~~9833~~ 9345 MHz
9,345

Ellason 200 Color Radar System

Ground Based Weather Radar

OPERATING HANDBOOK

EllasonAvionics

EllasonWeatherRadar

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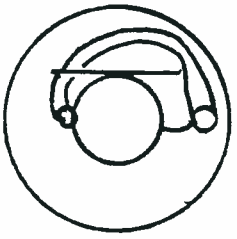
711 WHITEHEAD
WENTZVILLE, MO. 63385

ELLASON 200 WEATHER RADAR WITH 12" ANTENNA

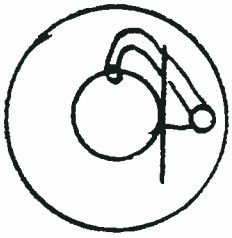
WARNING - IF THE CABLE IS NOT ROUTED CORRECTLY IT WILL BE DAMAGED.

THE CABLE MUST BE ROUTED CORRECTLY TO PREVENT DAMAGE DURING ROTATOR OPERATION. COMPARE THESE DIAGRAMS TO THE DIRECTION YOUR ANTENNA IS FACING. ROUTE CABLE AS SHOWN. MAKE SURE CABLE IS NOT TWISTED AND WILL LAY FLAT ON THE RADOME BASE.



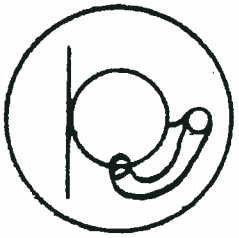
ANTENNA NORTH

ROTATOR WIRES ARE ON EAST SIDE OF RADOME BASE

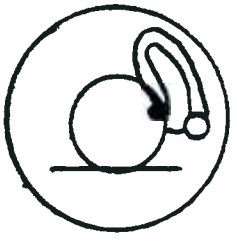


ANTENNA EAST

Phil Lowrey
806
Home 273-7224
work



ANTENNA WEST



ANTENNA SOUTH

ANY QUESTIONS CALL 314-532-3031

INDEX

INTRODUCTION

To effectively use the ELLASON 200 COLOR WEATHER RADAR does not require the operator to have a meterology background. However, any knowledge of meterology will provide a better understanding of what you will see with different air masses.

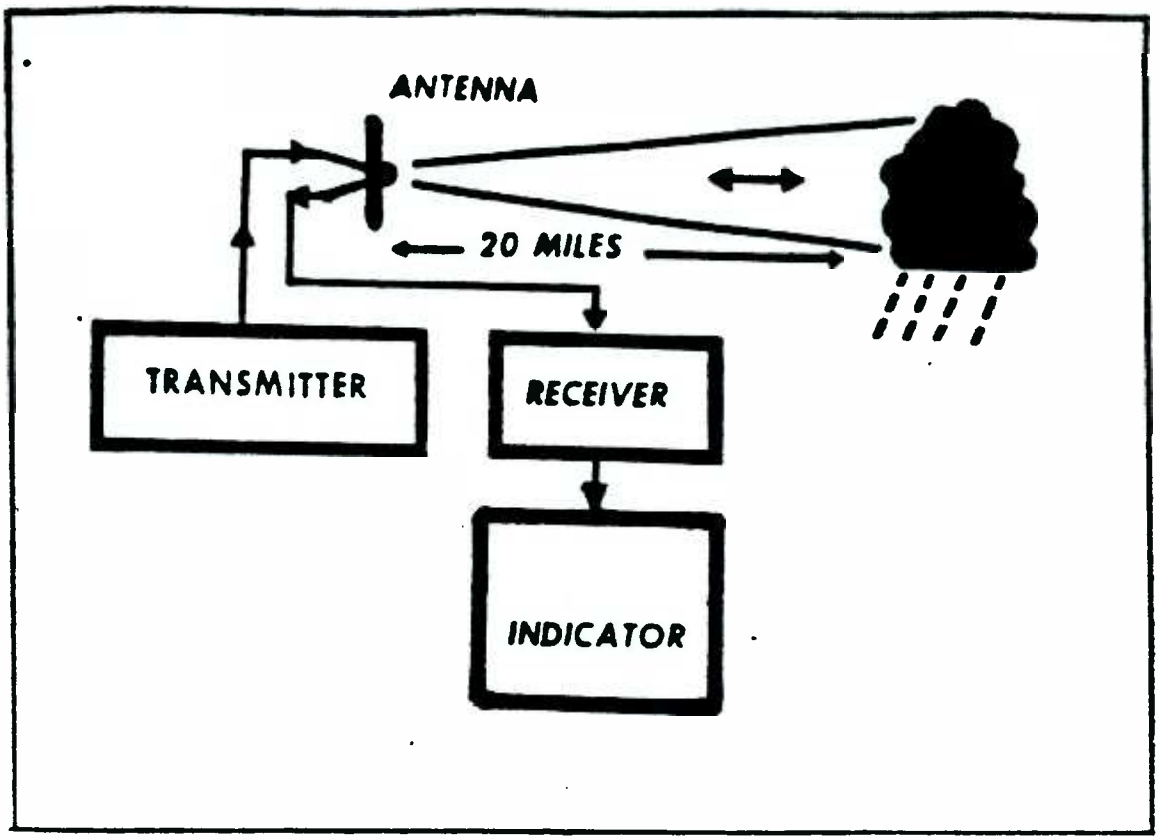
My purpose in designing the controls for this system was to have a radar that was easy to operate. I believe it will take a minimum of instruction for each person to understand all of it's functions. After you understand each function and a minimum of radar theory you can then be taught how to interpret what is being displayed on the screen. My method of using this system does not require any guess work by the operator as to what he will be looking at on the screen. If you are guessing about what you see on the radar, you are using the system wrong or you need more information. It is that simple!

Each operator will have unique reasons for needing the information provided by the radar system. Some may need to know the arrival time of light rain while others will only be interested in heavy rain and severe thunderstorm.

I would like to caution the operators that the weather radar is engineered to show WATER CONTENT of the cloud formation. Do not try and read something into the radar that is not there.

REMEMBER THE RADAR SHOWS WATER.

Arnold Q. Lane



FUNDAMENTAL OF HOW WEATHER RADAR WORKS.

There are 3 basic parts to the weather radar. They are (1) transmitter. (2) Receiver. (3) Indicator.

This is what happens. The transmitter transmits a pulse of radar energy. At the time the transmitter turns on, the receiver starts timing. When and if any of this pulse of energy is reflected back to the reciever, it can then be processed. First, the distance from the antenna can be calculated because the speed of radar waves is a constant factor. If, for example, the elasped time equates to the time for the pulse to travel 40 miles, the target will be 20 miles from the antenna. This allows the radar pulse to travel 20 miles to the target and 20 miles back to the receiver antenna, thus the 40 mile timing. Secondly, the receiver then must analyze how much of the signal was reflected back. If a small amount is reflected back,there is not much water content in the cloud formation. If a moderate amount of the transmitted energy is reflected back, we know there is a moderate amount of water content. If, however, a large amount of the energy is reflected,there is a heavy amount of water

content. Now is where the third item of the system comes in. The indicator is the means of displaying to the operator the distance position and intensity. Since the antenna is sweeping the horizon all the time, the receiver must process and display 3 items: azmuth, distance, and intensity. This intensity is displayed in green for light, yellow for moderate, and red for heavy water content. After the receiver has processed this information the transmitter transmits another pulse of energy and the process starts over. This occurs 240 times per second.

This, of course, is not a highly technical explanation, but is presented to give a basic explanation of how the weather radar works.

THE E200 SYSTEM

The Ellason 200 System is engineered for ground based detection and analysis of weather systems. The Ellason 200 has been designed for ease of operation and interpretation, utilizing a brilliant multi-color display. This lightweight X-band digital radar detects storms and produces a visual indication, in color, of their rainfall intensity. Light rainfall is displayed in bright green, medium rainfall in yellow, and heavy rainfall in red, clearly indicating approaching precipitation and possible damaging winds.

