# Contents

# The Study on Multi-parameter Combined Environment of the Accelerate Process of Spacecraft

## 1. Introduction

Spacecraft is influenced by environment factors, such as high linear acceleration, vibration, impact, high or low temperature, sound pressure and high or low air pressure, both in active and passive stage of flying progress, and it may affect the security and stability of spacecraft or even make flight failure. So, the reliability of spacecraft component needs to be detected under working conditions. The experiment will face some disadvantages, such as high cost, poor parameter controllability, environment pollution and etc. Therefore, it has an important theoretical and practical significance to carry out multi-parameter-combined environment simulation testing on the ground.

At present, the combined environment testing of China is limited to one or two parameters. A few developed countries have developed multi-parameter-combined environment testing device in the last century, which relates to five parameters: linear acceleration, vibration, temperature, sound pressure and air pressure, but it simultaneously relates to at most four of them. Accordingly, this project plans to build up five-parameter-combined environment testing device that relates to the five parameters mentioned above.

## 2. Main Responsibilities

- Realized five parameters of linear acceleration, vibration, temperature, sound pressure and air pressure combined environment testing.
- Developed a measure and control software for Multi-parameter Combined Environment testing based on LabVIEW.
- Developed an integrated circuit board for data processing of Multi-parameter based on the MCU.
- Developed the program for Multi-computer communication between DSP, MCU and PC by using Assembly Language.
- Completed fabrication, installation and debugging of the measure and control system.
- Completed lots of environment testing related to the five parameters, and wrote research reports.
- Application software: Proteus, MCU(AT89C52), Labview and Protel.

