[redacted]

b7C

October 3, 1997

VIA EXPRESS MAIL

SA [redacted]
FBI, New York Field Office
26 Federal Plaza, 23rd Floor
b7C New York, NY 10278

Dear [redacted]

Enclosed please find copies of primary data plots as you requested. You will note that I opted to plot all three data sets (ISP, JFK, & HPN) in order to develop the best possible picture relative to parts/debris disbursement. However, I did not incorporate or blend them into a single plot for two reasons. Firstly, the published magnetic variations for the JFK and HPN ASR systems (12°) do not appear correct. Hence, any attempt to offset values received by these sites would not have placed the targets in their proper relative positions to ISP data.

Secondly, target data received by the JFK and HPN systems would differ from the data received by the ISP ASR due to slant range from the receiving antenna. As an example of the slant range factor, I have enclosed a copy of a page (#39) extracted from FAA training Manual ETM 12-0-1 ***[Attachment #1]***.

Since the altitude of the primary target returns are not known, the determination of slant range correction factor(s) was not feasible.

In an effort to provide the broadest possible picture relative to primary target returns, along with plots that would not appear *"busy"* due to too much information crammed into a confined space, data presentations were completed in pair s from JFK, ISP, and HPN. One plots depicts target run length values associated with each return while the second plot (in the pair) depicts a numerical value associated with sequential timing of receipt of the data.

Per your request, I contacted [redacted] at the NTSB to obtain the estimated weight of the nose section. However, [redacted] advised me that the Safety Board did not know the estimated weight and further reported that calculations relative to the weight were not attempted.

A description of the data and plots is provided below.

DATA

A review of primary data returns in the immediate area of TWA800 was completed utilizing data received by the ISP, JFK, and ISP ASR systems. After selected data points were entered, they were plotted and reviewed in detail so as to eliminate targets that were associated with aircraft known to be in the area at the time of the mishap (*USN P-3, etc*). Returns selected in this process were entered in the computer utilizing the following format: TIME(UTC), nautical mile (NM) range, magnetic azimuth values in ACPS, and a single digit value between 1 and 7 which denoted target run length values. After entry, range and ACP data were converted to an X/Y grid format aligned to true north based on magnetic variation values contained in the NOS Digital Aeronautical Chart Supplement in effect at the time of the accident.

The term, target run length (TRL), in effect, refers to the size of a specific target. However, it does not directly reflect the size of a target but rather the radar cross section of a particular target. As an example, one needs to visualize a billboard located beside the highway. When viewed straight-on (*like the advertising folks want*), you will see the full size of the billboard, as 20 feet x 40 feet in height and width, and 6 inches thick. However, if the viewer were at a 45° angle and the viewed surface appeared as a 10 x 40 foot surface, its cross section would be reduced by approximately half. When the same billboard was viewed from a 90° point relative to the advertisement, the same object would appear as 10 foot in height and only 6 inches in width. At this angle, its 40 foot width would not be visible. Hence, a tumbling primary target, such as a large piece of aircraft skin, or a part from an aircraft, could register as a TRL value of 1 through 7, depending on the size of the cross section it presented at the time of detection. As an aid in visualizing the above, see ***[ATTACHMENT #2]***.

File: FAA-ISP1.DAT

All primary radar returns received by the ISP ASR system between 0031:15.97[1] and 0032:31.14 with line numbers added to the left of the time column for timing reference in plan view plots ***[ATTACHMENT #3]***.

File: FAA-JFK1.DAT

All primary radar returns received by the JFK ASR system between 0031:16.65 and 0033:12.12 with line numbers added to the left of the time column ***[ATTACHMENT #4]***.

File: FAA-HPN1.DAT

All primary radar returns received by the HPN ASR system between 0031:14.54 and 0032:34.42 with line numbers added to the left of the time column ***[ATTACHMENT #5]***.

PLOTTING

A series of plan view plots were completed utilizing the data listed above. Plots numbered as 1, 2, and 3 were utilized in development of the final plots described below.

PLOT: TWAISP4

Plan view plot covering a 3x3 NM area depicting the last two transponder returns received from TWA800 at 0031:06.57 and 0031:11.27, and all data contained in file TWA-ISP1.DAT. The numbers immediately above the primary target symbols (●) correspond to the line numbers in the data file and denote the sequence in which they were received. Additionally, each square mile grid is identified by a letter between A and I. Scale: major increments = 1 NM (*6,071 feet*), minor increments = 0.10 NM (*607 feet*). As can be seen by the over-writing of numerical and target symbols, addition and display of real time values would have made for a busy and very hard to read plot. Hence, it was determined that display of the appropriate line number signifying time sequence made for a more readable plot ***[ATTACHMENT #6]***.

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[1] All times shown herein reflect adjusted timing per DFDR correlation and indicate Coordinated Universal Time (UTC).