RADAR CONSOLE

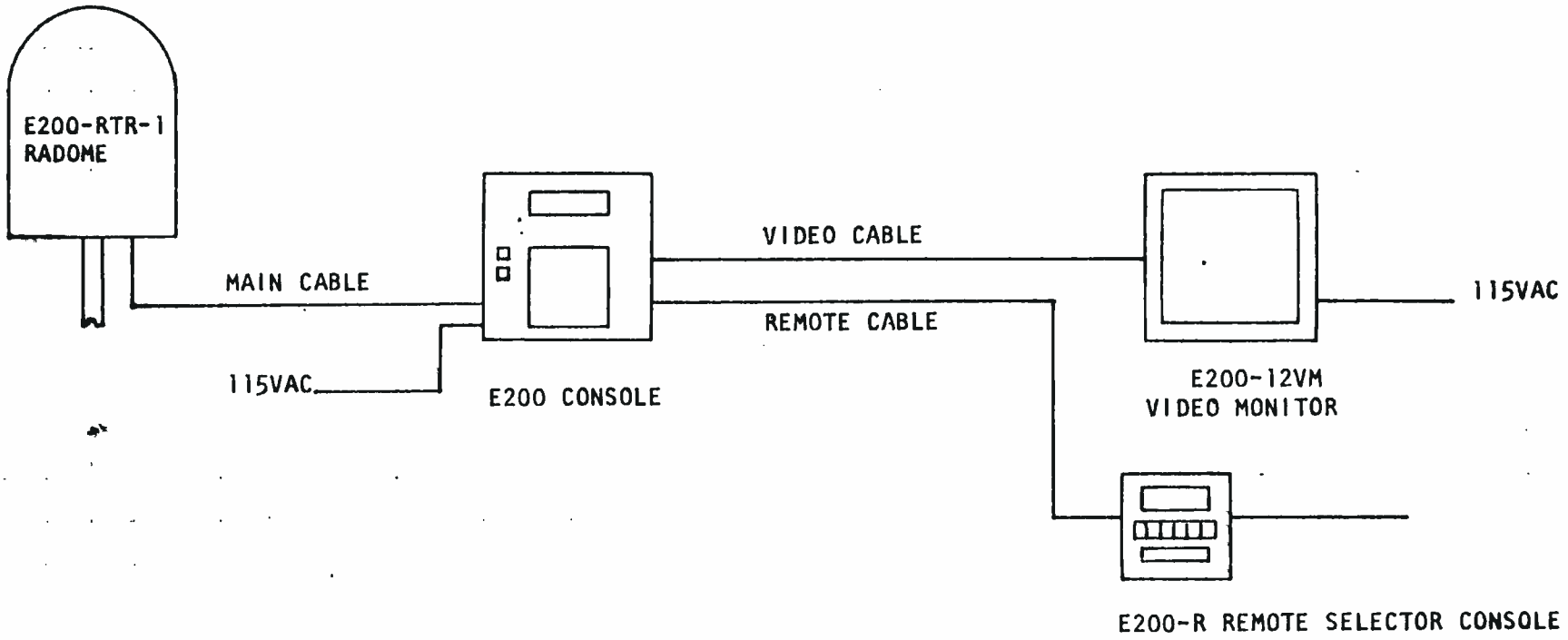
The radar console is human engineered to allow ease of operation with a minimum amount of training. The radar scope displays 90° sweep. The direction to be scanned is determined by depressing one of eight directional push buttons. Range can be selected from 10, 25, 50, 100 and 200 nautical miles. An antenna tilt is also available to better survey the vertical extent of the storm cells. In addition, a digital clock is mounted in the console as an aid to determining the speed of the storm movement.

RADOME

The radome, containing the transmitter, receiver, and antenna, is constructed of the highest quality of fibreglass. The unit can be either roof top or tower mounted. The console and radome are connected by a single cable using aircraft quality plugs. No special wiring is necessary.

REMOTE MONITOR AND CONSOLE

For viewing ease a video monitor and it's remote control console is available. This monitor can be used anywhere within your facility providing up to the minute weather information to additional personnel. The remote console allows direction and range to be selected from the monitor location. This large screen makes it easier to track storm cells.



BLOCK DIAGRAM FOR ELLASON 200 SYSTEM

E200 RADAR CONSOLE

Numbers relate to diagram in this section.

1. DIGITAL CLOCK

2. POWER ON/OFF

3. RADAR INDICATOR - ALL CONTROLS FOR INDICATOR ARE SHOWN SEPARATELY IN THIS SECTION.

4. ANTENNA IN TRANSIT LIGHT
   Light will be on anytime antenna is in transit. When the light goes out indicates that the antenna direction matches the button selected.

5. DIRECTIONAL CONTROL BUTTONS
   Are used to select direction to sweep with radar antenna. Push button in until it latches and antenna in transit light comes on. Direction of button selected will be in center of radar scope when intransit light goes out.

6. HOUR METER
   Shows time system has been operated.

7. DIGITAL CLOCK SLOW RESET.

8. DIGITAL CLOCK FAST RESET

9. NAME AND SERIAL NUMBER PLATE

10. SPARE FUSE FOR CONSOLE

11. FUSE FOR 115VAC POWER

12. 115V POWER CORD

13. FOAM AIR FILTER OVER AIR INTAKE
    The filter should be washed at least 1 time a month.

14. VIDEO COMPOSITE OUTPUT

15. RF OUTPUT

16. MAIN CABLE PLUG

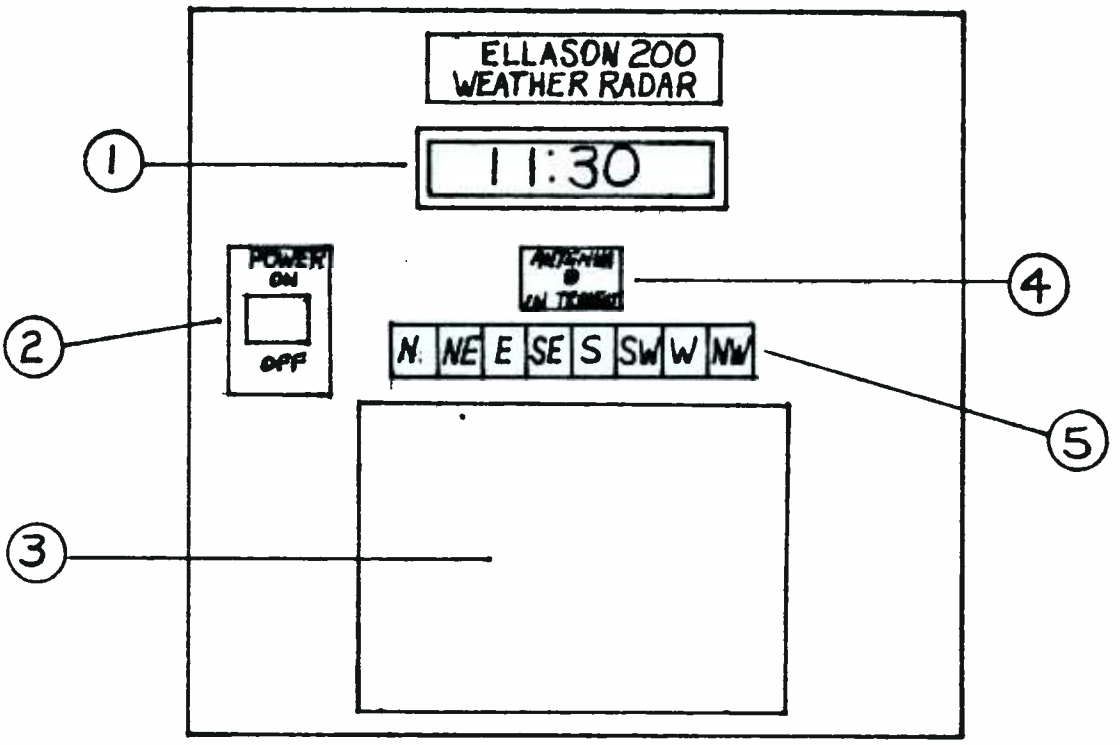
    Main cable runs from console to radome.

17. REMOTE CABLE PLUG

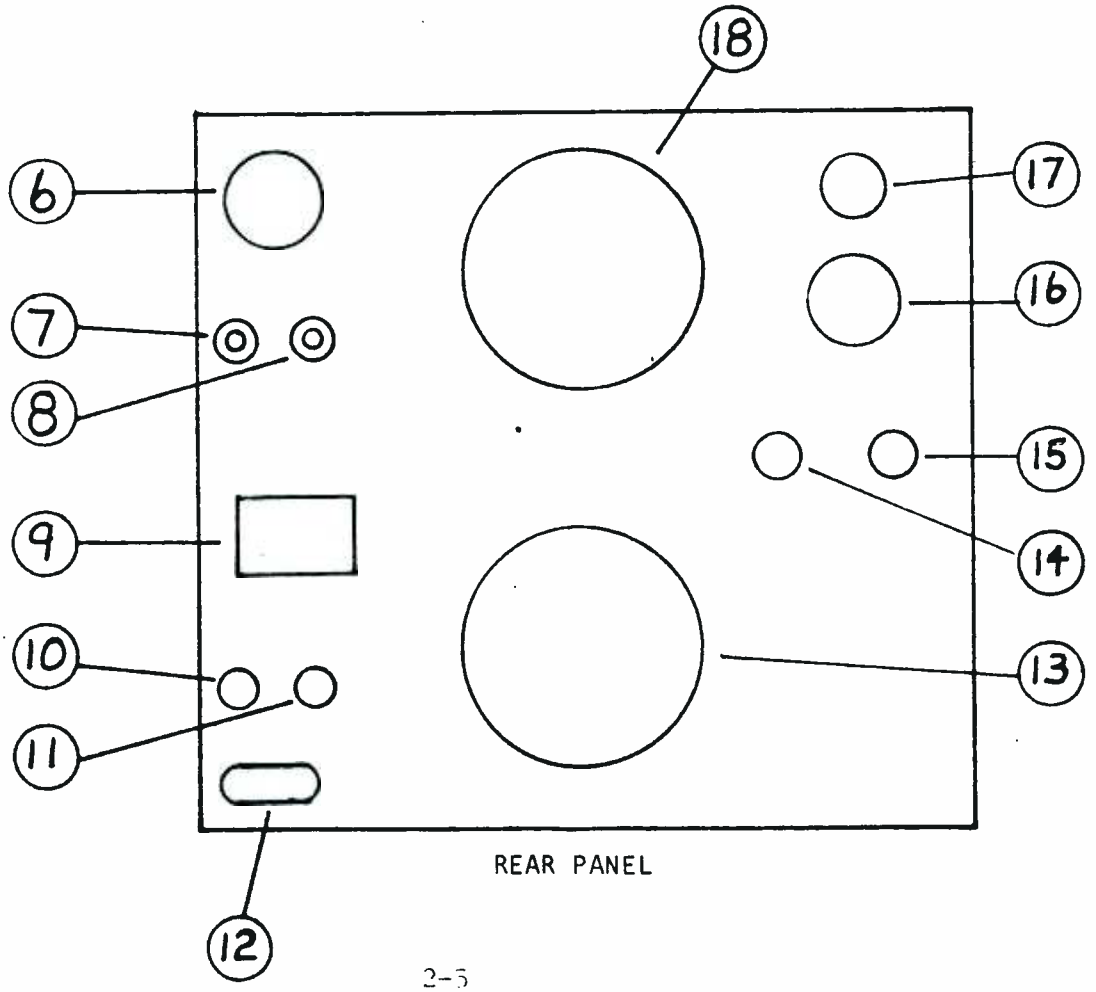
    Remote cable runs from console to remote control console

18. COOLING FAN

    Any time power switch in on this fan should be blowing air out of console.



