

**CRRES**

**COMBINED RELEASE AND  
RADIATION EFFECTS  
SATELLITE PROGRAM SUMMARY**

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for

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George C. Marshall Space Flight Center  
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**CRRES SCHEDULE.****APRIL, 1990****PEGSAT**

- Electric Field Structures

**JULY - AUGUST, 1990****KWAJALEIN**

- Spread-F Triggering

**SEPTEMBER, 1990****SOUTH PACIFIC CRITICAL VELOCITY  
RELEASES****JANUARY, 1991****HIGH ALTITUDE RELEASES**

- Cold Plasma Injection
- Plasmoid Formation & Substorm Dynamics
- Diamagnetic Effects

**JULY - AUGUST, 1991****CARIBBEAN PERIGEE**

- Gravitational Instability
- Momentum Coupling
- Field-Line Tracing & Equipotentiality

**MAY - JULY, 1992****PUERTO RICAN ROCKET RELEASES**

- E & F-region Instabilities
- Ionospheric Focused Heating
- Multi-Ion Expansion Processes
- HF Wave Interactions with Heavy Barium Plasma

## ACTUAL LAUNCH SEQUENCE

RELEASE	DATE	TIME	LATITUDE	LONGITUDE	ALTITUDE
Pegsat	04/5/90	19:10:00			
G-13	09/10/90	06:10:25	17.5 S	198.9 E	517
G-14	09/14/90	08:47:10	18.1 S	161.6 E	593
G-02	01//13/91	02:17:03	16.9 N	103.1 W	6180
G-07	01/13/91	07:05:00	8.0 N	86.7 W	33403
G-03	01/15/91	04:11:00	17.9 N	97.5 W	15053
G-04	01/16/91	06:25:00	0.7 S	53.8 W	23977
G-05	01/18/91	05:20:00	6.6 N	62.8 W	33337
G-10	01/20/91	05:30:00	8.9 N	75.6 W	33179
G-06	02/12/91	04:15:00	4.9 N	76.1 W	32249
G-08	02/17/91	03:30:00	0.4 N	58.1 W	33553
G-01	07/13/91	08:35:25	17.8 N	62.9 W	495
G-09	07/19/91	08:37:07	17.4 N	62.6 W	441
G-11a	07/22/91	08:38:24	16.8 N	60.3 W	411
G-11b	07/25/91	08:37:11	17.3	69.5 W	478
G-12	08/12/91	09:31:20	9.1 N	63.5 W	507
AA-3A	05/25/92	19:52:00			250
AA-4	05/30/92	04:11:00			285
AA-3B	06/06/92	08:37:31			173-230 (4)
AA-1	07/2/92	05:01:15			~250 (3)
AA-2	07/12/92	05:02:00			~250 (3)
AA-7	07/04/92	04:58:00			~250 (3)

**PEGSAT****EXPERIMENT: PEGSAT/PEGASUS 001A****Launch Date:** April 5, 1990**Time:** 1910 GMT**Launch Site:** Vandenberg, AFB**Launcher:** Pegasus**Weight:** 1160.0 kg.**Owner:** United States/Orbital Sciences

	<b>APOGEE</b>	<b>PERIGEE</b>	<b>PERIOD</b>	<b>INCLINATION</b>
<b>Initial</b>	680 km	495 km	96.424 min	94.2 min
<b>(current)</b>	599 km	438 km	94.995	94.1 min

**Point of Contact:** Eugene Wescott  
 Geophysical Institute  
 University of Alaska  
 Fairbanks, AK 99701

**SPAN - UAFGI::ROCKET**  
**PHONE (907) 474-7576**  
**FAX - (907) 474-7290**



## EL COQUI

### **EXPERIMENT AA-1**

**Title:** F-Region Irregularity Evolution

**Principal Investigators:** Edward C. Weber, Air Force Physics Laboratory  
Frank T. Kjuth, Geospace Research Inc.

**Co-Investigators:** K. Groves, M.C. Kelley, K. Vickery, L. Linson

**Location:** Arecibo Incoherent Scatter Radar (ISR) Beam,  
Puerto Rico

**Altitude:** 250 Km.

**Time:** Dawn, Launch 05:01:15 AST, Release ~05:03:45 AST  
**Date:** July 2, 1992

**Chemicals:** 22.5 Kg. Barium/2 mole % Strontium

The earth's ionosphere normally reflects high-frequency (HF) radio waves. This radio wave reflection off a smooth conducting ionosphere allows reception of AM radio, long range HF communications, and over-the-horizon surveillance radar. When stressed, this smooth layer fractures and somewhat like a fractured pane of glass obscures transmission in some directions and gives blinding glints in other directions. The ionosphere is electrically charged, and these fractures line up along the direction of the magnetic field and act like a picket fence to scatter radiowaves.

Understanding this plasma fracturing process is a great challenge, both at the level of basic physics and at a practical level of anticipating when the worldwide network of HF and satellite communications will experience degraded performance in certain regions of the world. This experiment and a companion experiment AA-7 will stimulate this plasma fracturing process with large barium releases in the F and E regions of the ionosphere over the Arecibo radar. The radar will diagnose the details of the structuring, and at the same time receivers on aircraft will monitor fading and disruption of satellite radio signals. Comparison of observation with theoretical predictions will be the acid test of present understanding of principles of plasma physics with far reaching implications.

### **EXPERIMENT AA-2**

**Title:** HF Ionospheric Modification of a Barium Plasma

**Principal Investigators:** Frank T. Kjuth, Geospace Research Inc.  
Lewis M Duncan, Clemson University

**Co-Investigators:** Edward C. Weber, M.C. Kelley, P.A. Bernhardt, J. Huba

**Location:** Arecibo High-Frequency Radio Heater Beam,  
Puerto Rico

**Altitude:** 250 Km.

**Time:** Dusk, Launch 05:02 AST; Release ~05:04:30 AST  
**Date:** July 12, 1992

**Chemicals:** 36 Kg. Barium (Ba/2 mole % Strontium), (Ba/2 mole % Europium), (Ba/4 mole % Lithium)

The Arecibo High-Frequency Radio Ionospheric Heater is a facility that is capable of beaming powerful radio waves upward into the ionosphere. These radio waves, millions of watts effective power, are capable of "pushing the ionosphere around" and creating significant perturbations and structures. In this experiment a heavy barium plasma will replace the natural light ionosphere plasma in the beam of the radio wave heater (Here "heavy" and "light" refer to the weight of the ions. Hydrogen and oxygen, the natural ions, have masses of 1 and 16 atomic mass units. while barium is "heavy" with 137 mass units). The heater beam will then be turned onto the new heavy plasma and for the first time scientists will be able to see how this plasma responds to the perturbations, and to compare the results to known results from previous heater experiments with the natural ionosphere.

### **EXPERIMENT AA-3 A**

Principal Investigator: Lewis M Duncan, Clemson University

Time:           Launch 19:52, Release 19:54:30  
                  May 25, 1992

### **EXPERIMENT AA-3 B**

Title:                               HF Induced Ionospheric Striations and Differential Ion Expansion

Principal Investigators:       Edward P. Szczuczewicz, Science Applications, International Corporation

Co-Investigators:               F.T. Djuth

Location:                         Arecibo HF Heater Beam,  
  Puerto Rico

Altitude:                         250 - 350 Km.

Time:                               Dusk  
  June-July 1991

Chemicals:                        Five 2.25 Kg. Barium releases; 4 with lithium doping.  
  (Ba/ 51 mole % Lithium, Ba/ 51 mole % Lithium, Ba/ 2 mole %  
  Lithium)

This experiment has two sets of objectives. The first is to release a small tracer amount of barium into an ionospheric region which has been heated and disturbed by the Arecibo high-frequency ionospheric heating transmitter. This barium release will "paint" the ionosphere and allow the heater-induced perturbations to become visible. The structuring can be studied over a large volume simultaneously, which cannot be done with a single probe. This experiment compliments the previous barium plasma heating experiment.

The second objective is a study of multi-ion expansion processes. Since ions are electrically charged they interact by means of long-range forces, and not just by local collisions. Not only that, but many natural processes such as the population of the magnetosphere with upward flowing ions from the ionosphere and the expansion of the atmospheres of stars involve ions of more than one type, or mass. For example, the ionosphere feeds the magnetosphere with hydrogen ions (protons) and oxygen ions with a mass ratio of 1::16. The ions do not act independently but rather the presence or absence of one type has a strong influence upon the other. Using a rocket, canisters loaded with a lithium (a light ion, mass = 7) and barium (a heavy ion, mass = 137) will be released from the rocket and the actual ion clouds will be formed some distance away. As the expanding ion clouds sweep past the rocket, instruments on-board the rocket will study the details of these ion clouds and learn the complex details of their interactions.

**EXPERIMENT AA-4**

Title: Ionosphere Focused Heating

Principal Investigator: Paul A. Bernhardt, Naval Research Laboratory

Co-Investigators: Donald E. Hunton/PL, Craig Pollack/MSFC, F. T. Djuth/Geospace, L. M. Duncan/U. of Tulsa, P. E. Argo/Los Alamos, C. Stokes/Franklin Research, P. Rodriguez/NRL, C. Siefring/NRL, H. Romero/NRL, L. Wagner/NRL, J. Goldstein/NRL.

Location: Arecibo High-Frequency Radio Heater Beam

Altitude: 250 Km

Time: Night,; Launch 04:11 AST, Release 04:14:30  
Date: May 30, 1992

Chemicals: 40 Kg. CF<sub>3</sub>Br (Trifluoromethylbromide)

The ionosphere bends radio waves just like a lens or prism bends light. A chemical release will be used to make a spherical lens in the ionosphere which will focus waves from a high-power ground transmitter into a powerful beam traveling upward. The power density input level is expected to be 10 to 100 times the level without focusing. The ionosphere is changed by this focused radio beam with its powerful energy input, and this will be important to understanding how the ionosphere responds to natural energy inputs such as occurs during magnetic storms and solar flares.

**Accomplishments:**

Chemical release produced a large (>30 km) hole in the F-layer centered within 6 km of the 5.1 MHz HF beam.

Large decrease ( $10^{-5}$  of ambient) in Langmuir probe current

Substantial (>50%) reduction in electron density measured by the Arecibo incoherent scatter radar.

Focusing of HF inside the density cavity.

First measurements of "caviton-like" structures inside the focused region.

Large enhancements in radar backscatter from ion-acoustic and electron-plasma waves.

No indications of electron acceleration to yield enhanced airglow.

Transient airglow enhancements were produced by chemical reactions.

Disruption of HF communications passing through the disturbed region.

**EXPERIMENT AA-7**

Title: E-Region Image Formation

Principal Investigator: Edward C. Weber, Air Force Physics Laboratory

Co-Investigators: K. Groves, F.T. Djuth, M.C. Kelley, J. Huba

Location: 125 Km south of Arecibo

Altitude: 250 Km  
 Time: Dawn; Launch 04:58 AST, Release ~04:59:40  
 Chemicals: 22.5 Kg. Barium/2 mole % Strontium

The layers of the ionosphere, the D, E and G regions, are connected by magnetic field lines. In this experiment a large barium release in the F-region will be placed so that the connected E-region is directly over the Arecibo radar. This experiment is the companion to AA-1 discussed earlier.

## **KWAJALEIN CAMPAIGN**

### **EXPERIMENTS AA-5, AA-6**

Title: Equatorial Instability Seeding  
 Principal Investigator: Michael M. Mendillo, Boston University  
 Co-Investigator: P.A. Bernhardt, M. Kelley, W. Schwartz, J. Huba, D. Hunton, R. Pfaff, L. Duncan, R. Tsunoda (need to find out all)  
 Location: Kwajalein Atoll, Marshall Islands  
 Altitude: Approximately 250 Km  
 Time: Dusk (need real dates)  
 Chemicals: 50 Kg. Sulfur Hexafluoride

The ionosphere near the equator, where the magnetic field is horizontal, suffers from naturally-occurring perturbations known as Spread-F. The normally smooth ionosphere becomes broken up and radio wave signals are distorted. These rocket experiments will release a chemical, sulfur hexafluoride, which will start a "bubble" at the bottom of the ionosphere, and trigger artificial Spread-F. This will allow study of the growth and decay of this effect with a controlled experiment. In these experiments one rocket will deploy the ionospheric depletion chemical, followed by a second rocket's carrying instrument to diagnose the release effects.

### **AN INTRODUCTION TO EXPERIMENTS G-1, G-2, G-3, G-4**

Diamagnetic Cavity, Unstable Velocity Distributions, Plasma Coupling

Principal Investigator: R.A. Hoffman (G-1,G-2,G-3), S.B. Mende (G-4)

Co-Investigators: M.B. Pongratz, D. Papadopoluos, R. Smith, R. Anderson, D. Young, H. Singer, E. Szuszczewicz, J. P. Heppner

Location: Over North America

Time: Sunlit Releases, Ground in Darkness

Altitude: B=15000, 5000, 1000, 200 gammas (1500-3000 km. 5000-6000 km. 14000-16000 km. >23000 km)

Chemicals: 5 Kg. Barium (One Small Canister) per release

As a result of natural processes, plasma clouds are often injected into the magnetosphere. These chemical releases can be used to study many aspects of such injections. When a dense plasma is injected into the inner magnetosphere, it is expected to take up the motion of the ambient plasma. However, it has been observed in previous releases at moderate altitudes that the cloud preserved its momentum for some time following the release and that parts of the cloud "peeled off" from the main cloud presumably due to the action of an instability. As one moves outward into the magnetosphere, the mirror force becomes less dominant and the initial conditions following a release are dominated by the formation of a diamagnetic cavity since the initial plasma pressure from the injected Ba ions is greater than the magnetic field energy density. A previous high-altitude release (31,300 km.) showed this to be the case initially, but at later times there was evidence for acceleration of the Ba plasma to velocities corresponding to 60,000 degrees K. This effect is not explained.

This series of experiments is therefore designed to inject plasma clouds into the magnetosphere under widely varying conditions of magnetic field strength and ambient plasma density. In this way the coupling of injected clouds to the ambient plasma and magnetic field, the formation of striations due to instabilities, and possible heating and acceleration of the injected Ba plasma can be studied over a wide range of magnetospheric parameters. Adding to the scientific yield will be the availability of measurements for the DOD/SPACERAD instruments which can monitor plasma parameters, electric and magnetic fields, and waves before, during, and after the releases.

### EXPERIMENT G1

13 July 1991

08:35:25 UT

POINT OF CONTACT:	Morrie Pongratz	SPAN - ESSDP1::PONGRATZ
	LANL	PHONE (505) 667-4740
	Group SST-7 MS-D466	FAX - (505) 665-0850
	Los Alamos, NM 87545	

EXPERIMENT OBJECTIVES: Diamagnetic Cavity, Plasma Coupling

Principal Investigator: R.A. Hoffman

Co-Investigators: M.B. Pongratz, D. Papadopoluos, R. Smith, R. Anderson, D. Young, H. Singer, E. Szuszczewicz, J.P Heppner, R. Hoffman

Location: Over North America

Time: Sunlit Releases, Ground in Darkness

#### EXPERIMENT ELEMENTS:

Coordinates of Release: 17.8N 62.9W 495 km  
 Canister Type: Small.  
 Chemicals: TI 1269gms B 572 gms BA 1468 gms SR 19 gms  
 Delay: None

#### STATIONS COVERING THE RELEASE:

Aircraft- Argentine B707, C135-127, C135-131 (mechanical problems- grounded)  
 Arecibo, PR. Bonaire, NA. St. Croix, St. Thomas, USVI (Caribbean)  
 Reconquista, Argentina

SUMMARY OF LAUNCH: Excellent optical data was obtained from several ground and airbourne observatories in the Caribbean and South America. Ground stations near the release at St. Croix and Guadeloupe studied the early time effects which caused the initially fast-moving ion cloud to stop and lose momentum and energy. At later times, some of the ions traveled upward along the magnetic field lines and were observed traveling to the southern hemisphere by ground observatories at Aruba, Bonaire, St. Croix, and Guadeloupe and by aircraft observatories in the Caribbean near Venezuela and in South America, south of Buenos.

The ion streak traveling along the magnetic field was seen to move westward due to electric fields in the magnetosphere. The experiment was done during a period of moderate to strong geomagnetic activity, and gave good data on the influence of such activity on the magnetosphere and ionosphere.

The effects of the release was seen as well by scientific instruments on the CRRES spacecraft, measuring ionospheric density, magnetic and electric fields, and waves. The Arecibo Incoherent Scatter Radar located in Puerto Rico measured the state of the ionosphere "upstream" of the release point and provided valuable data for correlation with other measurements. (This section is taken from "CRRES NEWS, July 13 1991 written by David L. Reasoner).

### **Aircraft- Argentine B707**

#### **STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerendel  
Max Planck Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::HAE  
PHONE 49-89-3299-3516 or 3503  
FAX - 49-89-3299-3569

#### **OTHER CONTACT (Data Held By):**

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Max Planck Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::VAL  
PHONE 49-89-3299-3513 OR 3503  
FAX - 49-89-3299-3569

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Video: UMATIC PAL

**FIELD(S) OF VIEW OF INSTRUMENTS:** 17.5x12 deg. FOV

**TIME PERIODS OF DATA:** From 20 min. through 50 min. after release

**SAMPLING RATES:** 40 ms

**FRAME RATES:** 0.12 - 0.64 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear sky; weak Ba II intensity

**INITIAL FINDINGS:** Barium streak found and photographed-Time of observation 08:55 through 09:45 UT.

**ADDITIONAL RESEARCH:** Triangulation will be performed.

### **Aircraft - C135-127**

#### **STATION LEADER AND/OR OTHER CONTACT:**

Rick Rairden  
DEPT 91-20 BLDG 255  
LPARL  
3251 Hanover St.  
Palo Alto, CA 94304

SPAN - LOCKHD::RAIRDEN  
PHONE (415) 424-3287  
FAX - (415) 424-3333

#### **FOR GEOGRAPHIC COORDINATES OF AIRCRAFT TRACK CONTACT:**

Eugene Wescott  
Geophysical Institute  
University of Alaska  
Fairbanks, AK 99701

SPAN - UAFGI::ROCKET  
PHONE (907) 474-7576  
FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

The Lockheed cameras are one wide-field (18 deg) with 4554A filter and one narrow-field (4 deg) with 4554A filter and selection of Fabry-Perot etalons. Data: 2 minutes realtime only. Failed to integrate. In-house listings of all image data sequences and notes of image quality and exposure levels, etc.

Also available: star-field data and barium calibration lamp images.

- 1) Analog composite video recordings on 3/4 inch Numatic and 1/2 VHS
- 2) Analog composite video recordings on 3/4 inch Numatic and 1/2 VHS

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 11.4X14.5 ICCD
- 2) ISIT TV slit spectrograph 5 degrees by 100 A resolution

**TIME PERIODS OF DATA:**

- 1) 08:35:25 to 08:44:15
- 2) 08:35:25 to 08:44:15

**SAMPLING RATES:**

- 1) Real time TV and integration filtered at 4554 1 to 4 seconds.
- 2) Real time TV

**FRAME RATES:**

- 1) 30 per second
- 2) 30 per second

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**

- 1) Good star fields, see satellite to burst. TV saturates as cloud expands, good data on ion streak up to maximum elevation then lost it.
- 2) Good spectra of release, some over loading of the brightest lines some spectra of ion streak.

**INITIAL FINDINGS:**

- 1) Much of the energy of the ions lost, perhaps due to collisions or some other process.
- 2) Only BaI, BaII, SrI, BaO, TiO lines identified.

**ADDITIONAL RESEARCH:**

- 1) Triangulation on the ion streak to determine E fields and conjugate relationships.
- 2) Emission rates for the Ba lines.

