José Nunes, CT1BOH / ct1boh@gmail.com

The Importance of Finishing Strong

The motivation for writing this article comes from Scott, KØMD, after he read my tweet comparing CR3OO's performance with TI7W's during 2017 CQ World Wide DX CW. "The contest was won in the last 9 hours of the contest. Three point advantage tough...," the tweet read. Scott tweeted back, asking me to write about the importance of finishing strong in contests. Said KØMD, "I thought Jose had made an important observation on Twitter, and his article explains his analysis regarding whether one's contest efforts are staying on target with one's goals. I hope you enjoy it as much as I did."

Winning a major contest like a CQ World-Wide Contest requires a strategy that works from start to finish. Many operators start aggressively, but, as fatigue sets in and rates drop, the will to persevere to the end may wane. To win, you must *start* strong, *stay* strong, and *finish* strong, whether it's radio contesting or an athletic competition.

To understand what it means to finish strong requires a comparison metric. Finish strong in relation to what? I will explore three dimensions that I consider important to follow: Propagation Potential, Target Performance, and Other competitors' scores. Let's acknowledge that 48-hour contests like the CQ WW are marathons. For a single operator, it is easy to get tired, get distracted, and lose perspective. So, finishing strong means not only staying alert for the last hours of the contest but, most important, staying maximally productive throughout the event.

Propagation Potential

A certain propagation potential exists for every contest; there isn't much we can do about it. All operators worldwide face the limits of what the ionoshphere will allow for HF communication from their locale or CQ Zone. But, because it's out of our control, we must adapt to the different scenarios.

In order to understand propagation potential and its consequences, I will use K3LR's best score during the 2014 CQ WW CW and compare it with best scores in the subsequent years (2015, 2016, and 2017). K3LR typically works every possible DXCC entity and CQ Zone available to operators in CQ Zones 3, 4, and 5 during CQ contests. If we analyze DXCC entities and zones "worked" during a CQ contest, typically K3LR will have worked those entities. Does that mean K3LR always has the same score potential? No, because different propagation during the sunspot cycle impacts K3LR's score as it does everyone else's score.

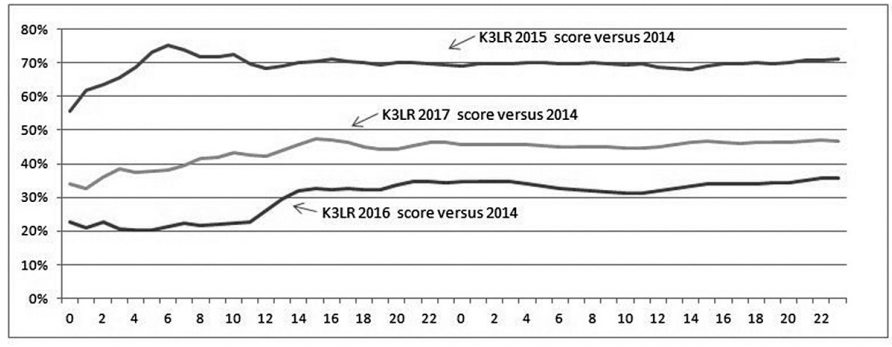

Figure 2 — K3LR's scores in 2015, 2016, and 2017 as compared with 2014, for each hour of the contest.

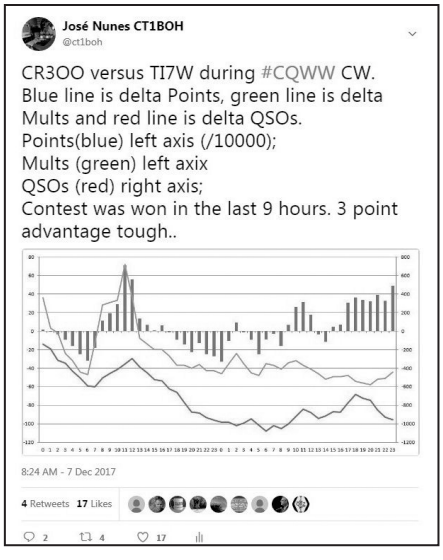

Figure 1 — CT1BOH's tweet.

