



**WESTERN REGION TECHNICAL ATTACHMENT
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WSR-88D CLUTTER SUPPRESSION AND THE VWP

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Introduction

To more effectively use the WSR-88D requires knowledge of the potential impacts of clutter suppression on radar products. Most WSR-88D operators are aware that clutter suppression can remove slow-moving targets and cause under-estimation of precipitation estimates near the zero isodop. This Technical Attachment (TA) illustrates how the failure to use clutter suppression can affect the VAD Wind Profile (VWP). Specifically, it is shown that erroneous winds are generated if suppression is not applied to the entire domain. In the case presented in this TA, the by-pass map (the most commonly used suppression method) failed to eliminate much of the clutter picked up by the radar. The near-zero velocities associated with the clutter resulted in near-zero VAD wind estimates.

Case Study

Effects of Various Filtering Techniques

The KMTX radar near the Great Salt Lake was used for this case. The VWP from 2338 UTC 15 March 1996 to 0114 UTC 16 March 1996 is shown in Fig. 1.

Initially, the VWP indicates that the winds between 11,000 and 14,000 ft are generally from the northwest at 30-40 kt, with little data available below 11,000 ft. At 0017 UTC, there is a dramatic increase in the vertical extent of the winds: data now extends from 7,000 ft to over 20000 ft, while, the wind speeds drop off to near 10 kt or less and shift to more westerly direction.

Deep and weak winds continue on the next volume scan. At 0046 UTC, the winds become stronger and have a smaller vertical extent, closely resembling the winds prior to 0017. It is believed that the presence of the winds at 7,000 and 9,000 ft are not related to the clutter but were the result of an increase in non-clutter targets (e.g., birds, insects, and/or clouds).

VAD Raw Data

The 2.5 degree Doppler velocity field at 0017 UTC is shown in Fig. 2. In Fig. 1 note that the VWP wind speeds were strong at this time. At the next volume scan (Fig. 3), there has been a large increase in the amount of data on the 2.5 degree tilt. Please note that most of the additional wind data are less than 5 kt, an indication that the data are derived from ground clutter. The reason for the increase in clutter is that the by-pass map was invoked whereas during the previous volume scan, clutter suppression was on everywhere.

The 88D velocity-azimuth display (VAD) is a good indicator of how raw data are used in the determination of the horizontal wind. The VAD taken at 13,000 ft from the 0017 UTC volume scan is shown in Fig. 4. Although there are few data points, what little data does exist fit very well to the sine curve. Thus, we have confidence that the 38 kt wind from 323 deg is valid.