PLOT: TWAISP4A thru 4I

A series of plan view plots (9) depicting 1x1 square NM areas with the letter indicated on the smaller (*3x3 NM*) plot appended to the number 4 to signify the area covered by the individual plots. Numbers immediately above the primary target symbols correspond to the line numbers in the data file and denote the sequence in which they were received. Evident in this series of plots is the fact that the over-writing of numerical and target symbols does not occur as was apparent in the 3x3 square mile plot. These plots are provided for the purpose of digitally scanning the material into a computer should further analysis be required by outside agencies. Scale: major increments = 1 NM, minor increments = 0.10 NM ***[ATTACHMENT #7]***.

PLOT: TWAISP5

Plan view plot covering a 3x3 nautical mile NM area depicting the last two transponder returns received from TWA800 at 0031:06.57 and 0031:11.27, and all data contained in file TWA-ISP1.DAT. In this plot, the numbers immediately above the primary target symbols (●) correspond to the Target Run Length values (*1 thru 7*) indicated under the column headed TRL in the data file. As with the above plot, each square mile grid is identified by a letter between A and I. Scale: major increments = 1 NM , minor increments = 0.10 NM As can be seen in this plot, over-writing of numerical and target symbols is also evident and demonstrates that had time values been added to the display, information would have been nearly impossible to distinguish ***[ATTACHMENT #8]***.

PLOT: TWAISP5A thru 5I

A series of plan view plots (9) depicting 1x1 square NM areas with the letter indicated on the smaller (*3x3 NM*) plot appended to the number 5 to signify the area covered by the individual plots. Numbers immediately above the primary target symbols correspond to the Target Run Length values indicated under the column headed TRL in the data file. Scale: major increments = 1 NM, minor increments = 0.10 NM ***[ATTACHMENT #9]***.

PLOT: TWAJFK4

Plan view plot covering a 3x3 NM area depicting the last transponder returns received from TWA800 at 0031:11.88 and all data contained in file TWA-JFK1.DAT. Numbers immediately above the primary target symbols correspond to the line numbers in the data file ***[ATTACHMENT #10]***.

PLOT: TWAJFK4A thru 4I

A series of plan view plots (9) depicting 1x1 square NM areas with the letter indicated on the smaller (*3x3 NM*) plot appended to the number 4 to signify the area covered by the individual plots. Numbers immediately above the primary target symbols correspond to the line numbers in the data file ***[ATTACHMENT #11]***.

PLOT: TWAJFK5

Plan view plot covering a 3x3 NM area depicting the last transponder returns received from TWA800 at 0031:11.88 and all data contained in file TWA-JFK1.DAT. Numbers immediately above the primary target symbols correspond to the Target Run Length values (*1 thru 7*) indicated under the column headed TRL in the data file ***[ATTACHMENT #12]***.

PLOT: TWAJFK5A thru 5I

A series of plan view plots (9) depicting 1x1 square NM areas with the letter indicated on the smaller (*3x3 NM*) plot appended to the number 5 to signify the area covered by the individual plots. Numbers immediately above the primary target symbols correspond to the Target Run Length values indicated under the column headed TRL in the data file. ***[ATTACHMENT #13]***.

PLOT: TWAHPN4

Plan view plot covering a 3x3 NM area depicting the last two transponder returns received from TWA800 at 0031:04.99 and 0031:09.69, and all data contained in file TWA-HPN1.DAT. Numbers immediately above the primary target symbols correspond to the line numbers in the data file ***[ATTACHMENT #14]***.

PLOT: TWAHPN4A thru 4I

A series of plan view plots (9) depicting 1x1 square NM areas with the letter indicated on the smaller (*3x3 NM*) plot appended to the number 4 to signify the area covered by the individual plots. Numbers immediately above the primary target symbols correspond to the line numbers in the data file ***[ATTACHMENT #15]***.

PLOT: TWAHPN5

Plan view plot covering 3x3 NM area depicting the last two transponder returns received from TWA800 at 0031:04.99 and 0031:09.69, and all data contained in file TWA-HPN1.DAT. Numbers immediately above the primary target symbols correspond to the Target Run Length values (*1 thru 7*) indicated under the column headed TRL in the data file ***[ATTACHMENT #16]***.

PLOT: TWAHPN5A thru 5I

A series of plan view plots (9) depicting 1x1 square NM areas with the letter indicated on the smaller (*3x3 NM*) plot appended to the number 5 to signify the area covered by the individual plots. Numbers immediately above the primary target symbols correspond to the Target Run Length values indicated under the column headed TRL in the data file. ***[ATTACHMENT #17]***.

LINE-OF-SIGHT

Since the subject of line-of-sight (LOS) came up early on in our discussions, I have provided LOS values for the JFK, HPN, and ISP ASR systems below. The calculations were completed utilizing a program developed at the NTSB, and still in use by that agency. The values listed below depict the NM range of the first primary target received by the site listed after loss of the flight's transponder signal, and represent the minimum MSL altitude that a target would be detected given all things atmospheric were normal at the time of the event. However, as you are aware from the presence of surface (primary) targets extracted from the ISP primary data set at ranges exceeding 40 NM, it appears that these targets were the result of a temperature inversion at the time of the incident.