**Arecibo, PR (Caribbean)**  
**18.3462N 66.7529W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Paul A. Bernhardt	SPAN - VA::BERN
NRL CODE 4780	PHONE (202) 767-0196
Washington, DC 20375	FAX - (202) 767-0631

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Filtered/Intensified CCD 455.4 nm Filter 2 nm BW 50 mm lens f/0.95
- 2) 35 mm Film Camerano filter 1600 speed film 36 exposures 50 mm lens f/1.8

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 45 deg. FOV
- 2) 45 deg. FOV

**TIME PERIODS OF DATA: 08:36:45 to 09:03:28**

**SAMPLING RATES:** 1 second exposure every 20 seconds

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Not good due to cloud cover

**INITIAL FINDINGS:** Only visual verification of Barium release

**Bonaire, NA (Caribbean)**  
**12.14N 68.24W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Mary Miller	SPAN - ELDYN::U6MLM
GSFC CODE 696	PHONE (301) 286-8751
Greenbelt, MD 20771	

**OTHER CONTACT (For IPD and Doppler Images):**

Nigel Meredith	SPAN - 19527::CBS%UK.AC.UCL.PH.APG::NPM
University College London	PHONE 010-44-71-636-8333 EXT.3430
London	FAX - 010-44-71-436-7615

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Intensified 4554A 35 mm B/W Film 2s/8s exp.
- 2) Intensified TV VHS Format
- 3) IPD Images Computer Tape 2 - 5 sec. exp.
- 4) Doppler Images Computer Tape variable (faint)

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 25 deg. FOV
- 2) ??
- 3) 20 deg. FOV
- 4) 2.5 deg. FOV

**TIME PERIODS OF DATA:**

- 1) 08:55 - 09:27
- 2) 08:55 - 09:27
- 3) 08:59 - 09:24
- 4) 08:59 - 09:24

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** The release occurred behind clouds, but the sky cleared at <sup>a</sup> R+20m. Data quality- good for 30+minutes after acquisition.

**Reconquista, Argentina**  
**29.2S 59.70W .50km**

**STATION LEADER AND/OR OTHER CONTACT:**

Eugene M. Wescott	SPAN - UAFGI::ROCKET
University of Alaska	PHONE (907) 474-7576
Fairbanks, AK 99701	FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 2 IPDs, filtered at 4554 A (30A width). Data recorded both on video, with time date, and Az-El, updated every second. Integrated frames are stored digitally every 5 to 15 seconds, varies.

**FIELD(S) OF VIEW OF INSTRUMENTS:** 20 degrees circular

**TIME PERIODS OF DATA:** Video - between 8:35 and 9:45. Digital - 8:38 to 9:00



**SAMPLING RATES:** Integrated digital data are stored between 5 and 15 seconds - varies with conditions.

**FRAME RATES:** Video is 30 fps, but data updated from IPDs only every 1 sec.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** No Ba detected due to intermittent clouds (only occasional stars). Data quality- poor.

NO FURTHER INFORMATION AVAILABLE

**St. Croix, USVI (Caribbean)**  
**17.718N 64.858W .264km**

**STATION LEADER AND/OR OTHER CONTACT:**

Morrie Pongratz	SPAN - ESSDP1::PONGRATZ
LANL	PHONE (505) 667-4740
Group SST-7 MS-D466	FAX - (505) 665-0850
Los Alamos, NM 87545	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 400 mm, Intensified 4554A 35 mm Film  
 Color Film

**FIELD(S) OF VIEW OF INSTRUMENTS:** ~4 deg. FOV

NO FURTHER INFORMATION AVAILABLE

**St. Thomas, USVI (Caribbean)**  
**18.327N 64.898W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Don Slater	Internet - don%sundown@pnlg.pnl.gov
BATTELLE Pacific Northwest Labs	PHONE (907) 474-7576
P.O. Box 999 MS - K6-84	
Richland, WA 99352	

**OTHER CONTACT (Data Held By):**

Mary Miller	SPAN - ELDYN::U6MLM
GSFC Code 696	PHONE (301) 286-8751
Greenbelt, MD 20771	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified CCD 512x512 2 bytes/pixel

**FIELD(S) OF VIEW OF INSTRUMENTS:** 20 deg.

**TIME PERIODS OF DATA:** \* 15 min.

**ASSESSMENT OF THE QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
 Weather- partly cloudy/hazy. Data- Some good

NO FURTHER INFORMATION AVAILABLE

## **EXPERIMENT G2**

**13 January 1991 02:17:03 UT**

<b>POINT OF CONTACT:</b>	Robert Hoffman	SPAN - DE696::U6RAH
	GSFC CODE 696	PHONE (301) 286-7386
	Greenbelt, MD 20771	FAX - (301) 286-9240

**EXPERIMENT OBJECTIVES:**

Diamagnetic Cavity, Plasma Coupling

Principal Investigator: R.A. Hoffman

Co-Investigators: M.B. Pongratz, D. Papadopoluos, R. Smith, R. Anderson,  
D. Young, H. Singer, E. Szuszczewicz, J.P. Heppner

Location: Over North America

Time: Sunlit Releases, Ground in Darkness

**EXPERIMENTAL ELEMENTS:**

Coordinates of Release: 16.9N 103.1W 6180 km

Canister Type: Small

Chemicals: TI 1269gms B 572 gms BA 1468 gms SR 19 gms

Delay: None

Model Calculations - Ted Fritz

LANL

MS - D438

Los Alamos, NM 87545

SPAN - ESSDP1::FRITZ

PHONE (505) 667-9234

FAX - (505) 665-3332

**STATIONS COVERING THE RELEASE:**

Bonaire, NA. St. Croix, USVI (Caribbean)

Cerro Tololo, Chile

Los Alamos (Breezy Point), White Sands, NM. Rosemary Hills, FL.

**Bonaire, NA (Caribbean)****12.24N 68.33W 0.0km****STATION LEADER AND/OR OTHER CONTACT:**

Mary Miller

GSFC CODE 696

Greenbelt, MD 20771

SPAN - ELDYN::U6MLM

PHONE (301) 286-8751

TYPE AND DESCRIPTION OF DATA ACQUIRED: Intensified 4554A 35 mm B/W Film \* 3  
min. 3s/10s exp.

FIELD(S) OF VIEW OF INSTRUMENT: 10 deg. FOV

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION): Due  
to occasional clouds, the ion streak was lost and the neutral residual was covered for \* 3 min.

NO FURTHER INFORMATION AVAILABLE

**Cerro Tololo, Chile****30.165S 70.81W 4.0km****STATION LEADER AND/OR OTHER CONTACT:**

Bob Candey

GSFC CODE 696

Greenbelt, MD 20771

SPAN - ELDYN::ORRMC

PHONE (301) 286-6707

**OTHER CONTACT (Data Held By):**

Mary Miller  
 GSFC CODE 696  
 Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
 PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified 4554A TV VHS format

**INSTRUMENT(S) FIELD OF VIEW:** 7-10 deg. FOV

**TIME PERIODS OF DATA:** <sup>a</sup> 40 minutes

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**

Clear skies, TV gain was turned down, so frames must be integrated to obtain acceptable images.

**NO FURTHER INFORMATION AVAILABLE**

**Los Alamos (Breezy Point), NM**

**STATION LEADER AND/OR OTHER CONTACT:**

Morrie Pongratz  
 LANL  
 Group SST-7 MS-D466  
 Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ  
 PHONE (505) 667-4740  
 FAX - (505) 665-0850

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 400 mm, Intensified 4554A 35 mm film

**FIELD(S) OF VIEW OF INSTRUMENTS:** ~4 deg. FOV

**NO FURTHER INFORMATION AVAILABLE**

**Rosemary Hills, FL.**  
**29.4N 82.5W 0.044km**

**STATION LEADER AND/OR OTHER CONTACT:**

David Rees, Nigel Meredith  
 University College London  
 London

SPAN - 19527::CBS%UK.AC.UCL.PH.APG::NPM  
 PHONE 010-44-71-636-8333 EXT.3430  
 FAX - 010-44-71-436-7615

**OTHER CONTACT (Data Held By):**

Mary Miller  
 GSFC CODE 696  
 Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
 PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 1) IPD Images (135 mm, 4554A filtered) 30 sec. exp. for <sup>a</sup> 50 min. 2) CCD Camera Images (50 mm)

White light - data yet to be processed. Doppler images of the bright central portion of the cloud - data yet to be processed.

**FIELD(S) OF VIEW OF INSTRUMENTS:** 1) 7.6 deg. FOV. 2) 9 deg. x 7.5 deg. FOV

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear skies, good data.

**NO FURTHER INFORMATION AVAILABLE**

**St. Croix, USVI (Caribbean)**  
**17.718N 64.858W .264km**

**STATION LEADER AND/OR OTHER CONTACT:**

Morrie Pongratz	SPAN - ESSDP1::PONGRATZ
LANL	PHONE (505)667-4740
Group SST-7 MS-D466	FAX - (505) 665-0850
Los Alamos, NM 87545	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 400 mm, Intensified 4554A 35 mm Film

**FIELD(S) OF VIEW OF INSTRUMENTS:** ~4 deg. FOV

**NO FURTHER INFORMATION AVAILABLE**

**White Sands, NM**  
**(MIT/LL ETS) 33.817N 106.699W (1)**  
**(WSMR ORTHO) 32.467N 106.274W (2)**

**STATION LEADER AND/OR OTHER CONTACT:**

Paul A. Bernhardt	SPAN - VA::BERN
NRL CODE 4780	PHONE (202) 767-0196
Washington, D.C. 20375	FAX - (202) 767-0631

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Filtered/Intensified CCD 2500 nm Focal Length, 455.4 nm Filter
- 2) 35 mm Film, 50 mm Focal Length, no Filter

**FIELD(S) OF VIEW OF INSTRUMENTS:** 1) 0.6 deg. FOV (2 of), 2) 27 deg. FOV (2)

**TIME PERIODS OF DATA:** 02:16:49 to 02:38:08

**SAMPLING RATES:** 2 second exposure every 20 seconds for camera 1). 4 second exposure every 20 seconds for camera 2).

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
 Excellent.

**INITIAL FINDINGS:** Curved Irregularities- Results described in "Probing the magnetosphere using chemical releases from the Combined Release and Radiation Effects Satellite", by P.A. Bernhardt, Phys. Fluids., 4, 2249-2256, 1992 and in "Plasma irregularities by cycloid bunching of the CRRES G-2 barium release" in press, J. Geophys. Res., 1992.

**EXPERIMENT G3**  
**15 January 1991 04:11:00 UT**

**POINT OF CONTACT:**

Robert Hoffman	SPAN - DE696::U6RAH
GSFC CODE 696	PHONE (301) 286-7386
Greenbelt, MD 20771	FAX - (301) 286-9240

**EXPERIMENT OBJECTIVES:** Diamagnetic Cavity, Unstable Velocity Distributions, Plasma Coupling

**Principal Investigator:** R. Hoffman



**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Intensified TV White Light 20-30 min.
- 2) 70 mm Color Film Neutral Expansion <sup>a</sup> 5 min

**FIELD(S) OF VIEW OF INSTRUMENTS:** 5x6 deg. FOV

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
Weather clear, TV data good, but ion is very faint

**NO FURTHER INFORMATION AVAILABLE**

**Cerro Tololo, Chile**  
**30.165S 70.81W 4.0 km**

**STATION LEADER AND/OR OTHER CONTACT:**

Bob Candey	SPAN - ELDYN::ORRMC
GSFC CODE 696	PHONE (301) 286-6707
Greenbelt, MD 20771	

**OTHER CONTACT (Data Held By):**

Mary Miller	SPAN - ELDYN::U6MLM
GSFC CODE 696	PHONE (301) 286-8751
Greenbelt, MD 20771	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified 4554A TV VHS Format <sup>a</sup>  
04:11 - 04:45

**FIELD(S) OF VIEW OF INSTRUMENTS:** 7-10 deg. FOV

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear skies, TV gain was turned down, so successive TV frames must be integrated to obtain acceptable images.

**NO FURTHER INFORMATION AVAILABLE**

**El Leoncito, Argentina**  
**31.802S 69.329W 2.4km**

**STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerendel	SPAN - MPE::HAE
Max Planck Institute fuer	PHONE 49-89-3299-3516 or 3503
extraterrestriche Physik	FAX - 49-89-3299-3569
8046 Garching, Germany	

**OTHER CONTACT (Data Held By):**

Dr. Arnoldo Valenzuela	SPAN - MPE::VAL
Max Planck Institute fuer	PHONE 49-89-3299-3513 OR 3503
extraterrestriche Physik	FAX - 49-89-3299-3569
8046 Garching, Germany	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Video: 1) UMatic PAL (TV-SEC) BA II filter 2) VHS PAL (TV-RCA) no filter

**FIELD(S) OF VIEW OF INSTRUMENTS:** 1) 6x4 deg. FOV. 2) 18 deg. FOV

**TIME PERIODS OF DATA:** 1) 04:11-06:00. 2) 04:11-05:00

**SAMPLING RATES:** 1) 40 ms. 2) 40 ms.

**FRAME RATES:** 40 ms - 5.12 sec.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear sky and good visibility, quality of recording good.

**ADDITIONAL RESEARCH:** For the southern hemisphere triangulation, observations from a second station (may be located in the northern hemisphere) is needed.

**Goddard Space Flight Center  
38.98N 76.85W**

**STATION LEADER AND/OR OTHER CONTACT:**

Paul Marionni

GSFC CODE 696

Greenbelt, MD 20771

SPAN - ELDYN::XRPAM

PHONE (301) 286-5403

**OTHER CONTACT (Data Held By):**

Mary Miller

GSFC CODE 696

Greenbelt, MD 20771

SPAN - ELDYN::U6MLM

PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified 4554A 35 mm B/W Film 18 min. 4s/15s exp. 8s/30s exp.

**FIELD(S) OF VIEW OF INSTRUMENTS:** 10 deg. FOV

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Weather clear. Data quality- good

**NO FURTHER INFORMATION AVAILABLE**

**Los Alamos (Breezy Point), NM.  
35.78N 106.23W 1.95km**

**STATION LEADER AND/OR OTHER CONTACT:**

Morrie Pongratz

LANL

Group SST-7 MS-D466

Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ

PHONE (505) 667-4740

FAX - (505) 665-0850

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 400 mm, Intensified 4554A 35 mm Film

**FIELD(S) OF VIEW OF INSTRUMENTS:** \* 4 deg. FOV

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good images 04:11 - 04:25 and 04:34 - 04:56

**NO FURTHER INFORMATION AVAILABLE**

**Richmond Hill, GA.  
31.85N 81.16W**

**STATION LEADER AND/OR OTHER CONTACT:**

Danny Williams

4424 Clovewood St.

Ladson, SC 29456

PHONE (803) 875-4260

**OTHER CONTACT (Data Held By):**

Mary Miller  
 GSFC CODE 696  
 Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
 PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** KONICA ST-G 3200 Color Prints 7 photographs over 11 min.

**FIELD(S) OF VIEW OF INSTRUMENTS:** \* 28 deg. FOV.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
 Weather clear, good photographs

NO FURTHER INFORMATION AVAILABLE

**Rosemary Hills, FL.**  
**29.4N 82.5W 0.044km**

**STATION LEADER AND/OR OTHER CONTACT:**

David Rees, Nigel Meredith  
 University College London  
 London

SPAN - 19527::CBS%UK.AC.UCL.PH.APG::NPM  
 PHONE 010-44-71-636-8333 EXT.3430  
 FAX - 010-44-71-436-7615

**OTHER CONTACT (Data Held By):**

Mary Miller  
 GSFC CODE 696  
 Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
 PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 1) IPD Images (135 mm, 4554A filtered) 30 sec. exp. for \* 5 min. 2) CCD Camera Images (50 mm) White light - data yet to be processed. Doppler images of the bright central portion of the cloud - data yet to be processed.

**FIELD(S) OF VIEW OF INSTRUMENTS:** 1) 7.6 deg. FOV. 2) 9x7.5 deg. FOV

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
 Observing conditions varied from good to poor. Good quality images were obtained during the clear sky intervals.

NO FURTHER INFORMATION AVAILABLE

**St. Croix, USVI (Caribbean)**  
**17.718N 64.858W .264km**

**STATION LEADER AND/OR OTHER CONTACT:**

Morrie Pongratz  
 LANL  
 Group SST-7 MS-D466  
 Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ  
 PHONE (505) 667-4740  
 FAX - (505) 665-0850

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 400 mm, Intensified 4554A 35 mm Film

**FIELD(S) OF VIEW OF INSTRUMENTS:** \* 4 deg. FOV

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good images 04:11 - 04:16, then sky becomes overcast.

NO FURTHER INFORMATION AVAILABLE



**White Sands, NM.**  
**MIT/LL ETS) 33.817N 106.699W (1) 1.532km**  
**(WSMR ORTHO) 32.467N 106.274W (2)**

**STATION LEADER AND/OR OTHER CONTACT:**

Paul A. Bernhardt	SPAN - VA::BERN
NRL CODE 4780	PHONE (202) 767-0196
Washington, DC 20375	FAX - (202) 767-0631

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Ebiscon A(14" Schmidt), no filter
- 2) Ebiscon B (31" Cassegrain), no filter
- 3) Filtered/Intens. CCD, 455.4 nm filter
- 4) 35 mm Film Camera, no filter, 1600 speed film, 36 exposure roll

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 3.5/7.0 deg. FOV (1)
- 2) 0.5/1.0 deg. FOV (1)
- 3) 0.6 deg. FOV (2)
- 4) 27 deg. FOV (2)

**TIME PERIODS OF DATA:** 04:10:47 to 04:28:48

**SAMPLING RATES:**

- 1) 1/30 second
- 2) 1/30 second
- 3) 4 second exposure every 20 seconds
- 4) 4 second exposure every 20 seconds

**YOUR ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Excellent, clear skies

**INITIAL FINDINGS:** Diamagnetic cavity structures- Results described in "Preliminary Study of the CRRES Magnetospheric Barium Releases" by J.D. Huba, P.A. Bernhardt, and J.G. Lyon, J. Geophys. Res., 97, 11-24, 1992 and in "Probing the magnetosphere using chemical releases from the Combined Release and Radiation Effects Satellite" by P.A. Bernhardt, Phys. Fluids., 4, 2249-2256, 1992.

**NO FURTHER INFORMATION AVAILABLE**

**EXPERIMENT G4**  
**16 January 1991      06:25:00 UT**

<b>POINT OF CONTACT:</b>	Robert Hoffman	SPAN - DE696::U6RAH
	GSFC CODE 696	PHONE (301) 286-7386
	Greenbelt, MD 20771	FAX - (301) 286-9240

**EXPERIMENT OBJECTIVES:** Diamagnetic Cavity, Plasma Coupling

**Principal Investigator:** Steve Mende

**Co-Investigators:** M.B. Pongratz, D. Papadopoluos, R. Smith, R. Anderson,  
D. Young, H. Singer, E. Szuszczewicz

**Location:** Over North America

**Time:** Sunlit Releases, Ground in Darkness

**EXPERIMENT ELEMENTS:**

Coordinates of Release: 0.7S 53.8W 23977km  
 Canister Type: Small  
 Chemicals: TI 1271gms B 574 gms BA 1471 gms SR 19 gms  
 Delay: None

Model Calculations - Ted Fritz

LANL  
 MS - D438  
 Los Alamos, NM 87545

SPAN - ESSDP1::FRITZ  
 PHONE (505) 667-9234  
 FAX - (505) 665-3332

**STATIONS COVERING THE RELEASE:**

Boston - LTF, Long Key, FL, Los Alamos (Breezy Point), White Sands, NM.  
 Cerro Tololo, Chile  
 El Leoncito  
 St. Croix.

