

**FIELD ASSISTANCE AND SUPPORT TEAM  
(FAST)  
DATA TECHNICAL (DATEC) SUPPORT**

	PAGE		PAGE
1. GENERAL . . . . .	2	4. COORDINATION . . . . .	10
OBJECTIVES OF DATEC SUPPORT . . . . .	2	Coordination Between Network Support and RFSCs . . . . .	11
2. DATEC SUPPORT PERSONNEL . . . . .	2	Coordination With Independent Com- panies . . . . .	11
A. Qualifications . . . . .	2	5. TEST EQUIPMENT . . . . .	12
B. Organization . . . . .	3	A. Field Force Test Equipment . . . . .	12
C. Responsibilities . . . . .	3	Basic Test Equipment . . . . .	12
Fundamental Responsibilities . . . . .	3	Accessible Test Equipment . . . . .	12
Continuing Responsibilities . . . . .	4	B. DATEC Support Test Equipment . . . . .	13
Availability . . . . .	4	Transmission and Data Test Sets . . . . .	13
Relationship with Other Support Groups . . . . .	4	Special Test Equipment . . . . .	13
D. Recording DATEC Support Activities . . . . .	4		
E. Job Aids . . . . .	5	Figures	
Interregional Communications . . . . .	5	1. Flowchart of Escalated Case Report Proce- dures . . . . .	9
Supportive Documentation . . . . .	5	2. Telephone Company Case 1 . . . . .	11
3. CASE ESCALATION . . . . .	5	3. Telephone Company Case 2 . . . . .	11
A. Administrative Escalation . . . . .	6	4. Network Technical Support . . . . .	11
B. Technical Escalation . . . . .	6	5. Bell—ICO Case 1 . . . . .	12
C. Technical Escalation Timing . . . . .	7	6. Bell—ICO Case 2 . . . . .	12
D. Escalation Procedure . . . . .	7		
E. Escalated Case Report . . . . .	7		

**NOTICE**

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**1. GENERAL**

**1.01** This section describes the objectives and operation of Data Technical (DATEC) Support. In addition, it outlines the background, the coordinating procedures, and the test equipment DATEC personnel need to perform effectively. DATEC is a discipline of the Field Assistance and Support Team (FAST) concept. Other FAST disciplines are: Software Technical (SOFTEC) Support, Voice and Nondata Special Services Technical (VOITEC) Support, and Customer Switching Technical (CSTEC) Support.

**1.02** This section is reissued to update DATEC Support procedures and to relate DATEC Support to FAST concepts.

**1.03** DATEC Support has proven itself to be an effective, capable organization. The growth in number and the complexities of data services that are forecasted will be a challenge for DATEC Support.

**OBJECTIVES OF DATEC SUPPORT**

**1.04** The primary objective of DATEC Support is to improve our data communications services by bringing data service problems to the attention of technical personnel through the use of FAST mandatory escalation procedures. The use of these procedures in conjunction with existing Bell System Practices (BSPs) can be an effective aid in reducing long service delays which cause acute customer dissatisfaction. An initial step toward the objective of improving data service is to ensure that the installation and maintenance forces are properly trained and equipped to carry out their basic data assignments.

**1.05** A second objective of DATEC Support is aiding the coordination of interregional and interarea data service problems by establishing definite procedures for obtaining technical assistance from distant locations. Following these procedures should help in promoting a teamwork approach to mutual problems and aid in providing a uniform grade of service.

**1.06** A third objective of DATEC Support is to provide business machine representatives a contact for technical questions regarding Bell System data services. These types of contacts should be cultivated in both directions as they could become invaluable when interfacing problems arise.

**1.07** The data services of concern to DATEC Support will include all data and data-related services. Some examples are:

- DATAPHONE® service
- DATAPHONE digital service
- DATASPEED® service
- Data access arrangements
- Private line data service (switched and nonswitched)
- Other Common Carrier (OCC) services
- Teletypewriter service.

DATEC Support personnel may also be concerned with transmission problems associated with Telegraph and Telephoto Services.

**1.08** For the purposes of this section, the term "field forces" refers to the installation, maintenance, and testing personnel and their supervision who are involved with the normal provision of data services. These persons may be located at central offices, test centers, high frequency equipment, customer premises, or intermediate locations.

**2. DATEC SUPPORT PERSONNEL**

**2.01** This part describes the typical qualifications, organization, responsibilities, and activities of DATEC Support personnel.

**A. Qualifications**

**2.02** To perform effectively, DATEC Support personnel must be experienced or trained in the following subjects:

- Transmission and circuit design
- Modulation and coding schemes
- Bell System data apparatus and terminals
- Interface circuits and arrangements
- Switching equipment and network structures
- Software operations
- Computer technology and teleprocessing
- Tariffed service offerings.

