AD-A164 160 SARSAT CANADIAN MISSION CONTROL CENTRE TCA TESTS AT 1215 MHZ RESOLUTE BAY 27-28 MAY 1984(U) DEFENCE RESEARCH ESTABLISHMENT OTTAWA (ONTARIO) W R MCPHERSON 1/1

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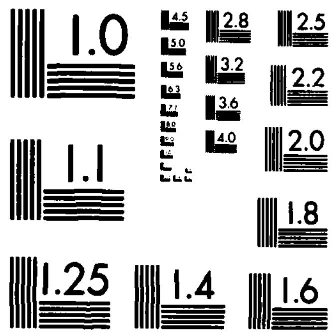
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# SARSAT
# CANADIAN MISSION CONTROL CENTRE
# TCA TESTS AT 121.5 MHz
# RESOLUTE BAY, 27-28 MAY 1984


by

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33X00

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## ABSTRACT

The Canadian SARSAT users initiated field trials to test the performance of the SARSAT ground station under the conditions of fringe coverage. The data generated as a result of these trials was analyzed and results are presented. It is concluded that SARSAT can function adequately under such conditions but that this performance can only be recognized by users, if they have better visibility into available signal processing quality indicators.

## RÉSUMÉ

Les usagers canadiens du système SARSAT ont mené des essais opérationnels afin d'évaluer la performance d'une station terrestre SARSAT dans des conditions de réception limitrophe. Les données recueillies à la suite de ces essais ont fait l'bjet d'une analyse et les résultats ont révélé que le système SARSAT peut fonctionner adéquatement dans des conditions de réception limitrophe. Il importe de signaler toutefois que seuls les usagers peuvent reconnaître cette performance s'ils sont sensibilisés davantage à la disponibilité des indicateurs de qualité en matière de traitement des signaux.

## 1.0 INTRODUCTION

The Canadian COSPAS-SARSAT users, and in particular the Officer-in-Charge of the Canadian Mission Control Centre (CMCC), were concerned about the performance of COSPAS-SARSAT under fringe coverage conditions. The particular condition of concern was the situation when the Time of Closest Approach (TCA) was either outside or near the edge of the ground tracking station's viewing window. In order to test the system under these conditions, the CMCC organized test activations of standard, commercially available Emergency Locator Beacons (ELTs) transmitting at 121.5 MHz through the Rescue Coordination Centre (RCC) Edmonton at a position on the periphery of the Ottawa SARSAT Local User Terminal (LUT) coverage. Tests were carried out at Resolute Bay (74.72N, 094.95W) on 27-28 May 84.

Evaluation personnel from the SARSAT Project Office at the Defence Research Establishment Ottawa, in analyzing the results of these tests, used the test data to illustrate developmental techniques which were being studied for the purposes of providing the Canadian COSPAS-SARSAT users with a more useful data package. It has been argued for some time that Canadian users are being provided too much extraneous data and at the same time they are being denied vital characterization data.

## 2.0 TEST/EVALUATION TECHNIQUE

Simply stated, the test conditions consisted of activating a commercially available ELT and leaving it on for the period in question. The test site was in northern extremes of Canada, a region of low ELT activity. Hence, the chance of interference from other ELT activity was considered low. Furthermore, Resolute Bay is at the extreme of Ottawa LUT coverage and therefore the test would generate evaluation data reflecting LUT performance under fringe conditions.

During the Demonstration and Evaluation phase of the SARSAT Project, all LUT data were routinely stored on magnetic tape and transferred to the SARSAT Evaluation Facility (SEF) where they were loaded onto a data base. These data were then available in a structured form for evaluation purposes.

As the evaluation of the data proceeded, it became evident that the Resolute Bay tests could provide a convenient mechanism to illustrate the potential that exists in LUT data to enhance user visibility into what might be occurring. This in turn would allow the Canadian user community to make better operational use of the COSPAS-SARSAT data.

This initial program of study led to a more indepth study which was subsequently carried out and documented elsewhere, see Ref. 1.

## 3.0 SUMMARY OF RESULTS

The summary results for the Resolute Bay tests are considered in terms of the data generated by the Ottawa LUT, the data passed to the CMCC, and the data the CMCC should have received (cluster analysis).

### 3.1 THE LUT DATA

Using the program LOCAT, see Ref. 2, the SEF data base was queried for all LUT generated ELT detections for the period 27-28 May 1984 within a radius of 250 km around the position 74.72N, 94.95W. The output from this query is illustrated in Tables 1(a) and 1(b). Note that the image data is not listed because the CMCC data was not integrated into the data base.

Table 1(a) identifies the pass, the estimated location of the ELT, the associated error and flag information (MCC Reference No., LUT event number, flag concerning whether CMCC was sent a message, and frequency band). Table 1(b) provides a subset of available LUT parameters which should be used to characterize the estimate.

Considering the total LUT data set, the following comments are made. The LUT provided 26 discrete detections on eight passes during the two day period. Three passes involved the SARSAT satellite and five passes used the COSPAS satellites. The location error ranged from a minimum of 4.46 km to a maximum of 232.45 km with a mean error of estimation being 49.1 km.

Referring to Table 1(b) and the PROB column, it should be noted that the LUT was totally unable to resolve ambiguity. On three occasions it chose the image location as the primary position, on five occasions it made the right choice, and on the remaining eighteen it gave equal weight to both locations.