**Boston, Lincoln Test Facility.**  
**42.424N 71.351W .036km**

**STATION LEADER AND/OR OTHER CONTACT:**

TECH.INT'L.CORP.  
 75A Wiggins Ave.  
 Bedford, MA 01730

PHONE (617) 275-8424  
 FAX - (617) 259-0734

**OTHER CONTACT (Data Held By):**

Mary Miller  
 GSFC Code 696  
 Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
 PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 1) Intensified TV White Light \* 70 mm Color Film Neutral Expansion/Ion Formation

**FIELD(S) OF VIEW OF INSTRUMENTS:** 1) 5x6 deg. FOV. 2) 12 deg. FOV.

**TIME PERIODS:** 1) 7 min. 2) \* 6 min.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
 Weather clear to hazy, TV data faint

**NO FURTHER INFORMATION AVAILABLE**

**Cerro Tololo, Chile.**  
**30.165S 70.81W 4.0 km**

**STATION LEADER AND/OR OTHER CONTACT:**

Bob Candey  
 GSFC CODE 696  
 Greenbelt, MD 20771

SPAN - ELDYN::ORRMC  
 PHONE (301) 286-6707

**OTHER CONTACT (Data held by):**

Mary Miller  
 GSFC CODE 696  
 Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
 PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

1) Intensified 4554A TV VHS format

- 2) Intensified 4554A 35 mm Film
- 3) Non-Intensified 35 mm Color Film

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 7-10 deg. FOV
- 2) 7-10 deg. FOV
- 3) 10-15 deg. FOV

**TIME PERIODS:** 1) <sup>a</sup> 20 minutes. 2) <sup>a</sup> 50 minutes. 3) <sup>a</sup> 8 minutes.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear skies, TV gain was turned down, so frames must be integrated to obtain acceptable images. 35 mm Intensified film images are excellent. 35 mm Color film image is small, but good.

**NO FURTHER INFORMATION AVAILABLE**

**El Leoncito, Argentina.  
31.802S 69.329W 2.4km**

**STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerendel  
Max Plank Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::HAE  
PHONE 49-89-3299-3516 or 3503  
FAX - 49-89-3299-3569

**OTHER CONTACT (Data Held By):**

Dr. Arnoldo Valenzuela  
Max Plank Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::VAL  
PHONE 49-89-3299-3513 or 3503  
FAX - 49-89-3299-3569

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Video: 1) UMatric PAL (TV-SEC) BA II filter 2) VHS PAL (TV-RCA) no filter

**FIELD(S) OF VIEW OF INSTRUMENTS:** 1) 6 x 4 deg. FOV. 2) <sup>a</sup> 18 deg. FOV.

**TIME PERIODS:** 1) 06:25-08:20, 2) 06:25-07:30

**SAMPLING RATES:** 1) 40 ms 2) 40 ms      **FRAME RATES:** 40 ms - 5.12 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear sky and good visibility, quality of recording good.

**ADDITIONAL RESEARCH:** For southern hemisphere triangulation, observations from a second station (may be located in the northern hemisphere) is needed.

**Long Key, FL  
24.83N 80.8W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Don Slater  
BATTELLE Pacific Northwest Labs  
P. O. Box 999 MS - K6-84  
Richland, Washington 99352

Internet - don%solar@pnl.pnl.gov  
PHONE (509) 376-8423

**OTHER CONTACT (Data Held By):**

Mary Miller

SPAN - ELDYN::U6MLM

GSFC Code 696  
Greenbelt, MD 20771

PHONE (301) 286-8751

TYPE AND DESCRIPTION OF DATA ACQUIRED: Intensified CCD 512x512 2 bytes/pixel

FIELD(S) OF VIEW OF INSTRUMENTS: 5.2 deg. FOV

TIME PERIODS: \* 1 hr. off/on

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):  
Weather at release time was good, then clouds over several times while observing.  
Data quality- good when no clouds.

NO FURTHER INFORMATION AVAILABLE

**Los Alamos (Breezy Point), NM.**  
**35.78N 106.23W 1.95km**

STATION LEADER AND/OR OTHER CONTACT:

Morrie Pongratz	SPAN - ESSDP1::PONGRATZ
LANL	PHONE (505) 667-4740
Group SST-7 MS-D466	FAX - (505) 665-0850
Los Alamos, NM 87545	

TYPE AND DESCRIPTION OF DATA ACQUIRED: 400 mm, Intensified 4554A 35 mm Film

FIELD(S) OF VIEW OF INSTRUMENTS: \* 4 deg. FOV

NO FURTHER INFORMATION AVAILABLE

**St. Croix, USVI (Caribbean).**  
**17.718N 64.858W .264km**

STATION LEADER AND/OR OTHER CONTACT:

Morrie Pongratz	SPAN - ESSDP1::PONGRATZ
LANL	PHONE (505) 667-4740
Group SST-7 MS-D466	FAX - (505) 665-0850
Los Alamos, NM 87545	

TYPE AND DESCRIPTION OF DATA ACQUIRED: 400 mm, Intensified 4554A 35 mm Film

FIELD(S) OF VIEW OF INSTRUMENTS: \* 4 deg. FOV

NO FURTHER INFORMATION AVAILABLE

**White Sands, NM.**  
**(MIT/LL ETS) 33.817N 106.699W (1)**  
**(WSMR ORTHO) 32.467N 106.274W (2)**

STATION LEADER AND/OR OTHER CONTACT:

Paul A. Bernhardt	SPAN - VA::BERN
NRL CODE 4780	PHONE (202) 767-0196
Washington, D.C. 20375	FAX - (202) 767-0631

TYPE AND DESCRIPTION OF DATA ACQUIRED: 1) Filtered/Intens. CCD, 455.4 nm filter  
2) 35 mm Film Camera, no filter, 1600 speed film, 36 exposure

FIELD(S) OF VIEW OF INSTRUMENTS: 1) 0.6 deg. FOV (2). 2) 27 deg. FOV (2)

TIME PERIODS: 06:24:46 to 06:42:51

SAMPLING RATES: 2 second exposure every 20 seconds.

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):  
Excellent, clear skies

INITIAL FINDINGS: Diamagnetic cavity structures- Results described in "Preliminary Study of the CRRES Magnetospheric Barium Releases" by J.D. Huba, P.A. Bernhardt, and J.G. Lyon, J. Geophys. Res., 97, 11-24, 1992 and in "Probing the magnetosphere using chemical releases from the Combined Release and Radiation Effects Satellite" by P.A. Bernhardt, Phys. Fluids., 4, 2249-2256, 1992.

NO FURTHER INFORMATION AVAILABLE

## **EXPERIMENT G-5**

### **18 January 1991      05:20:00 UT**

#### **Introduction**

Title: Stimulated Electron Precipitation to Produce Auroras

Principal Investigators: P. Bernhardt, G. Haerendel

Co-Investigators: S. Mende, T. Fritz, W. Peterson, E. Wescott,  
D. Papadopoulos, R. Smith, M. Pongratz, D. Simons

Location: Approximately 6 Re outside plasmopause on field line accessible by Millstone Hill Radar.

Time: Post-midnight local time (0000-0200 L.T.)

Other Conditions: Darkness over North America;  
Local Plasma Density < 1/cm<sup>3</sup>.

Chemicals: 20 Kg. Lithium (2 Large Canisters)

A lithium cloud will be released on an L>6 magnetic field line to enhance the cold plasma density in the magnetosphere. Wave particle interaction theory predicts that the electron density enhancement should precipitate trapped energetic electrons via interactions with whistler mode waves. Detection of the precipitation will be attempted with optical and radar observations of the aurora at the foot of the field line where the release occurred and by in-situ wave and particle diagnostics on CRRES.

#### **POINT OF CONTACT:**

Paul Bernhardt	SPAN - VA::BERN
NRL CODE 4780	PHONE (202) 767-0196
Washington, D.C. 20375	FAX - (202) 767-0631

#### **EXPERIMENT ELEMENTS:**

Coordinates of Release: 6.6N 62.8W 33337 km  
Canister Type: Large

Chemicals: 5A TI 5770 gms, B 2605 gms, LI 457 gms, EU 299 gms  
 : 5B TI 5770 gms, B 2605 gms, LI 457 gms, EU 299 gms  
 Delay: None

Model Calculations -	Ted Fritz LANL MS - D438 Los Alamos, NM 87545	SPAN - ESSDP1::FRITZ PHONE (505) 667-9234 FAX - (505) 665-3332
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**STATIONS COVERING THE RELEASE:**

Aircraft- C135-127  
 El Leoncito, Bonaire, NA (Caribbean)  
 Boston, MA - LTF, Goddard Space Flight Center, MD.\ Long Key, Rosemary Hills, FL.  
 Cerro Tololo, Chile

**Aircraft- C135-127.**

**STATION LEADER AND/OR OTHER CONTACT:**

Rick Rairden DEPT 91-20 BLDG. 255 LPARL 3251 Hanover St. Palo Alto, CA 94304	SPAN - LOCKHD::RAIRDEN PHONE (415) 424-3287 FAX - (415) 424-3333
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**FOR GEOGRAPHIC COORDINATES OF AIRCRAFT TRACK CONTACT:**

Eugene Wescott Geophysical Institute University of Alaska Fairbanks, AK 99701	SPAN - UAFGI::ROCKET PHONE (907) 474-7576 FAX - (907) 474-7290
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**TYPE AND DESCRIPTION OF DATA ACQUIRED:** U-matic 3/4" Video 04:55 - 05:34 UT.  
 Additional data was recorded on lower quality 8mm video cassette. Most images are white light;  
 occasional filter wheel cycles are made through 5577A, 4278A, 4862A, and 4890A (each of  
 ~30A width)

NO FURTHER INFORMATION AVAILABLE

**Bonaire, NA (Caribbean)**  
**12.24N 68.33W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Mary Miller GSFC CODE 696 Greenbelt, MD 20771	SPAN - ELDYN::U6MLM PHONE (301) 286-8751
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**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified White Light 35 mm B/W  
 Film.

**FIELD(S) OF VIEW OF INSTRUMENTS:** 10 deg. FOV

**TIME PERIODS OF DATA:** \* 7 min.

**SAMPLING RATES:** at 4s/15s exp and 8s/30s exp.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
Scattered clouds degraded data after first 4 minutes

NO FURTHER INFORMATION AVAILABLE

**Boston, Lincoln Test Facility.**  
**42.424N 71.351W .036km**

**STATION LEADER AND/OR OTHER CONTACT:**

TECH.INT'L.CORP.  
75A Wiggins Ave.  
Bedford, MA 01730

PHONE (617) 275-8424  
FAX - (617) 259-0734

**OTHER CONTACT (Data Held By):**

Mary Miller  
GSFC CODE 696  
Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified TV White Light

**FIELD(S) OF VIEW OF INSTRUMENTS:** 5x6 deg. FOV

**TIME PERIODS OF DATA:** \* 6 min.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
Weather clear, TV data good expansion detail

NO FURTHER INFORMATION AVAILABLE

**Cerro Tololo, Chile.**  
**30.165S 70.81W 4.0 km**

**STATION LEADER OR OTHER CONTACT:**

Bob Candey  
GSFC CODE 696  
Greenbelt, MD 20771

SPAN - ELDYN::ORRMC  
PHONE (301) 286-6707

**OTHER CONTACT (Data Held By):**

Mary Miller  
GSFC CODE 696  
Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- |  |              |
|--|--------------|
| 1) Intensified White Light TV VHS format | * 10 minutes |
| 2) Intensified White Light 35 mm Film    | * 7 minutes  |
| 3) Non-Intensified 35 mm Color Film      | 4 minutes    |

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 7-10 deg. FOV
- 2) 7-10 deg. FOV
- 3) 10-15 deg. FOV

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear skies, TV gain was turned down, so frames must be integrated to obtain acceptable images. Intensified 35 mm Film images fill the field of view after 7 minutes.

NO FURTHER INFORMATION AVAILABLE

**El Leoncito, Argentina.  
31.802S 69.329W 2.4km**

**STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerendel  
Max Planck Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::HAE  
PHONE 49-89-3299-3516 or 3503  
FAX - 49-89-3299-3569

**OTHER CONTACT (Data Held By):**

Dr. Arnoldo Valenzuela  
Max Planck Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::VAL  
PHONE 49-89-3299-3513 OR 3503  
FAX - 49-89-3299-3569

**TYPE AND DESCRIPTION OF DATA ACQUIRED: Video:**

- 1) UMatic PAL(TV-SEC) BA II filter
- 2) VHS PAL (TV-RCA) no filter

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 2x1.6 deg. FOV
- 2) 10 deg. FOV

**TIME PERIODS OF DATA:**

- 1) 05:20 - 05:25
- 2) 05:20 - 05:27

**SAMPLING RATES:**

- 1) 40 ms - 5.12 sec
- 2) 40 ms

**FRAME RATES:**

40 ms - 5.12 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**

Good sky conditions. Fair quality of recording.

**INITIAL FINDINGS:** Li observed for about 5 min (see above); EuI/EuII observation marginal.

**ADDITIONAL RESEARCH:** Determination of Li cloud expansion velocity and ionization time constant.

**Goddard Space Flight Center.  
38.98N 76.85W**

**STATION LEADER AND/OR OTHER CONTACT:**

Paul Marionni  
GSFC CODE 696  
Greenbelt, MD 20771

SPAN - ELDYN::XRPAM  
PHONE (301) 286-5403

**OTHER CONTACT (Data Held By):**

Mary Miller  
GSFC CODE 696  
Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified White Light 35 mm B/W Film



FIELD(S) OF VIEW OF INSTRUMENTS: 10 deg. FOV

TIME PERIODS OF DATA: \* 5 min. 4s/15s exp, 8s/30s exp.

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):  
Weather clear. Data quality- good.

NO FURTHER INFORMATION AVAILABLE

**Long Key, FL.**  
**24.83N 80.8W 0.0km**

STATION LEADER AND/OR OTHER CONTACT:

Don Slater	Internet - don%solar@pnl.gov
BATTELLE Pacific Northwest Labs	PHONE (509) 376-8423
P. O. Box 999 MS - K6-84	
Richland, WA 99352	

OTHER CONTACT (Data Held By):

Mary Miller	SPAN - ELDYN::U6MLM
GSFC CODE 696	PHONE (301) 286-8751
Greenbelt, MD 20771	

TYPE AND DESCRIPTION OF DATA ACQUIRED: Intensified CCD 512x512 2  
bytes/pixel

FIELD(S) OF VIEW OF INSTRUMENTS: 5.2 deg. FOV

TIME PERIODS OF DATA: \* 25 min.

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):  
Weather condition- good. Data quality- good.

NO FURTHER INFORMATION AVAILABLE

**Rosemary Hills, FL.**  
**29.4N 82.5W 0.044km**

STATION LEADER AND/OR OTHER CONTACT:

David Rees, Nigel Meredith	SPAN - 19527::CBS%UK.AC.UCL.PH.APG::NPM
University College	PHONE 010-44-71-636-8333 EXT.3430
London	FAX - 010-44-71-436-7615

OTHER CONTACT (DATA HELD BY):

Mary Miller	SPAN - ELDYN::U6MLM
GSFC CODE 696	PHONE (301) 286-8751
Greenbelt, MD 20771	

TYPE AND DESCRIPTION OF DATA ACQUIRED:

- 1) IPD Images (135 mm, 6710A filtered)
- 2) CCD camera images (50 mm)

White light - data yet to be processed. 10 sec. integration time. Doppler images of the bright central portion of the cloud - data yet to be processed.

FIELD(S) OF VIEW OF INSTRUMENTS:

- 1) 7.6 deg. FOV

2) 9x7.5 deg. FOV

TIME PERIODS OF DATA: 1) 30 sec. exp. for <sup>a</sup> 40 min. 2)  
 ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):  
 Observing conditions varied from good to moderate, with some haze from time to time. After six minutes, lens changed to 50 mm to accommodate the expanding cloud. At 05:39 the lens was changed to 28 mm.

NO FURTHER INFORMATION AVAILABLE

## EXPERIMENT G-6 12 February 1991, 04:15:00 UT

### Introduction

EXPERIMENT OBJECTIVES: Stimulation of Ion-Cyclotron Waves and Artificial Ion Precipitation

Principal Investigator: S. Mende

Co-Investigators: P. Bernhardt, G. Haerendel, T. Fritz, W. Peterson  
 E. Wescott, D. Papadopolous, R. Smith, M. Pongratz  
 D. Simons, A. Valenzuela, R. Anderson

Location: Approximately 6 Re outside plasmopause on field line accessible to Millstone Hill Radar.

Time: Pre-Midnight Local Time Sector (2200-2400 LT)

Other Conditions: Darkness over North America, Local Plasma Density  $N < 1/\text{cm}^3$

Chemicals: 20 kg. Lithium (2 Large Canisters)

It is expected that the pre-midnight sector will be dominated by energetic protons which precipitate to form the pre-midnight proton aurora. The injection of an artificial cloud of cold Lithium plasma will lead to the generation of ion-cyclotron waves, and these waves in turn will scatter protons into the loss cone leading to enhanced proton aurora. The enhanced precipitation will be detected by optical instruments at the foot of the field line, and the CRRES/GTO wave and particle instrumentation will aid in determining the optimum conditions for release.

POINT OF CONTACT:	Steve Mende LPARL 3251 Hanover St. Palo Alto, CA 94304	SPAN - LOCKHD::MENDE PHONE (415) 424-3282 FAX - (415) 424-3333
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### EXPERIMENT ELEMENTS:

Coordinates of Release: 4.9N 76.1W 32249 km

Canister Type: Large

Chemicals 6A: TI 5770 gms, B 2604 gms, LI 457 gms, EU 299 gms

6B: TI 5767 gms, B 2603 gms, LI 457 gms, EU 299 gms

Delay: None

Model Calculations -	Ted Fritz LANL MS - D438 Los Alamos, NM 87545	SPAN - ESSDP1::FRITZ PHONE: (505)667-9234 FAX: (505)665-3332
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**STATIONS COVERING THE RELEASE:**

Aircraft - C135-127

Boston LTF. Goddard Space Flight Center, MD. Los Alamos (Breezy Point), White Sands, NM.

Cerro Tololo, Chile

El Leoncito, Argentina

**Aircraft- C135-127.****STATION LEADER AND/OR OTHER CONTACT:**

Rick Rairden

DEPT 91-20 BLDG. 255

LPARL

3251 Hanover St.

Palo Alto, CA 94304

SPAN - LOCKHD::RAIRDEN

PHONE (415) 424-3287

FAX - (415) 424-3333

**FOR GEOGRAPHIC COORDINATES OF AIRCRAFT TRACK CONTACT:**

Eugene Wescott

Geophysical Institute

University of Alaska

Fairbanks, AK 20771

SPAN - UAFGI::ROCKET

PHONE (907) 474-7576

FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Video, U-MATIC 3/4". Additional data was recorded on lower quality 8mm video cassette. Most images are white light; occasional filter wheel cycles are made through 5577A, 4278A, 4862A, and 4890A (each of ~30A width)

**NO FURTHER INFORMATION AVAILABLE**

**Boston, Lincoln Test Facility.****42.424N 71.351W .036km****STATION LEADER AND/OR OTHER CONTACT:**

TECH.INT'L.CORP.

75A Wiggins Ave.

Bedford, MA 01730

PHONE (617) 275-8424

FAX - (617) 259-0734

**OTHER CONTACT (Data Held By):**

Mary Miller

GSFC CODE 696

Greenbelt, MD 20771

SPAN - ELDYN::U6MLM

PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified Television - White light -

**FIELD(S) OF VIEW OF THE INSTRUMENT:** 5x6 deg. FOV

**TIME PERIODS OF DATA:** \* 6 min.

**ASSESSMENT OF DATA:** Weather cloudy and hazy. Lithium expansion visible \* 5 minutes.

**NO FURTHER INFORMATION AVAILABLE**

**Cerro Tololo, Chile.****30.165S 70.81W 4.0 km****STATION LEADER AND/OR OTHER CONTACT:**

Bob Candey

GSFC CODE 696

Greenbelt, MD 20771

SPAN - ELDYN::ORRMC

PHONE (301) 286-6707

**OTHER CONTACT (Data held by):**

Mary Miller  
 GSFC CODE 696  
 Greenbelt, MD. 20771

SPAN - ELDYN::U6MLM  
 PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Intensified White Light TV VHS format
- 2) Intensified White Light 35 mm Film
- 3) Non-Intensified 35 mm color film
- 4) CCD - Intensified FITS images/9 trk tape

**FIELD(S) OF VIEW OF THE INSTRUMENT:**

- 1) 7-10 deg. FOV
- 2) 7-10 deg. FOV
- 3) 10-15 deg. FOV
- 4) 10-15 deg. FOV

**TIME PERIODS OF DATA:**

- 1) \* 10 minutes.
- 2) \* 10 minutes.
- 3) \* 2 minutes.
- 4) \* 12 minutes.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear skies, TV gain was turned down, so frames must be integrated to obtain acceptable images. 35 mm Intensified film images fill the FOV after 10 minutes 35mm Color film image and CCD images are good.

