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(NASA-CR-152503) RESEARCH OF MAGNETOSPHERIC  
PHYSICS PHENOMENA USING SOUNDING ROCKETS

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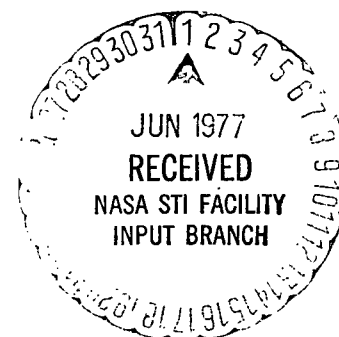
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Edward E. Bissell  
Chief Engineer for Operations  
Sounding Rocket Division  
NASA/GSFC  
Greenbelt, Maryland 20771



Dear Mr. Bissell:

This is the Semi-Annual Status Report covering work performed on grant NSG 5088 (Electron Echo IV, 21.027UE and Electron Echo V, 27.003UE) during the period 1 July, 1976 through 31 December, 1977. Since Dr. J.R. Winckler is presently on sabbatical, we are writing this report in his absence.

During this period, data analysis has continued on Echo IV, which was successfully launched from Poker Flat Research Range, Fairbanks, Alaska on 31 January, 1976. Efforts have been coordinated with the Echo IV associate investigators from the University of Alaska and the University of New Hampshire. The data analysis has included an extensive study of the electron accelerator beam, detector data correlations with the electron beam injections, and the study of about 30 onboard detected echoes.

Dr. J.R. Winckler, while on his sabbatical in the western United States and Europe, has given numerous talks and exchanged much information about the Echo IV results.

During this period Echo V development continued. The new design of the electron gun and circuits was completed and an increased current (200 milliamps at 40 kilovolts) gun was successfully tested. Also during this time a preliminary flight gun program was designated to incorporate four of these increased current guns. Layout and design work on the proposed payload was also extensively pursued. In August the Echo V mission vehicle was changed from an Aries (24.008UE) to a Nike Black Brant VC (27.003UE). Due to this change a second Echo V Pre-PIC was attended on 21 October, 1976, with an experimenter's data package presented.

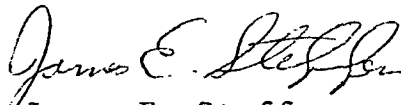
In November the feasibility and scientific merits of flying a separated payload with experiments and telemetry on both sections was investigated. On 17 December 1976 a new experimenter's data package was sent to Sounding Rocket Division (SRD) with this new separated payload design. This option of flying a separated payload was later rejected in favor of a single payload due to weight limitations of the Nike Black Brant VC.

The Echo V integration at SRD was scheduled to start the first week in November, 1977, with the launch window at Poker Flat Research Range set as the first week in February, 1978.

During this period there have been no publications relating to the Echo Experiment; however, a complete Echo bibliography is included for reference.

The Research and Technology Resume (NASA form T43) will be completed by Professor J.R. Winckler upon his return in June.

