AOA Receivers Benchmark Test (1998)

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AOA Benchmark

Summer 1998 saw the introduction of the next generation of AOA GPS receivers. In its ongoing role to evaluate new GPS products, UNAVCO obtained an AOA Benchmark receiver from JPL and began evaluating its performance as compared to the AOA SNR-8000 (TurboRogue).

Abstract

The AOA Benchmark tracks dramatically better below 20 degrees than the TurboRogue with the current AOA chokering with standard gain antenna. We also found that the Benchmark also tracks dramatically more observations and with significantly fewer slips for low elevation satellites when using a fairly unique AOA antenna we have at UNAVCO. This high-gain antenna uses a special high gain preamplifier designed by JPL (there are only three of these antennas). The increased performance of this antenna will have to be taken into account when considering receiver options for future work.

AOA Benchmark
Model: 7490900, s/n 1111
NASA 70093, NASA s/n 1838782
Power 90-250 VAC
10 Mb Flashcard
Firmware Version - 2.14b

High Rate Zero Baseline Tests

The high rate zero baseline tests were done using an AOA New Model Standard Gain Antenna (NMSG) and an AOA Antenna with JPL-Modified high gain pre-amplifiers.

Note: There are only three AOA Antenna with JPL-Modified high gain pre-amplifiers. There is one at UNAVCO (s/n 487), one at GODE (s/n 470), and one at SANT (s/n 489).

These tests consisted of two 1-hour files at the same time on two consecutive days, 1 sec sample rate, 0 elevation cut-off. Permanent Marker West (PRMW) was utilized as the antenna mount on the oof of the UNAVCO building. The bench on the roof of building Foothills Lab IV, (FL4, UCAR) was utilized as the marker for the tests run at FL4. All of the tests that were conducted with the AOA Benchmark were run in conjunction with a TurboRogue receiver.

These are files from the high rate zero baseline test at FL4.

bench3040.98S bench3040.98n bench3040.98o s3923040.98S s3923040.98n s3923040.98o

These are the files from the high rate zero baseline test at UNAVCO

bench2790.98S bench2790.98n bench2790.98o bench2790.ele bench2790.azi bench2790.ion

bench2790.iod bench2790.mp1 bench2790.mp2 bench2790.sn1 bench2790.sn2 s3922790.98o

s3922790.98S s3922790.98n

Standard Rate Zero Baseline Tests

The standard rate zero baseline tests were done using an AOA New Model Standard Gain Antenna and a High Gain Antenna. The tests consisted of two 20-hr files taken on consecutive days, 30 second sample rate, and zero elevation cut-off. These two tests were also done at the UNAVCO uilding and FL4, with the same antennas as the High rate zero baseline tests.

These are files from the standrad rate zero baseline test - FL4

bench3360.98S bench3360.98n bench3360.98o bench3360.ele bench3360.azi bench3360.ion

bench3360.iod bench3360.mp1 bench3360.mp2 bench3360.sn1 bench3360.sn2 s3913360.98S

s3913360.98n s3913360.98o s3913360.ele s3913360.azi s3913360.ion s3913360.iod

s3913360.mp1 s3913360.mp2 s3913360.sn1 s3913360.sn2

These are files from the standard rate zero baseline test - UNAVCO

PRBW3180.98S PRBW3180.98n PRBW3180.98o PRBW3180.ele PRBW3180.azi PRBW3180.ion

PRBW3180.iod PRBW3180.mp1 PRBW3180.mp2 PRBW3180.sn1 PRBW3180.sn2

Comparison of the New Model Standard Gain antenna verses the High Gain antenna

Two different New Model Standard Gain Antenna's were tested and the results were compared with the results from the JPL-Modified Antenna. The first set of data compares a TurboRogue receiver and he AOA Benchmark. This data was collected with both of the receivers being run off of a New Model Standard Gain Antenna.

In the next segment of data, you can see the difference between using a New Model Standard Gain Antenna and an JPL-Modified Antenna with the AOA Benchmark. You will see that when the benchmark is used with a New Model Standard Gain Antenna, the number of observations decrease, and the number of cycle slips increase. For example, compare bench0020.99S and bench0060.99S, and ook at the MP1: when the benchmark is used with the JPL-Modified Antenna, there are 2,585 observations in the 5-10 degree elevation range and 89 cycle slips. When the benchmark is used with the New Model Standard Gain Antenna, there are only 1,933 observations in the 5-10 degree elevation range and 494 slips.

If you compare two files for the TurboRogue; one using the New Model Standard Gain Antenna, and one using the JPL-Modified Antenna, there is no notable large difference in the number of observations or cycle slips in the 0-10 degree elevation range, in contrast to the dramatic difference that is seen when the Benchmark files are compared.