**2.03** In addition to the telecommunications disciplines, DATEC Support personnel should have a good appreciation for Customer Provided Equipment (CPE).

**2.04** DATEC Support personnel will often be communicating with individuals and organizations both inside and outside the Bell System. Therefore, they must have a sufficient technical background to be effective in these situations. Support personnel should also have a working knowledge of the Intercompany Services Coordination (ISC) plan, and other administrative procedures and functions of FAST including VOITEC, SOFTEC, and CSTECC.

#### B. Organization

**2.05** The specific manner in which DATEC Support is organized may vary in different locations. However, DATEC Support designees, who are part of the FAST organization, should be assigned to a Regional FAST Support Center (RFSC) and/or to a High Activity Location (HAL).

**2.06** The number of DATEC Support personnel needed for proper coverage is strongly influenced by the quantity, geographical dispersion and complexity of data services in the operating Region. There should be a minimum of two management-level DATEC designees for each RFSC. Additional RFSC DATEC and HAL DATEC personnel shall be assigned as needed per recommendations of the FAST Regional Headquarters.

**2.07** The designees must be able to travel to outlying points whenever necessary to carry out DATEC responsibilities.

#### C. Responsibilities

**2.08** The responsibilities of DATEC Support personnel fall into two general categories: **Fundamental Responsibilities** and **Continuing Responsibilities**. The **Fundamental Responsibilities** apply directly to the main objective of DATEC Support which is to supply service support of a technical nature to the data field forces. Items that fall into this first category will demand immediate attention when they arise. The **Continuing Responsibilities** apply indirectly to the main objectives of DATEC Support and should be performed between Fundamental case occurrences or during a particular case when they apply.

#### Fundamental Responsibilities

##### **2.09 On-Site Technical Field Assistance:**

DATEC Support personnel will be required to go to customer locations and possibly to central offices or intermediate locations when necessary to identify and resolve technical data service problems. The Support personnel should coordinate their efforts in these locations with local work groups according to normal administrative procedures. When assistance is needed at locations outside their assigned territories, Support personnel should coordinate their activities with the DATEC Support personnel at the distant locations.

**2.10 Technical Counsel:** DATEC Support personnel will advise on questions of a technical nature relating to data communications. These questions may originate from inside or outside the Bell System and may concern any of the following:

- Advice on specific types of data problems, ie, what to do first, second, third, etc
- Advice on specific units of data equipment such as specific data set options, etc
- Compatibility between CPE and Bell System equipment in accordance with current interconnection guidelines
- Tariff compliance of channels for customer-provided modems
- Suitability of switching machines for certain data services
- Advice on the technical feasibility of a customer service.

**2.11 Policy Council:** The DATEC Support personnel will assist the field forces in interpreting the Bell System's technical responsibilities in data communications. Some of the major items of concern may be the following:

- Technical responsibilities outlined in the tariffs
- Technical reference requirements
- Maintenance philosophy of data transmission systems as well as analog transmission systems

- Activities at the interface of data access arrangements, data jacks and data auxiliary sets
- Performance expectations of Bell System-provided equipment, facilities, and services
- Limits of responsibility on channel-only data services using customer-provided data modems.

### 2.12 **Supplemental Training of Field Forces:**

DATEC Support personnel will supplement the formal training of the field forces through on-site contacts on difficult data service problems. The use of sophisticated test equipment and methods should be demonstrated and explained where practical. This training can be of great benefit to both the field forces and Support personnel by sharing knowledge gained during problem investigations. Informal training, such as this, will take place automatically but should be carefully cultivated and can be augmented by verbal and written communication from the DATEC Support personnel.

#### Continuing Responsibilities

**2.13 *Quality Control:*** Quality control is a major Continuing Responsibility of DATEC Support personnel. In their position, the technical designees are able to observe the whole data service effort. They should identify areas where improvement is needed and refer them to the responsible organizations. Items of concern may include the following:

- Test equipment shortages, updating, and maintenance
- Poor service order documentation or flow
- Recommendations for improvements in administrative procedures
- Feedback on initial service planning and installation deficiencies to the groups originally responsible
- Technical recommendations for data service improvements
- Recommendations to AT&T on Bell System equipment design or BSP improvements.

**2.14 *Monitor Training Requirements and Effectiveness:*** DATEC Support person-

nel's frequent contact with the interdepartmental activities involved with data services offers an excellent opportunity to monitor training needs and effects. Some items of interest under this topic may include the following:

- Repeated field force difficulty with similar problems
- Excessive time to complete BSP tests before escalating data service problems
- Misunderstandings by sales forces or customers of a data service's operation, capabilities, or limitations.

