

Contesting and RTTY--The Basics

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Introduction and Copyright Notice

I am writing this narrative about contesting and RTTY to share with you the things I have learned from my experiences as a contester (principally CW) and long time RTTY enthusiast. Over the past seven or so years since I added my old friend, RTTY, to my growing interest in contesting, I've observed more and more RTTY contesters who are unfamiliar with both contesting in general and RTTY communications in particular. To be perfectly frank, the skill level of the average RTTY contester lies below that of today's CW contester, who is more aware of established and proven contest techniques promoting rapid, efficient, and accurate exchanges of contest data. My thoughts are echoed by the experienced RTTY contesters who have reviewed this paper. "Where are the Elmers?" I wondered, sometimes aloud in the heat of contest exchanges. Clearly, there are few if any, even though there is a wealth of written information about contesting, how to put a transceiver on the air in RTTY mode, and so forth. But sending and receiving RTTY signals during a contest does not make an amateur either a contester or a radioteletype operator. My purpose here is to improve the understanding of the "basics" of contesting and the basics of Radioteletype (RTTY) so that RTTY contesting can approach the speed, efficiency, and accuracy of its CW counterpart.

It wasn't too many years ago that RTTY was the only non-CW digital mode used by amateurs. As computers became more and more integrated with amateur equipment, a host of non-RTTY digital modes were introduced including Packet, AMTOR, PACTOR, PSK, OLIVIA, and many others. Unlike RTTY, none of the new digital modes is associated with a mechanical teleprinting machine (aka: "Teletype") In fact, all of the new digital modes require only computer software for both reception and transmission. The result has been a decline in amateur RTTY in favor of the newer digital modes. Today, most amateur digital ragchewing employs the newer modes. Weekday RTTY ragchewing is uncommon, but weekend RTTY contests fill the digital sub-bands with RTTY's distinctive "tweedle-tweedle" tones that are easily copied by either computer software or Teletype machines. During those contest weekends, it is clear that the average RTTY contester is unaware of the fundamental differences between RTTY and the newer digital modes he has become used to.

Regardless of the mode used, CW SSB, or RTTY, in a nutshell, all contest participants have the same objective: to send and receive those data elements required by the particular contest rules within the time limits of the contest. As in any competition, those amateurs making the most QSOs within the various entry classes "win" some form of recognition for their skills. The remaining amateurs "win" something as well: increased levels of experience, improved operating skills, bettering past year's scores, and so on.

Because the basic element of all contests is the QSO exchange, my purpose for writing this paper is to describe, discuss, and emphasize how contesters can send better and more efficient exchanges to other contesters, thus improve both the ease and the number of contest QSOs within the contest time period. Atmospheric conditions and propagation limitations always impact communications one way or another, and there is little we can do about them. But we can do something about our QSO exchanges and how we send them that will improve QSO rates and reduce needless interference to other operators.

I'll first discuss the basics of contesting in general so that you will see that contesting and "ragchewing" are distinctly different, introducing the need to make QSO exchanges informative, brief, and efficient. Then I'll move on to the topic of Radioteletype (RTTY), describing in considerable detail how and why it is very different from the newer digital modes with which you are no doubt familiar. My hope is that today's "newer" digital operators, those who did not "grow up" with mechanical teleprinting machines (aka "Teletype" machines), will understand the differences and incorporate them into their RTTY contest exchange designs. I'll spend considerable time describing contest QSO exchanges that I think are "efficient" for RTTY. I trust

you will see that whatever works for RTTY ragchewing is out of place in RTTY contesting. Finally, I'll conclude the document with a summary of contest operating tips that are appropriate to all contesting modes in general and RTTY in particular.

The major thrust of this work is RTTY contesting, but if you are interested in the basics of contesting and are not (yet) interested in RTTY, you should still find this document useful.

Copyright Notice: Within hours of completion of the 2012 edition of the CQ WW RTTY contest, I've already received requests for copies of this "Primer." Some of the requestors have asked about whether or not this document can be shared with others, so I place this Notice at the head of the document rather than burying it elsewhere. This narrative is my gift to amateur radio contesters and is **not copyrighted**, so please feel free to share a copy with anyone you encounter whom you feel would benefit from it. I have no monetary or pecuniary interest in this work, and neither should you, so you may not use it for sale, barter, or trade. I represent the ideas, experiences, and observations herein as my own; therefore, you may freely quote from this work, but you must associate my name and callsign with your quotes. You must neither add anything to nor remove anything from this document. The ideas expressed here are mine, and I stand behind them, so if anyone should have either kudos or objections, then they shall know whom to contact.

Some Biographical Notes

First, let's get acquainted. I began amateur RTTY in the mid 1970's, long before I became interested in contesting. My RTTY interest began when I acquired for a song a Model 15 ASR Teletype machine that was being retired by the FAA's Tucson International Airport operation. It helped to be a close friend of the FAA Tower Chief, K7VNO (SK)! To put it on the air, I built a HAL ST-6 demodulator or "terminal unit" as it was known then (aka: "modem," "data controller" in more modern terms) to interface the Model 15 with my Drake B-line, and I modified the Drake transmitter's VFO for Frequency Shift Keying (FSK) per the Drake manual. I had no Elmer, but I had the HAL manual, the 1973 ARRL Handbook, and a lot of optimistic get up and go. Those were the days of faded canary yellow paper rolled on spindles, inked typewriter ribbons, and ribbon re-inking contraptions.. Teleprinters were noisy and weren't "XYL approved," as are our "glass teletype" computer screens!

It's different now, of course. Today, interfaces between computer and radio are off-the-shelf appliances that are as close to plug and play as one can get. With a wide variety of software, the silent computer has replaced noisy machinery, and a dozen or two digital communication modes are available to choose from. Most are error correcting, so atmospheric noises and QRM have little or no effect on communications-- whatever is typed at one end is ultimately printed at the other. As we will see, such is not the case with Radioteletype (RTTY), which is best defined as "printing at a distance via the 5-level Baudot Code." RTTY and garbled characters and functions go hand in hand, and the knowledgeable RTTY operator, contesteer or rag chewer, always considers the potential for garbles as he transmits.

I acquired my tele type machine within months of purchasing my first digital computer, an IMSAI 8080 "kit," in late 1975. The IBM PC was still in the future. IMSAI was a competitor of Bill Gates' MITS, which produced the 8-bit Altair computer, and the two architectures were remarkably similar, each using a 100 conductor buss into which PC boards containing needed functions were plugged. Makers of those various "boards" sprung up in basements and small businesses (and BYTE magazine was started), so the "S-100 bus" chaps like myself could purchase board kits and populate their machines as they saw fit. Bare boards for

homebrew kludging were also available, and I homebrewed my own as well. I saw a natural progression of interfacing my amateur station equipment with my desktop computer, and I did just that. I first wrote a program that would send and receive CW (with speed tracking). I modified it to do the same with RTTY (easier, because RTTY is constant speed: no speed tracking necessary). When I acquired a Model 28 Tele type machine (100 words per minute), I interfaced it with my computer, and that was my first hard copy computer printer. It used 5-level Baudot Code as did 60 wpm RTTY, so I used a software look-up table to convert the computer's 8-level ASCII to Baudot and to keep track of "paper carriage shift," and other considerations that I'll discuss herein. I did all of my programming in Assembly Language because higher level languages like BASIC were pretty crude and taxed the meager amounts of RAM memory available in those days. All of this work took me into 5- and 8-level character codes to the data bit level.

As for contesting, I've operated Field Day for many years, but I didn't begin to get serious about contesting until about 15 years ago, when I began to participate in more and more events. As with RTTY, I had no contesting Elmer, so I was mostly self-taught. Since I'd been principally a CW operator since I was a Novice in 1959, my CW skills were mostly CW traffic handling and ragchewing. Serious contesting requires far more than 20 wpm code speeds and the ability to copy with a "mill" (manual typewriter) and not with a pencil. So like everything else available to the radio amateur, contesting required me to develop new skills and to improve older ones. Most of what I learned was through observation of other contesters. Once I became interested in actually competing in contest events, instead of simply making rather casual Field Day exchanges, I spent more time listening to other operators than I did making my own QSOs. Some operators seemed to make their QSOs quickly and effortlessly, while others were plagued by repeating their exchanges or by inability to work a pileup or from within a pileup. I tried to emulate the operators who seemed skilled and to avoid the techniques used by the unskilled. Sometimes, little tidbits of opinion would appear in print, but they were few and far between. I experimented a lot and got better at it, and a few years ago, I became acquainted with some experienced contesters who brought me the final distance, if there truly is such a thing.

I enjoy contesting for many reasons. It's a great way to test antennas, because a contester can make more contacts in a weekend (or in an hour) than in any other amateur activity. It's a great way to hone new skills or approaches to a contest QSO, because you can quickly see the effect of, say, a small change in a contest exchange format. Skilled contesters tend to be skilled DXers, too. I've reached what I call The Zone in life where Mr. Alzheimer is closer than ever, and contesting exercises my brain, possibly keeping Mr. A on the other side of my door. I'm not a "Big Gun" contester by any means, though. I could blame our canyon QTH terrain for that, I suppose, but other factors include a late start in contesting and possibly not enough longevity remaining to progress to the next hurdle of "Single Operator, Two Radios (SO2R)" setup and use. Still, I have some plaques and certificates, and contesting has improved my DXing skills and "wallpaper." What are your reasons for contesting?

Overview of Contesting Principles

As I mentioned in the Introduction, amateur radio contesting boils down to the sending, receiving, and recording in a contest log the data elements of the "exchange" required by the contest rules. Of course, there are a lot of operating techniques that can either facilitate or obstruct making on-the-air exchanges of data, but contest results depend only on the number of *accurate* exchanges that appear in the logs received by the contest sponsor. Simply put, during any contest event, each and every operator can make a choice regarding how easy or how difficult it will be for the other contesters to work him. He can craft his contest data exchanges to be efficient (or otherwise), and/or he can use contest operating procedures that are either quick and efficient or confusing, out of order, or that simply slow things down.

For me, contesting is the most fun, moment by moment, when I encounter an operator who is "easy" to work. His calls are short and crisp, his exchanges are well crafted, and his procedures, timing, and rhythm are spot on. Sadly, especially in RTTY events, those operators and exchanges are becoming fewer and further between. More and more RTTY contesters, by both their exchange construction and operating procedures, are difficult to work, and they are removing the pleasure of RTTY contesting that I (and many of the experienced RTTY contesters who have reviewed the early drafts of this paper) had come to enjoy.

The foci of this paper, then, are contest exchanges and contest operating procedures. Both are very different from "ragchewing!" Contesting is marked by maximizing accurately recorded QSO data per hour of operating time. Ragchewing is casual, and accuracy doesn't count for much. What works for ragchewing has little place in contesting! It is my hope that by the time you reach the end of this paper, you will have a feel for how to craft your contest exchanges and how to deliver them to other contesters through improved communication procedures. One of the foremost questions in your mind should be, "Am I easy or difficult to work in a contest?"

There are a lot of explanations, discussions, and tips in this document, so I do hope you will take your time as you read and study it. I spent years learning and experimenting with the "basics" that are presented here. As you go forward with your own observations and experimentation, there are even more techniques that you can learn that are not covered here. I do not represent this work as the "last word" on the topics discussed herein, so I expect to revise and update this document in the future as I receive feedback, comments, and suggestions from readers. Please feel free to check my qrz.com page to see if a newer revision is available.

Contesting Basics (Applies to All Modes)

Amateur radio contesting shares with all other competitive events the same principles of rules, boundaries, sportsmanship, and prizes, awards, or standings ladders for participants who amass points or other rewards for their skills and accomplishments. Although many competitive events are thought to separate the "winners" from the "losers," in amateur radio contesting, all participants can be winners in one way or another just by participating. The "Big Guns" of any contest, those amateurs whose scores place them in the top five or ten, would not be there if it weren't for the "Little Pistols" who participate. Thus, every contester depends on the presence and activity of every other contester in an event.

Terminology: "Running" and "Search and Pounce"

Here is some basic Contest-Speak that is important to understand: At any instant during a contest, all contest participants can be divided into only two groups:

1. those who occupy a single frequency and seek contest QSOs by calling CQ (the "Running" operators (or "Runners"), because they "run" their frequencies), and
2. those who tune their VFOs up and down the bands looking for CQs to answer (the "Search and Pounce" operators, or S&P ops for short).

Neither group can do without the other. Any operator can either Run or S&P, but to maintain good order, no one can do both at the same time on the same frequency. Contest QSOs are made only when a Running operator works a S&P operator, and vice versa. Running ops do not work other Running ops (things just don't work out well when two chaps are calling CQ on the same frequency), and S&P ops don't work other S&P ops. If you choose to be a S&P operator, you can switch to Running at any time you wish--all you need to do is to first find an empty frequency on which to make your CQ calls. That becomes difficult in big contests that fill the spectrum with Runners! If you've been Running for a while and tire of the stress and pace, then you can leave your Run frequency and tune around as an S&P operator. The majority of Single Operator Big Guns use two radios to do both--they Run a frequency on one band with one radio (and antenna system) while they S&P on a different band using a second radio (and a second antenna system). That's called SO2R, single op, two radios.

