Oscar III Orbits the Earth!

World-wide Two-Meter DX Records Established

BY WILLIAM I. ORR,* W6SAI

The band resembled 20 meters during a weekend contest . . . frantic calls . . . pile-ups . . . QRM . . . calls partially heard . . . QRZ? . . . bedlam! But it was not a contest in the usual sense of the word, and it was not 20 meters. This was March, 1965 and it was 2 meters, not 20 meters at all! Oscar III, the home-made radio amateur repeater satellite was in orbit about the earth, intercepting 2 meter signals from earth-bound radio amateurs, amplifying the signals instantaneously, and flinging them back to earth, as the amazing 36-pound electronics package spun about the globe in its 103-minute orbit. Yes, amateur radio had indeed entered an exciting new era of v.h.f. communication techniques and achievements! The first page of the book of events had barely been enscribed. Trans-oceanic reception and two-way QSO's had smashed a formidable v.h.f. barrier for a fortunate few. New states and call areas had been gained by many via the satellite. Would Oscar III leave a lasting effect on the 50-year tradition of amateur radio's record of performance and discovery? The outlook seemed hopeful . . . the prognosis was good . . . and Oscar III was working!

OVER five years of intensive work lay behind the group of radio amateurs, intently huddled about the racks of v.h.f. tracking equipment, recorders, transmitters and receivers. Two and one-half years of planning and more than eight thousand hours of design and assembly time on the satellite had finally been completed. The goal was always bright through the years, but the path had been dim and obscure, full of unexpected twistings, turnings and unwanted diversions. This effort was now clearly in the past. No more could be done. All that was left ahead was to wait . . . perhaps the hardest task of all . . . to wait for that precise moment in time when all would succeed or fail in an instant, far away in outer space.

The room was silent except for the hissing background noise of the tracking receiver tuned to the beacon frequency. Once the satellite had achieved orbit, if all went well, the beacon would signal success . . . and the beacon signal was expected about now . . . now . . . the amateurs virtually stopped breathing as the second hand of the GMT clock slowly swept across the anticipated time of acquisition. It should be right now . . . now. . . .

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Up goes the 4-bay tracking antenna at W6EE. W6ASH balances atop the 30-foot tracking tower on the roof of the Project Oscar building. The cross-polarized array is rotatable and movable in elevation.

Oscar III in Orbit

The drama evolved slowly and quietly at first. Oscar III was ejected from the parent research and development vehicle of the U.S. Air Force somewhere over Alaska, it had been estimated, leisurely arcing away from the larger satellite into its own 103-minute, 570-statute mile circular orbit, inclined at an angle of 70 degrees. As the radio amateur satellite was released from the carrier, its battery supply was activated and the four whip-like antennas sprang erect. Oscar III was in business, ready to repeat back to earth amateur signals it received on the 2-meter band!

Shortly after ejection was effected, the 145.85 Mc. telemetry beacon of Oscar III was heard at 2003 GMT (March 9, 1965) almost simultaneously by KL7FDB (Kodiak, Alaska), K6GSJ, K6UQH, W6ASH, W6NLZ and W2UK/KH6. In addition, K6GSJ heard bits of the satellite-repeated signal of K6UQH before Oscar III slipped out of range! It was noted by all observers that the 145.95-Mc. coherent beacon of the satellite had not been heard and was presumed inoperative. Sufficient tracking data had been accumulated, however, to permit Harley Gabrielson, W6HEK, and his prediction group to generate preliminary orbital predictions for a hasty QST broadcast from Oscar Hq station W6EE shortly after Oscar III passed below the horizon. W2UK/KH6 said goodbye to Oscar III during orbit 2 as the amateur satellite processed west-

ward over the ocean in its series of orbits as the earth revolved beneath it.

Oscar III over Europe and the Atlantic Seaboard

On the opposite side of the globe, Bill Brady (ex-W2ABP) in London logged Oscar III's beacon on orbit 3 for the first reported European reception.

Next to be alerted by the 145.85-Mc. beacon of Oscar III were DL6EZA and HB9RG, the former hearing the latter during orbit 4. In addition, ex-W2ABP (London) logged HB9RG during orbit 8!

