A. Identification

Contractor: Georgia Institute of Technology

Task Order Number: 1

Title: Mass Spectrometric Study of Drift Velocities, Diffusion and Reactions of Ions in Gases

B. Duration

Initial Date: October 1, 1967  Terminal Date: September 30, 1971

C. Cost

Total Amount Allocated by Project Squid: $96,143

During the period covered by this Task Order, this research has been supported in part by the U. S. Air Force Office of Scientific Research. The approximate fractions of the total support during this period are:

Project Squid - 50%

U.S. A.F.O.S.R. - 50%

The Georgia Institute of Technology has contributed to the Project Squid-supported program as outlined in our proposals of February 8, 1967; January 5, 1968; January 10, 1969; and January 21, 1970 by providing research equipment and salaries as indicated below:


Dr. D. J. Volz (Postdoctoral Fellow) - 1/2 time 1 September 1968 - 31 August 1970.

Dr. G. M. Thomson (Postdoctoral Fellow) - 1/2 time 15 September 1970 - 30 September 1971.
D. Participation (during the 48 months covered by the Task Order)

<table>
<thead>
<tr>
<th>Name of Investigator</th>
<th>Proportion of working time devoted to research</th>
<th>Fraction of salary charged to project **</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. E. W. McDaniel</td>
<td>25%</td>
<td>12.5%</td>
</tr>
<tr>
<td>Dr. D. W. Martin</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Dr. I. R. Gatland</td>
<td>13.5</td>
<td>13.5</td>
</tr>
<tr>
<td>Dr. D. J. Volz</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Dr. G. M. Thomson</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Mr. T. M. Miller</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Mr. J. T. Moseley</td>
<td>16</td>
<td>6</td>
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<tr>
<td>Mr. R. M. Snuggs</td>
<td>38</td>
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<tr>
<td>Mr. M. Takebe</td>
<td>3</td>
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<tr>
<td>Mr. H. A. Hunnicutt</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mr. J. H. Schummers</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Mr. J. Kalb</td>
<td>6</td>
<td>6</td>
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<tr>
<td>Mr. R. Laser</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Mr. D. R. James</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Mr. E. Graham</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

* Total man-months spent on this research divided by 48 months x 100

** Total salary charged to Project Squid divided by total salary for 48 months x 100
The following graduate students employed on the project were candidates for master's degrees in Physics during their employment: H. A. Hunnicutt, J. Kalb, R. Laser, D. R. James, and E. Graham.

The following graduate students employed on the project were candidates for Ph.D. degrees in Physics during their employment, the year in which each received his degree being indicated: T. M. Miller (1968), J. T. Moseley (1969), R. M. Snuggs (1970), J. H. Schummers (expected in 1972). In each case, the project research provided the basis for the award of the degree.

E. Object

The initial goal under the previous sub-contract with the University of Virginia was to design and build a drift tube mass spectrometer which would enable us to make accurate, quantitative studies of the behavior of mass-identified ions drifting, diffusing, and reacting in gases at thermal and supra-thermal energies at room temperature. This goal was accomplished. Under the present sub-contract with Purdue University, the apparatus was to be used to study ions in their various parent gases. At the same time, a theoretical program was to be undertaken which would provide the analysis necessary for the extraction of basic information on ionic drift, diffusion, and reactions from the raw data provided by the experiments.

F. Achievement

Measurements have been made on ions in hydrogen, deuterium, nitrogen, oxygen, nitric oxide, and carbon monoxide, and the theoretical analysis described above has been carried out. This research has resulted in the following publications:


During the period covered by this report, the following publications have also appeared or are in preparation:


G. Future Plans

The research described here is being continued with the aid of a grant from the U.S. Air Force Office of Scientific Research. In the near future, experiments will be performed on ions in the parent gases N_2O and CO_2.