# TABLE 1(a)

Located Data - Primary
Resolute Bay, 27-28 May 84

| | PRIMARY DATA | | | | | | PRIMARY | | SECONDARY | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DATE | SATPAS | MCCREF | EVENT | MESSNT | | ELTLAT | ELTLONG | ELTLAT | ELTLONG | DIFF | DLAT | DLONG |
| LOCATION LATITUDE - 74.7167 LONGITUDE - -94.9500 RADIUS - 250.0 | | | | | | | | | | | | | |
| 1) | 840527 | C1 09541 | 0 | 2 | 1 | 8 | 74.9518 | -95.0836 | | | 26.4580 | 26.1701 | -3.8616 |
| 2) | 840527 | C1 09541 | 0 | 3 | 0 | 8 | 74.6463 | -96.2523 | | | 39.0923 | -7.8373 | -38.3846 |
| 3) | 840527 | C1 09541 | 0 | 4 | 0 | 8 | 74.9656 | -94.9376 | | | 27.7099 | 27.7075 | .3578 |
| 4) | 840527 | C1 09542 | 0 | 2 | 1 | 8 | 74.7542 | -94.4638 | | | 14.8478 | 4.1741 | 14.2317 |
| 5) | 840527 | C1 09542 | 0 | 3 | 0 | 8 | 74.7822 | -94.5652 | | | 13.4203 | 7.2899 | 11.2437 |
| 6) | 840527 | C1 09542 | 0 | 4 | 0 | 8 | 74.7461 | -94.4667 | | | 14.5407 | 3.2709 | 14.1542 |
| 7) | 840527 | C1 09542 | 0 | 5 | 0 | 8 | 74.7706 | -94.4163 | | | 16.7447 | 5.9989 | 15.6056 |
| 8) | 840527 | C1 09542 | 0 | 9 | 1 | 8 | 74.6940 | -92.6233 | | | 68.3639 | -2.5273 | 68.3694 |
| 9) | 840527 | S1 06060 | 0 | 1 | 1 | 8 | 75.6398 | -91.0915 | | | 150.3389 | 102.7568 | 106.5271 |
| 10) | 840527 | S1 06060 | 0 | 2 | 1 | 8 | 75.1606 | -93.3897 | | | 66.9202 | 49.4130 | 44.4834 |
| 11) | 840528 | C1 09546 | 0 | 1 | 1 | 8 | 74.8885 | -94.7193 | | | 20.2740 | 19.1235 | 6.6949 |
| 12) | 840528 | C1 09546 | 0 | 2 | 0 | 8 | 74.8248 | -94.8406 | | | 12.4508 | 12.0328 | 3.1877 |
| 13) | 840528 | C1 09546 | 0 | 3 | 0 | 8 | 75.1318 | -94.1811 | | | 51.2909 | 46.2075 | 21.9622 |
| 14) | 840528 | C1 09546 | 0 | 4 | 1 | 8 | 73.0362 | -99.4200 | | | 232.4500 | -187.0699 | -145.1801 |
| 15) | 840528 | C1 09548 | 0 | 4 | 1 | 8 | 74.7566 | -94.9636 | | | 4.4597 | 4.4418 | -.3978 |
| 16) | 840528 | C1 09548 | 0 | 6 | 0 | 8 | 74.7521 | -95.3952 | | | 13.6309 | 3.9415 | -13.0338 |
| 17) | 840528 | C1 09548 | 0 | 7 | 1 | 8 | 74.6888 | -97.9787 | | | 88.9949 | -3.1067 | -89.0273 |
| 18) | 840528 | C2 05905 | 0 | 2 | 1 | 8 | 74.7669 | -95.0148 | | | 5.9021 | 5.5883 | -1.8954 |
| 19) | 840528 | C2 05905 | 0 | 4 | 0 | 8 | 74.7791 | -94.9304 | | | 6.9692 | 6.9463 | .5725 |
| 20) | 840528 | C2 05905 | 0 | 5 | 0 | 8 | 74.7718 | -94.9541 | | | 6.1348 | 6.1342 | -.1202 |
| 21) | 840528 | C2 05905 | 0 | 9 | 0 | 8 | 74.7895 | -94.9351 | | | 8.1157 | 8.1035 | .4349 |
| 22) | 840528 | C2 05905 | 0 | 14 | 0 | 8 | 74.8004 | -95.4854 | | | 18.2289 | 9.3169 | -15.6260 |
| 23) | 840528 | S1 06061 | 0 | 2 | 1 | 8 | 74.6997 | -95.3561 | | | 12.0718 | -1.8917 | -11.9287 |
| 24) | 840528 | S1 06061 | 0 | 3 | 1 | 8 | 74.6138 | -95.6764 | | | 24.2598 | -11.4549 | -21.4548 |
| 25) | 840528 | S1 06068 | 0 | 1 | 1 | 8 | 73.4009 | -100.1231 | | | 215.4372 | -146.4720 | -164.5065 |
| 26) | 840528 | S1 06068 | 0 | 4 | 1 | 8 | 74.0647 | -98.0401 | | | 117.5997 | -72.5798 | -94.4407 |

TABLE 1(b)

Located Data - Secondary
Resolute Bay, 27-28 May 84

| | CTA | SECOND PRIMARY POINTS | OUTPUT LOCATION SDEV | TREND | QUAL | PROB | NMWLS | TCA | QTIME | LOSTIM | BIAS | | CORR SCORE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1) | 9.2608 | 156 | 5.1351 | 1.6981 | 885 | 50 | 2 | 21.4012 | 21.1089 | 21.4072 | 14760. | 8224 | 8224 | 18688 |
| 2) | 9.6126 | 110 | 9.3293 | 1.1723 | 370 | 48 | 2 | 21.4000 | 21.1089 | 21.4072 | 15444. | 8224 | 8224 | 17408 |
| 3) | 9.2211 | 93 | 9.6695 | 3.3412 | 307 | 53 | 5 | 21.4013. | 21.1089 | 21.4072 | 14114. | 8224 | 8224 | 30208 |
| 4) | 2.2140 | 219 | 5.7240 | 0.8037 | 834 | 50 | 2 | 23.1591 | 22.9186 | 23.1669 | 16055. | 8224 | 8224 | 23552 |
| 5) | 2.2481 | 207 | 5.8571 | 2.0905 | 825 | 50 | 1 | 23.1592 | 22.9186 | 23.1669 | 14782. | 8224 | 8224 | 23040 |
| 6) | 2.2122 | 172 | 7.4350 | 1.5905 | 454 | 50 | 2 | 23.1591 | 22.9186 | 23.1669 | 16676. | 8224 | 8224 | 21248 |
| 7) | 2.2071 | 247 | 4.0835 | 1.5691 | 1681 | 50 | 1 | 23.1592 | 22.9186 | 23.1669 | 15427. | 8224 | 8224 | 22528 |
| 8) | 1.7326 | 81 | 17.1110 | 3.8180 | 221 | 50 | 3 | 23.1596 | 22.9186 | 23.1669 | 13517. | 8224 | 8224 | 21504 |
| 9) | 1.4313 | 158 | 4.1895 | 2.6638 | 919 | 50 | 3 | 22.7704 | 22.5311 | 22.7483 | 15368. | 8224 | 8224 | 30208 |
| 10) | 2.1819 | 124 | 7.8964 | 2.3829 | 417 | 50 | 4 | 22.7708 | 22.5311 | 22.7483 | 16004. | 8224 | 8224 | 27648 |
| 11) | -5.4045 | 161 | 6.6055 | 1.8263 | 582 | 50 | 2 | 6.2957 | 6.3161 | 6.5636 | 16669. | 8224 | 8224 | 16640 |
| 12) | -5.4752 | 195 | 5.0285 | 2.9826 | 1215 | 51 | 2 | 6.2958 | 6.3161 | 6.5636 | 16033. | 8224 | 8224 | 31744 |
| 13) | -5.1241 | 85 | 9.0237 | 1.5796 | 221 | 50 | 2 | 6.2956 | 6.3161 | 6.5636 | 17314. | 8224 | 8224 | 31744 |
| 14) | -7.6774 | 140 | 18.3580 | 15.4176 | 622 | 50 | 4 | 6.2954 | 6.3161 | 6.5636 | 15253. | 8224 | 8224 | 30720 |
| 15) | 6.3607 | 184 | 4.0238 | 2.0205 | 1158 | 48 | 2 | 9.8392 | 9.8600 | 10.0914 | 16033. | 8224 | 8224 | 16896 |
| 16) | 6.2464 | 160 | 6.2684 | 2.4491 | 575 | 50 | 2 | 9.8392 | 9.8600 | 10.0914 | 16674. | 8224 | 8224 | 30720 |
| 17) | 5.5585 | 97 | 15.2490 | 4.4972 | 260 | 50 | -5 | 9.8392 | 9.8600 | 10.0914 | 17336. | 8224 | 8224 | 31744 |
| 18) | 4.4181 | 219 | 5.5586 | 1.7694 | 801 | 50 | 2 | 4.2740 | 4.0097 | 4.2850 | 16514. | 8224 | 8224 | 24832 |
| 19) | 4.3981 | 201 | 5.6684 | 1.2093 | 740 | 51 | 2 | 4.2741 | 4.0097 | 4.2850 | 15228. | 8224 | 8224 | 22784 |
| 20) | 4.4030 | 233 | 3.2301 | 1.0319 | 1649 | 49 | 1 | 4.2740 | 4.0097 | 4.2850 | 15884. | 8224 | 8224 | 22528 |
| 21) | 4.4011 | 138 | 7.6104 | 1.9257 | 355 | 51 | 2 | 4.2741 | 4.0097 | 4.2850 | 17134. | 8224 | 8224 | 23808 |
| 22) | 4.5462 | 50 | 11.3864 | 1.4353 | 123 | 50 | 2 | 4.2740 | 4.0097 | 4.2850 | 13987. | 8224 | 8224 | 27136 |
| 23) | -2.4191 | 150 | 7.0575 | 5.6245 | 976 | 53 | -5 | 0.4406 | 0.1706 | 0.4258 | 15660. | 8224 | 8224 | 16896 |
| 24) | -2.3047 | 131 | 8.5459 | 2.2831 | 453 | 50 | 2 | 0.4404 | 0.1706 | 0.4258 | 16290. | 8224 | 8224 | 16640 |
| 25) | -16.3380 | 105 | 19.5473 | 11.0157 | 540 | 50 | 5 | 12.3967 | 12.4136 | 12.6597 | 15641. | 8224 | 8224 | 17408 |
| 26) | -15.5344 | 84 | 23.8881 | 8.8025 | 271 | 50 | 2 | 12.3948 | 12.4136 | 12.6597 | 16368. | 8224 | 8224 | 21504 |

