

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF RESEARCH ADMINISTRATION

RESEARCH PROJECT TERMINATION

Date: 9 Aug 1971

Project Title: Field Observations and Data Analysis of Upper Atmosphere and
Luminescence

Project No: E-16-602 (old B-204)

Principal Investigator: Dr. H. D. Edwards

Sponsor: U.S.A.F. Electronic Systems Division (AFSC); Bedford, Mass.

Effective Termination Date: 6-30-71 (Work period ended 3-31-71)*

Clearance of Accounting Charges: by 6-30-71

Grant/Contract Closeout Actions Remaining: Submission Final Invoice and Closing Documents.

*Final Report submitted late on 7-22-71.

Note: Follow-on project is E-16-616.

Assigned to: School of Aerospace Engineering

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GEORGIA INSTITUTE OF TECHNOLOGY
School of Aerospace Engineering
Atlanta, Georgia



7 MAY
B 449

QUARTERLY STATUS REPORT NO. 1

Contract Period: 1 April 1968 - 30 June 1968

Contract Number: F19678-68-C-0081
Georgia Tech Project Number: B204

Contract Objective: Photographic and Photometric Observations of Chemical Releases, Data Reduction Interpretation and Analysis

Contract Sponsor: Office of Aerospace Research
Air Force Cambridge Research Laboratories
United States Air Force
Bedford, Massachusetts

Attention: Mr. Tom Noel, CRUI

Principal Investigator: Howard D. Edwards

This report is intended only for the internal management uses of the contractor and the Air Force.

1. Investigations Being Undertaken

A. Data Reduction

(1) November-December 1967

Ada and Carla have been completed and sent to Tom Noel. Cloud orientations in Eden and Betty have caused problems in the position programs and have necessitated a considerable amount of work in editing the trail position data. A smaller section of cloud is involved in Eden and we have been working primarily with this rocket. If the hand editing is successful on Eden we hope that it can be applied to Betty.

(2) Report on Winds Measurements Made Through the November-December '67 Series.

Programs have been written to create a magnetic tape of trail releases that have been analyzed up through December 1967. The tape contains the velocities, magnitudes and headings of the winds and the shears, shear magnitudes and headings for these trails. A program is also being written to generate this report as well as similar reports that will be written in the future.

(3) May 1968 Series

A large amount of time and effort was spent reducing this series, which is now complete.

B. Instrumentation

(1) A field trip to Puerto Rico was made during April and May.

(2) Subsequent to the trip personnel were processing film and preparing equipment for the next trip which is scheduled for July 1968.

2. Reports Prepared

(1) "Energy Spectrum of Periodic Motions in the 95 to 135 km Region", in preparation (A. Woodrum, C. G. Justus, R. G. Roper).

(2) "Measurement of the Magnitude of the Irregular Winds in the Altitude Region Near 100 Kilometers", in preparation for publication in J.G.R. (Woodrum & Justus).

3. Investigations Planned for Next Quarter

- (A) Complete data reduction for November-December 1967 series and begin work on the July series.
- (B) Prepare for field trip to Eglin Air Force Base now scheduled for July 1968. Maintain and improve existing instrumentation.

4. Personnel, Administrative and Fiscal

- (A) Personnel changes: None.
- (B) Significant Administrative Changes: None.
- (C) Contract Balance as of 30 June 1968: \$57,000.

Submitted by:

Howard D. Edwards
Principal Investigator

GEORGIA INSTITUTE OF TECHNOLOGY
School of Aerospace Engineering
Atlanta, Georgia



QUARTERLY STATUS REPORT NO. 2

Contract Period: 1 July 1968 - 30 September 1968

Contract Number: F19628-68-C-0081
Georgia Tech Project Number B 204

Contract Objective: Photographic and Photometric Observations of Chemical Releases, Data Reduction Interpretation and Analysis

Contract Sponsor: Office of Aerospace Research
Air Force Cambridge Research Laboratories
United States Air Force
Bedford, Massachusetts

Attention: Mr. Tom Noel, CRUI

Principal Investigator: Howard D. Edwards

This report is intended only for the internal management uses of the contractor and the Air Force.

1. Investigations Being Undertaken

- (a) Data reduction was completed on the November-December 1967 Series. Reduction of the July 1968 series has been substantially completed. The first draft of a summary report on winds through the November-December 1967 series was completed. Improvements and updating of the data reduction procedures was carried out.
- (b) A field trip was made to Eglin Air Force Base during July 1968. Upon returning the film was processed and equipment improved and maintained.

2. Reports Prepared

- (1) "Measurement of the Magnitude of Irregular Winds in the Altitude Region Near 100 Kilometers" to be published in J.G.R. 73 December 1, 1968, Arthur Woodrum and C. G. Justus.
- (2) "Dissipation and Diffusion by Turbulence and Irregular Winds", prepared for Third Aeronomy Conference, University of Illinois, September 1968, and in preparation for publication, C. G. Justus.

3. Investigations Planned for Next Quarter

- (a) Complete data reduction of the July 1968 Series, and carry out other data reduction activities requested by AFCRL.
- (b) Prepare equipment and instrumentation for a field trip to Eglin.

4. Personnel, Administrative and Fiscal:

- (a) Personnel Changes: None
- (b) Significant Administrative Changes: None.
- (c) Contract Balance as of 30 September 1968: \$142,400.

Submitted by:

Howard D. Edwards
Principal Investigator

GEORGIA INSTITUTE OF TECHNOLOGY
School of Aerospace Engineering
Atlanta, Georgia



QUARTERLY STATUS REPORT NO. 3

Contract Period: 1 October 1968 - 31 December 1968

Contract Number: F19628-68-C-0081
Georgia Tech Project Number B 204

Contract Objective: Photographic and Photometric Observations of Chemical Releases, Data Reduction Interpretation and Analysis

Contract Sponsor: Office of Aerospace Research
Air Force Cambridge Research Laboratories
United States Air Force
Bedford, Massachusetts

Attention: Mr. Tom Noel, CRUI

Principal Investigator: Howard D. Edwards

This report is intended only for the internal management uses of the contractor and the Air Force.

1. Investigations Being Undertaken

- (a) Data reduction was completed on July 1967 series. Other data reduction activities were carried out as requested by AFCRL personnel.
- (b) A field trip was made to Eglin Air Force Base and vicinity during December 1968.

2. Reports Prepared

- (1) "Energy Spectrum of Periodic Motions in the 95 to 135 km Region", in preparation (A. Woodrum, C. G. Justus, R. G. Roper).
- (2) "Measurement of the Magnitude of the Irregular Winds in the Altitude Region Near 100 Kilometers", published J. Geophysical Res., 73, December 1, 1968, Arthur Woodrum and C. G. Justus.
- (3) "Dissipation and Diffusion by Turbulence and Irregular Winds", prepared for Third Aeronomy Conference, Univ. of Illinois, Sept. 1968, and in preparation for publication, C. G. Justus.

3. (a) Carry out data reduction for January 1969 series and other data reduction activities as requested by AFCRL personnel.

- (b) Prepare equipment and instrumentation for a field trip to Eglin now planned for January 1969.

4. Personnel, Administrations and Fiscal

- (a) Personnel changes - None
- (b) Significant Administration Changes - None
- (c) Contract Balance as of 31 December 1968 - \$109,500.

Submitted by:

Howard D. Edwards
Principal Investigator

GEORGIA INSTITUTE OF TECHNOLOGY
School of Aerospace Engineering
Atlanta, Georgia



QUARTERLY STATUS REPORT NO. 4

Contract Period: 1 January 1969 - 31 March 1969

Contract Number: F19628-68-C-0081
Georgia Tech Project Number B 204

Contract Objective: Photographic and Photometric Observations of Chemical Releases, Data Reduction Interpretation and Analysis

Contract Sponsor: Office of Aerospace Research
Air Force Cambridge Research Laboratories
United States Air Force
Bedford, Massachusetts

Attention: Mr. Tom Noel, CRAC

Principal Investigator: Howard D. Edwards

This report is intended only for the internal management uses of the contractor and the Air Force.

1. Investigations Being Undertaken

- a) A field trip was made to Eglin Air Force Base and vicinity during January 1969.
- b) Data reduction was partially completed on the January 69 series. Other data reduction activities were carried out as requested by AFCRL personnel.

2. Reports Prepared

- (1) "Dissipation and Diffusion by Turbulence and Irregular Winds Near 100 KM", submitted for publication (C. G. Justus)
- (2) "Measurements of Tidal-Period Winds in the 90 to 135 KM Region", submitted for publication (Arthur Woodrum and C. G. Justus)
- (3) "Approximation of a Trivariate Probability Density Function", submitted for publication (W. B. Moseley and C. G. Justus)
- (4) "The Distribution of Irregular Winds Near 100 KM", presented at 50th Annual AGU meeting, and submitted for publication (C. G. Justus)
- (5) "A Theory for the Energy Spectrum of Shear Dependent Turbulence", in preparation (C. G. Justus)

3. (a) Complete data reduction for the January 1969 series and carry out other data reduction activities as requested by AFCRL personnel.

- (b) Prepare equipment and instrumentation for a field trip to Eglin now planned for May 1969.

4. Personnel, Administrations and Fiscal

- (a) Personnel changes - None
- (b) Significant Administration Changes - None
- (c) Contract Balance as of 31 March 1969 - \$84,000.

Submitted by:

Howard D. Edwards
Principal Investigator

GEORGIA INSTITUTE OF TECHNOLOGY
School of Aerospace Engineering
Atlanta, Georgia



QUARTERLY STATUS REPORT NO. 5

Contract Period: 1 April 1969 - 30 June 1969

Contract Number: F19628-68-C-0081
Georgia Tech Project Number B 204

Contract Objective: Photographic and Photometric Observations of Chemical Releases, Data Reduction Interpretation and Analysis

Contract Sponsor: Office of Aerospace Research
Air Force Cambridge Research Laboratories
United States Air Force
Bedford, Massachusetts

Attention: Mr. Tom Noel, CRAC

Principal Investigator: Howard D. Edwards

This report is intended only for the internal management uses of the contractor and the Air Force.

1. Investigations Being Undertaken

- a) A field trip was made to Eglin Air Force Base and vicinity during May 1969.
- b) Data reduction was partially completed for the January 69 series and is underway on the May 1969 series. Other data reduction activities were carried out as requested by AFCRL personnel.

2. Reports Prepared

- (1) "Dissipation and Diffusion by Turbulence and Irregular Winds Near 100 KM", submitted for publication (C. G. Justus)
- (2) "Measurements of Tidal-Period Winds in the 90 to 135 KM Region", submitted for publication (Arthur Woodrum and C. G. Justus)
- (3) "Approximation of a Trivariate Probability Density Function", submitted for publication (W. B. Moseley and C. G. Justus)
- (4) "The Distribution of Irregular Winds Near 100 KM", presented at 50th Annual AGU meeting, and submitted for publication (C. G. Justus)
- (5) "A Theory for the Energy Spectrum of Shear Dependent Turbulence", in preparation (C. G. Justus)

3. Plans for Next Period

- (a) Complete data reduction for the May 1969 series and carry out other data reduction activities as requested by AFCRL personnel.
- (b) Prepare equipment and instrumentation for a field trip to Eglin now planned for the fall of 1969.

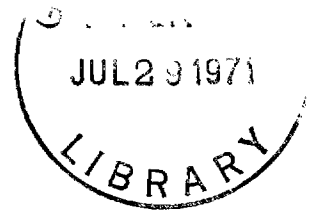
4. Personnel, Administrations and Fiscal

- (a) Personnel changes - Dalton Kurts terminated as of 30 June 1969
Joe Montgomery terminated as of 15 June 1969.
- (b) Significant Administration Changes - None
- (c) Contract Balance as of 30 June 1969 - \$36,000.

Submitted by:

Howard D. Edwards
Principal Investigator

GEORGIA INSTITUTE OF TECHNOLOGY
School of Aerospace Engineering
Atlanta, Georgia



QUARTERLY STATUS REPORT NO. 6

Contract Period: 1 July 1969 - 30 September 1969

Contract Number: F19628-68-C-0081
Georgia Tech Project Number B 204

Contract Objective: Photographic and Photometric Observations of Chemical Releases, Data Reduction Interpretation and Analysis

Contract Sponsor: Office of Aerospace Research
Air Force Cambridge Research Laboratories
United States Air Force
Bedford, Massachusetts

Attention: Mr. Tom Noel, CRAC

Principal Investigator: Howard D. Edwards

This report is intended only for the internal management uses of the contractor and the Air Force.

1. Investigations Being Undertaken

- a) Data reduction was completed for the January 69 series and for most of the May 1969 series. Other data reduction activities were carried out as requested by AFCRL personnel.
- b) Instrumentation was maintained and made ready for the next field trip now scheduled for late November and early December.

2. Reports Prepared

- (1) "Dissipation and Diffusion by Turbulence and Irregular Winds Near 100 KM", Jour. Atm. Sci., Sept. 1969 (C. G. Justus).
- (2) "Measurements of Tidal-period Winds in the 90 to 135 KM Region", J. Geophys. Res. 73, 7535-4104, 1969.
- (3) The Distribution and Structure of Irregular Winds Near 100 Km, submitted for publication (C. G. Justus)
- (4) The Response of Winds in the 90 to 140 Km Altitude Region to Variations in Solar Activity, submitted for publication (J. E. Hicks and C. G. Justus).

3. Plans for Next Period

- (a) Complete data reduction for the May 1969 series and carry out other data reduction activities as requested by AFCRL personnel.
- (b) Prepare equipment and instrumentation for a field trip to Eglin now planned for November-December 1969.

4. Personnel, Administrations and Fiscal

- (a) Personnel changes - Tom Hollomon terminated as of 1 September 1969.
- (b) Significant Administration Changes - None
- (c) Contract Balance as of 30 September 1969 - \$115,000

Submitted by:

Howard D. Edwards
Principal Investigator

GEORGIA INSTITUTE OF TECHNOLOGY
School of Aerospace Engineering
Atlanta, Georgia



QUARTERLY STATUS REPORT NO. 7

Contract Period: 1 October 1969 - 31 December 1969

Contract Number: F19628-68-C-0081
Georgia Tech Project Number B 204

Contract Objective: Photographic and Photometric Observations of Chemical Releases, Data Reduction Interpretation and Analysis

Contract Sponsor: Office of Aerospace Research
Air Force Cambridge Research Laboratories
United States Air Force
Bedford, Massachusetts

Attention: Mr. Tom Noel, CRAC

Principal Investigator: Howard D. Edwards

This report is intended only for the internal management uses of the contractor and the Air Force.

1. Investigations Being Undertaken

- a) Data reduction was completed for the May 69 series and started for the December 69 series. Other data reduction activities were carried out as requested by AFCRL personnel.
- b) A field trip to Eglin Air Force Base, Florida was made in December 1969.

2. Reports Prepared

- (1) "Dissipation and Diffusion by Turbulence and Irregular Winds Near 100 KM", Jour. Atm. Sci., 26, 1137-1141, 1969 (C. G. Justus).
- (2) The Distribution and Structure of Irregular Winds Near 100 Km, submitted for publication (C. G. Justus)
- (3) The Response of Winds in the 90 to 140 Km Altitude Region to Variations in Solar Activity, submitted for publication (J. E. Hicks and C. G. Justus).

3. Plans for Next Period

- (a) Complete data reduction for the December 1969 series and carry out other data reduction activities as requested by AFCRL personnel.
- (b) Prepare equipment and instrumentation for a field trip to Eglin now planned for March 1970.

4. Personnel, Administrations and Fiscal.

- (a) Personnel changes - None
- (b) Significant Administration Changes - None
- (c) Contract Balance as of 31 December 1969 \$97,000.

Submitted by:

Howard D. Edwards
Principal Investigator

GEORGIA INSTITUTE OF TECHNOLOGY
School of Aerospace Engineering
Atlanta, Georgia



QUARTERLY STATUS REPORT NO. 8

Contract Period: 1 January 1970 - 31 March 1970

Contract Number: F19628-68-C-0081
Georgia Tech Project Number B 204

Contract Objective: Photographic and Photometric Observations of Chemical Releases, Data Reduction Interpretation and Analysis

Contract Sponsor: Office of Aerospace Research
Air Force Cambridge Research Laboratories
United States Air Force
Bedford, Massachusetts

Attention: Mr. Charles A. Forsberg, CRAC

Principal Investigator: Howard D. Edwards

This report is intended only for the internal management uses of the contractor and the Air Force.

1. Investigations Being Undertaken

- a) Data reduction was completed for the December 1969 series. Other data reduction activities were carried out as requested by AFCRL personnel.
- b) A field trip to Eglin Air Force Base, Florida is planned for April - May 1970 and preparations are being made.

2. Reports Prepared

- (1) The Distribution and Structure of Irregular Winds Near 100 Km, (C. G. Justus) to be published in J. Geophys. Res., April 1970.
- (2) The Response of Winds in the 90 to 140 Km Altitude Region to Variations in Solar Activity, in review for publication (J. E. Hicks and C. G. Justus).

3. Plans for Next Period

- (a) Carry out data reduction for the April - May series and other data reduction activities as requested by AFCRL personnel.
- (b) Prepare equipment and instrumentation and carry out a field trip to Eglin during April - May 1970.

4. Personnel, Administrations and Fiscal.

- (a) Personnel changes - None
- (b) Significant Administration Changes - None
- (c) Contract Balance as of 31 March 1970 \$63,000.

Submitted by:

Howard D. Edwards
Principal Investigator

GEORGIA INSTITUTE OF TECHNOLOGY
School of Aerospace Engineering
Atlanta, Georgia



QUARTERLY STATUS REPORT NO. 9

Contract Period: April 1970 - 30 June 1970

Contract Number: F19628-68-C-0081
Georgia Tech Project Number B 204

Contract Objective: Photographic and Photometric Observations of Chemical
Releases, Data Reduction Interpretation and Analysis

Contract Sponsor: Office of Aerospace Research
Air Force Cambridge Research Laboratories
United States Air Force
Bedford, Massachusetts

Attention: Mr. Charles A. Forsberg, CRAC

Principal Investigator: Howard D. Edwards

This report is intended only for the internal management uses of the contractor
and the Air Force.

1. Investigation Being Undertaken

- (a) A field trip was made to Eglin Air Force Base, Florida during May, 1970. Equipment is being maintained and serviced in preparation for another field trip now scheduled for Fall, 1970.
- (b) Data reduction on the films for the May series has been started. Other data reduction activities were carried out as requested by AFCRL personnel. H. D. Edwards and C. G. Justus visited AFCRL on June 22 and 23 to discuss data reduction and contract administrative matters. Requests were made for several specific items pertaining to data reduction. These are being prepared.