The goal of every contester should be to make as many QSOs during the contest period as he (includes "she" in this document!) possibly can. A cooperative process will maximize contest rates for all who participate, just as it will take less time for 1000 people to evacuate a movie theatre if they put aside chaos in favor of being cooperative. Therefore, I'll discuss how the Runner and the S&Per can cooperate with each other to reach their mutual goal--to make contest QSOs quickly, efficiently, and accurately.

My goal as a Running op is to work each S&P op quickly while taking steps to ensure the QSO he and I enter into our logs is accurate, that is, without errors that will result in QSO rejections and penalties when the contest sponsor scores our logs. That calls for efficiency during our contest QSO, which means packing the required information exchange into the least amount of time, by crafting our exchange messages and procedures to minimize confusion and the need to repeat information already sent. This is conceptually easy to do, especially when only the Runner and S&Per are on frequency. Adding other S&Pers, as in a pileup can, and does, complicate things, especially when S&Pers aren't cooperating with each other or with the Runner. Keep these principles in mind, for in a few moments I'll discuss the basics of how to accomplish them, giving you more QSOs per hour, whether you are a Runner or an S&Per. Some of the tips apply equally well to working DXpeditions, too.

Operators who choose Running mode do so because Running is the quicker way to make a lot of QSOs per hour. It is far faster to occupy a single frequency and to call CQ than it is to tune around and search for a CQ to answer. Running ops "bring the contest to them." But Running ops must attract S&Pers, and that takes loud signals and snappy CQ messages that aren't sent too fast or too slow (in CW) or too long, too short, or too indistinguishable (in RTTY or SSB). Runners must also be loud enough to "hold" their frequencies--Runners with weak signals are quickly pushed aside by others who wish to Run (yes, "frequency theft" is part of the contesting game!). Runners have an obligation to make each QSO quickly so that the S&Pers in the pile won't have to wait very long for their chance to make a QSO. If the Runner's skills are weak, then S&Pers will get impatient and QSY for better hunting elsewhere.

S&Pers want quick service from their Runners, and they must help by being efficient themselves. They must craft their exchanges to transmit only the *minimum* information required by the rules of the contest and good operating practice, omitting any "fluff" in their exchanges that adds nothing beyond what is required. Runners look for the required information (given in the order listed in the contest's rules). Anything else only slows things down. And because the Runner can work only one S&Per at a time, only that S&Per should be transmitting during the QSO--all other S&Pers in the pile should *remain silent* until their turns arrive.

In CW contests, many Runners send their CQ and exchange messages at faster CW speeds than used for usual ragchews--30-plus words per minute. Faster CW speeds may in themselves make contest exchanges go faster, but they also set a tempo for all of the exchanges on the Running frequency. Potential callers (should) know in advance that the Runner wants a crisp, fast, and accurate exchange with his callers. But if your CW copying ability is slower than the Runner's, then don't be discouraged, because you can still make QSOs with them. Here's what you can do:

1. Listen carefully to the Running op for a while and copy his callsign and his exchange. You may have to listen to him send several exchanges, but you will eventually figure out what you need to make an exchange with him. Put those data elements into the entry window of your contest logging program so that you're ready to send them when your turn arrives. If the exchange includes a data field that changes from QSO to QSO, like a serial number, then increment the serial number by one for each QSO the Runner makes before you make your S&P call. When the QSO is finished, make your S&P call, and if the Runner responds to you, then send your exchange either with your hand key, your CW paddles, or your preprogrammed macro button. I'll discuss contest logger "macros" in the section, **RTTY Contest Exchanges and Macros**.
2. If your contest logger is set up to send your contest transmissions with macros, then increase your logger's CW speed to match (approximately) the Runner's reasonably closely. You will have a better chance standing out in a pileup if you send close to the speed the Runner desires than at, say, 15 wpm.
3. If you're still using a hand key or if you're a bit slow with the paddles, you have no choice but to call him anyway, using a speed that you can send accurately. A gentleman CW operator will slow down (a bit) for you, and you can make the QSO with each other.

Never forget that every CW Runner, even the Big Guns of Contesting was in your shoes once! CW Runners, you know in an instant who the beginners are, so if you "groom" them, then they just may become CW testers, adding to the pool of future contest points for you!

In RTTY mode, where it takes the same amount of time to send each character, the time spent in each QSO depends on QRM and on the amount of "fluff" in the exchanges. You cannot control QRN, but you can control fluff. I'll discuss that in the section called, "Fluff," Who Needs It?

The Basics of Making Contest QSOs

Now let's discuss the basics of how to make contest exchanges. The emphasis here is on making CW QSOs, because as I mentioned earlier, CW ops developed the procedures for information exchanges in the days of spark. CW ops are typically very skilled in making QSOs in crowded band conditions in a backdrop of poor band conditions, and they are very aware of the rhythm and tempo of contest exchanges. They are just like Sgt. Joe Friday of "Dragnet," they're focused on "just the facts." So to repeat the mantra, this is *not* how to make contest QSOs but rather how to make contest QSOs *quickly, efficiently, and accurately*. If you aren't interested in CW contesting, please read this section anyway, because its principles apply to all modes, and you will better understand what amounts to the same process when I discuss RTTY.

CW Contest QSO Procedure:

I like to think of the information exchanged between the Running op and the S&P op as a ping pong ball going back and forth between two players. It applies to all communication modes, and it should go stepwise like this (A discussion in italics follows each step):

1. The Runner "serves the ball" by calling CQ repeatedly until an S&P op responds by sending *only* his callsign. To illustrate, let's say that the contest is the WPX, where the exchange is RST plus serial number. K7IA is the Runner, and K7IPZ is the S&P op.

Runner: CQ CQ WPX K7IA K7IA
S&P: K7IPZ

In CW, it is sufficient for the S&Per to send his callsign only once. If QRN or QRM knocks out a dit or a dah, the Runner more than likely knows it and can ask for a repeat. The experienced CW ear is very good at copying CW signals in pileups of S&P operators. Notice how efficient these two transmissions are--only the essential information is passed, and no time is wasted by sending extraneous "fluff" that adds nothing, like prosigns, greetings, etc. Examples of "fluff" appear later.

2. K7IPZ, by sending his callsign, has returned the "ball" to me. Now it's my turn to "return the ball" to him by sending my contest exchange. I have three choices:

Runner: K7IPZ TU 599 012 K7IA (a)
or
K7IPZ TU 599 012 (b)
or
TU 599 012 (c)

The Runner, knowing who the S&P operator is, sends the exchange required by the contest rules, "599 012," where "012" is the Runner's current serial number. Each of the three contest exchange choices above is used, but the choice should be made based on propagation conditions, QRM QRN, size and behavior of the pileups, and the perceived CW skill of the S&P operator. Method (a) is the most complete, because it identifies each QSO participant, but it consumes more time, and when conditions are good, many ops consider it overkill. I use Method (a) in RTTY and Method (b) in CW, because I want the other op to see how I copied his callsign (and to correct me if I'm in error). Some Running ops choose Method (c), but I don't. It's quick, but it has a flaw: the Runner who sends it doesn't let the S&P op know if his callsign were copied and logged correctly. Runners who log a callsign incorrectly may subsequently refuse to work the true owner of that callsign, because the Runner had "worked him before," when in fact, he hadn't. This happens to me in many contests--when a Runner I've called sends "B4" ("before") to me, I assume he's really worked my friend and avid contester, Bob (K8IA) instead.

*I think it's better for the Runner to send the S&P op's callsign as part of the exchange so that the S&P op can be certain that the exchange is directed towards him, and not to other stations on frequency (other S&P operators on frequency should take note and **remain silent**). I send the exchange in the order given in the contest rules, too, because that's the format all*

operators expect, and that's how contest loggers' exchange entry windows are arranged. It's a nuisance when an operator sends contest exchange fields out of order, because editing the exchange windows inevitably results. I send "TU" as my confirmation of his callsign--it also adds a quick pause before my exchange is sent. Some ops consider it "fluff," though.

3. Now it's the S&P op's turn to return the ping pong ball--he sends his exchange to the Running op. At this point in the QSO, the S&P op has received my callsign at least twice during my CQs, so he should be certain that he knows who he is working. But I've copied the S&P's callsign only once--when he responded to my CQ. If band conditions are poor, it would be nice to copy the S&P's callsign a second time to confirm the first:

:

S&P:	K7IA TU 599 020 K7IPZ	(a)
	or	
	TU 599 020 K7IPZ	(b)
	or	
	TU 599 020	(c)

Again, in CW (but not RTTY), three exchange methods are used by S&P operators, and the comments made just before about them still apply. I use Method (a) for RTTY and Method (b) for CW. I never ever use Method (c), because I want the Runner to know how I copied his callsign. The "TU" acknowledges receipt of the Runner's exchange. The S&P op could acknowledge by sending "RRR" for "roger" or "QSL," but "TU" is faster.

4. Finally, it's the Runner's turn to hit the ball for the last time, if he feels all has been copied correctly.

Run:	K7IPZ TU QRZ K7IA	(a)
	or	
	TU QRZ K7IA	(b)
	or	
	TU QRZ (or less!)	(c)

The Runner efficiently acknowledges receipt of the S&P exchange with a "TU," and he lets others on frequency know he's ready for another QSO with a "QRZ," and he identifies himself as the Running operator. I use Method (a) for RTTY and Method (b) for CW. Some contesters consider the "QRZ" superfluous. I don't, because for many inexperienced contesters, it helps identify which of the two operators is the Runner. Sadly, a lot of Runners use Method (c) and don't identify themselves to the pileup after each QSO, but it's good practice to do so.

Here's a nutshell summary of the above CW Method (a) Contest Exchange Procedure:

Runner:	CQ CQ WPX K7IA K7IA	Runner's CQ call
S&P:	K7IPZ	S&P answers
Runner:	K7IPZ TU 599 012 K7IA	Runner's exchange
S&P:	K7IA TU 599 020 K7IPZ	S&P confirms & sends exchange
Runner:	K7IPZ TU QRZ K7IA	Runner confirms & calls for next QSO

CW Contest Exchange Procedure--Some Additional Notes:

All of the above assumes everything is working perfectly, and most of the time, it does. There are things that can get into the way of making quick, efficient, and accurate exchanges, such as QRN, QSB, QRM, equipment problems, fat fingers on the keyboard, and poor operating techniques by either the Running or the S&P operator. Here are some thoughts about things Runners and S&Pers can do to make contest exchanges work smoothly:

1. The Running Operator is in Charge of His Frequency's Pace, Tempo, and Discipline

The Running operator controls the pace and the tempo of the frequency--after all, it's "his" frequency (for as long as he can hold it). For contest QSOs (and DXpedition QSOs) to occur quickly, efficiently, and accurately, all participating operators must exhibit self control and discipline. It is the duty of the Running operator to establish and maintain discipline on his frequency, and to do so, the Running op must be disciplined himself. S&P operators are temporary visitors to the Running frequency, so they need to observe patiently how the Running op is conducting his frequency and take their cues from him. Here are some examples:

- a. If you are the Running op, you must identify yourself frequently. Just because Internet spotting assistance points S&P ops to you, it doesn't mean you don't need to ID yourself. Not every S&P op in your pileup arrived there because of spotting assistance--they do not know who you are, and it is inconsiderate of you not to tell them. You must frequently let your pileup know which one of the many signals is yours and that you are the Running op. Spotting assistance has caused many otherwise skilled Running ops to think that only an occasional identification "saves time for more QSOs." Nonsense! Be considerate and identify yourself in *every* QSO. Callsigns in Internet spots are not always accurate, and only a fool would work you without hearing your callsign for himself. A lot of operators, like me, prefer the "hunt" rather than assistance, so you need to let us know who you are. If I encounter a pileup, I move on if the Runner doesn't ID within three QSOs. I just won't waste the time it may take to get the Runner's callsign, only to discover that I've worked him before. If you are the S&P operator, and if you don't hear the Running op identify his callsign, you should consider moving on, too. If you believe the callsign in the Internet spot is correct without verifying it, you log it at the risk of losing contest points and of not getting a QSL card or LOTW (Logbook of the World) confirmation after the contest.
- b. If you are the Running op, and several S&P ops call you at the same time, the QRM often makes it difficult for you to distinguish a complete callsign. You may get only a couple of letters, or, better, a numeral and a letter or two. This is particularly the case in RTTY, because most callers are on nearly the same frequency and because RTTY "engines" cannot demodulate multiple signals very well. What should you do? If you were able to get a couple of letters, then send just those letters a couple of times. Now if you are one of the S&Pers in the pileup, and you hear those couple of letters sent, here is what you should do: If those couple of letters are part of your callsign, then you should respond to the Runner by sending *only* your callsign (once in CW, twice in RTTY). But if those two letters are not part of your callsign, you should *remain silent*, allowing the Runner and the indicated S&Per work each other. Don't worry--the Runner will eventually get to you, and "eventually" can be a very short time, if the S&Pers in the pileup behave themselves.

Here is where the Running op can promote discipline on his frequency: once you identify those couple of callsign letters and send them to the pileup, you should commit yourself to whoever owns that callsign. **Do not** abandon that S&Per by calling someone else (no matter how loud and clear his signal might be), because if you do, you will lose control of your frequency--every S&Per will call no matter how many fragments of a callsign you transmit. Your QSO rate will decline, and some of your S&Pers (like me) will get disgusted with you and leave your frequency. You are the one who must discipline your pileup, so if you are relentless in your quest to work a particular partial callsign, your S&Pers will quickly understand your approach, and most of them will let you do it. Sadly, some never observe and learn, though.

