Cascadia Rising Disaster Exercise
Frequency and Network Management Guidelines
Exercise Dates: June 8 and June 9, 2016

I Scope of Exercise Guideline:

This document is intended to facilitate NTS planning and operations during the Cascadia Rising exercise. These guidelines include recommendations for:

- Expediting the flow of test priority and test emergency message traffic generated at the local level and addressed to the FEMA National Response Coordinating Center (NRCC).
- Establishing specialized point-to-point circuits using NTS TCC assets to connect the simulated disaster area within the Cascadia Region with the FEMA NRCC in Washington, D.C.
- Specifying sufficient frequency and mode combinations (circuits) to supporting a dynamic response to propagation conditions, thereby ensuring that connectivity is maintained regardless of time-of-day, solar cycle, and geomagnetic conditions.
- Providing a moderate level of communications security by protecting frequency and mode information from non-exercise participants.
- Providing basic guidance for section and region traffic flow should NTS support be requested at the local level.

Please note that this document is significantly different from prior draft documents released due to the elimination of Washington State from the NTS component of the exercise.

II Exercise Purpose:

The NTS component should be viewed as a stand-alone, proof-of-concept exercise intended to test the NTS national messaging layer. This test of the NTS will be the primary responsibility of exercise participants. Additional responsibilities, such as conveying exercise traffic on behalf of local EMA activities is permissible, but nonetheless secondary to the primary NTS Cascadia Rising exercise functions.

This document addresses only the national "proof-of-concept" exercise. NTS volunteers should, however, also be prepared to support any local communications requirements, which may arise during the event.

III Methodology:

Preformatted "Inject messages" drafted by the exercise design team and the Federal Emergency Management Agency will be provided to selected NTS volunteers within the Cascadia Region. These "inject messages" are designed to test the NTS messaging layer by providing a measured and objective indication of message accuracy, completeness and reliability.

The inject messages will be originated via NTS at the times specified by the exercise design team. At the time specified, a message will originate via the ARRL National Traffic System, which will be routed to its destination using standard NTS net protocols. Upon reaching its destination, delivery to the Federal Emergency Management Agency will be performed using WebEOC.

A variety of controls will be built into the exercise process to support an objective and measurable evaluation process. Of particular interest are measures of *message completeness, accuracy and timeliness*. Exercise participants will be expected to record basic operational data during the exercise. This data will then be submitted to the exercise evaluation team at the conclusion of the exercise for subsequent analysis and the development of a post-exercise report. The following states will be active participants in this exercise.

- Oregon
- Idaho
- Northern California
- Alaska.

Some message traffic may also flow from the FEMA NRCC to the field. This will likely be in the form of specialized "bulletin" message traffic intended for wide distribution within a state to any emergency management agency or media outlets within the simulated disaster area. When one of these "QNC" bulletins is received by the NTS volunteer within the simulated disaster area, it may be distributed as instructed. More details on the management of this type of message traffic are provided below.

IV Exercise Message Flow:

As stated earlier, each exercise participant will be provided with a set of pre-formatted "inject messages." These inject messages will consist of radiograms enclosed in sealed envelopes, the outside of which are date and time-stamped to indicate the time at which the envelope is to be opened and the message originated via one of the NTS TCC "watch frequencies" or NTSD. Inject messages may be originated using the mode/network the radio operator deems most expedient provided the message originates according to this network management plan.

A. Message Originations and Record Keeping

Please note that this section has changed significantly.

Each inject message will have a serial number assigned by the exercise design team. The originating station should NOT change the message serial number under any circumstances. The assigned inject message serial number will be used to track the message as it is moves through the NTS(D) network layers. This serial number will then be referenced at various tracking data points throughout the NTS network, the data from which will be used to determine network efficiency, accuracy and similar factors.

A limited number of messages may be originated at the FEMA NRCC for distribution to the disaster area. These messages will likely be in the form of bulletin messages (QNC) intended for distribution to local emergency management agencies, NGO relief agencies and/or broadcast and print media facilities. The following rules apply to the management of this type of incoming message traffic:

- If the NTS volunteer is aware of a local ARES program active in the disaster simulation, he should forward the bulletin to his local EOC utilizing the available ARES network. The bulletin message should be transmitted in its entirety using the original, correct, radiogram format.