2. Reports Prepared

- (a) The Distribution and Structure of Irregular Winds Near 100 Km, J. Geophys. Res., 75 (12), 2171 - 2178, 1970. (C. G. Justus)
- (b) The Response of Winds in the 90 to 140 Km Altitude Region to Variations in Solar Activity, accepted for publication in J. Geophys. Res. (J. E. Hicks and C. G. Justus)
- (c) Wave Structure in the Prevailing Winds Near 100 Km, presented at the AGU Meeting, Washington, D. C., April 20 - 24, 1970. (C. G. Justus)
- (d) A Possible Correlation Between Turbulence and Mean Winds Near 100 Km, presented at the AMS Symposium, Boulder, Colorado, June 15 - 18, 1970. (C. G. Justus)

3. Plans for Next Period

- (a) Complete data reduction of the May series and other data reduction activities as requested by AFCRL personnel.
- (b) Prepare equipment and instrumentation and carry out a field trip to Elgin during the Fall of 1970.

4. Personnel, Administration, and Fiscal.

- (a) Personnel changes - none.
- (b) Significant Administration Changes - none.
- (c) Contract Balance as of 31 May 1970. \$49,000.

Submitted by:

Howard D. Edwards
Principal Investigator

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GEORGIA INSTITUTE OF TECHNOLOGY
School of Aerospace Engineering
Atlanta, Georgia

QUARTERLY STATUS REPORT NO. 11

Contract Period: 1 October 1970 - 31 December 1970

Contract Number: F19628-68-C-0081
Georgia Tech Project Number B-204

Contract Objective: Photographic and Photometric Observations of Chemical
Releases, Data Reduction Interpretation and Analysis

Contract Sponsor: Air Force Systems Command
Air Force Cambridge Research Laboratories
United States Air Force
Bedford, Massachusetts

Attention: Mr. Charles A. Forsberg, LKC

Principal Investigator: Howard D. Edwards

This report is intended only for the internal management uses of the contractor
and the Air Force.



1. Investigation Being Undertaken

- (a) A field trip was made to glin Air Force Based in October-November 1970. Subsequent to the field trip the film was processed and mailed to Air Force personnel.
- (b) Special single site wind data on Nina up trail are nearly completed. Special error analysis studies on Myra and Arlene were carried out. Some minor program alterations were completed in preparation for making a new program tape.

2. Reports Prepared

The Response of Winds in the 90 to 140 Km Altitude Region to Variations in Solar Activity, J. Geophys. Res., 75 (28), 5565-5570, 1970 (J. E. Hicks and C. G. Justus)

3. Plans for Next Period

- (a) Reduce data from the November series.
- (b) Test equipment and instrumentation to keep in readiness for the next field trip.

4. Personnel, Administration, and Fiscal.

- (a) Personnel changes - Marshall Cooksey resigned from the project effective 14 December 1970.
- (b) Significant Administration Changes - none.
- (c) Contract balance as of 30 November 1970. \$35,000.

Submitted by:

Howard D. Edwards
Principal Investigator

GEORGIA INSTITUTE OF TECHNOLOGY
School of Aerospace Engineering
Atlanta, Georgia

QUARTERLY STATUS REPORT NO. 12

Contract Period: 1 January 1971 - 31 March 1971

Contract Number: F19628-68-C-0081
Georgia Tech Project Number B-204

Contract Objective: Photographic and Photometric Observations of Chemical
Releases, Data Reduction Interpretation and Analysis

Contract Sponsor: Air Force Systems Command
Air Force Cambridge Research Laboratories
United States Air Force
Bedford, Massachusetts

Attention: Mr. Charles A. Forsberg, LKC

Principal Investigator: Howard D. Edwards

This report is intended only for the internal uses of the contractor and the
Air Force.



1. Investigations Being Undertaken

- (a) Data reduction has almost been completed for the rocket series which took place in October - November 1970.
- (b) Instrumentation has been kept in readiness for the next field trip now scheduled for April - May 1971

2. Reports Prepared

None

3. Plans for Next Period

- (a) Prepare final report as the contract work terminates on 31 March 1971.

4. Personnel, Administration and Fiscal

- (a) Personnel Changes - none
- (b) Significant Administrative Changes - none
- (c) Contract Balance aos of 28 February 1971 - \$12,480.00

Submitted by:

Howard D. Edwards
Principal Investigator

WINDS OBSERVED FROM
JULY 1968 THROUGH NOVEMBER 1970
IN THE 83 TO 216 KM ALTITUDE REGION



by

Carl G. Justus and Howard D. Edwards

School of Aerospace Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Contract No. F 19628-68-C-0081
Project No. 7635
Task No. 763514
Work Unit No. 76351401
Georgia Tech Project No. B-204

Final Report

1 April 1968 to 31 March 1971

May 1971

This document has been approved for public
release and sale; its distribution is unlimited.

Contract Monitor: Charles A. Forsburg
Aeronomy Laboratory

Prepared for

AIR FORCE CAMBRIDGE RESEARCH LABORATORIES
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
BEDFORD, MASSACHUSETTS 01730

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WINDS OBSERVED FROM
JULY 1968 THROUGH NOVEMBER 1970
IN THE 83 TO 216 KM ALTITUDE REGION

by

Carl G. Justus and Howard D. Edwards

School of Aerospace Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Contract No. F 19628-68-C-0081
Project No. 7635
Task No. 763514
Work Unit No. 76351401
Georgia Tech Project No. B-204

Final Report

1 April 1968 to 31 March 1971

May 1971

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Contract Monitor: Charles A. Forsburg
Aeronomy Laboratory

Prepared for

AIR FORCE CAMBRIDGE RESEARCH LABORATORIES
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
BEDFORD, MASSACHUSETTS 01730

Abstract

Horizontal winds and shears have been computed from 25 rocket released chemical trails. Tables are presented which give vertical profiles of wind speed, heading, and components and the wind shear components. Eight rockets created releases on the up and down leg of their trajectories. Four of these (November 1970: GENIE, HILDA, IDA, JACKIE) were launched within a ten minute interval and one (HELEN) was associated with near simultaneous releases from three other rockets (GRACE, INGER, JOY). These data are suitable for space and time variation studies. Two pairs of trails (UNA-VANESSA and DORA-EVELYN) are suitable for short time difference study since they were launched within an hour of each other. Horizontal and vertical winds were also computed from chemical puffs on the four pairs of up and down trail releases of the November 1970 series. These point wind data are presented in table form. Graphs of the horizontal trail wind data, and the vertical point wind data for the November 1970 series are also given.

TABLE OF CONTENTS

	Page
EXPLANATION OF THE TABLES	1
HORIZONTAL WIND AND SHEAR TABLES	
GRACE, 7/22/68, 2319 CDT	2
HELEN (U), 7/22/68, 2319 CDT	4
HELEN (D), 7/22/68, 2319 CDT	6
INGER, 7/22/68, 2319 CDT	7
JOY, 7/22/68, 2319 CDT	8
KAY, 1/6/69, 1741 CST	9
MAE, 1/7/69, 1738 CST	9
NITA, 1/11/69, 1932 CST	9
ODET, 1/13/69, 1743 CST	9
PEARL, 5/12/69, 2004 CDT	10
QUEENA, 5/12/69, 2023 CDT	10
REBA, 5/14/69, 2028 CDT	10
SOPHIA, 5/14/69, 2028 CDT	11
UNA (U), 12/5/69, 0500 CST	12
UNA (D), 12/5/69, 0500 CST	13
VANESSA, 12/5/69, 0556 CST	14
VANESSA, 12/5/69, 0556 CST	15
WENDY, 12/11/69, 2130 CST	16
ARLEEN (U), 5/6/70, 2005 CDT	17
ARLEEN (D), 5/6/70, 2005 CDT	18
BRENDA, 5/7/70, 2045 CDT	20
CLAIRE, 5/20/70, 2007 CDT	20

TABLE OF CONTENTS (CONT'D.)

	Page
DORA (U), 5/21/70, 0435 CDT	21
DORA (D), 5/21/70, 0435 CDT	22
EVELYN, 5/21/70, 0507 CDT	23
FRAN, 5/22/70, 0512 CDT	23
GENIE (U), 11/20/70, 1719 CST	24
GENIE (D), 11/20/70, 1719 CST	25
HILDA (U), 11/20/70, 1719 CST	26
HILDA (D), 11/20/70, 1719 CST	27
IDA (U), 11/20/70, 1719 CST	29
IDA (D), 11/20/70, 1719 CST	30
JACKIE (U), 11/20/70, 1719 CST	31
JACKIE (D), 11/20/70, 1719 CST	32
VERTICAL AND HORIZONTAL POINT WIND TABLES	
(GENIE, HILDA, IDA, JACKIE)	33
HORIZONTAL AND VERTICAL WIND GRAPHS	
(GENIE, HILDA, IDA, JACKIE)	37

EXPLANATION OF THE TABLES

Tables are presented which give horizontal wind speed, heading and components and shear components as determined from 25 rocket released chemical clouds. The releases occurred between July 1968 and November 1970 at Eglin Air Force Base, Florida. The initial coordinates were approximately 30°N , 87°W for these releases. Included in the tables are rocket code names, launch dates and launch times. All velocities are in m/sec and shears in m/sec/km. The shears were calculated by use of a spline fit cubic procedure with assumed zero second derivative at the end points, and, as a result, the shears for the first two and last two altitudes of a rocket may not be as accurate as the remaining values. Positive wind and shear components indicate winds and shears toward the north and east. Negative wind and shear components indicate winds and shears toward the south and west. Wind headings are given in degrees east of north.

The November 1970 series consisted of four pairs of up and down trail releases with puffs as well as trails. Horizontal and vertical winds determined from the puffs are also tabulated. Vertical winds are in m/sec and are positive upward. Graphs of the horizontal trail winds and vertical winds from the puffs are also given for the November 1970 series. Curves shown on the graphs are the spline fit cubic functions which were also differentiated to compute the wind shears.

CODE NAME..

GRACE LAUNCH DATE.. 7/22/68 TIME.. 2319 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
86	23	77	5	23	4	-24
87	6	23	6	2	-6	-13
88	5	216	-4	-3	-5	0
89	6	230	-4	-5	-3	-10
90	20	238	-11	-17	-6	-5
91	21	223	-15	-14	-6	1
92	28	216	-23	-17	-7	0
93	31	200	-29	-11	-8	7
94	42	189	-41	-6	-14	3
95	44	189	-43	-6	23	-4
96	11	254	-3	-11	35	1
97	15	350	15	-3	9	12
98	23	17	22	7	4	5
99	24	11	23	4	0	-9
100	23	336	21	-9	-7	-17
101	23	289	8	-22	-18	-1
102	16	211	-14	-8	-26	25
103	44	157	-40	18	-23	18
104	63	150	-55	32	-5	23
105	85	128	-52	67	9	37
106	108	113	-42	100	9	34
107	131	105	-34	126	8	6
108	113	101	-21	111	22	-20
109	96	88	4	96	18	-13
110	83	83	10	83	1	-13
111	73	83	8	73	-7	-6

GRACE "CONTINUED"

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
112	71	92	-2	71	-10	1
113	73	99	-11	72	-12	0
114	76	109	-25	72	-11	-1
115	77	115	-33	70	-11	-2
116	81	122	-43	69	2	1
117	83	106	-23	70	34	-2
118	65	81	10	64	23	-6
119	60	70	21	57	4	-13
120	46	60	23	40	-1	-15
121	34	58	18	29	-7	-9
122	25	62	12	22	-5	-4
123	23	70	8	21	-4	-1
124	18	84	2	18	-6	-5
125	15	105	-4	14	-6	-2
126	18	127	-10	14	-7	1
127	23	140	-17	15	-7	-2
128	28	156	-25	11	-8	-2
129	35	161	-33	12	-8	3
130	44	160	-41	15	-8	4
132	60	162	-57	19	-7	0
134	71	163	-68	20	-4	4
136	83	156	-76	33	-6	6
138	97	155	-88	41	-2	3
140	95	149	-81	49	6	4
142	86	142	-68	53	9	-2
144	63	137	-46	42	0	0

CODE NAME.. HELEN(U)

LAUNCH DATE.. 7/22/68

TIME.. 2319 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
89	23	235	-13	-19	2	-9
90	27	245	-11	-24	1	1
91	25	231	-16	-19	-14	3
92	40	211	-34	-21	-15	-1
93	44	204	-40	-17	0	8
94	39	194	-37	-10	7	3
95	29	198	-28	-9	9	3
96	19	192	-18	-4	15	0
97	8	254	-2	-8	9	0
98	2	332	2	-1	11	9
99	21	13	20	5	15	3
100	23	17	22	7	-10	2
101	18	100	-3	17	-46	26
102	49	160	-51	51	-27	26
103	81	130	-52	62	7	6
104	87	126	-51	71	0	10
105	97	118	-46	85	9	22
106	117	106	-33	112	17	26
107	131	97	-15	130	14	8
108	130	93	-6	130	7	-4
109	123	89	1	123	8	-12
110	109	86	8	109	3	-10
111	104	85	9	104	1	-6
112	96	85	9	96	-6	-4
113	95	90	0	95	-8	-3
114	90	92	-3	90	-1	-3
115	90	93	-5	90	-1	-3
116	83	93	-4	83	4	-7
117	77	86	5	77	15	-7
118	72	72	23	68	16	-11

HELEN(U) -CONTINUED-

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
119	65	58	34	55	7	-13
120	58	48	39	43	5	-9
121	58	41	44	38	5	-1
122	61	39	47	38	1	-1
123	60	37	48	36	3	-2
124	57	34	47	32	-14	-8
125	32	45	23	23	-23	-7
126	22	71	7	21	-13	2
127	25	107	-7	24	-14	4
128	33	125	-19	27	-10	2
129	41	135	-29	29	-14	3
130	57	144	-46	34	-16	4
132	81	151	-71	39	-11	4
134	103	149	-89	52	-5	9
136	107	146	-88	60	3	-6
138	69	156	-82	36	2	-11
140	84	161	-79	28	2	-1
142	79	163	-76	23	1	-5
144	76	172	-75	11	1	-4
146	69	173	-68	9	4	-1
148	59	177	-59	3	5	-2
150	48	177	-48	3	6	2
152	37	176	-37	2	4	-5
154	34	203	-31	-13	2	-4
156	33	210	-28	-16	2	-5
158	38	235	-22	-31	3	-4
160	33	240	-16	-29	2	3
162	29	243	-13	-26	2	2
164	25	244	-11	-22	-2	-1
166	32	238	-17	-27	-2	-1
168	30	238	-16	-25	0	0

CODE NAME.. HELEN(D) LAUNCH DATE.. 7/22/68 TIME.. 2319 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
107	123	97	-15	122	35	-26
108	100	82	14	99	18	-18
109	90	76	22	88	5	-6
110	89	71	29	85	5	-1
111	90	71	30	85	-1	2
112	93	72	29	88	-2	5
113	97	75	25	94	-5	6
114	105	79	19	103	-5	16
115	121	82	17	120	2	8
116	116	79	22	113	5	-15
117	93	74	26	89	5	-40
118	54	56	30	45	1	-31
119	44	53	27	35	-5	0
120	39	50	25	30	5	-14
121	35	21	32	12	1	-13
122	26	17	25	8	-11	-2
123	16	17	15	5	-10	-3
124	7	18	6	2	-7	-2
125	1	348	1	0	-8	-2
126	10	194	-9	-2	-10	-2
127	19	193	-18	-4	-10	-2
128	28	189	-27	-4	-10	-2
129	29	179	-29	-4	-5	3
130	32	174	-31	1	-1	4
131	37	170	-36	4	-4	3
132	40	169	-39	7	-4	2
133	41	164	-39	8	-1	2
134	41	157	-38	11	1	4
135	41	150	-36	16	2	5
136	44	140	-36	21	3	6
137	49	135	-35	28	1	7
138	57	130	-37	34	-2	8
143	49	116	-22	43	-1	8
144	47	114	-19	44	6	-3
145	55	119	-27	43	-4	3
146	56	121	-29	48	-6	4
147	57	126	-33	48	-2	-2
148	58	130	-37	44	-5	-2

CODE NAME.. INGER

LAUNCH DATE.. 7/22/68

TIME.. 2319 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	N=S WIND (M/S/KM)	E=W WIND (M/S/KM)	E=W SHEAR (M/S/KM)
92	18	286	5	-17	-18	-18	-7
93	24	239	-12	-21	-17	-17	3
94	29	207	-26	-13	-7	-7	7
95	27	209	-24	-13	12	12	-6
96	21	256	-5	-20	21	21	-4
97	23	310	15	-18	19	19	6
98	34	342	33	-11	16	16	7
99	45	356	44	-3	4	4	8
100	38	6	37	4	-19	-19	3
101	11	30	10	6	-32	-32	8
102	33	135	-23	24	-34	-34	23
103	69	140	-53	44	-21	-21	14
104	81	139	-61	54	5	5	11
105	84	124	-47	70	18	18	18
106	93	108	-28	88	21	21	19
107	111	95	-9	110	12	12	26
108	137	90	0	137	13	13	21
109	150	84	15	149	10	10	5
110	151	83	17	150	2	2	-4
111	142	81	22	140	5	5	-18
112	115	79	21	113	-10	-10	-34
113	73	67	3	73	-24	-24	-43
114	41	112	-15	38	-5	-5	-16
115	40	101	-7	39	14	14	5
116	42	83	5	42	12	12	8
117	58	73	17	56	9	9	15
118	72	70	24	67	8	8	10
119	76	67	29	70	-4	-4	-12
120	55	70	19	52	-9	-9	-8
121	58	76	14	57	-5	-5	4
122	52	83	7	52	-8	-8	-7
123	47	90	0	47	-7	-7	-5
124	42	99	-7	41	-7	-7	-5
125	39	109	-13	37	-6	-6	-4
126	39	118	-18	34	-5	-5	-3
127	39	125	-23	32	-4	-4	-2
128	40	132	-27	29	-5	-5	-2

CODE NAME.. JOY

LAUNCH DATE.. 7/22/68 TIME.. 2319 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
93	44	242	-21	-39	-2	-23
94	53	249	-19	-49	8	15
95	19	257	-4	-18	18	23
96	17	317	13	-12	16	3
97	27	351	27	-4	13	6
98	38	356	37	-3	7	1
99	41	1	41	1	-1	4
100	33	5	33	3	-17	0
101	8	24	7	3	-30	3
102	26	138	-19	17	-18	33
103	59	123	-31	49	-14	3
104	51	145	-42	29	4	-10
105	50	120	-25	44	16	19
106	53	111	-19	50	2	-3
107	46	110	-16	43	3	-8
108	40	108	-12	38	4	-1
109	42	100	-7	41	5	7
110	53	93	-3	53	5	19
111	76	88	3	76	7	23
122	75	16	72	21	-12	-7
123	60	14	58	15	-10	-34

CODE NAME.. KAY

LAUNCH DATE.. 1/ 6/69 TIME.. 1741 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
168.1	21	194	-20	-5	--	--
169.5	60	112	-23	56	--	--
193.8	29	188	-8	-1	--	--
202.0	32	188	-5	-1	--	--
206.2	62	54	36	50	--	--
211.9	74	70	25	68	--	--

