

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT INITIATION

Date: 2/3/77

Project Title: "Motorist Aid Citizens Radio Service (CB) as a Wide Area Communication System."

Project No: A-1940

Project Director: Mr. R. W. Wallace

Sponsor: Federal Highway Administration

Agreement Period: From 1/25/77 Until 5/24/78

Type Agreement: Contract No. DOT-FH-11-9232

Amount: \$152,047

Reports Required: Monthly Progress Reports, Work Plan and Schedule,
Tasks Documentation, Final Report.

Sponsor Contact Person (s):

Technical Matters

Mr. Frank Mammano
Federal Highway Administration
Office of Research
Traffic Systems Division
Washington, D. C. 20590

Contractual Matters
(thru OCA)

Mrs. Virginia Matthewson
Federal Highway Administration
Washington, D. C. 20590

Defense Priority Rating:

Assigned to: Electronics Technology (School/Laboratory)

COPIES TO:

Project Director
Division Chief (EES)
School/Laboratory Director
Dean/Director—EES
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Director, Physical Plant
Chief Information Office
Project File (OCA)
Project Code (GTRI)

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT TERMINATION

Date: 1/7/80

Project Title: Motorist Aid Citizens Radio Service (CB) as a Wide Area Communications System

Project No: A-1940

Project Director: C.S. Wilson

Sponsor: Federal Highway Administration

Effective Termination Date: 10/31/80

Clearance of Accounting Charges: 10/31/80

Grant/Contract Closeout Actions Remaining:

- ☒ Final Invoice and Closing Documents
- ☐ Final Fiscal Report
- ☐ Final Report of Inventions
- ☒ Govt. Property Inventory & Related Certificate
- ☐ Classified Material Certificate
- ☐ Other _____

Assigned to: ETL/CSG (School/Laboratory)

COPIES TO:

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Project Code (GTRI)
Other Project Code (OCA)

A-1940

ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

14 March 1977

43
B-59
Federal Highway Administration
Office of Research
Traffic Systems Division
Washington, DC 20590

Attention: Mr. Frank Mammano

Subject: Monthly Progress Report No. 1
Contract No. DOT-FH-11-9232
"Motorist Aid Citizen Radio Service (CB)
as a Wide Area Communication System" (CB-AIDS)
Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the period of January 25, 1977, through February 28, 1977.

GENERAL

The principal investigator, Ron Wallace, attended the annual meeting of the Transportation Research Board in Washington, DC, during which he met informally with Mr. Frank Mammano, Contract Manager, and Mr. Lyle Saxton, Chief of the Systems Development and Technology Group. He also attended the sessions on Citizens Band Radio and Innovations and Technological Development and the meetings of the Committee on Communications and the Committee on Motorist Information Systems.

The FHWA provided equipment was received on February 17, 1977. A letter (attachment A) confirming receipt of the equipment was sent to FHWA on March 4.

Enclosed as attachment B is a biographical sketch of Mr. S. L. Robinette, Jr., who is now available for the CB-AIDS program. It is felt that Mr. Robinette's background will make him a valuable addition to the project team, particularly in Tasks A, D, and E. Permission is hereby requested to use Mr. Robinette in these tasks.

WORK COMPLETED

A draft copy of the program plan and schedule was sent to the contract manager on February 9 for his comments.

During the reporting period, work was initiated on Task A and Task B as reported below.

The Task A activity was initiated with a brief review of related activities in motorist aid systems and CB radio monitoring teams. Information on the existing motorist aid systems will be held for later cost comparisons with CB-AIDS. The preparation of visual aids for the CB-AIDS presentations was initiated. A 2 x 2 slide format was selected for the presentation in order to allow the use of a Carousel projector with an enclosed screen if necessary. Motorist aid systems slides are being solicited from FHWA for possible use in the presentation. The current mobile CB radio, digital adapter, base station CB radio, digital decoder/display unit, and telephone interconnect equipment were received and set up in the lab. The system operated satisfactorily with the exception of an occasional failure of the DA to initiate a sequence when the mike was keyed. The telephone interconnect equipment was connected to the system but not to the telephone line. A clicking type of interference was noted with the telephone interconnect equipment.

The Task B effort was concentrated primarily on specifying mobile and base CB radios and antennas for the pilot program and an investigation of the telephone interconnect problem. Good quality 23 channel (if available) CB radios with four or five pin DIN mike connectors on the mobile units are to be selected. A large amount of information on commercially available telephone interconnect equipment has been gathered, and telephone company personnel have been contacted to insure that their requirements are satisfied. Some effort has been devoted to a review of the current digital adapter and remote station design. Some problems have been encountered with incorrect and incomplete information on the schematics, and it would be useful to have accurate full size schematics if these are available.

PROBLEM AREAS

No problems have been encountered that would affect either the time or money constraints of the contract.

WORK PLANNED FOR NEXT MONTH

Work will continue on Task A and Task B during the next reporting period.

The Task A effort will include scheduling presentations with selected agencies, industry groups, and user groups for targetted mid-April presentations; completion of the presentation visual aids materials; and improvement of the operating characteristics of the demonstration hardware.

The Task B effort will include the purchase of commercial CB radio equipment and a continuation of the design effort on the digital adapters and remote stations. The planned DA design calls for a low profile chassis that may be mounted above or below the mobile CB radio and a single connection to the installed CB radio through the mike connection. Power for the DA will be provided through the mike connector resulting in no requirement for external power connections.

MANAGEMENT INFORMATION

The following information gives the managerial and estimated financial status of the contract as of February 28, 1977:

(A) Cumulative Costs

<u>Category</u>	<u>Planned</u>	<u>Costs Current Month</u>	<u>Cumulative</u>
Task A	\$ 20,592	\$5425	\$5425
Task B	34,387	1481	1481
Task C	10,453	----	----
Task D	66,250	----	----
Task E	<u>20,364</u>	<u>----</u>	<u>----</u>
TOTAL	\$152,046	\$6906	\$6906

(B) Estimated cost to complete: \$145,140.

(C) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Current Month</u>	<u>Man-Hours Expended Cumulative</u>
Principal Investigator		
R. W. Wallace	120	120
Principal Research Engrs.		
D. W. Robertson/H.H. Jenkins	8	8
Senior Research Engineer		
R. W. Moss	16	16
Assist. Research Engrs.		
C.S. Wilson/D.R. Sentz	72	72

Federal Highway Administration
14 March 1977
Page Four

(D) Percentage of work performed: See Figure 1.

Respectfully submitted,

Ronald W. Wallace
Project Director

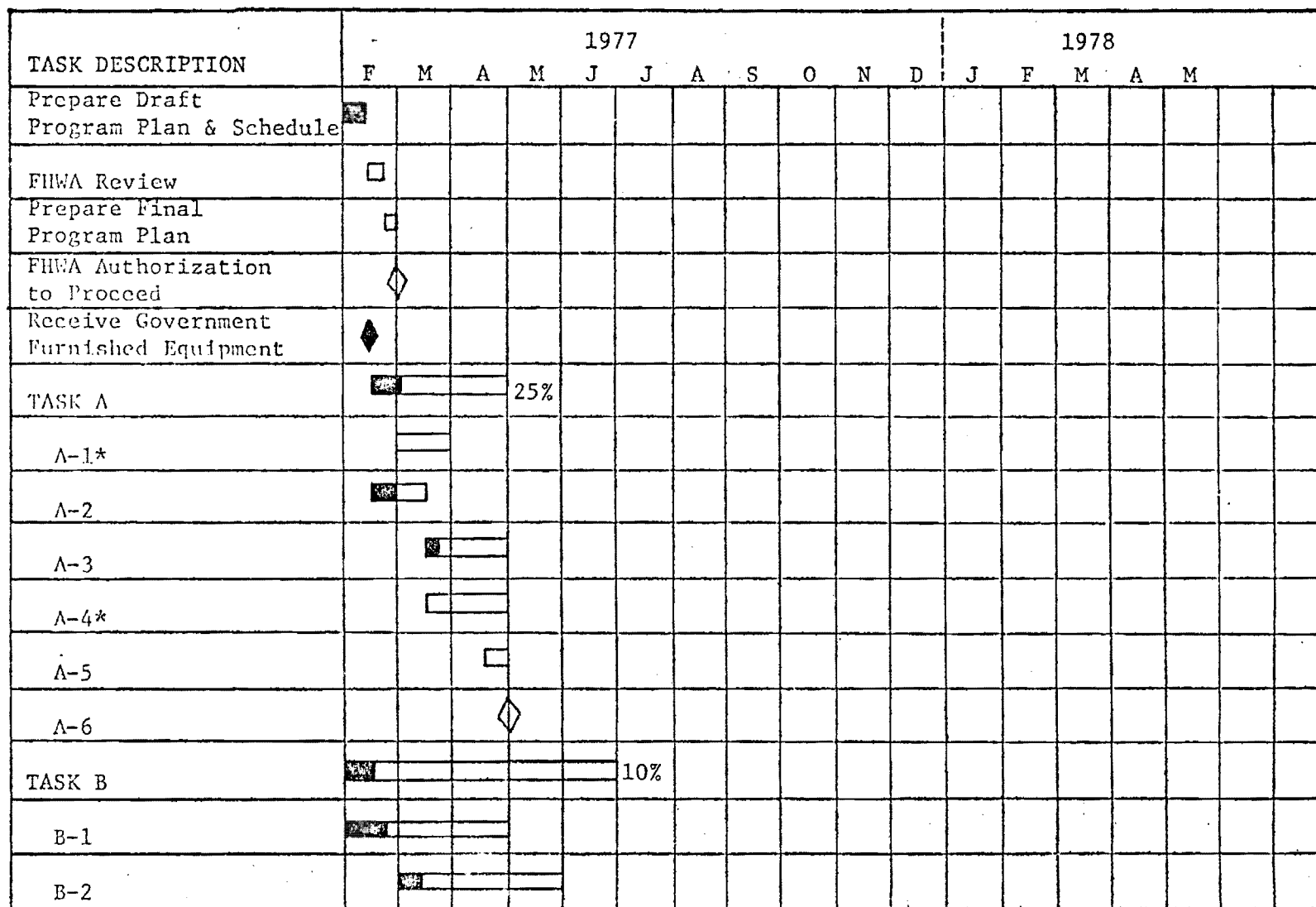
RWW:gh

Approved: —

D. W. Robertson, Director
Electronics Technology Laboratory

Attachments

FIGURE 1.
CB-AIDS TASK SCHEDULE


































Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◇ indicates milestone event.
3. * indicates substantial external factors in subtask.

CB-AIDS TASK SCHEDULE (continued)

[illegible]

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
D-3																	
D-4																	
D-5																	
D-6																	
D-7*																	
D-8																	
D-9																	
D-10																	
D-11																	
D-12																	
D-13																	
D-14																	
D-15																	
D-16																	
D-17																	

CB-AIDS TASK SCHEDULE (continued)

[illegible]

ATTACHMENT A



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

3 March 1977

Federal Highway Administration
Office of Research
Traffic Systems Division
Washington, D.C.

Attention: Mr. Frank Mammano

Subject: Receipt of GFE for Contract No. DOT-FH-11-9232

The following equipment was received from the Federal Highway Administration on February 17, 1977, for use in Contract DOT-FH-11-9232.

<u>Item No.</u>	<u>Description</u>	<u>No.</u>
1(A)	Realistic Navaho Model TRC-30A CB Transceiver, Modified, Serial #14360221, Honeywell #270-2101-001, DOT #DOT-FH-11-8483.	1
(B)	Realistic Dynamic Microphone, Model #21-1172.	1
(C)	AC Power Cord.	
2.	Johnson Messenger Model 323A CB Transceiver, Modified, Serial No. 323A075-91788, Honeywell No. 270-2201-001, DOT #DOT-FH-11-8483. Set includes digital adapter.	1
3.	Digital Decoder/Display Unit, Honeywell No. EL8-0318-1, DOT #DOT-FH-11-8483.	1
4.	Reach Electronics, Inc., Phone Patch Model 3IT53, Serial No. 49615 G-2302, Honeywell No. 560-0701-001, Honeywell No. 560-0702-001, Dot #DOT-FH-11-8483.	1
5.	Miscellaneous cables and connectors as listed below.	
(A)	2' long coax cable with BNC connectors.	3

Federal Highway Administration
Page Two
3 March 1977

<u>Item No.</u>	<u>Description</u>	<u>No.</u>
(B)	2 wire-shielded cable with phone plugs.	1
(C)	Amphenol 145-25F connector with two wires.	1
(D)	Cable with 7 pin Amphenol connector on one end and 14 pin Cinch 57-30140 on the other end.	1
(E)	30" connecting wire with spade type terminals.	1

The only damage noted was a bent antenna connector on item 1(A).

Sincerely,

Ronald W. Wallace
Project Director

RWW:mmm

cc: Mrs. Virginia Matthewson
Ms. Phyllis Oliver

ATTACHMENT B

Georgia Institute of Technology

BIOGRAPHICAL SKETCH

ROBINETTE, SPURGEON L., JR.--Senior Research Engineer, Lecturer
Engineering Experiment Station

Education

Undergraduate Study, Howard College	1939
B.S.E.E., University of Alabama	1950
M.S.E.E., Georgia Institute of Technology	1959

Georgia Institute of Technology Employment 1954-Present

Experience Summary: Staff member and director of projects concerned with studies of interference in communications systems, voice and digital communications evaluation, component design and test, transducers, thin-films, power systems for spacecraft, telecommunications, public safety radio, radio tracking, aircraft navigation, wind generation of power, grounding and lightning protection. Taught courses in electronics, computer simulation, energy conversion, logic circuits, and digital computer organization, and applications of technology in criminal justice systems. Consulting in the areas of police, fire, and emergency medical radio, CATV, and microwave networks.

Current Fields of Interest

Control systems; automatic control; system design and analysis, simulation and math modeling; circuitry; communications systems; radio frequency interference; microwave devices; physical and chemical instrumentation; electrical energy systems; public safety communications; microwave networks.

Technical Contributions

- One patent
- Five articles in professional journals related to technology applications in the public sector.
- Principal investigator on a systems engineering design of an integrated emergency communication system for an urban government.
- Consultant on medical emergency communication systems.
- Twenty-nine technical reports on sponsored programs. Specifically related to this program are:
 1. "Electronics Telecommunications Technology and Improving Urban Life in Atlanta," Special Report, Project A-1256, submitted to the National Academy of Engineering, Washington, DC, July 1970.
 2. "Georgia Telecommunications," for the State of Georgia Reorganization and Management Improvement Study, July 1971.
 3. "A Unified Emergency Communications System for DeKalb County," Volumes I & II, Georgia Tech Project A-1362, December 1971.
 4. "City of Savannah Public Safety Communication System," Final Report, Georgia Tech Project A-1505, September 1973.



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

13 April 1977

Federal Highway Administration
Office of Research
Traffic Systems Division
Washington, DC 20590

Attention: Mr. Frank Mammano

Subject: Monthly Progress Report No. 2
Contract No. DOT-FH-11-9232
"Motorist Aid Citizen Radio Service (CB)
as a Wide Area Communication System" (CB-AIDS)
Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of March 1977.

GENERAL

The formal authorization to proceed with the contractual tasks was received in a letter from the Contract Manager, Frank Mammano, dated March 7, 1977 (HRS-32). The authorization was based on the program plan submitted by Georgia Tech on February 9 and subsequent telephone conversations between the Georgia Tech principal investigator, Ron Wallace, and Mr. Mammano. A revised program plan was submitted to Mr. Mammano on April 1 incorporating the agreed upon modifications to the program plan. After final approval, the program plan will be formally submitted through the contracts office.

WORK COMPLETED

During the reporting period, work continued on Task A and Task B as reported below:

Task A - A list of the names of representatives of organizations to whom the CB-AIDS presentation will be made has been compiled. The list includes representatives in the four categories of regulatory agencies, response groups, user groups, and industry groups. This list is composed of those representatives in the Washington, D.C., metropolitan area. A similar

list is being compiled for the Atlanta, Georgia area. The Washington area representatives will be contacted to schedule presentations during approximately the last week in April. The Atlanta representatives will be scheduled for presentations at a later date. A set of slides on Motorist Aid Systems was borrowed from the FHWA and applicable slides were copied. These slides will be combined with slides of the CB-AIDS concept and hardware for the presentations.

A library of CB and motorist aid information has been assembled and is available to the project team.

A modification was made to the Digital Adapter which eliminated the intermittent operation. The modification consisted of using a spare one-shot circuit to eliminate a timing problem on the reset pulse. The DA has operated since the modification without any failures.

Task B - The work on Task B included the specification and purchase of commercial CB radio equipment and design of Digital Adaptor, Remote Station, and Central Control Unit.

An investigation of the performance characteristics of various CB transceivers was conducted during March leading to the purchase of two base station units, two mobile units, and associated antennas. In order to provide equipment comparisons, 40 channel base and mobile and 23 channel base and mobile units were purchased. The following specific items were purchased:

40 channel base - Motorola model 4000 with model T2015A converter

40 channel mobile - Motorola model 4000

26 channel base - Pace model CB-113

26 channel mobile - SBE model SBE-29CB

Base station antennas - Antenna Specialists model M-400

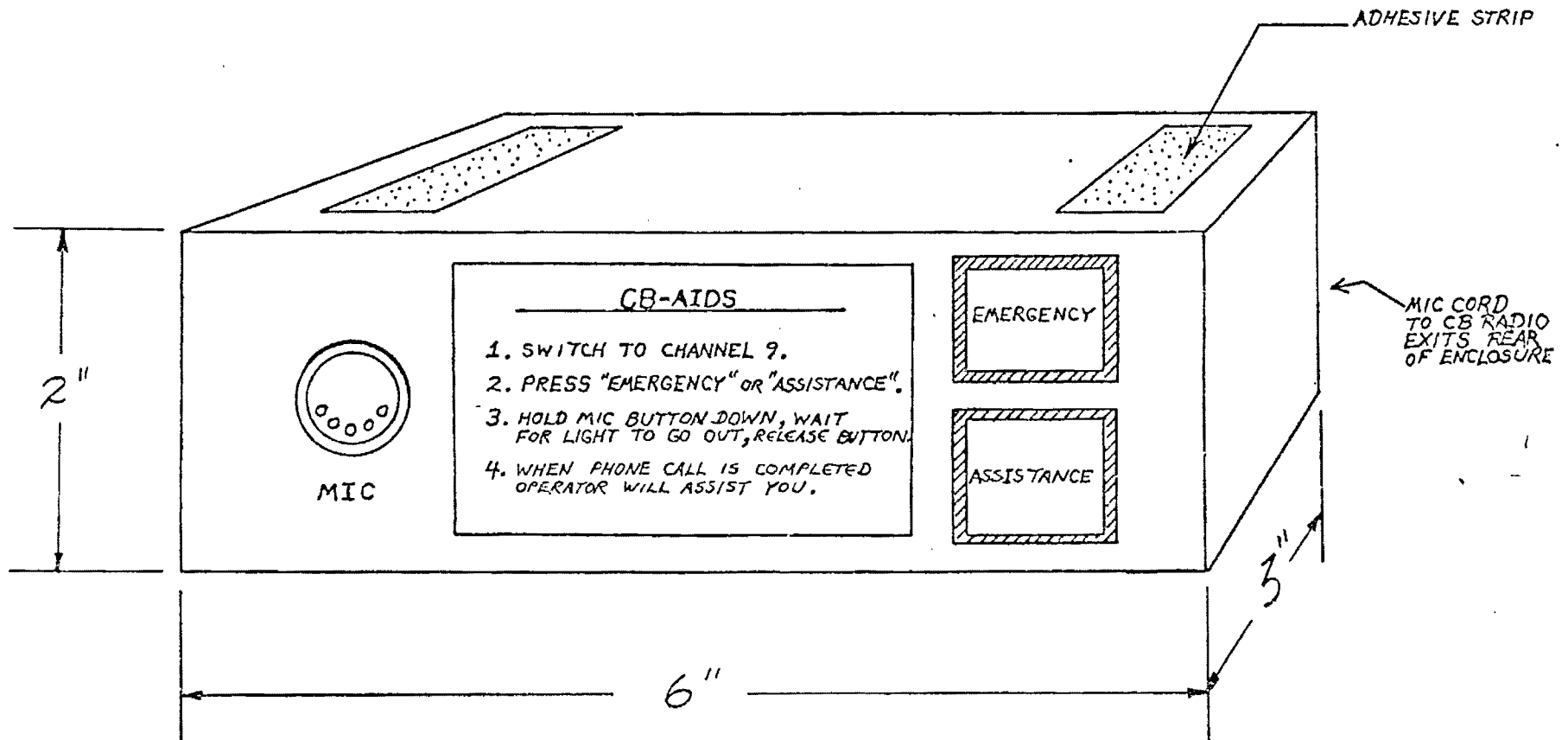
Mobile antennas - Kraco model KA2424

The review of the DA design resulted in modifications of the timing circuit to eliminate intermittent operation, modifications of the emergency and assistance lamp driver circuits to simplify the layout, and modification of the audio interface circuit to improve the signal to noise ratio of the tone burst. These modifications will be included in the breadboard model and documented in the next reporting period.

The DA packaging design has been oriented toward being compatible with a large variety of CB radio types. The attached sketch (figure 1) indicates

Figure 1

Digital Adapter Configuration



the current configuration. The package is being planned with 2" x 3" x 6" dimensions with the front panel measuring 2" x 6". The DA is designed to receive its power from the microphone connection under most circumstances. An auxiliary power connection will be available for use with CB radios that do not have power available at the mike connector. The DA front panel will contain the microphone input connector and the emergency and assistance pushbuttons. The connector to the CB radio will be routed through a grommet on the rear panel. The DA will be attached to either the top or bottom of the CB radio with an adhesive material.

The current Remote Station design has been reviewed to identify improvements which may be incorporated into the design and to allow for the automatic dialing feature for telephone interconnect. The phase lock loop approach currently used for bit demodulation is a good method which will be retained; however, the sampling bit detector will be replaced by an improved integrating bit detector which will reduce the bit error rate. A number of telephone interconnection devices have been reviewed and although a final selection has not been made, the selected device will be simple to install and operate. FCC approved telephone line isolators will be purchased for connection to the Bell System circuits.

The Central Control Unit design was initiated during March. A basic block diagram was produced which is shown as figure 2. As may be seen the CCU will provide telephone interconnection with the RS, information display, and a printed record of each call. As currently envisioned the time of receipt of the call will be printed followed by the RS ID, user ID, and call category (E or A). When the call has been completed and the telephone disconnected the time will again be printed. This information may then be used to follow up on all uses of the system. An added item which is being considered is a tape recorder which will automatically record all conversations over the system.

PROBLEM AREAS

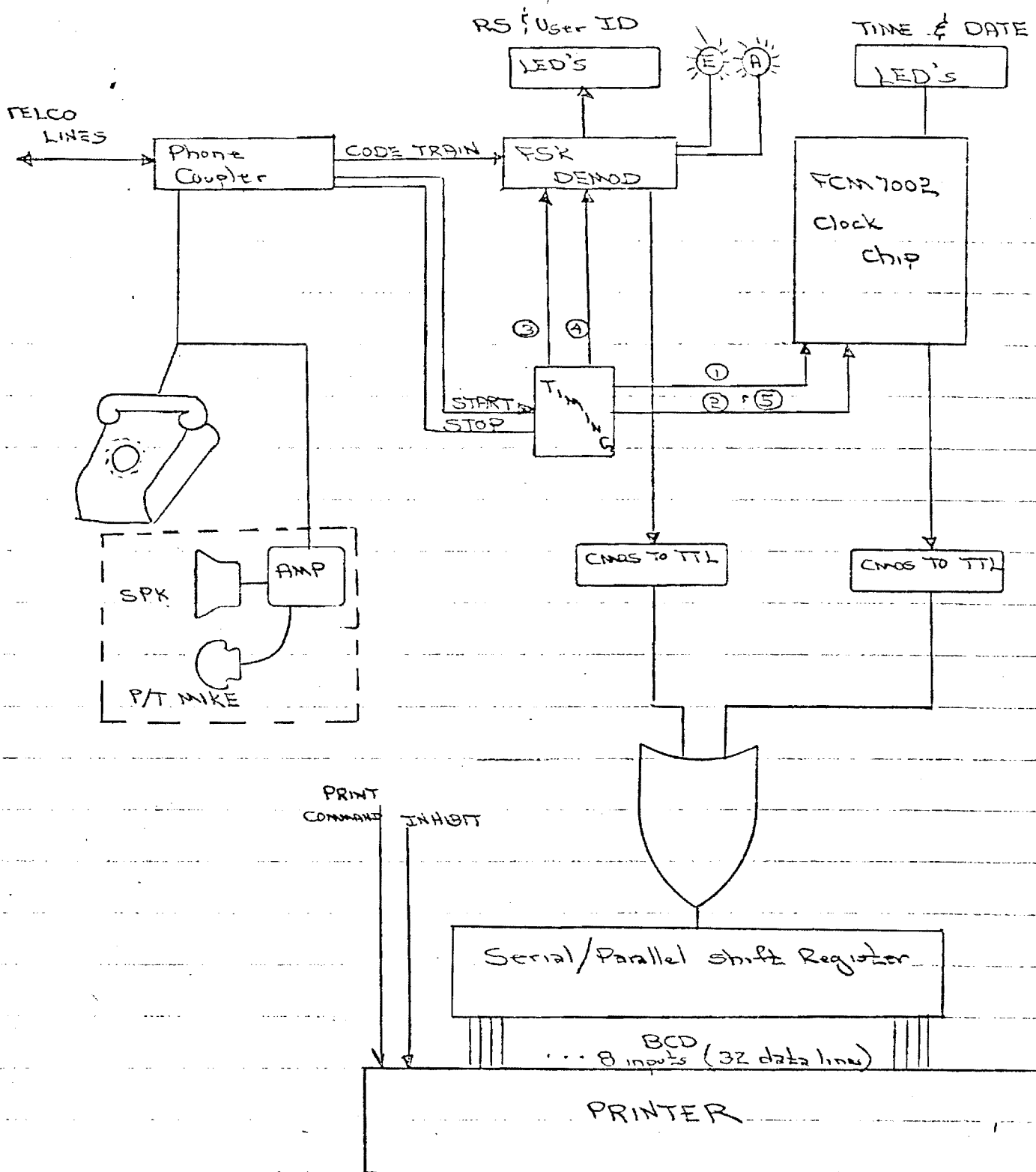
It now appears that the demonstrations of CB-AIDS to the various interested groups will probably be postponed until early in May extending the completion of Task A until the end of May. Other than this, no problems have been encountered that would affect either the time or funding constraints of the contract.

WORK PLANNED FOR NEXT MONTH

Work will continue on Tasks A and B and will begin on some preliminary aspects of Task D during the next reporting period.

The Task A effort will include finalization of the presentation material in a meeting with FHWA and final scheduling of the presentations to interested

Figure 2
CCU Block Diagram



groups in the Washington, D.C., metropolitan area. The actual presentations will probably be scheduled during May.

The Task B effort will include completion of a breadboard of the improved design DA, and a continuation of the RS and CCU detailed design with the purchase of most required parts for the two RSs and single CCU.

The Task D activity will include the design effort required to convert the DA design to mass production and the preliminary development of pilot program test site criteria.

MANAGEMENT INFORMATION

The following information gives the managerial and estimated financial status of the contract as of March 31, 1977:

(A) Cumulative Costs

<u>Category</u>	<u>Planned total</u>	<u>Current Month</u>	<u>Cumulative Costs</u>
Task A	\$20,592	\$ 6,250	\$11,675
Task B	34,387	3,843	5,324
Task C	10,453	-	-
Task D	66,250	-	-
Task E	<u>20,364</u>	<u>-</u>	<u>-</u>
TOTAL	\$152,046	\$10,093	\$16,999

(B) Estimated cost to complete: \$135,047

(C) Key Personnel Man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Cumulative</u>
Principal Investigator R. W. Wallace	120	240
Principal Research Engrs. D. W. Robertson/ H. H. Jenkins	8	16
Senior Research Engr. R. W. Moss	32	48
Assist Research Engr. C. S. Wilson/ D. R. Sentz	138	210

(D) Percentage of work performed:

See Figure 3.

Respectfully submitted,

Ronald W. Wallace
















RWW:am

Approved:

D. W. Robertson, Director
Electronics Technology Laboratory

Figure 3

CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
Prepare Draft Program Plan & Schedule																	
FHWA Review																	
Prepare Final Program Plan																	
FHWA Authorization to Proceed																	
Receive Government Furnished Equipment																	
TASK A					50%												
A-1*																	
A-2																	
A-3																	
A-4*																	
A-5																	
A-6																	
TASK B						25%											
B-1																	
B-2																	

Notes:



1.  filled in portion indicates percentage of completion.
2.  indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 3

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
B-3																	
B-4																	
B-5																	
B-6*																	
B-7																	
B-8																	
TASK C																	
C-1																	
C-2*																	
C-3*																	
C-4																	
C-5																	
TASK D																	
D-1																	
D-2																	

Figure 3

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
D-3																	
D-4																	
D-5																	
D-6																	
D-7*																	
D-8																	
D-9																	
D-10																	
D-11																	
D-12																	
D-13																	
D-14																	
D-15																	
D-16																	
D-17																	

Figure 3

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
D-18																	
D-19																	
TASK E																	
E-1																	
E-2																	
E-3																	
E-4																	
Attend TRB & FCP																	
Submit Progress Report																	
Design Reviews																	
Prepare & submit Draft Final Report																	
Prepare & submit Final Report.																	



ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

13 May 1977

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano

Subject: Monthly Progress Report No. 3
Contract No. DOT-FH-11-9232
"Motorist Aid Citizen Radio Service (CB)
as a Wide Area Communication System" (CB-AIDS)
Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of April, 1977.

GENERAL:

The approved program plan and schedule were formally submitted to FHWA through the contracts office on May 4, 1977.

WORK COMPLETED:

During the reporting period, work continued on Task A and Task B as reported below:

Task A - A set of 33 slides was prepared for use in presentations of the CB-AIDS program. A "draft" presentation was presented to FHWA representatives Frank Mammano and Lyle Saxton of the Traffic System Division, Milt Heywood and Bob Harp of the Office of Traffic Operations, and Bob Ellington of the Implementation Division on April 21. Following a review of the presentation and slides, it was decided to change the approach used in some of the slides. Instead of using item listings, the new concept is to restrict each slide to a main idea accompanied with a lively illustration. Work was initiated on the development of 17 new slides to reflect this approach. Highly technical slides will be available for reference but will not be included in the main presentation.

Task B - The work on Task B has included design of the Digital Adapter, Remote Station, and Central Control Unit.

Redesign of the Digital Adapter has been completed with the new design which has been included as an attachment to this report. The major design changes are the modification to the reset timing circuit to eliminate intermittent operation, modification of the audio interface circuit to improve tone burst signal to noise ratio, and modifications to the emergency and assistance logic and driver circuitry to simplify the layout.

Referring to the figures 1 - 8 of the attachment, the various circuits used in the design will be discussed.

1. Output circuit - the circuit couples the tone filter output to the microphone input and is the same as the previous design.
2. RC filter - this circuit filters the PDM signal and is unchanged.
3. Output configuration and control - this circuit connects the PDM tone signals to the CB Radio input connector and has been improved by gating off the microphone during tone transmissions.
4. PDM forming logic - this circuit has been modified to eliminate a logic gate.
5. Shift register - this circuit provides the DA identification code and the E or A indication. It has been modified for pilot program use. As shown the first two registers contain prewired digits. The third register will contain the unique ID which will be programmed by drilling through a plated through hole which is connected to either the logic '1' or logic '0' line. The forth register contains the prewired number and the E/A indicator.
6. Clock - this is the basic system timing circuit which is unchanged.
7. Button circuit - this circuit receives the emergency or assistance push button request and sets the appropriate register and indicator light. It has been improved by the elimination of superfluous registers and gates, the addition of an indicator interlock, and the substitution of appropriate lamp driver transistors.
8. Generation of all timing signals... - this circuit is unchanged.
9. Generation of mike key control signals... - this circuit initiates the DA operation when the mike key is depressed. The original version of this circuit was the culprit in the intermittent operation. It has been improved with the addition of the second mike key one shot which eliminates the untimely resetting of the mike key sequence register.

10. Lamp driver FF's reset circuit - this is the system reset circuit which is unchanged.

The design concept of the Remote Station was completed during April. Figure 9 of the attachment is a flow chart of the RS operations. The operations are briefly described as follows. The RS initially checks for the receipt of a valid data word. The system requires two consecutive identical patterns for validity. If a valid word is received, it is stored in a shift register and the RS identification code is merged with the DA user ID in the data word. At this point, the CB transceiver is keyed on to verify message reception to the call initiator and the CCU number is automatically dialed. If the CCU number is busy, the call is disconnected and the RS is reset to the initial condition to receive a new request. If the CCU number is not busy, the RS sends the data word to the CCU when the call is answered. At this time, the control of the RS transceiver is passed to the CCU and the voice operated switch (VOX) is actuated. The CCU controls the RS transceiver by sending a three tone code at the beginning and end of each voice transmission. The VOX has a time out signal associated with it which will provide a back up disconnect signal so that the transmitter will automatically be turned off in case of circuit failure. The normal turn off and return to the initial condition will be provided by a hang up tone from the CCU.

A block diagram of the RS design is included as figure 10 of the attachment. As of the end of April, the circuit design of the automatic telephone dialer and the integrate and dump FSK demodulator have been completed. Parts are being ordered as the design of each subsection is completed. Many of the previously ordered parts have been received.

The front panel layout of the Central Control Unit has been completed. The display includes RS ID, User ID, emergency or assistance indication, and data/time ID. The months activity was primarily developed to the design of the time source and data formatter portions of the CCU. The time source uses a standard consumer digital clock calendar chip with the controls designed to provide continuous display of the data and time. The data formatter is used to route the appropriate data to the printer. The printer provides a permanent record of all calls using three lines of data for each call. The first line includes the data and time of call initiation and whether it was emergency or assistance. The second line consists of RS ID and user DA ID. The final line includes the data and time of call termination.

PROBLEM AREAS

As previously noted, the demonstrations of CB-AIDS to the various interested groups has been delayed until the slide presentation is in a

final form. Otherwise, there are no problems that would affect either the schedule or funding constraints of the contract.

WORK PLANNED FOR NEXT MONTH

Work will continue on Tasks A, B, and D during the next reporting period.

The Task A effort will include the completion of the revised CB-AIDS 35mm slides and the establishment of a presentation schedule.

The Task B effort will include completion of the DA first prototype and a continuation of the RS and CCU design and fabrication.

The Task D effort will include the layout of the printed circuit board and further pilot program definition.

MANAGEMENT INFORMATION.

The following information gives the managerial and estimated financial status of the contract as of April 30, 1977:

(A) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Cost</u>
Task A	\$20,592	\$ 5,165	\$ 16,840
Task B	34,387	7,870	13,195
Task C	10,453	-0-	-0-
Task D	66,250	1,055	1,055
Task E	<u>20,364</u>	<u>-0-</u>	<u>-0-</u>
TOTAL	\$152,046	\$14,090	\$31,090

(B) Estimated cost to complete: \$120,956

(C) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-hours Current Month</u>	<u>Expended Cumulative</u>
Principal Investigator R. W. Wallace	120	360
Principal Research Engineers D. W. Robertson/ H. H. Jenkins	16	32
Senior Research Engineer R. W. Moss	32	80
Assist. Research Engineers C. S. Wilson/ D. R. Sentz	202	412

(D) Percentage of work performed: (See Figure 1)

Respectfully submitted.

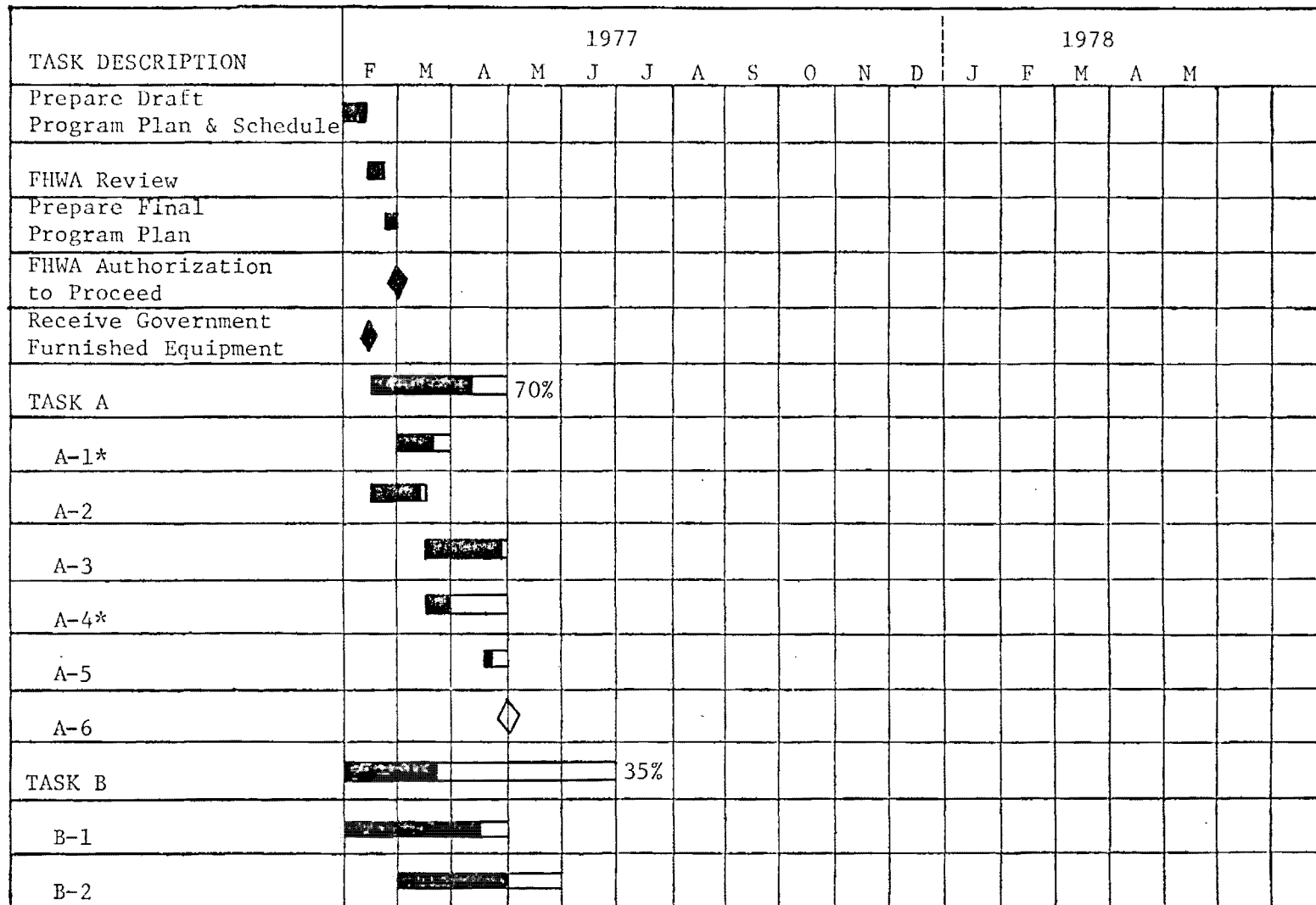
R. W. Wallace
Project Director

RWW:am

Approved:

D. W. Robertson, Director
Electronics Technology Laboratory

Figure 1. CB-AIDS TASK SCHEDULE



Notes:



1.  filled in portion indicates percentage of completion.
2.  indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 1. CB-AIDS TASK SCHEDULE (continued)

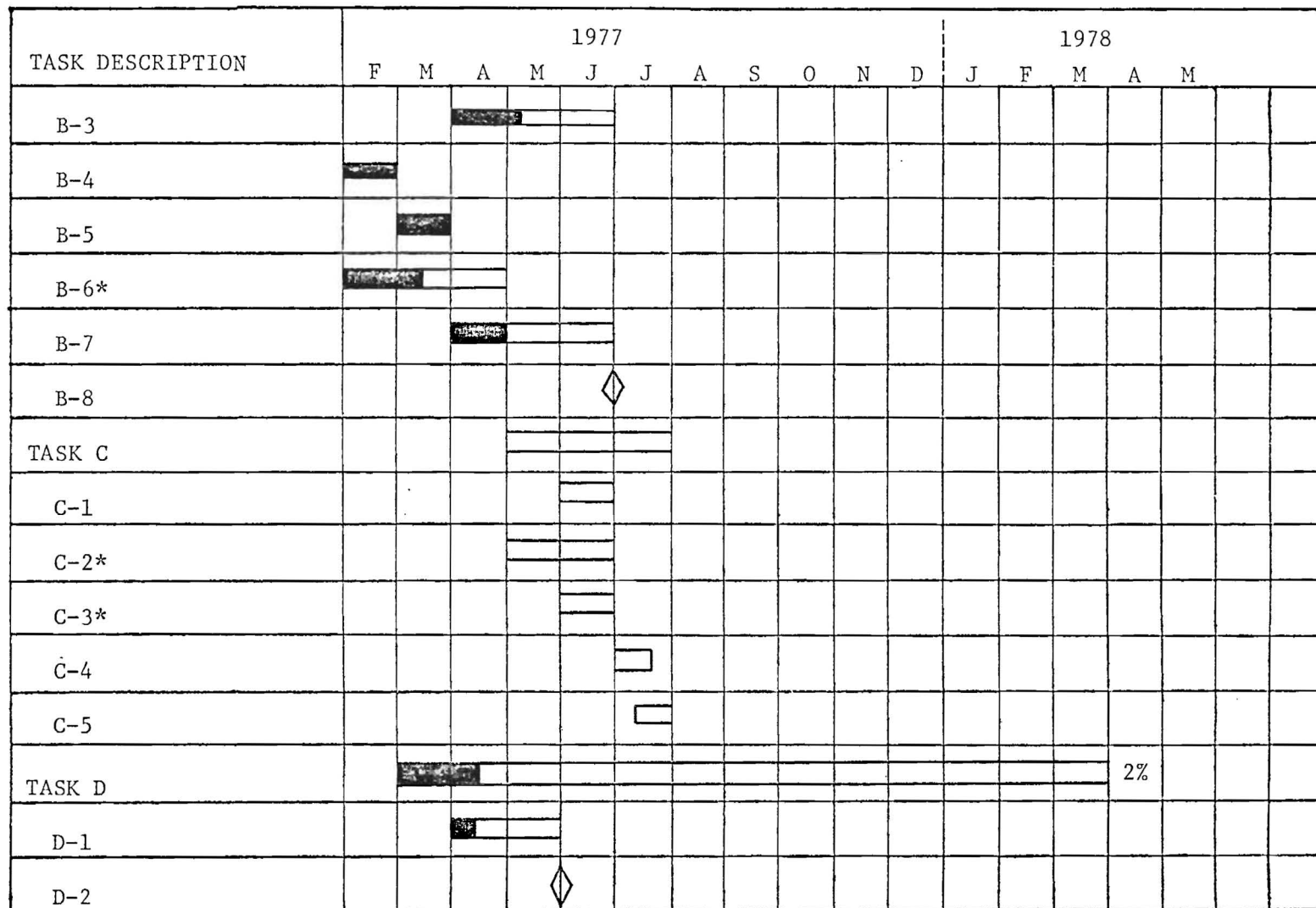


Figure 1. CB-AIDS TASK SCHEDULE (continued)

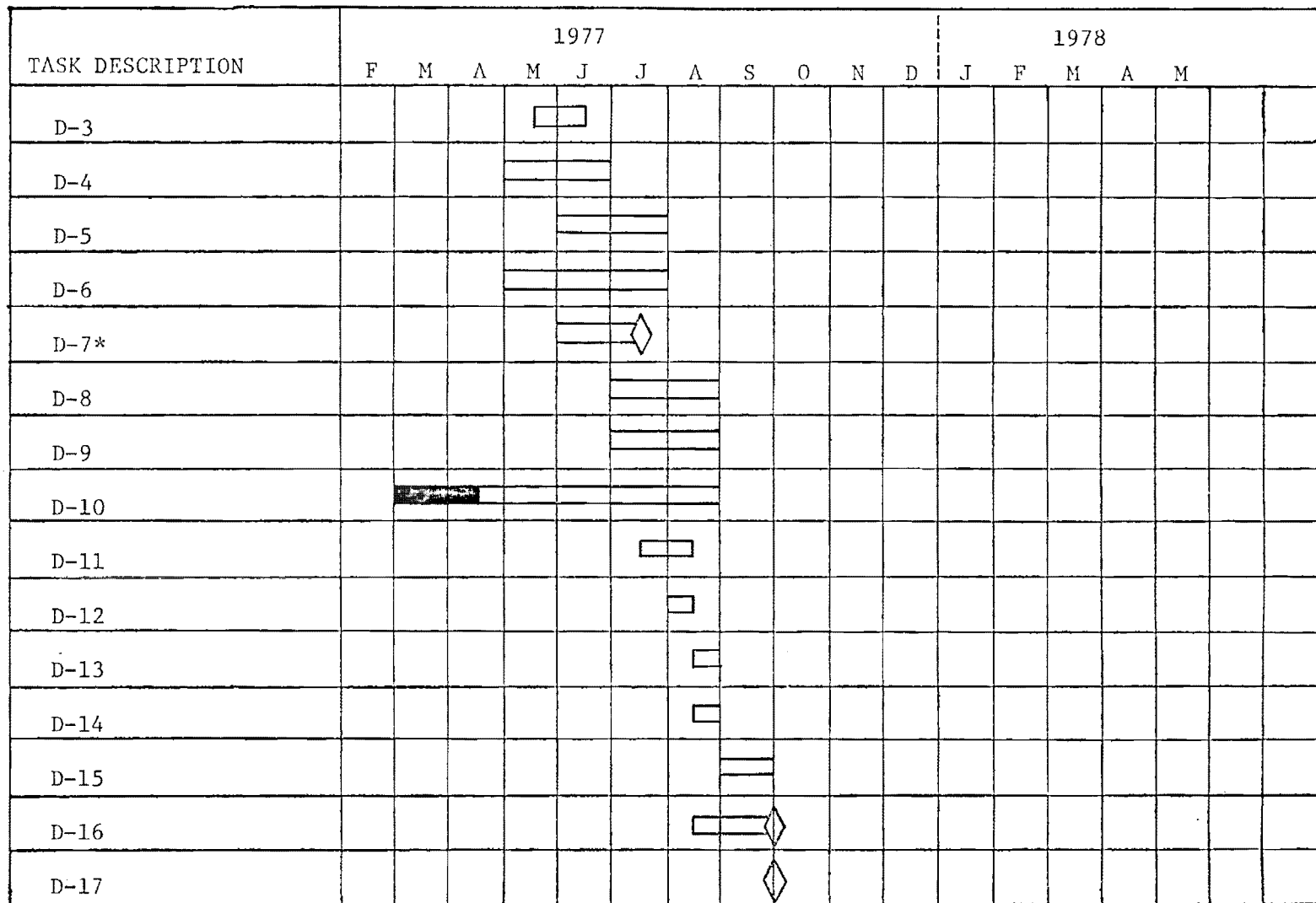
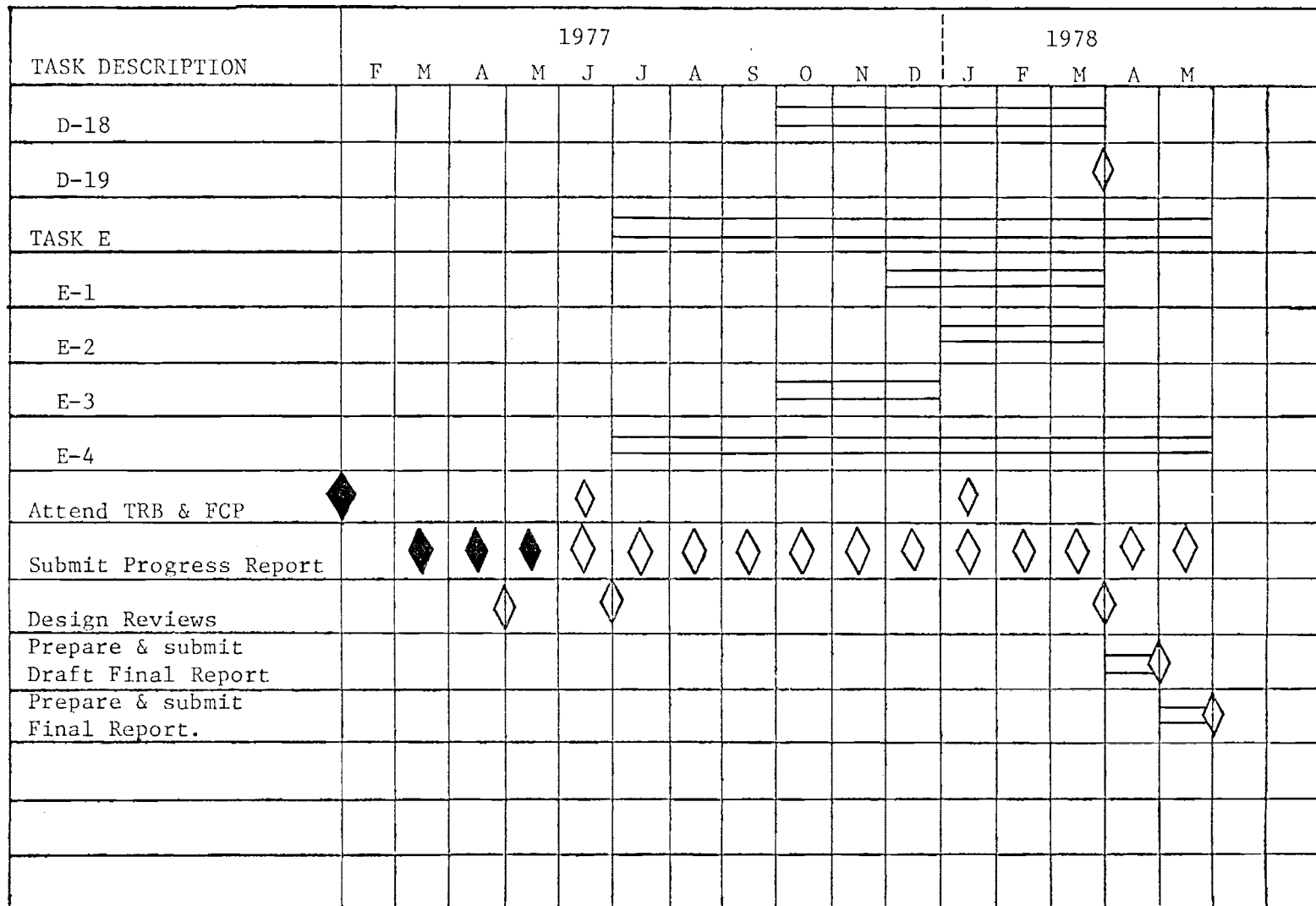


Figure 1. CB-AIDS TASK SCHEDULE (continued)

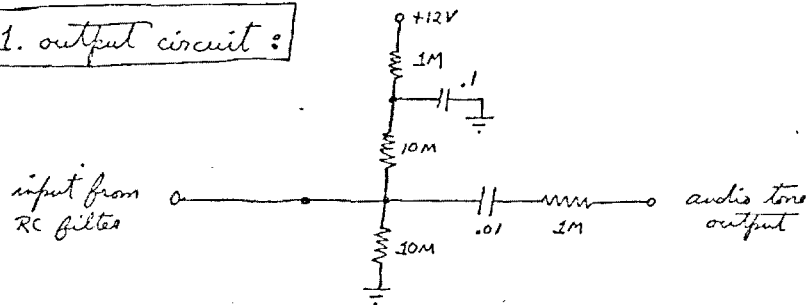


Attachment

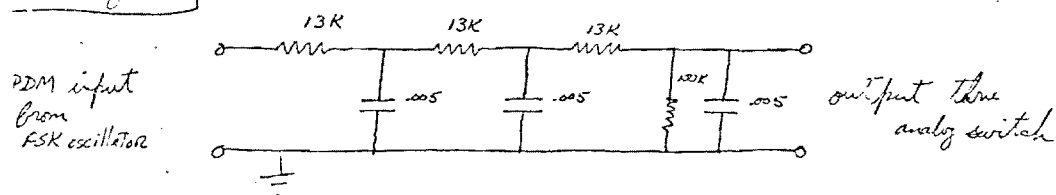
Digital Adapter and Remote Station Working Sketches

Notes on Digital Adapter:

1. output circuit:



2. RC filter



2A: OUTPUT CONFIGURATION & CONTROL

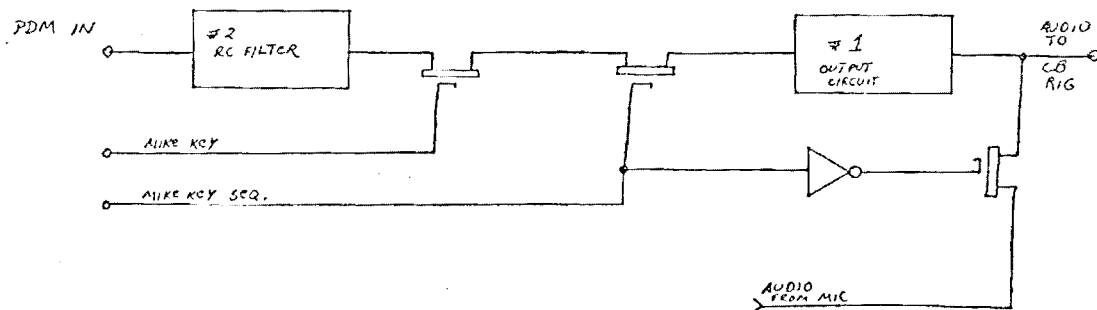
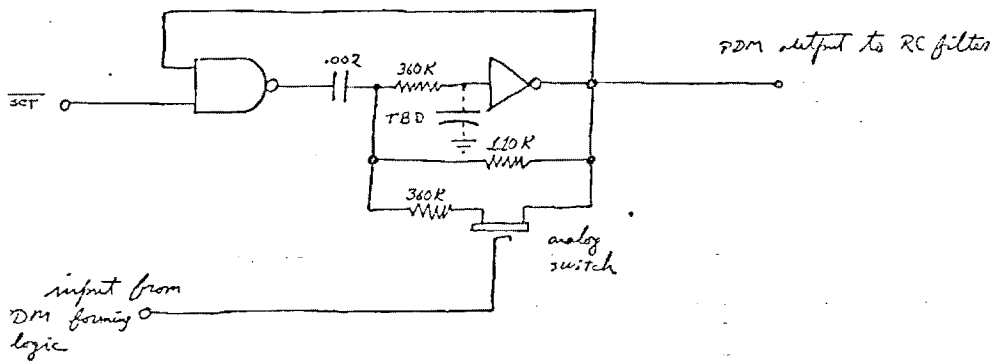
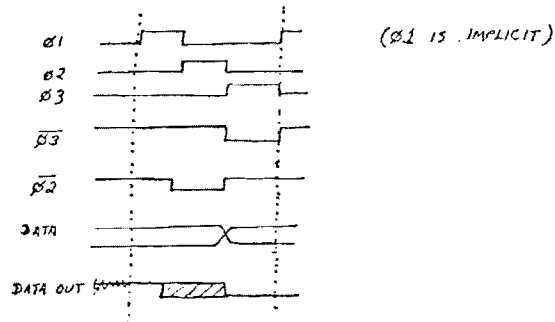
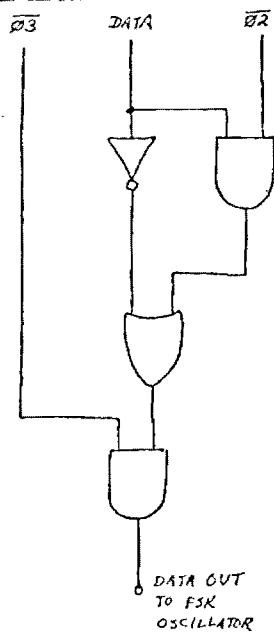


Figure 1, DA Circuits 1, 2, and 2A

3. FSK oscillator (Pulse Duration Coding)

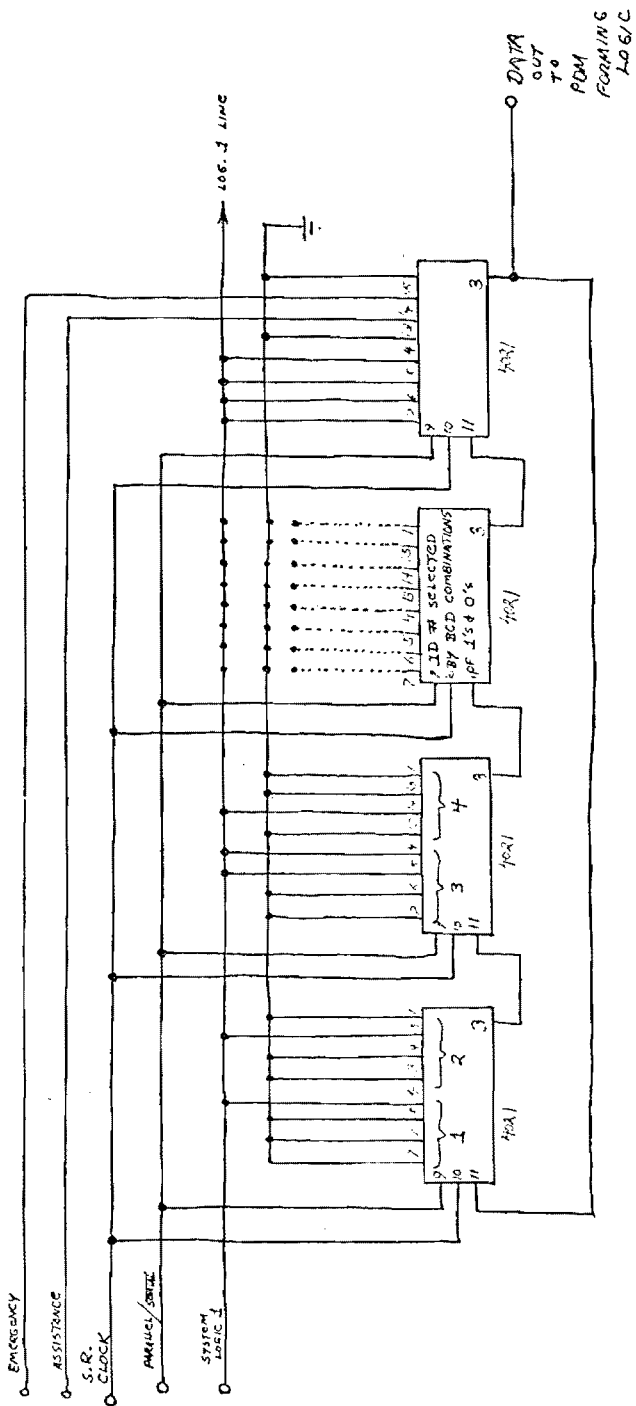


4. PDM forming logic



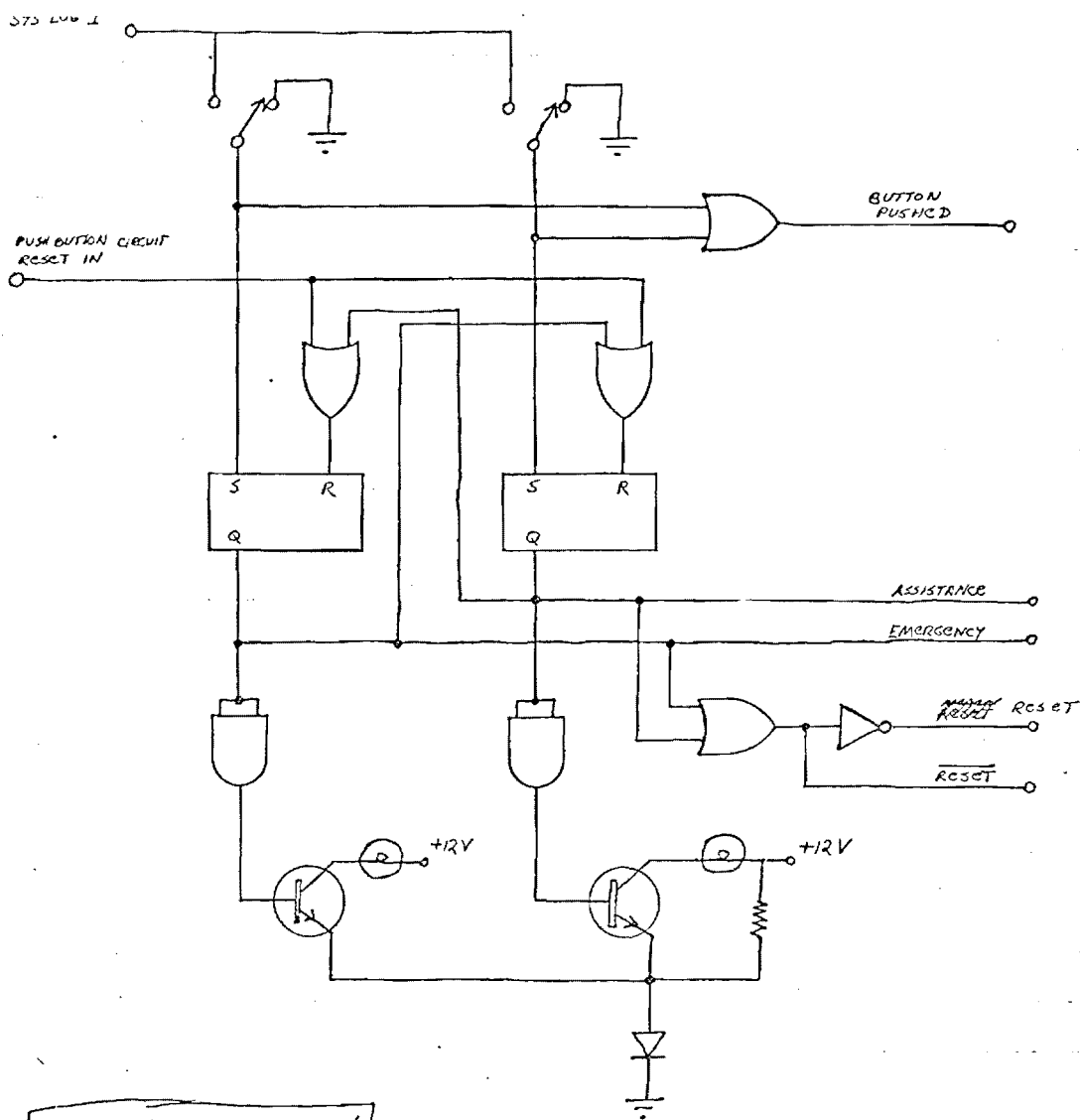
- NOTE: 1) DATA LINE changes at ↑ transition of D3
- 2) data out always high during D1
- 3) " " " low " D3