FRONT PANEL



REAR PANEL

E200 RADAR INDICATOR

Numbers relate to diagram in this section.

1. INT/OFF--Rotary control used to turn radar system on and off and to adjust brightness (intensity) of display. At initial turn-on the system will be in standby and STBY will be displayed in the lower left corner of radar scope.

2. STBY--Momentary push buttons used to select standby after radar has been used in the WX mode. In standby, antenna does not scan, transmitter is not operating. STBY is displayed in lower left corner of scope and 100 in the right upper corner of scope.

3. WX/C--Alternate action momentary pushbuttons used to select weather detection operation. When radar is first turned on, and the WX/C button is pushed, WAIT will be displayed in the lower left corner of the scope. After warm up period (approximately 60 seconds) the radar will be operational and the mileage range marks will show on the scope. At this time WX will appear in lower left corner of scope below the color bar. Depress WX/C button after unit is operational and CYC will appear instead of WX. In this mode any target shown in red (level 3) will flash on and off one time per second. Depress WX/C again and unit will switch back to WX. When unit in CYC mode the gain is automatically selected to pre-set.

4. MAP--Momentary pushbutton selection of map mode will give a one step gain reduction on the receiver. During map mode, the colors of the depiction will change. This allows the operator to know immediately the gain control is not set for correct color depiction.
   The only usual function this mode has is the gain reduction.

Numbers relate to diagram in this section

5. TEST--This mode allows the operator to determine system operation. The word test is displayed in lower left corner of scope. The colors should show normal.

6. FRZ—Momentary pushbutton is used to freeze picture. The sytem continues to operate but the picture is frozen. This is used to establish a movement of storm cells. After system has been in FRZ for a period of time the operator may select W/X and see new positions of storm cells when the picture is updated.

7. GAIN—Lower left rotary control will change gain of reciever. The system is designed to be operated in pre-set. (This is the full counter clockwise position.) The numbers 123 will be shown beneath the color bar. Full clockwise is the most sensitive position.

8. TGT ALRT--Slide control used to turn target alert function on or off. When on, a letter T in a red rectangle is displayed to identify the alert function is active. When a level 3 (Red) return is processed by the receiver from the target alert area the symbol TGT in a red rectangle is displayed in upper left corner and flashes once each second.

   The alert area is a wedge 7.5 degrees on both sides of center of the scope starting at 60nm and extending to 160 nm from the antenna.

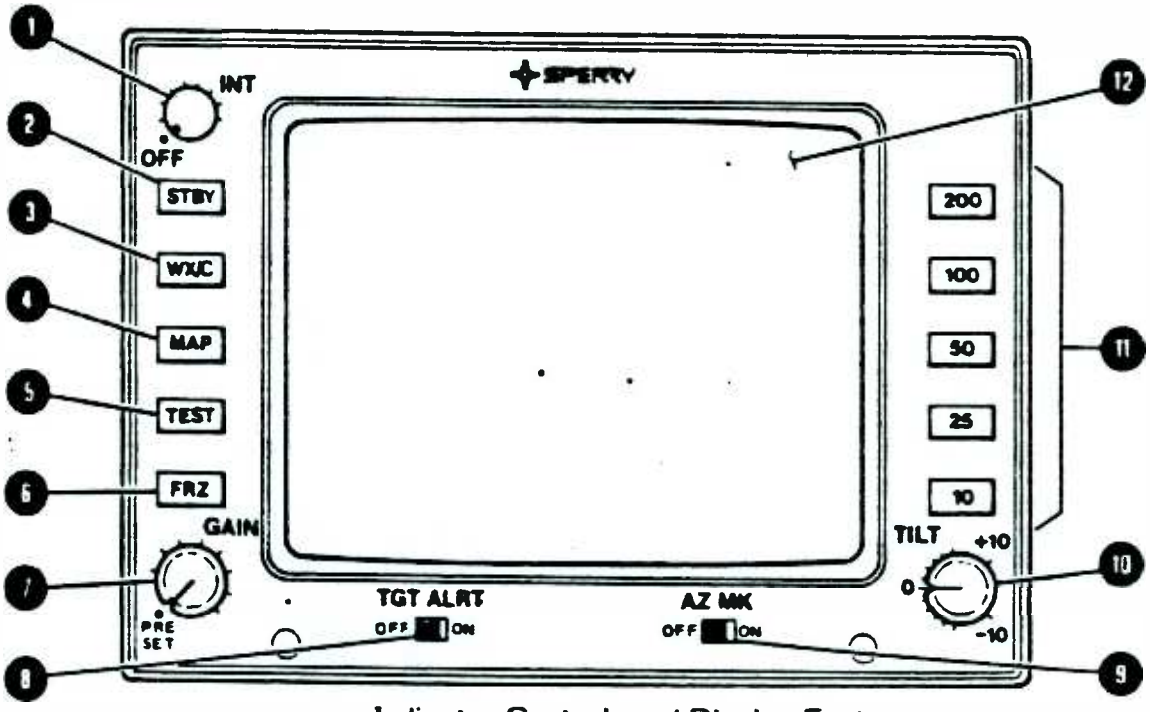
   TGT alert is automatically deactivated if MAP is selected or if variable gain is used.

9. AZ MK—Slide control used to either display or not display azimuth markers.

10. ANTENNA TILT CONTROL

11. RANGE SELECTION--Monetary pushbuttons used to select one of five ranges. When the system turned on, 100 mile range is automatically selected.

Operating Controls



Indicator Controls and Display Features

E200R REMOTE CONTROL CONSOLE

Numbers relate to diagram in this section.

1. Antenna Intransit Light.

   This light will be on any time antenna is in transit. When the light goes out the antenna direction matches the button selected.

2. Directional Control Buttons

   are used to select direction to sweep with radar antenna. Push button in until it latches and antenna intransit light comes on. Direction of button selected will be in center of radar scope when intransit light goes out.

3. Range Selection

   Monetary pushbuttons used to select one of five ranges. When system turned on 100 mile range is automatically selected.

4. WX/C

   Alternate action monetary push button switch is used to select weather detection operation. When the radar is first turned on the WX/C button is pushed, "WAIT" will be displayed in the lower left corner of the scope. After the warm-up period, approximately 60 seconds, the radar will be operational and the mileage range marks will show on the scope. At this time "WX" will appear on the lower left corner of the scope below the color bar. Depress WX/C button after radar is operational and "CYC" will appear instead of "WX". In this mode any target shown in red, level 3, will flash on and off one time per second. Depress the WX/C again and the unit will be in "WX" mode. When the unit is in "CYC" mode the gain is automatically selected to pre-set.

Numbers relate to diagram in this section.

5. FRZ

The momentary push button is used to freeze the picture. The system continues to operate;but,the picture is frozen. This is used to establish a movement of storm cells. After the system has been in "FRZ" for a period of time, the operator may select "W/X" and see the new position of storm cells when the picture is updated.

6. TEST

This mode allows the operator to determine system operation. The word "TEST" is displayed in the lower left corner of the scope. The colors should show normal.

NOTE: Target alert, azimuth markers and tilt control must be transfered to remote control console. This is accomplished by pushing the lighted directional button until the antenna-intransit light comes on.

Target alert and azimuth markers will only work if the main caonsole controls for these function are off. If the main console switches are on, they cannot be turned off by remote console.

7. TGT ALRT

The push button switch is used to turn on or off the target alert. When on a letter T in a red rectangle is displayed to identify the alert function is active. When a level 3, red, return is processed by the receiver from the target alert area the symbol "TGT ↑ " in a red rectangle is displayed in the upper left corner and flashes once each second.

The alert area ia a wedge 7.5 degrees on both sides of center of thescope starting at 60nm and extending to 160nm from the antenna.

8. AZ MK

Push button to turn azimuth markers on or off.

E200R REMOTE CONTROL CONSOLE

Numbers relate to diagram in this section.

9. TILT

The Rotary control used to select TILT of antenna beam.Tilting beam is necessary to track cells as they move closer to antenna. TILT can be used to find tallest cell in a group of cells.

10. DIGITAL CLOCK

11. REMOTE CABLE PLUG

The cable connects the main console to the remote console.

12. POWER CORD

115V for clock.

