

Leap Second Survey Results - 2015

The June 30/July 1, 2015 leap second once again caused some confusion and concern among the stations, and prediction providers. This documents pulls together some of the experiences and some of the issues that need to be addressed. The leap second recap from 2012 had some of the same points.

Stations

Several stations and networks were queried shortly before and after the leap second regarding their experience. The following patterns arise:

- One prominent prediction provider had problems which distorted the predictions from several days before to several days after the leap second, causing difficulty for some stations. Other stations simply realized there was a problem and moved on to use predictions from backup providers. The problem required up to several hundred msec of time bias, peaking at the time of the leap second, making it difficult for stations to predict the bias in any precise way.
- A couple of the major networks reported no problems. Predictions not handling the leap second or leap second flag correctly were handled with backup predictions or the insertion of 1 second time biases.
- Weather and off-duty crews once again played a factor, limiting many stations' experience.
- Regardless of the reason, the data output world wide dipped significantly from July 1-3.
- Software at some stations still does not use the leap second flag.

Predictions

The following discusses the leap second flag in the CPF file records, since it is a visible indication that the prediction centers were trying to accommodate the format. When the leap second flag is set to '1', the prediction record must not contain the leap second correction. This is not as easily determined. The results are based on examining predictions from all centers for at least some of their predictions from June 29-July 3.

- Seven providers used the leap second flag properly, some after last minute prompting.
- One provider set the flag set backwards: set to '1' for the day before the leap second and '0' afterwards. They have been contacted, and they promise to correct the issue.
- One provider had the flag set properly for lower satellites, but not the GNSS satellites.
- Two providers ended prediction files just prior to the leap second and started new ones after the leap second. This is a clean way of handling the leap second, if losing a few passes over the leap second is not an issue.
- The rest of the providers did nothing special, ignoring the leap second flag.
- Of those providers that set the leap second flag, it was cleared (i.e., set back to 0) on July 1, except for two providers, one of which cleared the flag on July 2 and the other a couple of days later. This is permitted by the format, and only causes issues for stations not paying attention to the leap second flag.

Analysis Centers

There were no reports of issues from the analysis center this time.

Other notes

The predictions providers, stations, and analysts were notified and reminded about the leap second at least four different times, the last being a couple weeks before the leap second. The prediction centers were offered help in reviewing their predictions for conformity of their handling of the leap second flag. Two stations took advantage of that offer. One network replied that they were ready for the leap second, and that was a network that reported had no problems.

Conclusion

The most obvious issue for this leap second was the major problems with one predictions providers' cpf files giving the wrong predictions for several days before and after the leap second. This issue will undoubtedly be fixed with before the next leap second.

Once again, the **prediction providers must pay attention to the leap second**. Those without a strategy this time need to either

- apply the leap second flag correctly and test the resulting predictions, or
- end cpf files prior to the leap second and start new ones (with leap second included) after it.

Likewise, **stations are also responsible for having a strategy to handle leap seconds**. The best strategy would be to use the leap second flag properly. Since some of the prediction providers may continue to ignore the proper leap second procedures, the stations need to be ready to apply an appropriate time bias. Unfortunately, a time bias and clock offset (which is what the leap second is) are not mathematically the same, and a 1-second time bias will not necessarily get the pointing and range gate close enough to take data.

It could help the stations if the ILRS sent a list of those providers not implementing the leap second a couple days before the leap second. The ILRS continuing to send reminders about the leap second is also a good idea.