Figure 2, DA Circuits 3 and 4



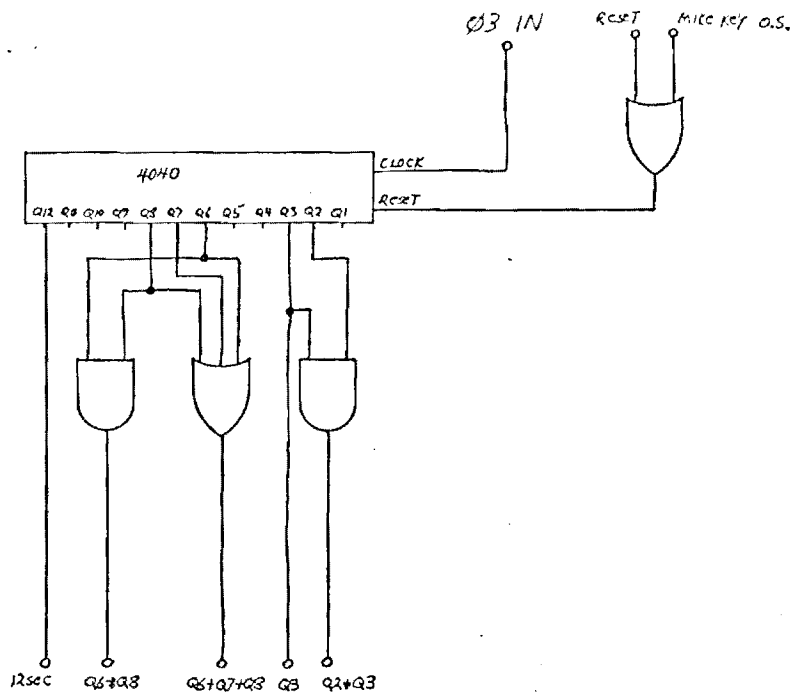
5. Shift Register (Circulating Shift)
7421's

Figure 3, DA Circuit 5



7 Button circuit
including Lamp drivers

Figure 5, DA Circuit 7



8. GENERATION OF ALL TIMING SIGNALS FROM 0.3 CLOCK

$$\begin{aligned}
 126.7_s &\rightarrow 2^{11} \rightarrow 2048 \\
 &\quad \times 6 \text{ MS} \\
 &\quad \hline
 &\quad 12288 \text{ MS} \\
 &\quad = 12.29 \text{ SECONDS}
 \end{aligned}$$

Figure 6, DA Circuit 8

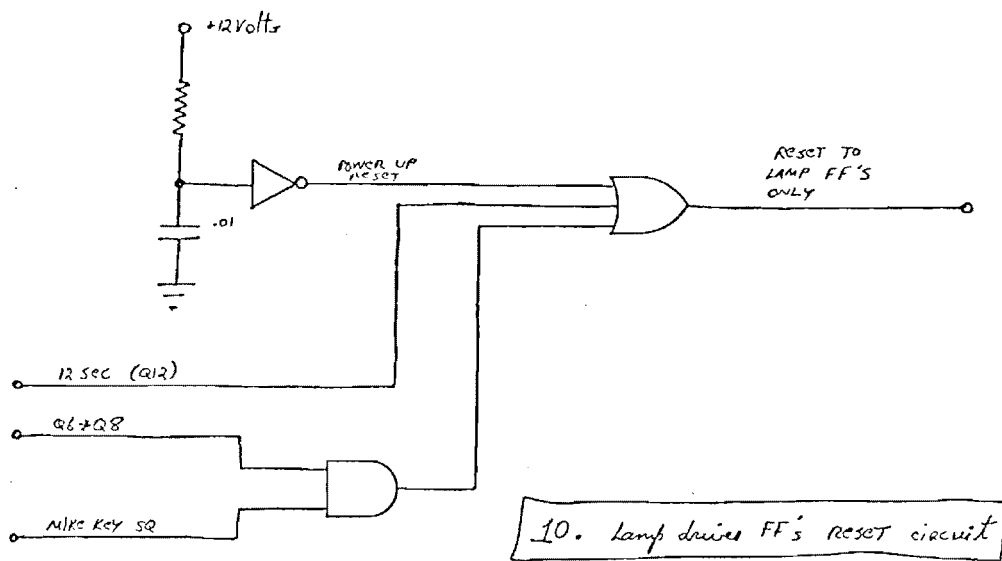


Figure 8, DA Circuit 10

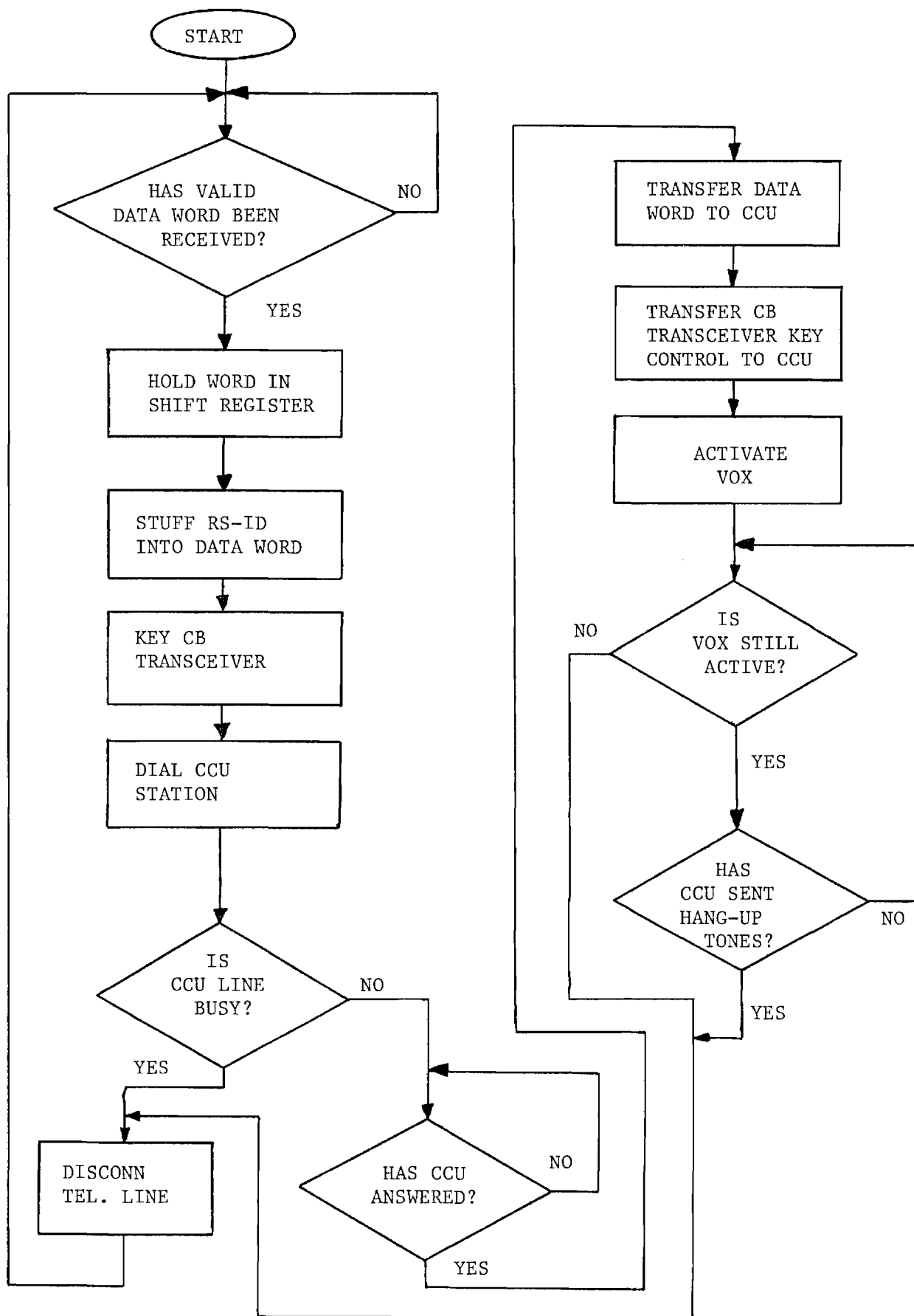


Figure 9, Remote Station Flow Chart

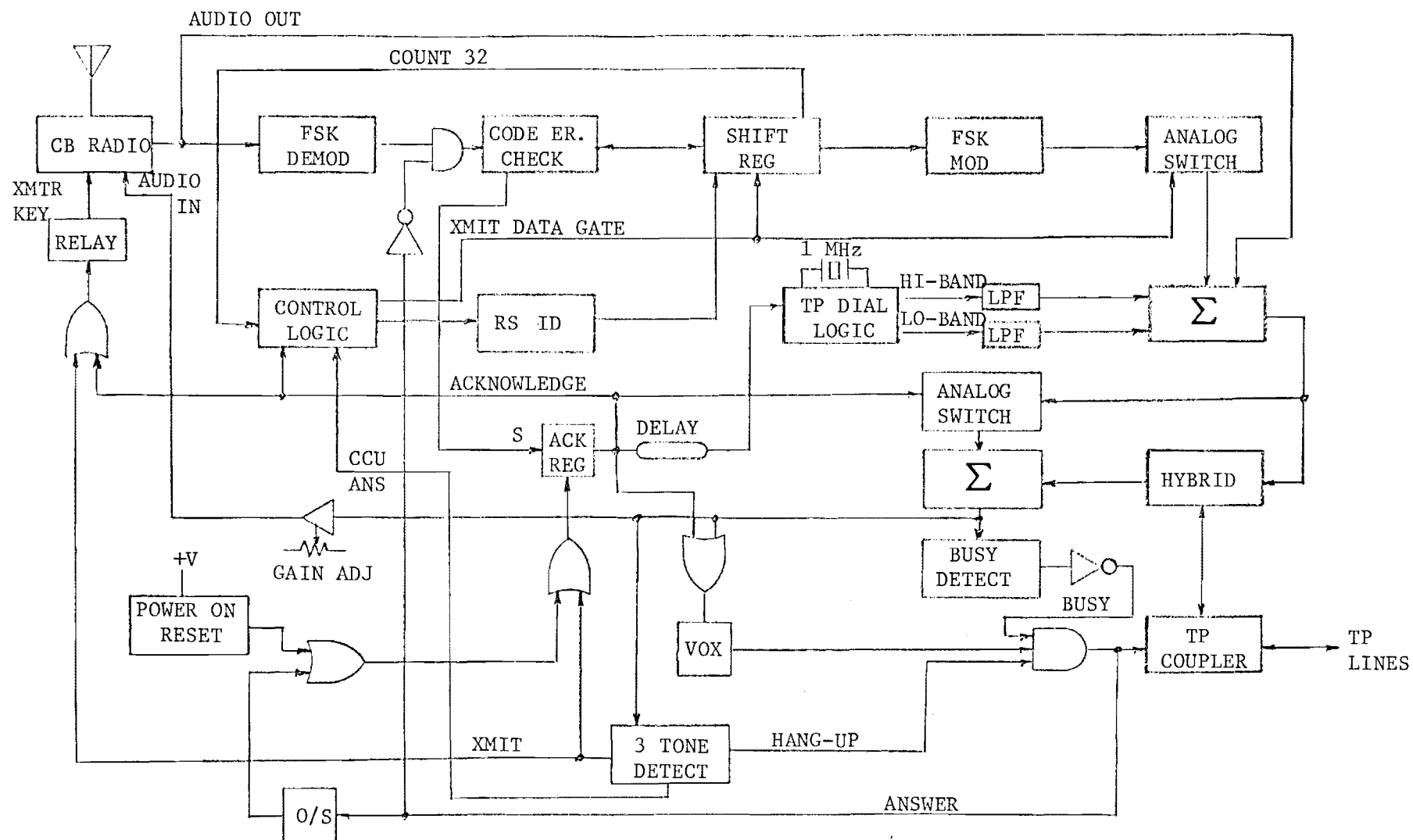


Figure 10. Remote Station Block Diagram

ISSUE	ENGR.	TITLE	
	DRAWN	REMOTE STATION BLOCK DIAGRAM	
		NO. OF SHEETS PER SET	SHEET

A-1940



ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

June 13, 1977

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano

Subject: Monthly Progress Report No. 4 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communication System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232
for the Month of May, 1977.

WORK COMPLETED:

During the reporting period, work continued on Task A, Task B, and
Task D as reported below.

Task A - The Task A effort was primarily concentrated on the develop-
ment and construction of slides for presentation purposes. New slides were
developed to provide more color and use of illustrations to replace some
previous slides which consisted of listings of features.

Presentation of the CB-AIDS concept was initiated on May 19 with a morn-
ing presentation to FHWA officials and an afternoon presentation to Federal
Communications Commission officials. FHWA representatives attending the
meeting were Mssrs. F. Mammano, L. Saxton, R. Harp and W. Wood. Comments
from this meeting indicated a desire to include more detailed information in
the slide presentation to emphasize the benefits of CB-AIDS as compared to
present CB monitoring efforts. Another idea expressed was that the CCU
operator should have the capability to remotely alter the assistance telephone
number stored in the remote stations. This capability would facilitate the
use of volunteer monitors working from their homes for assistance calls.

The afternoon presentation was attended by the FCC representatives listed
below in addition to Mssrs. Mammano, Saxton, and Ellington of FHWA.

<u>NAME</u>	<u>ORGANIZATION</u>
George Enuton	FCC, PRD
George Harewberg	FCC, OCE
Mel Murray	FCC, OCE
Mark Swartwout	FCC, PRPG

Following the slide presentation, the FCC representatives indicated the desirability of programs of this nature since monitoring and assistance may be provided over a large area within the antenna height and transmitted power limitations of Part 95 of the FCC Rules and Regulations. They indicated that the following actions would be necessary for FCC approval of the program within existing regulations.

1. Authority must be granted for the wireline remote control of the transceiver.
2. Use of the frequency shift keyed selective calling feature of the digital adapter will require a request of a waiver on the emission limitations.

It was determined that Georgia Tech would prepare a letter which would provide the necessary background and details of the program with justification of the waivers requested. It was also decided that the waiver requests on emission limitations for the 100 mobile unit licenses with digital adapters would be submitted as a group by Georgia Tech to minimize the required administrative activities.

Task B - The work on Task B has included design and fabrication of the Digital Adapters, Remote Stations, and Central Control Unit.

This task requires the fabrication of two prototype Digital Adapters. The first prototype has been completed and tested successfully with a CB radio and the current decoder/display unit. Performance of the unit was tested with component variations and under elevated temperature conditions with satisfactory results under all conditions. The results of these tests will be documented in the Task B design review. The first prototype used wirewrap construction. For more efficiency in developing the DA design, it was decided to use the printed circuit board technique for the second prototype. The printed circuit board was designed and laid out during the month. A two sided board design with plated through holes was selected. Copies of the P.C. negatives for both sides of the board are included as figures one and two of

the attachment. Four boards are being produced for initial evaluations. These boards were ordered commercially and will be delivered early in June.

During tests of the prototype DA with FHWA provided DA and decoder/display, it was determined that the decoder/display would not properly display certain numbers in one of the segments. An investigation showed that the segment was not wired correctly. This problem was corrected and the unit now appears to operate satisfactorily. Also, the audio output of the base station CB radio ceased due to a component failure. This problem was also corrected. Working with the current equipment was somewhat hampered by a lack of sufficient documentation of the design.

The Remote Station design was completed during the past month and fabrication of the subsystem boards was initiated. The RS will use wire wrap boards with all subsystems except the CB transceiver included in a single chassis. Each subsystem board is being functionally checked upon completion. After all boards have been individually checked, they will be interconnected and checked out as a complete system. The addition of the capability of programming the assistance telephone number remotely will require additional components and some design changes in the current system. All parts for the existing RS design have been ordered and most have been received.

Logic design of the Central Control Unit was virtually completed during the period and detailed circuit layouts and wire lists were generated. Chassis layout with front and rear panel interconnections was initiated.

In considering the possibility of programming the RS assistance telephone number from the CCU a number of alternatives could be investigated. One goal would be to adopt a design which would minimize changes to the CCU design. A possible implementation would be to use the normal telephone push button dialer to set the number and to use the RS and User ID display to display the programmed number as returned by the RS for verification. The procedure to program the assistance number would be as follows. The CCU operator would dial the RS telephone number. After call was answered, the operator would press an access code followed by the new assistance number on the normal telephone dial. After the number was received by the RS, it would be retransmitted as though it were an identification number. The CCU would receive this number and display it in the normal manner from which the operator could visually verify the number. The number and the time of its setting would be automatically recorded by the printer.

Task D - The Task D effort was concentrated in digital adapter fabrication and development of pilot program test site selection criteria. The DA fabrication effort included DA physical layout, printed circuit board design and procurement, and quantity ordering of DA components.

In the remaining effort of Task D, site selection criteria were developed to include the items listed below. First, however, it should be noted that an operational CB-AIDS system could be implemented at any location which has

a mobile CB user population, telephone lines, and response agencies. However, for the pilot program, other factors are required in order to maximize the probability of a meaningful demonstration. These factors are included with the necessary technical criteria for test site selection. The criteria are:

1. Cooperative government leaders and agencies.

The test site selected must have government leaders and agencies such as the Governor, Mayor, public safety agency, State DOT, and local police who will provide total support of the program. Obviously, this is a necessary condition for the test site.

2. Available response facilities.

The test site must have an existing response facility to respond to emergency calls. This facility must agree to include the CCU in their response console and answer CB-AIDS calls at no charge.

3. Available volunteer monitors.

The test site must have an existing organization of volunteer monitors who would agree to provide assistance in the program.

4. Large CB User population.

In order to provide adequate use of the system, the test site should include a CB user population large enough to provide an adequate test sample and a general awareness of CB use. Although rural areas may have a greater need for an operational CB-AIDS system on certain occasions due to the distance of stranded motorists from help, the pilot program must be based on a larger population base since the numbers of digital adapters and remote stations are limited to 100 and two respectively.

5. Available system maintenance facilities.

The site must have the resources to provide timely maintenance and monitoring of the systems operation.

6. High number of incidents.

The area covered by the remote stations must have a high daily average of incidents which would require a response through CB-AIDS. The high number of incidents is required to increase the probability of detection of a sufficient number of incidents by CB-AIDS users. Incident statistics should be available from the local traffic engineering department.

7. Availability of power and telephone facilities for remote station installations.

The test site must have two areas available with power and telephone circuits available for installation of the remote stations.

PROBLEMS AREAS

Some delay in completing the Task A items have been encountered due to the time involved in slide design and production. The addition of remote programming of the assistance number is beyond the scope of the present tasks and will have a minor cost and time impact on the schedule. FHWA authorization will be required to initiate this item. Fabrication of the Remote Stations and the Central Control Unit has fallen behind schedule and will delay both the completion of Task B and the initiation of Task C. Additional fabrication assistance has been added to cope with this problem. Presently a one month delay is projected. However, no additional costs are anticipated.

WORKED PLANNED FOR NEXT MONTH

Work will continue on Tasks A, B, and D during the next reporting period.

The Task A effort will include the addition of slides to further explain the CB-AIDS program and further presentations to selected groups.

The Task B effort will include completion of the second DA prototype using a printed circuit board, further fabrication of the remote stations, and fabrication initiation of the CCU.

The Task D effort will include the completion of the PC board design with any necessary corrections, ordering of all parts for production, further refinement of test site selection, and initiation of specification of measurement parameters.

MANAGEMENT INFORMATION

The following information gives the managerial and estimated financial status of the contract as of May 31, 1977:

(A) Cumulative Costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Cost</u>
TASK A	\$20,592	\$2,806	\$19,646
TASK B	34,387	8,614	21,809
TASK C	10,453	0	0
TASK D	66,250	1,815	2,870
TASK E	<u>20,364</u>	<u>0</u>	<u>0</u>
TOTAL	\$152,046	\$13,235	\$44,325

(B) Estimated cost to complete: \$107,721.

(C) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Cumulative</u>
Principal Investigator R. W. Wallace	106	466
Principal Research Engineers D. W. Robertson/ H. H. Jenkins	16	48
Senior Research Engineer R. W. Moss	16	96
Asst. Research Engineers C. S. Wilson/ D. R. Sentz	164	576

(D) Percentage of work performed: (see figure 1)

Respectfully submitted,

Ronald W. Wallace
Project Director

RWW:am

Enclosure

APPROVED:

D. W. Robertson, Director
Electronics Laboratory

Figure 1 - CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
Prepare Draft Program Plan & Schedule	■																
FHWA Review	■																
Prepare Final Program Plan	■																
FHWA Authorization to Proceed	◆																
Receive Government Furnished Equipment	◆																
TASK A	■■■■				90%												
A-1*	■■																
A-2	■■■																
A-3		■■■															
A-4*		■■■															
A-5			■														
A-6				◆													
TASK B	■■■■■					60%											
B-1	■■■■																
B-2		■■■															

Notes:

1. ■■■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 1 - CB-AIDS TASK SCHEDULE (continued)

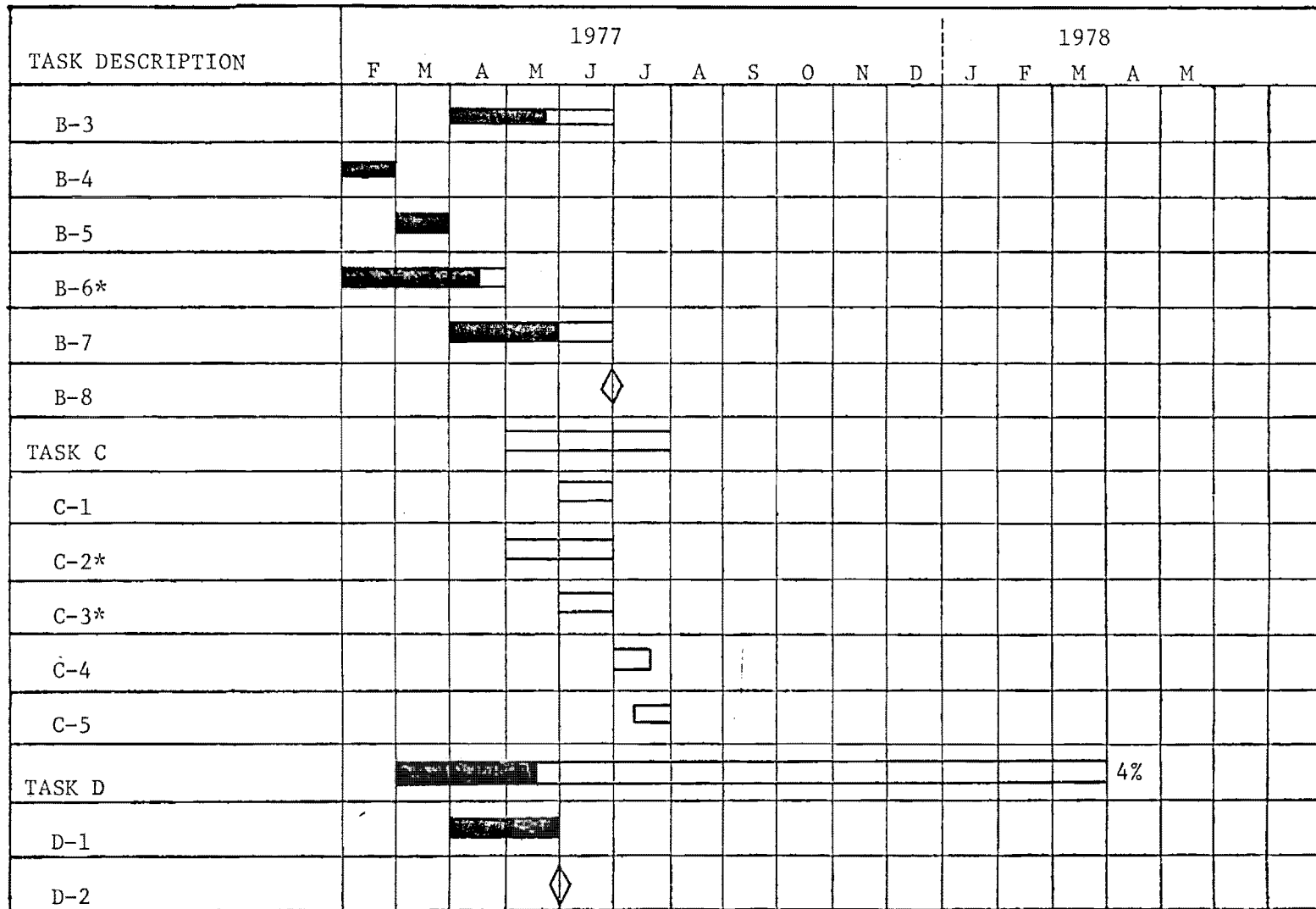


Figure 1 - CB-AIDS TASK SCHEDULE (continued)

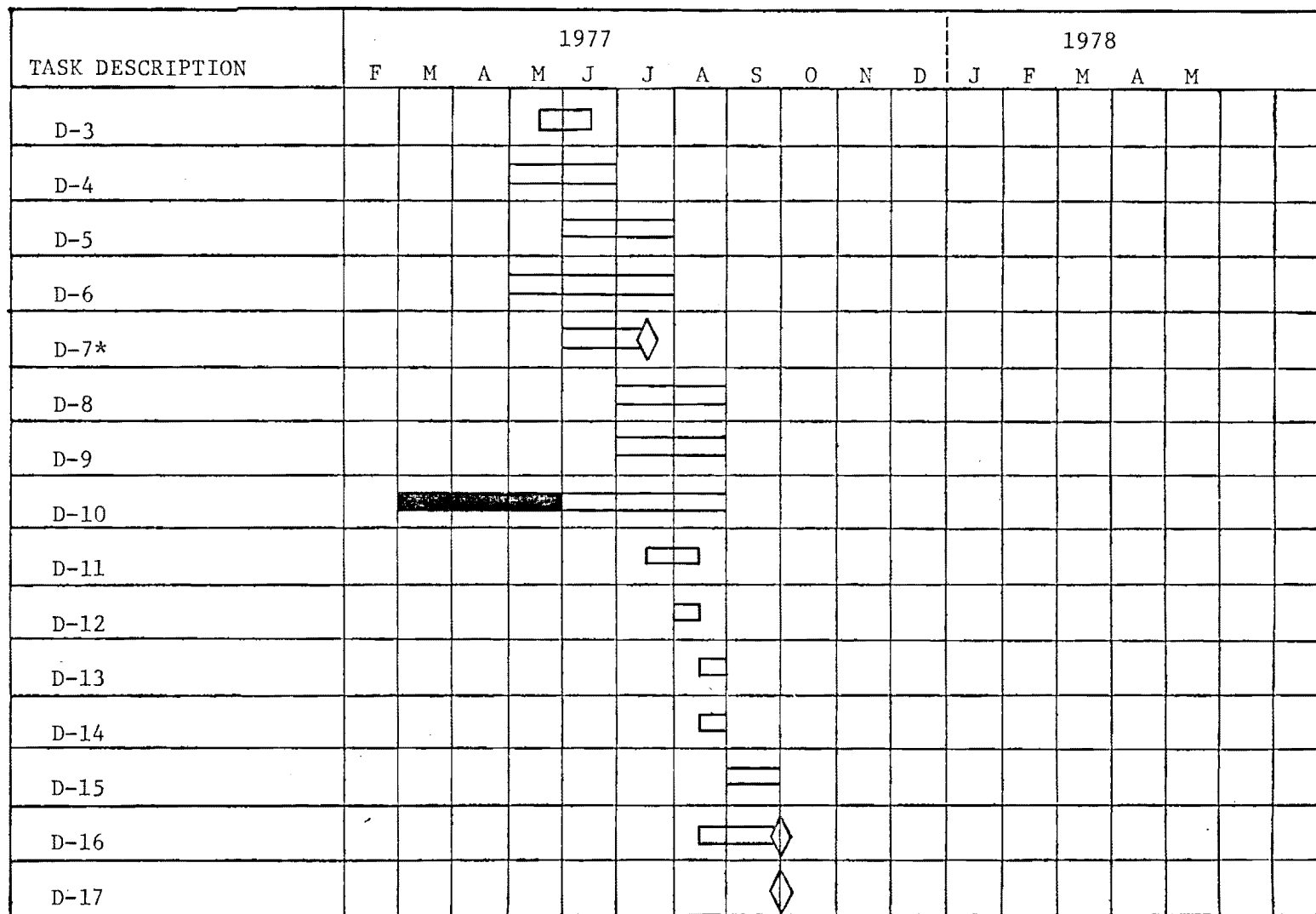
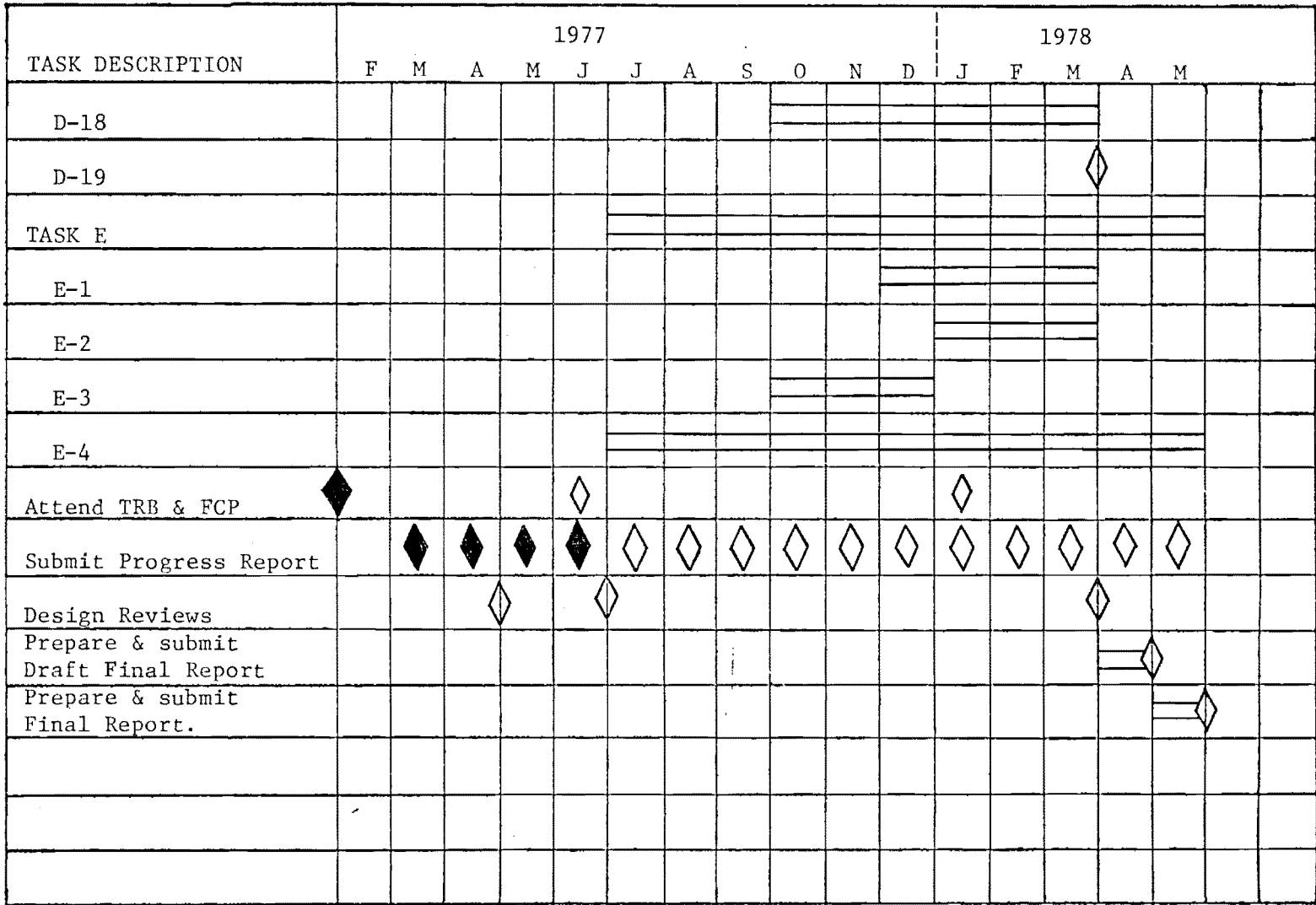


Figure 1 - CB-AIDS TASK SCHEDULE (continued)



ATTACHMENT

DIGITAL ADAPTER

PC BOARD LAYOUTS

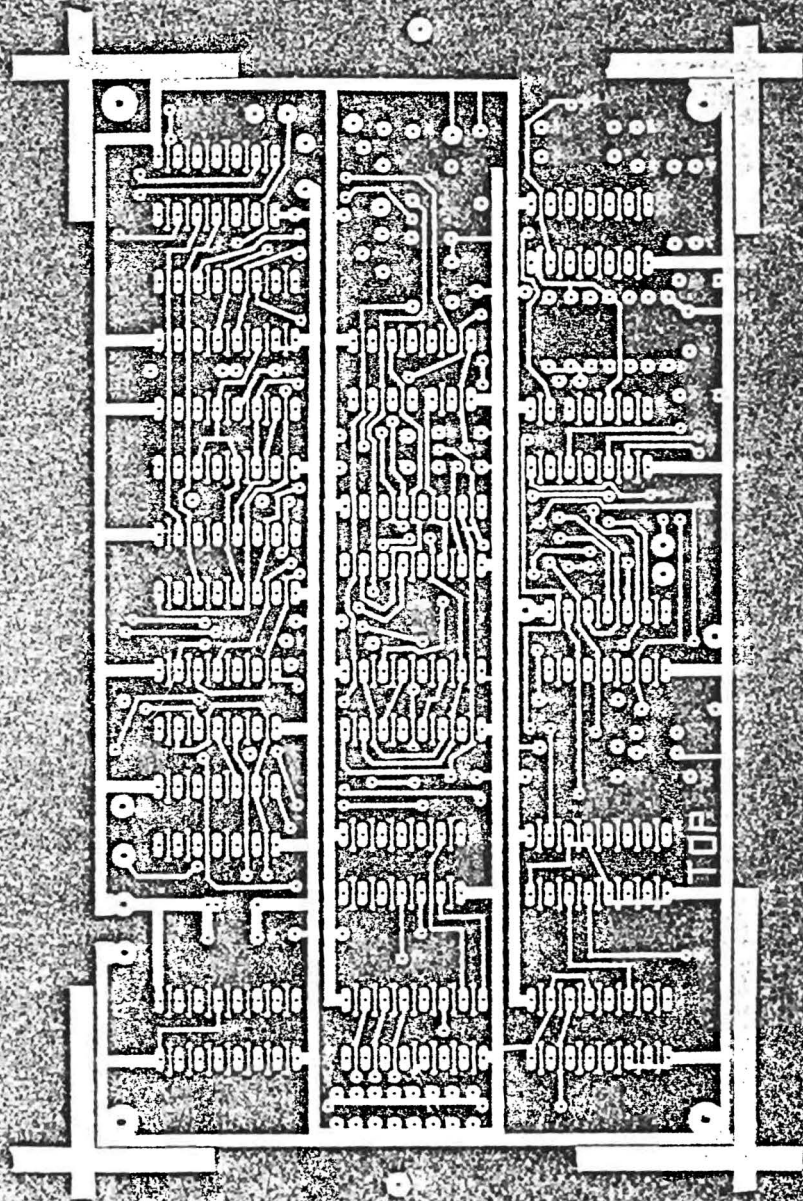


Figure 1 - Digital Adapter
PC Board Top Side Negative

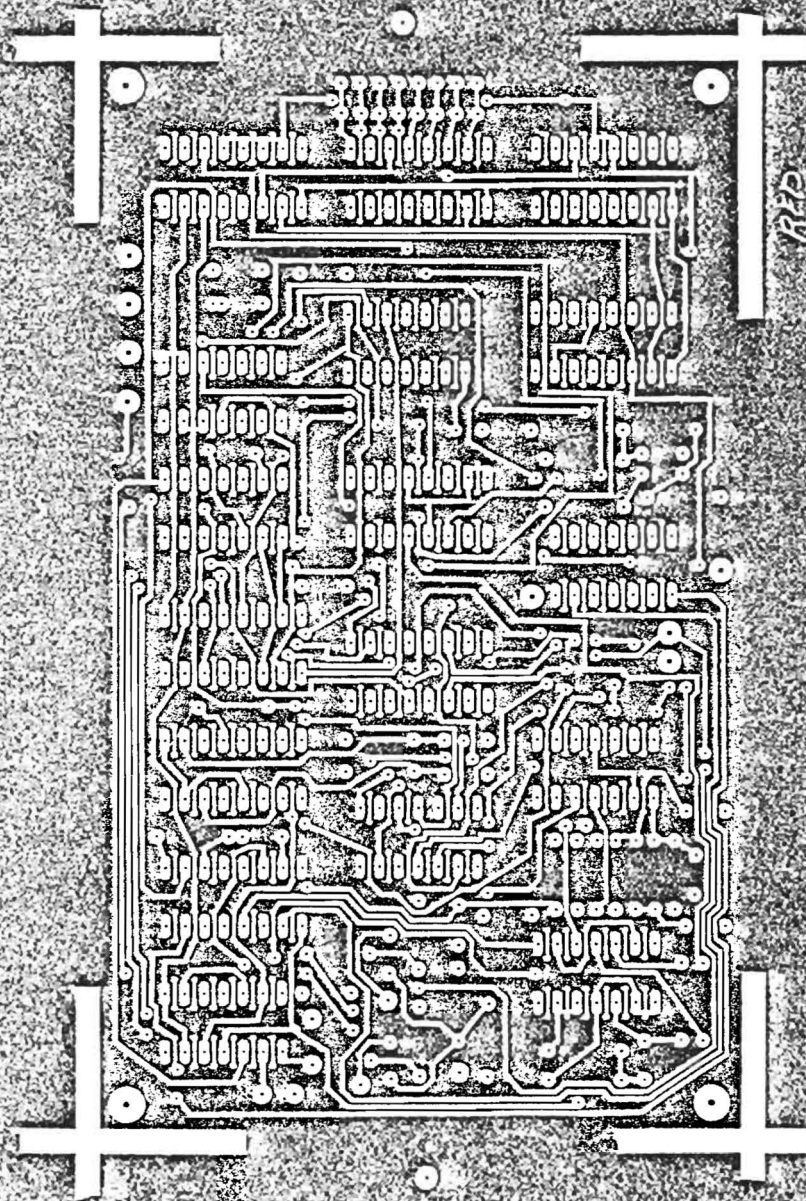


Figure 2 - Digital Adapter
PC Board Bottom Side Negative



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

July 14, 1977

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano

Subject: Monthly Progress Report No. 5 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communication System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of June, 1977.

WORK COMPLETED:

During the reporting period work continued on Task A, Task B, and Task D as reported below.

Task A - Work continued on the preparation of slides for CB-AIDS presentations. Five new slides were produced to augment the previously produced slides. The new slides are listed and described below:

1. Title Slide; Two new versions of the title side were produced, one with "Federal Highway Administration" abbreviated for balance and another using the Georgia Tech and FHWA logo's for identification.
2. Monitoring: present coverage. This slide illustrates a typical coverage pattern of present channel 9 monitoring systems.
3. Monitoring: CB-AIDS. This slide illustrates the coverage potential of the CB-AIDS channel 9 monitoring system.
4. Time coverage comparison; This slide uses a bar chart presentation to compare CB-AIDS and current monitoring coverage and man hours required for 24 hour monitoring.
5. CB-AIDS features: The potential advantages of the CB-AIDS system are listed.

July 14, 1977

Page Two

Work was initiated on a written script to accompany the slide presentation. A 20 to 30 minute goal for the time of presentation has been established. Further presentations to appropriate parties will now be scheduled.

On June 10 the FHWA provided CB radios, digital adapter, decoder/display unit, and telephone interconnect unit were returned to the FHWA.

Task B - The work on Task B has included continued design and fabrication of the digital adaptors, remote stations, and central control unit and the preparation of waiver requests for FCC authorization of the CB-AIDS program.

The four printed circuit evaluation boards for the digital adapters were delivered early in the month. The second prototype DA was fabricated with one of these printed circuit boards. After a few minor modifications to the board, correct operation of the DA was obtained. These modifications were applied to the p.c. board layout for the production run.

Fabrication of two of the three wire wrap boards for each remote station was completed during the month and testing of the phase lock loop tone decoder and pulse width demodulator board for RS number was initiated.

For the central control unit, the front and rear panel layouts were completed. Wiring was initiated on the timing and control and clock and printer interface board during June with approximately 20 percent completed by the end of the month.

As a result of the meeting with FCC officials in Washington described in last month's progress report, a letter was prepared which includes the necessary authorization and waiver requests from the FCC. A draft copy of the letter is included as an attachment to this report.

Task D - The Task D effort continued with the fabrication of the printed circuit boards for the pilot program digital adapters. It was decided to order 120 printed circuit boards in order to allow for sufficient spares in fabricating the DAs. These boards were ordered with delivery expected by mid July. Work was initiated on the development of a method for efficiently checking out the completed DA boards. The use of a microprocessor based method of testing the boards is being investigated. With this concept the boards will be tested for correct operation before final packaging.

Preparation of a users log and a use evaluation form was initiated during the month. The users log in conjunction with the digital printer output will provide information on user ID, remote station ID, time of call, duration of call, type of call, and responses provided. The use evaluation form will be used to collect information on the response provided, response time, and appropriateness of response.

July 14, 1977

Page Three

PROBLEM AREAS

Task B fabrication of the two remote stations and the central control unit remains somewhat behind schedule.

WORK PLANNED FOR NEXT MONTH

Work will continue on Tasks A, B, and D during the next reporting period.

The Task A effort will include further presentations to appropriate representatives in potential pilot program areas.

The Task B effort will include continued fabrication and testing of the remote stations and the central control unit.

The Task D effort will include initiation of fabrication of the 100 production digital adapters and further development and specification of program documentation materials.

MANAGEMENT INFORMATION

The following information gives the managerial and estimated financial status of the contract as of June 30, 1977.

(A) Cumulative costs

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Cost</u>
Task A	\$20,592	\$ 156	\$19,802
Task B	34,387	6,486	28,295
Task C	10,453	0	0
Task D	66,250	3,141	6,011
Task E	<u>20,364</u>	<u>0</u>	<u>0</u>
TOTAL	\$152,046	\$9,783	\$54,108

(B) Estimated cost to complete: \$97,938.

July 14, 1977
Page Four

(C) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Cumulative</u>
Principal Investigator R. W. Wallace	112	578
Principal Research Engineer D. W. Robertson/ H. H. Jenkins	16	64
Senior Research Engineer R. W. Moss	8	104
Asst. Research Engineers C. S. Wilson/ D. R. Sentz	53	629

(D) Percentage of work performed: (see figure 1)

Respectfully submitted, ,

Ronald W. Wallace
Project Director

RWW:am

Attachements

Approved:

D. W. Robertson, Director
Electronics Technology Laboratory

Figure 1. CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
Prepare Draft Program Plan & Schedule	■																
FHWA Review	■																
Prepare Final Program Plan		■															
FHWA Authorization to Proceed		◆															
Receive Government Furnished Equipment	◆																
TASK A	■■																

Notes:

1. ■■■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 1. CB-AIDS TASK SCHEDULE (continued)

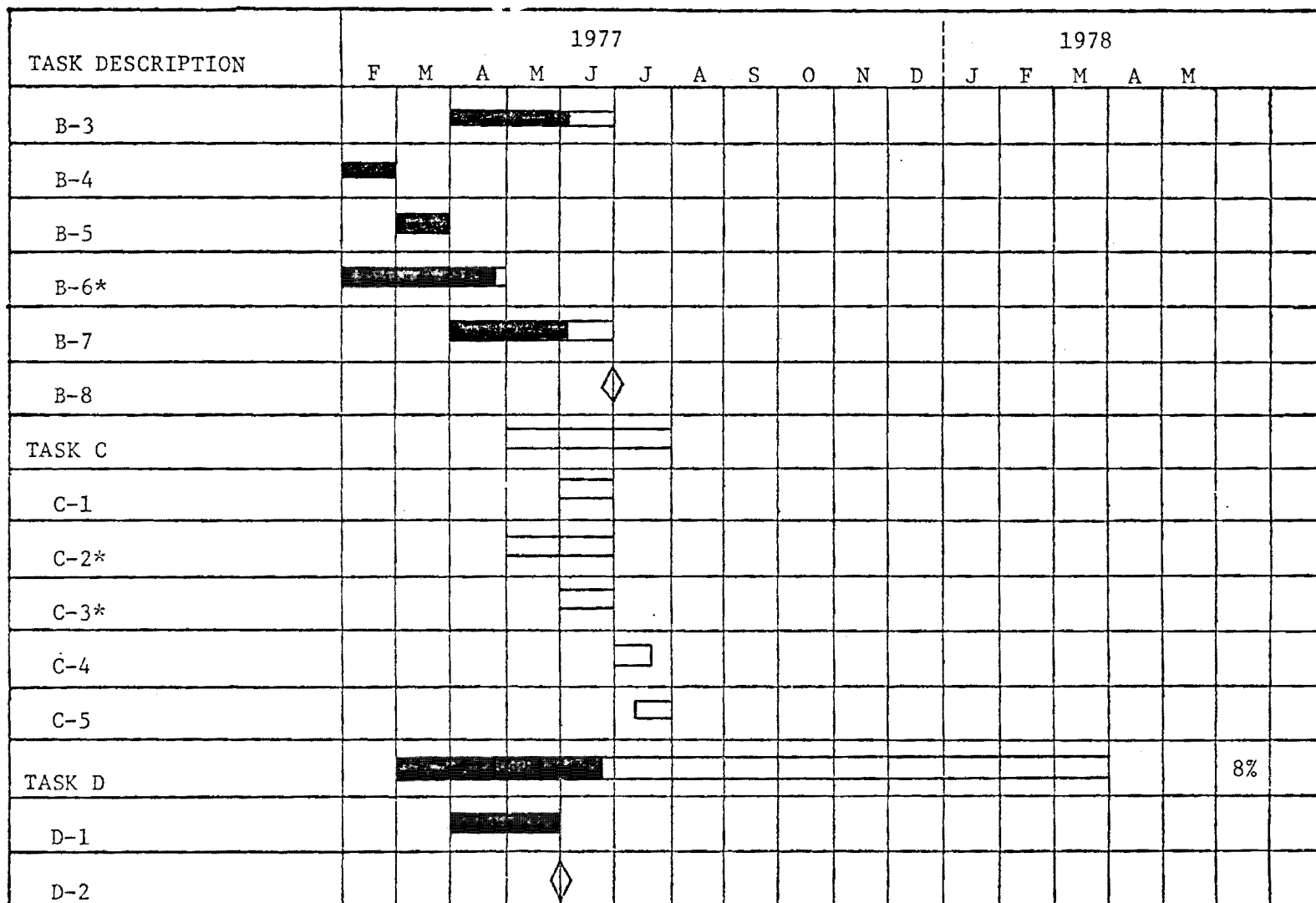


Figure 1. CB-AIDS TASK SCHEDULE (continued)

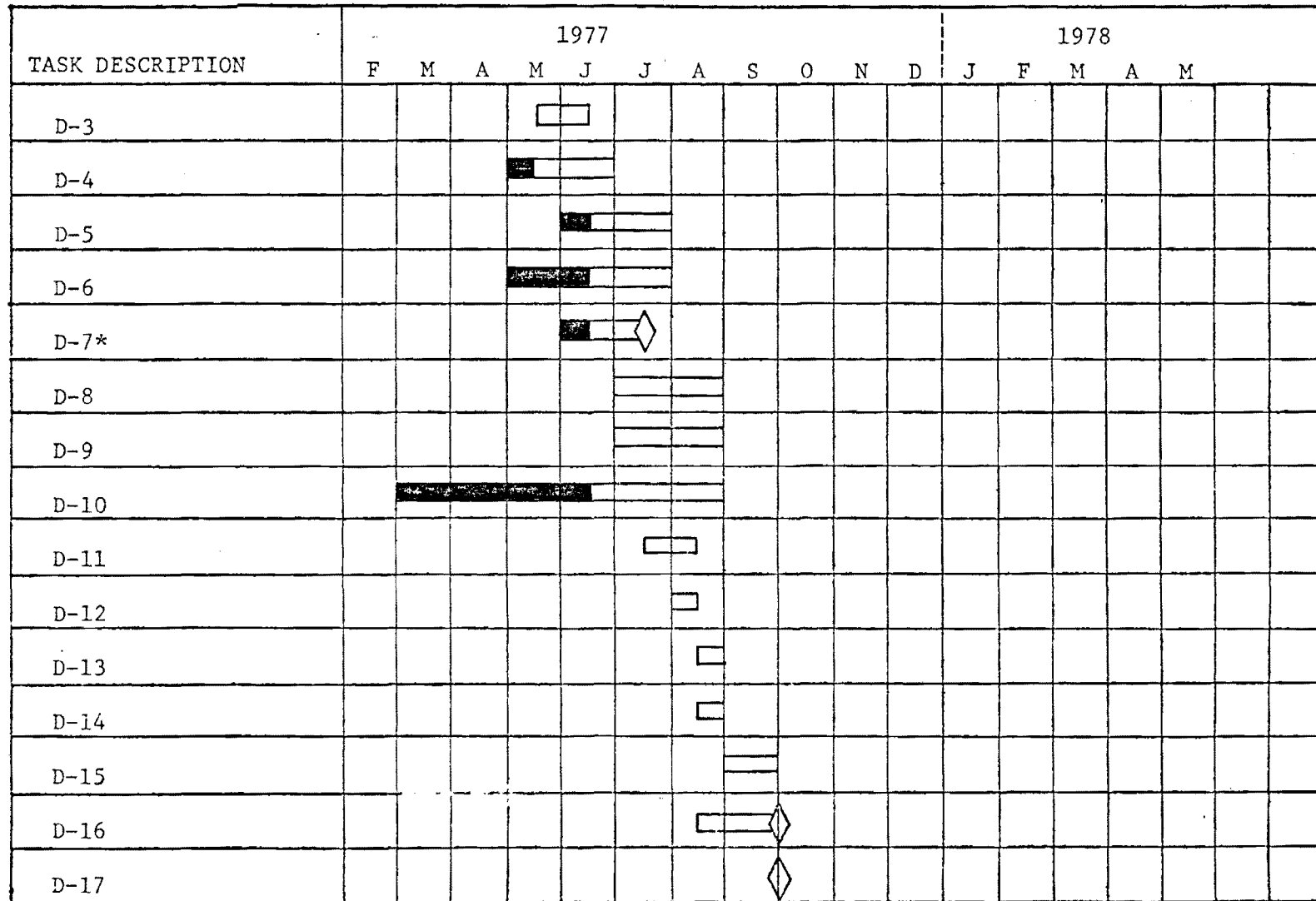


Figure 1. CB-AIDS TASK SCHEDULE (continued)

[illegible]

ATTACHEMENT

DRAFT COPY OF FCC WAIVER REQUEST LETTER

DRAFT

July 13, 1977

Federal Communications Commission

Washington, D.C. 20554

Subject: Waiver and Special Authority Request for Experimental
Use of Citizens Radio Service for Motorist Aid.

Attention: Mr. George Enuton, PRD

Gentlemen:

Georgia Tech is currently engaged in a research program to determine the feasibility of using Citizens Band radio for Motorists Aid. This program is sponsored by the Traffic System Division of the Federal Highway Administration. To perform the tasks required by the contract, waivers to some portions of part 95 of the FCC Rules and Regulations will be required. First an overall description of the program will be given which will be followed by the specific waiver requests and justifications.

The program, which is formally titled "Motorist Aid Citizens Radio Service (CB) as a Wide Area Communication System" and informally designated Citizens Band Automatic Interconnect Digital System (CB-AIDS), is based on previous FHWA work in the development of a Motorists Aid Transceiver. In a previous contract, performed by Honeywell, a CB radio digital adapter and a remote station decoder and display unit which was attached to a CB base station transceiver were developed. The digital adapter was placed in the CB radio microphone input line and upon processing either an E (emergency) or A (assistance) button and keying the microphone a digital frequency shift keyed sequence of 960 milliseconds duration would be transmitted. This information was received by the base station radio with the decoder/display unit where the E or A indication and the users identification number were displayed. This reception could then be followed by normal voice communications.

Building upon the previous work, the CB-AIDS program will consist of the selection of a pilot program test city in which 100 digital adapters will be distributed to selected CB users with mobile transceivers. Two remote stations with transceivers will be installed which will use a telephone

DRAFT

DRAFT

interconnect to access an emergency dispatcher with a central control unit. As designed a remote station will receive and decode the tone sequence and will automatically dial one of two numbers for either emergency aid or assistance information. (The remote stations will be unmanned.) When the dispatcher answers the call at the central control unit, the E or A indication, the user ID, and the remote station ID will be displayed and recorded. Control of the remote station transceiver will be passed to the dispatcher who will engage in the appropriate dialog with the motorist and provide the required assistance. In an operational system it is anticipated that a larger number of remote stations with an approximate coverage radius of three miles each would be used for an area coverage system.

The specific waiver requirements for the pilot program system which would be of a six to twelve month duration are listed below:

1. Requirement: One hundred selected users will use digital adapters to send tone encoded signals to initiate use of the CB-AIDS system.

Waiver requested: A waiver of FCC Rules and Regulations paragraph 95.47 (d) Types of emission is requested which would allow the use of tone signals which would establish a connection to a remote station in order to initiate a telephone connection to one of two numbers for emergency or assistance calls.

Comments: In distributing the digital adapters, Georgia Tech will assign a specific identification number to each user. His name, address, telephone number, and call sign will be recorded. Georgia Tech will provide this information to the FCC for the entire group in order to minimize the required administrative processing.

2. Requirement: The transceiver in each remote station must be remotely controlled over wireline facilities by the response dispatcher.

Authority requested: Authority to implement wireline control of two transceivers on an experimental basis is requested.

Comments: The remote station transmitter will be controlled by a voice operated switch which is actuated by the person called. Safety features will be included which will reduce the possibility of false keying. An interlock will be included to enable the transmitter to be keyed only when a call is in process. Also a time out feature will limit the length of transmissions. The remote control of these transceivers will be included under Georgia Tech's Citizen Radio license K _____.

The pilot program will be located in _____, _____ and will be conducted from _____, _____ to _____, _____.

DRAFT

DRAFT

If any additional information is required please call me at telephone number (404) 894-3544.

Sincerely,

Ronald W. Wallace
Research Engineer

RWW:am

DRAFT



ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

A-1140

August 17, 1977

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 6 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communication System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of July, 1977.

WORK COMPLETED:

During the reporting period work continued on Task A, Task B, and Task D as reported below.

Task A - The CB-AIDS slides are now ready for further presentations which will be scheduled in coordination with the Contract Manager. During the month Messrs. Gunther Lerch and Glen Price of the FHWA Region 4 (southeastern) headquarters and Mr. Grover Bowman of the FHWA Georgia Division headquarters were contacted and informed of the CB-AIDS program. Following these contacts a meeting was held with Messrs. Archie Burnham and William Owens of Georgia DOT on July 18. Also attending were Mr. Grover Bowman of FHWA Division and Messrs. Ronald Wallace and S. L. Robinette of Georgia Tech. In this meeting, Georgia DOT provided information on the Georgia RUSH (Radio Users Send Help) Program which commenced this year. This program is organized to provide coordinated volunteer monitoring of Channel 9 on a statewide basis and is sponsored by Georgia DOT and the Georgia State Patrol. Mr. Wallace provided information on the CB-AIDS program and its objective.

Task B - The work on Task B included continued design and fabrication of the prototype digital adapters, the two remote stations, and the central control unit equipment.

The two prototype digital adapters have been completed and correct operation has been verified. The fabrication of the production units will be described under the Task D paragraph as this is a Task D activity.

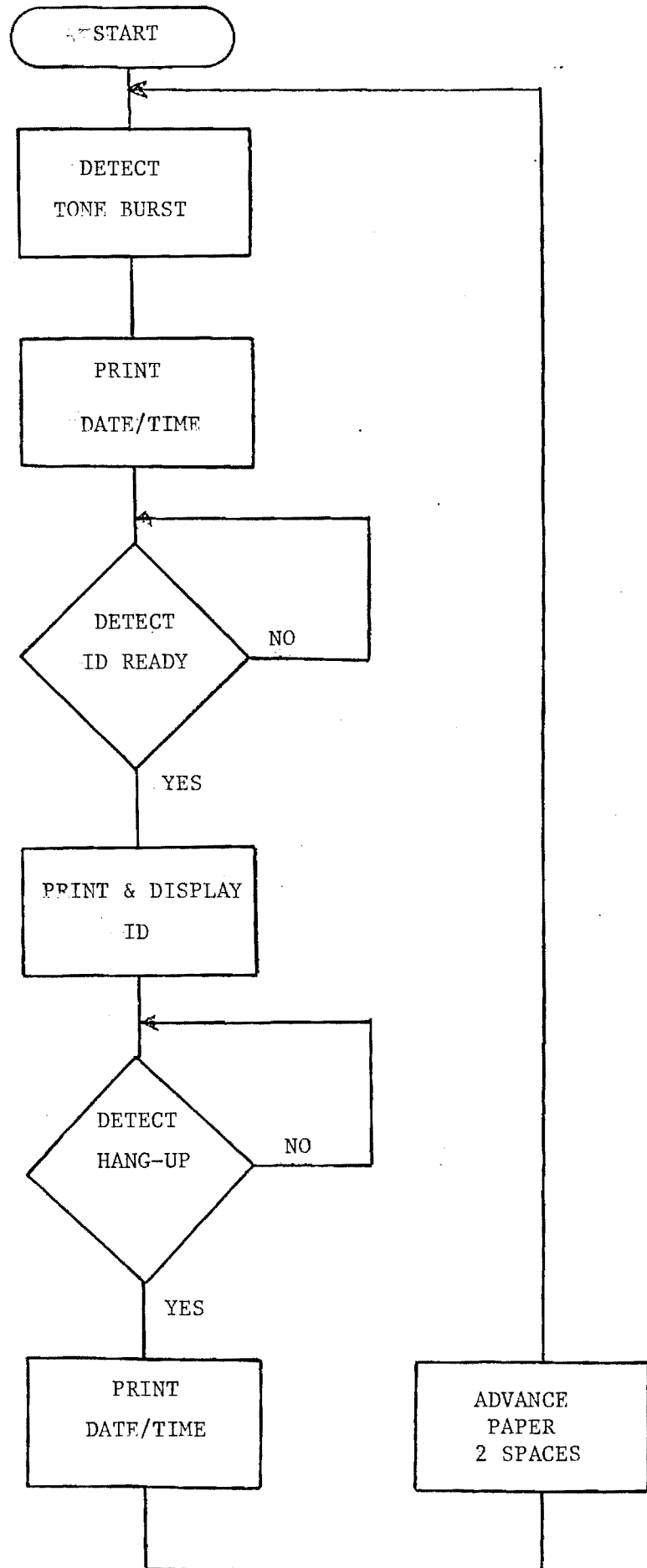
Wiring of all remote station circuits except the telephone interconnect has been completed. Checkout of these circuits is about 75 percent complete. The telephone interconnect boards were found faulty and have been returned to the manufacturer for repair or replacement.

Wiring of the central control unit timing and control and clock and printer interface board was completed and checkout initiated. Considerable problems were experienced with the digital clock/calendar circuit chip (Fairchild FCM 7002) due to incorrect data sheet information and crosstalk on the control lines. These problems were solved and this portion of the CCU is operational. The timing and control logic was debugged and is now operational. The digital printer did not originally provide the capability for a remotely controlled paper feed and was modified to provide this function on the interconnect cable. The printer control logic was debugged and now provides correct operation. The CCU flow chart is included as Figure 1. The figure also indicated the printout format. Operation of the CCU may be described as follows. The system is initially in the "start" condition awaiting on incoming call. When a call is received, a tone burst is generated which is detected by the CCU and the date and time are printed by the digital printer. The date and time are printed on a single line in order of month, day, hours, minutes, and seconds. This provides the time of call initiation. Next the remote station and user identification data are received and stored by the CCU. This information is then printed in the following order - remote station ID number (one digit), emergency or assistance call (* = E, - = A), and user ID number (six digits). This will provide a record of the remote station originating the call, the type of call, and the user who placed the call. When the call is completed the hang-up condition is detected by the CCU and the date and time are again printed in the same format as before. This provides a record of the time of call completion. Following this the paper on the printer is advanced two spaces to aid readability and the CCU is returned to the initial condition to await the next call.