- If no local ARES organizations are active in the disaster simulation, the message may be held with the appropriate time of receipt recorded.

- Bulletin messages may be distributed on other Amateur Radio circuits such as SATERN networks, MARS networks and the like at the NTS volunteer's discretion.

- *Bulletins intended for distribution to local broadcast, print or other media facilities should NOT be delivered or distributed* once they reach the NTS volunteer in the field. Instead, the message should be filed and the date and time of receipt recorded. This will prevent any possible misunderstanding should a message inadvertently end-up in the actual news-media stream.

It will be necessary for each NTS operator, who originates an exercise inject message, to populate the "station of origin" field with his station call sign and the signature field with his *last name only*, before transmitting the inject message. This will identify the station responsible for originating the message. This will further define network topography and facilitate evaluation of the exercise.

All operators responsible for facilitating message flow, either outgoing or incoming, will maintain an evaluation log indicating the times associated with the origination, relay, receipt and/or delivery of messages. This message log will be provided to all active stations as part of their exercise package provided by the exercise design team. This log, along with copies of all messages transmitted and received, should be retained and then submitted to the evaluation team immediately after the exercise. An SASE will be provided with each volunteer exercise packet to facilitate the rapid submission of event data. Please submit this data within 7-days of the conclusion of the exercise.

Essentially, the message traffic handling process is the same as that associated with the handling of routine message originations, only with an added layer of record-keeping and the use of unique injection points to facilitate traffic flow.

B. Role of Section Nets:

Please note that this section has changed.

Section nets may be activated in response to a local request from ARRL Section Staff. However, from the standpoint of this FEMA proof-of-concept test, section nets will NOT be a primary player in this exercise. Instead, outgoing message traffic addressed to the FEMA NRCC will be originated using NTSD or one of the TCC radiotelephone or radiotelegraph watch frequencies specified in the frequency/mode matrix (fig. 2).

C. Role of Region 7 Voice and CW Nets:

Please note that this section has changed significantly.

The Region 7 Network (RN7) can be activated at the discretion of one or more section traffic managers within the exercise area. *However, the RN7 net will not be an active participant in the FEMA component of the exercise.*

D. Transcontinental Corps (TCC):

TCC, along with NTSD, will be the primary gateway to the FEMA NRCC. The TCC will maintain a set of watch frequencies (QSX), which will be monitored to facilitate the flow of test priority or test emergency radiograms destined for the FEMA NRCC in Washington, D.C. NTS personnel should utilize these point-to-point circuits only for test priority or test emergency precedence traffic. The TCC operators will be responsible for the following functions:

1. Ensuring that all watch frequencies are fully staffed.
2. Direct delivery of inject messages addressed to the NRCC via WebEOC (only after the message traffic has been conveyed via RF to the NTS Eastern Area).
3. Routing of NRCC messages received to the EPA Section Nets of NTS Region 3.

The TCC QSX frequencies are specified in the mode/frequency matrix (see Figure 2 below). As can be seen in the frequency matrix, a variety of options exist to support propagation conditions. NTS personnel will need to exercise a degree of flexibility when selecting an operating frequency. If a TCC operator is unavailable on a particular frequency, please select an alternate frequency. Likewise, when standing watch as a TCC operator or when attempting to establish contact from the field, be certain to use a broader IF bandpass. A station may need to move slightly off-frequency to avoid adjacent channel interference. Narrow filters, such as those with 500 Hz or less bandpass may result in a failure to hear a calling station.

Additional TCC relay stations will also be available within the NTS Central Area to facilitate message flow in response to unanticipated propagation anomalies. In all cases, the TCC operators have been carefully selected to ensure reliability.

E TCC CW Calling Procedures:

TCC operators will periodically identify their presence on a radio circuit in order to indicate their availability to receive traffic. The following net call format is recommended to indicate that a TCC liaison station is standing watch on a frequency:

"QSX NTS de WB8SIW K"

Stations in the simulated disaster area or serving as liaison to TCC may use the following calling format:

"NTS NTS de K8QMN QTC 2 TP K"

In this latter example, K8QMN is identifying the fact that he holds two test-priority (exercise priority) messages for the TCC circuit.

