1982b

"Inflight Estimation of Spacecraft Attitude-Sensor Accuracy and Alignments," M. D. Shuster, D. M. Chitre, and D. P. Niebur, *Journal of Guidance, Control and Dynamics*, Vol. 5, No. 4, July–August 1982, pp. 339–343.

The first part of this work was carried out, because it was suspected that inconsistencies in the attitude estimate might be due to poor sensor performance inflight. The work used samples of the QUEST overlap eigenvalue to provide an effective measurement for the error levels of the three fine attitude sensors: a fine Sun sensor and two fixed-head star trackers. The methodology presented provides a consistent estimator when there are three or more vector sensors. The results showed that the error levels in flight matched those claimed by the vendors within the accuracy of the error-level estimates (10%). The observed inconsistency was later traced to errors in the star-identification software.

The portion of the article on alignment estimation was very primitive and not completely correct. It was, however, the first alignment estimation algorithm to treat the question of observability correctly. What it treated incorrectly were: (1) the correlation between effective alignment measurements; and (2) the initial condition. That alignment portion was superseded by 1991c and 1991d. 2005f gives a lightly more general form of the inflight accuracy estimator, which can be applied to more than three sensors.

Readers of this paper should probably skip over the portion on alignment estimation.

The first part of the work was performed after I had left CSC as a favor to friends (especially Frank VanLandingham) who had uncovered the problem during definitive data processing. The work on alignment had been the source of frustration for many years. I would not figure out the right way to do in until 1985.

Superseded by 1991c, 1991d.