13. CLOCK RESET SLOW

14. CLOCK RESET FAST

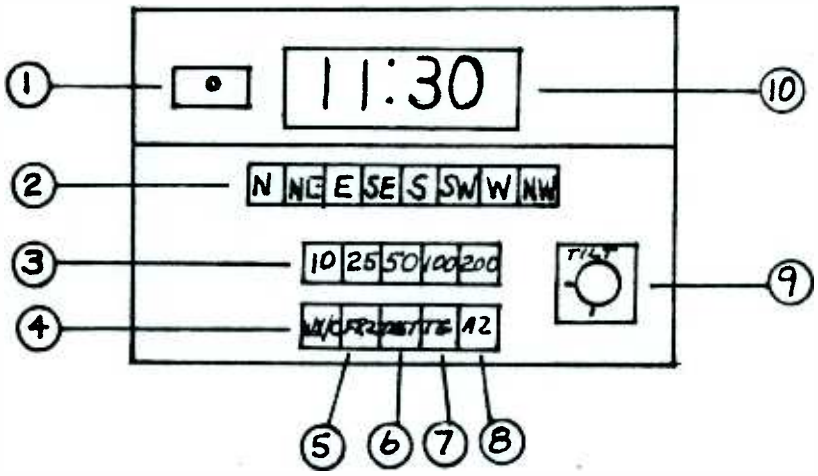
15. NAME PLATE AND SERIAL NUMBER

16. FUSE

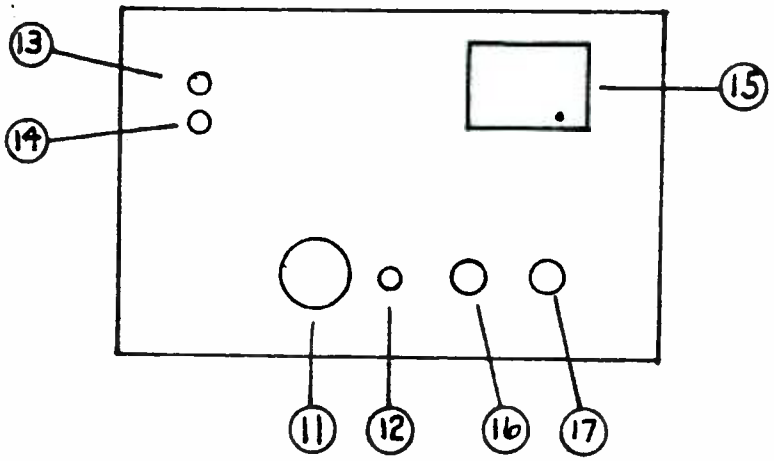
17. SPARE FUSE

E200R REMOTE CONTROL CONSOLE

FRONT PANEL



BACK PANEL



E200 RADAR SYSTEM

OPERATING THE RADAR SYSTEM

To Turn System on

1- Verify Clock is on.

2- Turn power switch ON. ON switch will light when system is on.

3- You should see 2 lights - power on switch should be lighted and one directional button should be lighted.

4- Push lighted directional button

Verify antenna in transit light comes on as button is fully depressed.

Note- If directional buttons were depressed while power was off, ANTENNA WILL NOT BE IN POSITION INDICATED until this operation is completed. Antenna in transit light may be on for several seconds or until it's position agrees with the directionsl button depressed. Intransit should always light while any of the directional buttons are being depressed against their stops.

5- Verify screen shows STBY in lower left hand corner and 100 in upper right hand corner.

6- Press TEST - Test color bars should show on screen.

7- Press WX/C - WAIT should appear in lower left corner of screen.

After a short period not to exceed 60 seconds the radar will be operational. The picture appears with mileage rings, and there will be green, yellow, and red color bars in the lower left corner. The system always comes on in the 100 mile range.

8- Set antenna t ilt 2° - 5° or a local setting that has been found to work best.

9- Verify gain control on lower left of indicator is full counterclockwise to pre-set. If the system is pre-set, there will be the numbers 123 just below the 3 color bars on the lower corner of the screen.

10- The radar is now ready to use.

USING THE ELLASON 200 SYSTEM

After completing the directions for turning the system"on"you are ready to use the system.

If the area you want to look at is already known you may push the directional button for that area,and when the antenna intransit light goes out you are looking in that direction. The recommended method for surveying the complete area is to make one complete 360 degree scan of your area.

TO DO THIS DO THE FOLLOWING-

When you turned the system on you pushed the "N" or "NW" button. This means the system is in one of these positions. The rotator is designed to turn clockwise from "N" to "NW" and counterclockwise from"NW to"N". If at this time you push the button that is not latched down the system will start to rotate and make one turn to the selected direction. If you watch the screen you will be able to survey the complete area in 45 seconds.

You are always located at the bottom of the screen and the picture you are seeing is the area around you as the antenna turns. If you were to stand on the roof top and face "N" or "NW" and than turn slowly to view the horizon until you arrived at the other direction, you would be looking at exactly what the radar is seeing.

When you see some weather you can go back and survey the rainfall and storm activity. When the system is in PRE SET gain the areas shown in different colors have the following estimated rainfall.

Green- less than .2 inch rainfall per hour
YELLOW- .2 to .5 inches rainfall per hour
RED- more than .5 inches rainfall per hour

It is best to refer to these areas as having rainfall being

GREEN- light
YELLOW- moderate
RED- heavy

USE OF GAIN CONTROL

The colors relate to estimated rainfall rates and are only valid when the system is in pre set. This mode is shown by the numbers 123 appearing below the color bar on the screen. The operator can use the variable gain control to find the areas of greatest water content. To do so you push the pre set button and verify the letters VAR appears on the screen in place of 123. Turn the gain knob CCW, this should clear any weather from the screen. Now rotate the know CW and the area that first appears Green will be the area with the most water content. If you have light rainfall or snow, you may want to increase the sensitivity by rotating the knob full CW. This will allow you to see the areas of the lease amount of moisture within the design of the radar.

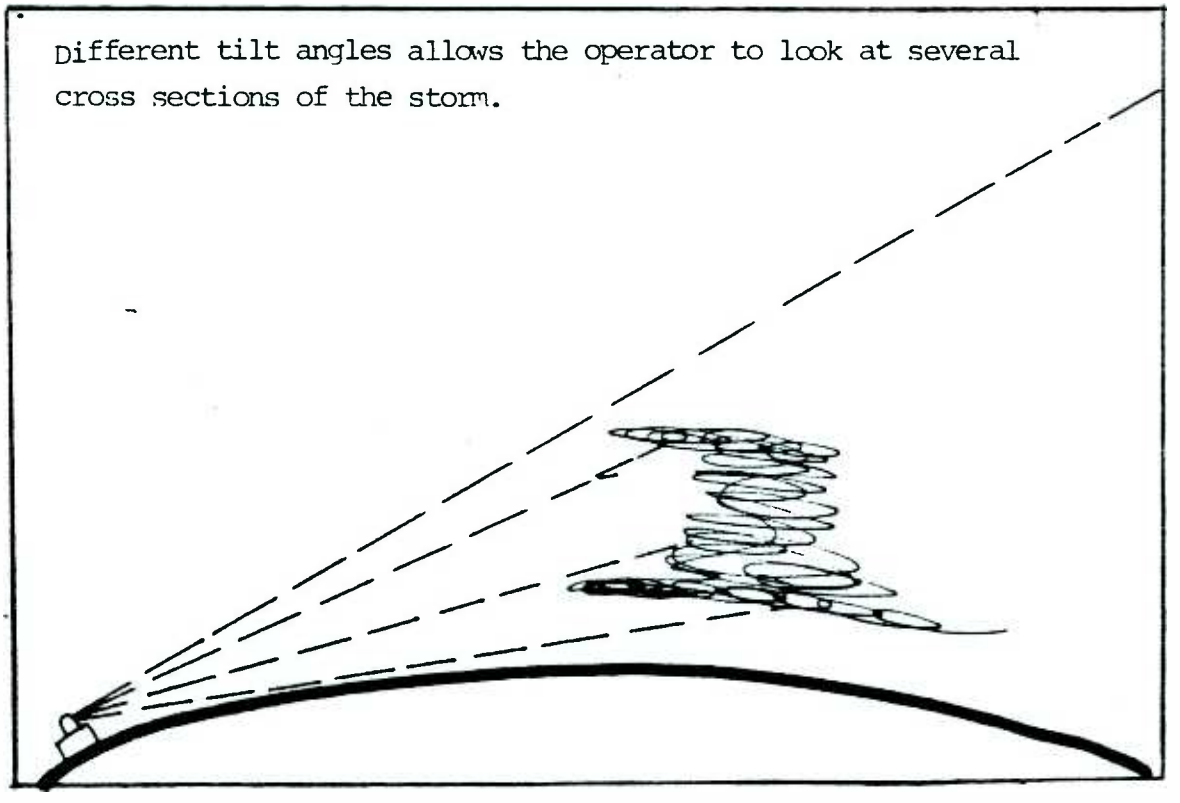
If you will envision, you are looking at a bird's eye view of the storm and understand what is on the screen is a very narrow cross section of the storm cell. With this knowledge you will better understand the value of gain control to locate the areas of heavy water content. This also gives you an insight as to what you are seeing when you change the tilt angle. With the tilt you are selecting the area of the cell that you want to look at.

TILT CONTROL

The Tilt Control will allow the operator to change the angle of the antenna. This allows the operator the capability of surveying the vertical structure of the storm cell. This information is useful in finding the tallest cell. The tallest cell usually has the most water content and related gusty winds. It is recommended that you track the tallest cell. To locate the tallest cell rotate the tilt knob full clockwise. Now turn CCW until the first spot of green shows on the screen. This area is the area with the tallest cloud formation. Now lower the antenna until you find the tilt angle that gives the largest area of weather on the screen. It is best to track the area of heaviest weather as this will be the area of the most rain and wind.

I recommend that you keep track of the tallest cell. This cell normally has the most severe weather associated with it.

