USING SERVICE CALL MEASUREMENT TO IMPROVE OPERATIONS

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ABSTRACT

This paper describes the implementation of a comprehensive, Company-wide program of service call reporting and measurement. This program provides uniformity in definition of causes of service calls as well as a measurement mechanism that provides for comparative performance ratings across all systems. The program is tailored for highlighting the causes of service deficiencies and provides the ideal mechanism for monitoring the effectiveness of corrective programs.

This comprehensive program has allowed for the accumulation of a highly-detailed historic data base. This data base is proving to be an invaluable tool in many ways. For example, decisions on purchases of new equipment are more easily made with the statistical knowledge of which manufacturer's products provide the best performance over time in a given operational environment. Staffing levels are now more accurately established based on predictable workloads. The best technical operations department structure for a given technology group in a given market is no longer a matter of conjecture.

Finally, the service call performance data base is analyzed against other parameters (e.g. customer satisfaction and operational expenses) allowing insight into the mechanics of providing the best possible service to our customers in the most cost effective manner.

INTRODUCTION

The traditional approach of evaluating the quality of service a subscriber receives is to measure cable distribution system compliance to prescribed technical standards, as mandated by the franchise and the FCC. This form of evaluation, though scientifically correct, only provides a means of appraisal during the actual process of testing. Lacking is the appraisal from day-to-day, month-to-month, and year-to-year of the systems performance as experienced by the subscriber.

To fill the shortfall left from periodic "proof of performance" testing and a schedule-driven preventive maintenance program, Cox developed a demand driven technical appraisal program utilizing service calls as the instrument for establishing demand. By counting, classifying, comparing and analyzing service calls, a comprehensive management tool has been developed with results reaching far beyond merely supplementing our preventive maintenance programs.

While this may seem to be an unconventional approach, the results speak for themselves. But more significantly, a new era of customer awareness infiltrated all levels of the organization. A continuity of functional responsibility and a sharing of ideas replaced independent spheres of activity and frequently disjointed or fragmented operating groups. It has clearly been established, through our experience, that a service call tracking program can be the catalyst for organizational reinforcement and improved customer service.

During the third and fourth quarter of 1983, Cox's Management and Engineering Staff nationally embarked upon the development of a "grass roots" Service Call Tracking Program. The goal of the program is to utilize the tabulation of service call statistics as the "corner stone" of a program that would evolve over time into a multi-element engineering and plant operations management tool to improve the effectiveness and efficiency of the engineering and technical disciplines within the Corporation. This was accomplished using a participative task force approach, beginning at the systems, then grouping systems into geographical identifiable regions and ultimately consolidating nationally. The objective of the "grass roots" development program was to secure a uniform set of measurement indices which were compatible and applicable across the spectrum of all systems regardless of their technological classifications.

SERVICE CALL TRACKING PROGRAM COMPONENTS

The fundamental components of the Service Call Tracking Program are segmented into three sections:

- Service call statistics collection and reporting
- Review of consolidated measurements and results
- Multivariate analysis

Service Call Statistics Collection and Reporting

The procedural foundation for the collection of statistics is a Cox Standard Practice and Procedure outlining the specific process for coding, counting and reporting service calls. The Standard provides a functional description and a definition of each working component of the tracking program. Omitted is a treatise on trouble shooting techniques, leaving this facet to be reinforced within Cox's Regional Training Centers via written Training Modules. The Standard prescribes three instruments that specify the uniform structure for collection of statistics and field reporting:

- o A standard service call form, (Exhibit 1)
- o A standard prescribed set of symptom, fault, and solution designations with numeric identifier codes, (Exhibit 2)
- o A Monthly Summary Report used for submission of the aggregate occurrence of fault codes. (Exhibit 3)

The Standard provides generic procedural guidelines for various aspects of handling customer inquiries:

- o General conduct guidelines for service technicians in the subscriber's home and during the service call resolution process,
- o Detailed instructions for the documentation required on service calls and the Service Call Tracking Reports,
- o Subscriber inquiry handling instructions for Customer Service Representatives and service call dispatching procedures,
- o System outage reporting and logging.

Additionally, documented within the body of the Standard is the method for evaluating and classifying individual service calls. Of particular importance are the operational instructions ensuring uniformity in the measurement period, "cut off" dates, and the method for qualifying multiple subscriber service calls for counting purposes which are the resultant of a common reported service deficiency.

Each service call receives three problem identifier codes during the processing cycle, yielding the following information:

- o Symptom - A description of the problem noted by Customer Service Representative, ascertained from the subscriber's description of the reported service deficiency,
- o Fault Code - An identification of the major fault found by the service or maintenance technician at the time of resolving the service deficiency,
- o Solution Code - A description of the corrective action taken by the service or maintenance technician.

Each of the numeric codes corresponds to those listed in Exhibit 2.

Of the three problem identifier codes associated with each service call, only the summation of the "fault" code is reported on the Monthly Service Report. The analysis of other codes is left to the supervisors at the systems to summarize and incorporate into their management and training programs.

Consolidated Measurement and Reporting

Each system's Monthly Summary Report is forwarded by submission of computer disk, MCI Mail or hard copy to Corporate Engineering for consolidation. All of the Monthly Summary Reports are received no later than the 10th of the following month to allow a timely receipt of the returned consolidated results. The consolidation process is IBM PC-based with the intertie capability to the Corporation's Management Information System data base enabling the analysis of the service call statistics "real time" relationship among other system operating parameters.

Before the end of the next reporting month, a packet comprised of the Company-wide consolidation of Service Call statistics accompanied with one or more selective subject reviews is distributed to each system and plant operations manager.

Reviews Distributed:

I. Fault Code Summaries

A tabulation of a single month's major fault code categories, percentage of total calls for each, and percentage of subscriber base for each. (Exhibit 4, A & B)

II. Trend Analysis

Utilizing a combination of consolidated and categorical statistical inquiries, reports are generated to indicate trends, both with univariate fault code and bivariate fault code comparisons, e.g. technology group vs. fault code. (Exhibit 5, A&B)

The objective of trend analysis information is to provide system management and supervisory personnel with performance ratings enabling them to monitor the effectiveness of correct programs and an overview of plant or field operations.

Two illustrative examples of the types of trend analysis provided are:

- o Total service deficiencies by category or subcategory per month and/or by quarter as a percentage of total subscribers and/or percentage of total deficiencies-annualized.

- o Total service deficiencies by category or subcategory per month and/or quarter as a pecentage of total subscribers and/or percentage of total deficiencies presented within and across technology groups-annualized.