- c. If you are a S&P op, you must let the Running op send his exchange first, as shown in the procedure above. **Do not** answer a Runner's CQ by sending your exchange to him! If you do, then you'll upset the tempo of the QSO exchange and slow things down. And, while you're sending your lengthy exchange out of order, the Runner cannot copy other S&Pers who are calling at the same time. It is inconsiderate to other callers and to the Runner. If you are the Running op, and you respond to the S&P's out of order exchange, then you are failing to discipline that operator. You are missing a chance to teach him that his sloppy procedure is unacceptable. I do not respond to S&Pers who do this, no matter how relentless they are, and even if there are no other callers on frequency--I'm just not that greedy for QSO points! Instead, if there is another caller on frequency (and if I could copy his callsign against the background of the Mr. Out-of-order's exchange), I work him. Otherwise, I simply call CQ again and work other callers, hoping Mr. Out-of-order will get the idea. He never does, and that is one reason why I am writing this document. If you as a Runner wish to eliminate this kind of behavior (and others), then I urge you to be more of a disciplinarian.

2. The S&P Op Should Request Repeats If Needed

If you are the S&P op, and if you don't get the Runner's exchange (or his callsign) to your satisfaction, or if you have any doubt, then ask him to repeat whatever you need until you have it correctly. Do NOT send your exchange until you get his data into your log! The Runner wants to make a complete QSO with you, so he will be VERY cooperative about your repeat request!

3. The S&P Op Must Ensure the Runner Gets S&P Exchange Information Accurately

If you're the S&P op, it is your duty to ensure that the Runner gets all of your exchange information (especially your callsign) correctly, too. You can see in the above "ping pong" example that the Runner should send your callsign in his transmissions to you a couple of times. If he copied your callsign incorrectly, he will send it to you incorrectly, too. You must pay attention to what he sends to you, and if he is in error, you must correct him. Just send your correct callsign a couple of times, and he'll get the idea. He'll be grateful for your effort! This is a courtesy to him (one of the very basics of amateur radio!). It may not make a difference in your contest standing, but it will affect his. If you don't correct your callsign and if you are pursuing a WAS or DXCC certificate, then the Running op will log your callsign incorrectly, and he will submit the incorrect callsign to LOTW. You get the idea--you won't get a QSL card or an LOTW confirmation from him!. Here's what you should do to be more certain that he has your callsign and exchange correctly:

- a. After you send your exchange to him, always wait on the Runner's frequency until he confirms receipt to you (See Step 4 in the **CW Contest Procedure** above). If he is in doubt about your exchange, he will request a repeat, so don't move off frequency until after he acknowledges. This may sound fundamental, but it's surprising how many RTTY and CW chaps send their exchanges and immediately disappear! I don't log those QSOs, because they are not complete two-way exchanges, so my time taken for the QSO attempt is wasted, and if there are other S&Pers waiting their turns to work me, their time is wasted, too. New Mexico isn't a "rare" state, but it's close. Sometimes I get QSL cards from chaps who aren't in my contest log. I don't spend time wondering why.
- b. If, after the QSO is finished, you feel the need to verify the Runner's callsign, you can still do it--just stay on frequency and wait for the Runner's next CQ and ID. You can also verify his exchange, including serial number (just deduct one from whatever he sends to the next op). You don't need to transmit to do this (and you shouldn't, either). Remember, the Runner does not have that opportunity, so he has to get it right the first time!
- c. If the above fail, you can work the Runner again. There is no penalty to either operator for duplicate log entries (see next paragraph).

4. The Running Op Should Work Duplicate Callers

If you are the Running op, and if you get a call from someone you have worked before, then **work him again!** It is for your benefit, and his, to do so. He may be in your log, but he just told you that **you are not in his log!** If you want credit for working him (and not the penalty that you will get if he submits his log to the sponsor), then you need to work him again. It is silly to send "B4" or "dupe," and it is ridiculous and time consuming to argue with him about whether or not you've already worked him (or to waste time telling him the date and time you worked him). Penalties for duplicates were common in the old days of paper log submissions, but there is no penalty for dupes in Cabrillo logs. In recent years, more and more contest rules state what I've just said, "work the dupes," and, further, "do not delete dupes from your logs." If you are an S&Per and if a Runner sends "B4" or "dupe," then don't waste your time arguing with him. You really have no option other than to QSY, let him take the penalty that he deserves, and hunt for another Runner who is better informed.

5. Contest Signal reports

If you're new to contesting, then you've no doubt noticed that no matter how strong or weak a signal is, the signal report is always "599" or "59" in SSB. Yes, gone are the days when signal reports in contests had any meaning, but they are still required by many contests. Just please "go with the flow," and send "599" or "59" as required. Today's contests are fast-paced, and contest loggers default to "599/59" (N1MM skips over those pre-completed data fields when the usual cursor advance key is pressed). Speed and QSO rates are the parameters of interest now. You can send a "579" if you wish, but you'll mark yourself as an "uninformed" operator (read: a "lid") as the other op fumbles to make an infrequent edit of his Rcvd RST data field. Happily, there are contests where the RST is not part of the exchange, but in the meantime, think of the Signal Report as a convenient pause in the exchange where you can catch your breath!

Contest Logging Programs --What They Can Do for You

Gone are the days of pencil and paper logging in contests. Contesting has become so specialized that computer programs for general station logging are just not up to the tasks required by contesters. A well organized and efficient logging program that supports the major communication modes and contest events eliminates a lot of hassle when it comes to getting your radio equipment ready to make contest QSOs for you. There are many contest loggers available, spanning the cost range from free to rather expensive. I use N1MM Logger (free), and it defies the old saying, "you get what you pay for." A team of avid contesters/software gurus continuously maintains and improves it, releasing software updates almost weekly. Its initial learning curve is rather steep, but in recent years, the introductory "getting it going" documentation has improved greatly. If that doesn't do it for you, then N1MM's Reflector will get you into touch with other operators (and the gurus) who take pleasure in helping users out. If you're interested, then just Google "N1MM," and a copy is waiting for you. It supports all contest modes. I make mention of N1MM because the logger-related things I mention here reflect my experience with N1MM--I have no familiarity with the other loggers.

Whatever logger you have or will choose, you should look for some minimum performance requirements beforehand. It should interface with your radio, so that when you change your radio's VFO frequency or mode, the logger will know it so that it can create your contest log file with the frequency and mode attached to each QSO. It should support your radio's CAT command structure so that you can issue radio control commands within the logger's macros. It should interface with an outboard CW keyer (if you are a CW op) so that it can send contest exchanges. Your logger should interface with the digital modes, either standalone data controllers or software engines, like MMTTY, MMVARI, or, FLDIGI. If you're a phone contester, your logger should be able to play .wav files into your radio's MIC or LINE IN jacks. Audio files of your voice giving your common contest calls and exchanges at the press of a keyboard key can really save your voice box in an SSB contest!

Your contest logger should allow you to program a good number of "macro" keys on your computer's keyboard (usually the "F-keys" 1-12). A "macro" is a text message, a rig control sequence, or a combination of both that is associated with a keyboard key (usually a Function-key). Pressing that F-key sends the associated contents. Thus, when I'm in Running mode, I press the F-1 key to send my CQ message, the F-2 key to send my exchange, and the F-3 key to say "TU QRZ K7IA," as in the example procedure presented.

Your contest logger should be able to prepare your contest log for submission to the contest sponsor in the standard format required. It should also be able to export your contest log in a format usable as input for your master station log and for Logbook of the World. It should have a help file/manual that gets you going and keeps you going, and it should have technical support.

It could have many other features, of course, but I regard these as the bare minimum.

Contest Log Submission and Checking

No matter why you enter and work a contest, even if it is only to "hand out points" to more serious contesters, you should submit your log to the contest sponsor. Contest sponsors value logs for several reasons besides determining who should receive the 1st place plaques and other certificates. Every submitted log is used to cross check every other log's accuracy, and sponsors want to know how many amateurs participate in their contest events. Amateurs submitting logs demonstrate the kind of interest that sponsors

want to see--it helps them determine whether to continue sponsoring the event in the future, to add more prizes, to change the rules, and so forth.

All contest sponsors that I know of prefer logs in digital form and formatted according to the "Cabrillo" standard, which is nothing more than a standardized columnar format of all QSOs made and preceded by an information header containing your callsign, name and address, name of contest, etc. Many sponsors will accept your tabulated log on floppy disk, and a few will accept paper logs if the number of QSOs isn't very large (say 100 or less). But because the Cabrillo method is standard now, you can expect sponsors to gradually and completely eliminate their acceptance of floppy disks and paper logs. Each of the leading contest logger programs will produce a properly formatted Cabrillo log at the click of the mouse, so the time it takes to submit your log shouldn't be an issue.

Contest sponsors allow anywhere from a few days to a month for participants to submit their logs, so when you read the contest rules before the contest, it is wise to make note of the submission deadline date and the email address to which your log is sent.

After the submission deadline date, the sponsor goes to work on all of the logs received. The goal, of course, is to rank order the entrants according to their total contest points received in the contest. Multiple rank orders are produced according to the number of entry classes within the contest rules, such as Single Operator entrants, Multi Operator entries, Power levels (QRP Low, High), Mode (CW only, Phone only, RTTY only, Mixed), Number of bands worked (All bands, 15 meters only, etc.), and geography (worldwide, by continent, by Zone, by state/province, etc.).

Rank ordering is simple compared to the process of checking every QSO for validity, so validity checking is performed first. The fundamental approach is that since two amateurs are involved in each QSO, the data exchanged between the two amateurs involved in each QSO are compared. That's a lot of comparisons for even a modest contest! If the data elements match, both QSOs are declared valid and are given full credit by the sponsor. However, if the data elements don't match, then one the contester in error is penalized according to the contest sponsor's rules. For example, let's say that my log says I worked you at a particular date, time, freq, and mode, but your log doesn't contain "K7IA" for that date, time, freq, and mode (plus/minus reasonable time and freq differences). That could happen because:

1. You didn't log K7IA (or any callsign even close to K7IA). Maybe you were unsure of the exchange and didn't log it, or maybe your logging software hiccupped, or you pressed the wrong key in your keyboard. If K7IA isn't in your log, but if you're in K7IA's log, then K7IA is "awarded" a penalty for Not In Log (NIL) and he loses credit for that QSO, plus one (or more) additional QSOs as a penalty. K7IA may also lose a multiplier. NIL penalties are very severe!
2. Your log doesn't have K7IA, but it has something close (in Morse) to it, like Bob, K8IA, or K7SA, or K7EA. In RTTY, a garbled callsign won't match the other operator's. In this situation, K7IA suffers no penalty, but YOU do! Your penalty is awarded for a "busted" callsign.
3. Let's say both callsigns match, but one of us has an error in the received exchange (in WPX, either the RST or the serial number is incorrect). The op with the incorrect exchange gets docked. Here's another reason why all signal reports are 599 or 59!

You can see why serious contesters want to get everything right. The really serious ops, whose goal is to actually WIN the event, often win by a margin of fewer than ten (out of a few thousand) QSOs between

them and second place! Next time you work a contest, notice how slowly the total score increases at the beginning of the event, and if you work long enough, observe how the score accelerates as your QSO points and multipliers build up. The Big Guns of contesting often work a couple thousand (or more) QSOs in a weekend event, so you can imagine how their total scores change with each QSO they work. For them, a busted call that is the only QSO having a unique multiplier can cost a few thousand points in some contests.

So here's the crux of contesting: it's a cooperative, mutually dependant effort between Runners and S&Pers. S&Pers ultimately have an advantage, because they can always get QSO fills from the repetitive exchanges sent by the Runners. The Runners get only one chance to get it right, so they depend on the S&Pers to make certain it happens. Please help them out!

And just a little gee-whiz info: there is one contest that docks and penalizes *both* operators if *either one* makes an error, and that is the Russian DX contest. Amazingly, the ops appear to be just as casual about exchange procedures as they do in "regular" contests. Go figure...

RTTY Basics

Getting to Know the Teletype Machine and the Baudot Code

To really understand RTTY, you must first have a basic understanding of how RTTY originated. I discuss that here, and I truly hope to whet your appetite for more information, because it will not only give you an appreciation for the mechanical geniuses who developed "teletype" machines, it will also help you become a better RTTY operator. To go deeper, just Google "teletype" or "RTTY," and you will find a wealth of information and other links to look at.

The Teletype Machine, Very Simplified

Recall, "teleprinting" means printing at a distance (from the Greek root "tele"). The first teleprinting machines appeared in 1846, the same year Samuel Morse began telegraph service between New York City and Washington, D.C. Many approaches to teleprinting machines were developed after that date. Emile Baudot developed a five element code in 1874, which was adopted for use in France in 1877 and by Britain in 1897. Later, Murray added carriage control codes to Baudot's list, and he rearranged Baudot's character codes to minimize operator fatigue and to minimize the number of punched holes in paper tape corresponding to how frequently those characters were typed. For a more complete history of teleprinting machines, go to

www.en.wikipedia.org/wiki/Teleprinter

The machine most used by radio amateurs was developed and manufactured by the Teletype Corporation. That machine is the Model 15, and it was spawned by earlier Teletype Corp. approaches. It made its debut in 1930 and was in continuous production until the early 1960's. Properly lubricated and maintained, it could reliably operate 24/7 for months on end. After Teletype ceased production, and after faster mechanical Teletype machines became available, the Model 15 was phased out and replaced by faster machines. It became available to amateurs at surprisingly low cost.

