COMBINED RELEASE AND RADIATION EFFECTS SATELLITE (CRRES) EXPERIMENTS DATA COLLECTION, ANALYSIS, AND PUBLICATION


Research Institute
The University of Alabama in Huntsville
CONTRACTOR REPORT

COMBINED RELEASE AND RADIATION EFFECTS
SATELLITE (CRRES) EXPERIMENTS
DATA COLLECTION, ANALYSIS, AND
PUBLICATION

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CONTRACT NO. / DELIVERY ORDER NO. NAS8-30886/11

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Combined Release and Radiation Effects Satellite (CRRES) program experiments data collection, analysis, and publication activities are described. These activities were associated with both the satellite chemical releases and a planned Puerto Rico sounding rocket campaign. To coordinate these activities, a working group meeting was organized and conducted.
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ABSTRACT

Combined Release and Radiation Effects Satellite (CRRES) program experiments data collection, analysis, and publication activities are described. These activities were associated with both the satellite chemical releases and a planned Puerto Rico sounding rocket campaign. To coordinate these activities, a working group meeting was organized and conducted.
ACKNOWLEDGEMENTS

The authors gratefully acknowledge the cooperation encountered in collecting, analyzing, and publishing data. These data were provided by all Principal Investigators associated with the CRRES program. Presentation of summary data in this report should not imply any claims on origination of the data.

The services provided by Mr. Morgan McCook are also gratefully acknowledged. His consulting services were critical to successful performance of this effort. In addition, conversations with MSFC personnel at various points in time during this investigation were both helpful and quite insightful.
This technical report was prepared by the University of Alabama in Huntsville Research Institute. This is the final report of technical work performed under contract number NAS8-36955, Delivery Order Number 11.

The principal investigator was Terry N. Long, Associate Director of the UAH Research Institute. Most of the technical work was performed by Melanie O. Alzmann of the UAH Research Institute and Mr. Morgan McCook acting as an independent consultant. Mr. Clarence Gearhart of the Institutional Control Branch, Assistant Director for Management Office, Science and Engineering Directorate, Marshall Space Flight Center, NASA was the technical coordinator.

The views, opinions and/or findings contained in this report are those of the authors and should not be construed as an official MSFC position, policy, or finding unless so specified by other MSFC/NASA documentation.

Except as may be otherwise authorized, this report and its findings require MSFC approval before release to third parties.
INTRODUCTION

The University of Alabama in Huntsville Research Institute has participated in the CRRES Program since May 1989 with various data management, scheduling, configuration management, and working group coordination and participation functions. Investigator working group meetings have been conducted at the many strategic locations, planned and arranged by the Research Institute. The CRRES satellite assembly, launch, and chemical releases have been documented on film and video tape. The CRRES sounding rockets have been filmed and video taped during their development and testing. Additionally, the Research Institute has worked closely with the CREES project office by keeping it continuously aware of schedules and achievements and by assisting in both information gathering and research data collection.

This delivery order concentrated on experiments data collection, analysis, and publication activities. These activities were associated with both the satellite chemical releases and a planned Puerto Rico sounding rocket campaign. To coordinate these activities, a working group meeting was organized and conducted.
SUMMARY

Contact with the satellite was lost on 12 October 1991. Ball's summary description of the event is provided in Appendix A. For completeness, a summary of CRRES chemical releases information is provided in Appendix B. This includes a summary table and detailed parameters in three additional tables. The first detailed parameter table is the time and location of each release. The second detailed parameter table gives the chemical makeup of each canister. And the third set of tables is a listing of the orbital elements associated with each release.

An Investigators Working Group meeting was conducted 27-29 October 1991 at Goddard Space Flight Center in Greenbelt, MD. Documentation of the meeting activities was accomplished and distributed to the CRRES project office. An agenda of the meeting is included in Appendix C along with an attendees list. To support this meeting, several preparatory meetings were required in Washington, D.C.

Most of the data gathered during this effort was gathered in conjunction with the 27-29 October 1991 Working Group meeting. The format of CRRES Release Experiment Summaries and a sample summary are provided in Appendix D. A listing of the packages of data acquired and being held by the University of Alabama in Huntsville is provided in this report's bibliography.

