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13. ABSTRACT (Maximum 200 words)  
  
This is the final report for the contract N00014-90-C-0003. Under this contract a HF plasma wave receiver was delivered for the Swedish spacecraft Freja and subsequently launched in October, 1992. The receiver was designed to sense short wavelength intermittent plasma waves in the frequency range characterized by the electroplasma and gyrofrequency. The receiver is operating nominally and preliminary data analysis indicates the common occurrence of coherent and modulated Langmuir waves with amplitudes of several to greater than 20 mV/m.

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Final Technical Report for  
DOD Award No. N00014-90-C-0003

OSP #18378

Studies of Electrostatic Waves and VLF-Wave Particle Interaction in the  
Ionosphere

Principal Investigator - Paul M. Kintner

The ONR contract to Cornell University (N00014-0-C-0003) was awarded to design and construct a high frequency plasma wave instrument for the Swedish spacecraft Freja and to understand the sources and effects of electrostatic waves in the ionosphere.

The HF plasma wave instrument was designed, constructed, and delivered to the Swedish Space Corporation. The instrument was launched on the Freja satellite in October, 1992 and performed nominally. The HF instrument was designed to provide the first electric field waveforms in the frequency range 50 kHz - 47 Hz. Preliminary data reduction shows nearly monochromatic waves with large amplitudes. As of this date the instrument is spreading as designed and is expected to continue operating for the Freja lifetime.

The study of electrostatic waves in the ionosphere covered several scientific themes from spatial irregularities to ion beam generated waves. Much of the study used data from the Viking spacecraft but also included data from some NASA spacecraft. In total this study produced 10 publications in refereed, archived journals, five invited presentations, and 10 contributed presentations. The papers and presentations are listed in the Appendix.

In addition, two graduate students received major funding from this grant. Both students have completed their Ph.D. degrees. One, Wayne Scales, is an assistant professor at Virginia Polytechnic Institute and the other, Jorge Vago, is a postdoctoral associate with the European Space Agency.

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## Appendix

### A. Published Work Acknowledging ONR

- Holmgren, G., and P. M. Kintner, Experimental evidence of widespread regions of small scale plasma irregularities in the magnetosphere, *J. Geophys. Res.*, 95, 6015, 1990.
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- Garbe, G. P., R. L. Arnoldy, T. E. Moore, P. M. Kintner, and J. L. Vago, Observations of transverse ion acceleration in the topside auroral ionosphere, *J. Geophys. Res.*, 97, 1257, 1992.
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- Vago, J. L., P. M. Kintner, S. W. Chesney, R. L. Arnoldy, K. A. Lynch, T. E. Moore, and C. J. Pollock, Transverse ion acceleration by localized lower hybrid waves in the topside auroral ionosphere, *J. Geophys. Res.*, 97(A11), 16,935-16,957, 1992.

## **B. Invited Papers Acknowledging ONR**

- Kintner, P. M., Plasma wave processes in the low altitude auroral acceleration zone, Cambridge Workshop in Theoretical Geoplasma Physics, 1989.
- Kintner, P. M., Plasma waves and transverse ion acceleration - A tutorial lecture, Cambridge Workshop in Theoretical Geoplasma Physics, 1991.
- Kintner, P. M., Plasma waves and transversely accelerated ions in the Terrestrial Ionosphere, APS Division of Plasma Physics Meeting, 1991.
- Bostrom, R., G. Holmgren, and P. M. Kintner, Determining electric fields from double density probe measurements of plasma convection, AGU Fall Meeting, 1991.
- Kintner, P. M., J. Vago, R. Arnoldy, T. Moore, and C. Pollock, Localized transverse ion acceleration by lower hybrid waves, Chapman Conference on Microscale and Mesoscale Phenomena in Space, 1992.
- Kintner, P. M., Transverse ion acceleration in the O<sup>+</sup> source region, Spring AGU Meeting, 1992.

## **C. Contributed Papers Acknowledging ONR**

- Moore, T. E., D. L. Reasoner, R. L. Arnoldy, and P. M. Kintner, Topside observations of the auroral ionosphere, American Geophysical Union Spring Meeting, 1989.
- Pollock, C. J., T. E. Moore, R. L. Arnoldy, L. J. Cahill, and P. M. Kintner, Three-D thermal/super thermal ion composition measurements obtained during the ARCS 4 sounding rocket flight, American Geophysical Union Fall Meeting, 1990.
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