Task D - Fabrication of the digital adapters continued during the month. Delivery of the printed circuit boards was delayed and is now expected in early August. All parts for the 120 digital adapters to be produced have now been received with the exception of the printed circuit boards, the chassis, the pushbutton switches, and the precision capacitors for frequency control. All of these parts are on order and delivery is expected soon. A microprocessor based checkout system for the digital adapters was completed. This system can check out the circuits both before and after they have been installed in the chassis and provide a printout to document correct operation.

The draft versions of the CB-AIDS Users' Log and Use Evaluation form were completed and are included as Figure two and Figure three. FHWA's comments on the forms are solicited. The Users' Log will be filled out by the monitor for each incoming call. The Use Evaluation form will be filled out by CB-AIDS program representatives based on interviews with originators of calls. These two forms plus the digital printout will provide the basic data for system use evaluation.

Figure 1. Central Control Unit (CCU) Flow Chart



U U U U U U U U U U
 * * * * *
 U U U U U U U U U U
 { 2 SPACES }
 DATE | TIME
 U U U U | U U . U U U
 R S | E / A | D A I D * * * * *
 U U U U | U U U U U U
 DATE | TIME
 U U U U U U U U U U
 * * * * *
 U U U U U U U U U U

Example of Print Format

* = E

- = A

CB-AIDS USERS' LOG

Date: _____
month day year

Time of Call				
User ID				
Other Motorist Call Sign/Auto License				
Type of Incident				
Accident				
- Injuries				
- Fatalities				
- No. Vehicles				
Stalled Vehicle-occupied				
Stalled Vehicle-unoccupied				
Road Obstruction				
Major Traffic Jam				
Traffic Equip. Malfunction				
Reckless Driver				
Information Request				
Vehicle on Fire				
Other				
Action Taken				
Called State Hwy. Patrol				
Called City Police				
Called County Police				
Called Sheriff				
Called Fire Dept.				
Called Ambulance				
Called Service St.				
Called Hwy. Dept.				
Called Utility Co.				
Gave Caller Info.				
None				
Other				
Time Motorist Notified				

FIGURE 3. CB-AIDS USE EVALUATION FORM

CB-AIDS USE EVALUATION

NAME: _____

ADDRESS: _____

USERS ID: _____

USERS CALL SIGN: _____

TYPE OF INCIDENT: _____

ACTION TAKEN: _____

DATE OF USE: _____

LOCATION OF USE: _____

ROAD CONDITION: _____

WEATHER CONDITION: _____

TIME PROBLEM OCCURRED: _____

TIME CALL INITIATED: _____

TIME CALL COMPLETED: _____

TIME REQ. ASSISTANCE PROVIDED: _____

TIME INCIDENT COMPLETED: _____

RATE THE FOLLOWING ITEMS

	Excellent	Good	Satisfactory	Fair	Poor
Appropriateness of Response					
Timeliness of Response					
Quality of CB-AIDS Communi- cations					

ADDITIONAL REMARKS : _____

PROBLEMS AREAS

Task B fabrication of the two remote stations and the central control unit remains behind schedule due to unanticipated circuit problems. This has delayed the initiation of Task C since the completed hardware is required for Task C to begin.

WORK PLANNED FOR NEXT MONTH

Work will continue on Tasks A, B, and D during the next reporting period.

The Task A effort will include the scheduling of CB-AIDS presentation to appropriate agencies. The main effort of Task A is virtually complete at this time.

The Task B effort will include continued fabrication and testing of the remote stations and central control unit.

The Task D effort will include continued fabrication and testing of 120 digital adapters and further development of program documentation activities.

MANAGEMENT INFORMATION

The following information gives the managerial and estimated financial status of the contract as of July 31, 1977.

(A) Cumulative costs

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Cost</u>
Task A	\$20,592	\$ 439	\$ 20,241
Task B	34,387	5,293	33,588
Task C	10,453	0	0
Task D	66,250	6,392	12,403
Task E	<u>20,364</u>	<u>0</u>	<u>0</u>
TOTAL	\$152,046	\$12,124	\$ 66,232

(B) Estimated cost to complete: \$85,814.

(C) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Cumulative</u>
Principal Investigator R. W. Wallace	96	674
Principal Research Engineer D. W. Robertson/ H. H. Jenkins	16	80
Senior Research Engineer R. W. Moss	0	104
Asst. Research Engineers C. S. Wilson/ D. R. Sentz	130	759

(D) Percentage of work performed (see Figure 4)

Respectfully submitted,

Ronald W. Wallace
Project Director

RWW:am

Attachments:

Approved:

D. W. Robertson, Director
Electronics Technology Laboratory

Figure 4. CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
Prepare Draft Program Plan & Schedule	■																
FHWA Review	■																
Prepare Final Program Plan	■																
FHWA Authorization to Proceed	◆																
Receive Government Furnished Equipment	◆																
TASK A	■■■■					98%											
A-1*		■■															
A-2		■■															
A-3			■■■														
A-4*			■■■														
A-5				■													
A-6				◆													
TASK B	■■■■■					80%											
B-1	■■■■																
B-2		■■■■■															

Notes:

1. ■■■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

FIGURE 4. CB-AIDS TASK SCHEDULE (continued)

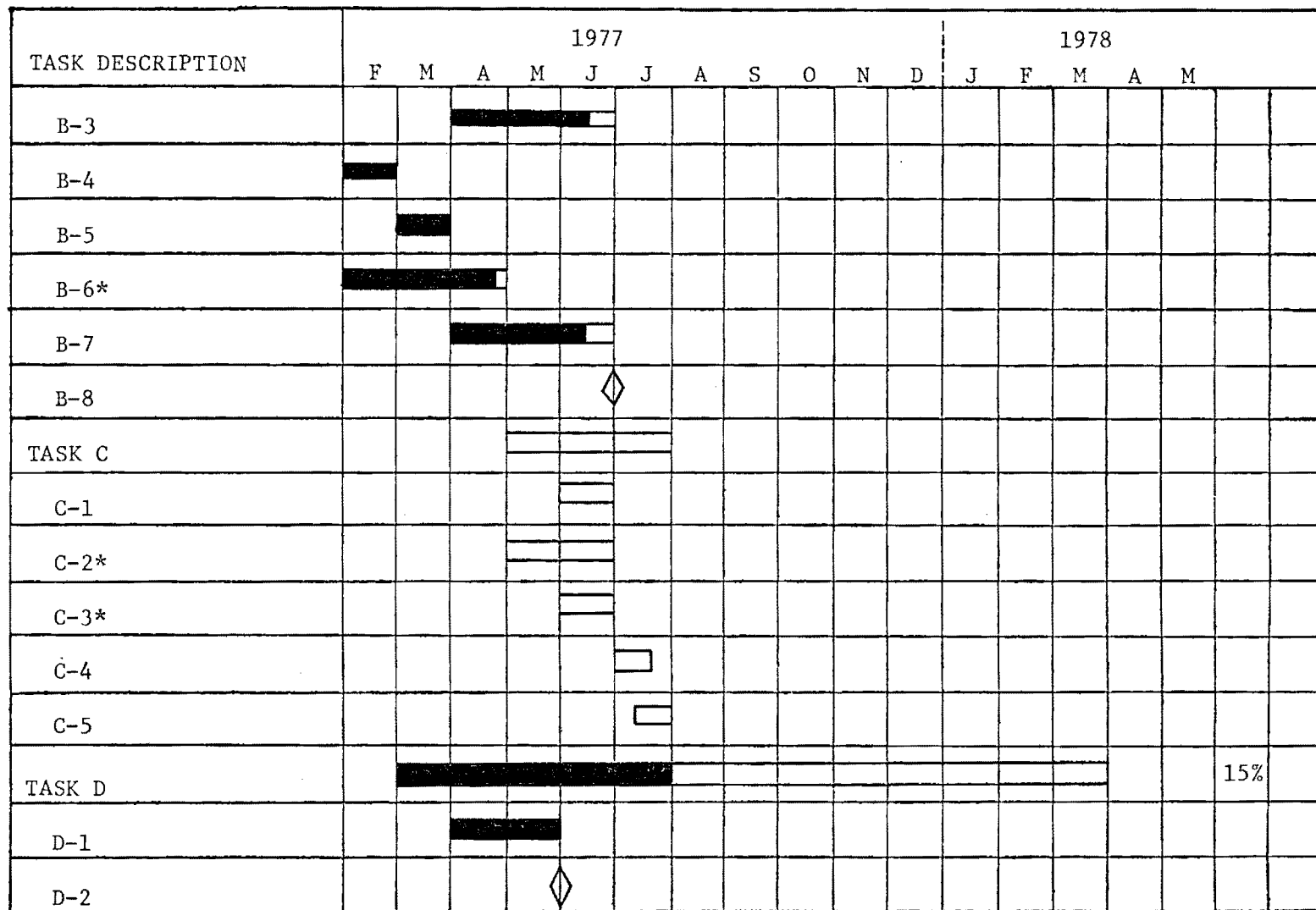


FIGURE 4. CB-AIDS TASK SCHEDULE (continued)

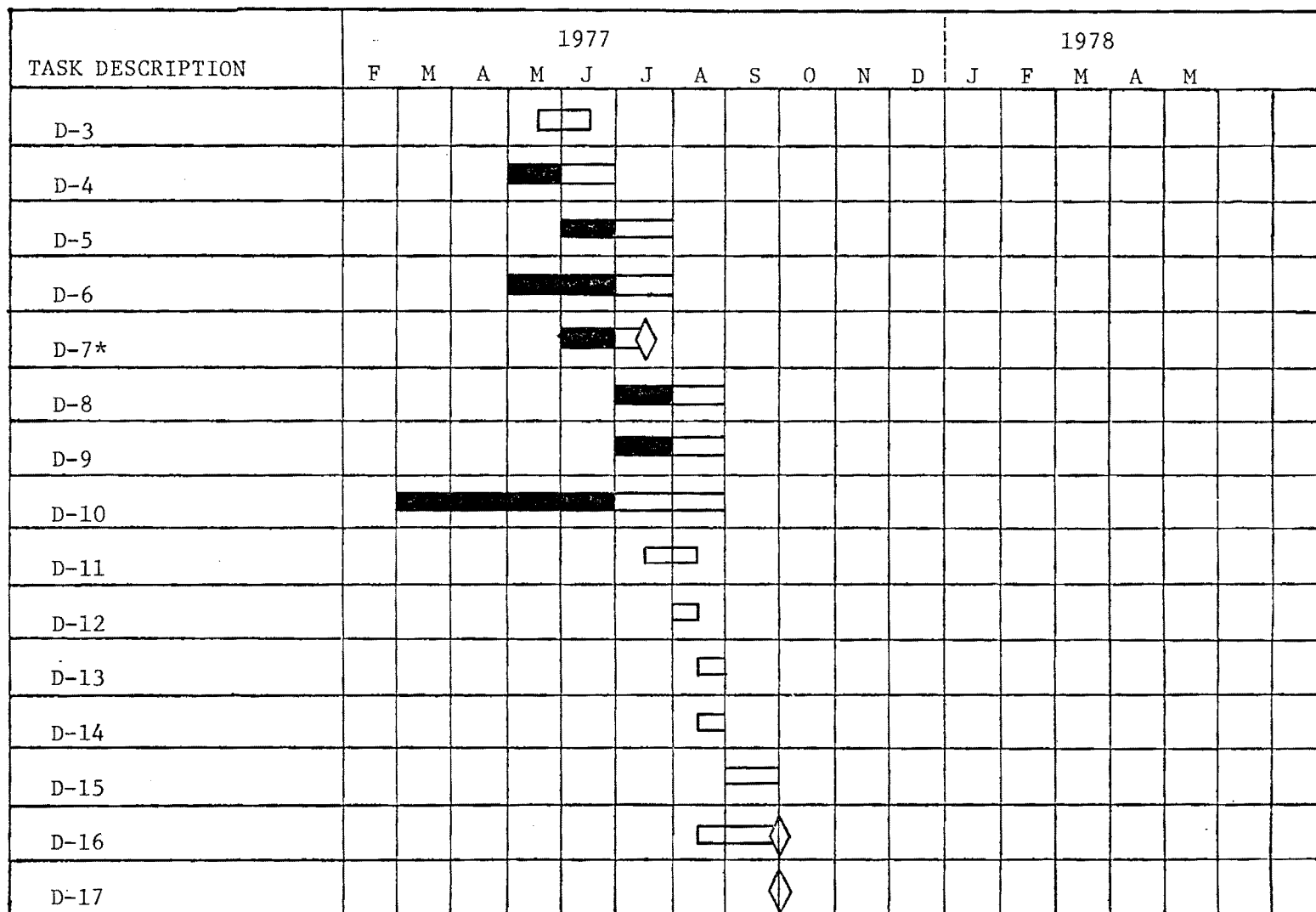
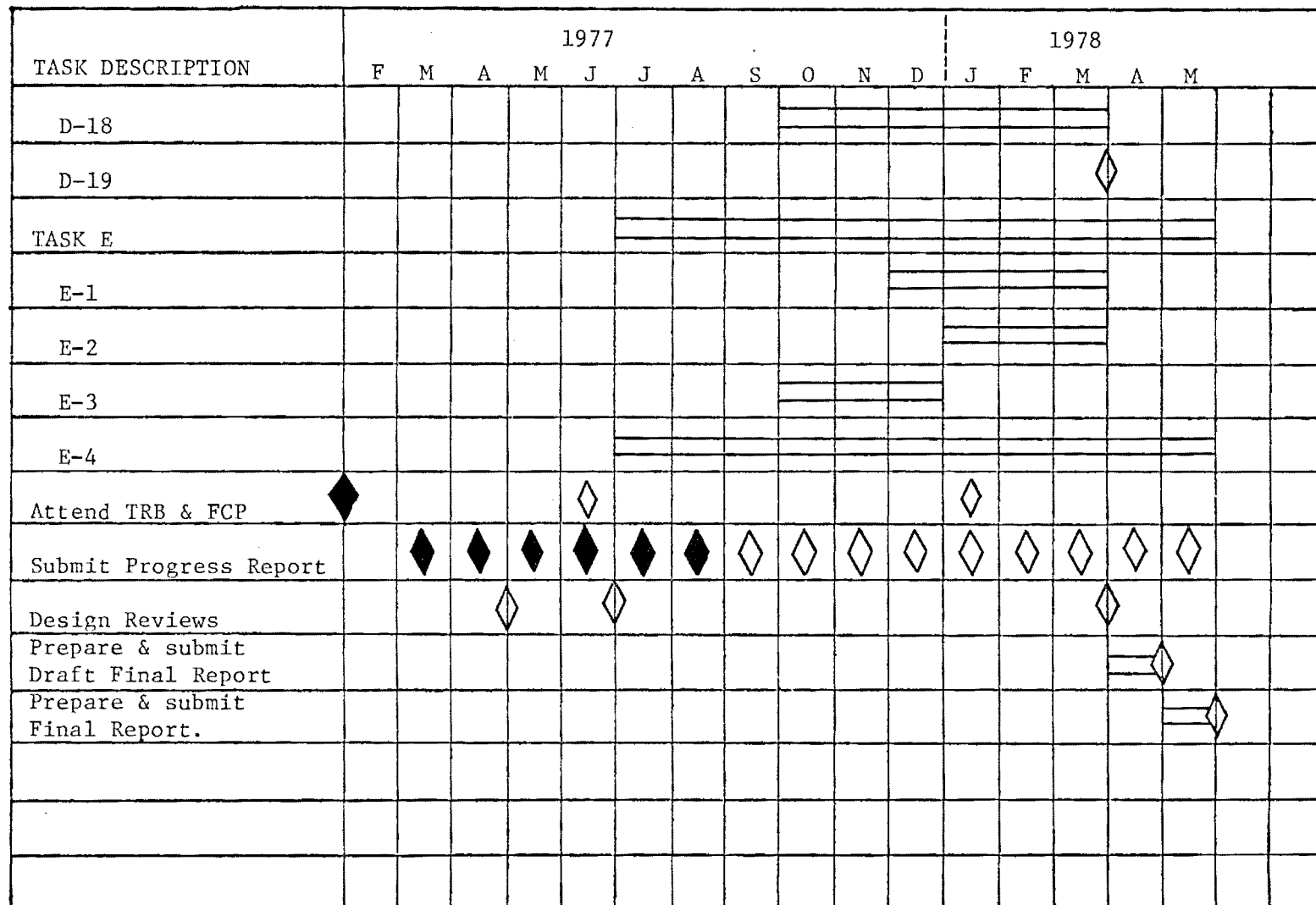


FIGURE 4. CB-AIDS TASK SCHEDULE (continued)



A-1940



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

September 19, 1977

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D. C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 7 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communication System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of August, 1977.

The contract was modified on August 10 to include the capability of setting one of the numbers that the remote stations will dial from the central control unit. The modification includes the following addition to Task B of the Statement of Work:

- 2.a. The "emergency" number shall be hardware programmable in the remote station equipment. The "assistance" number shall be remotely programmable from the Central Control Unit. The RS shall be able to receive calls initiated by the CCU and, upon receipt of properly coded signals, alter the stored "assistance" number to correspond with the number selected by the CCU. This number shall then be automatically retransmitted to the CCU for verification.
- 3.b. The CCU operator shall be able to initiate telephone calls to the remote stations and send signals which will alter the "assistance" number stored in the RS. The CCU shall receive and display the retransmitted number from the RS for operator verification."

As a result of this modification two months have been added to the work schedule.

WORK COMPLETED:

During the reporting period work continued on Task A, Task B, and Task D as reported below.

Task A - A script to accompany the CB-AIDS slide presentation was prepared and is included as Attachment A to this report. A September meeting is scheduled which will include a presentation of the CB-AIDS concept to Georgia DOT, Georgia State Patrol, FHWA Region 4, and FHWA Georgia Division representatives. Following this meeting the Task A activities will be concluded.

Task B - The work on Task B included continued design, fabrication, and testing of the two remote stations and the central control unit equipment. The major efforts on the remote stations were directed to the design of the telephone interconnect circuitry and the associated remote telephone number memory storage and retrieval capability. This new task that adds the capability for the remote station to receive and store a seven-digit telephone number required some redesign of both the existing telephone interconnect system and the digital word processor. This new design and the necessary redesign have been completed. Circuit board fabrication will be initiated within the next several days.

A telephone interconnect system has been designed that permits the necessary message transfer and signaling capability between the central control unit and the two remote stations. The fabrication of this telephone interconnect system is presently underway.

Power supplies have been designed and will be fabricated in printed circuit form. The artwork for the circuit boards has been completed and sent to a local printed circuit board manufacturer. Delivery of the finished boards is expected by mid September.

The effort on the central control unit was primarily devoted to debugging the pulsewidth demodulator and the data formatter circuits and interfacing the printer. Presently the CCU is approximately 90 percent complete. The date/time, remote station (RS) and user ID LED displays are functional. The digital adapter code can be processed and a print-out can be obtained, however, problems exist in the printer strobe timing for the date/time printout.

The lay-out of the front panel has been completed and is being silk-screened at the present. A portion of the CCU has been mounted in the chassis.

Task D - Work continued on digital adapter fabrication and pilot program system planning.

During August, 120 of the final version printed circuit boards for the digital adapter units were received. Three units were assembled and tested. It was discovered that a short trace was missing on the PC boards, probably as a result of handling the artwork before the separation negatives were made. This means that a short length of wire must be installed as a jumper on each of the PC boards during assembly. This problem is considered minor as very little additional effort is required to correct it.

Improvements were made in the microcomputer-based test station for the digital adapter units. The improvements consist of additional software to process the received data so that it is displayed properly on the computer terminal. A program listing is included as Attachment B.

Final engineering sketches for the digital adapter enclosures were completed and are included as Attachment C.

Most of the parts have been received for assembly of the 100 digital adapter units. Some items are not expected until mid September, however, such as the lighted push button switches. Assembly of the PC boards will begin early in September.

Work continued on the design and planning of the pilot program and documentation procedures. Much of the detailed work in this area must be coordinated with operating personnel in the pilot program.

PROBLEM AREAS:

Task B fabrication remains slightly behind schedule due to unanticipated hardware problems. This and the fact that the pilot program area has not yet been selected have delayed Task C initiation.

WORK PLANNED FOR NEXT MONTH:

Work will continue on Tasks A, B, and D during the next reporting period.

The Task A effort should be concluded with a presentation to Georgia DOT representatives and a report of the Task A activities during September.

The Task B effort will include continued fabrication and testing of the two remote stations and the central control unit.

The Task D effort will include continued fabrication of the production digital adapters, determination of potential pilot program test areas, and development of program documentation.

MANAGEMENT INFORMATION:

The following information gives the managerial and estimated financial status of the contract as of August 31, 1977. The Task B costs have been increased to reflect the contract modification discussed earlier.

(A) Cumulative costs

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Cost</u>
Task A	\$20,592	\$ 52	\$20,293
Task B	40,179	6,942	40,530
Task C	10,453	0	0
Task D	66,250	6,237	18,640
Task E	<u>20,364</u>	<u>0</u>	<u>0</u>
TOTAL	\$157,836	\$13,231	\$79,463

(B) Estimated cost to complete: \$78,373.

(C) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Cumulative</u>
Principal Investigator R. W. Wallace	104	778
Principal Research Engineers D. W. Robertson/H. H. Jenkins	16	96
Senior Research Engineer R. W. Moss	0	104
Asst. Research Engineers C. S. Wilson/D. R. Sentz	200	959

(D) Percentage of work performed: (see Figure 1).

Respectfully submitted,

Ronald W. Wallace
Project Director

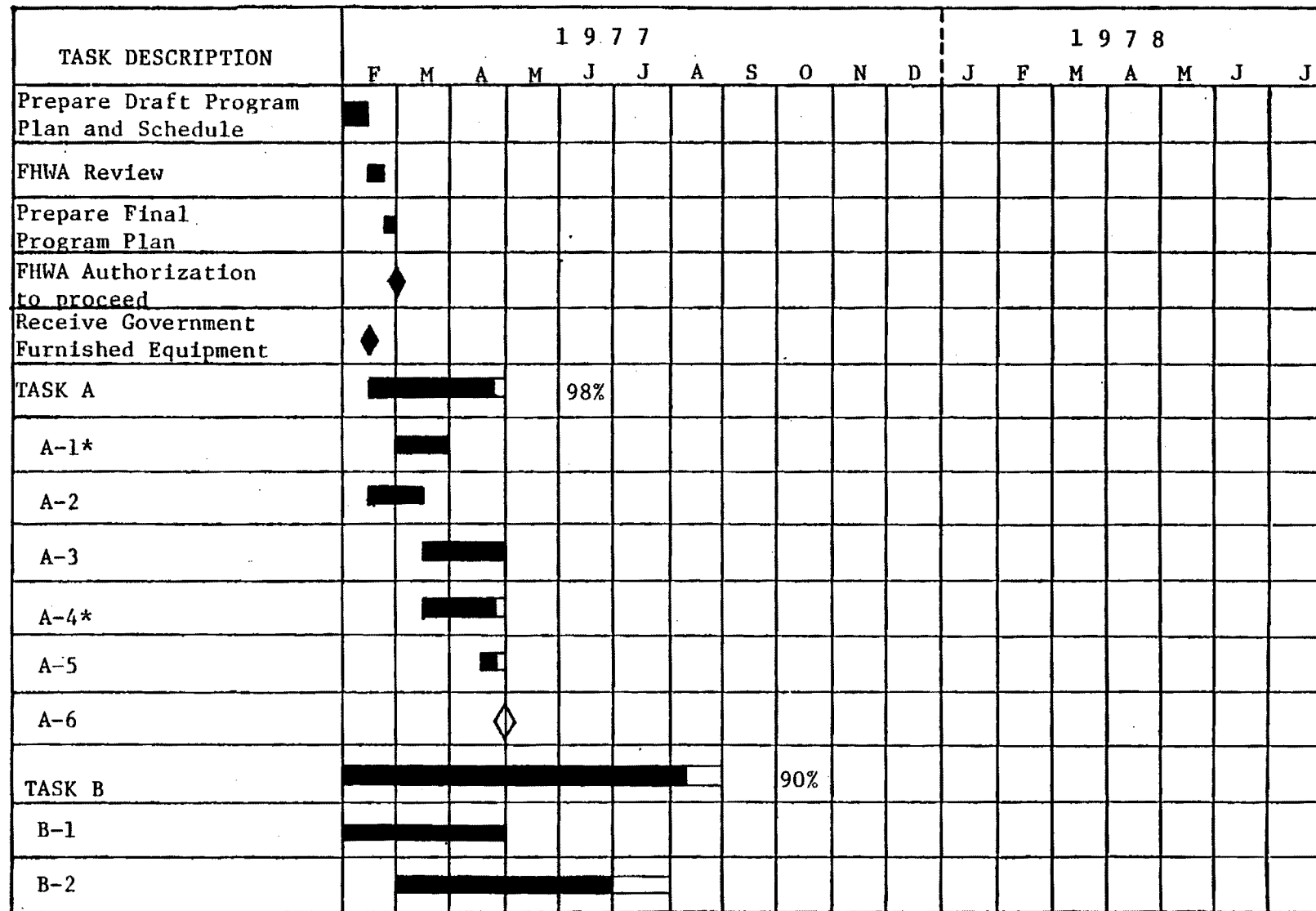
RWW:am

APPROVED:

D. W. Robertson, Director
Electronics Technology Laboratory

Attachments

Figure 1. CB-AIDS TASK SCHEDULE



Notes:

1. filled in portion indicates percentage of completion.
2. ◇ indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 1. CB-AIDS TASK SCHEDULE (continued)

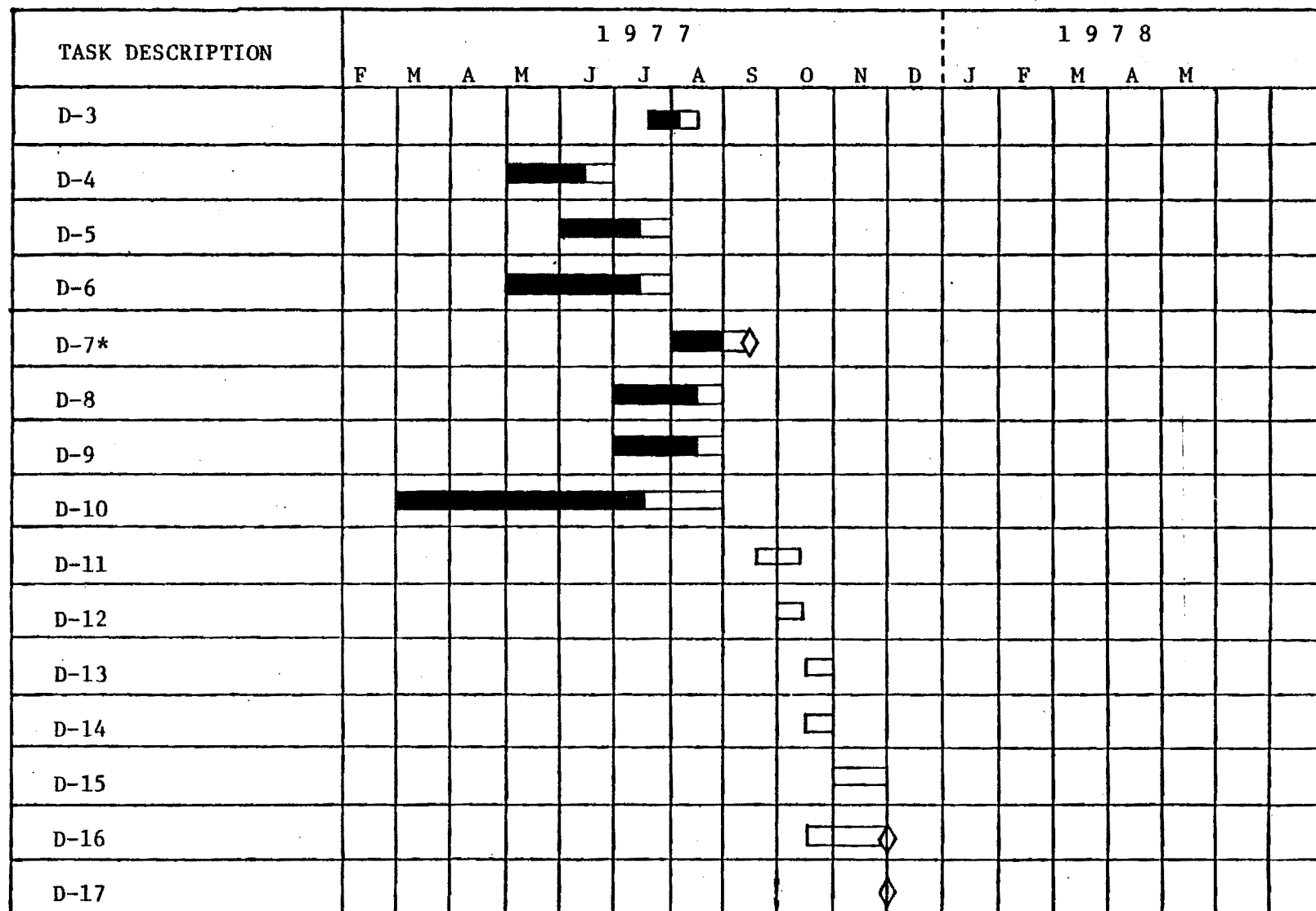


Figure 1. CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1 9 7 7												1 9 7 8							
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J		
D-18																				
D-19																				
TASK E																				
E-1																				
E-2																				
E-3																				
E-4																				
Attend TRB & FCP																				
Submit Progress Report																				
Design Reviews																				
Prepare & Submit Draft Final Report																				
Prepare & Submit Final Report.																				

ATTACHMENT A

CB-AIDS Presentation Script

CB-AIDS PRESENTATION SCRIPT

Slide 1 - The following presentation will introduce a new concept in motorist aid systems in which a disabled motorist is able to communicate directly from his vehicle to a centralized response dispatcher. This system which is called the Citizens Band Automatic Interconnect Digital System or CB-AIDS for short is presently being developed by Georgia Tech under the direction of the Federal Highway Administration. But before describing the CB-AIDS system I would like to first discuss the need for Motorist Aid Systems, the elements of a MAS, and some of the MAS now being used in the U.S.

Slide 2 - As one of the major advances in transportation, the multi-lane, high speed, limited access highway has become a familiar sight throughout the country providing efficient, trouble-free traveling most of the time. However, even on these highways motorists will occasionally encounter difficulties such as...

Slide 3 - Tire problems...

Slide 4 - engine problems...

Slide 5 - or weather problems...

Slide 6 - Based on recent studies, 70 million disablement stops were experienced by motorists in 1976 out of 1.4 trillion miles traveled.

Slide 7 - Since the Federal Aid Primary Highway System accommodates 50 percent of national highway travel it is estimated that 35 million disablement stops occurred on the Federal Aid System.

Slide 8 - Stopped vehicle studies and call box service requests indicate that the majority of stops are due to mechanical, tire, and gas, oil, and water problems. When a disablement stop does occur...

Slide 9 - the motorist is confronted with

- o inconvenience and delay
- o fears and anxieties
- o inaccessibility of services
- o few good samaritans to assist, and
- o roadway hazards

Slide 10 - All of which can sometimes be very frustrating to the affected motorist. In the attempt to help such motorists - Motorist Aid Systems have been developed to provide the following functions.

Slide 11 - Detection - the awareness that a motorist at a certain location needs help .

Slide 12 - Definition - identification of the type of assistance needed.

Slide 13 - Dispatch - sending the appropriate vehicle.

Slide 14 - Service - providing the assistance needed.

Slide 15 - and recording - to provide the necessary documentation of assistance required and provided.

Slide 16 - These five functions must be linked by a communications network into an integrated system.

Slide 17 - There are basically three types of motorist aid systems which have been developed. Roadside terminals and highway patrols have operated for several years in a number of states. In-vehicle communications is in its infancy and may be provided by volunteer organizations or government agencies.

Slide 18 - A wide variety of roadside terminal designs has been demonstrated. Shown here is a pushbutton terminal with which a stranded motorist may request one of four types of assistance. The types of assistance are identified by the pictures at the four pushbuttons. The yellow button will call a tow truck, the black button an ambulance, the blue button will call the police, and the red button will call the fire department. With this particular roadside terminal there is no voice contact. When a button is pushed the speaker at the upper right corner of the box emits a tone to indicate that the message has been sent.

Slide 19 - One variation of the roadside terminal includes a standard telephone with which the stranded motorist may establish voice contact with the aid dispatcher.

Slide 20 - In 1976 there were 47 call box systems operating over 19 hundred miles of highway in 19 states. 17 additional installations were then being planned but 8 projects had been abandoned. A serious problem with the call box system is vandalism. Roadside call boxes are also tempting targets for hunters.

Slide 21 - Another motorist aid system is the service patrol. These patrols provide experienced site control. Often the required assistance may be provided by the patrol, or if not, they can directly contact the aid dispatcher. However, the patrols suffer from high costs, varying coverage, and interference with police duties when this is a police service.

Slide 22 - Studies have shown the costs of the call box systems to vary from \$2. to \$30 per call with an average of around \$12 per call while the cost of patrols ranges from \$18 to \$25 per call.

Slide 23 - It has been suggested that the increasing use of citizens band radio could offer a more cost effective answer to the needs of the motorist in distress. Channel 9 has been designated for motorist aid messages. But can the 30 million CB users be mobilized to utilize channel 9 in an effective manner? There are a number of public agencies and volunteer groups which monitor Channel 9. If the public can utilize Channel 9 effectively, and if a reliable response system can be created to answer calls for help, then an effective motorist aid system might be possible.

Slide 24 - CB is not without its problems. There is channel congestion, there is adjacent channel interference, there are FCC rules violations, and the monitoring of Channel 9 may be sporadic.

Slide 25 - The present CB motorist aid system can be represented as a CB operator trying to contact a motorist aid dispatcher who, if he receives the call for help, will contact a service provider. The service itself will then be sent to the motorist in need. An examination of the present system reveals a number of shortcomings. First of all, the present system is unstructured; that is, it consists of a large number of potential monitors who are more-or-less randomly located and who are active as monitors at random times. This means that the present system may not dependably provide continuous time coverage or total area coverage.

Slide 26 - Further examination of the present system permits a listing of requirements for an effective CB motorist aid system. These requirements are structure, effective use of Channel 9, selective calling, caller identification, and continuous time and total area coverage.

Slide 27 - The CB-AIDS system being developed is designed to meet these requirements. The motorist shown in this slide is calling for help by depressing one of two pushbuttons, either an emergency or an assistance pushbutton. When a button is actuated, a coded message is transmitted through his CB radio and is received by an unattended remote station. The decoded message activates an automatic dialer in the remote station which dials the telephone number of the aid dispatcher. When the dispatcher depresses his microphone push-to-talk button upon answering the call, he is in voice contact with the CB operator requesting help. The dispatcher determines the nature and location of the emergency and then telephones the nearest appropriate service organization which provides service to the disabled vehicle. The CB-AIDS system may use Channel 9 more effectively than the present system because the communication between motorist and dispatcher is direct. The adapters which are used to permit pushbutton selection provide positive caller identification. Continuous time coverage and total area coverage are feasible, depending only upon the density and the number of remote stations. The remote station^s will be less prone to vandalism than roadside call boxes, since they do not require user access.

Slide 28 - To compare the present CB system with the proposed CB-AIDS system, as an example, it has been postulated that a certain urban network of interstate highway would be monitored on the average by nine CB base stations with three providing 24 hours of coverage, five providing 16 hours of coverage, and one providing eight hours of coverage. Only a small portion of the highway network would be monitored.

Slide 29 - A CB-AIDS system with 17 remote stations and one monitoring center would provide 24 hours coverage of the entire highway network.

Slide 30 - The graph indicates the continuous coverage of a potential CB-AIDS system as compared to the less effective present CB monitor system. It should be noted that in this example the CB-AIDS system would require only 24 man-hours per day for complete coverage whereas the present system requires 160 man-hours of monitoring time.

Slide 21 - The equipment which adapts a CB radio for the pushbutton, code signal actuation can be small in size.

Slide 32 - It can be mounted on the side of the radio, or incorporated in the radio cabinet.

Slide 33 - Or it can be outboard unit, connected between the CB microphone and the radio set.

Slide 34 - The basic remote station equipment is a CB radio, control circuit, and automatic dialing circuitry.

Slide 34 - For this demonstration project the dispatcher will be provided a telephone, a decoder display which identifies the callers ID number, a microphone, and an automatic record keeping printer.

Slide 36 - Centralizing the monitoring and dispatch function will permit the dispatch center to be fully implemented.

Slide 37 - When the system is operational at a selected site it will be evaluated. It is anticipated that 6 months will be required for a thorough and proper evaluation. A limited number of digital adopters will be provided to selected CB radio users in the test area for pilot program evaluation.

Slide 38 - The Federal Highway Administration realizes that the interstate highway system is used by people, who will sometimes require emergency assistance. CB-AIDS is a program designed to enhance the use of CB radio for motorist aid.

ATTACHMENT B

DA Checkout Program Listing

MOTOROLA M6800 CROSS ASSEMBLER, RELEASE 1.1

```

00001          NAM      CB-AIDS
00002          *  CB-AIDS  DIGITAL ADAPTER DECODER
00003          *
00004          *  DONALD R. SENTZ          JULY 7, 1977
00005          *
00006          *  THIS PROGRAM IS DESIGNED TO DECODE THE PDM DATA
00007          *  STREAM GENERATED BY THE DIGITAL ADAPTER UNITS AND
00008          *  PRINTS DATA ON TTY IN HEX FORMAT. THE ENTIRE DATA
00009          *  STREAM IS PRINTED, INCLUDING REPEATS AND SYNC
00010          *  BITS.
00011          *  THIS PROGRAM RUNS ON THE MEK-6800D1 MODULE,
00012          *  USING ONE INPUT LINE ON THE PIA. THE INPUT IS
00013          *  OBTAINED FROM A PLL TONE DECODER ATTACHED TO
00014          *  THE SPEAKER LEADS OF THE RECEIVER.
00015          *
00016          8008      PREGA  EQU      $8008      PERIPHERAL DATA REG. A
00017          8009      CONTRA EQU      $8009      CONTROL REG. A
00018          E07E      PDATA1 EQU      $E07E      MIKBUG PRINT ROUTINE
00019          E0CA      OUT2HS EQU      $E0CA      MIKBUG HEX OUTPUT ROUTINE
00020          *
00021      0000          ORG      $0000
00022      0000 01      CUVALU FCB      1          CURRENT VALUE OF DEMOD OUTPUT
00023      0001 00      MRKCNT FCB      0          MARK SAMPLE COUNT
00024      0002 0000    SPACNT FDB      0          SPACE SAMPLE COUNT
00025      0004 0000    BUFFR  FDB      0,0,0,0,0  ROOM FOR 160
00026      0006 0000
00027      0008 0000
00028      000A 0000
00029      000C 0000
00030      000E 0000          FDB      0,0,0,0,0  DECODED BITS
00031      0010 0000
00032      0012 0000
00033      0014 0000
00034      0016 0000
00035      0013 0001      SHFTMP RMB      1
00036      0019 0001      SHFCNT RMB      1
00037      001A 0001      ATEMP  RMB      1
00038      001B 53      MSG1   FCC      /SEQ ERROR, TRY AGAIN/
00039      001C 45
00040      001D 51

```

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001E 20
001F 45
0020 52
0021 52
0022 4F
0023 52
0024 2C
0025 20
0026 54
0027 52
0028 59
0029 20
002A 41
002B 47
002C 41
002D 49
002E 4E
00031 002F 0D      FCB      SD,SA,SA,S4
0030 0A
0031 0A
0032 04
00032 0033 0D      MSG2     FCB      SD,SA
0034 0A
00033 0035 43      FCC      /CB-AIDS DIGITAL ADAPTER TESTER/
0036 42
0037 2D
0038 41
0039 49
003A 44
003B 53
003C 20
003D 44
003E 49
003F 47
0040 49
0041 54
0042 41
0043 4C
0044 20
0045 41
0046 44
0047 41
0048 50
0049 54
004A 45
```

004B	52				
004C	20				
004D	54				
004E	45				
004F	53				
0050	54				
0051	45				
0052	52				
00034	0053	0D	CR2LF	FCB	SD,\$A,\$A,4 <CR>+2<LF>'S FOR OUTPUT
	0054	0A			
	0055	0A			
	0056	04			
00035	0057	FF	EOD	FCB	255 END-OF-DATA LOOP COUNT
00036	0058	05	VMRCNT	FCB	5 VERIFICATION LOOP COUNT
00037	0059	05	VSPCNT	FCB	5 DITTO
00038	005A	0018	BUFEND	FDB	BUFR+20 END-OF-BUFFER POINTER
00039	005C	07	RCOUNT	FCB	7 BIT COUNTER
00040	005D	0017	XTEMP	FDB	BUFR+19

```

00043          *
00044          * HERE IS ENTRY POINT OF PROGRAM
00045          *
00046 0060      ORG      $0060
00047 0060 CE 0033 START LDX      #MSG2
00048 0063 BD E07E      JSR      PDATA1  PRINT HEADER ON TTY
00049 0066 86 04      BEGIN LDA A    #$04  PIA INITIALIZATION
00050 0063 B7 8009      STA A    CONTRA  ALL INPUTS, NO INTERRUPTS
00051 006B CE 0001      LDX      #1      X POINTS TO MRKCNT OR SPACNT
00052 006E C6 3F      NUWAIT LDA B    #$3F
00053 0070 B6 8008 WAIT  LDA A    PREGA
00054 0073 84 02      AND A    #2      MASK UNUSED BITS
00055 0075 27 F7      BEQ      NUWAIT  WAIT FOR 0-1 TRANS.
00056 0077 5A      DEC B      VERIFY 0-1 TRANS.
00057 0078 26 F6      BNE      WAIT
00058 007A 20 2C      BRA      CURVAL  GO SAMPLE THE INPUT.
00059 007C 91 00      RETURN CMP A    CUVALU IF 0-1 TRANSITION, CHK FOR
00060 007E 2D 06      BLT      NEWMRK  START OF NEW BIT PERIOD.
00061 0080 2E 16      BGT      NEWSPC  ELSE, CHK FOR SPACE
00062 0082 6C 01      INC      MRKCNT,X IF NEW VALUE = OLD VALUE,
00063 0084 20 22      BRA      CURVAL  COUNT IT AND DO AGAIN
00064 0086 D6 58      NEWMRK LDA B    VMRCNT BEGIN MARK VERIFICATION
00065 0088 27 05      BEQ      MRCONT  IF=0, MARK IS VERIFIED
00066 008A 5A      DEC B
00067 008B D7 58      STA B    VMRCNT
00068 008D 20 19      BRA      CURVAL  ELSE KEEP CHECKING
00069 008F C6 05      MRCONT LDA B    #5  INITIALIZE VSPCNT
00070 0091 D7 59      STA B    VSPCNT
00071 0093 09      DEX      POINT TO MARK SAMPLE COUNTER
00072 0094 97 00      STA A    CUVALU  SAVE CURRENT VALUE (A MARK)
00073 0096 20 47      BRA      PROCES  UPDATE BUFFER
00074 0098 D6 59      NEWSPC LDA B    VSPCNT BEGIN SPACE VERIFICATION
00075 009A 27 05      BEQ      SPCONT  IF=0, SPACE IS VERIFIED
00076 009C 5A      DEC B
00077 009D D7 59      STA B    VSPCNT
00078 009F 20 07      BRA      CURVAL  ELSE KEEP CHECKING
00079 00A1 C6 05      SPCONT LDA B    #5  INITIALIZE VMRCNT
00080 00A3 D7 58      STA B    VMRCNT
00081 00A5 08      INX      POINT TO SPACE SAMPLE COUNTER
00082 00A6 97 00      STA A    CUVALU  SAVE THIS VALUE ( A SPACE )

```



```

00084
00085 * ROUTINE TO READ INPUT PORT
00086 *
00087 * THIS ROUTINE READS THE PIA, MASKS UNUSED BITS
00088 * TO 0, AND RETURNS RESULT IN REG. A AFTER CHECKING
00089 * FOR VALIDITY. A=0 FOR SPACE, 1 FOR MARK.
00090 * IF DATA HASN'T BEGUN ( NUWAIT LOOP ),
00091 * COMPUTER WAITS UNTIL 0-1 TRANSITION ENCOUNTERED
00092 * SAYS IF S00 ENCOUNTERED AGAIN, VERIFY END-OF-DATA
00093 * BY READING S00 100 TIMES.
00094 *
00095 00A8 B6 8008 CURVAL LDA A PREGA LOOK AT TONE DECODER
00096 00AB 34 02 AND A #2 SET UNUSED BITS TO 0
00097 00AD 27 06 BEQ TEST0 IF ALL ARE 0, TEST FOR E-O-D
00098 00AF C6 FF LDA B #255 RESTORE E-O-D COUNT
00099 00B1 D7 57 STA B EOD
00100 00B3 20 C7 BRA RETURN
00101 00B5 7A 0057 TEST0 DEC EOD ELSE CHECK E-O-D 100 TIMES
00102 00B3 27 4C BEQ FIXBUF DATA STREAM HAS ENDED
00103 00BA 20 C0 BRA RETURN OR IT WAS A VALID SPACE.
00104 *
00105 * WHEN E-O-D IS VERIFIED, THIS
00106 * PART OF PROGRAM PRODUCES A TTY
00107 * DUMP OF THE BUFFER IN HEX FORMAT.
00108 *
00109 00BC CE 0004 OUT LDX #BUFFR POINT TO START OF BUFFER
00110 00BF 3D E0CA OUTHEX JSR OUT2HS PRINT CONTENTS OF THIS LOC.
00111 00C2 9C 5A CPX BUFEND CHECK FOR 20 LOCS DUMPED.
00112 00C4 26 F9 BNE OUTHEX CONTINUE DUMP IF NOT DONE YET
00113 00C6 CE 0053 LDX #CR2LF
00114 00C9 3D E07E JSR PDATA1 PRINT CR + 2 LF'S
00115 00CC 36 07 REINIT LDA A #7 INITIALIZE RCOUNT
00116 00CE 97 5C STA A RCOUNT
00117 00D0 DE 5A LDX BUFEND SET UP TO CLEAR BUFFR
00118 00D2 09 DEX INITIALIZE XTEMP
00119 00D3 DF 5D STX XTEMP
00120 00D5 6F 00 CLRBUF CLR 0,X
00121 00D7 09 DEX
00122 00D3 26 FB BNE CLRBUF DO CUVALU,MRKCNT,SPACNT, TOO
00123 00DA 6C 00 INC 0,X SET CUVALU TO 1
00124 00DC 08 INX SET REG X TO 1
00125 00DD 20 8F BRA NUWAIT START OVER

```

```

00127      *
00128      * BOOKKEEPING ROUTINE
00129      *
00130      * THIS ROUTINE BUILDS DATA BUFFER BY DECIDING WHAT
00131      * VALUE THE DATA BIT SHOULD BE. IT SHIFTS THE BIT
00132      * INTO A WORD OF THE BUFFER. WHEN A WORD IS FILLED
00133      * IT GOES TO THE NEXT WORD ( STARTS FILLING
00134      * BUFFER AT LAST LOCATION ).
00135      *
00136 00DF 96 01      PROCES LDA A   MRKCNT   GET # OF MARK SAMPLES
00137 00E1 91 02      CMP A   SPACNT   COMPARE # OF SPACE SAMPLES
00138 00E3 0C          CLC           ASSUME A MARK
00139 00E4 2E 01      BGT      CONTP    IF A MARK, BRANCH.
00140 00E6 0D          SEC           CARRY BIT HOLDS DATA.
00141 00E7 DE 5D      CONTP LDX      XTEMP  GET CURRENT LOC. IN BUFFER
00142 00E9 66 00      ROR      0,X     SHIFT DATA INTO WORD
00143 00EB 7A 005C    DEC      RCOUNT CHECK FOR FULL WORD
00144 00EE 26 0C      BNE      BITDUN   IF>0, STILL ROOM HERE
00145 00F0 C6 03      LDA B   #3       ELSE RESET BIT COUNTER
00146 00F2 D7 5C      STA B   RCOUNT
00147 00F4 09          DEX           AND POINT TO NEXT WORD
00148 00F5 8C 0002    CPX      #2
00149 00F8 27 0C      BEQ      FIXBUF   CHECK FOR END OF BUFFER
00150 00FA DF 5D      STX      XTEMP    REPLACE BUFFER POINTER
00151 00FC 7F 0001 BITDUN CLR      MRKCNT RESET SAMPLE COUNTERS
00152 00FF 7F 0002    CLR      SPACNT
00153 0102 DE 01      LDX      MRKCNT   CLEAR INDEX REGISTER
00154 0104 23 A2      BRA      CURVAL

```

```

00156          * ROUTINE TO ADJUST BITS IN BUFFER
00157          *
00158 0106 DE 5A  FIXBUF LDX      BUFEND
00159 0108 09      DEX
00160 0109 6F 00      CLR      0,X      CLEAR LAST BUFFER LOC
00161 010B 09      TRYAGN DEX      SET UP POINTER
00162 010C 8C 0002    CPX      #2      TEST FOR END OF BUFFER
00163 010F 27 1F      BEQ      ERROR   AND QUIT IF TRUE
00164 0111 86 F7      LDA A    #-8
00165 0113 97 19      STA A    SHFCNT  TEST FOR NO MATCH
00166 0115 A6 01      LDA A    1,X      GET VALUE FROM BUFFER
00167 0117 97 1A      STA A    ATEMP   SHIFT-AND-CHECK SEQUENCE
00168 0119 E6 00      LDA B    0,X      GET NEXT LOC IN BUFFER
00169 011B 96 1A      LOOP2  LDA A    ATEMP   GET WORD FOR TESTING
00170 011D 84 F9      AND A    %11111001  MASK "E" AND "A" BITS
00171 011F 81 F0      CMP A    %11110000  TEST FOR THIS PATTERN
00172 0121 27 16      BEQ      BUFADJ   IF A MATCH, WE ARE DONE
00173 0123 96 19      LDA A    SHFCNT
00174 0125 4C      INC A
00175 0126 27 E3      BEQ      TRYAGN   IF NO MATCH, CHECK NEXT WORD
00176 0128 97 19      STA A    SHFCNT
00177 012A 54      LSR B      ELSE SHIFT BIT TO CARRY
00178 012B 76 001A    ROR      ATEMP   AND SHIFT CARRY TO TEST WORD
00179 012E 20 EB      BRA      LOOP2   AND TEST FOR MATCH AGAIN

00131 0130 CE 001B  ERROR  LDX      #MSG1
00182 0133 BD E07E      JSR      PDATA1  PRINT ERROR MESSAGE
00183 0136 7E 00CC      JMP      REINIT  AND TRY AGAIN

```

```

00185      * THIS ROUTINE SHIFTS THE BITS IN THE BUFFER
00186      * THE # OF TIMES SPECIFIED BY SHFCNT, SO THAT
00187      * ID NUMBER CAN BE PRINTED PROPERLY IN HEX DUMP.
00188      *
00189 0139 CE 0017 BUFADJ LDX      #BUFFER+19   START AT END OF BUFFER
00190 013C 09          DEX
00191 013D 96 19      LDA A  SHFCNT   ADD 9 TO SHFCNT TO
00192 013F 8B 03      ADD A  #8       ESTABLISH PROPER COUNT
00193 0141 27 19      BEQ    NOSHFT   SKIP SHIFT SEQ IF=0
00194 0143 97 19      STA A  SHFCNT
00195 0145 96 19      LOOP3  LDA A  SHFCNT   RESET SHFCNT FOR THIS LOC
00196 0147 97 18      STA A  SHFTMP   USE SHFTMP AS COUNTER
00197 0149 A6 01      LDA A  1,X      GET LOC TO BE FIXED
00198 014B E6 00      LDA B  0,X      GET NEXT LOC
00199 014D 54        LOOP4  LSR B      DO A SHIFT OF ONE BIT FROM
00200 014E 46          ROR A          NEXT LOC TO THIS LOC
00201 014F 7A 0018    DEC    SHFTMP   AND COUNT THE SHIFT
00202 0152 26 F9      BNE    LOOP4     SHIFT UNTIL SHFTMP=0
00203 0154 A7 01      STA A  1,X      REPLACE FIXED WORD TO BUFFER
00204 0156 09          DEX
00205 0157 3C 0002    CPX    #2       TEST FOR LAST LOC DONE
00206 015A 26 E9      BNE    LOOP3     IF NOT KEEP FIXING.
00207 015C 7E 00BC    NOSHFT JMP     OUT   ELSE WE ARE THRU

```

00209 * INITIALIZATION SEQUENCE

```

00211 015F CE 001A PRSTRT LDX      #001A
00212 0162 4F          CLR A
00213 0163 A7 00      LOOP7  STA A  0,X
00214 0165 09          DEX          CLEAR ALL LOCS< 001B
00215 0166 26 FB      BNE    LOOP7
00216 0168 6F 00      CLR    0,X
00217 016A 6C 00      INC    0,X      SET LOC 0 TO 1
00218 016C 36 FF      LDA A  #3FF
00219 016E 97 57      STA A  EOD
00220 0170 36 05      LDA A  #S05
00221 0172 97 58      STA A  VMRCNT
00222 0174 97 59      STA A  VSPCNT
00223 0176 36 07      LDA A  #7
00224 0178 97 5C      STA A  RCOUNT
00225 017A CE 0017    LDX      #S0017
00226 017D DF 5D      STX     XTEMP
00227 017F 7E 0060    JMP     START

```

