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Notes on Scottsbluff, Nebraska, Tornadoes, 27 June 1955

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ABSTRACT

Some general characteristics of thirteen tornadoes that occurred on the afternoon of 27 June 1955 in Scottsbluff County, Nebraska, are related. Two of these caused widespread attention due to their size and their proximity to the cities of Scottsbluff and Mitchell, Nebraska. These two were photographed extensively by residents near their paths. The experience of two men directly beneath one of the two large tornadoes is related.

1. Description of the tornadoes

The tornado outbreak in Scottsbluff County, Nebraska, on 27 June 1955 has provided some of the most interesting tornado data yet compiled. Some of the unusual features already have been pointed out [1, 2], and the purpose of this note is to record additional details.

The following aspects of these tornadoes are of particular interest:

a) This tornado situation, at the time, was unquestionably the most photographed in history (10 movies, 35 Kodachrome slides, over 90 black and white photos, and many damage photos).

b) These tornadoes were observed by many persons. They were associated with a single cumulonimbus cloud which moved down the North Platte Valley at 12–15 kn during a 2½-hr period.

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The cloud base was about 4000 ft above the ground, the tornadoes occurred in the southeast quadrant of the thunderstorm cell, and the visibility was excellent since the rain and hail occurred to the north and west of the tornadoes.

c) At least 13 different tornado funnels which reached the ground were observed in Nebraska over a 30-mi path. In one instance, three different tornadoes occurred on or near one farm during a 15- to 20-min period, and each moved in a different direction (towards the east, northeast, and south, in this order). It is well known that family-type or multiple tornado outbreaks occur, but it was not generally known before this series that so many tornadoes could occur with the same cloud structure and move in different directions at about the same time.

d) The largest of these tornadoes passed within a half mile of the Weather Bureau Airport Sta-

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tion at Scottsbluff, and several photographs were taken of the radar PPI scope during the time of the tornado. These are the first radarscope photographs with a tornado within this short range.

c) Many damage photographs were taken, including aerial shots of (a) a cemetery after one funnel had passed through the grounds (providing conclusive evidence of cyclonic rotation by the direction of fall of the headstones and trees), and (b) some unusual concentric markings in a field evidently caused by the tornado vortex.

f) Many details regarding the tornado vortex were described by five witnesses near the tornado center and written up by Mr. Russ Stewart, Radio Station KNEB (excerpts are quoted later).

The first tornado in this series occurred 14 mi northwest of Chugwater, Wyoming (70 mi west of Scottsbluff) at 1300 MST. A cursory check of the area between Chugwater and the western edge of Scottsbluff County revealed neither damage nor sighted tornadoes. The first tornado in Nebraska (No. 1) on this day formed around 1500 MST over a flooded field on the west edge of Henry, Nebraska. This was first observed as a spray of water, then became a slender column of considerable height which was described by an observer at Henry as being "about as thick as a

man's leg." This funnel moved towards the southeast, through Henry, and caused some minor damage to two homes as it moved between them. This tornado lasted only a few minutes.

Another very small tornado funnel (No. 2) estimated to be about the same size as No. 1, was observed in Henry at about the same time. This funnel moved towards the east, tore up a row of cottonwood trees, and quickly dissipated.

The third tornado (No. 3), also small, was sighted southeast of Henry around 1545 MST and moved north. This location was over fields and the North Platte River. Some damage to trees was noted. This funnel was observed only a few minutes.

Another tornado (No. 4) occurred "around 1530 MST" on the L. A. Surber farm between Henry and Morrill. This funnel passed just north of the farm house, cracked plaster in the house, sand-blasted the paint on the west and south sides, plucked feathers from chickens, destroyed and damaged several trees, demolished a granary one mile to the east, and then evidently dissipated. (A tornado also occurred on this same farm between 2300 and midnight the previous day.)