The minimum configuration of a Model 15 was only a printing unit within a "soundproof" enclosure. Amateurs preferred the combination printer and keyboard, of course. My Model 15 also had a paper tape reader and a paper tape punch, so I could prepare a transmission in advance by punching a paper tape using

the hunt and peck keyboard method. Then I could feed the tape through the tape reader, sending my message at full speed, 60 wpm. I used paper tape for my station description, hence the term "brag tape."

The inner workings of the Model 15 are quite complicated. See a still photo at

www.aetherltd.com/images/frontview1med.jpg

and a video of one in action at <http://www.youtube.com/watch?v=MI00ngVwrcU>

The video shows Model 15 action with cover both in place and removed. Notice that the machine is only slightly quieter when its cover is in place. Unfortunately, I could not find a video showing a teletype operator at work. He is (usually) silent.

In simplistic terms, a constant speed electric motor turns a spindle that interacts with an ingenious arrangement of electric solenoids, latches, cams, levers, code bars, and tiny switches to produce or to utilize precisely timed sequences of electrical pulses (digital bits in Baudot Code). The speed at which the bits are sent is determined by the rotational speed of the machine's constant rpm motor and therefore its spindle. The keyboard is not mechanically linked to the local printer, except that the keyboard and printer share the constant speed electric motor. Teletype components (printer, keyboard, paper tape reader and tape punch) are all connected in series with a DC power supply. That circuit is called the "local loop." Pressing a key on the keyboard initiates a sequence of make and break switching of the DC current flowing in the local loop, and the sequence of switching corresponds to the Baudot Code for the particular key that is pressed. If the printer is connected to the local loop (and in amateur setups, it always is), then the make-break sequence causes the printer to print the character corresponding to the key that was pressed. The operator would see on paper the character he typed. If a transmitter keying circuit were added to the local loop, then the make-break switching sequence in the local loop would key the transmitter, producing what we still call "mark" and "space" frequencies. Similarly, a Radio Teletype demodulator (or "terminal unit" in older terminology) could be connected to the local loop. Demodulating incoming mark-space tones from a radio receiver would cause make-break sequences in the local loop, driving the printer to display incoming characters from a transmitter miles away.

Here it suffices to say that pressing a key on the keyboard produces a timed string of electrical binary bits consisting of a start bit, five data bits, and a stop bit. Each keyboard key produces a unique data bit stream. The unique sequence of the five data bits corresponds to the key that was pressed, just like our computer keyboards. Similarly, when the printer receives a stream of data bits, the data bits are mechanically decoded by a code bar, which selects the unique mechanical hammer (typebar) corresponding to the data bit pattern. That typebar is briefly connected to the rotating spindle which causes it to strike an inked ribbon and paper. An image of the letter or numeral on the business end of the typebar is thus transferred to the paper. It is very much like an old fashioned manual typewriter that can be seen in museums! Each Baudot combination of five Baudot data bits establishes a unique one-to-one relationship between keyboard key and printing typebar. Broadly speaking, pressing a keyboard key produces a corresponding action by and (and all) printers connected to the communications circuit, be it a land wire or a radio circuit.

That, in two paragraphs "explains" how a mechanical teletype machine works! You can watch a brief video of a visual description at:

<http://www.youtube.com/watch?v=niYDegfpfAs&feature=related>

Now is a good time to examine the photo of the Model 15 keyboard appearing in the Wikipedia link. Note that is a very abbreviated keyboard, compared to your computer's keyboard. It contains only enough alphabet characters, numerals, and punctuation to get the job done--no frills. Note especially that all letters are capitalized (no lower case), and numerals and punctuation share the letter keys. Why is that?

Integrating the Baudot Code and the Teletype Machine

By the time the Teletype Corporation began to develop its teleprinting machines, the 5-level Baudot Code was already well established, and the 5-level code was adequate for sending the alphabet, the numerals, and common punctuation characters. Were five data bits enough to do the job, though? Perhaps six would be better? Let's see.

Five binary data bits yield 32 possible combinations of characters that can be transmitted (two raised to the fifth power is 32). Six data bits would yield 64 combinations, and our familiar 8 data bits provide 256. We already know that the five bit Baudot system was chosen, so how does one transmit 26 letters, 10 numerals, and a host of punctuation symbols when there are only 32 possible combinations? Elegantly, that's how. Two of the 32 combinations (assigned to two keyboard keys) are used to "shift" the printer's paper carriage into what we now call "upper case/lower case." The teletype machine has no "case," though. It has "shift," just like your computer's keyboard (just look at the Shift keys). Shifting the teletype's paper upwards and downwards allows placing two printing characters onto each typebar, doubling the effective number of each keyboard key (just like the manual office typewriters of yesteryear). Two keys control shift, the LTRS key and the FIGS key. In Letters shift, alphabetic characters are printed, and in Figures shift, numerals and punctuation are printed. If the paper carriage is in LTRS shift, then pressing FIGS moves the carriage upwards into FIGS shift, and that's where it *stays* until the LTRS key is pressed again. I emphasize that the teletype machine's carriage remains in one case or the other until it is *commanded* to change by receipt of either the Baudot LTRS or FIGS characters. Note that all 5-bit Baudot combinations are considered "characters." Most are printing characters, while some, like LTRS and FIGS are nonprinting.

If you are familiar with an old manual typewriter, and if you watched the video of the Model 15 in action, then you've probably noticed that the teletype printer and the manual typewriter mechanisms work in reverse:

The manual typewriter's paper carriage moves from left to right as the line of print advances, and the typebar assembly moves up and down to "shift" between lower and upper "case".

The teletype's paper carriage moves up and down to shift between letters and figures "shift," and it's typebar assembly moves from left to right to advance the line of print.

How the Teletype Machine Operator Does His Job

The Teletype (also known as "TTY") machine operator is not an ordinary typist, because he doesn't use an ordinary typewriter (or a computer that emulates the Baudot Code!). Teletype operators must constantly be on their toes, aware of which shift the carriage is in and where the paper carriage is, in relation to the spot on the paper where printing takes place. Let's take a look at how the TTY operator operates his keyboard.

Since most plain text is alphabetic, the TTY spends most of its time in LTRS shift. When the TTY operator encounters punctuation or numerals, he must shift the carriage upwards to send them. For example, how would a 1930's vintage land wire TTY operator send weather bulletin to the other teleprinters on the "wire"

circuit? Assume a portion of what he intends to send is "current temp is 98 and humidity is 11 percent."
Here are the keystrokes he would make to send it:

CURRENT TEMP IS <FIGS>98<LTRS> AND HUMIDITY IS <FIGS>11<LTRS> PERCENT

where <FIGS> represents a key press of the FIGS key, and similar for the LTRS key

Note a few things: there is no lower case alphabet; to send a group of numerals, the FIGS key is pressed only once; any number of numerals and/or punctuation can be sent after a single press of FIGS; and the LTRS key must be pressed to shift the carriage to Letters shift for alphabetic characters. Our computer keyboards do not work this way. The Shift key in our computer keyboards must be held down to print capital letters and "upper case" numerals--punctuation characters. Or, another way of saying it, computer keyboard Shift keys are not "sticky" as are TTY keyboard LTRS and FIGS keys.

Now let's fast forward a bit to the mid 1970's, when I rescued my Model 15 TTY from the FAA's trash heap (the Model 15 was a 60 wpm machine, and the FAA had upgraded to 100 wpm, using the Model 28). If I wanted to send my callsign by amateur radio to another operator, here's how I would do it with my Model 15 (assume the carriage starts in Letters shift):

K <FIGS> 7 <LTRS> I A
(The white space is for clarity--the space bar is not pressed.)

The amateur at the receiving end would see "K7IA" appear on his print paper, assuming good band conditions (no garbles).

If I forgot to press the FIGS key, the following would be sent to the other station:

"KUIA" (numeral 7 and letter U share the same print hammer)

If I remember to press FIGS but forget to press LTRS:

"K78-" (I and 8 on same hammer, and A and hyphen on same hammer)

If I press both FIGS and LTRS keys correctly, and if a quick static crash garbles only the FIGS data bits, then my printer would say "K7IA" (garbles affect only the receiver's print), but the receiving operator would see

K<garble character>UIA

(Where the "garble character" comes from scrambled FIGS data bits. The carriage remains in LTRS shift, so letter "U" replaces numeral "7." Pressing the LTRS key changes nothing, because the TTY is already in Letter shift, so the last two letters of my callsign print normally. Note: The static crash may be long enough to garble the character(s) following the FIGS character, producing unpredictable print at the receiving end. My entire callsign plus whatever follows may be replaced with random print. It is possible for a garble to change any Baudot character into a carriage shift character, and the carriage will dutifully follow its command, leading to unintelligible strings of alphabetic plus numeric and punctuation characters. For you enthusiasts of thermodynamic s, garbles

increase the entropy of information exchange (read: a bad thing!). By the way, repeatedly sending the LTRS key at 60 wpm is what produces RTTY's "diddle."

Some later teletype machines contained a mechanical upgrade called Unshift on Space (UOS) that would return the paper carriage to LTRS after a space character was sent or received. It was a great idea, but how was one to know if the other chap's machine had the UOS upgrade? In the old days, we didn't know, so we pressed the LTRS key anyway; but now, computer RTTY software emulates the old mechanical UOS upgrade and allows UOS to be turned on or off.

There are other non-printing keys that are on the mechanical keyboard, and two of them control the paper carriage. They are the "CAR RET" and "LINE FEED" keys, which I'll call "CR" and "LF," respectively. Pressing the CR (Carriage Return) key causes typebar assembly to move leftward to the paper's left margin. But the CR key does not turn the platen, so the paper is not advanced. That's the job of the LF (Line Feed) key. Another non printing key is "BELL"--pressing it rings the bell within the other operator's teletype machine, an attention getter.

Computer RTTY software combines the CR and LF Baudot characters whenever the keyboard's Enter key is pressed. Both CR and LF characters are sent to the other station, however, and I'll refer to them as the "CRLF pair." If you're sharp, and if you listen and watch closely to incoming RTTY, you can hear incoming RTTY tones while there is a short pause in the print action whenever your computer's RTTY "carriage" is "returned" to the left margin. Can you guess what happens if either the CR or LF Baudot characters is garbled by QRN or QRM?

In the days of teleprinting machines, when the line of print neared the right margin, the operator had to tap both the CR and LF keys (in either order) to advance not just his, but also the other printer's line of type. Every teletype operator had to think about both his and of the other fellow's printer, especially on radio circuits where garbles from QRM, QRN, QSB, etc. wreaked havoc on Baudot data bits. Here are some examples:

1. If the operator forgets to press CR (or QRN garbles the character)--what happens? The carriage doesn't return. If the LF character isn't garbled, the next intended line is added to the end of the existing line. If the incoming line is long enough, the typebar assembly will eventually reach the right margin and stop moving. But the typebars will continue printing, producing a box-like blob of ink at the right margin, until the next CR is received. The text is within the blob, unreadable.
2. If the operator forgets to press LF (or QRN garbles it), the CR character will return the carriage to the left margin (if the CR is ungarbled), and the incoming line will overprint the line just printed.
3. What if both the CR and LF characters are garbled? The effect is unpredictable, because the CR and LF can become any other characters. Since there are more printing than nonprinting characters, probability suggests that two random characters will be printed in their place, but it's also possible that nonprinting character(s) could be produced by the garble, shifting the carriage and/or printing "phantom" characters.

You can see that the Model 15 TTY operator had to be continuously aware of how radio conditions could affect the receiving machine's print. Computer emulation of RTTY has not changed that, so you need to be thinking about it, too.

When propagation conditions were poor, teletype operators would press the CR twice or three times (ditto for LTRS and FIGS keys) to improve shift and carriage control. If the carriage were at the left margin, additional CRs would do nothing. Multiple presses of LTRS or FIGS would likewise not change the TTY's shift state. Pressing the LF key more than once would advance the paper, and professional TTY ops may have done just that, but because it consumed paper, thrifty amateurs avoided using the LF key excessively!

In a sense, it's a bit of a shame that computer emulation of Baudot has automated the LTRS and FIGS keys. Had LTRS and FIGS remained, today's RTTY ops would approach their contest (and ragchewing) typing very differently, as we will see in the examples below. Even though we don't have to press non-existent LTRS and FIGS keys, we must think about them as we construct our contest exchanges, because the LTRS and FIGS codes are sent over the air by RTTY software.

Now you can see why I've made so many references to garbles, QRN, etc. in earlier pages.