## 3. Related Pictures

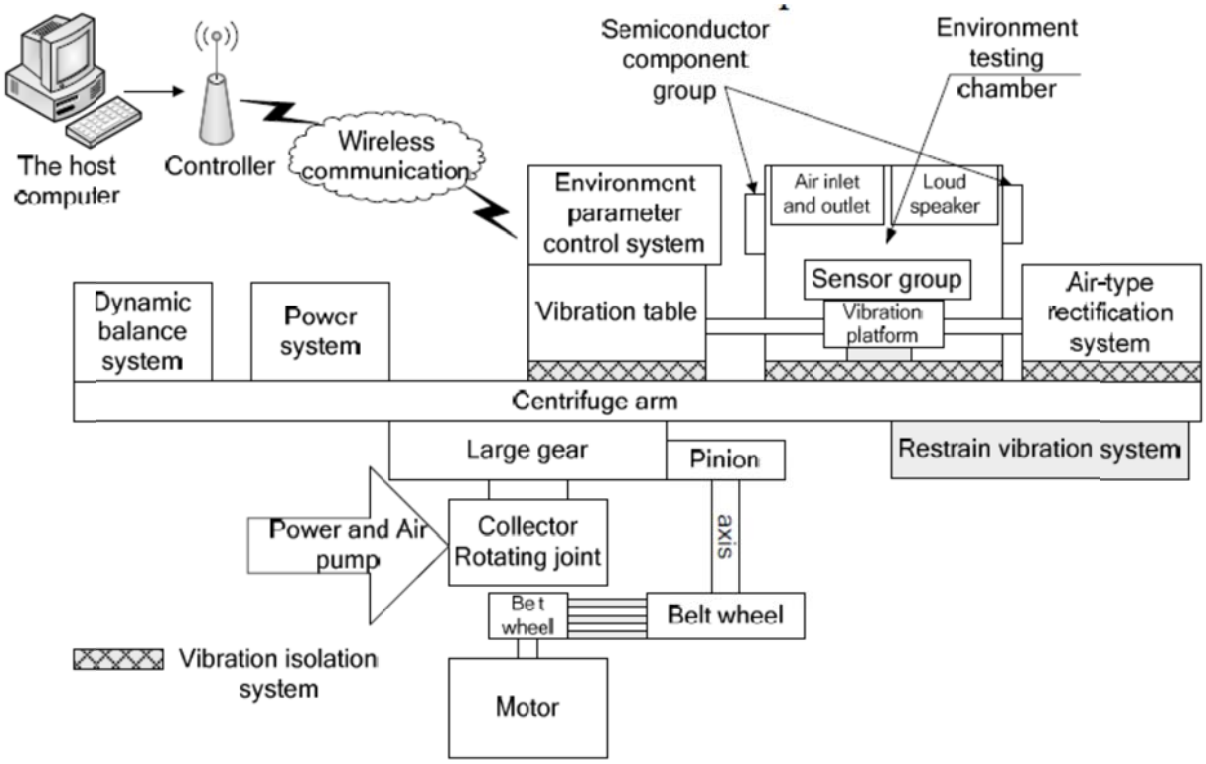


Fig. 3.1 Structure of multi-parameter-combined environment testing device

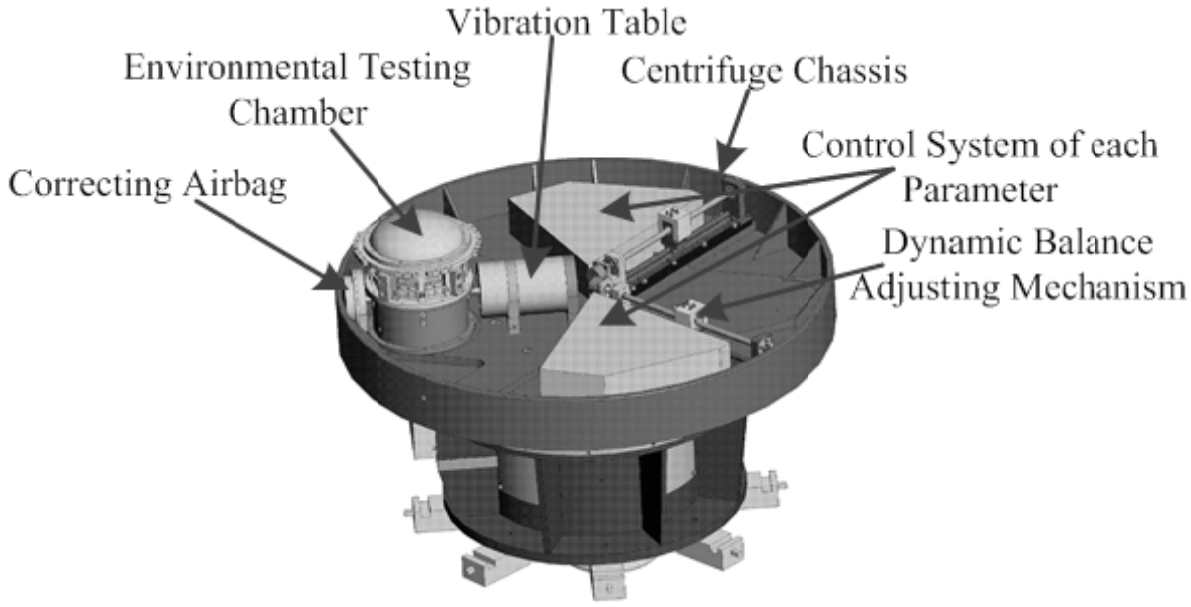


Fig. 3.2 Three-dimensional structure of multi-parameter-combined environment testing device