The TCC rep might respond in a format similar to:

"K8QMN de WB8SIW QRK 4 QRV K"

In this transmission, the TCC rep is providing a report indicating readability followed by an indication that he is "ready to copy."

Generally, the same CW traffic handling procedures used on daily NTS networks apply here, with just slight modification.

F. **Role of NTSD**

The NTS Digital Networks are now equipped with BPQ-32 software, which forwards traffic as soon as it is uploaded to the Region Hub. This greatly expedites the flow of traffic and also facilitates other features well suited to the processing of served agency traffic.

NTSD is available for all exercise traffic. Sufficient circuit capacity should be present to facilitate large quantities of NTS exercise traffic under most circumstances.

A review of the frequency/mode matrix (fig. 2) identifies the Region 7 primary entry point for exercise traffic. This primary entry point, as well as the alternate entry point and Pacific Area Hub are highlighted in yellow. The primary entry points should be the first choice for uploading outgoing exercise traffic to NTSD.

In the event of propagation anomalies or interference, NTSD traffic can be uploaded to any hub within the system. Please note that the Pacific Area portion of the frequency matrix includes approximately 13 DRS stations. These DRS facilities typically poll the region hub and may not maintain a continuous watch on the frequencies indicated. Therefore, they should be utilized only for specialized point-to-point service if required.

V Network Selection:

In the event of a catastrophic disaster, it is anticipated that many volunteers at the local level would need to rely on standby power and renewable energy to support communications. This would include battery power, solar panels, and possibly generators during the initial hours of operation or until fuel supplies were depleted. Therefore, this exercise will emphasize not just the use of NTS digital resources, which require more complex and less portable equipment, but also radiotelegraph (CW) and radiotelephone (SSB) circuits.

In summary, these basic guidelines apply:

- Inject messages of test priority or test emergency precedence may be transmitted by any one of the three specified networks (TCC –CW, TCC-SSB or NTSD).

- Traffic of test welfare or routine precedence should be originated only by normal NTS network routings or via NTSD.

A. National Traffic System Digital (NTSD):

The destination section net associated with the FEMA NRCC, which will serve as the primary gateway for message delivery to the NRCC will be the *Eastern Pennsylvania Section* located within NTS Region 3. All inject messages routed to the NRCC via NTSD will be automatically routed to this section network. Do NOT change the address on any inject messages destined for the NRCC. The zip-code, in particular, is essential to the proper, automatic routing of this message traffic via NTSD. Furthermore, please note that this zip-code may not match the public address of record for the served agency.

The Digital Relay Station (DRS) function will be in place throughout the exercise period within the EPA destination section. This will ensure that a specific, predictable routing is in place for FEMA NRCC traffic transferred via NTSD.

NTSD capable stations should review the frequency matrix (fig. 2) to ensure familiarity with various NTSD nodes throughout the Pacific and Central Area in the event that propagation dictates alternate injection points.

Assistance with NTSD technical problems can be obtained by contacting the Area Digital Coordinator (ADC).

B. TCC Radiotelegraph:

The radiotelegraph (CW) watch frequencies will be monitored throughout the exercise by qualified operators who are also trained and equipped to deliver traffic destined to the NRCC. These operators have been vetted and are of professional caliber.

Radiotelegraph is the *preferred manual mode* for the TCC function. CW circuits provide a degree of confidentiality in that media organizations are generally incapable of intercepting the message traffic. Furthermore, most radio amateurs without experience in NTS net operations will be unable to follow the progress of the network. Radiotelegraph networks also offer higher efficiency (more messages conveyed per hour) than voice networks. This combination of improved efficiency and confidentiality are preferable for FEMA traffic. Finally, CW would prove to be one of the more survivable modes during a catastrophic disaster due to its limited bandwidth and the simplicity of equipment involved, thereby allowing disaster area operators to use low power, simple transceivers.

C. TCC Radiotelephone:

The radiotelephone (SSB) watch frequencies will be monitored throughout the exercise by qualified operators who are also trained and equipped to deliver traffic destined for the NRCC.

Voice also has advantages, some of which include universal familiarity, a larger operator pool of NTS volunteers, and its position as a "common denominator" mode. However, it is also the mode most subject to interference and propagation anomalies. The SSB TCC function should be considered *secondary* to the TCC CW function.