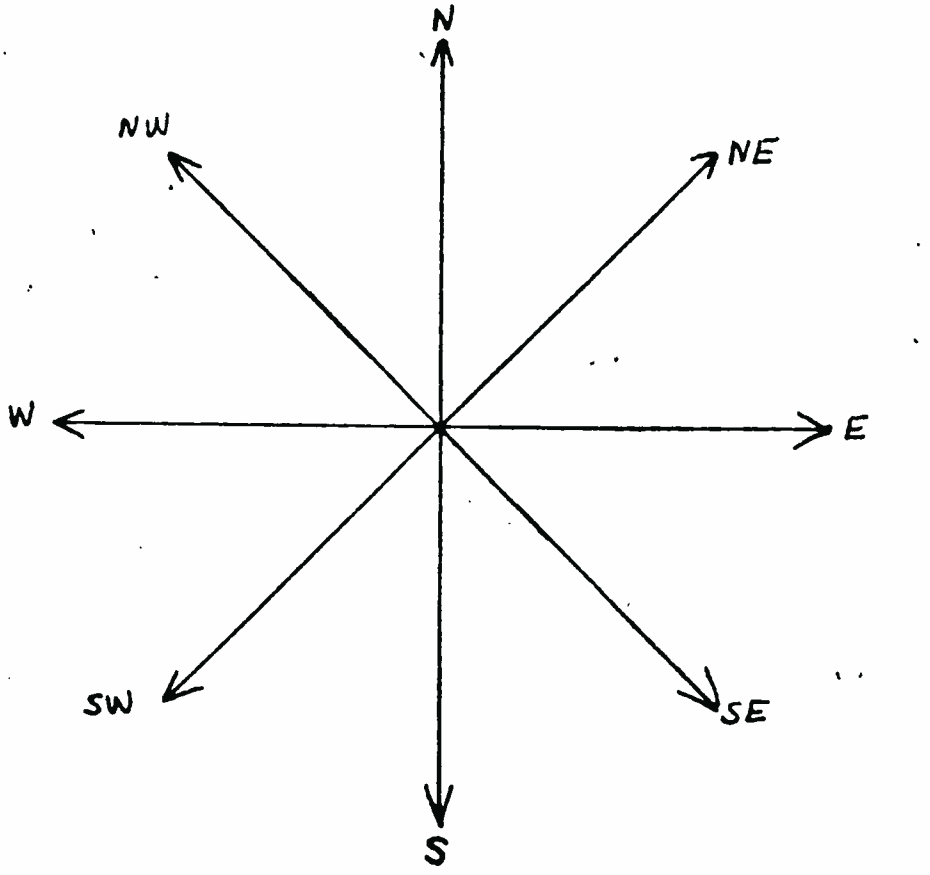
Another necessary function of the tilt is to keep the stormcell within site of the radar beam. As the cell moves closer to the antenna site, the angle of the antenna will have to be raised to keep the radar focused on the cell. This is the same method a duck hunter will use to keep the duck in his gunsight as it flies closer. This operation of the tilt control keeps the weather on the scope and also causes ground returns to disappear.



TRACKING STORM CELLS

Tracking storm systems is easily accomplished with the use of an acetate overlay on the screen. With a marker you can mark the location and time on the overlay. Allow at least 30 minutes and then mark the new location of the stormcell. Select the leading edge of the cell and draw a line from the first location to the new location. The movement in distance can now be measured by using the mileage markers on the screen. The direction can be determined by comparing this line with the known direction of the center of the antenna.

An easy way to determine the direction is to use a piece of acetate and make a compass rose as per the sample drawing. By putting this overlay on the screen with the selected direction at the top of the screen you will be able to determine the direction of the movement.



APPENDIX

In this section you will find information of a general nature. This information, pictures, and diagrams cover meteorology, theory of weather radar, statistical data on thunderstorms and tornados. Also, there is miscellaneous information related to weather and the use of radar.

This information is presented to give very basic information to the operators of the Ellason System. It is not intended to be an in-depth study of theory or meteorology. I have had questions asked during training classes that related to this information. These were valid questions and I enclosed this information as a means of answering these common questions. I would like to encourage those of you with an interest in meteorology to contact your local national weather service to find out the vast amount of information that is available. If you want to become more involved you may want to inquire at your local college or university about courses. I believe that the best short course available on meteorology, and is available almost every where, is the meteorology section of a private pilot ground school. Contact your local pilot training school and ask if they have a ground school available. The time spent on this will be worth it.

Tornados

Tornatoes occur with severe thunderstorms. They are violent, circular whirlpools of air shaped like inverted funnel or tube hanging from cumulonimbus cloud. (See explanation of this type cloud in section on thunderstorms.) These violently rotating columns of air range in diameter from about 100 feet to one-half mile. Tornados do not always reach the ground, but, when they do, they are the most destructive of all atmospheric phenomena on a local scale. Sometimes tornados decend erratically, reaching the ground at points along their paths and completely missing others. This is the reason houses on one side of a street will be destroyed and those on the other side not damaged.

Technically the funnel cloud must touch the ground to be a tornado. When the funnel cloud extend from the thunderstorm but does not reach the ground it is called a "funnel cloud".

Tornados are dark in appearance because of the dust and debris they have sucked into their whirlpools. The destructiveness of tornados is caused by the very low pressure (vacuum) in their centers and the high wind speeds this causes. This great suction caused by the low pressure sometimes lifts heavy objects off the ground. This is what happens when houses are lifted and moved off their foundations and cars are moved from where they are parked. The wind has never been measured but judging by damage it is believed winds within a tornado may reach as much as 300 mph.

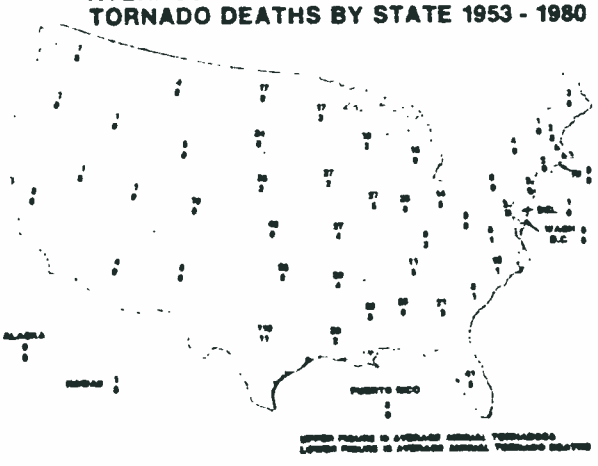
MONTHS OF PEAK TORNADO ACTIVITY

At NOAA's National Severe Storms Forecast Center (NSSFC) in Kansas City, Mo., National Weather Service meteorologists monitor atmospheric conditions in North America using surface weather observations from hundreds of locations, radar information, satellite photographs, temperature, moisture, and wind speeds in varying levels of the atmosphere, and reports from pilots. Combining these thousands of pieces of information, NSSFC forecasts are able to determine the current state of the atmosphere. When threatening conditions are detected, the work of issuing watches and warnings begins!

A WATCH is issued by the NSSFC to indicate when and where severe thunderstorms and/or tornadoes are ***most likely to occur***. A Severe Thunderstorm Watch implies that the storms may develop to significant strength to produce large hail (¾ inch or greater in diameter) and/or damaging winds. Since all severe thunderstorms are potential tornado producers, a Severe Thunderstorm Watch does not preclude the occurrence of tornadoes. A Tornado Watch means that conditions are favorable for the occurrence of both tornadoes and severe thunderstorms

Watches are usually issued for areas about 140 miles wide and 200 miles long. During a Tornado Watch, everyone in or near the Watch area should be alert for signs of threatening weather and make preliminary plans for action. Listen to NOAA Weather Radio, commercial radio, or television for further information.

AVERAGE NUMBER OF TORNADOES AND TORNADO DEATHS BY STATE 1953 - 1980



WARNINGS are issued by local National Service Offices when severe thunderstorms or tornadoes are indicated by radar or reported by trained spotters or other reliable sources. While radar is an invaluable tool, it cannot be relied upon totally to identify all severe weather. Trained spotters with rapid communication capabilities are critical to the warning process. SKYWARN spotter networks are composed of volunteers such as Amateur Radio and Citizen's Band radio groups as well as emergency service units such as police, firemen and Civil Defense personnel. The SKYWARN spotter networks are the backbone of the warning service and save many lives each year.

Yet, even the best combination of radar and trained spotters cannot identify all tornadoes and severe thunderstorms. If you see a tornado or funnel cloud, report it immediately to a local government agency and ask them to relay your report to the National Weather Service. Tornadoes can occur without warning, and your report and actions could not only save your life but others as well.

A WARNING will describe the area at risk from a tornado or severe thunderstorm. This is determined from the location, size, direction, and speed of movement of the storm (which can be erratic). A severe thunderstorm presents the danger of damaging winds, large hail (three-fourths of an inch in diameter or larger), lightning and heavy rainfall. Listen closely to the information contained in the warning. If a tornado is nearby, take protective cover immediately. At times, you may be in a warning area, but the reported tornado may not be nearby. Remember, you may still be at risk and should be prepared to take cover since the storm may be moving your way or may even produce additional tornadoes or damaging winds.

THUNDERSTORM

Cumulonimbus - The cloud formation of a thunderstorm have a lumpy or billowy appearance and are called "cumulus" meaning "accumulation". The word "nimbus", which means "rain cloud" is added to those "cumulus" clouds that produce precipitation. Thus, cumulonimbus.