And now the thrill of the chase began! Resembling elusive hare and pursuing hound, Oscar III swept across the United States in successive orbits, alerting hundreds of v.h.f. enthusiasts who awaited the satellite with growing excitement! During orbit 6, as Oscar III passed in a southernly direction near 70 degrees west Longitude, the storm of v.h.f. activity broke, leaving a trail of new v.h.f. records in the wake of the satellite. For the first time in the history of amateur radio it was possible to hear all districts in the U.S.A. on the 2-meter band via the fantastic "bird" whirling overhead! Before Oscar III had worked its way past the east coast of W-land, W8PT logged W4WNH for the first reported U.S.A. reception via Oscar III, K8UIF heard W8KAY, K1HTV heard K2IEJ, W2AZL heard K2MWA/2 and the telemetry beacon of Oscar III was heard by K6HMS in far-distant Costa Mesa, California.

"Many are Called but Few are Chosen"

The following orbit (7) over mid-western U.S.A. permitted scores of stations to hear each other via Oscar III, but the rapid flight of the satellite gave little time for amateurs to adjust themselves to the new techniques of operation necessary to achieve satellite-repeated contacts. Old v.h.f. communication techniques proved generally inadequate to meet the exciting new challenge. Many called too fast, or too slow: too short, or too long. Pile-ups grew on strong satellite-repeated signals. Those lucky radio amateurs who establish the world's first satellite-repeated QSO's will long remember the amazing sensation of having the 2-meter band suddenly burst alive with signals from hundreds, and even thousands of miles away! The news quickly swept hamdom: *Oscar III was in orbit and was working!*

The First QSO's Via Oscar III

The history of the first days of life of Oscar III is confused and blurred, emerging only after a search of log records and tape recordings. It is still not complete, and not all contacts are yet verified. Even so, it is an exciting story. Honors for the first reported two-way satellite-repeater QSO go to HB9RG (Zurich, Switzerland) and DL6-EZA (Schoerzingen, Germany) who established c.w. contact via Oscar III early during orbit 9. Shortly thereafter, during orbit 13, K9AAJ (Quincy, Ill.) and K2IEJ (Oceanside, N.Y.) achieved the second two-way repeater QSO, and established the first two-way U.S.A. contact via Oscar III. As tape recorded at K9AAJ, this contact went as follows:

(Orbit 13, March 10, 1965 at 1701 GMT)

. . . . . DE K2IEJ
K2IEJ DE K9AAJ BK
R K9AAJ DE K2IEJ S6 BK
TKS S4 HR BK
R TKS 73 DE K2IEJ
R R TKS 73 DE K9AAJ

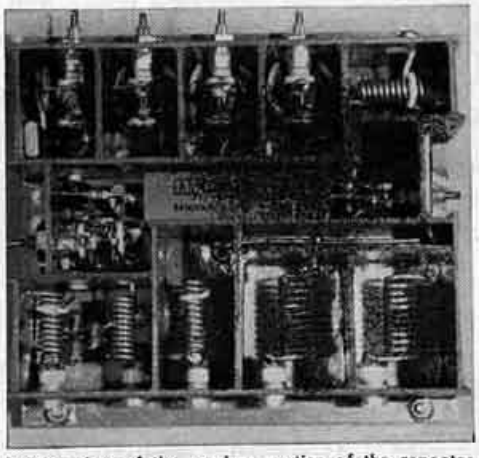
And that's how it was done! In less than 30 seconds, these two satellite-tamers followed in the footsteps of HB9RG and DL6EZA as record holders in a new phase of v.h.f. amateur radio communication!

Amateur DX Records via Oscar III Grow Daily

DX records were made and broken daily via Oscar III. The first reported transcontinental reception via the repeater satellite occurred during orbit 7 when K6HMS (Costa Mesa, Calif.) heard W1JSM (Waltham, Mass.). By orbit 9, Oscar III and the 2-meter band were red-hot: K9AAJ heard and recorded the c.w. signals of KL7CUH (College, Alaska) and HB9RG had worked a DL station, as previously mentioned. During a later orbit over Australia, VK7DK and VK7LZ established contact via Oscar III for the first reported QSO from "down under".

Hardly had the crew at Oscar Hq. recovered from this good news than W1BU (Medfield,

K6UAA puts the finishing touches on the tracking equipment at W6EE. Telemetry signals plus WWV was recorded on tape. A low-noise converter and ARR-15 receiver were used for tracking.



Interior view of the receiver portion of the repeater. Across the lower edge are the r.f. stages, with the i.f. stages at the top and the 30 Mc. crystal filter mounted at the center of the assembly. After completion, the equipment was poured full of quick-setting epoxy foam.