Again, any of the three networks above may be used to relay exercise priority or exercise emergency radiograms from the Region/Section level to the FEMA NRCC.

VI Mode and Frequency Designators:

In order to limit potential interference with the exercise, a degree of communications security, consistent with FCC rules, is necessary. Therefore, we have designated each radiotelegraph and radiotelephone frequency with a three-letter frequency designator. These should be used to specify a frequency on which to meet or to which one might refer a station (QNY/QNV/QNQ).

These mode and frequency designators should NOT be published on the web nor should they be distributed on e-mail lists. As such, they are considered "confidential." However, they may be shared with those who are participating in the Cascadia Rising exercise as well as with NTS net members in good standing. When sharing this data, please ensure the member is briefed on these confidentiality requirements.

VII Cascadia Rising Network Topography:

Figure 1 (below) provides an overview of proposed network topography and message flow during the disaster exercise.

Please Note that this diagram has changed significantly to reflect the elimination of Washington State from the exercise.

VIII Message Format:

All Cascadia Rising message traffic must be transmitted using the standard radiogram format. This format provides the necessary network management data and administrative tools needed to track and service messages within the national messaging layer. While all inject messages are pre-formatted in radiogram format, any messages, which are changed to a non-standard (other than radiogram) format will count as an exercise failure.

Most messages will be transmitted in the form of "circuit test" coded traffic. This is permitted under FCC regulations and it is designed to provide a superior test of NTS performance. This method also eliminates the possibility of an inject message originated to the NRCC from conflicting with inject messages (events) associated with local exercises.

A typical message format might be:

221 TP K8QMN 15 PORTLAND OR 2331Z JUN 10
FEMA NRCC
1 INDEPENDENCE MALL
PHILADELPHIA PA 19106

TEST MESSAGE X QRZJU TLZSR QRTTJ LRUCK ZDERN DWARY QUARL
TSCRJ MOUTS X TEST MESSAGE

RICHARDS

Another format may include operational status reports pertaining to NTS personnel:

31 TP K8QMN 16 PORTLAND OR 2331Z JUN 11
TOM MILLS AF4NC
NETWORK RESOURCE MANAGER
1 INDEPENDENCE MALL
PHILADELPHIA PA 19106

TEST MESSAGE X OPERATIONAL ON BATTERY AND SOLAR POWER EXPECTED
OPERATIONAL CAPACITY INDEFINITE X TEST MESSAGE

STEVENS

Yet an additional alternative format may outline the operational status of a local ARES group:

35 TP W8IHX 17 BOISE ID 1444Z JUN 10
TOM MILLS AF4NC
NETWORK RESOURCE MANAGER
1 INDEPENDENCE MALL
PHILADELPHIA PA 19106

TEST MESSAGE X AMATEUR RADIO EMERGENCY SERVICE ACTIVATED 33 OPERATORS
OPERATING IN TWO SHIFTS X TEST MESSAGE

GRIFFITH

Delivering stations should change the "X" (X-ray) within message traffic to a period and the "query" to a question-mark when transcribing incoming messages addressed to the NRCC for delivery via WebEOC or other "hard copy" delivery methods.

Other operational notes:

1. When transmitting five-letter cipher groups via radiotelegraph or radiotelephone, please leave an extra pause between groups.

2. The receiving operator may want to repeat back the text to the transmitting station for confirmation, particularly when receiving messages containing cipher groups.

3. Save copies of all message traffic originated, received or otherwise processed through your station for submission during the post-exercise evaluation.

IX All-Cap Default:

While NTSD (digital network) is capable of conveying message traffic containing complex punctuation and mixed-case text, all traffic originated for "Cascadia Rising" will maintain the default "all-cap" or "case-insensitive" message format. Punctuation shall also be limited to the "X" for period and "Query" for the question-mark. This is done to enhance interoperability between digital modes and manual network modes. For example, a message may start or end its journey at a location in which an operator is utilizing a man-pack transceiver, a stack of self-carbon paper message forms and a pencil. Likewise, a message may originate on a public safety two-way radio frequency and then be transferred to NTS(D) for transmission to an EOC or coordinating center. By utilizing the "all-cap" default, one can accommodate any communications interoperability requirement.