About 10 min later, another tornado (No. 5) was observed to form near the Dave Grasmick

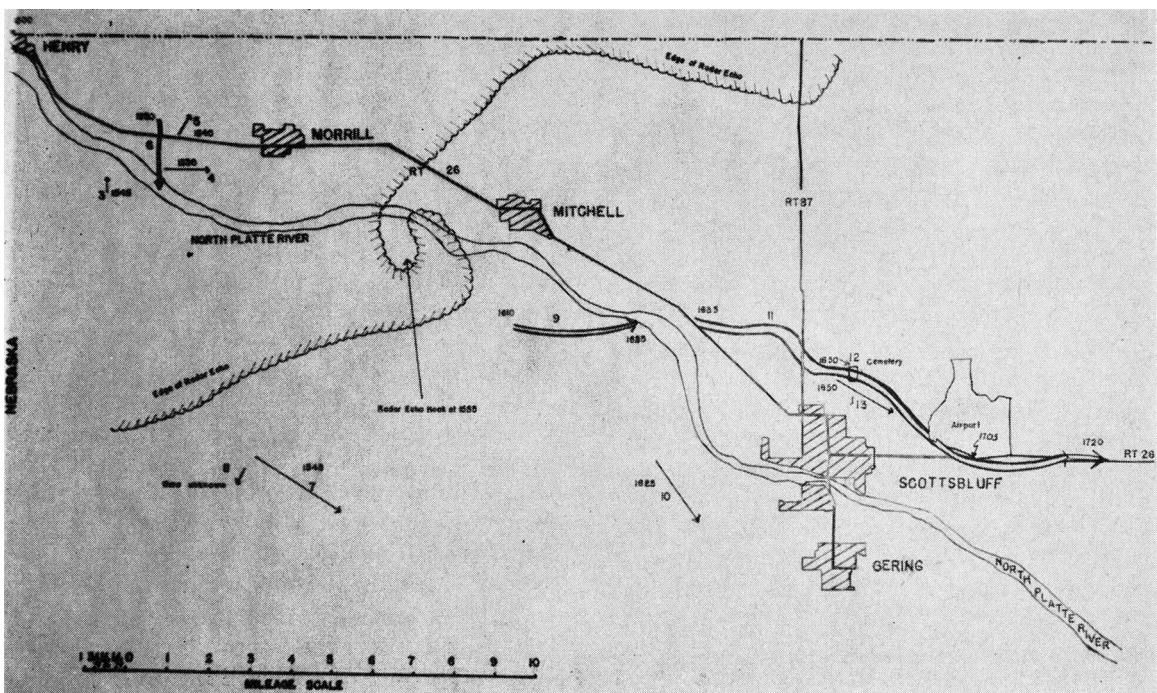


FIG. 1. Map showing locations and movement of the confirmed tornadoes in Scottsbluff County, 27 June 1955. Arrows extend only from points where persons saw the funnel (except No. 8) and where damage occurred at the ground. All times shown are estimates.

farm buildings. This small funnel moved towards the northeast, caused extensive damage to buildings, sucked up all the water over a small, flooded pasture, and dissipated within a few minutes.

Still another 10 min later, a large funnel (No. 6) appeared suddenly on a hill top three miles west of Morrill. This tornado moved southward for about one and a half miles, causing extensive damage to two sets of farm buildings. It dissipated as it moved over the river. Two inches of rain fell shortly after the tornado dissipated. Two photographs of this funnel were taken by Mr. J. E. Jarrell, and one by Mr. Gene Surber.

About 1530–1600 MST, a small funnel (No. 7) lifted a steel granary across the road near the Walter Butcher farm and demolished it. This funnel was observed to move to the southeast for two to three miles. Another funnel (No. 8) evidently struck another steel granary about one half mile to the southwest of No. 7, moved the granary one half mile to the southwest, and demolished it.

Around 1615 MST, a funnel (No. 9) formed two miles south of Mitchell. Many photographs were taken of this funnel, and it might be classed as an average sized tornado. This funnel moved eastward three miles to the North Platte River, leaving extensive damage in its wake. As it crossed the river, the funnel seemed to change color from a greyish white to a darker grey. At this point, many observers reported that the funnel appeared to become torn apart and dissipated. The time was given as around 1630 to 1640 MST. However, scattered damage to trees and farm buildings continued for the next two miles.