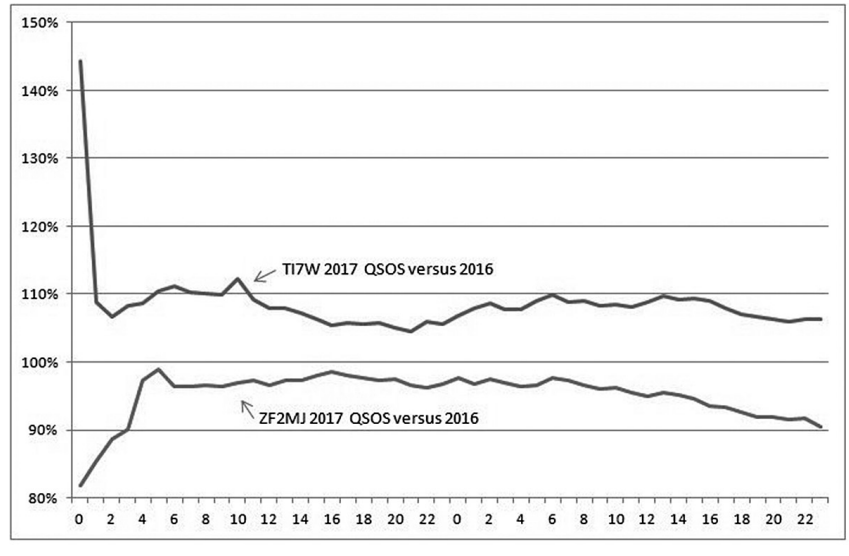

Figure 3 — ZF2MJ and TI7W QSOs in 2017 and 2016 for each hour of the contest.

K3LR always participates in the MM category, fielding a team of excellent operators, bringing the best hardware to the competition, and working to improve every season. The team of operators at K3LR may change with time, but even when the roster changes from year to year, the K3LR team performs to the limit of what is possible within a given propagation zone.

When we compare the scores from K3LR in 2015, 2016, and 2017 versus their performance in 2014 (see Figure 2), what is immediately striking is that the lines run parallel to each other and to the 100% reference of 2014. At around 1400 UTC on first day, it is obvious what the final score will be. In 2015 the score was at 70% of 2014, and their final score was 70% of the 2014 high. In 2016 the score was at 36% of 2014, and in 2017 the score was at 47% of 2014.

It is very important to understand that propagation has huge impacts in the way bands behave. Let's analyze K3LR's QSOs on the low bands (160-40), on the high bands (20-10), on the lowest bands (160-80), on night/day transition bands (40-20), on 15, and on 10 (see Table 1). 2014 was a great year. Not only were the high bands wide open, the low bands were in very good shape too.

On the other hand, 2016 was a terrible year. Both the high and low bands were terrible, with only marginal condition on 10, and 160 and 80 very bad as well. No wonder K3LR's score in 2016 was only 36% of 2014's top score. 2017 was a typical downward-to-low sunspot cyle year but still not with the low-band conditions that might be expected.

The savvy operator needs to understand the potential of propagation for the current contest in order to adapt his operation: What should the high band/low band QSO mix be? Will the high bands open early or late? Should the operator stay longer on the day/night transition bands or move quickly to the adjacent bands? Will 10 meters open or will stay spotty? What will be the shape of the low bands? Correctly answering these question is pivotally important for band presence strategy and for keeping contest performance at the very limit of that year's potential propagation. Tracking performance this way ensures "finishing strong."

Now let's look at how ZF2MJ and TI7W fared during the 2017 and 2016 CQ contests, to illustrate how to use the concept of potential propagation to track contest performance while finishing strong. I will use QSOs data instead of scores, in order to remove multiplier influences (See Figure 3).

• TI7W had a much better start than in 2016, while ZF2MJ had a much worse start.

• TI7W, in 2017, was operating consistently above his 2016 performance with between 6 and 9% more QSOs, while ZF2MJ was operating consistently below his 2016 QSO performance with some 2% fewer QSOs until 0800 UTC on the second day.

• ZF2MJ, in the last hours of the contest (after 0800 UTC) on the second day, consistently degrades his QSO performance versus 2016, finishing at 91%, or, to put it another way, with 9% fewer contacts than in 2016.

Assuming TI7W was operating at his propagation potential, ZF2MJ not only did not match this potential, but in the last hours of the contest, saw the gap widen. There may be an explation. Maybe TI7W had an upgrade in station performance from 2016 to 2017. Maybe the TI7W antennas/location performed better with lower angles during the low of the sunspot cycle, or maybe there was better local propagation conditions. Perhaps ZF2MJ was tired at the end or had technical or interference issues that lowered his rates. Potential explanations are many, but whatever the reason, the data demonstrate that during a given time period as the contest closed, TI7W outperformed ZF2MJ station in comparison to their historical data.