Mass.) reported that he had heard the satellite-repeated *trans-oceanic* signals of HB9RG during pass 19 (0252 GMT) when Oscar III was over the mid-atlantic! This electrifying report raised the old v.h.f. query: was it possible to communicate across the Atlantic on the 2-meter band? Moonbounce activity had provided an affirmative answer to this question, and now the means was at hand to accomplish this near-impossible feat by means of another medium — and one that numbers of v.h.f. enthusiasts could employ with their normal station equipment — if Lady Luck smiled their way!

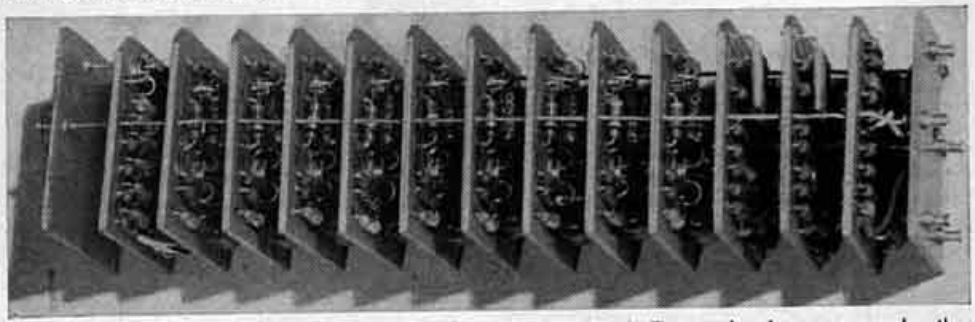
While W1BU and others worked frantically to achieve the impossible, other radio amateurs continued to establish more v.h.f. contacts via Oscar III. During orbit 22, KL7CUH heard U.S. amateur signals via Oscar III as far east as W4WNH and K2IEJ. The old 2-meter land-based DX records continued to topple: HB9RG worked SM7OSC during orbit 30 and heard UP2ON during orbit 32. Sam Harris, W1BU, heard G3-LTF in England during orbit 33, and VE3ETO reported reception of DL3YBA. As of this orbit, however, no European amateur had reported hearing an American amateur via Oscar III repeater. As a further temptation, W1BU heard SM7OSC during orbit 34, and W6NLZ worked K2GUG for the first reported trans-continental Oscar III QSO during orbit 35. During orbit 36, W6QJW heard W2UK/KH6. Could the trans-pacific path between California and Hawaii be conquered too?

The First Transatlantic QSO via Oscar III

The first transatlantic QSO grew a bit nearer as DL3YBA reported hearing U.S.A. stations during orbit 35, and EI6D reported reception of K2GUG during orbit 47. EI6D also received the satellite-repeated signals of W9ZIH and K2GUG during orbit 48! On the west coast, WA6MGZ (Mountain View, Calif.) was heard by W2UK/-KH6 (orbit 51) and W6GDO (Sacramento, Calif.) heard KL7CUH (orbit 51). The stage seemed set for some long distance records. Finally, after painstakingly accurate orbital calculations and perfect timing W1BU used orbit 61 to achieve a two-way Oscar-repeater QSO across the Atlantic Ocean with DL3YBA (Munich, Germany)! The record-shattering contact took place at 0322 GMT during a mutually useable contact period that existed for less than two minutes! This fleeting instant, during which the satellite passed through the tiny "target area" in mid-atlantic was sufficient for two knowledgeable v.h.f. experts to establish a new record! Signals were very QSA, and about S3 to S4.

During orbit 63, W6GDO copied W4HJQ on sideband, for the first reported U.S.A. long-distance s.s.b. reception via Oscar III, and WA6MGZ heard W2UK/KH6 during orbit 65 off the California coast. The following orbit (66), K2MWA/2 reported reception of G6AG, while EI2A heard K2MWA/2, DL3YBA and HB9RG. Fellow-Irishman EI6D heard K2GUG and F3NB heard K2MWA/2 — all during the same orbit. A bit later, WA2WEB heard EA4AO and G3EDD (orbit 162), and was heard by KL7CUH (orbit 119).

Almost everything that occurred on 2 meters after these first few exciting days was an anti-climax. During a telephone conversation between W1BU and W6SAI, Sam remarked casually, and as an after thought, that he had logged a QSO with HB9RG on orbit 72, and had a partial contact with G3LTF during orbit 74! (So what else was new?).



The transistorized HI keyer of Oscar III was built on 14 small circuit boards. The complete keyer measures less than six inches long. Power requirements: 20 volts at less than 4 ma.!

