

ENGINEERING RESEARCH INSTITUTE
UNIVERSITY OF MICHIGAN
ANN ARBOR

QUARTERLY REPORT

UMH - 3

CONTRACT NOrd-7924

(Period 1 April to 1 July 1951)

Project M604-9

U.S. NAVY DEPARTMENT, BUREAU OF ORDNANCE
CONTRACT NOrd-7924, TASK UMH-3

25 July 1951

UMH-3-B BOUNDARY-LAYER STUDIES

UMH-3-D TURBULENCE

PROBLEM STATEMENT

This problem embraces the construction of apparatus for measuring intensity and scale of velocity fluctuations, and the use of such apparatus in a study of the effects of airstream turbulence on the evaporation of a liquid fuel spray. Also included is the development of methods for comparing rates of evaporation in a series of experiments. The variables to be investigated are intensity and scale of turbulence and the airstream velocity.

PERSONNEL WORKING ON PROBLEM

The personnel working on the problem consists of A. R. Hanson supervised by Arnold M. Kuethe.

WORK ACCOMPLISHED

(Period 1 April to 1 July, 1951)

The final report CM-667, "The Effects of Turbulence and Wind Speed on the Rate of Evaporation of a Fuel Spray," has been printed for distribution.

FUTURE WORK

The issuance of CM-667 terminates the problem contract.

UMH-3-F ON THE TRANSPORT PHENOMENA IN RAREFIED GASES

PROBLEM STATEMENT

Theoretical investigation of transport phenomena in rarefied gases.

PERSONNEL WORKING ON PROBLEM

The personnel working on the problem are C. S. Wang Chang and George E. Uhlenbeck.

WORK ACCOMPLISHED

(Period 1 April to 1 July, 1951)

Part of the time has been spent on the continuation of the study of the transport phenomena in polyatomic gases, including the preparation of a detailed report under that title. This report contains the calculation of the transport coefficients and the relaxation time. It also correlates our work with the published works of others, especially on the dispersion of sound and the relaxation time.

Attention has been turned back to the first approximation calculation of the drag on a small sphere. It involves complicated multifold integrals, and considerable difficulty has been met with.

FUTURE WORK

(Period 1 July to 1 October, 1951)

It is hoped that the difficulties in the calculation of the drag on a small sphere can be overcome, since once a particularly favorable order of integration is found the extension to more practical cases of general geometry might be possible. A large portion of the time of the next few months will probably be spent on this calculation.

UMH-3-H HYDRAULIC VACUUM DEVICE

PROBLEM STATEMENT

Study of the characteristics of hydraulic vacuum devices which may be used in connection with large hydraulic compressors. This investigation is to cover vacuum-air mass flow characteristics down to one-tenth atmosphere absolute pressure for an assumed optimized design. The study is to be theoretical and experimental on scale models, and is to be carried to such a stage that a comprehensive evaluation can be made of the device's usefulness in connection with a supersonic ram jet testing laboratory.

PERSONNEL WORKING ON PROBLEM

The personnel engaged during this quarter were R. A. Dodge, W. W. Hagerty, and J. W. Luecht.

WORK ACCOMPLISHED

(Period 1 April to 1 July, 1951)

Experimental work was continued after the apparatus had been arranged so as to increase the vacuum leg. Experiments have now been made with three values of three lengths of vacuum leg, and these confirm that considerably greater length than can be had in the laboratory is needed. It appears clear that the method of using water at high velocity to entrain air may make the vacuum device practicable. The work is completed except for the report.

FUTURE WORK

It is planned to complete the report as soon as possible and to close this part of the project.

UMH-3-J VARIABLE MACH NUMBER DEVICE

PROBLEM STATEMENT

1. To conduct an exploratory test program in the University of Michigan 8" x 13" supersonic wind tunnel for the purpose of investigating the use of an inclined or rotating wedge to change the Mach number of a supersonic wind tunnel. The test program shall include the calibration of the flow properties of the wedge test rhombus for both expansion and compression turning.

2. On the basis of the program carried out in accordance with the above paragraph, a complete report is to be prepared which shall include specific recommendations regarding the application of this technique to the Ordnance Aerophysics Laboratory supersonic tunnel.

PERSONNEL WORKING ON PROBLEM

Acting Supervisor for the summer is J. R. Sellars. No other personnel are employed at the present.

WORK ACCOMPLISHED

(Period 1 April to 1 July, 1951)

Construction of the first model as well as some special rake probes is completed, and testing will start when wind tunnel time is available.

FUTURE WORK

(Period 1 July to 1 October, 1951)

The first tests will be designed to investigate only a few of the over-all aspects of the problem, such as tunnel blocking and the determination of the optimum width of wedge to avoid as much side interaction with the wall boundary layer as possible. Subsequent tests will investigate the flow in greater detail as well as attempting to delineate more carefully the practical limits of such tests in tunnels with fixed walls.