## 3.2 THE CMCC DATA

The LUT has a sideband filter which reduces extraneous detections going to the CMCC. This filter is based on a distance criteria and is only available for the COSPAS satellites.

In the case of the Resolute Bay tests, 14 detections passed the LUT filter. The CMCC visibility into results indicated a location error ranging from a minimum of 4.4 km to a maximum of 232.5 km with a mean error of estimation being 74.9 km. This increase in error is due to good sideband estimates for COSPAS satellites being held at the LUT while the CMCC received bad sideband estimates for the SARSAT satellite.

Mean error estimates by satellite at each facility, i.e. LUT and CMCC, are summarized in Table 2.

TABLE 2

Mean Error of Location (Km)

| | Satellite | | |
|---|---|---|---|
| | COSPAS | SARSAT | BOTH |
| LUT | 34.5 | 97.8 | 49.1 |
| CMCC | 57.7 | 97.8 | 74.9 |

A number of items are apparent from the data in Table 2. Firstly, it is evident that COSPAS is performing better than SARSAT. This however is a known fact. Secondly, while it is necessary to have sideband filtering available, the CMCC without additional information is actually losing location resolution.

This now leads into a discussion concerning what data the CMCC should receive.

## 3.3 CLUSTER DATA

Table 3(a) and 3(b) contain the data which the CMCC should have received. It consists of nine detections. Table 3(a) would constitute the operational data while Table 3(b) contains the parameter information. It is suggested that Table 3(b) data while of necessity be available at the CMCC, they are only required on an exception basis.

TABLE 3(a)

Cluster Data - Primary
Resolute Bay, 27-28 May 84

Primary Data for the first element in each cluster

| PASS # | CL # | CL SIZE | # DET | SEQ # | DATE | SATPAS | EVENT | MESSG | FREQ | LAT | LONG | REGION | PROBS | PROBT | QP | CTA | TCA | Flags STD | TREND | FREQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 3 | 1 | 1 | 840527 | C1 09541 | 2 | 1 | 8 | 74.9518 | -95.0836 | | 50 | 46 | .5954 | 1 | 0 | 0 | 0 | 8 |
| | | | | | | | | | | 68.4582 | -39.4700 | | 50 | 54 | .5954 | | | 0 | 0 | |
| 2 | 1 | 2 | 1 | 4 | 840527 | S1 06060 | 1 | 1 | 8 | 75.6398 | -91.0915 | | 50 | 50 | .7678 | 0 | 1 | 0 | 0 | 8 |
| | | | | | | | | | | 77.3864 | -82.4490 | | 50 | 50 | .7678 | | | 0 | 0 | |
| 3 | 1 | 5 | 1 | 6 | 840527 | C1 09542 | 2 | 1 | 8 | 74.7542 | -94.4638 | | 50 | 59 | .8245 | 1 | 0 | 0 | 0 | 8 |
| | | | | | | | | | | 73.0106 | -80.9718 | | 50 | 41 | .8245 | | | 0 | 0 | |
| 4 | 1 | 2 | 1 | 11 | 840528 | S1 06061 | 2 | 1 | 8 | 74.6997 | -95.3561 | | 53 | 82 | .6806 | 1 | 0 | 0 | 1 | 8 |
| | | | | | | | | | | 71.5650 | -107.4454 | | 47 | 18 | .0590 | | | 0 | 2 | |
| 5 | 1 | 5 | 1 | 13 | 840528 | C2 05905 | 2 | 1 | 8 | 74.7669 | -95.0148 | | 50 | 51 | .8051 | 1 | 0 | 0 | 0 | 8 |
| | | | | | | | | | | 71.3938 | -68.1011 | | 50 | 49 | .8051 | | | 0 | 0 | |
| 6 | 1 | 3 | 1 | 18 | 840528 | C1 09546 | 1 | 1 | 8 | 74.8085 | -94.7193 | | 50 | 49 | .7696 | 1 | 1 | 0 | 0 | 8 |
| | | | | | | | | | | 81.2669 | -48.1382 | | 50 | 51 | .7696 | | | 0 | 0 | |
| | 2 | 1 | 4 | 21 | 840528 | C1 09546 | 4 | 1 | 8 | 73.0362 | -99.4200 | | 50 | 50 | .6711 | 1 | 1 | 1 | 2 | 8 |
| | | | | | | | | | | 81.4306 | -32.3261 | | 50 | 50 | .6711 | | | 1 | 2 | |
| 7 | 1 | 3 | 1 | 22 | 840528 | C1 09548 | 4 | 1 | 8 | 74.7566 | -94.9636 | | 48 | 48 | .8829 | 1 | 1 | 0 | 0 | 8 |
| | | | | | | | | | | 70.0103 | -133.5229 | | 52 | 52 | .8781 | | | 0 | 0 | |
| 8 | 1 | 2 | 1 | 25 | 840528 | S1 06068 | 1 | 1 | 8 | 73.4009 | -100.1231 | | 50 | 50 | .4857 | 1 | 1 | 2 | 2 | 8 |
| | | | | | | | | | | 59.7966 | -11.6798 | | 50 | 50 | .4857 | | | 2 | 2 | |