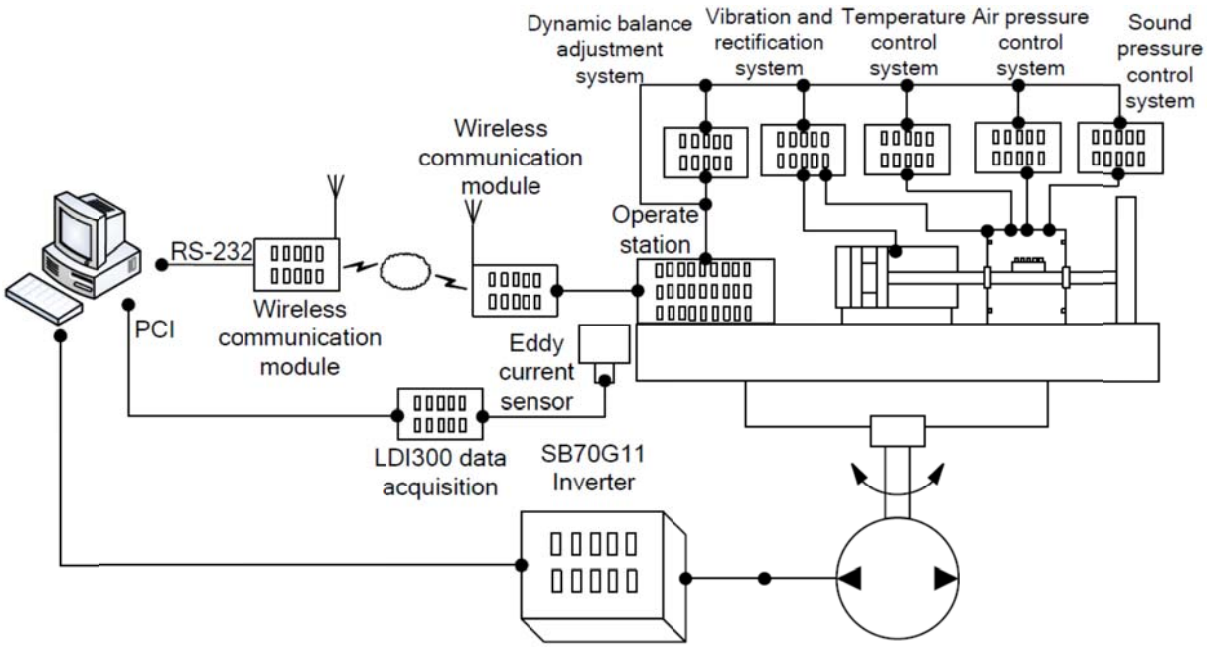


Fig. 3.3 Connection diagram of overall control experiment of the control software