```
00229 0200          ORG    $0200
00230 0200 7E 015F  JMP    PRSTRT

00232              *  NOW SET UP START ADDRESS IN LOC. A048, A049
00233              *
00234 A048          ORG    $A048
00235 A048 0200     FDB    $0200
00236              END
```

EOI. 1 FILES. 1 RECS. 1760 WORDS.

ATTACHMENT C

Digital Adapter Configuration

FRONT PANEL LAYOUT, CHINESE DIGITAL ADDRESS UNITS, ACTUAL SIZE

TOTAL REQ'D 100 UNITS

$\frac{1}{4}$ " 10 UNITS (PRINT ONLY FOR FORMS)

$\frac{2}{16}$ " 13 UNITS

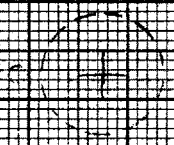
$\frac{5}{16}$ " 13 UNITS

$\frac{11}{16}$ " 4 UNITS

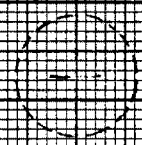
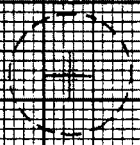
$\frac{5}{8}$ "

ALL UNITS

FEDERAL HIGHWAY ADMINISTRATION / GEORGIA INSTITUTE OF TECHNOLOGY



CB-AIDS



MOTORIST AID SYSTEM

1" 2 3/4" 1 3/4" 1"

$\frac{1}{8}$ " MOUNTING HOLES
REQUIRED ONLY FOR THE 13 UNITS
HAVING $\frac{5}{16}$ " MAIN HOLE
(5 PIN DIN RECEPTACLE)

3 STEPS
MICROPHONE CONNECTORS

13 UNITS: IMPROVED CB-AIDS 1 PIN
13 UNITS: DIN 5 PIN
4 UNITS: MOTOROLA 4 PIN
10 UNITS: PRINT ONLY ONLY
100

2-2-77

BASE AND REAR PANEL LAYOUT DIGITAL ADAPTERS

ACTUAL SIZE

100 units

REAR

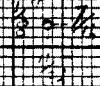


50



3"

4 mounting holes
for
PC Board
each 1/8"

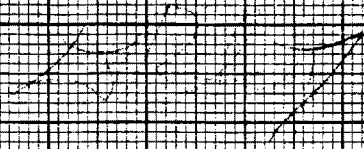


FRONT

REAR PANEL



1/4" HOLES
FOR
WIRE
STRAIN RELIEF



A-1940



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

October 24, 1977

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D. C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 8 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communication System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of September, 1977.

WORK COMPLETED:

During the reporting period work was concluded on Task A, continued on Task B and Task D, and initiated on Task C. Details of the work on the Tasks are reported below.

Task A - The work on Task A was concluded with a presentation of the CB-AIDS concept at a meeting including FHWA, Georgia DOT, and Georgia Tech representatives in Atlanta, Georgia.

Participating in the meeting were:

FHWA -
Frank J. Mammano
Lyle Saxton
William A. Wood
Grover C. Bowman
Glen Price
Henry H. Rentz
Gordon R. Brooks

Georgia DOT -
Archie Burnham
Bill Owen
Jim Taylor

Georgia State Patrol -
Sgt. J. R. Nix

Georgia Tech -
Ronald W. Wallace

Mr. Mammano opened the meeting with a review of the background of FHWA's role in motorist aid systems and the previous work leading up to the current contract. Ron Wallace then presented a slide presentation on CB-AIDS and opened the floor to a discussion of the possibility of operating the pilot program in Georgia based on the pilot program selection criteria. Mr. Burnham said that he felt a number of areas in Georgia would meet the criteria and that Georgia DOT would be interested in supporting the program here. Areas suggested were Atlanta, Macon, Augusta, and Columbus, Georgia. At the close of the meeting Messrs. Wallace and Burnham agreed to meet later to further discuss potential sites. Further site selection activities will be discussed under Task D.

Task B - The Task B activity included continued fabrication and testing of the two remote stations and the central control unit equipment.

Both remote stations have been completely wired with the exception of some wiring required for the stored "assistance" number circuits. The approach being taken is to completely check out the first remote station before beginning to check out the second one in order to avoid duplication of troubleshooting. The first remote station demodulator board has been checked out and is operating correctly. The remaining boards (word processor, telephone interconnect, and telephone number storage and dialler) have been checked out with the exception of the "assistance" number storage circuits and a tone detection portion of the circuitry which has been delayed due to parts delivery problems. The part creating the delay is a DTMF (dual tone multiple frequency) decoder which is required to decode the new "assistance" number from the CCU. Delivery of this part is now scheduled for mid-October. Power supply circuit boards for the remote stations and CCU were completed and assembled.

The central control unit assembly was completed with the exception of the power supply and the board containing the remote transmitter control tone generator and the FSK demodulator. A minor problem remains in the printer interface which causes an occasional misprinting of the minutes portion of the time printout. This problem appears to be due to the date/time multiplexor timing and is currently being investigated. A power

control circuit was designed for the printer to avoid the necessity of running the printer full time as this would required oiling the ribbon reel every ten hours. With the new circuit the printer will only be turned on when a call is received which will decrease its operating time significantly.

Task C - The Task C effort was initiated with preliminary tests of the digital adapter in conjunction with the mobile CB radios under field conditions. Some radio frequency interference and ignition noise were noted during the tests. Bypass capacitors strategically placed on the input and output lines to the DA eliminated the 27 MHz interference. The ignition noise effects are radio dependent and are being investigated.

Task D - Under Task D the effort included site selection activities, DA fabrication, and program planning.

A potential site for the pilot program in the Atlanta area suggested by Georgia DOT was in DeKalb County northeast of Atlanta around Interstate 285 between Interstate 85 and Interstate 20. This area includes residences, shopping centers, small businesses, and industrial companies. It is a heavy traffic area with a high rate of incidents. Arrangements are being made to meet with police officials in this area to determine local interest.

During this period the preparation of the DA chassis was completed with drilling of the mounting and component holes and silk-screening of the front panels. The printed circuit boards were filled with components and are ready for soldering.

Work on the program continued with the development of a users manual for the CB-AIDS participants and the composition of data logs and evaluation forms.

PROBLEM AREAS:

Task B fabrication is somewhat behind schedule due to hardware delivery problems and longer than anticipated check out delays.

WORK PLANNED FOR NEXT MONTH:

Work will continue on Tasks B, C, and D during the next reporting period.

The Task B effort will include continued fabrication and testing of the two remote stations and the central control unit, a request for FCC authorization of the pilot program with necessary waivers, and preparation of drawings and manuals for the system hardware.

The Task C effort will include a continuation of system tests.

The Task D effort will include continued fabrication and testing of the digital adapters, investigation of pilot program test sites, and program documentation development.

MANAGEMENT INFORMATION:

The following information gives the managerial and estimated financial status of the contract as of September 30, 1977.

(A) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Cost</u>
Task A	\$ 20,592	\$ 355	\$20,648
Task B	40,179	5,306	45,836
Task C	10,453	1,843	1,843
Task D	66,250	7,617	26,257
Task E	<u>20,364</u>	<u>0</u>	<u>0</u>
TOTAL	\$157,836	\$15,121	\$94,584

(B) Estimated cost to complete: \$63,252.

(C) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Cumulative</u>
Principal Investigator R. W. Wallace	120	898
Principal Research Engineers D. W. Robertson/H. H. Jenkins	16	112
Senior Research Engineer R. W. Moss	8	112
Assistant Research Engineers C. S. Wilson/D. R. Sentz	203	1162

(D) Percentage of work performed: (see Figure 1).

Respectfully submitted,

Ronald W. Wallace
Project Director

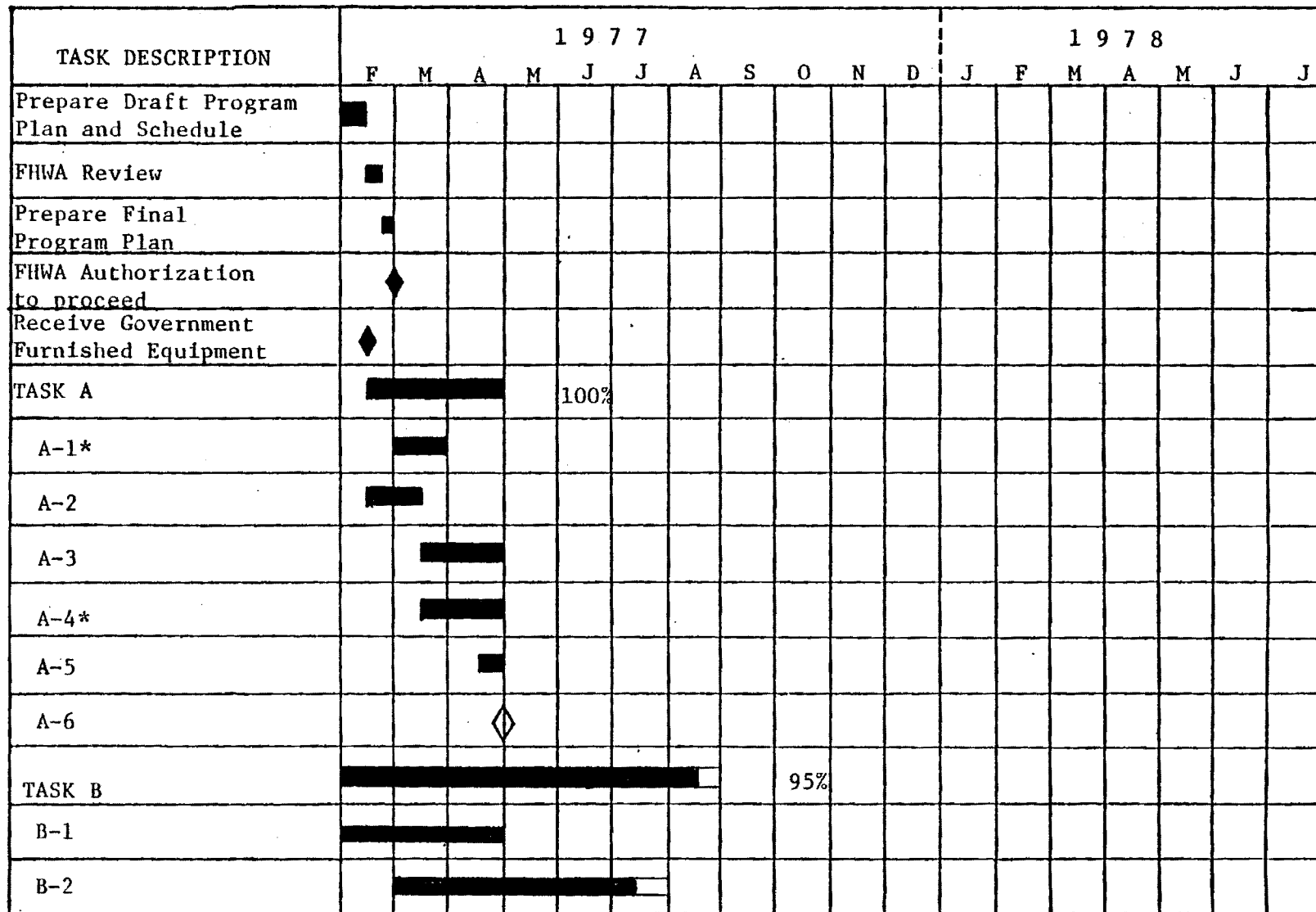
RWW/slb

APPROVED:



D. W. Robertson, Director
Electronics Technology Laboratory

Attachments

FIGURE 1. CB-AIDS TASK SCHEDULE



Notes:

1.  filled in portion indicates percentage of completion.
2.  indicates milestone event.
3. * indicates substantial external factors in subtask.

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1 9 7 7												1 9 7 8				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
D-3																	
D-4																	
D-5																	
D-6																	
D-7*																	
D-8																	
D-9																	
D-10																	
D-11																	
D-12																	
D-13																	
D-14																	
D-15																	
D-16																	
D-17																	

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978					
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
D-18																		
D-19																		
TASK E																		
E-1																		
E-2																		
E-3																		
E-4																		
Attend TRB & FCP																		
Submit Progress Report																		
Design Reviews																		
Prepare & Submit Draft Final Report																		
Prepare & Submit Final Report.																		

ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

November 28, 1977

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 9 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communication System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of October, 1977.

WORK COMPLETED:

During the reporting period work continued on Tasks B, C, and D. Details of the work on the tasks are reported below.

Task B - The Task B activity included continued fabrication and testing of the two remote stations and the central control unit equipment and preparation of manuals for the digital adapters, remote stations, and central control unit.

Work continued on the checkout of remote station number 1. The individual boards were checked out and installed in the chassis. Interconnection of the boards was initiated. The automatic telephone dialer has been checked out for both the DIP switch "emergency" number and the semiconductor stored "assistance" number by initiating calls through the telephone central office serving the Georgia Tech campus. The portion of the telephone number storage board which is used to decode the incoming new "assistance" number from the CCU has not been completely checked out due to a delivery problem with the DTMF decoder. Due to failure to deliver, the order to the original vendor, Cermetek, has been cancelled and a new source, BEI Microelectronics, has been selected. Shipment of the part is now scheduled for November 29, 1977. Wiring and board checkout of remote station number 2 continued during the month.

The problem in the central control unit printer interface was located and corrected by changing the timing signals in the date/time multiplexor. The printer now correctly records the time of call receipt, RS/user identification numbers, and time of call completion. The power supply circuit board and the FSK demodulator and remote transmitter control tone generator board are currently being installed in the CCU.

Draft copies of the manuals for the digital adapter, remote station, and central control unit were prepared and are now being edited for final preparation.

Task C - Range tests with the digital adapter/transceiver combination continued on the Georgia Tech campus. The bypass capacitors on the input and output lines of the DA's substantially reduced the effects of radio frequency interference including ignition noise in the mobile units.

Work continued on interconnecting the remote station and the central control unit through the dial telephone network. An input circuit was added to the CCU to enable the FSK demodulator circuit only while data are being received in order to eliminate false triggering of the input shift register during non-data tone transmissions. The circuit has been implemented in the CCU with correct operation verified.

Task D - Work in Task D continued in the selection of the pilot program test site, developing the operational procedures, and fabricating the digital adapters.

In conjunction with Georgia DOT representatives, Archie Burnham, Bill Owen, and C. B. Collins, a number of pilot program sites were considered including suburban Atlanta (North Dekalb County), Macon, Augusta, and Valdosta, Georgia. It was felt that these sites would meet the selection criteria previously developed. The recommended site is the suburban Atlanta location. In addition to meeting the selection criteria, the county police officials have worked with Georgia Tech researchers on previous programs and have established an excellent working relationship. Preliminary contacts have been made with Dekalb County Chief of Police Hand who is interested in supporting the program. The test site will be selected in the next month in conjunction with the FHWA Contract Manager.

A waiver request was submitted to the FCC in order to use the digital adapters for the purpose of tone modulated data transmissions in the citizens radio band. Approval of this request is anticipated within the next reporting period.

Work continued on the establishment of program operational procedures. The following items are included in the operational procedures.

- o program description
- o system operating instructions

- o DA users manuals
- o forms

Work on the digital adapters progressed with the soldering of the components on all of the boards. A total of 110 boards were produced in order to provide adequate spares. Currently the boards are being inspected and assembled into the chassis.

PROBLEM AREAS:

Task B fabrication remains behind schedule which is delaying the completion of several Task C items. Another factor impacting the completion of Task C items is the fact that the pilot program test site has not been chosen. Tasks C-2 through C-5 can not be initiated until the site has been officially selected.

WORK PLANNED FOR NEXT MONTH:

Work will continue on Tasks B, C, and D during the next reporting period.

The Task B effort will include continued testing of the two remote stations and the central control unit and preparation of system documentation.

The Task C effort will include a continuation of system tests.

The Task D effort will include continued fabrication and testing of the digital adapters, selection of the pilot program test site, and pilot program implementation.

MANAGEMENT INFORMATION:

The following information gives the managerial and estimated financial status of the contract as of October 31, 1977

(A) Cumulative Costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Cost</u>
Task A	\$20,592	\$ 0	\$20,648
Task B	40,179	6,671	52,507
Task C	10,453	2,093	3,936
Task D	66,250	7,236	33,493
Task E	<u>20,364</u>	<u>0</u>	<u>0</u>
TOTAL	\$157,836	\$16,000	\$110,584

(C) Key personnel man-hours expended:

(D) Percentage of work performed: (see figure 1)

R. W. Wallace,
Project Director

APPROVED:

Attachments

FIGURE 1, CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1 9 7 7												1 9 7 8					
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
Prepare Draft Program Plan and Schedule	■																	
FHWA Review	■																	
Prepare Final Program Plan		■																
FHWA Authorization to proceed		◆																
Receive Government Furnished Equipment	◆																	
TASK A	■■■■				100%													
A-1*		■■																
A-2		■■■																
A-3			■■■															
A-4*			■■■															
A-5				■														
A-6				◆														
TASK B	■■■■■■■■								97%									
B-1	■■■■																	
B-2		■■■■■■■■																

Notes:

1. ■■■■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1 9 7 7												1 9 7 8				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
B-3			■	■	■	■	■	■									
B-4	■	■															
B-5		■	■														
B-6*	■	■	■	■													
B-7			■	■	■	■	■	■									
B-8								◇									
TASK C						■	■	■	■	■	■	6%					
C-1							■	■	■	■	■						
C-2							■	■	■	■	■						
C-3*							■	■	■	■	■						
C-4								■	■	■	■						
C-5								■	■	■	■						
TASK D		■	■	■	■	■	■	■	■	■	■				35%		
D-1			■	■	■	■	■	■	■	■	■						
D-2								◇									

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1 9 7 7												1 9 7 8				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
D-3																	
D-4																	
D-5																	
D-6																	
D-7*																	
D-8																	
D-9																	
D-10																	
D-11																	
D-12																	
D-13																	
D-14																	
D-15																	
D-16																	
D-17																	

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1 9 7 7												1 9 7 8						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
D-18																			
D-19																			
TASK E																			
E-1																			
E-2																			
E-3																			
E-4																			
Attend TRB & FCP																			
Submit Progress Report																			
Design Reviews																			
Prepare & Submit Draft Final Report																			
Prepare & Submit Final Report.																			



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

December 23, 1977

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 10 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communication System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of November 1977. The project director, Ronald W. Wallace, attended the Federally Coordinated Programs Research Review Conference in Columbus, Ohio, on November 9 and 10 during which he presented a description of the program and the pilot program test site.

Also during the past month special temporary authority was received from the Federal Communications Commission for the requested waivers and authorizations. A copy of this letter is included as Attachment A to this report.

The DeKalb County, Georgia area was approved by FHWA as the test site allowing arrangements to be initiated with the local organizations which will participate in the program.

WORK COMPLETED:

During the reporting period work continued on Tasks B, C, and D. Details of work on the tasks are reported below.

Task B - The Task B activity included continued fabrication and testing of the two remote stations and the central control unit equipment.

Work continued on the checkout of remote station number one. Interconnection of the boards in the chassis was completed as was the interconnection of the boards with the power supply and panel connectors. Some problems were encountered in the audio processing portion of the telephone interconnect section of the remote station. A disagreeable amount of noise was present in the voice signal as routed from the CB radio output to the telephone hybrid. This problem was investigated with corrective action taken

to eliminate the coupled noise. Wiring continued on the individual boards for remote station number two. Some of the wiring is being delayed until remote station number one is completely checked out to allow the inclusion of any required changes.

Installation of the power supply, FSK demodulation, and remote station transmitter control tone generator board was completed in the central control unit. The power supply was checked out with proper operation verified. The FSK demodulator operates properly with data present. However, the phase locked loop detector generates output pulses when no data are present causing the demodulator to continue processing signals with no data, affecting both the display and printout. This problem is currently being investigated. The printer power control circuit was installed and checked out with proper operation verified. This circuit turns on the printer only when a call is being processed, resulting in reduced wear and maintenance requirements of the ribbon drive mechanism.

Work continued on the draft copies of the manuals. The current version of the manuals for the digital adapter, remote station, and central control unit has been sent to the Contract Manager under separate cover.

Task C - Work during the month continued on the interconnection of the remote station and the central control unit through the dial telephone network. Calls were placed by pressing the request buttons on a digital adapter which was attached to a CB radio. The modulated signal was received by another radio which was attached to the remote station. The RS demodulated the signal and dialed the telephone to which the CCU was connected. The CCU operator answered the call and maintained voice communication with the DA user for the duration of the call. Although intelligible, the voice quality needed improvement. This will be accomplished through level adjustments and improved line matching in the remote station and central control unit circuits.

With the approval of the test site location, further contacts were made with the DeKalb County Police Department which has expressed an interest serving as the emergency dispatch location for the program. Detailed discussions were held with Lt. Perry Whitley, who heads the communications department and his technical assistant, Mr. Gary Nix. They will discuss the program with Chief of Police Hand, who must approve their participation.

The Southern Bell Telephone Company representative for the area was contacted and given a description of the program. He stated that, provided no special conditioning was required, the telephone service could be installed within seven to 10 days of placing the order.

Task D - The Task D activity continued with work primarily in the site selection and digital adapter fabrication areas.

With FHWA approval of the pilot program test site, progress was made in the arrangements with an emergency dispatch agency and with the identification of potential digital adapter recipients. Detailed discussions were held with the DeKalb County Police Department communications personnel as previously indicated. They are interested in participating in the program and will request approval by the Chief of Police. This should be no problem

since Chief Hand expressed interest in the program during previous contact with Georgia Tech. Through the Georgia DOT Radio Users Send Help (RUSH) program office, contact was made with local REACT Club officers. As a result of this contact, Georgia Tech will have a representative at their December meeting to discuss their participation in the program.

As previously noted authority was granted by the FCC for tone signaling and remote transmitter control for this program. This authority is granted under the Georgia Tech CB license and a list of digital adapter users will be provided to the FCC.

The 100 digital adapter circuit boards were completed during the month. The boards were individually inspected after they had been assembled and wave-soldered. Most of the boards required minor fixes consisting of removing solder bridges between adjacent foil traces. An average of about four bridges per board were detected and corrected.

After correcting the solder bridges the boards were tested for proper operation using the microprocessor-based test station developed for this purpose. Eighty of the one hundred boards functioned correctly on their first test. Of the twenty which malfunctioned, eighteen had about one undetected solder bridge per board, which when removed resulted in normal functioning. One board had an inoperative IC which when replaced resulted in normal functioning, and one board was discarded and replaced by a spare constructed from existing spare parts supplies for the digital adapters.

Work was begun on installing the boards into their boxes and making connections to the switch assemblies. Final wiring will be completed pending receipt of information on the CB radios to be used in the pilot program.

PROBLEM AREAS:

Completion of the remote station hardware remains a problem since it is behind schedule and is over the allocated budget for Task B. This will have to be evaluated in relationship to the overall budget.

WORK PLANNED FOR NEXT MONTH:

Work will continue on Tasks B, C, and D during next month.

The Task B effort will include any modifications required for the remote stations and central control unit as revealed by system tests.

The Task C effort will include continued system interconnection tests both in the lab and in field tests and in arranging for CCU installation.

The Task D effort will include continued digital adapter assembly of the completed boards into the chasses and remote station site selection.

MANAGEMENT INFORMATION:

The following information gives the managerial and estimated financial status of the contract as of November 30, 1977.

(A) Cumulative Costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,592	\$ 0	\$ 20,648
Task B	40,179	3,165	55,672
Task C	10,453	3,201	7,137
Task D	66,250	5,988	39,481
Task E	<u>20,364</u>	<u>0</u>	<u>0</u>
TOTAL	\$157,836	\$12,354	\$122,938

(B) Estimated cost to complete: \$34,898.

(C) Key personnel man-hours expended

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Cumulative</u>
Principal Investigator R. W. Wallace	96	1082
Principal Research Engineer D. W. Robertson/H. H. Jenkins	16	144
Senior Research Engineer R. W. Moss	16	136
Assistant Research Engineer C. S. Wilson/D. R. Sentz	232	1631

(D) Percentage of work performed (see Figure 1).

Respectfully submitted,

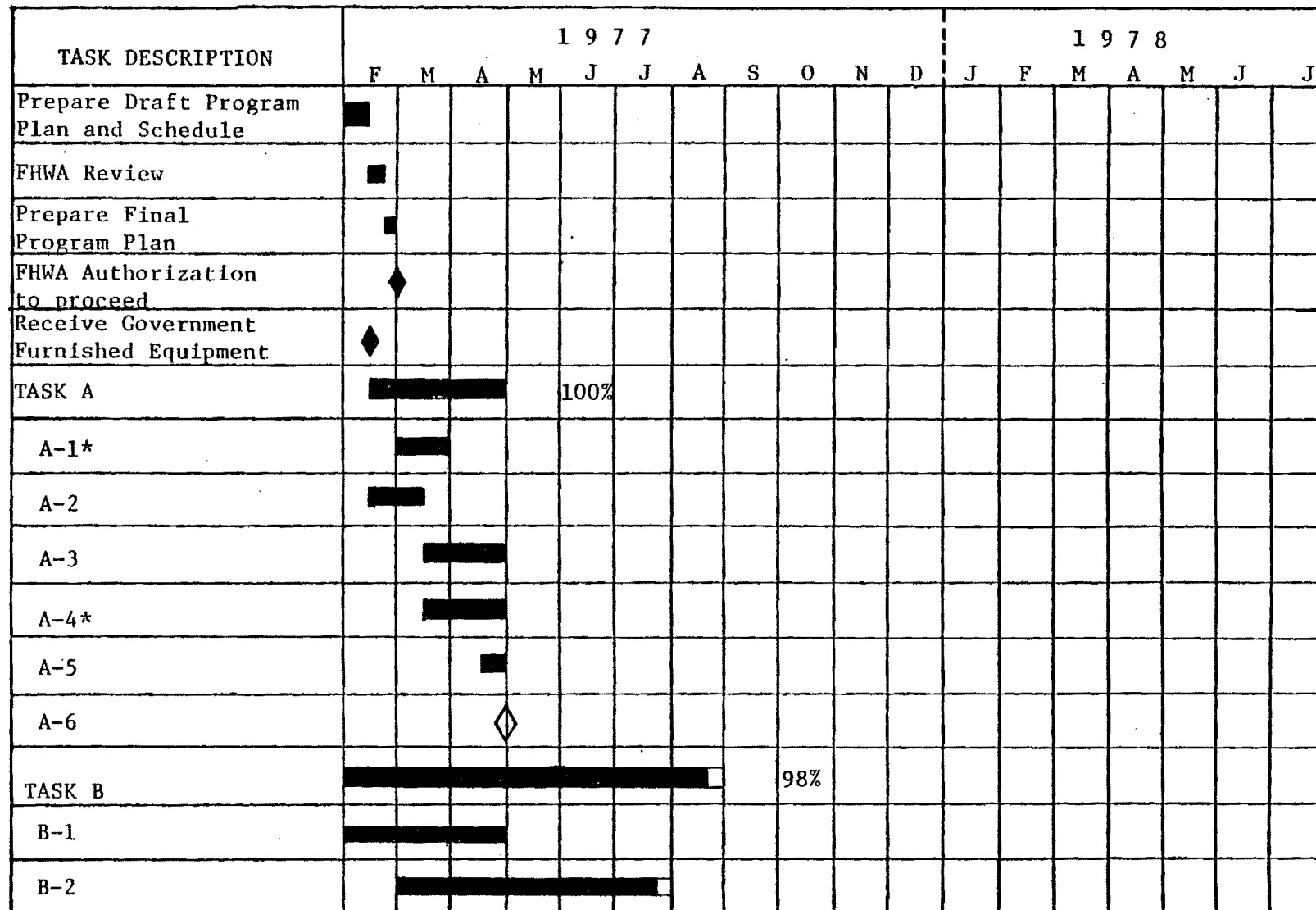
R. W. Wallace
Project Director

Approved: _____

D. W. Robertson, Director
Electronics Technology Laboratory

RWW:lb

Figure 1. CB-AIDS TASK SCHEDULE



Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 1. CB-AIDS TASK SCHEDULE (continued)

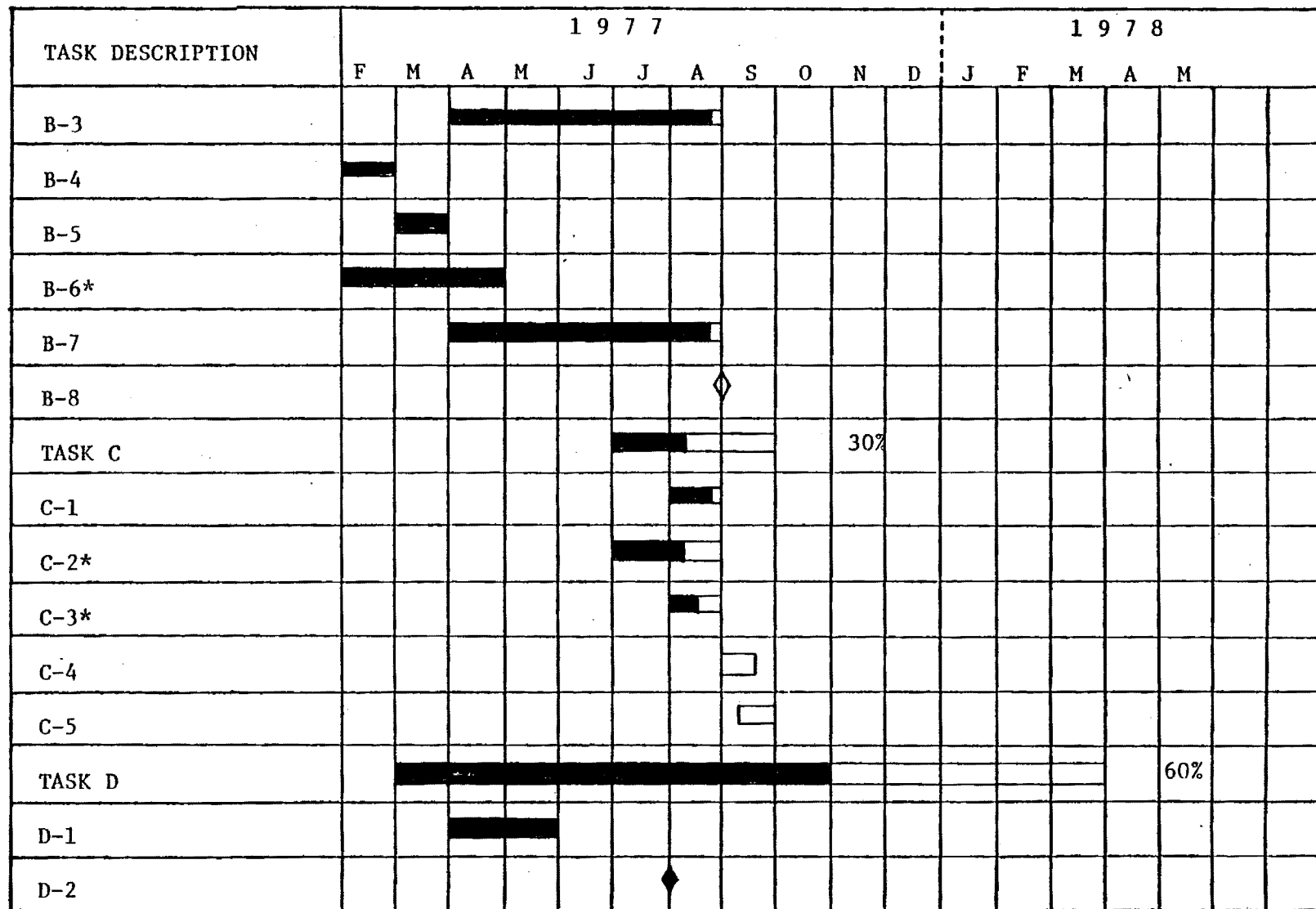


Figure 1. CB-AIDS TASK SCHEDULE (continued)

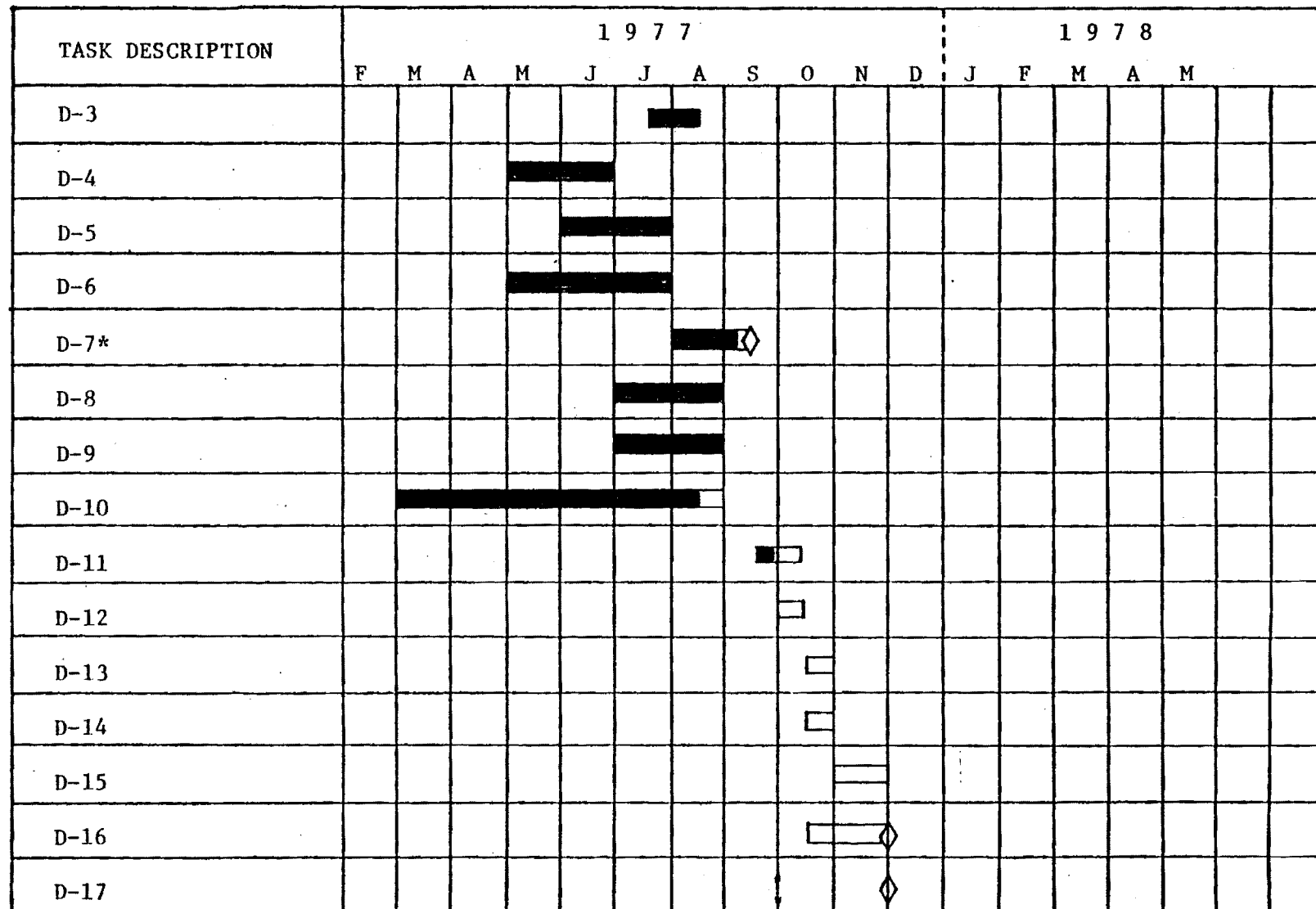
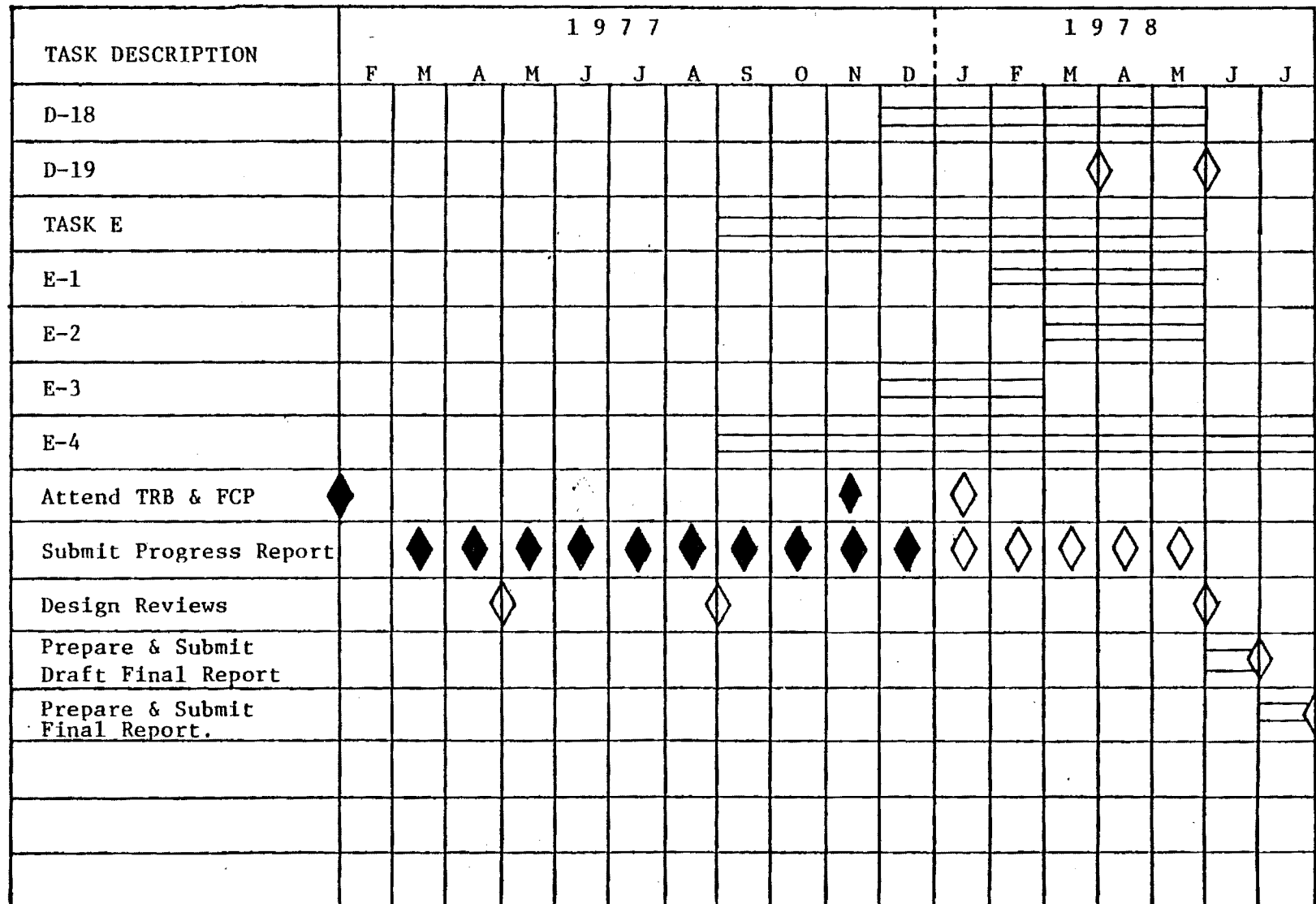


Figure 1. CB-AIDS TASK SCHEDULE (continued)



Attachment A

FCC Authorization for CB-AIDS Program

Copy To Rm Walcott
ERB
Orig File
8

FEDERAL COMMUNICATIONS COMMISSION

WASHINGTON, D.C. 20554

NOV 17 1977

IN REPLY REFER TO:

7526

Georgia Institute of Technology
Engineering Experiment Station
Atlanta, Georgia 30332

In re: Citizens Band (CB) Radio
Station KDZ 7830

Gentlemen:

In accordance with your letter dated October 19, 1977, Special Temporary Authority is hereby granted to permit Citizens Band (CB) radio station KDZ 7830 to transmit tone modulated signals (coded digital information and control signals) in connection with Federal Highway Administration contract to study the feasibility of using CB radio for motorist aid for the period ending June 30, 1978. This operation may be conducted in Atlanta Georgia and vicinity with up to 100 mobile units. The following types of coded digital information may be transmitted:

- (1) Station call sign and unit identifier, and
- (2) digital message indicating whether the call is an emergency report or a routine request for assistance.

Sections 95.459 and 95.513(a) of the Rules are waived only to the extent to permit the above operation. All other terms for station KDZ 7830 remain the same.

Authority is also granted to permit operation of two (2) CB transmitters by wireline remote control for use in connection with the above activities.

The operation of the remotely controlled transmitters is authorized subject to the following conditions:

1. Authorized control operators must be on duty at the control point during periods when the remotely controlled transmitters are in operation.
2. The control point must have adequate means to aurally monitor all transmissions and to render the transmitters inoperative should improper operation occur.
3. The remotely controlled transmitters must be adequately protected against access by unauthorized persons.

4. The remotely controlled transmitters must be adequately protected against unauthorized station operation, either through activation of the wireline control link or otherwise.
5. This letter must be posted with the station license as part of the station records.

This authority is granted pursuant to Section 95.475(b) of the FCC Rules, as amended.

This authority may be revoked by the Commission in its discretion at any time.

Sincerely yours,

Charles A. Higginbotham
Chief, Safety and Special
Radio Services Bureau



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

February 13, 1978

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 11 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communication System" (CB-AIDS) Georgia Tech Project A-1940.

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232
for the month of December 1977.

During the month agreement was reached with the DeKalb County Police Department to act as the emergency response location and with the Dual County REACT club to provide volunteers to install digital adapters and to act as the assistance response organization. Volunteers for digital adapter installation are also being provided by the Capital City REACT club.

WORK COMPLETED:

During the reporting period work continued on Tasks B, C, and D.
Details of this work are reported below.

Task B - The Task B activity included continued fabrication and testing of the two remote stations and the central control unit.

Remote station number one was completed with the exception of the requirement for controlling the transmitter during "assistance" calls. For "emergency" calls, the RS is connected through the dial telephone connection to the police department which has the central control unit. Associated with the CCU is a push to talk microphone which generates a separate three tone burst at the beginning and end of each transmission from the CCU. These tones are detected by the RS and are used for positive control of the RS transmitter. This positive control is not feasible for