This is data for the Benchmark and a TurboRogue receiver run off of a New Model Standard Gain Antenna.

bench3350.98S bench3350.98n bench3350.98o bench3350.ele bench3350.azi bench3350.ion

bench3350.iod bench3350.mp1 bench3350.mp2 bench3350.sn1 bench3350.sn2 s3913350.98S

s3913350.98n s3913350.98o s3913350.ele s3913350.azi s3913350.mp1 s3913350.mp2

s3913350.sn1 s3913350.sn2 s3913350.ion s3913350.iod

The following is the Benchmark run with a JPL-Modified Antenna, and a New Model Standard Gain Antenna. The bench0040*.* files are with the first New Model Standard Gain Antenna, the bench0060*.* files are with the second New Model Standard Gain Antenna tested, and the bench0020*.* and the bench0030*.* files are with the JPL-Modified Antenna.

bench0020.99S bench0020.99n bench0020.99o bench0020.ele bench0020.azi bench0020.ion

bench0020.iod bench0020.mp1 bench0020.mp2 bench0020.sn1 bench0020.sn2 bench0030.99S

bench0030.99o bench0030.99n bench0030.ele bench0030.azi bench0030.ion bench0030.iod

bench0030.mp1 bench0030.mp2 bench0030.sn1 bench0030.sn2 bench0040.99S bench0040.99o

bench0040.99n bench0040.ele bench0040.azi bench0040.ion bench0040.iod bench0040.mp1

bench0040.mp2 bench0040.sn1 bench0040.sn2 bench0060.99S bench0060.99n bench0060.99o

bench0060.ele bench0060.azi bench0060.ion bench0060.iod bench0060.mp1 bench0060.mp2

bench0060.sn1 bench0060.sn2

Summary

The AOA Benchmark tracks dramatically better below 20 degrees than the TurboRogue with the current AOA chokering with standard gain antenna. The Benchmark tracks dramatically more observations and with significantly fewer slips for low elevation satellites when using a unique AOA antenna we have at UNAVCO. This high-gain antenna uses a special high gain preamplifier designed by JPL (there are only three of these antennas). The increased performance of this antenna will have to be taken into account when considering receiver options for future work.

Baud Rates

The Benchmark is able to download data at all of the available Baud rate settings.

Real Time Serial

The benchmark can offload data without the X-modem overhead. This was done by setting up the offload in real time serial protocol, and logging the data continously to a file. The following sample rates and baud rates were tested using the capture function in Seyon. Seyon is a complete full-featured telecommunications package for the X Window System. Seyon has many features such as: a dialing directory that supports an

unlimited number of entries, a terminal emulation window that is delegated to xterm (so all the familiar xterm functions are available for use), script language to automate tedious tasks, an unlimited number of slots for external files, and support for Zmodem auto-download. These are just a few of the capabilities of Seyon. The capture function in Seyon captures data that is being sent to the screen, and saves it in a home directory. A script can also be used to capture the data, which was done for baud rate 19.2 at one second sample rate. This data is easily retrievable, and can then be translated into Rinex using teqc (for more information on teqc, go to the software section of the Developement and Testing Web Page. One must note that there will be a time delay when doing an offload in real time.

BAUD RATE	SAMLE RATE (seconds)	RESULTS
4800	30	works
9600	30	works
9600	5	works
9600	1	Artifact of Seyon
19200	30	works
19200	5	works
19200	1	used Java script
38400	30	works
38400	5	freezes
38400	1	freezes
57600	30	works
57600	5	freezes
57600	1	freezes
115200	30	freezes
115200	5	freezes
115200	1	freezes

Data Found Under Testing Directory

N.M.S.G.- New Model Standard Gain Antenna
H.G. - High Gain Antenna

FILE NAMES	BUILDING TESTED IN	TYPE OF ANTENNA USED	DATES OF TESTING
high_zero_baseline_UNAVCO	UNAVCO	N.M.S.G.	Oct. 6-8, 1998
high_zero_baseline_FL4	FL4	H.G.	Oct. 29-31, 1998
30sa_on_same_antenna	UNAVCO	N.M.S.G.	Oct. 9-12, 1998 Nov. 11-12, 1998
stndrd_zero_baseline_FL4 (gold standard splitter)	FL4	H.G.	Dec. 2-3, 1998
stndrd_zero_baseline_UNAVCO	UNAVCO	N.M.S.G.	Nov. 13-16, 1998
real_time_serial	FL4	H.G.	Dec. 18-21, 1998
Dave	FL4 / UNAVCO	N.M.S.G. & H.G.	Dec. 1, 1998
benchmark_UNAVCO	UNAVCO	N.M.S.G.	Dec. 22-23, 1998
NMSG_FL4	FL4	N.M.S.G.	Dec. 30-31, 1998 Jan. 4, 1999
highgain_UNAVCO	UNAVCO	H.G.	Jan. 1-3, 1999

ANTENNA	MODEL	SERIAL NUMBER
1st New Model Standard Gain Antenna Tested	7490582-2	410
2nd New Model Standard Gain Antenna Tested	7490582-2	386
High Gain	7490400-4	487 NASA 70011

Send questions or comments about this page to Chuck Meertens (chuckm@unavco.org) or Victoria Andreatta (victoria@unavco.org)

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