To add clarification to the reviews, trend analysis information is presented by technology group designations.

Technology group designations are prescribed by the system bandwidth:

- o Group I - 220 MHz Systems
- o Group II - 240-270 MHz Systems
- o Group III - 300-330 MHz Systems
- o Group IV - 400-440 MHz Systems
- o Group V - 500-550 MHz Systems

III. Comparative and Correlative Reviews

Staying with a categorical format, comparisons are generated exemplifying variances between systems. As an additional component, the comparisons are structured to be the culmination of the extraction and correlation of fault codes to statistics with several data bases:

- o Current and historical Monthly Service Call Summaries,
- o Individual system equipment profiles,
- o System demographic profiles,
- o System monthly financial/staffing profiles
- o Customer satisfaction surveys
- o Other selected circumstances such as system age, geographic location, service offerings, and so forth.

Two illustrative examples of the composition of the reviews are:

- o The distribution of service deficiencies by major fault code category as a percentage of total service calls, or percentage of total subscribers compared/correlated within and across technology groups, regional location, equipment vendor and etc. (Exhibit 6, A&B)

- o A distribution of service deficiencies by subcategory of a major fault code as a percentage of total service calls, or a percentage of total subscribers compared/correlated within and across technology groups, equipment vendor, environmental characteristics, system topology, installation practices and etc. (Exhibit 7, A,B,& C)

These reviews are formulated with the objective of providing the system management and supervisory personnel guidance in planning, development and implementation of subscriber service enhancement and plant upgrade programs.

Multivariate Analysis

The multivariate analysis deals with the simultaneous relationship among several operations variables. In other words, multivariate analysis techniques differ from univariate and bivariate analysis in that it directs attention away from the analysis of the mean and variance of a single variable, or from the "pairwise" relationship between two variables, to the analysis of the covariances or correlation reflecting the extent of relationship among three or more variables.

The analysis work is utilized in developing long range strategies and plans through higher resolution studies of plant performance statistics.

An example of the applications and resultant benefits gained from multivariate analysis is best presented by outlining a potential example of its utilization in the selection, implementation and maintenance of set-top terminals. The analysis is likely to be time-phased study dependent upon the sequence of events, availability of data and the changes in outcome and process objectives. Three phases of concentration could follow these lines:

- o Multivariate analysis of existing installed base of set-top terminals correlated to:
  - ambient environment
  - equipment vendor
  - internal versus external subcontractor repair expense
  - equipment age
  - "churn" and "spin" of services
  - inventory requirements
  - system topology and design criteria
  - set-top terminal failure mode profiles

- o Multivariate analysis of the proposed equipment to be procured correlated to:
  - pertinent results from the multivariate analysis of the companies experience with set-top terminals, as determined from the initial study
  - life expectancy versus depreciable life profiles
  - subscriber acceptance and required level of functional training

- o Ongoing multivariate analysis of the newly installed equipment correlated to:
  - repair expense
  - inventory levels
  - equipment age
  - occurrence and intensity of fault codes
  - ambient environment
  - subscriber satisfaction

The ongoing analysis after installation provides the information to forecast maintenance expense, replacement timetables and the activation of warranty contingencies.

With the information produced through the reports, reviews and analysis, the resultant data is utilized to formulate, test and direct the strategic plans to provide the best possible service to our subscribers in the most efficient manner. Cox is currently utilizing the data base to direct these Engineering activities:

- o Training
- o Rebuild decisions
- o Purchasing agreements
- o Standards and practices
- o Equipment selection
- o Warranty enhancements and monitoring
- o Engineering audits
- o Monitoring results of modification programs
- o Identification and monitoring of corrective programs
- o Monitoring for external environmental impacts on plant
- o Derivation of preventive maintenance programs

A significant benefit of the program is the ability to get instant feedback, more accurately forecast expected results, and the allocation of internal and external resources. Cox's Engineering now has the ability to establish quantifiable expected results of it's Engineering programs. Additionally, we have the ability to reappraise these programs periodically during implementation affording us the opportunity to maximize benefits, minimize the financial impact, and make mid-course corrections as required.

Future Enhancements

The evolution of the program has been planned through the next five years. Significant capital expenditures have been made for hardware and software to further develop the statistics data base and data base management software capabilities. A CADD based system design and mapping program has completed it's first year of implementation. Programs to couple status monitoring, dispatching and customer service files are staged.

What is the eventual benefit? It is within the scope of the program, by accumulating intervals between repairs and calculating the present value of amounts of moneys expended for repairs, to prescribe when and where rebuilds should be undertaken. By referencing repairs to a pole or pedestal in the data base, rebuild determinations could be narrowed to a distribution line.

All of these features offer potential for improved financial performance, extended useable equipment life, and even better customer service.

SUMMARY

In summary, though at first the implementation of the tracking of service calls seemed a mammoth undertaking, time has seen refinements in the process. Management and data entry of the program by Corporate Engineering requires less than 50% of a single staff members time. The "upside" gains have more than offset the inconvenience and incremental cost. Cox, in 1984, achieved a 29.6% reduction in total service calls. Based on a valuation by truck roll, this is an equivalent reduction in cost of $477,000 per month. The resultant recovered manhours is being converted into stronger preventive Maintenance Programs and additional time devoted to training. All this equates to a received benefit in the form of better service to our subscribers.

An important point to note with a management tool of this nature, no specific tolerance limits of satisfactory performance were required or established. Rather, the motivation to continually strive for improvement upon the most current optimal performance achievements is the implied standard.

EXHIBIT 1

STANDARD SERVICE CALL FORM

Cox Cable Communications

SERVICE ORDER

Appointment:
Date: _____ Time: _____
Report Date: _____ Time: _____

System: _____ Grid: _____
Customer's Name: _____
Address: _____ Zip: _____
Phone Number: _____ Other: _____

Problem Symption(s):
Code: _____
Serv. Level: _____
Comment: _____
By: _____

Representative's Findings:
Code: _____
Serv. Level: _____
Comment: _____
By: _____

Solution Code: _____ Completion Date: _____ Time: _____
By: _____ Employee # _____
Supervisor/System Engineer Review: _____ Date: _____
T R Code: ___ ___ ___ / ___ ___ ___ / ___ ___ ___
Rescheduled Appoint.: Date: _____ Time: _____ By: _____