Working sessions were performed at Wallops Flight Facility with mechanical technicians and payload managers to develop requirements for a sounding rocket campaign to be held by the CRRES program in the spring of 1992. A list of sounding rocket campaign requirements developed during these sessions follows:
Science Requirements Topics For A Sounding Rocket Program

| Payload Requirements: | Pointing (simple & complex)  
| | Deployments (booms)  
| | Separations (ejectables)  
| | Chemical Releases  
| | Data Rates  
| | Recoverable Payloads  
| | Up-link Commands  
| | Real-Time Decision Points  
| Supporting Services: | Parts  
| | Modelling  
| | Testing  
| | Trajectories  
| | Logistics  
| Special Requirements: | In-situ Measurements vs. Remote Sensing  
| | Students  
| | Launch Windows  
| | Launch Criteria  
| | Coordinator With Satellite  
| | Instrument Development  
| | Quick Response to the Unanticipated  

Working sessions were also held at Wallops Flight Facility with the sounding rocket campaign manager and electrical technicians to develop a schedule of windows for the CRRES sounding rocket campaign. A draft schedule was derived and provided to the CRRES Project Scientist. This preliminary schedule is included in Appendix E.
CONCLUSIONS AND RECOMMENDATIONS

The CRRES Program completion will be an exciting achievement for both NASA and the University of Alabama in Huntsville. Plans are underway for The Sounding Rocket Campaign in Puerto Rico. It is recommended that any additional scopes of work that may be developed for future phases of the CRRES program be directed to the UAH Chemistry Department with George Miller designated as the Principal Investigator. To support this, the Research Institute's Senior Research Project Coordinator familiar with the CRRES program will be transferred to the Chemistry Department to provide continuity with any future delivery orders.

An excellent opportunity for student involvement exists to aid in the collection of research data from the CRRES chemical releases. Additionally, student involvement is encouraged in future documentation of CRRES achievements and execution of working group meetings.

The planned sounding rocket launches in Puerto Rico have renewed the need for close coordination between Principal Investigators, NASA staff, and the CRRES Project Office. Hopefully, the University of Alabama in Huntsville will be given the opportunity to provide a key role in the renewed CRRES program.
BIBLIOGRAPHY


Appendix A

Ball's Satellite Status Report Summary
CRRES STATUS

LAST GOOD CONTACT WITH CRRES WAS OCTOBER 12, 1991
AT 1010-1025 GMT.
NO RESPONSE AT 1200-1250 GMT.
SHORT (2-3 MINUTE) TRANSMITTER SIGNALS WERE HEARD
ON OCTOBER 16 AND 17.
NO RESPONSE SINCE.
PROBABLE CAUSE IS A BATTERY SHORT.
IF SPACECRAFT IS UNDERVERVOLTAGE IT IS PROBABLY VERY
COLD, BUT IT SHOULD WARM UP BY MID-NOVEMBER
TO EARLY DECEMBER.
ATTEMPTS TO CONTACT ARE CONTINUING.
Appendix B