There were several interesting observations of this funnel (No. 9). A ranger on the Scottsbluff Memorial, who was watching the funnel through field glasses some five miles away, reported a gap forming in the funnel shortly before it disappeared. The ranger stated that a very narrow vortex tube was visible for only a few seconds as this tornado appeared to be dissipating. He also reported that the change in color of the funnel as it moved over the river was nearly instantaneous, and that the grey color started at the bottom, moving upward. He described the rotation (counterclockwise) of tree branches near the bottom of the funnel. The funnel was described as being definitely funnel-shaped when south of Mitchell but becoming more of a column by the time it reached the river. (Numerous photographs confirm this.) Numerous other observers described how the debris was apparently sucked upward into the funnel; rotation of debris was observed (several described

it as counterclockwise, while others could not comment). In general, debris was carried upward and *no* observers of the many interviewed could remember seeing any debris thrown out of the funnel at any time or place. These observations are believed to be especially dependable. Since the funnel was rather narrow over this distance, very little dust was noted around the funnel, and the visibility in the area was excellent.

At the same time No. 9 was being watched, a very narrow vortex (No. 10) suddenly appeared in a field three and a half miles south of the position of No. 9. A dust whirl was noticed at first, and an observation moments later revealed a very narrow column extending from the ground to the cloud base. This narrow funnel moved towards the southeast, destroyed a machine shed, and disappeared after moving about a mile. In the general area between No. 3 and No. 9, numerous funnels which didn't reach the ground were reported (7 funnels were observed at one time).

Around 1650 MST, a large funnel cloud (No. 11) appeared very suddenly, and destruction was immediate and intense. From the time and position, this vortex may have been a reappearance of No. 9. However, since so many observers were certain that there was no tornado visible for a period of some 15 min (some scattered damage evidently did occur during this time interval), it is classed here as a separate tornado. This large vortex maintained contact with the ground for a distance of some 11 mi. Extensive destruction was caused as it moved north of the City of Scottsbluff and within a half mile of the weather station at the airport. The description of encounters with the tornado center [1], funnel measurements [1], ground markings [1], and most of the photographs deal with this tornado funnel.

An important factor in the minimum loss of life [2] with a tornado of this extent was the excellent distribution of information via the Scottsbluff Radio Station KNEB and KOLT. Both stations relayed the tornado forecasts and warnings for that area at frequent intervals prior to the time of the Scottsbluff tornado. From the time the tornado was sighted west of Scottsbluff, an announcer from Radio Station KOLT gave a nearly continuous description of the storm movement and position from the top of the building.

The following excerpts are quoted from some notes prepared by Mr. Russ M. Stewart of KNEB:

"Shortly after 4 pm, a big storm funnel (No. 9) was sighted almost due west of Scottsbluff. The

KNEB Mobile Unit was taken out to follow the path of the storm and to warn residents to flee the path of the storm. This funnel was followed for several minutes until it suddenly disappeared from sight, apparently back into the heavens from which it came.

With that, the KNEB Mobile Unit returned to Scottsbluff and was nearing the center of town when again a storm funnel (No. 11) was sighted to the northwest of the city. The KNEB Mobile Unit then drove to a point near the Scottsbluff Cemetery where higher ground would give a good vantage point from which to broadcast.

Just as the Mobile Unit reached the main gates of the cemetery, the storm veered in from the Northwest, destroyed several farm homes, then crossed a road to the south, partially destroyed another farm, and veered Eastward directly towards the Cemetery. As we broadcast this storm of destruction, we were waiting for the funnel to chart a direct path so we could take a different one. As the cloud approached us (it apparently covered several acres of ground), it paused in its progress apparently to churn backwards and forwards, picking up momentum for newer and greater damage in the next half hour. Small funnels suddenly appeared to the north and south of the main funnel, trapping our unit's position in a rather sharp triangle and forcing us to take refuge inside the main gates of the Cemetery. At the time, we thought we could escape through another gate to the south but, when we arrived there, we found it securely padlocked and chained.