CUSTOMER. FREQUENCY RESPONSE PLOT

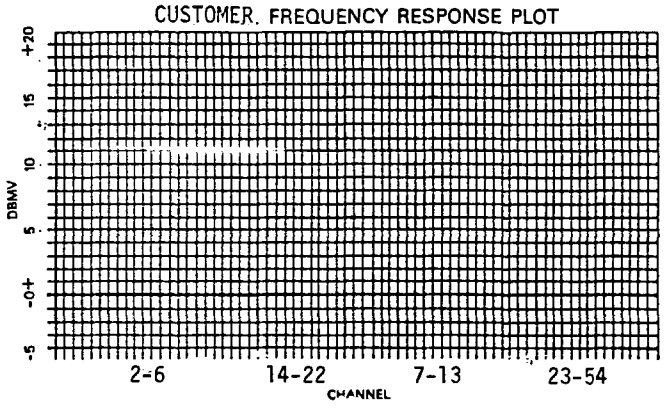

EXHIBIT 2

TROUBLE CODES

SYMPTOM (000)

001 NO PICTURE
002 SNOW
003 WAVY LINES
004 GHOSTING (DPU)
005 FLASHING
006 FADING
007 AUDIO BUZZ
008 NO COLOR
009 SCRAMBLED PICTURES
010 CHANGING CHANNELS

MAJOR FINDINGS (000)

HEADEND (100)

101 ELECTRICAL EQUIPMENT
102 OFF-AIR SIGNAL
103 MICROWAVE FADE
104 MICROWAVE FAILURE
105 POWER FAILURE
106 TVRO FAILURE
107 STUDIO
108 COMPUTER

SYSTEM (200)

201 FEEDER CABLE
202 TRUNK CABLE
203 SPLICE/CONN. PROBLEM
204 PASSIVE FAILURE
205 LEVELS BAD
206 LINE EXTENDER/BRIDGER
207 TRUNK AMP
208 POWER SUPPLY
209 POWER OUTAGE
210 TAP FAILURE

DROP (300)

301 TRANSFORMER
302 SPLITTER/FM TAP
303 DROP CABLE
304 TRAP
305 CONNECTOR
306 GROUNDING
307 A/B SWITCH
308 BAD INSTALL

CUSTOMER (400)

401 CUSTOMER TERMINAL
402 FM RCVR PROBLEM
403 COURTESY CALL
404 TAMPERING
405 NO PROBLEM

ADMINISTRATIVE (500)

501 DISC IN ERROR
502 CLERICAL ERROR

CONVERTER (600)

BASIC

601 FAILURE
602 EDUCATE CUST
603 REMOTE

DESCRAMBLER

604 FAILURE
605 EDUCATE CUST
606 REMOTE

ADDRESSABLE

607 FAILURE
608 EDUCATE CUST
609 REMOTE

NOT HOME (700)

SOLUTION (000)

001 REPLACED
002 SET LEVELS
003 REMADE CONNECTION
004 RESTORED POWER
005 REPLACED FUSE
006 CHECKED WITH MONITOR
007 INSTALLED SWITCH
008 ADDITIONAL WORK REQUIRED-NOTIFIED DISPATCH
009 RECONNECTED

Cox Cable Communications

EXHIBIT 3

Figure 2 - 3

MONTHLY SERVICE CALL REPORT

Month / Year ____ / ____

SYSTEM _____ NO. TOTAL SUBS _____

PLANT MILES AERIAL _____ + UNDERGROUND _____ = TOTAL _____

PLANT AGE ____ Yrs. REBUILT ____% ____% of Customers have Converters

PLANT VEHICLES ____

HEADEND (100)			
101	ELECTRONIC EQPT	____	
102	OFF AIR SIGNAL	____	
103	MICROWAVE FADE	____	
104	MICROWAVE FAIL	____	
105	POWER FAILURE	____	
106	TVRO FAILURE	____	
107	STUDIO	____	
108	COMPUTER	____	
	SUBTOTAL	____	
	% OF TOTAL CALLS	____	%

SYSTEM (200)			
201	FEEDER CABLE	____	
202	TRUNK CABLE	____	
203	SPLICE/CONNECTOR PROBLEM	____	
204	PASSIVE FAILURE	____	
205	LEVELS BAD	____	
206	LINE EXTENDER/ BRIDGER	____	
207	TRUNK AMP	____	
208	POWER SUPPLY	____	
209	POWER OUTAGE	____	
210	TAP FAILURE	____	
	SUBTOTAL	____	
	% OF TOTAL CALLS	____	%

DROP (300)		
301	TRANSFORMER	____
302	SPLITTER/FM TAP	____
303	DROP CABLE	____
304	TRAP	____
305	CONNECTOR	____
306	GROUNDING	____
307	A/B SWITCH	____
308	FAULTY INSTALL	____
	SUBTOTAL	____
	% OF TOTAL CALLS	____ %

CUSTOMER (400)			
401	CUST TERMINAL	____	
402	FM RCVR PROBLEM	____	
403	COURTESY CALL	____	
404	TAMPERING	____	
405	NO PROBLEM	____	
	SUBTOTAL	____	
	% OF TOTAL CALLS	____	%

ADMINISTRATIVE (500)			
501	DISC IN ERROR	____	
502	CLERICAL ERROR	____	
	SUBTOTAL	____	
	% OF TOTAL CALLS	____	%

CONVERTER (600)			
BASIC			
601	FAILURE	____	
602	EDUCATE CUST	____	
603	REMOTE	____	
DESCRAMBLER			
604	FAILURE	____	
605	EDUCATE CUST	____	
606	REMOTE	____	
ADDRESSABLE			
607	FAILURE	____	
608	EDUCATE CUST	____	
609	REMOTE	____	
	SUBTOTAL	____	
	% OF TOTAL CALLS	____	%

NOT HOME (700)			
	SUBTOTAL	____	
	% OF TOTAL CALLS	____	%

SERVICE CALL TOTAL ____

BACKLOG	
BEGINNING	____
CALLS REC'D	____
CALLS CLEARED	____
ENDING B'LOG	____

SYSTEM OUTAGE	
QUANTITY	____
MAJOR	____
MINOR	____
STANDBY PO SUPPLIES %	____
POWER CO RELATED	____

CALLS CLEARED	#	%
WITHIN 1 DAY	____	____
WITHIN 2 DAYS	____	____
LONGER	____	____
TOTAL CLEARED	____	____

SERVICE CALL SUMMARY

SYSTEM CALLS PER PLANT MILE (200)	____
SYSTEM CALLS PER SUBSCRIBER	____
DROP CALLS PER PLANT MILE (300)	____
DROP CALLS PER SUBSCRIBER	____
CONVERTER CALLS PER PLANT MILE (600)	____
CONVERTER CALLS PER SUBSCRIBER	____
NON-SYSTEM CALLS PER PLANT MILE	____
NON-SYSTEM CALLS PER SUBSCRIBER	____
SERVICE CALLS PER PLANT MILE	____
SERVICE CALLS PER CUSTOMER	____

PREPARED BY _____

Plant Manager Review _____

Due to Atlanta by 5th.