CRRES Release Information Summaries
<table>
<thead>
<tr>
<th>EXPERIMENT</th>
<th>Release Number</th>
<th>HOLE #</th>
<th>RELEASE CMD#</th>
<th>CANISTER TYPE and CHEMICAL</th>
<th>CHEM WT (LBS)</th>
<th>EJECT ** WT (LBS)</th>
<th>RELEASE LOCATION</th>
<th>RELEASE TIMER</th>
<th>OBSERVATIONAL SUPPORT</th>
<th>RELEASE PERIOD</th>
<th>OBSERVATIONAL SUPPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-Altitude Magnetospheric</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diamagnetic Cavity, Plasma</td>
<td>G-2</td>
<td>37</td>
<td>6</td>
<td>Small Ba,2% Sr</td>
<td>7.54</td>
<td>19.29</td>
<td>North America, 19 Re</td>
<td>25 MIN</td>
<td>N. Hemisphere</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coupling</td>
<td>G-3</td>
<td>16</td>
<td>11</td>
<td>Small Ba,2% Sr</td>
<td>7.51</td>
<td>19.27</td>
<td>North America, 35 Re</td>
<td>25 MIN</td>
<td>Winter,90-91 moon down</td>
<td></td>
<td>Ground sites in both Northern and Southern Hemispheres</td>
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<tr>
<td>G-4</td>
<td>13</td>
<td>3</td>
<td></td>
<td>Small Ba,2% Sr</td>
<td>7.47</td>
<td>19.22</td>
<td>North America, 55 Re</td>
<td>25 MIN</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Stimulated Electron</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precipitation/ Aurora Prod.</td>
<td>G-5</td>
<td>17</td>
<td>18</td>
<td>Large Li,3% Eu</td>
<td>20.33</td>
<td>45.09</td>
<td>North America, &gt;6.0 Re</td>
<td>25 MIN</td>
<td>N. Hemisphere</td>
<td></td>
<td>Same as G-2,3,4 with addition of Millstone radar(foot of field)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>41</td>
<td></td>
<td>Large Li,3% Eu</td>
<td>20.33</td>
<td>45.09</td>
<td></td>
<td>25 MIN</td>
<td>Winter,90-91 moon down</td>
<td>0000 0200 LT</td>
<td></td>
</tr>
<tr>
<td>Stimulated Ion-Cyclotron</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Waves and Ion Precipitation</td>
<td>G-6</td>
<td>24</td>
<td>8</td>
<td>Large Li,3% Eu</td>
<td>20.33</td>
<td>45.09</td>
<td>North America, &gt;6.0 Re</td>
<td>25 MIN</td>
<td>N. Hemisphere</td>
<td></td>
<td>Same as G-2,3,4 with addition of Millstone radar(foot of field)</td>
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<tr>
<td></td>
<td></td>
<td>48</td>
<td></td>
<td>Large Li,3% Eu</td>
<td>20.30</td>
<td>45.02</td>
<td></td>
<td>25 MIN</td>
<td>Winter,90-91 moon down</td>
<td>2200-2400 LT</td>
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<tr>
<td>Ion Tracing and Acceleration</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>G-7</td>
<td>22</td>
<td>22</td>
<td>Large Li,3% Eu</td>
<td>20.28</td>
<td>45.09</td>
<td>North America, &gt;6.0 Re</td>
<td>25 MIN</td>
<td>N. Hemisphere</td>
<td></td>
<td>Same as G-2,3,4 with addition of Millstone radar(foot of field)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>46</td>
<td></td>
<td>Large Li,3% Eu</td>
<td>20.30</td>
<td>45.11</td>
<td></td>
<td>25 MIN</td>
<td>Winter,90-91 moon down</td>
<td>2000 0200 LT</td>
<td></td>
</tr>
<tr>
<td>Stimulating Magnetospheric</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Substorm</td>
<td>G-10</td>
<td>21</td>
<td>2</td>
<td>Large Ba,2% Sr</td>
<td>27.77</td>
<td>51.53</td>
<td>North America, &gt;6.0 Re</td>
<td>25 MIN</td>
<td>N. Hemisphere</td>
<td></td>
<td>Same as G-2,3,4 with addition of Millstone radar(foot of field)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45</td>
<td></td>
<td>Large Ba,2% Sr</td>
<td>26.76</td>
<td>51.57</td>
<td></td>
<td>25 MIN</td>
<td>Winter,90-91 moon down</td>
<td>0000-0200 LT</td>
<td></td>
</tr>
<tr>
<td>Caribbean Perigege</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Gravitational Instability,</td>
<td>G-8</td>
<td>*19</td>
<td>19</td>
<td>Large Ba,2% Sr</td>
<td>26.79</td>
<td>51.60</td>
<td>Field line pass thru Jacarca, Peru</td>
<td>25 MIN</td>
<td>NASA DC-8 and Argentine 707 ground sites in Ecuador, Dom. Rep. Jacamara radar,</td>
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<td></td>
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<tr>
<td>Field Equipotentiality</td>
<td></td>
<td></td>
<td></td>
<td>Large Ba</td>
<td>26.77</td>
<td>51.53</td>
<td></td>
<td>25 MIN</td>
<td>Summer,91 moon down,dawn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Line Tracing and</td>
<td></td>
<td>*23</td>
<td>23</td>
<td>Large Ba,4% Li</td>
<td>27.69</td>
<td>52.50</td>
<td>Caribbean latitudes</td>
<td>25 MIN</td>
<td>N. Hemisphere</td>
<td></td>
<td>Same as G-2,3,4 with addition of Millstone radar(foot of field)</td>
</tr>
<tr>
<td>Equipotentiality, Momentum</td>
<td>G-9</td>
<td>*47</td>
<td>47</td>
<td>Large Ba,4% Li</td>
<td>26.77</td>
<td>51.53</td>
<td>450-800 km</td>
<td>25 MIN</td>
<td>Summer,91 two successive moon down periods</td>
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<tr>
<td>Coupling</td>
<td>G-11A</td>
<td>14</td>
<td>4</td>
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<td>7.47</td>
<td>19.22</td>
<td>Caribbean latitudes</td>
<td>450-800 km</td>
<td>N. Hemisphere</td>
<td></td>
<td>Same as G-2,3,4 with addition of Millstone radar(foot of field)</td>
</tr>
<tr>
<td>G-11B</td>
<td>38</td>
<td>20</td>
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<td>Small Ba,2%</td>
<td>7.47</td>
<td>19.22</td>
<td>Caribbean latitudes</td>
<td>450-800 km</td>
<td>Winter,90-91 moon down</td>
<td>2000 0200 LT</td>
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<tr>
<td>G-12A</td>
<td>15</td>
<td>25</td>
<td></td>
<td>Small Ba,2%</td>
<td>7.51</td>
<td>19.27</td>
<td>Caribbean latitudes</td>
<td>450-800 km</td>
<td>Winter,90-91 moon down</td>
<td>2000 0200 LT</td>
<td></td>
</tr>
<tr>
<td>G-12B</td>
<td>39</td>
<td>24</td>
<td></td>
<td>Small Ba,2%</td>
<td>7.47</td>
<td>19.22</td>
<td>Caribbean latitudes</td>
<td>450-800 km</td>
<td>Winter,90-91 moon down</td>
<td>2000 0200 LT</td>
<td></td>
</tr>
<tr>
<td>Diamagnetic Cavity, Plasma</td>
<td>G-1</td>
<td>40</td>
<td>21</td>
<td>Small Ba,2% Sr</td>
<td>7.51</td>
<td>19.27</td>
<td>Caribbean latitudes</td>
<td>450-800 km</td>
<td>N. Hemisphere</td>
<td></td>
<td>Same as G-2,3,4 with addition of Millstone radar(foot of field)</td>
</tr>
<tr>
<td>Coupling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25 MIN</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Critical Velocity</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Ionization</td>
<td>G-13</td>
<td>20</td>
<td>1</td>
<td>Large Ba</td>
<td>26.74</td>
<td>51.46</td>
<td>S. Pacific(American Samoa)</td>
<td>25 MIN+2.5 SEC</td>
<td>Learjet and DC-8 and ground sites in Samoa and Fiji</td>
<td>Aug. 1990</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>44</td>
<td></td>
<td>Large Sr</td>
<td>22.12</td>
<td>46.84</td>
<td>450-600 km</td>
<td>25 MIN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G-14</td>
<td>42</td>
<td>14</td>
<td></td>
<td>Large Ba</td>
<td>26.74</td>
<td>51.64</td>
<td>S. Pacific(American Samoa)</td>
<td>25 MIN+2.5 SEC</td>
<td></td>
<td>Aug. 1990</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>19</td>
<td></td>
<td>Large Ca</td>
<td>21.03</td>
<td>46.84</td>
<td>450-600 km</td>
<td>25 MIN</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*THERE ARE HOLE HOLE BATTERY TEMPERATURE MONITORS.
**EJECT WEIGHT INCLUDES CHEMICAL, CANISTER AND RCU, (ALL RCUS WEIGH 2.89 LB).

