

MID-IOWA SKYWARN ASSOCIATION



Amateur Radio Severe Storm Spotting Operations Manual

February 2018 Revision

Table of Contents

- I. Mission and Organization
- II. Observation Guidelines / Safety Precautions / Spotter Training
- III. Activation of Skywarn
- IV. Linked Repeater Operations Guidelines
- V. County Operations Guidelines, HF & APRS
- APPENDIX A. Modified Beaufort Scale
- APPENDIX B. Hail Size Reporting
- APPENDIX C. Memorandum of Understanding between the National Weather Service and American Radio Relay League
- APPENDIX D. Mid-Iowa Skywarn Association Leadership Positions
- APPENDIX E. Generic Preamble for a County Skywarn Net
- APPENDIX F. Acronym Glossary
- APPENDIX G. Acknowledgements

I. Introduction and Organization

This manual is designed to be used as a reference to enhance and provide for efficient Skywarn Amateur Radio operations within the National Weather Service (NWS) County Warning Area (CWA) served by NWS office at Des Moines, IA. Since Skywarn Amateur Radio operations are a dynamic program, this manual will change and grow with the program. This manual may cover operations that do not affect you directly. Please be aware of procedures outside of your area so you may assist, if necessary. Each county should supplement this manual with its own internal policies and procedures.

Comments/Updates

Informational updates to this manual should be routed through your local ARES (Amateur Radio Emergency Service) County EC and sent to the address listed below. We also welcome comments and suggestions from all spotters.

Mid-Iowa Skywarn Association
c/o National Weather Service
9607 NW Beaver Drive
Johnston, IA 50131
E-Mail: info@mid-iowaskywarn.org
Web: <https://www.mid-iowaskywarn.org/>

Authority

Skywarn is a volunteer program run by the NWS to receive reports of severe weather from the public for the purpose of advising the public about impending danger due to severe thunderstorms, tornadoes, floods or other hazardous weather conditions.

Amateur radio operators participate in Skywarn as trained severe weather spotters and provide a radio emergency communications network for relay of severe weather reports to the NWS. Skywarn spotters need not be ARES members to participate in Skywarn nets but should attend spotter training every two years. However, ARES is the primary amateur radio

organization with whom the NWS works to establish the Skywarn communications networks.

Authority to establish and operate Skywarn networks through ARES is given in the Memorandum of Understanding between NWS and American Radio Relay League (ARRL), dated January 19, 1988 (Appendix C). This operations manual is based on the recommendations of the Des Moines weather service office Skywarn committee, composed of NWS Personnel and ARRL ARES leaders in the 51-county warning area (CWA) served by the NWS Des Moines (See Appendix D).

Organization

Amateur Radio Skywarn operations in Central Iowa are organized as follows:

Skywarn Executive Committee - Responsible for final approval of Skywarn policies and procedures within the NWS Des Moines area of responsibility.

Skywarn Advisory Committee - Responsible for developing policies and procedures of the Skywarn Amateur Radio Net to ensure an efficient operation in accordance with the goals of ARES and NWS Des Moines.

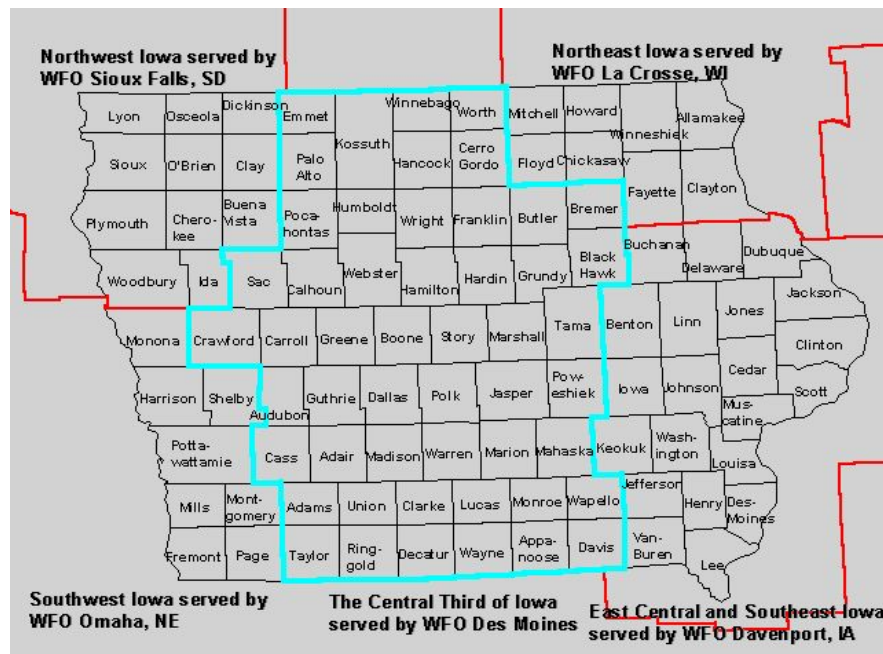
Skywarn Amateur Radio Coordinator - Organizes and responsible for the day-to-day operation of the entire Skywarn Amateur Radio Net in accordance with established policies and procedures. Specific duties include:

1. Ensure that volunteers are available to serve at NWS Des Moines station when requested by the NWS.
2. Ensure NWS Des Moines station is properly set up and all operators are trained.
3. Coordinate Skywarn communications issues and resolve problems with the impacted counties. Unresolved problems should be referred to the Executive Committee.

Skywarn Mission

The mission of Skywarn is to provide timely and accurate reports of severe weather to the NWS office in Des Moines through the use of trained spotters. Spotter networks are made up of a number of groups, including law enforcement, firefighters, emergency management, media and volunteers from the general public who have been trained in severe weather spotting procedures. Another key spotter group is amateur radio operators, who typically provide reports of severe weather directly to the NWS office via amateur radio networks.

The Des Moines office of the National Weather Service is responsible for forecasts and the issuing of severe weather warnings for the central half of Iowa, including the counties highlighted in blue below:



The focus of this guide is on the amateur radio Skywarn program at the National Weather Service in Des Moines.

Spotter Safety

All stations should follow basic safety rules while engaged in spotting storms. Heed all warnings issued by the NWS. Des Moines National Weather Service amateur radio net control station, K0DMX, will attempt to announce a warning to each county when potentially severe weather is approaching; however, each spotter is responsible for his or her own safety. Remember to keep a low profile during lightning events and during possible tornado events.

Spotters participate in Skywarn activities at their own risk! Use common sense when driving in hazardous weather conditions and be aware of dangers associated with severe weather.

Your safety and the safety of others should be your first priority.

Please remember these safety tips when spotting:

- When mobile, try to spot in pairs so that one person can focus on driving while the other can observe weather conditions and operate radio equipment.
- When mobile, please check in with net control when you are spotting, and check out when you leave the net. Also, if you must leave your vehicle while spotting please try to notify net control.
- Always have multiple escape routes available when mobile spotting.
- Beware of lightning while spotting. This not only includes mobile spotting, but also while spotting from home.
- When mobile spotting, obey all traffic laws and avoid distractions as much as possible. If spotting solo, find a safe place to pull off the road, observe conditions, and make reports.

II. Observation Guidelines

What Is Reportable

Notice: The threshold for "reportable" weather may be changed by the net control station to provide more meaningful information to the NWS and make the reporting system more efficient.

Skywarn spotters are strongly encouraged to take a NWS spotter training class at least every other year. These courses are offered during the spring of each year throughout the 51-county warning area. The schedule for spotter training (usually held mid February through Mid April) is normally posted on the Des Moines NWS web site starting in January of each year at <http://www.weather.gov/dmx>. The schedule is typically updated weekly throughout the spring. If you don't see a course scheduled in your area, contact your county Homeland Security (Emergency Management) director to see about scheduling a class in your county.

The spotter training class covers the subject of what is considered "Reportable, Significant, or High Priority" weather. A basic definition of what is considered to be reportable is listed in the next section.

Reportable Weather

- Tornado, funnel, wall cloud or land spout
- Flash Flooding
- Structural damage due to weather conditions
- Downed power lines and tree damage (give estimated trunk/limb size diameter)
- Hail (report any hail along with size and duration) – see measurement guidelines in Appendix B)
- Winds 30 mph or greater (measured or estimated – see the Beaufort Scale in Appendix A)
- Rain in excess of 1 inch per hour

As stated above this is only a basic definition, and the requests for information from NWS Des Moines may include requests that would not be normally be considered "Reportable or Significant".