Computers Emulate But Do Not Replace Teletype Machines

Let's now fast forward to modern RTTY, where computers emulate mechanical teleprinters without replacing them. To emulate RTTY, computer software must be able to communicate with a mechanical teletype machine, and vice versa. There are no mechanical printing machines dedicated to today's plethora of digital modes. PSK31 and beyond are strictly computer to computer. RTTY unique in this regard, so if you're going to do a good job with the RTTY mode, you must operate your computer as though you are a Model 15 TTY operator. Digital operators who think RTTY is the same as computer to computer digital modes have missed the boat about RTTY. You can imagine the extra typing skills a teletype operator needed to control paper carriage return and shift while he thought about the effects of propagation and conditions and garbled characters at the receiver's end. Computer emulation eliminates the need for us to press CR, LF, LTRS and FIGS keys; but it does not eliminate the need to recognize their presence in transmitted text. We must always consider how printed and nonprinted characters may appear at the receiving end.

Here's the bottom line: in error correcting digital modes, whatever the sender transmits, the receiver prints (within reason of band conditions); but garbles are the way of life with RTTY. Once you accept this difference, you are on your way to becoming a true RTTY operator. It is my hope that the discussions and tips below will illustrate how the RTTY op's brain, rather than his computer, can overcome many of the shortcomings of 5-level Baudot Code.

Our computers use ASCII characters internally and translate it into the Baudot code for our RTTY operations. The non-printing characters CR, LF, LTRS, and FIGS are automatically produced. "Word wrap" is automatic and prevents stacking up printed characters at the right margins. Pressing the Enter key automatically sends the CR and LF characters, one right after the other. Emulation software automatically takes care of carriage shift, too. If the carriage is in Letters shift when a numeral or a punctuation key is pressed, the FIGS nonprinting character is sent, followed by the numeral or punctuation. If the emulator is in Unshift on Space (UOS) mode, pressing the space bar returns the carriage to Letters shift. When sending a callsign, the transitions between Letters and Figures Shift is performed automatically. All of these automatic functions may work flawlessly at the sender's end, but they may not work perfectly at the receiver's end, especially when radio conditions are poor, thanks to the effects of garbles.

Here are three axioms concerning garbles: First, garbles always affect received printout. The effect ranges from small (a single character is misprinted) to large (the receiver's carriage shifts to or remains in an undesired state, printing a short/long string(s) of unintelligible characters). Second, the greater the length of the transmitted message, the greater is the probability that a garble will occur. Third, the more transitions there are between Letters and Figures shift (as in callsigns and contest exchanges), the greater the chance of garbled LTRS and FIGS characters. We shall see how the RTTY op can minimize the effects of garbles by making good decisions about how he constructs his contest transmissions.

Putting it all Together--RTTY Contesting

We've considered contesting in a general way (ideas that apply equally well to CW, SSB, and RTTY) and described the inner workings and shortcomings (compared to modern digital modes) of mechanical teletype machines and the Baudot Code. Now let's put it together and discuss RTTY contesting.

With only a few differences, RTTY contesting is the same as CW contesting. In a nutshell, a garbled CW character affects only that character, but a garbled RTTY character can affect up to the entire contest transmission. Experienced CW ops can usually copy a single caller's signal from within a pileup of callers, but the average RTTY engine cannot do that. Multiple S&P callers at or near the Runner's zero beat frequency produce nearly constant mark and space tones, and engines cannot separate one caller from another. For these reasons, RTTY contest exchanges will never be quite as effective as their CW counterparts. Making small modifications to the CW exchanges described in the **CW Contest Exchange Procedure** can improve the effectiveness and fidelity of RTTY exchanges. That is the thrust of this discussion.

Please keep in mind, and I'll be perfectly frank here-- whenever an operator closes the key and puts his signal on the air, he demonstrates his communication skill and knowledge level. My aim here is to improve the quality of the communication skills of RTTY operators by helping them to improve their knowledge of the RTTY mode.

For RTTY contesting, I use N1MM Logger linked with the MMTTY engine. Other loggers should be similar. Before I began using N1MM, I used MMTTY in standalone mode for contesting, and you can, too. I assume you already have a working RTTY arrangement.

Setting Up Your Radio And RTTY Engine For RTTY Contesting

First, for both Run and S&P modes, make sure engine's Unshift on Space (UOS) is turned on. This will return the paper carriage to LTRS shift after every space is received. UOS was designed to at least limit how long a mechanical printer would remain in Figures shift if a garble destroys reception of a LTRS shift character. The next (ungarbled) space character returns the carriage to LTRS shift, and with luck, the receiving operator will get enough data to satisfy his logger's requirements.

Setting Up Your Radio and RTTY Engine For S&P Mode:

Turn both Receiver Incremental Tuning (RIT) and engine's Automatic Frequency Control (AFC) off. Make sure your transceiver is not in SPLIT frequency mode.. Doing these things will ensure that your receiver and transmitter frequencies are matched so that when you tune your receiver to zero beat the Runner's frequency, your transmitter will also be on his frequency. During the week before a contest, practice zero

beating incoming RTTY signals (with whatever tuning display your RTTY engine has) so that when contest time comes, it will be second nature for you to zero beat Running ops' signals. These days, there aren't very many RTTY signals on the air, but on the day or two before a big RTTY contest (like the CQ WW RTTY in September), there is more RTTY activity. As you work those operators, ask them if you are at zero beat with them. MMTTY has three tuning displays: FFT (mark & space tones vs. radio's audio passband frequency), X-Y cross tuning scope, and waterfall. I use the FFT display exclusively. Once you have called the Running op, NEVER use your main tuning knob to adjust your receiver! If you do, you will also change your transmit frequency, and the Runner will have to waste time trying to re-tune your transmitted signal. Leave your VFO alone--the Runner will fine tune his receiver (with his RIT) to copy you.

Setting Up Your Radio and RTTY Engine For Running Mode:

In Run mode, your transmitted frequency must remain fixed, because that's where the S&P ops are listening to you. NEVER use your main tuning knob to adjust your receiver's frequency. Instead, use your RIT knob. If you are prone to bumping accidentally your main tuning VFO knob, then use your radio's LOCK button to lock the knob so your transmitted frequency will not change. Set the RTTY engine's AFC on or off (your choice), turn on RIT (also your choice), and set RIT offset to zero. It is unreasonable to expect that every S&P call will be at exactly zero beat. The best we can hope for is that most S&P ops will be close enough to zero beat that their callsigns will print immediately. Sometimes it just doesn't happen, so most of the time I Run with my AFC and RIT turned on. MMTTY's AFC responds quickly enough so that for callers who are close to zero beat (and who send their callsigns twice instead of once), I don't miss anything. For slower AFC response (occurs when S&Ps are far from zero beat), I assist AFC by manually adjusting RIT. When the RTTY bands are crowded in big contests, if my passband tuning is rather wide (300-350 Hz) and if no one in my passband is calling me, my AFC will begin tracking signals adjacent to my passband. When that happens, I reduce my DSP passband width to 200-250 Hz or so, and/or turn K3's "Dual Passband" on and turn AFC off. Then I tune manually with the RIT knob. If you decide to turn your RIT on in Run mode, then you must either remember to reset RIT offset to zero after each QSO, or, better, include in your computer logger's RTTY macros a command to reset RIT offset to zero after each QSO is in the log. I'll illustrate how to do this in the next section. If you don't reset your RIT, then your receiver will not be tuned to your Run frequency, and the next S&P caller will appear to be off frequency. He isn't--your receiver is!

RTTY Contest Exchanges and Macros

RTTY contest exchanges follow the same general theme as the CW exchanges I presented in **CW Contest Exchange Procedure** section above, but because the human brain does a better job than a RTTY engine when it comes to copying one signal from a pileup of many, I modify the CW transmissions slightly for RTTY. CW and RTTY contesters used to send their contest transmissions manually, but those days are over. Now, contest loggers can send entire text strings plus radio control sequences at the press of a keyboard key (usually a Function-key). In the case of N1MM logger and others, each F-key can be associated with text strings and radio control commands. Radio commands can be used to reset RIT offset to zero, send CRLF sequences, change CW speed, etc. N1MM has a wealth of preprogrammed macros that are specific for nearly every (modern) radio you may be using--just tell N1MM your radio's model, and N1MM's "canned" macros are ready for you to use.

Macros really automate the QSO process because they eliminate the need for typing the same QSO text strings over and over at manual typing speeds, they eliminate "fat finger" typos that have to be corrected, and they ensure that all of your QSO exchanges are uniform in content and appearance. If you have not yet

chosen your contest logger, then make certain it will richly serve you with "canned" macros. You can put any message into any F-key, but the usual arrangement is, for Run mode:

Key	Purpose	Example Contest Procedure
F-1	your CQ macro	Step 1
F-2	your exchange macro	Step 2
F-3	your TU & QRZ macro	Step 4

RTTY Macros for Running Mode

To refresh your memory, briefly review once again the **CW Contest Exchange Procedure** section above. In RTTY, you must include "canned" macros to place your radio into transmit mode and to do other things. Here are my Running macros for the recent SARTG RTTY contest, where the exchange is RST plus serial number:

Key	Purpose	Run Mode Macro String
F-1	CQ	{tx}{enter} CQ CQ SARTG {MyCall} {MyCall} {enter}{rx}{clearrit}
F-2	Exch	{tx}{enter} {HisCall} TU 599-#-# {MyCall} {enter}{rx}
F-3	TU & QRZ	{tx}{enter} {HisCall} TU QRZ SARTG {MyCall} {enter}{tx}{clearrit}

You can see that the core format is the same as I use for CW contesting, but there are some additions for RTTY. All characters within braces "{}" are N1MM's "canned" macros that control the radio and do not print:

{tx}	Closes the PTT (Push to Talk) line and puts the transmitter into transmit mode
{rx}	Returns your radio to receive mode
{enter}	Sends the Baudot CR and LF characters (usually referred to as CRLF) to begin a new line of print on the S&P operator's computer screen
{clearrit}	Clears RIT offset. You can see that I reset my RIT to zero every time I call CQ and every time I conclude a QSO by sending the macro in the F-3 key. Do not clear RIT when you send your exchange, though, because the QSO is not yet finished. If you do, you will change your receive frequency before the S&P op sends his exchange.
{HisCall}	Sends the other operator's callsign (in this case, the S&P's callsign if it has been entered into the logger's callsign entry box).
{MyCall}	Sends my callsign (in my case, "K7IA").
#	The single character pound sign is N1MM's macro for sending the current QSO serial number. The serial number is incremented by one after the current QSO is logged.

The remainder of each macro, not included within braces, is plain text. It will be printed on the S&P's screen, if there are no garbles. Let's take a closer look at the exchanges above and compare them to what we've seen in the **Contest Exchange Procedure**, which was for CW contests:

RTTY Run Mode F-1 Macro (CQ Call):

The RTTY CQ call message is the same as its CW counterpart, but take note of how I construct it and every RTTY transmission I send. Each of my RTTY contest transmissions begin and end with the {enter} macro; that is, each transmission begins and ends with a CRLF, making every line I send stand alone on a new line of print. It is easier for me (and the other operator) to see it clearly that way. Also, I surround every transmission between space characters. You may not perceive them in the above print, but there's a space character immediately following the first {enter} macro and immediately before the second {enter} macro. Constructing RTTY transmissions this way improves visual and contest logger "parsing." I further simplify parsing by placing "parsing separators" between repeated alphabetic strings and between repeated numeric strings in contest exchanges. I use space characters to separate alphabetic strings and hyphens to separate numeric strings (here, the RST and repeated serial numbers) because hyphens are Figures shift punctuation and they don't obscure vision of adjacent numeric strings. Now let's discuss "parsing."

Parsing Exchange Elements

Parsing is not new to you--you're doing it right now. As you read this, you are visually parsing the words, thanks to the spaces and punctuation characters between them. If there were no such separators, it would be very difficult but not impossible to read the text. Without RTTY parsing separators, callsigns and exchanges are often difficult to read, and it is nearly impossible for a contest logger to distinguish a valid callsign or exchange fields. Yes, loggers like N1MM look for callsigns and color highlight them on the

receiver's screen, but N1MM cannot find callsigns unless they are surrounded by parsing separators. Three events interfere with parsing separators: they may be garbled in transmission; phantom letters usually appear at the tail end of the other op's transmissions; and most commonly, most RTTY operators don't include parsing separators in the first place. We cannot prevent garbles and phantom characters, but we can encourage operators to use parsing separators.

Phantom Characters: I've already discussed garbles, the first of the above three events, so let's move to the second, the appearance of phantom characters. If you have ever made more than a handful of RTTY contacts, you have undoubtedly seen a "phantom" character or two appear on your screen where the "typehead" is when the other operator's RTTY signal disappears. It happens because the transition from RTTY signal to normal background noise is not a smooth one, and the sound card interprets the transition audio as RTTY and makes a character (or two). This is not the fault of the sound card or your RTTY engine, because I saw the very same thing back in the 1970's when I was using my Model 15 and ST-6 analog demodulator. If the sending operator doesn't include parsing separator characters in his transmissions, the beginning and end of his every transmission will be joined to phantom characters. This makes visual parsing difficult and logger parsing nearly impossible. Result: the receiving operator must either manually enter callsigns and exchange data by keystrokes, or ask the sender for a repeat. Either way, the QSO rate slows down. I emphasize that it is the transmitting operator, and not the receiving operator, who must take steps to make his transmissions easy for the receiving operator to parse. This is why I send every contest transmission as a separate line of type and why I ensure that every string in that line of type is sandwiched between parsing separators. For parsing to work, both the CRLF and space character "sandwich" must be created.