TABLE 3(b)

Cluster Data - Secondary
Resolute Bay, 27-28 May 84

Secondary Data for the first element in each cluster

| PASS # | # DET | SEQ # | CTA | BIAS | PTS | PPTS | STD | TREND | PROBS | PROBT | DP | TCA | AOS | DTCA | LOS | MAJOR | MINOR | DRIFT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 9.2608 | 14760. | 156 | 298 | 5.1351 | 1.6981 | 50 | 46 | -4 | 21.4012 | 21.1089 | 8.6 | 21.4072 | 8.932 | 2.206 | 0.0000 |
| | | | -8.6523 | 14796 | 156 | 298 | 5.0494 | 1.4582 | 50 | 54 | 4 | | 21.1089 | | 21.4072 | 8.069 | 2.003 | 0.0000 |
| 2 | 4 | 2 | 1.4313 | 15368. | 158 | 384 | 4.1895 | 2.6638 | 50 | 50 | 0 | 22.7704 | 22.5311 | 7.8 | 22.7403 | 50.368 | 1.966 | 0.0000 |
| | | | -1.2478 | 15376 | 158 | 384 | 4.2146 | 2.6998 | 50 | 50 | 0 | | 22.5311 | | 22.7483 | 51.070 | 1.956 | 0.0000 |
| 3 | 6 | 3 | 2.2140 | 16055. | 219 | 412 | 5.7240 | 0.8037 | 50 | 59 | 9 | 23.1591 | 22.9186 | 7.0 | 23.1669 | 13.671 | 1.192 | 0.0000 |
| | | | -1.9305 | 16065 | 219 | 412 | 5.6638 | 1.1352 | 50 | 41 | -9 | | 22.9186 | | 23.1669 | 13.211 | 1.160 | 0.0000 |
| 4 | 11 | 4 | -2.4191 | 15660. | 150 | 340 | 7.0575 | 5.6245 | 53 | 82 | 29 | 0.4406 | 0.1706 | 8.5 | 0.4258 | 33.546 | 2.375 | 0.0000 |
| | | | 2.2234 | 15591 | 13 | 29 | 8.0017 | 26.1090 | 47 | 18 | -29 | | 0.1706 | | 0.4258 | 9999.000 | 483.345 | 0.0000 |
| 5 | 13 | 5 | 4.4181 | 16514. | 219 | 403 | 5.5586 | 1.7694 | 50 | 51 | 1 | 4.2740 | 4.0097 | 7.6 | 4.2850 | 7.035 | 1.248 | 0.0000 |
| | | | -4.0661 | 16534 | 219 | 403 | 5.5992 | 1.8334 | 50 | 49 | -1 | | 4.0097 | | 4.2850 | 6.813 | 1.214 | 0.0000 |
| 6 | 18 | 6 | -5.4045 | 16669. | 161 | 385 | 6.6055 | 1.8263 | 50 | 49 | -1 | 6.2957 | 6.3161 | -8.6 | 6.5636 | 28.487 | 2.905 | 0.0000 |
| | | | 5.7234 | 16700 | 161 | 385 | 6.6047 | 1.7736 | 50 | 51 | 1 | | 6.3161 | | 6.5636 | 29.706 | 3.087 | 0.0000 |
| 6 | 21 | 7 | -7.6774 | 15253. | 140 | 336 | 18.3580 | 15.4176 | 50 | 50 | 0 | 6.2954 | 6.3161 | -8.7 | 6.5636 | 74.882 | 9.406 | 0.0000 |
| | | | 8.1123 | 15295 | 140 | 336 | 18.3776 | 15.4288 | 50 | 50 | 0 | | 6.3161 | | 6.5636 | 78.896 | 10.260 | 0.0000 |
| 7 | 22 | 8 | 6.3607 | 16033. | 184 | 441 | 4.0238 | 2.0205 | 48 | 48 | 0 | 9.8392 | 9.8600 | -8.2 | 10.0914 | 14.873 | 1.728 | 0.0000 |
| | | | -6.0325 | 16001 | 183 | 439 | 3.6791 | 1.8638 | 52 | 52 | 0 | | 9.8600 | | 10.0914 | 13.073 | 1.490 | 0.0000 |
| 8 | 25 | 9 | -16.3380 | 15641. | 105 | 243 | 19.5473 | 11.0157 | 50 | 50 | 0 | 12.3967 | 12.4136 | -8.4 | 12.6597 | 131.843 | 20.229 | 0.0000 |
| | | | 17.5297 | 15701 | 105 | 243 | 19.4970 | 10.9351 | 50 | 50 | 0 | | 12.4136 | | 12.6597 | 150.555 | 23.648 | 0.0000 |

The data are the result of merging sidebands within the pass according to a distance criteria (250 km) and an ELT bias check (3000 Hz). In addition, a quality factor which is an indicator of density of the Doppler curve correcting for the amount of the curve seen by the LUT is provided. Finally, three types of flag information are provided. The first gives an indication of the goodness of the geometry, i.e. the Cross Track Angle (CTA) at TCA, and the TCA flags, the second type describes the structure of the Doppler curve, i.e. Standard Deviation (STD) and Trend, and the third resolves dual frequency beacons (SARSAT only).

The flag definitions used were as follows:

| | | |
|---|---|---|
| CTA Flag: | 0 | $CTA < 2^\circ$ |
| | 1 | $2^\circ \leq CTA < 18^\circ$ |
| | 2 | $CTA \geq 18^\circ$ |
| TCA Flag: | 0 | unless $TCA < (AOS - 60 \text{ seconds})$ or $TCA > (LOS + 60 \text{ seconds})$ |
| STD Flag: | 0 | $0 \leq STD < 9$ |
| | 1 | $9 \leq STD < 19$ |
| | 2 | $19 \leq STD < 28$ |
| | 3 | $STD \geq 28$ |
| TREND Flag: | 0 | $0 \leq TREND < 5$ |
| | 1 | $5 \leq TREND < 10$ |
| | 3 | $TREND \geq 10$ |
| FREQ Flag: | 121.5 MHz | 8 |
| | 243 MHz | 16 |
| | 121.5/243 MHz | 24 |

The data given in Table 3 are summarized in Table 4 to illustrate how operationally, merged data could be actioned.