The NWS Des Moines Amateur Radio Station (K0DMX) will advise the net control stations at the regional level of what type of information is needed. Regional net control stations and liaison stations should pass this information on to the county nets as quickly as possible. If the NWS Des Moines Station is extremely busy in another area, the regional net control station may request a brief "Do you have any 'SEVERE' reports, over", this is indicative that there is trouble in another area and they are just checking with you to make sure that nothing has popped up while they have been on another frequency. The best answer is "negative, over" when you may be holding marginal or non-reportable information.

How to Report

Reports should be sent to the county or a link repeater system net control station as soon as possible. The reports should be sent in the following format:

Reporting Criteria/Keywords:

Tornado / Land spout

Funnel Cloud - Be sure of your observations!

Wall Cloud – Is it rotating or non-rotating? Watch for a minute or two before reporting.

Flooding - Blocked or washed out roads, bridges, railroads, water over banks of rivers, curb, evacuations, etc.

Hail - Use a coin size to report (don't use "marble sized"). See NWS table on terms to use for reporting hail size.

High Winds - 30 MPH or greater. Indicate if report is estimated or measured. See NWS table to help estimate wind speed.

Storm Damage - Large grove of trees downed, power lines, windows blown out, major roof/building, vehicles blown over, etc.

Visibility - When visibility is less than ½ mile due to rain or blowing dirt.

Rainfall - 1/4 inch in 15 minutes, 1 inch in a short time. Rain gage reports should include start and end times.

NOTE: The NWS, or Net Control Station (NCS) may limit reports to certain conditions when a life-threatening event is imminent! Remember—Only one person can transmit and be heard at one time! If the NCS says you are a weak station, break your report into small segments to make sure the NCS is able to copy you!

Event Time: Report the time the event occurred, whether it's occurring now or if it occurred several minutes ago.

Reporting Procedures:

1. Transmit your **CALL SIGN** plus one of the **KEY WORDS** listed above in the "Criteria" list.
2. The net control station (NCS) will then acknowledge with your **CALL SUFFIX** and the words "**GO AHEAD**".
3. On your next transmission state the **CONDITION, TIME, LOCATION, and SOURCE (CTLS)**.
4. After receiving your report the NCS will then acknowledge your last transmission.

Notes/Definitions:

TIME should be in standard 12 hour format.

LOCATION should be your county, affected city or town (nearest major cross streets if possible).

CONDITION: What weather event from your "KEYWORD" is happening.

SOURCE: Your call sign. If you are reporting a weather event from another source, please name that source.

Example of an On Air Exchange:

Reporting Station: "This is WØXYZ....HAIL"

Net Control Station: "XYZ GO AHEAD"

Reporting Station: "MEASURED ¾ INCH HAIL, OCCURRING NOW AT 4:35 PM, STORY COUNTY, 1MILE NE OF MAXWELL, WØXYZ".

Net Control Station: "ROGER, XYZ, COPY MEASURED ¾ INCH HAIL, OCCURRING NOW AT 4:35PM, STORY COUNTY, 1 MILE NE OF MAXWELL, ". (if any other information is needed, NCS will ask the calling station). This is K0DMX."

What NOT to Report

Be very careful when sending in reports! The intention here is not to discourage reports, but to make sure that the reports that are sent are useful in nature.

For example, some of the reports that have been received at NWS offices during severe weather events that have not been useful include:

"Dark clouds," "Heavy Wind," "Lots of Lightning," "Rain" (these aren't necessarily considered severe weather)

"Marble or Ball-Size Hail" (Marbles and balls come in many sizes; instead give actual size or relate to a coin size such as dime, penny, nickel, quarter, etc.)

Use common sense when giving reports! Think of how the person receiving these reports will interpret them, and how useful they will be in determining the severity of the weather.

During severe weather events, the National Weather Service office can get very busy with multiple meteorologists operating radar consoles, consulting with peers and issuing warnings; heavy radio traffic from various agencies on public safety frequencies, multiple telephone calls and other activity. Therefore, net control operators at the amateur radio console may not always immediately respond to calls.

During such events, it's important to **listen first** before contacting net control and **only provide relevant reports**. Reports of imminent severe weather (i.e. tornado) will be given priority by net control.