ASR	RANGE from ASR	MINIMUM ALTITUDE
JFK	50.46nm	1,687'
HPN	53.34nm	1,885'
ISP	21.51nm	306'

Keep in mind that, based on a standard set of circumstances (*weather, atmosphere, radar tuning, etc.*), the ASR antenna should not receive or detect primary targets below the minimum altitudes listed above.

TARGET SELECTION

For the most part, primary targets were selected in the area of the last received transponder return commencing with the time of the next expected return and continuing for approximately 1¼ minutes (0031:14 - 0032:00), with the exception of JFK data which continues through 0033:12.

The selection of above times is based on my experience with past in-flight break-up accident sequences and the intentional destruction of target drones, while a GCI controller in the military. These experiences have shown that after a time period of approximately 60-75 seconds after an airframe experiences a catastrophic in-flight failure, primary radar targets tend to represent a scenario more closely associated with a chaff [2] drop rather than an intact aircraft, or portion of one.

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[2]CHAFF - Thin, narrow metallic strips of various lengths that reflect RF energy. These reflectors, when dropped from an aircraft and allowed to drift downward, with the wind, result in the appearance of targets of varying sizes on radar scopes (displays).

A brief visual review of plotted data indicates the HPN ASR system received the least amount of primary target returns while the JFK system received a larger number of returns. The difference in the number of primary returns received from these sites, at nearly identical ranges, tends to indicate that the temperature inversion played a factor in contributing to the lessor number of targets received by HPN versus the larger number of targets received by JFK.

Of interest in the HPN data is that after 0032:34.671, primary target returns become very intermittent and cease in the accident area at 0033:07. Within the JFK data, only 11 targets are recorded after 0032:30, and become increasingly intermittent in the accident area with primary targets ceasing after 0035:21.

Although primary data associated with the ISP ASR was selected through 0032:31.387 for the purposes of the aforementioned plots, primary target returns within the ISP data are indicated beyond 0040:00. Many of the latter targets appeared near stationary and no determination could be made as to whether these targets were aircraft debris aloft or surface targets (small boats) that reportedly responded to the scene of the crash. Additionally, the possibility exists that a portion of the ISP primary data points could be attributed to heavy dense smoke from a fossil (jet) fuel fire. The foregoing statement may garnish a few snickers, however, I have witnessed several occurrences where such smoke conditions appeared on radar (JFK & EWR ASR systems) as very faint (*TRL 1 values*) from structural fires in and around the New York City area while a controller at JFK. Additionally, I have observed this occurrence in the Minneapolis area while an FAA controller.

DISCUSSION

In an effort to present both sequential target listings and TRL values in a combined view, a series of three joint-plots were created for each of the ASR systems. These plots were designated as TWA**JFK**7/7A, TWA**HPN**7/7A, and TWA**ISP**7/7A ***[ATTACHMENT # 18].***

Based on information you provided relative to debris locations documented during the recovery phase ***[ATTACHMENT # 19]***, I have marked each of the above plots with circles to indicate the locations of debris from the forward portion of the aircraft in ***green*** and the aft portion of the aircraft in ***blue***. Additionally, I have placed an ***orange*** circle around a grouping of returns that appear immediately to the right of the apparent flight track of TWA800, approximately 1 N.M. southwest of the area encompassing the nose or forward section.

Since I could not recall seeing a similar depiction of primary target data while visiting CTO nor was there an indication of this debris pattern in the copy of the Oceaneering plot indicating TWA800 Tag Locations provided by FAX, I became quite curious as to what portions of the aircraft these could be.

Within the ISP and HPN plots, targets located in the orange circle appear to be closely grouped within an area measuring approximately 0.2 NM east/west and 0.4 NM north/south. Within these plots, both data sets indicate TRL values generally at 3 and below. However, both data sets also include a single TRL value of 7 near the northern end of the target field.

In the JFK plots, targets within the orange circle indicate TRL values of between 5 and 7 while for the most part they appear near the end of the data set. The grouping of the JFK data appears to be generally within a 0.4 NM diameter area.

The relatively tight grouping of these targets in all three data sets (less than ½ NM) would tend to indicate more vertical movement versus lateral movement.

Additionally, plotted data indicates targets located within the orange area appear immediately to the right (*abeam*) of the projected flight path of TWA800 at a distance of approximately 0.5 NM, at 0031:16.224 in the ISP data set. Coincidentally, the first appearance of this target in the HPN data occurred at 0031:14.792 and was also located approximately 0.5 NM to the right of the projected flight path.

A similar target appears to the right of the projected flight track at 0031:16.895 in the JFK data set but at a distance of approximately 0.25 NM.

The above information indicates that some portion or component of the aircraft kicked out to the right nearly immediately after loss of the transponder signal and experienced a throw to the right of the aircraft's flight track of between 0.25 and 0.5 NM. Once it lost the momentum that caused its departure from the aircraft, the part or parts associated with this debris descended to the ocean surface very near vertically with minimal lateral movement.

Target returns located within the green (fwd) and blue (aft) coincide with the information depicting debris fields in the Oceaneering TWA800 Tag Location plot.