We drove around the cemetery as the huge storm cloud appeared to be marking time for its mad rush through the area in which we were taking refuge. As we drove around, we could see the storm increasing in intensity, and we also noticed a small caretaker's building on the eastern edge of the cemetery, a building with an apparently strong foundation. When the storm made its lunge toward the east and directly towards us, we hurriedly drove to the rear of this building, all the time warning our audience of the storm's position and path. Finally, when it was about 100 yd from us, we abandoned our station wagon and slid into the basement. We did not have time to turn off the equipment, and the roar of the storm was all that followed our final words. The wind strength increased many times as the storm roared towards us and, as it passed over our position or just to the south of us, it became very dark, almost totally black without any light of any kind. In the basement with us were two

caretakers and various equipment of a cemetery such as rough boxes, digging tools, *etc.*, and a large furnace which at the height of the storm started to move around the small basement. The windows were sucked out of the basement by the vacuum created by the storm, and it became very hard to breathe at the height of the storm. We could hear the havoc being created by it—trees and tombstones crashing near us and, during the height of the storm, digging tools such as shovels, axes, *etc.*, were sucked out of a cabinet at the bottom of the entrance to the basement and whisked up and out of the entrance like straws. The temperature during this time dropped very noticeably, and an afternoon that had been very warm suddenly became quite cold.

As soon as the storm abated so that we could risk going outside, we reached our mobile unit which was badly damaged but still intact, got back on the air, and continued to describe the movement of the storm funnel which by this time was again temporarily at a halt just at the eastern edge of the cemetery. Again, the huge storm cloud was threshing backwards and forwards, first moving a short distance to the northeast, then back, and then to the southeast. The cone of the funnel was moving in a counter-clockwise motion and, from our close proximity, we could see evidence of the storm's havoc inside the funnel—house and barn roofs, grain bin tops, trees and many other items being whirled around like straws. As we stood there describing the scene to our radio audience, the tail of the funnel was moving backwards and forwards, picking up hot-bed covers from a stack some 30 or 40 yd from us and tossing them one at a time in many different directions. At no time did the storm take more than one hot-bed cover at once, and it appeared to be dealing them like a person would deal a deck of cards. Wind suction was still very strong; it had been very difficult to get the five or six feet to our station wagon to get the microphone and get back to the doorway. After three or four minutes of this apparent inaction, the storm again sprang to life and roared over the hill away from us in a path which at that time we warned our listeners would be in a direct line between the cemetery and Minatare, some 11 mi southeast.

The storm was over us, from the time we were caught in front of the cemetery until it surged away from us, for approximately fifteen minutes. Later reports showed that many persons who would have been caught in the path of the storm

heard our broadcast and fled to safety. Undoubtedly this report is not as complete as it might have been, for I doubt very much if under the circumstances the writer or anyone else could remember all of the important facts and details of such a storm. However, the details as to wind velocities, drop in temperature, lack of lightning within the funnel, and other such details have been checked and corroborated by the others who experienced this June 27th afternoon of Special Events Broadcasting with the KNEB Mobile Unit."

The small funnel (No. 12) to the north of the main funnel (No. 11), described above, was confirmed by other observers also. Some farm buildings about a half-mile north of the track of No. 11 were seriously damaged. This tornado was observed only a very few minutes, and damage was reported at only one point.

The small funnel (No. 13) described by Mr. Stewart as being south of No. 11 (about one quarter to one half mile) was observed only a few minutes also. It was very close to the track of No. 11, and slightly behind (west of) it. An inspection of damage did not reveal apparent separate tracks. During the time of No. 11 and No. 12, there was considerable dust in the air within a mile or so of the tornadoes and further details on these funnels were not available.

Many observers who were in the vicinity of No. 11 reported that the cloud base itself was rotating (some said violently) in a counterclockwise direction for at least 30 min, perhaps longer. Some of the movies also showed this rotation. The part of the cloud that was rotating was centered about the main funnel and extended outward in all directions for two to three miles with a diameter of some five miles. Descriptions and photographs of this tornado suggest a shallow bowl-shape for this part of the cloud. Tornado No. 10 occurred near the edge of this part of the cloud. Numerous funnels which did not reach the ground were observed on the south side of this rotating bowl; none were reported on the north side. At the ground, where these funnels aloft were observed, surface winds were strong, gusty, and shifting. Spotty wind damage was reported here. Observations of the cumulonimbus cloud itself suggested nothing unusual for this type.