NO FURTHER INFORMATION AVAILABLE

**El Leoncito, Argentina.**  
**31.802S 69.329W 2.4km**

**STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerendel  
 Max Plank Institute fuer  
 extraterrestriche Physik  
 8046 Garching, Germany

SPAN - MPE::HAE  
 PHONE 49-89-3299-3516 or 3503  
 FAX - 49-89-3299-3569

**OTHER CONTACT (Data Held By):**

Dr. Arnoldo Valenzuela  
 Max Plank Institute fuer  
 extraterrestriche Physik  
 8046 Garching, Germany

SPAN - MPE::VAL  
 PHONE 49-89-3299-3513 or 3503  
 FAX - 49-89-3299-3569

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Video: VHS PAL (TV-RCA) no filter.

**FIELD(S) OF VIEW OF INSTRUMENTS:** \* 10 deg. FOV

**TIME PERIODS:** 04:15 - 04:20 UT

**SAMPLING RATES:** 40 ms

**FRAME RATES:** 40 ms - 5.12 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good quality of recordings.

**INITIAL FINDINGS:** Li observed for 5 minutes. EuI/EuII observation marginal.

ADDITIONAL RESEARCH: Determination of Li cloud expansion velocity and ionization time constant.

**Goddard Space Flight Center.**  
**38.98N 76.85W**

STATION LEADER AND/OR OTHER CONTACT:

Paul Marionni	SPAN - ELDYN::XRPAM
GSFC CODE 696	PHONE (301)286-5403
Greenbelt, MD 20771	

OTHER CONTACT (Data Held By):

Mary Miller	SPAN - ELDYN::U6MLM
GSFC CODE 696	PHONE (301) 286-8751
Greenbelt, MD 20771	

TYPE AND DESCRIPTION OF DATA ACQUIRED: Intensified White light 35 mm B/W Film

FIELD(S) OF VIEW OF THE INSTRUMENT: 10 deg. FOV

TIME PERIODS OF DATA: \* 7 min.

SAMPLING RATES: 4s/15s exp. 8s/30s exp.

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):  
 Weather condition- good. Data quality- good.

NO FURTHER INFORMATION AVAILABLE

**Los Alamos (Breezy Point).**  
**35.78N 106.23W 1.95km**

STATION LEADER AND/OR OTHER CONTACT:

Morrie Pongratz	SPAN - ESSDP1::PONGRATZ
LANL	PHONE (505) 667-4740
Group SST-7 MS-D466	FAX - (505) 665-0850
Los Alamos, NM 87545	

TYPE AND DESCRIPTION OF DATA ACQUIRED: 400 mm, Intensified 4554A 35 mm Film  
 Objective Grating

FIELD(S) OF VIEW OF THE INSTRUMENT: \* 4 deg. FOV

NO FURTHER INFORMATION AVAILABLE

**White Sands.**  
**(MIT/LL ETS) 33.817N 106.699W (1)**  
**(WSMR ORTHO) 32.467N 106.274W (2)**

STATION LEADER AND/OR OTHER CONTACT:

Paul A. Bernhardt	SPAN - VA::BERN
NRL CODE 4780	PHONE (202) 767-0196
Washington, DC 20375	FAX - (202) 767-0631

TYPE AND DESCRIPTION OF DATA ACQUIRED:

1) Ebiscon A (14" Schmidt)

2) Ebiscon B (31" Cassegrain)

**FIELD(S) OF VIEW OF THE INSTRUMENT:**

- 1) 3.5/7.0 deg. FOV (1)
- 2) 0.5/1.0 deg. FOV (1)

NO FURTHER INFORMATION AVAILABLE

**EXPERIMENT G-7**  
**13 January 1991          07:05:00 UT**

**Introduction**

**EXPERIMENT OBJECTIVES:** Ion Tracing and Acceleration

Principal Investigator: W. Peterson

Location: Magnetosphere

Time: 07:05:00 UT

Altitude: 33403 km

Chemicals: 20 Kg. Lithium (2 Large Canisters)

This experiment is proposed in the sense that it would require two additional Lithium canisters to be carried on the CRRES/GTO using two spare large canister that were left after the allocation of canisters to the existing experiments was made. Originally, this experiment planned to use the GTO Lithium and Barium releases to trace ion transport and acceleration through the magnetosphere. Detection of the ions would be with mass spectrometers on board existing satellites. Due to the delays in the CRRES program, it now appears that there may not be suitable satellites (ISEE, DE) still operating when the main group of CRRES/GTO releases are done in 1991-1992. Therefore, this experiment would be best done by waiting until components of the ISTP mission are in place and choosing an optimum location for the release based on the position of the CRRES/GTO and other satellites with mass spectrometers. This experiment offers a unique opportunity to study the transport and possible acceleration of ions from a point release, and will be very complementary to the goals of the ISTP Program with regard to study of the sources of plasma within the magnetosphere.

POINT OF CONTACT: W. Peterson LPARL 3251 Hanover St. Palo Alto, CA 94304	SPAN - LOCKHD::PETE PHONE (415) 424- FAX - (415) 424-
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Co-Investigators: Haerendel, Valenzuela, Rairden, Wescott, Candey, Pongratz

**EXPERIMENT ELEMENTS:**

Coordinates of Release: 8.0N 86.7W 33403 km  
 Type of Canister: Large  
 Chemicals: 7A, TI 5768 gms B 2603 gms LI 457 gms EU 299 gms  
 7B, TI 5768 gms B 2603 gms LI 457 gms EU 299 gms  
 Delay: None

Model Calculations - Ted Fritz LANL MS - D438	SPAN - ESSDP1::FRITZ PHONE (505) 667-9234 FAX - (505) 665-3332
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Los Alamos, NM 87545

**STATIONS COVERING THE RELEASE:**

Aircraft- Argentine B-707, C135-127  
 Cerro Tololo, Chile  
 El Leoncito, Argentina  
 Rosemary Hills, FL. Los Alamos (Breezy Point), White Sands, NM  
 Satellite - Akebono  
 CRRES  
 Dynamics Explorer-1

**Aircraft- Argentine B707**

**STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerendel	SPAN - MPE::HAE
Max Planck Institute fuer	PHONE 49-89-3299-3516 or 3503
extraterrestriche Physik	FAX - 49-89-3299-3569
8046 Garching, Germany	

**OTHER CONTACT:**

Dr. Arnoldo Valenzuela	SPAN - MPE::VAL
Max Planck Institute fuer	PHONE 49-89-3299-3513 or 3503
extraterrestriche Physik	FAX - 49-89-3299-3569
8046 Garching, Germany	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Video-UMatic PAL Filter: Li I and Eu I & II

**FIELD(S) OF VIEW OF INSTRUMENTS:** 6x4 deg. FOV

**TIME PERIODS OF DATA:** 07:05 - 07:07 UT

**SAMPLING RATES:** 40 ms - .32 sec.                      **FRAME RATES:** 40 ms - 5.12 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
 Clear sky. Good quality of recording.

**INITIAL FINDINGS:** Li observed for about 2 min (see above). EuI/EuII observation marginal.

**ADDITIONAL RESEARCH:** Determination of Li cloud expansion velocity and ionization time constant.

**Aircraft- C135-127.**

**STATION LEADER AND/OR OTHER CONTACT:**

Rick Rairden	SPAN - LOCKHD::RAIRDEN
DEPT 91-20 BLDG. 255	PHONE (415) 424-3287
LPARL	FAX - (415) 424-3333
3251 Hanover St.	
Palo Alto, CA 94304	

**FOR GEOGRAPHIC COORDINATES OF AIRCRAFT TRACK CONTACT:**

Eugene Wescott	SPAN - UAFGI::ROCKET
Geophysical Institute	PHONE (907) 474-7576
University of Alaska	FAX - (907) 474-7290
Fairbanks, Alaska 99701	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Video, U-MATIC 3/4"

Additional data was recorded on lower quality 8mm video cassette. Most images are white light; occasional filter wheel cycles are made through 5577A, 4278A, 4862A, and 4890A (each of ~30A width).

**TIME PERIODS OF DATA:** 06:54 - 07:42 UT

**NO FURTHER INFORMATION AVAILABLE**

**Cerro Tololo, Chile.  
30.165S 70.81W 4.0 km**

**STATION LEADER AND/OR OTHER CONTACT:**

Bob Candey	SPAN - ELDYN::ORRMC
GSFC CODE 696	PHONE (301) 286-6707
Greenbelt, MD 20771	

**OTHER CONTACT (Data Held By):**

Mary Miller	SPAN - ELDYN::U6MLM
GSFC CODE 696	PHONE (301) 286-8751
Greenbelt, MD 20771	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Intensified White Light TV VHS format
- 2) Non - Intensified 35 mm Color Film
- 3) CCD - Intensified FITS images/9 trk tape

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 7-10 deg. FOV
- 2) 10-15 deg. FOV
- 3) 10-15 deg. FOV

**TIME PERIODS OF DATA:**

- 1) <sup>a</sup> 10 minutes
- 2) <sup>a</sup> 5 minutes
- 3) <sup>a</sup> 2 minutes

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear skies, TV gain was turned down, so frames must be integrated to obtain acceptable images. 35 mm Color film image is good. CCD images are ?.

**NO FURTHER INFORMATION AVAILABLE**

**El Leoncito, Argentina.  
31.802S 69.329W 2.4km**

**STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerendel	SPAN - MPE::HAE
Max Planck Institute fuer	PHONE 49-89-3299-3516 or 3503
extraterrestriche Physik	FAX - 49-89-3299-3569
8046 Garching, Germany	

**OTHER CONTACT (Data Held By):**

Dr. Arnoldo Valenzuela	SPAN - MPE::VAL
Max Planck Institute fuer	PHONE 49-89-3299-3513 OR 3503
extraterrestriche Physik	FAX - 49-89-3299-3569



8046 Garching, Germany

**TYPE AND DESCRIPTION OF DATA ACQUIRED: Video:**

- 1) UMatic PAL(TV-SEC) 07:05-07:07
- 2) VHS PAL (TV-RCA) 07:05-07:07

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 4x6 deg. FOV
- 2) \* 18 deg. FOV

**TIME PERIODS OF DATA: ??**

**SAMPLING RATES: 40 ms**

**FRAME RATES: 40 ms - 2.56 sec**

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good sky. Fair quality of recording.

**INITIAL FINDINGS:** Li observed for about 2 minutes (see above). EuI/EuII observation marginal.

**ADDITIONAL RESEARCH:** Determination of Li cloud expansion velocity and ionization time constant.

**Los Alamos (Breezy Point).**  
**35.78N 106.23W 1.95km**

**STATION LEADER AND/OR OTHER CONTACT:**

Morrie Pongratz

LANL

Group SST-7 MS-D466

Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ

PHONE (505) 667-4740

FAX - (505) 665-0850

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 400 mm, Intensified 4554A 35 mm Film

**FIELD(S) OF VIEW OF INSTRUMENTS:** \* 4 deg. FOV

**NO FURTHER INFORMATION AVAILABLE**

**Rosemary Hills, FL.**  
**29.4N 82.5W 0.044km**

**STATION LEADER AND/OR OTHER CONTACT:**

David Rees, Nigel Meredith

University College London

London

SPAN: 19527::CBS%UK.AC.UCL.PH.APG::NPM

PHONE:010-44-71-636-8333 EXT.3430

FAX: 010-44-71-436-7615

**OTHER CONTACT (Data Held By):**

Mary Miller

GSFC CODE 696

Greenbelt, MD 20771

SPAN - ELDYN::U6MLM

PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) IPD Images (135 mm, 6710A filtered) 30 sec. exp. for \* 30 min.
- 2) CCD camera images (50 mm) White light - data to be processed.

Doppler images of the bright central portion of the cloud- data to be processed.

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 7.6 deg. FOV

2) 9 deg. x 7.5 deg. FOV

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
Observing conditions varied from good to moderate, with some haze from time to time. After twelve minutes, lens changed to 50 mm to accommodate the expanding cloud. Cloud monitored until 07:35 (30 min.)

NO FURTHER INFORMATION AVAILABLE

### Satellite.

#### EXPERIMENTAL ELEMENTS:

A pair of large lithium canisters released over the field of view of the Millstone Radar at a time favorable for detection by at least one satellite other than CRRES. At the time of release three satellites had operating ion mass spectrometers: CRRES, Dynamics Explorer - 1, and Akebono. Dynamics Explorer - 1 was in a favorable location for detection of released lithium.

#### TYPE AND DESCRIPTION OF DATA ACQUIRED:

From DE-1: None: The satellite stopped accepting commands and the tape recorder failed after data supporting the release were acquired but before they could be transmitted to the ground. A ground command link was established to be DE in mid February, but the tape recorder failed completely. DE-1 operations ended in March 1991.

From Akebono: SMS data in Summary Spectrograph format for available orbit segments.

From CRRES: IMS-LOW data in Summary Spectrograph format. IMS-LOW averaged over 5 to 15 minute time intervals.

INITIAL FINDINGS: No lithium ions detected on Akebono or CRRES.

NO FURTHER INFORMATION AVAILABLE

### White Sands.

(MIT/LL ETS) 33.817N 106.699W (1)  
(WSMR ORTHO) 32.467N 106.274W (2)

#### STATION LEADER AND/OR OTHER CONTACT:

Paul A. Bernhardt	SPAN - VA::BERN
NRL CODE 4780	PHONE (202) 767-0196
Washington, DC 20375	FAX - (202) 767-0631

#### TYPE AND DESCRIPTION OF DATA ACQUIRED:

- 1) Filtered/Intens. CCD, European Neutral Filter
- 2) 35 mm Film Camera, no filter, 50 mm f/1.8 lens

#### FIELD(S) OF VIEW OF INSTRUMENTS:

- 1) 0.6 deg. FOV (2)
- 2) 27 deg. FOV (2)

TIME PERIODS OF DATA: 07:04:03 to 07:03:45 ??????

SAMPLING RATES: Both cameras: 4 sec on exposure every 20 seconds

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION): Good lithium neutral cloud images. Clear skies

INITIAL FINDINGS: Lithium expansion, and high resolution of therrite. Results described in "Probing the magnetosphere using chemical releases from the Combined Release and Radiation Effects Satellite" by P.A. Bernhardt, Phys. Fluids., 4, 2249-2256, 1992.

NO FURTHER INFORMATION AVAILABLE

**EXPERIMENT G-8.**  
**17 February 1991                      03:30:00 UT**

**Introduction**

**EXPERIMENT OBJECTIVES:** Gravitational Instability, Field Equipotentiality, Ambipolar Acceleration

Principal Investigator: D. J. Simons

Co-Investigators: T. Fritz, M. B. Pongratz, G. Haerendel, S. Mende

Location: Greater than 6 Re on a field line connected to plasma sheet

Time: Dawn; 03:30:00

Altitude: Near CRRES/GTO Perigee

Chemicals: 40 Kg. barium (2 Large Canisters) with 5% Lithium

**DESCRIPTION:** The injection of heavy ions into the plasma sheet in the period during the growth phase of a magnetic substorm should lead to the formation of a region of magnetic reconnection as the ions move across the equator. The heavy ions will add both mass and momentum to the already distorted tail like field within the plasma sheet. This would occur after the barium has undergone its initial expansion and has coupled to the background plasma. If the timing is correct we should be able to visualize with optical instrumentation as well as with the onboard instrumentation, the plasma convection inward and outward from the so-called "x-point of reconnection. If the release were to fail to initiate the reconnection at its location the natural progress of the substorm will still permit the visualization of the inward convection of the magnetic field and trapped plasma sheet during the so-called "expansion" phase of the storm, since the injected plasma should be well inside the position of any natural occurring "a-point". This experiment will require the real-time monitoring of the trapped energetic electron population identified. This would also be helped by real-time data on the state of the magnetic field near injection and the interplanetary magnetic field upstream of the bow shock.

**POINT OF CONTACT:**

Morrie Pongratz

LANL

Group SST-7 MS-D466

Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ

PHONE (505) 667-4740

FAX - (505) 665-0850

**EXPERIMENTAL ELEMENTS:**

Coordinates of Release: 0.4N 58.1W 33553 km

Canister Type: Large

Chemicals: 8A TI 4556 gms B 2056 gms BA 5410 gms

8B TI 4282 gms B 2068 gms BA 5304 gms SR 67 gms

Delay: None

Model Calculations - Ted Fritz  
LANL

SPAN - ESSDP1::FRITZ  
PHONE (505) 667-9234

MS - D438  
Los Alamos, NM 87545

FAX - (505) 665-3332

#### STATIONS COVERING THE RELEASE:

Aircraft- C135-127

Bonaire, NA. St. Croix, USVI (Caribbean)

Boston- LTF. Goddard Space Flight Center, MD. Los Alamos (Breezy Point), White Sands, NM. Edisto Island, SC

Cerro Tololo, Chile

El Leoncito, Argentina

#### SUMMARY OF LAUNCH:

The G-8 High-altitude barium release was accomplished on Feb. 17, 1991 at 03:30:00 UTC. The satellite position was 0.4 N, 58.1 W, altitude 33553 km. The satellite instruments indicated a thermal plasma density of  $2.3 \text{ elec/cm}^3$ , energetic electron fluxes of  $1.8 \times 10^8$  (perpendicular) and  $6 \times 10^7$  (parallel)  $\text{keV/cm}^2\text{-ster-sec}$ , and the Boulder K was 1+ -2-. The Millstone Radar was showing pre-midnight westward convection, the electric field strength at the estimated position of the conjugate to the CRRES satellite was estimated as 13 millivolts/meter.

Prior to the release, the aircraft in Canada reported overhead diffuse aurora of 900 Rayleighs with weak arcs north of the zenith. Roger Anderson reported that CRRES was measuring weak Auroral Kilometric Radiation with a lower frequency limit of 150 kHz. At the release, Howard Singer reported 100% diamagnetism lasting for 12 seconds. After the release the following was observed.

1. The aircraft reported activation of an arc to the north which lasted from 03:31:10 until 04:10:00.
- 2) The AKR signature showed intensification with the lower frequency cutoff moving down to 100 kHz between 03:36 and 04:15. It was not possible to observe AKR between 03:30 and 03:36 due to the shielding effect of the barium cloud.
- 3) Low-frequency emissions were observed between 03:36 and 03:43, extending from 4 Hz to 100 Hz. There was no similar low-frequency activity observed at any other time between 02:41 and 04:28.

We had fairly good coverage from the ground optical sites. The New Mexico sites were unfortunately clouded over most of the time but they did manage a few frames of data. Richland, Washington had clouds and heavy haze in the event area. The east coast of the US was good for the duration. St. Croix and Bonaire were good for the event, and Arecibo started out clouded over but later cleared and tracked the Ba streak(s) from 0415 to 0445. Cerro-Tololo and El Leoncito were good initially, but El Leoncito clouded over later.

Curiously, at 0445 three stations, Cerro-Tololo, GSFC, and Bonaire reported that they could no longer track the Ba streaks, and the observers felt that the streaks dimmed. This was possibly due to increased activity which caused the Ba cloud to diffuse more rapidly and thereby decrease the surface brightness.

There was a near-overflight of the DMSP F-9 satellite at 03:49, although the track was somewhat to the west of the conjugate point. Nonetheless, this wide-area should provide valuable additional information.

(This section is taken from "CRRES NEWS, July 13 1991 written by David L. Reasoner).

**Aircraft- C135-127**

## STATION LEADER AND/OR OTHER CONTACT:

Rick Rairden  
DEPT 91-20 BLDG. 255  
LPARL  
3251 Hanover St.  
Palo Alto, CA 94304

SPAN - LOCKHD::RAIRDEN  
PHONE (415) 424-3287  
FAX - (415) 424-3333

## FOR GEOGRAPHIC COORDINATES OF AIRCRAFT TRACK CONTACT:

Eugene Wescott  
Geophysical Institute  
University of Alaska  
Fairbanks, AK 99701

SPAN - UAFGI::ROCKET  
PHONE (907) 474-7576  
FAX - (907) 474-7290

FOR G8 USAF (aircraft) a/c3127 DATA CONTACT: E.M. Wescott

TYPE AND DESCRIPTION OF DATA ACQUIRED: Video, U-MATIC 3/4"

Additional data was recorded on lower quality 8mm video cassette. Most images are white light; occasional filter wheel cycles are made through 5577A, 4278A, 4862A, and 4890A (each of ~30A width).

