ABSTRACT

Andøya Rocket Range has built up a variety of test equipment and procedures for qualification of sounding rocket payloads, in order to ensure the functionality, flight worthiness and stability of rocket vehicles.

The payload structures undergoes mechanically bending test, test of nose cone and doors release and separation mechanism during actual spin rate. Booms and sensors are deployed and tested with actual spin rate meant for the chosen rocket configuration.

During the 2nd integration, the payload undergoes environmental tests, such as temperature cycling and interference test. Dynamic balancing is another important issue that is examined and corrected as well as detection of moment of inertia and center of gravity. Finally the whole payload configuration undergoes vibration in all axes according to the stress the vehicle will be exposed for.

All mechanical and electrical data, figures and related information from the tests are recorded, evaluated and filed – in accordance to Andøya Rocket Range QMS, which is based on the ISO 9000 certified management system. A test report is presented and handed over to the Project Investigators.

1. INTRODUCTION

Andøya Rocket Range (ARR) has - during the latest 5 decades - launched sounding rockets into the northern hemisphere for national and international institutions. During the latest years, ARR has launched self-made payloads. Test and qualification of the vehicles have been executed outside the range, caused by lack of test equipment and suitable facilities. However, now ARR have this test facilities and competence inhouse.

2. BUILDING FACILITIES

During this year a new building has been raised “Fig. 1”. The building houses a well-equipped mechanical workshop for minor mechanical production and adjustments. The building also contains two spacious payload assembly and check-out halls. Each of these halls is equipped with one 1.5 metric tons crane which covers most of the rooms.

For safety purposes, all payload halls are well supplied with electrical grounding system on walls, floor and workbenches. Here are also facilities for discharge of personal static electricity.

A number of power outlets for 230VAC, 50 Hz and 115VAC, 50 Hz are spread around the walls are available. The power supply has “No brake” facility.

3. TEST EQUIPMENT

3.1 Spin table

The spin table disc has a usable diameter of 500 mm and spin rate, continuous adjustable from 0 to 13 RPS, with read-out resolution of 1/10 RPS “Fig. 2”. Equipment mounted on the disc, can be electrically connected the Control desk’s 15-pin D-sub Female connector, via slip-rings connected to 10 ea conductors, each 0.75 mm². These conductors can be connected to by means of momentary switches or “on/off” switches connected to 10 ea “Banana” connectors on the Control desk. The speed stability is taken care of by the heavy disc (90 kg) itself and frequency regulated speed control.
Safety net around the spin table protects involved personnel in case of unforeseen incidents.

### 3.2 Dynamic balance machine and MOI sensor

The Dynamic balance machine “Fig. 3” is controlled from the same control desk as the Spin table. The machine is – if in use – bolted to the floor in the test hall. Together to the machine ARR utilize the “Easy Balance” instrument. The “Easy Balance” uses two sensors simultaneously to make the dynamic balancing in two planes. The same machine has also additionally equipped to measure the moments of inertia (MOI) for all three axes on the object under test.

![Figure 2. Spin table](image)

### 3.3 Bending tool

This tool is used to detect and measure slop in the joints and elasticity of the payload skin structure. This test is manually executed by means of a hydraulic jack to bend the object under test ”Fig. 4”. A number of digital micro gauges are used to measure and register the changes along the payload. One micro gauge is used on the base - as reference to the others.

![Figure 4. Bending jig](image)

### 3.4 Vibration machine

A vibration machine is available for vibrating the payload in all three axes. The ready balanced, complete payload undergoes vibration tests; one sine wave vibration run with reduced power, in order to detect resonance frequencies. A separate run using random frequency specter vibrations simulates the actual vibrations during the flight for the actual motor configuration.

### 3.5 Temperature chamber

The payloads are also tested in a temperature chamber, cycling 5 times the temperature between 0 and 60 degrees Centigrade. This test is valuable to detect bad connections in the electronics as well as the mechanics.
3.6 Tip dispersion measurement

The tip dispersion will also be measured in order to detect any misalignment in the payload structure. This is also a valuable verification in order to avoid stress in the joints as well as payload coning.

3.7 RF and Interference test.

The whole payload is tested with all instruments running to analyze the frequency specter and test each instrument separately looking for disturbances or interference.

3.8 CG detection

Center of gravity (CG) to the payload is detected and measured by means of a “knife edge”. This knowledge is important for calculations of stability of the whole vehicle during flight.