Many observers were questioned regarding observations of electrical discharges in the vicinity of the funnel. It may be noted that neither Mr. Stewart nor any of the 5 persons with him observed lightning of any kind even though the main

tornado vortex passed within 100 ft of their shelter. Many other observers emphatically stated that there were no visible electrical discharges in the vicinity of any of the funnels observed. At the same time, lightning was frequently observed in connection with the thunderstorm above and some discharges are faintly visible in some of the tornado movies taken there. One person did report a "ball of fire" rolling along a railroad track which was about three miles south of No. 11.

Large hailstones were reported in Scottsbluff County in connection with this storm. All reported hail fell from the part of the thunderstorm cell which was either west or north of the time and location of the tornadoes. Detailed reports are not available, but it appears that hail occurrences were confined to an area extending south of the tornado tracks no more than three miles and about five miles to the north. Baseball-sized hail was reported in Mitchell (two miles north of the path), two-inch hail was reported between Scottsbluff and Mitchell, and many reports of golf-ball-sized hail were received. Rainfall amounts exceeding one-half inch also seemed to be confined to this same general area.

Some study of the photographic material (photographs were taken only of the 3 largest tornadoes: No. 6, No. 9, No. 11) which was made available to the Weather Bureau for duplication by the many photographers in this area, brought out several interesting items. Several of the movies, all of which were taken on Kodachrome, showed a definite cyclonic rotation of both the cloud base and the funnel itself. The movies were taken at distances of one and a half to five miles from the tornado. While occasional flashes of lightning within the cloud were visible, there was no evidence of electrical discharges within or near the funnel itself.

The Kodachrome slides show a variation in color of the funnel. An important part of this variation is undoubtedly due to lighting conditions and exposure. But it also appeared that, early in the life of two of the funnels, condensed moisture was largely responsible for the funnel being visible. Later in the life cycle, it appeared that the visible portion of the funnel was largely composed of dust (the interior, of course, being obscured).

Some of the photographers snapped their cameras at frequent intervals (less than a minute apart), and study of these series photos showed erratic movements of the bottom of the funnel. This was also described by eyewitnesses. Esti-

mates of these movements, based upon changing angles from photographs available, showed that the distance could be as much as a half mile during this short-time interval. Many eye-witnesses reported damage occurring when the visible portion of the funnel was well above the ground. This was confirmed by several photographs.

Photographs were taken near the time tornadoes No. 9 and No. 11 first became visible and within a few minutes after No. 6 formed. All of these photographs showed that the tornadoes were funnel-shaped at the time of formation, even before the visible portion reached the ground. Also, photographs taken during the life cycle of these three tornadoes showed that the vortex assumed the shape of a cylinder or column later in its life cycle in all three cases. In the case of No. 6, the cylindrical shape was observed just before dissipation. Tornado No. 11 had a cylindrical shape during about the last half of its life. This change in shape apparently occurred shortly after it struck the cemetery. Photographs were taken just before No. 9 and No. 11 terminated, and these show that the vortex appears to be torn apart rather than to have disappeared into the clouds. (See fig. 4 of Van Tassel's article [1].) Finally, large vortices began as large tornadoes and remained so until terminating abruptly, whether their life span covered 10 (No. 6) or 35 (No. 11) minutes. None of the small vortices (Nos. 1, 2, 3, 4, 5, 7, 8, 10, 12, 13) ever increased appreciably in size, and all were short lived.

One of the most interesting groups of funnel photographs taken during this tornado situation is the series taken by Mr. Leo Schumacher. Eleven photographs were taken of tornado No. 11 from near its beginning until it dissipated. The first photograph (fig. 2) was taken at a distance of 6.5 mi and shows a large funnel which apparently does not quite reach the ground. The second photograph (fig. 3), which was taken about two minutes later and at a distance of about six miles, shows a large destructive tornado. The fifth photograph (fig. 4) was taken at a distance of five miles. The eighth photograph (fig. 5) was taken at the time the tornado was near the airport, a distance of five miles. Note that while the diameter appears a little smaller, it is still a very destructive tornado. Fig. 6 is a photograph taken toward the south-southeast just before it dissipated one and three-quarters miles away. Note the lone, extremely narrow vortex that appears to enter the cloud from its leading edge rather than at the cloud base. It may be

