Sideslip Anomaly

Summary

The sideslip angle, β, was measured during the UH–60A Airloads Program with a yaw vane mounted on the test boom at the front of the aircraft. An examination of data obtained during the level flight performance testing on Flights 84–90 has indicated an anomaly in the sideslip data and this anomaly is described in this note. The anomaly is a shift in the bias that occurred for most of the counters in Flights 89 and 90 and care must be taken when using sideslip measurements for these counters.

Level Flight Performance Tests

Level flight performance measurements were made on Flights 84–90 during the UH–60A Airloads Program. Data were obtained as airspeed was varied for six weight coefficients. The airspeed limits in most cases were determined by available power. The pilots employed different strategies for aircraft trim during these level flight tests depending upon the airspeed. At low airspeeds the pilots normally attempted to maintain a zero sideslip angle and they accepted the consequent non-zero roll attitude. However, for airspeeds above the minimum power speed, the pilots normally trimmed the aircraft to ball-centered flight where the roll attitude was zero. To achieve ball-centered flight, however, the pilots allowed some sideslip which provided the roll moment required for trim through the aircraft's static dihedral. The aircraft's static dihedral tends to increase significantly with forward speed so that very little sideslip is required for ball-centered flight at the highest speeds.

Level flight performance testing of the 1st-year production UH–60A (Nagata et al. 1981) and the 6th-year production aircraft (Marshall et al. 1985) include charts of "inherent sideslip," which is defined as the sideslip required for ball-centered flight. For these tests, a sensitive lateral accelerometer was used to determine the ball-centered flight conditions. The sideslip measured during the level flight performance tests of Flights 84–90 are compared to the inherent sideslip values of these two referenced tests in Figure 1. At low airspeeds the inherent sideslip angle for the USAAEFA tests does not necessarily show good agreement with the present measurements and this is expected as the pilot does not attempt to fly ball centered at the lower airspeeds. At higher airspeeds generally good agreement is seen with the sideslip angles from Marshall et al. (1985). The UH–60A configuration tested in the Airloads Program is more similar to the 6th-year production aircraft tested by Marshall et al. (1985) than the 1st-year aircraft. The most significant difference between the two configurations is the installation of fairings for the Extended Stores Support System (ESSS) in the 6th-year production aircraft[1]. The cause of the difference between the inherent sideslip angles determined by Nagata et al. (1981) and Marshall et al. (1985) is not known. It seems unlikely that the installation of the ESSS fairings would cause a difference of this size.

[1] The UH–60A Airloads Aircraft, S/N 82–23748, is in fact the same aircraft tested by Marshall et al. (1985). However, the aircraft has been updated since those tests. The most significant external change is the installation of the wire strike protection system.

