To build a DML flat panel speaker & test it's characteristics & compare it to a Typical Bookshelf Speaker

Most households have a typical bookshelf speaker, however there is a potential in Distributed Mode Loudspeaker (DML) to provide the equivalent standard yet reduce the space a typical bookshelf speakers requires. The current DMLs available are of a significantly higher price than the typical bookshelf speaker; this document shows the positives and negatives of a DML, as well as the development and build of a low cost DML. Tests will use standards from British Standards Institution (BSI) to provide a dependable comparison between a typical bookshelf speaker and a finished DML. As the DML was never completed, the information collected was used to foresee the results of the project. This project was not a success, due to the prediction that was made using the research and pilot tests, the budget prevented use of higher quality materials that may have led ultimately to a success.

INTRODUCTION

This project was to create DML that was be affordable for home use, yet still produce high quality audio. To achieve this required testing of a range of different materials, with tests that allowed an accurate comparison between typical bookshelf speakers on the market.

BACKGROUND

A DML is a flat panel speaker. The DML was developed and patented by the UK company NXT, yet the principle patent is held by the British Ministry of Defence, due to a research project of the United Kingdom's Defence Evaluation Research Agency (DERA).

For the panel of the speaker, the recommended panels that are most commonly used are of light mass, but stiff and strong.

DML's work by attaching electromagnetic exciters to a flat panel made of a resonating material, which produces a uniformly distributed vibration, with the panel becoming the speaker's diaphragm.

AIMS AND OBJECTIVES

- Determine the acoustic resonance of a variety of different materials by testing.
- Design and create a DML flat panel speaker using the most effective material identified during first testing phase.
- Test DML speaker using correct standards, tests will include:
  - Frequency response under free-field conditions
  - Effective frequency range under free-field conditions
  - Maximum Sound Pressure Level (SPL) limited by distortion under free-field conditions
  - Conclude the comparison of the DML speaker to the typical Dynamic Bookshelf Speaker.

METHOD

Three main tests will be conducted throughout this project to evaluate the DML speakers:

- Frequency response under free-field conditions
- Effective frequency range
- Maximum SPL limited by distortion

The tests will be carried out under the same conditions but will have the following variables including size of material, the material and the position of the exciter on the panel of DML. When referring to the method throughout the project, these variables will be stated. Each test will be completed to the correct standard.

EXCITER

The exciter used for this project is the Dayton audio DAEX30HESF-4 High Efficiency steered Flux Exciter, which is the most powerful exciter in Dayton audio line. It has an impedance of 4 Ohms and an RMS Power Handling 40 watts. The exciter can be seen in *figure 1*.

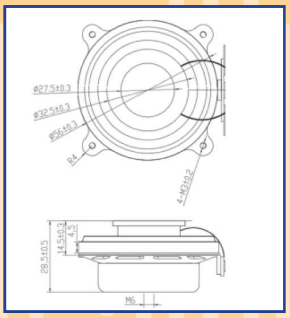

Figure 1. (Ohm, 2020)

INITIAL BUILD

A DML consists of two main parts; the exciter and the material that the exciter is going to vibrate. When planning the build, it is important that different types and size of materials are tested before creating the final DML, so that the most efficient and effective material can be used. The flowing materials were selected for testing:

Hard Wood plywood	density of: 500-600kg/m^3
Marine Plywood	density of: 680-800kg/m^3
Soft plywood	density of: 460-520kg/m^3
Oriented Strand Board (OSB)	density of: 600-680kg/m^3
Chip Board	density of: 620-740kg/m^3
Medium density Fibreboard (MDF)	density of: 700-720kg/m^3
Polystyrene	density of: 11-32kg/m^3

PILOT TESTS

Due to the circumstances only two pilot test where completed, in *figure 2* you can see the set up of the pilot tests and in *figure 3* you can see the data collected.

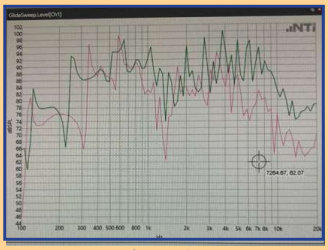

Figure 2.

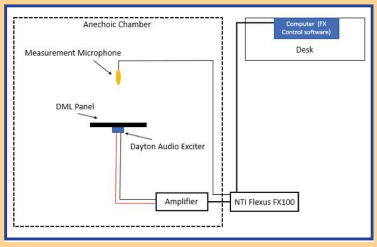

Figure 3.

PLANED TESTS

Using the method the tests would have tested two different sizes of 7 different materials, one size being width 29.7cm, length 42cm, depth 9mm and the other being width 60cm, length 80cm, depth 9mm. As well as changing the positioning of the exciter from central to off axis.

CONCLUSION

Overall this project has had its limitations, yet the information displayed, allows the reader to gain an insight into what a DML speaker is and provides a detailed method to evaluate the materials that could be used to make a DML speaker.