## TIME PERIODS OF DATA:

- 1a) 01:02 - 03:08 UT (intermittent data)  
1b) 03:20 - 04:17 UT

NO FURTHER INFORMATION AVAILABLE

**Bonaire, NA (Caribbean).**  
**12.24N 68.33W 0.0km**

## STATION LEADER AND/OR OTHER CONTACT:

Mary Miller  
GSFC CODE 696  
Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
PHONE (301) 286-8751

TYPE AND DESCRIPTION OF DATA ACQUIRED: Intensified 4554A 35 mm B/W Film

FIELD(S) OF VIEW OF INSTRUMENTS: 10 deg. FOV

TIME PERIODS OF DATA: \* 57 min.

SAMPLING RATES: exp.8/30 sec.

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION): Clear with spotty clouds, ion at edge of film due to optical misalignment.

NO FURTHER INFORMATION AVAILABLE

**Boston, Lincoln Test Facility.**  
**42.424N 71.351W .036km**

## STATION LEADER AND/OR OTHER CONTACT:

TECH.INT'L.CORP.  
75A Wiggins Ave.  
Bedford, MA 01730

PHONE (617) 275-8424  
FAX - (617) 259-0734

OTHER CONTACT (Data Held By):

Mary Miller  
 GSFC CODE 696  
 Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
 PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Intensified Television White light
- 2) 70 mm Color Film

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 5x6 deg. FOV
- 2) \* 18 deg. FOV

**TIME PERIODS OF DATA:**

- 1) \* 69 minutes.
- 2) 29 minutes.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**

Weather condition- clear. Data quality- good

NO FURTHER INFORMATION AVAILABLE

**Cerro Tololo, Chile.**  
**30.165S 70.81W 4.0 km**

**STATION LEADER AND/OR OTHER CONTACT:**

Bob Candey  
 GSFC CODE 696  
 Greenbelt, MD 20771

SPAN - ELDYN::ORRMC  
 PHONE (301) 286-6707

**OTHER CONTACT (Data Held By):**

Mary Miller  
 GSFC CODE 696  
 Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
 PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Intensified 4554A TV VHS format
- 2) Intensified 4554A 35 mm Film
- 3) Non-Intensified 35 mm Color Film
- 4) CCD - Intensified FITS images/9 trk tape

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 7-10 deg. FOV
- 2) 7-10 deg. FOV
- 3) 7-10 deg. FOV
- 4) 10-15 deg. FOV

**TIME PERIODS OF DATA:**

- 1) \* 55 minutes
- 2) \* 45 minutes
- 3) \* 20 minutes
- 4) \* 50 minutes

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear skies, TV gain was turned down, so frames must be integrated to obtain acceptable images. Intensified 35 mm film is excellent. 35 mm Color film image is good. CCD images are good.

NO FURTHER INFORMATION AVAILABLE

**Edisto Island, S.C.  
32.43N 80.35W**

**STATION LEADER AND/OR OTHER CONTACT:**

Danny Williams  
4424 Clovewood St.  
Ladson, SC 29456

PHONE (803) 875-4260

**OTHER CONTACT (Data Held By):**

Mary Miller  
GSFC CODE 696  
Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** KONICA ST-G 3200 Color Prints

**FIELD(S) OF VIEW OF INSTRUMENTS:** ~15 deg. FOV

**TIME PERIODS OF DATA:** 10 exposures over 19 minutes

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
Weather clear, good photographs.

NO FURTHER INFORMATION AVAILABLE

**El Leoncito, Argentina.  
31.802S 69.329W 2.4km**

**STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerendel  
Max Plank Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::HAE  
PHONE 49-89-3299-3516 or 3503  
FAX - 49-89-3299-3569

**OTHER CONTACT (Data Held By):**

Dr. Arnaldo Valenzuela  
Max Plank Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::VAL  
PHONE 49-89-3299-3513 or 3503  
FAX - 49-89-3299-3569

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Video:

- 1) UMatic PAL (TV-SEC) BA II filter
- 2) VHS PAL (TV-RCA) no filter

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 2.0x1.6 deg. FOV
- 2) \* 10 deg. FOV

**TIME PERIODS:**

- 1) 03:30 - 04:00 UT
- 2) 03:30 - 04:00 UT

**SAMPLING RATES:**

- 1) 40 ms - 2.6 sec
- 2) 40 ms

**FRAME RATES:** 40 ms - 2.6 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good seeing conditions. End of observation release +30 min (after release) due to sudden cloud coverage. Good quality of recordings.

**INITIAL FINDINGS:** Diamagnetic cavity apparent. Diffuse part separates towards west from main part.

**ADDITIONAL RESEARCH:** Triangulation will be performed with other stations or with the magnetic field model.

**Goddard Space Flight Center.  
38.98N 76.85W**

**STATION LEADER AND/OR OTHER CONTACT:**

Paul Marionni  
GSFC CODE 696  
Greenbelt, MD 20771

SPAN - ELDYN::XRPAM  
PHONE (301) 286-5403

**OTHER CONTACT (Data Held By):**

Mary Miller  
GSFC CODE 696  
Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified 4554A 35 mm B/W Film

**FIELD(S) OF VIEW OF INSTRUMENTS:** 10 deg. FOV

**TIME PERIODS OF DATA:** \* 73 min. 4s/15s exp. 8s/30s exp.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
Weather condition- clear Data quality- good

NO FURTHER INFORMATION AVAILABLE

**Los Alamos (Breezy Point).  
35.78N 106.23W 1.95km**

**STATION LEADER AND/OR OTHER CONTACT:**

Morrie Pongratz  
LANL  
Group SST-7 MS-D466  
Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ  
PHONE (505) 667-4740  
FAX - (505) 665-0850

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 400 mm, Intensified 4554A 35 mm Film  
Field Cals. Objective Grating

**FIELD(S) OF VIEW OF INSTRUMENTS:** \* 4 deg. FOV

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Film not high quality.

NO FURTHER INFORMATION AVAILABLE



**St. Croix, USVI (Caribbean).  
17.738N 64.773W**

**STATION LEADER AND/OR OTHER CONTACT:**

Morrie Pongratz

LANL

Group SST-7 MS-D466

Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ

PHONE (505) 667-4740

FAX - (505) 665-0850

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 400 mm, Intensified 4554A 35 mm Film

**FIELD(S) OF VIEW OF INSTRUMENTS:** ~4 deg. FOV

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**

Excellent high resolution data

NO FURTHER INFORMATION AVAILABLE

**EXPERIMENT G-9.  
19 JULY 1991 08:37:07 UT**

**Introduction**

**EXPERIMENT OBJECTIVES:** Field Line Tracing and Equipotentiality, Momentum Coupling Velocity Distribution Relaxation and Field Equipotentiality

**Principal Investigator:** M. Pongratz

**Co-Investigators:** D. Simons, D. Papadopolous, R. Smith, S. Mende, E. Wescott, R. Hoffman, R. Anderson, W. Swartz, E. Szuszczewicz

**Location:** Caribbean with Orbital Velocity Perpendicular to Magnetic Field.

**Time:** Dawn

**Altitude:** CRRES/GTO near Perigee

**Chemicals:** 40 kg. barium (2 Large Canisters)

An artificial plasma release at high velocity produces a state of free energy that is far removed from thermal equilibrium. Departures from thermal equilibrium in the form of non-Maxwellian distributions and distributions peaked away from zero velocity lead to kinetic instabilities which create high-frequency electric fields. These electric fields provide anomalous collisions allowing momentum, energy, and current transport that would not otherwise exist in the absence of binary collisions. Such processes compete with the polarization fields in slowing down the cross-field directed plasma and lead to very different plasma states at the end of the coupling process. This experiment will investigate what instabilities are active; the instability saturation, or limiting conditions; the resulting electric and magnetic DC and AC fields, and the final velocity distribution of the injected plasma.

**POINT OF CONTACT:**

M. Pongratz

LANL MS - D466

Group SST

Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ

PHONE (505) 667-4740

and

E. Wescott

SPAN - BARBEY::ROCKET

Geophysical Institute  
University of Alaska  
Fairbanks, AK 99701

PHONE (907) 474-7576  
FAX - (907) 474-7290

#### EXPERIMENTAL ELEMENTS:

Coordinates of Release: 17.4N 62.8W 441km

Canister Type: Large

Chemicals: 9A TI 4692 gms B 2118 gms BA 5202 gms LI 11 gms  
9B TI 4693 gms B 2118 gms BA 5203 gms LI 11 gms

Delay: None

#### STATIONS COVERING THE RELEASE:

Aircraft- Argentina B-707, Aircraft- C135-127, Aircraft- C135-131  
Arecibo, PR. Aruba. St. Croix, USVI. St. Thomas, USVI (Caribbean)  
Reconquista, Argentina

#### SUMMARY OF LAUNCH:

The G-9 barium release was done on Feb. 19, 1991 at 08:37:07 UTC. at 17.4 N, 62.8 W, altitude 441 km. This location was directly over the island nation of St. Kitts. The release was immediately confirmed by visual sightings, with reports of "very spectacular". The early-time measurements showed that most of the ions skidded to a stop in 7 kilometers, but that some ions decoupled from the plasma cloud and traveled upward and downward along the magnetic field in single particle trajectories.

Both Caribbean aircraft reported "excellent data", with tracking of the barium ion streaks to the horizons. This confirms that a portion of the ions made the trip along the magnetic field for large distances.

The release was seen and the subsequent ions tracked by ground sites at Arecibo, St. Croix, Guadeloupe, and Aruba. Observations were made as well by the Soviet Committee for Hydrometeorology Research ship "Professor Zubov" located in a favorable position for triangulation with the sites at St. Croix and Guadeloupe.

The ground site at Reconquista, Argentina observed barium ions coming along the magnetic field lines from the northern release point. The position showed that the ions had drifted westward under the influence of a magnetospheric electric field. The magnetic field indices at the release time were A = 17 and K = 04 (Boulder).

The B-707 aircraft over the South Atlantic observed barium ion streaks beginning at 11 minutes after release until 1 hour, 10 after the release.

This experiment therefore satisfied the dual objectives of studying both early-time momentum coupling (the process that stops the majority of the ions) and the conjugate-point tracing to the opposite end of the magnetic field in the southern hemisphere.

(This section is taken from "CRRES NEWS, July 19 1991 written by David L. Reasoner).

#### **Aircraft- Argentine B707.**

#### STATION LEADER AND/OR OTHER CONTACT:

Prof. Gerhard Haerendel  
Max Planck Institute fuer  
extraterrestrische Physik

SPAN - MPE::HAE  
PHONE 49-89-3299-3516 or 3503  
FAX - 49-89-3299-3569

8046 Garching, Germany

**OTHER CONTACT:**

Dr. Arnoldo Valenzuela  
Max Planck Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::VAL  
PHONE 49-89-3299-3513 or 3503  
FAX - 49-89-3299-3569

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Video-UMatic PAL

**FIELD(S) OF VIEW OF INSTRUMENTS:** 17.5x12 deg. FOV

**TIME PERIODS OF DATA:** From 11 min.- 1:40 hr. after release

**SAMPLING RATES:** 40 ms

**FRAME RATES:** 0.12 - 0.64 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear sky. Good quality of data, bright BaII intensity

**INITIAL FINDINGS:** Motion of Ba ions parallel B and sedimentation observed.

**ADDITIONAL RESEARCH:** Motion of Ba ions parallel B faster than expected. Sedimentation slower than expected and at higher altitudes than expected. Good coupling of both conjugate hemispheres.

**Aircraft- C135-127.**

**STATION LEADER AND/OR OTHER CONTACT:**

Rick Rairden  
DEPT 91-20 BLDG. 255  
LPARL  
3251 Hanover St.  
Palo Alto, CA 94304

SPAN - LOCKHD::RAIRDEN  
PHONE (415) 424-3287  
FAX - (415) 424-3333

**FOR GEOGRAPHIC COORDINATES OF AIRCRAFT TRACK CONTACT:**

Eugene Wescott  
Geophysical Institute  
University of Alaska  
Fairbanks, AK 99701

SPAN - UAFGI::ROCKET  
PHONE (907) 474-7576  
FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** The Lockheed cameras are one wide-field (18 deg) with 4554A filter and one narrow-field (4 deg) with 4554A filter and selection of Fabry-Perot etalons. Data: 7 minutes. In-house listings of all image data sequences and notes of image quality and exposure levels, etc. Also available: star-field data and barium calibration lamp images.

**FIELD(S) OF VIEW OF INSTRUMENTS:** see above.

**TIME PERIODS OF DATA:** see above.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Data quality- good

**NO FURTHER INFORMATION AVAILABLE**

**Aircraft- C135-131.****STATION LEADER AND/OR OTHER CONTACT:**

Eugene Wescott  
 Geophysical Institute  
 University of Alaska  
 Fairbanks, AK 99701

SPAN - UAFGI::ROCKET  
 PHONE (907) 474-7576  
 FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Analog composite video recordings on 3/4 inch Numatic and 1/2 VHS

**FIELD(S) OF VIEW OF INSTRUMENTS:** ICCD TV, Super Ferron lens 11.4x14.5 deg. FOV

**TIME PERIODS OF DATA:** 08:37:00 - 09:35

**SAMPLING RATES:** Real time TV

**FRAME RATES:** 30 per second and integrated fields 1 to 4 seconds

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good star field, follow satellite to release, can follow tip to near horizon, lost it at 08:54, 09:02 moved to northern bottom cloud and streak, good stars in white light. At 09

**INITIAL FINDINGS:** ions followed to past the magnetic equator and they were picked up by the MPE 707 near the southern conjugate.

**ADDITIONAL RESEARCH:** Detailed analysis of velocity of tip, convection at both conjugates, field line matching with models, ionospheric activity parameters.

**Arecibo, PR (Caribbean).  
 18.4N 66.88W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Paul A. Bernhardt  
 NRL CODE 4780  
 Washington, DC 20375  
 OTHER CONTACT (Data Held By):

SPAN - VA::BERN  
 PHONE (202) 767-0196  
 FAX - (202) 767-0631

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Filtered/Intensified CCD, 455.4 nm Filter 2 nm BW, 50 mm lens f/0.95
- 2) 35 mm Film Camera, no filter. 1600 speed film 36 exposures 50 mm lens f/1.8

**FIELD(S) OF VIEW OF INSTRUMENTS:**

**TIME PERIODS OF DATA:** 08:36:45 - 09:03:28

**SAMPLING RATES:** 1 second exposure every 20 seconds

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good data, clear skies.

**NO FURTHER INFORMATION AVAILABLE**

**Reconquista, Argentina.**  
**29.2S 59.70W .050 km**

**STATION LEADER AND/OR OTHER CONTACT:**

Eugene M. Wescott  
 University of Alaska  
 Fairbanks, AK 99701

SPAN - UAFGI::ROCKET  
 PHONE (907) 474-7576  
 FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 2 IPDs, filtered at 4554 A (30A width). Data recorded both on video, with time date, and Az-El, updated every second. Integrated frames are stored digitally every 5 or 15 seconds, varies.

**FIELD(S) OF VIEW OF INSTRUMENTS:** 20 degrees circular

**TIME PERIODS OF DATA:** 8:39 - 09:20 UT

**SAMPLING RATES:** Digital data varies between 15 sec. and 5 sec.

**FRAME RATES:** Video is 30fps, but camera data is updated every 1 sec.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good quality - stars are visible down to magnitude 6.0 through a 30A filter. Ba cloud seemed very dim from ground site.

**INITIAL FINDINGS:** Cloud seems diffuse, difficult to find tip. Fits very well to guessed field-line-trace.

**ADDITIONAL RESEARCH:** Need to triangulate with other images in southern hemisphere to get tip positions and field line traces.

**St. Croix, USVI (Caribbean).**  
**17.738N 64.773W**

**STATION LEADER AND/OR OTHER CONTACT:**

Morrie Pongratz  
 LANL  
 Group SST-7 MS-D466  
 Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ  
 PHONE (505) 667-4740  
 FAX - (505) 665-0850

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 400 mm, Intensified 4554A 35 mm Film  
 50 mm Ektachrome film, Objective Grating

**FIELD(S) OF VIEW OF INSTRUMENTS:** ~4 deg. FOV

**NO FURTHER INFORMATION AVAILABLE**

**St. Thomas, USVI (Caribbean).**  
**18.327N 64.898W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Don Slater  
 BATTELLE Pacific Northwest Labs  
 P. O. Box 999 MS - K6-84  
 Richland, WA 99352

Internet - don% solar@pnl.gov  
 PHONE (509) 376-8423

**OTHER CONTACT (Data Held By):**

Mary Miller  
GSFC Code 696  
Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
PHONE (301) 286-8751

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified CCD 512x512 2 bytes/pixel

**FIELD(S) OF VIEW OF INSTRUMENTS:** 20 deg. FOV

**TIME PERIODS OF DATA:** \* 15 minutes

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
Weather condition- cloudy with rain. Some good data

**NO FURTHER INFORMATION AVAILABLE**

## **EXPERIMENT G10**

**20 January 1991**

**05:30:00 UT**

### **Introduction**

This experiment was conceived to study the effect of cold plasma freshly injected into the plasma sheet of the Earth's magneto-tail on the onset of a magnetic substorm. The investigation is based upon a theoretical model of substorm behavior which is derived primarily from observations of phenomenological behavior before, during and after substorms. It has been observed during quiet periods, that time before and after a substorm that the magnetosphere slowly fills up with plasma primarily of ionospheric origins. The geomagnetic field expands under this particle pressure and becomes in essence blown-up like a balloon. In the Earth's magneto-tail the magnetic field is most distorted away from a dipole configuration with a region of field reversal up the center of this tail. There is a current sheet (called the plasma sheet) running up this center line to provide the necessary curl of B to support the field reversal. Geometrically it is as if the field lines have been pulled outwards and distorted to such an extent that the oppositely directed parts of the field come closer together. During or just prior to a magnetic substorm some process allows the oppositely directed magnetic fieldlines to break and jump the plasma sheet. They join together from opposite sides and snap back towards the Earth carrying plasma with them. The field relaxes back towards a dipole-like configuration and trapped particles are accelerated and dumped back into the ionosphere. The question of this investigation centers around the nature of this so called magnetic reconnection and its position as a primary driver of substorm onset or simply as a result of some other incompletely understood complex of primary drivers. It is postulated that the addition of plasma into the near-Earth plasma sheet from a barium release would lead to enhanced turbulence in the region which would provide sufficient dissipation (conductivity) to facilitate this reconnection process. By releasing barium in the midnight sector on a L-shell of 6 or greater with the satellite in the outward portion of the orbit, it will be possible to get plasma to the plasma sheet. This must occur during a quiet time well after the last substorm when the magnetosphere is filled with plasma and well distorted. If reconnection should result and a full blown substorm occur, a careful examination of the extensive optical and in-situ data provided by the CRRES program would provide an excellent opportunity to determine the precise role of reconnection in substorm onset

### **POINT OF CONTACT:**

D. J. Simons  
LANL MS - Dxxx  
Group SST  
Los Alamos, NM 87545

SPAN - ESSDP1::SIMONS  
PHONE (505) 667-xxxx

**EXPERIMENT OBJECTIVES:** Stimulate Magnetospheric Substorm

**Principal Investigator:** D. J. Simons

Co-Investigators: R. Hoffman, M. Pongratz, S. Mende, D. Papadopolous, A. Valenzuela,  
G. Haerendel

Location: Caribbean at Points Selected for Conjugate Point Geometry

Time: Dawn

**EXPERIMENTAL ELEMENTS:**

Coordinates of Release: 8.9N 75.6W 33179 km

Canister Type: Large

Chemicals: 10A TI 4584 gms B 2069 gms BA 5305 gms SR 67 gms  
10B TI 4583 gms B 2069 gms BA 5305 gms LI 67 gms

Delay 10A: None

Delay 10B: 5 seconds

Model Calculations - Ted Fritz

LANL

MS - D438

Los Alamos, NM 87545

SPAN - ESSDP1::FRITZ

PHONE (505) 667-9234

FAX - (505) 665-3332

**STATIONS COVERING THE RELEASE:**

Aircraft- Argentine B707, C135-127

Bonaire, NA. St. Croix, USVI (Caribbean)

Cerro Tololo, Chile

El Leoncito, Argentina

Long Key, FL. Los Alamos (Breezy Point), White Sands, NM

**Aircraft- Argentine B707.**

**STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerendel  
Max Planck Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::HAE

PHONE 49-89-3299-3516 or 3503

FAX - 49-89-3299-3569

**OTHER CONTACT (Data Held By):**

Dr. Arnoldo Valenzuela  
Max Planck Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::VAL

PHONE 49-89-3299-3513 OR 3503

FAX - 49-89-3299-3569

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Video: UMatic PAL(TV-SEC) Ba II  
Filter(4554A)

**FIELD(S) OF VIEW OF INSTRUMENTS:** 4x6 deg. FOV

**TIME PERIODS OF DATA:** 05:30 - 06:30

**SAMPLING RATES:** 40 ms - 32 sec

**FRAME RATES:** 0.12 - 0.64 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear  
sky, good quality of recording, good data.