FORM 01[illegible]

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EXHIBIT 4

4-A

MAJOR FAULT CODE SUMMARY CONSOLIDATED

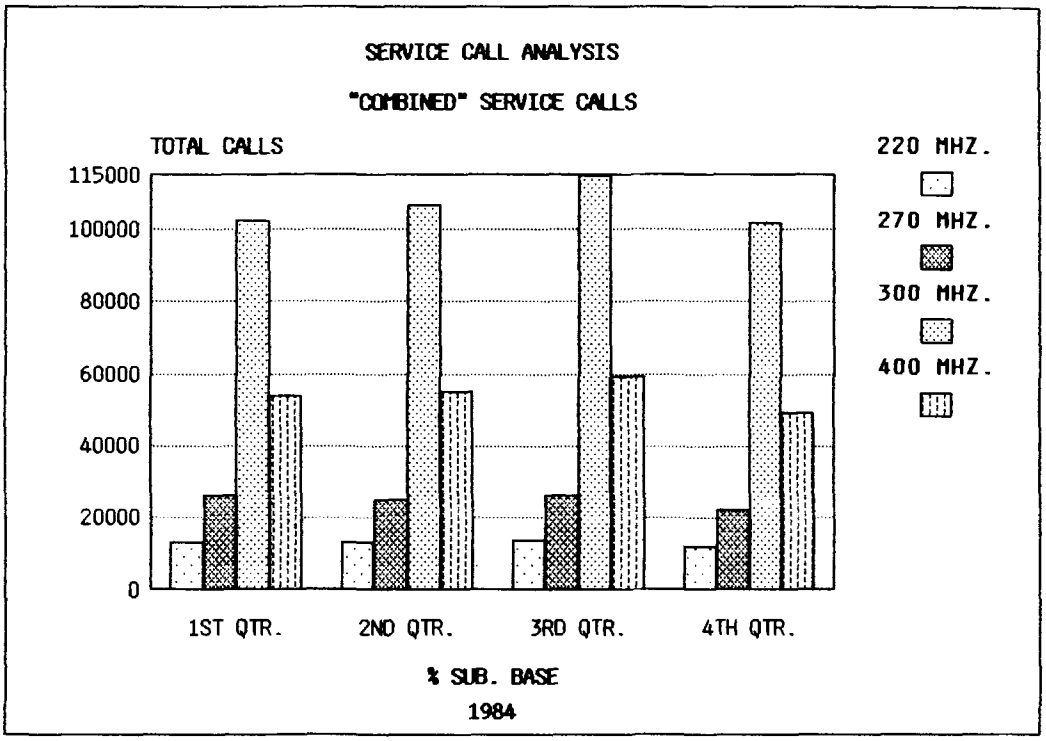
BASIC SUBS	HEADEND	SYSTEM	TOTAL BY CATEGORY DROP	CUSTOMER	ADMIN	CONV	NOT HOME	TOTAL	%OF SUB BASE
1544513 OCT 83	300	6198	17324	19386	2193	20451	6243	72095	4.67%
1563792 NOV 83	343	5689	17368	19280	1955	19657	6016	70308	4.50%
1581064 DEC 83	561	5144	16700	16983	1826	17795	6314	65323	4.13%
1589415 JAN 84	264	6035	17248	17672	1600	21409	5477	69705	4.39%
1600493 FEB 84	264	4595	16671	15876	1970	19497	5407	64280	4.02%
1620962 MAR 84	165	4175	16529	14786	2091	17718	5473	60937	3.76%
1633882 APR 84	198	4702	18253	16157	2456	19719	5629	67114	4.11%
1643384 MAY 84	215	4706	18313	16543	2172	18462	5407	65818	4.01%
1644047 JUN 84	198	5229	17927	15704	1985	19918	4926	65887	4.01%
1656027 JUL 84	142	5518	19033	16613	2000	21745	5279	70330	4.25%
1658299 AUG 84	158	5334	18444	16961	2407	21973	5225	70502	4.25%
1668750 SEP 84	144	5139	19390	17164	2446	22575	5752	72610	4.35%
1683867 OCT 84	116	4843	17996	15439	2028	19229	5009	64660	3.84%
1696696 NOV 84	134	4400	16921	14822	2050	18381	4876	61584	3.63%
1702221 DEC 84	156	4211	15497	14074	1852	17780	5038	58608	3.44%
1506285 JAN 85	231	4071	15269	13493	1671	14885	4221	53841	3.57%
1511031 FEB 85	97	4904	15867	14293	1954	16462	4567	58144	3.85%

4-B

MAJOR FAULT CODE SUMMARY SYSTEM "X"

BASIC SUBS	TOTAL BY CATEGORY (100)	(200)	(300)	(400)	(500)	(600)	(700)	TOTAL	%OF SUB BASE
59570 OCT 83	74	1051	487	1624	65	737	142 0.76	4180	7.02%
59755 NOV 83	100	688	1081	1153	63	661	8	3754	6.28%
60892 DEC 83	385	910	841	1049	27	470	19	3621	5.95%
61815 JAN 84	55	825	1112	1159	67	765	1 0.75	3985	6.45%
60548 FEB 84	18	537	1299	1048	85	868	199	4054	6.70%
60684 MAR 84	4	542	1151	985	101	711	129	3543	5.85%
61677 APR 84	12	498	1197	1198	77	584	223 0.75	3789	6.14%
63000 MAY 84	67	433	1512	1495	93	725	257	4582	7.27%
64000 JUN 84	6	312	1389	1099	109	597	71	3583	5.47%
64282 JUL 84	14	379	1152	983	81	446	75 0.63	3130	4.87%
63960 AUG 84	7	258	1078	757	115	557	176	2948	4.61%
62063 SEP 84	4	352	1487	1089	136	601	325	3914	6.31%
61280 OCT 84	1	252	1341	734	123	439	333 0.60	3223	5.26%
61150 NOV 84	7	210	1183	627	95	514	333	2889	4.72%
61879 DEC 84	1	240	1126	658	83	667	411	3186	5.22%
925675	675	7488	**********	1328	9342	2702		54381	5.87%

