswagen in the far side of the garage.

Ed Hilton, W6VKP, and Lance Ginner, K6GSJ, swung their arms and moved about to keep warm, and waited for Don to speak. There was a long pause, during which one of the 2-meter receivers poured out a torrent of gibberish into the cold air, interrupted regularly by "HI," transmitted in code. Finally, after an eon, Don sighed heavily. "This project has taken over two years worth of spare time, and I already feel ten years older . . ." He gestured towards W6VKP, the owner of the garage workroom. "Oscar III is as ready as it ever will be, in view of the limited time we have left to work on it. This box of gear hanging on the end of the rope represents

about eight thousand hours of time and effort by crazy hams who had a crazy idea, and were crazy enough not to give up." He reached for the master switch on the work bench. "Well, I give up," he said. He swept off the control switch and the captive satellite and the receivers subsided into silence. Don wrapped his jacket about himself to defeat the cold and spoke decisively, "I think we would have been wiser to spend *more* time building a heater for Hilton's garage and *less* time working on a space satellite. I suggest we QRT and get to bed. I think I have a touch of pneumonia. Moreover, it's tomorrow morning already!"



Bob Walton, W6CYL, wiped the perspiration from his face on the sleeve of his shirt and slowly straightened up in front of the 20-meter transmitter of W6EE. The small room was stifling, and smelled of hot rosin, grease, sweat, a sandwich forgotten in the wastepaper basket, hot steel, and stale tobacco smoke. In the corner of the room, three RTTY printers chattered madly away, debating the relative merits of RY RY RY, SG SG SG, and QUICK BROWN FOX. The half-horsepower blower of the transmitter power supply poured a steady stream of moist, warm air in the room, and filled every corner with a steady 120-cycle whine, nearly drowning out the 2125-cycle tone of an audio oscillator, running unattended in a rack full of complex gear. Two telephones rang intermittently, but no one paid the slightest attention. Chuck Cook, W6SCR, buried in the vitals of the 80-, 40- and 20-meter c.w. transmitters let out a howl of anguish. "Hey! Who stole the 872A that I swiped from W6ASH in the next room?" he queried. Bob glanced at his wristwatch and noted it was nearly 1000 GMT. Ignoring Chuck, he said, almost to himself, "My family expected me home by midnight." Chuck looked up from his inelegant position under the transmitter console and spoke unhappily, "This 20-meter transmitter is still blowing fuses. We may have to use dynamite on it."

W6CYL fished in a rat's nest of analyzers, RTTY tape, defunct tubes and unidentifiable objects on the control table and tossed a packet of fuses in the general direction of W6SCR. He looked across the room at Bob Weitbrecht, W6NRM, who stood arms akimbo, in front of an oscilloscope, armed with a screwdriver and a steaming soldering iron. The scope glared back defiantly, flaunting a green, zany image that twitched spasmodically in time with one of the RTTY printers.

Chuck crawled out from beneath the transmitter rack and gazed about him. "I think we're spending too much time on installation and not enough time shoveling out this place," he announced. "If we're not on the air by 4 A.M., I vote we go home and get to bed early for a change.

A little more time spent on a ventilation system would be a big help, too."