Was ZF2MJ aware of these differences? If yes, perhaps he could have adjusted his strategy or operating tactics to recover and boost his QSO total, at least during the last hours of the contest? Will these differences prompt changes to the hardware, software, and operating tactics for the 2018 contest season? Should operators track their performance metrics as I suggest, so they are aware of what may be happening to their performance compared to historical data?

Target Performance

Finishing strong involves not only pushing at the end but staying at maximum potential QSO rate or propagation-allowable score. It's very important to know the propagation potential, not only to adapt band presence strategy, but to know if QSO and multiplier totals are in line, according to a reference score. This reference score is the target score or a target variable. Most contest loggers offer the ability to plot a target score, a target QSO, or a target multiplier and follow them throughout the contest. With this tool, anyone can track individual performance against a reference and react in case of divergence.

What reference score or variable should be followed? Contests are about breaking records and winning. So, the first reference is a world record, a continental record, or a country record. It's not always possible to break these records, so just winning is the next best target. Because propagation potential is not fully known before the contest, the savvy contester will create several target files in order to choose the correct one when the contest starts…and after, a few hours, when the propagation potential becomes evident. For example, if the propagation potential is 60% of a record year, it is demoralizing to use a target performance of the record year. A target performance of 65-70% is a better choice, to ensure motivation throughout the contest.

Figure 4 shows CR3OO's 2017 score versus EA8BH's world record. Until 1600 UTC on the first day, CR3OO's score was in line with the world record. After that they diverged constantly until the very end. Although we are comparing two different types of operation (EA8BH was SO2R, and CR3OO was 2BSIQ (two bands, synchronized interleaved QSOs)

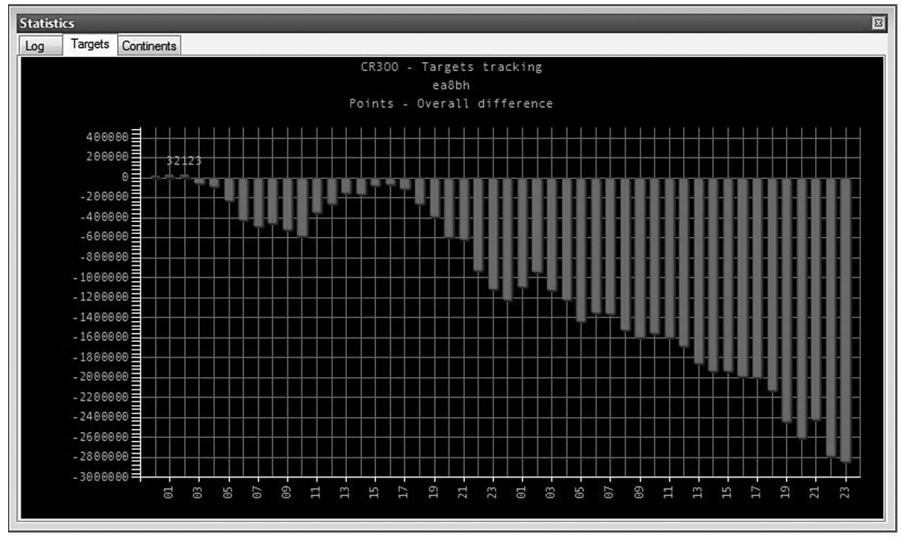

Figure 4 — A comparison between CR3OO's 2017 score and EA8BH's world record.

and two different propagation potentials (EA8BH was enjoying Year 2000 peak propagation, while CR3OO was facing the sunspot propagation low in 2017), CT1BOH had two options: See the world record target vanish, or re-target in line with the extant 2017 propagation potential. Re-targeting eliminates an elusive, potentially demoralizing target, and ensures that CR3OO finishes strong.

Figure 5 is a line graph showing the evolution of CR3OO's score in 2017 versus EA8BH's world record in 2000 for every one of the 48 hours of the contest. The graph shows that CR3OO's 2017 operation was at around 84% of the world record. Retargeting to a 85-90% score is preferable to going after an impossible score.