assistance calls since these calls will be answered by a variety of selected individuals at varied locations. The current approach includes a voice operated switch in the RS to control the transmitter in the assistance mode. The use of this approach will be tested to determine its acceptability. Little additional work was completed on remote station number two pending the completion of tests on remote station number one.

A number of approaches were investigated with the demodulation of the input signal to the CCU from the RS. This additional effort is required due to the action of the phase locked loop detector during the absence of a signal. Since the phase error signal is used as the data output, this output is present without an input signal due to the inherent searching action of the PLL in the presence of noise. In order to avoid the installation of a full scale word processor in the CCU as was done in the RS, other approaches were investigated. These included special character detection, active analog filtering, and digital filtering. The digital filtering approach currently appears to offer the most promise.

Task C - The Task C activity continued with further laboratory and field tests of the interconnected system and the coordination with the DeKalb County Police Department for CCU installation.

Following system tests in the laboratory, a field test of the system was performed using a moving vehicle with a digital adapter, remote station number, and the central control unit. The test setup is shown in Figure 1. This field test consisted of having the RS and CCU co-located within the laboratory with each unit connected to a separate telephone line via its respective telephone coupler. The RS was also interconnected with a CB transceiver as will be done in the full scale test and evaluation of the CB-AIDS system. Although the RS and CCU were co-located for this preliminary test, the interconnection between the two units was as will be done in the full scale evaluation phase of this research program.

For this limited test of the RS, a digital adapter and associated CB transceiver were placed in a vehicle which was then driven to numerous locations within a quarter mile to five mile radius of the laboratory located remote station. The test route and the call results are shown in Figure 2 and Table 1 respectively. Good performance was obtained over a considerable distance; the quality of the speech was noted to be quite satisfactory over the telephone interconnect so long as the radio link remained satisfactory.

The remaining Task C activity during the month involved coordination with the police for installation of the CCU and associated equipment. Dimensions of the CCU, digital printer, and telephone coupler were provided to the police communications center technical assistant who will insure that space and power are available at the operator's console.

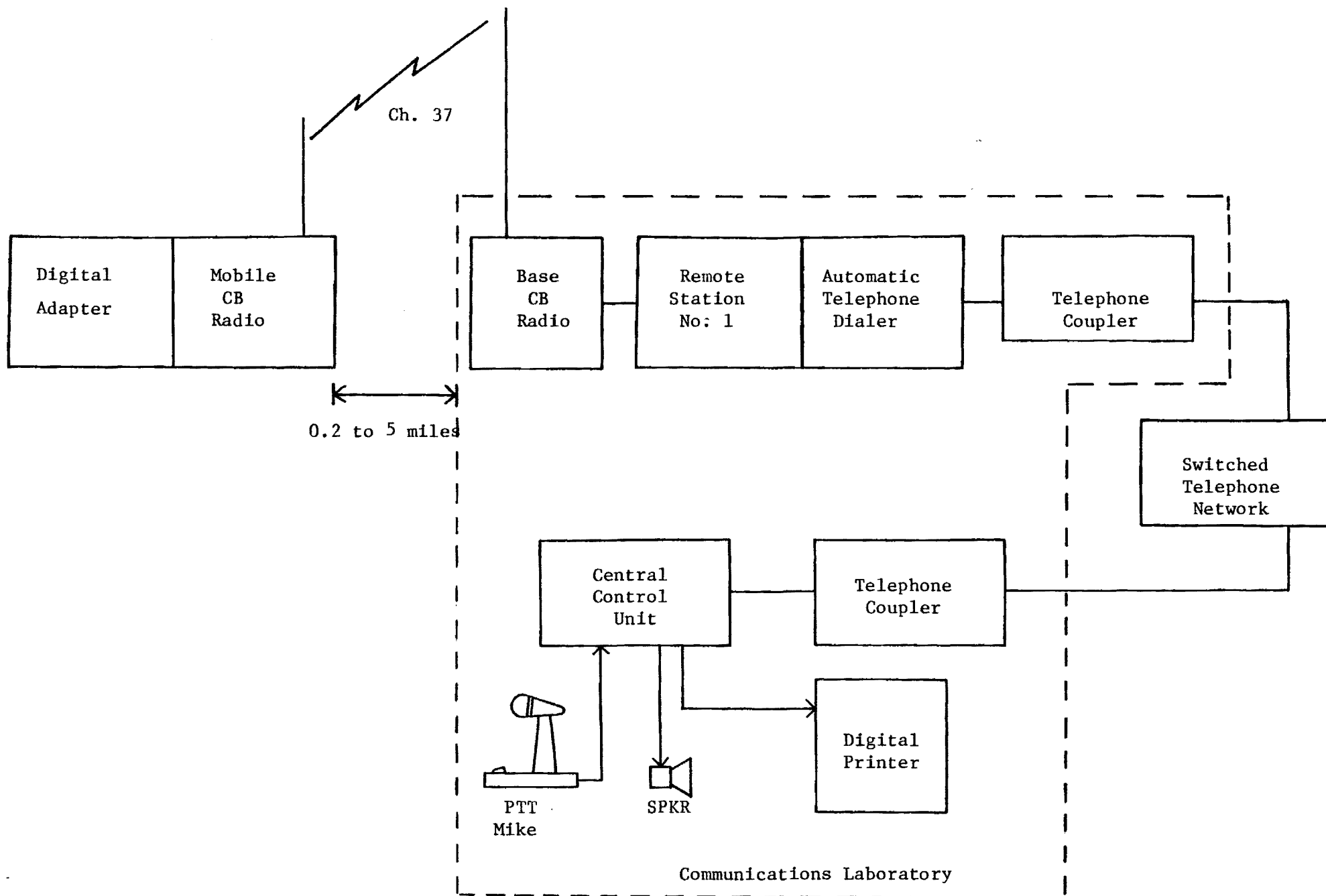


Figure 1. CB-AIDS Field Test Configuration

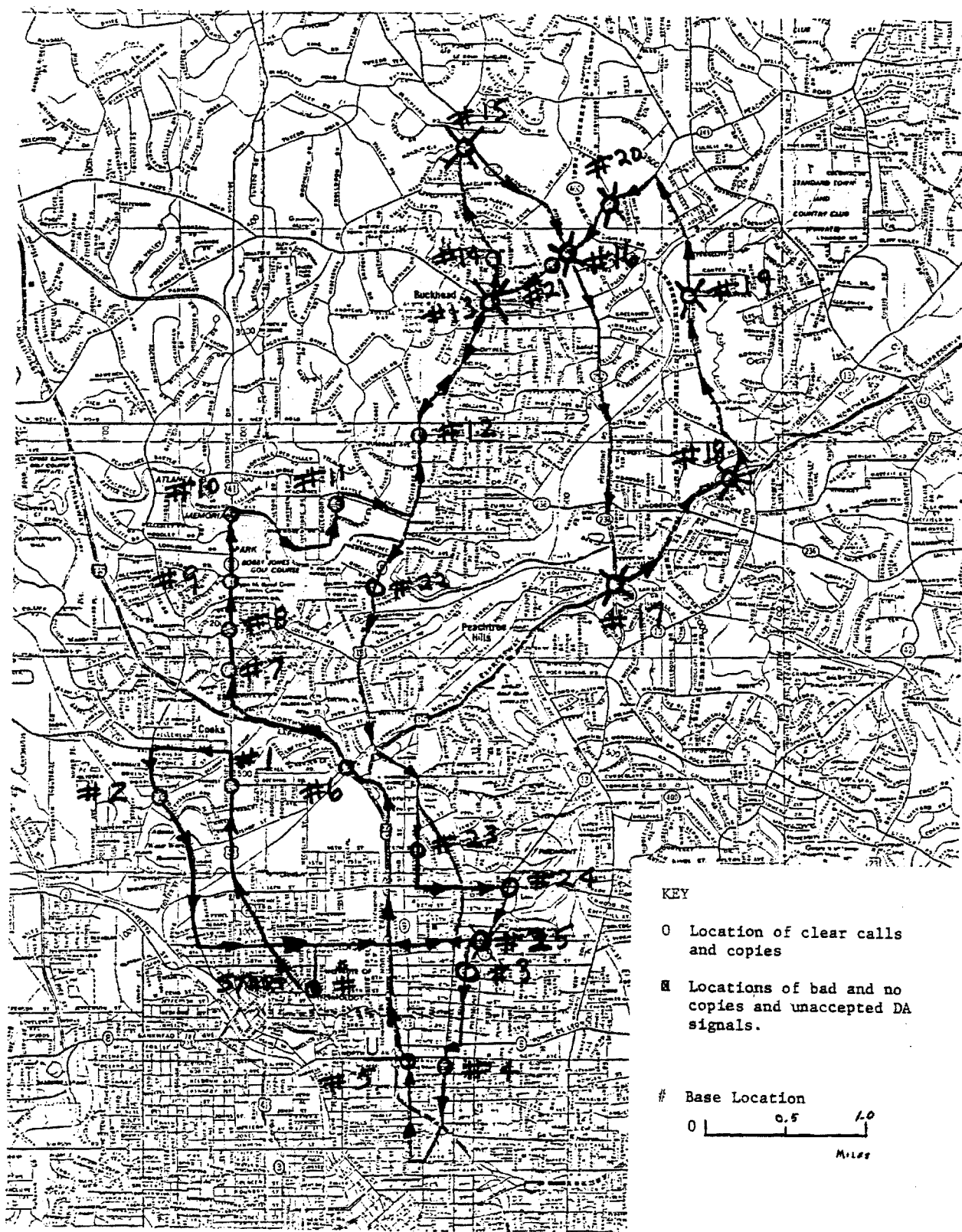


Figure 2. CB-AIDS Field Test.

TABLE 1
CB-AIDS FIELD TEST RESULTS

Location Number	Range In Miles	Voice Quality	DA Signal Received	Demod. Mode	Notes
1	1.4	Excellent	Yes	ID	
2	1.5	Excellent	Yes	ID	
3	1.0	Excellent	Yes	ID	
4	0.8	Excellent	Yes	ID	
5	0.6	Excellent	Yes	ID	Also tested busy tone
6	1.3	Excellent	Yes	ID	
7	2.0	Good	Yes	ID	
8	2.2	Excellent	Yes	ID	
9	2.5	Good	Yes	ID	
10	2.8	Good	Yes	ID	
11	2.8	Good	Yes	ID	
12	3.3	Good	Yes	C	
13	4.1	Poor	Yes	C	
14	4.4	Fair	Yes	C	
15	5.0	Poor	No	C/ID	No Lock in Either Mode
16	4.6	Poor	No/Yes	C	Signal accepted on 3rd try
17	2.8	Fair	No/Yes	C	Signal accepted on 2nd try
18	3.7	Poor	No/Yes	C	
19	4.6	Poor	No	ID	
20	4.9	Poor	No/Yes	ID	Signal accepted on 2nd try
21	4.5	Good	Yes	ID	
22	2.4	Good	Yes	ID	
23	1.7	Excellent	Yes	ID	
24	1.1	Excellent	Yes	ID	

Task D - The Task D activity continued with remote station site selection, participant selection, and digital adapter fabrication activities.

Approval of the participation of the DeKalb County Police Department in the pilot program was granted by Chief Hand. With his approval the specific area was discussed further with police and state DOT and RUSH representatives. The consensus area based on the site selection criteria was determined to be in north DeKalb County including Interstates I-85 and I-285, and U. S. Highways 23, 29, and 78. Specific locations for the remote stations are being investigated by use of topographical maps of the area. Permission has been requested at an industrial organization at a particularly promising location. With the approval of this location, the second complementary site will be selected.

On December 13, the CB-AIDS slide presentation was provided to the Capital City REACT meeting which included officers of the Dual County REACT club. Forms (see Figure 3) were distributed to determine the interest of members of these clubs to volunteer to participate in the program. Twelve positive responses were received and the names were provided to the police who have requested that they be allowed to approve the digital adapter recipients. More responses are anticipated later.

Installation of digital adapter printed circuit boards into the chasses was completed. About half of the boards have been modified for ground true push to talk operation. Final switch wiring will be completed when the associated CB radio types are known.

PROBLEM AREAS:

Completion of the remote station hardware is an acute problem area by virtue of being behind schedule and over budget. Although this effort is virtually complete it has impacted the schedule of the succeeding tasks. Based on this problem the required budget for completion is being evaluated.

WORK PLANNED FOR NEXT MONTH:

Work will continue on Tasks B, C, and D during the next month.

The Task B effort will include remote station numbers one and number two completion and completion of the central control unit.

The Task C effort will include remote site range tests and further laboratory testing.

The Task D effort will include final remote site selection and program coordination for system installation.

PLEASE RETURN TO: R. W. Wallace
Georgia Tech/EES/ETI
Atlanta, GA 30332

CB-AIDS QUESTIONNAIRE

Name: _____
(First) (Middle I.) (Last)

Home Address: _____
(Street) (Apt. #)

(City) (County) (Zip)

Telephone: Home _____ Work _____

Occupation: _____

Place of Work: _____
(Company) (Location)

Major Routes Driven Daily: _____

Distance from Home to Work: _____

CB Radio Information: _____
(Make) (Model)

(Type mike connection - 4 pin, 5 pin, direct wired, etc.)

CB Organization Affiliation: _____

How Long a CB User: _____

FCC Call Sign: _____

Handle: _____

Vehicle Information: _____
(Make) (Model) (Year)

(Battery Voltage) (Type Ground-Pos./Neg.)

I would like to participate in the CB-AIDS Program:

(Signature)

(Do NOT complete below this line)

DA Serial Number _____

Date Installed _____ Date Returned _____

Figure 3. CB-AIDS Users Questionnaire.

MANAGEMENT INFORMATION:

The following information gives the managerial and estimated financial status of the contract as of December 31, 1977.

(A) Cumulative Costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$20,592	\$ 0	\$ 20,648
Task B	40,179	1,972	57,644
Task C	10,453	5,589	12,726
Task D	66,250	3,384	42,865
Task E	<u>20,364</u>	<u>0</u>	<u>0</u>
Total	\$157,836	\$10,945	\$133,883

(B) Estimated cost to complete: \$45,800 *

* Currently being evaluated.


(C) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Cumulative</u>
Principal Investigator R. W. Wallace	30	1112
Principal Research Engineers D. W. Robertson H. H. Jenkins	8	152
Senior Research Engineer R. W. Moss	3	139
Assistant Research Engineers C. S. Wilson, D. R. Sentz	96	1727

(D) Percentage of work performed. (See Figure 4).

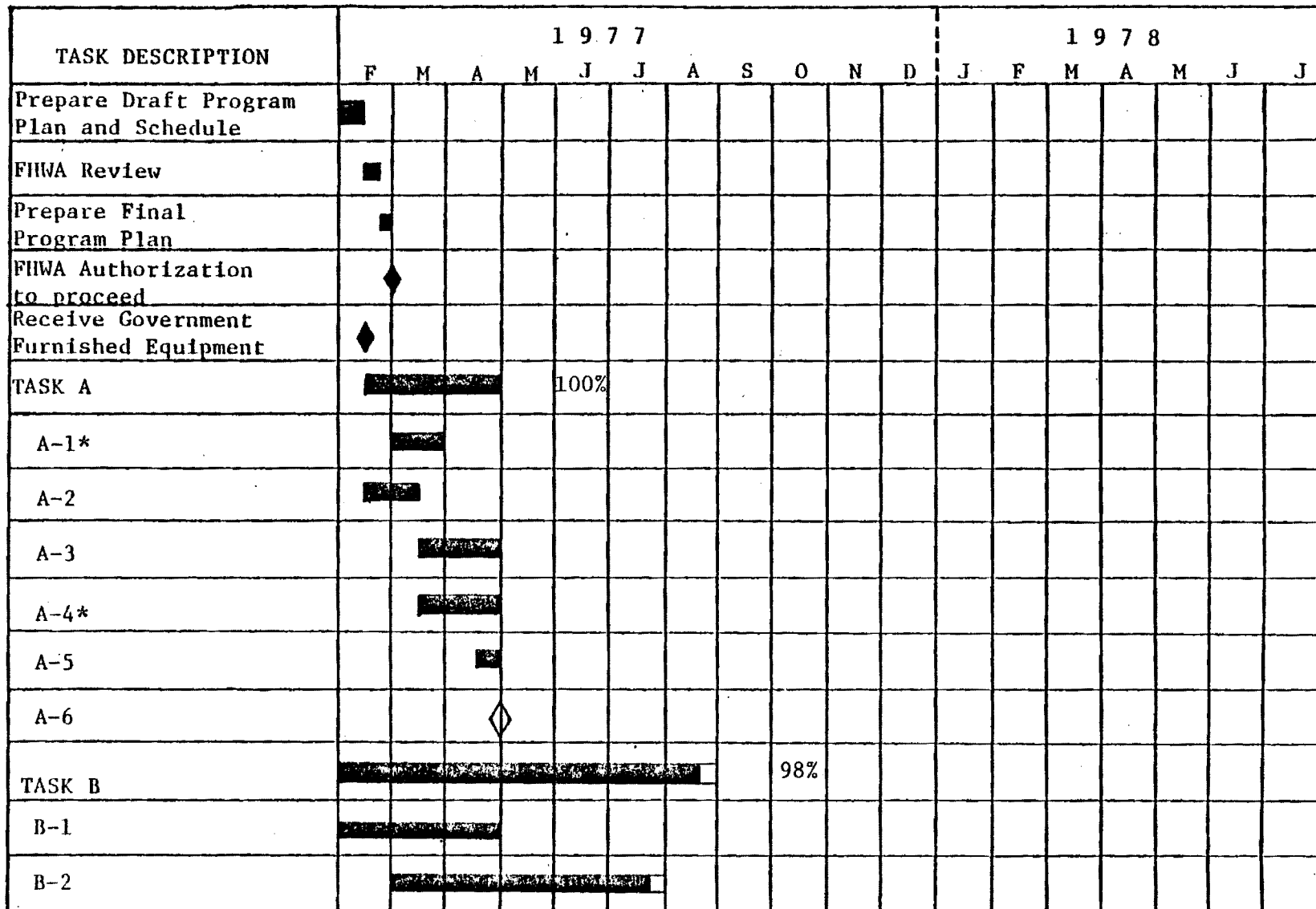
Respectfully submitted,

Ronald W. Wallace,
Project Director

Approved: 

D. W. Robertson, Director
Electronics Technology Laboratory

Figure 4. CB-AIDS TASK SCHEDULE



Notes:

1. ■■■■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subject

Figure 4. CB-AIDS TASK SCHEDULE (continued)

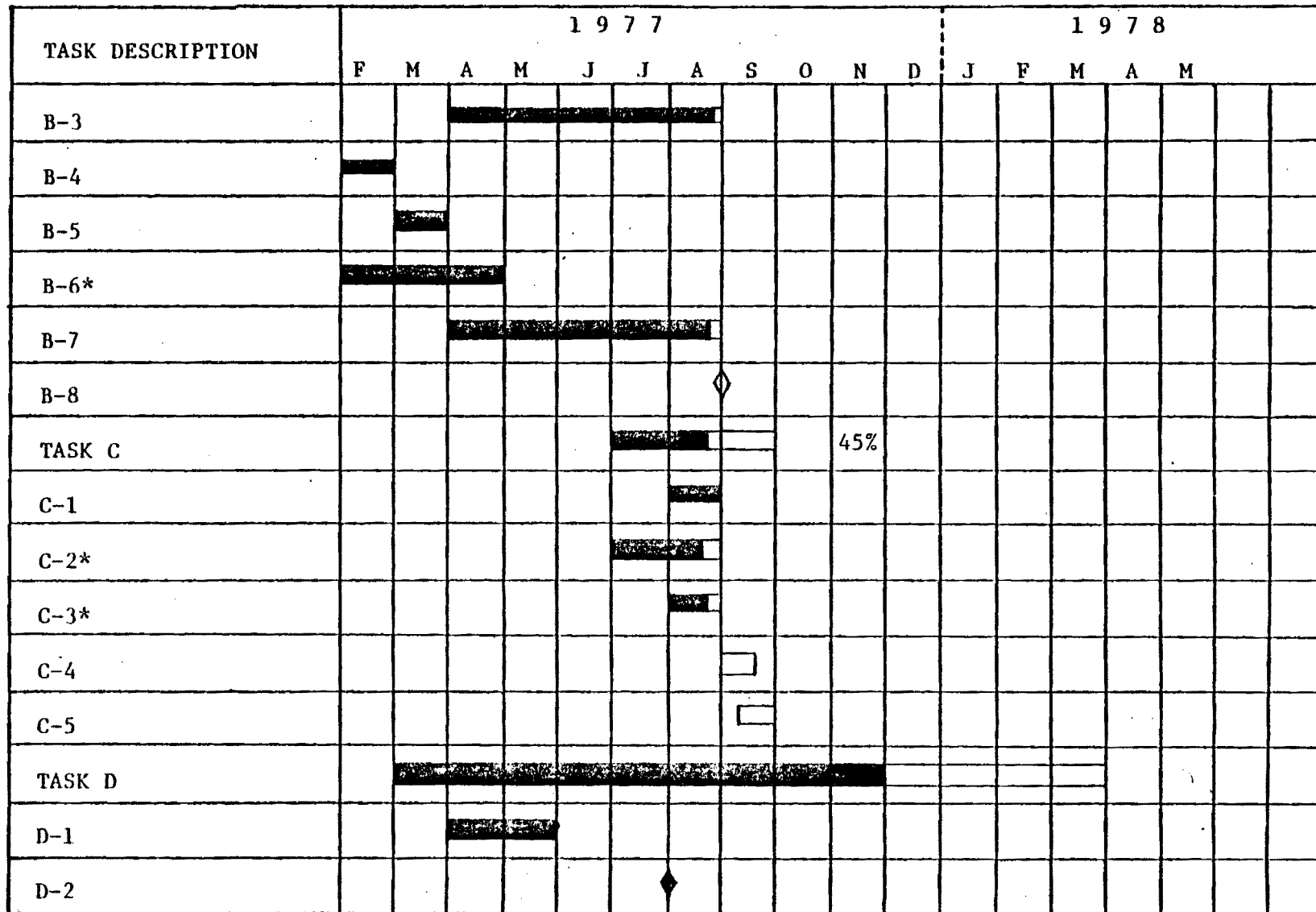


Figure 4. CB-AIDS TASK SCHEDULE (continued)

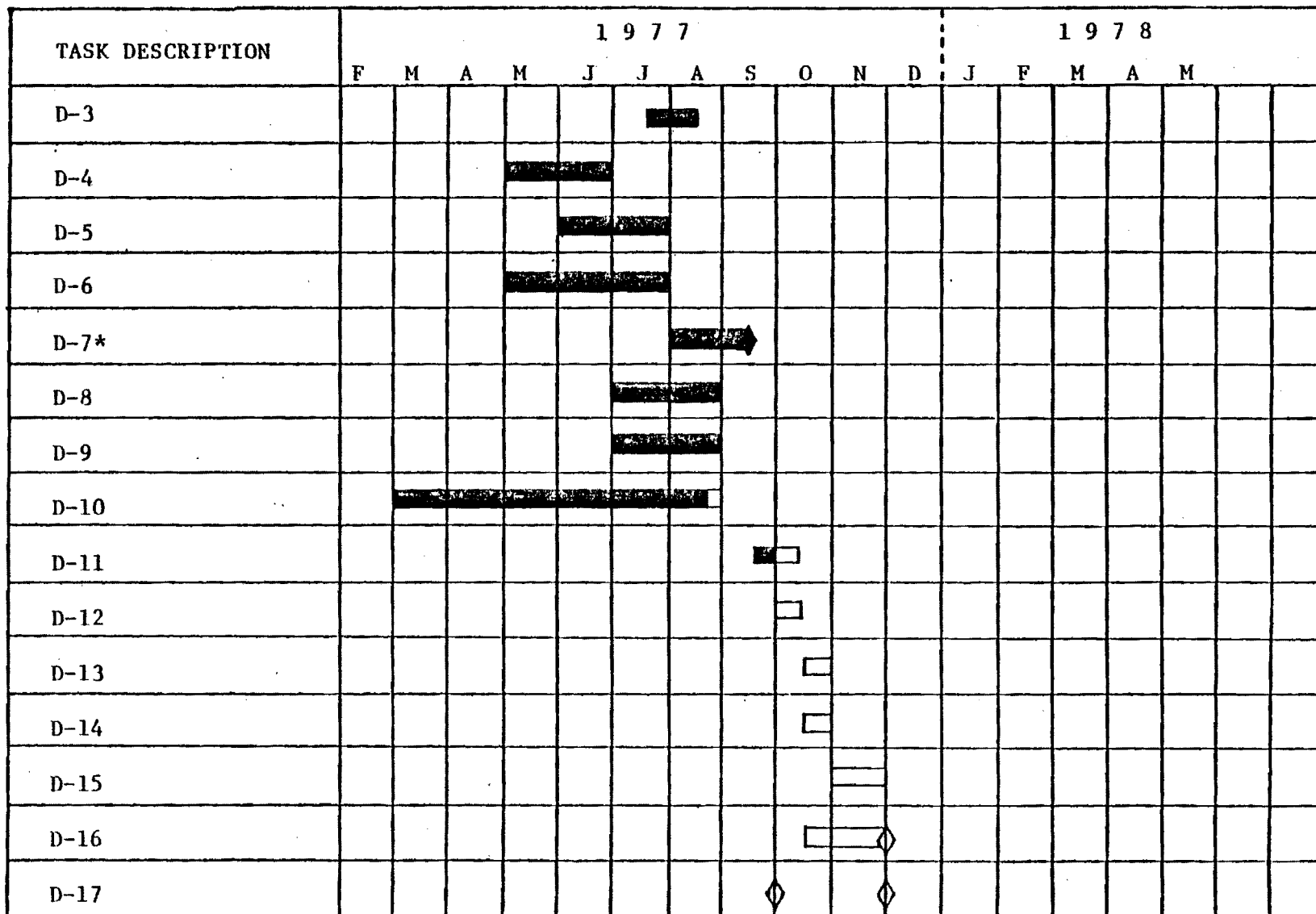
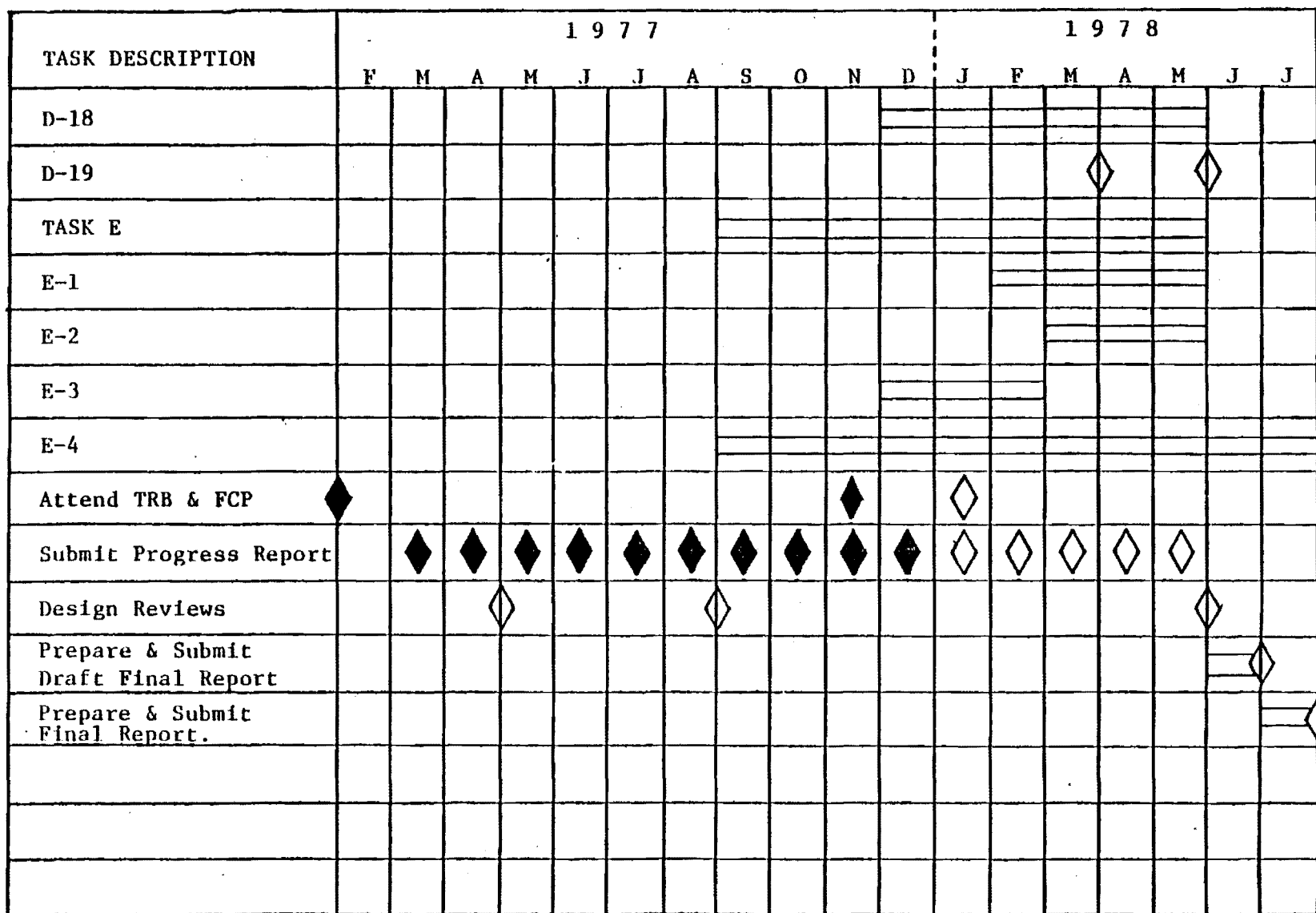


Figure 4. CB-AIDS TASK SCHEDULE (continued)



A-1940



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

February 22, 1978

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 12 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communication System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of January 1978. Ron Wallace, the principal investigator, attended the Transportation Research Board annual meeting on January 16 and 17 and provided a status report on the program to the Communications Committee.

WORK COMPLETED:

During the reporting period work continued on tasks B, C, and D. Details of this work are reported below.

Task B - The Task B activity included continued fabrication and testing of the two remote stations and the central control unit.

The first remote station was completed during the month. The use of the voice operated switch (VOX) to control the CB transmitter was completed and tested. With proper adjustment of the received signal level, good telephone hybrid balance, and a sufficient received telephone signal, the VOX operates the radio satisfactorily. However, it was noted that level adjustments are critical in this mode. At a low setting of the CB receiver volume, the signal transmitted over the telephone circuit is too low for good reception. If the volume is set too high, the signal coupled to the receive side of the telephone hybrid due to hybrid unbalance and echo return may be large enough to activate the VOX, turning on the transmitter. Thus, this signal must be set at a moderate level. The second remote station is currently in final assembly with all inter-board and chassis wiring completed.

February 22, 1978

Page 2

The central control unit was completed and successfully tested. The digital filtering approach to data signal detection was selected. With this approach the signal from the telephone line is detected through the phase locked loop detector and applied to a circuit which detects the presence of 150 milliseconds of a signal which has a period of six milliseconds with a logic "1" level that is from one to five milliseconds in duration. From this circuit, the signal is routed to a digital pulse width demodulator and then into a shift register display. This circuitry has proven extremely reliable in detecting the data signal without false detection on noise.

Task C - The Task C activity continued with further laboratory tests of the interconnected system and radio range tests at the selected remote station locations.

The laboratory tests of the interconnected system were performed using the first remote station and the CCU connected through the Georgia Tech telephone exchange. Calls were initiated using a digital adapter attached to a CB radio with a dummy load on the antenna connection. Likewise the radio associated with the remote station was terminated in a dummy load. By this means tests could be completed within a single lab without radio frequency interference. Calls were successfully initiated through the digital adapter with excellent audio quality noted at both the digital adapter and central control unit. In testing another system function, the CCU operator dialed the number of the remote station and entered the "assistance" number into the remote station. The remote station successfully stored the number and returned it to the CCU for display and verification. Following this, a digital adapter was used to initiate an assistance call and the remote station dialed the stored number correctly.

As will be described in detail under Task D, the two remote station sites were tentatively selected in the pilot program area. The sites are two high schools, Sequoyah and Shamrock, which are located at high elevations.

Initial contacts were made with the telephone local offices which would serve the Dekalb County Police Station, Sequoyah High School and Shamrock High School. The telephone company representatives stated that service to each of the locations could be installed within seven to ten days after receipt of an installation order.

February 22, 1978

Page 3

Task D - The Task D activity continued with remote station site selection and range tests and digital adapter fabrication activities.

Difficulties were encountered with the industrial site that was initially selected. After numerous calls, the president of the firm stated that his company did not have sufficient space for the remote station equipment. Following this, an alternate approach was taken. After noting the locations of public schools in the pilot program area, several were selected as having sufficient elevation above existing terrain to be viable sites. The Dekalb County school superintendent's office was contacted to explore the possibility of placing the two remote stations in schools. After hearing about the program, the superintendent's office agreed to cooperate. Two high schools, Sequoyah and Shamrock, were tentatively selected based on study of topographical maps of the area. The principals of these schools agreed to their schools participation in the program. A preliminary trip was made to each of the high schools in association with representatives of the school system facilities personnel in order to investigate possible locations for the remote station equipment. An area near the gymnasium was selected which will provide power, security, and easy access to telephone lines.

During the month, range tests were completed at the high schools. These tests were strictly audio tests to determine voice quality over varying distances and locations from the schools. In performing the tests, a CB radio was located at the school with the antenna on the roof while a mobile unit placed calls at frequent intervals along a test route. Operators in the mobile unit and at the school recorded their assessment of the voice quality of each call. The route and the quality results from remote station number one, Shamrock High School, are given by figure one and table one, respectively, while the route and results from remote station number two, Sequoyah High School, are given by figure two and table two, respectively. Based on the results, the schools appear to be viable sites that will provide excellent coverage of the pilot program area.

Based on the CB radios owned by the personnel who have indicated a desire to participate in the program, final switch and connector wiring of 12 digital adapters was completed. The digital adapters will be installed when police department approval is received.

The forms requesting information from potential participants as illustrated in the last progress report was incorrectly labeled as a questionnaire and should not be considered as such. The form is a user information form and has been correctly labeled as shown by figure three.

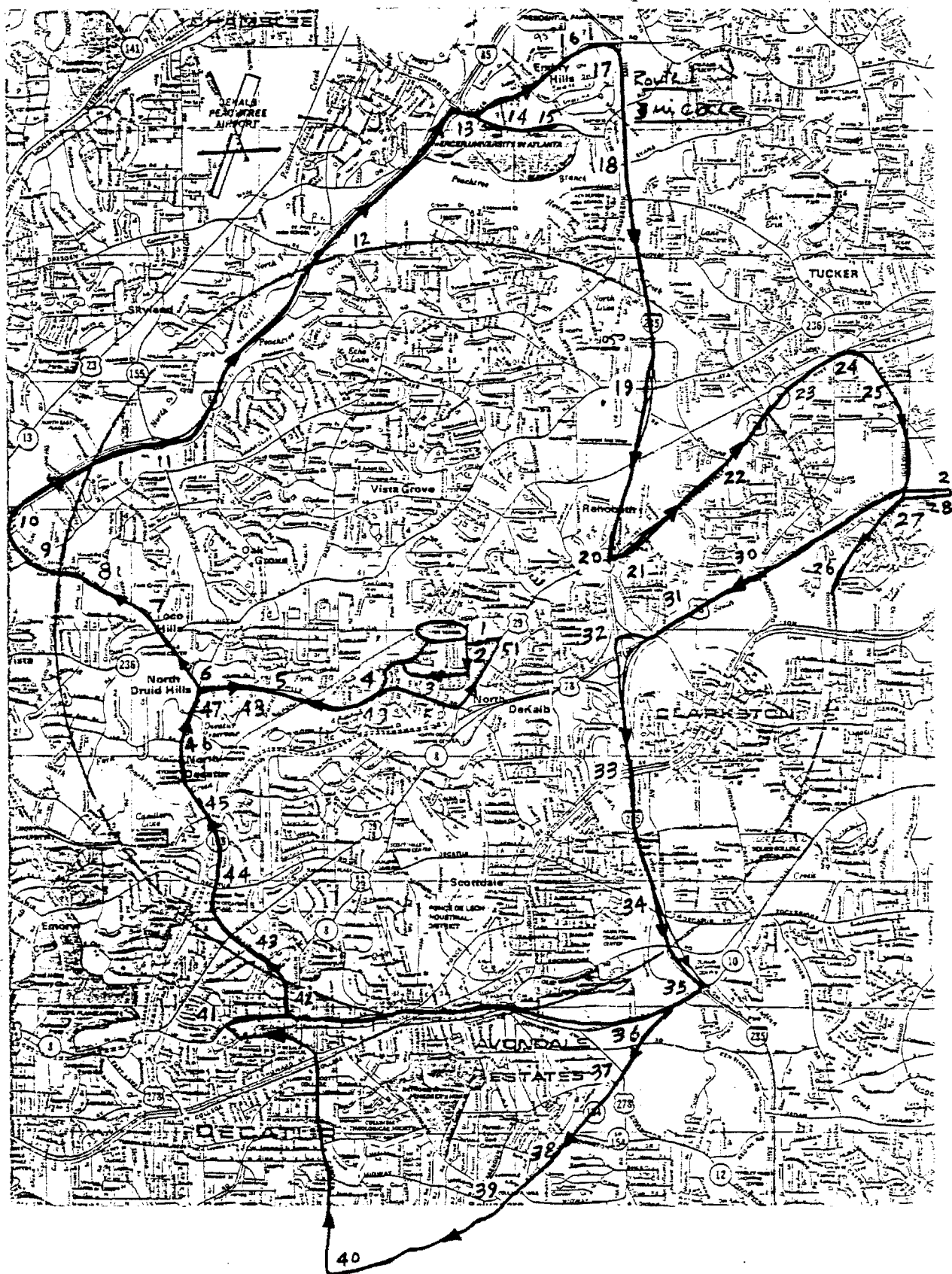


Figure 1. Remote Station Number One Test Route

ATE January 24, 1978

BASE STATION READABILITY

MOBILE UNIT ONE READABILITY

HANNEL 37

SHAMROCK HIGH SCHOOL

Location	E	G	F	P	No Copy	E	G	F	P	No Copy	Comments
King Lot-Shamrock HS	x					x					
Olive & Harcourt Dr.	x					x					
Olive & N. Druid Hills		x				x					
Druid Hills & Birch	x					x					
Druid Hills & Sprind Creek	x					x					
Druid Hills & Clairmont		x					x				
Druid Hills & Berkley Ln.		x					x				
Druid Hills & Kinoh Hill Dr.		x					x				
Druid Hills & Briarcliff		x					x				
Druid Hills & I-85		x					x				
I-85 & Clairmont Rd.		x					x				
I-85 & Shallowford Rd.		x					x				
I-85 & Chamblee-Tucker Rd		x					x				
Chamblee-Tucker & Flowers			x					x			
Flowers at N Fork Pch't Crk				x						x	
Chamblee-Tucker & Buckeye		x						x			
Chamblee-Tucker & 285											
I-85 & Evans Rd.			x					x			
I-85 & Lavista Rd		x					x				
I-85 & Lawrenceville Hwy		x					x				
Lawrenceville & Montreal		x					x				
Lawrenceville & Cooledge			x				x				
Lawrenceville & Shady Ln			x				x				
Lawrenceville & Fellowship			x						x		
Leewood & Fellowship				x					x		
Leewood & Idlevale Dr.			x					x			
Leewood & Sare Pkwy				x					x		
Sare Pkwy. & Mt Industrial		x							x		
Industrial & Stone Mt. Pk				x					x		
Stone Mt. Pk & Cooledge Rd			x					x			
Stone Mt Pk 1 mi from 285		x					x				
Stone Mt Pk & 285	x						x				
I-85 & E Ponce DeLeon Ave	x					x					
Decatur Rd at Police Hdq	x					x					
Memorial Dr & Covington Hwy		x					x				tried channels 12 & 13 too busy
Memorial Dr & Covington Dr		x					x				now on

PAGE 10 PAGE TWO REMOVE SECTION NUMBER ONE (CONT.)

MOBILE UNIT ONE READABILITY

SHAMROCK HIGH SHCOOL

[illegible]

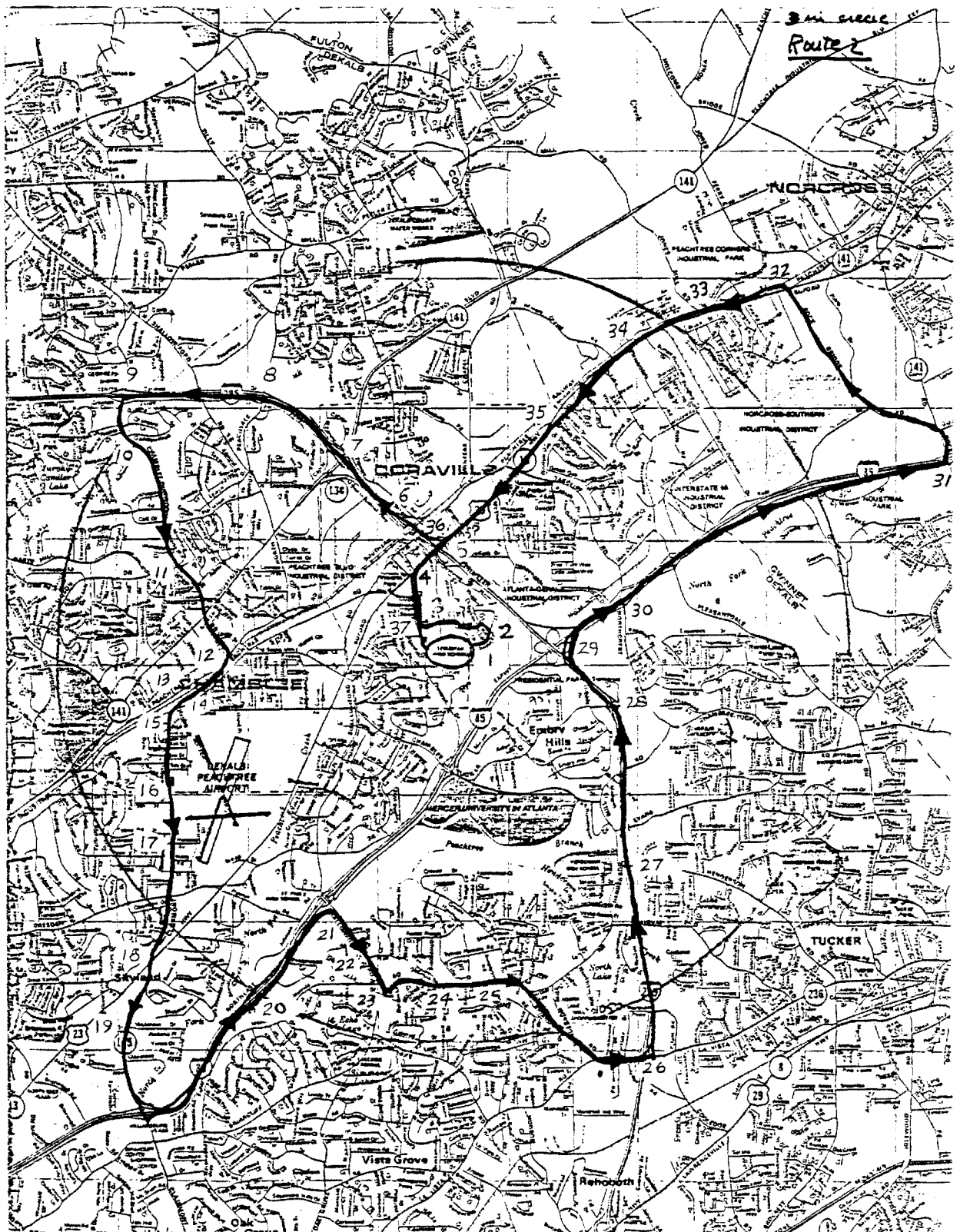


Figure 2. Remote Station Number Two Test Route

SEQUOYAH HIGH SCHOOL

Location	E	G	F	P	No Copy	E	G	F	P	No Copy	Comments
Sequoyah High Pkg lot	x					x					
Santa Fe & Cherokee	x					x					
Chestnut & Beechwood	x					x					
Chestnut & Buford Hwy	x					x					
Buford Hwy & 285		x				x					
285 & General Mtrs Assbly		x					x				
285 & Peachtree Inds.				x				x			
285 & No. Peachtree Rd				x				x			
285 & Chamblee Dunwoody		x					x				
Chblee-Dunwdy & Ashentree		x					x				
Chblee-Dunwdy & Harts Mill		x					x				
Chble-Dunwdy & Pct'e Ind		x					x				
Pct'e Ind. & Decree Rd		x					x				
Pct'e Rd & New Pct'e Rd		x					x				
N. Pct'e Rd & Clairmont		x						x			
Clrmt at DeKb Pch. Airport			x					x			
Clrmt & Georgian Dr				x				x			
Clrmt & Buford Hwy				x				x			
Clrmt Rd & Wilmont Dr.				x					x		
85 bet. C'mt & S'ford				x						x	
S'ford Rd. & 85		x							x		
S'ford & Lk Flair Cir.		x						x			
S'ford & Braircliff		x						x			
Braircliff & Payton Rd.		x						x			
Braircliff & Briarcrest		x						x			
Lavista & 285		x					x				tried chl. 11, too busy, no
285 & Henderson Rd		x						x			on 7
285 & Chamblee-Tucker		x					x				
285 & 85		x					x				
85 & Northcrest Rd.	x						x				
85 & Rock Bridge Rd		x					x				
Rock Br. & Buford Hwy		x					x				
Buford Hwy & Jones Mills			x					x			
Buford Hwy & Pleasantdale		x					x				
Buford Hwy & New Pch't		x					x				
Buford Hwy & 285		x				x					
Chestnut Dr. & Pineland	x					x					

PLEASE RETURN TO: R. W. Wallace
Georgia Tech/EES/ETL
Atlanta, GA 30332

CB-AIDS USER INFORMATION

Name: _____
(First) (Middle I.) (Last)

Home Address: _____
(Street) (Apt. #)

(City) (County) (Zip)

Telephone: Home _____ Work _____

Occupation: _____

Place of Work: _____
(Company) (Location)

Major Routes Driven Daily: _____

Distance from Home to Work: _____

CB Radio Information: _____
(Make) (Model)

(Type mike connection - 4 pin, 5 pin, direct wired, etc.)

CB Organization Affiliation: _____

How Long a CB User: _____

FCC Call Sign: _____

Handle: _____

Vehicle Information: _____
(Make) (Model) (Year)

(Battery Voltage) (Type Ground-Pos./Neg.)

I would like to participate in the CB-AIDS Program:

(Signature)

(Do NOT complete below this line)

DA Serial Number _____

Date Installed _____ Date Returned _____

Figure 3. CB-AIDS User Information Form

PROBLEM AREAS:

Completion of remote station hardware remains behind schedule. Some time was also lost due to difficulties in arranging for the remote station sites. During the next reporting period, a detailed evaluation of the task and financial status of the contract will be completed.

WORK PLANNED FOR NEXT MONTH:

Work will continue on Tasks B, C, and D during the next month.

The Task B effort should be completed during the month with the final testing of remote station number two.

The Task C effort will include installation of the central control unit at the Dekalb County Police Headquarters and the installation of the remote stations at the selected high schools.

The Task D effort will include project coordination and initiation of digital adapter installation in the user vehicles.

MANAGEMENT INFORMATION:

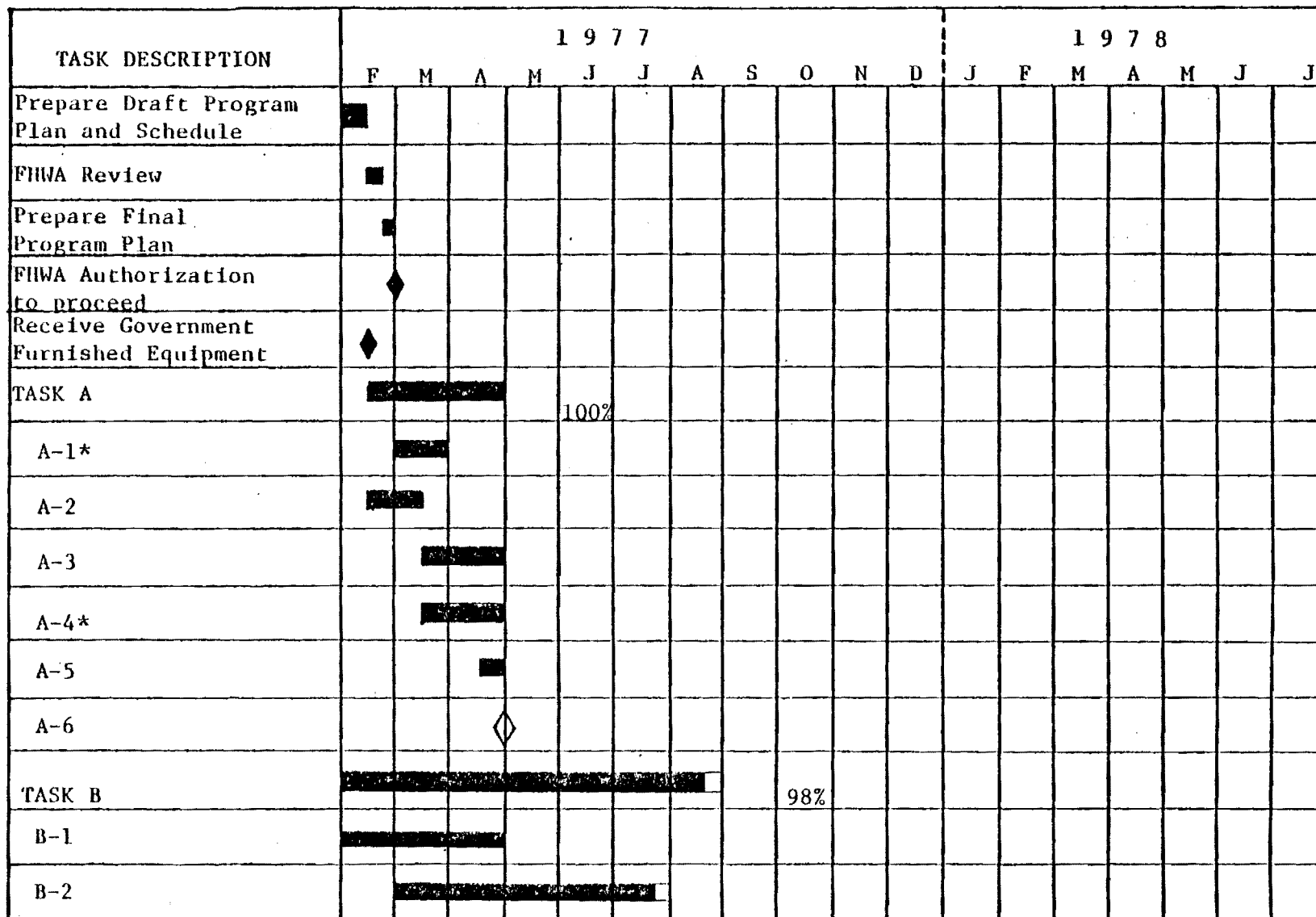
The following information gives the managerial an estimated financial status of the contract as of January 31, 1978.

(A) Cumulative Costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,592	\$ 0	\$ 20,648
Task B	40,176	2,540	60,184
Task C	10,454	2,333	15,059
Task D	66,250	1,968	44,833
Task E	20,364	0	0
	<u>\$157,836</u>	<u>\$6,841</u>	<u>\$140,724</u>

(B) Estimated cost to complete: \$38,000

FIGURE 4. CB-AIDS TASK SCHEDULE



Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

FIGURE 4. CB-AIDS TASK SCHEDULE (continued)

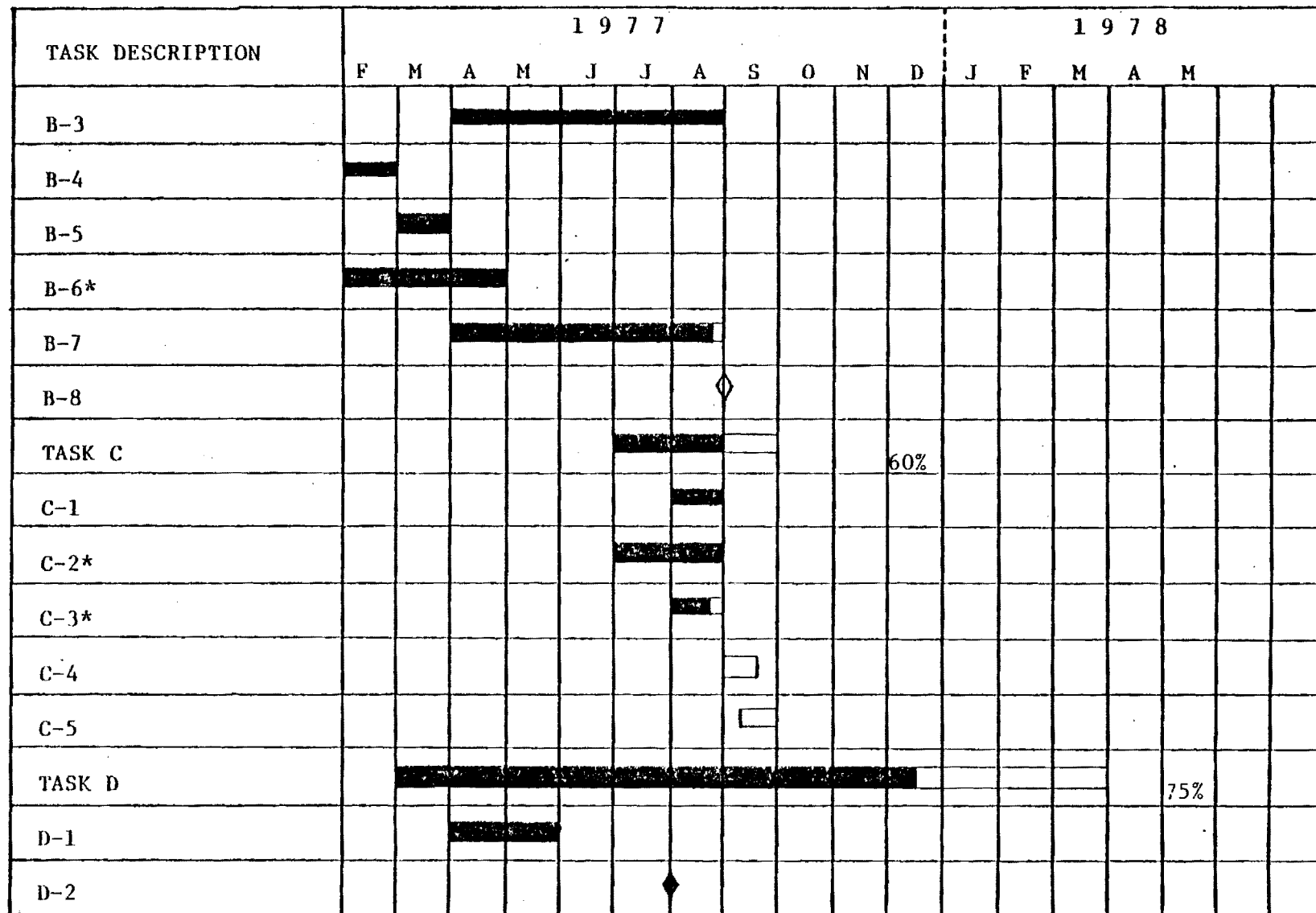
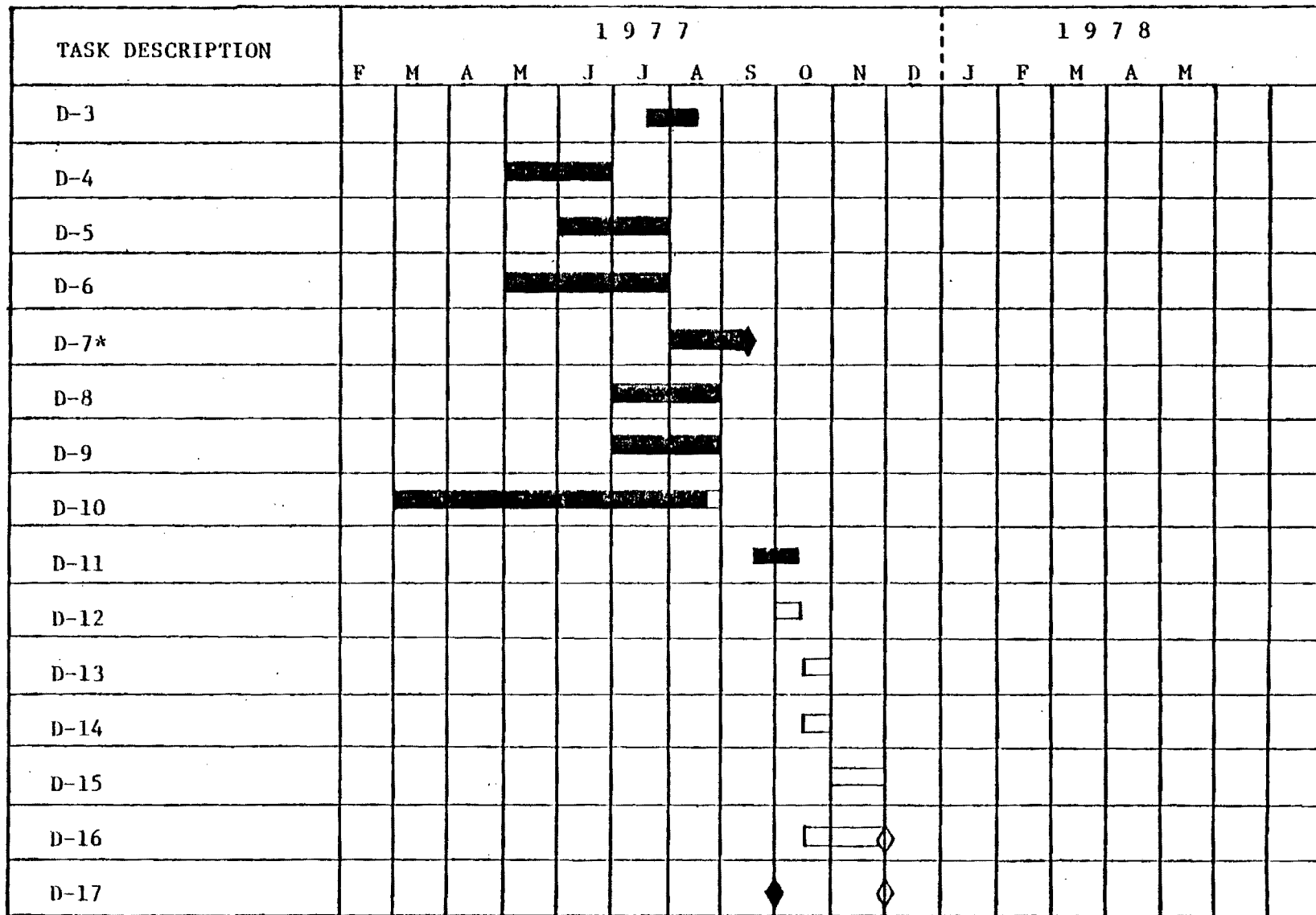


FIGURE 4. CB-AIDS TASK SCHEDULE (continued)



9



A-1940



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

March 24, 1978

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D.C. 20590

Attention: Mr. Frank Mannano
Contract Manager

Subject: Monthly Progress Report No. 13 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communication System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of February 1978.

WORK COMPLETED:

During the reporting period work was completed on Task B and continued on Tasks C and D. Details of this work are reported below.

Task B - The hardware development on this task was completed during the month with the final assembly and checkout of the second remote station. At this time the central control unit and both remote stations are ready for field installation. The only effort remaining in Task B is the final preparation of drawings and schematic diagrams.

Task C - The Task C effort continued with system tests of the second remote station using vehicles equipped with digital adapters on the Georgia Tech campus. The users of the DAs were able to activate the remote station which then dialed the number of the CCU for the audio connection. The RS correctly dialed the CCU number and sent the identification numbers which were correctly received and displayed by the CCU. Voice communications between the CCU operator and the DA user were acceptable. It was noted that the quality of the second RS which used the 23 channel CB radio was not as good as that obtained with the 40 channel unit.

Other activity included the ordering and installation of telephone service for the pilot program. Standard business telephone service was ordered for the two remote station sites and a standard business line with a protective coupling arrangement was ordered for the CCU site. Protective coupling arrangements were not needed at the remote station sites since approved couplers are included with the remote station equipment.

The telephone line was installed at Shamrock High School on February 16 and the line at the DeKalb County Police Department was installed on February 27. At the end of the month the line at Sequoyah High School had not been installed. The lines used are standard dial circuits which are provided at a cost of about \$37 per month including touch tone service and an unlisted number.

Task D - The Task D effort included fabrication and installation of digital adapters, further work on forms and manuals, and remote station and central control unit coordination activities.

Early in the month approval of the first 19 digital adapter users was received from the DeKalb County Police Department. During the latter part of the month 16 digital adapters were installed on the users' radios. Some problems were encountered during the installations. Microphone pin configurations varied considerably for the four pin microphones but seemed to be reasonably standard for the five pin microphones. The most significant problems were encountered with the push-to-talk line levels and with RF interference. Most radios used a push-to-talk configuration which changed the level of the PTT line from +12 Volts to ground when the microphone was keyed. These radios presented no problem. However, some radios used electronic push-to-talk which produced a voltage change of +9 Volts to +6 Volts. Since this voltage change was the signal used to trigger a one-shot multivibrator with a threshold of 6 Volts, proper operation was not obtained. The input circuit to the one-shot was modified to produce a level change which would provide the required signal. RF interference varied considerably among the various radios. Generally the interference was eliminated by placing 0.01 μ f bypass capacitors across the audio line.

A CB-AIDS users guide and a CCU operator's manual were completed and are included as Attachments One and Two, respectively.

Further investigation of the facilities at the schools resulted in a more preferred location near the school offices. At Sequoyah, the selected location was a supply room which also housed the school burglar alarm system and the telephone system main frame. This room is adjacent to the school offices and remains locked at all times. The Shamrock remote station will be located in a vault which contains school files and the burglar alarm system. This room is open during the school day but is inside the office area with constant monitoring. Both of the locations have easily assessable power outlets, good access to the telephone lines, short antenna cable runs to the roof, and excellent security.

PROBLEM AREAS:

Due to previously reported hardware configuration problems, the program is behind schedule. A detailed analysis of the status was performed during the month and forwarded to FHWA. The analysis showed a need for additional funds and a four month extension for contract completion.

WORK PLANNED FOR NEXT MONTH:

Work will continue on Tasks C and D during the next month. This work will include hardware installation and testing at the CCU and remote stations. Digital adapter installations will continue and preliminary systems tests will be initiated.

MANAGEMENT INFORMATION:

The following information gives the managerial and estimated financial status of the contract, as of February 28, 1978.

(A) Cumulative Costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,952	0	\$ 20,648
Task B	40,176	\$2,145	62,329
Task C	10,454	2,670	17,729
Task D	66,250	1,156	45,989
Task E	<u>20,364</u>	<u>0</u>	<u>0</u>
	\$157,836	\$5,971	\$146,695

(B) Estimated cost to complete: \$31,605

(C) Key Personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	32	1175
Principal Research Engineers D. W. Robertson/H. H. Jenkins	0	160
Senior Research Engineer R. W. Moss	0	142
Assistant Research Engineers C. S. Wilson/D. R. Sentz	96	1943

(D) Percentage of work performed: (see Figure 1).

Respectfully submitted,

Ronald W. Wallace
Project Director

RWW/lb

CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1 9 7 7												1 9 7 8						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
Prepare Draft Program Plan and Schedule	■																		
FHWA Review	■																		
Prepare Final Program Plan		■																	
FHWA Authorization to proceed		◆																	
Receive Government Furnished Equipment	◆																		
TASK A	100																		
A-1*		■																	
A-2	■																		
A-3		■																	
A-4*		■																	
A-5			■																
A-6				◆															
TASK B	99																		
B-1	■																		
B-2		■																	

Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
B-3																	
B-4																	
B-5																	
B-6*																	
B-7																	
B-8																	
TASK C																	
C-1																	
C-2*																	
C-3*																	
C-4																	
C-5																	
TASK D																	
D-1																	
D-2																	

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978				
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
D-3							■										
D-4				■	■	■											
D-5					■	■	■										
D-6				■	■	■	■										
D-7*							■	→									
D-8						■	■										
D-9						■	■										
D-10		■	■	■	■	■	■										
D-11								■									
D-12									□								
D-13										□							
D-14										□							
D-15											▬						
D-16											□	◇					
D-17								◆			◇						

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1 9 7 7												1 9 7 8							
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J		
D-18																				
D-19																				
TASK E																				
E-1																				
E-2																				
E-3																				
E-4																				
Attend TRB & FCP																				
Submit Progress Report																				
Design Reviews																				
Prepare & Submit Draft Final Report																				
Prepare & Submit Final Report.																				

CENTRAL CONTROL UNIT OPERATING INSTRUCTIONS

Introduction

The Central Control Unit (CCU) basic operating function is the central receiving point for all emergency calls initiated through the Remote Station (RS). The CCU has five (5) modes of operation, (1) it is the central control for two-way communication between the motorist and the CCU's operator; (2) it controls the operation of the Remote Station; (3) it serves as a data information center, displaying the date/time, Digital Adapter and Remote Station identification codes; (4) it controls the digital recorder to give a permanent copy of all emergency calls received; (5) it has a programmable mode which enables the CCU operator to enter or reassign telephone numbers in the remote station's assistance memory.

Turn on Procedure

Note: These procedures will only be used in case of a power failure or when the CCU is turned off:

- Step 1: Turn the CCU on/off switch (2) to the on position. The pilot lamp will glow and the date/time display (15) will be all "9's" and the RS/USER ID will be at random display or off.