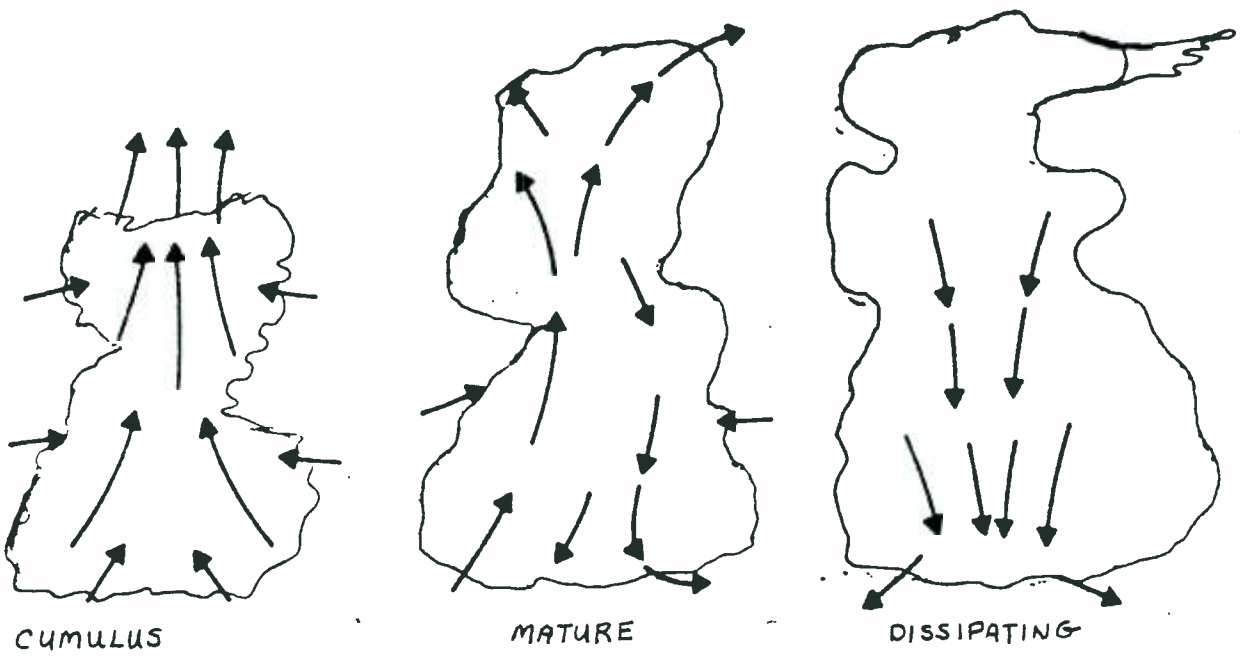
Thunderstorms are local storms which invariably are produced by the cumulonimbus clouds and are always accompanied by lighting and thunder.

Individual thunderstorms are rarely larger than 10 miles in diameter, and their life cycle is from 20 minutes to 1½ hours. It is very common for thunderstorms to develope in clusters of two or more. Clusters, with individual thunderstorms at various stages of development, sometimes are over 100 miles in diameter and will last for 6 hours or longer.

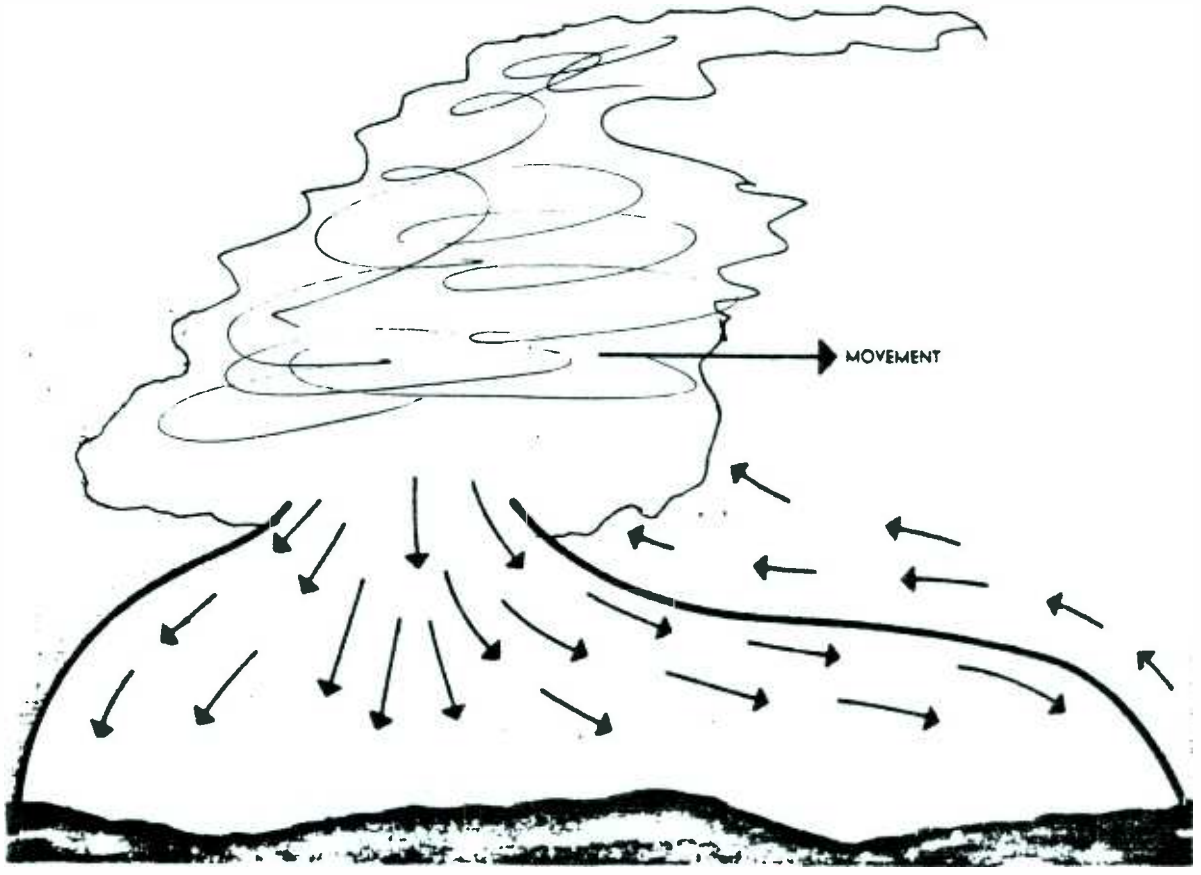
A thunderstorm has 3 stages: cumulus, mature, and dissiapting.
Cumulus - The first stage is always a cumulus cloud. The main feature of the CUMULUS or building stage is the updraft which man extend from near the earth's surface to several thousand feet above the visible cloud top. There usually is no falling precipitation during this stage becuase the drops are being carried upward, or are more or less suspended in the ascending air currents.

Mature - The beginning of rain at the earth's surface initiates the MATURE stage of the thunderstorm. The raindrops and ice particles have grown to the extent that they can no longer be supported by the updrafts. In the mature stage, the cloud tops usually grow to 25,000 or 35,000 feet and occassionally break through the tropopause, reaching heights of 50,000 to 60,000 feet. As the raindrops fall, they drag air with them. This is a major factor in the formation of the downdrafts which characterize every thunderstorm in it's mature stage.

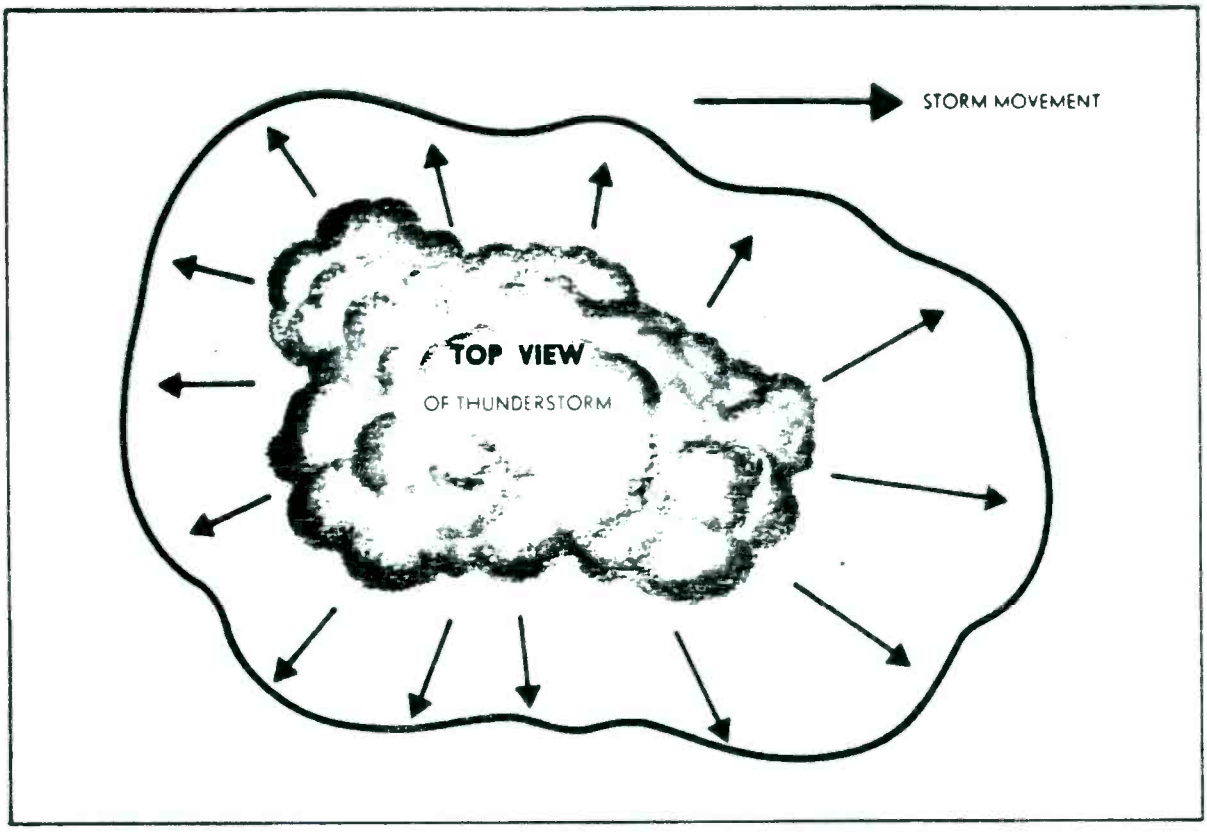
Dissipating Stage -
Throughout the mature stage, the downdrafts continue to develop and spread vertically and horizontally, while the updrafts are continually weakening. As a result of this action, the entire thunderstorm ultimately beoomes an area of downdrafts. The dissipating stage is usually the most prolonged of the three stages.