CODE NAME.. MAE

LAUNCH DATE.. 1/ 7/69 TIME.. 1738 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
179.9	120	87	6	119	--	--
180.0	13	158	-4	2	--	--
191.3	12	201	-3	-1	--	--
195.0	119	91	-2	119	--	--
209.2	32	317	3	-3	--	--
214.5	168	79	26	136	--	--

CODE NAME.. NITA

LAUNCH DATE.. 1/11/69 TIME.. 1932 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
113.4	118	304	66	-96	--	--
120.9	133	327	106	-68	--	--
135.0	299	151	-101	56	--	--

CODE NAME.. DDET

LAUNCH DATE.. 1/13/69 TIME.. 1743 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
183.9	26	173	-11	1	--	--
186.4	150	92	-5	149	--	--
192.3	33	196	-11	-3	--	--
197.8	120	86	8	119	--	--

CODE NAME.. PEARL LAUNCH DATE.. 5/12/69 TIME.. 2004 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	N=S SHEAR (M/S/KM)	E=W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
115.1	41	17	30	9	---	---
117.0	92	317	67	-62	---	---
118.4	57	312	38	-42	---	---
121.2	63	334	57	-28	---	---
129.5	44	24	38	17	---	---
131.1	45	323	35	-27	---	---
137.4	50	211	-38	-23	---	---
146.3	54	185	-53	-4	---	---

CODE NAME.. QUEENA (U&D) LAUNCH DATE.. 5/12/69 TIME.. 2023 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	N=S SHEAR (M/S/KM)	E=W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
143.9	67	169	-23	5	---	---
159.1	69	196	-66	-19	---	---
162.7	76	235	-19	-27	---	---
173.4	54	266	-3	-35	---	---
190.9	64	259	-7	-34	---	---
199.3	72	250	-12	-33	---	---

CODE NAME.. REBA LAUNCH DATE.. 5/14/69 TIME.. 2005 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	N=S SHEAR (M/S/KM)	E=W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
112.5	57	234	-34	-46	--	--
114.6	22	239	-11	-18	--	--
117.2	15	221	-11	-9	--	--
119.1	10	108	-3	8	--	--
121.6	24	152	-21	11	--	--
123.4	26	169	-25	5	--	--

CODE NAME.. SOPHIA LAUNCH DATE.. 5/14/69 TIME.. 2028 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	N=S SHEAR (M/S/KM)	E=W SHEAR (M/S/KM)
198.0	15	300	7	-13	..	..
199.0	17	292	6	-16	..	..
200.0	19	286	5	-18	..	..
201.0	21	282	4	-21	..	..
202.0	24	279	4	-24	..	..
203.0	20	274	1	-20	..	..
204.0	20	274	1	-20	..	..
205.0	20	274	1	-20	..	..
206.0	20	275	2	-19	..	..
207.0	18	276	2	-18	..	..
208.0	16	259	-3	-15	..	..
209.0	15	258	-3	-15	..	..
210.0	15	257	-3	-15	..	..
211.0	15	257	-3	-14	..	..
212.0	15	256	-3	-14	..	..
213.0	14	250	-3	-14	..	..
214.0	13	234	-8	-11	..	..
215.0	13	233	-8	-10	..	..
216.0	13	232	-8	-10	..	..

CODE NAME..	UNACU)	LAUNCH DATE.. 12/ 5/69				TIME.. 500 CST			
HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	N=S WIND (M/S)	E=W WIND (M/S)	N=S SHEAR (M/S/KM)	E=W SHEAR (M/S/KM)	
93	89	71	29	84	-37	-37	19	19	
94	98	93	-5	98	-27	-27	2	2	
95	95	106	-25	92	-16	-16	-5	-5	
96	97	114	-39	88	-11	-11	-9	-9	
97	87	123	-47	73	-6	-6	-15	-15	
98	78	132	-52	58	-2	-2	-19	-19	
99	65	146	-54	36	-6	-6	-18	-18	
100	68	156	-62	27	-5	-5	-3	-3	
101	64	162	-61	20	7	7	-18	-18	
102	50	187	-50	-6	15	15	-26	-26	
103	42	217	-33	-25	16	16	-13	-13	
104	39	247	-15	-36	24	24	-9	-9	
105	48	285	12	-47	25	25	-16	-16	
106	69	297	31	-62	17	17	-6	-6	
107	72	310	46	-55	11	11	14	14	
108	68	322	54	-42	9	9	10	10	
109	74	331	65	-35	11	11	4	4	
110	80	337	73	-32	6	6	3	3	
111	83	341	78	-27	4	4	8	8	
112	81	348	79	-17	-4	-4	9	9	
113	67	353	67	-8	-20	-20	11	11	
114	43	6	42	4	-23	-23	12	12	
115	28	27	25	13	-14	-14	6	6	
116	22	70	8	21	-26	-26	14	14	
117	44	121	-22	38	-24	-24	14	14	
118	59	129	-37	46	-10	-10	5	5	
119	69	132	-46	51	-6	-6	4	4	
120	73	133	-49	53	-2	-2	1	1	
121	75	134	-52	54	-3	-3	-1	-1	
122	76	137	-55	52	-3	-3	-1	-1	
124	80	137	-58	54	0	0	5	5	
126	87	131	-58	66	0	0	3	3	
128	89	132	-59	66	-1	-1	1	1	
130	93	131	-61	70	0	0	1	1	

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CODE NAME.. UNAC(D)          LAUNCH DATE.. 12/ 5/69  TIME.. 500 CST

HEIGHT (KM)  SPEED (M/S)  HEADING (DEG)  N-S WIND (M/S)  E-W WIND (M/S)  N-S SHEAR (M/S/KM)  E-W SHEAR (M/S/KM)
*****      *****      *****      *****      *****      *****      *****
 91          54          70          19          51          -6          39
 92          82          81          12          81          -7          15
 93          86          87          4           85          -11         7
 94          96          96          -9          95          -14         -2
 95          84          107         -24         81          -17         -14
 96          85          118         -40         75          -9          -4
 97          79          122         -42         67          0           -11
 98          69          130         -44         53          -5          -16
 99          63          145         -51         37          -8          -14
100          65          155         -59         27          -7          -7
101          65          162         -62         20          4           -10
102          52          175         -52         5           10          -21
103          49          203         -45         19          7           -24
104          47          240         -23         -41         47          -20
105          64          301         33          -55         39          -2
106          67          315         48          -48         11          9
107          77          327         65          -42         14          3
108          83          333         74          -37         15          10
109          95          346         91          -24         6           11
110          86          348         84          -18         10          4
111          79          351         78          -12         -9          8
112          63          358         63          -2          -18         11
113          45          12         45          9           -18         11
114          33          37         27         20          -20         12
115          34          81         6           33          -21         12
116          44          106         -12         43          -14         6
117          52          118         -24         46          -12         3
118          62          127         -37         50          -12         3
119          72          132         -48         53          -11         4
120          82          136         -59         57          -8          1
121          87          140         -66         56          -10         -1
122          95          143         -76         57          -3          -1
123          89          143         -71         54          7           -4
124          85          143         -67         51          0           0
126          96          143         -76         58          -5          5
127          102         143         -81         62          -4          3
128          107         143         -85         65          0           0

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CODE NAME.. VANESSA

LAUNCH DATE.. 12/ 5/69 TIME.. 556 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
85	21	351	21	-3	15	7
86	33	0	33	0	8	-3
87	36	348	35	-7	-4	-5
88	34	347	33	-8	6	1
89	32	355	32	-3	-32	15
90	23	107	-7	22	0	28
91	57	62	27	50	17	31
92	83	85	7	83	-25	29
93	98	93	-5	98	-13	-4
94	89	107	-26	85	-21	-8
95	92	116	-41	83	-11	-11
96	77	128	-47	61	-2	-22
97	66	136	-47	46	0	-13
98	59	145	-49	34	-2	-9
99	56	153	-50	26	-1	-12
100	51	168	-50	11	1	-12
101	47	178	-47	2	4	-12
102	34	207	-30	-16	42	-20
103	43	310	27	-33	50	-14
104	66	324	54	-39	10	4
105	64	333	57	-29	0	10
106	61	337	57	-23	0	2
107	62	338	57	-23	1	1
108	60	340	56	-20	-4	6
109	53	346	51	-13	-3	7
110	46	353	45	-5	-15	11

VANESSA

-CONTINUED-

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
111	25	17	24	7	-17	10
112	18	49	12	14	-17	8
113	26	113	-10	24	-18	7
114	34	127	-20	27	-6	1
115	40	134	-28	29	-14	3
116	54	143	-43	33	-10	3
117	58	144	-47	34	-3	2
118	64	144	-52	37	-5	3
119	69	144	-55	41	-3	3
120	73	143	-59	44	-4	4
121	78	142	-61	49	-2	5
122	82	139	-62	54	0	4
124	87	138	-65	58	-2	0
126	90	140	-68	58	-1	1
128	93	138	-69	62	0	1
130	94	139	-70	62	0	0
132	95	138	-71	63	0	1
134	96	138	-71	64	0	1
136	97	137	-71	66	0	1
138	99	136	-71	69	0	2
140	101	133	-69	74	1	2
142	104	131	-69	78	0	4
144	96	130	-61	74	13	4
146	38	145	-31	22	6	-18
148	35	144	-28	20	13	-17
150	45	37	36	27	44	5
152	138	20	130	47	0	6

CUDE NAME	WENDY	LAUNCH DATE	12/11/69	TIME	2130	CST
HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	N=S SHEAR (M/S/KM)	E=W SHEAR (M/S/KM)
****	****	****	****	****	****	****
99	48	255	-13	-47	2	-6
100	52	263	-7	-52	14	-4
101	58	281	11	-57	12	-6
102	68	285	17	-66	9	-12
103	82	293	32	-75	16	-1
104	85	303	46	-72	12	-1
105	99	306	58	-81	13	-12
106	113	309	71	-88	9	-3
107	112	312	74	-83	0	15
108	101	319	75	-66	4	8
109	98	320	75	-64	-14	12
110	66	317	48	-45	-29	10
111	54	297	25	-48	-20	-5
112	47	279	8	-46	-12	4
113	44	274	3	-44	4	-1
114	48	285	13	-47	10	-2
115	50	293	20	-46	5	3
116	46	302	25	-39	4	14
117	36	317	26	-24	-2	9
118	31	316	22	-21	-3	4
119	25	328	21	-13	-1	9
120	21	345	20	-5	-1	7
121	19	7	19	2	-1	8
122	20	31	17	10	-2	8
123	22	51	14	17	-2	6
124	26	63	12	23	-3	7
125	31	75	8	30	-4	6
126	34	83	4	34	-3	2
127	36	88	2	36	-3	2
128	38	92	-1	38	-2	1
129	37	95	-3	37	-2	0
130	38	98	-5	38	-2	0
131	39	100	-7	38	-1	1
132	40	100	-7	40	0	3
133	42	99	-7	42	-1	1
134	42	101	-8	41	-1	-1
135	41	103	-9	40	-1	-1
136	40	104	-10	39	0	0

CODE NAME.. ARLEEN(B2H6) LAUNCH DATE.. 5/6/70 TIME.. 2005 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
103	127	162	-121	40	-3	-8
104	134	167	-130	31	-21	-12
105	151	175	-150	14	-1	-22
106	131	183	-131	-7	22	-14
107	113	186	-113	-12	25	-1
108	84	190	-82	-15	24	-4
109	72	196	-69	-19	9	-4
110	64	201	-60	-23	9	-3
111	58	206	-52	-25	8	-2
112	52	211	-44	-27	4	-1
113	50	211	-43	-25	3	7
114	35	205	-31	-15	24	7
115	14	263	-2	-14	25	-3
116	23	310	15	-18	14	-3
117	36	326	30	-20	15	-2
118	47	334	42	-21	9	0
119	51	338	47	-19	1	3
120	49	340	46	-17	-1	2
121	48	341	46	-16	0	0
122	49	339	46	-17	0	-2
123	50	336	46	-20	0	-2
124	51	335	46	-22	-1	-3
125	53	329	46	-27	2	-8
126	61	324	49	-36	2	-6
127	61	322	48	-38	0	0

CODE NAME., ARLEEN (NA) LAUNCH DATE., 5/6/70 TIME., 2005 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
94	103	102	-21	101	-9	6
95	110	105	-28	106	-3	4
96	110	104	-27	107	3	-3
97	108	104	-25	105	-2	3
98	109	106	-31	105	-5	-15
99	89	113	-35	81	-5	-12
100	92	110	-32	86	19	7
101	82	103	-19	80	-24	-23
102	93	148	-79	49	-65	-26
103	126	165	-121	34	-23	-9
104	136	171	-134	22	-9	-22
105	140	182	-140	-5	3	-20
106	128	186	-127	-13	20	-4
107	107	189	-106	-16	20	0
108	89	190	-88	-15	20	-1
109	70	197	-67	-20	17	-6
110	61	204	-55	-25	9	-4
111	55	210	-47	-28	7	-1
112	49	214	-41	-27	7	2
113	40	218	-32	-24	10	3
114	29	226	-20	-21	13	3
115	19	256	-5	-19	18	1
116	24	308	15	-19	18	0
117	33	326	27	-18	7	1
118	37	331	32	-18	7	0
119	46	337	42	-18	10	0
120	51	341	49	-17	2	1

ARLEEN (NA) -CONTINUED-

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	N=S SHEAR (M/S/KM)	E=W SHEAR (M/S/KM)
121	50	341	47	-16	-2	1
122	48	341	46	-16	-2	1
123	44	342	42	-13	-4	3
124	39	345	37	-10	-5	3
125	32	346	31	-8	-9	3
126	21	349	21	-4	-8	3
127	13	355	12	-1	-12	4
128	5	124	-3	4	-12	3
129	12	153	-11	6	-7	2
130	21	158	-19	8	-9	3
132	39	160	-36	13	-9	3
134	56	161	-53	19	-7	2
136	64	163	-61	19	-2	2
138	72	164	-69	20	-9	5
140	100	159	-93	36	-9	8
142	112	155	-102	47	-3	4
144	120	154	-107	54	0	3
146	119	150	-102	60	2	2
148	122	149	-105	63	-3	2
150	130	149	-111	67	-2	1
152	132	150	-115	65	-2	-1
154	137	151	-120	66	-3	1
156	141	152	-124	66	-1	-1
158	137	153	-123	62	1	-2
160	133	154	-120	58	2	-2
162	129	155	-117	54	0	-1
164	130	156	-119	52	0	-1
166	131	157	-121	50	0	0

CODE NAME.: BREDA

LAUNCH DATE.. 5/ 7/70 TIME.. 2045 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
107.5	91	207	-81	-41	--	--
110.8	66	201	-56	-21	--	--
111.0	56	237	-30	-45	--	--
114.4	53	335	37	-17	--	--
114.5	28	312	19	-21	--	--
117.5	73	345	68	-18	--	--
119.6	57	347	55	-13	--	--
120.9	55	17	50	15	--	--
125.3	11	97	-1	9	--	--
128.5	35	165	-31	8	--	--
128.8	192	227	-9	-9	--	--
131.8	295	230	-30	-36	--	--
133.5	66	163	-63	19	--	--
135.3	68	151	-59	33	--	--
139.4	106	179	-105	2	--	--

CODE NAME.: CLAIRE

LAUNCH DATE.. 5/20/70 TIME.. 2007 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
93	84	186	-83	-9	42	-6
94	50	186	-49	-5	19	23
95	52	143	-41	31	8	34
96	60	120	-29	52	9	12
97	64	114	-26	59	3	4
98	66	109	-21	63	5	6
99	74	104	-17	72	19	7

CODE NAME.. DORA(U)

LAUNCH DATE.. 5/21/70 TIME.. 435 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
100	70	94	-5	70	-11	-8
101	66	104	-16	64	-12	-2
102	72	110	-25	67	-1	7
103	75	103	-17	73	16	1
104	70	86	5	69	29	-4
105	76	61	37	67	31	-5
106	82	44	59	58	9	-11
107	76	39	59	48	-4	-7
108	72	37	58	43	3	-6
109	64	33	54	35	-23	-7
110	28	64	13	26	-45	-17
111	23	179	-22	1	-25	-29
112	47	210	-40	-23	-15	-14
113	59	204	-54	-23	-11	12
114	60	187	-60	-7	1	13
115	55	182	-54	-2	6	0
116	48	187	-47	-5	12	-7
117	35	207	-31	-16	18	-14
118	35	244	-15	-32	11	-17
119	50	260	-8	-50	4	-18
120	67	266	-5	-67	4	-16
121	79	269	-1	-79	3	-4
122	76	271	1	-76	1	5
123	73	271	1	-73	7	1

CODE NAME,, DURA(D)

LAUNCH DATE,, 5/21/70 TIME,, 435 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
100	79	53	48	63	-28	6
101	72	72	22	69	-21	5
102	73	86	6	73	-14	3
103	74	95	-6	74	-7	0
104	71	95	-6	71	6	-8
105	63	87	4	63	12	0
106	76	80	13	75	2	21
107	80	83	10	79	0	-35
108	23	53	14	18	0	-54
109	13	314	9	-9	-4	-16
110	24	285	6	-23	-7	-9
111	27	258	-5	-27	-12	-2
112	34	242	-16	-30	-10	-5
113	45	232	-28	-35	-13	-5
114	57	225	-40	-40	-11	-5
115	66	222	-49	-44	-7	-1
116	69	220	-53	-44	1	-1
117	68	224	-49	-47	18	-14

CODE NAME.: EVELYN

LAUNCH DATE.. 5/21/70 TIME.. 507 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
101.7	73	104	-18	71	--	--
104.1	53	102	-11	51	--	--
108.2	15	156	-13	6	--	--
113.3	29	261	-4	-29	--	--
114.9	31	287	9	-29	--	--
130.8	136	251	-44	-128	--	--
151.3	190	252	-49	-152	--	--
154.0	136	258	-29	-132	--	--
157.7	160	266	-10	-160	--	--
160.5	156	264	-16	-154	--	--

CODE NAME.: FRAN

LAUNCH DATE.. 5/22/70 TIME.. 512 CDT

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
113.2	143	175	-139	13	--	--
114.1	140	178	-139	5	--	--
115.2	129	184	-128	-8	--	--
115.7	129	182	-128	-3	--	--
116.8	103	207	-91	-47	--	--