When the sending operator makes it easy for the logger to parse, the receiving operator can enter QSO info simply by mouse clicks, speeding up the QSO (and avoiding entry typos). For example, N1MM will identify every combination of letters and numerals as a callsign if that combination follows the general format rules of a callsign. Every instance of a so-identified "callsign" is color highlighted on the screen, and a mouse click on a highlighted callsign places it into the callsign box of the QSO entry window. No more slow manual typing! No more fat finger typos! Additionally, while contest exchange elements are not color highlighted, left clicking them, one at a time, places them into their respective entry boxes in the QSO entry window. The chaps that seem to respond quickly to contest exchanges they receive aren't fast typists--they're fast mouse clickers!! They are fast only when their senders include parsing separators in their transmissions.

Here is an illustration of phantom characters and parsing:

I'll send my CQ call using the Running F-1 Macro above, and I see the following on my screen:

```
    CQ CQ SARTG K7IA K7IA      (Print begins in column 2)
V                               (Phantom character in column 1)
```

The first line is the text in my F-1 macro (including the leading space character). The last two characters I send is the CRLF pair, placing the typehead at the first column of the second line. The transition from RTTY audio to background noise (MMTTY listens to my Tx monitor) prints the "V" in the second line's first column--a "phantom character." There's a good chance the S&P has a phantom character or two in the first column(s) of his second line. His phantom character(s) may not be the same as mine, because his sound card is different than mine. But you should always assume the other operator is seeing phantom characters.

Now suppose my friend K7IPZ, answers my call by sending only his callsign (twice) without including CRLF and separator spaces at beginning and end of his transmission. Here's what I might see on my screen, beginning with the display above:

```
CQ CQ SARTG K7IA K7IA
VK7IPZ K7IPZYQ
```

Here you can see that K7IPZ's callsign is concatenated to the phantom "V," and two more phantom characters, "YQ" produced by the transition at the end of K7IPZ's transmission have been added to the display. My screen's "typehead" sits immediately after the phantom "Q," because K7IPZ did not begin with a CRLF pair. "VK7IPZ" follows the rules of a callsign, and it will be color highlighted by N1MM. "K7IPZYQ" will not be highlighted. You can imagine how excited I might be as I think, erroneously, that an Australian is calling me, but the presence of "K7IPZYQ" means the "Australian" is a phantom, too.

If K7IPZ had instead placed space characters at the beginning and end of his transmission, then my screen would display:

```
CQ CQ SARTG K7IA K7IA
V K7IPZ K7IPZ YQ
```

and both instances of his callsign, K7IPZ, would be highlighted. K7IPZ's line of print still ends in the column following the letter "Q" above, instead of at the beginning of the following line. Since K7IPZ sent his callsign more than once, and since both instances match each other, then I am certain that my copy of his callsign is correct. But if there is no match, then I'll wonder which of the two is correct. I'll need a "tiebreaker," to decide, so I'll ask him for a repeat, slowing things down.

It's would be far easier if K7IPZ had added CRLFs at beginning and end along with the parsing separators. This would be the result on my screen (his screen would be similar):

```
CQ CQ SARTG K7IA K7IA
V
K7IPZ K7IPZ
JS
```

Note that phantom characters (most likely different ones) still appear in the first column in a line, but the leading space of the CQ message and his callsign appear in the second column. K7IPZ's transmission is now easy to parse by eye and by logger, and I can immediately send my exchange to him.

The example above shows how parsing the beginning and end of a transmission is facilitated. Now let's consider parsing of exchange elements. When I send my F-2 exchange to K7IPZ, here is what his screen should display:

CQ CQ SARTG K7IA K7IA	My CQ call
H	Phantom character
K7IPZ K7IPZ	His parsed S&P F-1 callsign
WL	Phantom characters
K7IPZ TU 599-078-078 K7IA	My parsed Run F-2 exchange
MU	Phantom characters

Notice how "tidy" the appearance of his screen is. If K7IPZ is using a logger that can parse callsigns and data elements, then all he needs to do is to hover the mouse cursor over one of the serial numbers, "078," and left-click to copy the s/n into its data entry box. He should have already left-clicked my callsign as I called CQ, so there's no need to do it again. And because the signal report is "599," there's no need to click it, because loggers default to "599." Parsing transmitted strings reduces data entry to mouse clicks, and every operator can make more QSOs per hour.

Let's look quickly at the exchange of a hypothetical contest where signal report, serial number, and first name are exchanged. My Run F-2 exchange would be:

K7IPZ TU 599-066-066 DAN DAN K7IA

All K7IPZ needs to do is to hover the mouse over a serial number, 066, and left click, then hover over my name, DAN, and left click. Data entry finished, send exchange, and QSO is finished.

I would NOT craft my exchange as:

K7IPZ TU 599-066-066-DAN-DAN K7IA

and I'll leave it to you to decide why...

Use a space character to separate alphabetic strings (a space is nonprinting and ensures the carriage remains in LTRS shift), and use a FIGS shift punctuation character to separate groups of numbers (because the carriage is already in FIGS shift). If you use a space character to separate number groups, then the carriage will first downshift to LTRS shift (recall Unshift on Space is turned on), and then another FIGS shift has to be sent before the next numeric string can be sent. Sending more FIGS and LTRS increases the probability that one of them will be garbled, leaving the carriage in the incorrect shift. (Remember that when UOS is turned on, a space character is automatically followed by a LTRS shift.) I use the hyphen to separate numeric strings it is a FIGS shift character and because it doesn't interfere with vision (see F-2 macro above).

RTTY Run Mode F-2 Macro (the Exchange):

Now let's look at the exchange macro in Run F-2:

F-2 Exch {tx}{enter} {HisCall} TU 599-#-# {MyCall} {enter}{rx}

This format will print as a standalone line on the other chap's printer, it increments the serial number, and it sends the callsigns of both S&P op and Running op, in that order, just like in the **CW Contest QSO Procedure** section. Sending both callsigns (in the standard order) lets everyone on the Run frequency know whom the Runner and the S&P ops are. But because the Run and S&P F-2 exchanges are identical (RTTY S&P exchanges are discussed below), neither one makes clear which callsign is the Runner and which is the S&P, because it depends on who is sending. This is not a problem, because in the context of the exchange, the Runner and the "target" S&P involved in the exchange and most of the S&P ops in the pileup should know who is who. However, newcomers to the pileup after the Runner has made his CQ call do not know.

If they are like me, they want to know without having to wait around for the Runner to make his next CQ call. Here's why:

As a Runner, you should always be aware that S&P operators are continuously searching for Running ops that they haven't yet worked. While you are working your pileups, be they large or small, S&P ops are tuning to your Run frequency and arriving at random points during your ongoing QSOs. They try to evaluate who you are and whether or not they have already worked you. You should make it easy for them to know who you are, and you can help them by placing your callsign within each of your QSO transmissions. If you happen to be sending your F-2 exchange as they arrive, they will at least know that one of the two callsigns in your F-2 exchange is yours and the other is the S&P's (but they won't know which is which). Early in the contest, chances are the new coming S&P hasn't worked either callsign, and so he will stay on your frequency long enough for you to complete the ongoing QSO. But later in the contest, the new coming S&P may have worked one or both callsigns, and he may or may not wish to remain on your Run frequency and join your pileup. When I am working S&P, it's really annoying to remain on a Runner's frequency while the Runner is repeating his F-2 exchange over and over (because of QRN, QRM, or the engaged S&P simply flubbing the exchange), only to learn later that I've already worked him. Therefore, when I'm working S&P and encounter a Runner who doesn't identify himself very often, I pass him by, hunting for a Runner who makes it easy for me to work by identifying himself.

Interestingly, one of the chaps who reviewed a recent draft of this paper offered the only explanation I've heard regarding the practice of sending the F-2 exchange sandwiched between the other chap's callsign, {HisCall}, while omitting {MyCall} entirely (I call this the "two by zero" format). He is a very experienced RTTY op, and here is what he said:

"During a **large** pileup [emphasis mine] the running station may start his exchange before some S&P stations have stopped calling. The target S&P may miss his callsign due to QRM but has a good chance of catching the second one. This method may prevent some repeats. It also gives the S&P double confirmation that the running station has the correct S&P call. I agree with your presentation but prefer the format:

```
F-2 Exch      {tx}{enter} {HisCall} TU 599-#-# {HisCall}{enter}{rx}"
```

My reviewer makes a good point here: he feels forced to send his exchanges in this manner because S&Pers in large pileups tend to send their callsigns more than once, or worse, over and over, causing so much QRM on the Runner's frequency that the "target" S&P (the S&P op the Runner is attempting to work) is often not sure if the Runner is working him or someone else. The "two by zero" format immediately above attempts to compensate for pileup QRM after the Runner's CQ transmission, but it still leaves new coming S&Pers uninformed. I thought about his observation during this weekend's running of the CQ WW RTTY contest, and I did so especially when I was "spotted" by a large number of operators, who were attracted by my New Mexico multiplier. I was using my "one by one" exchange format and not using the "two by zero" approach, even in pileups where I roughly estimated 10-15 callers in unison (how can one estimate the depth of such a pile?). Because no S&P caller ever asked me to repeat my exchange to clarify his identity, I cannot make a case for the "two by zero" format. But for those operators who wish to send {HisCall} twice, then I suggest this "two by one" format as an alternative:

```
F-2 Exch      {tx}{enter} {HisCall} TU 599-#-# {HisCall} {MyCall} {enter}{rx}
```

This variation identifies both Runner and S&P, and while it takes a little more time to send (less than two seconds), it is still faster than repeating the entire exchange. Note that there is more than one way to construct RTTY contest exchanges, and you should feel free to experiment; but always ask yourself if your experimental approaches make QSOs easier or more difficult. This is perhaps the best place to mention that as a Runner in the CQ WW RTTY, I was rarely asked to repeat my entire exchange. I was, however, asked to repeat my CQ Zone (New Mexico is Zone 4, while most 7-land callsigns are in Zone 3) or my state (NM is often confused with "MN").

My reviewer makes another point here, and it has nothing to do with how the Runner's exchange is constructed. It involves the amount of QRM the Runner must contend with whenever he attracts a large pileup. Once you begin operating as a Runner yourself, you will quickly see that Runners would rather have small pileups than no responders at all to their CQ calls. But Runners would prefer small, easy to manage pileups than pileups that are large, competitive, and undisciplined. Most S&Pers in large pileups tend to press their callsign macro buttons over and over as a way of competing with the other S&Pers. Doing so does not enhance the Runner's ability to work his callers. Instead, it slows the entire process down, as I saw this weekend, where my "small pileup" QSO rates of 120-130 per hour dropped to 60-70 in large pileups). [When I'm Running and this happens, there are only a few things I can do, and they depend on the size of the contest. In small contests, where new Running frequencies are easy to find, I can simply QSY and Run somewhere else in the hopes that at least some of the undisciplined S&Ps get the idea. In large events, like the CQ WW RTTY, empty Run frequencies are difficult to find, and I'm fundamentally not a quitter to begin with. I can simply press my CQ macro button two or three times in the hopes of driving the impatient S&Pers away, but who wants to dismiss potential contest points, or, of more importance, multipliers? Lately, I've begun to use a macro button that sends "DX CODE OF CONDUCT--PSE ONLY {HisCall}" where {HisCall} is the callsign (or partial callsign) of the S&Per I'm trying to work. Interestingly, each time I send that macro, the unruly pileup becomes silent, and I work the S&Per smoothly. That suggests that the DX Code of Conduct has made a good impression worldwide and that S&Pers really do want the Runner to promote discipline on his frequency.]

If you are working S&P, and if you encounter a large pileup, then exert some self control, and be patient. Press your callsign macro button only once, sending your RTTY callsign no more than twice (only once in CW). Or, try a "delayed" call, so that at least the tail end of your callsign might print on the Runner's screen (but don't delay too long, because the Runner may already be working a different caller. For delayed calls, first study the Runner's rhythm to get a feel for whether a delayed call would work at all, and if so, just when to call. Be a keen observer as you listen, and keep thinking about the possibilities! It will make you a better tester and a better DXer!) After you make your call, always give the Runner a chance to work the callsign (or partial callsign) that he can pick out. He may pick you, or he may pick someone else. Even in RTTY, it isn't always the Big Signal Chaps who are worked first--in my case, I work the guy whose callsign prints, regardless of whether he prints first, last, or in between. I go for accuracy and not speed. If you aren't successful after the Runner makes a few QSOs, then consider making a note of the frequency and Runner's callsign, and QSY. Your departure will make the pileup smaller and easier for the Runner, so that when you return, you'll have a better chance to get him.

Signal Reports and RTTY: Many RTTY testers send RST as "5NN," just as CW testers do; but RTTY operators who know what you have been reading here never send "5NN." They send "599," and you already know why. But just to remove all doubt: "599" is all numeric, so why needlessly bounce the carriage

to LTRS shift and back and forth? And the real potential downside is the effect of garbles, our old friend by now.

