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U.S. Weather Bureau. National Weather Satellite Center.
APT, Automatic Picture Transmission training classes.

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# APT,

## Automatic Picture Transmission

# TRAINING CLASSES

First Session - July 8 - 20, 1963 Second Session - July 22 - Aug. 2, 1963

Almost one hundred weathermen from all over the United States and parts of Europe and Asia gathered in the National Weather Satellite Center during the period July 8 through August 2, 1963 for the first and second training courses on the Automatic Picture Transmission (APT) System.

Members of the training classes were welcomed by Dr. S. Fred Singer, Director and David S. Johnson, Deputy Director of the NWSC on July 8 and July 22, 1963 respectively.

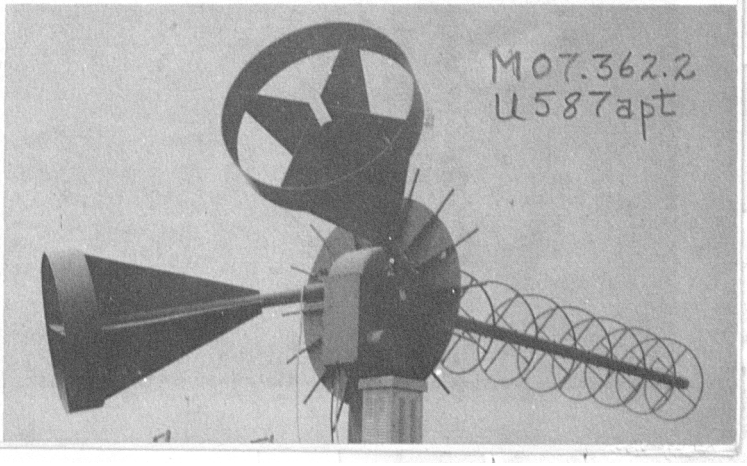
Staff members of the National Weather Satellite Center briefed meteorologists on the various programs being conducted at the Center. Dr. Arnold H. Glaser, ARACON Geophysics Company, and David W. Holmes, NWSC, lectured on satellite orbital parameters and APT equipment; Carl Erickson and Vincent Oliver from NWSC, and Colonel James Jones and Captain Robert Fett, USAF, as visiting lecturers to the classes discussed the meteorological applications of satellite photography.

Instructions were given on the details of receipt and utilization of data from the APT subsystems on TIROS and Nimbus by Arthur Schwalb, NWSC, and Robert White, ARACON Geophysics Company. Frank E. Christensen, Frank Dahlman and AG1 Jack Woods assisted in the laboratory work sessions.

126848

During each of the two-week classes the meteorologists were introduced to the APT system, shown how it works, how to prepare antenna programs; they were given problems in fitting perspective grids to satellite pictures and the problems connected with gridding. Photo interpretation and meteorological interpretation of TIROS photos with conventional reports were part of intensive laboratory sessions designed to give the meteorologists a good working knowledge of the APT system.

Meteorologists from eleven Weather Bureau Forecast Centers, numerous Air Force and Navy installations, and a few meteorologists from foreign meteorological services who will have the APT equipment will use the information and experience obtained at these training classes in the near future in day-to-day observational and forecasting operations.



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# National Oceanic and Atmospheric Administration
# TIROS Satellites and Satellite Meteorology

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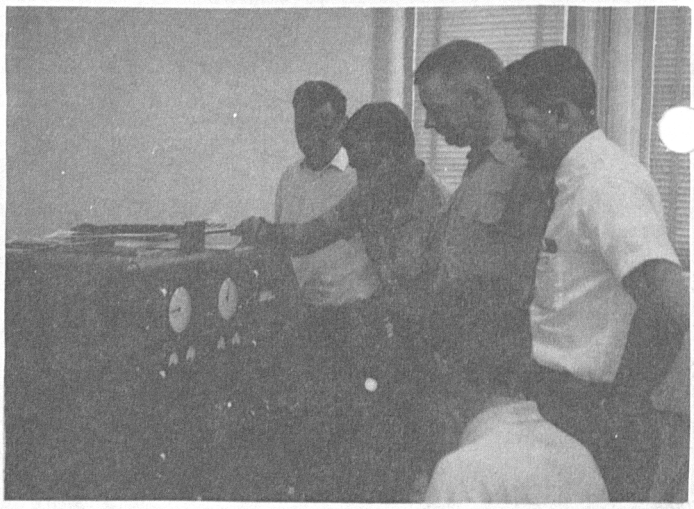
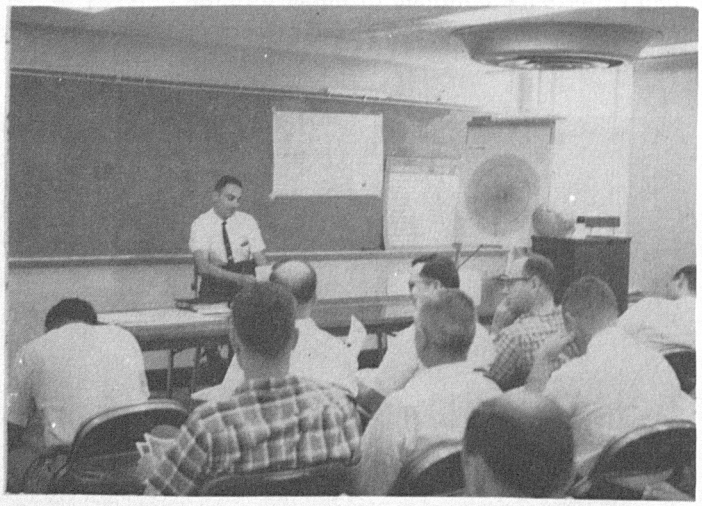
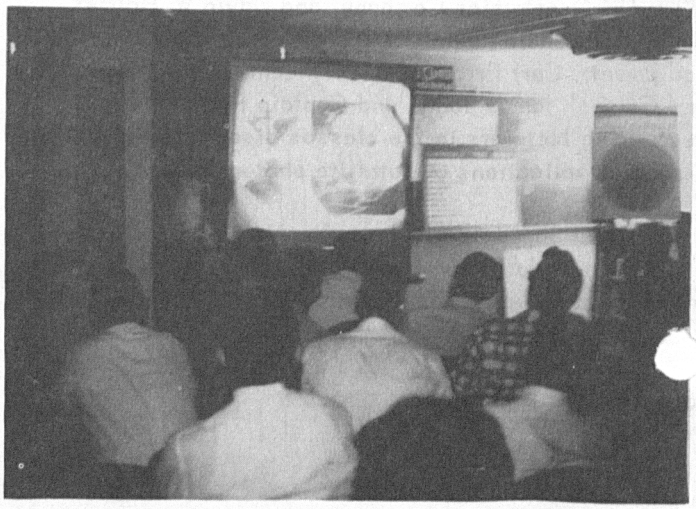
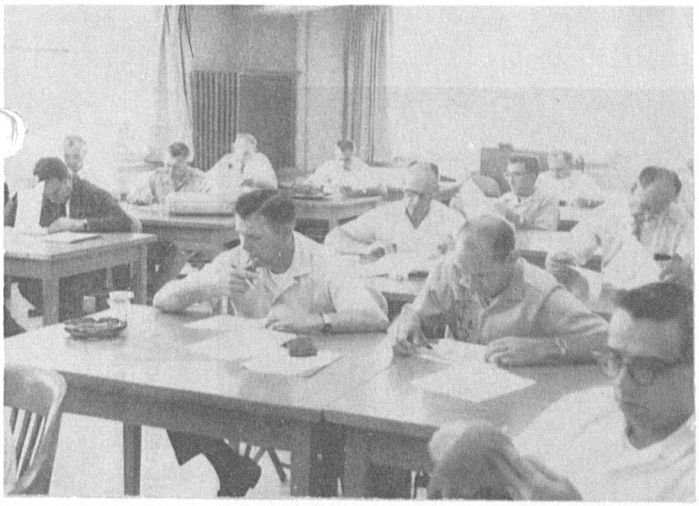
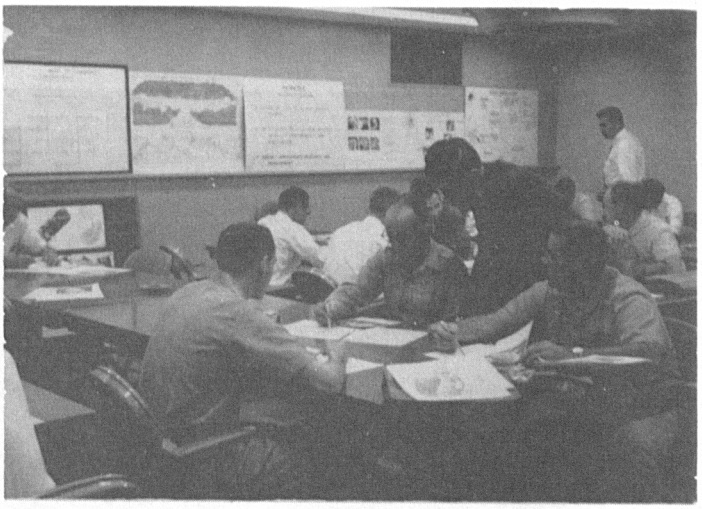