Sincerely,



James E. Steffen  
Research Fellow



Kenneth N. Erickson  
Adjunct Associate Professor

JES/KNE/jl  
cc: Virginia Kendall ✓  
Code 250.5 GSFC

## BIBLIOGRAPHY

Papers on the Electron Echo Experiments by University of Minnesota

- "Electron Echo Experiment: A New Magnetospheric Probe", R.A. Hendrickson, R.W. McEntire, J.R. Winckler, *Nature* 230, pp 564, 1971.
- "Controlled Experiment on Wave-Particle Interactions in the Ionosphere", D.G. Cartwright, P.J. Kellogg, *Nature*, 231, pp. 11, 1971.
- "Plasma Waves Artificially Induced in the Ionosphere", J.W. Jones and P.J. Kellogg, *J. Geophys. Res.*, 75, 2166, 1973.
- "Observations of Radiation from an Electron Beam Artificially Injected into the Ionosphere", D.G. Cartwright and P.J. Kellogg, *J. Geophys. Res.*, 79, 1439, 1974.
- "Electron Echo Experiment 1: Comparison of Observed and Theoretical Motion of Artificially Injected Electrons in the Magnetosphere", R.W. McEntire, R.A. Hendrickson, and J.R. Winckler, *J. Geophys. Res.*, 79, 2343, 1974.
- "An Investigation of Wave-Particle Interactions and Particle Dynamics Using Electron Beams Injected from Sounding Rockets", J.R. Winckler, *Space Science Rev.*, 15, p. 751, 1974.
- "Investigation of Electron Dynamics in the Magnetosphere with Electron Beams Injected from Sounding Rockets", J.R. Winckler, *J. Geophys.* 40, p. 729, 1974.
- "Echo II: A Study of Electron Beams Injected into the High-Latitude Ionosphere from a Large Sounding Rocket", J.R. Winckler, R.L. Arnoldy and R.A. Hendrickson, *J. Geophys. Res.*, 80, p. 2083, 1975.
- "Echo II: Observations at Churchill of a 4 keV Peak in Low-Level Electron Precipitation", R.L. Arnoldy, R.A. Hendrickson, and J.R. Winckler, *J. Geophys. Res.*, 80, 2316, 1975.
- "Measurements of 3914 Å Light Production and Electron Scattering from Electron Beams Artificially Injected into the Ionosphere", Gordon Israelson and J.R. Winckler, *J. Geophys. Res.*, 80, 3709, 1975.
- "Echo I: An Experimental Analysis of Local Effects and Conjugate Return Echoes from an Electron Beam Injected into the Magnetosphere by a Sounding Rocket", R.A. Hendrickson, R.S. McEntire, and J.R. Winckler, *Planet. & Sp. Sci.*, 23, 1431-1444, 1975.

"A Determination of F-Region Effective Recombination Coefficients from the Echo II Sounding Rocket Plasma Wave and Particle Measurements", R. L. Arnoldy, R. A. Hendrickson and J. R. Winckler, J. Geophys. Res., 80, p. 4307, 1975.

"The University of Minnesota Electron Echo Experiments", P. J. Kellogg, D. G. Cartwright, R. A. Hendrickson, S. J. Monson, and J. R. Winckler. Presented at June, 1975, COSPAR meeting, to be published in Space Research.

"Whistler Mode Plasma Waves Observed on Electron Echo II", S. J. Monson, P. J. Kellogg, and D. G. Cartwright, J. Geophys. Res. 81, p. 2193-2199, 1976.

"Electron Echo III: In Situ Measurements of Vector Ion Flow in the Ionospheric F-Region", B. G. Morgan and R. L. Arnoldy (University of New Hampshire).

"Electron Echo III: Description of Geophysical Conditions and Comparison of Radar and In-flight Ion Drift Measurements", J. R. Winckler, R. L. Arnoldy and R. A. Hendrickson.

"Electron Echo III: Comparison of Observed Echo Results and Various Magnetic Field Models", R. A. Hendrickson and J. R. Winckler.

(The last three are abstracts for 56th Annual Meeting, AGU 16-20 June, 1975, Washington, D. C.).

"Echo III: The Study of Electric and Magnetic Fields with Conjugate Echoes from Artificial Electron Beams Injected into the Auroral Zone Ionosphere", R. A. Hendrickson, R. L. Arnoldy and J. R. Winckler, Geophys. Res. Letters 3, p. 409, 1976.

"The Electron Echo Experiments: Injection of Energetic Electrons into the Earth's Magnetosphere", R. A. Hendrickson, COSPAR Symposium on Active Experiments in Space Plasma, Boulder, Colo., June 3-5, 1976.

"Ground Observations of Radio Signals from a 10-40 keV Electron Beam in the Ionosphere", S. J. Monson and P. J. Kellogg (COSPAR, Symposium on Active Experiments in Space Plasma, Boulder, Colo., June 3-5, 1976).

"Observations of the Medium Around a 10-40 keV Electron Accelerator in the Ionosphere", P. J. Kellogg and S. J. Monson (COSPAR Symposium on Active Experiments in Space Plasma, Boulder, Colo., June 3-5, 1976).

"A Summary of Recent Results under the 'Echo' Program for the Study of the Magnetosphere by Artificial Electron Beams", J.R. Winckler, Cosmic Physics Technical Report #168, 1976.