CODE NAME..	GENIE(UP)	LAUNCH DATE..	11/20/70	TIME..	1719 CST	
HEIGHT	SPEED	HEADING	N-S WIND	E-W WIND	N-S SHEAR	E-W SHEAR
(KM)	(M/S)	(DEG)	(M/S)	(M/S)	(M/S/KM)	(M/S/KM)
*****	*****	*****	*****	*****	*****	*****
93	15	198	-14	-4	-2	-2
94	17	200	-16	-6	-3	-1
95	20	198	-19	-6	-3	0
96	22	204	-20	-9	4	-6
97	22	234	-13	-18	7	-10
98	27	254	-7	-26	5	-8
99	34	267	-2	-34	6	-6
100	36	274	3	-35	2	4
101	21	261	-3	-20	-18	31
102	32	149	-27	16	-21	30
103	52	139	-39	34	-6	14
104	64	132	-43	47	-1	7
106	56	136	-40	40	0	-3
107	57	138	-42	39	-3	-3
108	49	143	-39	29	18	-16
109	21	140	-16	13	10	-9
110	16	152	-14	7	15	-15
111	18	312	12	-13	14	-12
112	16	303	9	-14	-1	-2
113	28	308	17	-22	8	-10
114	34	302	18	-28	-2	-5
115	40	300	20	-34	5	-8
116	50	302	26	-43	5	-7
117	57	302	30	-48	5	-6
118	66	304	37	-54	6	-5
119	70	304	39	-58	0	-3
120	71	302	37	-60	-5	-2
122	67	287	20	-64	-8	-4
124	77	278	11	-76	-2	-5
126	84	276	9	-84	0	-4
128	96	277	12	-95	2	-7
130	103	279	15	-102	2	5
132	85	283	19	-83	2	7
134	81	285	21	-79	-2	3
136	66	282	14	-64	-3	8
138	52	283	12	-51	-7	2

CODE NAME..	GENIE(D)	LAUNCH DATE..	11/20/70	TIME..	1719	CST
HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
83	80	69	28	75	-2	0
84	80	70	27	76	0	3
85	82	72	26	78	-6	-4
86	70	75	18	68	-4	-11
87	59	79	11	58	-24	-10
88	56	115	-23	51	-25	0
89	60	123	-32	50	-4	-14
90	44	150	-37	22	-3	-32
91	36	186	-35	-4	3	-20
92	37	208	-33	-17	4	-7
93	33	217	-26	-20	6	-2
94	29	222	-21	-19	5	8
95	22	210	-19	-11	-3	-2
96	34	225	-24	-24	-1	-13
97	38	238	-20	-32	5	-8
98	44	251	-15	-42	10	-8
99	45	269	-1	-44	12	2
100	45	279	7	-44	6	-9
101	51	282	10	-50	-5	18
102	11	225	-8	-8	-32	48
103	50	147	-42	28	-23	21
104	67	141	-52	42	-8	16
105	82	137	-60	56	2	0
106	65	139	-49	43	10	-13
107	55	140	-42	35	10	-10
108	30	141	-23	19	27	-22
109	3	322	2	-2	16	-14
110	13	310	8	-10	3	-8
111	28	306	16	-22	15	-18
112	52	310	34	-40	11	-11
113	55	310	35	-42	-3	2
114	52	308	32	-41	-5	2
115	47	304	26	-39	-6	0
116	44	299	21	-39	-5	0
117	41	295	17	-37	-3	1
118	44	292	16	-40	0	-1
119	46	291	16	-43	-2	-3
120	49	286	13	-47	-3	-3
122	54	282	11	-52	-1	-5
124	68	278	9	-67	0	-9
126	84	277	10	-84	1	-6
128	89	277	10	-89	0	0
130	86	278	11	-85	0	3
132	81	278	11	-80	0	3
134	74	277	9	-73	-1	5
136	61	277	7	-60	-1	7
138	47	275	4	-47	-2	7
140	31	270	0	-31	-2	8
142	16	258	-3	-16	0	0

CODE NAME.. HILDA(U) LAUNCH DATE.. 11/20/70 TIME.. 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
90	44	160	-42	15	9	-19
91	32	185	-31	-3	13	-17
92	24	219	-19	-15	9	-4
93	20	234	-12	-16	10	-5
94	25	264	-3	-24	0	-1
95	21	234	-12	-17	-9	9
96	21	226	-14	-15	2	-6
97	26	247	-10	-24	5	-6
98	24	259	-5	-23	5	4
99	23	269	0	-23	4	-7
100	34	275	3	-34	3	-7
101	29	272	1	-29	-12	16
102	20	188	-20	-3	-25	35
103	50	143	-40	30	-10	20
104	58	137	-43	40	-4	12
105	68	133	-46	50	6	-7
106	40	139	-31	26	14	-22
107	28	145	-23	16	8	-8
108	13	154	-12	6	11	-9
109	2	184	-2	0	9	-5
110	10	324	8	-6	11	-6
111	22	327	18	-12	9	-5
112	30	324	24	-17	3	-7
113	34	315	24	-24	-2	-3
114	33	311	21	-25	-2	-2
115	37	306	22	-30	3	-9
116	46	302	25	-39	0	-6
117	50	300	25	-43	6	-6
118	62	304	35	-52	4	-6
119	62	300	31	-54	-7	-2
120	62	294	25	-57	-5	-2
121	62	290	21	-58	-4	-2
123	68	283	16	-67	-1	-7
125	83	282	17	-81	0	-4
127	84	282	17	-83	1	1
129	85	283	19	-83	0	-1
131	90	281	18	-88	0	-4
133	94	281	17	-92	-2	4
135	77	279	12	-76	-2	5
137	76	279	12	-75	0	2
139	64	277	8	-64	1	-6

CODE NAME.. HILDA(D)

LAUNCH DATE.. 11/20/70 TIME.. 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
*****	*****	*****	*****	*****	*****	*****
85	80	50	52	61	-14	-3
86	69	56	39	57	-12	-7
87	57	63	26	51	-17	1
88	53	88	2	53	-30	-8
89	46	128	-28	36	-25	-10
90	57	146	-47	32	-17	-12
91	60	172	-59	8	1	-27
92	48	193	-47	-11	16	-10
93	37	205	-34	-16	13	-7
94	31	228	-21	-23	9	-1
95	27	222	-20	-18	-9	4
96	34	214	-28	-19	5	-6
97	29	244	-13	-26	12	-8
98	36	253	-11	-34	1	-8
99	43	264	-4	-42	8	-6
100	47	271	1	-46	0	-2
101	48	272	1	-47	10	-1
102	38	283	8	-37	-17	34
103	30	160	-29	10	-33	38
104	54	145	-44	31	-10	18
105	77	137	-56	52	-10	17
106	80	136	-57	56	10	-10
107	56	137	-41	38	18	-20
108	32	137	-24	22	18	-13
109	12	120	-6	11	13	-10
110	1	35	1	1	6	-10
111	14	307	9	-11	7	-15

HILDA(D) -CONTINUED-

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
112	30	297	13	-27	3	-13
113	41	294	17	-38	5	-13
114	57	295	24	-51	6	-9
115	59	296	26	-53	-1	1
116	58	294	23	-53	-2	1
117	56	293	22	-51	-3	2
118	53	289	18	-50	-2	1
119	52	289	17	-49	-1	1
120	50	288	15	-48	1	-2
122	64	292	24	-59	2	-6
124	71	285	19	-68	-3	-5
126	82	281	16	-81	-1	-5
128	88	279	14	-87	-1	-2
130	89	278	12	-88	0	2
132	82	279	13	-81	0	5
134	71	279	11	-70	-2	6
136	57	278	8	-57	-1	8
138	40	277	5	-40	-2	8
140	26	270	0	-26	-3	6
142	16	251	-5	-15	-2	5
144	10	197	-9	-3	-1	7
146	15	140	-11	9	-1	5
148	23	126	-14	19	0	4
150	30	111	-10	28	4	5
152	37	93	-2	37	3	4
154	43	86	3	43	3	3
156	51	76	13	50	0	0

CODE NAME.,. IDA(U)

LAUNCH DATE.,. 11/20/70 TIME.,. 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
96	52	221	-39	-33	18	2
97	41	235	-23	-34	12	-4
98	43	250	-15	-40	7	-6
99	43	261	-7	-43	8	0
100	41	272	1	-41	9	5
101	32	279	5	-31	-10	16
102	20	220	-16	-13	-21	16
103	29	187	-29	-3	-8	4
104	33	173	-32	4	1	18
105	44	137	-32	30	-6	22
106	55	138	-41	37	-3	-8
107	37	147	-31	20	19	-19
108	12	150	-10	6	17	-10
109	1	259	0	-1	7	-3
110	12	317	9	-8	14	-21
111	45	307	27	-36	18	-20
112	59	312	39	-44	6	-7
113	70	307	42	-56	4	-12
114	79	307	48	-63	2	2
115	72	309	45	-57	-6	4
116	68	304	38	-56	-7	1
117	63	301	32	-54	-4	0
118	64	296	28	-57	-6	-4
119	63	288	19	-60	-11	-4
120	67	278	10	-66	-7	-6
121	72	273	3	-72	-8	-6
122	80	265	-7	-80	7	-15

CODE NAME.. IDA(D) LAUNCH DATE.. 11/20/70 TIME.. 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
95	33	237	-18	-27	2	-6
96	36	244	-16	-33	3	-3
97	36	250	-12	-34	5	1
98	34	259	-7	-34	4	-2
99	41	266	-3	-40	4	-11
100	48	272	2	-48	4	6
101	27	268	-1	-27	-15	28
102	24	187	-24	-3	-20	15
103	39	166	-38	9	-15	19
104	66	147	-56	36	-14	26
105	80	139	-60	52	6	3
106	66	138	-49	44	13	-15
107	43	143	-34	26	23	-24
108	5	163	-5	1	27	-19
109	17	323	13	-10	12	-7
110	31	322	24	-19	13	-12
111	50	320	38	-32	10	-11
112	56	317	42	-38	1	-4
113	58	314	40	-41	-5	-2
114	53	307	32	-42	-10	-2
115	50	298	23	-44	-7	1
116	46	295	20	-42	-1	1
117	47	294	20	-43	0	0
118	48	293	19	-44	-1	-7
119	59	287	17	-56	-3	-12
120	66	281	13	-65	-4	-6
122	77	273	4	-77	-4	-7
124	92	268	-3	-91	-3	-5
126	94	265	-8	-93	-2	1
128	91	263	-11	-90	-1	1
130	88	262	-12	-87	0	2
132	81	263	-10	-80	1	5
134	70	263	-8	-69	0	6
136	56	262	-8	-55	1	8
138	39	264	-4	-39	2	7
140	26	269	0	-26	4	6
142	16	308	10	-13	3	9
144	13	22	12	5	1	6
146	23	32	19	12	7	5
148	48	39	38	30	-1	-2

CODE NAME.. JACKIE(CU) LAUNCH DATE.. 11/20/70 TIME.. 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	N-S SHEAR (M/S/KM)	E-W SHEAR (M/S/KM)
90	47	162	-45	15	0	-3
91	45	168	-44	10	1	-8
92	42	180	-42	0	4	-8
93	37	188	-36	-5	6	-3
94	32	195	-31	-8	3	-4
95	33	205	-30	-14	1	-8
96	37	219	-28	-23	1	-8
97	41	227	-28	-30	1	-7
98	43	236	-24	-36	8	-2
99	37	250	-13	-34	13	2
100	35	271	1	-34	14	-3
101	36	285	9	-34	3	9
102	13	247	-5	-12	-21	33
103	30	142	-24	19	-13	20
104	41	138	-30	28	-1	6
105	47	129	-30	37	-2	10
106	54	130	-34	42	-5	-4
107	46	141	-35	29	6	-16
108	27	147	-23	15	18	-13
109	4	139	-3	2	19	-13
110	17	317	13	-12	10	-14
111	30	308	19	-24	5	-8
112	40	309	25	-31	9	-11
113	56	307	34	-44	6	-10
114	62	306	36	-50	4	-7
115	73	305	41	-60	3	-7
116	74	303	41	-62	-3	1
117	72	302	38	-61	-2	1
118	70	301	36	-60	-2	0
119	68	299	33	-59	-5	2
120	63	294	26	-58	-9	0
122	67	274	4	-67	-9	0
124	77	264	-8	-76	0	-6

CODE NAME.. JACKIE(D) LAUNCH DATE.. 11/20/70 TIME.. 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	N=S SHEAR (M/S/KM)	E=W SHEAR (M/S/KM)
90	43	138	-32	29	-13	-15
91	44	165	-42	11	-4	-23
92	40	196	-38	-11	10	-13
93	31	204	-28	-13	4	2
94	33	202	-30	-12	-4	1
95	34	200	-32	-12	-1	-3
96	36	206	-32	-16	2	-2
97	33	219	-25	-21	13	-15
98	43	256	-11	-42	13	-15
99	45	267	-2	-45	5	0
100	46	271	1	-45	1	4
101	38	269	-1	-37	-4	7
102	33	253	-10	-31	-17	11
103	36	195	-34	-9	-29	35
104	66	155	-59	28	-16	29
105	74	148	-62	40	12	-4
106	50	148	-43	27	19	-18
107	29	160	-27	10	16	-13
108	11	171	-11	2	14	-6
109	5	290	2	-5	14	-9
110	22	318	16	-15	11	-10
111	32	313	21	-23	3	-8
112	41	309	26	-32	7	-11
113	55	309	34	-43	9	-8
114	62	311	40	-47	2	-1
115	60	310	39	-46	-3	1
116	58	309	36	-45	-2	1
117	55	309	35	-43	-2	2
118	53	307	32	-42	-3	0
119	52	303	29	-44	-4	-2
120	53	298	24	-47	-5	-4
122	62	282	13	-60	-7	-9
124	77	269	-2	-77	-6	-7
126	88	264	-9	-87	-3	-3
128	90	262	-13	-89	-1	1
130	86	261	-14	-85	0	3
132	80	259	-15	-79	0	4
134	71	258	-14	-70	1	5
136	60	257	-13	-58	1	6
138	47	258	-10	-46	3	8
140	30	267	-1	-29	4	6
142	22	279	3	-22	0	5

*****NOV. 1970 SERIES POINT WINDS*****

CODE NAME., GENIE(UP) LAUNCH DATE., 11/20/70 TIME., 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	VERT WIND (M/S)
*****	*****	*****	*****	*****	*****
103,3	51	141	-37	30	18
106,8	56	140	-36	30	30
109,4	18	313	8	-8	14
112,2	22	289	7	-20	8
115,3	55	303	30	-46	10

CODE NAME., GENIE(D) LAUNCH DATE., 11/20/70 TIME., 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	VERT WIND (M/S)
*****	*****	*****	*****	*****	*****
84,7	85	72	26	81	-2
88,3	58	118	-27	51	1
92,6	33	224	-23	-22	7
96,5	47	242	-20	-38	14
100,6	52	281	9	-45	24
103,9	71	140	-54	45	5
106,8	52	141	-40	32	3
109,6	14	316	10	-9	5
112,3	60	314	41	-43	3
115,4	50	303	27	-42	8
118,1	47	291	17	-43	14
120,8	55	288	17	-52	3
123,2	70	289	22	-66	-3
125,8	80	284	19	-78	0
128,6	88	281	16	-85	16
131,6	85	279	13	-82	18

*****NOV, 1970 SERIES POINT WINDS*****

CODE NAME., HILDA(U) LAUNCH DATE., 11/20/70 TIME., 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	VERT WIND (M/S)
89,2	57	146	-47	32	-1
92,8	23	231	-15	-18	1
96,1	69	217	-44	-33	42
99,6	81	249	-22	-59	51
103,2	48	149	-34	21	26
106,0	67	134	-45	47	15
108,7	8	298	3	-5	6
111,8	32	318	22	-20	13
114,6	41	304	23	-34	4
117,4	58	301	29	-49	8
120,1	59	291	21	-55	-3
122,7	59	285	15	-56	-4

CODE NAME., HILDA(D) LAUNCH DATE., 11/20/70 TIME., 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N-S WIND (M/S)	E-W WIND (M/S)	VERT WIND (M/S)
85,1	36	49	24	27	0
87,8	59	73	16	49	-26
92,1	41	208	-36	-19	0
95,9	37	228	-22	-24	19
100,0	54	280	8	-43	32
102,9	40	147	-32	21	18
106,2	67	137	-45	41	11
108,3	16	121	-6	10	13
111,2	28	297	12	-24	8
114,1	59	298	27	-53	3
117,0	55	292	20	-51	8
119,9	57	289	18	-52	11
125,8	81	279	12	-80	3
132,7	78	279	13	-77	-1
139,3	29	278	4	-27	10
146,4	24	122	-11	19	8
154,5	49	82	7	48	1
161,1	71	90	0	67	0

*****NOV. 1970 SERIES POINT WINDS*****

CODE NAME., IDA(U) LAUNCH DATE., 11/20/70 TIME., 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	VERT WIND (M/S)
*****	*****	*****	*****	*****	*****
103,4	50	168	-46	10	18
106,4	55	141	-42	34	11
109,1	16	312	7	-8	12
111,5	58	307	34	-46	8
113,9	81	306	46	-64	18
116,4	69	297	30	-60	18
118,7	59	287	17	-54	14
120,8	80	280	13	-78	8

CODE NAME., IDA(D) LAUNCH DATE., 11/20/70 TIME., 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	VERT WIND (M/S)
*****	*****	*****	*****	*****	*****
89,4	34	184	-26	-2	-22
92,7	32	204	-25	-11	-17
95,9	40	237	-21	-33	0
99,6	54	276	6	50	20
102,2	40	163	-38	12	6
105,0	82	137	-59	56	4
107,6	13	210	-4	-2	13
110,3	53	322	41	-32	10
112,6	53	312	36	-39	2
115,1	46	301	23	-39	1
117,5	51	292	19	-47	1
119,9	64	281	12	-62	7
122,4	76	273	4	-75	10
124,8	91	270	1	-89	19