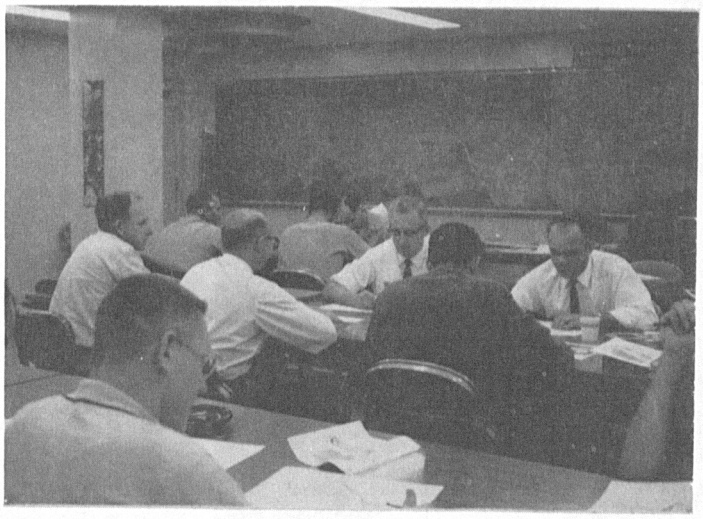
# LAB SESSIONS

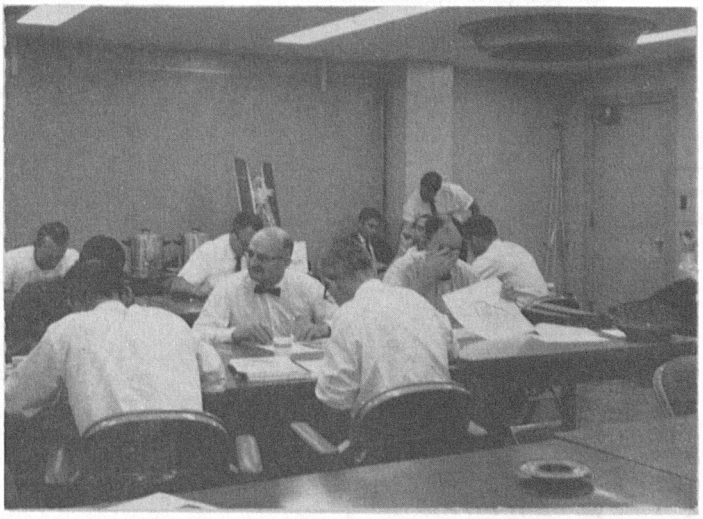






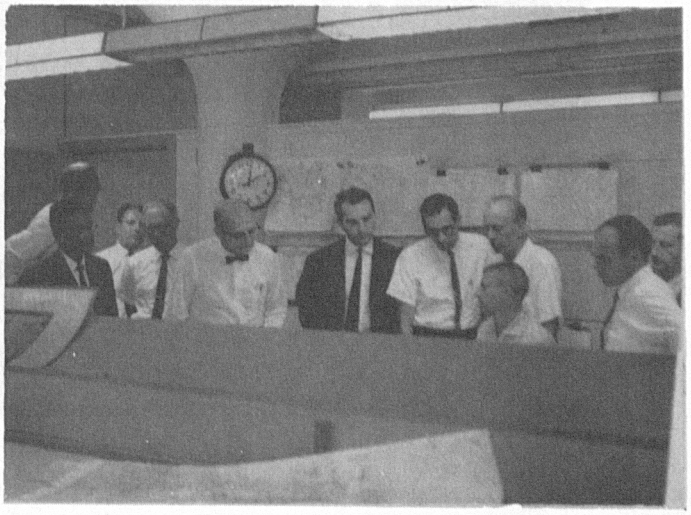




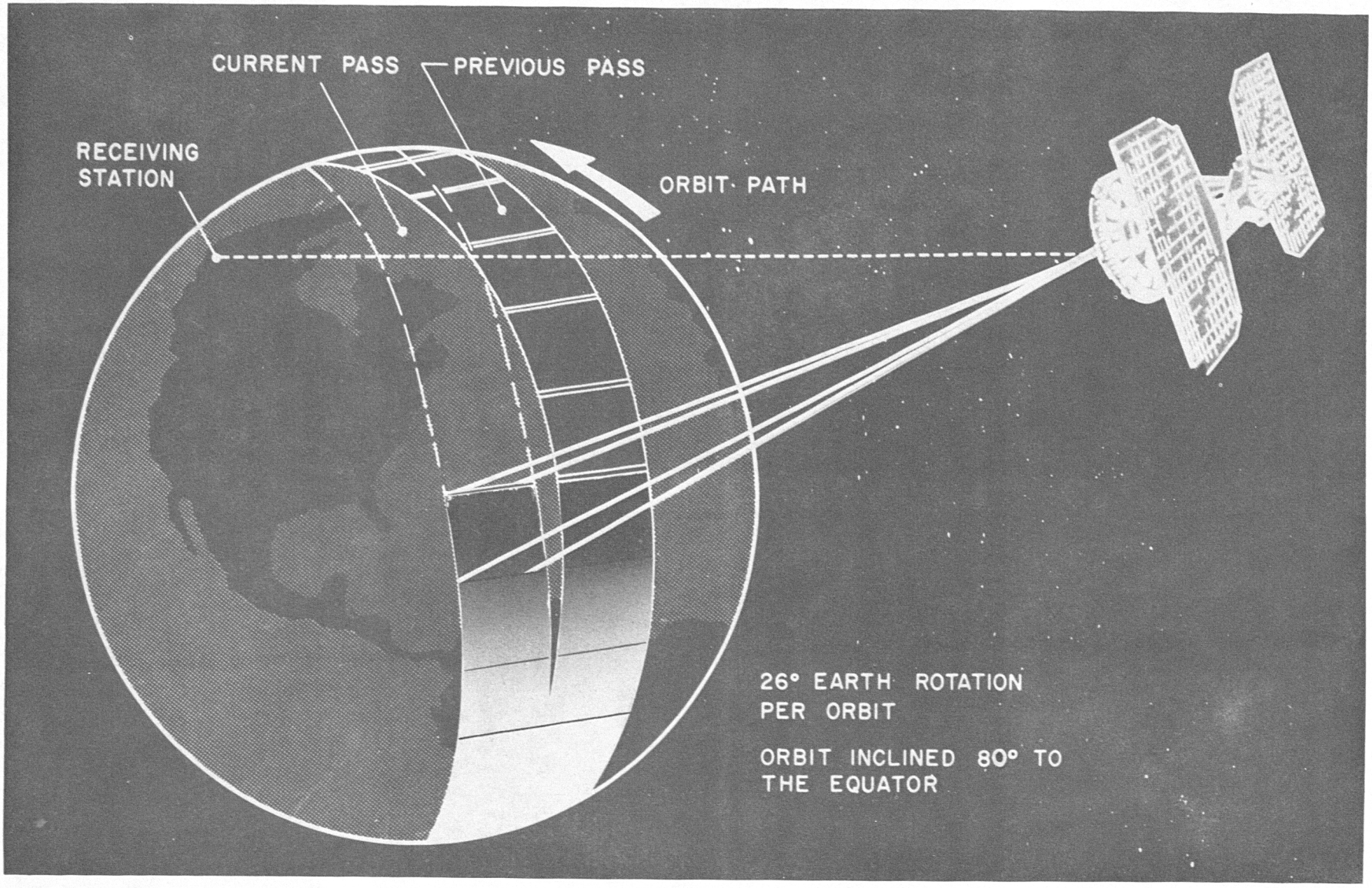


# LECTURES AND INFORMAL DISCUSSIONS

## A visit to the National Meteorological Center



# APT SYSTEM NIMBUS




The Nimbus satellite will be launched into a nearly polar orbit. Its Automatic Picture Transmission System will continually photograph cloud coverage of the Earth below, each photo taking in some 1,000 x 1,000 miles. Twice a day at about noon locally, the satellite will pass within range of any given APT Ground Station in the world, providing it with good local area pattern photos.

# EMERGENCY PROCEDURES FOR PREPARATION

# OF THE OEC CHART

## Introduction:

The following instructions should be used in conjunction with the APT Users Guide and Picture Gridding Procedures prepared for TIROS APT applications.

These procedures can be used to compute information relative to antenna programming and preparation of the OEC chart when the Daily Message is not received for periods up to about three days.

Materials Necessary:

1. APT Tracking Diagram
2. Transparent orbital overlay for Tracking Diagram
3. Last Received Daily Messages
4. Attitude Diagrams: Azimuth and Nadir Angle with appropriate Time Scales

## GENERAL PROCEDURES

### I. Equatorial Crossing: Computations for Antenna Programming

Purposes:
1. To determine those orbits which can be acquired on days when no daily message is received.
2. To compute equator crossing longitude and time where applicable.

Preparation: Non Recurring

1. Subdivide the equator line on the transparent orbital overlay into segments equal to the nodal increment. Begin at the plotted orbit and progress in a westward direction for 360 degrees. (See p. 9-10 APT Users Guide)

Procedure:

1. Find the approximate equator crossings of orbits subsequent to the reference orbit as follows:

   a) Place the transparent orbital overlay on the Tracking Diagram so that the plotted subpoint track crosses the equator at the longitude of the last available reference orbit.

b) Read the longitudes of subsequent equator crossings directly under the subdivisions marked on the transparent overlay.

2. Determine each acquirable orbit number by adding to the reference orbit number the number of subsequent equator crossings.

3. Determine precise equator crossing longitude by adding algebraically the longitudinal increments to the longitude of the reference orbit.

4. Determine time of equator crossing by adding time increments between equator crossings (nodal periods) to the time of the reference orbit equator crossing.

The antenna program can be computed in the normal manner with the information derived from this procedure.