TABLE 4

RESOLUTE BAY
MERGE SUMMARY

| PASS | SAT PASS | ERROR (KM) | CLUSTER SIZE | QUALITY | FLAGS | | | | CATEGORY |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CTA | TCA | STD | TREND | |
| 1 | C1 9541 | 26.5 | 3 | 0.60 | 1 | 0 | 0 | 0 | GOOD |
| 2 | S1 6060 | 150.4 | 2 | 0.77 | 0 | 1 | 0 | 0 | POOR |
| 3 | C1 9542 | 14.8 | 5 | 0.82 | 1 | 0 | 0 | 0 | EXCELLENT |
| 4 | S1 6061 | 12.1 | 2 | 0.68 | 1 | 0 | 0 | 1 | GOOD |
| 5 | C1 5905 | 5.9 | 5 | 0.81 | 1 | 0 | 0 | 0 | EXCELLENT |
| 6 | C1 9546 | 20.3 | 3 | 0.77 | 1 | 1 | 0 | 0 | GOOD |
| | C1 9546 | 232.5 | 1 | 0.67 | 1 | 1 | 1 | 2 | BAD |
| 7 | C1 9548 | 4.5 | 3 | 0.88 | 1 | 1 | 0 | 0 | EXCELLENT |
| 8 | S1 6068 | 215.4 | 2 | 0.49 | 1 | 1 | 2 | 2 | BAD |

## 3.4 DATA CATEGORIZATION

Subsequent work at DREO developed additional approaches to analytically categorize LUT generated alerts based upon a parameter set as illustrated in Table 3, See Ref. 1. For the purpose of analyzing the Resolute Bay tests, an intuitative categorization was made and is given in Table 4. Given that the CMCC has the data from Table 3 available, it could categorize the LUT alerts along the approaches now described.

On Pass 1, the cluster size was 3, indicative of a carrier plus 2 sidebands, hence a reasonable functioning ELT. The quality indicator was acceptable but not spectacular. Geometry and data quality flags were all okey. Hence, not a spectacular detection, but a solid good detection.

Pass 2 suffered a number of shortcomings. Firstly, the cluster size is small. Clusters of size 1 or 2 appear to be "orphan activities". Secondly, geometry is bad. However, for what curve is available, the data is solid. Hence, it is not a bad detection, but it is obviously a poor one.

Pass 3 seems to have everything going for it. It is simply classified excellent.

Pass 4 has a few problems. The cluster size is down, and there is some question about data quality, i.e. the Trend flag is on and the Quality factor is low. However, geometry is good. On this subjective basis it is classified good.

Pass 5 like pass 3 requires no discussion. It is judged excellent.

Pass 6 provided two estimates. The second estimate is an obvious sideband. One geometry and two data quality flags are indicating poor results. Furthermore the single element cluster suggests a sideband that missed the cluster filter. It is judged bad data. The first estimate in Pass 6 is obviously the primary location. However, the TCA flag is on and therefore the data is categorized as good.

Pass 7 is a problem to classify. Cluster size is reasonable (a cluster size of 2 seems to be a threshold), the TCA flag is on but quality is very high. The classification is somewhere between good and excellent, and excellent was aribitarily chosen.

Pass 8 requires no discussion. It is obviously a bad estimate.

## 4.0 DISCUSSION

It is apparent from the foregoing analysis that the Ottawa LUT, even under conditions of fringe coverage, can produce good results. The problem is that the operational personnel at the CMCC are not able to distinguish good data from bad data because they do not have sufficient visibility into the total LUT parameter set.

Volume is the biggest problem faced by the Canadian COSPAS-SARSAT user. While the Resolute Bay tests provide a very restricted sample from which to extrapolate cluster merging effects on data volume, the following comments are made. The LUT started out with 26 detections, the sideband filter reduced the data to 9 detections. Furthermore, with ancilliary data provided by the cluster analysis, 3 poor or bad alerts were easily recognized. Therefore of the 26 LUT detections, 20 can be screened out as either not being operationally useful data (the 17 detections filtered out by the cluster analysis) or data of such dubious quality that, in isolation, immediate operational action should not be taken (the 3 latter detections). This filtering could imply a 77% reduction in data volume from LUT to the actioning CMCC operator with no loss in operational effectiveness. In fact, with increased visibility into data quality, operational effectiveness is enhanced.

Table 5 expands on Table 2 to illustrate enhanced confidence in location estimation following a cluster analysis.

TABLE 5

MEAN ERROR OF LOCATION (Km)

| | Satellite | | |
|---|---|---|---|
| | COSPAS | SARSAT | ALL |
| LUT | 34.5 | 97.8 | 49.1 |
| CMCC | | | |
| . Current Filter | 57.7 | 97.8 | 74.9 |
| . Cluster Filter | | | |
| Excellent/Good Data | 14.4 | 12.1 | 14.0 |
| Poor/Bad Data | 182.9 | 232.5 | 199.4 |

The implication in quoting enhanced confidence, as illustrated in Table 5, is that CMCC operators must have facilities to recognize good and bad data. The analysis of the Resolute Bay tests demonstrate that facilities do exist within the current LUT data set.

The discussion so far has concentrated on having a historical perspective on a known beacon activation during a know time period. This is not the normal operational environment at the CMCC. In order to illustrate clustering capabilities on a pass-by-pass basis, one particular pass, C1 09542, 27 May 84 is considered.

Table 6 illustrates a minimum data set that could be sent by the LUT to the CMCC for operational processing. Data packing in the example given could consist of twelve records, a header record and eleven data records.

As a result of the cluster analysis four data displays are generated. These include:

Operational Data Set (Primary Data)
Operational Data Set (Secondary Data) - Parameter
Cluster Data Set (Primary Data)
Cluster Data Set (Secondary Data) - Parameter

TABLE 6

Sample Transfer Data Set
LUT to CMCC

SAT Pass: C1 09542    AOS: 22.9186
Time: 840527    LOS: 23.1669

| | | | Primary | | Secondary | |
|---|---|---|---|---|---|---|
| Seq. No. | LUT Seq. | Freq. | ELTLAT | ELTLONG | ELTLAT | ELTLONG |
| 1) | 1 | 8 | 44.7677 | -118.5648 | 42.5169 | - 89.2099 |
| 2) | 2 | 8 | 73.0106 | - 80.9718 | 74.7542 | - 94.4638 |
| 3) | 3 | 8 | 74.7822 | - 94.5652 | 73.0116 | - 80.8571 |
| 4) | 4 | 8 | 73.0061 | - 80.9967 | 74.7461 | - 94.4667 |
| 5) | 5 | 8 | 73.0305 | - 80.9567 | 74.7706 | - 94.4163 |
| 6) | 6 | 8 | 36.0704 | - 94.3136 | 37.3911 | -113.5813 |
| 7) | 7 | 8 | 36.0615 | - 95.3960 | 37.3662 | -113.4967 |
| 8) | 8 | 8 | 25.7772 | -100.8325 | 26.3154 | -109.0557 |
| 9) | 9 | 8 | 73.3308 | - 82.1293 | 74.6940 | - 92.6233 |
| 10) | 10 | 8 | 44.6901 | -118.1331 | 42.5145 | - 89.5930 |
| 11) | 11 | 8 | 42.4615 | -125.6715 | 39.6361 | - 83.2387 |