**INITIAL FINDINGS:** Ba main cloud and diffuse Ba separate.

**ADDITIONAL RESEARCH:** Motion perpendicular B towards west and determination of the electric field perpendicular to B.

### **Aircraft- C135-127.**

**STATION LEADER AND/OR OTHER CONTACT:**

Rick Rairden	SPAN - LOCKHD::RAIRDEN
DEPT 91-20 BLDG. 255	PHONE (415) 424-3287
LPARL	FAX - (415) 424-3333
3251 Hanover St.	
Palo Alto, CA 94304	

**FOR GEOGRAPHIC COORDINATES OF AIRCRAFT TRACK CONTACT:**

Eugene Wescott	SPAN - UAFGI::ROCKET
Geophysical Institute	PHONE (907) 474-7576
University of Alaska	FAX - (907) 474-7290
Fairbanks, AK 99701	

For G10 USAF (aircraft) a/c3127 data contact: E.M. Wescott

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Video, U-MATIC 3/4" . Additional data was recorded on lower quality 8mm video cassette. Most images are white light; occasional filter wheel cycles are made through 5577A, 4278A, 4862A, and 4890A (each of ~30A width). 04:09 - 06:10 U.T. 1) 2 Intensified CCD cameras looking toward the ionosphere 250 km N of A/C 127

**FIELD(S) OF VIEW OF INSTRUMENTS:** 11x14 deg. FOV

**TIME PERIODS OF DATA:** 05:30:00 - 06:30:00

**SAMPLING RATES:** Video standard

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good

**INITIAL FINDINGS:** No aurora at release time. Very faint rays to the north (obvious during turn at 05:34). Very faint forms in field of view at 05:39. Activity starting at 05:40 - rayed arc moves in from east.

**Bonaire, NA (Caribbean).**  
**12.24N 68.33W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Mary Miller	SPAN - ELDYN::U6MLM
GSFC CODE 696	PHONE (301) 286-8751
Greenbelt, MD 20771	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified 4554A 35 mm B/W Film

**FIELD(S) OF VIEW OF INSTRUMENTS:** 10 deg. FOV

**TIME PERIODS OF DATA:** 52 min. exp. 8/30 sec.

**ASSESSMENT OF DATA QUALITY:** Clear, good data

**NO FURTHER INFORMATION AVAILABLE**



**Cerro Tololo, Chile.**  
**30.165S 70.81W 4.0 km**

**STATION LEADER AND/OR OTHER CONTACT:**

Bob Candey	SPAN - ELDYN::ORRMC
GSFC CODE 696	PHONE (301) 286-6707
Greenbelt, MD 20771	

**OTHER CONTACT (Data Held By):**

Mary Miller	SPAN - ELDYN::U6MLM
GSFC CODE 696	PHONE (301) 286-8751
Greenbelt, MD 20771	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Intensified 4554A TV VHS format
- 2) Intensified 4554A 35 mm Film
- 3) Non-Intensified 35 mm Color Film
- 4) CCD-Intensified-FITS images/9 trk tape

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 7-10 deg. FOV
- 2) 7-10 deg. FOV
- 3) 7-10 deg. FOV
- 4) 10-15 deg. FOV

**TIME PERIODS OF DATA:**

- 1) 55 minutes
- 2) 62 minutes
- 3) 48 minutes
- 4) 15 minutes

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear skies, TV gain was turned down, so frames must be integrated to obtain acceptable images. Intensified 35 mm Film is excellent. 35 mm Color Film image is very good. CCD images are good.

NO FURTHER INFORMATION AVAILABLE

**El Leoncito, Argentina.**  
**31.802S 69.329W 2.4km**

**STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerendel	SPAN - MPE::HAE
Max Planck Institute fuer	PHONE 49-89-3299-3516 or 3503
extraterrestriche Physik	FAX - 49-89-3299-3569
8046 Garching, Germany	

**OTHER CONTACT (Data Held By):**

Dr. Arnoldo Valenzuela	SPAN - MPE::VAL
Max Planck Institute fuer	PHONE 49-89-3299-3513 OR 3503
extraterrestriche Physik	FAX - 49-89-3299-3569
8046 Garching, Germany	

**TYPE AND DESCRIPTION OF DATA ACQUIRED: Video:**

- 1) UMatric PAL(TV-SEC) Ba II Filter(4554A)
- 2) VHS PAL (TV-RCA) No Filter

## FIELD(S) OF VIEW OF INSTRUMENTS:

- 1) 2x1.6 deg. FOV
- 2) \* 10 deg. FOV

## TIME PERIODS OF DATA:

- 1) 05:30 - 07:50 UT
- 2) 05:30 - 07:00 UT

## SAMPLING RATES:

- 1) 40 ms - 5.12 sec
- 2) 40 ms

FRAME RATES: 40 ms - 5.12 sec

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION): Good sky, good quality of recording.

INITIAL FINDINGS: Diamagnetic cavity seen. Ba main cloud and diffuse part separate.

ADDITIONAL RESEARCH: Motion perpendicular B towards west. Main part faster than diffuse part.

**Long Key, FL.**  
**24.83N 80.8W 0.0km**

## STATION LEADER OR OTHER CONTACT:

Don Slater  
 BATTELLE Pacific Northwest Labs  
 P. O. Box 999 MS - K6-84  
 Richland, WA 99352

Internet - don%solar@pnl.gov  
 PHONE (509) 376-8423

## OTHER CONTACT (Data Held By):

Mary Miller  
 GSFC CODE 696  
 Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
 PHONE (301) 286-8751

TYPE AND DESCRIPTION OF DATA ACQUIRED: Intensified CCD 512x512 2 bytes/pixel

FIELD(S) OF VIEW OF INSTRUMENTS: 5.2 deg. FOV

TIME PERIODS OF DATA: \* 1 hour

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION): Weather and data good.

NO FURTHER INFORMATION AVAILABLE

**Los Alamos (Breezy Point).**  
**35.78N 106.23W 1.95km**

## STATION LEADER AND/OR OTHER CONTACT:

Morrie Pongratz  
 LANL  
 Group SST-7 MS-D466  
 Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ  
 PHONE (505) 667-4740  
 FAX - (505) 665-0850

TYPE AND DESCRIPTION OF DATA ACQUIRED: 400 mm, Intensified 4554A 35 mm Film

FIELD(S) OF VIEW OF INSTRUMENTS: ~4 deg. FOV

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION): Brief, but good quality film

NO FURTHER INFORMATION AVAILABLE

**St. Croix, USVI (Caribbean).**  
**17.718N 64.858W .264km**

STATION LEADER AND/OR OTHER CONTACT:

Morrie Pongratz

LANL

Group SST-7 MS-D466

Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ

PHONE (505) 667-4740

FAX - (505) 665-0850

TYPE AND DESCRIPTION OF DATA ACQUIRED: 400 mm, Intensified 4554A 35 mm film

FIELD(S) OF VIEW OF INSTRUMENTS: ~4 deg. FOV

NO FURTHER INFORMATION AVAILABLE

**White Sands.**

**(MIT/LL ETS) 33.817N 106.699W (1)**  
**(WSMR ORTHO) 32.467N 106.274W (2)**

STATION LEADER AND/OR OTHER CONTACT:

Paul A. Bernhardt

NRL CODE 4780

Washington, DC 20375

SPAN - VA::BERN

PHONE (202) 767-0196

FAX - (202) 767-0631

TYPE AND DESCRIPTION OF DATA ACQUIRED:

- 1) Filtered/Intens. CCD camera, 445.4 nm filter 2 nm BW
- 2) 35 mm Film Camera

FIELD(S) OF VIEW OF INSTRUMENTS:

- 1) 0.6 deg. FOV (2)
- 2) 27 deg. FOV (2)

TIME PERIODS OF DATA:

SAMPLING RATES:

FRAME RATES:

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):  
 Weak Data. Cloud Cover

NO FURTHER INFORMATION AVAILABLE

## INTRODUCTION TO EXPERIMENTS G-11, G-12

Titlt: Mirror Force, Field Equipotentiality, Ambipolar Acceleration

Principal Investigator: E. Wescott

Co-Investigators: R. Hoffman, M. Pongratz, S. Mende, D. Simons,  
D. Papadopolous, A. Valenzuela, G. Haerendel

Location: Caribbean at Points Selected for Conjugate Point Geometry

Time: Dawn

Altitude: CRRES/GTO near Perigee

Chemicals: 10 kg. Barium (2 small canisters) G-11, G-12

The "mirror force" technique for dispersing visible Barium ion tracers along magnetic field lines provides the only feasible means for measuring the altitude distribution of weak parallel electric fields. The objective is to evaluate the accuracy and time-altitude resolution of this technique and establish the observational and model simulation approaches to extract parallel electric fields from the measured Ba ion motions. By conducting tests at low latitudes the threshold accuracy's and limitations can be defined under conditions of extremely weak parallel electric fields prior to extensive application in future high-latitude missions where highly complex parallel electric field distributions can be anticipated.

One of the fundamental early concepts in space plasma physics was that magnetic field lines are "frozen into" the plasma. This means that parallel electric fields are zero and that field lines are equipotentials. It also means that the transverse electric field should be identical at both ends of the field line at the same magnetic field strength. In one previous experiment using a Ba shaped charge release at low latitude it was observed that the Ba ions in opposite hemispheres did not move identically and hence it was concluded that the field line was not an equipotential. In another case the observations agreed with the "frozen in" concept. These releases will paint entire field lines between the hemispheres, and will be done under varying conditions of magnetic activity. High-resolution optical observations in both hemispheres should permit determination of where and under what conditions a breakdown of the equipotential condition occurs.

It should be remarked that experiments G-8 through G-12 all benefit from the high release altitude of the CRRES/GTO compared to the original baseline of CRRES in LEO at 358 km. The experiments all depend upon launching ions upward along magnetic field lines, and this process is impeded by collisions of the ions with the upper atmosphere. Computer modeling has shown that a significant difference, perhaps an order of magnitude, exists in the number of ions launched upward from initial injection altitudes of 400 versus 358 km.

## EXPERIMENT G11a

**22 JULY 1991 08:38:24 UT**

### POINT OF CONTACT:

E. Wescott	SPAN - UAFGI::ROCKET
Geophysical Institute	PHONE (907) 474-7576
University of Alaska	FAX - (907) 474-7290
Fairbanks, AK 99701	

### EXPERIMENT OBJECTIVES:

Mirror Force, Field Equipotentiality, Ambipolar Acceleration  
Principal Investigator: E. Wescott

Co-Investigators: R. Hoffman, M. Pongratz, S. Mende, D. Simons,  
D. Papadopolous, A. Valenzuela, G. Haerendel

Location: Caribbean at Points Selected for Conjugate Point Geometry

Time: Dawn

**EXPERIMENTAL ELEMENTS:**

Coordinates of Release: 16.8N 60.3W 411 km  
 Canister Type: Small  
 Chemicals: TI 1270 gms B 573 gms BA 1371 gms SR 19 gm  
 Delay: None

**STATIONS COVERING THE RELEASE:**

Aircraft- Argentine B707, C135-127, C135-131  
 Arecibo, PR. Bonaire, NA. St. Croix, St. Thomas, USVI. (Caribbean)  
 Aruba  
 Reconquista, Argentina

**SUMMARY OF LAUNCH:**

The CRRES G-11a release was done on July 22, 1991 at 08:38:24 UTC. The release location was 16.8 N, 60.3 W, altitude 411 km, a point northeast of Guadeloupe.

The release was observed and tracked by several ground sites and two aircraft in the caribbean. The ion streak was observed to initially travel southward, and the slow considerably. In contrast with G-1 and G-9, there was no immediate signature of the barium ions in the southern hemisphere.

Initial reports from the Caribbean sites indicated that the ion cloud did not travel very far up the field and most of the ions remained in a region near the initial release point. The location of the release had been chosen so that the pitch angle (angle between the magnetic field and the spacecraft velocity vector ) was as large as possible so that the ions would have a larger velocity component upward along the field line than in previous releases. However, the altitude (411 km ) was lower than in previous releases and this may have allowed increased collisions with the neutral atmosphere to impede the ion transportation.

(This section is taken from "CRRES NEWS, July 24 1991 written by David L. Reasoner).

**Aircraft- Argentine B707.**

**STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerndel	SPAN - MPE::HAE
Max Planck Institute fuer	PHONE 49-89-3299-3516 or 3503
extraterrestriche Physik	FAX - 49-89-3299-3569
8046 Garching, Germany	

**OTHER CONTACT:**

Dr. Arnoldo Valenzuela	SPAN - MPE::VAL
Max Planck Institute fuer	PHONE 49-89-3299-3513 or 3503
extraterrestriche Physik	FAX - 49-89-3299-3569
8046 Garching, Germany	

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Clear sky

**INITIAL FINDINGS:** no observations

**NO FURTHER INFORMATION AVAILABLE**

**Aircraft- C135-127.****STATION LEADER AND/OR OTHER CONTACT:**

Rick Rairden  
DEPT 91-20 BLDG. 255  
LPARL  
3251 Hanover St.  
Palo Alto, CA 94304

SPAN - LOCKHD::RAIRDEN  
PHONE (415) 424-3287  
FAX - (415) 424-3333

**FOR GEOGRAPHIC COORDINATES OF AIRCRAFT TRACK CONTACT:**

Eugene Wescott  
Geophysical Institute  
University of Alaska  
Fairbanks, AK 99701

SPAN - UAFGI::ROCKET  
PHONE (907) 474-7576

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** The Lockheed cameras are one wide-field (18 deg) with 4554A filter and one narrow-field (4 deg) with 4554A filter and selection of Fabry-Perot etalons. Data: 6 minutes. In-house listings of all image data sequences and notes of image quality and exposure levels, etc.

Also available: star-field data and barium calibration lamp images.

- 1) Analog composite video recordings on 3/4 inch Numatic and 1/2 inch VHS
- 2) Analog composite video recordings on 3/4 inch Numatic and 1/2 inch VHS

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) ISIT TV slit spectrograph 5 deg. x 100 A resolution
- 2) ICCD TV, Super Ferron lens 11.4x14.5 deg.

**TIME PERIODS OF DATA:**

- 1) 08:38:00 - 09:30
- 2) 08:38:00 - 09:30

**SAMPLING RATES:**

- 1) Real time TV
- 2) Real time TV

**FRAME RATES:**

- 1) 30 per second
- 2) 30 per second

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**

- 1) Good spectra of release, some over loading of the brightest lines some spectra of ion streak.
- 2) Saw satellite cross field to burst, but there was a slight haze. Good data in white light of burst and weak ion streak. At +1m 30s put on 4554 ion filter and tracked streak for about 5 min, when it became very faint. Returned to northern end of cloud at 08:58, hazy, but sufficient stars. Put on 4554 filter but few stars, returned to white light and tracked obvious cloud until sky became too bright at 09:30.

**INITIAL FINDINGS:**

- 1) Only BaI, BaII, SrI, BaO, and TiO lines identified.
- 2) The ion streak was very weak and could not be followed to the horizon, but the northern ionospheric cloud was followed for about 50 min.

**ADDITIONAL RESEARCH:**

- 1) Emission rates for the Ba lines.
- 2) Detailed analysis of the convection of the northern cloud, comparison with the MPE observations from the southern aircraft.

**Aircraft- C135-131.****STATION LEADER AND/OR OTHER CONTACT:**

Eugene Wescott	SPAN - UAFGI::ROCKET
Geophysical Institute	PHONE (907) 474-7576
University of Alaska	FAX - (907) 474-7290
Fairbanks, AK 99701	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Analog composite video recordings on 3/4 inch Numatic and 1/2 inch VHS

**FIELD(S) OF VIEW OF INSTRUMENTS:** ICCD TV, Super Ferron lens 11.4x14.5 deg.

**TIME PERIODS OF DATA:** 08:38:00 - 09:30

**SAMPLING RATES:** Real time TV

**FRAME RATES:** 30 per second

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Saw satellite cross field to burst, but there was a slight haze. Good data in white light of burst and weak ion streak. At +1m 30s put on 4554 ion filter and good star field and tip to 08:51 some streak to 08:56. Returned to northern end of cloud at 08:57:28 and followed it until sky became too bright.

**INITIAL FINDINGS:** The ion streak was very weak and could not be followed to the horizon, but the northern ionospheric cloud was followed for about 50 min.

**ADDITIONAL RESEARCH:** Detailed analysis of the convection of the northern cloud, comparison with the MPE observations from the southern aircraft.

**Arecibo, PR (Caribbean).**  
**18.3462N 66.7529W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Paul A. Bernhardt	SPAN - VA::BERN
NRL CODE 4780	PHONE (202) 767-0196
Washington, DC 20375	FAX - (202) 767-0631

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Filtered/Intensified CCD, 455.4 nm. Filter 2 nm BW, 50 mm lens f/0.95.
- 2) 35 mm Film Camera, no filter, 1600 speed film. 36 exposures, 50 mm lens f/1.8.

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 45 deg. FOV
- 2) 45 deg. FOV

**TIME PERIODS OF DATA:** 08:38:18 - 09:13:19

**SAMPLING RATES:** 1 second exposure every 20 seconds

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Not good due to scattered sunlight from haze

**INITIAL FINDINGS:** Visual verification of Barium releases

**NO FURTHER INFORMATION AVAILABLE**

**Aruba (Caribbean).  
12.5N 70W**

**STATION LEADER AND/OR OTHER CONTACT:**

Eugene Wescott	SPAN - UAFGI::ROCKET
Geophysical Institute	PHONE (907) 474-7576
University of Alaska	
Fairbanks, AK 99701	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Analog composite video recordings on 3/4 inch Numatic and 1/2 inch VHS

**FIELD(S) OF VIEW OF INSTRUMENTS:** ISIT TV unfiltered 12.5x16 deg. FOV

**TIME PERIODS OF DATA:** 08:38:00 - 09:30

**SAMPLING RATES:** Real time TV      **FRAME RATES:** 30 per second

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Saw satellite cross field to burst, no stars, no useful data.

**INITIAL FINDINGS:** The ion streak was very weak and could not be followed to the horizon, but the northern ionospheric cloud was followed for about 50 min.

**ADDITIONAL RESEARCH:** Detailed analysis of the convection of the northern cloud, comparison with the MPE observations from the southern aircraft.

**Bonaire, NA (Caribbean).  
12.14N 68.24W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Mary Miller	SPAN - ELDYN::U6MLM
GSFC CODE 696	PHONE (301) 286-8751
Greenbelt, MD 20771	

**OTHER CONTACT:**

Nigel Meredith	SPAN - 19527::CBS%UK.AC.UCL.PH.RPG::NPM
University College	PHONE 010-44-71-636-83338 EXT.3430
London	FAX - 010-44-71-436-7615

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Intensified 4554A 35 mm B/W Film exp.2s/8s
- 2) Intensified 4554A Television

**DATA BY UCL:**

- 3) IPD Images 4554A - 50 mm LENS - 30 sec. exp.
- 4) Doppler Images - (faint) for same periods as above

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 25 deg. FOV
- 2)
- 3)
- 4)

**TIME PERIODS OF DATA:**

- 1) 08:41 TO 09:21
- 2) \* 40 min.