A roar of sound resembling a blast furnace engulfed Bill Eitel, W6UF, as he opened the upstairs door of the Oscar building and stepped from darkness into the harsh glare of a string of bare bulbs. W6UF balanced the 75S-3 receiver on his hip as Bill Orr, W6SAI, and "Chuck" Towns, K6LFH, carefully strung a 40-meter radial around him out the door, and into the night. Behind them, unheeded, a tape recorder chanted, "one, two, three, testing. This is W6EE, W6-Echo, Echo testing. . . ." Coaxial cables wrapped around the sideband gear in the background like dark serpents, coiling and writhing out the window. A compact WWV receiver sang its monotonous tune in the tracking rack and somebody on 2 meters was delivering a windy monologue from the speaker of the tracking receiver. Oblivious of the racket, Jack Walbert, K6UAA, and Gregory Tobin, W6CCN, were enmeshed in the complexities of the tracking system antenna and receivers. Somebody on 80-meter s.s.b. suddenly started to call W6EE in an impatient voice as the intercom to the c.w./RTTY room below buzzed impatiently. W6SAI swung himself gingerly through the window, lowering himself from the tracking table to the floor, trailing a control cable behind him. At the same time, a tremendous crash shook the building, and a fine rain of plaster dust filtered down from the ceiling, landing atop the equipment. It landed on W6UF and the receiver he was placing on the tracking table. Bill looked about him and winced. "Perhaps we should have taken a bit of time from satellite work and used it to soundproof this room," he mused. "This place sounds like Times Square at midnight on New Year's eve." He started to look about him for the coaxial plugs he had placed down a moment before as K6UAA shouldered his way farther behind the tracking console. . . .





At the apex of the 30-foot tracking tower poised atop the building, above the clamor of the last-minute activities, Walt Read, **WGASH**, swore gently to himself as the beam rotator slipped from his grasp and plunged with a resounding thump to the roof platform. Hanging from the top of the tower by his safety belt, Walt peered down into the night, shielding his eyes from the light of a bulb dangling at the end of a long extension cord. An ungainly tracking antenna swung from a rope, half-way up the steel tower. "O.K. gang, easy does it," Walt called in a soft voice to the shadowy figures on the roof below him. "That's it . . . up she comes!" He reached down to grasp the rotator which came to rest, neatly scraping the skin off his right leg.

Walt looked at the Dali-esque scene below him and listened to the uproar emanating from the building, half hidden in the night. "Well," he thought. "All this effort will be worthwhile if Oscar III works!" He paused and swung the rotator over his head into position. "Perhaps we should have spent *more* time on the satellite and *less* time on the tracking station and communications equipment!"

Now, at last, in the light of the warm morning sun, the building stood silent. The RTTY was mute and the loudspeakers were turned down. The 'scope on the WWV receiver wavered in silence and the assembled amateurs sat, each wrapped in his own thoughts. The Tracking and Control Station, W6EE, was finally in order. All

that remained was to receive the exciting information that Oscar III was in orbit and working. The telephone, ready to bring word from the radio amateurs standing by at remote tracking locations, was silent. The suspense seemed intolerable, and words were exchanged in monosyllabic whispers. The GMT clock on the wall hummed softly to itself, telling no secrets to the anxious radio amateurs awaiting hopeful word of the forthcoming orbit. Suddenly, like an explosion, the telephone rang. . . .

The Tracking and Control Station, W6EE

Project Oscar control station W6EE served a dual purpose. First, it was instrumental in disseminating orbital information necessary for users of Oscar III, and; second, it gathered operational information about the operation of the satellite and collected the various telemetry and "calls heard" reports.

Starting during the early summer of 1964, schedules were generated with various Oscar Coordinating Stations in all parts of the world. These schedules were run on 7 Mc. by W6ASH from his own station until W6EE was activated, early in February, 1965.

It was decided that W6EE would broadcast orbital predictions for Oscar III on 80, 40 and 20 meters via c.w., RTTY and s.s.b. transmissions. The station was accordingly designed to accomplish this mission. W6EE was housed in a two-story building (formerly an old carriage house) on the campus of Foothill College, Los Altos Hills, California. Special 220-volt and 3-phase power lines were run to the building to accommodate the numerous transmitters, and the college graciously permitted the erection of a 70-foot steel tower atop a nearby hill to support the stacked 20- and 40-meter rotary beams. A supplementary 30-foot tower atop the Oscar building supported the 144 Mc. tracking antenna.

