

**Contract Report 5-32979**

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**REFINE RESEARCH PLAN  
FOR USE OF ATLAS DATA  
5-32979**

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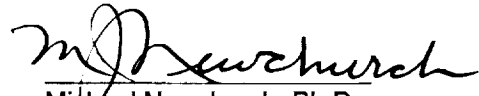
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The principal investigator was Dr. Michael Newchurch.

Dr. Tim Miller of the Earth System Processes and Modeling Branch, Earth Science & Applications Division, Space Science Laboratory, MSFC/NASA was the technical coordinator for MSFC.

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Approval:

  
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**ATLAS**  
**Final Report**  
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**Principal Investigator: M.J. Newchurch**

**Introduction**

The purpose of this work supporting the ATLAS-2 mission scientist, Dr. Tim Miller at MSFC, is to provide scientific understanding of the stratospheric chemical measurements performed by the suite of ATLAS instruments. To accomplish this objective, the principal investigator continued a collaboration with Dr. Mark Allen at JPL to perform photochemical model studies of the stratosphere and continued a collaboration with Dr. Derek Cunnold at Georgia Tech to study SAGE and Dobson Umkehr ozone measurements. This effort resulted in one SAGE II science team presentation and two journal papers accepted pending revision.

**ATLAS-2 Mission Scientist Team**

As a member of the ATLAS-2 Mission Scientist Team, the principal served on console during the ATLAS-2 mission that flew on board STS-56 Discovery.

**JPL Model**

The JPL model is a 1-dimensional, time-dependent photochemical model with exhaustive photochemical treatment, spherical geometry, and accurate radiative transfer [Froidevaux et al., 1985]. This model has been used to investigate trace constituents critical to stratospheric chemistry [Allen and Delitsky 1990, 1991]. These studies used measurements from the ATMOS instrument when it flew on the Space Lab-3 mission. The ATMOS instrument is now a part of the ATLAS payload.

The work on this contract has focused on studying the effect of initial model partitioning of chlorine on the resultant concentration of chlorine monoxide (ClO) a critical trace species in the ozone destruction mechanism. Having developed a working relationship with the appropriate scientists and having developed a working knowledge of the model including the necessary computer hardware and software, the principal investigator is now operating the JPL model at MSFC and the scientific assessment of the chlorine partitioning is in progress. We are also comparing model results to balloon measurements of Waters and Chance.

**SAGE and Umkehr analysis**

One of the critical questions in the area of stratospheric ozone is the magnitude of the trend of ozone amounts. Two of the primary instruments for measuring trends are the orbiting Stratospheric Aerosol and Gas Experiment and the ground-based Dobson instruments. During this year, the principal investigator was selected as a member of the SAGE II science team. In collaboration with Dr. Derek Cunnold, the principal investigator will performed extensive analysis of the SAGE II and Umkehr data sets in an intercomparative study. As a result of the first SAGE II meeting, the principal investigator

formed an affiliation with a number of other scientists that are interested in collaborating on research of interest to the ATLAS program.

### Conclusion

As a result of this contract, the principal investigator developed an ability to run the JPL 1-dimensional time-dependent photochemical model at MSFC and is currently investigating a critical scientific question concerning chlorine photochemistry. Additionally, he has conducted research into the relationship between two key ozone measurement instruments (SAGE and Dobson Umkehr). The results of this research were presented at the first meeting of the newly reformed SAGE II science team, of which the principal investigator is now a member and accepted, pending revision, by JGR (Newchurch and Cunnold, 1993a, 1993b). The principal investigator also served on-console as a member of the ATLAS-2 Mission Scientist team during the mission.

### References

- Allen, M.A., and M.L. Delitsky, Stratospheric NO, NO<sub>2</sub>, and N<sub>2</sub>O<sub>6</sub>: A comparison of model results with Spacelab 3 Atmospheric Trace Molecule Spectroscopy measurements, *J. Geophys. Res.*, 95, 14,077-14,082, 1990.
- Allen, M.A., and M.L. Delitsky, Inferring the abundances of ClO and HO<sub>2</sub> from Spacelab 3 Atmospheric Trace Molecule Spectroscopy observations, *J. Geophys. Res.*, 96, 2913-2919, 1991.
- Froidevaux, L., M.A. Allen, and Y.U. Yung, A critical analysis of ClO and O<sub>3</sub> in the mid-latitude stratosphere, *J. Geophys. Res.*, 90, 12,999-13,029, 1985.
- Newchurch, M.J., and D.M. Cunnold, Aerosol effect on Umkehr ozone profiles using SAGE II measurements, accepted pending revision *J. Geophys. Res.*, 1993a.
- Newchurch, M.J., and D.M. Cunnold, SAGE II-Umkehr ozone profile comparisons, accepted pending revision by *J. Geophys. Res.*, 1993b.