EXHIBIT 5


SERVICE CALL ANALYSIS
"COMBINED" SERVICE CALLS
TOTAL CALLS
115000
100000
80000
60000
40000
20000
0
1ST QTR.
2ND QTR.
3RD QTR.
4TH QTR.
220 MHZ.
270 MHZ.
300 MHZ.
400 MHZ.
% SUB. BASE
1984

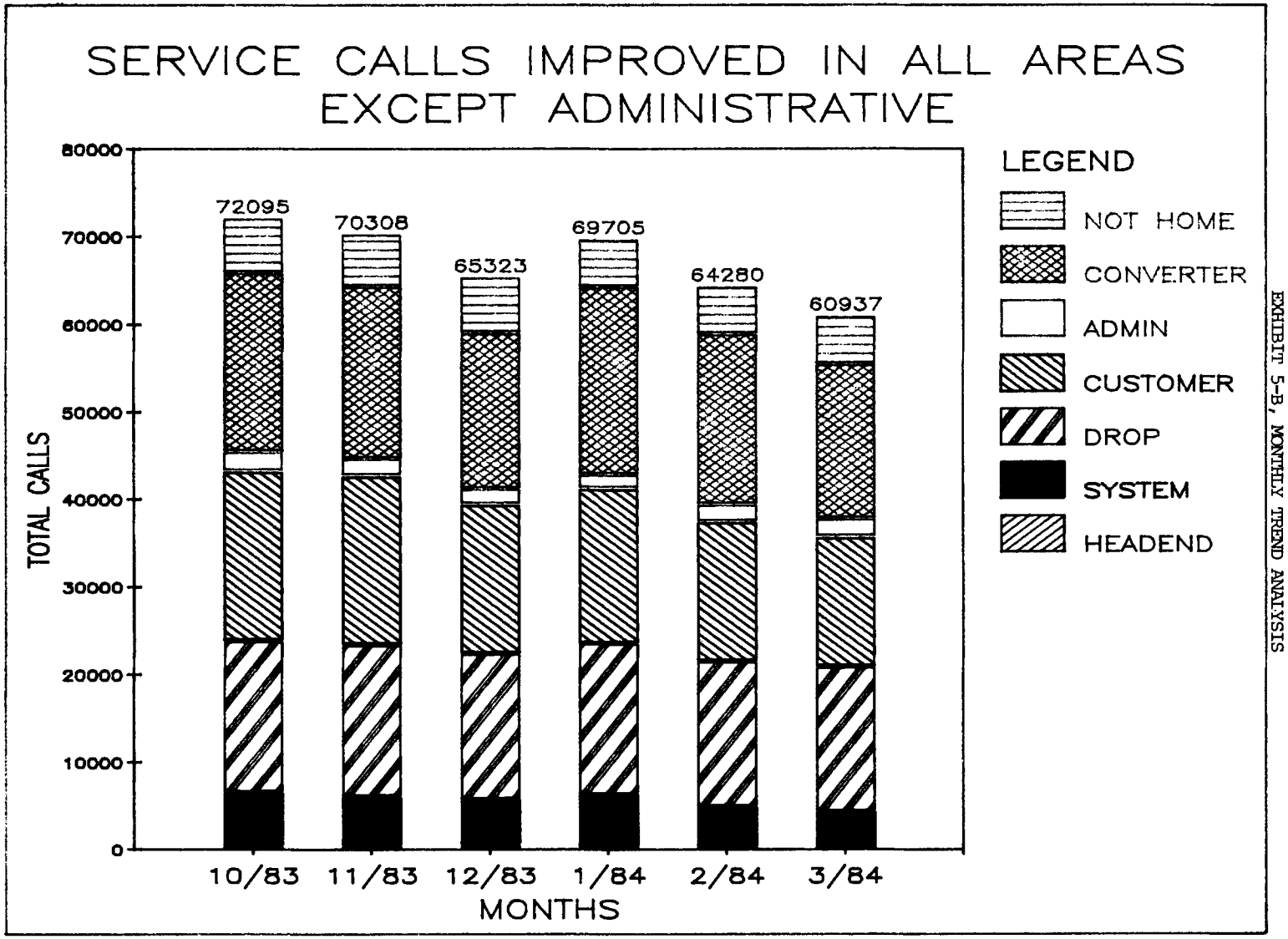
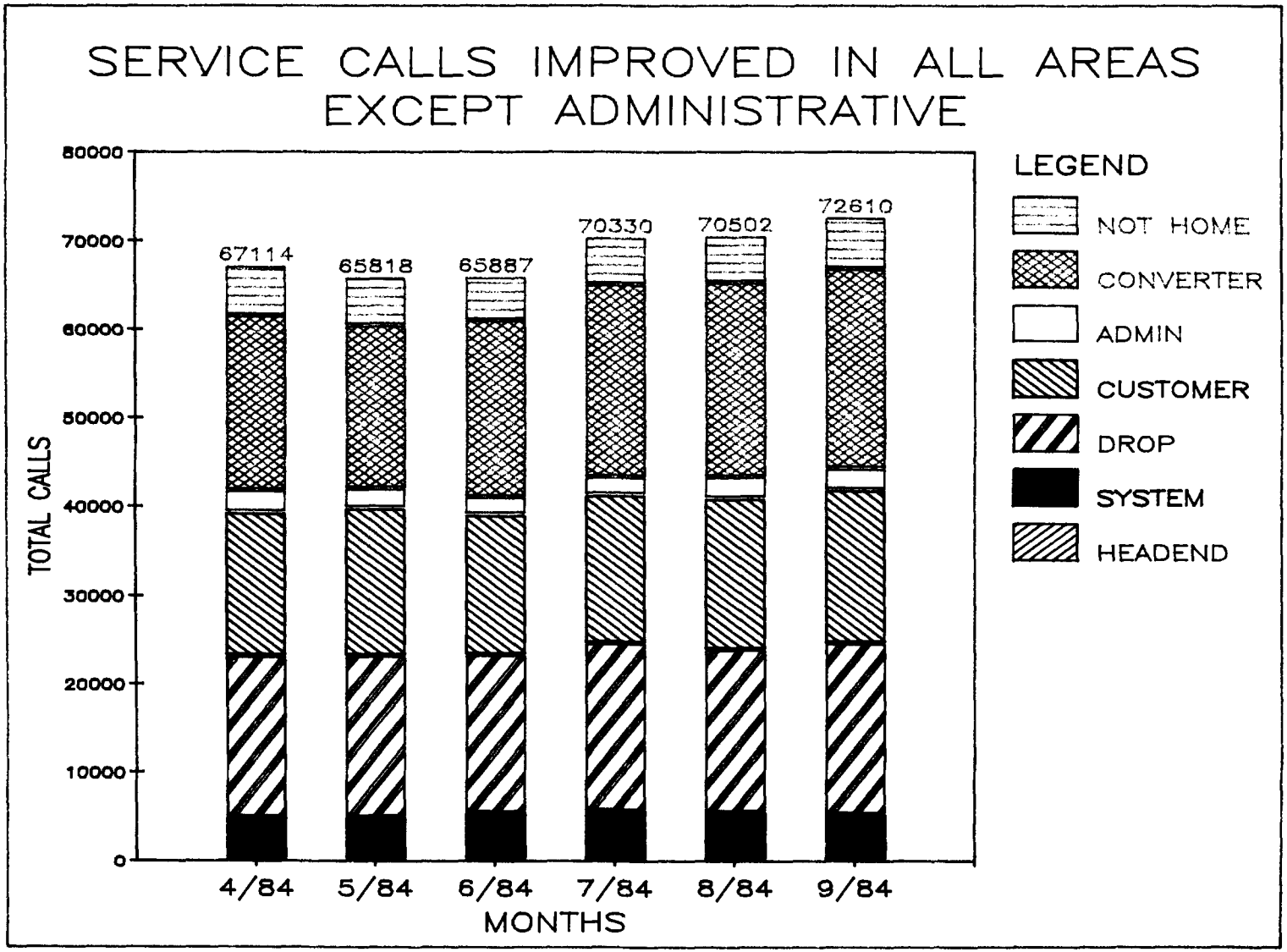