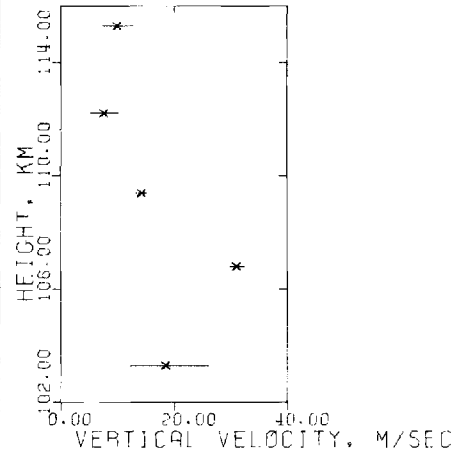
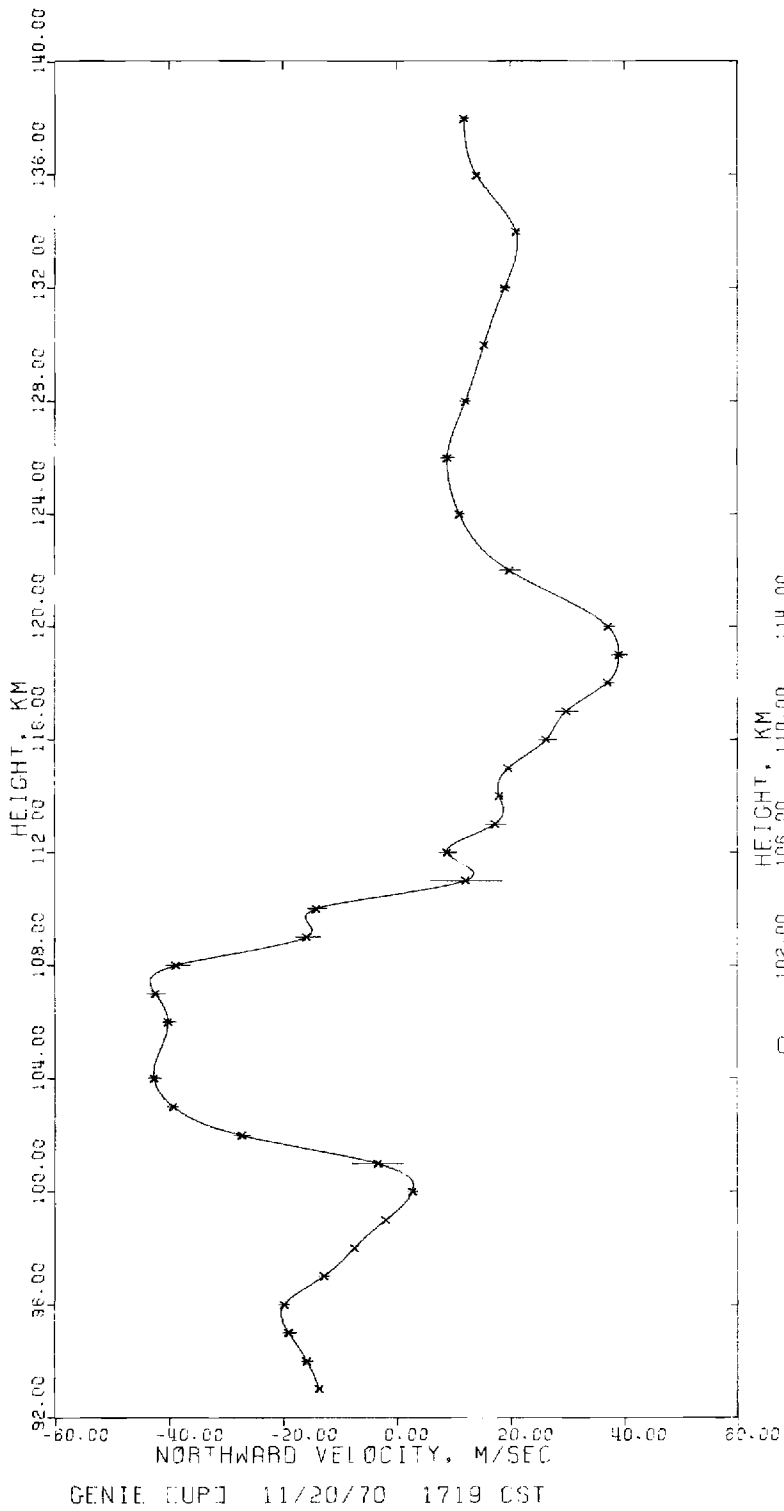
*****NOV, 1970 SERIES POINT WINDS*****

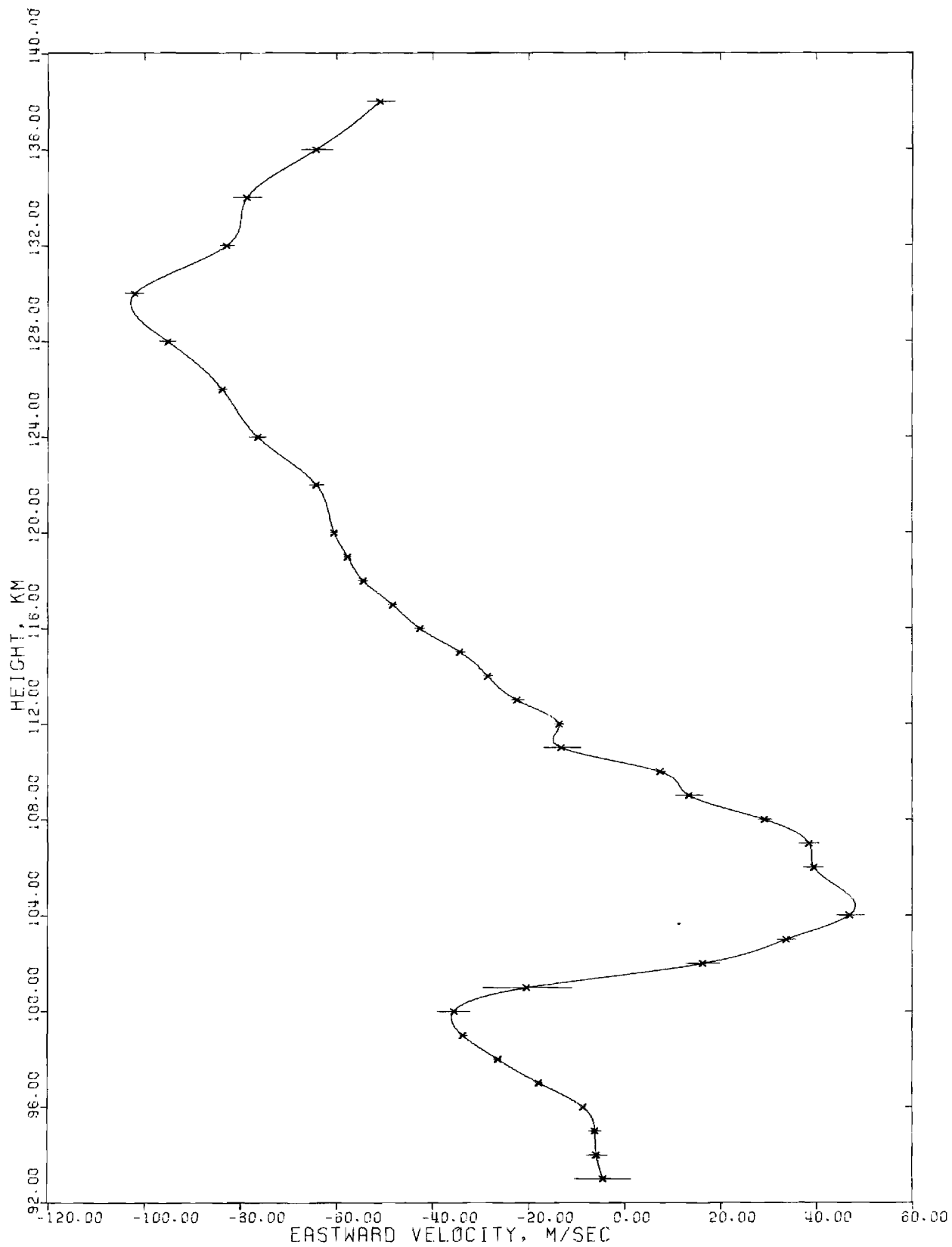
CODE NAME,, JACKIE(U) LAUNCH DATE,, 11/20/70 TIME,, 1719 CST

HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	VERT WIND (M/S)
*****	*****	*****	*****	*****	*****
89,8	44	162	-42	13	-1
93,9	48	202	-26	-10	12
97,3	43	233	-25	-33	9
101,1	33	279	5	-28	16
104,0	46	131	-30	35	4
108,0	32	161	-26	9	16
110,7	22	331	17	-9	2
113,5	61	311	40	-46	17
117,2	70	301	36	-59	13
119,8	60	295	25	-53	13
122,9	78	267	-3	-77	13
125,6	83	259	-16	-81	7

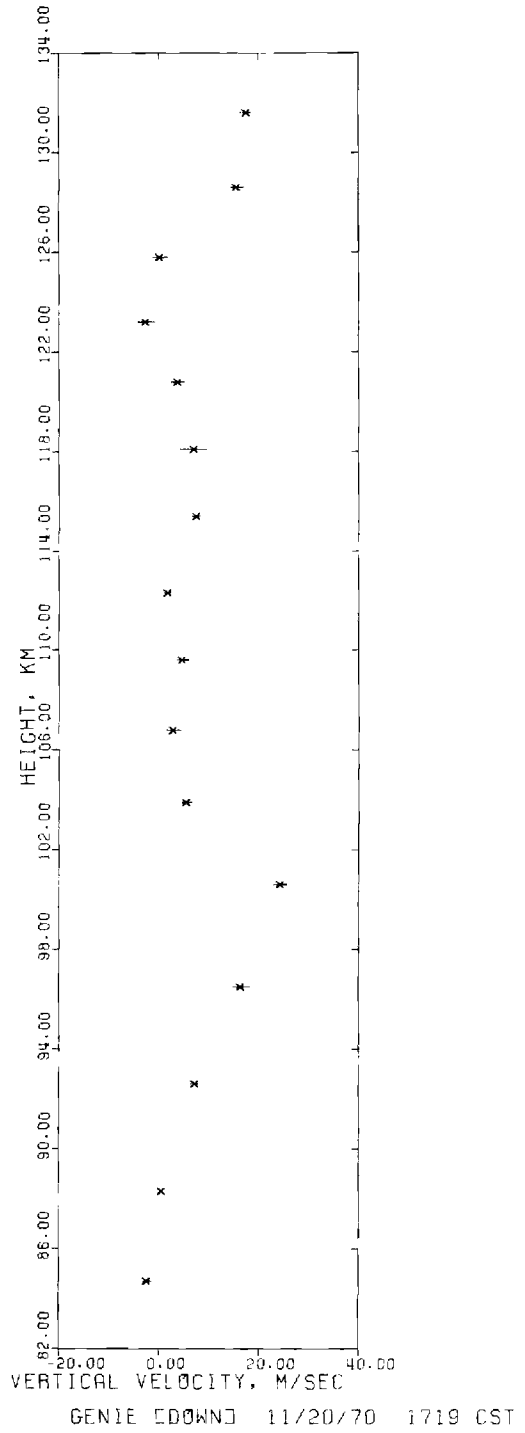
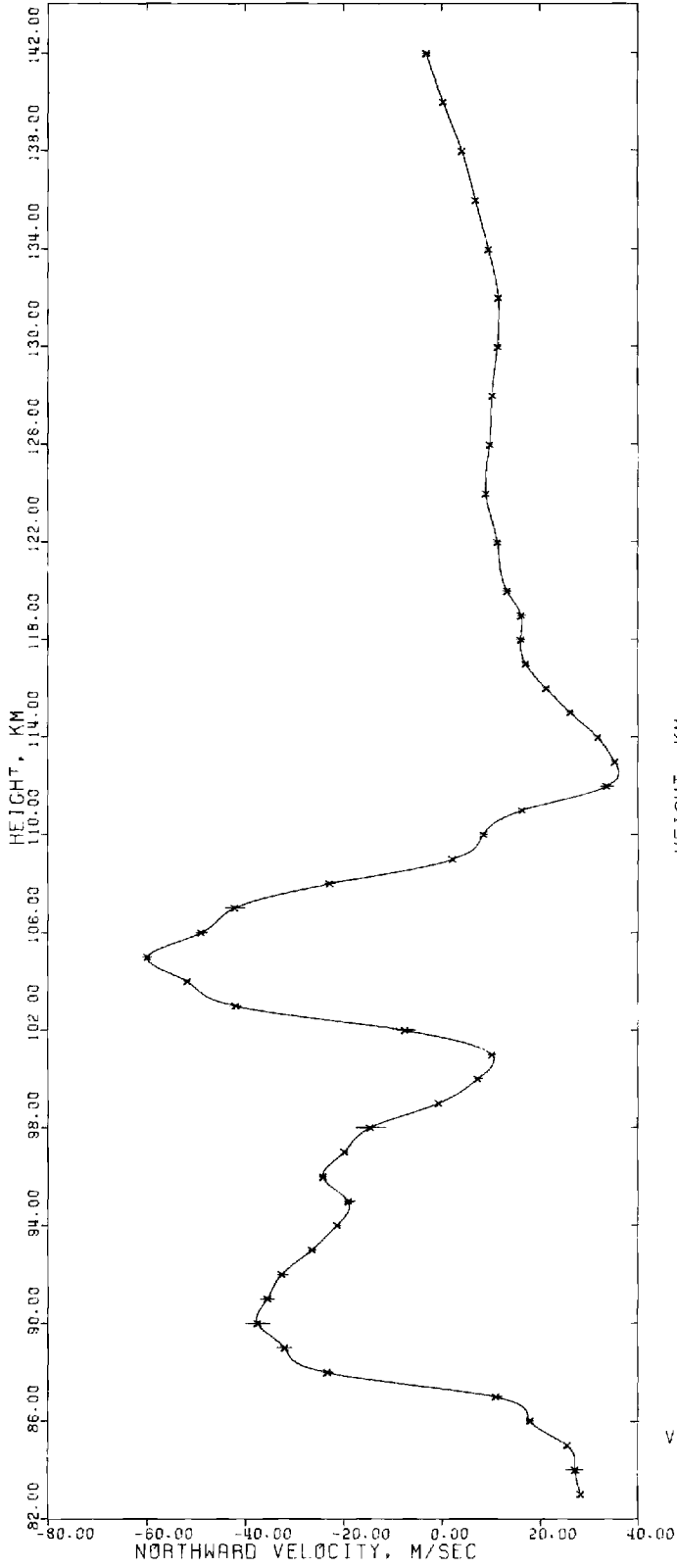
CODE NAME,, JACKIE(D) LAUNCH DATE,, 11/20/70 TIME,, 1719 CST

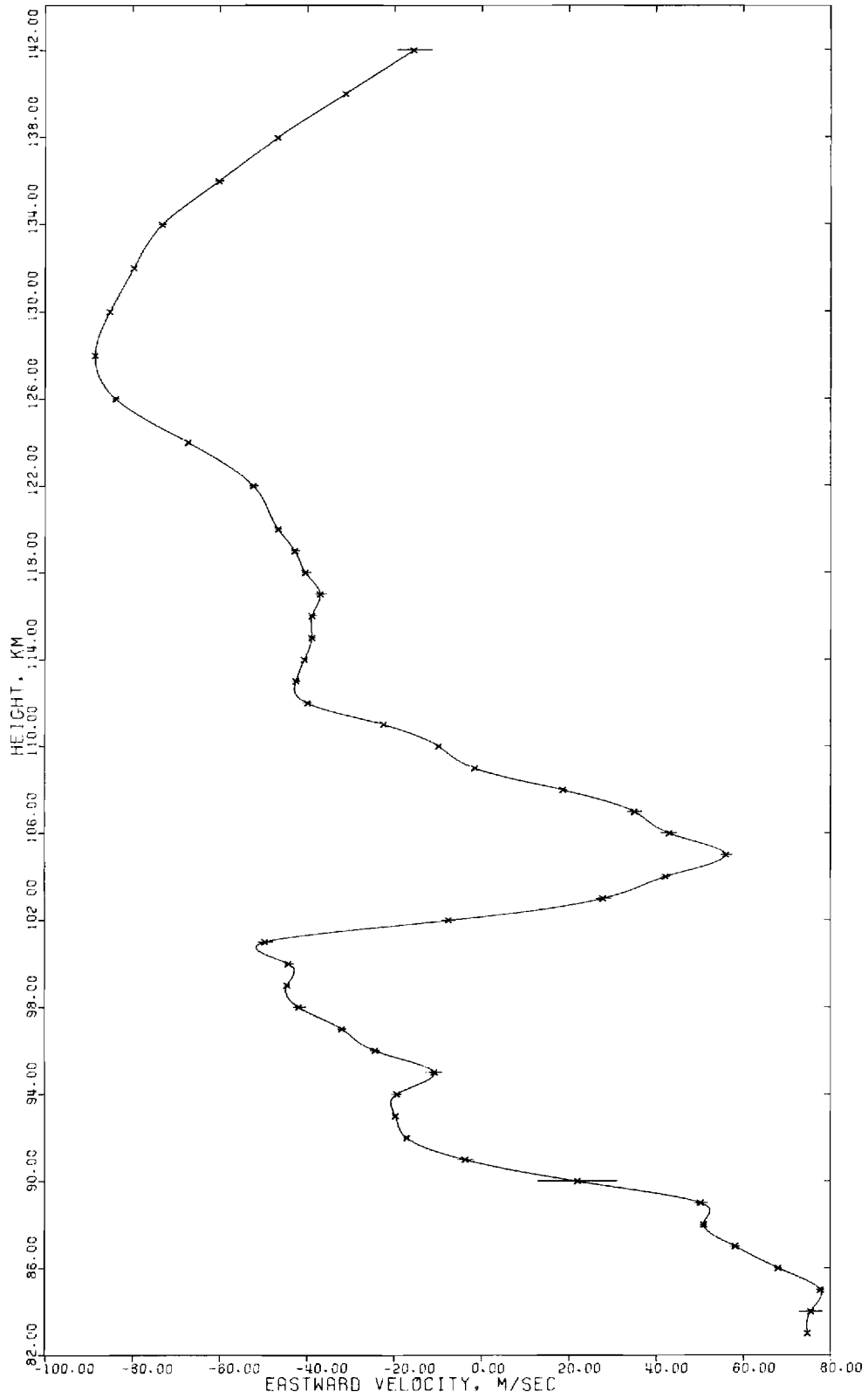
HEIGHT (KM)	SPEED (M/S)	HEADING (DEG)	N=S WIND (M/S)	E=W WIND (M/S)	VERT WIND (M/S)
*****	*****	*****	*****	*****	*****
89,5	43	135	-28	28	-17
94,3	39	194	-28	-7	26
97,1	40	258	-8	-38	12
101,5	49	250	-12	-34	33
104,4	78	147	-64	42	19
107,2	19	156	-12	6	13
110,0	34	319	24	-21	9
112,9	60	311	40	-45	5
115,8	56	312	38	-42	2
118,3	55	306	32	-45	-3
118,6	52	311	34	-39	1
123,8	74	273	4	-74	0
127,1	84	268	-3	-84	6
129,3	74	264	-7	-72	14
131,8	60	264	-7	-59	9