- Step 2: Push reset button (9). This will reset the RS/USER ID to read all "0's".
- Step 3: Check the date/time display (15) for all segment operation by positioning the function switch (3) to the lamp test position. The display should read all 8's indicating all segments are functional.
- Step 4: Setting the correct month/day. Note: In performing this step the month/day will be displayed on both the date and time displays.
- Rotate the function switch (3) fully counter-clockwise so that the pointer is adjacent to the Mo and Day push buttons.
 - Depress and hold the MO button (4) until the correct month is displayed.
 - Depress and hold the DAY button (5) until the correct day is displayed.

Step 5: Setting the correct time. Note: In performing this step the hours/minutes will be displayed on both the date and time displays.

- a. Rotate function switch (3) one position counter-clockwise so that the pointer is adjacent to the HR and MIN push buttons.
- b. Depress and hold the HR button (4) until the correct hour is displayed.
- c. Depress and hold the MIN button (5) until the correct minute is displayed.
- d. The seconds will automatically start at "00" when you return the function switch (3) to the RUN position.

Step 6: Starting the clock. Using another visual time source rotate function switch (3) to the run position at the pre-set time.

Step 7: The CCU is now in the standby mode.

CCU CALL SIGN KDZ 7830

ANSWERING A CALL USING THE CCU:

- Step 1: When the telephone set rings, push the answer/hang-up switch (10) to the answer position on the CCU.
- Step 2: Before pushing the microphone bar down, wait until the identification codes for the RS/USER ID to be displayed at the CCU and for the digital printer to print the date/time and RS/USER ID codes.
- Step 3: Using the push-to-talk microphone push the bar down, pausing briefly each time you push the bar down to allow time for the Remote Station to receive the 3 tone command signals and answer the call, i.e., this is DeKalb County Police, KDZ 7830 OVER. Note, Treat the CCU as a CB transceiver and comply with the appropriate FCC rules and regulations.
- Step 4: At the termination of the call, sign off the CCU, i.e., this is KDZ 7830 CLEAR.
- Step 5: Return the answer/hang-up switch (10) to the hang-up position. Within 3 seconds after hang-up, the digital printer will print the termination date/time and return the CCU to a standby mode.

Permitted Messages

User discretion is advised when using the digital adapter and any other "Channel 9" transmission. There are explicit rules and regulations set forth by the FCC about the use of Channel 9, some examples of permitted messages are:

1. "I am out of gas on I-95",
2. "There is a fire at 4th and Main",
3. "There is an accident at 4th and Main",
4. "There is a drunk driver on I-95, between Exit 3 and 4 heading North."

Examples of messages not permitted on Channel 9.

1. "I am out of gas in my driveway",
2. "Traffic is moving smoothly on I-285",
3. "This is patrol unit number 1. Everything is quiet here",
4. "This is observation post number 1. No tornados sighted."

The following priorities should be observed in the use of Channel 9.

1. Communication relating to an existing situation dangerous to life or property, i.e., fire, automobile accident.
2. Communication relating to a potentially hazardous situation, i.e., car stalled in a dangerous place, lost child, boat out of gas.
3. Road assistance to a disabled vehicle on the highway or street.
4. Road and street directions.

If you suspect that the DA is not operating properly or if you have any questions PLEASE call:

Ron Wallace
Ga. Tech
EES/ETL/CTG
894-3544 - Business
394-1314 - Home

-or-

Bob Wilson
Ga. Tech
EES/ETL/CTG
894-3544 - Business
475-5893 - Home

Operating instructions for storing a telephone number into the memory of
a Remote Station

NOTE: If you make a mistake at any point in entering the telephone number into the memory, you must terminate the call and repeat steps 1 through 7.

STEP 1: At the Central Control Unit (CCU) place the answer/hang-up switch (10) in the answer position and dial the desired remote station, via the CCU's touch tone pad.

a) No. 1 Remote Station telephone number: (451-1407)

b) No. 2 Remote Station telephone number: (321-4109)

STEP 2: When the telephone connections is made, a beeping tone will be heard. This indicates that the remote station has answered your call; for you to answer back you must press the "digit 3" on the touch tone pad and hold down for a minimum of 4 seconds. (If the tone is still heard when you release the "digit 3" push the "digit 3" again and hold down for another 4 seconds.) This will cause the tone to stop and connect you with the remote station.

STEP 3: At the CCU you must briefly (less than one second) press the Store Button (12) (located on the right hand side of the CCU front panel and just above the answer/hang-up switch). Wait for the Remote Station to respond with a tone of 1-2 seconds duration. This indicates that you have accessed the memory and are now ready to enter the phone number, via the touch tone pad, into memory.

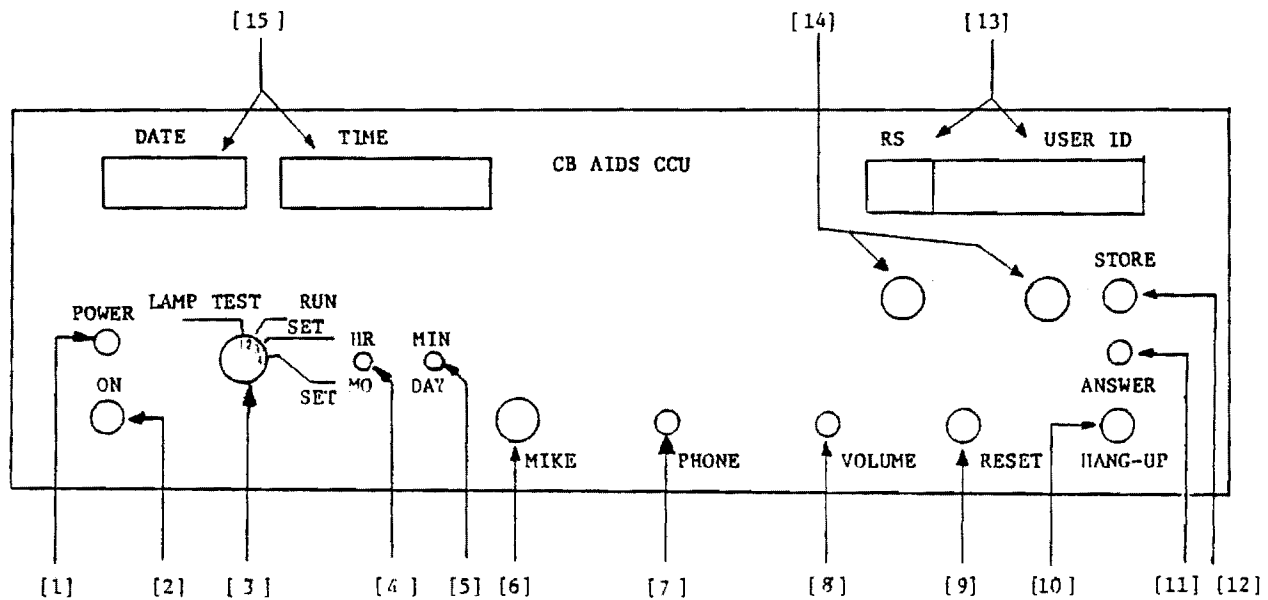
STEP 4: Begin entering the 7 digit phone number into memory. You have only 30 seconds to perform this step.

STEP 5: After you have entered the final digit of the telephone number into the memory, the number will be automatically read back to the CCU and be displayed on the RS and USERS ID (13). Note: the last digit will be displayed in the RS Display position. For example, if the programmed number were 894-3541, the display would read

	RS	USERS ID						
	1		8	9	4	3	5	4
DIGIT	7th		1st	2nd	3rd	4th	5th	6th

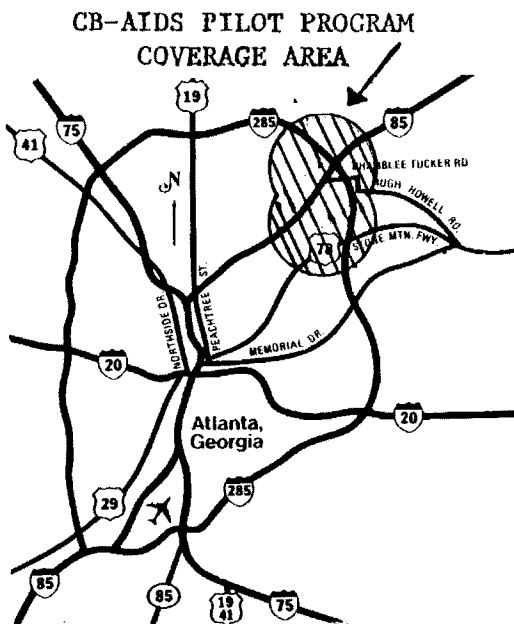
STEP 6: Verify the number you programmed and return the answer/hang-up switch to the hang-up position.

STEP 7: If the number does not agree, return the answer/hang-up switch to the hang-up position and repeat steps 1 thru 7.



CENTRAL CONTROL UNIT (CCU) FRONT PANEL

- [1] POWER: Lamp indicates when main power is on.
- [2] ON: Main power switch.
- [3] Function Switch: Four position switch used for (1) LAMP TEST - checks all segments for operation, (2) RUN - normal operation, (3) SET - used in conjunction with HR/MO [4] pushbutton, (4) SET - used in conjunction with MIN/DAY [5] pushbutton.
- [4] HR/MO: Pushbutton for setting HR/MO of digital clock.
- [5] MIN/DAY: Pushbutton for setting MIN/DAY of digital clock.
- [6] MIKE: With a microphone plugged in it allows the CCU operator to control the remote station and talk to CB operator.
- [7] PHONE: With head phones plugged in it allows you to monitor incoming calls and disables the CCU's speaker.
- [8] VOLUME: Controls CCU's speaker and headphone levels.
- [9] RESET: Depressed resets RS/USER ID display to all zeros.
- [10] ANSWER/HANG-UP (two-position lever): Hang-up position disconnects phone line and puts CCU in standby mode. Answer position (up) answers incoming calls.
- [11] ANSWER LIGHT: Indicates (glows) when the answer switch is in the answer position.
- [12] STORE (pushbutton): Depressed briefly allows access to the remote station's memory.
- [13] RS/USER ID: Displays the remote station and USER ID codes when the answer/hang-up switch is in the answer position.
- [14] E and A LAMPS: E light on indicates an emergency call. A light on indicates an assistance call.
- [15] DATE/TIME: Continuously displays the month, day, hour, minutes and seconds.



CB-AIDS

GEORGIA INSTITUTE OF TECHNOLOGY
ENGINEERING EXPERIMENT STATION
FEDERAL HIGHWAY ADMINISTRATION



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

April 21, 1978

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 14 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on contract number DOT-FH-11-9232 for the month of March, 1978.

During the month work continued on Tasks C and D. Details of this work are reported below.

Task C - The Task C effort consisted of completing the remote station and central control unit installation. The telephone service at Sequoyah High School was installed on March 10. During the testing of the Shamrock High School remote station, it was noted that the touch tone dial signals would not be accepted by the telephone company central office. This was found to be due to the fact that the central office serving this location was not equipped with an Electronic Switching System (ESS) which meant that the incoming line had to be connected to touch tone (DTMF) decoding circuits. This service was installed on March 9. After this the remote station correctly dialed the programmed number when initiated. Numerous problems were experienced with the CCU telephone connection. When the CCU was initially installed it operated correctly; however, protective coupling was not provided. After contacting the telephone company who installed a protective coupler, the CCU could no longer seize the telephone line and thus could no longer initiate nor answer telephone calls. After further consultation with the telephone company another coupler was installed and correct operation was obtained.

Task D - The Task D activity included installation and testing of the remote stations and CCU equipment and further installation of digital adapters.

Some electromagnetic interference problems were noted at both remote stations. After considerable experimentation and analysis it was determined that the problem was caused by coupling of the transmitted signal from the CB antenna back into the equipment room via the burglar alarm antenna and cable. Physical separation of the antennas and judicious cable placement solved the problem at both locations. The Sequoyah remote station was installed first and provided good operation in the emergency mode and intermittent operation in the assistance mode. The problem with the assistance mode appears to be due to the wide variations in both the CB radio output level and the telephone received signal level and in the difficulties in maintaining sufficient telephone hybrid balance over varying conditions. Since the RS transmitter is keyed by the action of a voice operated switch in the assistance mode, these conditions affect the reliability of communications in this mode. Since the emergency mode uses a three tone control for the transmitter the above problems do not occur for emergency calls. Some initial problems in reliably keying the transmitter in the emergency mode in the presence of noise were eliminated by improved matching of the tone filters and by extending the tone duration.

The Shamrock remote station was installed next and experienced interference problems similar to those at Sequoyah. These problems were also solved through proper positioning of the antennas and cables. An additional problem encountered here was with the CB radio transmissions entering the school intercom system. This was also solved through physical placement of the CB antenna. It was noted that signal quality from this station was less than that experienced at the Sequoyah High School. Also the noise level appears higher and the squelch setting tends to drift. Overall the Shamrock station, which uses a 23 channel radio, has shown much poorer performance than the Sequoyah station.

After the correct telephone coupler was installed as previously discussed, the CCU functioned properly. A separate touch tone pad was added to facilitate dialing and remote station programming from the CCU.

Additional digital adapters were installed during the month bringing the total installed to 19. Following the field experience with a volunteer who reversed the power connections to his digital adapter, burning out several IC chips, a design modification was made to the DA to include a power diode in series with the input power supply line.

PROBLEM AREAS:

Locating a sufficient number of volunteers for the digital adapters has been a problem. Publicity through the local CB clubs and on the Georgia Tech campus has not provided enough volunteers. Other means of seeking volunteers will be developed.

WORK PLANNED FOR NEXT MONTH:

Work will be concluded on Task C, continued on Task D, and initiated on Task E during the next month. Following a visit by the FHWA Contract Manager, Mr. Frank Mammano, early in the month, use of the system by the volunteers will be initiated.

MANAGEMENT INFORMATION

The following information give the managerial and estimated financial status of the contract as of March 31, 1978.

(A) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$20,592	\$ 0	\$20,648
Task B	40,176	0	62,329
Task C	10,454	1,255	18,984
Task D	66,250	1,953	47,942
Task E	<u>20,364</u>	<u>0</u>	<u>0</u>
	\$157,836	\$3,208	\$149,903

(B) Estimated cost to complete: \$28,397.

(C) Key personnel man-hours expended:

<u>Position/ Name</u>	<u>Man-hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	32	1,207
Principal Research Engineers		
D. W. Robertson	8	168
H. H. Jenkins		
Senior Research Engineer	0	142
R. W. Moss		
Assistant Research Engineers	0	1,943
C. S. Wilson		
D. R. Sentz		

(D) Percentage of work performed: (See Figure 1)

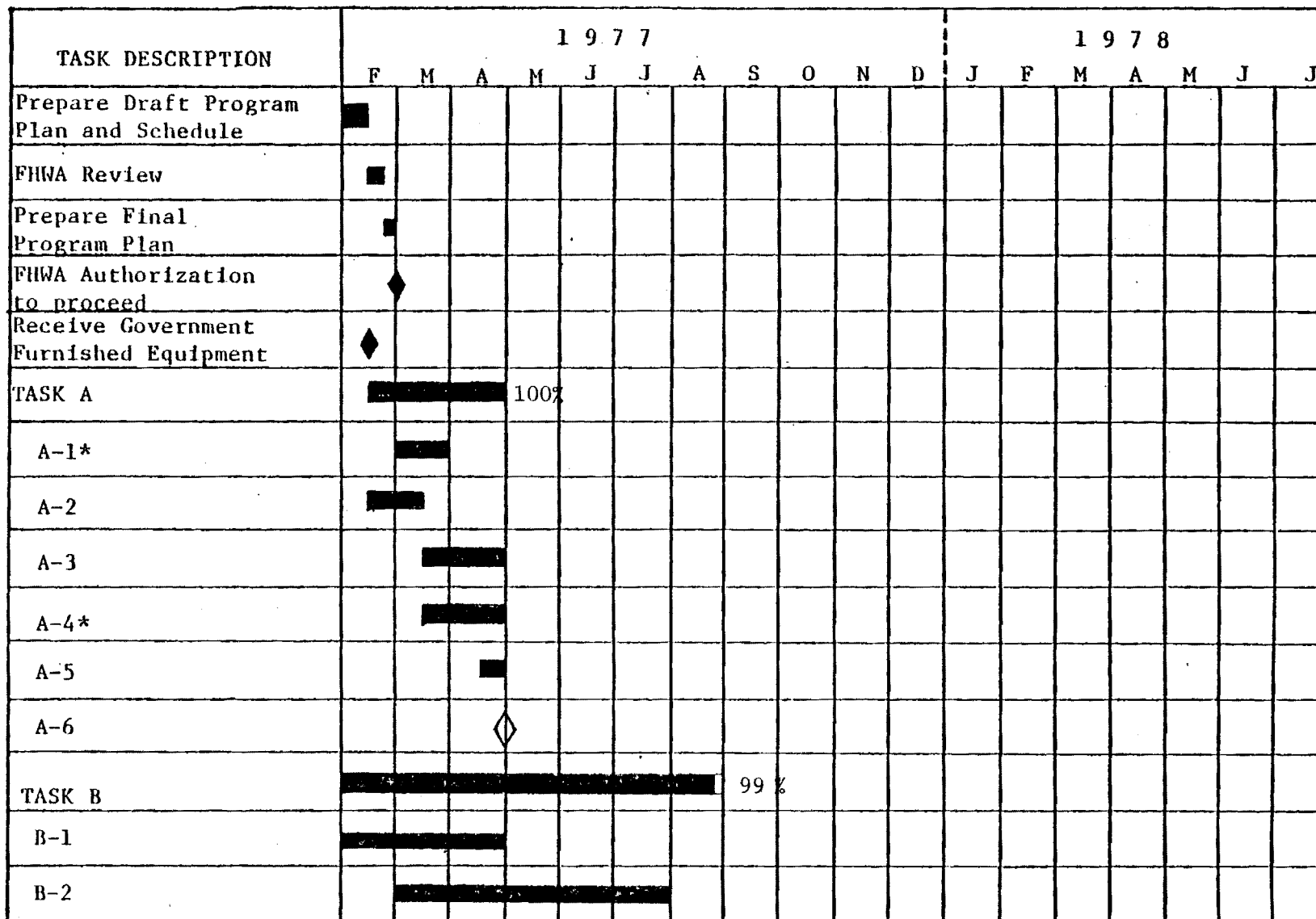
Respectfully submitted,

R. W. Wallace
Project Director

RWW:ls1
Approved:

D. W. Robertson, Director
Electronics Technology Laboratory

Figure 1. CB-AIDS TASK SCHEDULE



Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 1. CB-AIDS TASK SCHEDULE (continued)

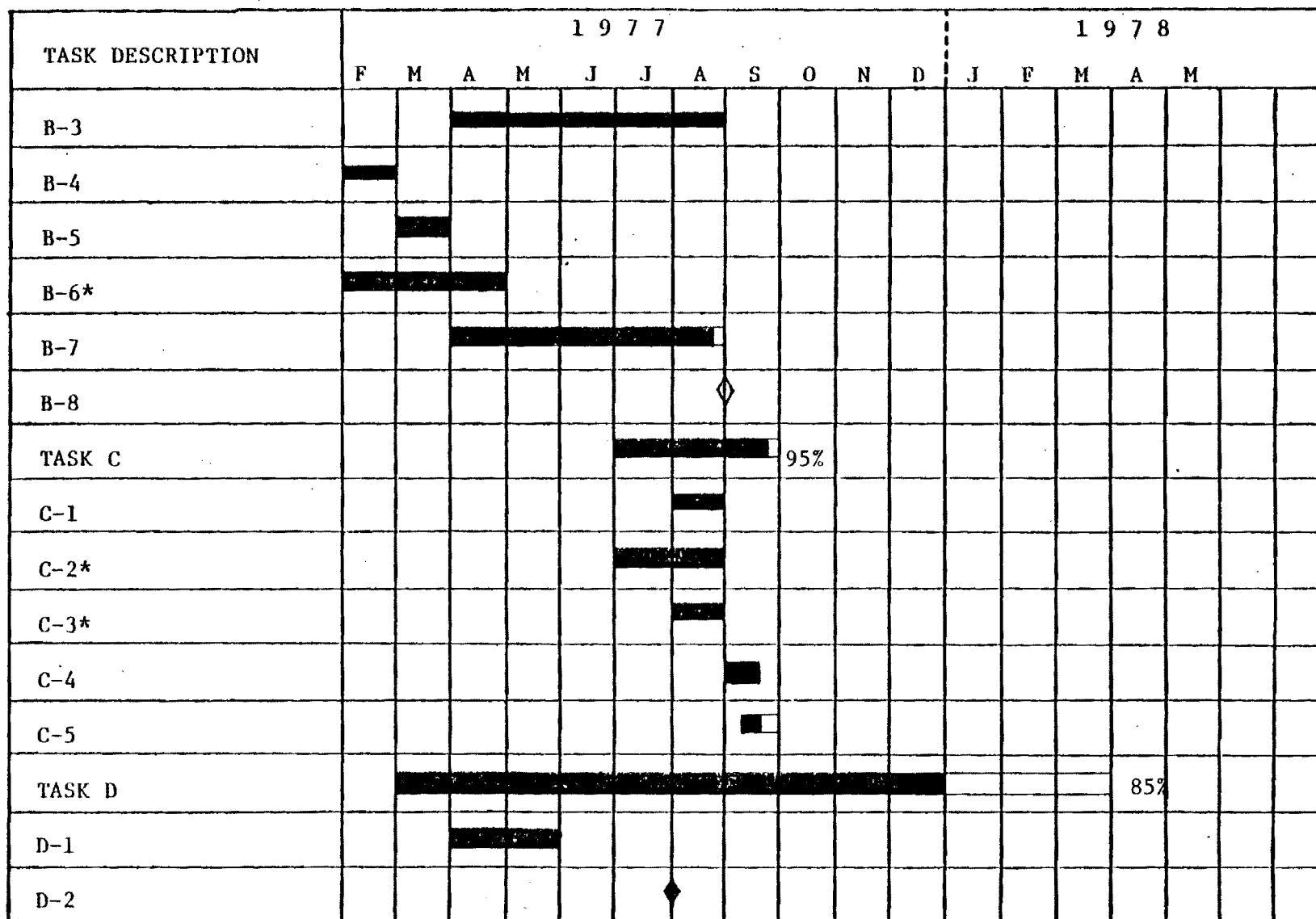
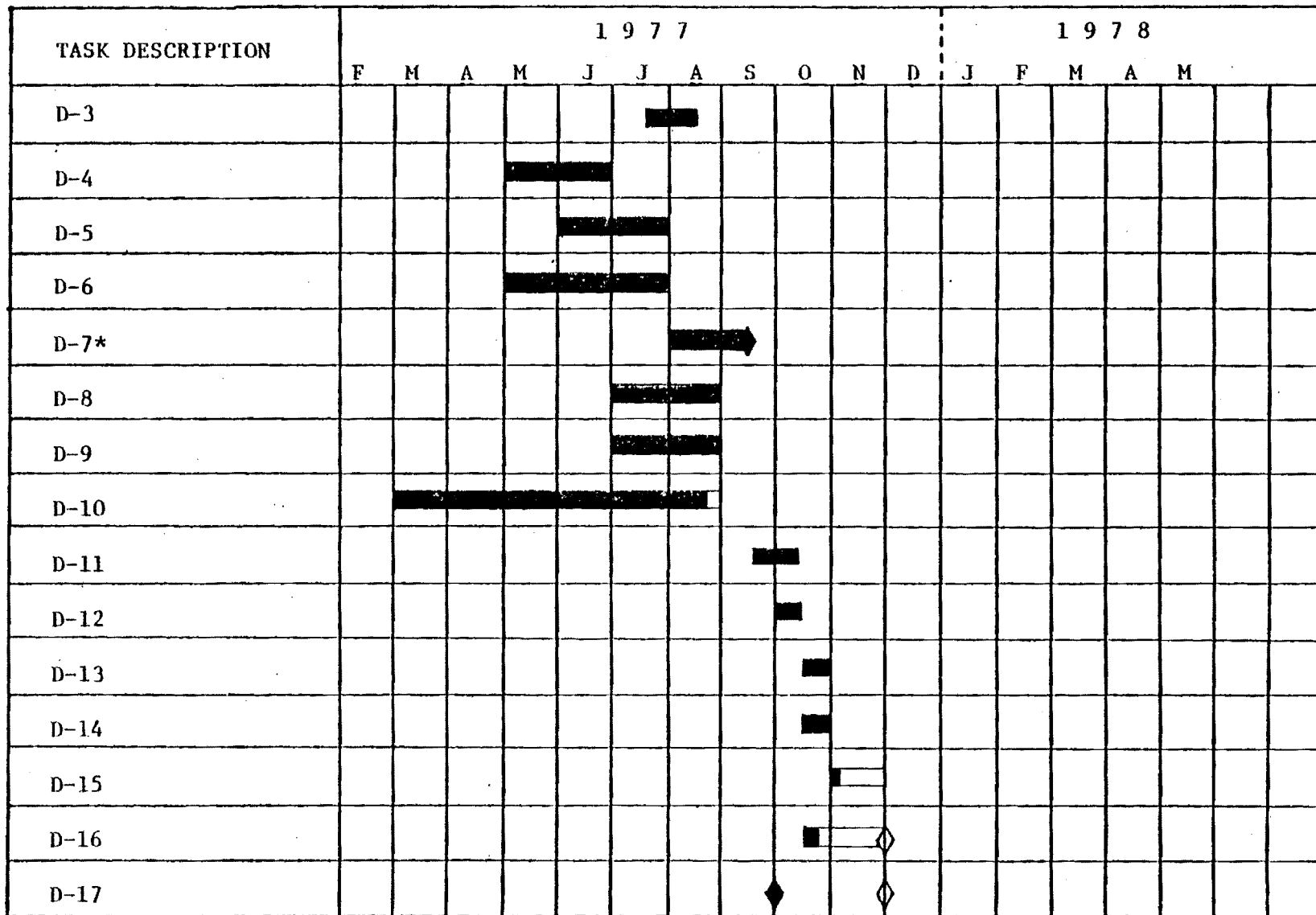


Figure 1. CB-AIDS TASK SCHEDULE (continued)



24



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

May 19, 1978

Federal Highway Administration
Office of Research
Traffic Systems Division ARS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 15 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940.

Gentlemen:

This letter reports the activities on Contract Number DOT-FH-11-9232 for the month of April, 1978.

The Contract Manager, Mr. Frank Mammano, visited the test site on April 4 and approved initiation of the six month test period. Prior to visiting the test site a project status review was held with the following attendees:

Mr. Frank Mammano	FHWA TSD
Mr. Dave Kelly	FHWA Ga. Division
Mr. Archie Burnham	Georgia DOT
Mr. Bill Owens	Georgia DOT
Mr. Richard Moss	Georgia Tech
Mr. Don Sentz	Georgia Tech
Mr. Ron Wallace	Georgia Tech
Mr. Bobby Wilson	Georgia Tech
Mr. Charles Wilson	Georgia Tech

During the month work was completed on Task C, continued on Task D, and was initiated on Task E. Details of this work are reported below.

Task C - The Task C effort was completed with field tests including installed digital adapters in the test site area. Calls were initiated within a three mile radius of each of the remote stations. Reception at the Sequoyah remote station was excellent with the telephone interconnection completed on most of the attempts. Reception at the Shamrock remote station was intermittent. Over several days the range within which a DA tone sequence would initiate a telephone connection varied from two miles to less than a mile. As previously reported this was the station with the 23 channel radio exhibiting an unstable squelch circuit. It was decided to purchase another 40 channel base station radio to replace the existing

unit in this station. The new radio was installed on April 21 and excellent results were obtained with system initiation occurring over most of the three mile coverage area.

Task D - The Task D effort included preliminary system tests, DA fabrication and installation, and pilot program initiation.

System field tests continued during the first week of April. The initial mixed results (i.e. good coverage at Sequoyah versus poor coverage at Shamrock) have been described above. The group was told that they could check out their digital adapters on Saturday, April 8, in the test site area. These tests were carried out on channel 10 to avoid using channel 9 for testing. Those testing their DA's at that time were able to initiate the system through Sequoyah but not through Shamrock. The system was set to channel 9 on Sunday, April 9, and the users were instructed to begin using the system for legitimate calls. The first "real" use of the system, occurring on April 12, was a call reporting a disabled school bus.

During the month nine additional DA's were installed bringing the total to 28 in the field. Based on the initial field experience with the DA's, additional circuits have been added to the design. Due to the large number of vehicles that exhibit considerable ignition noise on the 12 volt line, ignition suppression coils have routinely been added to the power input lines of all DA's. Also noted on some CB radio models were large positive (+40 volts) and negative (-20 volts) spikes on the push to talk lines and negative voltages on the audio lines. These voltages exceeded the ratings of the CMOS circuitry included in the DA's and caused some chip failures. Limiting diodes were added to the input lines to solve this problem.

Securing a large number of volunteers for the DA's has been a problem. So far information about the program has been limited with no general release to the public. This limited publicity has not generated the number of volunteers needed for the program. Therefore, a request to release information was submitted to the Contract Administrator. When the release is approved, volunteers will be requested through newspapers in the pilot program area.

Task E - The purpose of Task E is to evaluate and document the results of the pilot program. This task was initiated with the commencement of the pilot program on April 9 and the resulting accumulation of call data. Call documentation consists of three basic items. First the user making the call fills out a CB-AIDS incident report, next the CCU operator fills out a system log sheet, and finally the user and remote station ID numbers and call initiation and call completion times are automatically printed. The current Task E effort consists of collecting these data.

PROBLEM AREAS: Placement of the 100 digital adapters remains a problem. With the approval of the release of information to local newspapers, it is anticipated that this problem will be relieved. However, until the release is approved, securing of volunteers will continue through personal contact.

WORK PLANNED FOR NEXT MONTH: Work will continue on Tasks D and E during the next month. Installation of digital adapters and collection of use data will be the major items of effort.

MANAGEMENT INFORMATION: The following information gives the managerial and estimated financial status of the contract as of April 30, 1978.

(A) Cumulative Costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,592	\$ 0	\$ 20,648
Task B	40,176	0	62,329
Task C	10,454	1,383	20,367
Task D	66,250	2,014	49,956
Task E	<u>20,364</u>	<u>952</u>	<u>952</u>
	\$157,836	\$4,349	\$154,252

(B) Estimated cost to complete: \$24,048.

(C) Key personnel man-hours expended:

<u>Position/ Name</u>	<u>Man-hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	54	1261
Principal Research Engineers D. W. Robertson H. H. Jenkins	8	176
Senior Research Engineer R. W. Moss	0	142
Assistant Research Engineers C. S. Wilson D. R. Sentz	24	1967

(D) Percentage of work completed: (See figure 1).

Respectfully submitted,

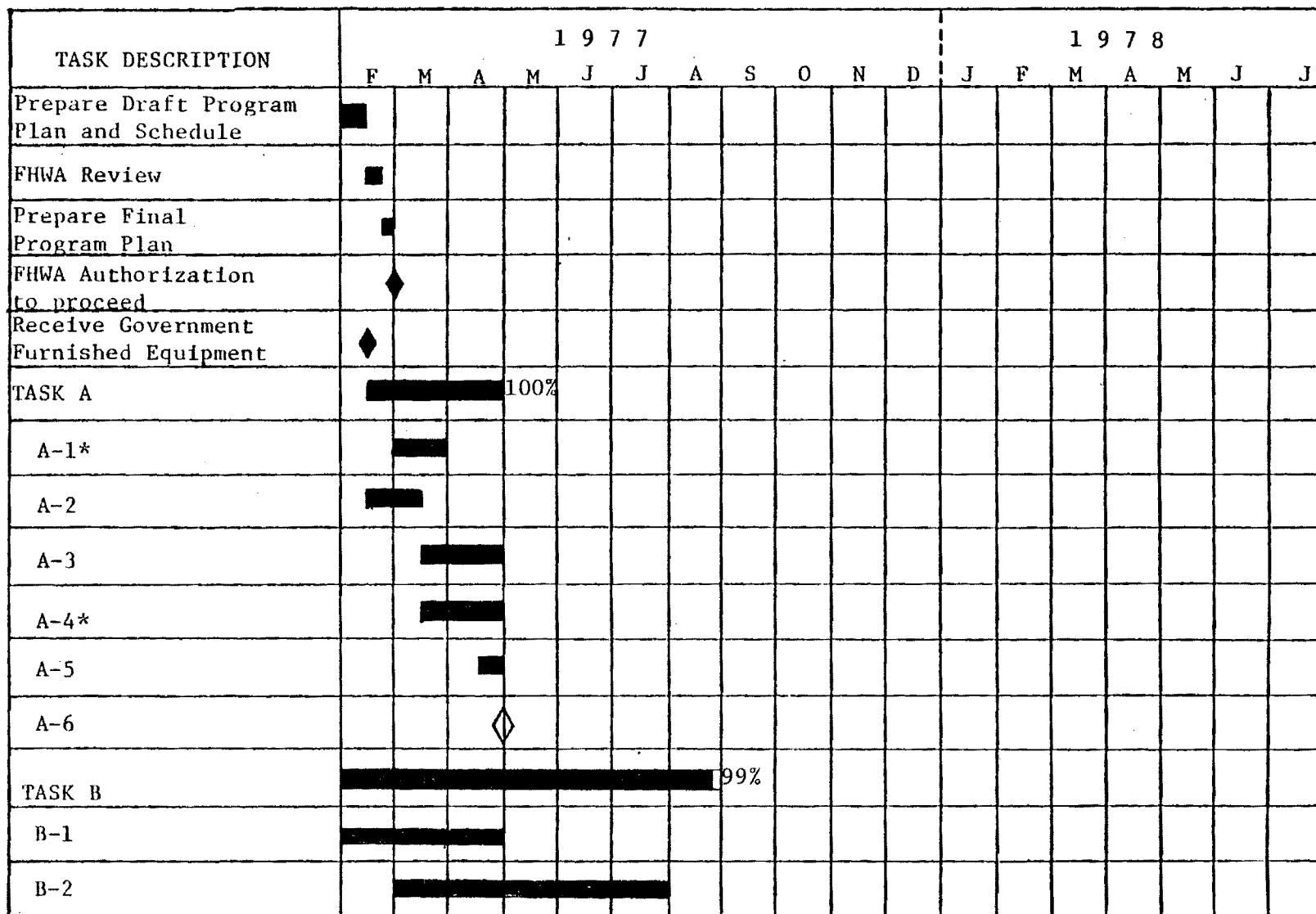
R. W. Wallace
Project Director

RWW:ls1



APPROVED

D. W. Robertson, Director
Electronics Technology Laboratory

Figure 1.



Notes:

1.  filled in portion indicates percentage of completion.
2.  indicates milestone event.
3. * indicates substantial external factors in subtask.

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
D-18																			
D-19																			
TASK E																			
E-1																			
E-2																			
E-3																			
E-4																			
Attend TRB & FCP																			
Submit Progress Report																			
Design Reviews																			
Prepare & Submit Draft Final Report																			
Prepare & Submit Final Report.																			



ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

A-1940

June 20, 1978

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 16 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of May 1978.

Two presentations of the CB-AIDS program were made during the period covered. In May a presentation was made to the Georgia Chapter of the Association of Public Safety Communications Officers (APSCO). This group is primarily composed of officers and managers of police department communications centers. The second presentation was made to the Communications Committee of the Transportation Research Board and included a status report on the system and a field demonstration.

During the month work continued on Tasks D and E. Details of this work are reported below.

Task D - The Task D effort continued with installation of digital adapters and monitoring of the program.

By the end of the month, a total of 32 digital adapters had been installed. The lack of a sufficient number of volunteers is the reason for this low number. FHWA authorization to release information (Attachment One) was received at the end of the month and a news release is being prepared for early June. It is anticipated that this publicity will attract additional volunteers.

Due to the field problems experienced with the "Assistance" mode, a number of lab tests were performed. The object of the tests was to determine the following:

- Passive (transformer) telephone hybrid isolation over the voice frequency band (200-3000 Hz)
- Matching network impedances required for passive hybrid balance over the voice frequency band

- Active (operational amplifier) hybrid isolation over the voice frequency band

The active hybrid was built and tested based on the suggestion that this approach would result in greater input/output isolation.

A full report on the tests is included as Attachment Two to the report. The main conclusions reached are that the passive hybrid showed greater isolation over the voice frequency band than the active hybrid and the hybrid isolation is considerably decreased at frequencies other than the specific frequency used for setting the null.

These results impact the "assistance" mode in the following manner. In this mode the CB transmitter is keyed on by use of a voice operated switch (VOX) which detects signals from the telephone line. Since a two-wire telephone circuit is used, both incoming and outgoing signals are on the telephone line. The telephone hybrid circuit is used to isolate the outgoing voice signals from the incoming voice signals thus converting a two-wire system to a four wire system. In the remote station the signal received from the CB radio is placed on the outgoing lines to the hybrid and the incoming lines are connected to the microphone input to the CB radio and to the VOX which activates the push to talk switch. With perfect balance of the hybrid, total input/output isolation is achieved and the system works well. Without perfect balance some of the received audio from the CB radio is coupled to the incoming lines of the hybrid. If the VOX sensitivity is low enough it will key the transmitter thus turning off the receiver which releases the VOX which in turn turns off the transmitter. At this time the received signal is again present and a condition of oscillation results. Decreasing the sensitivity of the VOX eliminates this condition. However, if the sensitivity is reduced too much, then the desired incoming signal will not control the VOX and the transmitter will not turn on when desired. In practice a very narrow VOX sensitivity range exists causing this to be a critical adjustment. Indeed with some circuits and speakers the incoming signal is less than the coupled signal and the VOX cannot be set to allow proper operation. Using these results the remote stations will be set for optimum operation recognizing that perfect operation is not achievable under all conditions.

Task E - At the end of May a total of 75 calls had been placed through the system. Some of the calls were test calls required for system maintenance. A total of 20 incident reports have been received. The CCU operator logs have not been filled out completely. There has been some operator turnover which has had a detrimental effect on this part of the programs as the operators must be trained and are not as proficient as desired during the learning period.

Problem Areas: Securing a sufficient number of volunteers remains a problem. The funding situation is acute. A question existed over the inclusion of a 9.35 percent charge for retirement in the proposal amendment rather than a 9.1 percent charge as in the original contract. Upon reviewing the contract it was noted that the previous modification for adding the remotely programmed assistance number selection had included the modification to the current 9.35 percent rate. Thus the amendment was in full agreement with the contract and the funds should be authorized soon.

Work Planned for Next Month: Work will continue on Task D and E efforts in digital adapter installation and data collection.

Management Information: The following information gives the managerial and estimated financial status of the contract as of May 31, 1978.

(a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,590	\$ 0	\$ 20,648
Task B	40,179	0	62,329
Task C	10,453	0	20,367
Task D	66,250	3,360	53,316
Task E	<u>20,364</u>	<u>805</u>	<u>1,757</u>
	\$157,836	\$4,165	\$158,417


(b) Estimated cost to complete: \$19,883

(c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	40	1301
Principal Research Engineers D. W. Robertson H. H. Jenkins	0	176
Senior Research Engineer R. W. Moss	0	142
Assistant Research Engineers C. S. Wilson D. R. Sentz	0	1967

(d) Percentage of work completed: (see Figure 1)

Respectfully submitted,

 R. W. Wallace
Project Director

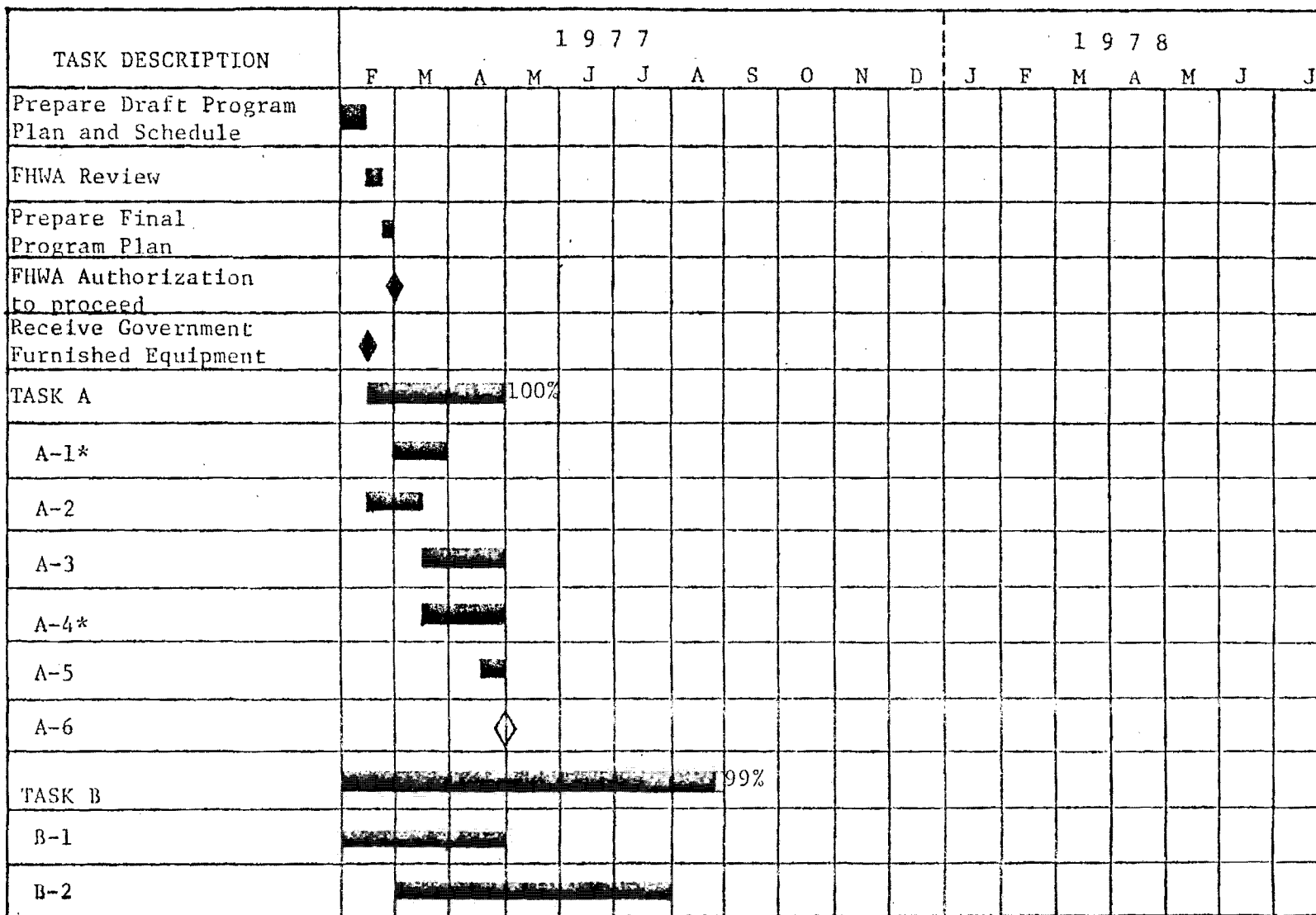
RWW:lb

Approved:

D. W. Robertson, Director
Electronics Technology Laboratory

Attachments

Figure 1
CB-AIDS TASK SCHEDULE



Notes:



1.  filled in portion indicates percentage of completion.
2.  indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 1
CB-AIDS TASK SCHEDULE (continued)

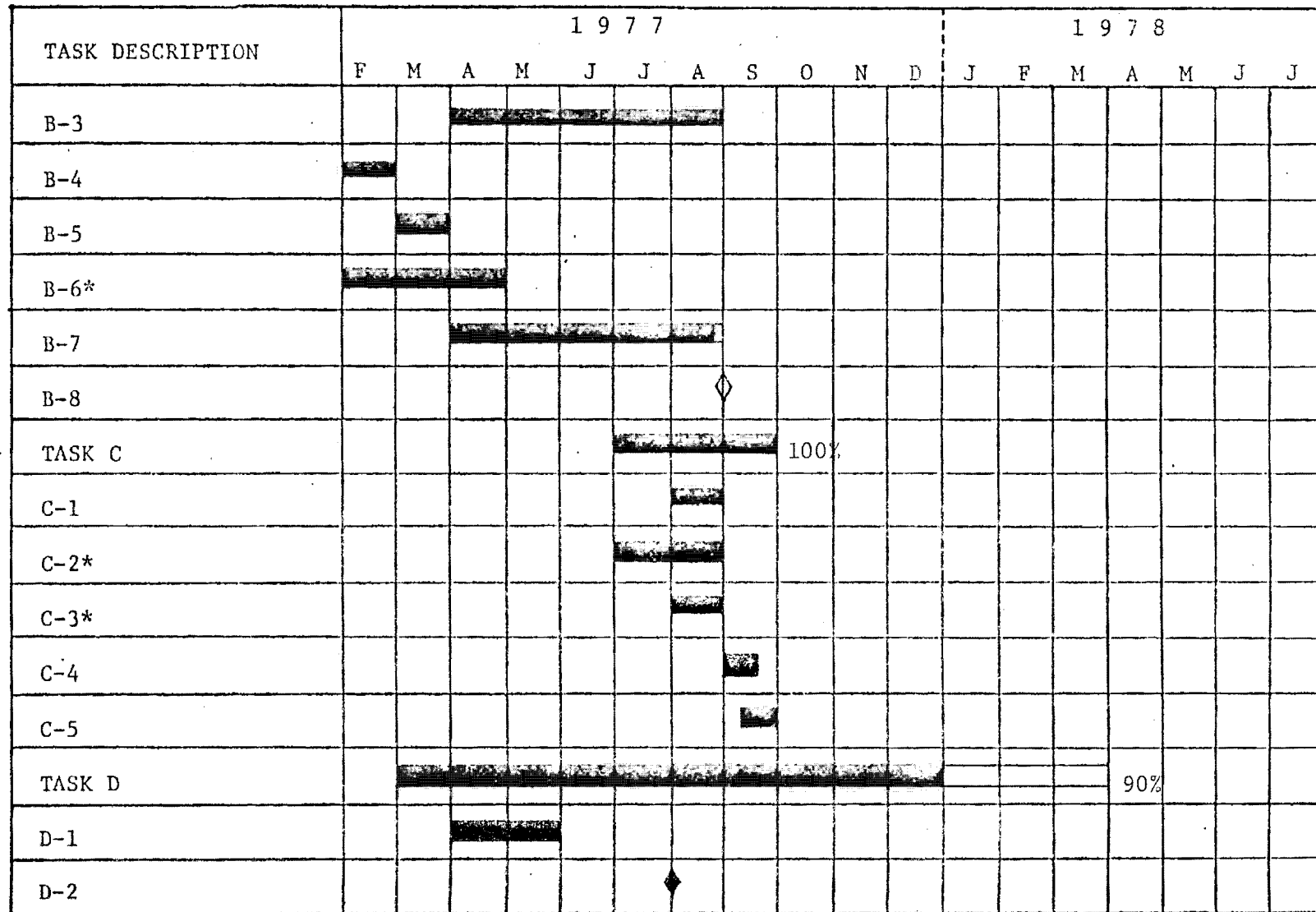
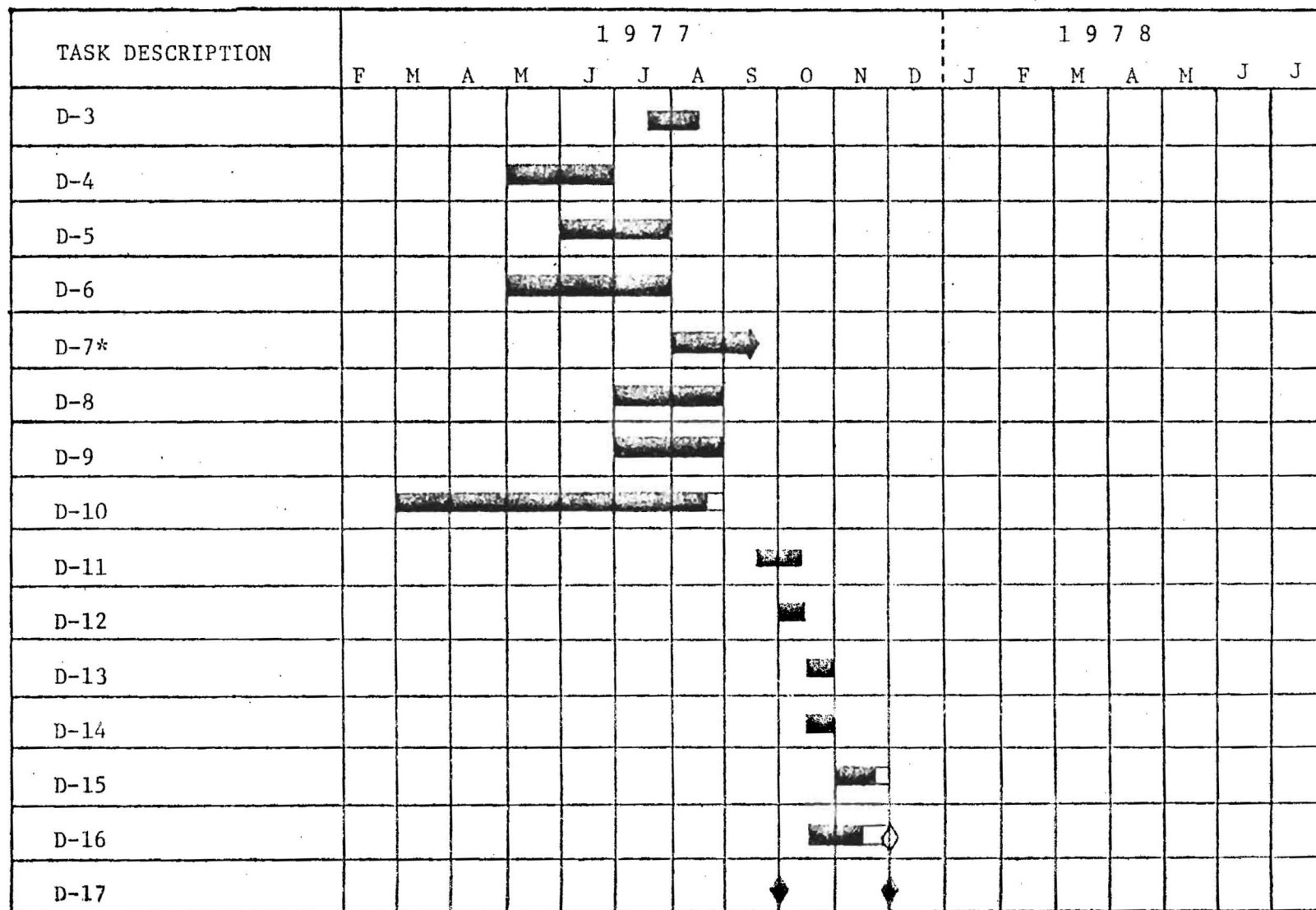


Figure 1
CB-AIDS TASK SCHEDULE (continued)



CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
D-18																			
D-19																			
TASK E																		4%	
E-1																			
E-2																			
E-3																			
E-4																			
Attend TRB & FCP																			
Submit Progress Report																			
Design Reviews																			
Prepare & Submit Draft Final Report																			
Prepare & Submit Final Report.																			

Attachment 1

Letter of Approval to Release Information



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
WASHINGTON, D.C. 20590

A-940
Wallace/STL

MAY 22 1978

IN REPLY REFER TO:

HCP-41

Georgia Tech Research Institute
Administration Building
Georgia Institute of Technology
Atlanta, Georgia 30332

Attention: Mr. R. W. Wallace

Gentlemen:

Pursuant to Article III of Contract DOT-FH-11-9232, this letter confirms verbal approval provided by Mrs. Janet K. Ford on May 19, 1978, to release information concerning this contract in accordance with your letter dated April 14, 1978.

The Federal Highway Administration does not object to the release of the requested information. However, permission to release this information does not relieve your firm of any obligation or responsibility it might have either under the contract or under law.

Sincerely yours,

LS
JS

L. D. McCollam, Chief
Research Contract Administration
Branch
Office of Contracts and Procurement

cc: R. W. Wallace
A. H. Becker

RECEIVED

MAY 26 1978

OFFICE OF CONTRACT
ADMINISTRATION

Attachment 2

Remote Station Hybrid Tests

During the month of May 1978, a series of tests were performed on the CB-AIDS Remote Station telephone hybrid circuit. These tests are described below.

1.0 Remote Station Voice Connection Circuits

A simplified block diagram of the pertinent voice connection circuits in the remote station is shown in Figure 1. The signal paths may be described as follows. The audio output from the CB radio is routed through a summing network to an isolation (unity gain) amplifier. The amplifier output is connected to the input of the telephone hybrid through a 620 Ω resistor. The signal is coupled through the hybrid to the telephone lines. Due to hybrid unbalance, some of the signal will also be coupled to the output of the hybrid. (The ratio of the input signal to the output signal expressed in dB is termed the isolation.) The telephone line signal is then routed to the KS-20445 telephone coupler which is connected via the local loop to the telephone central office. Following the appropriate trunk line switching, this signal is connected through a KS-20445 telephone coupler to the Central Control Unit equipment. Voice signals from the CCU follow the reverse path to the hybrid in the RS. Through the hybrid these signals are routed through a summing network to a 28 dB gain amplifier. The output of this amplifier is routed in parallel to an attenuator and an analog switch. The output of the attenuator is applied to the microphone input of the CB radio. The analog switch, when on, routes the signal to a syllabic detector which when energized keys the CB radio push-to-talk line.

Tests were performed to determine the key elements involved in optimizing level settings in the RS to reduce false keying created by hybrid unbalance while increasing correct keying by voice signals over the telephone connection. The following tests were completed.