EXHIBIT 5-B, MONTHLY TREND ANALYSIS


SERVICE CALLS IMPROVED IN ALL AREAS EXCEPT ADMINISTRATIVE
TOTAL CALLS
80000
70000
60000
50000
40000
30000
20000
10000
0
67114
65818
65887
70330
70502
72610
4/84
5/84
6/84
7/84
8/84
9/84
MONTHS
LEGEND
NOT HOME
CONVERTER
ADMIN
CUSTOMER
DROP
SYSTEM
HEADEND

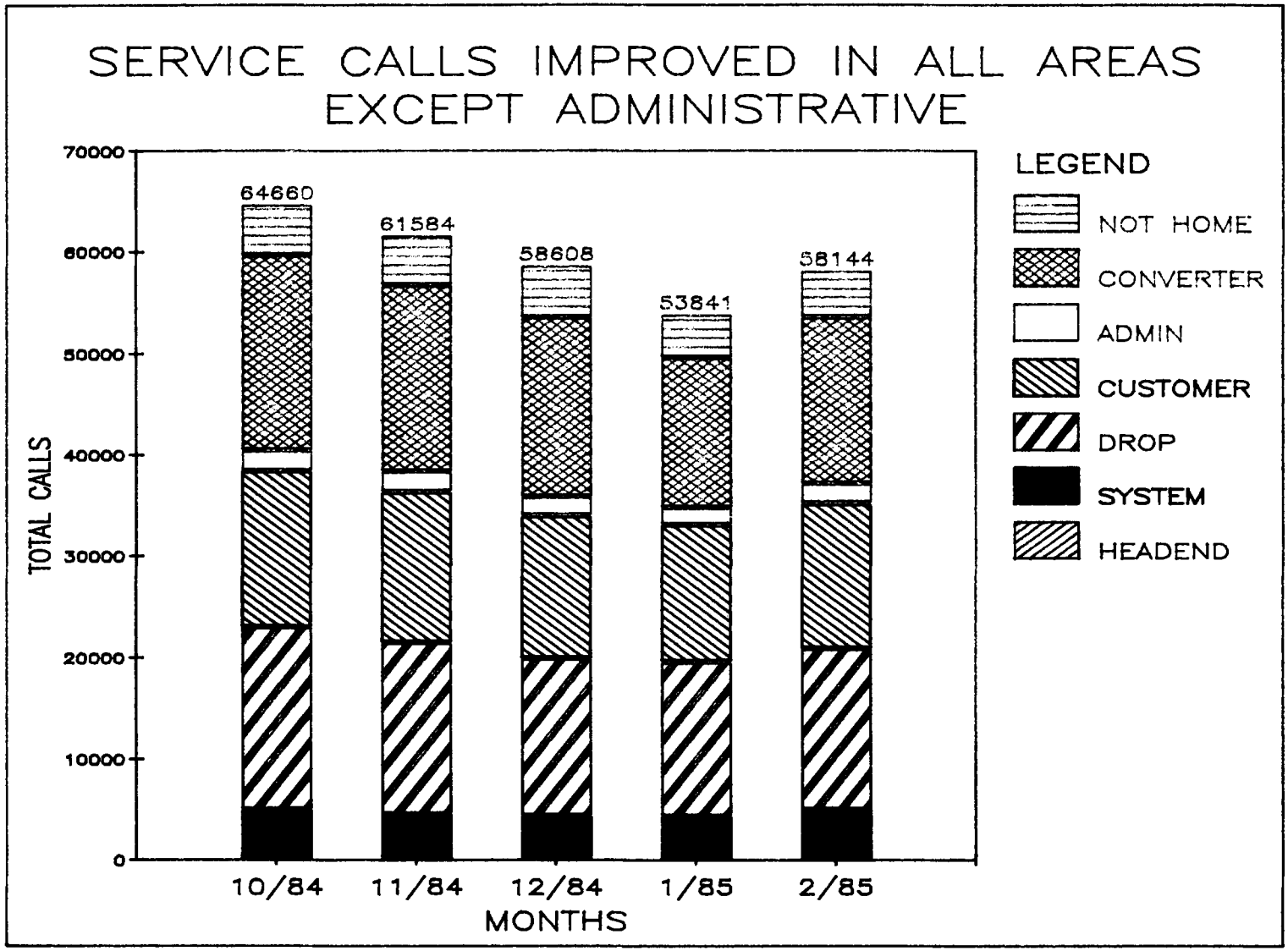
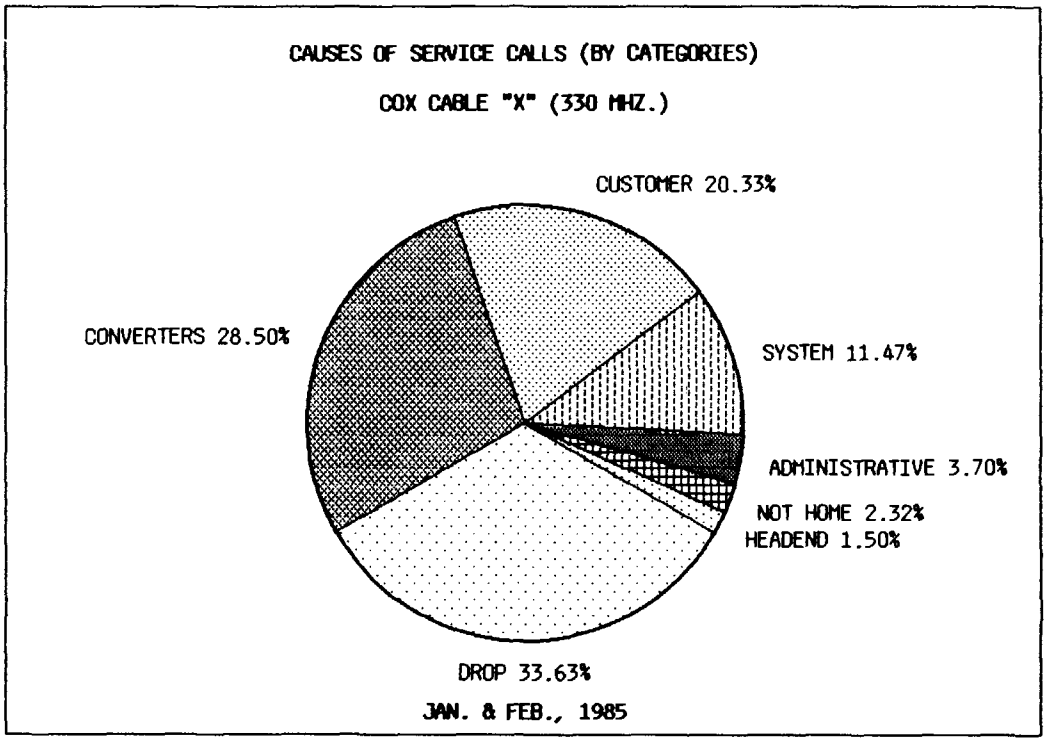