It's important to follow other targets througout the contest. These may vary and depend on the operator objectives:

- QSO rate (opening hours, mid-contest, sunrise hours, final hours…)
- S&P rate (90 or better during the opening hours…)
- SO2R rate (10 mults per hour with the second radio…)
- Number of zones (all 40 zones, at least *n* zones per band…)
- Work a certain number of countries according to continent (90% of EU mults…)

Each operator must set these different targets to follow; a mix of targets ensures consistent motivation. Setting all targets will ensure that the operator is alert and motivated througout the contest poised to finish strong.

Other Competitors' Scores

Amateur Radio contests are different than other sports, because the playing field differs among competitors, and because scores are not known until the end. Although the unknown nature of the contest is changing with the advent of real-time score-sharing , real-time scores are not yet widespread.

Not knowing your competitors' scores requires pushing hard *all the way to the end*, in order to finish strong, but once again is this enough? It depends on what the other competitors are doing. Let's go back to CR3OO, TI7W, and ZF2MJ in 2017 and compare each score against their respective 2016 scores.

Figure 6 is a line graph showing the evolution of CR3OO, TI7W, and ZF2MJ in 2017 versus the respective scores in 2016 for every hour of the contest. As the graph shows, CR3OO and TI7W are performing in 2017 above their 2016 performance (+9% and +6%, respectively, at the end), and ZF2MJ is performing below his 2016 performance (–9% at the end).

CR3OO and ZF2MJ did not share their scores on real-time sharing platforms, but TI7W did. CR3OO was not aware of TI7W's and ZF2MJ's scores. TI7W and ZF2MJ also were not aware of each other's scores.

Let's assume that *all* competitors were unware of the other scores. ZF2MJ starts the contest, and after 0600, he can see that his score is stabilized at around –2% of his 2016 score. Is this good or bad? 2017 is 1 year later than 2016, and with the cycle going down, perhaps this is good. But, if he knew that TI7W's score was up around 6% his 2016 score, then the perspective is different.

Competitors should check not only their competitors' scores but also those in other categories that could act as reference. CR3OO, TI7W, and ZF2MJ operate using 2BSIQ. The M2 category is a good indicator for reference. CR3W routinely operates M2 category, finishing first. In 2016 they finished first, and they did it again in 2017. CR3W's score is a good indicator for operator performance. Of course, CR3OO and CR3W were not aware of each other's scores during the contest, but we can check them now.

Figure 7 shows the evolution of CR3OO's and CR3W's scores in 2017 versus the respective scores in 2016 for each hour of the contest. If CR3OO had known CR3W's score, he certainly would have been happy during the contest, because CR3W was up around 4% while CR3OO was up around 9%. And, had CR3OO known the scores of ZF2MJ and

Table 1 — K3LR QSO distribution by year, according to different band groupings.

Year	Total QSOs	160-40	20-10	160/80	40/20	15	10
2017	7,825	3,917	3,908	1,800	4,651	1,273	101
2016	6,189	2,582	3,607	1,175	3,752	1,057	205
2015	9,808	4,544	5,264	1,751	5,399	2,097	561
2014	12,991	4,794	8,197	1,949	6,255	2,684	2,103

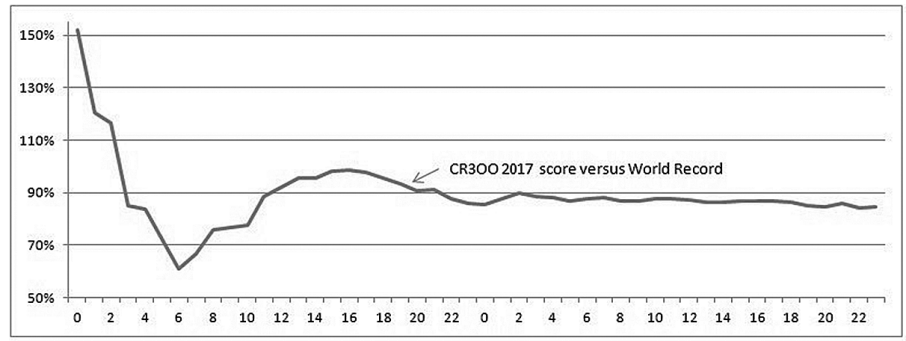

Figure 5 —CR3OO's performance in 2017 versus the EA8BH world record in 2000 for each hour of the contest.