While we're on the subject, why do CW ops send "5NN" instead of "599?" Reason: It's faster to send the letter "N" than the number "9" in CW. Owing to the code-free licensing structure of recent decades, new ops tend not to know Morse, so here's a quick lesson. The letter "N" is sent not because it's the first letter of the word "nine," but because it is similar (in a way) to the Morse numeral "9:"

N	dah dit
9	dah dah dah dah dit

Even if you aren't familiar with Morse, you can see that it takes considerably longer to send a "9" than an "N," In CW-speak, "N" is a "cut" for numeral nine, because it joins, figuratively, the four dahs of Morse nine into one dah, "cutting" sending time. There are many other cuts. For example letter "T" (one dah) is a cut for numeral zero (5 dahs). Similarly "M" and "O" are also cuts for numeral zero (2 and 3 dahs respectively). Another common one is "A" for numeral one (I'll let you look that one up!). And there are still more, which are too over-the-top for me. Personally, I think cuts are inconsiderate of other operators. They were developed by the high speed CW types who must believe that the cumulative time saved by sending cuts in a 48 hour contest will allow them to make two or three more QSOs--all at the expense of others who have to decipher the cuts and enter them as numerals. N1MM deciphers the common cuts these days, but I've gotten used to doing it in my head and hitting the correct numeric keys (I hope). But consider a cut like "ANTA" at 35 words per minute, and you'll have to wonder if the QSO is worth logging. I'm OK with T, O, and A, but I draw the line for "E" for numeral five.

Consider also that in RTTY, every character takes the same amount of time to send, so sending "5NN" takes more time to send than does sending "599" because of the shift characters added. Those who send "5NN" demonstrate how little their understanding of RTTY is.

Running F-3 Macro (TU and QRZ):

Except for radio control "canned" macros and the CRLF sequence sent by the {enter} macro, the Run F-3 exchange is the same as its CW counterpart.

RTTY Macros for S&P Mode

Here are the S&P macros I used for the recent SARTG RTTY contest:

Key	Purpose	S&P Mode Macro String
F-1	MyCall 3	{tx}{enter} {MyCall} {MyCall} {MyCall} {enter}{rx}{end}{s&p}
F-2	S&P Exch	{tx}{enter} {HisCall} TU 599-#-# {MyCall} {enter}{rx}
F-3	TU	{tx}{enter} {HisCall} TU {MyCall} {enter}{tx}
F-4	MyCall 2	{tx}{enter} {MyCall} {MyCall} {enter}{rx}

This macro set has a couple of new N1MM canned macros: {end} and {s&p}. If they weren't included, pressing the S&P F1 key would send my callsign three times plus CRLF and parsing separator spaces, before N1MM switches to Running mode. The {end}{s&p} sequence is a workaround to make N1MM

remain in S&P mode. I press F-1 when I want to send my callsign three times, and I press F-4 to send it twice. I make my choice depending on band conditions and how hard the other operator seems to be struggling to copy me. In the rare event I need to send my callsign more than three times, I can press F-4 twice, etc.

Note the RTTY S&P exchange macro key, F-2. Pressing it will send the Runner's callsign, then the S&P's exchange, and then the S&P's callsign. This format is short and sweet, and it's the same "one by one" format used in the Run F-2 exchange macro. It identifies both participants in the QSO, letting the Runner know you've copied his callsign correctly (or otherwise). Because RTTY and CW signals are so different, RTTY doesn't lend itself to the choices CW contesters have when they choose F-2 exchanges. I strongly urge you to send your S&P using this format, and I'll explain my reasons in detail in Example 4 of the following section.

"Fluff," Who Needs It?

Many RTTY ops add a lot of needless little messages, prosigns, graphics, etc. to their exchanges, while forgetting the need to make their transmissions complete and understandable. I refer to such time-consuming additions as "fluff." Fluff conveys no information pertinent to the contest, it's not part of the required contest exchange, it increases the risk of garbled characters, and it wastes time for everyone on the Runner's frequency. Most fluff is sent by RTTY S&P ops, but some Runners and CW ops do it too. Contesting is not ragchewing--save your fluff for ragchewing please. Here are some examples:

1. S&P answering my CQ with:

```
{tx}{enter} K7IA K7IA DE K7IPZ K7IPZ PSE KN {enter}{rx}
```

Comment: Lengthy calls like this one are inconsiderate of every one on frequency because they QRM the calls made by other S&Pers. I know *my* callsign, but what I need is *his*, and only his, so there's no reason to send my callsign. In ragchewing, "DE" is sent, but it's not needed in CW or RTTY contesting--good contesters know who the transmission is "from." "PSE" is a plea for a response. Believe me, all Running ops are excited about working you and don't need your plea! Finally, "KN" and "K" are variations of "go ahead." I'll go ahead when your RTTY carrier disappears.

2. Attempts at fancy graphics:

```
{tx}{enter}.....K7IPZ K7IPZ.....{enter}{rx}
```

```
[a new one I received recently is a "smiley face" :-) ]
```

Comment: Although he sent his callsign twice--perfect for good conditions, he did not add space parsing character separators at the beginning and end of his transmitted text. His graphics (periods and smiley face) are useless to the Runner, and they are all in FIGS shift, a magnet for garbles when the callsign is finally transmitted.

3. **Miscellaneous fluff:** Some operators send things that are appropriate for ragchew QSOs but not for contest QSOs. Some examples: Some ops send unneeded things like "UR RST" or just "UR;" experienced contesters know the first exchange element is often the RST and that it will (almost)

always be "599." Some send my name, garnered from qrz.com; I already know my name, and it's "Dan" and not "Daniel," unless you're my Mother, and you have a beef with me! Some send the current date and time (hours, minutes, seconds); no contest requires it, and I have an atomic clock. One chap used to send a lengthy greeting at QSO conclusion: "Vaya con dios mi amigo, etc." A few others have sent their lengthy "station equipment" messages, or in the days-of-old terminology, their "brag tapes." This may be interesting in ragchewing, but it's *never* appropriate in contesting! When I'm contesting, I log contest QSOs and not ragchew QSOs.

If you have any doubt about whether something is fluff, then just check the contest rules to see what the exchange is, and stick to that. But if you encounter a good friend in a contest, and if you wish to send a greeting, then by all means, do it! Leading edge contest loggers offer a simple way to send plain text directly from your keyboard, so *do not* program your macro keys with fluff that you'll send to everyone you work. If you're Running the frequency, it's your decision about how long your personal greeting could be. When I'm in a big pileup, and S&Pers are waiting, I don't send greetings out of respect for the waiting S&Pers. If things are slow, and if no one is waiting, I'll swap a couple of brief comments with my RTTY buddy. But if you are S&P, then keep it short, or you might lose your buddy.

4. Callsign redundancy and callsign omission within the same exchange:

```
{tx}{enter} K7IA TU 599-456-456 K7IA {enter}{rx}
```

Comment: The traditional procedure for quickly exchanging a short piece of data, dating back a century ago to the days of spark CW traffic handling is to send the other op's callsign first, then the brief data, and then concluding with your own callsign. It's the same order as the elements of written correspondence, established centuries ago: Salutation or greeting to addressee, body text, closing and signature of sender. The above QSO exchange identifies the "addressee" twice and omits the identification of the sender, and therefore, it makes no sense, even though at least half of RTTY testers do it this way these days. Are they simply copying others without thinking, or am I missing something here?

Let's think about it for a moment. When I'm Running, there are three things I want the S&P to tell me in his exchange:

- a. I want him to send my callsign, because his exchange is the only time he will send my callsign to me. Even though I've sent my callsign numerous times in my CQ call(s), I want to know if he has copied it correctly. If he has miscopied it, I want to correct his copy, so that he will log me accurately. It's my duty to him in the QSO.
- b. I want him to send his exchange, and in RTTY I want to see the important elements of his exchange twice (signal report is not important, because it's always "599"), and I want to see his exchange elements *sent in the order given in the contest rules*. If any element sent twice doesn't match each other, I'll ask for a repeat. If conditions are poor, and he sends an exchange element only once, I'll ask him to repeat it until I get two that match, so send your exchange elements twice and save the time it takes for a repeat request.

- c. I want him to send his callsign, so that I can confirm or deny the callsign I have already recorded. The best time for a RTTY Runner to ask for confirmation of an S&P callsign is after the Runner sends his exchange and not before, when other RTTY S&Pers may still be calling (yes, some ops just cannot figure out when to stop calling). After the Runner sends his exchange, which includes the S&P's callsign, it's less ambiguous as to whom the Runner and the S&Per are. It's better to confirm the S&P's callsign at the end of the S&P's exchange, because by that time, most other S&Pers on frequency have realized that the Runner is working someone other than them. I do indeed make callsign entry errors, but only a very small percentage of S&P ops notice it and correct me. Thank goodness for them! I would make fewer errors if the S&Ps would identify themselves at some point in their exchanges, rather than causing me to take the time to ask for repeats.

I hope I have convinced you to send both your Run and your S&P exchanges as follows:

```
{tx}{enter} K7IA TU 599-456-456 K7IPZ {enter}{rx} (instead of the format above).
```

More Macros For CW and RTTY Modes

Here's where having a dozen or so macros is really helpful. You can be very creative with additional macro keys. For example if you want the other operator to repeat something, you can create a macro that sends "NR NR?" if you need his serial number. And you can create another macro that sends only "#-#-#" if you're asked to repeat your number. [It's annoying when I ask for a serial number to be repeated and the other chap sends the entire F-2 exchange, including callsigns (and fluff), so just give the other operator exactly what he asks for. Additional macro keys are perfect for that.]

As other examples for macros, consider these: We live off grid and depend on sunshine for our energy needs (a diesel generator backup serves for overcast days), so I've programmed some macro keys to set my K3's output power (linear amp's drive power) to different levels. When conditions are good, I use reduced power, but a click of a macro button increases my power output as dramatically as needed to bust a pileup or make up for poor conditions. After the QSO is logged, another mouse click reduces output power and makes the batteries happy (especially at night or on overcast days).

I've also programmed several macro keys for various DSP passband tuning widths. One macro toggles K3's "Dual Passband" on and off, which is wonderful for weak signal RTTY. If I cannot copy a weak signal after making several attempts, a macro button will send "WEAK PSE LATER." Many of those ops return after 10-15 minutes with signals strong enough to make the QSO. Lastly, for the operators who don't confirm a callsign or exchange after my request, "{HisCall} YOU ARE NIL," and I delete whatever I have of the "QSO" from my log. If he's already moved off of my Run frequency, then he never receives that message, but it notifies the other operators who are on frequency that I do not log questionable QSOs.

Summary

I do hope that the descriptions, discussions, and examples in this document have been both enlightening and helpful to both your contesting and RTTY interests. It took many years of study, observation, and experimentation for me to learn what I have presented and discussed here, and I am happy to offer them to you in this "little" document. Now it's time for you to put these pearls into practice, and to do so, "practice" is

the key word. I suggest that you begin by making certain that you have successfully connected your computer, your computer logging program, your interface device, and your radio together. Doing so should be straightforward in theory, but it can be a challenge in practice. Don't worry, though, because interfacing equipment and getting everything to work together are all part of hamming, and you will take great satisfaction from having done it. Assistance is nearby, too--contest logger developers want you to be successful, and contesters want you to get on the air and join the fun, because you represent points and mults! You have value!!

Once you're satisfied with how your equipment operates, then program your contest logger's macro buttons, and try them out. Set your transmitter's output power level to zero (or minimum), and connect a dummy load if your radio doesn't have a "test" mode that allows everything to function without putting your signals on the air. Make some "dummy" QSOs, and log them, to get familiar with how your contest logger functions. Try programming unused macro keys to get a feel for how the macro editor (if there is one) works and how built-in macros work. Watch the RTTY Window's print, and verify your intentions of your macros against whatever is printed. Verify your macros before each contest, too.

Thank you for your interest in contesting in general and in RTTY contesting in particular. I do hope you find this narrative both stimulating and informative and that it will help you to improve your basic contesting skills. See you in the contests!

Appendix A: A Summary of Contesting and RTTY Tips

1. Before any contest, DO read the sponsor's Rules. Make note of the required contest exchange, and craft your exchange macros accordingly. DO NOT send anything in addition to the required exchange. Note also the starting and ending times of the contest, and convert them to your local time, if you think in terms of local time, as I do. Set your computer's clock to the correct time so that your logger will use Zulu time. Customize your macros for the contest you'll be working, and test them to ensure they send what you intend to send. Make note of the address to which you submit your log and the log submission deadline. DO submit your log--the sponsor will be grateful for it (especially state QSO Parties).
2. DO pay attention to and study how other contesters conduct their QSOs. You've read about my approaches and my discussions, but study how others are operating. If they do things that make contest QSOs go faster and smoother (for both parties), then emulate them, and assess your alterations--are your contest QSOs becoming easier or not?
3. DO pay attention to band conditions and make adjustments as band conditions change. Conditions may change moment by moment for better or worse, and ultimately, at day's end, the higher bands are going to close and lower bands are going to open up. Adjust your strategy accordingly, and adjust how you work other operators, too. If an operator is struggling to copy you, asking you to repeat your exchange or callsign, then don't be stingy--send your info more than just once or twice, and don't give up on him unless you simply cannot copy him through the noise.
4. In most hobbies, your knowledge and skills are unknown to others, but in amateur radio, when you put your signal and callsign on the air, the whole world knows yours. While every amateur makes a mistake now and then, the "lid" makes them continuously. Grow with your hobby--don't be a lid.