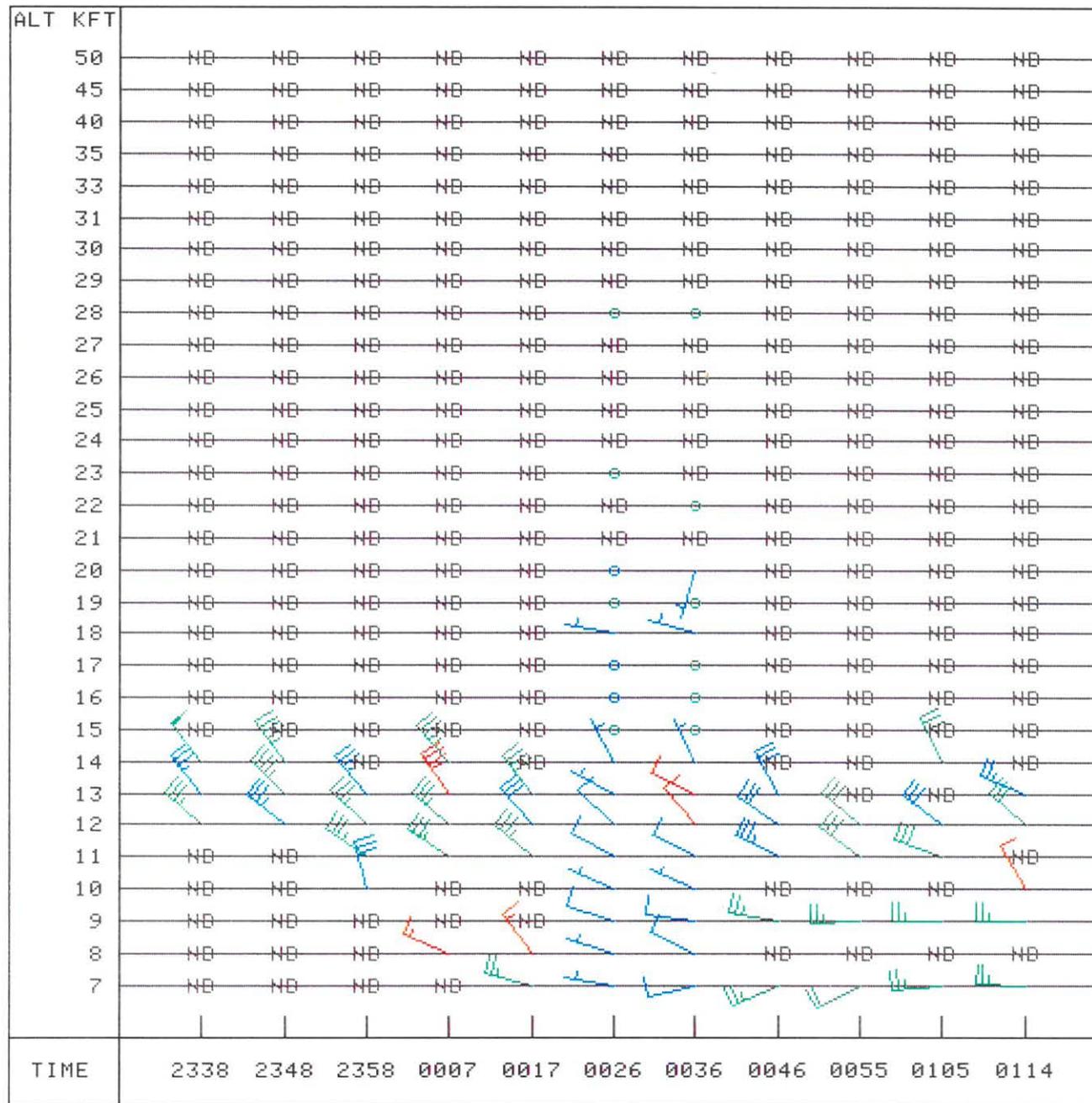
The 13,000 ft VAD at 0026 UTC is a different story (Fig. 5). With the by-pass map being used, the zero-velocity clutter data dominate the VAD: the wind speeds have dropped to 7 kt. In addition, there are fewer valid velocities having large values. This is caused when, within a range bin, sparse meteorological data are overwhelmed by the predominance of zero-velocity clutter data.

At 0046 UTC, clutter suppression was again turned on everywhere. The VAD (not shown), appeared much like the earlier VAD, with suppression everywhere, with no clustering of data about the zero line and a high wind speed (29 kt).

Conclusions

This TA demonstrates that excessive ground clutter can significantly degrade derived velocity products. This is particularly noticeable in the VWP product, but will also be true for other velocity products.

A cautious approach is suggested on the use of clutter suppression, since its overuse can also have adverse effects. In this case, degradation of the VWP winds might not have been as severe if more meteorological targets had been present. When velocity data are questionable, excess clutter should be considered as a possible cause.