## II. Subpoint Track

**Purpose:** To extrapolate the terrestrial satellite track for use in photo analyses.

**Procedure:**

1. Determine algebraically the separation between the equator crossings of orbit to be tracked and the last reference orbit.

   NOTE: This distance should be the shortest separation distance as opposed to the total angle determined in I above, It may be a distance either east or west of the reference orbit.

2. Add the longitudinal increment determined in I to the subpoint longitudes of the last reference orbit for those minutes after ascending node where data is expected. For a given time after ascending node, latitudes may be considered conservative.

3. Check the computed subpoints by:

   Placing the subpoint track on the orbital overlay at the computed equator crossing and reading the approximate subpoint location at two minute intervals.

   NOTE: This method is <u>inexact</u> and should be used only as a gross check of computed points.

## III. Principal Point Track

Purpose: To extrapolate satellite attitude parameters and compute picture center coordinates for use in photo analysis.

Introduction: Once the subpoint track has been plotted, azimuth and nadir angles must be computed to complete the OEC preparation. The basic parameters for these computations are NON, TOT and Time. (Values for NON and TOT and their 24 hour rates of change are given in the Daily Message, Part III.)

Procedure:

1. Extrapolate NON and TOT for the day when no daily message is received using the values provided in part III of the last Daily Message.

   NOTE: A daily curve of NON & TOT should be maintained at the ground station to provide a check of the values in part III. The rate of change as provided should not indicate an abrupt change from the slope of the existing curves. If a sudden change in slope is indicated, a teletype garble should be suspected and the value estimated from the extrapolated curve. If the magnetic attitude control has been or will be activated, this fact will be indicated in plain language and in this instance the curves should change abruptly.

   a) Determine if NON is positive or negative before applying rate of change of the parameters. When azimuth values in part II of the Daily Message lie between 0 and 180 degrees, the satellite is looking to the left of its subpoint path, and NON (by convention) is positive; when the values are between 180 and 360 degrees, the satellite is looking to the right of its subpoint path and NON is negative.

   b) Rate of change values must be applied in an algebraic sense. Example: NON: minus 25.2 degrees
      Rate of change: 3.1 degrees/day (negative since tenths figure is odd)
      NON 24 hours later: minus 28.3 degrees.

2. Graphically determine nadir angle and azimuth of the principal line for the subpoints already plotted. See example p 5 thru 10 .

   a) Use the charts on pages 31, 32 and 35 of the Users' Guide--these are also provided in larger format in the APT kit.