The Support personnel should document any training deficiencies and recommend improvements to the appropriate training organization.

#### Availability

**2.15** DATEC Support personnel must always ensure that someone is accessible to assist with data service problems during normal working hours. After-hours assistance requests should be handled through normal off-hour administrative channels. The Support personnel must not be so encumbered by non-DATEC duties that they are unavailable to the field for technical support activities.

#### Relationship with Other Support Groups

**2.16** DATEC Support should coordinate data service activities with the other FAST Support groups: VOITEC, SOFTEC, and CSTECC. This also includes coordinating and referring problems to the Network Technical Support (NTS) for clearance. With telephone companies having data specialists, close coordination must also be maintained. Using the special talent of all these groups is essential to the best problem solving effort.

#### D. Recording DATEC Support Activities

**2.17** All case activities of DATEC Support personnel should be recorded as outlined in the FAST Operations Guide. The standard maintenance sections in the 309, 314, 59X, 660, and 668 Divisions will include an outline of the information DATEC Support personnel require when called from the field for assistance.

**2.18** Documentation with an outline of the problem and its solution is an invaluable aid in ap-

praising data service efforts and DATEC Support effectiveness. Nonescalated cases of telephone advice on field force questions and assistance on other DATEC Support team's data service problems might also deserve recording since much operational time may be involved.

**2.19** Each RFSC and HAL DATEC Support group will maintain its own active current file of Case Reports.

**2.20** Activity Summary Reports will be generated by the Technical Support Management System (TSMS). These reports can display activities on a HAL, Regional, Corporate, or FAST discipline (eg, DATEC) basis.

**2.21** Particular data service problem solutions may be of interest to DATEC Support personnel in other RFSCs. These DATEC cases should be entered into the Computer Assisted Technical Support/Data Base (CATS/DB) system for transmission to the FAST Headquarters. If they are of systemwide interest, FAST Headquarters will use this information to generate Technical Advisories.

#### E. Job Aids

##### Interregional Communications

**2.22** There is frequent need for intraregional and interregional communications among DATEC and other FAST Support personnel. To encourage this communication, CATS/DB contains the names, telephone numbers, and addresses of the FAST Support personnel throughout the Bell System. CATS/DB is a data bank of stored information that assists in complex problem solving. It contains Technical Advisories, Flashes, and other technical inputs concerning known trouble conditions and their remedies.

##### Supportive Documentation

**2.23** To keep adequately informed, DATEC Support personnel will require an up-to-date file of reference information in two general categories: information from Bell System sources and information from non-Bell System sources.

**2.24** *Information from Bell System Sources:* Some useful Bell System documents that cover data-related material are as follows:

- Bell System Practices on data apparatus and equipment, private line channels, etc

- "Bell System Data Communications Technical References"—available from WE, Indianapolis
- Telecommunications Transmission
- Engineering (three volumes from Bell Systems Communications Technology Engineering (BSCTE))
- "Transmission Systems for Communications," Fourth Edition—available from WE, Indianapolis.

In addition to the above items, DATEC Support personnel must have ready access to engineering letters (ELs), AT&T Letters, schematic drawings (SDs), circuit descriptions (CDs), etc.

**2.25** *Information from Non-Bell System Sources:* Some worthwhile references available from outside the Bell System include the following:

- Electronic Industries Association, Interface Standards RS-232-B, RS-232-C, RS-334, RS-449, etc
- "Data Transmission" by W. R. Bennett & J. R. Davey, McGraw-Hill, 1965
- "Principles of Data Communications" by R. W. Lucky, J. Salz, & E. J. Weldon, Jr., McGraw-Hill, 1968
- A frequently updated source of information on data communications equipment, such as "Data Pro," "Auerbach," "Office Automation," etc
- Publications by various vendors on their equipment and its operation
- Military Standard—MIL. STD 188-type.

A good working relationship should be established between DATEC Support personnel and data services vendors and contacts should be made periodically to discuss mutual technical problems and to exchange information related to current data services and hardware.

### 3. CASE ESCALATION

**3.01** Formal and uniform escalation procedures are necessary to bring the proper resources to

bear on data service problems. Complex problems encountered by the field forces, such as incompatibility between the data apparatus and the customer's method of operation, programming difficulties in the business machine, or poor performance due to an unusual transmission impairment, often require expert assistance for a fast resolution of the problem. To improve the installation and maintenance of data services and to help avoid long service delays and customer complaints, the field forces must be provided with rapid access to technical personnel who can assist in resolving these problems.

**3.02** There are two basic kinds of escalation for data service problem cases: administrative and technical. These two types of escalation and the conditions under which they apply are outlined below.