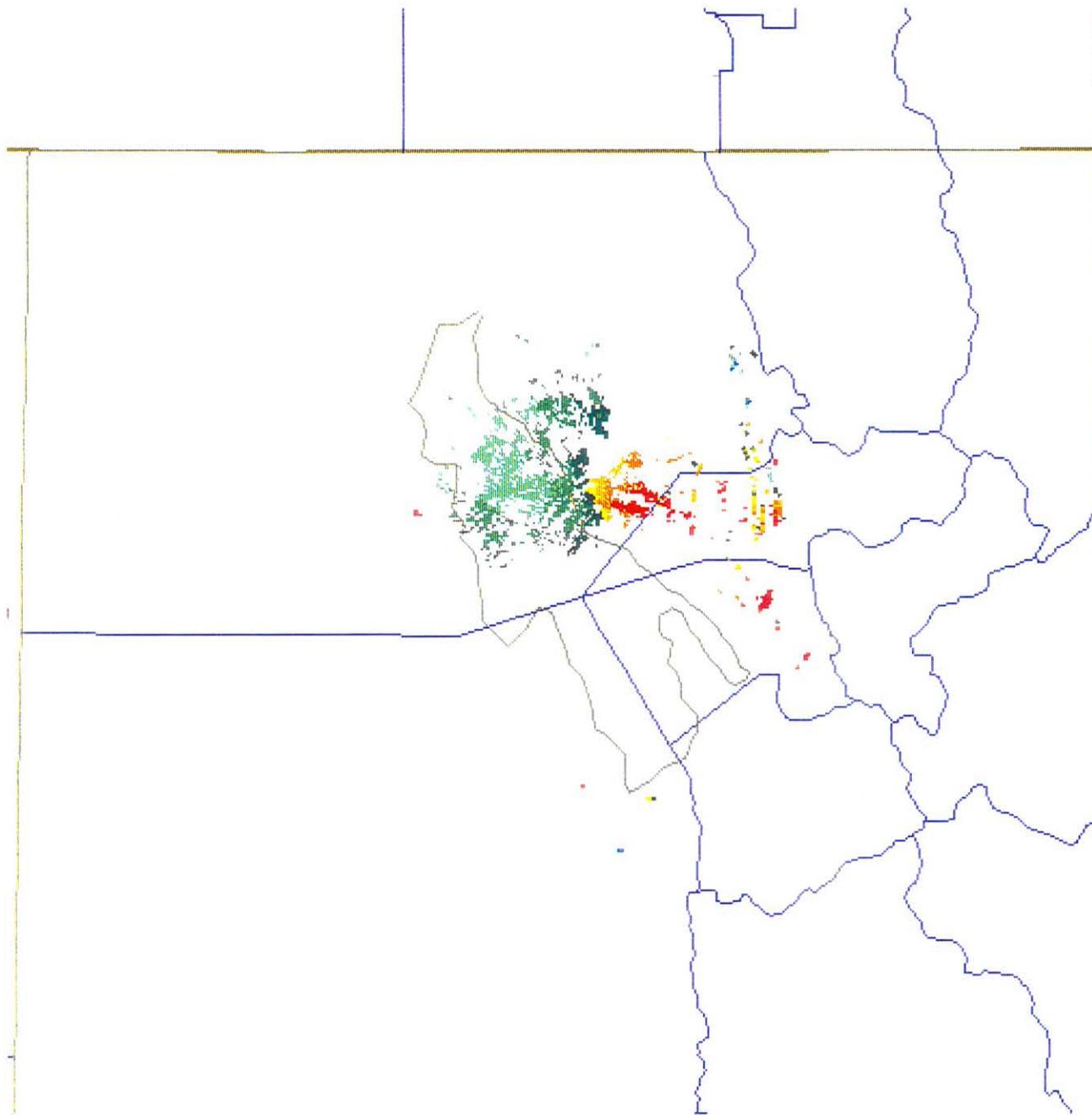
03/16/96 01:29
 VAD WIND PROFILE
 48 UWP
 03/16/96 01:14
 RDA:KMTX 41/15/46N
 6574 FT 112/26/49W
 MODE B / 32
 MAX=311 DEG 28 KT
 ALT: 12000 FT

0 KT RMS
 4
 8
 12
 16

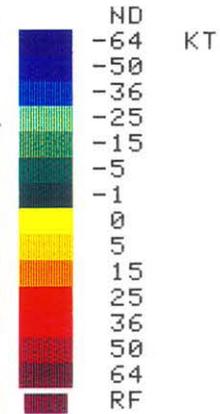
FL= 1 COM=1

A/R (RDA)
 015 VAD 0114 U
 PROD RCVD: SRM RPS
 KMTX 0124 0.5
 16/0128 PROD STAT=
 AVAILABLE
 HARDCOPY
 HARDCOPY REQUEST
 ACCEPTED

Fig. 1



03/16/96 00:59
 BASE VEL 27 U
 124 NM .54 NM RES
 03/16/96 00:17
 RDA:KMTX 41/15/46N
 6574 FT 112/26/49W
 ELEV= 2.5 DEG
 MODE B / 32
 CNTR 201DEG 14NM
 MAX= -42 KT 74 KT