X Cascadia Rising Network Frequency Matrix:

Figure 2, defines the default frequencies and modes for Cascadia Rising. Please refer to this chart, particularly when interfacing with upper-echelon network functions

Please note that various frequencies and modes are identified, which are not specifically related to the NTS component of the exercise. These are provided to ensure that sufficient data is available to facilitate monitoring and evaluation of other network activities, or operations, which may be implemented on an as-needed basis in support of local requirements. Please pay close attention to all notes within the frequency/mode matrix to prevent inadvertent transmission of confusion during communications operations.

XI Cascadia Rising NTS Exercise Time Frames

The exercise will be conducted in three phases designed to test a variety of propagation conditions:

June 8 (UTC):

Exercise Phase One: 1701Z to 2200Z (081701Z JUN 2016 to 082200Z JUN 2016)

June 9 (UTC):

Exercise Phase Two: 0001Z to 0400Z (090001Z JUN 2016 to 090400Z JUN 2016)

Exercise Phase Three: 1401Z to 1800Z (091401Z JUN 2016 to 091800Z JUN 2016)

Questions regarding this document may be submitted to:

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Fig. 1 – Cascadia Rising Network Topography

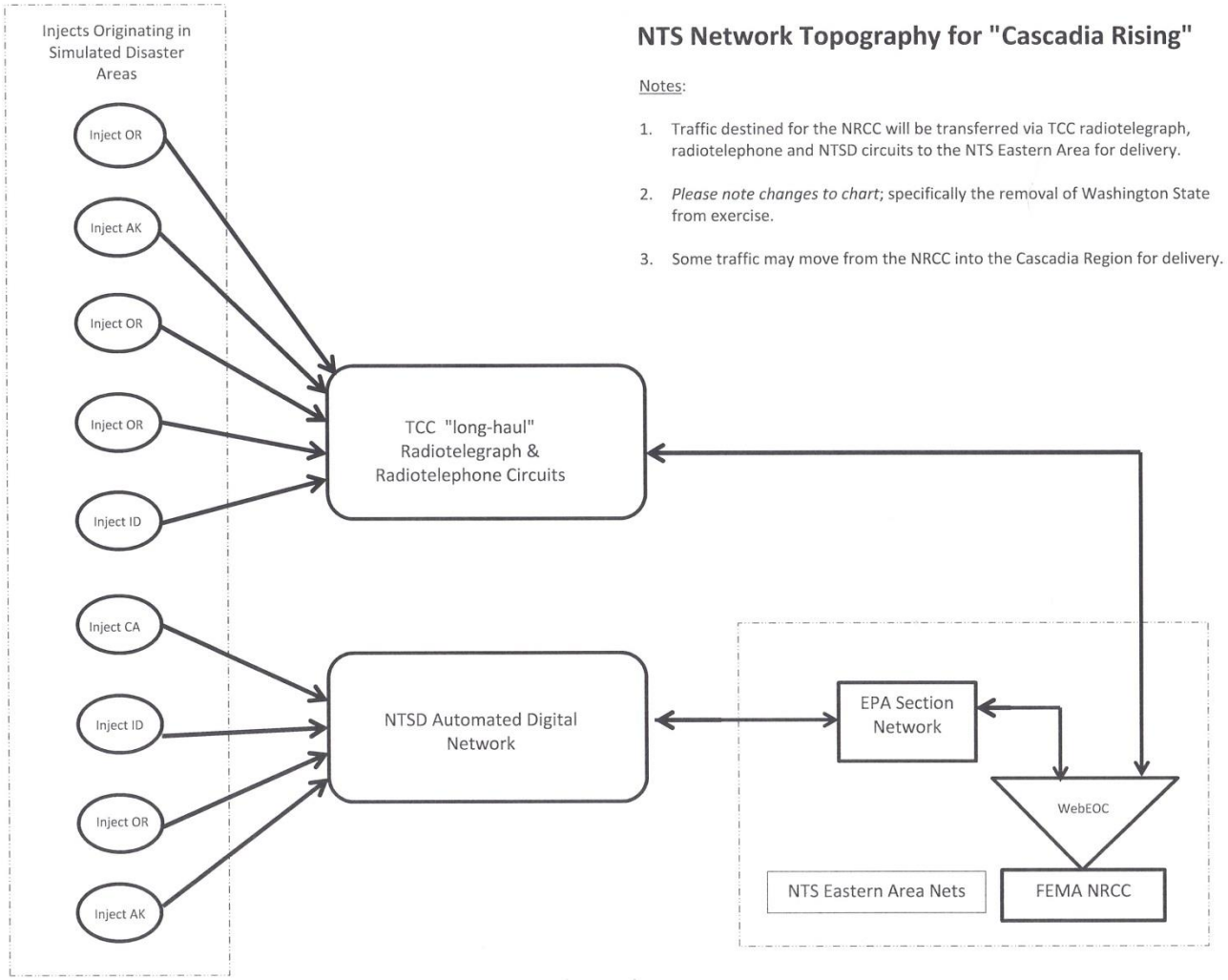

Fig. 2: <u>Important Note</u>: QSX Time periods reflect theoretical 24-hour operation. For actual exercise time frames, please see Section XI on page 10 of this document

Cascadia Rising Manual Mode Frequency Matrix								