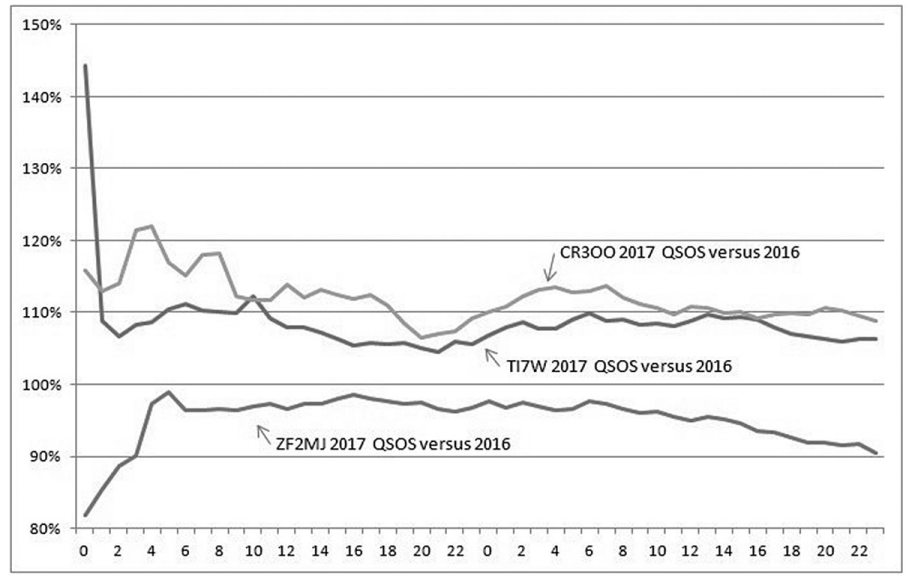

Figure 6 — The performance of CR3OO, TI7W, and ZF2MJ in 2017 as compared with the respective scores in 2016 for each hour of the contest.

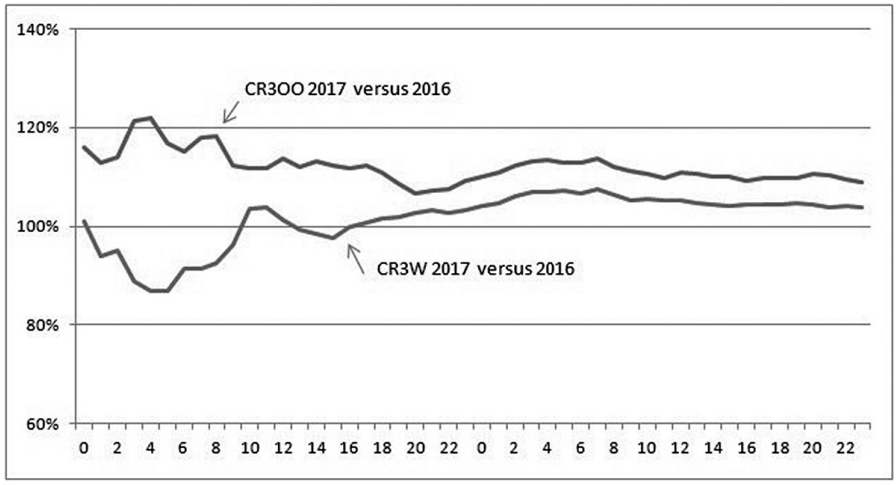

Figure 7 — CR3OO's and CR3W's scores in 2017 versus 2016 for each hour of the contest.

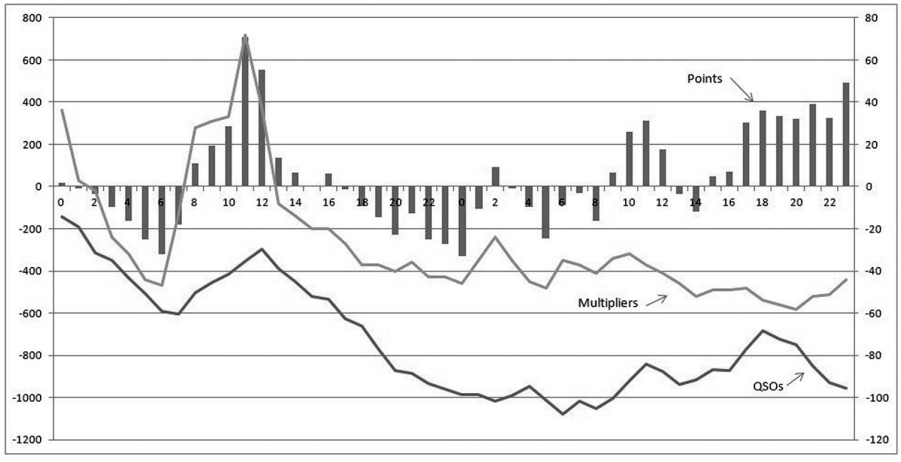

Figure 8 — A comparison of score variables (points, QSOs, and multipliers) over the 48 hours of the contest between CR3OO and TI7W, — the claimed #1 and #2 finishers.