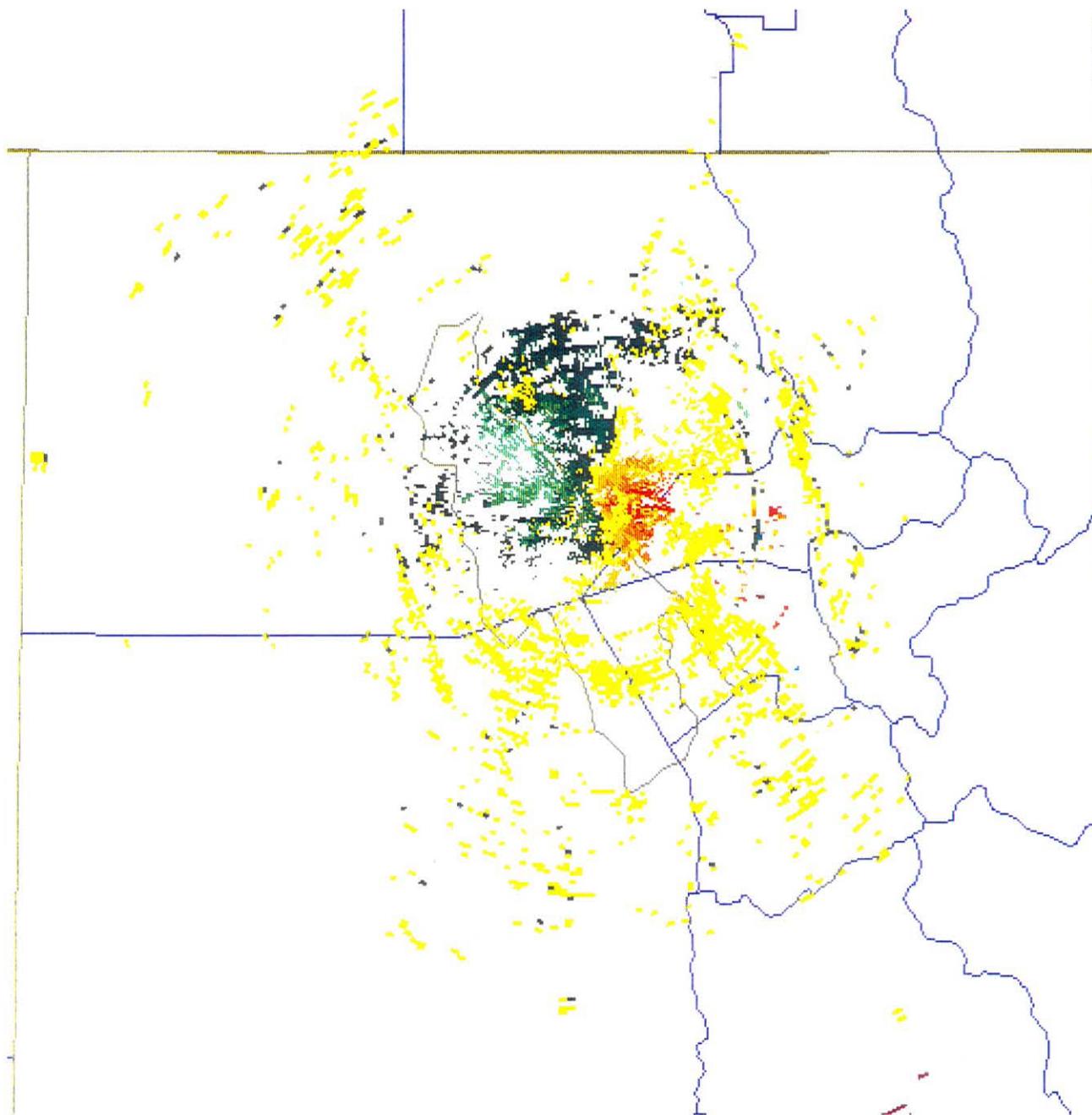


MAG=2X FL= 1 COM=1

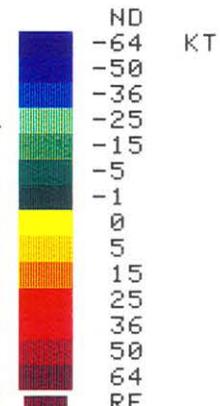
A/R (RDA) 201 DEG
 10386FT 14 NM
 Q15 VAD 0046 U
 PROD RCVD: SRM RPS
 KMTX 0055 0.5
 16/0052 *TIME OUT*
 CAN'T EDIT RCM
 HARDCOPY

HARDCOPY REQUEST
 ACCEPTED

Fig. 2



03/16/96 01:04
 BASE VEL 27 U
 124 NM .54 NM RES
 03/16/96 00:26
 RDA:KMTX 41/15/46N
 6574 FT 112/26/49W
 ELEV= 2.5 DEG
 MODE B / 32
 CNTR 201DEG 14NM
 MAX= -55 KT 83 KT

