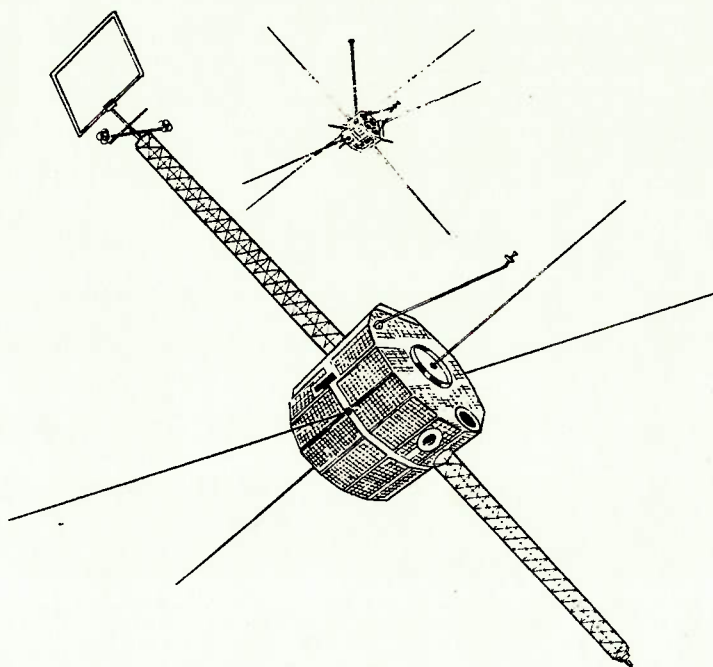


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DETAILED ORBIT/ATTITUDE DATABASE DESIGN
FOR THE MISSION ANALYSIS
COMPUTING SYSTEM (MACS)



BY

COMPUTER SCIENCES - TECHNICOLOR ASSOCIATES

OCTOBER 1981

CSTA

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DESIGN MACS

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Prepared For
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

By
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SECTION 1 - INTRODUCTION

This document establishes the Orbit/Attitude database design for the Dynamics Explorer (DE) Mission Analysis Computation System (MACS). The first section details the information contained in each of the files that comprises the database and their relative levels of storage. The second section describes the database in the database language of RAMIS II. The third section gives estimated sizing information for the total satellite lifetimes.

In the description of the files, it should be noted that the definitive/predictive flag and the signs of the Z component of the Egress and Ingress points are stored together in the field FLAGS. The field FLAGS is defined as follows:

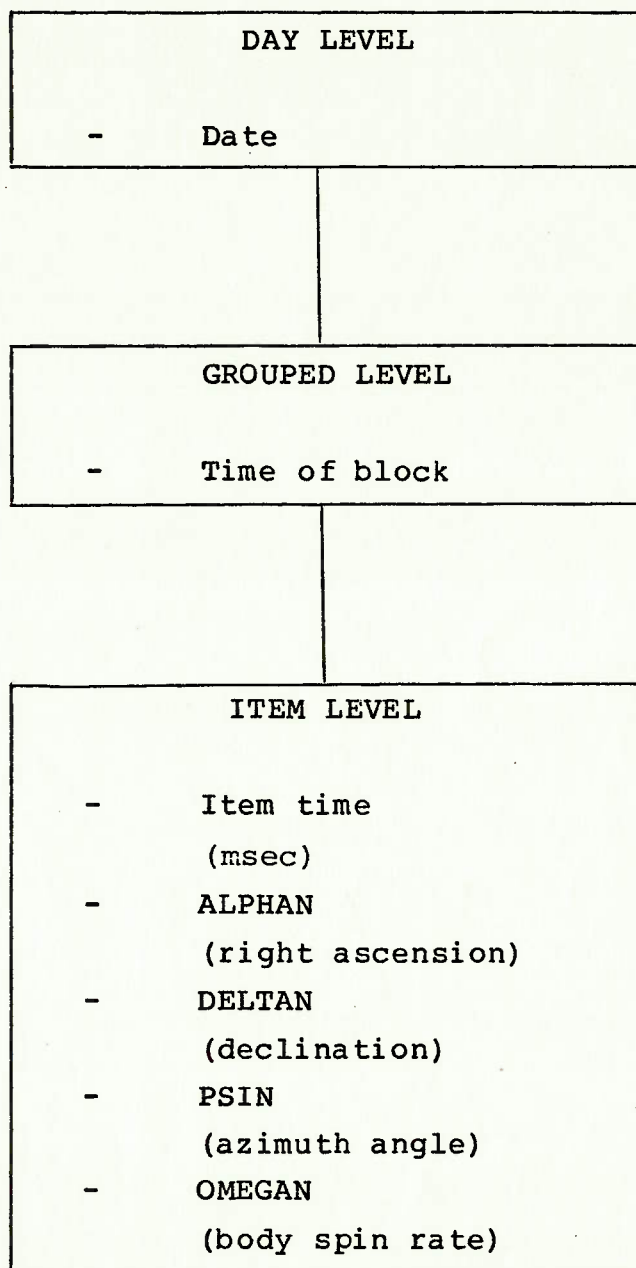
- MSB1 - No significance
- MSB2 - Sign of IngressZ (0 positive, 1 negative)
- MSB3 - Sign of EgressZ (0 positive, 1 negative)
- MSB4 - 4 minute predictive/definitive flag
- MSB5 - 1st minute magnetic predictive/definitive flags
- MSB6 - 2nd minute magnetic predictive/definitive flags
- MSB7 - 3rd minute magnetic predictive/definitive flags
- MSB8 - 4th minute magnetic predictive/definitive flags