#### **A. Administrative Escalation**

**3.03** Administrative escalation is the normal organizational technique for resolving problems that are fairly well defined in most companies. This procedure refers problem cases through the chain of command successively higher until a supervisory level is reached that can resolve the problems on an intra- or interdepartmental basis. This type of escalation is effective in dealing with administrative problems but is not always the most effective method of rapidly resolving difficult technical problems.

**3.04** Administrative escalation is appropriate and effective in dealing with the following kinds of data service problems:

- Basic deficiencies in planned customer service
- Service order deficiencies; orders late, incomplete, too many supplements, etc
- System design; physical equipment layout, circuit design deficiencies, normal data set option assignment, known interface incompatibilities
- Field personnel availability
- Field personnel training
- Component availability and supply—data apparatus, key telephone units, terminal equipment and facilities

- Inadequate test equipment—quantity, quality, availability
- Difficulty in coordinating personnel for end-to-end testing
- Customer training deficiencies.

#### **B. Technical Escalation**

**3.05** Technical escalation is the direct referral of data service problems to DATEC Support personnel by field force supervisors and subsequent referral by FAST Support personnel to higher levels of technical assistance as required. These technical escalation procedures are intended to supplement existing administrative procedures and standard BSPs by assisting the normal work groups in fulfilling their responsibilities but not supplanting them.

**3.06** There are two levels of Data Technical Support available for assisting field forces on data service problems.

- (1) The first level is from RFSC DATEC Support working through an HAL.
- (2) Second level Support is through RFSC where assistance is available from Bell Telephone Laboratories (BTL), Western Electric (WE), Teletype Corporation (TTY), or the manufacturer of general trade products.

**3.07** Additional support may come from AT&T FAST Headquarters where assistance is available for additional help in solving problems of a general nature such as policy decisions or interpretations, and broad interregional coordination. AT&T Headquarters will also coordinate support from other organizations on a corporate-to-corporate level and make final decisions as to the extent of support.

**3.08** Technical escalation of data service problems is appropriate under the following conditions:

- (a) The service meets Bell System specifications but does not meet the customer's performance expectations.
- (b) The service does not meet Bell System specifications and the problem source cannot be identified.
- (c) The service has generated three or more similar trouble reports in 30 days.

### C. Technical Escalation Timing

3.09 Technical escalation will only work successfully if a time limit for required actions is established and observed. Meeting the time limit will require local procedures to keep field supervision informed of the status and expected disposition of data service problems.

3.10 The following time limits for escalation are intended as a Bell System objective:

- (a) When a service meets Bell System specifications but fails to meet the customer's performance expectations, **escalate immediately** (paragraph 3.11).
- (b) When a service does not meet Bell System test requirements and the problem source cannot be identified, **escalate within 4 hours** of the discovery of the problem (paragraph 3.12).
- (c) When three similar trouble reports on the same service are received within 30 days and have been closed out as "test OK," "came clear," "found OK," "no trouble found," etc, **escalate immediately** when the third report is received (paragraph 3.13).

3.11 Situations, such as in paragraph 3.10 (a), may occur at installation when the customer attempts to use the service for the first time or on a repair visit. **Do not optimize parameters when test results are clearly within limits.**

**Note:** The test results must be available when escalating to DATEC Support personnel.

3.12 In the case of paragraph 3.10 (b), the **within 4 hours** limit means that escalation can occur before 4 hours but must not exceed this if a resolution of the problem is not in sight. These hours are usually considered to be working hours but could be continuous hours in the case of a severe data service problem.

3.13 The requirement for escalation in paragraph 3.10 (c) may be difficult to oversee without the aid of local maintenance groups. A local procedure should be implemented to assist in this area.

### D. Escalation Procedure

3.14 The following is a step-by-step procedure of the activities resulting from a case of technical escalation:

(a) Field force supervisors must request technical assistance under the conditions outlined in paragraph 3.10 to the first level of DATEC Support. They will escalate through their Customer Service Support Office (CSSO) or Maintenance Operation Control Center (MOCC) to an RFSC.

(b) The Region DATEC Support personnel will render initial assistance by telephone. Some stubborn cases may not be cleared quickly by phone consultation and will require travel to the problem location. DATEC Support must arrange to provide **on-the-job assistance after 4 hours** have expired from the time they were first consulted if resolution of the problem is not in sight. This procedure gives the field forces up to 8 hours of trouble investigation—4 hours without and 4 hours with technical consultation by phone. Standard contingency travel arrangements should be planned in advance to all parts of the territory covered by the DATEC Support personnel.

(c) After **8 hours of on-site assistance** HAL DATEC Support personnel must contact the RFSC for technical support if resolution of the problem is still not imminent.