Rev. 6 2/22/90

TOTALS 441.09 930.51
FIGURE 1-1 CRRES/GTO HIGH-ALTITUDE RELEASES

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>TYPE</th>
<th>DOPANT</th>
<th>RELEASE LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-2</td>
<td>Sm Ba</td>
<td>(2% Sr)</td>
<td>1.8 earth radII over North America</td>
</tr>
<tr>
<td>G-3</td>
<td>Sm Ba</td>
<td>(2% Sr)</td>
<td>3.5 earth radII over North America</td>
</tr>
<tr>
<td>G-4</td>
<td>Sm Ba</td>
<td>(2% Sr)</td>
<td>5.5 earth radII over North America</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>TYPE</th>
<th>DOPANT</th>
<th>RELEASE LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-5</td>
<td>2 Lg Li</td>
<td>(3% Eu)</td>
<td>&gt;6 earth radII over Millstone Hill Radar Site</td>
</tr>
<tr>
<td>G-6</td>
<td>2 Lg Li</td>
<td>(3% Eu)</td>
<td>(</td>
</tr>
<tr>
<td>G-7</td>
<td>2 Lg Li</td>
<td>(3% Eu)</td>
<td></td>
</tr>
<tr>
<td>G-10</td>
<td>2 Lg Ba</td>
<td>(2% Sr)</td>
<td></td>
</tr>
</tbody>
</table>
The following tables give the parameters of the CRRES releases.