- Passive hybrid isolation - phone line
- Passive hybrid balance impedance - phone line
- Passive hybrid isolation - coupler
- Passive hybrid balance impedance - coupler

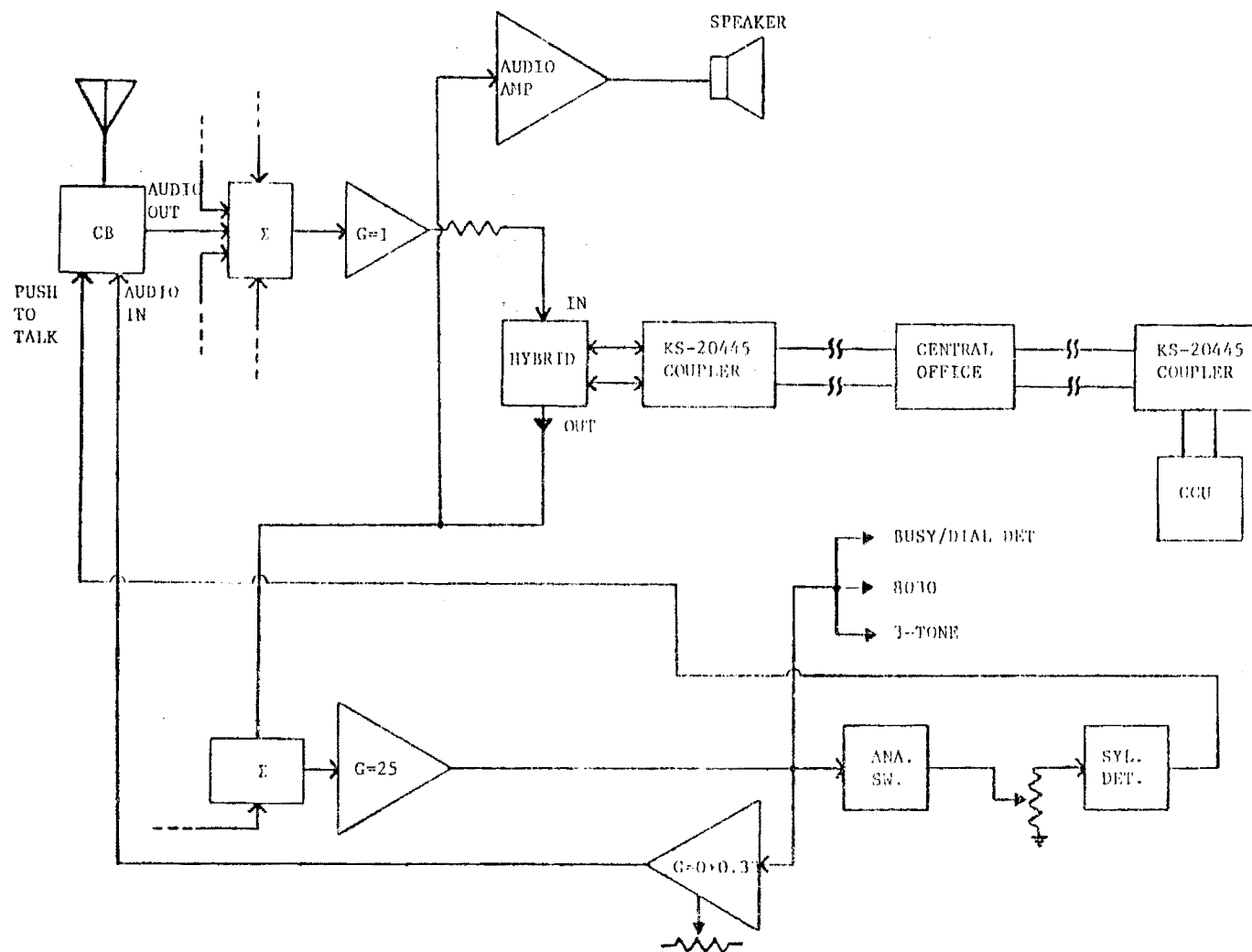


Figure 1. Simplified RS Voice Circuit Block Diagram.

- Passive hybrid isolation - coupler to office transformer
- Active hybrid isolation - phone line

These tests will not be described.

2.0 Hybrid Tests

The tests were performed on two basic types of hybrids - passive and active. The passive hybrid was the standard dual transformer design as shown in Figure 2. The active hybrid used cross-coupled operational amplifiers with isolation transformers as shown in Figure 3. The test schedule is shown in Table 1.

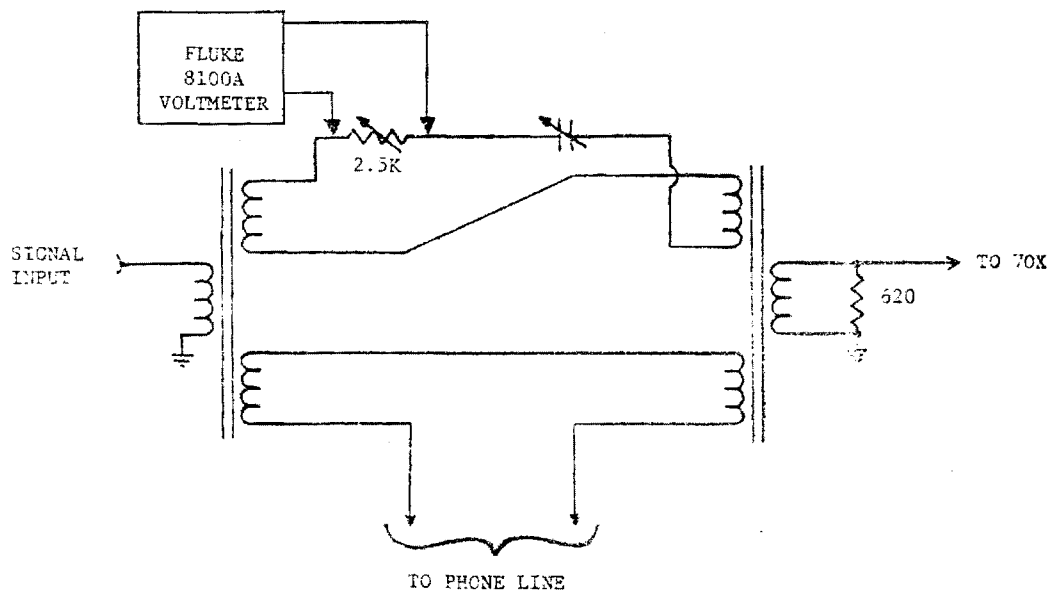


Figure 2. Passive Hybrid.

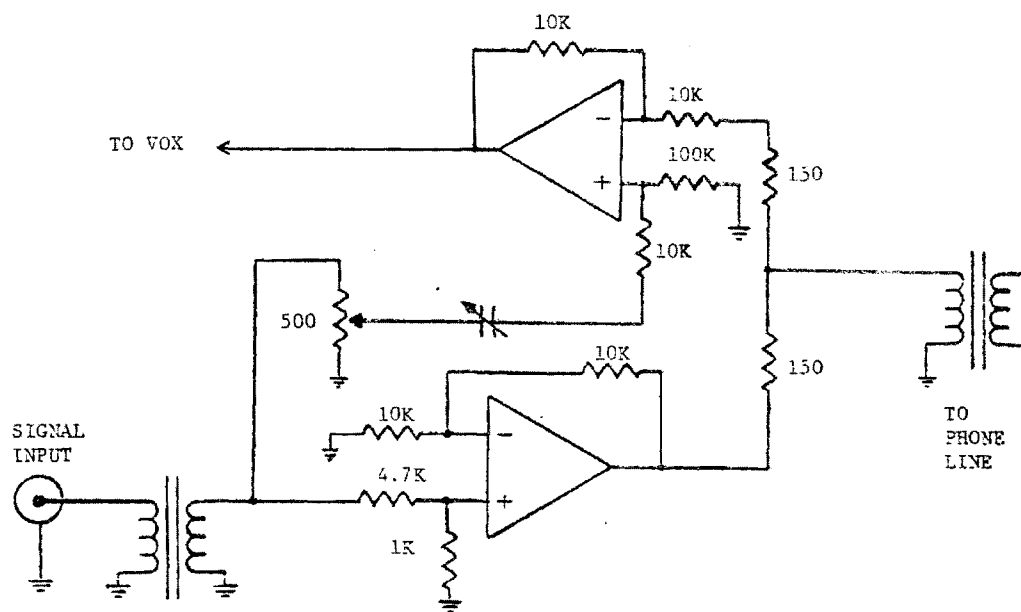


Figure 3. Active Hybrid.

TABLE 1
HYBRID TEST SCHEDULE

<u>Hybrid Test Name</u>	<u>Test Setup</u>	<u>Test Results</u>
Passive Isolation - Phone Line	Figure 4	Table 2
Passive Impedance for Balance	Figure 4	Table 3
Passive Isolation - Coupler	Figure 5	Table 4
Passive Impedance for Balance	Figure 6	Table 5
Passive Isolation - Coupler to Transformer	Figure 7	Table 6
Active Isolation - Phone Line	Figure 8	Table 7

TABLE 2
PASSIVE HYBRID - PHONE LINE, ISOLATION TEST

<u>Frequency</u> (Hz)	<u>Hybrid Input</u> <u>Signal Level</u> (V _{p-p})	<u>Phone Line</u> <u>Signal Level</u> (V _{p-p})	<u>Hybrid Output</u> <u>Signal Level</u> (V _{p-p})	<u>Hybrid</u> <u>Isolation</u> <u>-20 Log</u> <u>(dB)</u>
200	1.8	1.0	0.08	27.04
500	2.0	1.0	0.13	23.74
750	2.0	1.0	0.09	26.94
1000	2.0	1.0	-	60.00
1250	2.0	1.0	0.08	27.96
1500	2.0	1.0	0.145	22.79
2000	2.0	1.0	0.23	18.79
3000	1.95	1.0	0.35	14.92

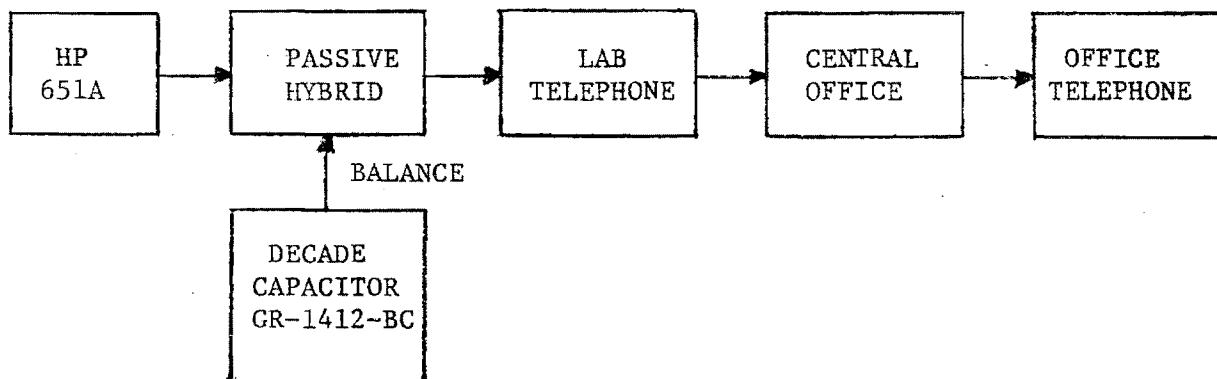


Figure 4. Test Setup - Passive Hybrid to Phone Line.

TABLE 3
PASSIVE HYBRID - PHONE LINE,
IMPEDANCE REQUIRED FOR BALANCE

Frequency (Hz)	R (Ω)	C (μ F)	Z (Ω)
200	-	0.440	1209-j723
500	1209	0.440	1209-j723
750	766	0.254	766-j835
1000	502	0.220	502-j723
1250	382	0.207	382-j615
1500	312	0.200	312-j531
2000	245	0.191	245-j305
3000	189	0.174	189-j305

Note: When the phone line is replaced with a series RC (620 Ω & 0.1 μ F +5%, ARCO type PJ polystyrene) the R and C readings are R = 627, C = 0.097 μ F and the null remains good over the 200 to 3000 Hz frequency range.

TABLE 4
PASSIVE HYBRID - COUPLER, ISOLATION TEST

<u>Frequency</u>	<u>Hybrid Input Signal Level</u> (V _{P-P})	<u>Coupler Signal Level</u> (V _{P-P})	<u>Hybrid Output Signal Level</u> (V _{P-P})	<u>Hybrid Isolation</u> <u>-20 Log</u> (dB)
200	2.0	1.10	0.180	20.92
500	2.0	1.20	0.075	28.52
750	2.0	1.20	0.035	35.14
1000	2.0	1.15	-	60.00
1250	2.0	1.10	0.028	37.08
1500	2.0	1.10	0.045	32.96
2000	2.0	1.10	0.075	28.52
3000	2.0	1.10	0.125	24.08

Note: For these tests it was necessary to connect the decade capacitor in parallel with the pot rather than series. At 1000 Hz R = 450Ω, C = 7000 pF for hybrid balance.

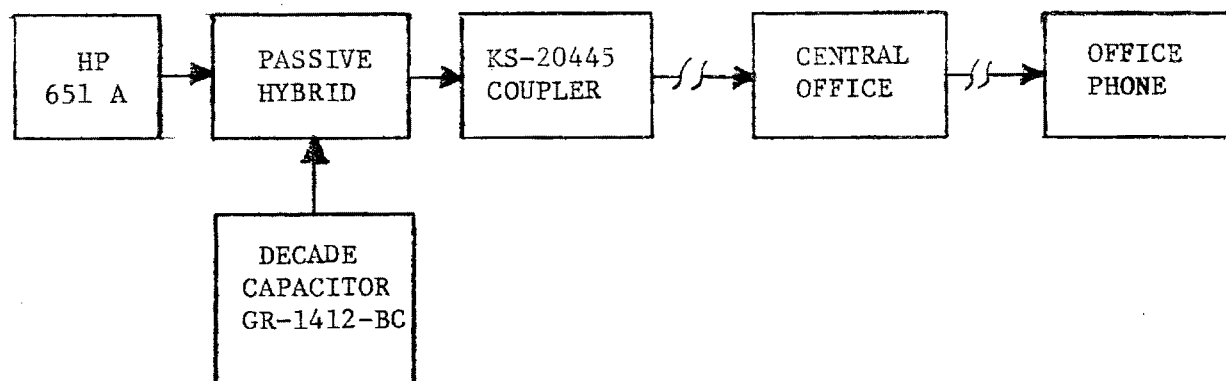


Figure 5. Test Setup - Passive Hybrid to Coupler.

TABLE 5

PASSIVE HYBRID - COUPLER, IMPEDANCE REQUIRED FOR BALANCE

Frequency (Hz)	R (Ω)	C (μF)	L^* (mH)	Z (Ω)
200	-	-	-	-
500	369	0.208	510	$465 + j72$
750	333	0.088	510	$429 - j8$
1000	275	0.049	510	$371 - j44$
1250	213	0.031	510	$309 - j102$
1500	144	0.0217	510	$240 - j83$
2000	26	0.0123	510	$122 - j61$
3000	-	-	-	-

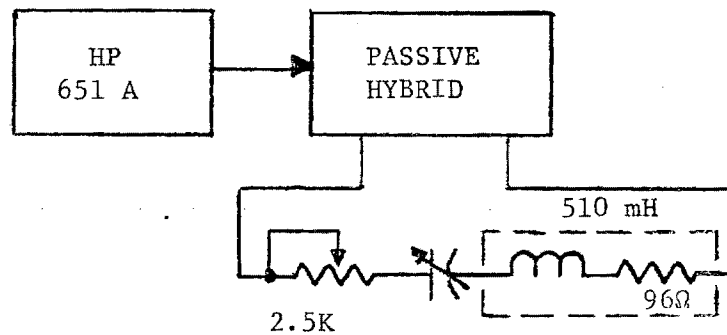
*DC resistance = 96Ω 

Figure 6. Passive Hybrid with KS-20445, LI Coupler Impedance Required for Balance.

TABLE 6

PASSIVE HYBRID - COUPLER TO TRANSFORMER ISOLATION TEST

Frequency (Hz)	Hybrid Input Signal Level (V _{p-p})	Coupler Signal Level (V _{p-p})	Hybrid Output Signal Level (V _{p-p})	Hybrid Isolation -20 Log (dB)
200	2.0	1.12	0.18	20.92
500	2.0	1.16	0.07	29.12
750	2.0	1.16	0.04	33.98
1000	2.0	1.14	..	60.00
1250	2.0	1.10	0.02	40.00
1500	2.0	1.08	0.04	33.98
2000	2.0	1.06	0.07	29.12
3000	2.0	1.06	0.11	25.19

Note: For hybrid balance at 1000 Hz $R = 452\Omega$, $C = 1000$ pF with C in parallel with R

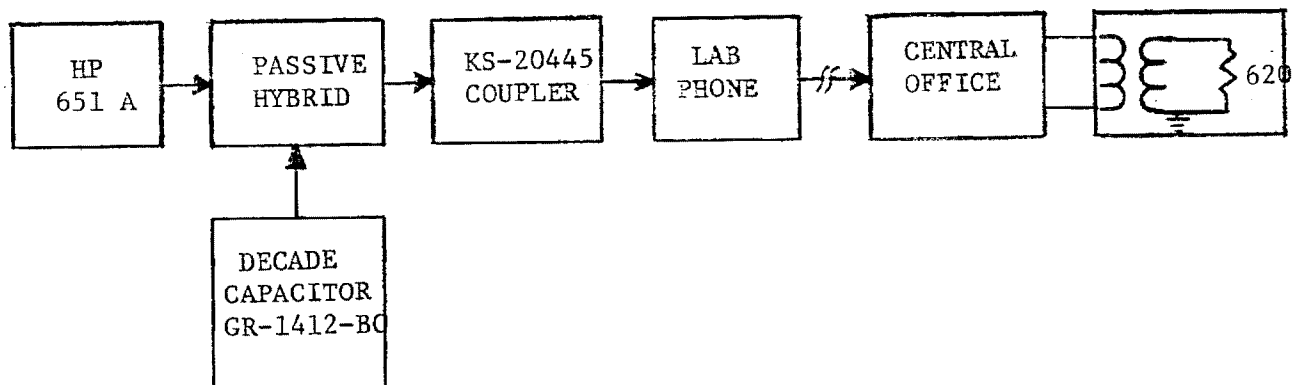


Figure 7. Test Setup Passive Hybrid with KS-20445, L1 Coupler (to office transformer).

TABLE 7
ACTIVE HYBRID - PHONE LINE, ISOLATION TEST

Frequency (Hz)	Hybrid Input Signal Level (V _{p-p})	Phone Line Signal Level (V _{p-p})	Hybrid Output Signal Level (V _{p-p})	Hybrid Isolation -20 Log (dB)
200	1.04	0.56	0.26	6.66
500	1.04	0.84	0.16	14.40
750	1.04	0.90	0.065	22.83
1000	1.04	0.92	0.010	39.28
1250	1.04	0.92	0.050	25.30
1500	1.04	0.92	0.090	20.19
2000	1.04	0.88	0.150	15.37
3000	1.04	0.80	0.215	11.41

Note: GR capacitor and pot set for max hybrid isolation @ 1000 Hz.

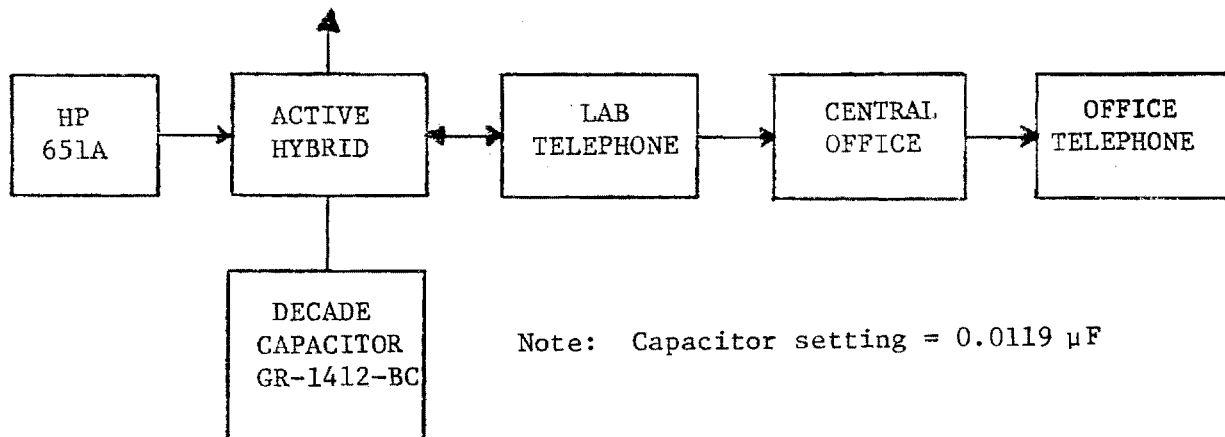


Figure 8. Test Setup - Active Hybrid to Phone Line.

LIBRARY DOES NOT HAVE

Monthly Progress Report No. 17



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

August 22, 1978

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 18 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of July, 1978. During the month work continued on Tasks D and E as reported below.

Task Effort

The Task D effort continued with further installation of digital adapters and program monitoring. By the end of the month a total of 65 digital adapters had been installed. During the period the first loss of a DA by theft was reported. The loss occurred on July 14 after the DA has been installed on July 13. The GTRI contract administrator was notified to initiate the appropriate reporting procedures indicated by the memo included as Attachment One. Other Task D activity included the collection of call data for analysis.

The Task E effort included the reduction of call data. By the end of the month a total of 190 calls had been placed through the system. Of these calls, 80 have been documented through incident reports. There is a continuing effort of individual telephone calls to encourage completion of incident reports by the users. Based on the incident reports received, voice quality of the telephone patch has been rated by the users in the following manner.

<u>Category</u>	<u>Percentage</u>
Excellent	40
Good	16
Fair	18
Poor	10
Unsatisfactory	13
No Answer	4

Problem Areas: Submission of incident reports by the users in a timely manner requires continued supplications.

Work Planned for Next Month: Work will continue on the Task D and E efforts in digital adapter installation and data collection.

Management Information: The following gives the managerial and estimated financial status of the contract as of July 31, 1978.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	3,149	58,830
Task E	10,160	749	3,313
	<u>\$178,300</u>	<u>\$3,898</u>	<u>\$165,487</u>

b) Estimated cost to complete: \$12,813.

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-hours Current Month</u>	<u>Expended Total</u>
Principal Investigator		
R. W. Wallace	51	1368
Principal Research Engineers		
D. W. Robertson	3	179
H. H. Jenkins		
Senior Research Engineer	0	142
R. W. Moss		
Assistant Research Engineers		
D. R. Sentz	0	1967
C. S. Wilson		

d) Percentage of work completed: (See Figure 1)

Respectfully submitted,

R. W. Wallace
Principal Investigator

APPROVED: ^

D. W. Robertson, Director
Electronics Technology Laboratory

CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1 9 7 7												1 9 7 8					
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
Prepare Draft Program Plan and Schedule	■																	
FHWA Review	■																	
Prepare Final Program Plan		■																
FHWA Authorization to proceed		◆																
Receive Government Furnished Equipment	◆																	
TASK A	■■																	

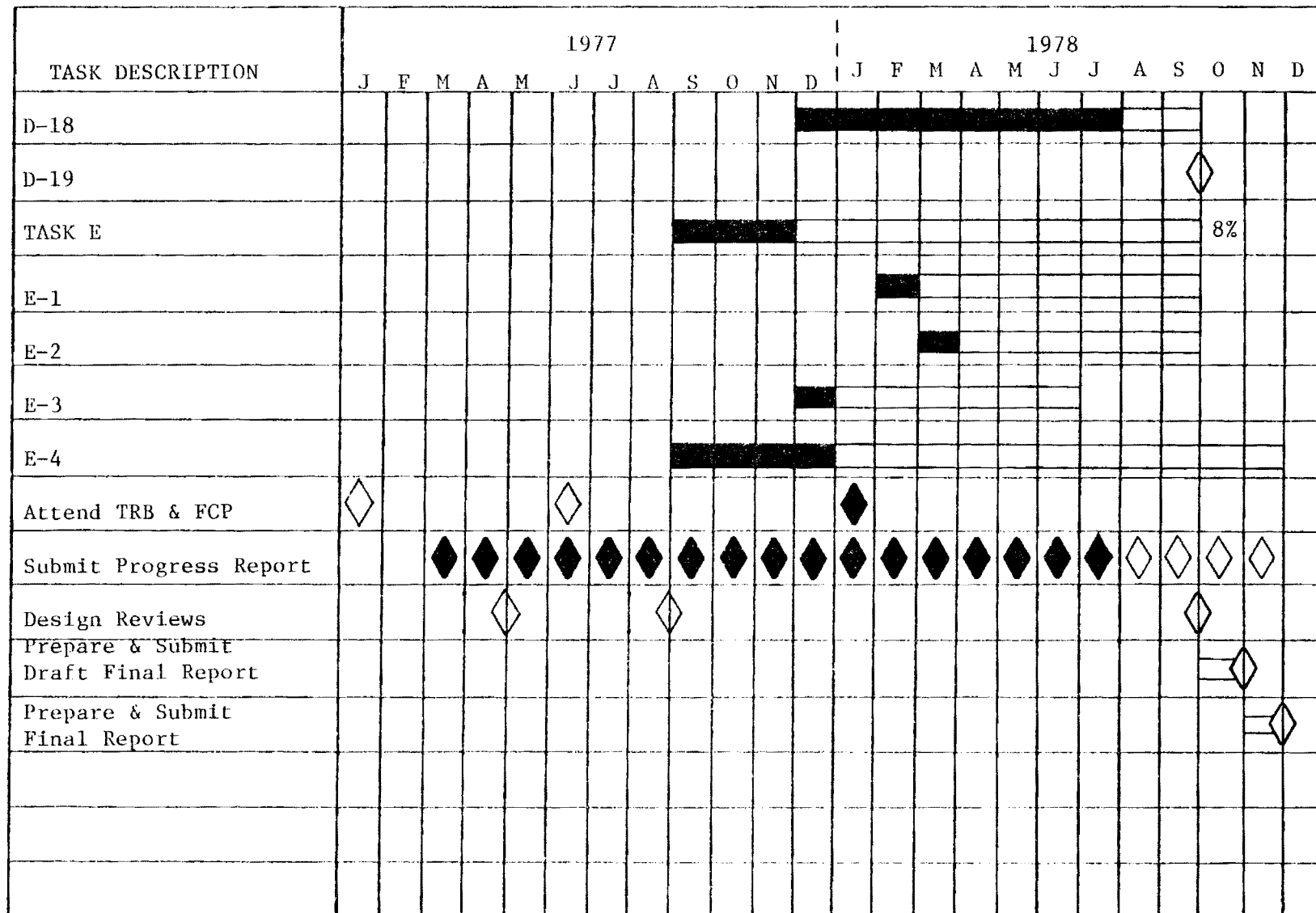
Notes:

1. ■■■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

CB-AIDS TASK SCHEDULE (continued)

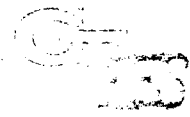
TASK DESCRIPTION	1 9 7 7												1 9 7 8						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
B-3																			
B-4																			
B-5																			
B-6*																			
B-7																			
B-8																			
TASK C																			
C-1																			
C-2*																			
C-3*																			
C-4																			
C-5																			
TASK D																			
D-1																			
D-2																			

Figure 1
CB-AID TASK SCHEDULE (continued)



ATTACHMENT ONE

LETTER REPORTING DIGITAL ADAPTER THEFT



ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

July 21, 1978

MEMORANDUM

To: Phyllis Oliver

From: R. Wallace

RWW

Subject: Stolen Digital Adapter - CB-Aids Project A-1940

Mr. Ron Buchanan, one of the CB-AIDS volunteers, reported that his CB radio and digital adapter were stolen on July 14, 1978. The DA, serial number 1234567, was installed on July 13, 1978. The radio and DA were taken from Mr. Buchanan's parked and locked car.

This information should be reported to the FFWA contracts office in order to release our liability.

/lb

cc: C. E. Smith

A-1940



ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

September 27, 1978

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 19 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of August 1978. During the month work continued on Tasks D and E as reported below. In addition, a presentation describing the CB-AIDS program was made to the Motorist Services Committee of the Transportation Research Board which met in conjunction with the Institute of Traffic Engineers' annual meeting in Atlanta, Georgia on August 10.

Task Effort

The effort on Tasks D and E continued with monitoring of the program, data collection, and analyses. Some problems were encountered during the month at one of the remote stations and at the central control unit at the DeKalb County Police Headquarters.

Following a failure to initiate the system from a location that should have been well within the range of the Sequoyah remote station, the site was investigated and it was found that the radio was set on channel 38. Earlier in the day a call had been placed through this station by a volunteer on channel 9. Therefore, the channel had been changed for a limited amount of time. Later, at the same school, it was discovered that the antenna had been knocked down. It was re-erected with a larger platform and guy wires. These incidents indicate that there is a security problem at the high school. It is anticipated that when the regular school year begins, school security will improve.

During August, the DeKalb County Police Department renovated its communications room with the addition of new operator consoles. During the transition period there were times when the CCU was turned off to be moved into the console and when the telephone line was accidentally disconnected. It is probable that some attempts to use the system were not completed due to these disconnections which resulted in an aggregate

off time of about eight hours. In addition to these technical problems, personnel turnover continues, creating the need for continual training. Apparently due to the low scale of wages paid to the telephone monitors, the job is used primarily as a stepping stone to better paying positions.

A cost analysis of the CB-AIDS system was performed during the month and is included as Attachment A to this report. Costs were projected for an operational system covering 60 miles with ten remote stations. The estimate included both implementation and operational costs. The total costs were compared to past and existing call box and patrol motorists' aid systems on a per mile basis. The CB-AIDS system compared favorably to these systems on the basis of agency costs. The major disadvantage of the CB-AIDS system is the cost to the motorist for the digital adapter. However, the analysis shows that the cost of a digital adapter would be \$43 for an add-on model or \$20 for an in-radio model. These costs may be considered moderate when compared to the prices paid for such CB radio auxiliary devices as power mikes. The willingness of the public to purchase a device such as a digital adapter is indicated by the response to a questionnaire which was compiled during a study for the State of Virginia by Price and Davis of VPI. The questionnaire was sent to 15,000 CB licensees in Virginia based on a random sample of licensed operators in the state. Nine point two percent (or 1376) of those receiving the questionnaire responded. Of particular interest are questions V and VI which were:

"V. How do you predict CB operators will feel about buying, at their own expense, a manually controlled signal attachment for their CB, if it costs less than \$25.00?

VI. How do you feel about buying such a device?"

These questions were asked in the context of using CB radio for citizens' safety. The response to question V indicated a "weak but willing" commitment to spend money on the part of other CB operations whereas the response to question VI indicated a much stronger commitment of the respondents to spend money on such a device with 40.1 percent indicating that they felt extremely good about such a purchase and 64.2 percent responding positively. Extending these figures to the national population results in an estimated market of 750,000 CB users willing to purchase a digital adapter at a total expenditure of \$18.75 million.

Problem Areas

Obtaining incident reports from the volunteers remains a problem as only 40 percent of the system uses are being reported. Also the CCU operators are not consistently filling out the CCU log sheets. The problem here stems from the fact that the operators also are used to

answer incoming telephone calls and use a keyboard entry method for logging these calls. The manual entry log sheets required for CB-AIDS represent a change in routine and therefore are not always filled out.

Work Planned for Next Month

During the next reporting period work will continue on data collection and preparation of the draft final report.

Management Information

The following gives the managerial and estimated financial status of the contract as of August 31, 1978.

a) Cumulative costs

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939		20,367
Task D	60,771	1,179	60,009
Task E	10,160	2,951	6,264
	<u>\$178,300</u>	<u>\$4,130</u>	<u>\$169,617</u>

b) Estimated cost to complete: \$8,683

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	86	1454
Principal Research Engineers D. W. Robertson H. H. Jenkins	8	187
Senior Research Engineer R. W. Moss	0	142
Assistant Research Engineers D. R. Sentz C. S. Wilson	0	1967

d) Percentage of work completed: (see Figure 1)

Respectfully submitted,

R. W. Wallace
Principal Investigator

APPROVED:

D. W. Robertson, Director
Electronics Technology Laboratory

CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1 9 7 7												1 9 7 8						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
Prepare Draft Program Plan and Schedule	■																		
FHWA Review	■																		
Prepare Final Program Plan		■																	
FHWA Authorization to proceed		◆																	
Receive Government Furnished Equipment	◆																		
TASK A	■	■	■	■	100%														
A-1*		■	■																
A-2	■	■																	
A-3		■	■	■															
A-4*		■	■	■															
A-5			■	■															
A-6				◆															
TASK B	■	■	■	■	■	■	■	■	■	■	■	99%							
B-1	■	■	■	■															
B-2		■	■	■	■	■	■												

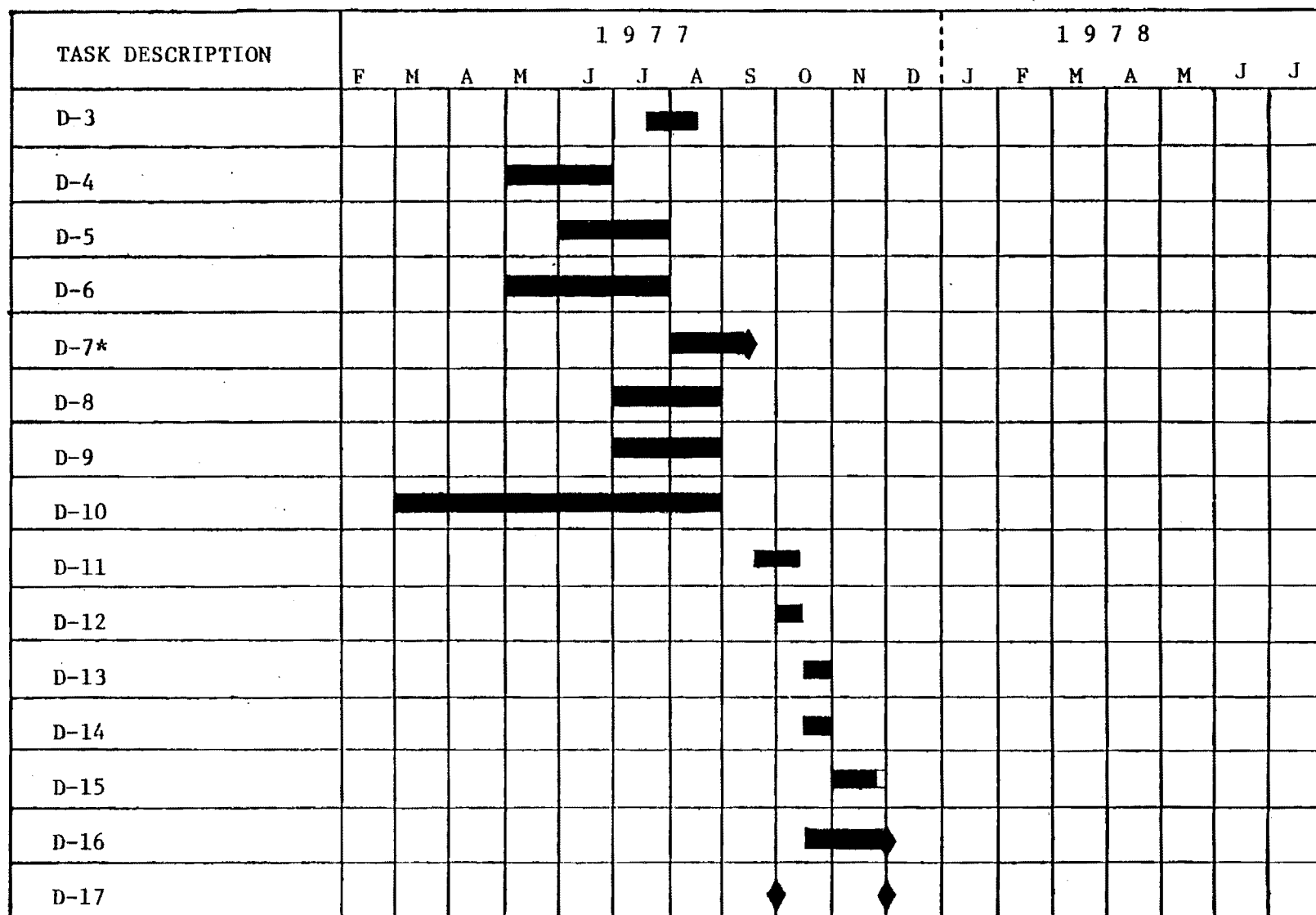
Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1 9 7 7												1 9 7 8						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
B-3																			
B-4																			
B-5																			
B-6*																			
B-7																			
B-8																			
TASK C																			
C-1																			
C-2*																			
C-3*																			
C-4																			
C-5																			
TASK D																			
D-1																			
D-2																			

Figure 1
CB-AIDS TASK SCHEDULE (continued)



ATTACHMENT A

CB-AIDS COST CALCULATIONS

AND COMPARISONS

CB-AIDS Cost Calculations and Comparisons

The projected operational costs for a CB-AIDS type of motorist aid system are developed in order to provide a comparison with existing and former operational motorist aid systems.

Costs are developed in two basic areas - agency costs and motorist costs. The agency costs include the elements required for implementing the remote station and central control unit equipment and telephone costs. Motorist costs are those required for the in-vehicle digital adapter.

In developing the agency costs a hypothetical system is postulated which covers 60 miles of interstate highway in a suburban/rural environment with gentle rolling hills. Due to the nature of radio systems, costs will be variable with differing demographic and terrain features. Hilly areas and large urban populations will require more closely spaced remote stations with a consequent increase in system cost whereas flat, rural areas will allow more distant remote station locations at a decreased system cost. The postulated system results in an average remote station spacing of six miles.

A remote station consists of a Citizens Band transceiver with antenna, a digital decoder, a code processor, a telephone dialer, telephone interface and controller, audio processing circuits, and power supplies housed in a weather tight enclosure. The estimated cost of the remote station is developed to include all parts and labor as detailed in Table 1. As shown a remote station may be fabricated completely for \$6400 including provision for a profit of approximately 20 percent. This is the assembled cost requiring only the connection to a power source and the telephone line for operation.

The installation cost for a remote station is calculated as shown in Table 2 along with the total monthly cost which includes lease charges, maintenance costs, and capital cost amortization over 10 years at an 8 percent interest rate. From this the total annual cost for a remote station is estimated to be \$2250.

In a similar manner central control unit equipment and system costs are calculated as shown by Tables 3 and 4. The CCU equipment is less

TABLE 1

REMOTE STATION FABRICATION COST ESTIMATE

<u>Item</u>	<u>Parts</u>	<u>Labor</u>	<u>Profit</u>	<u>Total Cost</u>
CB Radio and Antenna	\$ 200	\$ 0		
Control Circuits	600	3000		
Telephone Interconnection	200	0		
Enclosure	200	0		
Fabrication	100	1000		
Complete RS	\$1300	\$4000	\$1900	\$6400

TABLE 2
OPERATIONAL RS COST CALCULATION

<u>Item</u>	<u>Capital Cost</u>	<u>Annual Lease</u>	<u>Total Annual Cost*</u>
Remote Station	\$6400	\$ 0	\$ 932
Power	500	180	253
Telephone	300	420	464
Maintenance		600	600
Total	\$7200	\$1200	\$2250

*Capital costs amortized over 10 years at 8%.

TABLE 3

CENTRAL CONTROL UNIT FABRICATION COST ESTIMATE

<u>Item</u>	<u>Parts</u>	<u>Labor</u>	<u>Profit</u>	<u>Total Cost</u>
Processor and Display	\$ 600	\$2000		
Telephone Interconnection	200	0		
Enclosure	150	0		
Fabrication	50	200		
Complete CCU	\$1000	\$2200	\$650	\$3850

TABLE 4
OPERATIONAL CCU COST CALCULATIONS

<u>Item</u>	<u>Capital Cost</u>	<u>Annual Lease</u>	<u>Total Annual Cost</u>
Central Control Unit	\$3850	\$ 0	\$ 561
Telephone	50	420	427
Maintenance		212	212
Total	\$3900	\$ 632	\$1200

complex than RS equipment and is installed in the responding agency's communications room resulting in a lower cost than the RS. The resulting CCU cost per year is \$1200. This cost does not include any labor charges for operating personnel other than maintenance personnel.

For the postulated 60 mile system a total of 10 remote stations and one central control unit are required. Table 5 indicates the total system cost calculations. Based on a 10 year lifetime with an eight percent cost of money the total annual cost is projected to be \$23,700 or \$395 per mile.

This cost may be compared to published costs of various installed and projected systems as shown in Table 6. Costs of call box systems have been taken from a 1976 study by Fullerton et al. [1] and patrol costs have been taken from Molnar et al. [2]. For consistent comparisons the call box cost data were revised to 1978 dollars based on an eight percent per year inflation rate. The annual costs were also revised to indicate a 10 year capital cost amortization with an eight percent per year cost of money. The patrol costs were revised from the given 1968 figures to 1978 dollars based on an inflation rate of five percent per year from 1968 to 1973 and eight percent per year from 1973 to 1978.

These results show that based strictly on agency cost, the CB-AIDS system compares favorably with both call-box and patrol motorist aid systems, with only the Oklahoma Turner Turnpike call box system costing less. However, it should be noted that this system's low cost resulted from a five to 10 mile terminal spacing meaning a disabled motorist would have to walk an average of about two miles to the nearest call box provided that he knew in which direction he would find the closer call box.

The other part of the CB-AIDS system cost is for the in-vehicle equipment, the digital adapter. Projected digital adapter costs have been developed for two configurations - an add on digital adapter and an in-radio digital adapter. The add-on DA would be added to existing CB radios in a similar manner as used with the current prototype DA's, i.e. electrically through the microphone connector and mechanically through a simple adhesive or screw on attachment. The in-radio DA would be included with the transceiver circuitry at the time of manufacture. Both approaches are based on the use of a custom LSI circuit to provide the signaling

TABLE 5

SYSTEM COST FOR ONE CCU AND TEN REMOTE STATIONS

<u>Item</u>	<u>Per RS</u>	<u>Total RS</u>	<u>CCU</u>	<u>Total Cost</u>	<u>Cost Per Mile</u>
Capital Cost	\$7200	\$72000	\$3900	\$75900	\$1265
Annual Lease	1200	12000	632	12632	211
Total Annual Cost	2250	22500	1200	23700	395

TABLE 6

<u>Type System</u>	<u>Location</u>	<u>Annual Cost/Mile</u>
CB-AIDS Radio/ Telephone	Proposed System	\$ 395
Call Box - Coded		
	Maryland, I-495	\$2510
	Texas, I-45	4582
	Florida, I-75	1321
	Massachusetts, I-495	2624
	Massachusetts, I-195	2215
	Illinois I-55/I-70/I-270	2743
	New Jersey Atlantic City Expressway	796
Call Box - Voice, Wire		
	Michigan, I-94	\$2573
	New York, I-87	1560
	Illinois, I-80	2016
	California, LA Freeways	1615
	Delaware, I-95	7827
	Oklahoma, Turner Turnpike	98
	Pennsylvania, I-80	1583
Call Box - Voice, Radio		
	Florida, I-95/I-195	\$1788
	Connecticut, I-84/I-91	3100
Patrol		
	Illinois (Urban)	\$15580
	Ohio	3431
	Nebraska	652
	Tennessee	869

function. Both would also use panel mounted push button switches for calling. The add-on DA would also include a separate printed circuit board, case, and microphone connector hardware. The estimated costs of the add-on and in-radio DA's are \$43 and \$20, respectively, including provision for a profit of about 40 percent each. The cost details are shown in Table 7.

TABLE 7
DIGITAL ADAPTER COST ESTIMATE

<u>Item</u>	<u>Add-On DA</u>	<u>In-Radio DA</u>
Case	\$ 3	\$ 0
Hardware	8	4
Circuits	8	8
P.C. Board	2	0
Fabrication	10	2
Profit	12	6
Total	\$43	\$20

REFERENCES

- [1] Fullerton, I. J., J. H. Kell, and E. A. Aiona, Jr., "Notorist Aid System Study" DOT-FH-11-8745, JHK and Associates, August 1976.

- [2] Molnar, D. E., C. B. Shields, and D. D. Robinson, Driver-Aid System for Controlled-Access Rural Highway, Final Report Phase I, Battlle Memorial Institute, February 29, 1968.



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

October 19, 1978

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 20 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of September 1978. During the month work continued on Tasks D and E as reported below.

Task Effort

The effort on Tasks D and E continued with monitoring of the program, data collection, and analyses.

During the first of the month the central control unit equipment at the DeKalb County Police Headquarters was relocated to a console dedicated to special services - CB radio monitoring and fire and burglar alarms. This move required the installation of additional telephone cabling and the relocation of the microphone jack to the bottom of the chassis.

The technical manuals for the digital adapter, remote station, and central control unit were completed and draft copies are delivered with this report.

A summary of the calls received through September by the CB-AIDS system is listed below. Sixty nine percent of the calls received have been from interstate highways with 70 percent of these on I-285 and 30 percent on I-85.

<u>Category</u>	<u>Percentage</u>
Accident without injuries	32
Stalled vehicle - occupied	25
Information request	10
Accident with injuries	7
Traffic equipment malfunction	6
Reckless driver	5
Road obstruction	4
Stalled vehicle - unoccupied	3
Others	8

Work Planned for Next Month

During the next reporting period work will continue on data collection and reduction and preparation of report material in addition to normal system maintenance.

Management Information

The following gives the managerial and estimated financial status of the contract as of September 30, 1978.

a) Cumulative Costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	\$1,531	61,540
Task E	<u>10,160</u>	<u>1,448</u>	<u>7,712</u>
	\$178,300	\$2,979	\$172,596

b) Estimated cost to complete: \$5,704

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	39	1493
Principal Research Engineers D. W. Robertson H. H. Jenkins	8	195
Senior Research Engineer R. W. Moss	0	142
Assistant Research Engineers D. R. Sentz C. S. Wilson	0	1967

d) Percentage of work completed: see Figure 1.

Respectfully submitted,

R. W. Wallace
Principal Investigator

Approved:

D. W. Robertson, Director
Electronics Technology Laboratory

CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1 9 7 7												1 9 7 8					
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
Prepare Draft Program Plan and Schedule	■																	
FHWA Review	■																	
Prepare Final Program Plan		■																
FHWA Authorization to proceed		◆																
Receive Government Furnished Equipment	◆																	
TASK A	100%																	
A-1*		■																
A-2		■																
A-3			■															
A-4*			■															
A-5				■														
A-6				◆														
TASK B	100%																	
B-1		■																
B-2		■																

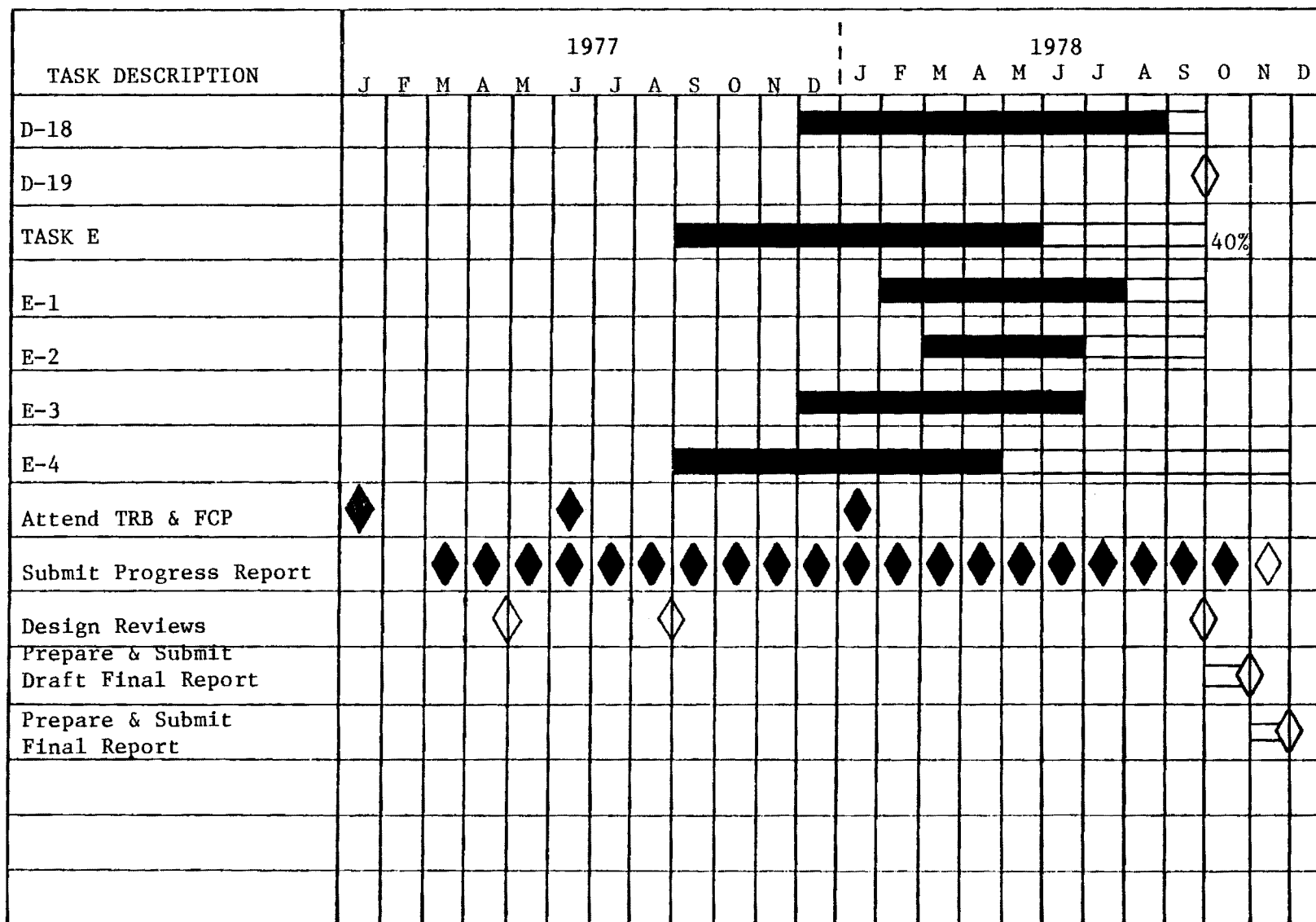
Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1 9 7 7												1 9 7 8						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
B-3																			
B-4																			
B-5																			
B-6*																			
B-7																			
B-8																			
TASK C																			
C-1																			
C-2*																			
C-3*																			
C-4																			
C-5																			
TASK D																			
D-1																			
D-2																			

Figure 1
CB-AID TASK SCHEDULE (continued)





ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

November 17, 1978

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 21 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of October 1978. During the month work continued on Tasks D and E as reported below. Discussions were held with FHWA on the possible addition of a third remote station and a six month extension of data collection. This work will be discussed further during the next month.

Task Effort

The effort on Tasks D and E continued with data collection and analyses and system maintenance. The primary effort consisted of central control unit, remote station, and digital adapter maintenance. Two users indicated problems with their digital adapters and brought them in for repair. The units were replaced by existing spares and will be checked out at a later date as time permits.

Preliminary data analysis indicates that user ratings of excellent or good voice quality predominate for distances from the remote stations up to about five kilometers. Beyond this distance, ratings of fair, poor, and unsatisfactory are indicated about as often as excellent and good ratings. Voice quality ratings also show variability with time of day. From 6 AM until 12 PM, excellent and good ratings predominate; from 12 PM until 5 PM, excellent ratings predominate; from 5 PM until 8 PM, good and fair ratings predominate; from 8 PM until 12 AM, excellent ratings again lead; and from 12 AM until 6 AM insufficient data exist for trend indication. These preliminary results indicate that for the locations used in the pilot program full time good quality coverage may be expected within a five kilometer radius of each remote station.

Work Planned for Next Month

During the next reporting period work will continue on data collection and analysis.

Management Information

The following information gives the managerial and estimated financial status of the contract as of October 31, 1978.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	291	61,831
Task E	<u>10,160</u>	<u>\$1,008</u>	<u>8,720</u>
Total	\$178,300	\$1,299	\$173,895

b) Estimated cost to complete: \$4,405

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	40	1533
Principal Research Engineer	0	195
Senior Research Engineer	0	142
Assistant Research Engineer	0	1967

d) Percentage of work completed: see Figure 1.

Respectfully submitted,

R. W. Wallace
Principal Investigator

APPROVED

D. W. Robertson, Director
Electronics Technology Laboratory

CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978							
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J		
Prepare Draft Program Plan and Schedule	■																			
FHWA Review	■																			