Spotters in areas not imminently threatened by severe weather should minimize radio traffic to ensure vital information can be relayed during such events.

Reporting Without Use of Amateur Radio

If amateur radio communications to the NWS are not available or a repeater is not in service, here are some alternate methods of reaching the Des Moines NWS office during severe weather:

- Call via telephone on the 1-800-SKYWARN line (1-800-759-9276). Report severe weather in the same manner as used on the Skywarn amateur radio net.
- Text or e-mail, including pictures and video, to dmx.spotterreport@noaa.gov or (515) 240-5515

Storm Spotter Training

Skywarn spotters are strongly encouraged to take a NWS spotter training class at least every other year. These courses are offered during the spring of each year throughout the 51-county warning area. The schedule for spotter training (usually held mid February through Mid April) is normally posted on the Des Moines NWS web site starting in January of each year at <http://www.weather.gov/dmx>. The schedule is typically updated weekly throughout the spring. If you don't see a course scheduled in your area, contact your county Homeland Security (Emergency Management) director to see about scheduling a class in your county.

There are many internet sites with storm spotting training information. At the MISA web site (<https://www.midiowaskywarn.org/>) click on the "resources" menu item to find resources to examine or to review information to use in recognizing severe storm features to improve the information you relay to the National Weather Service.

III. Activation of Skywarn

Spotters are generally activated at the request of local officials in coordination with the National Weather Service.

Preparing for Severe Weather

Spotters are encouraged to stay abreast of weather forecasts throughout the year to be prepared for the possible activation of Skywarn on any given day. In today's technologically driven society, weather information is available through a wide source of media and internet sources.

A good source of current and forecast weather information is your local NOAA Weather Radio Station. Most of Iowa is now covered by at least one NOAA Weather Radio Station. Frequencies for NOAA Weather Radio stations in Iowa can be found on the NWS web site.

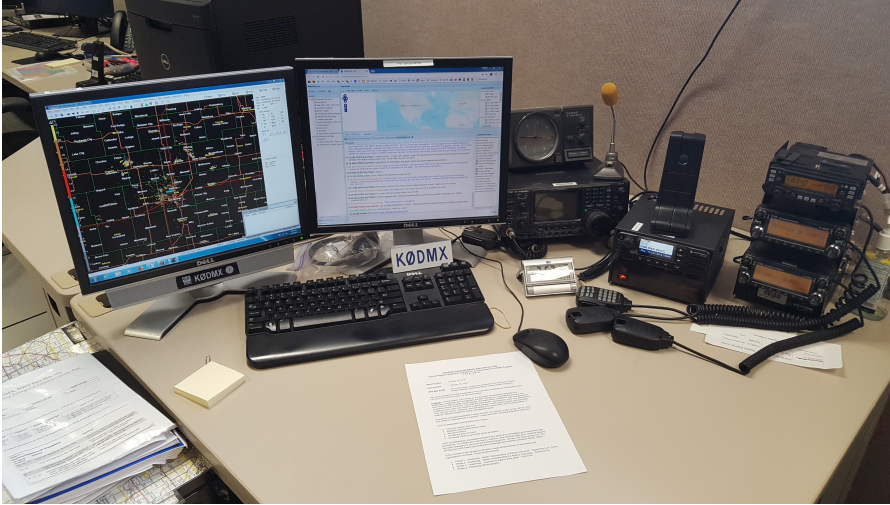
The National Weather Service web site is another excellent source of forecasts, severe weather outlooks and other information. The Des Moines NWS web site is located at <http://www.weather.gov/dmx>.

Each day, the NWS issues a "Hazardous Weather Outlook" highlighting the potential for severe weather within the 51-county warning area during the next 24 hours, plus the potential for severe weather later in the forecast period. In addition, a "Spotter Information Statement" is often included addressing the possibility of spotter activation during the period. The Hazardous Weather Outlook can be found on the NWS web page, and is often broadcast on NOAA Weather Radio as well.

Spotters are strongly encouraged to monitor NOAA Weather Radio, internet, media and other sources when there is a threat of severe weather on a given day. Furthermore, spotters are encouraged to monitor local amateur radio net frequencies and be prepared for possible net activation when there is a high potential for severe weather.

Procedure for Activation by NWS Des Moines

The National Weather Service will contact the Skywarn Amateur Radio Coordinator to activate the amateur radio Skywarn net. The Amateur Radio Coordinator will implement the Skywarn call chain to ensure that an operator reports to the NWS office.