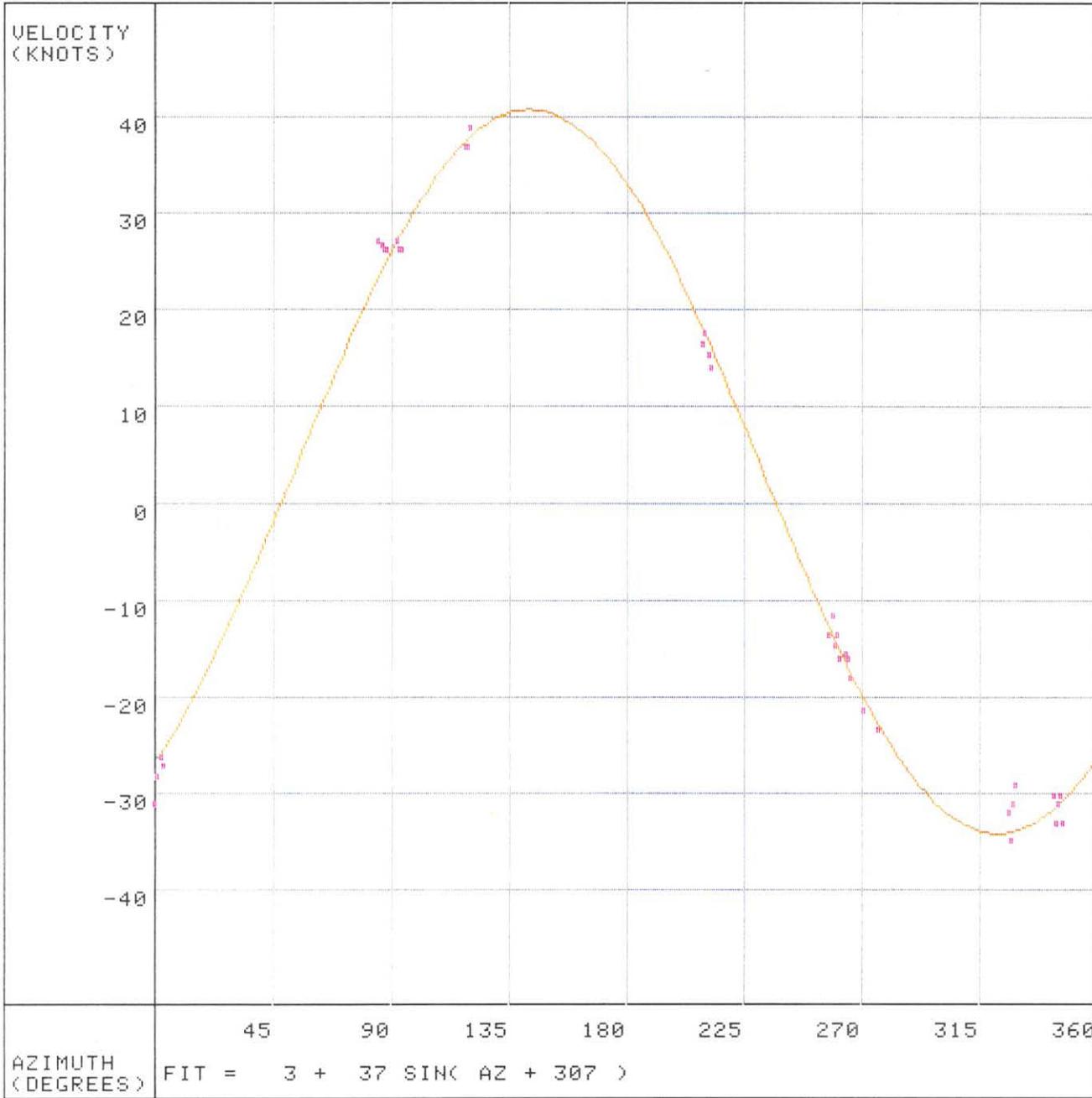


MAG=2X FL= 1 COM=1

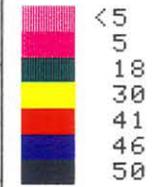
A/R (RDA) 239 DEG
 34826FT 86 NM
 Q15 R 0055 R
 PROD RCUV: SRM RPS
 KMTX 0055 2.5
 16/0052 *TIME OUT*
 CAN'T EDIT RCM
 HARDCOPY

HARDCOPY REQUEST
 ACCEPTED

Fig. 3



03/16/96 00:42
 VELOCITY AZIMUTH
 DISPLAY 84 UAD
 03/16/96 00:17
 RDA:KMTX 41/15/46N
 6574 FT 112/26/49W
 ALT= 13 KFT
 MODE B / 32
 RMS ERROR: 2 KT
 323 DEG 38 KT
 E= 3.5DEG SR= 17NM
 DBZ