NOTE: The nadir angle diagram shown on p. 31 of the Users' Guide is a family of curves of nadir angle with time, drawn for minimum nadir angles from 0 to 90 degrees, at 5° increments. The curve is symetrical around TOT with nadir angles increasing to 90 degrees one quarter orbit from the occurrence of NON. Since azimuth is a direct function of NON and time from NON, the azimuth diagram (p. 32 of the Users' Guide) is a family of curves of azimuth angle with time plotted for given values of NON from 0 to 90 degrees.

b) Convert the abscissa on the attitude diagrams from mean anomoly (Anglular distance in the orbit) to time using the scale appropriate to the orbital period on p. 34 of the Users' Guide.

1. Relabel the time scale relative to times after ascending node for that portion of the orbit plotted on the OEC chart.

2. Locate TOT in the relabeled time scale.

3. Position the scale on the charts (azimuth and nadir angle) so that TOT is coincident with the vertical $t_o$ line.

   NOTE: The azimuth chart must be inverted when used for times before TOT.

4. Draw a vertical line from the abscissa to intersect the curve for the predetermined value of NON. Read the value of nadir or azimuth angle (depending on diagram used) on the ordinate.

   NOTE: The azimuth angle determined in 4 above is the acute angle from track of the principal line and is comparable to the total azimuth of the principal line provided in the Daily Message. The smallest angle from the subpoint track that will ever be made by the principal line will be the numerical value of NON in degrees.

3. Plot principal point positions as determined from the azimuth and nadir angle computations.

   NOTE: Care must be taken when plotting the azimuth angle on the OEC. First, one must be absolutely sure whether the satellite is looking left (NON plus) or right (NON minus) of track. It must be remembered that the angle determined from the azimuth chart is the acute angle from track. Before TOT the principal lines should indicate that the satellite is looking behind its subpoint while after TOT it will be looking ahead.

IV. Example: Emergency Procedure--Preparation of OEC chart

Reference: Daily Message

A. Preparation--Initial Data

1. Date of Reference Orbit: 12/30/63

2. Reference Orbit Number: 1959

a) Equator crossing: 15:53:18Z
103.18 degrees W

b) NON (#1959): minus 10.0 degrees
RR:(Rate of Change) plus 3.0 degrees

c) TOT (#1959): 40.0 minutes AAN
RR (Rate of Change): plus 0.8 minutes/day

d) Nodal Period: 99 minutes 43 seconds

e) Longitudinal increment between equator crossings:
25.15 degrees

f) Picture Data Possible:
36 minutes AAN to 50 minutes AAN

3. Date no daily message available 12/31/63

4. Acquirable Orbit Number 1973 (from Tracking Diagram)
(14 orbits after reference orbit on 12/30/63)

B. Computations

1. Equator Crossing

a) Time
Equator Crossing 1959: 15:53:18Z
Nodal Period: 98 Minutes 43 Seconds
Extrapolate 14 orbits to orbit #1973:
98 minutes 43 seconds x 14 =
23 hours 02 minutes 02 seconds (Interval
from 1959 to 1973)

| | | |
|---|---|---|
| 15 : 53 : 18 Z | 12/30/63 | |
| + 23 02 02 | 12/31/63 | Equator Crossing orbit 1973 |
| 14 : 55 : 20 Z | | |

b) Longitude

Longitude equator crossing orbit 1959: 103.18° W
Longitudinal increment of equator crossings: 25.15 degrees

Extrapolate 14 orbits to orbit #1973
25.15 x 14 = 352.10 degrees to the west

| | | |
|---|---|---|
| 103.18° | west | |
| +352.10° | west | |
| 95.28 | west | longitude of equator crossing orbit 1973 |

NOTE: equator crossing of this orbit is 7.9° further east than the reference orbit of the last daily message (1959)

2. Sub point track

Referring to the reference orbit 1959, for a given minute after ascending node on orbit 1973, the sub point would be at the same latitude; the longitude would be 7.9 degrees east of those on orbit 1959.

3. Nadir Angle (Minutes 36 to 50 AAN)

a) Time scale - use 100 minute period.

b) NON (computed)
-10.0 + 3.0 = -7.0 degrees

c) TOT (computed)
40.0 + 0.8 = 40.8 minutes AAN

Nadir angle computation (see diagram --figure 2)

| Minute | Nadir Angle |
|---|---|
| 38 AAN | 12.8 degrees |
| 40 " | 7.9 " |
| 42 " | 8.5 " |
| 44 " | 13.5 " |

4. Azimuth

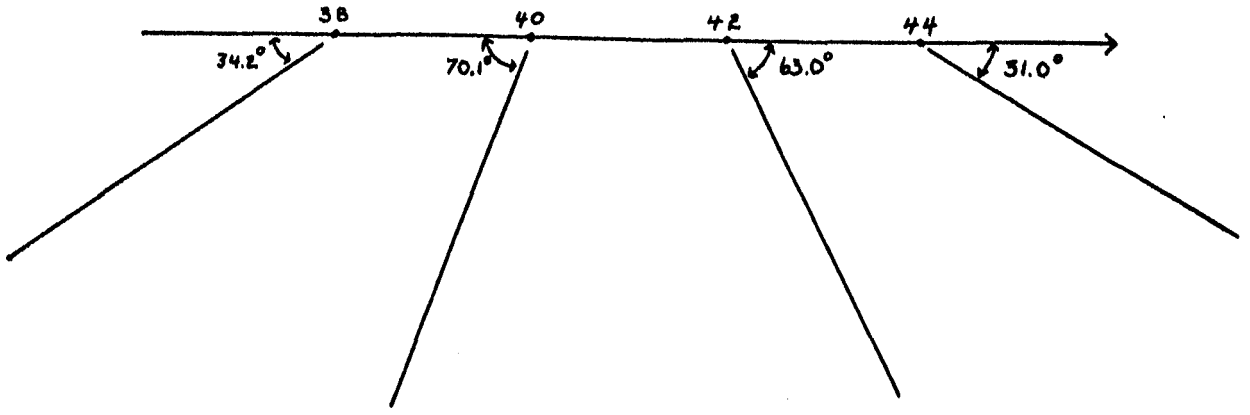
a) Time scale as above

b) NON -7.0 degrees

c) TOT 40.8 degrees

Azimuth angle computation (acute angle from track)

| Minute | Azimuth Angle |
|---|---|
| 38 AAN | 34.2 degrees |
| 40 " | 70.1 " |
| 42 " | 63.0 " |
| 44 " | 31.0 " |




NON minus - Satellite looking right of track.