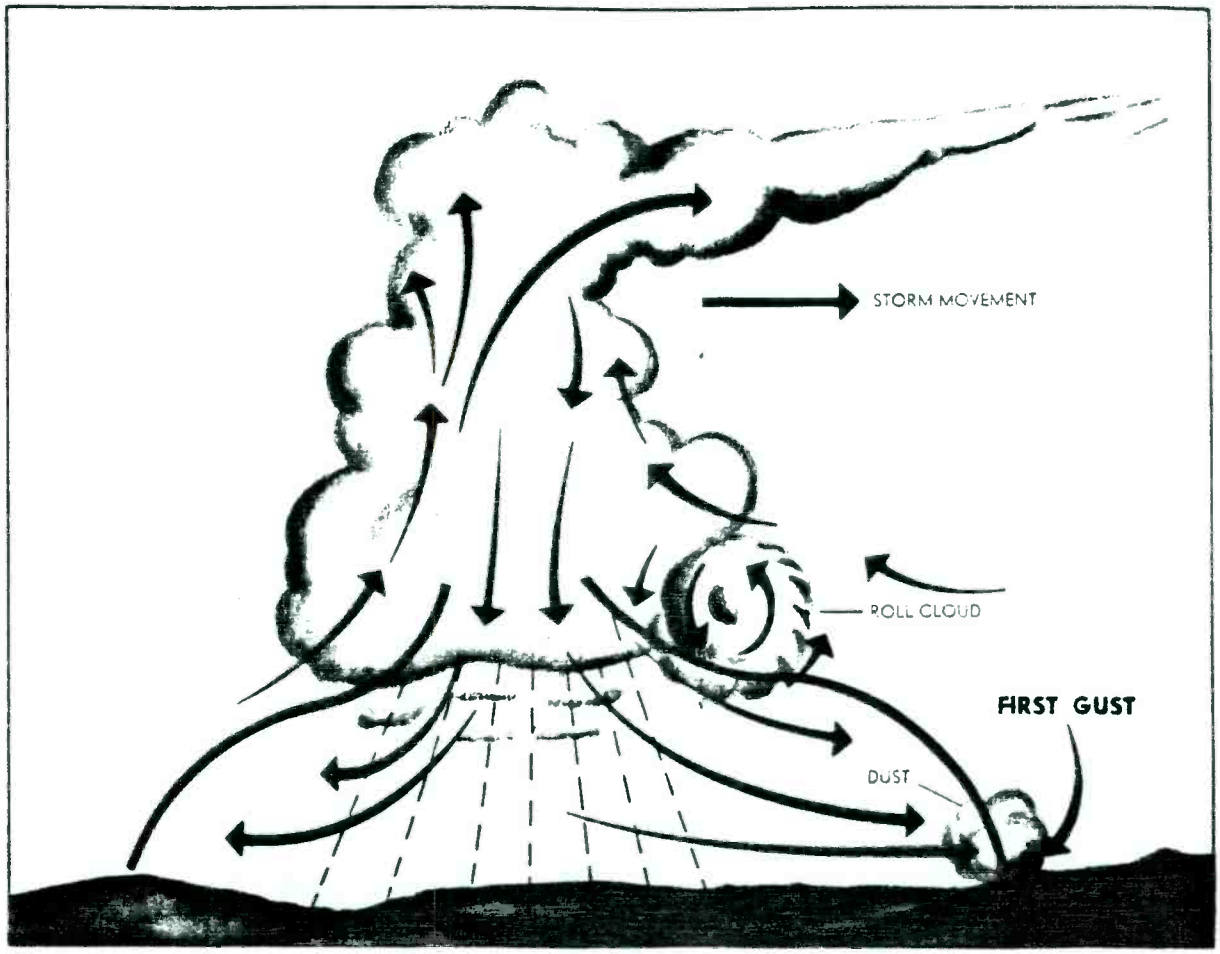
The stages of a thunderstorm.



Winds near the ground accompanying a thunderstorm.

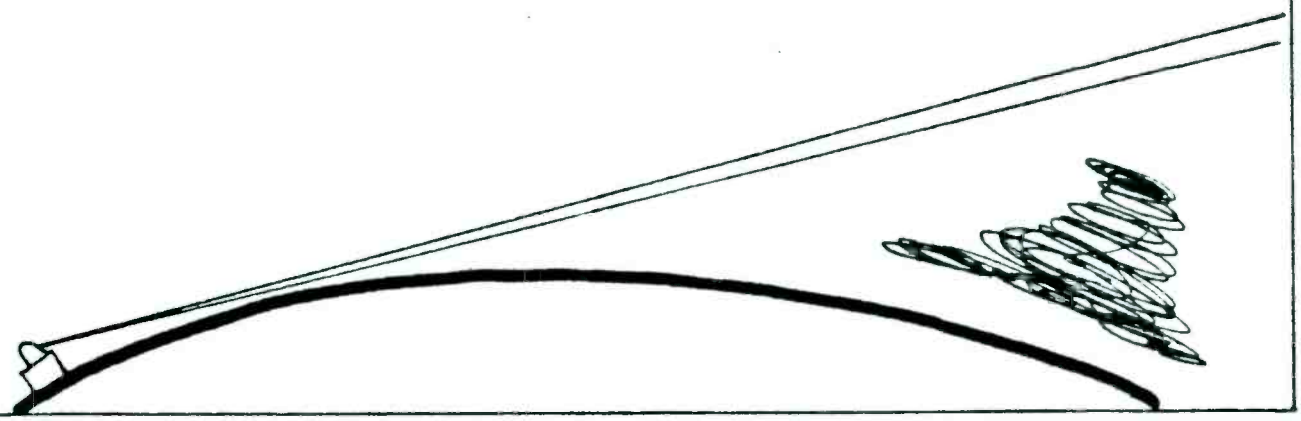


Surface winds resulting from thunderstorm downdrafts.



Air currents leading to the thunderstorm's first gust.

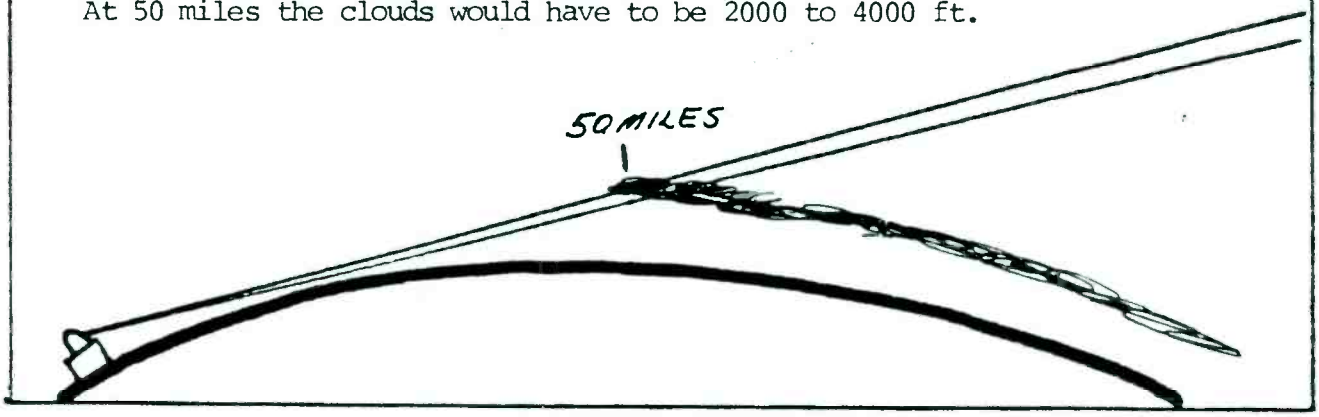
In this example the storm cell will not show because it is over the horizon and not within the radar beam.



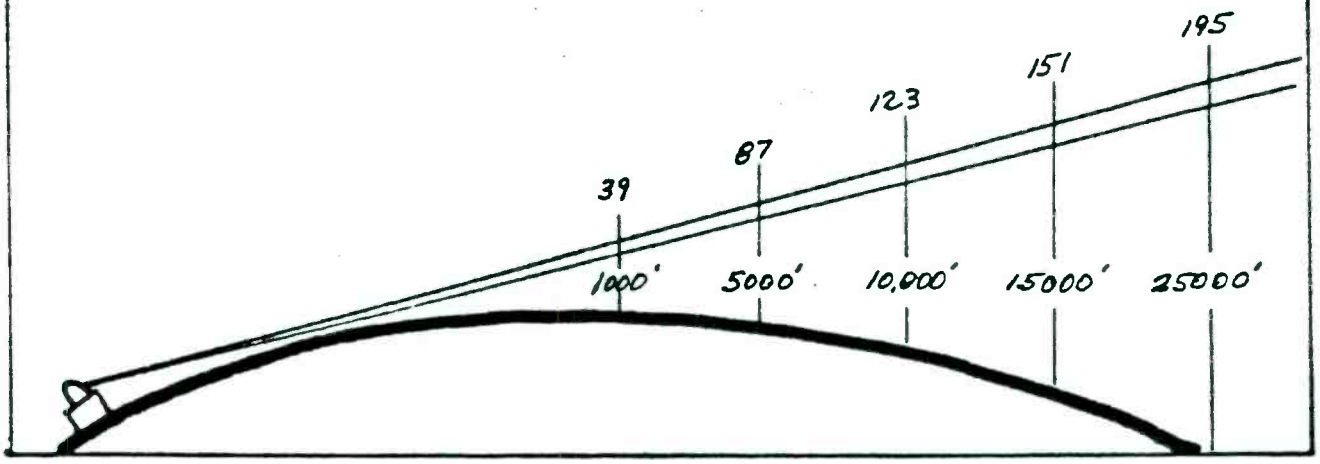
The storm cell and the leading edge of low altitude clouds are within view of the radar. However, the cell following the first one can not be seen because it is not tall enough. The dash lines indicate the radar beam when it is tilted to find the top of the cell.