Parameters - Primary Location

| | CTA | POINTS | SDEV | TREND | NMWLS | TCA | BIAS |
|---|---|---|---|---|---|---|---|
| 1) | 11.0759 | 314 | 10.6123 | 2.2657 | 2 | 23.0099 | 14589. |
| 2) | -1.9305 | 219 | 5.6638 | 1.1352 | 2 | 23.1589 | 16065. |
| 3) | 2.2481 | 207 | 5.8571 | 2.0905 | 1 | 23.1592 | 14782. |
| 4) | -1.9266 | 172 | 7.3423 | 1.9567 | 2 | 23.1589 | 16686. |
| 5) | -1.9240 | 247 | 4.0283 | 1.4274 | 1 | 22.9734 | 15437. |
| 6) | -7.1370 | 108 | 17.1609 | 8.9501 | 2 | 22.9734 | 8252. |
| 7) | -7.0730 | 100 | 16.3438 | 8.7486 | 3 | 22.9733 | 7626. |
| 8) | -3.9139 | 117 | 24.7359 | 10.7925 | -5 | 22.9196 | 12834. |
| 9) | -1.4769 | 81 | 17.0974 | 3.7443 | 3 | 23.1595 | 13525. |
| 10) | 10.7741 | 96 | 20.7957 | 3.1007 | 4 | 23.0094 | 14208. |
| 11) | 16.4584 | 136 | 15.2269 | 5.7642 | 3 | 23.0015 | 11845. |

Parameters - Secondary Location

| | CTA | POINTS | SDEV | TREND | NMWLS | TCA | BIAS |
|---|---|---|---|---|---|---|---|
| 1) | -10.2371 | 318 | 11.9351 | 5.6294 | 2 | 23.0105 | 14568. |
| 2) | 2.2140 | 219 | 5.7240 | 0.8037 | 2 | 23.1591 | 16055. |
| 3) | -1.9590 | 207 | 5.9432 | 2.3200 | 1 | 23.1590 | 14793. |
| 4) | 2.2122 | 172 | 7.4350 | 1.5905 | 2 | 23.1591 | 16676. |
| 5) | 2.2071 | 247 | 4.0835 | 1.5691 | 1 | 23.1592 | 15427. |
| 6) | 7.5750 | 107 | 17.6056 | 9.8031 | 3 | 22.9732 | 8262. |
| 7) | 7.5077 | 100 | 16.7639 | 9.1539 | 3 | 22.9731 | 7636. |
| 8) | 3.5019 | 118 | 25.6544 | 8.6011 | 3 | 22.9195 | 12862. |
| 9) | 1.7326 | 81 | 17.1110 | 3.8180 | 3 | 23.1596 | 13517. |
| 10) | -9.9660 | 96 | 21.6035 | 6.1796 | 3 | 23.0101 | 14187. |
| 11) | -15.4231 | 135 | 16.6356 | 6.4050 | 2 | 23.0038 | 11781. |

These data are illustrated in Table 7(a)-(d). Note that in the secondary data set, a number of LUT parameters not given in Table 6, are provided. The utility of these parameters, i.e. Major, Minor and Drift are still being investigated. It should also be noted that Table 7 data are not considered as operational displays. However, they do include all the data required for CMCC operator action.

Referring now to Table 7(a), the following operator actions are envisaged. Clusters 3, 4 and 5 require no immediate action. In the absence of external (or previous pass data), the information provided is too ambiguous to do anything with. Data quality is low, and cluster sizes are small. It is even suggested that such data be surpressed from the CMCC operator as "orphan alerts" until such time as additional pass data is correlated to it. Clusters 1 and 2 requires attention. Cluster 1 is good data although the cluster size is small. However this negative factor is counter-balanced by the high quality of the data and the apparent image resolute capability, amplified by the PROB factor calculated using Trend. Cluster 2 requires no discussion. It is the beacon in Resolute Bay.

Tables 7(c) and (d) are the detailed cluster data which provide the additional information on the structure of the cluster. These data are only required on a exception basis.

## 5.0 SUMMARY COMMENTS

The CMCC tests at Resolute Bay have been analyzed and the results presented. It has been demonstrated that the LUT can operate very well under the conditions of fringe coverage given that one has sufficient visibility into LUT available parameters to interpret the data.

Furthermore, the potential capability of CMCC operators to quickly and effectively action COSPAS-SARSAT data, assuming they are given the right data set, has been illustrated.

Statistical studies were initiated to develop supporting evidence for the methodologies outline (see Ref. 1). It was important to establish cluster analysis threshold parameters, e.g. distance and bias criteria. The utility of Trend as a ambiguity resolver versus Standard Deviation has to be demonstrated. The new quality factor, while looking very promising, must be validated. The size of the cluster seems to be a strong indicator of how CMCC operators should respond to COSPAS-SARSAT data. Finally, the specific data required at the CMCC from the LUT has to be specified.

TABLE 7(a)

Operational Data
Primary Data Set

| PASS # | CL # | CL SIZE | # DET | SEQ # | DATE | SATPAS | EVENT | MESSG | FREQ | LAT | LONG | REGION | PROBS | PROBT | QP | CTA | TCA | Flags STD | TREND | FREQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 1 | 1 | 840527 | C1 09542 | 1 | 1 | 8 | 44.7677 | -118.5648 | | 53 | 71 | .7258 | 1 | 0 | 1 | 0 | 8 |
| | | | | | | | | | | 42.5169 | -89.2099 | | 47 | 29 | .7351 | | | 1 | 1 | |
| | 2 | 5 | 3 | 3 | 840527 | C1 09542 | 2 | 1 | 8 | 73.0106 | -80.9718 | | 50 | 41 | .8233 | 1 | 0 | 0 | 0 | 8 |
| | | | | | | | | | | 74.7542 | -94.4638 | | 50 | 59 | .8233 | | | 0 | 0 | |
| | 3 | 2 | 8 | 8 | 840527 | C1 09542 | 6 | 1 | 8 | 36.0704 | -95.3136 | | 51 | 52 | .3003 | 1 | 0 | 1 | 1 | 8 |
| | | | | | | | | | | 37.3911 | -113.5813 | | 49 | 48 | .2976 | | | 1 | 1 | |
| | 4 | 1 | 10 | 10 | 840527 | C1 09542 | 8 | 1 | 8 | 25.7772 | -100.8325 | | 51 | 44 | .4643 | 1 | 0 | 2 | 2 | 8 |
| | | | | | | | | | | 26.3154 | -109.0557 | | 49 | 56 | .4683 | | | 2 | 1 | |
| | 5 | 1 | 11 | 11 | 840527 | C1 09542 | 11 | 1 | 8 | 42.4615 | -125.6715 | | 52 | 53 | .3271 | 1 | 0 | 1 | 1 | 8 |
| | | | | | | | | | | 39.6361 | -83.2387 | | 48 | 47 | .3247 | | | 1 | 1 | |