(d) Requests from HAL Support personnel to the RFSC DATEC Support personnel for information and documentation must be honored either verbally or with the actual material within 2 hours from the time the request was initiated.

(e) Problems referred to RFSC DATEC Support personnel which remain unresolved may require additional technical support. Regional Headquarters DATEC Support will usually contact BTL, WE, or others who are to provide technical assistance on the problem as soon as possible.

(f) Additionally, Regional Headquarters DATEC Support may contact FAST Headquarters DATEC Support for advice or assistance after procedures of paragraphs 3.15 through 3.18 have been followed. FAST Headquarters, with the aid of Bell Telephone Laboratories, Teletype Corporation, or Western Electric, will provide assistance on the problem as soon as possible.

### E. Escalated Case Report

3.15 DATEC Support personnel should pursue problems unresolved by initial consultation or

**SECTION 010-521-100**

on-the-job assistance by a search of the CATS/DB Technical Advisory (TA) file and the Escalated Case Report (ECR) file. Search of these files will determine if a similar problem has been previously solved or escalated. If this search does not resolve the problem, the RFSC will escalate to a Subject Matter Expert (SME) for a referral, solution or testing plan, and enter a Case Report of the problem into CATS/DB.

**3.16** This Case Report will list the problem and the action taken. The RFSC will enter the Case Report into CATS/DB as normally sent to FAST Headquarters except that the word ESCALATE will be entered into the STATUS field.

**3.17** Upon receipt of the Case Report, FAST Headquarters will prepare the ECR and enter it into the CATS/DB ECR file. Questions on ECRs should be referred to FAST Headquarters and not to originating RFSCs.

**3.18** After an RFSC has resolved a problem that has been escalated, the RFSC will submit another Case Report into CATS/DB with reference to the ECR number. Then FAST Headquarters will convert all this information into a TA as necessary and delete the ECR from CATS/DB. Figure 1 is a flow-chart of ECR procedures.