The amateur radio console at the NWS office in Des Moines.

The amateur radio station at the Des Moines NWS office consists of the following equipment:

- Motorola XPR5550 UHF MOTOTRBO Transceiver
- Icom IC-2720 VHF/UHF Transceiver
- Icom IC-2820 VHF/UHF D-STAR Transceiver (2)
- Icom IC-746 PRO HF Transceiver
- Yaesu Rotor Control
- Computer with access to radar and APRS

IV. Regional Hub Operational Guidelines

Net Operational Modes

During activation of Skywarn, the net may operate in one of the following modes:

Skywarn Standby Alert

Severe weather is possible within 30 minutes to 2 hours, but is not imminent. Amateur radio operators may feel free to use the repeater for normal activities, but please try to break up transmissions so that the net control station can break in to provide briefings or activate the net.

Skywarn Activation

Severe weather is imminent or possible within the next 30 minutes. All radio traffic should be directed through net control, and radio traffic should be limited to providing severe weather reports if at all possible.

Skywarn De-activation

The severe weather event has passed or no severe weather is expected within the next 2 hours. Normal amateur radio activity may resume on the repeater.

V. Local Area Skywarn Net Operations Guidelines; HF and APRS

Local County/Area (VHF/UHF) Nets

Nets may be established on local repeaters that are not linked into one of the hub systems listed above. If possible, a liaison station should be established to collect and pass along reports back to K0DMX on one of the hub networks. The liaison station should check in with K0DMX net control to inform the operator at the NWS that they are serving in that capacity.

If radio contact cannot be made by the liaison station with K0DMX, reports of severe weather should be passed along to the National Weather Service via telephone at 1-800-SKYWARN (1-800-759-9276) by the local net control station or liaison.

A current list of local repeaters can be found at the Iowa Repeater Council web page, which is located at www.iowarepeater.org.

Skywarn HF Net

The National Weather Service office maintains a HF (high frequency) transceiver at the amateur radio console that is able to communicate on most amateur radio HF bands. HF frequencies are not typically utilized for severe weather spotting activities; however HF bands may be used in the event of a disaster or to relay communications to/from other National Weather Service offices.

Automatic Packet Reporting System (APRS)

The National Weather Service K0DMX net control station has access to APRS technology during active Skywarn nets. If you are mobile spotting and have APRS equipment, please notify net control. For more information on APRS, visit http://en.wikipedia.org/wiki/Automatic_Packet_Reporting_System.

Appendix A

Modified Beaufort Scale for Estimating Wind Speed

30-40 mph - Whole trees in motion; inconvenience felt when walking against.

40-50 mph - Breaks twigs off trees; general impedes progress when walking against.

51-58 mph - Slight structural damage occurs to buildings. Smaller tree limb damage.

58-72 mph - Shingles torn off or minor structural damage; breaks off large limbs; pushes over shallow rooted trees.

73-112 mph - Substantial roof and structural damage; windows broken; trailer houses overturned; large trees uprooted.

113+ mph - Roofs torn off houses; weak buildings and trailer houses destroyed; large trees uprooted.

Appendix B

Hail Reporting Guidelines

Measurement	Reference
1/4"	Pea Size
1/2"	
3/4"	Penny Size
7/8"	Nickel Size
1"	Quarter Size
1 1/4"	Half Dollar Size
1 1/2"	Walnut or Ping Pong Ball Size
1 3/4"	Golf Ball Size
2"	Hen Egg Size
2 1/2"	Tennis Ball Size
2 3/4"	Baseball or Orange Size
3"	Teacup Size
4"	Grapefruit Size
4 1/2"	Softball Size

Appendix C

MEMORANDUM OF UNDERSTANDING BETWEEN

THE NATIONAL WEATHER SERVICE

AND

THE AMERICAN RADIO RELAY LEAGUE, INC.

I. PURPOSE

The purpose of this document is to state the terms of a mutual agreement (Memorandum of Understanding) between the National Weather Service (NWS) and the American Radio Relay League, Inc. (ARRL) that will serve as a framework within which volunteers of the ARRL may coordinate their services, facilities and equipment with NWS in support of nationwide, state and local early weather warning and emergency communications functions. It is intended, through joint coordination and exercise of the resources of ARRL, MNS and Federal, State and local governments, to enhance the nationwide posture of early weather warning and readiness for any conceivable weather emergency.