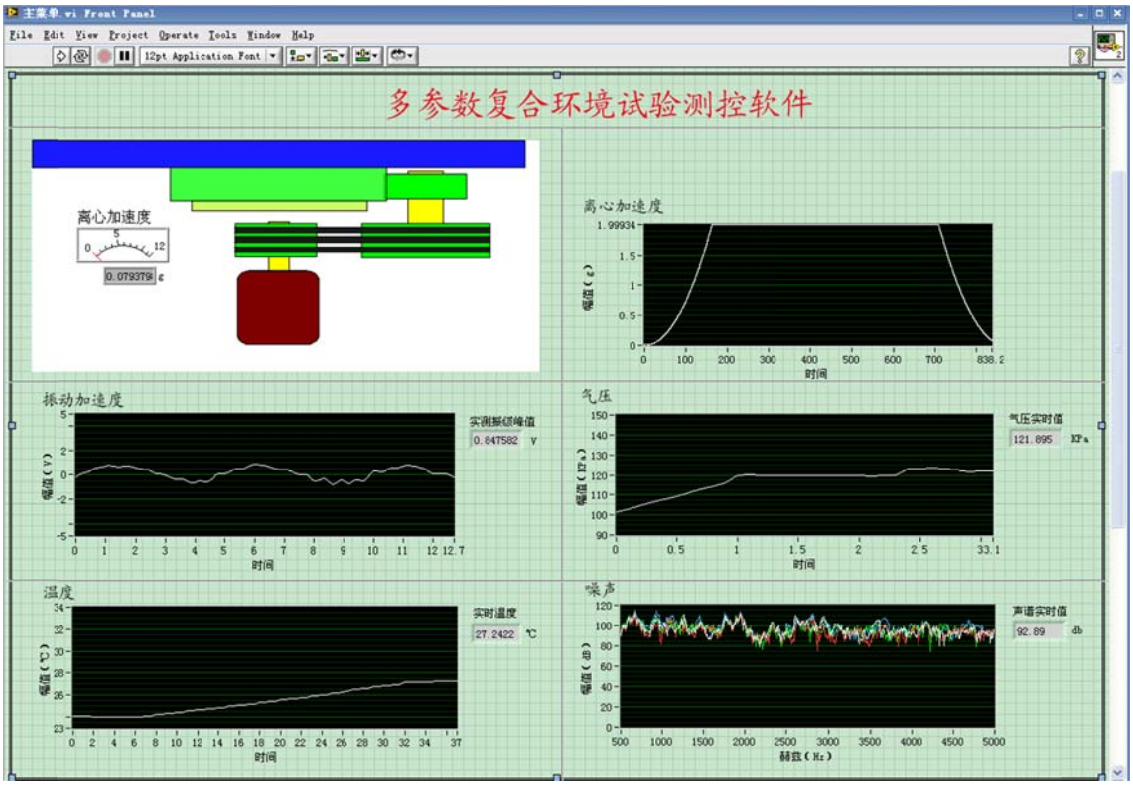


Fig. 3.4 Measure and control software based on LabVIEW

Fig. 3.5 Physical picture of multi-parameter-combined environment testing device

# Infrasound Generating Device based on Displacement Feedback type Vibration Table

## 1. Introduction

At present, China has not carried out research on the Infrasound generating device, but has carried out much research on the sinusoid pressure generator and made some achievements. However, a few developed countries have accumulated considerable research experience on the infrasound generating device and developed some mature products. So, there is still a wide gap between domestic and foreign product.

Accordingly, this project plans to build up a kind of Infrasound generating device based on displacement feedback type vibration table. The infrasound generating device has the advantages of generating low distortion sinusoidal infrasonic acoustic signal, high calibration precision of infrasonic microphone, and generating infrasonic acoustic signal whose frequency could below 0.1Hz. Furthermore, the experiment results show that performance of the infrasound generating device has reached the level of similar foreign products.

## 2. Main Responsibilities

- Completed three-dimensional model and two-dimensional drawings of the Device by using SolidWorks.
- Conducted acoustic analysis of the Infrasonic generating cavity and model analysis of the Device by using ANSYS.
- Completed fabrication, installation and debugging of the Device, and sound pressure test of Infrasonic generating cavity and acoustic calibration test of infrasound microphone.
- Assisted in developing the calibration software of infrasound microphone based on LabVIEW.
- Application Software: Solidworks, ANSYS, and LabVIEW.