	Primary frequencies and access points to NTSD highlighted in YELLOW							
	Frequency Application = RMS							
	DOCUMENT CONFIDENTIAL - DO NOT PUBLISH - INTERNAL NTS USE ONLY							
TCC Mode/Frequencies								
Designator							**QSX Time Periods**	
NAA	3563	CW	NIGHT				**0100Z to 1159Z**	
NAB	3845	SSB	NIGHT				**0100Z to 1159Z**	
NBA	7115	CW	NIGHT				**0100Z to 1159Z**	
NBB	7232	SSB	NIGHT				**0100Z to 1159Z**	
NCA	10115	CW		QSX 24-HOURS				
NDA	14115	CW		DAY			**1300Z to 0300Z**	
NDB	14345	SSB		DAY			**1300Z to 0300Z**	
NFA	21115	CW		DAY			**1600Z to 2359Z**	
NFB	21345	SSB		DAY			**1600Z to 2359Z**	
Notes:	1. All frequencies are +/- 5 KHz to accommodate other users							
	2. FEMA NRCC Liaisons please call "QSX FEMA de (Call Sign) periodically							
	immediately following the top and bottom of hour.							
	3. QSX maintained throughout time periods indicated							
Section Net Frequencies								**General Sessions**
Washington State:								
WAA	3563	CW	NIGHT					1430Z/0145Z
WAB	7038	CW		DAY				
WAC	1818	CW	NIGHT					
WAD	3975	SSB	NIGHT					0100Z
WAE	7268.5	SSB		DAY				
WAF	7283.5	SSB		DAY				
Oregon State								
ORA	3569	CW	NIGHT					0130Z/0500Z
ORB	7068	CW		DAY				
ORC	3920	SSB	NIGHT					0030Z
ORC	3990	SSB	NIGHT		Note: ARES Net			
Idaho State								
IDA	3572	CW	NIGHT					0245Z
IDB	7043	CW		DAY				
IDC	3937	SSB	NIGHT					0200Z
IDD	3990	SSB	NIGHT		Note: ARES Net			1400Z
IDE	3929	SSB	NIGHT					
IDF	TBD	SSB		DAY				
Region 7 Net								
R7A	1818	CW	NIGHT					
R7B	3560	CW	NIGHT					0230Z/0430Z
R7C	7042	CW		DAY				
R7D	3925	SSB	NIGHT					1745Z/0815Z
R7E	7235	SSB		DAY				