**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** \The release was obscured by clouds, however the ion streak was tracked from 08:41 to 09:21 (\* 40 min)

NO FURTHER INFORMATION AVAILABLE

**Reconquista, Argentina.  
29.2S 59.70W .050km**

**STATION LEADER AND/OR OTHER CONTACT:**

Eugene M. Wescott  
University of Alaska  
Fairbanks, AK 99701

SPAN - UAFGI::ROCKET  
PHONE (907) 474-7576  
FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 2 IPDs, filtered at 4554 A (30A width). Data recorded both on video, with time date, and Az-El, updated every second. Integrated frames are stored digitally every 5 to 15 seconds, varies.

**FIELD(S) OF VIEW OF INSTRUMENTS:** 20 degrees circular

**TIME PERIODS OF DATA:** Video - 8:38 - 9:05. Digital - 8:38 - 9:05

**SAMPLING RATES:** Integrated digital data are stored every 5 to 15 sec.- varies with conditions.

**FRAME RATES:** Video is 30fps, but IPD image updated every 1 sec.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**  
Good. Perfect weather resulted in beautiful star fields - including stars to magnitude 7.0 through a 30A filter.

**INITIAL FINDINGS:** No Ba was seen in unprocessed data, but good star calibrations should yield maximum possible amount of Ba that could have been detected.

**ADDITIONAL RESEARCH:** See above

**St. Croix, USVI (Caribbean).  
17.738N 64.773W**

**STATION LEADER AND/OR OTHER CONTACT:**

Morrie Pongratz  
LANL  
Group SST-7 MS-D466  
Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ  
PHONE (505) 667-4740  
FAX - (505) 665-0850

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 400mm, Intensified 4554A. 35 mm film, 6300A, 50 mm Ektachrome.

**FIELD(S) OF VIEW OF INSTRUMENTS:** ~4 deg. FOV

NO FURTHER INFORMATION AVAILABLE

**St. Thomas, USVI (Caribbean).**

**18.327N 64.898W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Don Slater Internet: don%solar@pnl.gov  
 BATTELLE Pacific Northwest Labs PHONE (509) 376-8423  
 P. O. Box 999 MS - K6-84  
 Richland, WA 99352

**OTHER CONTACT (Data Held By):**

Mary Miller SPAN - ELDYN::U6MLM  
 GSFC Code 696 PHONE (301) 286-8751  
 Greenbelt, MD 20771

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Intensified CCD 512x512 2 bytes/pixel

**FIELD(S) OF VIEW OF INSTRUMENTS:** 20 deg. FOV

**TIME PERIODS OF DATA:** \* 45 min.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**

Weather mostly clear, some clouds near end of observing period. Good data

**NO FURTHER INFORMATION AVAILABLE**

**EXPERIMENT G11b**

**25 JULY 1991 08:37:11 UT**

**POINT OF CONTACT:** E. Wescott SPAN - UAFGI::ROCKET  
 Geophysical Institute PHONE (907) 474-7576  
 University of Alaska FAX - (907) 474-7290  
 Fairbanks, AK 99701

**EXPERIMENT OBJECTIVES:**

Mirror Force, Field Equipotentiality, Ambipolar Acceleration

Principal Investigator: E. Wescott

Co-Investigators: R. Hoffman, M. Pongratz, S. Mende, D. Simons,  
 D. Papadopolous, A. Valenzuela, G. Haerendel

Location: Caribbean at Points Selected for Conjugate Point Geometry

Time: Dawn

**EXPERIMENTAL ELEMENTS:**

Coordinates of Release: 17.3N 69.5W 478 km  
 Canister Type: Small  
 Chemicals: TI 1270 gms B 573 gms BA 1471 gms SR 19 gms  
 Delay: 5 seconds

**STATIONS COVERING THE RELEASE:**

Aircraft- Argentine B707, C135-127, C135-131  
 Arecibo, PR. Aruba. St. Croix, St. Thomas, USVI. (Caribbean)  
 Reconquista, Argentina

## SUMMARY OF LAUNCH:

The G-11b was unique among the CRRES experiment series. One small barium (1.5 kg) canister was ignited at a point below the UV terminator, and 17 seconds later the expanding neutral cloud crossed the terminator into sunlight. The objectives of this release were to study the contributions of early-time thermal ionization to the barium yield, to study the contribution of charge exchange and collisional ionization to the process, and to study the photoionization and early-time barium plasma processes under the conditions of an initially diffuse neutral cloud. This in contrast to the usual situation of a release in sunlight where the neutral cloud is initially very dense. In other words, this was a test to see if the photoions, created from a neutral cloud that had expanded to 50 kilometers diameter, would act more as a single particles and would be less affected by the collective MHD effects that caused significant ion energy loss in the earlier releases.

The release occurred on Feb. 25, 1991 at 08:37:1 UTC at 17.3 N, 290.5 E, 478.2 km altitude, or a point just south of the Dominican Republic. The magnetic conditions was relatively quiet. The estimated A index for the previous 24 hours 07, and the Boulder K index at 0000, 0300, and 0600 was 02, 0900 was 04, at 1200 was 03. At 1800 UTC on July 25 the A index was 12.

The negative factors operating were that the Caribbean stations had a full moon a few degrees above the horizon at the time of the release, and the South American stations had a full moon 10 -20 degrees elevation. This, coupled with considerable haze in the Caribbean resulting from the recent passage of a tropical wave, made the viewing conditions less than ideal. On the plus side, however, the three aircraft all had excellent viewing conditions and were placed to view the release in the opposite direction (Caribbean aircraft) or 90 degrees (South American aircraft) to the setting full moon.

Two ground optical sites reported seeing ions at the release point, which were apparently created at the moment of release and became visible as the sun rose through the point. The majority of the ions, formed when the neutral cloud crossed into the sunlight, were seen to stay near the point of formation. However, the St. Croix optical site and the Caribbean aircraft observed an initial fast ion streak going southward up the magnetic field line.

The prize for the first sighting again goes to Mike Mendillo on Aruba, who gave the first report of the canister ignition and 17 seconds later saw the bright glow as the neutral cloud entered sunlight.

At 1006 UTC the communication Center in Buenos Aires reported that B-707 flying at 47.0 S, 60.0 W saw the ion streak at times between T + 35 and T + 44 minutes.

In every respect, this experiment is considered a success. The prime objective was to study barium ion plasma formation under a new set of conditions, and as a plus ions reached the conjugate point in the southern hemisphere. (This section is taken from "CRRES NEWS, July 25 1991 written by David L. Reasoner).

### Aircraft- Argentine B707.

#### STATION LEADER AND/OR OTHER CONTACT:

Prof. Gerhard Haerendel  
Max Planck Institute fuer  
extraterrestriche Physik  
8046 Garching, Germany

SPAN - MPE::HAE  
PHONE 49-89-3299-3516 or 3503  
FAX - 49-89-3299-3569

#### OTHER CONTACT:

Dr. Arnoldo Valenzuela  
Max Planck Institute fuer  
extraterrestriche Physik

SPAN - MPE::VAL  
PHONE 49-89-3299-3513 or 3503  
FAX - 49-89-3299-3569

8046 Garching, Germany

TYPE AND DESCRIPTION OF DATA ACQUIRED: Video-UMatic PAL

FIELD(S) OF VIEW OF INSTRUMENTS: 17.5x12 deg. FOV

TIME PERIODS OF DATA: From 35 min - 44 min after release.

SAMPLING RATES: 40 ms

FRAME RATES: 0.12 - 0.64 sec

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION): Clear sky; Weak Ba II intensity.

INITIAL FINDINGS: Very weak BaII streak along B.

ADDITIONAL RESEARCH: No triangulation possible with other southern hemisphere stations.

### Aircraft- C135-127.

STATION LEADER AND/OR OTHER CONTACT:

Eugene Wescott  
Geophysical Institute  
University of Alaska  
Fairbanks, AK 99701

SPAN - UAFGI::ROCKET  
PHONE (907) 474-7576

TYPE AND DESCRIPTION OF DATA ACQUIRED:

- 1) Analog composite video recordings on 3/4 inch Numatic and 1/2 inch VHS
- 2) Analog composite video recordings on 3/4 inch Numatic and 1/2 inch VHS

FIELD(S) OF VIEW OF INSTRUMENTS:

- 1) ISIT TV slit spectrograph 5 deg.x 100 A resolution
- 2) ICCD TV, Super Ferron lens 11.4x14.5 deg.

TIME PERIODS OF DATA:

- 1) 08:37:00 to 09:30
- 2) 08:37:00 to 08:52

SAMPLING RATES:

- 1) Real time TV
- 2) Real time TV

FRAME RATES:

- 1) 30 per second
- 2) 30 per second

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

- 1) Good spectra of release, some over loading of the brightest lines some spectra of ion streak and northern ion cloud.
- 2) Good release, then followed the expanding shell as it went into sunlight. At 08:38:20 put on 4554 ion filter and followed the diffuse streak up the field lines until 08:44:00. There is no more useful data.

INITIAL FINDINGS:

- 1) Only BaI, BaII, SrI, BaO, and TiO lines identified.

2) The field aligned ion streak was very weak and diffuse, so the technique of releasing in the dark and then having solar ionization did not result in many ions going up the field line with normal velocities.

**ADDITIONAL RESEARCH:**

- 1) Emission rates for the Ba lines.
- 2) The CIV aspects of the release are very important.

**Aircraft- C135-131.**

**STATION LEADER AND/OR OTHER CONTACT:**

Eugene Wescott	SPAN - UAFGI::ROCKET
Geophysical Institute	PHONE (907) 474-7576
University of Alaska	
Fairbanks, AK 99701	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Analog composite video recordings on 3/4 inch Numatic and 1/2 inch VHS

**FIELD(S) OF VIEW OF INSTRUMENTS:** ICCD TV, Super Ferron lens 11.4x14.5 deg.

**TIME PERIODS OF DATA:** 08:37:00 - 09:37

**SAMPLING RATES:** Real time TV

**FRAME RATES:** 30 per second

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good release, good images of ions above terminator and development of field aligned jet visible, 08:39:56 unfiltered real time, good bright lower cloud and field aligned jet. 08:40:40 4554A filtered. Good data for approx 90 min. 09:27 nice field aligned jet with the Placides.

**INITIAL FINDINGS:** Lots of ions formed. Jet did not go up as fast as expected.

**ADDITIONAL RESEARCH:** The CIV aspects of the release are very important.

**Arecibo, PR (Caribbean).  
18.3462N 66.7529W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Paul A. Bernhardt	SPAN - VA::BERN
NRL CODE 4780	PHONE (202) 767-0196
Washington, DC 20375	FAX - (202) 767-0631

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Filtered/Intensified CCD, 455.4 nm filter. 2 nm BW, 50 mm lens f/0.95.
- 2) Filtered/Intensified CCD, 553.5 nm filter. 2 nm BW, 50 mm lens f/1.2.
- 3) 35 mm Film Camera, no filter 1600 speed film 36 exposure, 50 mm lens f/1.8

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 45 deg. FOV
- 2) 45 deg. FOV
- 3) 45 deg. FOV

**TIME PERIODS OF DATA:** 08:37:00 - 09:13:19

**SAMPLING RATES:** 1 second exposure every 20 seconds

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good with some degradation due to scattered sunlight from haze.

**INITIAL FINDINGS:** Visual verification of Barium releases

**Aruba (Caribbean).  
12.5N 70W**

**STATION LEADER AND/OR OTHER CONTACT:**

Eugene Wescott	SPAN - UAFGI::ROCKET
Geophysical Institute	PHONE (907) 474-7576
University of Alaska	
Fairbanks, AK 99701	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** Analog composite video recordings on 3/4 inch Numatic and 1/2 inch VHS.

**FIELD(S) OF VIEW OF INSTRUMENTS:** ISIT TV unfiltered 12.5x15 deg. FOV

**TIME PERIODS OF DATA:** 08:37:00 - 08:40

**SAMPLING RATES:** Real time TV

**FRAME RATES:** 30 per second

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good release, saw shell come into sunlight and large ion cloud until obscured by clouds 08:40.

**INITIAL FINDINGS:** Lots of ions formed. Jet did not go up as fast as expected.

**ADDITIONAL RESEARCH:** The CIV aspects of the release are very important.

**Reconquista, Argentina.  
29.2S 59.70W .050km**

**STATION LEADER AND/OR OTHER CONTACT:**

Eugene M. Wescott	SPAN - UAFGI::ROCKET
University of Alaska	PHONE (907) 474-7576
Fairbanks, AK 99701	FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 2 IPDs, filtered at 4554 A (30A width). Data recorded both on video, with time date, and Az-El, updated every second. Integrated frames are stored digitally every 5 to 15 seconds, varies.

**FIELD(S) OF VIEW OF INSTRUMENTS:** 20 degrees circular

**TIME PERIODS OF DATA:** Video - 8:38 - 9:05. Digital - 8:38 - 9:05

**SAMPLING RATES:** Integrated digital data are stored between 5 and 15 sec.- varies with conditions.

**FRAME RATES:** Video at 30fps, but IPD image updated every 1 sec.

**ASSESSMENT OF DATA QUALITY:** Poor. Light from the full moon (90%) was scattered by moisture in the air - only a few of the brightest stars could be seen.

INITIAL FINDINGS: No Ba was seen. See above.

ADDITIONAL RESEARCH: See above

**St. Croix, USVI (Caribbean).  
17.738N 64.773W**

STATION LEADER AND/OR OTHER CONTACT:

Morrie Pongratz	SPAN - ESSDP1::PONGRATZ
LANL	PHONE (505) 667-4740
Group SST-7 MS-D466	FAX - (505) 665-0850
Los Alamos, NM 87545	

TYPE AND DESCRIPTION OF DATA ACQUIRED: 400 mm, Intensified 4554A 35 mm Film  
6300A 50 mm Ektachrome

FIELD(S) OF VIEW OF INSTRUMENTS: ~4 deg. FOV

NO FURTHER INFORMATION AVAILABLE

**St. Thomas, USVI (Caribbean).  
18.327N 64.898W 0.0km**

STATION LEADER AND/OR OTHER CONTACT:

Don Slater	Internet: don%solar@pnl.gov
BATTELLE Pacific Northwest Labs	PHONE (509) 376-8423
P. O. Box 999 MS - K6-84	
Richland, WA 99352	

OTHER CONTACT (Data Held By):

Mary Miller	SPAN - ELDYN::U6MLM
GSFC Code 696	PHONE (301) 286-8751
Greenbelt, MD 20771	

TYPE AND DESCRIPTION OF DATA ACQUIRED: Intensified CCD 512x512, 2 bytes/pixel

FIELD(S) OF VIEW OF INSTRUMENTS: 12 deg. FOV

TIME PERIODS OF DATA: \* 25 min.

ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):  
Weather good during first 24 minutes, the becomes cloudy

NO FURTHER INFORMATION AVAILABLE

**EXPERIMENT G12**

**12 AUGUST 1991 09:31:20 UT**

POINT OF CONTACT:

E. Wescott	SPAN - UAFGI::ROCKET
Geophysical Institute	PHONE (907) 474-7576
University of Alaska	FAX - (907) 474-7290
Fairbanks, AK 99701	

EXPERIMENT OBJECTIVES: Mirror Force, Field Equipotentiality, Ambipolar Acceleration

Principal Investigator: E. Wescott

Co-Investigators: R. Hoffman, M. Pongratz, S. Mende, D. Simons,  
D. Papadopolous, A. Valenzuela, G. Haerendel

Location: Caribbean at Points Selected for Conjugate Point Geometry

Time: Dawn

**EXPERIMENTAL ELEMENTS:**

Coordinates of Release: 9.1N 63.5W 507 km

Canister Type: Small

Chemicals: 12A; TI 1271gms B 573 gms BA 1471 gms SR 19 gms  
12B; TI 1271gms B 574 gms BA 1471 gms SR 19 gms

Delay 12A: None

12B: 5 sec.

**STATIONS COVERING THE RELEASE:**

Aircraft- C135-127, N146 Learjet  
Arecibo, PR. Aruba. Bonaire, NA.St. Croix, USVI (Caribbean)  
El Leoncito, Reconquito, Argentina

**SUMMARY OF LAUNCH:**

The final chemical release from the CRRES spacecraft occurred at 09:31:20 UT at an altitude of 507 km. The release was located at 9.1 N latitude and 63.5 W longitude about 320 km west of Trinidad. Two small barium canisters were released containing 3.0 kg of barium. Both Arecibo and Bonaire ground sites saw the release and recorded data until background became too bright. Aruba also observed the release and ion streak. The KC-135, located over the Caribbean north of Bonaire, tracked the ion streak as it traveled over the equator and down to the horizon. The ion streak was seen traveling to the conjugate point by both the Learjet and the ground site at reconquista. (This section is taken from "CRRES NEWS, July 13 1991 written by David L. Reasoner).

**Aircraft- C135-127.**

**STATION LEADER AND/OR OTHER CONTACT:**

Rick Rairden  
DEPT 91-20 BLDG. 255  
LPARL  
3251 Hanover St.  
Palo Alto, CA 94304

SPAN - LOCKHD::RAIRDEN  
PHONE (415) 424-3287  
FAX - (415) 424-3333

**FOR GEOGRAPHIC COORDINATES OF AIRCRAFT TRACK CONTACT:**

Eugene Wescott  
Geophysical Institute  
University of Alaska  
Fairbanks, AK 99701

SPAN - UAFGI::ROCKET  
PHONE (907) 474-7576  
FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** The Lockheed cameras are one wide-field (18 deg) with 4554A filter and one narrow-field (4 deg) with 4554A filter and selection of Fabry-Perot etalons. Data: 6 minutes. In-house listings of all image data sequences and notes of image quality and exposure levels, etc. Also available: star-field data and barium calibration lamp images.

- 1) Analog composite video recordings on 3/4 inch Numatic and 1/2 inch VHS
- 2) Analog composite video recordings on 3/4 inch Numatic and 1/2 inch VHS



**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) ISIT TV slit spectrograph 5 deg.x 100 A resolution
- 2) ICCD TV, Super Ferron lens 11.4x14.5 deg.

**TIME PERIODS OF DATA:**

- 1) 09:31:00 to 09:40
- 2) 09:31:00 to 09:50

**SAMPLING RATES:**

- 1) Real time TV
- 2) Real time TV

**FRAME RATES:**

- 1) 30 per second
- 2) 30 per second

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):**

Excellent data.

- 1) Good spectra of release, some over loading of the brightest lines some spectra of ion streak and northern ion cloud. Initial burst in slit shows continuum in shell.
- 2) Good release and star field unfiltered followed ion streak tip until 09:40 with 4554A filter integrating 1 to 4 seconds, but few stars. 09:44 amorphous blob, 09:50 end of data due to sky brightness.

**INITIAL FINDINGS:**

- 1) Only BaI, BaII, SrI, BaO, and TiO lines identified.
- 2) There is probably enough data to determine the E field in the north.

**ADDITIONAL RESEARCH:**

- 1) Emission rates for the Ba lines.
- 2) Triangulate with all available data north and south.

**Aircraft- N146 Learjet at burst time.****STATION LEADER AND/OR OTHER CONTACT:**

Eugene Wescott	SPAN - UAFGI::ROCKET
Geophysical Institute	PHONE (907) 474-7576
University of Alaska	FAX - (907) 474-7290
Fairbanks, AK 99701	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** IPD imager filtered at 4554A (30A). Data recorded both on video with time and data, updated every second. Integrated frames are stored digitally every 5 to 15 seconds.

**FIELD(S) OF VIEW OF INSTRUMENTS:** IPD 20 degrees circular

**TIME PERIODS OF DATA:** 09:37:00 - 10:00

**SAMPLING RATES:** Once per second while accumulating.

**FRAME RATES:** 30 per second on video, digital image stored every 5 to 15 seconds.

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** The ion streak became visible above the northern horizon at 09:37:00. It was followed to the conjugate ionosphere where it became a bright cloud at 09:54. Due to sky brightness, the stars were lost by 09:56. The end of useful data 10:00. Could still see ions until 10:04:00.