European Amateurs QSO via Oscar III

European radio amateurs were quick to utilize the repeater capabilities of Oscar III. Starting with the initial reception of HB9RG by DL6EZA, it has been reported that HB9RG has contacted DL6EZA (orbit 9), DL9GU (orbit 17), DJ4ZC (s.s.b., orbit 19), SM7OSC (orbit 30), and SM7BA (orbit 49)! In addition, this star Swiss DX'er heard UP2ON (orbit 32) and OK1CG (orbit 34). Hans also contacted G3ABR during orbit 59.

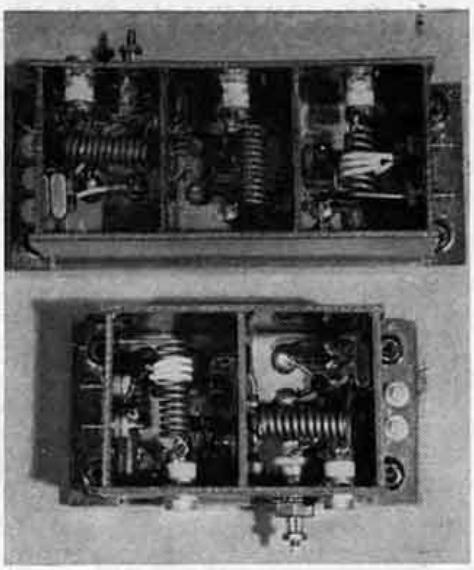
French amateurs F9DE, F2RD and F3NB received DL3YBA and HB9RG via Oscar III during orbit 50. HB9RG, in turn, worked DJ3ENA (orbit 60), OK1CG (orbit 61), and OZ9AC (orbit 63). Swedish amateur SM6PU worked HB9RG (orbit 62) and Irish EI2A heard DL3YBA and HB9RG during the same orbit. Old-time DX'er EA4AO (ex-EAR96) achieved Spanish honors via Oscar III when he worked HB9RG (orbit 88). EI4Q in Dublin heard SM-7OSC, EA4AO, G6AG, DL3YBA and an unidentified OE1 (Austria) during the same orbit.

The first reported Italian QSO was I1BMV–HB9RG (orbit 169). UR2BU (TARTU Estonian S.S.R.) logged DL3YBA, HB9RG, G6AG, EA4AO, OK2WCG, SM7OSC, DJ2RSA, while F3NB heard ON4FG and LZ1KBA.

English G6AG was logged "across the pond" by W1BU, W1JSM, and W1YQI during orbit 102. During orbit 105, W2UK/KH6 logged W6YK. Even though the W6 — K6 path had not yet been conquered by a two-way Oscar III, "Tommy", W2UK/KH6 proved his mettle by logging KL7CUH (orbit 120) via Oscar III for the first reported KH6 — KL7 reception!

Scores of Stateside QSO's via Oscar III

While all the frenzied trans-oceanic DX activity was going on, scores of U.S. amateurs were making two-way QSO's via Oscar III and collecting new states and call areas in their log books. Satellite-repeated contacts, while still elusive and difficult to achieve, were now being made on many orbits of Oscar III over W-land and Canada. What had been amazing, newsworthy and astounding a few days or hours before, now seemed relatively commonplace. Discussions of one- or two-thousand mile QSO's no longer evoked astonishment among the followers of Oscar III. The satellite was working, to the immense satisfaction of amateurs, and all was well with the world!



These are the two beacon transmitters. The small unit is the 145.95 Mc. coherent beacon which apparently failed during or soon after launch. The large unit is the telemetry beacon on 145.85 Mc.

What will we amateurs think once the battery of Oscar III has been exhausted and the long distance signals no longer appear regularly on the 2-meter band? Will the exciting days of March, 1965 resemble a hazy dream in which the v.h.f. band was turned topsy-turvy by an orbiting miracle? Oscar III was but an example of creative accomplishment by a group of dedicated amateurs and showed one path to new, undreamed communication techniques. What will the future bring? Will others dream such dreams? Each QSO via Oscar III stands as a salute of a deed well done! May other such deeds be created by radio amateurs in days ahead! QST

Strays

Received too late to be included in W3ZP's article in the April issue, this view of the modified Heath HW-12 transceiver shows the locations of the Monimatch switch (upper left), and attenuator switch (upper right). The crystal and crystal/v.f.o. switch are mounted below the original bias-set/operate switch at the lower right.