SERVICE CALLS IMPROVED IN ALL AREAS
EXCEPT ADMINISTRATIVE
TOTAL CALLS
70000
60000
50000
40000
30000
20000
10000
0
64660
61584
58608
53841
58144
10/84
11/84
12/84
1/85
2/85
MONTHS
LEGEND
NOT HOME
CONVERTER
ADMIN
CUSTOMER
DROP
SYSTEM
HEADEND

EXHIBIT 6-A



6-B

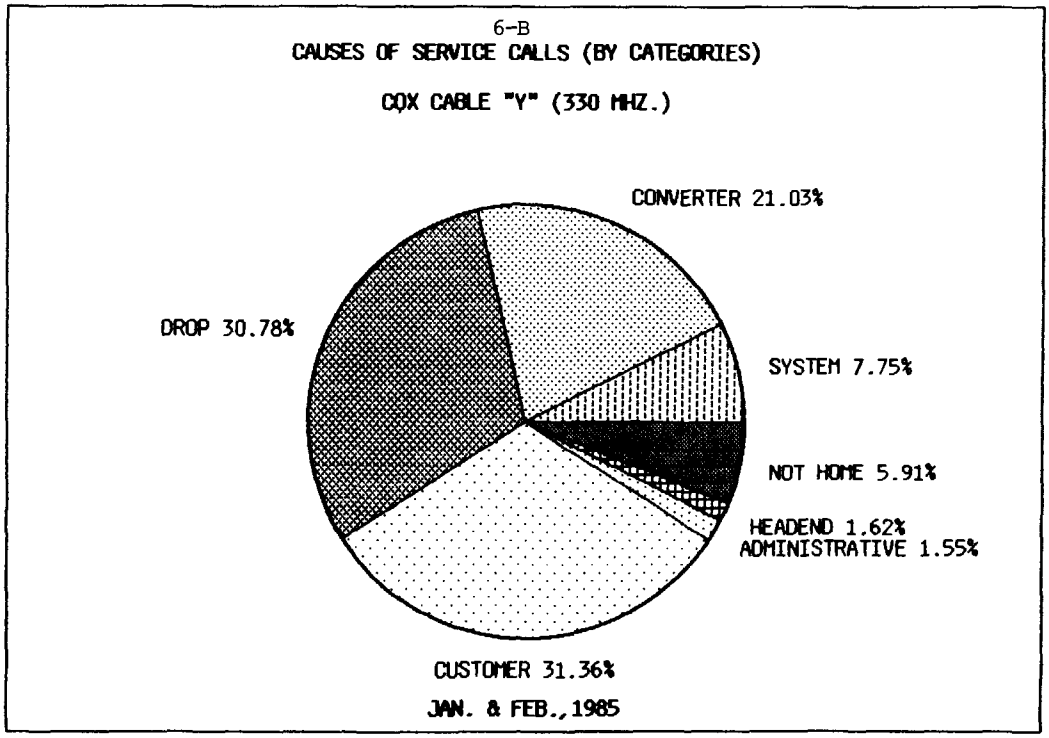
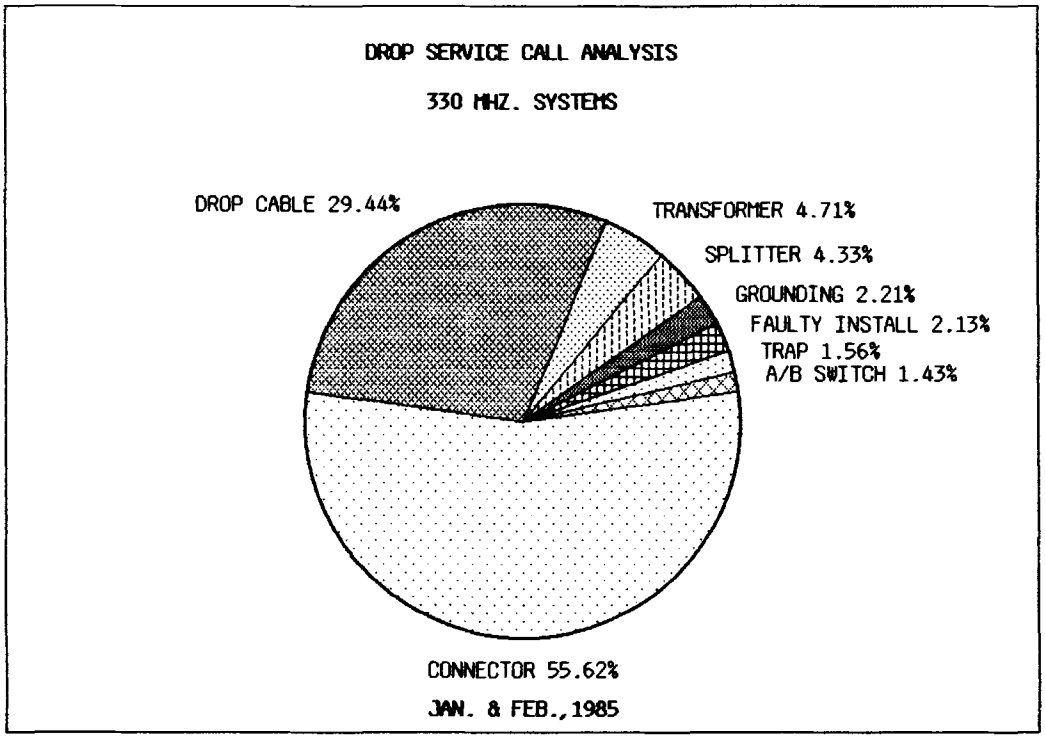
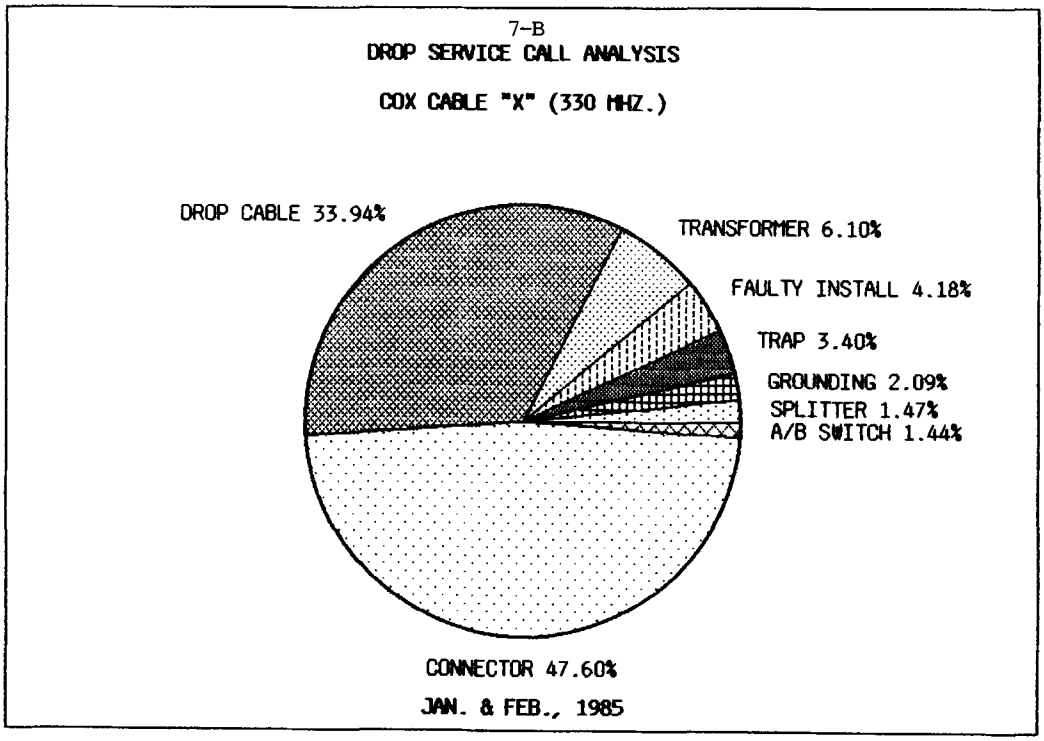