# TIME SCALES FOR ATTITUDE NOMOGRAMS

(CIRCULAR ORBIT, ONE QUADRANT)

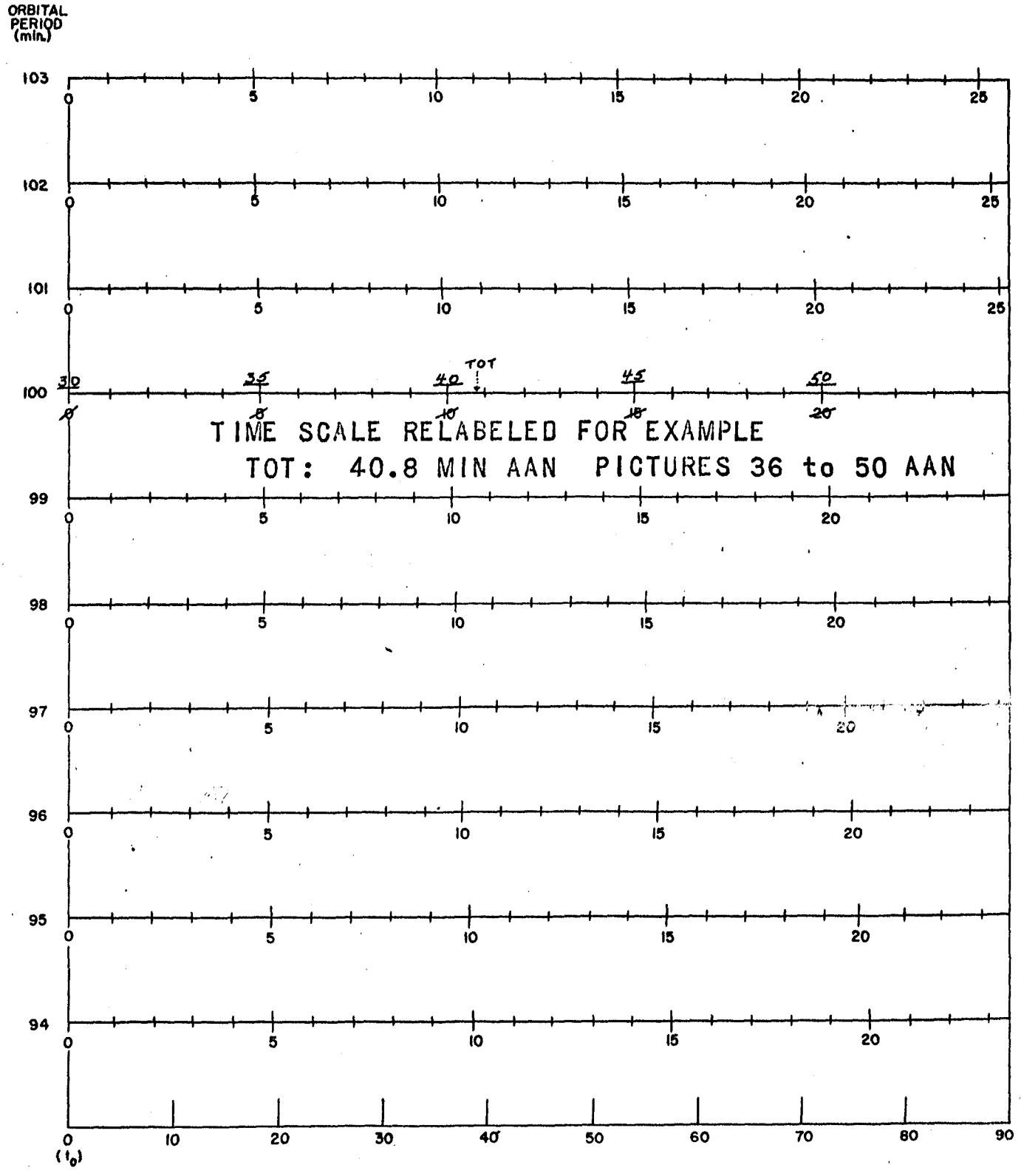



FIGURE 1

# ATTITUDE DIAGRAM

NADIR ANGLE

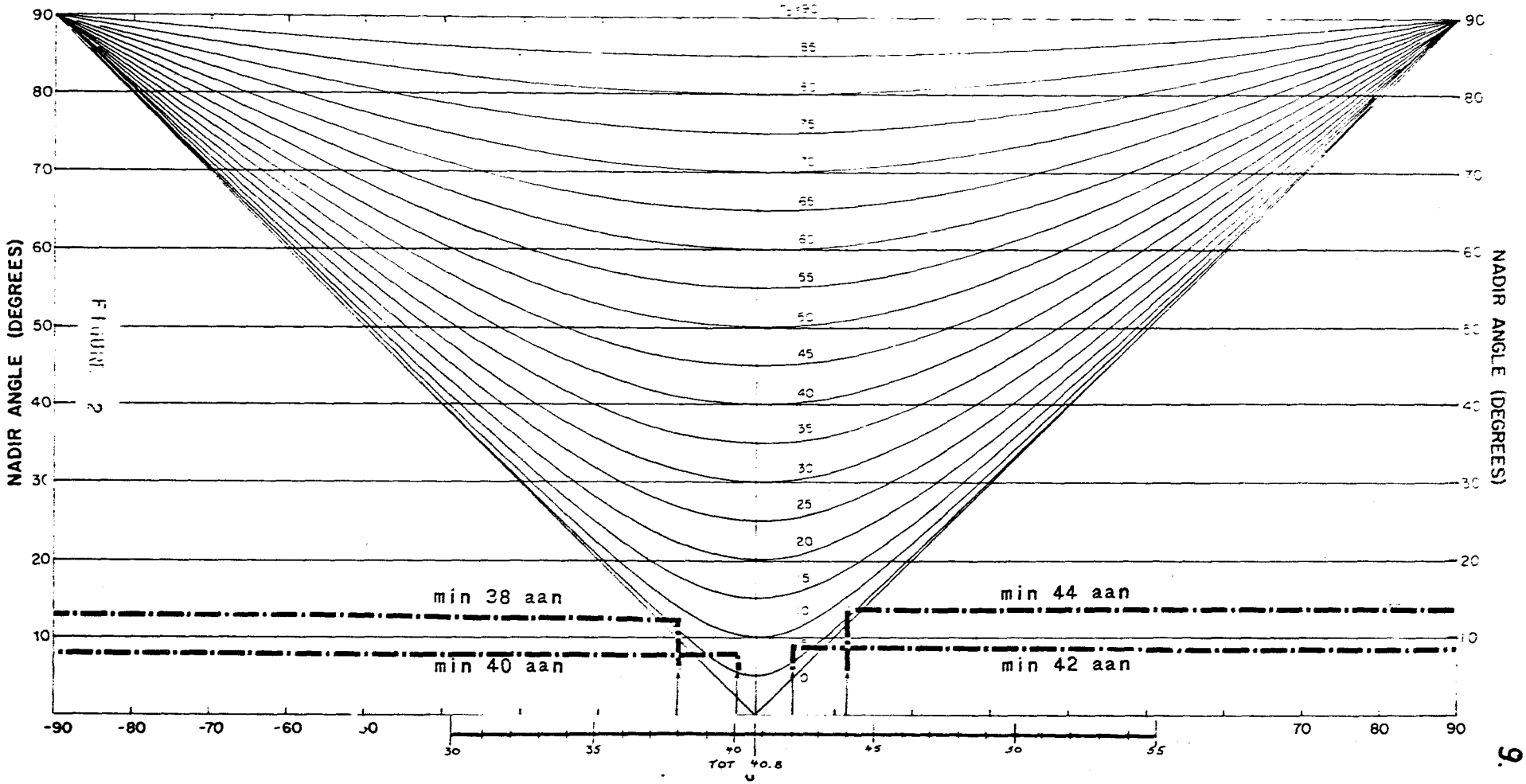
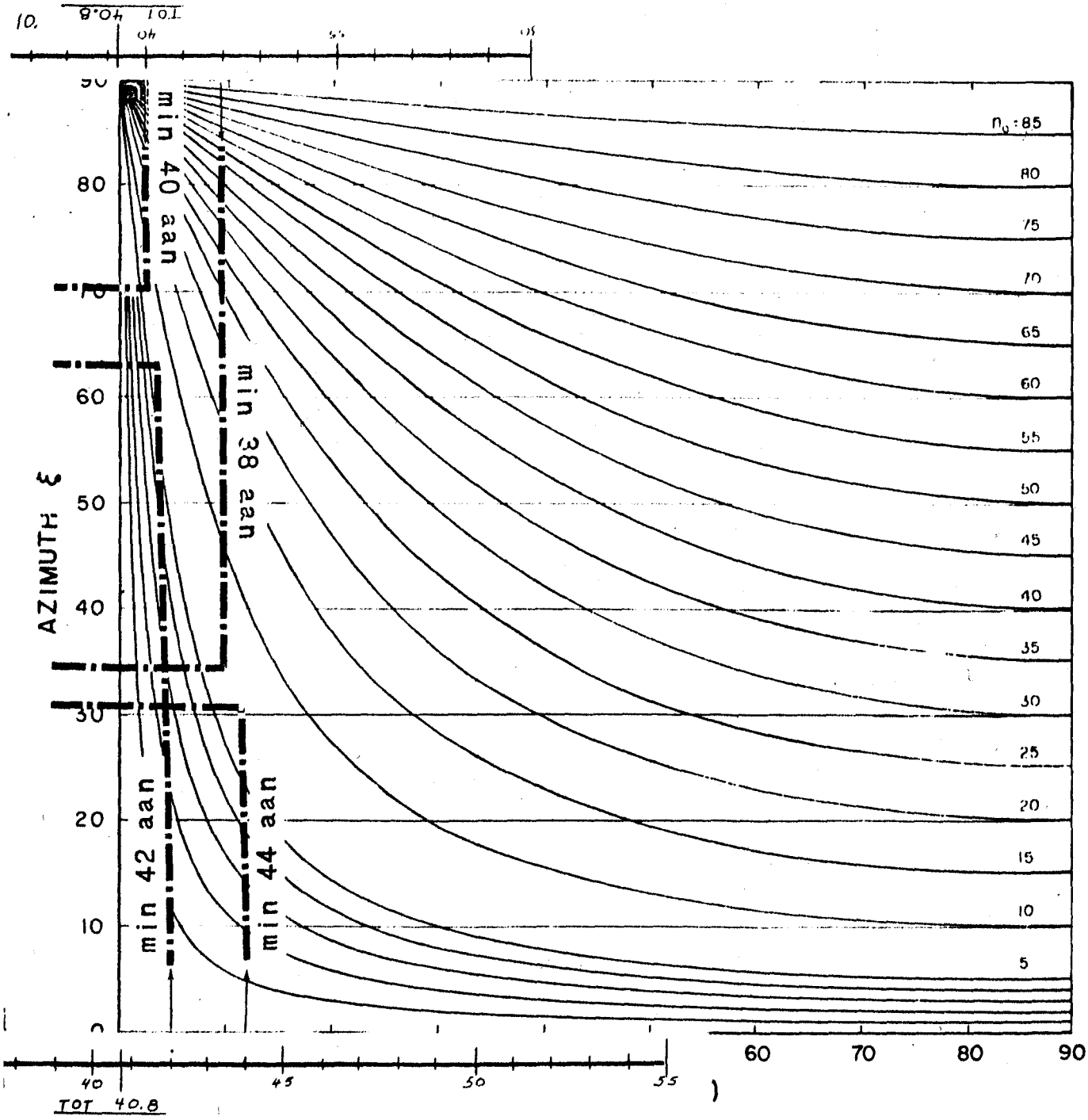



FIGURE 2




**ATTITUDE DIAGRAM**
AZIMUTH

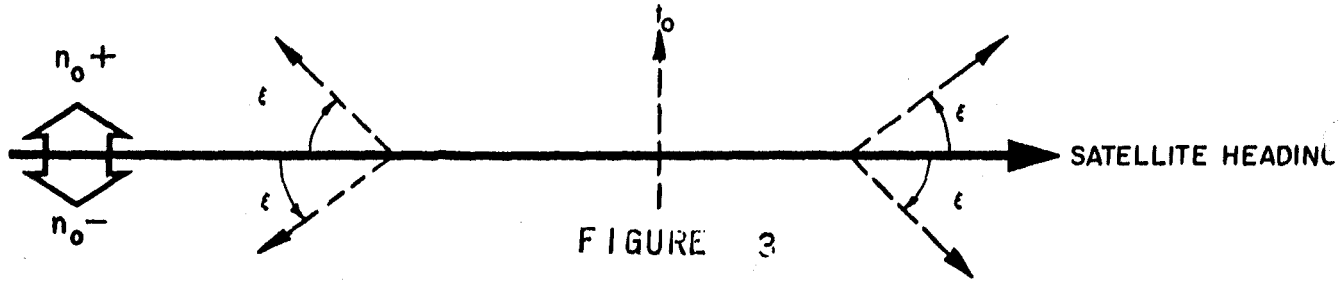



FIGURE 3

NIMBUS APT ALERT AND EPHEMERIS PREDICT

TBUS 2 KWBC _____Z

APT PREDICT

MMYYSS

PART I

$ON_rN_rN_rN_r$ $OY_rY_rG_rG_r$ $Og_rg_rs_rs_r$ $Q_rL_oL_ol_ol_o$ Tggss $LL_oL_ol_ol_o$

$N_4N_4N_4N_4G_4$ $G_4g_4g_4s_4s_4$ $Q_4L_oL_ol_ol_o$

$N_8N_8N_8N_8G_8$ $G_8g_8g_8s_8s_8$ $Q_8L_oL_ol_ol_o$

$N_{12}N_{12}N_{12}N_{12}G_{12}$ $G_{12}g_{12}g_{12}s_{12}s_{12}$ $Q_{12}L_oL_ol_ol_o$

PART II

$02Z_{02}Z_{02}Q_{02}$ $L_aL_al_aL_oL_ol_o$ $04Z_{04}Z_{04}Q_{04}$ $L_aL_al_aL_oL_ol_o$

$06Z_{06}Z_{06}Q_{06}$ $L_aL_al_aL_oL_ol_o$ $08Z_{08}Z_{08}Q_{08}$ $L_aL_al_aL_oL_ol_o$

$10Z_{10}Z_{10}Q_{10}$ $L_aL_al_aL_oL_ol_o$ ---etc.

