EXPLORER 12 MAGNETOMETER RECORDS

16 AUGUST, 1961–6 DECEMBER, 1961

by

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This set of records was prepared in the Physics Department of the University of New Hampshire between August 1962 and August 1966. The data from which these records were made were provided by the NASA Goddard Space Flight Center, in digital form, on magnetic tapes. The data tapes contained magnetic field measurements from a three-component Schonstedt Instrument Company fluxgate magnetometer, the time of the measurements, and several other useful related measurements. Each sensor had a nominal range of $\pm 1000$ gammas in measurement of the magnetic field component along its sensitive axis. One sensor, the Z sensor, was aligned approximately (within $2^\circ$) with the spin axis of the satellite throughout the flight. The spin rate was approximately 30 rpm. The other two sensors, X and Y, were orthogonal to the first sensor and to each other. Each sensor was sampled in sequence X, Y, Z during a 50-millisecond interval, and the sample rate was three times each second. During ground processing the analog magnetometer signals were digitized with an effective digitization channel width of 24 gammas. Each component measurement had an uncertainty due to digitization of $\pm 12$ gammas, as well as other errors due to possible changes in preflight calibration. The other errors have been
discussed in several papers on the Explorer 12 magnetometer data. These papers are listed in the bibliography.

The X, Y, Z measurements were used to compute

\[ B = \sqrt{\frac{x^2 + y^2 + z^2}{x^2 + y^2}} \], \quad \alpha = \tan^{-1} \sqrt{\frac{x^2 + y^2}{x^2}} / z \] and

\[ \psi = \psi_0 + \omega \Delta t + \tan^{-1} \frac{Y}{X} \] (where \( \omega \) is spin angular velocity, \( \Delta t \) is time between measurement and "see-sun" time and \( \psi_0 \) angle between sun sensor and x sensor, Figure 1). In an average of several individual measurements, the digitization error, if random, may be reduced. The data points shown in these records are averages of 32 individual computed values (occasionally 16 values) of B, \( \alpha \) and \( \psi \). One data point was computed every 500 km in radial distance. The time interval between points varies from a few minutes near 5 \( R_e \) to an hour near apogee. The records have served as an initial survey of the Explorer 12 data, have aided in selection of periods for more intensive study, and have provided material for several papers listed in the bibliography. The records have been useful in determining the location of the magnetosphere boundary; the distortion of the field inside the magnetosphere and the general level of low frequency (<0.001 cps) magnetic fluctuations in the magnetosphere. They have not been adequate for detailed studies of the magnetopause, for studies of low amplitude fluctuations in the magnetosphere or for any studies of the transition region.

The measured values B, \( \alpha \), \( \psi \) shown here were plotted by hand at the appropriate geocentric radial distances specified on a "Master Orbit" magnetic tape also provided by GSFC.
Data below 5 $R_e$ were not plotted because the magnitude increases rapidly and the field distortion becomes imperceptible on the scale of these records. The vertical scale for $B$ is in gammas and the scales for $\alpha$ and $\psi$ in degrees. The approximate time and magnetic latitude of a measurement may be obtained from the auxiliary Universal Time and latitude scales at the top of each record.

The predicted field $B$, $\alpha$, and $\psi$, according to the Jensen and Cain, 1962, reference field, was computed from information provided on the Master Orbit tape on the assumption that the spin axis direction was 47° Right Ascension and -27.5° Declination in celestial coordinates.

Since the processing and plotting of these data several errors have been noted in the original plots. In late 1965 facilities became available at UNH for computer processing (IBM 1620) and automatic plotting (Cal Comb) of magnetic tape data. We have reprocessed the Explorer 12 data and have prepared automatic plots of $B$, $\alpha$, $\psi$ once every five minutes. The original records have been compared to these more recently plotted records and corrections have been made where necessary. In addition, a careful check of time, magnetic latitude and predicted field has been made. A number of errors may still remain in these records, but they are useful in showing the general characteristics of the outer magnetosphere and its boundary in the fall of 1961.
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The enthusiastic assistance of many technical and administrative employees at UNH was essential. Among these employees were Anne Anderson, Carl Flanders, Herbert Scheibel and Phyllis Warnock.
References

A. Papers Based Principally on Explorer 12

Magnetic Results


B. Papers Based Partially on Explorer 12

Magnetic Results


C. Review Articles


D. Abstracts


SPIN AXIS

DIRECTION OF THE MAGNETIC FIELD IN RELATION TO THE SUN-SPIN PLANE.
INBOUND AUGUST 19, 1961
INBOUND SEPTEMBER 22, 1961

GM LAT.

IBI (y)

RE
OUTBOUND OCTOBER 6, 1961
OUTBOUND OCTOBER 20, 1961

I - B (y)

$R_E$
INBOUND OCTOBER 29-30, 1961
OUTBOUND  OCTOBER 31, 1962