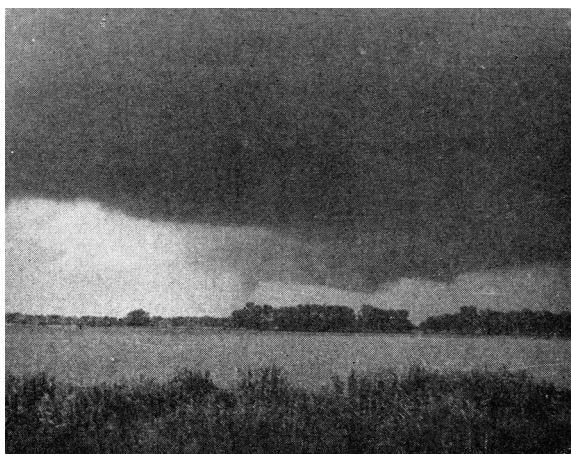


FIG. 2. Photograph of tornado No. 11 just after development (1645 MST). The tornado is 6.5 mi away. Courtesy of Leo Schumacher.

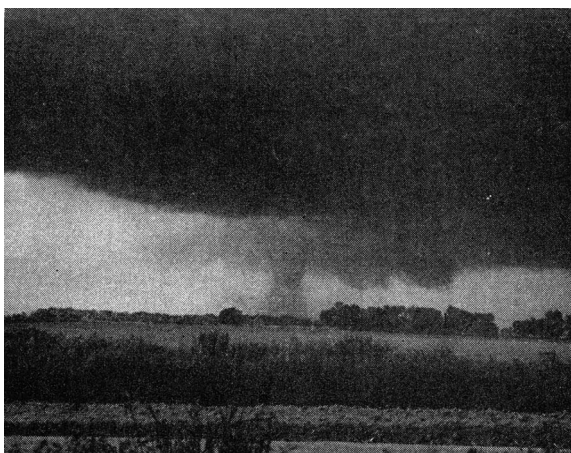


FIG. 3. Photo of No. 11 about 2 min later at about 6 mi distance. Courtesy of Leo Schumacher.



FIG. 4. Photo of No. 11 at a distance of 5 mi, around 1700 MST. Courtesy of Leo Schumacher.

observed that the structure of the remains of the tornado is very similar to that illustrated in Van Tassel's description [1], except that the vortex is still visible in the Schumacher photograph. Also, as in the forest ranger's description of No. 9, this narrow vortex was visible for only a very short time interval. (A photograph taken about two minutes before that shown in fig. 6 showed a funnel about the size of that shown in fig. 5.) Estimates of the thunderstorm-cell movement from the radar were 12–15 mph. While Mr. Schumacher took photographs at intervals of 1 to 8 min, none of his photographs showed the funnels indicated here as No. 12 or 13.

There are different sizes and shapes of tornado funnels so that the area of destruction is neces-



FIG. 5. Photo of No. 11 at a distance of 5 mi, around 1710 MST. Courtesy of Leo Schumacher.

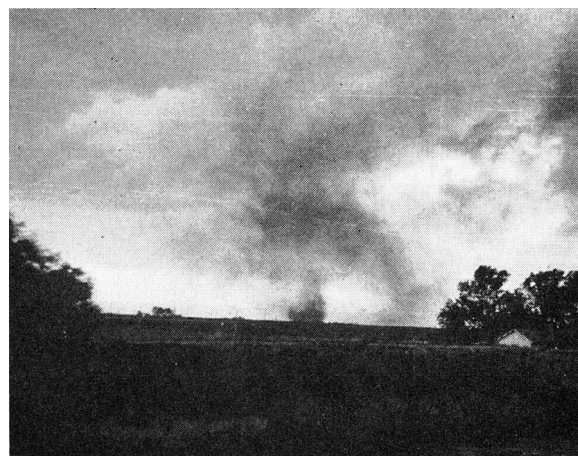


FIG. 6. Photo of No. 11 at a distance of $1\frac{3}{4}$ mi, around 1720 MST. Note the very narrow vortex. Courtesy of Leo Schumacher.

sarily a function of tornado size (diameter at the ground) and path length. There has been much conjecture regarding relative strengths of "large" and "small" tornadoes. Data from this survey show that small vortices may be extremely violent even though their path width may only be a few feet. Thus, the wind speed or pressure gradient within the vortex appears to be largely independent of tornado diameter.