The field PFLAG in the Attitude file is defined as follows:

- MSB1 - (0 no significance, 1 indicates time is start time)
- MSB2 - (0 no significance, 1 indicates time is end time)
- MSB3 - No significance
- MSB4 - No significance
- MSB5 - No significance
- MSB6 - No significance
- MSB7 - No significance
- MSB8 - No significance

SECTION 2 - FILE CONTENTS

2.1 ATTITUDE FILE



2.2 ORBIT FILE

DAY LEVEL

- Ascending node date

ORBIT LEVEL

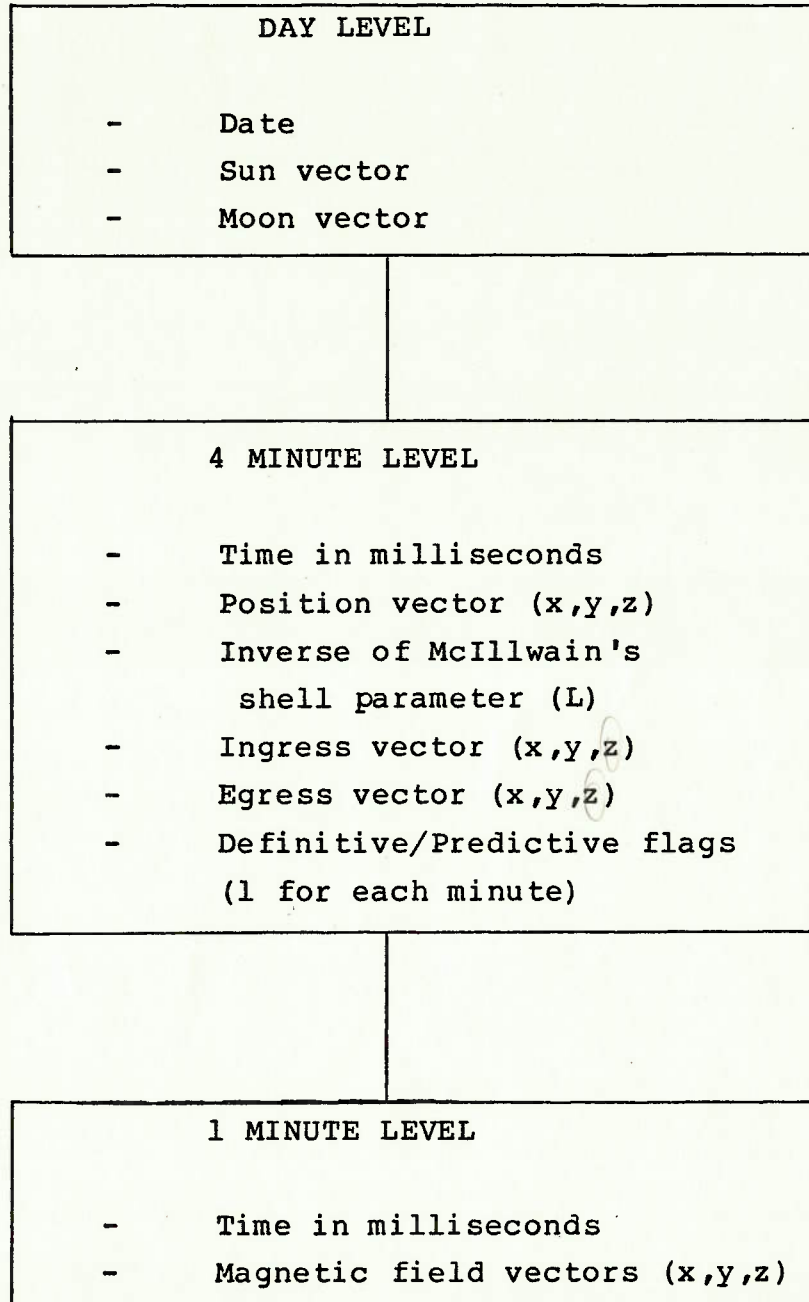
- Ascending node time
- Orbit number
- Period
- Rate of change of period
- Semimajor axis
- Inclination
- Eccentricity
- Right ascension of ascending node
- Rate of change of right ascension of ascending node
- Perigee height
- Apogee height
- Argument of perigee
- Rate of change of argument of perigee