**INITIAL FINDINGS:** There is probably enough data to determine the E field in the south by field line matching.

**ADDITIONAL RESEARCH:** Triangulate with all available data north and south.

**Arecibo, PR (Caribbean).**  
**18.3462N 66.7529W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Paul A. Bernhardt	SPAN - VA::BERN
NRL CODE 4780	PHONE (202) 767-0196
Washington, DC 20375	FAX - (202) 767-0631

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Intensified Video Camera.
- 2) Filtered/Intensified CCD 455.4 nm filter 5 nm BW 50 mm lens f/0.95.
- 3) 35 mm Film Camera, no filter 1600 speed film 36 exposures 55 mm lens f/1.8.

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 45 deg. FOV
- 2) 45 deg. FOV
- 3) 45 deg. FOV

**TIME PERIODS OF DATA:** 09:30:00 - 10:10:00

**SAMPLING RATES:**

- 1) 1/30 second video
- 2) 1 second exposure every 20 seconds
- 3) 2 second exposure every 20 seconds on film

**FRAME RATES:**

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Good video but some degradation due to scattered sunlight from haze

**INITIAL FINDINGS:** Visual verification of Barium release

**Aruba (Caribbean)**  
**12.5N 70W**

**STATION LEADER AND/OR OTHER CONTACT:**

Eugene Wescott	SPAN - UAFGI::ROCKET
Geophysical Institute	PHONE (907) 474-7576
University of Alaska	FAX - (907) 474-7290
Fairbanks, AK 99701	

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) ISIT TV filtered at 4554A
- 2) ICCD Imager filtered at 4554A

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) ISIT TV 12.5x15 deg. FOV
- 2) ICCD 11.4x14.5 deg. FOV

**TIME PERIODS OF DATA:**

- 1) 09:31:00 - 09:50
- 2) 09:31:00 - 09:50

**SAMPLING RATES:** Real time TV and integration 1-4 sec

**FRAME RATES:**

- 1) 30 per second
- 2) 30 per second

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** The release occurred behind some clouds. The ISIT saw some barium from time to time in breaks in the clouds. The filtered ICCD saw nice field aligned streaks through breaks in the clouds. After 09:40 the bottom of the streak can be seen with stars. 09:44 is end of useful data.

**INITIAL FINDINGS:** There is probably enough data to determine the E field in the north by triangulation and field line model matching.

**ADDITIONAL RESEARCH:** Triangulate with all available data north and south.

**Bonaire, NA (Caribbean).  
12.14N 68.24W 0.0km**

**STATION LEADER AND/OR OTHER CONTACT:**

Mary Miller  
GSFC CODE 696  
Greenbelt, MD 20771

SPAN - ELDYN::U6MLM  
PHONE (301) 286-8751

**OTHER CONTACT:**

Nigel Meredith  
University College London  
London

SPAN - 19527::CBS%UK.AC.UCL.PH.APG::NPM  
PHONE 010-44-761-636-8333 EXT.3430  
FAX - 010-44-71-436-7615

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 1) Intensified 4554A 35 mm B/W Film \* 5 min. 4s/15s exp.
- 2) Intensified 4554A TV \* 5 min.

**DATA BY UCL:**

- 3) IPD Images 4554A - 50 mm LENS - 30 sec. exp. same period as above
- 4) Doppler Images - (faint) for same periods as above

**FIELD(S) OF VIEW OF INSTRUMENT:**

- 1) 25 deg. FOV
- 2)
- 3)
- 4)

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** The release shortly before sunrise; the sky was clear in the release area. The ion moved south, southwest and was lost in clouds after about 5 minutes. At that time the sky was too light to recover.

**NO FURTHER INFORMATION AVAILABLE**

**El Leoncito, Argentina.**  
**31.802S 69.329W 2.4km**

**STATION LEADER AND/OR OTHER CONTACT:**

Prof. Gerhard Haerendel  
 Max Plank Institute fuer  
 extraterrestriche Physik  
 8046 Garching, Germany

SPAN - MPE::HAE  
 PHONE 49-89-3299-3516 or 3503  
 FAX - 49-89-3299-3569

**OTHER CONTACT (Data Held By):**

Dr. Arnoldo Valenzuela  
 Max Plank Institute fuer  
 extraterrestriche Physik  
 8046 Garching, Germany

SPAN - MPE::VAL  
 PHONE 49-89-3299-3513 or 3503  
 FAX - 49-89-3299-3569

**TYPE AND DESCRIPTION OF DATA ACQUIRED: Video:**

- 1) UMatic PAL
- 2) VHS PAL

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 2.0x1.6 deg. FOV
- 2) 2.0x1.6 deg. FOV

**TIME PERIODS: 09:36 - 10:10 UT**

**SAMPLING RATES: 40 ms - 2.6 sec**

**FRAME RATES: 40 ms - 2.6 sec**

**INITIAL FINDINGS: Motion parallel B and sedimentation observed.**

**(ADDITIONAL RESEARCH: Triangulation will be made with Lear Jet.**

**Reconquista, Argentina.**  
**29.2S 59.70W .050km**

**STATION LEADER AND/OR OTHER CONTACT:**

Eugene M. Wescott  
 University of Alaska  
 Fairbanks, AK 99701

SPAN - UAFGI::ROCKET  
 PHONE (907) 474-7576  
 FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED: 2 IPDs, filtered at 4554 A (30A width).  
 Data recorded both on video, with time date, and Az-El, updated every second. Integrated  
 frames are stored digitally every 5 to 15 seconds, varies.**

**FIELD(S) OF VIEW OF INSTRUMENTS: 20 degrees circular**

**TIME PERIODS OF DATA:**

Video - 9:21 - 9:44  
 Digital - 9:31 - 9:50

**SAMPLING RATES: Integrated digital data are stored between 5 and 15 seconds - varies with  
 conditions.**

**FRAME RATES: Video is 30fps, but data updated from IPDs only every 1 sec.**

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Poor.  
Light from the rising sun was scattered by moisture in the air - only a few of the brightest stars could be seen.

**INITIAL FINDINGS:** No Ba was seen. See above

**St. Croix, USVI (Caribbean).**  
**17.738N 64.773W**

**STATION LEADER AND/OR OTHER CONTACT:**

Morrie Pongratz

LANL

Group SST-7 MS-D466

Los Alamos, NM 87545

SPAN - ESSDP1::PONGRATZ

PHONE (505) 667-4740

FAX - (505) 665-0850

**TYPE AND DESCRIPTION OF DATA ACQUIRED:** 50 mm Ektachrome

**NO FURTHER INFORMATION AVAILABLE**

## **INTRODUCTION TO EXPERIMENTS G-13, G-14**

**Title:** Critical Velocity Ionization

**Principle Investigators:** Gene M. Wescott

**Co-Investigators:** D. Papadopolous, R. Smith, G. Haerendel, A. Valenzuela,  
M. Kelley, R. Anderson

**Location:** South Pacific in the vicinity of Fiji and American Samoa

**Time:** Dusk

**Altitude:** CRRES/GTO Near Perigee

**Chemicals:** Ba 5400 gms Sr 3900 gms G-13  
Ba 5400 gms Ca 1900 gms G-14

The objective of these releases is to investigate the critical ionization velocity phenomenon, first proposed by Alfven to explain mass differentiation in planetary formation, or why the inner planets are made of heavy material and the outer planets are mostly hydrogen. The critical ionization velocity model states that if the relative velocity of a neutral species and a magnetized plasma is large enough, ionization of the neutral gas will take place even though the gas is so thin that the particles are not directly colliding. Barium, calcium, and strontium will be released in these experiments, for these materials have a range of critical ionization velocities and this will allow study of the effect over a wide range of this parameter.

## **EXPERIMENT G13**

**10 September 1991 06:10:25 UT**

**POINT OF CONTACT:**

E. Wescott

Geophysical Institute

University of Alaska

Fairbanks, AK 99701

SPAN - UAFGI::ROCKET

PHONE (907) 474-7576

FAX - (907) 474-7290

**EXPERIMENT OBJECTIVES:** Critical Ionization Velocity (CIV I)

**EXPERIMENT ELEMENTS:**

Coordinates of Release: 17.5S 198.9E 517 km  
 Canister Type: Large  
 Chemicals: 13A; TI 4254 gms B 1920 gms SR 3784 gms  
 13B; TI 4554 gms B 2055 gms BA 5408 gms  
 Delay 13A: None  
 13B: 2.5 sec.

**STATIONS COVERING THE RELEASE:**

Aircraft- C135-131, Aeromet Inc Learjet

**Aircraft- Air Force C135.**  
**21.5S 160.5W at release**

**STATION LEADER AND/OR OTHER CONTACT:**

Eugene Wescott  
 Geophysical Institute  
 University of Alaska  
 Fairbanks, AK 99701

SPAN - UAFGI::ROCKET  
 PHONE (907) 474-7576  
 FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 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).
- 3) White light intensified camera (ISIT) to record the burst.

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 20 deg. circular
- 2) 11x14 deg. FOV

**TIME PERIODS OF DATA:**

Video: 06:00 - 06:30  
 Digital: 06:10 - 06:30

**SAMPLING RATES:** Integrated data stored every 5 to 15 seconds, varies with conditions.

**FRAME RATES:** Video at 30fps, but IPD image updated every 1 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** 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

**Aircraft- Aeromet Inc Learjet.**  
**19.3S 164.9W at release**

**STATION LEADER AND/OR OTHER CONTACT:**

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 University of Alaska  
 Fairbanks, AK 99701

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 PHONE (907) 474-7576  
 FAX - (907) 474-7290

**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 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).

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 20 deg. circular
- 2) 11x14 deg. FOV

**TIME PERIODS OF DATA:**

Video: 06:00 - 06:30  
 Digital: 06:10 - 06:30

**SAMPLING RATES:** Integrated data stored every 5 to 15 seconds, varies with conditions.

**FRAME RATES:** Video at 30fps, but IPD image updated every 1 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** 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)

**EXPERIMENT G14**  
**10 September 1991 08:47:10 UT**

<b>POINT OF CONTACT:</b>	E. Wescott Geophysical Institute University of Alaska Fairbanks, AK 99701	SPAN - UAFGI::ROCKET PHONE (907) 474-7576 FAX - (907) 474-7290
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**EXPERIMENT OBJECTIVES:** Critical Ionization Velocity (CIV II)

**EXPERIMENTAL ELEMENTS:**

Coordinates of Release: 18.1S 161.6E 593 km  
 Canister Type: Large  
 Chemicals: 14A; TI 5214 gms B 2353 gms CA 1891 gms  
 14B; TI 4554 gms B 2056 gms BA 5409 gms  
 Delay: 14A: None  
 14B: 2.5 sec.

**STATIONS COVERING THE RELEASE:**

Aircraft- C135-131, Aeromet Inc Learjet

**Aircraft- Air Force C135.**  
**20.0S 160.8E at release**

**STATION LEADER AND/OR OTHER CONTACT:**

Eugene Wescott Geophysical Institute University of Alaska Fairbanks, AK 99701	SPAN - UAFGI::ROCKET PHONE (907) 474-7576 FAX - (907) 474-7290
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**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

- 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).

3) White light intensified camera (ISIT) to record the burst.

**FIELD(S) OF VIEW OF INSTRUMENTS:**

- 1) 20 deg. circular
- 2) 11x14 deg. FOV

**TIME PERIODS OF DATA:**

Video: 08:37 - 09:15

Digital: 08:47 - 09:15

**SAMPLING RATES:** Integrated data stored every 5 to 15 seconds, varies with conditions.

**FRAME RATES:** Video at 30fps, but IPD image updated every 1 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Very good for Ba. Ba was seen rising above the terminator from both planes. Good for Ca.

**INITIAL FINDINGS:** See Wescott et al. 1992 (JGR to be published)

**Aircraft- Aeromet Inc Learjet.  
22.4S 157.9E at release**

**STATION LEADER AND/OR OTHER CONTACT:**

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Fairbanks, AK 99701

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**TYPE AND DESCRIPTION OF DATA ACQUIRED:**

1) IPD filtered at 4554A (30 A width) saved as both digital integrated data, and video record of integration;

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**TIME PERIODS OF DATA:**

Video: 08:37 - 09:15

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**FRAME RATES:** Video at 30fps, but IPD image updated every 1 sec

**ASSESSMENT OF DATA QUALITY (CLOUD COVER, LIGHT CONTAMINATION):** Very good for Ba. Ba was seen rising above the terminator from both planes. Good for Ca.

**INITIAL FINDINGS:** See Wescott et al. 1992 (JGR to be published)



## APPENDIX: RUSSIAN STATIONS

### OPTICAL EQUIPMENT:

#### Gran-Piedro Mountain (Cuba)

TV camera with the intensifier of a sensitivity  $10^{-3}$ - $5 \cdot 10^4$  lx with recording information Panasonic with  $F = 50$ mm.

One guidance system with the intensifier which has a resolution of 0.6 nm and spectrum recording.

The neon spectrum from a self-contained source was used to identify the spectrum in a frame.

A two channel photometer with a field of view of each channel 6, centered in the lines of ionized Ba and principle atmospheric emissions has also been used.

Two cameras with 35 mm and 60 mm films were mounted on a separate holder.

#### Airplane - YaK-40

Two B/W cameras with the intensifier, one of which was paired with a high-sensitive spectrograph.

Equipment characteristics were similar to those in Gran-Piedro. In addition, to obtain images in several spectral ranges, the interference filters set before the input lens were used.

Video cameras F-10 and M7 (Panasonic) with 8 transfocaters were used to obtain a colored image of a barium cloud at the initial phase of its formation.

The slitless spectrograph with the grating of 600 slits/mm was used.

To obtain the formation images applied were also the wide-frame camera AFA-BA-21C ( $F = 210$  mm, aspect ratio of frame size 130 x 180 mm) and 35 mm camera.

#### HYDROMET RESEARCH VESSEL - "PROF. ZUBOV"

Four tele systems produced on a basis of TV cameras WV-1410, WV-1850, F10 (Panasonic) which were supplied with the image intensifier, TV units transmitting tubes of image isocon (sensitivity of  $10^{-6}$ - $5 \cdot 10^{-7}$  lx) and isocon (sensitivity of  $10^{-5}$ - $5 \cdot 10^{-6}$  lx) types.

The lens of different types with different focal lengths were used as the entrance optics.

The sensitivity of guaranteed recording cloud formation at all stages.

Temporal resolution specified by frame frequency was 0.02 sec.

For photographic recording space formation structure used were a well-known 35 mm camera and two RFK-5 cameras with high-sensitive lens of the focal length of 80 mm and 58 mm, one of which with an electron-optical intensifier.

The formations were recorded on a high-sensitive 35 mm film with 10 frames per second.

Wide-frame cameras MK-25 (F = 250 mm), AFA-BA-21C (F = 210 mm) and UA-47 (F = 100 mm) provided for recording images on a high-sensitive film of 19 and 8 cm, respectively, with exposure 1-10 sec.

Filming was carried out with light color filters.

To study spectral radiation composition applied was CP-48 spectrograph equipped with the image intensifier (the operating spectral region of 400-800 nm; resolution 0,5-1 nm; field of view 10 x 12 deg.; time of spectrum exposure 0,5-5s), as well as spileless, tele and photo high-sensitive spectrographs similar to those installed on the airplane and Gran-Piedro mountain.

Photometric equipment involved four photometers, two of which are similar on Gran-Piedro mountain but one is equipped with a vertical scanning device.

The third and the fourth photometers are designed for recording radiation in separate spectral regions specified by narrow-band interference filters (4-10A).

Principle characteristics: measured luminance threshold 10-9W/sr m; field of view 0,5-6 deg.

Photometer data were entered to computers.

It should be noted that after a part of data has been photochemically treated, found was the decrease in their speed due to meteorological conditions, therefore only the initial cloud formation phases were registered.

## HYDROMET RESEARCH VESSEL - "PROF. ZUBOV"

EQUIPMENT	MEASURED PARAMETERS STUDIED EVENTS	PRINCIPLE TECHNICAL DATA
Ion probe "Basis ionosounder.	<p>Electron density distribution in ionosphere, including its modification.</p> <p>Artificial spread F event when modifying ionosphere in active experiments.</p>	<p>Frequency band 0.3-20 MHz Pulse duration 100 ms. Repetition frequency 50 (100)Hz. Pulse power 15 kW. Delta-antenna.</p>
Multi-frequency complex of Doppler sounding.	<p>Dynamic processes in ionosphere. Fine structure dynamics of modified ionosphere. Plasma distribution in modified ionosphere with high resolution. Artificial spread F.</p>	<p>Sounding at 8 frequencies in the 2-20 MHz range. Pulse duration 50-500 ms. Repetition frequency 100 or 200 Hz. Radiation intensity 1.5 kW. Rubidium frequency standard, instability not less than 10E-10. Spectral treatment with resolution 1/32 Hz at the complete analyzing band to 16 Hz 16-channel recording of measurement data, calculating dynamic spectra and secondary processing with PC IBM.</p>
Receiving-recording equipment of Doppler radio set signals.	<p>Radio-wave propagation in undisturbed and modified ionosphere in inclined paths.</p> <p>Diagnostic of spread F.</p>	<p>Receiving complement of broadcasting radiostations in the 2-32 MHz range. Recording of Doppler. Spectra of broadcasting radio stations in the band up to 200 Hz with resolution not less than 0.1 Hz. Two antennas of the "incident beam" type.</p>
A set for recording satellite radio beacon signals.	Diagnostics of ionospheric structure and its disturbances.	<p>Recording ionospheric Doppler shift component of two coherent radio waves emitted by navigation satellites. Working frequencies 150 MHz and 400 MHz</p>

### APPENDIX : PUBLICATIONS

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- Collin, H.L. et al. Low-energy ion mass spectrometer on CRRES. *Journal of Spacecraft and Rockets*. Vol. 29, No. 4, 1992; 617-620.
- Gussenhoven, S., and Mullen, E.G., and Sagalyn, R.C. CRRES Spacerad experiment descriptions. Air Force Geophysics Lab., Rept. AFGL-TR-85-0017. January 1985.
- Johnson, M.H. and Kierein, J. Combined Release and Radiation Effects Satellite. *Journal of Spacecraft and Rockets*. Vol. 29, No. 4, 1992; 556-563.
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- Koons, H.C., Roeder, J.L., Harbridge, W.B. Extremely low frequency wave analyzer. *Journal of Spacecraft and Rockets*. Vol. 29, No. 4, 1992; 606.
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- Nightingale, R.W. et al. CRRES spectrometer for electrons and protons. *Journal of Spacecraft and Rockets*. Vol. 29, No. 4, 1992; 614-617.
- Papadopolous, K. CIV triggering in Ba injection experiments. *Transactions of the American Geophysical Union, Spring Meeting Supplement*. Vol. 72, April 23, 1991; 230.
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- Rodriguez, P. Overview of the LASSII experiment on the Combined Release and Radiation Effects Satellite. *Journal of Spacecraft and Rockets*. Vol. 29, No. 4, 1992; 564-565.
- Singer, H.J. et al. Diamagnetic cavities formed by the CRRES high altitude chemical release experiments. *Transactions of the American Geophysical Union, Spring Meeting Supplement*. Vol. 72, April 23, 1991; 230.
- Singer, H.J. et al. Fluxgate magnetometer instrument on the CRRES. *Journal of Spacecraft and Rockets*. Vol. 29, No. 4, 1992; 599-600.
- Trzcinski, E. et al. NRL-701 LASSII/QIMS quadrapole ion mass spectrometer on CRRES. *Journal of Spacecraft and Rockets*. Vol. 29, No. 4, 1992; 604-606.
- Vampola, A.L. Combined Release and Radiation Effects Satellite. *Journal of Spacecraft and Rockets*. Vol. 29, No. 4, 1992; 555.
- Vampola, A.L., and Roeder, J.L. Outer zone energetic electron response to the GTO CRRES chemical releases. *Transactions of the American Geophysical Union, Spring Meeting Supplement*. Vol. 72, April 23, 1991; 230.

Voss, H.D. et al. Medium energy ion mass and neutral atom spectrometer. *Journal of Spacecraft and Rockets*. Vol. 29, No. 4, 1992; 566-569.

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