PART III

$02Z_{02}Z_{02}Q_{02}$ $L_aL_al_aL_oL_ol_o$ $04Z_{04}Z_{04}Q_{04}$ $L_aL_al_aL_oL_ol_o$

$06Z_{06}Z_{06}Q_{06}$ $L_aL_al_aL_oL_ol_o$ $08Z_{08}Z_{08}Q_{08}$ $L_aL_al_aL_oL_ol_o$

$10Z_{10}Z_{10}Q_{10}$ $L_aL_al_aL_oL_ol_o$ --- etc.

PART IV

## EXPLANATION OF CODE SYMBOLS

| | |
|---|---|
| TBUS 2 | - Nimbus APT Bulletin originating in the United States |
| KWBC | - Traffic entered at Washington, D. C. |
| APT PREDICT | - Identifies message content. |
| MMYYSS | - Message serial number<br>MM - month of year<br>YY - day of month<br>SS - number of Nimbus spacecraft to which predict applies. |
| PART I | - Equator crossing predicts follow. |
| $ON_rN_rN_rN_r$ $OY_rY_rG_rG_r$ $Og_rg_rs_rs_r$ | |
| O | - Indicator, reference orbit equator crossing information follows. (NOTE: Information in Parts II and III applies directly to this reference orbit.) |
| $N_rN_rN_rN_r$ | - Number of reference orbit. |
| $Y_rY_rG_rG_rg_rg_rs_rs_r$ | - Day (YY), hour (GG), minute (gg), and second (ss - GMT- on which satellite crosses the equator northbound on the reference orbit $N_rN_rN_rN_r$. |
| $Q_rL_oL_ol_ol_o$ | - Octant and longitude in degrees and hundredths at which satellite crosses the equator northbound on reference orbit $N_rN_rN_rN_r$. (Octant at equator will be that into which the satellite is moving.) |
| T | - Indicator, nodal period follows. |
| ggss | - Nodal period, minutes and seconds between consecutive equator crossings. (Hundreds group will not be included: ex. 100 minutes 13 seconds will be coded as 0013). |
| L | - Indicator, nodal longitude increment follows. |
| $L_oL_ol_ol_o$ | - Degrees and hundredths of longitude degrees between consecutive equator crossings. |
| $N_4N_4N_4N_4$ | - Number of the fourth orbit following the reference orbit. |
| $G_4G_4g_4g_4s_4s_4$ | - Hour (GG), minute (gg), and second (ss), at which satellite crosses the equator northbound on orbit $N_4N_4N_4N_4$. |

$Q_4L_oL_ol_ol_o$ - Octant and longitude in degrees and hundredths at which satellite crosses equator northbound on orbit $N_4N_4N_4N_4$.

$N_8N_8N_8N_8$ - 8th and 12th orbits following reference orbit.

$N_{12}N_{12}N_{12}N_{12}$

PART II - Satellite altitude and subpoint coordinates at 2 minute intervals--after time of equator crossing follows.

$02Z_{02}Z_{02}Q_{02}$

02 - Information pertinent to 2 minutes after equator crossing follows.

$Z_{02}Z_{02}$ - Satellite altitude in tens of kilometers. At 2 minutes after equator crossing

$Q_{02}$ - Octant of globe at 2 minutes after equator crossing.

$L_aL_al_aL_oL_ol_o$

$L_aL_al_a$ - Latitude of satellite subpoint in degrees and tenths of degrees at 2 minutes after equator crossing.

$L_oL_ol_o$ - Longitude of satellite subpoint in degrees and tenths of degrees at minute 2 after equator crossing.

(This information is repeated at 2 minute intervals of the sunlit portion of the equator).

PART III - Satellite altitude and subpoint coordinates at 2 minute intervals prior to time of equator crossing follows.

$02Z_{02}Z_{02}Q_{02}$

02 - Information pertinent to minute 2 <u>before</u> equator crossing follows.

$Z_{02}Z_{02}$ - Satellite altitude in tens of kilometers at 2 minutes after equator crossing.

$Q_{02}$ - Octant of globe at 2 minutes after equator crossing.

$L_aL_al_aL_oL_ol_o$

$L_aL_al_a$ - Latitude of satellite subpoint in degrees and tenths of and tenths of degrees at minute 2 before equator crossing.

$L_oL_ol_o$ - Longitude of satellite subpoint in degrees and tenths of degrees at minute 2 before equator crossing.

(This information is repeated at 2 minute intervals over the sunlit portion of the orbit south of the equator).

PART IV - Remarks.

TIROS APT ALERT AND EPHEMERIS PREDICT

TBUS 1 KWBC_____Z

APT PREDICT

MMYYSS

PART I

$N_1N_1N_1N_1G_1$ $G_1g_1g_1s_1s_1$ $Q_1L_oL_ol_ol_o$ $N_2N_2N_2N_2G_2$ $G_2g_2g_2s_2s_2$ $Q_2L_oL_ol_ol_o$

$ON_rN_rN_rN_r$ $OY_rY_rG_rG_r$ $Og_rg_rs_rs_r$ $Q_rL_oL_ol_ol_o$ Tggss $LL_oL_ol_ol_o$

$N_4N_4N_4N_4G_4$ $G_4g_4g_4s_4s_4$ $Q_4L_oL_ol_ol_o$ $N_5N_5N_5N_5G_5$ $G_5g_5g_5s_5s_5$ $Q_5L_oL_ol_ol_o$

PART II

$t_ot_oZ_oZ_oQ_o$ $L_aL_al_aL_oL_ol_o$ $a_oa_oa_oa_oA_oA_o$ $A_ou_ou_ou_ou_o$

$t_2t_2Z_2Z_2Q_2$ $L_aL_al_aL_oL_ol_o$ $a_2a_2a_2a_2A_2A_2$ $A_2u_2u_2u_2u_2$

$t_4t_4Z_4Z_4Q_4$ $L_aL_al_aL_oL_ol_o$ $a_4a_4a_4a_4A_4A_4$ $A_4u_4u_4u_4u_4$

$t_6t_6Z_6Z_6Q_6$ $L_aL_al_aL_oL_ol_o$ $a_6a_6a_6a_6A_6A_6$ $A_6u_6u_6u_6u_6$

**********

$t_{32}t_{32}Z_{32}Z_{32}Q_{32}$ $L_aL_al_aL_oL_ol_o$ $a_{32}a_{32}a_{32}a_{32}A_{32}A_{32}$ $A_{32}u_{32}u_{32}u_{32}u_{32}$

$t_{34}t_{34}Z_{34}Z_{34}Q_{34}$ $L_aL_al_aL_oL_ol_o$ $a_{34}a_{34}a_{34}a_{34}A_{34}A_{34}$ $A_{34}u_{34}u_{34}u_{34}u_{34}$

PART III

$T_1T_2T_3T_4T_5$ $A_cA_cA_cRR$ $T_cT_cT_cRR$ $(A_sA_sA_sRR$ $T_sT_sT_sRR$ $S_is_is_is_is_i)$