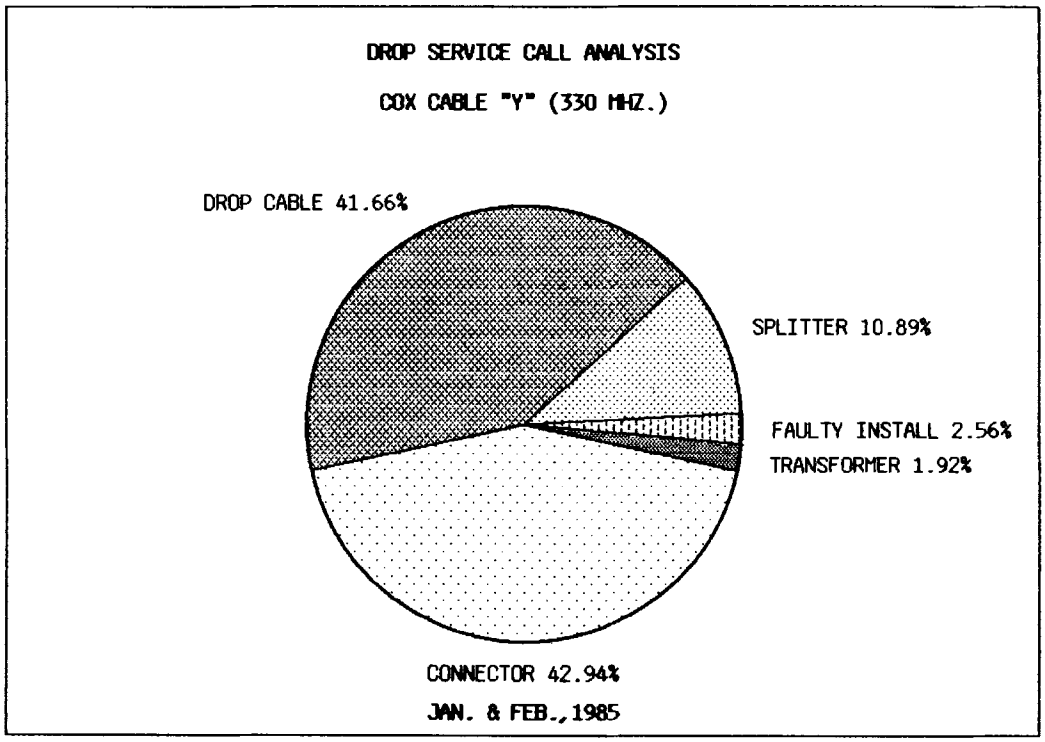
EXHIBIT 7-A



7-B



7-C


DROP SERVICE CALL ANALYSIS
COX CABLE "Y" (330 MHZ.)
DROP CABLE 41.66%
SPLITTER 10.89%
FAULTY INSTALL 2.56%
TRANSFORMER 1.92%
CONNECTOR 42.94%
JAN. & FEB., 1985