## TABLE 7(b)

### Operational Data
### Secondary Data Set

Secondary Data for the first element in each cluster

| PASS # | # DET | SEQ # | CTA | BIAS | PTS | PPTS | STD | TREND | PROBS | PROBT | DP | TCA | AOS | DTCA | LOS | MAJOR | MINOR | DRIFT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 11.0759 | 14589. | 314 | 363 | 10.6123 | 2.2657 | 53 | 71 | 18 | 23.0099 | 22.9186 | -2.0 | 23.1669 | 4.207 | 3.581 | 0.0000 |
| | | | -10.2371 | 14568 | 318 | 368 | 11.9351 | 5.6294 | 47 | 29 | -18 | | 22.9186 | | 23.1669 | 4.353 | 3.648 | 0.0000 |
| 1 | 3 | 2 | -1.9305 | 16065. | 219 | 412 | 5.6638 | 1.1352 | 50 | 41 | -9 | 23.1589 | 22.9186 | 7.0 | 23.1669 | 13.211 | 1.160 | 0.0000 |
| | | | 2.2140 | 16055 | 219 | 412 | 5.7240 | 0.8037 | 50 | 59 | 9 | | 22.9186 | | 23.1669 | 13.671 | 1.192 | 0.0000 |
| i | 8 | 3 | -7.1370 | 8252. | 108 | 150 | 17.1609 | 8.9501 | 51 | 52 | 1 | 22.9734 | 22.9186 | -4.2 | 23.1669 | 10.987 | 10.187 | 0.0000 |
| | | | 7.5750 | 8262 | 107 | 149 | 17.6056 | 9.8031 | 49 | 48 | -1 | | 22.9186 | | 23.1669 | 12.323 | 11.011 | 0.0000 |
| 1 | 10 | 4 | -3.9139 | 12834. | 117 | 232 | 24.7359 | 10.7925 | 51 | 44 | -7 | 22.9196 | 22.9186 | -7.4 | 23.1669 | 64.931 | 7.857 | 0.0000 |
| | | | 3.5019 | 12862 | 118 | 234 | 25.6544 | 8.6011 | 49 | 56 | 7 | | 22.9186 | | 23.1669 | 66.920 | 7.908 | 0.0000 |
| 1 | 11 | 5 | 16.4584 | 11845. | 136 | 164 | 15.2269 | 5.7642 | 52 | 53 | 1 | 23.0015 | 22.9186 | -2.5 | 23.1669 | 16.414 | 9.360 | 0.0000 |
| | | | -15.4231 | 11781 | 135 | 162 | 16.6356 | 6.4050 | 48 | 47 | -1 | | 22.9186 | | 23.1669 | 17.374 | 9.058 | 0.0000 |

TABLE 7(c)

Cluster Data
Primary Data Set

| | | Primary Data | | | | | | | | | | | | | | | | Flags | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PASS # | CL # | CL SIZE | # DET | SEQ # | DATE | SATPAS | EVENT | MESSG | FREQ | LAT | LONG | REGION | PROBS | PROBT | QP | CTA | TCA | STD | TREND | FREQ |
| 1 | 1 | 2 | 1 | 1 | 840527 | C1 09542 | 1 | 1 | 8 | 44.7677 | -118.5648 | | 53 | 71 | .7258 | 1 | 0 | 1 | 0 | 8 |
| | | | | | | | | | | 42.5169 | -89.2099 | | 47 | 29 | .7351 | | | 1 | 1 | |
| | | | 2 | 2 | 840527 | C1 09542 | 10 | 0 | 8 | 44.6901 | -118.1331 | | 51 | 67 | .2224 | 1 | 0 | 2 | 0 | |
| | | | | | | | | | | 42.5145 | -89.5930 | | 49 | 33 | .2224 | | | 2 | 1 | |
| 1 | 2 | 5 | 3 | 3 | 840527 | C1 09542 | 2 | 1 | 8 | 73.0106 | -80.9718 | | 50 | 41 | .8233 | 1 | 0 | 0 | 0 | 8 |
| | | | | | | | | | | 74.7542 | -94.4638 | | 50 | 59 | .8233 | | | 0 | 0 | |
| | | | 4 | 4 | 840527 | C1 09542 | 3 | 0 | 8 | 74.7822 | -94.5652 | | 50 | 53 | .7799 | 1 | 0 | 0 | 0 | |
| | | | | | | | | | | 73.0116 | -80.8571 | | 50 | 47 | .7799 | | | 0 | 0 | |
| | | | 5 | 5 | 840527 | C1 09542 | 4 | 0 | 8 | 73.0061 | -80.9967 | | 50 | 45 | .6466 | 1 | 0 | 0 | 0 | |
| | | | | | | | | | | 74.7461 | -94.4667 | | 50 | 55 | .6466 | | | 0 | 0 | |
| | | | 6 | 6 | 840527 | C1 09542 | 5 | 0 | 8 | 73.0305 | -80.9562 | | 50 | 52 | .9293 | 1 | 0 | 0 | 0 | |
| | | | | | | | | | | 74.7706 | -94.4163 | | 50 | 48 | .9293 | | | 0 | 0 | |
| | | | 7 | 7 | 840527 | C1 09542 | 9 | 1 | 8 | 73.3308 | -82.1293 | | 50 | 50 | .3059 | 0 | 0 | 1 | 0 | |
| | | | | | | | | | | 74.6940 | -92.6233 | | 50 | 50 | .3059 | | | 1 | 0 | |
| 1 | 3 | 2 | 8 | 8 | 840527 | C1 09542 | 6 | 1 | 8 | 36.0704 | -95.3136 | | 51 | 52 | .3003 | 1 | 0 | 1 | 1 | 8 |
| | | | | | | | | | | 37.3911 | -113.5813 | | 49 | 48 | .2976 | | | 1 | 1 | |
| | | | 9 | 9 | 840527 | C1 09542 | 7 | 0 | 8 | 36.0615 | -95.3960 | | 51 | 51 | .2782 | 1 | 0 | 1 | 1 | |
| | | | | | | | | | | 37.3662 | -113.4967 | | 49 | 49 | .2782 | | | 1 | 1 | |
| 1 | 4 | 1 | 10 | 10 | 840527 | C1 09542 | 8 | 1 | 8 | 25.7772 | -100.8325 | | 51 | 44 | .4643 | 1 | 0 | 2 | 2 | 8 |
| | | | | | | | | | | 26.3154 | -109.0557 | | 49 | 56 | .4683 | | | 2 | 1 | |
| 1 | 5 | 1 | 11 | 11 | 840527 | C1 09542 | 11 | 1 | 8 | 42.4615 | -125.6715 | | 52 | 53 | .3271 | 1 | 0 | 1 | 1 | 8 |
| | | | | | | | | | | 39.6361 | -83.2387 | | 48 | 47 | .3247 | | | 1 | 1 | |