## Explanation of Code Symbols

| | |
|---|---|
| TBUS 1 | - TIROS APT BULLETIN originating in U.S. |
| KWBC | - Traffic entered circuit at Washington, D. C. |
| APT PREDICT | - Identifies message content. |
| MMYYSS | - Message serial number consisting of the number of the month (MM), day of the month (YY), and satellite number (SS) to which predict applies. |
| PART I | - Equator crossing predicts follow. (NOTE: Messages will be prepared for regional dissemination. Each message will contain information pertinent to a sequence of 5 orbits which can be acquired by APT stations within regions) |
| $N_1N_1N_1N_1$ | - Number of the first orbit in the regional orbit sequence |
| $G_1G_1g_1g_1s_1s_1$ | - Hours (GG), minutes (gg), seconds (ss)- GMT- at which the satellite crosses equator northbound on on orbit $N_1N_1N_1N_1$. |
| $Q_1L_oL_ol_ol_o$ | - Octant (Q) and longitude ($L_oL_ol_ol_o$) in degrees and hundredths of degrees at which satellite crosses equator northbound on orbit $N_1N_1N_1N_1$. |
| $N_2N_2N_2N_2$ | - Number of the 2d orbit in the regional orbit sequence. |
| $O\ N_rN_rN_rN_r\ OY_rY_rG_rG_r\ Og_rg_rs_rs_r$ | |
| O | - Indicator, reference orbit equator crossing information follows. (NOTE: Information in Part II applies directly to this reference orbit.) |
| $N_rN_rN_rN_r$ | - Number of reference orbit. |
| $Y_rY_rG_rG_rg_rg_rs_rs_r$ | - Day (YY), Hour (GG), minute (gg), and second (ss)- GMT- on which satellite crosses the equator northbound on reference orbit $N_rN_rN_rN_r$. |
| $Q_rL_oL_ol_ol_o$ | - Octant and longitude in degrees and hundredths at which satellite crosses the equator northbound on reference orbit $N_rN_rN_rN_r$. |
| Tggss | - Period between equator crossings (nodal period) in minutes and seconds. |
| T | - Indicator, Nodal period follows |

| | |
|---|---|
| ggss | - Minutes (gg) and seconds (ss) (Hundreds group will not be included: ex. 100 minutes 13 seconds will be coded as 0013.) |
| $LL_oL_ol_ol_o$ | - Longitudinal increment between equator crossing. |
| L | - Indicator, longitudinal increment follows. |
| $L_oL_ol_ol_o$ | - Longitudinal increment. Whole degrees and hundredths of degrees. |
| PART II | Predicted ephemeris for reference orbit follows. |
| $t_ot_oZ_oZ_oQ_o$ | |
| $t_ot_o$ | - Time of first point in minutes after ascending node. |
| $Z_oZ_o$ | - Satellite altitude in tens of kilometers at $t_ot_o$. |
| $Q_o$ | - Global octant at $t_ot_o$. |
| $L_aL_al_aL_oL_ol_o$ | - Latitude ($L_aL_al_a$), longitude ($L_oL_ol_o$), of satellite subpoint at $t_ot_o$ in degrees and tenths of degrees. |
| $a_oa_oa_oa_oA_oA_o$ | - |
| $a_oa_oa_oa_o$ | - Azimuth of principal line in degrees and tenths of degrees (measured from satellite heading at $t_ot_o$). |
| $A_oA_o$ | - Nadir angle in whole degrees at $t_ot_o$. |
| $A_ou_ou_ou_ou_o$ | - |
| $A_o$ | - Nadir angle, tenths of a degree at $t_ot_o$. |
| $u_ou_ou_ou_o$ | - Rotational component of satellite earth attitude in degrees and tenths of degrees. This is frequently referred to as the "S" angle: The angle in the film plane between the fiducial line and the forward heading direction of the satellite. |

INFORMATION IN PART II IS REPEATED AT INTERVALS OF 2 MINUTES FOR THE PORTION OF THE ORBIT OVER WHICH PICTURES CAN BE TAKEN.

| | |
|---|---|
| PART III | - Supplemental information follows. |
| $T_1T_2T_3T_4T_5$ | - Approximate time of first picture on each of the 5 passes covered in this APT predict message. Time will be given in minutes after $t_ot_o$ in Part II. To find real time, add T to $t_ot_o$ and time of applicable equator crossing. |

$A_cA_cA_cRR$

$A_cA_cA_c$ - Nadir component of satellite earth attitude -- (NON) minimum nadir angle measured in the orbit in degrees and tenths of degrees.

RR* - 24 hour rate of change of minimum nadir angle (NON) in degrees and tenths.

$T_cT_cT_cRR$

$T_cT_cT_c$ - Time component of satellite earth attitude (TOT). Time, in minutes and tenths of minutes after equator crossing the minimum nadir angle (NON) occurs. Applies to the reference orbit in each 5 orbit sequence.

RR* - 24 hour rate of change of time of minimum nadir angle (TOT) in minutes and tenths of minutes.

$A_sA_sA_sRR$

$A_sA_sA_s$ - Nadir component of satellite sun attitude in degrees and tenths.

RR - 24 hour rate of change of $A_sA_sA_s$ in degrees and tenths.

$T_sT_sT_sRR$

$T_sT_sT_s$ - Time component of satellite sun attitude in minutes and tenths.

RR - 24 hour rate of change of $T_sT_sT_s$ in minutes and tenths.

$S_is_is_is_is_i$

$S_i$ - Indicator, sun supplement angle follows.

$s_is_is_is_i$ - Sun supplement angle in degrees and tenths of degrees.

*NOTE: RR, rates of change of attitude parameters, can be either positive or negative. The following convention will govern: if RR is positive, the tenths figure will be even. If the true value is odd, the next higher even integer will be encoded for the tenths group. If RR is negative, the tenths figure will be odd. If the true value is even, the next higher odd integer will be encoded for the tenths group.

MEMORANDUM

To : Attendees
APT Training Course

Date: October 30, 1963

From : Satellite Operations Branch
National Weather Satellite Center

Subject: APT Materials

Several hours of your APT Training Course were spent in practicing the extrapolation of information from the Daily Alert Message for use in the event of a communication failure. No written procedures were available for guidance at that time; we promised to provide one. It is enclosed. Naturally, it is hoped that no one will ever need make these extrapolations but the method is detailed here should the occasion arise.

The APT Alert and Ephemeris Predict in symbolic form is provided again for your information. It should be noted that the letters used in the symbolic format have been changed in several instances to conform with current international procedures. The data format has NOT been changed. Everything will appear in exactly the same position as it did in the examples used for class study. To repeat, only the symbolic letter format has been changed.

The PIO release is for general information. If you are unable to find your picture at least you should be able to recognize a friend or acquaintence.

Perspective and Transfer grids for the APT system are being prepared at present and will be sent to participating stations within the next two or three weeks.

Transmission of a routine Daily Message is expected to begin on circuits 8275 and 8279 December 2, 1963, at 1910Z. This data initially will be for TIROS VII and will permit tracking of the spacecraft beacons.

It is suggested that tracking and analysis procedures be reviewed concurrent with the beginning of transmission of the Daily Message so that everyone will be ready to go after the initial engineering checkout after the launch of TIROS VIII.

Detailed instructions for determining picture taking time have been prepared and will be distributed with the grids.

If any question on tracking or analysis procedure remains at this time, I hope you will communicate with us immediately.

Art. Schwalb

Arthur Schwalb

Enclosures

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