II. RECOGNITION

The National Weather Services recognizes that the ARRL is the principal organization representing the interests of more than 400,000 U.S. radio amateurs and because of its Field Organization of trained and experienced communication experts, can be of valuable assistance in early severe weather warning and tornado spotting.

The American Radio Relay League recognizes the National Weather Service with Restatutory responsibility for providing civil meteorological services for the people of the United State. These services consist of:

1. Issuing warnings and forecasts of weather and flood conditions affecting the nation's safety, welfare and economy; and,

2. Observing and reporting the weather of the U. S. and its possessions. To perform these functions and many related, specialized weather services, NWS operates a vast network of stations of many types within the U.S.; it cooperates in the exchange of data in real time with other nations, including obtaining of weather reports from ships at sea.

III. ORGANIZATION OF THE AMERICAN RADIO RELAY LEAGUE

The American Radio Relay League is a noncommercial membership organization of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communications in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct. A primary responsibility of the Amateur Radio Service, as established by the Federal Communications Commission, is the rendering of public service communications for the general public, particularly in times of emergency. Using Amateur Radio operators in the amateur frequency bands, the ARRL has been serving the public, both directly and through government and relief agencies, for more than fifty years. To that end, the League created the Amateur Radio Emergency Service (ARES) and the National Traffic System (NTS). The League's Field Organization consists of sixty-seven administrative sections managed by elected Section Managers. A Section is a League-created political boundary roughly equivalent to states (or portions thereof). The Section Manager appoints expert assistants to administer the various emergency communications and public service programs in the section. Each section has a vast cadre of volunteer appointees to perform the work of Amateur Radio at the local level, under the supervision of the Section Manager and his/her assistants.

IV. ORGANIZATION OF THE NATIONAL WEATHER SERVICE

The National Weather Service consists of a National Headquarters in Washington, D.C., and six regional offices in the United States: Eastern, Southern, Central, Western, Alaska and Pacific. An NWS Public Information Office is located at Weather Service Headquarters. Fifty-two Weather Service Forecast Offices and 209 Weather Service Offices provide warnings and forecasts to the Nation.

SKYWARN is the spotter program sponsored by the NWS. Radio amateurs have assisted as communicators and spotters since its inception. In areas where tornadoes and other severe weather have been known to threaten, NWS recruits volunteers, trains them in proper weather spotting procedures and accepts the volunteers' reports during watches and episodes of severe weather. By utilizing the SKYWARN volunteers, the NWS has "eyes and ears" throughout the affected area in conjunction with NWS sophisticated weather monitoring equipment.

V. PRINCIPLES OF COOPERATION

A. The American Radio Relay League agrees: to encourage its volunteer Field Organization appointees, especially the Amateur Radio Emergency Service, to contact and cooperate with Regional Weather Service Headquarters for the purpose of establishing organized SKYWARN networks with radio amateurs serving as communicators and spotters.

B. ARRL further agrees to encourage its Section management teams to provide specialized communications and observation support on an as-needed basis for NWS offices in other weather emergencies such as hurricanes, snow and heavy rainstorms, and other severe weather situations.

C. The National Weather Service agrees to work with ARRL Section Amateur Radio Emergency Service volunteers to establish SKYWARN networks, and/or other specialized weather emergency alert and relief. The principle point of contact between the ARRL Section and local NWSS offices is the Meteorological Services Division of the appropriate NWS Regional Office. The addresses of the Regional offices are listed below.

The national contact for ARRL is the Public Service Branch, ARRL Headquarters, Newington, CT 08111.

National Weather Service Eastern Region
NOAA
585 Stewart Avenue
Garden City, NY 11530
Telephone: 516-228-5400

National Weather Service Southern Region
NOAA
819 Taylor St Rm 10A26
Fort Worth, TX 76102
Tel: 817-334-2688

National Weather Service Central Region
NOAA
601 E. 12th St Room 1836
Kansas City, MO 64106
Tel: 816-374-5463

National Weather Service Western Region
NOAA
Box 1118B, Federal Building
125 S. State Street
Salt Lake City, UT 84147
Tel: 801-524-5122

National Weather Service Alaska Region
NOAA
Box 23, 701 C. Street
Anchorage, AK 99513
Tel: 907-271-5136

National Weather Service Pacific Region
NOAA
PO Box 50027
Honolulu, HI 96850
Tel: 808-546-5680

Silver Spring, MD
January 19, 1988

For the American Radio Relay League,
ARRL Secretary Perry F Williams, W1UED

For the National Weather Service,
Assistant Administrator for Weather Services, Dr. Richard E. Hallgren.