5. CW operators: if you use a hand key, a bug, or paddles, then first learn how to send copyable Morse. It takes practice, but you can do it! Learn how to set the spring tensions in your straight key, bug, and paddles so that your CW is smooth and not mushy or choppy. Spend some time listening to ARRL's daily code practice sessions (5 to 35 wpm) and CW Bulletins (18 wpm, plain text). Get a "feel" for the rhythm of dits, dahs and the spaces between them and between words. Try to emulate W1AW's machine-generated CW. Don't worry about whether you'll become a machine, because you won't. Every CW op has little nuances which determines their individual "fists!" Practice sending with whatever sending device you prefer. Try recording your sending with a tape recorder, your computer's sound card, or anything else you have. Then listen to your recording(s) and compare the accuracy of your characters and numerals, etc., and compare the rhythm of your fist with W1AW. Is it easy or difficult to copy your own fist? CW is both an art and a skill, and like any other, it requires practice. You will find great rewards when your skill suddenly "arrives!"
6. CW operators: learn how to copy CW with the best "code reader" around--the human brain. Microprocessor-based code readers are impediments, and not aids, to learning CW, and they have little value in big, crowded CW contests because simply seeing print appear on a screen doesn't tell you which of the many signals is being printed.. You can quickly earn WAS and DXCC even if your CW speed is rudimentary, but if you rely on a software code reader, rather than your brain, you'll miss a lot of DX.
7. If you are a speedy CW Running op, and a slow speed S&P op calls you, then slow down your CW speed for him. He'll appreciate it, and he just might become another CW contester because of your courtesy. If you've been contesting for years, they try to recall what it was like when you were at the beginning of the learning curve.
8. Always check your copy of incoming call signs, and if the other operator has sent your call sign incorrectly, it is your duty to correct him. If you are the S&P operator, then DO NOT leave the Runner's frequency until he confirms receipt of your exchange. If you QSY too quickly, you will not hear his request for a repeat, and he will not enter the QSO into his log.
9. If you're Running, then DO work dupes who call you. If you're S&P and a Runner thinks you are a dupe, then DON'T argue with him--just QSY and work someone else. He's already handed you a penalty if you aren't in his log, so let him take his.
10. Whenever you select a Run frequency for any contest mode (CW, SSB, RTTY), DO NOT use frequency sub-bands that are "allocated by Gentlemen's agreement" for specialized amateur communications. For example, in RTTY contests, it is easy to encroach upon sub-bands used by Packet, AMTOR, PACTOR, etc. Those operators can be very "territorial," and many will seem to deliberately QRM you, because they often cannot use RTTY to communicate with you. No, the frequency is not "theirs" any more than it is "yours," but by convention and Gentleman's agreement, they are "stuck" there and really have nowhere else to go. So if you experience QRM from another digital mode (or voice nets or SSTV signals in the SSB bands), be a Gentleman contester, and QSY. The "Gentlemen's agreement" sub-bands are listed in ARRL's "The Considerate Operator's Frequency Guide," found at

<http://www.arrl.org/files/file/conop.pdf>

11. There are some weekends when there is a plethora of contests within the same mode and time periods. Runners should craft their CQ macros to identify (by brief abbreviations) exactly which of the many contests they are working, rather than sending "CQ CQ TEST" etc.
12. If you're S&P, DO NOT TRANSMIT:
 - When the Runner is transmitting (he cannot hear you when he's transmitting);
 - When the Runner is working someone else;
 - When the Runner is attempting to work a partial callsign that is decidedly NOT YOURS;
 - When you don't know who the Runner is;
 - On the Runner's frequency if he is operating "SPLIT frequency" Some "rare" DX contesters operate Split, and nearly all DXpeditions these days do too. If you transmit on the Runner's frequency, he will not hear you, because he is listening for calls on a different frequency. Learn how to put your radio into Split mode so that you. The Runner/DXer will tell you approximately where he is listening. CW ops: When the DXer says "UP 5," it means he's listening 5 kHz higher than his transmit frequency. If he says "UP," then he's listening higher, so you'll have to find him, just like the rest of us. Enjoy the hunt--it's almost as much fun as working him; and Whenever you are in doubt about what's going on.

I adhere to and support the DX Code of Conduct, and I urge you to visit its website at www.dx-code.org and to familiarize yourself with the principles underlying the Code. The Code is the product of many worldwide amateurs who promote good manners and behavior among amateurs who work DX. Because contesting and working DX are very similar, the principles apply to contesting as well.

13. If you're S&P, then DO send your callsign once in CW (and SSB) and 2-3 times in RTTY, to answer a Runner's CQ. DO NOT send the Runner's callsign--he already knows it, and it may confuse other S&Pers as to who the Runner is. DO send your signal report only once. In CW and SSB, DO send the rest of your exchange only once, but in RTTY, send the rest of your exchange twice in good conditions, three times in poorer conditions. DO not send "fluff" in either CW or RTTY.
14. When you work S&P, study the Runner's habits and rhythm as he works other S&Pers in pileups. He may give you some hints regarding the quickest way to work him. Does he answer the first caller, or would it be better to make your call a bit delayed?
15. If you are S&P, take note of the size of the Runner's pileup, if there is one. The larger the pileup, the more difficult it is for the Runner to work a QSO because of the amount of QRM from transmitting S&Pers. Send your callsign no more than twice at a time, and resist the urge to keep pressing your callsign macro key. Even big pileups can be worked quickly if (and only if) the S&Pers have self control and are patient. The same applies to Dxing in any mode.
16. If you're S&P, DO NOT respond to a Runner's CQ by sending your exchange. It upsets the rhythm of the QSO, it may QRM the proper calls made by other S&Pers, and it slows down the process for everyone. Answer a Runner's CQ by sending only your callsign--once for CW contests, and twice for RTTY contests.

17. All contest signal reports are either "599" or "59." Go with the flow, and DO NOT send anything else--it slows things down and lets others know that you aren't really a contester.
18. DO send your contest exchanges in the order given by the rules. That's the order the contest operators and loggers expect.
19. If an operator is obviously struggling to copy any part of the QSO, then DO help him out. In CW, you can slow your sending speed down so that it pierces the QRN better. In SSB, give your callsign phonetically, and use the international phonetics, which are more familiar. In any mode, repeat your transmission a little more than usual.
20. When asked to repeat an exchange element, DO send only what is asked for. DO NOT send the entire exchange. Program a macro key to send only a single exchange element, such as name, serial number, etc., if there are several exchange elements.
21. After you make your CQ call, DO give a little time for an S&P op to respond. It may be hard to believe, but some CW ops seem to enjoy calling CQ more than they enjoy making QSOs! My 1 by 2 callsign doesn't take very long to send at 30 wpm, but after I send it, I'm stunned to hear the Runner's next CQ already in progress. So when you're running, spend some time listening between your CQ calls--you'll make more QSOs that way.
22. If you are the Running op, then DO identify yourself after every QSO. Many callers do not use spotting assistance, so you should let them know who you are. They may have worked you already, so why make them wait on frequency only to learn that you are in their logs?
23. If the Running op appears to be skilled (working QSOs quickly and efficiently), then DO NOT give up on him in a pileup. Be patient, and he will eventually work you. If you must QSY to hunt someone else, then make note of the Runner's callsign and frequency (or spot the Runner on your logger's Band map window) and go back to him later. Many Runners are busy because they are "rare" multipliers, so go back and work him when he may be less busy, and get him into log and for your WAS & DXCC!
24. In big pileups, the Running op may get only a partial callsign. DO make certain it's yours before you transmit again! If your callsign does not contain the partial call, then the Runner is trying to work someone else, and not you. **Remain silent!** If you send your call again, your lack of self control is adding to the QRM, slowing down the Runner's progress, and causing needless misery to everyone on frequency. If the Running op begins to work another chap, then likewise remain silent until the Runner finishes the QSO and calls either QRZ or CQ again. While you're waiting, try to see if the Runner has a calling pattern. Is he calling early callers or late callers? But again, once a QSO is in progress (which includes the Runner's attempt to get a full callsign from a partial callsign), remain silent and minimize the QRM. If all else fails, make note of the Runner's callsign and frequency, and return to the Runner's frequency later. Usually DX ops are very busy early in the contest, but they get "hungry" for QSOs on the second day. Keep hunting, and you'll get him! Everything in this tip applies to DXpeditions, too, so practice in contests, and work the DXpeds during the week!
25. DO set up your radio and your RTTY engine for S&P so that you can zero beat the Runner. Practice zero beating your radio as you make RTTY ragchewing QSOs so that you can transmit

within the Running op's passband. If you are too far off the Runner's frequency, he will work the chap who is at zero beat and not you.

26. Whenever you are S&P in RTTY, DO make every effort to zero beat the Running station. As you may know, in CW contests (and Dxing), it is often advantageous to tune away from the Running station's zero beat, because the CW op's ear is far better at separating signals than is a RTTY engine. However, in RTTY, tuning away from the Runner's zero beat increases QRM and slows things down for everyone in the pileup, so DO NOT tune away from zero beat.
27. DO construct every RTTY transmission so that it minimizes the need for LTRS and FIGS carriage shifting.
28. DO construct every RTTY transmission so that it facilitates parsing. Place a CRLF sequence at the beginning and end of every transmission, surround your entire text string with space characters, and use parsing separators within your exchange. Use a space character between alphabetic strings (like between words on the printed page), but DO NOT use spaces to separate groups of numerals-- use a hyphen instead.
29. DO eliminate "fluff" from your each of your transmissions.
30. DO send both callsigns in RTTY F-2 exchanges:

```
{tx}{enter} K7IA TU 599-456-456 K7IPZ {enter}{rx}  
or  
{tx}{enter} K7IA TU 599-456-456 K7IA K7IPZ {enter}{rx}
```

instead of

```
{tx}{enter} K7IA TU 599-456-456 K7IA {enter}{rx}
```

31. If you're Running, then DO NOT adjust your VFO--use RIT instead. In S&P, DO NOT adjust your VFO after you have called the Runner. You should have already tuned him to zero beat before you answered his CQ! If you're not at zero beat with the Runner, he will zero beat you before he sends his F-2 exchange if he can copy your callsign. If a Runner is simply not responding to your calls, stop calling, and check for zero beat. You may be so far away that you are out of his passband.
32. In RTTY mode, DON'T be stingy with your callsign or your exchange elements, except DO send RST only once. Some operators think their signals are louder than they really are, and apparently don't believe that QRN and QRM can be regional. They send their callsigns only once (and without parsing separators). In my experience, they are difficult to work, and I've learned not to waste time with them--I just call CQ again.
33. When you're operating S&P mode, pay attention to the Runner's rhythm. Suppose you answer a Runner's CQ, and he doesn't respond to anyone as promptly as his rhythm would suggest. DON'T just sit there, call him again! This occurs pretty frequently in RTTY contests, and I see it a lot when I'm Running. Here's what is happening: I call CQ, and 2-3 S&Pers respond, all near zero beat (all on top of each other). My RTTY engine cannot pull out even a partial callsign. Because the callers are in time synch with each other (or because of skip conditions), they cannot hear each other, so

each of them is unaware of other callers. For whatever reason, those S&Pers usually just sit silently and wait for "someone to do something," and the Runner is probably that "someone." As the Runner, I have some "do something" choices: I can send my macro, "AGN AGN," I can call another CQ, or I can just wait for at least one of the S&Pers to call me again in the hopes that I'll get at least a partial callsign. Experience has taught me NOT to send another CQ or my AGN macro, because invariably all of the S&Pers will call me again, in synch with each other, as before. So instead, I wait for an S&Per to wake up and call me. That S&Per will make the QSO, while the sleepers are sleeping! So be the alert and thinking S&Per, make your call, and get your QSO.

How long do I wait for a sleeping S&Per to wake up? Hard to say, but I don't wait very long, especially when the bands are crowded in big contests. Bands crowded with Running ops make for a shortage of "empty" frequencies for additional Runners. Each Run frequency is precious and must be safeguarded from interlopers who decide to become Runners. So if I were to wait too long, an interloper may rightly assume my Run frequency is empty, and he will occupy it in a flash by calling his own CQ. So without waiting too long, I'll call CQ again to hold "my" Run frequency. Therefore, as soon as you realize the Runner isn't calling anyone, make your call, and make the QSO happen!

Appendix B: Self-Assessment

I urge every contester (and DX enthusiast) to do some periodic self-examination by asking the most basic of questions: "Am I easy to work in a contest?" Here are some example questions you might ask yourself:

1. Do I identify myself regularly?
2. In RTTY, do I zero beat the Running operator?
3. Are my contest exchanges brief, complete, and follow the order given in the rules?
4. Do I construct my RTTY macros so that they minimize the number of nonprinting characters and thus reduce the effects of garbles?
5. When I am asked to repeat an exchange element, do I send only what I'm asked for, or do I waste time repeating the entire exchange?
6. Are my RTTY transmissions easy to parse by eye and by contest logger?
7. If the other operator is obviously struggling to copy my callsign or an exchange element, do I repeat it a little more than usual, or do I continue to send it just once or twice?
8. Do I always verify that the other operator sends my callsign correctly, and if he doesn't, do I try to correct his copy?
9. Do I purposely observe and evaluate other operators as a means to improve my operating skills (and to eliminate poor skills)?