## 3. Related Pictures

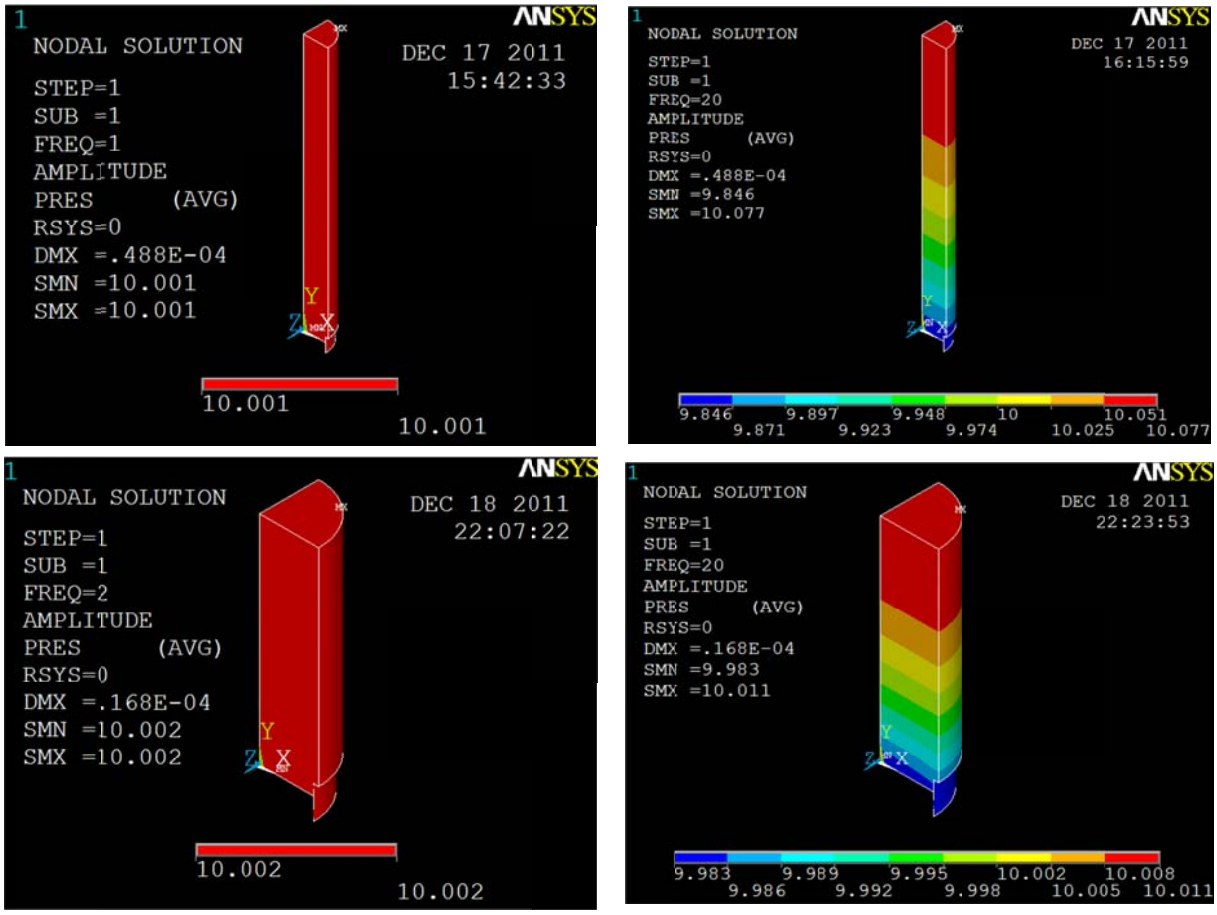


Fig. 3.1 Acoustic analysis of Infrasound generating cavity based on ANSYS

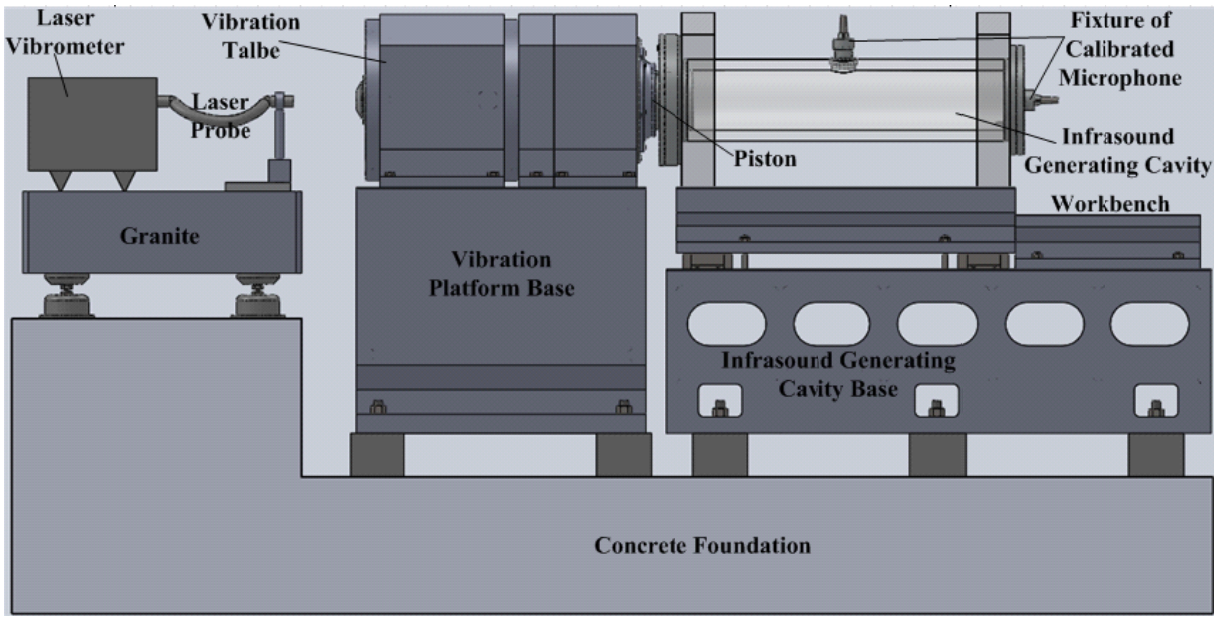


Fig. 3.2 Structure of Infrasound generating device and the name of each component