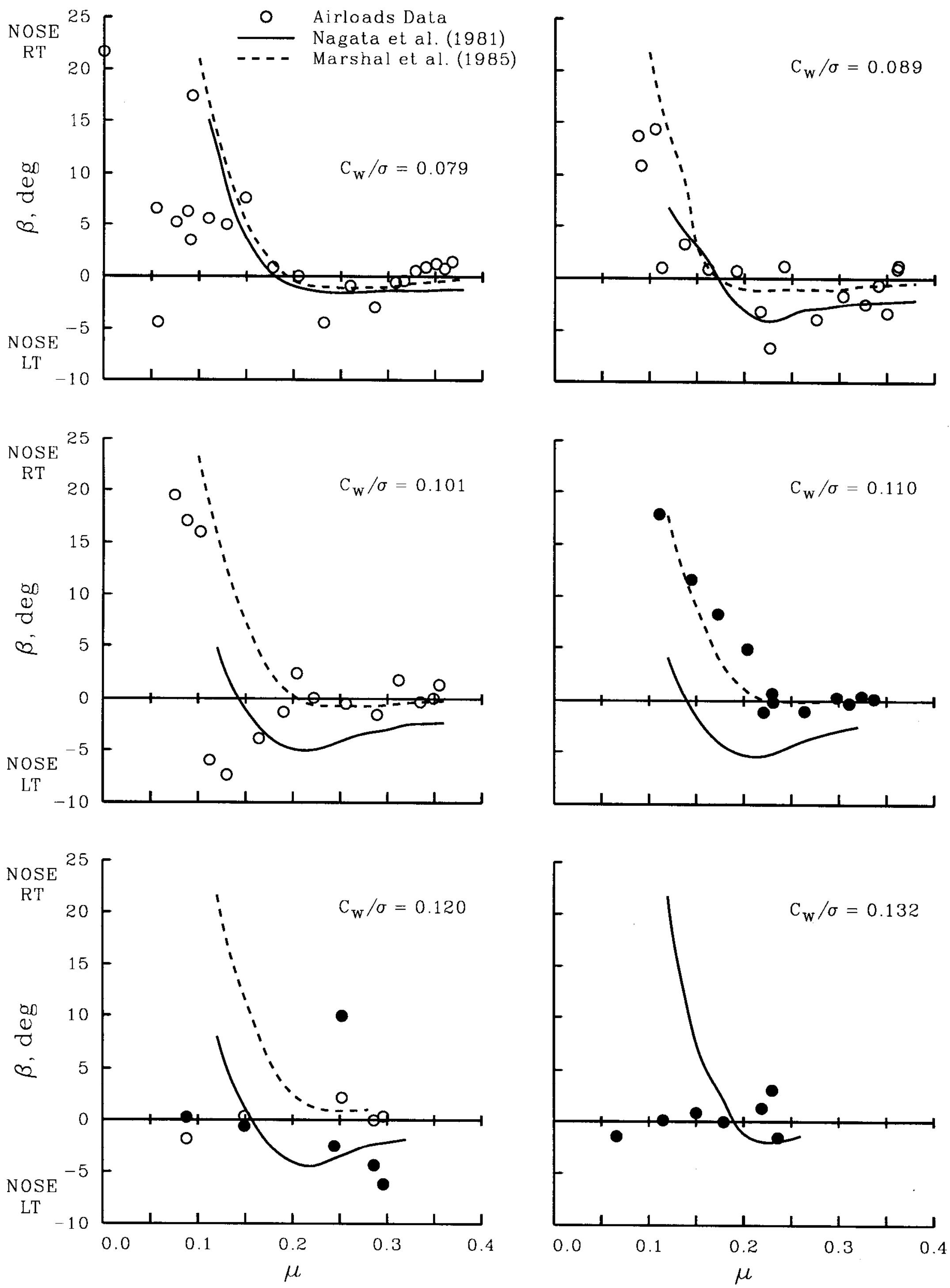

Figure 1 – Comparison of measured sideslip angle for six level flight performance conditions with measurements obtained by Nagata et al. (1981) and Marshall et al. (1985). Solid circles have been shifted by –39.77 deg.

The bias value for the sideslip angle determined in the pre- and post-flight static calibrations for Flights 89 and 90 is significantly offset from all other flights in the Airloads Program. The bias offset of –39.77 deg is quite noticeable in the data. The measured sideslip values shown here for the three highest weight coefficients have been arbitrarily shifted by –39.77 deg on an ad hoc basis. However, this bias shift was not used for all test points as can be seen for five of the airspeeds for $C_W/\sigma = 0.12$. It appears that the bias shift that occurred on these two flights was in some cases intermittent. The cause of this anomaly is unknown.

Conclusions

The bias shift in the pre- and post-static calibrations encountered on Flights 89 and 90 is not seen on any other flight and hence the problem with this bias shift appears to be restricted to these two flights. However, this bias shift did not occur for all counters on these flights and it is possible that a related shift has occurred for individual counters on other flights. No systematic search has been made for other flights to see if this anomaly occurs for other counters. Although other anomalous cases have not been found, the use of the sideslip measurement for other flights needs to be done with some caution.

References

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