The first radar photographs which showed the characteristic "hook" were taken at 1555 MST (see fig. 1). At this time, the usual position of the tornado relative to the "hook" would have placed it nearly 15 mi WNW of the Scottsbluff Airport. However, the tornado was not seen, nor was damage found, until about 15 to 20 min later and some 4 mi closer to the airport. This would seem to indicate that the "hook" was a reflection of some circulation aloft which was present for some time before the visual tornado actually reached the ground.

2. Summary

1. Numerous descriptions of funnel rotation, large or small, were of cyclonic rotation in all cases.

2. A cold core was observed at the ground in the large tornado (No. 11).

3. Numerous small vortices and funnels not reaching the ground were observed south of the small-scale (5-mi diameter) cyclonic rotation of the cloud base. The larger funnels occurred near the center of this cyclonic rotation.

4. Direction of funnel movement appears to be independent of the direction of the large-scale winds aloft.

5. Small vortices did not increase appreciably in size, nor did large vortices become small, except for a very short time interval at dissipation.

6. Small vortices may be extremely violent.

7. Funnels may shift their apparent speed and direction, over a distance of at least a half mile within a minute's time, due to the whipping action near the ground. (This is based upon estimates of funnel height and change in angle from three series of photographs.)

8. Initiation and termination of visible vortices, large or small, appear to be abrupt processes, not gradual ones.

9. Damage surveys, for those interested in the storm model, should include details regarding the time and location of *all* vortices.

Acknowledgments.—The author gratefully acknowledges the wholehearted cooperation of the

many persons who contributed photographs and information for the compilation of data for this survey. Particular thanks are due Mr. Leo Schumacher, Mr. Russ Stewart of Radio Station KNEB, "Hap" Ellis of KOLT, the many photographers who so kindly permitted reproductions of their work, and the several newspapers who were very helpful in providing information. Thanks also are due Mr. Edgar L. Van Tassel,

Mr. Harrie E. Foster, Mr. Al Hauck, and Miss Georgina Neubrand for helping with the preparation of data.

REFERENCES

1. Van Tassel, L., 1955: The North Platte Valley tornado outbreak of June 27, 1955. *Mon. Wea. Rev.*, **83**, 255-265.
2. Beebe, R. G., 1956: Tornadoes during 1955. *Weatherwise*, **9**, 18-21.

ANNOUNCEMENTS

Postdoctoral Research Associateships

The Air Research and Development Command, U. S. Air Force, has announced that the postdoctoral research associateships of 1959-60 (see BULLETIN, AMS, November 1958, p. 609) constitute a continuing program. Plans are now being formulated for 1960. The closing date for submission of applications will remain approximately the same for each year—about mid-January.

Questions or requests for additional information should be addressed to Headquarters, ARDC, USAF, Attention: RDSPCP, Andrews Air Force Base, Washington 25, D. C., or to the Fellowship Office, National Academy of Sciences—National Research Council, 2101 Constitution Avenue, N.W., Washington 25, D. C.

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(ANNOUNCEMENTS continued on page 159)

NECROLOGY

Ralph H. Jackman

Ralph Henry Jackman, Lieutenant Commander, U. S. Navy, died at Corpus Christi, Texas, on 7 December 1958.

Commander Jackman was born in Rochester, New York, in January 1912. Prior to service as aerological officer in the Navy since 1951, he had been employed with the U. S. Weather Bureau and Pan American Airways in New York and Miami. He joined the American Meteorological Society in 1954.

He is survived by his widow, Mrs. Olga Jackman of 1806 North Oriole Avenue, Norfolk 3, Virginia.

Carl A. Otto

Carl A. Otto, chief engineer of the Johnson Service Company, Milwaukee, Wisconsin, died in Milwaukee on 2 September 1958.

Mr. Otto, who was born in Oshkosh, Wisconsin, in 1896, had been with the Johnson Company since 1914 and its chief engineer since 1922. He had more than twenty patents to his credit during his long years as head of Research and Development and was author of innumerable technical bulletins on Johnson instruments which included various meteorological and aircraft devices.

A member of the American Society of Tool Engineers, the American Society of Mechanical Engineers, and the American Chemical Society, Mr. Otto joined the American Meteorological Society in 1946.