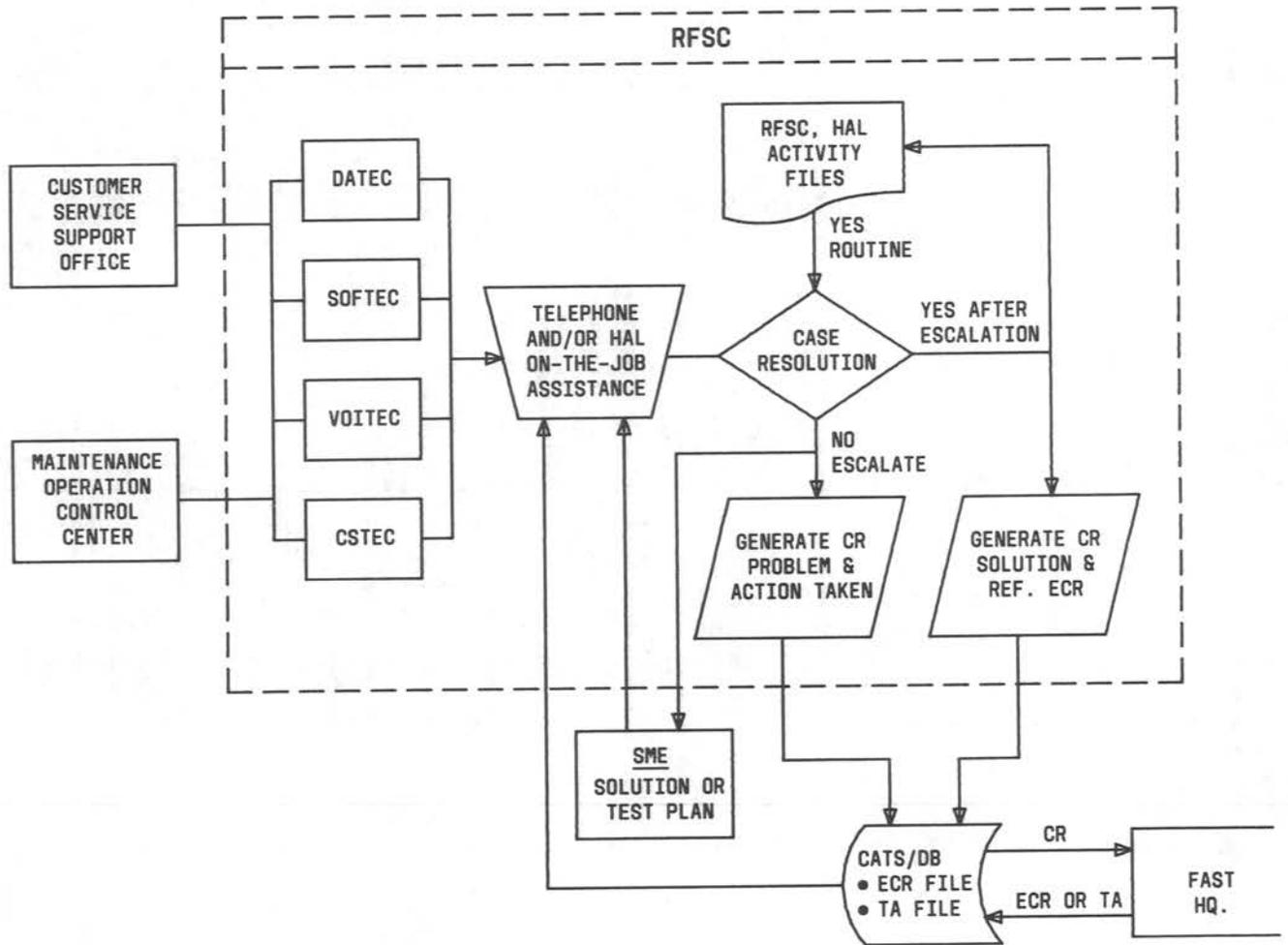


Fig. 1—Flowchart of Escalated Case Report Procedures

## 4. COORDINATION

4.01 This part discusses some of the coordination aspects involved with the FAST DATEC Support effort. These coordination procedures are intended to supplement, not replace, existing administrative and control office responsibilities and practices by efficiently bringing in the proper DATEC Support assistance on complex technical data problems.

4.02 There must be efficient coordination and cooperation among all the parties concerned with the provision of data services. This applies equally to both inter- and intraregional relationships. When more than one RFSC or HAL DATEC Support team is involved with a particular data service problem, the team that resolves the problem should always provide feedback of the results to the other teams that have assisted.

4.03 **Interdepartmental Coordination:** The successful fulfillment of the FAST DATEC Support responsibilities depends upon how well the Support personnel are supported by other organizations within the Region. Regardless of the department to which the designee is assigned (see paragraph 2.05), he must be able to freely contact and work with all the other company organizations involved with data services and vice versa. The quality of a customer's service is of utmost importance and DATEC Support personnel recommendations for improvement should be taken in that light.

4.04 **Coordination Between RFSCs:** DATEC Support personnel groups must coordinate their efforts with other RFSC groups to obtain assistance at work locations outside their Region. Situations arise where a data service problem is escalated at one location resulting from a problem which exists at the far end or where the same data service problem is escalated at each location. In these cases, coordination is a necessity and some illustrations, which also apply to interarea situations, are shown in the following examples:

- **Example 1:** A data station in Region A territory has a problem communicating with a data station in Region B territory. The data

service problem is escalated to RFSC DATEC Support personnel in Region A. Investigation and further testing shows the problem source appears to be within Region B territory. Region A's assisting group consults with Region B RFSC DATEC Support assistance and recounts the testing activity and conclusions. Region B RFSC confirms the findings and agrees to assume the major investigative role for the resolution of the problem. Region A RFSC assists with further testing where necessary and awaits feedback of the problem resolution from Region B RFSC Support group.

- **Example 2:** A data service between Region A and Region B develops a data service problem. Region A receives the first report and, eventually, the problem is escalated to Region A's RFSC DATEC Support personnel. Meanwhile, escalation occurs in Region B. While the additional testing recommended by Region A's RFSC DATEC personnel is taking place, they learn of the dual escalation and contact Region B's RFSC DATEC Support. They agree that Region A's RFSC DATEC Support will assume the major investigative role since it was the initial reporting location and Region B's personnel will assist where necessary. Further investigation indicates that the data problem source appears to be in Region B's territory. The two RFSC DATEC Support groups confer and decide that Region B's RFSC DATEC should now take on the major investigative role in their location and provide feedback of the problem resolution.

4.05 The two examples illustrated above point out two general rules for coordination:

- (1) In single escalation cases, the RFSC DATEC Support in a Region will coordinate the problem investigation until the case is resolved. An RFSC DATEC Support group in another Region may accept the case if it can more effectively handle the investigation coordination due to the problem source, main customer location, etc, (Fig. 2).