I doubt that NTSB personnel have plotted all three primary data sets as contained in the enclosed attachments although the recommendation to complete such a process was communicated.

For your convenience, I have provided three complete sets of text and plots. Also, I have provided six large (30x30") plots depicting numbered sequential returns as well as TRL values from the three ASR systems.

Feel free to call if you have any questions, comments , or suggestions. I should be in for the next few weeks.

Very truly yours,

[redacted] b7C

Encl.

VIA EXPRESS MAIL
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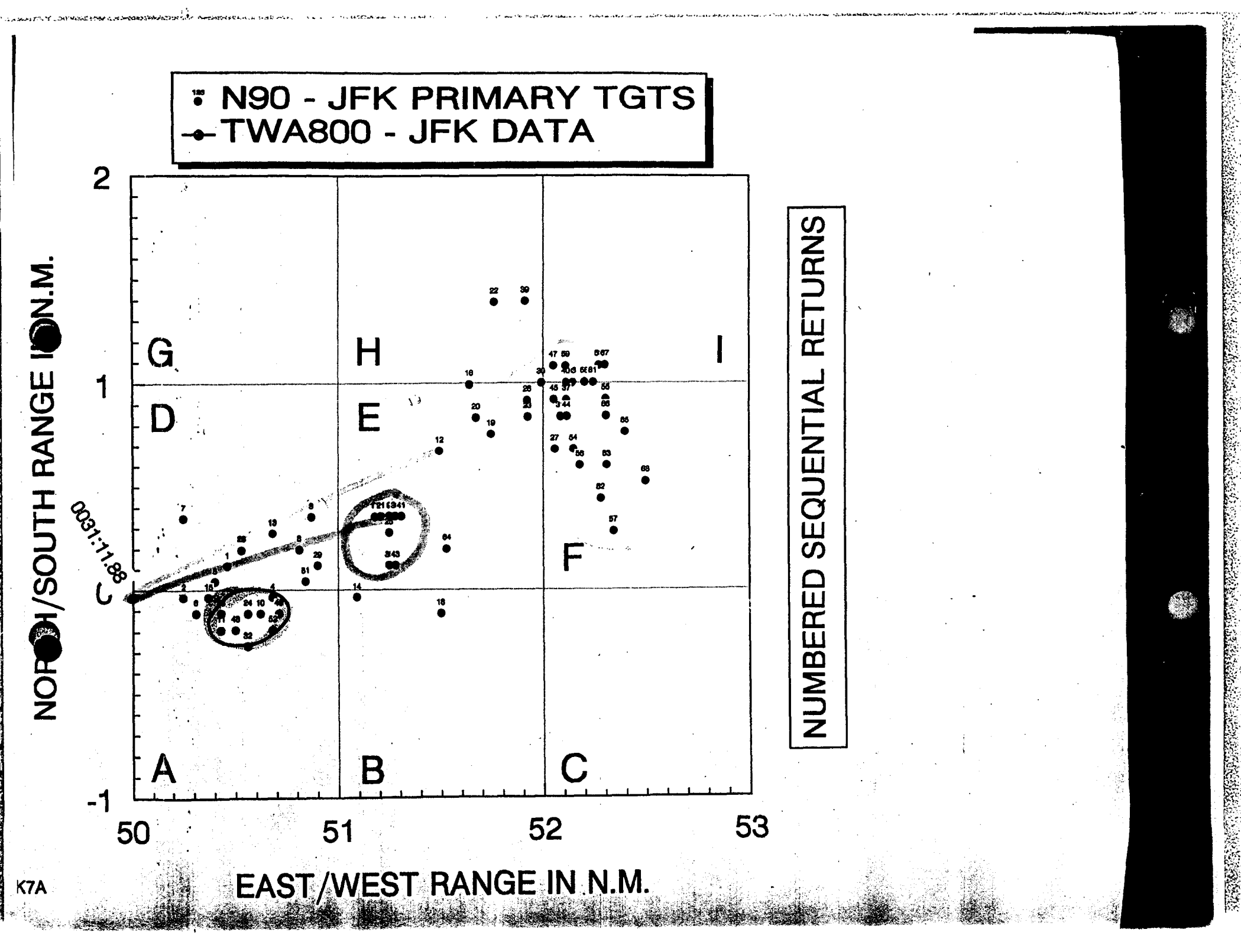
PACKAGE 2 of 2 = EH549463824US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TWA800 - JFK DATA
NUMBERED SEQUENTIAL RETURNS
NORTH/SOUTH RANGE IN N.M.
EAST/WEST RANGE IN N.M.
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H
I
D
E
F
A
B
C
2
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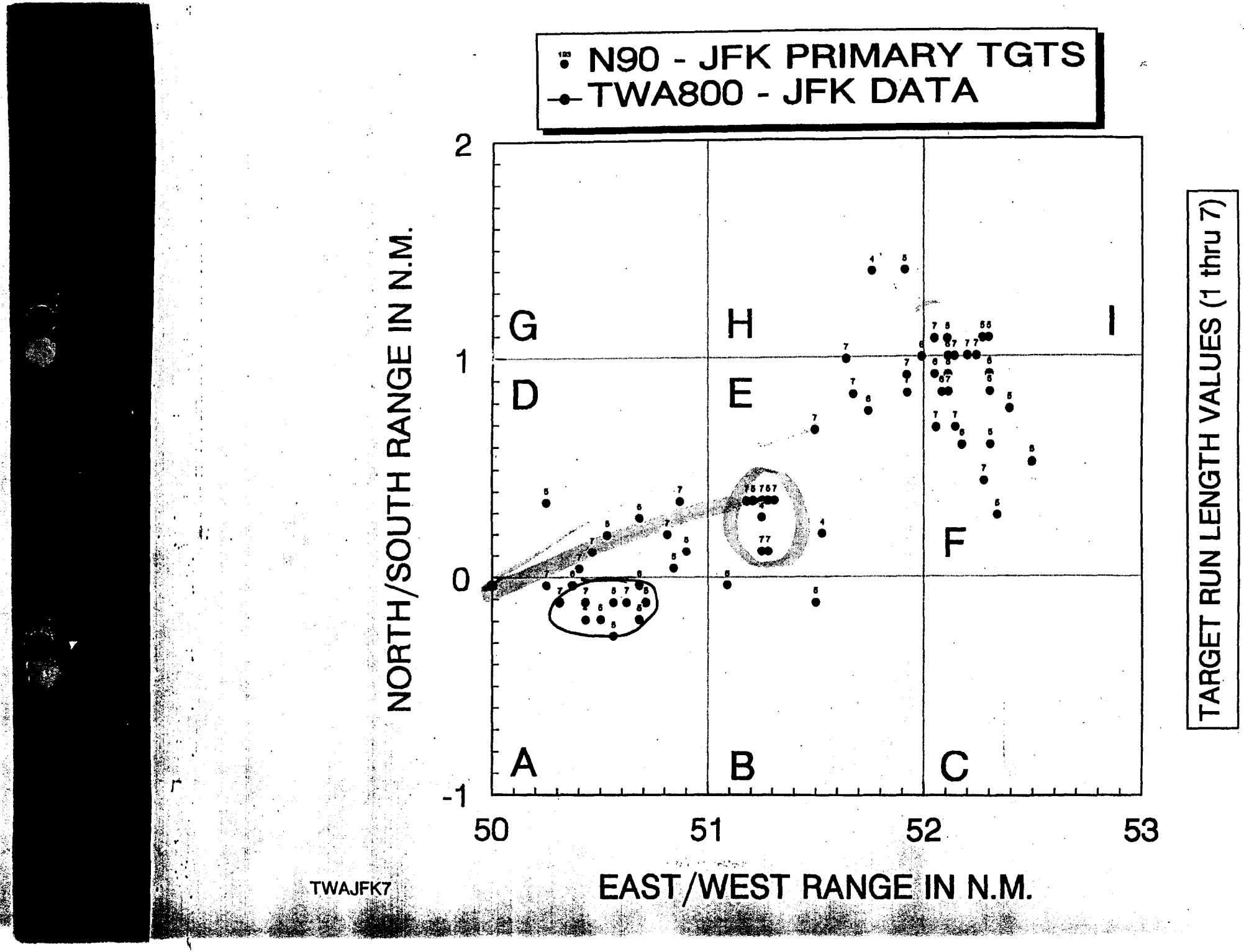
50
51
52
53
K7A