FL= 1 COM=1

Q15 STI 0026 R
 PROD RCUD: SRM RPS
 KMTX 0036 1.5
 16/0027 DELTA SYS
 CAL = 0.50 DBZ
 HARDCOPY
 HARDCOPY REQUEST
 ACCEPTED

Fig. 4

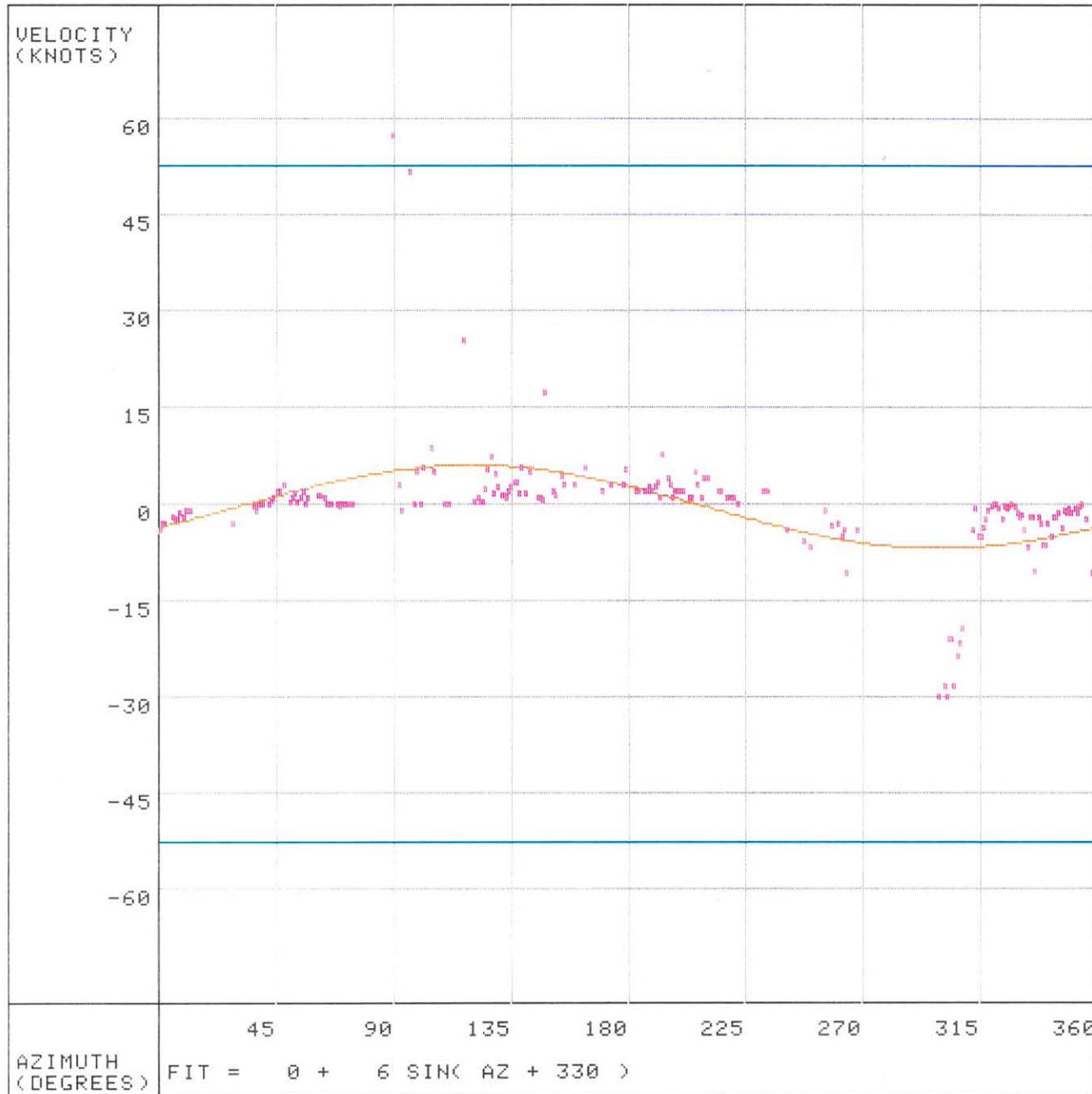


Fig. 5