MISCELLANEOUS LEVEL

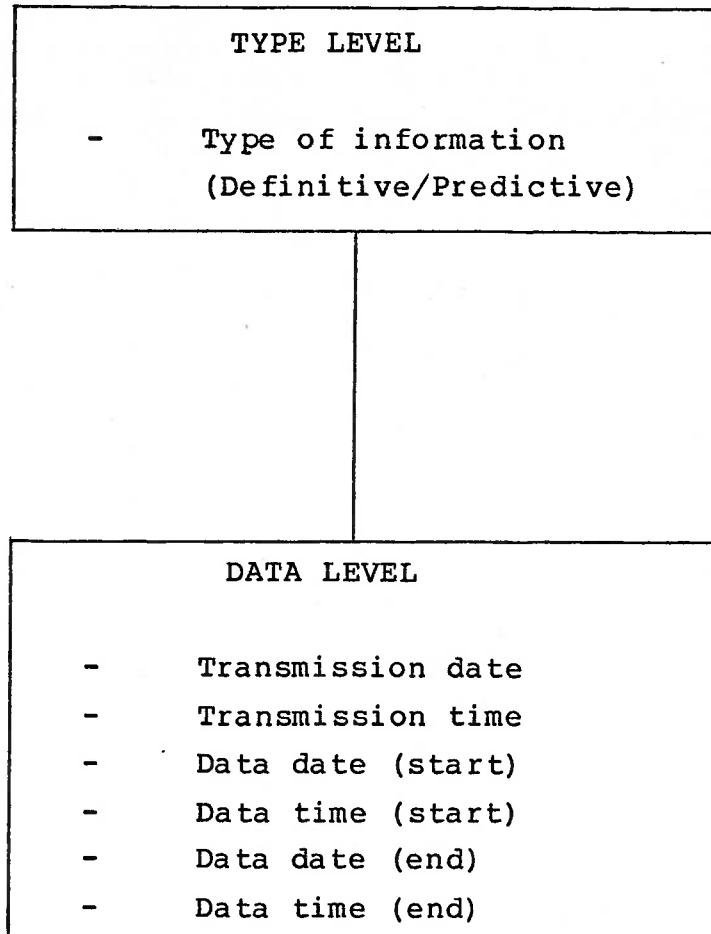
- Perigee time(s)
- Sunrise time(s)
- Sunset time(s)

2.3 TIMED ORBIT FILE

daily orbit file



2.4 TRANSMISSION FILE



SECTION 3 - DATABASE STRUCTURE

3.1 TIMED ORBIT FILE

FILE = XORTIM,

LEVEL = DAY, D, 122,

5 = DATE, YYDDD, I, 5, \$

5 = SUNX, SX, F, 9.6, \$

5 = SUNY, SY, F, 9.6, \$

5 = SUNZ, SZ, F, 9.6, \$

5 = MOONX, MX, F, 9.1, \$

5 = MOONY, MY, F, 9.1, \$

5 = MOONZ, MZ, F, 9.1, \$

LEVEL = 4MO, S, 120,

5 = TIME4, T4, I, 9, \$

5 = XCOORD, PX, F, 9.1, \$

5 = YCOORD, PY, F, 9.1, \$

5 = ZCOORD, PZ, F, 9.1, \$

5 = INVL, IL, F, 9.7, \$

5 = INGRESSX, IX, F, 9.3, \$

5 = INGRESSY, IY, F, 9.3, \$

5 = EGRESSX, EX, F, 9.3, \$

5 = EGRESSY, EY, F, 9.3, \$

5 = FLAGS, F, A, 1, \$

5 = DUMMY1, D1, A, 3, \$

LEVEL = 1MO, S, 4,

5 = TIME1, T1, I, 9 \$

5 = BX, XMAG, F, 9.6, \$

5 = BY, YMAG, F, 9.6, \$

5 = BZ, ZMAG, F, 9.6, \$

TIME

3.2 ORBIT FILE

FILE = XORBIT,
LEVEL = DAY, D, 183, 44000
5 = ANDATE, AND, I, 5, \$
LEVEL = ORB, S, 4, TIME
5 = ANTIME, ANT, I, 9, \$
5 = ORBNO, ONO, I, 6, \$
5 = PERIOD, P, F, 9.6, \$
5 = RTCPER, RP, F, 9.6, \$
5 = SEMIMAJ, A, F, 9.1, \$
5 = INCLIN, I, F, 9.6, \$
5 = ECCEN, E, F, 9.6, \$
5 = RAAN, RA, F, 9.6, \$
5 = RTCRAAN, RRA, F, 9.6, \$
5 = PEALT, PA, F, 9.1, \$
5 = APALT, AA, F, 9.1, \$
5 = ARGPE, AP, F, 9.3, \$
5 = RTCPG, RPG, F, 9.6, \$
LEVEL = VAR, U, 2,
5 = PETIME, PT, I, 9, \$
5 = SUNRISE, SR, I, 9, \$
5 = SUNSET, SS, I, 9, \$