Appendix D

Mid-Iowa Skywarn Association Amateur Radio Leadership Positions

SKYWARN Executive Committee

Brenda Brock, KC0NEX, Meteorologist in Charge, NWS Des Moines

Jeff Johnson, KC0OGL, Warning Coordination Meteorologist, NWS Des Moines

Shane Searcy, N0ZXJ, Information Technology Officer, NWS Des Moines

Brad Small, KC0OGK, Senior Meteorologist, NWS Des Moines

Skywarn Advisory Committee

Mid-Iowa Skywarn Association President, Tom Reis N0VPR

Mid-Iowa Skywarn Association Vice President, Jeff Johnson KC0OGL

Mid-Iowa Skywarn Association Secretary & Treasurer, Kevin Sanders K0KDS

County and District EC for each of the 51 counties served by NWS Des Moines

Iowa Amateur Radio Emergency Service (ARES) Leadership:

Tom Brehmer, N0LOH, ARRL Section Manager (SM) Iowa
n0loh@arrl.org

Dan Miller AC0OF, Section Emergency Coordinator (SEC), Iowa
danielmiller347@gmail.com

Iowa Amateur Radio Emergency Service County EC and District EC Contacts: Available on the web at: <http://www.ares.rf.org/index.html>

Appendix E

Generic Preamble for a County/Local Skywarn Net

Each county should have several NCS operators available but there are circumstances when none is available. Should any spotters find themselves in a situation where they are the only station capable of assuming net control then they should take it. The following preamble is provided for these type situations. In a case such as this, attempt to contact the county EC or any of his assistants for instructions and help. This preamble is not intended to replace any existing preamble in use by any county. The EC of any county has the formal authority on any ARES nets.

Identify First:

“This is _____” *(insert call sign here)*.

State the situation and response:

“The National Weather Service in Des Moines has requested activation of a Skywarn net. There is a *(insert Severe Thunderstorm/Tornado Watch/Warning, if unknown –threat of severe weather)* for *(Name of county)*.”

This is a directed net, and this station shall serve as net control.

Are there any stations experiencing SEVERE WEATHER at this time?

Is there a station that can contact a linked repeater system and act as liaison?

Station’s wishing to join the net, give your call sign and location.”

Maintain a minimum of a liaison station and try to have someone monitor the NWS broadcast on 162.xxx and keep a log of all contacts and report to the EC of your county as soon as possible. Maintain net operation by announcement every ten minutes:

“This is _____ *(insert call sign)* for _____ *(insert county)* Skywarn.

Are there any reports of SEVERE WEATHER at this time?

Any stations wishing to check in, give your call sign and location.”

The NCS of the link repeater system will advise you as to what reports they are looking for, any special instructions or when you can deactivate the net. When closing the net it is considered proper to thank all stations participating and the repeater owner/operators/trustees for its use.

Appendix F

Acronym Glossary

- ARES:** Amateur Radio Emergency Service
- ARRL:** American Radio Relay League
- CWA:** County Warning Area
- DEC:** District Emergency Coordinator (ARES)
- EC:** Emergency Coordinator (ARES)
- MISA:** Mid-Iowa Skywarn Association
- NCS:** Net Control Station
- NWS:** National Weather Service
- WFO:** Weather Forecast Office

Appendix G

Acknowledgements

Special thanks to the following organizations and people for use of materials, information and assistance with preparing this guide:

National Weather Service, Des Moines
Milwaukee, WI Skywarn Association
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NWS Meteorologists, Des Moines, Iowa Office
Jim Snapp, NA0R
Kevin Sanders, K0KDS
Tom Reis, N0VPR
Jeff Johnson, KC0OGL
Dan Case, KB0JUL
American Radio Relay League

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This new version replaces all former versions of the MISA Operations Manual. Please destroy previous versions of this manual.