N90 - JFK PRIMARY TGTS
TWA800 - JFK DATA
NORTH/SOUTH RANGE IN N.M.
EAST/WEST RANGE IN N.M.
TARGET RUN LENGTH VALUES (1 thru 7)
2
1
0
-1
50
51
52
53
A
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C
D
E
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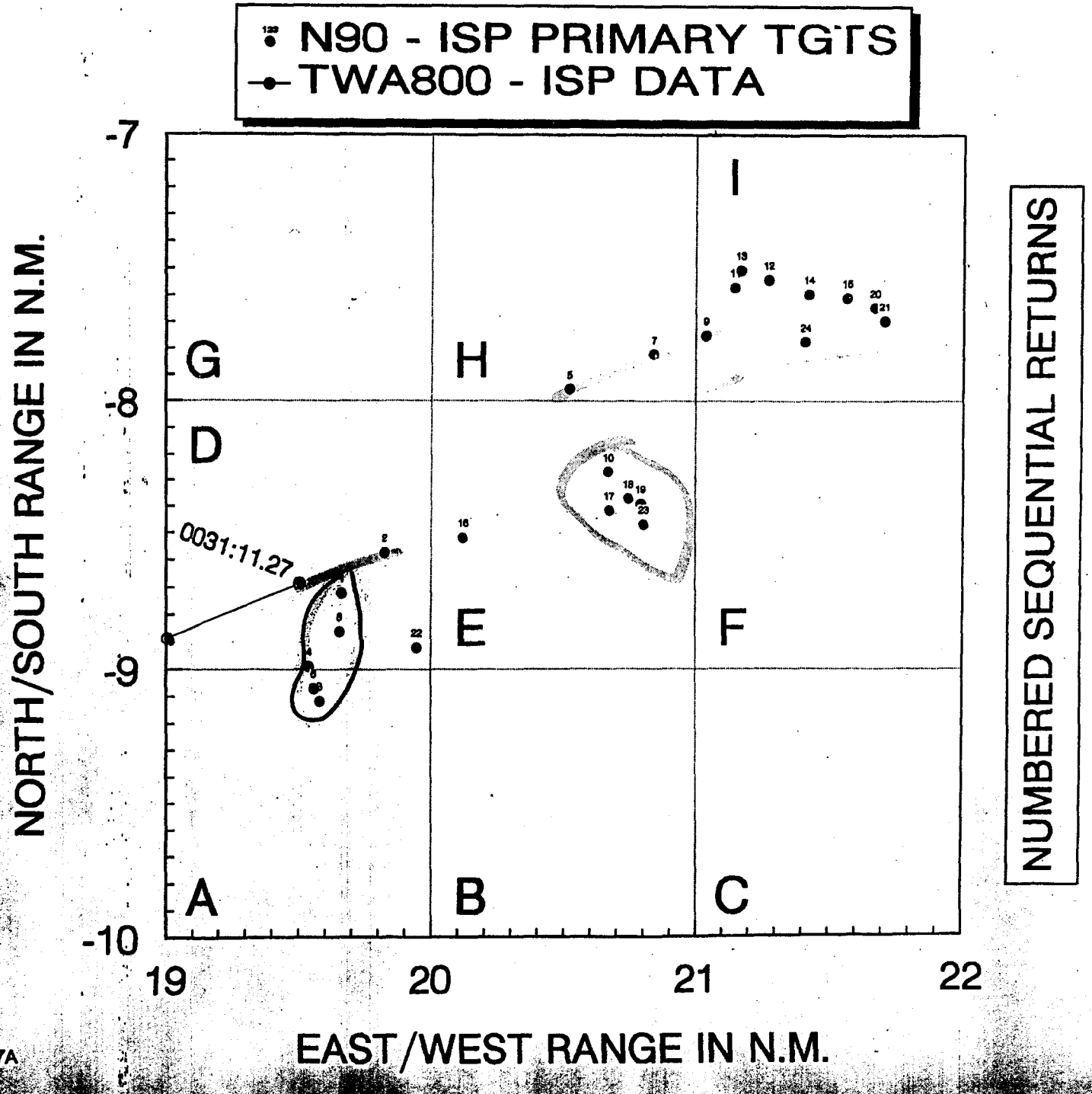
G
H
I
TWAJFK7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TWA800 - ISP DATA
-7
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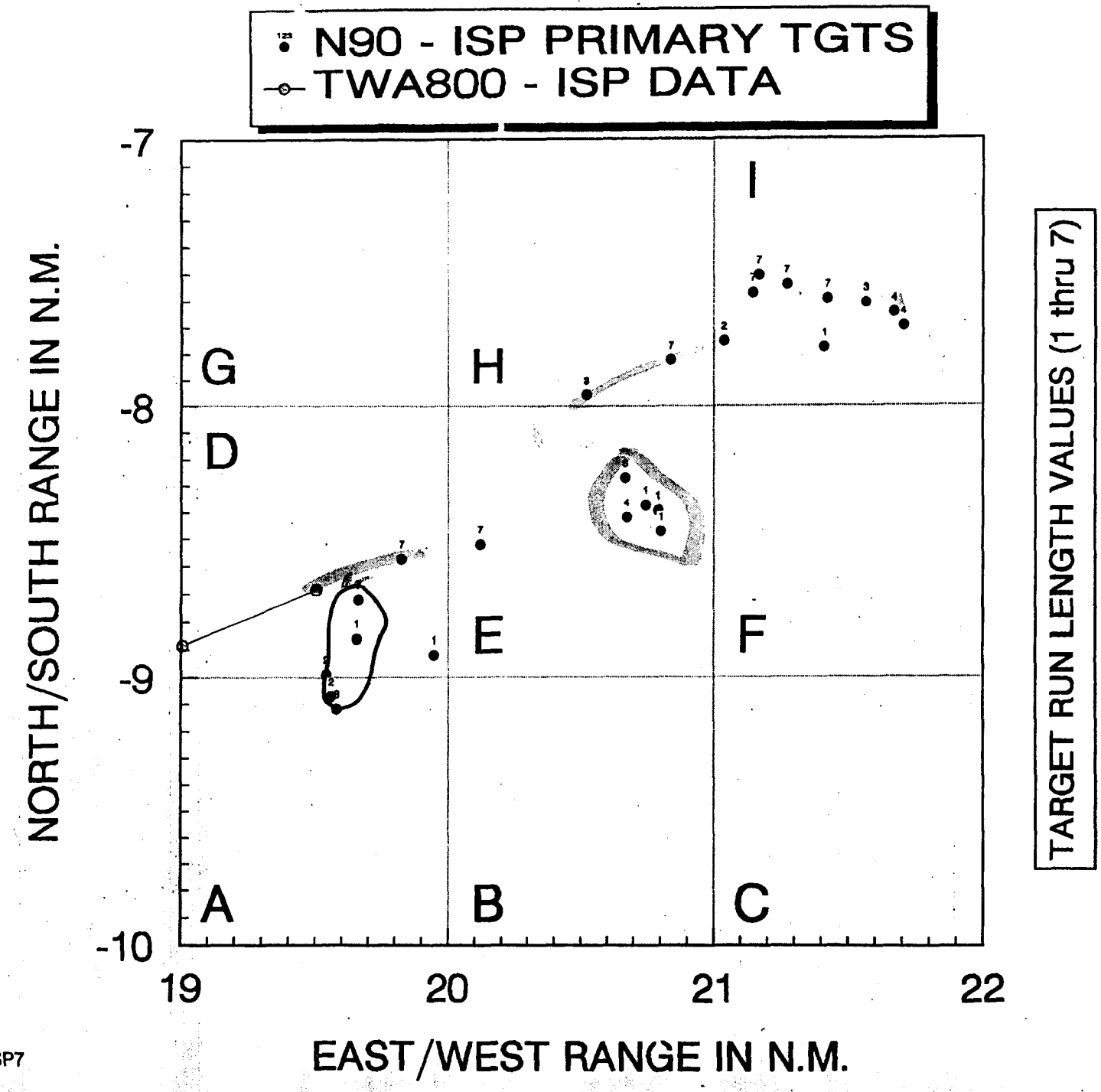
0031:11.27
NORTH/SOUTH RANGE IN N.M.
EAST/WEST RANGE IN N.M.
NUMBERED SEQUENTIAL RETURNS