TI7W, he would have been even more delighted with his performance.

We have seen that contest scores run parallel to each other. This is because we are looking at top operators, and because everybody runs at or close to the propagation potential or at the station potential for the particular moment of the cycle. But, are there any actionable decisions that can alter performance? There are, and these require us to examine the data more closely — even microscopically (see Figure 8).

This graph compares score variables (points, QSOs, and multipliers) during the 48 hours of the contest between CR3OO and TI7W, the claimed #1 and #2 finishers according to 3830scores.com. It should be noted that TI7W is a 2-pointer, while CR3OO is a 3-pointer. Both operate 2BSIQ, running two bands at the same time (similar to M2), but with only one signal on the air, alternating between transmit on Radio 1 and receive on Radio 2 and vice versa. The 3-point advantage is likely offset by TI7W's being geographically closer to the US, which allows super-high rates because of better syncronization of shorter calls. The bar graph shows the point difference. CR3OO finished with 489,000 more points, 44 fewer mults, and 956 fewer contacts.

TI7W gained 600 QSOs until 0700 UTC (CR3OO's sunrise), CR3OO recovers 300 QSOs during his morning, TI7W gains again until 959 QSOs at 2300, and then this difference stabilizes until the end of the contest. Looking at multipliers we can sumarise that the difference remains more or less constant throughout the contest, with TI7W netting 44 more mults.

Focusing on score, we see that positions shifted throughout the contest. TI7W was in the lead untils 0700, then CR3OO was ahead from 0800 to 1600, then TI7W was in the lead from 1700 until 0800 on the second day, then CR3OO took over the lead from 0900 until 1200, with a tie period from 1300 to 1600. Then, CR3OO took the lead for the last 7 hours of the contest.

The 1700 hour seems to be pivotal, when the score differential jumped to 304,000 points, Hours 21 and 23 also provided gains to CR3OO, which finished 489,000 ahead.

Despite tough propagation and that the fact that both competitors performed at their station/propagation potential, had TI7W been aware of the score at CR3OO, could he have done something different to pull out a victory? Could he fight back, perhaps at 1700 during the second day? Might he have changed his strategy, instead doing 2BSIQ, perhaps shifting to SO2R, or even to S&P?

We will never know of course, nor can we know if changing strategy (from 2BSIQ to SO2R, or S&P mult hunting, for example) might have led to improved performance and score, but this is worth pondering.

Our observations suggest, though, that the final 7 hours of the 48-hour CQ WW CW was what enabled CR3OO to finish strong and take the lead at the end.

Let's look at the key moments — 1700, 2100, and 2300.

• During the 1700 hour on the second day, TI7W had a 133 hour versus 235 for CR3OO. This and one additional multiplier provided the score boost.

• During the 2100 hour on the second day, CR3OO did S&P between 2127 until 2144, working just 10 QSOs but 11 mults. This was only possible because the band had closed to the US, but was open to Caribbean. If the band was open to the US, CR3OO would have continued 2BSIQ, because the speed of finding mults would be much lower than running; point-wise, it would typically be better to stay with 2BSIQ.

• During the final hour of the contest, CR3OO stopped 2BISQ and shifted to run only, between 2316 and 2359 on 160. This move netted 9 mults, but this was only possible because CR3OO was missing some easy mults on 160. Had CR3OO already worked those easy mults the preceeding night, he would not have moved to 160 to run but continued operating 2BSIQ because of the point advantage

These strategic decisions enabled CR3OO to finish strong and potentially win the contest. But, it would be interesting to know what TI7W might have done in reaction, had real-time data about the tactics of CR3OO been available to TI7W. I'm convinced that *something* would have been different.

It's fun to analyze contest performance and speculate about how changes in strategy might alter the outcome. Radiosport is about preparing for the best, and then adjusting strategies as conditions unfold.