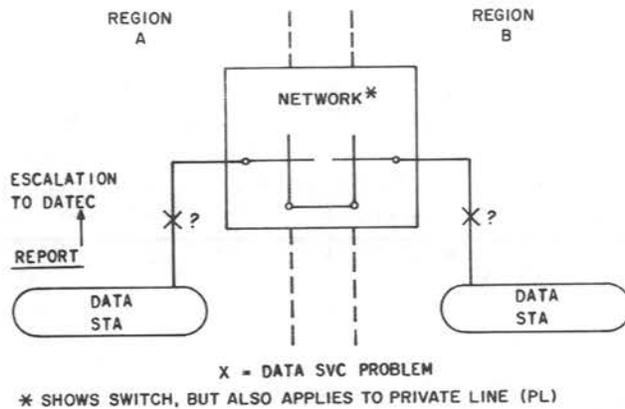


Fig. 2—Telephone Company Case 1

(2) In dual escalation cases, the RFSC DATEC Support in a Region will coordinate the investigation. The other RFSC DATEC Support Region will assist until either the case is resolved or the problem cause is indicated to be within the other Region, and they agree to assume coordination (Fig. 3).

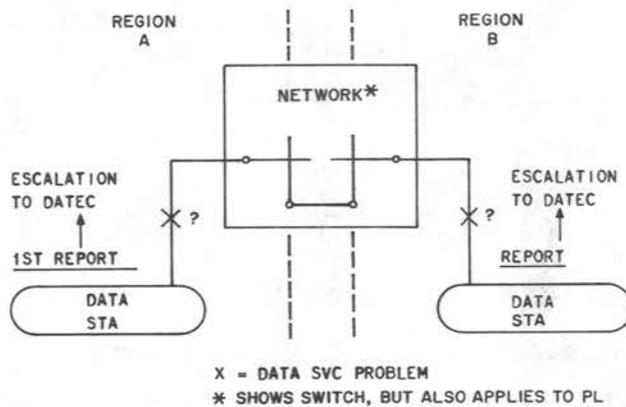


Fig. 3—Telephone Company Case 2

#### Coordination Between Network Support and RFSCs

**4.06** Network Technical Support (NTS) personnel must coordinate their efforts with RFSC personnel to obtain technical assistance at work locations outside their jurisdiction and vice versa. The coordination guidelines supplement normal control office procedures for difficult data service problems.

**4.07** The following general guidelines should be

used for coordinating DATEC Support activities involving NTS and RFSCs. When a data service problem has been isolated by RFSC DATEC support personnel, the RFSC designee will notify NTS personnel to provide assistance and assume the major investigative role. Fig. 4 shows a switched service, but it also applies to private line.

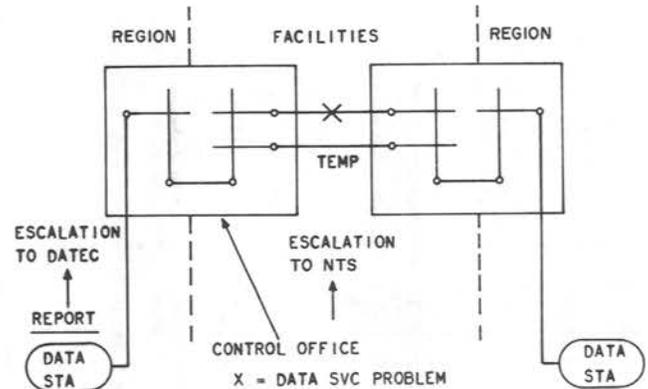


Fig. 4—Network Technical Support

#### Coordination With Independent Companies

**4.08** Due to the traditional close-working relationship with Independent Telephone Companies, the coordination of DATEC Support efforts on services partially provided by an Independent Company should be handled by the RFSC in whose Region the Independent Company operates. The coordination of data service problem investigations should proceed similar to paragraph 4.05, depending on the circuit configuration, and according to the guidelines of the local Bell Independent Relations department. On some particularly complex data service problems, the Independent Company may request or agree to assistance from the Region DATEC Support personnel. This, also, should be handled according to local Bell Independent Relations procedures.

**4.09** Two of the data problem situations that may arise should be handled as follows:

- (a) A problem develops on a data service jointly provided by an Independent Company at one end and the other end terminates in a Region. Testing indicates the problem source appears to be in a Region. Escalation and coordination of RFSC DATEC Support efforts should be handled by the

Region in whose area the problem source is indicated (Fig. 5).

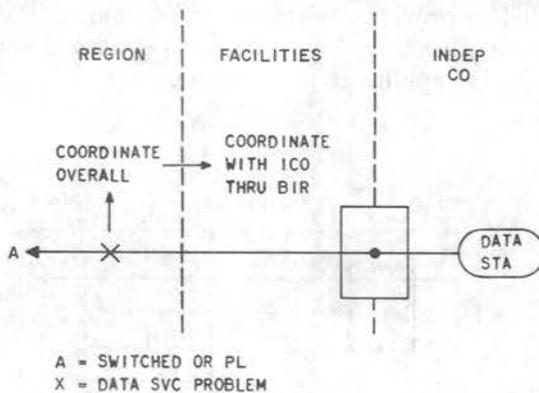


Fig. 5—Bell—ICO Case 1

(b) A problem develops on a data service jointly provided by an Independent Company at one end and the other end terminates in a Region. Testing indicates the problem source appears to be in an Independent Company location. The local RFSC should handle coordination of DATEC Support efforts with that Independent Company and agree to provide assistance, if necessary (Fig. 6).