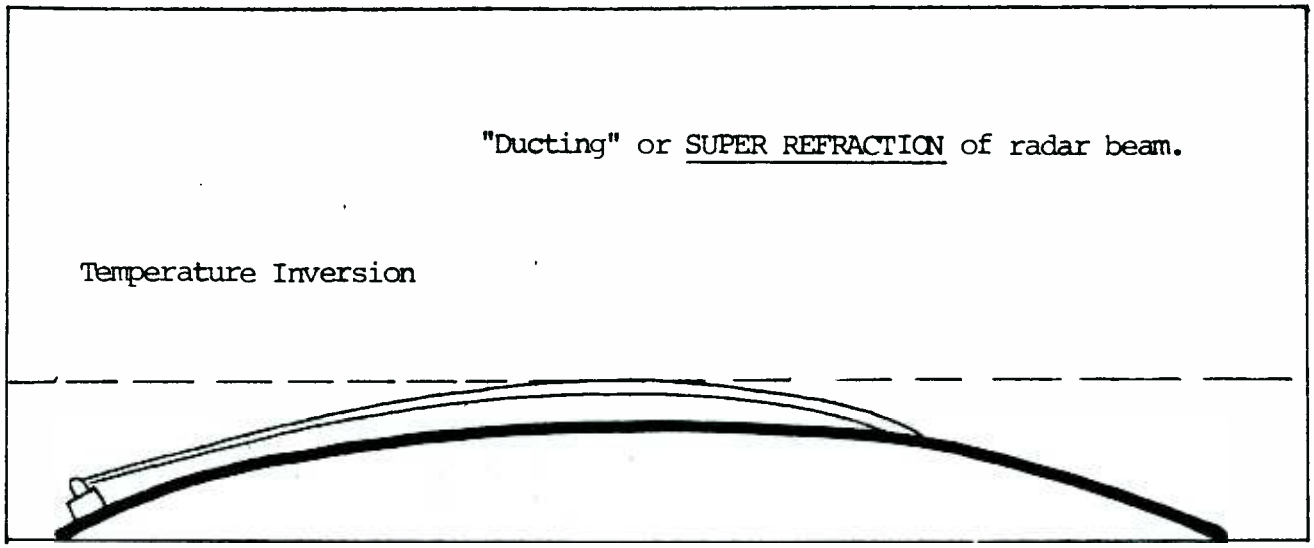
In this example you can see that low altitude clouds will not show on the radar scope until they are within the line of sight that the radar must have. These are typical formations in the fall and winter months. Most clouds that produce snow are low altitude clouds.

At 50 miles the clouds would have to be 2000 to 4000 ft.



Line of sight distance from radar antenna.





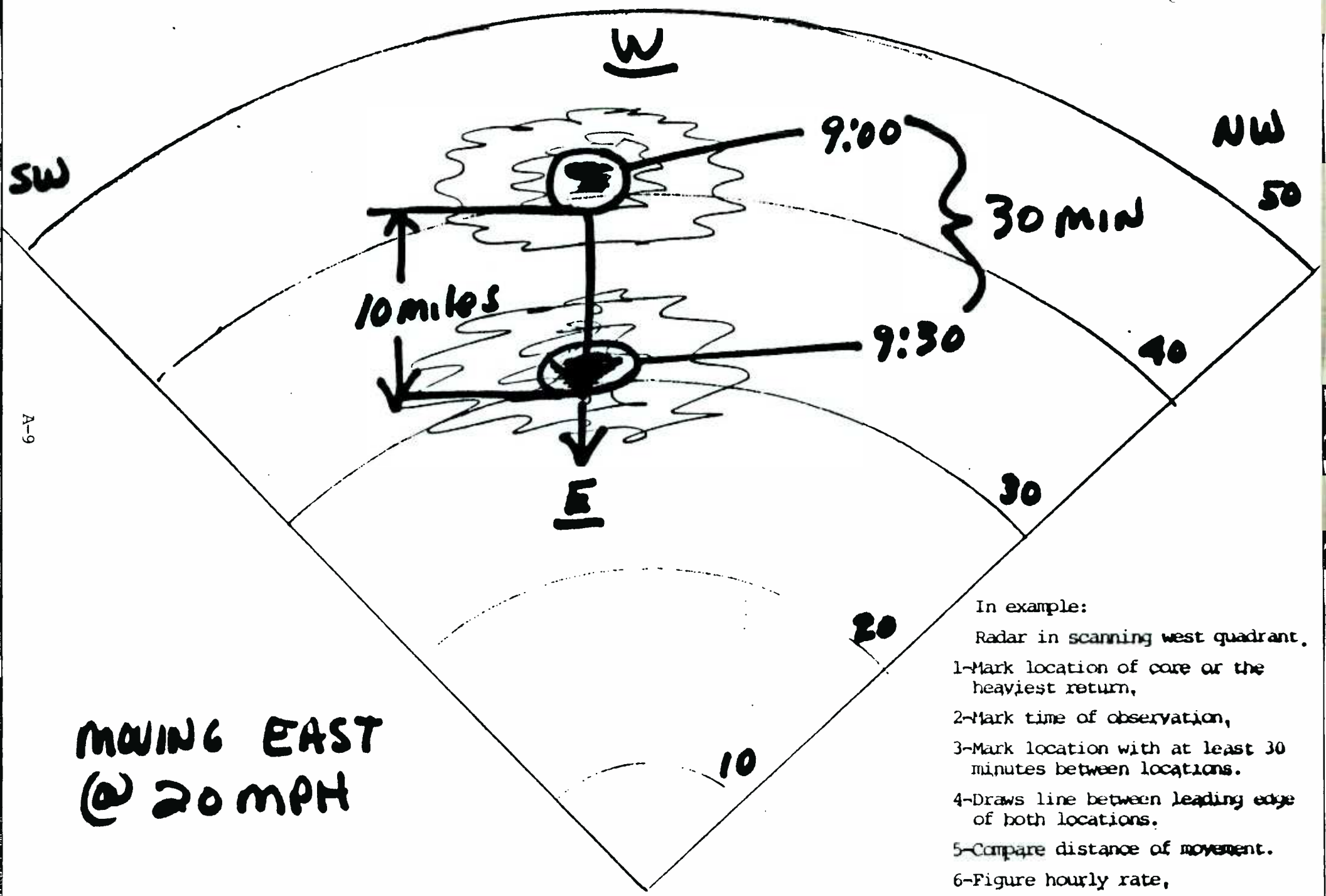
Anomalous Propagation (AP)

Anomalous propagation is extraordinary display of ground targets. It can be mistaken for precipitation echoes. Super refraction of the radar beam causes this to happen. Another term for super refraction is "Ducting". This is when the radar beam is trapped below an inversion. This is often the case during early morning hours when the surface has cooled by radiation, and the temperature increases and moisture decreases with height. In this case you have a sharp moisture gradient level. Cold air outflow associated with thunderstorms sometimes causes ducting. During ducting conditions, the radar will show an enlarged ground clutter and can present ground targets at great distance.

The time we have experienced these enlarged ground targets with the Ellason radar has been during stable conditions with a temperature inversion. The enlarged ground target does not move and will show 90% red.

The clues that your target is anomalous propagation are

1- A stable atmosphere with a temp inversion.
2- The target will be enlarged with 90% red and in most cases more than 50 miles from antenna.
3- The target will not move and may stay in the same location for 3-4 hours.
4- Normally only shown early morning hours.



MOVING EAST @ 20 MPH

In example:

Radar in scanning west quadrant.

1-Mark location of core or the heaviest return,

2-Mark time of observation,

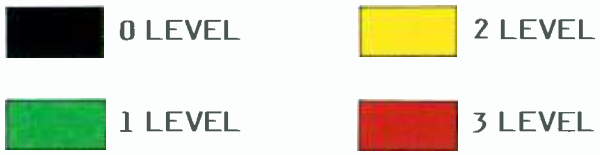
3-Mark location with at least 30 minutes between locations.

4-Draws line between leading edge of both locations.

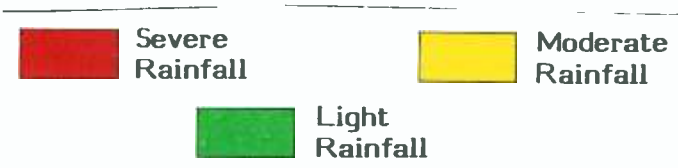
5-Compare distance of movement.

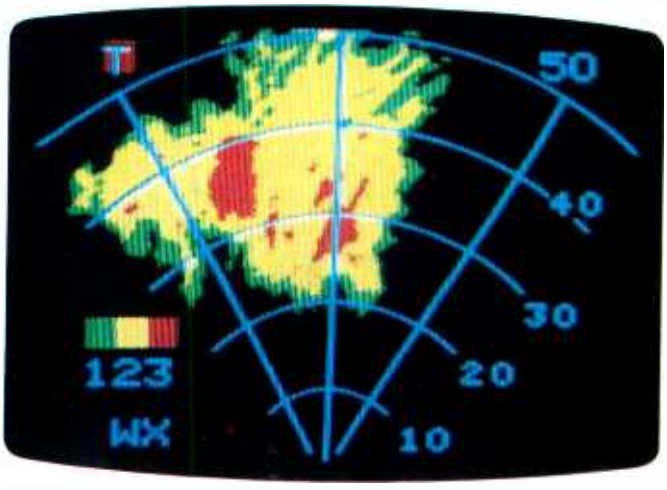
6-Figure hourly rate,

7-Determine direction by using direction overlay,



TEST MODE
WITH TGT ALRT ON
RED AREA WILL
FLASH





SAMPLE OF WEATHER
ON THE 50 MILE
RANGE