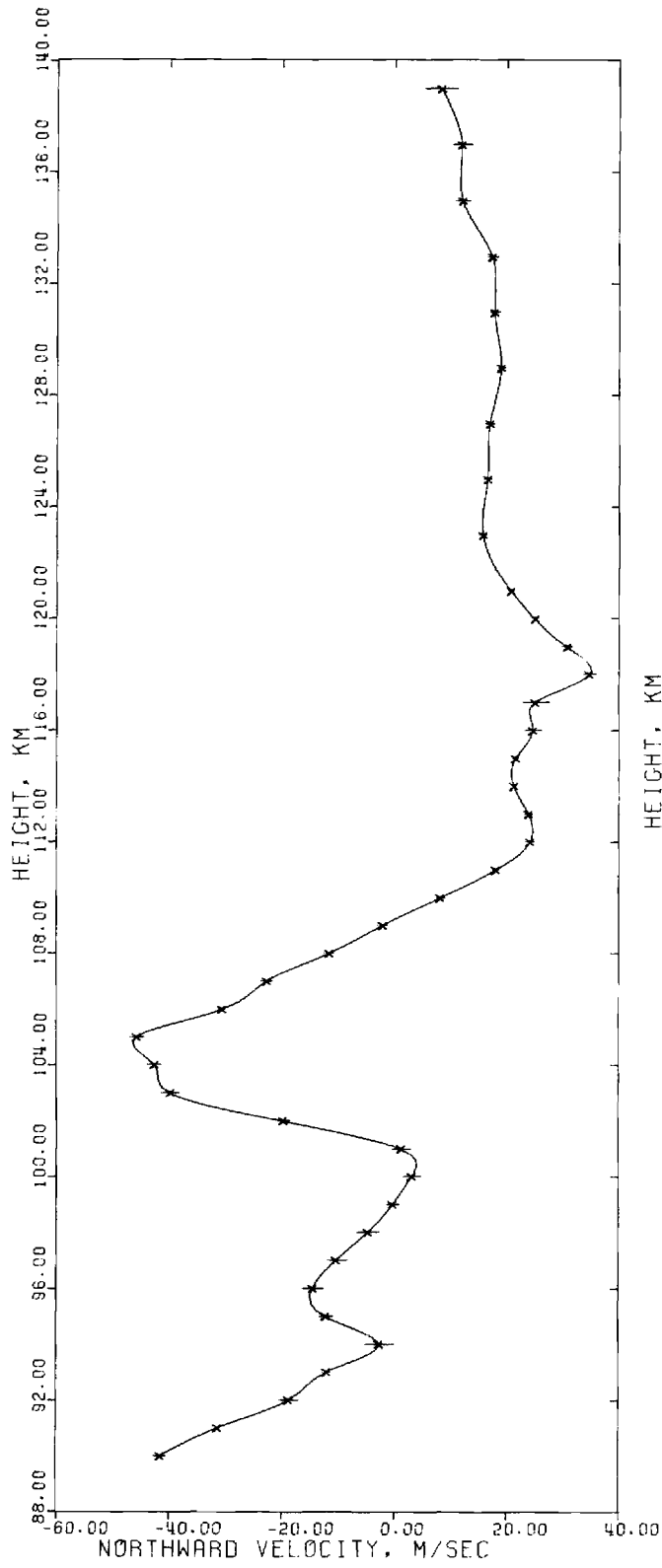


GENIE [UP] 11/20/70 1719 CST

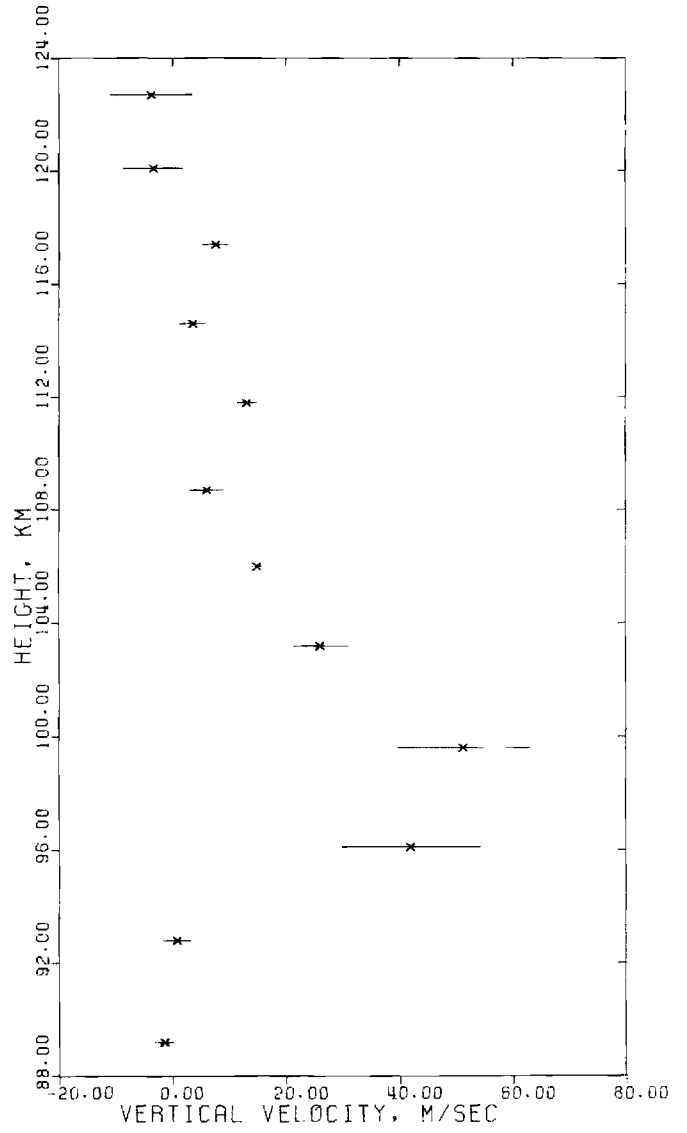




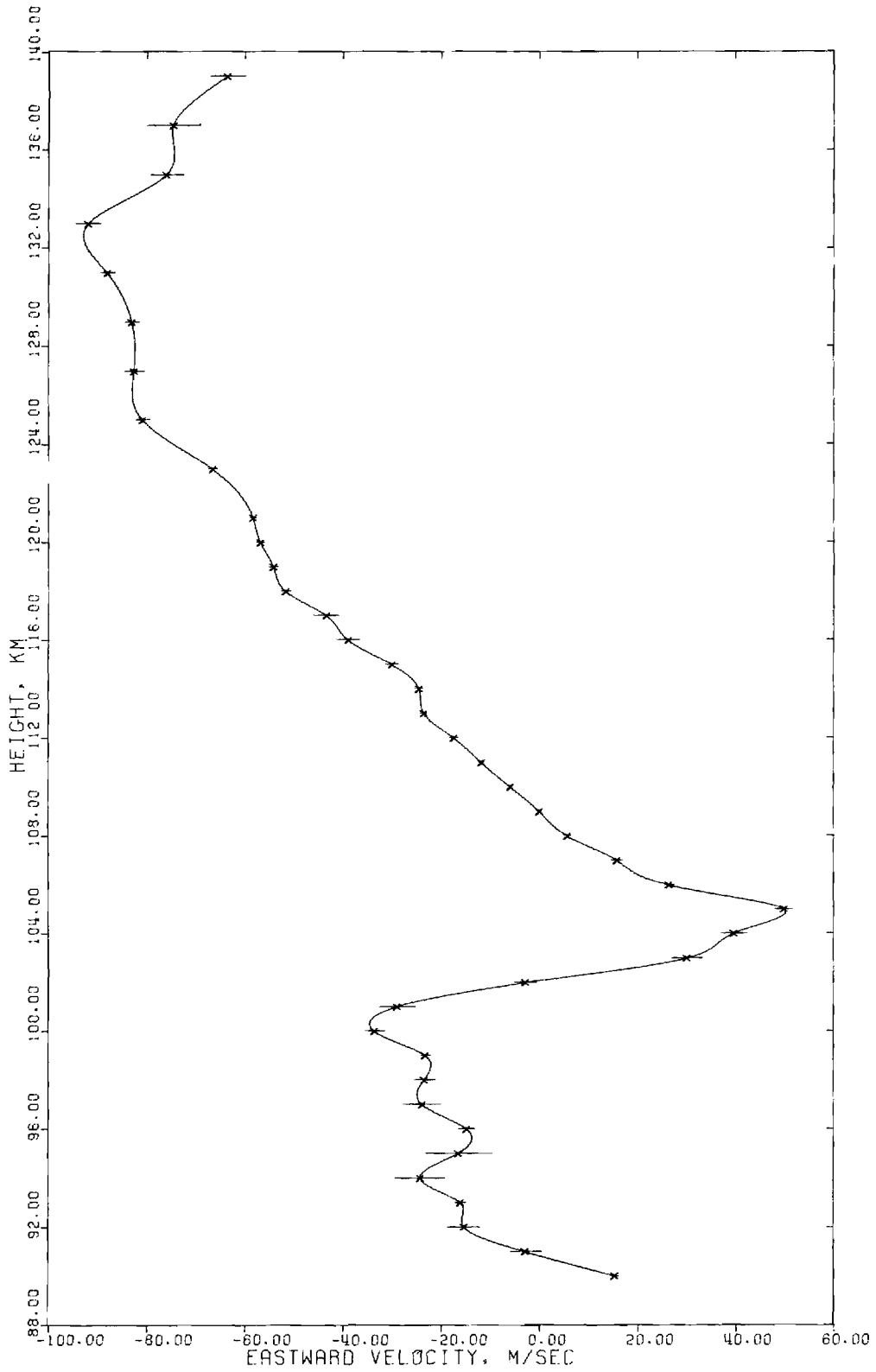
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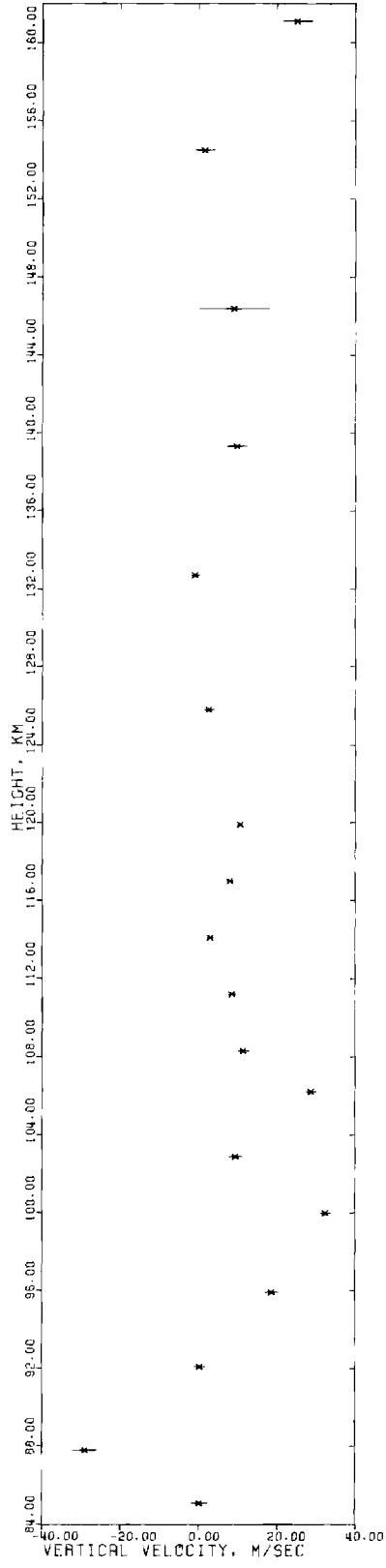
HILDA CUPJ 11/20/7070 1719 CST

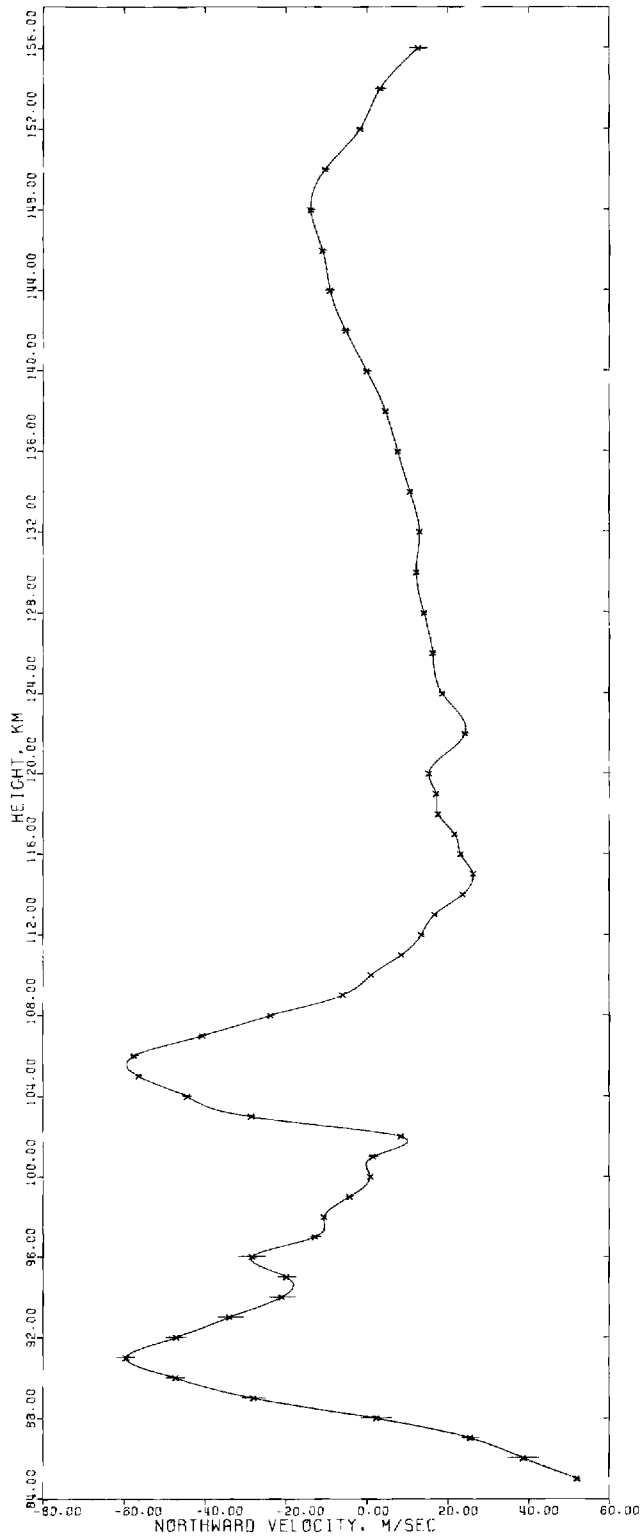


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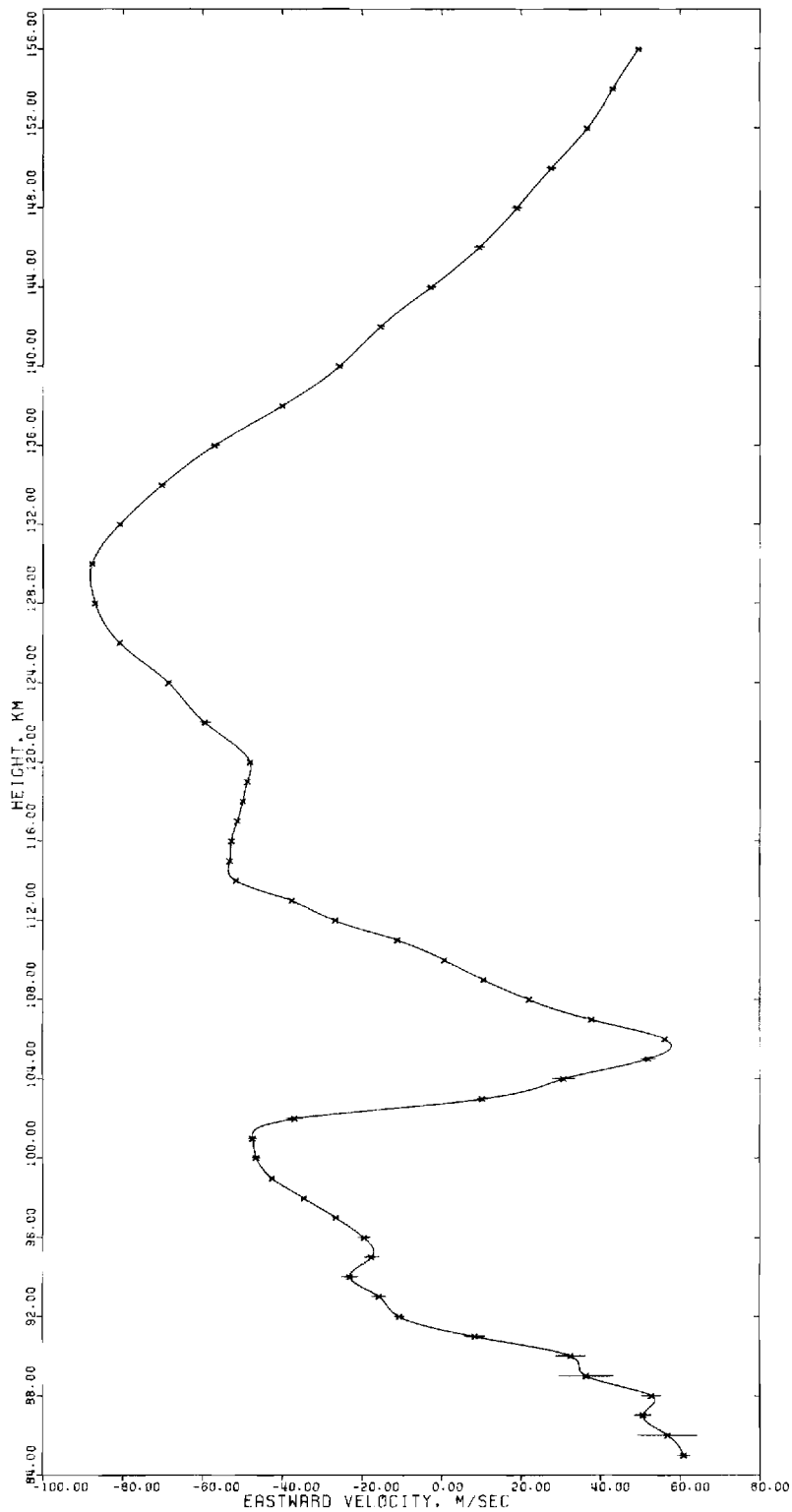