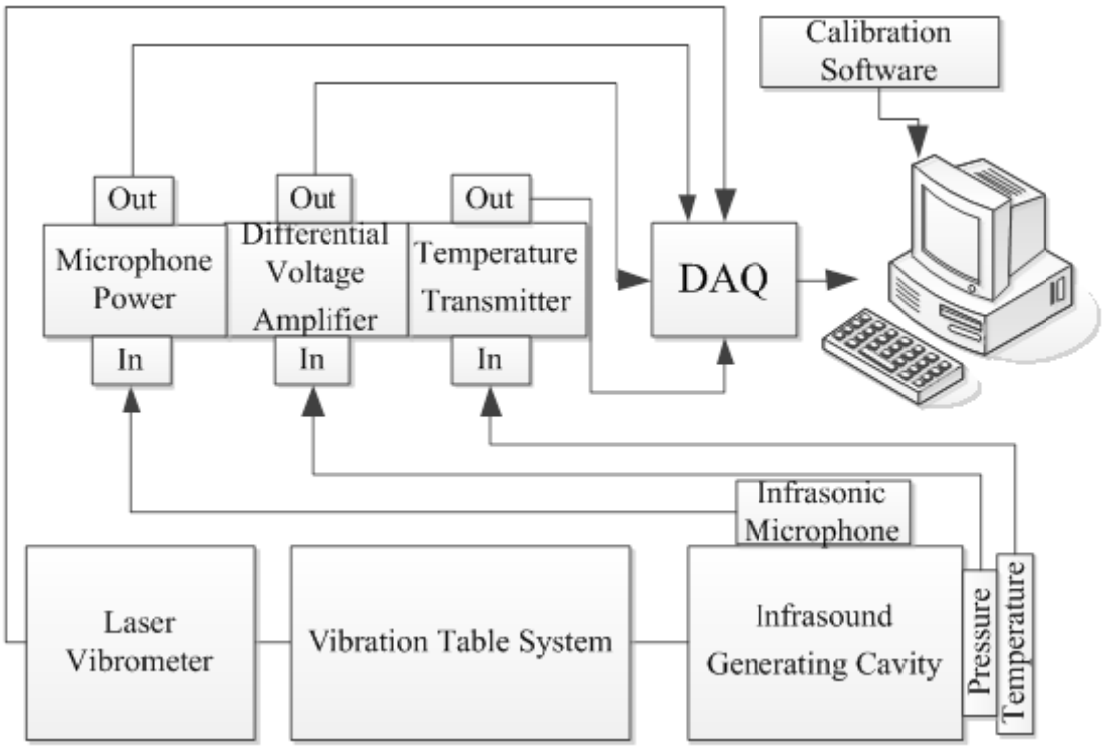


Fig. 3.3 Schematic of Infrasonic microphone calibration system

Fig. 3.4 Physical picture of Mechanical components of Infrasound generating device

Fig. 3.5 Physical picture of hardware of Control system of Infrasound generating device