

Title: Microdisturbance Sources and Characterisation

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Abstract:

The goal of the Microdisturbance Sources and Characterization project was to characterise the evolution and correlate microdisturbance signatures of a reaction wheel due to launch environmental effects (vibration and shock) via on-ground testing. Therefore, different vibration and pyroshock tests with increased test level were applied to the reaction wheel with different bearing sets. The test campaign included microvibration tests to observe influences to the bearings, reaction wheel structure and its performance as well as the microvibration finger print.

During the project, extensive knowledge of the microdisturbance signature of the RW260 reaction wheel was gained. A comprehensive analysis of the obtained microvibration test data as well as a comparison between the pre- and posttest visual inspection were performed. Parameter for particular interest that indicate any improvement or degradation of the respective microvibration sources and resonance phenomena were identified. A friction estimation showed that in most cases the test campaign reduce ball bearing friction, resulting in longer roll-out time. The main disturbance signature results from the outer race imperfection of the ball bearing units (Order 2.6). For this order, changes between low, medium and high test levels can be seen depending on test axis. Over the whole test campaign, the parameters are oscillating around an average value, not allowing a tendency from low to high or high to low.

The bearings as a main disturbance factor with its instability has been analyzed and modelled in a simulation. Removing disturbance bearing effects, especially bearing instabilities, should have a high priority for the improvement of the RW260.