3.3 ATTITUDE FILE

FILE = XATTITUDE,
LEVEL = DAY, D, 183,
5 = DATE, YYDDD, I, 5, \$
LEVEL = 10M, S, 144,
5 = TIME10, T10, I, 9, \$
LEVEL = ATT, S, (105 for A, 150 for B, 240 for
deterministic)
5 = MSEC, MS, I, 9, \$ TIME
5 = ALPHAN, AN, A, 2, \$

5 = DELTAN, DN, A, 2, \$
5 = PSIN, PN, A, 2, \$
5 = PFLAG, PF, A, 1, \$
5 = DUMMY1, D1, A, 1, \$
5 = OMEGAN, WN, F, 9.4, \$

3.4 TRANSMISSION FILE

FILE = XTRANS,

LEVEL = TYP, S, 2,

5 = TYPE, T, A, 1, \$

5 = DUMMY, D, A, 3, \$

LEVEL = TRN, S, 800

5 = TRANSD, TD, I, 5, \$

5 = TRANST, TT, I, 9, \$

5 = DATAD, DD, I, 5, \$

5 = DATAT, DT, I, 9, \$

5 = ENDD, ED, I, 5, \$

5 = ENDT, ET, I, 5, \$

SECTION 4 - ESTIMATED FILE SIZES

The file sizing estimates are based on the following assumptions:

- (1) DE-A has a 50% data rate and 5 year lifetime
- (2) DE-B has a 30% data rate and 2 year lifetime
- (3) Deterministic data has a 20% data rate on DE-B.

The estimation technique used is taken from the RAMIS II Users Manual.

4.1 TIMED ORBIT FILE

FILE = XORTIM

LEVEL = DAY

Data size = 7 words

Segment size = 11 words

Segment block size = 1344 words

Level size = 28226 words

LEVEL = 4MO

Data size = 10 words

Segment size = 14 words

Segment block size = 1682 words

Level size = 12,910,000 words

LEVEL = 1MO

Data size = 4 words

Segment size = 6 words

Segment block size = 26 words

Level size = 24,110,000 words

FILE SIZE = 37,050,000 words = 20,500 RAMIS

blocks = 8200 tracks

4.2 ORBIT FILE

FILE = XORBIT

LEVEL = DAY

Data size = 1 word

Segment size = 5 words

Segment block size = 917 words

Level size = 12,840 words

LEVEL = ORB

Data size = 13 words

Segment size = 17 words

Segment block size = 70 words

Level size = 268,000 words

LEVEL = VAR

Data size = 3 words

Segment size = 3 words

Segment block size = 8 words

Level size = 245,300 words

FILE SIZE = 526,100 words = 292 RAMIS

block = 117 tracks

449 6.5812

4.3 ATTITUDE FILE

FILE = XATTITUDE

LEVEL = DAY

Data size = 1 word

Segment size = 5 words

Segment block size = 917 words

Level size = 16,512 words

LEVEL = 10 M

Data size = 1 word

Segment size = 5 word

Segment block size = 722 words

Level size = 2,370,000 words

LEVEL = ATT	A	B	DET
Data size =	4	4	4
Segment size	6	6	6
Segment block size	632	602	1,442
Level size =	79,000,000	7,650,000	158,000,000

FILE SIZE = 248,000,000 words = 140,000 RAMIS
 blocks = 56,000 tracks

4428.5710

4.4 TRANSMISSION FILE

FILE = XTRANS

LEVEL = XTYP

Data size = 1 word
 Segment size = 5 words
 Segment block size = 12 words
 Level size = 12 words

LEVEL = TRN

Data size = 6 words
 Segment size = 8 words
 Segment block size = 6402
 Level size = 38,400 words

FILE SIZE = 38,400 words = 22 RAMIS
 blocks = 9 tracks

4266.6667

DATA BASE SIZE = 285.5 million words = 64,300 tracks

This data base exceeds 1 disk pack and therefore must be logically broken in several data bases for Ramis' use.

4.5 SEARCH ACCESS

Given the above designs, the following number of segments and Ramis blocks must be read on the average to reach the correct element on the bottom level. Satellite A is assumed.

FILE	SEGMENTS	BLOCKS
XORTIM	245	6
XORBIT	96	4
XATTITUDE	316	4