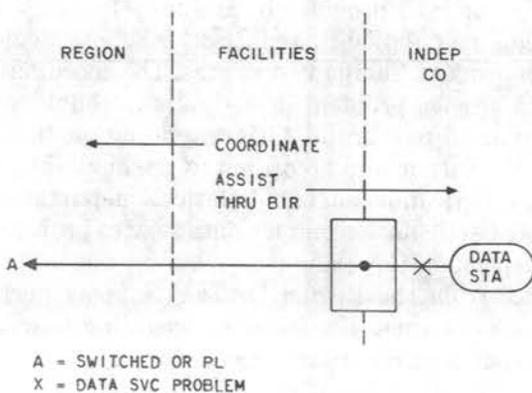


Fig. 6—Bell—ICO Case 2

## 5. TEST EQUIPMENT

5.01 The technically complex nature of data communications services demands that the persons involved with the installation and maintenance of these services be adequately equipped with the proper test equipment. This part provides recommendations for transmission and specialized equipment for DATEC Support personnel. Additional test equipment is required for narrowband, wideband, and digital services.

### A. Field Force Test Equipment

#### Basic Test Equipment

5.02 The field force which installs and maintains the data services listed in paragraph 1.06 must be equipped to perform the basic tests outlined in the BSPs on data services. These same tests are usually made when a data service problem arises for comparison to the most recently recorded benchmarks. Some of the parameters that may be measured are as follows:

- Net loss
- Frequency response
- Impulse noise
- Message circuit noise
- Average error rate
- Envelope delay distortion.

#### Accessible Test Equipment

5.03 Situations may arise during installation or maintenance testing of a particular type of data service in which more than the basic tests should be made. Of particular importance to the performance of high-speed modems is the effect of phase jitter, single frequency interference, and intermodulation distortion. Since these parameters are contributed primarily by carrier systems, the most logical arrangement for their measurement is between offices where intervening carrier facilities exist. The measuring sets for these tests should be available to personnel in those offices.

5.04 One of the useful troubleshooting test equipments for field force use is the portable dual

trace oscilloscope. The scope has the following features:

- (a) Dual trace, separate vertical amplifiers
- (b) At least 10-MHz bandwidth (3 dB down)
- (c) Vertical amplifier sensitivity of at least .05 volt/div
- (d) DC balance adjustment on each amplifier
- (e) External trigger capability
- (f) Accurate vertical and horizontal time capabilities.

**5.05** Suggested data field force applications of an oscilloscope are as follows:

- Verification of voltage levels or fluctuations on interface leads which must conform with Electrical Industry Association (EIA) or other standards
- Observation of distortion on-line signals or eye patterns
- Monitoring ac power lines to note the correlation between hits on the ac power and errors received by Bell System data modems
- Verification of noise or spurious signals on dc interface leads.

When signals are observed on the telephone lines, a test adapter for transformer isolation must be used since the local loop is electrically balanced and oscilloscopes without differential amplifiers and some other models of test equipment are unbalanced to power ground at their inputs. A test adapter for monitor isolation is described in Section 107-180-100.

#### **B. DATEC Support Test Equipment**

**5.06** The test equipment needs of the HAL or RFSC DATEC Support have three categories as follows:

- (a) Transmission test sets
- (b) Data modem test sets
- (c) Special test equipment.

**5.07** The equipment recommended in these categories could be used by one or more DATEC Support groups, depending upon the number of data services within an operating area and the need. The recommendations are designed to equip the Support groups with adequate equipment usable on the wide variety of data services. The equipment should be assigned to the DATEC Support groups for use either by themselves or in particular situations by the field force.

#### **Transmission and Data Test Sets**

**5.08** DATEC Support personnel should have the capability of measuring the following transmission parameters:

- Phase jitter
- Phase and gain hits
- Intermodulation distortion
- Single-frequency interference
- Frequency shift (carrier offset)
- Return loss
- Singing point margin
- Envelope delay distortion
- Peak/Average Ratio (P/AR)
- Frequency response
- Noise
- Loss.

**5.09** The DATEC Support personnel should also have test equipment capable of measuring data modem error rate and interface lead condition.

#### **Special Test Equipment**

**5.10** Occasionally, data service problems develop where standard tests do not uncover the source of the problem. Special test equipment is necessary in these instances to provide the capability of in-service monitoring of data set interfaces, line signals and performing further data tests such as character generation and data terminal emulation.