NTSD SCAN/ALE - Select frequency based on propagation							
Eastern Area NTSD MBO					**Operational 24-hours**	**Pactor Mode**	
WB2FTX	3591.9	3593.9				**Butler, NJ**	3
	7091.4	7094.9	7100.4	7102.4			
	10140.9	10142.9					
	14095.9						
KW1U	3591.9	3593.9				**Concord, MA**	3
	7051.5	7100.4					
	10140.9						
	14097.9	14112.4					
	21093.4						
WA4ZXV	3591.9	3593.9				**Norcross, GA**	3
	7100.4	7102.4					
	10140.9	10142.9					
	14097.9	14112.4					
	21093.4						
W4DNA	3591.9	3593.9				**Goldsboro, NC**	3
	7100.4	7102.4					
	10140.9	10142.9					
	14095.9	14097.9					
W3JY	3591.9	3593.9				**Malvern, PA**	3
	7091.4	7102.4					
	10142.9						
	14112.4						
	21093.4						
N3OS	3591.9					**Dade City, FL**	3
	7100.4	10140.9					
	14112.4						
	18102.4						
	21093.4						
Central Area NTSD MBO							
W5SEG	3589	3591				**Segiun, TX**	3
	7091.5	7098.5					
	10143	10145					
	14111.5	14112.4					
WB9FHP	3591	3591.9	3593.9			**Paoli, IN**	3
	7091.4	7100.4	7102.4				
	10140.9	10141.9	10142.9				
	14095.9	14097.9	14104.9	14112.4	14113.9		
	18108.4						
	21093.4						
KM0R	3591.9	3593.9				**Columbia, MO**	3
	7100.4	7102.4	10140.9	10142.9			
	14097.9	14109.9	14112.4	14113.9			

Pacific Area NTSD MBO								
W5KAV	3587	3591	3597			Rochester, WA	3	Pacific Area Hub
	7100.4	7102.4	7104.4					
	10144	10145.9						
	14095.9	14097.9	14104.9	14113.9				
	18103	18108.4						
WS6P	3591.9	3593.9				West Point, CA	3	
	7102.4	7104.4						
	14112.4	14113.9						
K6HTN	7065.9	7102.4				Pasadena, CA		DRS - no QSX
K7EAJ	3587					Hillsboro, OR	3	DRS - no QSX
AC7AI	3587					Montesano, WA		DRS - no QSX
VE7GN	3587	3571.5	3591.9	3593.9	3595	Gabriolo, BC, Can	3	RN7 Hub
	3597	3615						Primary Entry Point
	7065.4	7065.9	7091	7104.4	7100.4			
	7102.4							
	14064	14113.9						
KA7HRC	3587					Mount Hood, OR		Hood River Co. ARES
W7ARC	3587					Lynnwood, WA		
AG6QO	3591.9					Winters, CA		
	7103							
	14107.9							
N7JJ	3587					Shoreline, WA		DRS - no QSX
WB6OTS	3587	3590.5	3597			Sierra Vista, AZ	3	Alternate Pacific
	7094.9	7100.4	7102.4	7104.4				Area Hub
	10.144							
	14098.9	14105	14108.4	14110.4				
KC7ZZ	3591.9					Tuscon, AZ		DRS - no QSX
	7102.4							
						Yuma, AZ		
KC5ZGG	3591.9							DRS - no QSX
	7102.4							
KF7PVD	3591.9					Beaverton, OR		DRS - no QSX
	7102.4							
W7JSW	3591.9					Scottsdale, AZ		DRS - no QSX
	7102.4							
K7FLI	3591.9					Sahuarita, AZ		DRS - no QSX
	7102.4							
K0TER	3591.9					Colorado Springs, CO	3	DRS - no QSX
	7102.4							
	14113.9							

Pacific Area NTSD Continued							
N5HC	3591.9				Rio Rancho, NM	3	DRS - no QSX
	7102.4						
N7IE	3591.9				Layton, UT	3	DRS - no QSX
	7102.4						
	10142.9						
	14113.9						
N7JCO	3591.9				Clinton, UT	3	DRS - no QSX
	7102.4						
	14113.9						
NS7K	3587	3591.87			Clearfield, UT	3	
	7101.27	7103.25	7095.77				
	10147						
	14114.75						

5-mHz (60-meter) State and Federal Operations

Frequencies provided for monitoring ONLY. Do NOT transmit on any of these frequencies.

Channel			
1	5332	Calling Frequency	(Establish contact, move to available working frequency to clear traffic)
2	5348	Data Communications	
3	5358.5	Working Frequency	
4	5373	Working Frequency	
5	5404	Working Frequency	

Notes:

1. 60-meters shared between ARES, MARS, National Guard, Federal and state emergency management, etc.
2. FEMA Region 10 call sign: KF0EMA
3, Bothell, Washington MURS using WF4EMA
4. Note that reference frequency differs from center-of-intelligence frequency by 1.5 kHz (i.e. 5332.0 may may require a dial frequency offset by 1.5 kHz or 5330.5).

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