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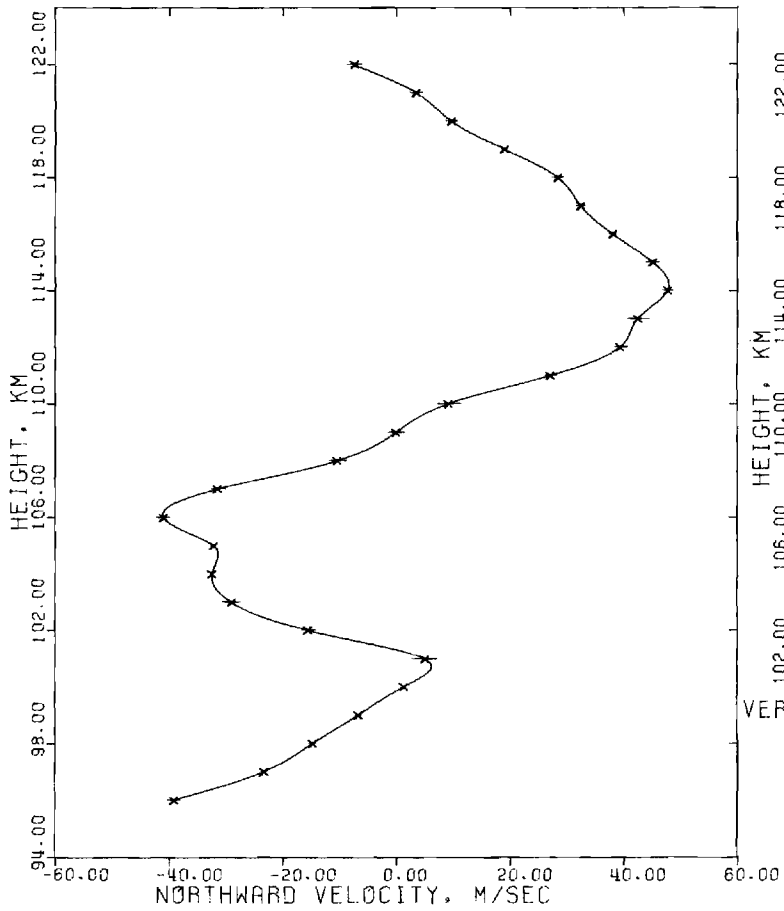




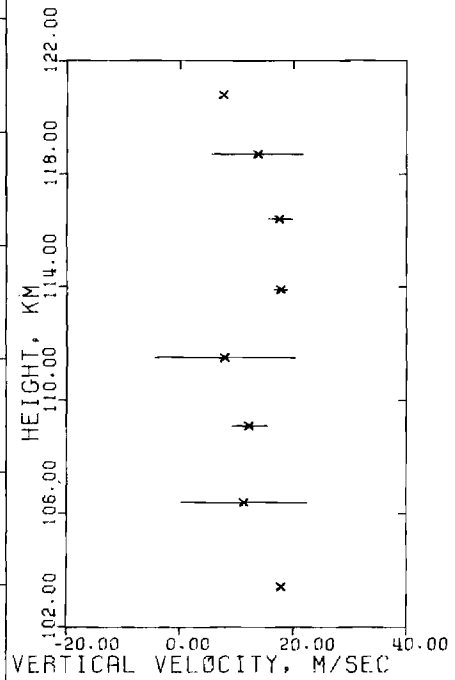
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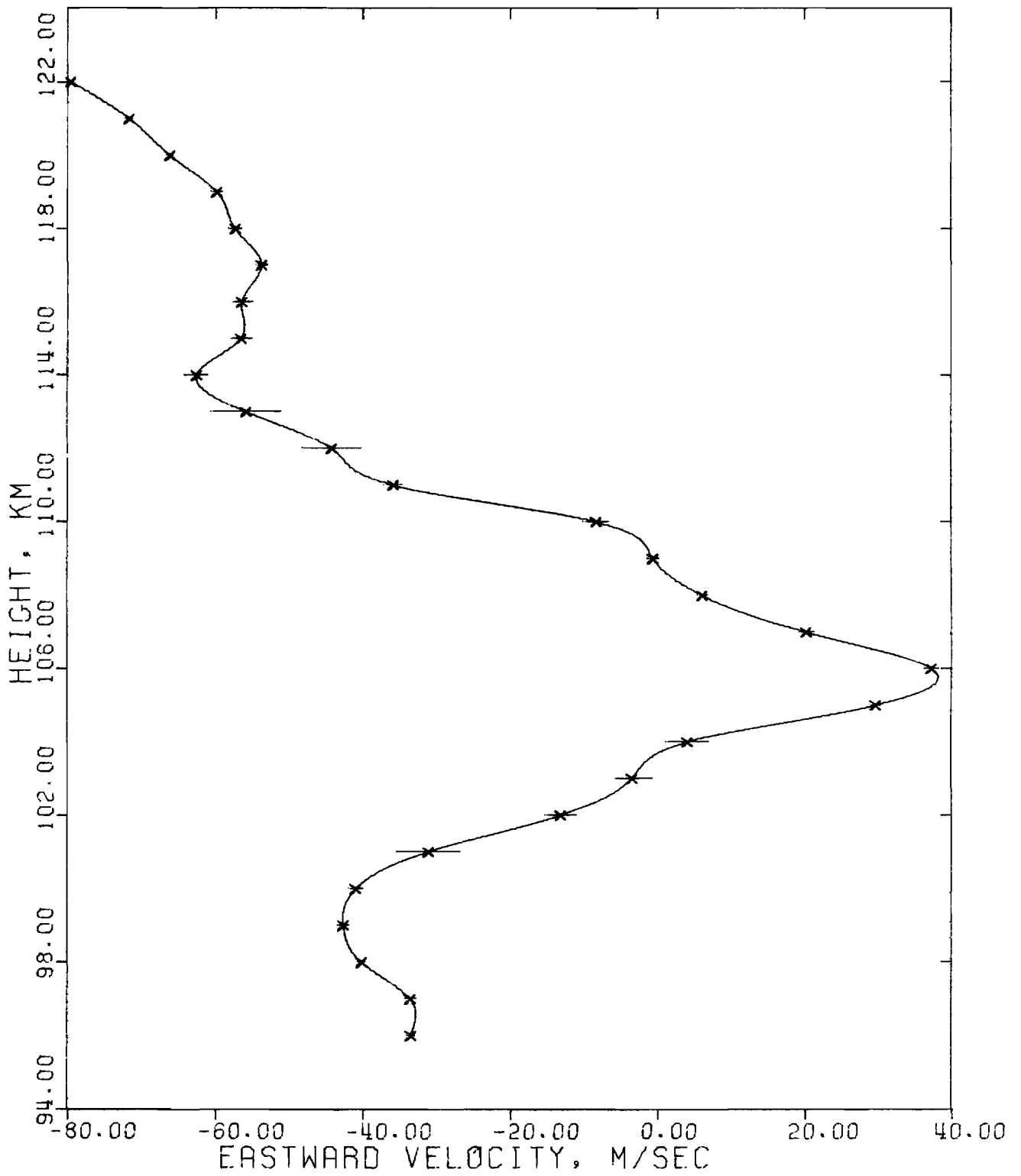
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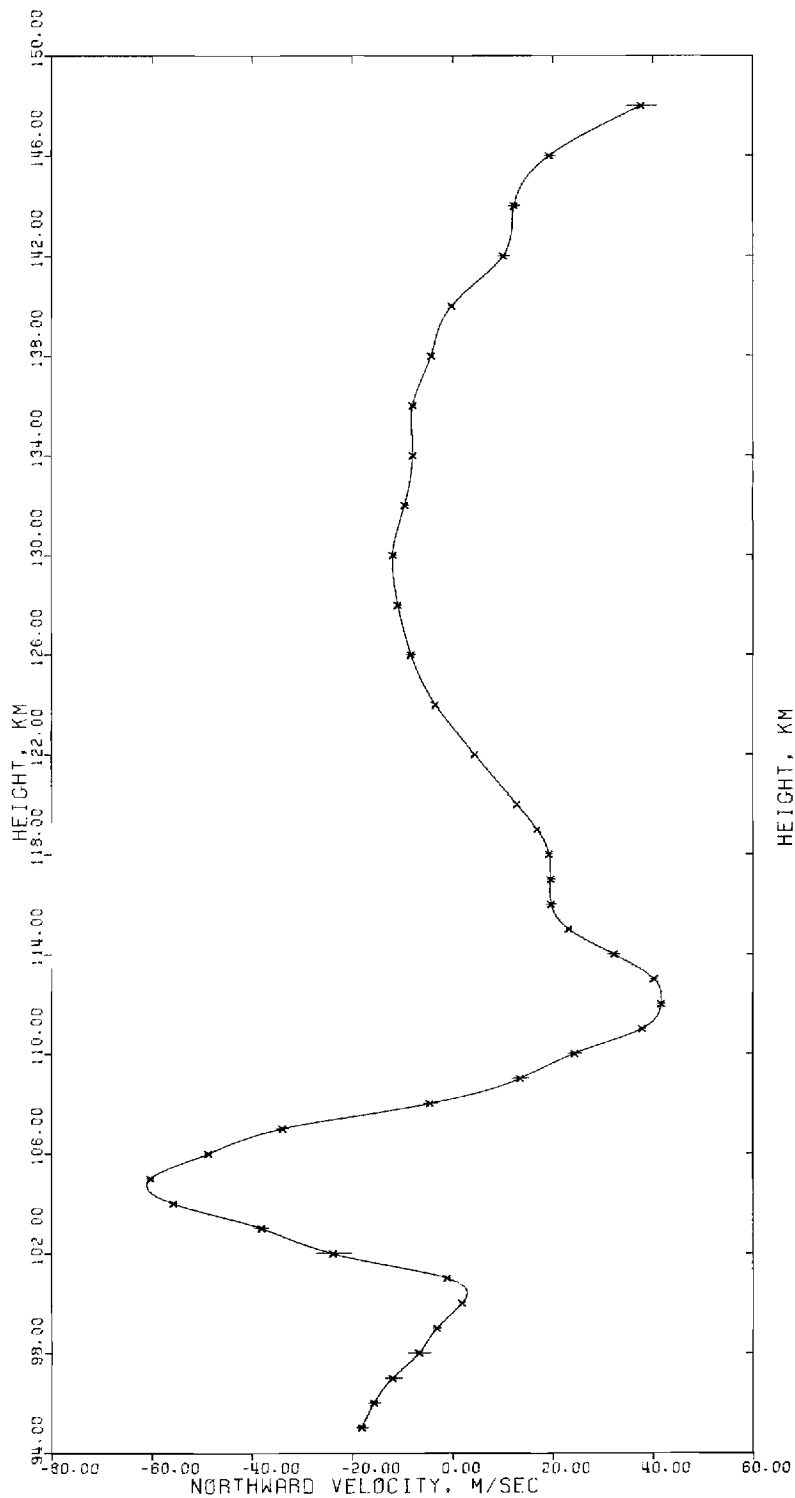
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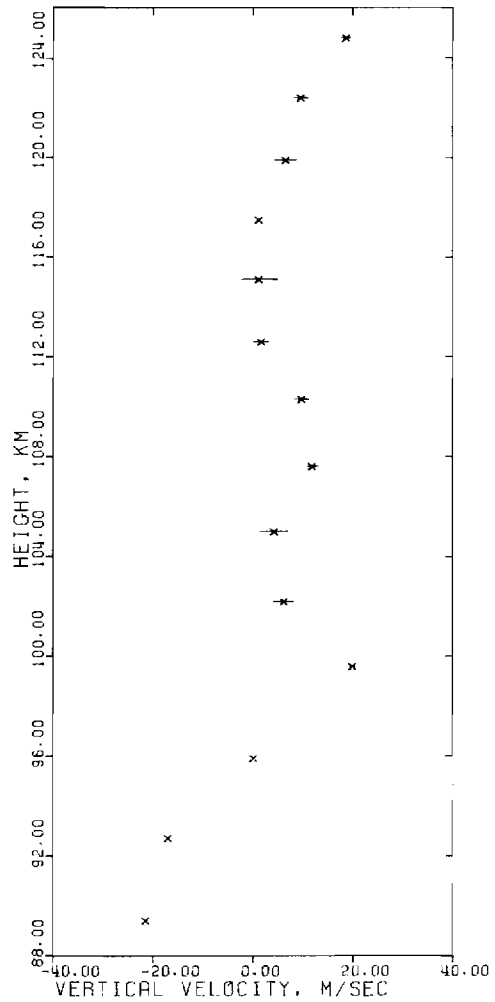
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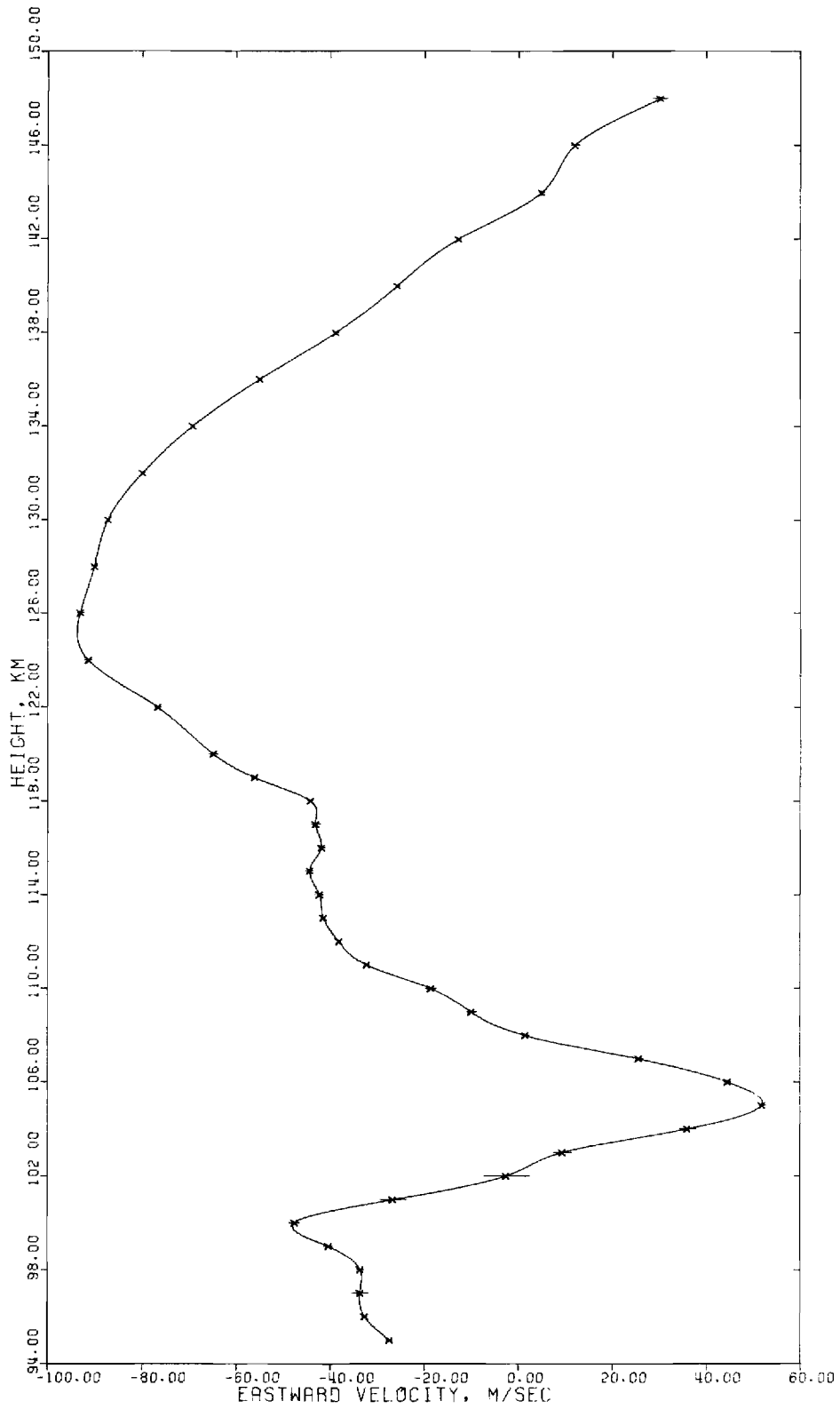
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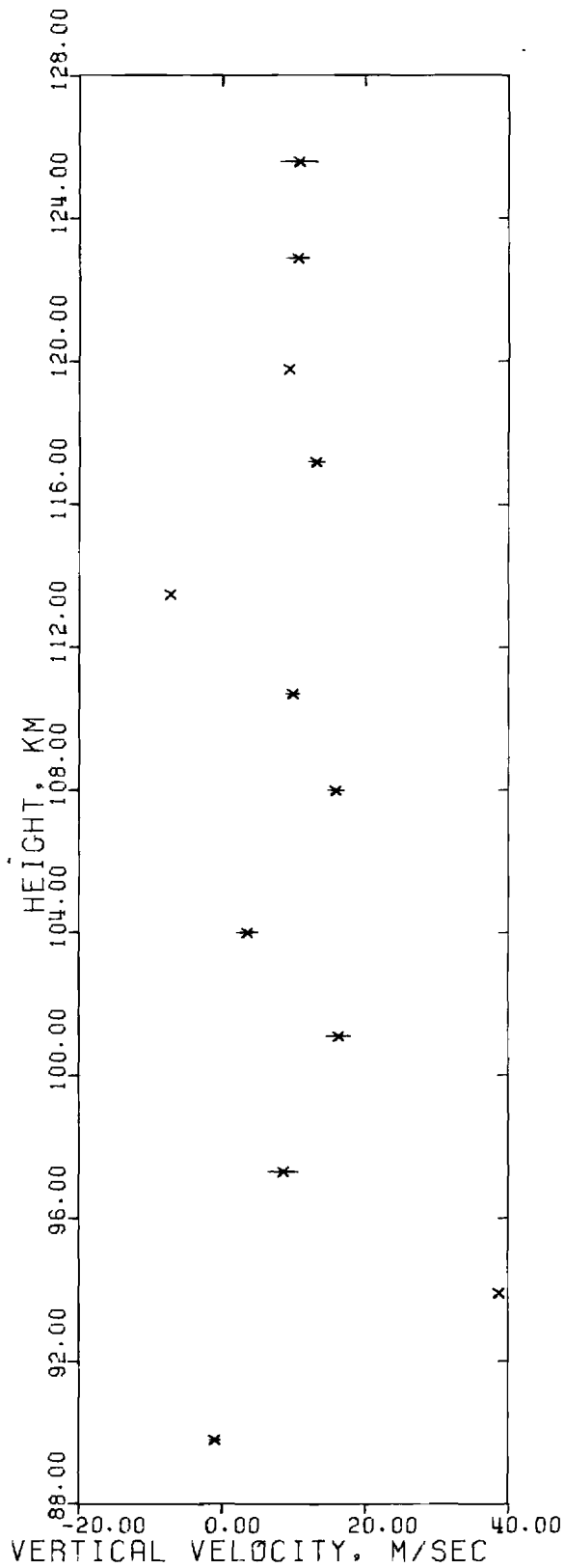
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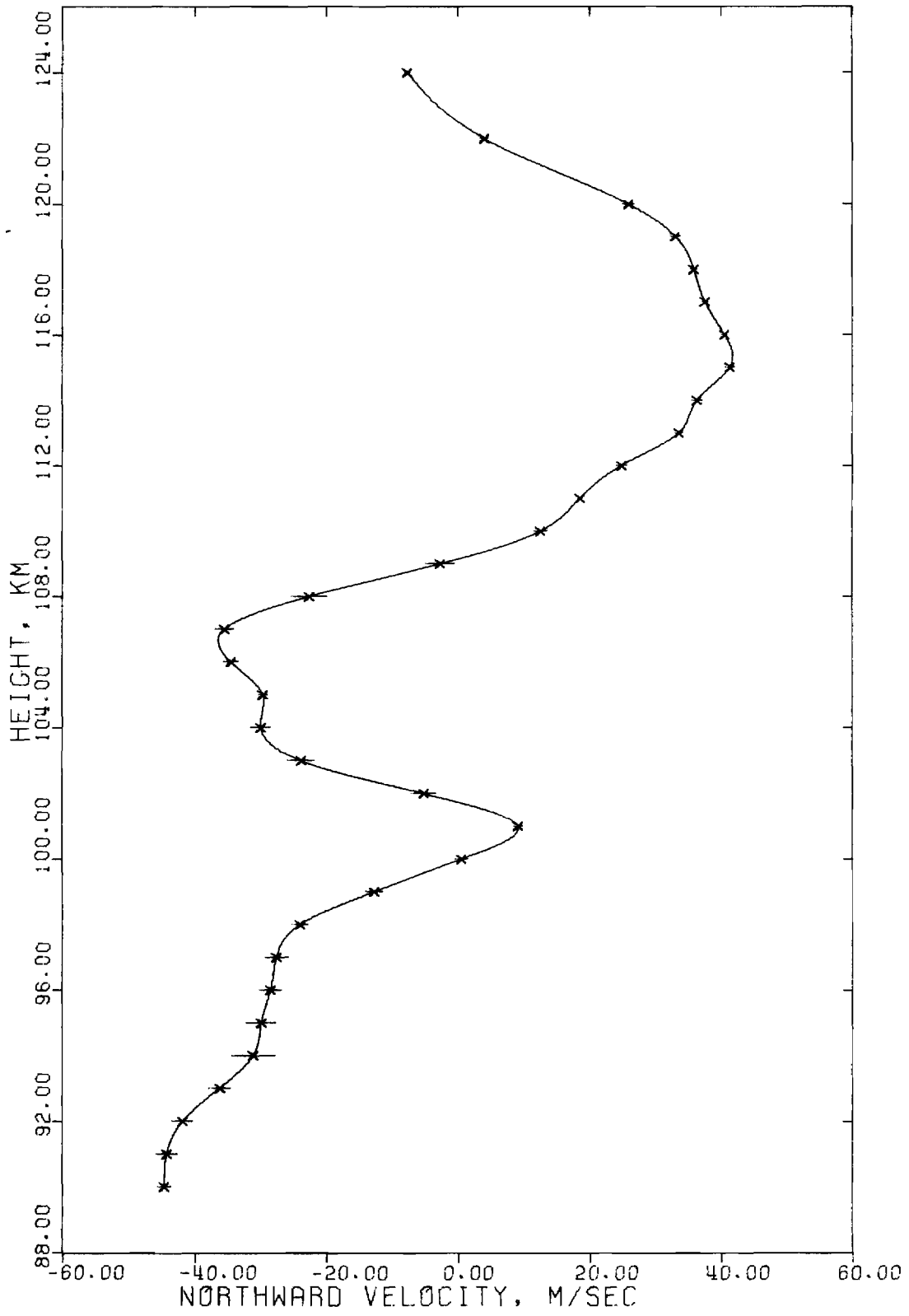
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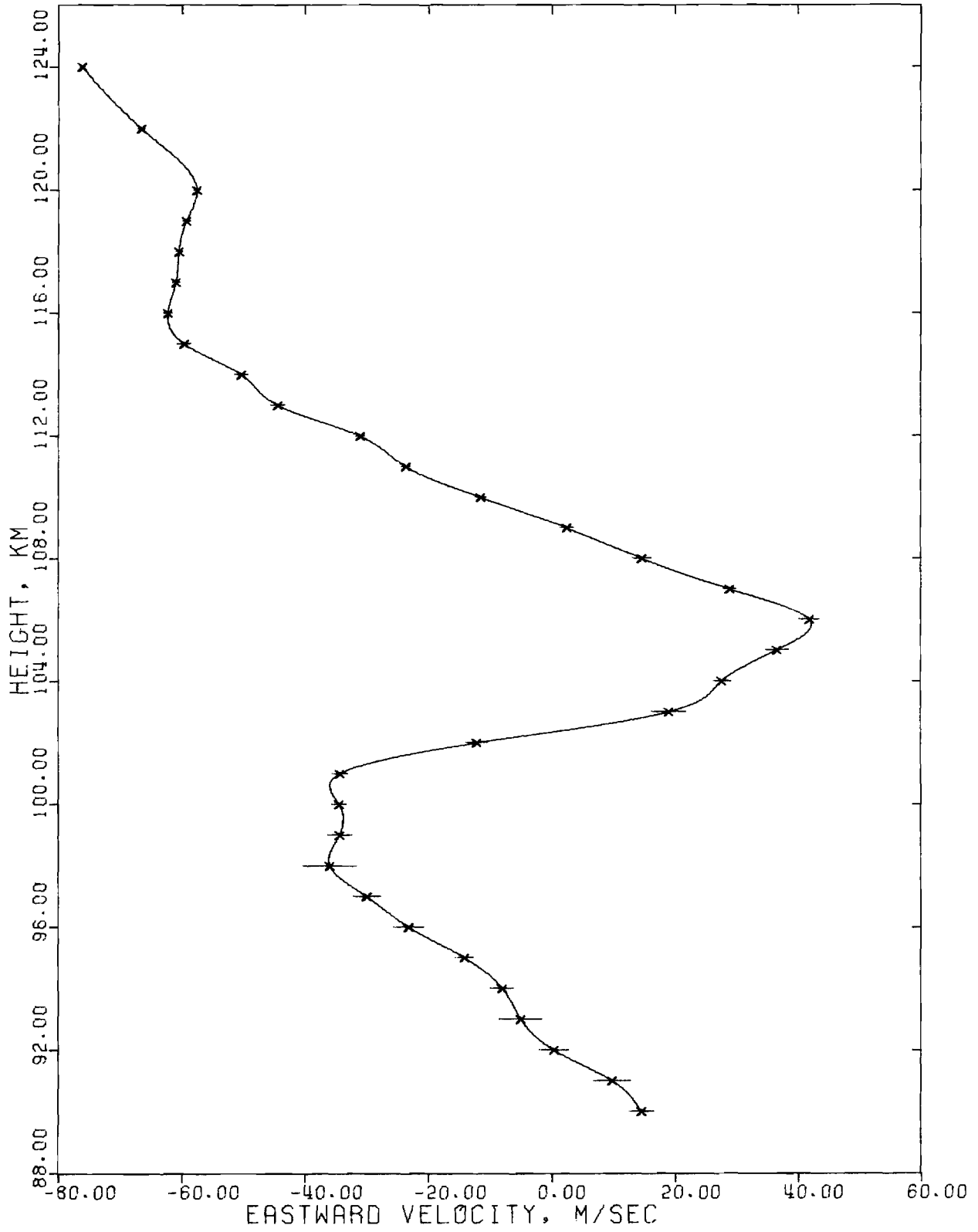
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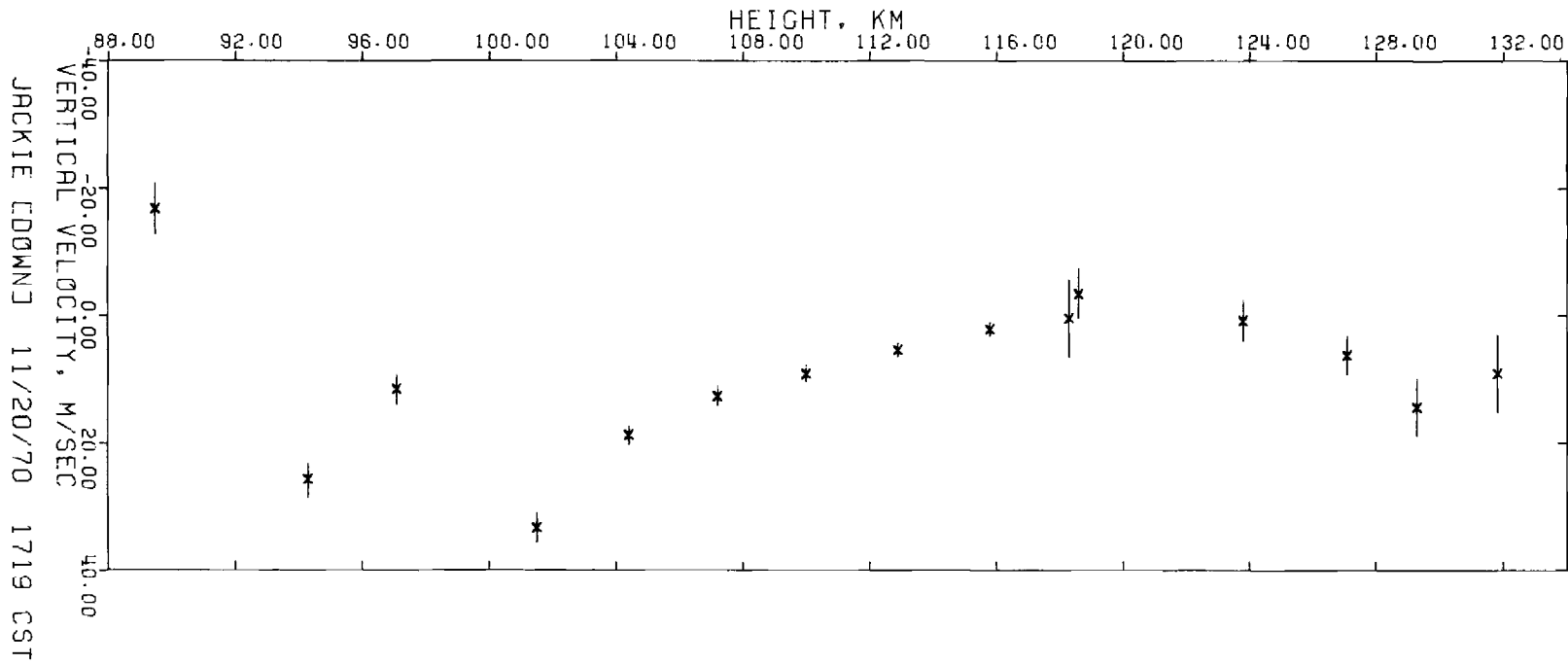
JACKIE [CUP] 11/20/70 1719 CST