The top floor of the two-story Oscar building was occupied by the sideband equipments. Complete kilowatt s.s.b. installations were generously loaned to Project Oscar by the Collins Radio Co., the Hallcrafters Co., and the Hammarlund



Co. Each station was operated on one amateur band, and was fixed-tuned on a chosen frequency. The three transmitters were operated by a central control console so that all could be driven from a single microphone, or from a tape recorder containing the pre-recorded prediction messages.

The ground floor of the Oscar building held the c.w. and RTTY gear. Three separate transmitters were used, one each for 80, 40 and 20 meters. Loaned to the project by AF MARS members, the transmitters were powered by a single 2000 volt, 3-phase power supply. Separate RTTY exciters were used for each band, and a Collins 310-B exciter served as a driver for the c.w. transmissions.

A corner of the ground floor of the Oscar building held the c.w. control room and the four R-391/URR receivers, loaned to the project by Army MARS. The c.w. tapes were punched by W6ASH in this room, and transmitted by means of a Bohme automatic keyer. Included in this area was a standby v.f.o. and the antenna control console.

Assembly of the W6EE station and check-out took most of 1964. Reliability was a prime necessity and the equipment was tested and reworked until it provided 24-hour-a-day performance. It is a tribute to the sideband gear, and also to the composite c.w. and RTTY equipment, that outage was an absolute minimum, and that when W6EE was off the air because of equipment troubles, it amounted to only the replacement of a fuse, or a defunct tube. When W6EE hit-the-air on March 9, 1965 it operated with little equipment trouble until the conclusion of the Oscar III mission. Success of the prediction broadcasts is of course due to the devoted crew of operators who manned the gear during all schedules.

Three operator shifts were employed, one for



each mode of transmission. W6EE suffered a near-mortal blow during the week of March 21-26, when most of the operators left for New York City to attend the IEEE show. Replacement operators were hastily recruited, however, and most of the prediction broadcasts were maintained.

The operators of W6EE wish to thank those many amateurs who cooperated in this effort and to express apologies to the many standbys that W6EE could not QSO because of pressing schedules. QST

NEW BOOKS

GE Silicon Controlled Rectifier Hobby Manual, by General Electric Application Engineering Center, Rectifier Components Department, West Genesee St., Auburn, New York. 5½ by 8½ inches, 70 pages, illustrated. Price, \$1.00.

Perplexed by the growing numbers of solid-state devices? General Electric's handbook is written for a person in just this situation — the hobby-minded who wish to experiment with the latest inventions in the electronics field. A discussion of how semiconductor devices work introduces the book, explaining the operation of silicon rectifiers, transistors, zener diodes, light-activated switches, and silicon controlled rectifiers. Simple language is used and important points illustrated with diagrams. Simple circuits to be constructed at home are included to show the operation of the devices discussed. One important chapter on the care of semiconductors should be read before any experiments are undertaken. The amateur should know about voltages, currents, heatsinks, mounting, and soldering or he runs the chance of ruining a valuable semiconductor. The rest of the handbook is devoted to construction projects for the home, hamshack, and workshop. These projects include light dimmers, power supplies, motor speed

controls, lamp flashers, and light-operated devices. All the projects use the GE Experimenter Line of semiconductors that are available from local dealers.

RCA Receiving Tube Manual, Technical Series RC-23, by Electronic Components and Devices, Radio Corporation of America, Harrison, New Jersey. 609 pages, including index, 5½ by 8 inches, paper cover. Price, \$1.25.

If you are looking for information on a tube, this RCA book has been revised to make things easier. The Technical Data Section covers all the current RCA receiving tubes, and a fifty-page tabulation provides easy reference on discontinued types. The manual has been restyled and a new format and type face have been used to make the page easier on the eye. Maintenance technicians will find information on picture tubes for black-and-white and color receivers.

Popular features of past editions have been retained, including tube-base data, resistance-coupled amplifier information, and the Circuits Section for constructors. The book may be obtained from RCA tube distributors or directly from the Commercial Engineering Section.

— WIKLK