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What is the Effect of Bad Lever Arms in the GNSS/INS Filter?

1. What type of magnitude of error can be expected?

The magnitude of the errors are difficult to quantify in a "nice & neat" formula. The effect is non-linear, and depends on the dynamics encountered, GPS positioning mode, and if there are GPS outages. The most important thing is that the lever arm standard deviations provided in the *SETIMUTOANTOOFFSET* command are at least as large as the true uncertainty in the lever arm. For example, If you have 10cm accurate lever arms, and you are operating in RTK mode, you have degraded the GPS positions used to update the INS to:

10cm (lever arm error) + the RTK std dev + the attitude error propagated down the length of the lever arm.

2. Would the effect on the GNSS/INS filtering be expected to remain constant?

The error from an incorrect lever arm will be fairly constant as the vehicle travels straight but will vary as the vehicle turns. Users may see heading errors and position/velocity errors during the turns.

3. What is the difference in the effect of miscalculated lever arms in single antenna vs dual antenna scenarios?

Incorrect lever arm values in the horizontal direction will impact heading the most in a single antenna solution.

When using a dual antenna system, an incorrect lever arm to the second antenna will introduce a bias to the *ALIGN* heading value that is used to align and update the INS. With alignment, it means the initial INS heading error will be the same as the lever arm error, but the heading standard deviations may not reflect it, unless the *SETIMUTOANTOOFFSET2* was entered with true standard deviations.

The SPAN solution must converge to the truth from this wrong starting point, which it can only do with good GPS coverage and good dynamics. With the *HEADING* logs being used as an update to SPAN, large *SETIMUTOANTOOFFSET2* standard deviations will lead to the *HEADING* solution being weighted less (i.e. have less effect); if the standard deviations are falsely small, it will lead to INS solution being biased (in heading) by the amount of the second lever arm error and possibly to system instability.