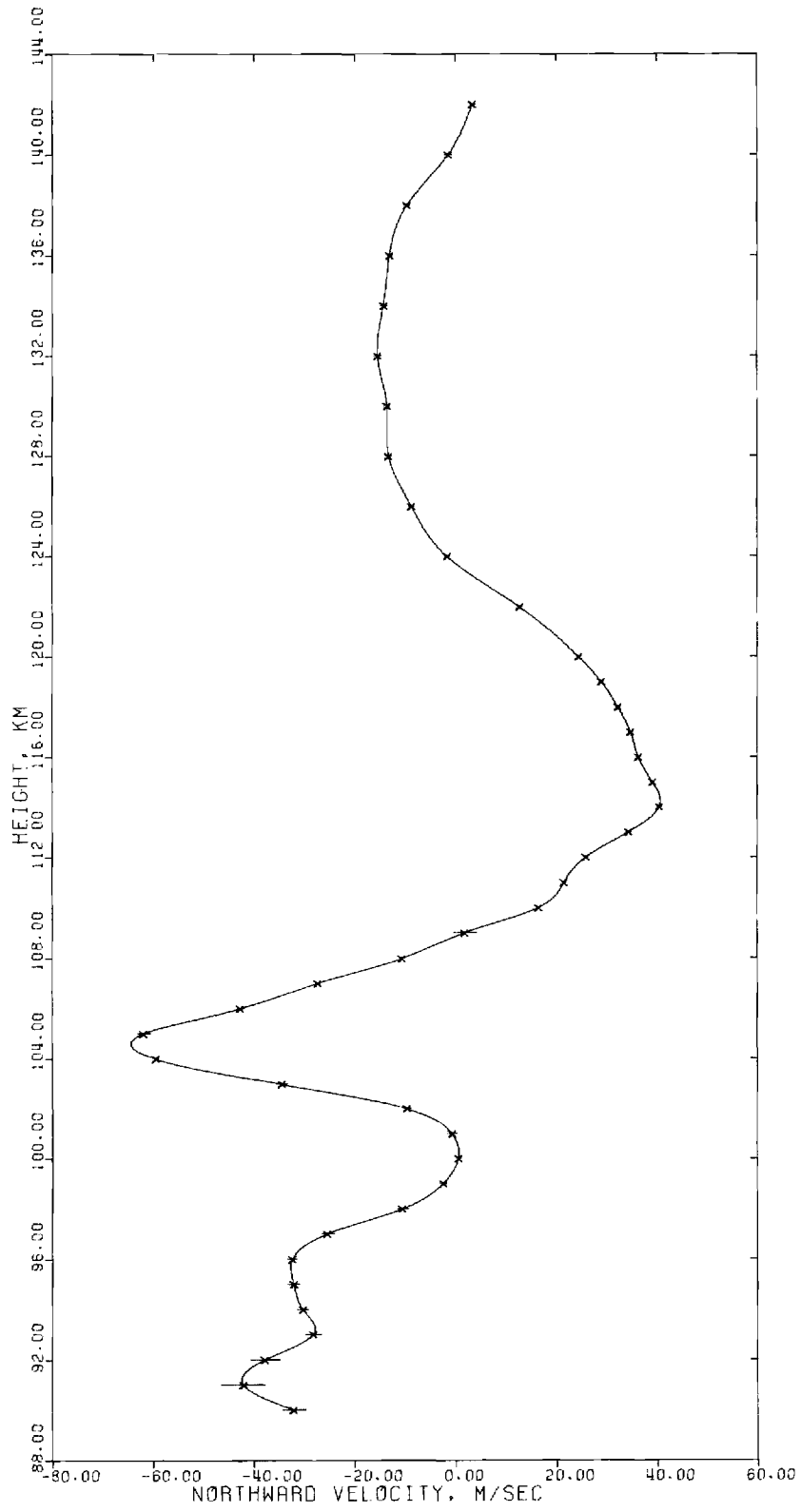


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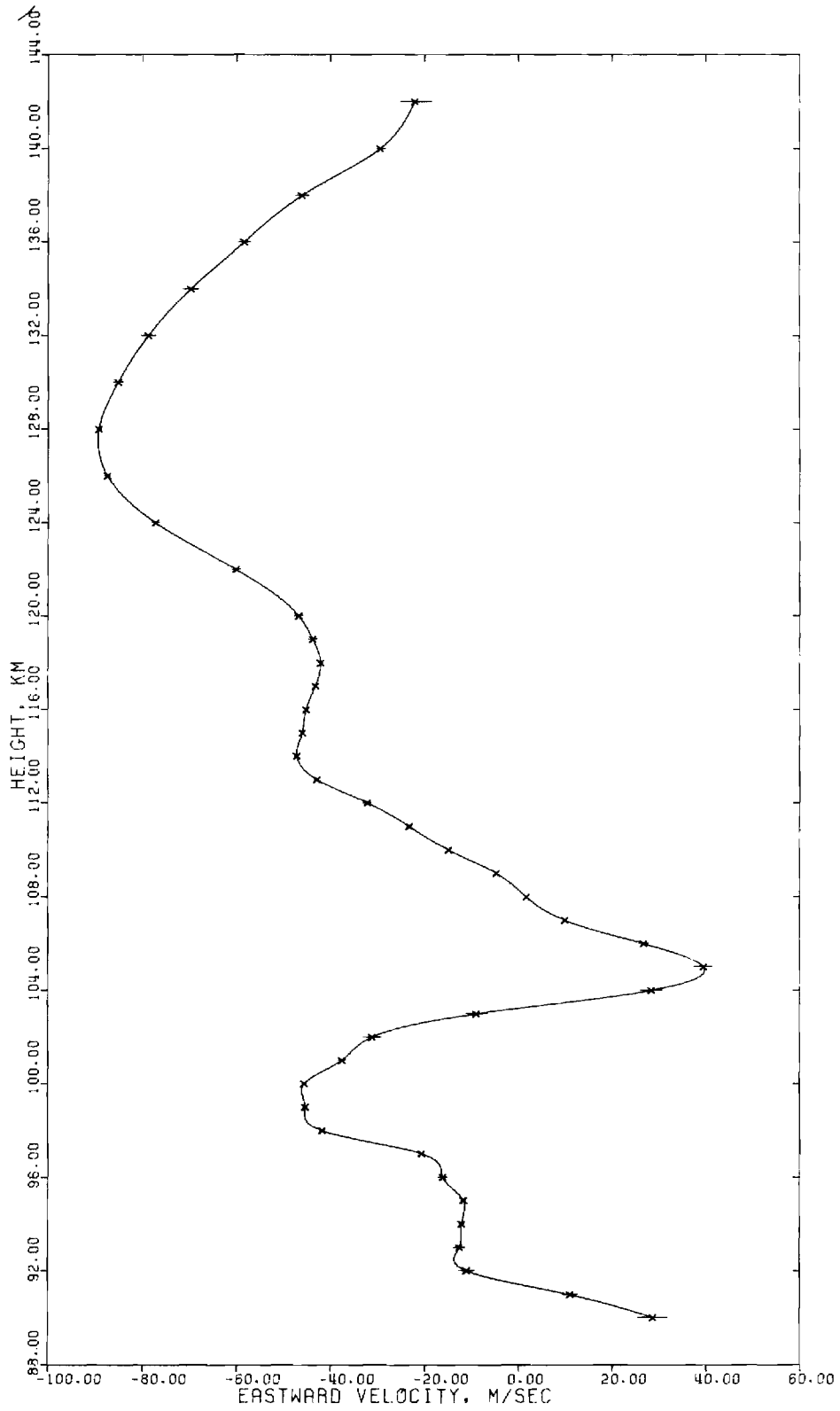


JACKIE [UP] 11/20/70 1719 CST





JACKIE [DOWN] 11/20/70 1719 CST



JACKIE [DOWN] 11/20/70 1719 CST

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13. ABSTRACT <p>Horizontal winds and shears have been computed from 25 rocket released chemical trails. Tables are presented which give vertical profiles of wind speed, heading, and components and the wind shear components. Eight rockets created releases on the up and down leg of their trajectories. Four of these (November 1970: GENIE, HILDA, IDA, JACKIE) were launched within a ten minute interval and one (HELEN) was associated with near simultaneous releases from three other rockets (GRACE, INGER, JOY). These data are suitable for space and time variation studies. Two pairs of trails (UNA-VANESSA and DORA-EVELYN) are suitable for short time difference study since they were launched within an hour of each other. Horizontal and vertical winds were also computed from chemical puffs on the four pairs of up and down trail releases of the November 1970 series. These point wind data are presented in table form. Graphs of the horizontal trail wind data, and the vertical point wind data for the November 1970 series are also given.</p>			

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