N90 - ISP PRIMARY TGTS
TWA800 - ISP DATA
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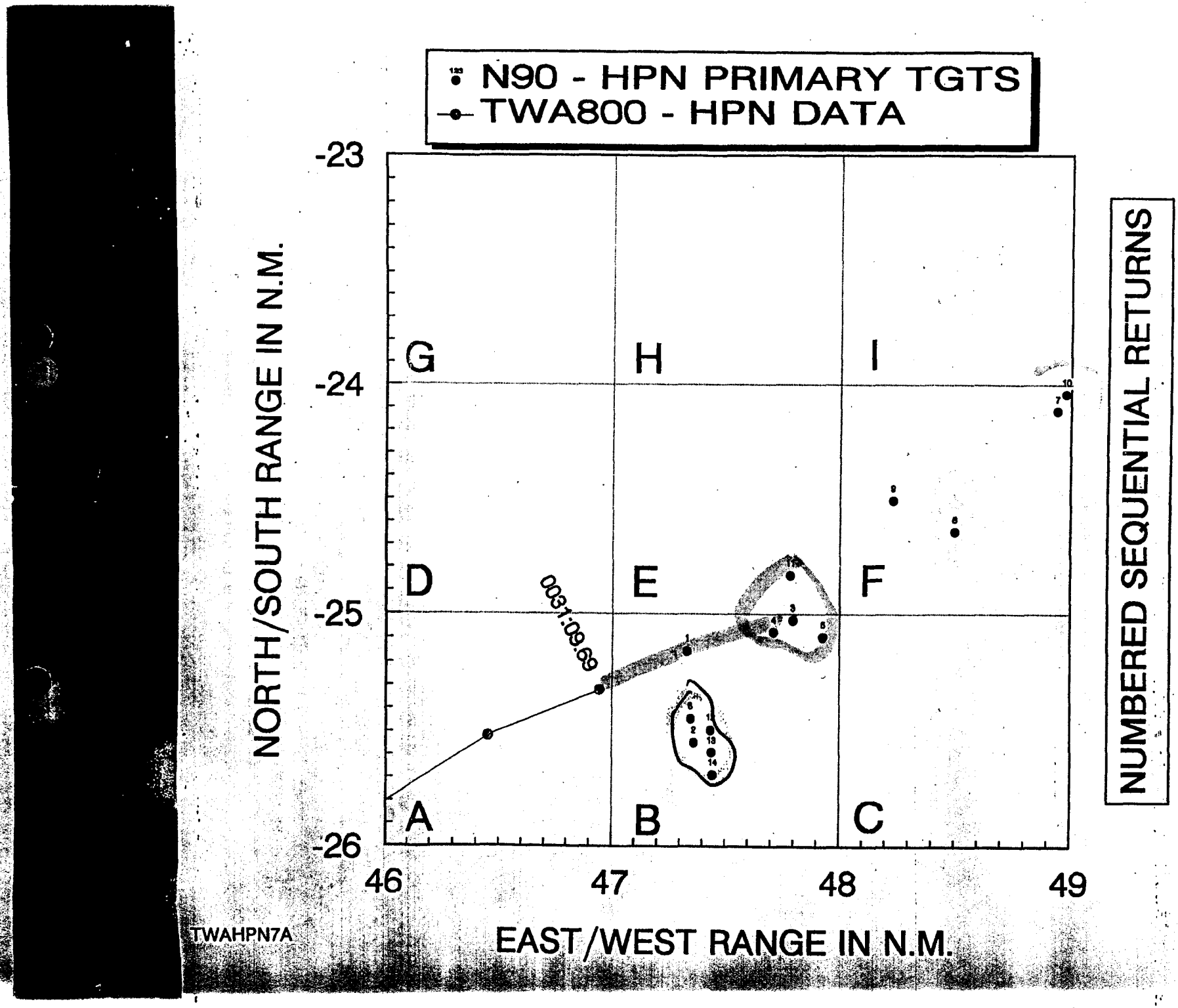
NORTH/SOUTH RANGE IN N.M.
EAST/WEST RANGE IN N.M.
TARGET RUN LENGTH VALUES (1 thru 7)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TWA800 - HPN DATA
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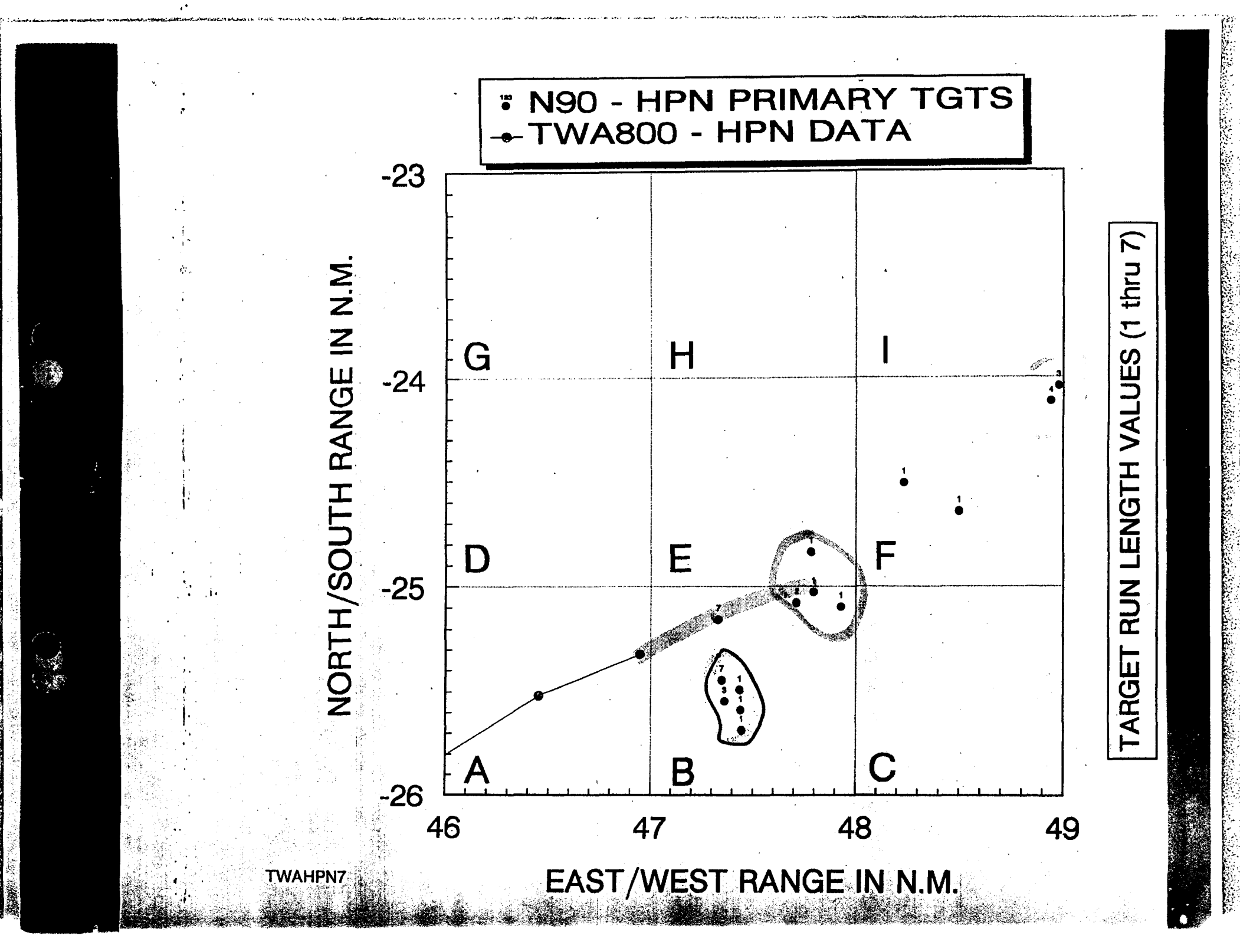
NORTH/SOUTH RANGE IN N.M.
EAST/WEST RANGE IN N.M.
NUMBERED SEQUENTIAL RETURNS
TWAHPN7A


N90 - HPN PRIMARY TGTS
TWA800 - HPN DATA
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NORTH/SOUTH RANGE IN N.M.
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EAST/WEST RANGE IN N.M.
TARGET RUN LENGTH VALUES (1 thru 7)
TWAHPN7