The first table is the time and location of each release done to date. The release is identified by its "G" number, and these numbers correspond to the experiment descriptions in the science definition document.

The second table gives the chemical makeup of each canister. All chemical weights are in grams. The titanium and boron are the thermite components. We assume 100 percent vaporization efficiency of the metals, although that is still under study. Normally the canisters are ignited 24 minutes 58 seconds after ejection from the CRRES satellite. Some canisters have an additional small delay time, and this is shown in the column "DELAY."

The last set of tables is a listing of the orbital elements which are appropriate for each release. The orbital elements are Osculating Keplerian and in most cases the epoch time is very close to the time of the release. Thus they can be used to compute the satellite position and velocity at times spanning the release time with high accuracy. However, no drag terms are included and hence these elements are not useful for determining the satellite position at other times. The Mean Motion is calculated on the basis of the period between perigees before and after the element epoch time. The epoch time is Day of Year.Decimal Day format, with Day 1 = January 1.
<table>
<thead>
<tr>
<th>RELEASE</th>
<th>DATE</th>
<th>TIME</th>
<th>LATITUDE</th>
<th>LONGITUDE</th>
<th>ALTITUDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-13</td>
<td>09/10/90</td>
<td>06:10:25</td>
<td>17.5 S</td>
<td>198.9 E</td>
<td>517</td>
</tr>
<tr>
<td>G-14</td>
<td>09/14/90</td>
<td>08:47:10</td>
<td>18.1 S</td>
<td>161.6 E</td>
<td>593</td>
</tr>
<tr>
<td>G-02</td>
<td>01/13/91</td>
<td>02:17:03</td>
<td>16.9 N</td>
<td>103.1 W</td>
<td>6180</td>
</tr>
<tr>
<td>G-07</td>
<td>01/13/91</td>
<td>07:05:00</td>
<td>8.0 N</td>
<td>86.7 W</td>
<td>33403</td>
</tr>
<tr>
<td>G-03</td>
<td>01/15/91</td>
<td>04:11:00</td>
<td>17.9 N</td>
<td>97.5 W</td>
<td>15053</td>
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<tr>
<td>G-04</td>
<td>01/16/91</td>
<td>06:25:00</td>
<td>0.7 S</td>
<td>53.8 W</td>
<td>23977</td>
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<tr>
<td>G-05</td>
<td>01/18/91</td>
<td>05:20:00</td>
<td>6.6 N</td>
<td>62.8 W</td>
<td>33337</td>
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<tr>
<td>G-10</td>
<td>01/20/91</td>
<td>05:30:00</td>
<td>8.9 N</td>
<td>75.6 W</td>
<td>33179</td>
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<td>G-06</td>
<td>02/12/91</td>
<td>04:15:00</td>
<td>4.9 N</td>
<td>76.1 W</td>
<td>32249</td>
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Appendix C

28-29 October 1991
CRRES Data Exchange Meeting
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TUESDAY, OCTOBER 29

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<td>Baumbach, Mark</td>
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<td>(310) 336-6519</td>
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<td>Bernhardt, Paul A.</td>
<td>Naval Research Lab</td>
<td>(202) 767-0196</td>
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<td>Blanchard, Paul</td>
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<td>(703) 556-7108</td>
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<td>Fritz, Ted</td>
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<td>Stokes, Charles S.</td>
<td>Franklin Res. Center</td>
<td>(215) 666-3020</td>
</tr>
<tr>
<td>Szuszkewicz, Ed</td>
<td>SAIC/LASS</td>
<td>(202) 287-3725</td>
</tr>
<tr>
<td>Valenzuela, Arnoldo</td>
<td>MPE</td>
<td>49-89-3299-3513</td>
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<tr>
<td>Walker, David</td>
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<tr>
<td>Wescott, Gene</td>
<td>Univ. of Alaska</td>
<td>(907) 474-7576</td>
</tr>
<tr>
<td>Wilken, Berend</td>
<td>MPAe - Lindau</td>
<td>49-5551-401-431</td>
</tr>
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Appendix D