# TABLE 7(d)

## Cluster Data
## Secondary Data Set

| PASS # | # DET | SEQ # | CTA | BIAS | Secondary Data PTS | PPTS | STD | TREND | PROBS | PROBT | DP | TCA | AOS | DTCA | LOS | MAJOR | MINOR | DRIFT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 11.0759 | 14589. | 314 | 363 | 10.6123 | 2.2657 | 53 | 71 | 18 | 23.0099 | 22.9186 | -2.0 | 23.1669 | 4.207 | 3.581 | 0.0000 |
| | | | -10.2371 | 14568 | 318 | 368 | 11.9351 | 5.6294 | 47 | 29 | -18 | | 22.9186 | | 23.1669 | 4.353 | 3.648 | 0.0000 |
| 1 | 2 | 2 | 10.7741 | 14208. | 96 | 111 | 20.7957 | 3.1007 | 51 | 67 | 16 | 23.0094 | 22.9186 | -2.0 | 23.1669 | 15.195 | 13.094 | 0.0000 |
| | | | -9.9660 | 14187 | 96 | 111 | 21.6035 | 6.1796 | 49 | 33 | -16 | | 22.9186 | | 23.1669 | 14.659 | 12.375 | 0.0000 |
| 1 | 3 | 3 | -1.9305 | 16065. | 219 | 412 | 5.6638 | 1.1352 | 50 | 41 | -9 | 23.1589 | 22.9186 | 7.0 | 23.1669 | 13.211 | 1.160 | 0.0000 |
| | | | 2.2140 | 16055 | 219 | 412 | 5.7240 | 0.8037 | 50 | 59 | 9 | | 22.9186 | | 23.1669 | 13.671 | 1.192 | 0.0000 |
| 1 | 4 | 4 | 2.2481 | 14782. | 207 | 390 | 5.8571 | 2.0905 | 50 | 53 | 3 | 23.1592 | 22.9186 | 7.0 | 23.1669 | 14.142 | 1.260 | 0.0000 |
| | | | -1.9590 | 14793 | 207 | 390 | 5.9432 | 2.3200 | 50 | 47 | -3 | | 22.9186 | | 23.1669 | 14.045 | 1.256 | 0.0000 |
| 1 | 5 | 5 | -1.9266 | 16686. | 172 | 323 | 7.3423 | 1.9567 | 50 | 45 | -5 | 23.1589 | 22.9186 | 7.0 | 23.1669 | 18.553 | 1.673 | 0.0000 |
| | | | 2.2122 | 16676 | 172 | 323 | 7.4350 | 1.5905 | 50 | 55 | 5 | | 22.9186 | | 23.1669 | 19.275 | 1.722 | 0.0000 |
| 1 | 6 | 6 | -1.9240 | 15437. | 247 | 465 | 4.0283 | 1.4274 | 50 | 52 | 2 | 23.1590 | 22.9186 | 7.0 | 23.1669 | 8.941 | 0.777 | 0.0000 |
| | | | 2.2071 | 15427 | 247 | 465 | 4.0835 | 1.5691 | 50 | 48 | -2 | | 22.9186 | | 23.1669 | 9.266 | 0.802 | 0.0000 |
| 1 | 7 | 7 | -1.4769 | 13525. | 81 | 153 | 17.0974 | 3.7443 | 50 | 50 | 0 | 23.1595 | 22.9186 | 7.0 | 23.1669 | 99.591 | 5.940 | 0.0000 |
| | | | 1.7326 | 13517 | 81 | 153 | 17.1110 | 3.8180 | 50 | 50 | 0 | | 22.9186 | | 23.1669 | 101.923 | 6.028 | 0.0000 |
| 1 | 8 | 8 | -7.1370 | 8252. | 108 | 150 | 17.1609 | 8.9501 | 51 | 52 | 1 | 22.9734 | 22.9186 | -4.2 | 23.1669 | 10.987 | 10.187 | 0.0000 |
| | | | 7.5750 | 8262 | 107 | 149 | 17.6056 | 9.8031 | 49 | 48 | -1 | | 22.9186 | | 23.1669 | 12.323 | 11.011 | 0.0000 |
| 1 | 9 | 9 | -7.0730 | 7626. | 100 | 139 | 16.3438 | 8.7486 | 51 | 51 | 0 | 22.9733 | 22.9186 | -4.2 | 23.1669 | 12.571 | 10.147 | 0.0000 |
| | | | 7.5077 | 7636 | 100 | 139 | 16.7639 | 9.1539 | 49 | 49 | 0 | | 22.9186 | | 23.1669 | 13.676 | 10.875 | 0.0000 |
| 1 | 10 | 10 | -3.9139 | 12834. | 117 | 232 | 24.7359 | 10.7925 | 51 | 44 | -7 | 22.9196 | 22.9186 | -7.4 | 23.1669 | 64.931 | 7.857 | 0.0000 |
| | | | 3.5019 | 12862 | 118 | 234 | 25.6544 | 8.6011 | 49 | 56 | 7 | | 22.9186 | | 23.1669 | 66.920 | 7.908 | 0.0000 |
| 1 | 11 | 11 | 16.4534 | 11845. | 136 | 164 | 15.2269 | 5.7642 | 52 | 53 | 1 | 23.0015 | 22.9186 | -2.5 | 23.1669 | 16.414 | 9.360 | 0.0000 |
| | | | -15.4231 | 11781 | 135 | 162 | 16.6356 | 6.4050 | 48 | 47 | -1 | | 22.9186 | | 23.1669 | 17.374 | 9.058 | 0.0000 |

Once the above items are better quantified then the merge in terms of the pass-to-pass clustering of data can be addressed. However, it is readily apparent that this is just a cluster analysis on a different level, i.e. the same methodology can be applied. The only difference now is that a Kalman Filter type approach should be used to derive better location estimates once ambiguity has been resolved.

## 6.0 REFERENCES

1. W.R. McPherson and S.Y. Slinn, "SARSAT LUT to CMCC Alert Data Interface - A Critical Review". DREO Technical Note 84-24, December 1984

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| | |
|---|---|
| 1. ORIGINATING ACTIVITY<br>Defence Research Establishment Ottawa<br>Department of National Defence<br>Ottawa, Ontario K1A 0Z4 | 2a. DOCUMENT SECURITY CLASSIFICATION<br>UNCLASSIFIED |
| | 2b. GROUP |

3. DOCUMENT TITLE

SARSAT CANADIAN MISSION CONTROL CENTRE TCA TESTS AT 121.5 MHz RESOLUTE BAY, 27-28 MAY 84

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

TECHNICAL NOTE

5. AUTHOR(S) (Last name, first name, middle initial)

McPHERSON, W. Roy

| | | |
|---|---|---|
| 6. DOCUMENT DATE<br>JULY 1985 | 7a. TOTAL NO. OF PAGES<br>18 | 7b. NO. OF REFS<br>2 |
| 8a. PROJECT OR GRANT NO.<br>33X00 | 9a. ORIGINATOR'S DOCUMENT NUMBER(S)<br>DREO TECHNICAL NOTE NO. 85-16 | |
| 8b. CONTRACT NO. | 9b. OTHER DOCUMENT NO.(S) (Any other numbers that may be assigned this document) | |

10. DISTRIBUTION STATEMENT

UNLIMITED

| | |
|---|---|
| 11. SUPPLEMENTARY NOTES | 12. SPONSORING ACTIVITY |

13. ABSTRACT

The Canadian SARSAT users initiated field trials to test the performance of the SARSAT ground station under the conditions of fringe coverage. The data generated as a result of these trials was analyzed and results are presented. It is concluded that SARSAT can function adequately under such conditions but that this performance can only be recognized by users, if they have better visibility into available signal processing quality indicators.

DSIS
77-065

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