Format and Sample of CRRES Release Experiment Summaries
CRRES RELEASE INFORMATION SUMMARY

EXPERIMENT ID (G1 ... G14) AND DATE:

STATION NAME AND LOCATION (GEOGRAPHIC COORDINATES):

PRINCIPAL POINT OF CONTACT (Experimenter's Name (PI), Tel. Number, FAX Number, SPAN or INTERNET address):

EXPERIMENT OBJECTIVES:

EXPERIMENT ELEMENTS (release materials, size and number of canisters, altitude and coordinates of the release, prevailing conditions):

TYPE AND FORM OF DATA ACQUIRED (FILM, VIDEO, FORMATS, ETC):

FIELD(S) OF VIEW OF THE INSTRUMENTS:

TIME PERIODS OF THE DATA, SAMPLING RATES, FRAME RATES:

YOUR ASSESSMENT OF THE QUALITY OF THE DATA (CLOUD COVER PROBLEMS, LIGHT CONTAMINATION):

INITIAL FINDINGS:

MAJOR ISSUES TO BE ADDRESSED BY MORE COMPLETE ANALYSIS OF RESULTS:

(With thanks to Mary Miller and Ed Szuszczewicz)
Experiment ID: G-13

Date: 9/10/90

Principal point of Contact-

Name (PI): Eugena M. Wescott
Tel. Number: (907) 474-7576
FAX: (907) 474-7290
Span: BARNEY::ROCKET

Experiment Objectives: Critical Ionization Velocity (CIV I)

Experiment Elements-

Release Materials: Ba, Sr
Size/# of canisters: 1 large each (Ba 5408g, Sr 3784g)
Release location-
Altitude: 517 km
Latitude: 17.5 N
Longitude: 198.9 E
Release time - 06:10:25 UT
Site location- Air Force C-135 and Aeromet Inc Learjet
Altitude: C-135 10km, Learjet 12km
Latitude(at release): C-135 21.5 S, Learjet 19.3 S
Longitude(at release): C-135 160.5 W, Learjet 164.9 W

Type and Form of Data Acquired: Each plane equipped with: 1) IPD filtered at 4554A (30 A width) saved as both digital integrated data, and video record of integration; 2) Intensified CCD that was run either in straight video mode - unfiltered - or integrated video, filtered at 4078 (30 A width). The C-135 also had a white light intensified camera (ISIT) to record the burst.

Field(s) of View of Instruments: IPDs 20 degrees circular, ICCDs 11x14 degrees

Time Periods of Data: video - 6:00 to 6:30
digital - 6:10 to 6:30
CRRES Release

**Sampling Rates:** integrated data stored every 5 to 15 seconds, varies with conditions

**Frame Rates:** video at 30fps, but IPD image updated every 1s

**Assessment of Data Quality:** Very good for Ba. Ba was seen rising above the terminator from both planes. Fair for Sr - The Sr cloud was very dim, only seen in a few integrated frames on ICCD.

**Initial Findings:** See Wescott et al. 1992 (JGR to be published)

**Additional Research:** In progress
Appendix E

Preliminary Puerto Rico Sounding Rocket Campaign Schedule
<table>
<thead>
<tr>
<th>ROCKET</th>
<th>PRINCIPAL INVESTIGATOR</th>
<th>WINDOW</th>
<th>PAYLOAD MANAGER</th>
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<td>SZUSZCZEWICZ</td>
<td>JUNE 1 - JUNE 13</td>
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<td>MAY 26 - JUNE 6</td>
<td>EBERSPEAKER</td>
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<td>JUNE 8 - JUNE 28</td>
<td>DETWILER</td>
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<td>PFAPP</td>
<td>JUNE 15 - JUNE 28</td>
<td>DETWILER</td>
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<td>SCOTT</td>
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</tr>
<tr>
<td>36083</td>
<td>CARLSON</td>
<td>JULY 6 - JULY 13</td>
<td>SCOTT</td>
</tr>
</tbody>
</table>

The above represents a tentative Puerto Rico Sounding Rocket Campaign SCHEDULE. This schedule was derived by Melanie Alzmann, and should not be considered final. I derived this schedule by compiling information from three sources and determined it to be the most complete and accurate schedule as of January 8, 1992. If changes occur, I will advise as soon as aware.

Melanie A. Alzmann
1/16/92