Prepare Final Program Plan	■																			
FHWA Authorization to proceed	◆																			
Receive Government Furnished Equipment	◆																			
TASK A	■	■	■	■	100%															
A-1*	■	■	■																	
A-2	■	■																		
A-3		■	■	■																
A-4*		■	■	■																
A-5			■	■																
A-6				◆																
TASK B	■	■	■	■	■	■	■	■	100%											
B-1	■	■	■	■																
B-2		■	■	■	■	■	■													

Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

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[illegible]

Figure 1
CB-AIDS TASK SCHEDULE (continued)

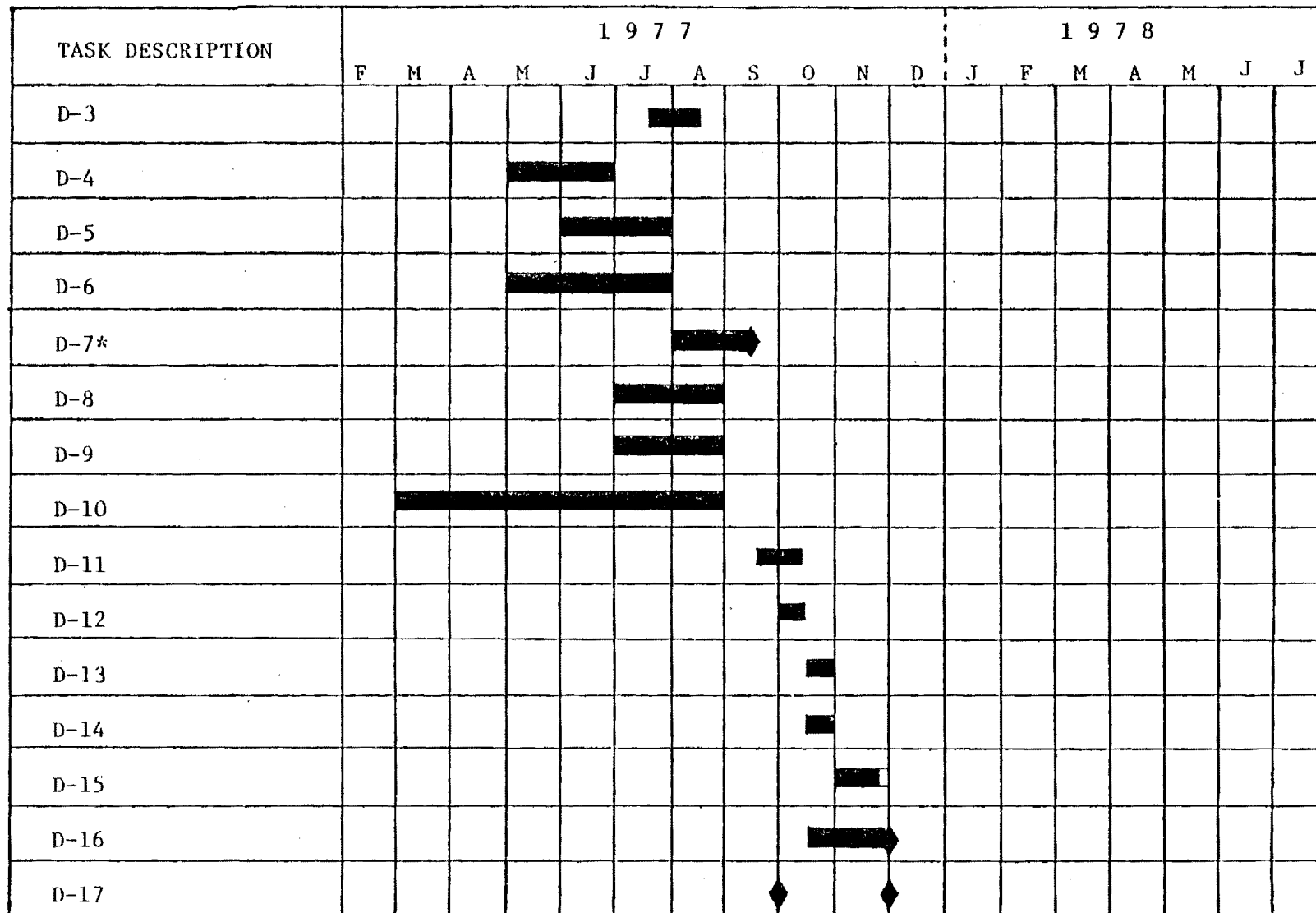
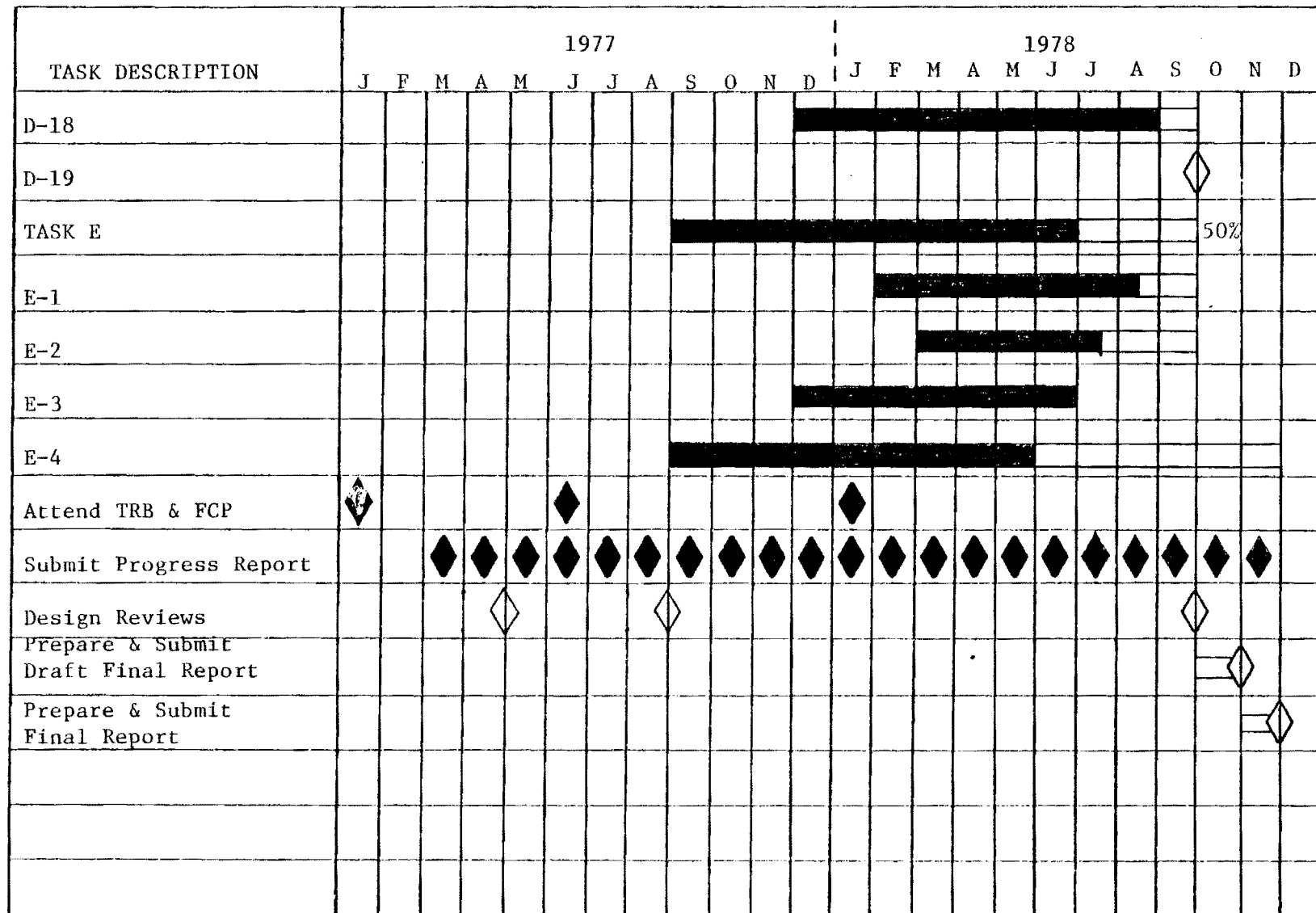


Figure 1
CB-AID TASK SCHEDULE (continued)





ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

A-1940

December 18, 1978

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 22 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of November 1978. During the month work continued on Tasks D and E as reported below.

A proposal to extend data collection by six months and to add a third remote station to the southern part of DeKalb County was submitted to FHWA. The third remote station would provide coverage of I-285 and I-20 in an area to the south of the DeKalb County Police Headquarters.

Task Effort

The effort on Tasks D and E continued with monitoring of the program, data collection, and analyses.

Data collected from CB-AIDS volunteers through the end of November are shown by the graphs included in Attachment A to this report. The first five figures are time versus distance plots of users reporting excellent, good, fair, poor, and unsatisfactory communications, respectively. These data were derived from the incident reports submitted by the users. Figure A-6 gives the cumulative distribution of voice quality reports versus distance for each of the ratings while Figure A-7 gives the cumulative distribution versus time of day. The slope of each curve is proportional to the probability density function for the indicated variable. These curves tend to verify good quality communications for a radius of five kilometers around the remote stations. Also the relative increase in less than good quality communications during the afternoon rush hours is indicated.

Work Planned for Next Month

During the next reporting period work will continue on data collection and reduction and preparation of report material in addition to normal system maintenance.

Management Information

The following gives the managerial and estimated financial status of the contract as of November 30, 1978.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	903	62,734
Task E	<u>10,160</u>	<u>730</u>	<u>9,450</u>
	\$178,300	\$1,633	\$175,528

b) Estimated cost to complete: \$2,772

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	48	1581
Principal Research Engineers D. W. Robertson H. H. Jenkins	0	195
Senior Research Engineer R. W. Moss	0	142
Assistant Research Engineers D. R. Sentz C. S. Wilson	0	1967

d) Percentage of work completed: see Figure 1.

Respectfully submitted,

R. W. Wallace
Principal Investigator

Approved:

D. W. Robertson, Director
Electronics Technology Laboratory

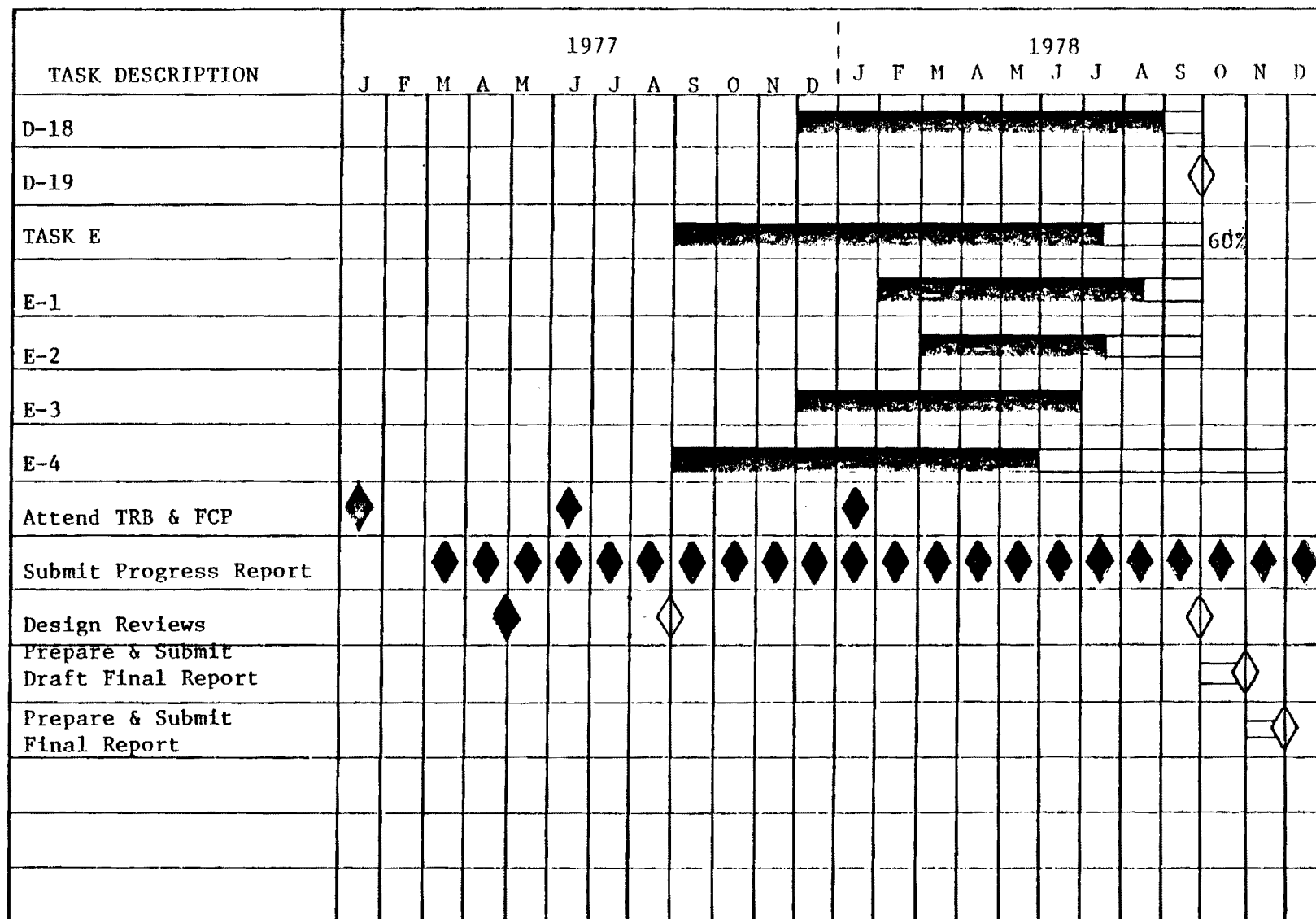
CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
Prepare Draft Program Plan and Schedule	■																		
FHWA Review	■																		
Prepare Final Program Plan		■																	
FHWA Authorization to proceed		◆																	
Receive Government Furnished Equipment	◆																		
TASK A	■■■■■■■■■■■■ 100%																		
A-1*		■■																	
A-2		■■																	
A-3			■■																
A-4*			■■																
A-5				■															
A-6				◆															
TASK B	■■■■■■■■■■■■■■■■■■■■ 100%																		
B-1	■■	■■	■■																
B-2		■■	■■	■■	■■	■■													

Notes:

1. ■■■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 1
CB-AID TASK SCHEDULE (continued)



ATTACHMENT A

CB-AIDS Communications Quality as Reported
By User Incident Reports

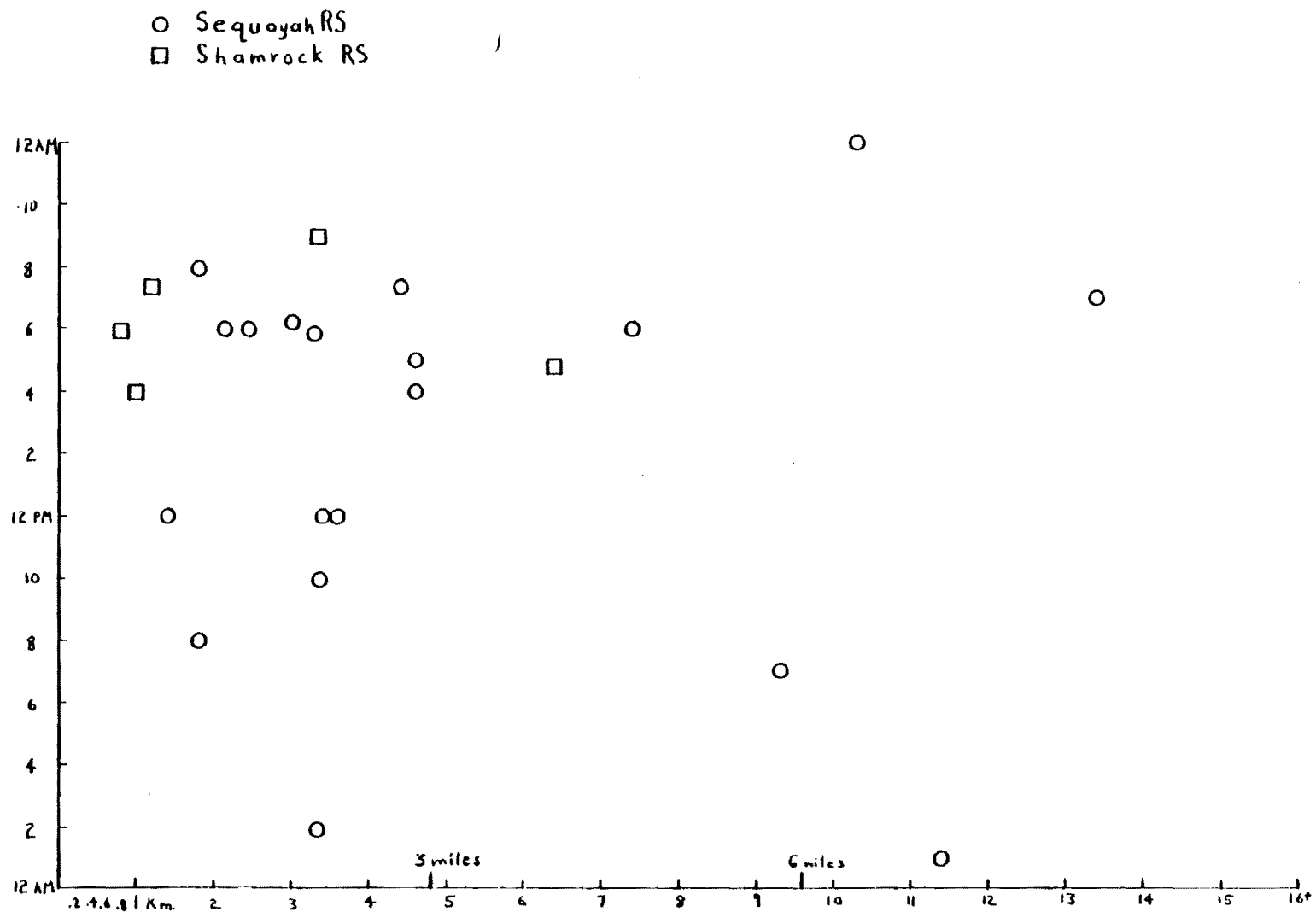


Figure A-2. Distribution of Volunteers Reporting Good Communications Quality

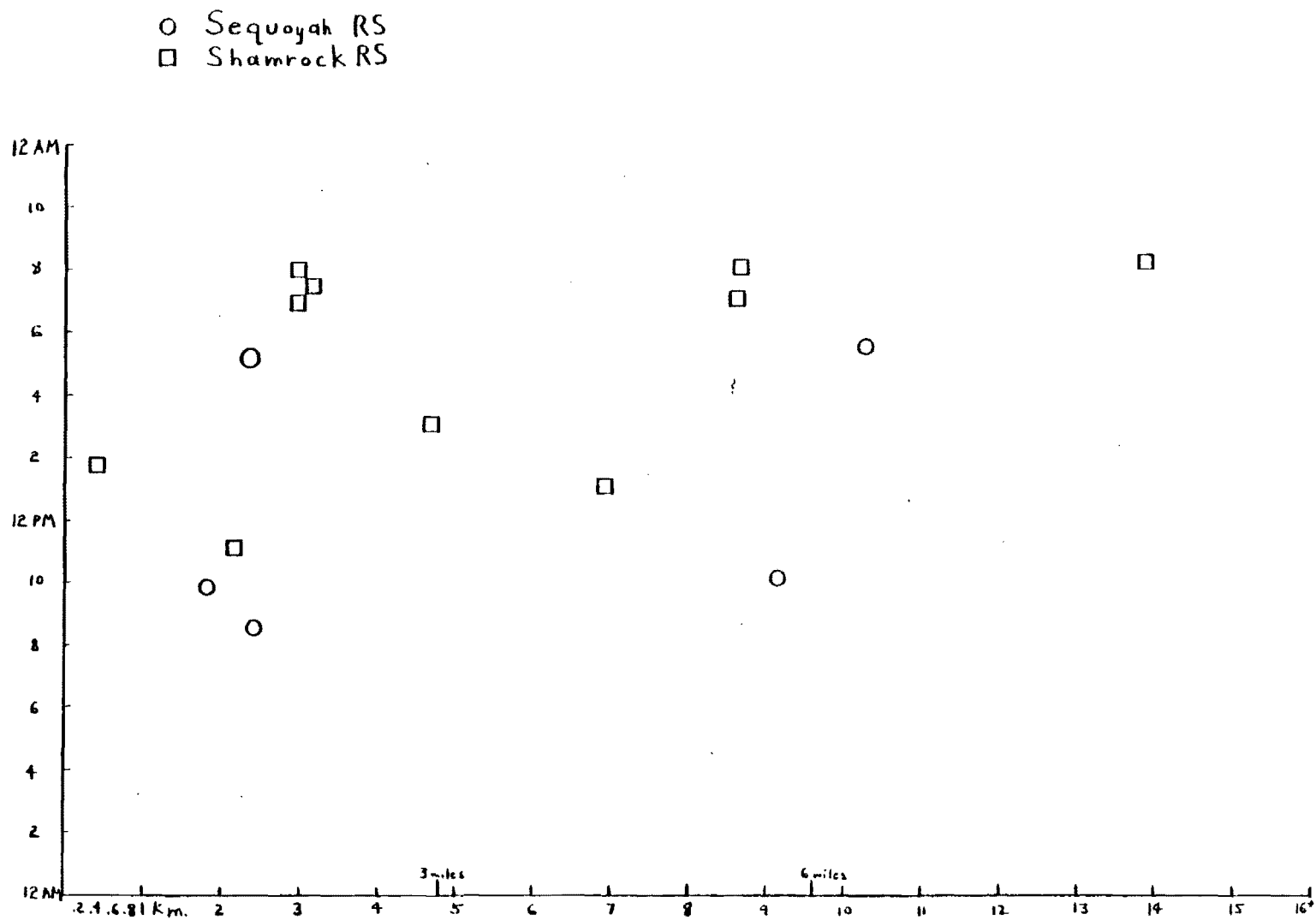


Figure A-3. Distribution of Volunteers Reporting Fair Communications Quality

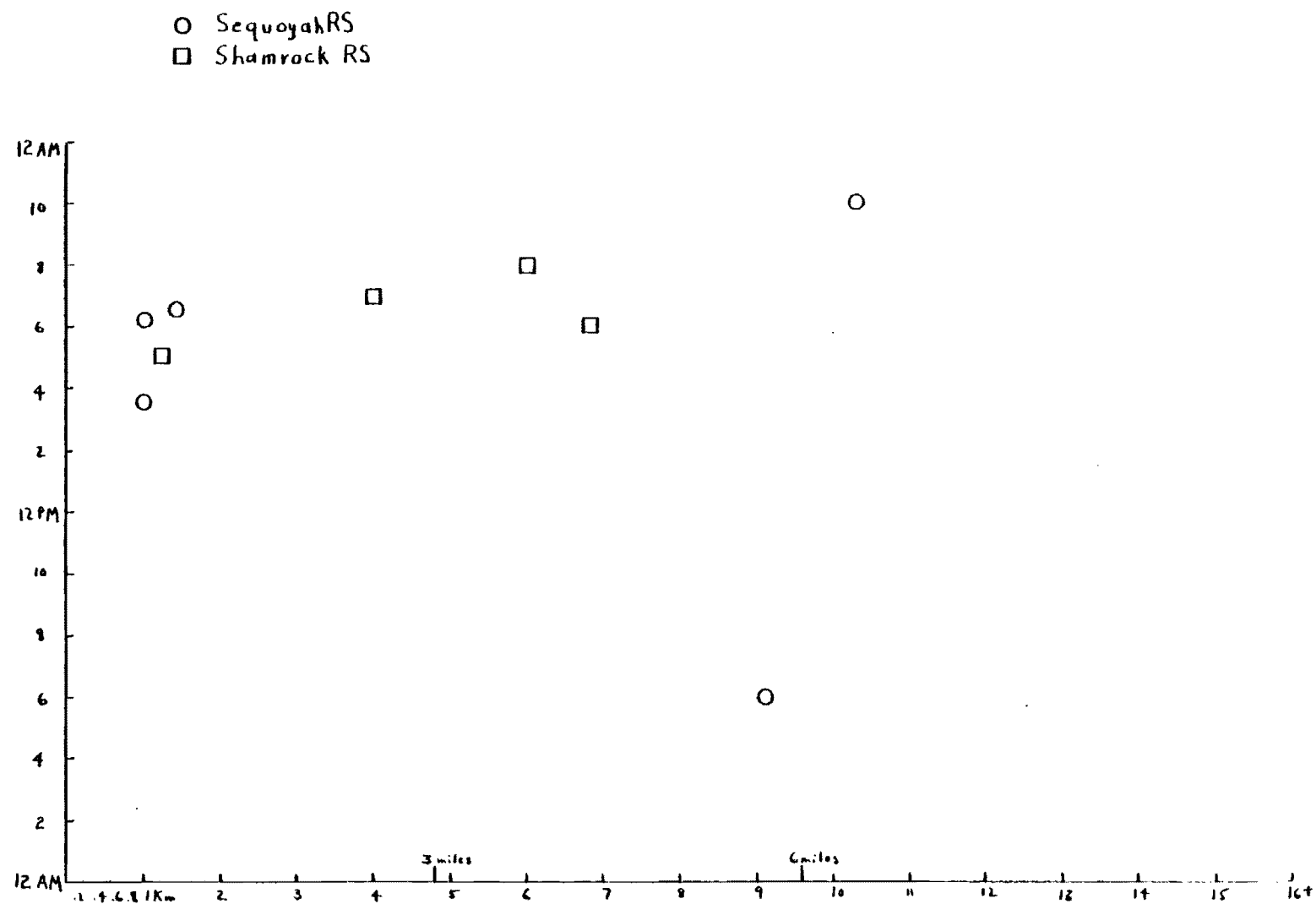


Figure A-4. Distribution of Volunteers Reporting Poor Communications Quality

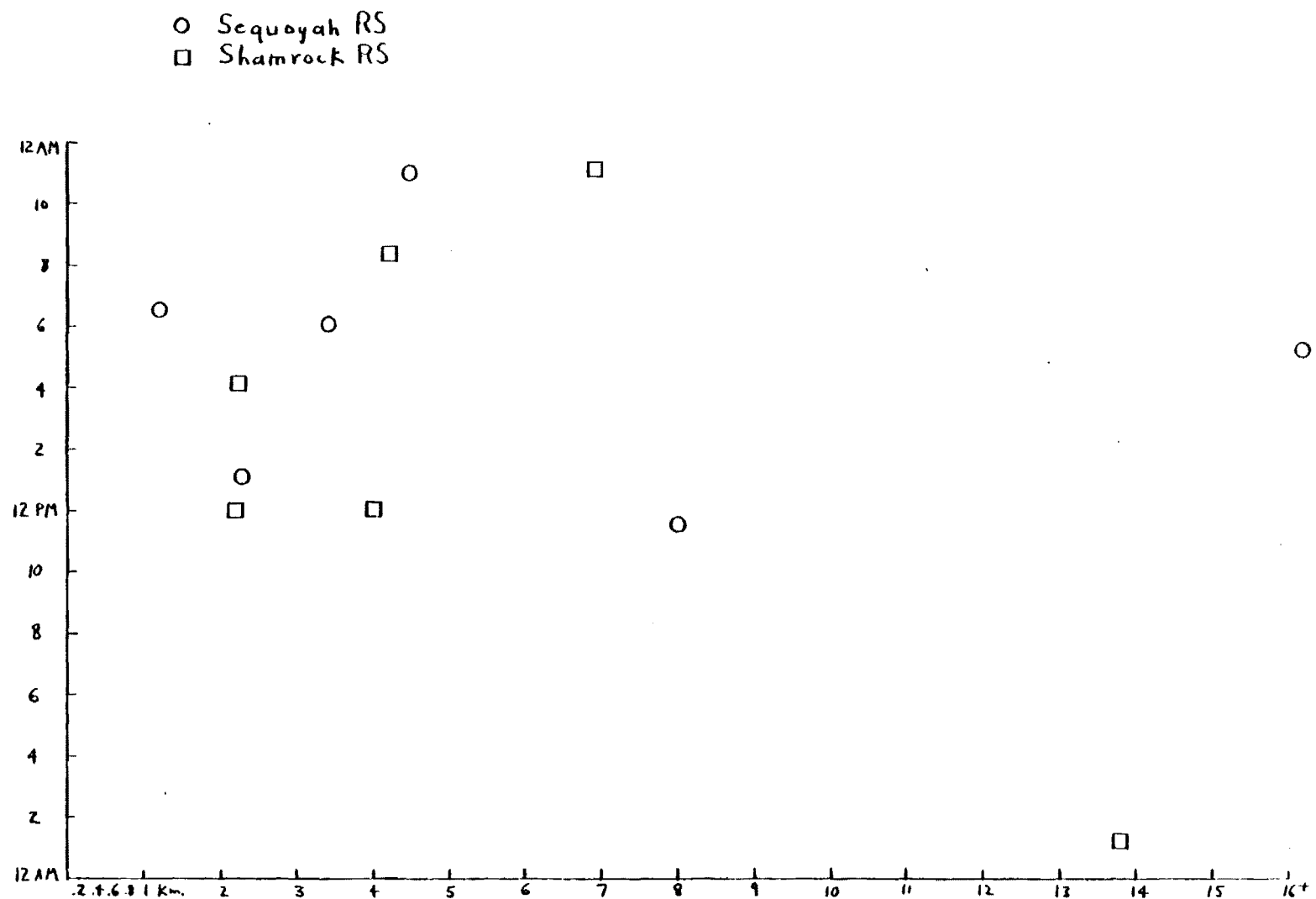


Figure A-5. Distribution of Volunteers Reporting Unsatisfactory Communications Quality

Number Reporting

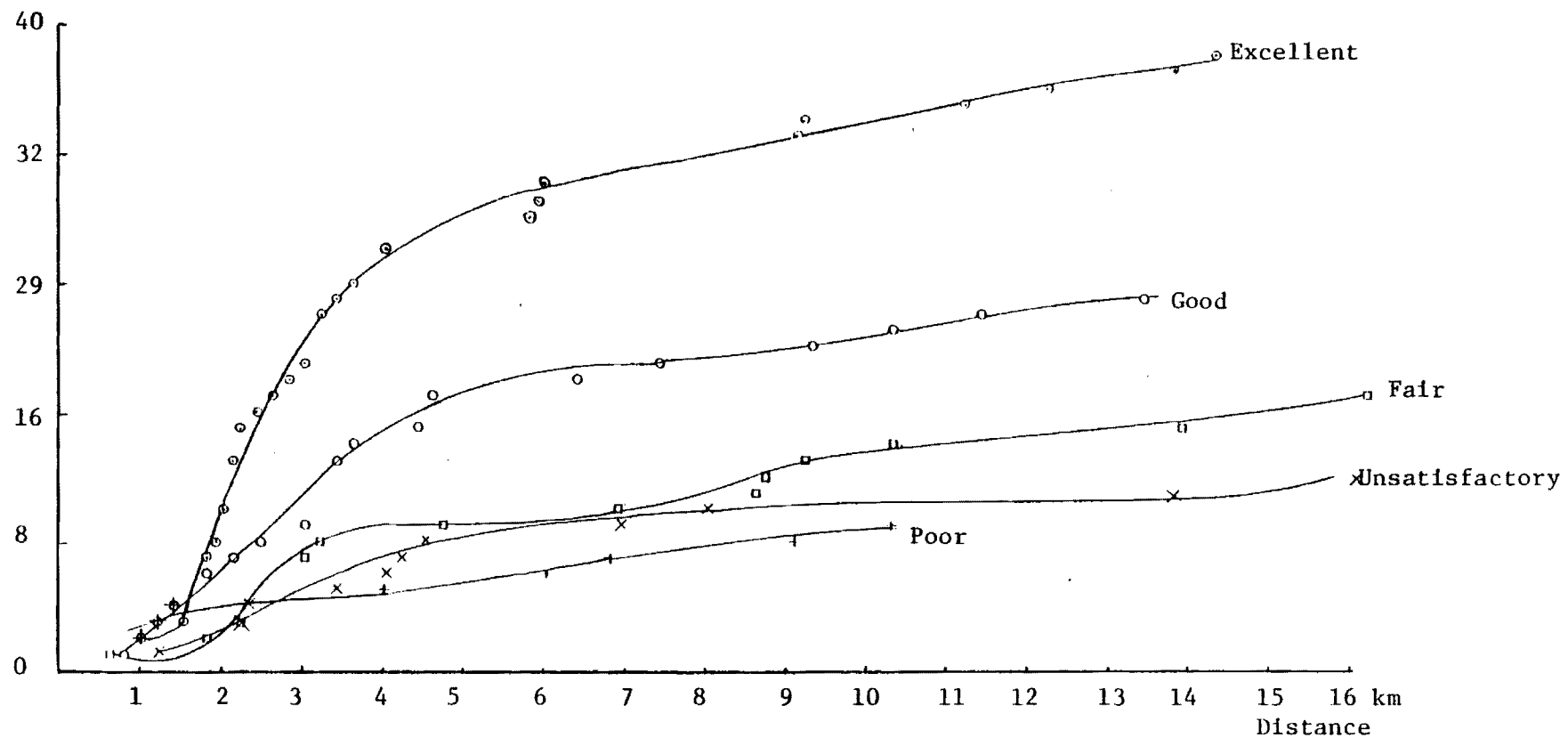


Figure A-6. Cumulative Distribution of Communications Quality Reports Versus Distance

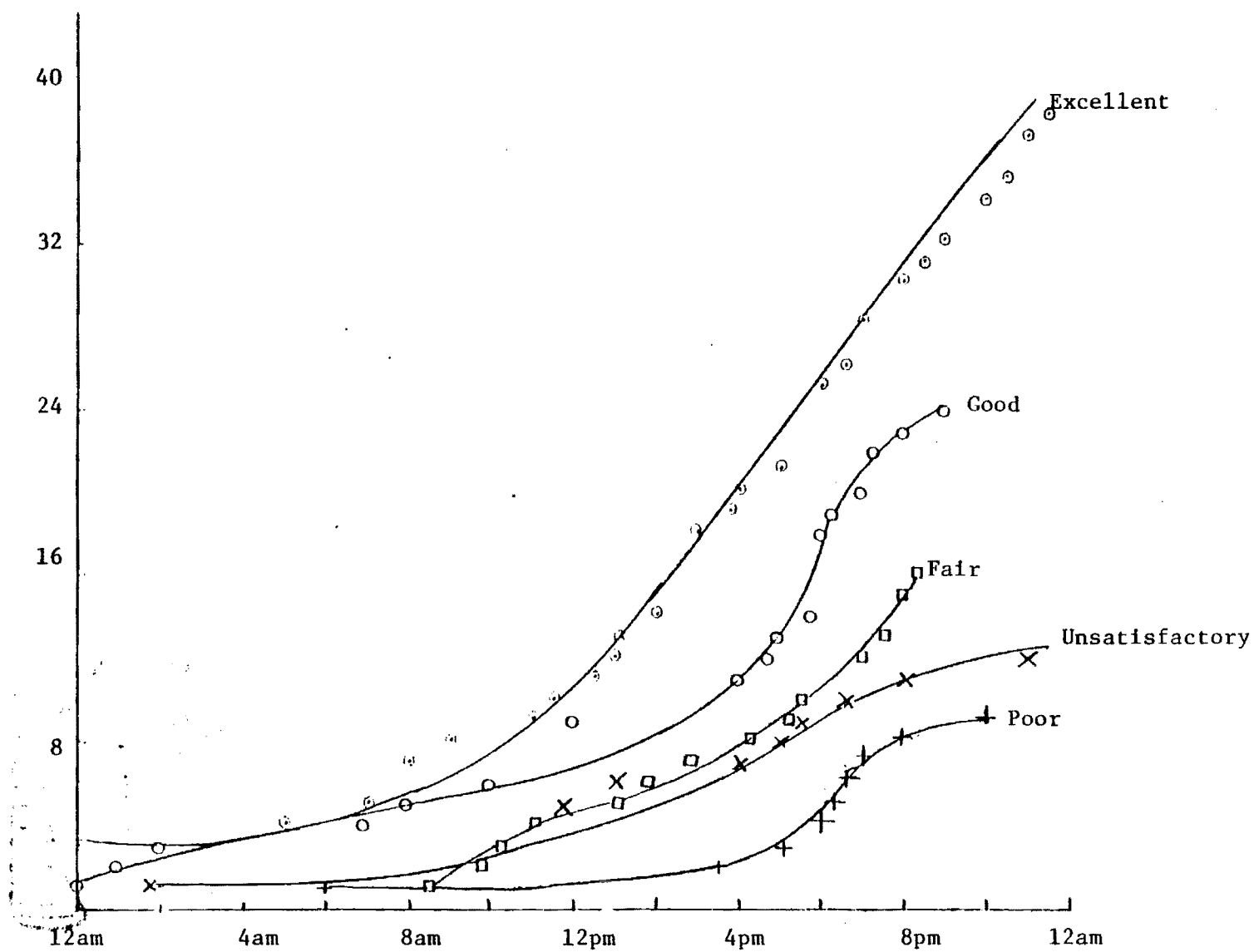


Figure A-7. Cumulative Distribution of Communications Quality Versus Time of Day.



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

January 26, 1979

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, DC 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 23 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of December 1978. During the month, work continued on Tasks D and E as reported below. In anticipation of the addition of a third remote station in the southern part of DeKalb County, four preliminary sites were selected and are shown by Figures A-1 through A-4 in Attachment A. The figures show the Atlanta metropolitan area with present remote station coverage indicated by the shaded circles. Coverage by the DeKalb County Police base station is shown by the unshaded circle. Coverage by the proposed remote station is shown by the dashed circle. The potential sites are:

- (1) Columbia High School
- (2) Georgia Association of Educators Building
- (3) Horis Ward Funeral Home
- (4) DeKalb College - South campus.

A request was sent to the FCC for a one year extension on the existing waiver for station KDZ 7830 and to include a third remote station. A copy of this request is included as Attachment B.

Task Effort

The effort on Tasks D and E continued with data collection and analyses and system monitoring.

Work Planned for Next Month

During the next reporting period, work will continue on data collection and analysis.

Management Information

The following information gives the managerial and estimated financial status of the contract as of December 30, 1978.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	325	63,059
Task E	<u>10,160</u>	<u>1,088</u>	<u>10,538</u>
Total	\$178,300	\$ 1,416	\$176,941

b) Estimated cost to complete: \$1,359 is required to complete the effort as presently authorized with \$24,988 additional required to add a third remote station and to extend the data collection by six months.

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	35	1616
Principal Research Engineer	0	195
Senior Research Engineer	0	142
Assistant Research Engineer	0	1967

d) Percentage of work completed: see Figure 1.

Respectfully submitted,

R. W. Wallace
Principal Investigator

APPROVED

D. W. Robertson, Director
Electronics Technology Laboratory

Attachment A

CB-AIDS Coverage with Various Sites for
Third Remote Station.

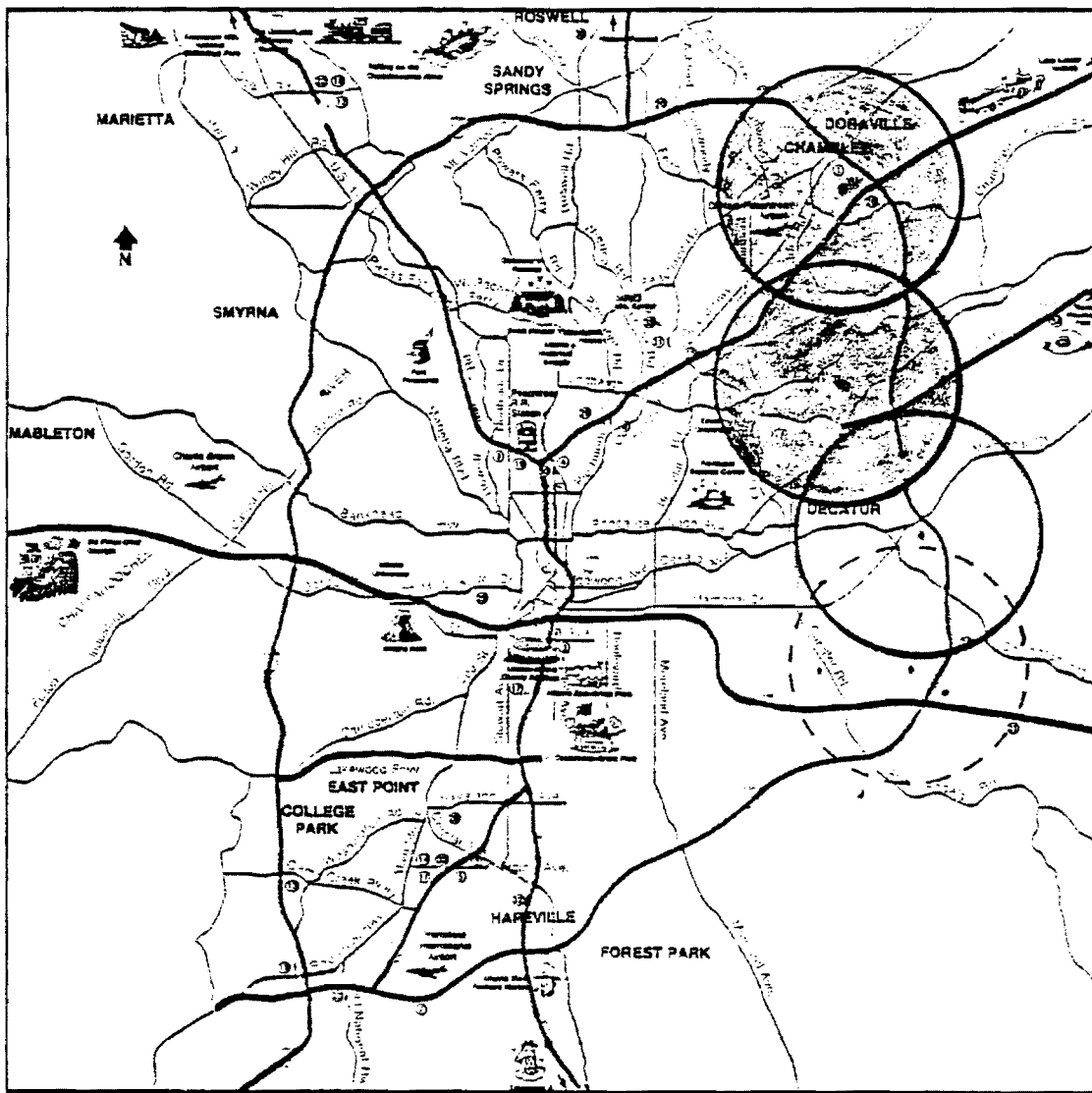


Figure A-1. CB-AIDS Coverage with Third RS at Columbia High School.

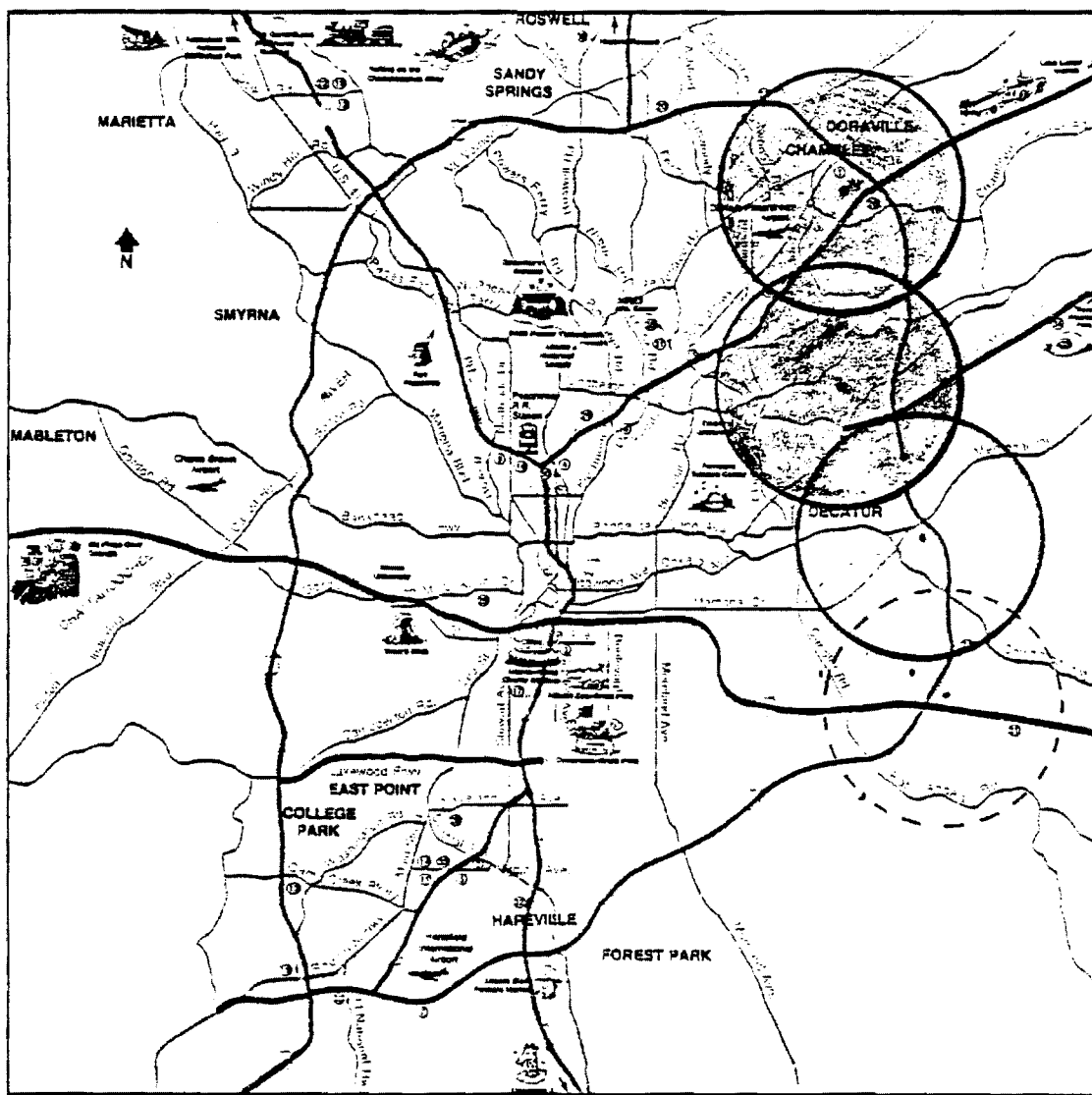


Figure A-2. CB-AIDS Coverage with Third RS at GAE Building.

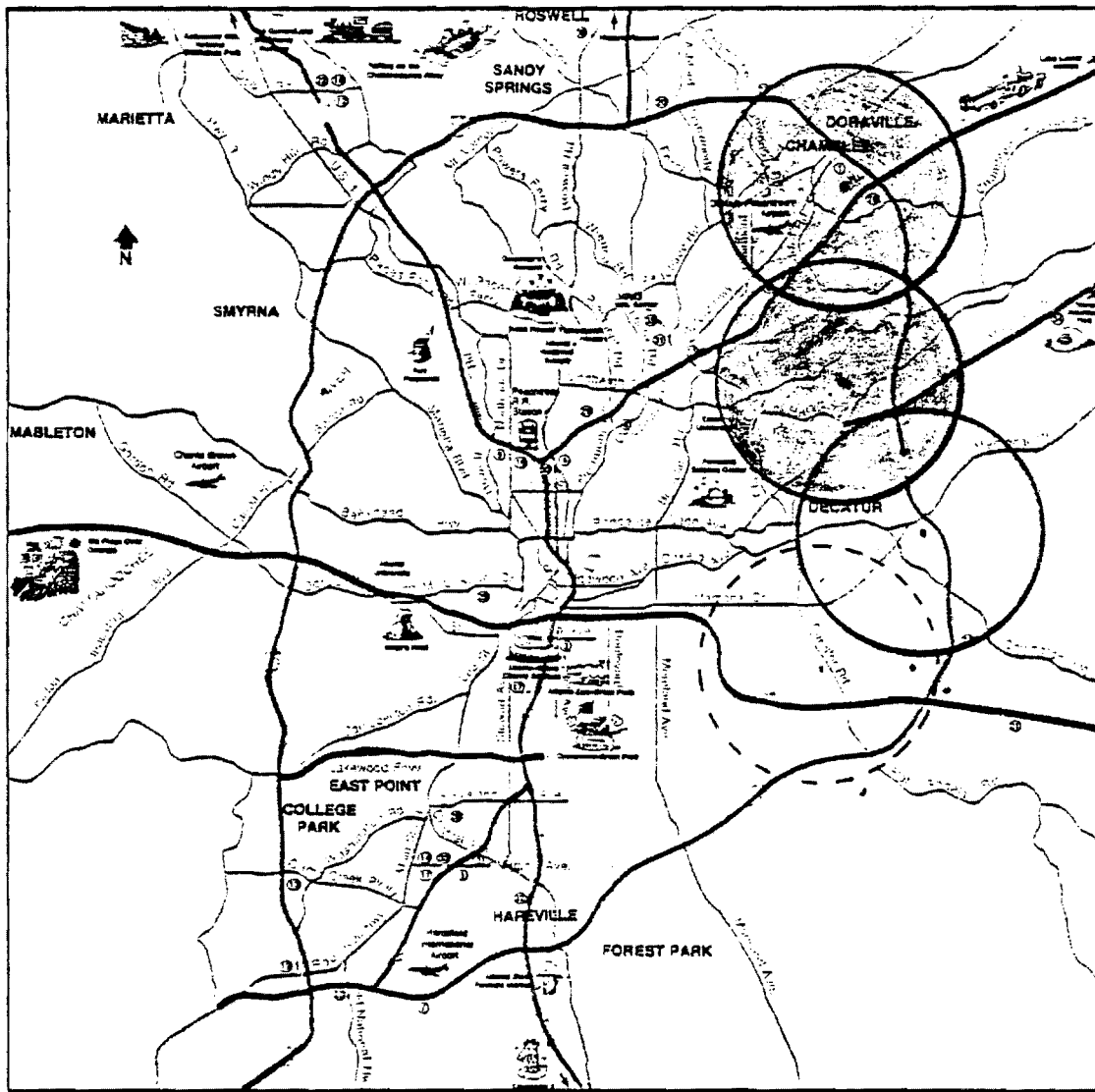


Figure A-3. CB-AIDS Coverage with Third RS at Horis Ward Funeral Home.

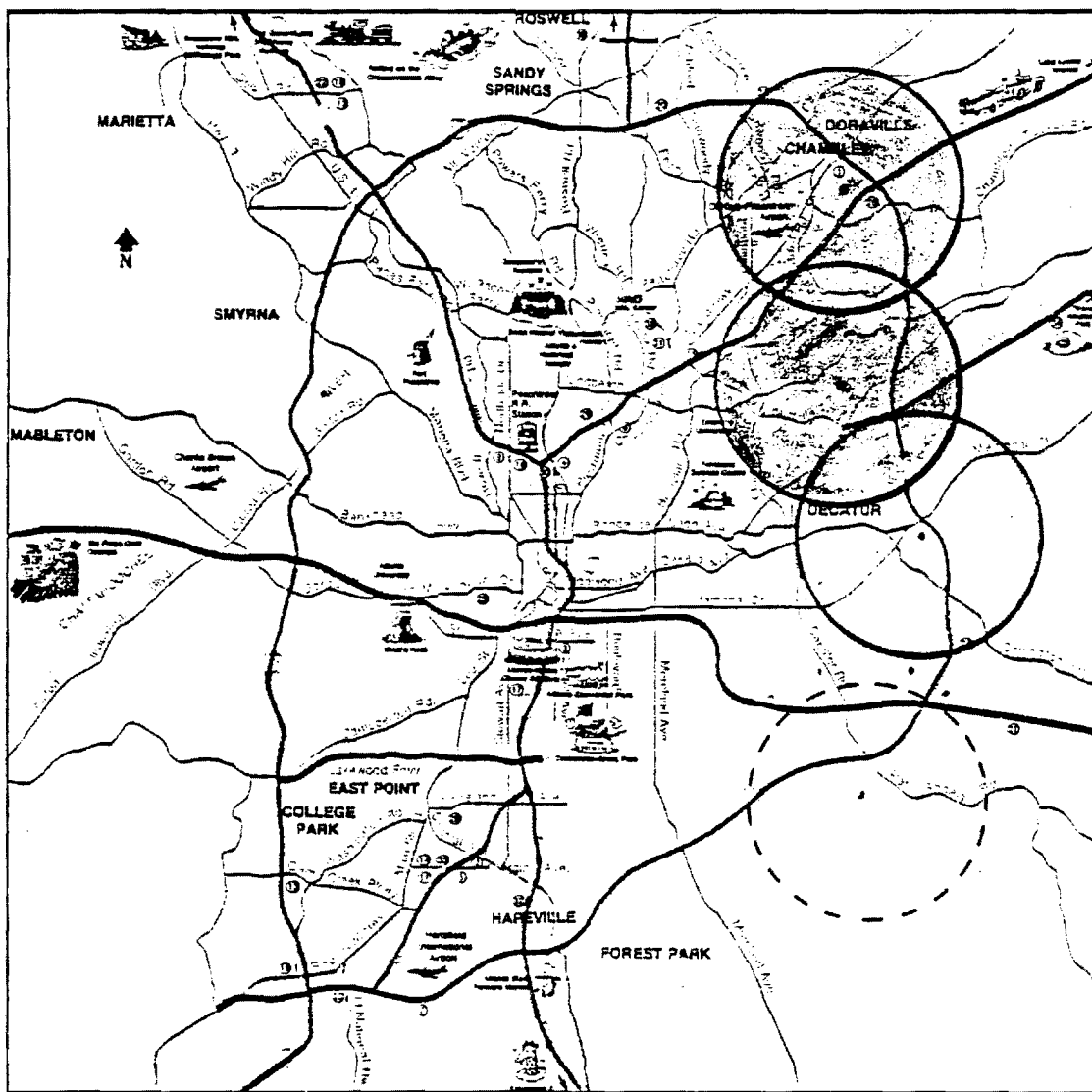
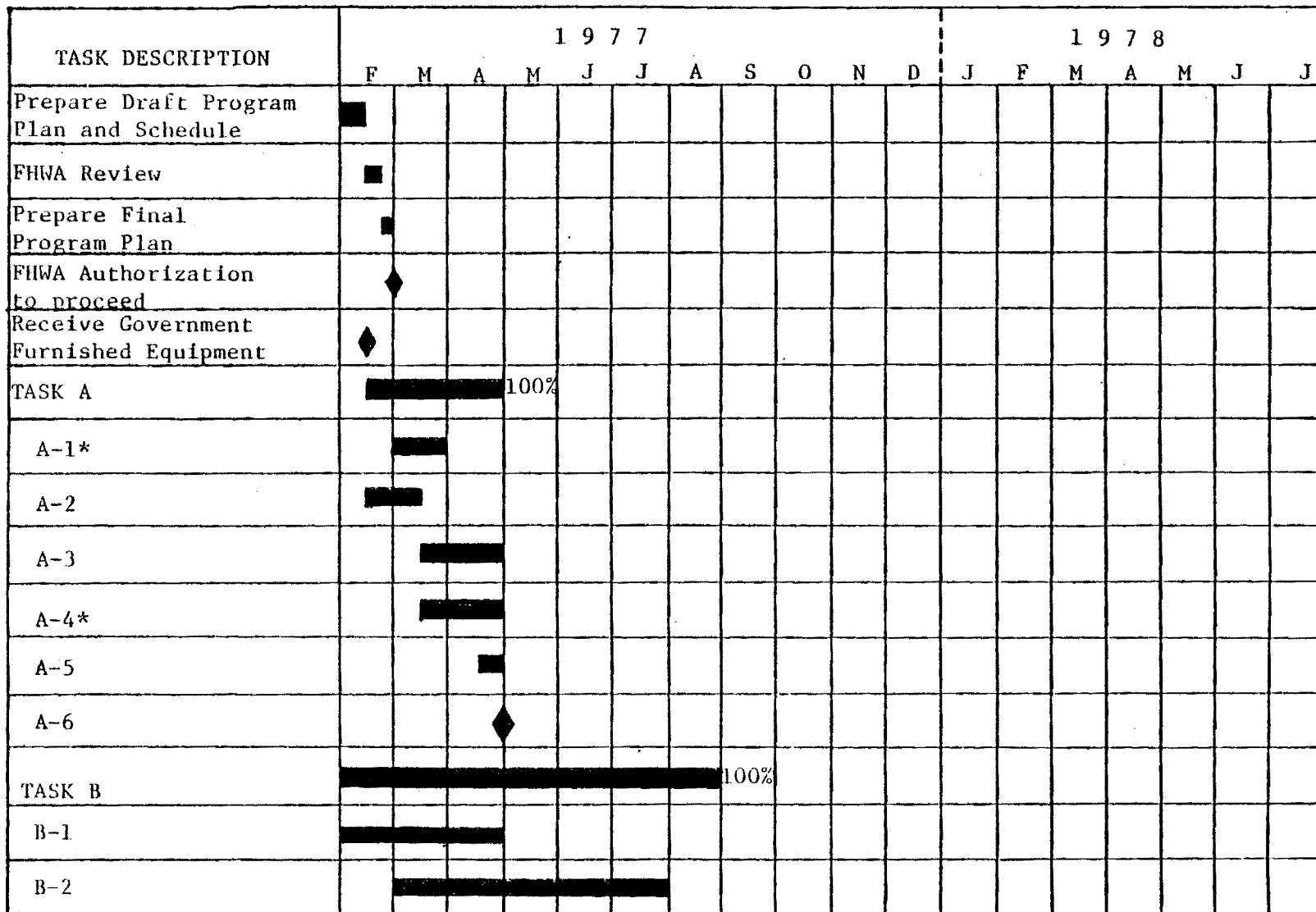


Figure A-4. CB-AIDS Coverage with Third RS at Dekalb College.

FIGURE 1
CB-AIDS TASK SCHEDULE



Notes:



1.  filled in portion indicates percentage of completion.
2.  indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 1
CB-AIDS TASK SCHEDULE (continued)

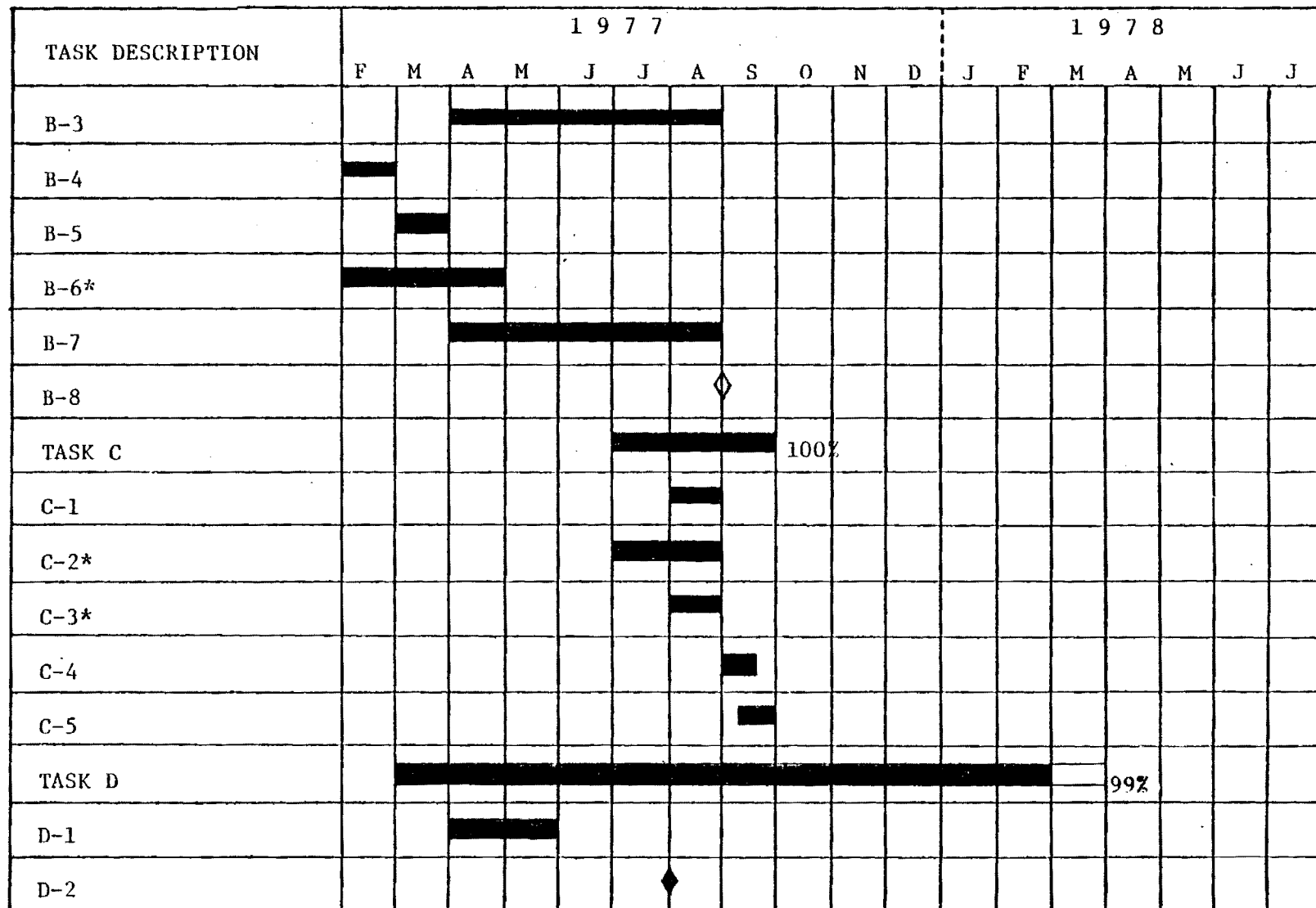


Figure 1
CB-AIDS TASK SCHEDULE (continued)

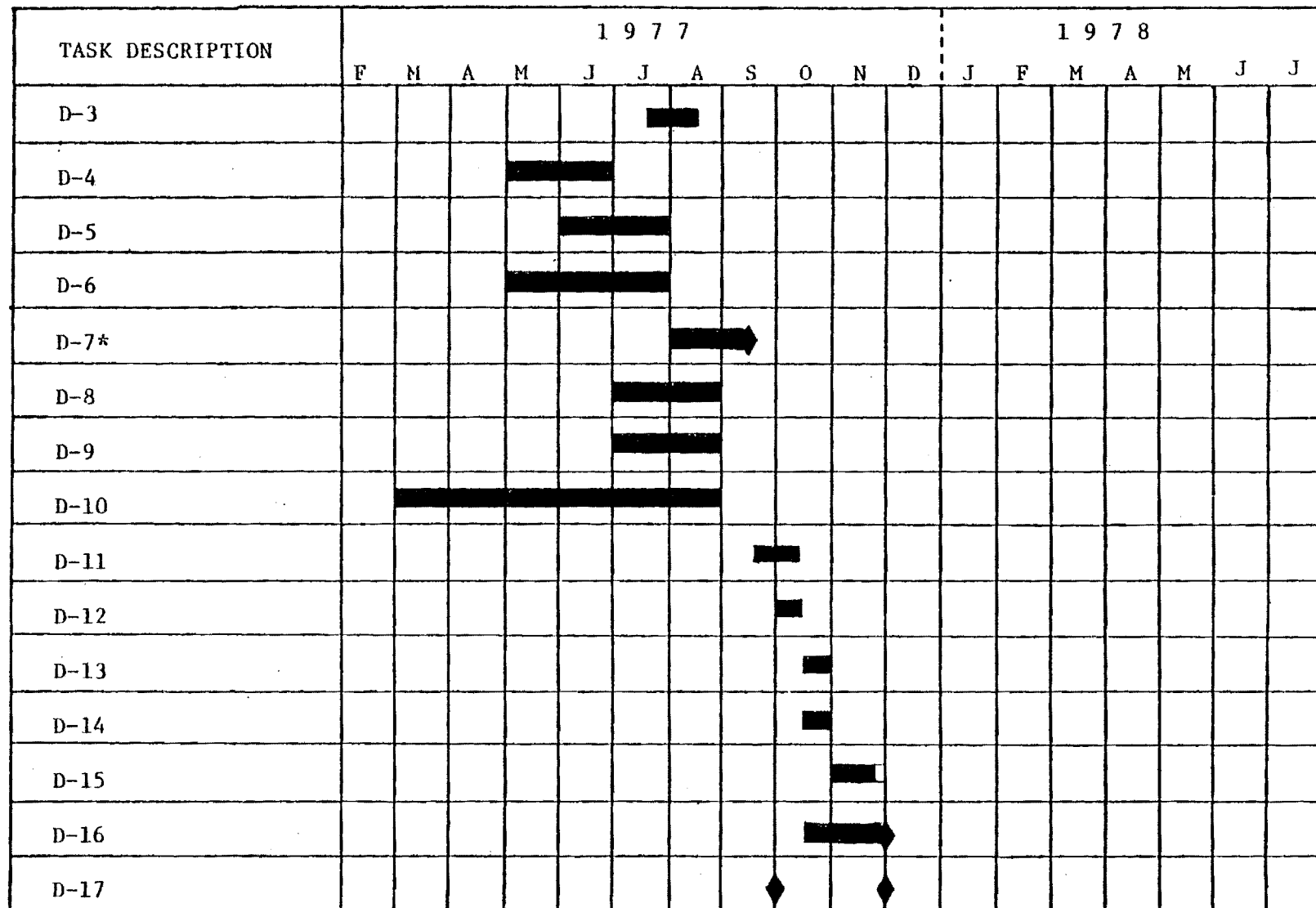
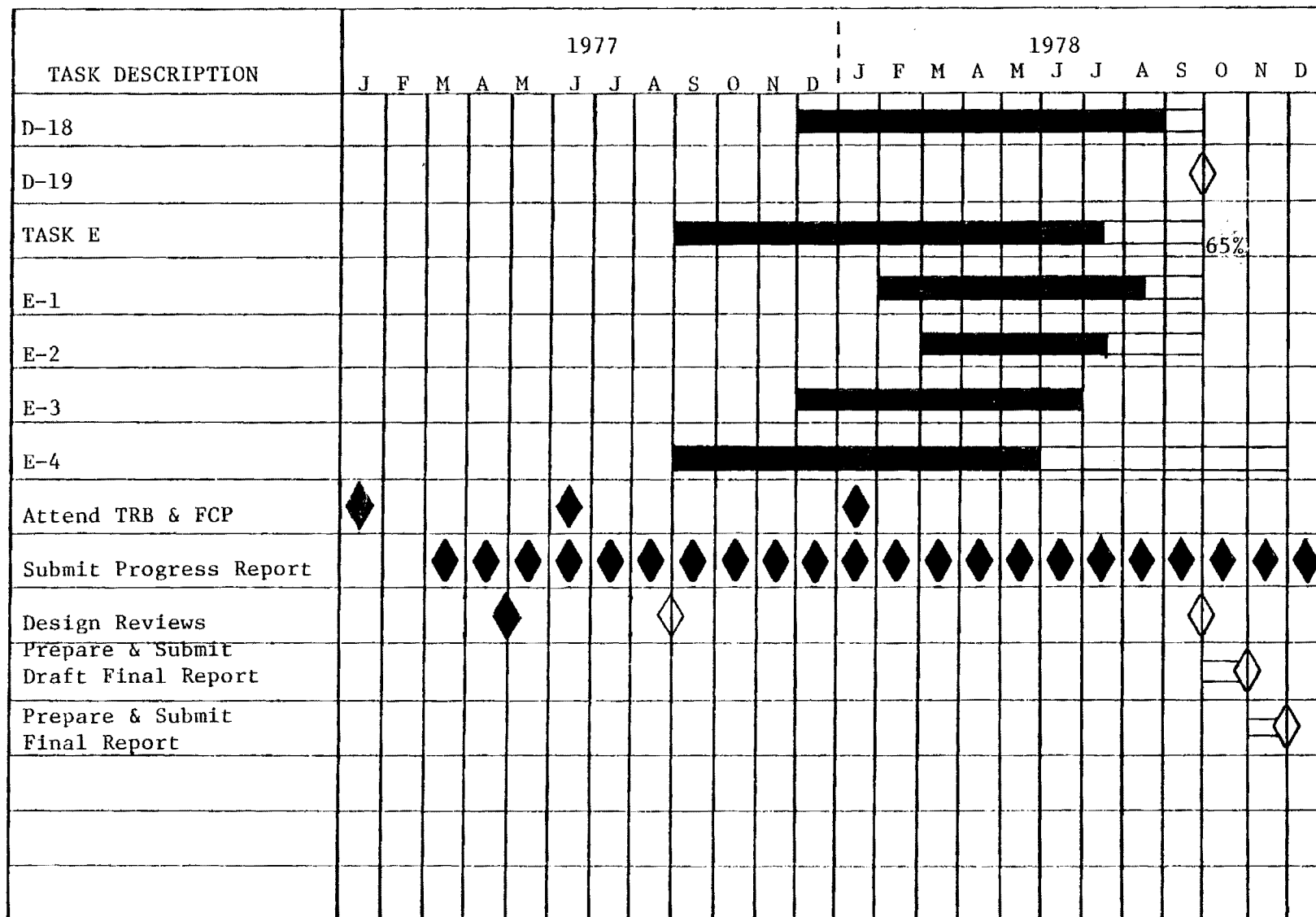


Figure 1
CB-AID TASK SCHEDULE (continued)



ATTACHMENT B

COPY OF LETTER TO FCC
REQUESTING EXTENSION OF WAIVER
FOR CB-AIDS

(without enclosures)



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

December 13, 1978

Federal Communications Commission
Safety and Special Radio Service Bureau
Washington, D.C. 20554

Attention: Mr. Carlos V. Roberts, Bureau Chief

Reference: 7526, CB Radio Station KDZ 7830

Gentlemen:

The Georgia Institute of Technology requests an extension of Special Temporary Authority for tone modulated signal operation over CB radio station KDZ7830 (Reference 7526, copy attached) for the period through December 31, 1979. This will allow an additional period for gathering more data for the CB-AIDS pilot program as requested by the Federal Highway Administration.

Permission is also requested for the installation of a third remote controlled station operating on CB channel 9 (27.065 MHz). This station would be number three in the following list.

<u>Remote Station Number</u>	<u>Location</u>	<u>Elevation</u>	<u>Latitudes/ Longitudes</u>
1	Shamrock High School Decatur, Ga.	311m (1020ft)	33° 48' 30" 84° 16' 25"
2	Sequoyah High School Doraville, Ga.	290m (950ft)	33° 53' 30" 85° 30' 00"
3	Columbia High School Decatur, Ga.	293m (960ft)	33° 41' 40" 84° 14' 40"

If you need any additional information please call the undersigned at (404) 894-3544.

Sincerely,

R. W. Wallace
Principal Investigator
CB-AIDS Program

cc: A. Becker
P. Oliver

Enclosure

A-1940



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

February 27, 1979

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 24 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of January 1979. During the month, work continued on Tasks D and E as reported below.

Task Effort

The effort on Tasks D and E continued with data collection and analyses and system monitoring. Task F was initiated with remote station site selection and hardware construction.

Work Planned for Next Month

During the next reporting period, work will continue on data collection and analysis and remote station construction.

FCC authorization was received to operate the remote stations through December 1979. Approval was received from the principal of Columbia High School to install the third remote station at that location.

Management Information

The following information gives the managerial and estimated financial status of the contract as of January 31, 1979.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	20,648	0	20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	102	63,161
Task E	10,160	270	10,808
Task F	24,988	2,964	2,964
Total	\$203,288	\$3,336	\$180,277

b) Estimated cost to complete: \$23,011

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended* Total</u>
Principal Investigator R. W. Wallace	56	1789
Principal Research Engineer	0	209
Senior Research Engineer	0	152
Assistant Research Engineer C. S. Wilson	68	2241

d) Percentage of work completed: see Figure 1.

Respectfully submitted,

R. W. Wallace
Principal Investigator

APPROVED:

D. W. Robertson, Director
Electronics Technology Laboratory

*Hours have been adjusted upward by seven percent to account for cumulative round-off error.

CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
Prepare Draft Program Plan and Schedule	■																		
FHWA Review	■																		
Prepare Final Program Plan		■																	
FHWA Authorization to proceed		◆																	
Receive Government Furnished Equipment	◆																		
TASK A	100%																		
A-1*		■																	
A-2	■																		
A-3		■																	
A-4*		■																	
A-5			■																
A-6				◆															
TASK B	100%																		
B-1	■																		
B-2		■																	

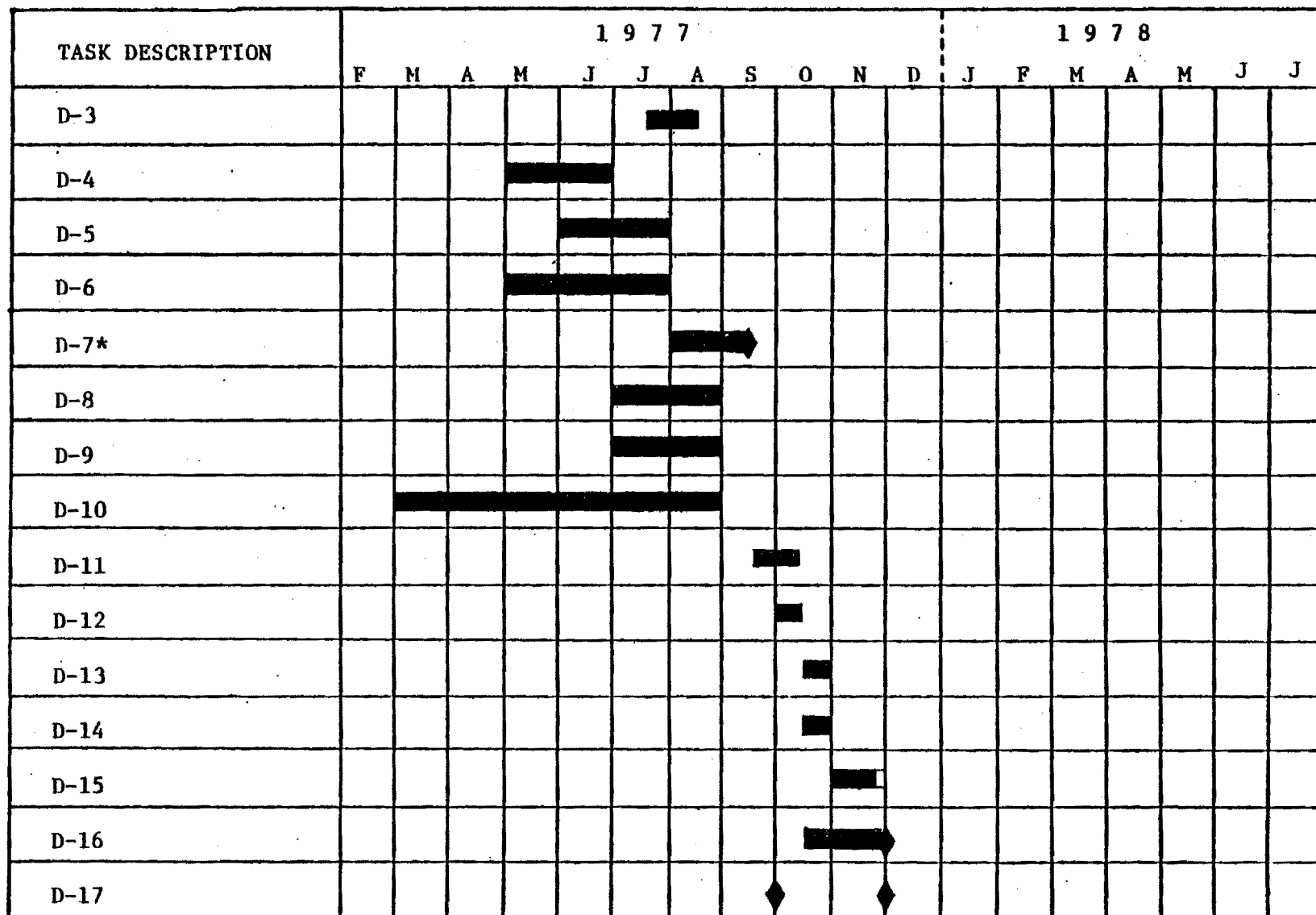
Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

之

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Figure 1
CB-AIDS TASK SCHEDULE (continued)



[illegible]



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

June 14, 1979

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 25 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-9232 for the month of February 1979. During the month, work continued on Tasks D, E, and F as reported below.

Task Effort

The effort on Tasks D and E continued with data collection and analyses and system monitoring. Task F was initiated with remote station site selection and hardware construction. Under Task F work is beginning on the additional remote station with major emphasis directed to issuing purchase orders for the necessary materials and supplies for equipment fabrication.

Work Planned for Next Month

During the next reporting period, work will continue on data collection and analysis and on acquisition of supplies for remote station fabrication. It is expected that some efforts can be directed to initial fabrication with use of parts on-hand and with those materials which can be quickly acquired.

Management Information

The following information gives the managerial and estimated financial status of the contract as of February 28, 1979.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	125	63,286
Task E	10,160	285	11,093
Task F	24,988	5,325	8,289
Total	\$203,288	\$5,735	\$186,012

Mr. Frank Mammano
June 14, 1979
Page 2

b) Estimated cost to complete: \$17,276

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended* Total</u>
Principal Investigator R. W. Wallace	39	1828
Principal Research Engineer	0	209
Senior Research Engineer	17	169
Research Engineer C. S. Wilson	94	2335

d) Percentage of work completed: see Figure 1.

Respectfully submitted,

R. W. Wallace
Principal Investigator

APPROVED:

D. W. Robertson, Director
Electronic Technology Laboratory

TASK DESCRIPTION	1977												1978							
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J		
Prepare Draft Program Plan and Schedule	■																			
FHWA Review	■																			
Prepare Final Program Plan		■																		
FHWA Authorization to proceed		◆																		
Receive Government Furnished Equipment	◆																			
TASK A	■■■■■■■■■■■■ 100%																			
A-1*		■■■■																		
A-2		■■■■																		
A-3			■■■■■■																	
A-4*			■■■■■■																	
A-5				■																
A-6				◆																
TASK B	■■■■■■■■■■■■■■■■■■■■ 100%																			
B-1	■■■■	■■■■	■■■■																	
B-2		■■■■■■■■■■■■■■■■■■■■																		

Notes:

1. ■■■■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

TASK DESCRIPTION	1977												1978						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
B-3			■	■	■	■	■												
B-4	■	■																	
B-5		■	■																
B-6*	■	■	■																
B-7			■	■	■	■	■												
B-8							◆												
TASK C						■	■	■	100%										
C-1							■	■											
C-2*						■	■	■											
C-3*							■	■											
C-4								■											
C-5								■											
TASK D		■	■	■	■	■	■	■	■	■	■	■	■	■	99%				
D-1			■	■	■														
D-2						◆													

٢

TASK DESCRIPTION	1977												1978						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
D-3																			
D-4																			
D-5																			
D-6																			
D-7*																			
D-8																			
D-9																			
D-10																			
D-11																			
D-12																			
D-13																			
D-14																			
D-15																			
D-16																			
D-17																			

[illegible]

A-1940



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

June 15, 1979

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 26 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-9232 for the month of March 1979. During the month, work continued on Tasks D, E, and F as reported below.

Task Effort

The effort on Tasks D and E continued with data collection and analyses and system monitoring. The major project efforts have been directed to Task F with specific emphasis on fabrication of the new remote station. All needed materials and supplies were ordered last month and during the current month a substantial portion of the supplies have been received; as a result, it has been possible to at least begin the fabrication process. It is expected that essentially all required materials and supplies will be delivered during the coming month.

Work Planned for Next Month

During the next reporting period, work will continue on data collection and analysis and remote station construction. We expect to make considerable progress toward fabrication of the new remote station during the coming month if no difficulties are encountered in acquisition of materials and supplies.

Management Information

The following information gives the managerial and estimated financial status of the contract as of March 31, 1979.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	90	63,376
Task E	10,160	175	11,268
Task F	24,988	3,722	12,011
Total	\$203,288	\$3,987	\$189,999

Mr. Frank Mammano
June 15, 1979
Page 2

b) Estimated cost to complete: \$13,289

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended* Total</u>
Principal Investigator R. W. Wallace	34	1862
Principal Research Engineer	0	209
Senior Research Engineer	0	169
Research Engineer C. S. Wilson	58	2393

d) Percentage of work completed: see Figure 1.

Respectfully submitted,

R. W. Wallace
Principal Investigator

APPROVED:

D. W. Robertson, Director
Electronic Technology Laboratory

TASK DESCRIPTION	1977												1978							
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J		
Prepare Draft Program Plan and Schedule	■																			
FHWA Review	■																			
Prepare Final Program Plan		■																		
FHWA Authorization to proceed		◆																		
Receive Government Furnished Equipment	◆																			
TASK A	■■■■■■■■■■ 100%																			
A-1*		■■■■																		
A-2		■■■■																		
A-3			■■■■																	
A-4*			■■■■																	
A-5				■■																
A-6					◆															
TASK B	■■■■■■■■■■■■■■■■■■■■ 100%																			
B-1	■■■■■■■■■■																			
B-2		■■■■■■■■■■■■■■■■■■■■																		

Notes:

1. ■■■■■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

CB-AIDS TASK SCHEDULE (continued)[illegible]

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978					
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
D-3																		
D-4																		
D-5																		
D-6																		
D-7*																		
D-8																		
D-9																		
D-10																		
D-11																		
D-12																		
D-13																		
D-14																		
D-15																		
D-16																		
D-17																		

[illegible]



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

June 18, 1979

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 27 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-9232 for the month of April 1979. During the month, work continued on Tasks D, E, and F as reported below.

Task Effort

During the current month, project efforts have continued on Tasks D, E and F, with major emphasis directed to Task F. Fabrication of the new remote station continues. We have encountered some difficulties in acquiring a few of the needed supplies. However, we are attempting to shorten these potential delivery times while simultaneously searching for alternate vendors or for satisfactory substitutes.

Work Planned for Next Month

During the next reporting period, work will continue on data collection and analysis and on acquisition of supplies for remote station construction. It is expected that fabrication of the new remote station can be completed, or near-completed, during the coming month.

Management Information

The following information gives the managerial and estimated financial status of the contract as of April 30, 1979.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	150	63,526
Task E	10,160	223	11,491
Task F	24,988	2,811	14,822
Total	\$203,288	\$3,184	\$193,183

Mr. Frank Mammano
June 18, 1979
Page 2

b) Estimated cost to complete: \$10,105

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended* Total</u>
Principal Investigator R. W. Wallace	34	1896
Principal Research Engineer	0	209
Senior Research Engineer	0	169
Research Engineer C. S. Wilson	58	2451

d) Percentage of work completed: see Figure 1.

Respectfully submitted,

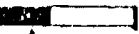

R. W. Wallace
Principal Investigator

APPROVED:

D. W. Robertson, Director
Electronic Technology Laboratory

TASK DESCRIPTION	1977												1978							
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J		
Prepare Draft Program Plan and Schedule	■																			
FHWA Review	■																			
Prepare Final Program Plan	■																			
FHWA Authorization to proceed	◆																			
Receive Government Furnished Equipment	◆																			
TASK A	██████████ 100%																			
A-1*		██████																		
A-2		██████																		
A-3			██████																	
A-4*			██████																	
A-5				██																
A-6				◆																
TASK B	██████████ 100%																			
B-1	██████	██████	██████																	
B-2		██████	██████	██████	██████															

Notes:

1.  filled in portion indicates percentage of completion.
2.  indicates milestone event.
3. * indicates substantial external factors in subtask.

CD-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1 9 7 7												1 9 7 8							
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J		
B-3			█	█	█	█	█	█												
B-4	█	█																		
B-5		█	█																	
B-6*	█	█	█	█																
B-7			█	█	█	█	█	█												
B-8								◆												
TASK C						█	█	█	█	█	█	100%								
C-1							█	█												
C-2*						█	█	█												
C-3*							█	█												
C-4								█	█											
C-5								█	█											
TASK D		█	█	█	█	█	█	█	█	█	█	█	█	█	█	99%				
D-1			█	█	█															
D-2							◆													

— 254 —

TASK DESCRIPTION	1977												1978					
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
D-3																		
D-4																		
D-5																		
D-6																		
D-7*																		
D-8																		
D-9																		
D-10																		
D-11																		
D-12																		
D-13																		
D-14																		
D-15																		
D-16																		
D-17																		

TASK DESCRIPTION	1977						1978								1979									
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
D-18																								
D-19																								
Task E																								83%
E-1																								
E-2																								
E-3																								
E-4																								
Task F																								25%
F-1																								
F-2																								
F-3																								
F-4																								
F-5																								
Submit Progress Report	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◇	◇	◇	
Final Report																					P	E	>	



ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

August 23, 1979

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 28 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-9232 for the month of May 1979. During the month, work continued on Tasks D, E, and F as reported below.

Task Effort

During the current month, project efforts have continued on Tasks D, E, and F; major emphasis is directed to Task F. Fabrication of the third remote station is essentially complete. There have been delays due to availability problems with a few necessary supplies. However, at present all needed supplies for completion of the third remote station have been received.

Work Planned for Next Month

During the coming month, work will continue on data collection and analysis efforts and on completion, installation and test of the third remote station.

Management Information

The following information gives the managerial and estimated financial status of the contract as of May 31, 1979.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	175	63,701
Task E	10,160	248	11,739
Task F	24,988	3,293	18,115
Total	\$203,288	\$3,716	\$196,899

Mr. Frank Mammano
August 23, 1979
Page 2

b) Estimated cost to complete: \$6,389

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended* Total</u>
Principal Investigator R. W. Wallace	14	1910
Principal Research Engineer	0	209
Senior Research Engineer	3	172
Research Engineer	121	2572

d) Percentage of work completed: see Figure 1.

Respectfully submitted,

for R. W. Wallace
Principal Investigator

APPROVED:

R. W. Moss, Head
Communication Systems Branch

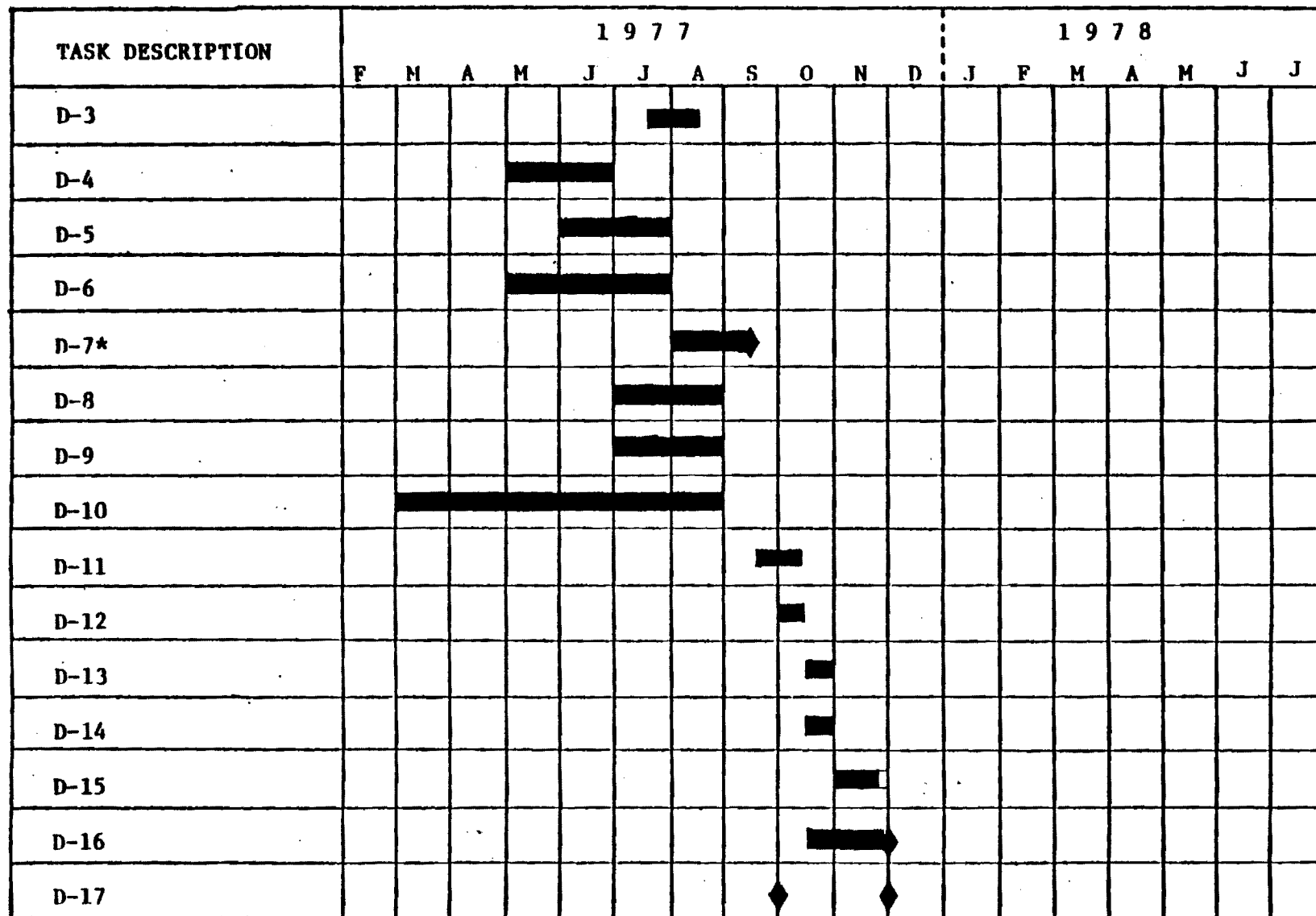
CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
Prepare Draft Program Plan and Schedule	■																		
FHWA Review	■																		
Prepare Final Program Plan		■																	
FHWA Authorization to proceed		◆																	
Receive Government Furnished Equipment	◆																		
TASK A	100%																		
A-1*		■																	
A-2		■																	
A-3			■																
A-4*			■																
A-5				■															
A-6				◆															
TASK B	100%																		
B-1		■																	
B-2		■																	

Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 1
CB-AIDS TASK SCHEDULE (continued)





ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

August 24, 1979

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 29 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-9232 for the month of June 1979. During the month, work continued on Tasks D, E, and F as reported below.

Task Effort

Fabrication of the third remote station has been completed and installation has occurred at Columbia High School. This location will provide coverage of additional portions of I-285 and of that portion of I-20, East where it intersects with I-285. The high school is located at a high point relative to the surrounding terrain and thus good radio coverage is expected.

Work Planned for Next Month

During the coming month, work will continue on data collection and analysis and on test and evaluation of the new remote station.

System Usage

During June no reported usage of the CB-AIDS system occurred, this in contrast to one reported usage in May and three in April. The decreased usage seems to be the result of several factors. First, there have been several occurrences of vandalism against the antennas at both high schools (Sequoyah and Shamrock) resulting in system failure. At one high school the last occurrence of vandalism resulted in total destruction of the antenna but which has subsequently been replaced in a more secure manner. However, there is no practical way to ensure against overt vandalism with the antennas in their present location.

A second factor causing reduced usage is due to the DeKalb Police Department adding a 911 emergency telephone system. Addition of this 911 system has resulted in some telephone related equipment problems and further, has placed additional time demands on police personnel. These additional time demands have prevented police personnel from answering the Central Control Unit during peak hours and perhaps have thus discouraged use of the CB-AIDS system to some degree.

Mr. Frank Mammano
August 24, 1979
Page 2

Management Information

The following information gives the managerial and estimated financial status of the contract as of June 30, 1979.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	160	63,861
Task E	10,160	283	12,022
Task F	24,988	3,148	21,263
Total	<u>\$203,288</u>	<u>\$3,591</u>	<u>\$200,490</u>


b) Estimated cost to complete: \$2,798

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended* Total</u>
Principal Investigator R. W. Wallace	15	1925
Principal Research Engineer	0	209
Senior Research Engineer	17	189
Research Engineer	68	2640

d) Percentage of work completed: see Figure 1.

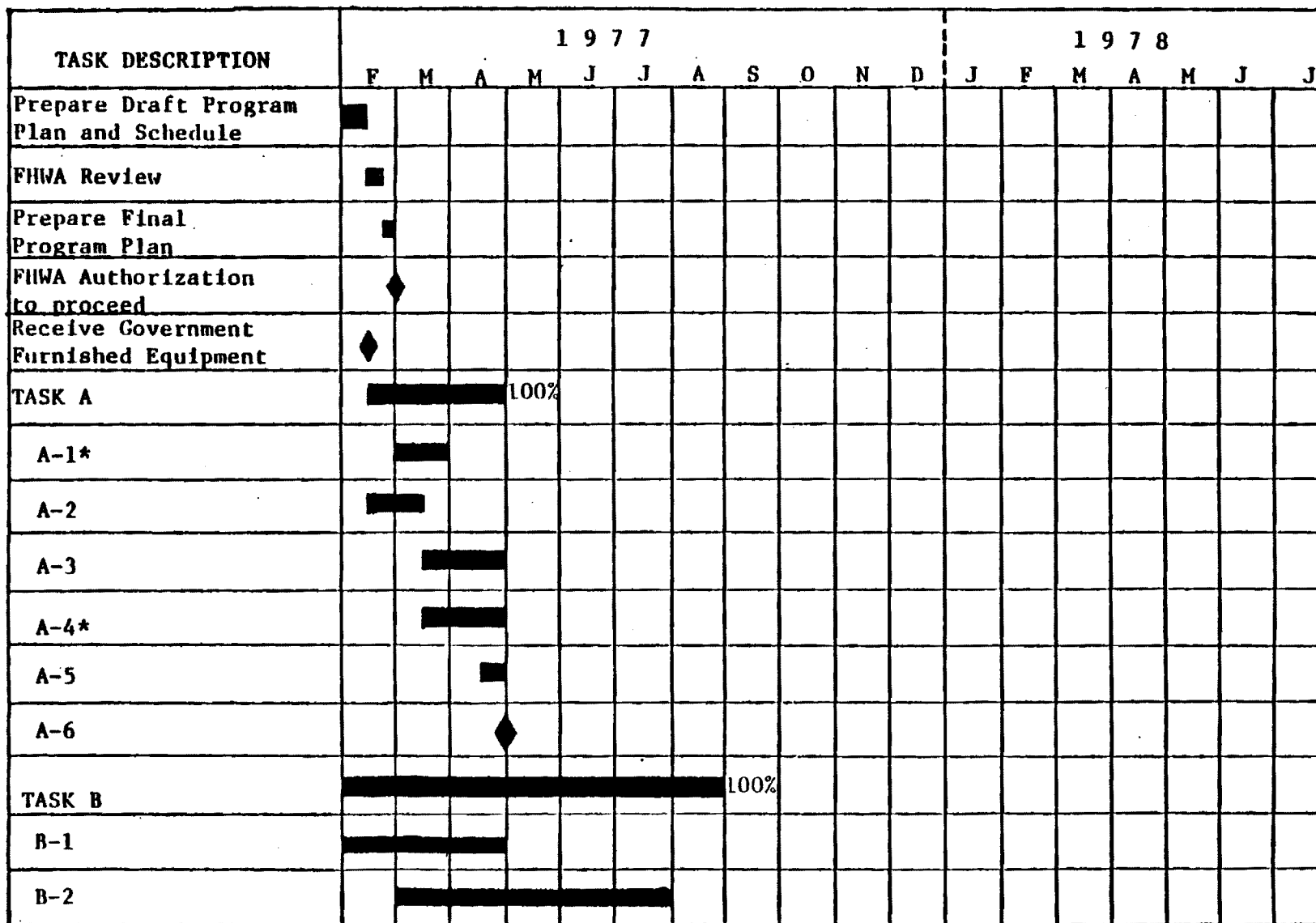
Respectfully submitted,

 R. W. Wallace
Principal Investigator

APPROVED:

R. W. Moss, Head
Communication Systems Branch

Figure 1
CB-AIDS TASK SCHEDULE



Notes:



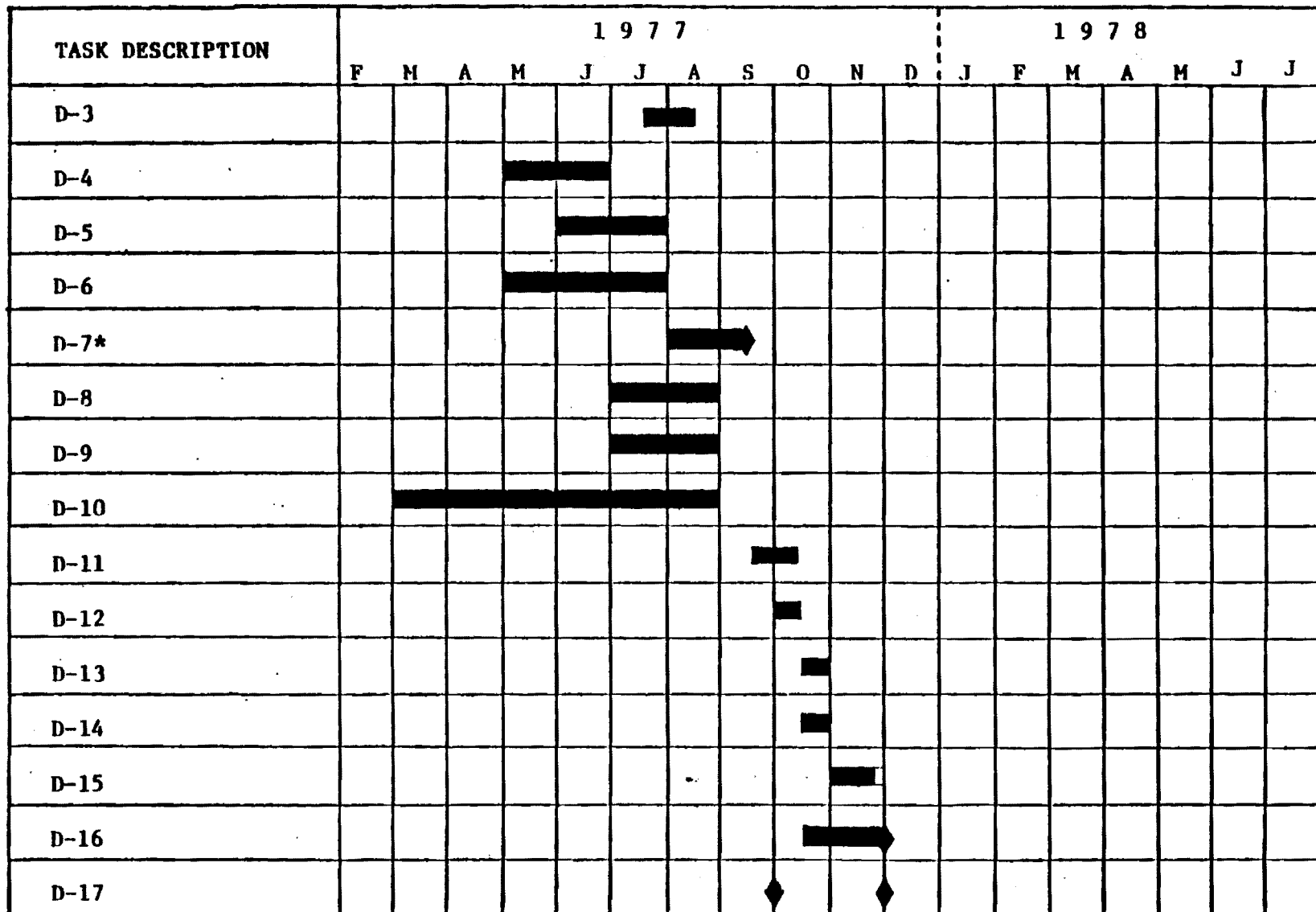
1.  filled in portion indicates percentage of completion.
2.  indicates milestone event.
3. * indicates substantial external factors in subtask.

Figure 1
CB-AIDS TASK SCHEDULE (continued)



[illegible]



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

August 27, 1979

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 30 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-9232 for the month of July 1979. During the month, work continued on Tasks D, E, and F as reported below.

Task Effort

During the current reporting period, project efforts have continued on Tasks D, E, and F. Major emphasis has been directed to Task F and specifically to performance evaluation of the new remote station.

Work Planned for Next Month

During the coming month, work will continue on general data collection activities and on monitoring effectiveness of the third remote station.

System Usage

During July no reported usage of the CB-AIDS system occurred. However, contact has been made with a portion of the system users (the remainder to be soon notified) and during the early part of August increased usage has been evident.

Shortly after installation of the third remote station at Columbia High School we experienced a large number of false alarms in the form of an unknown individual keying up the new remote station, thus calling the DeKalb Police but never identifying himself in anyway, i.e., no voice contact. Individuals from the FCC and Georgia Department of Transportation, at one time, got within about a quarter-mile of the individual, using a mobile DF, before transmissions ceased. In the recent several weeks, these false alarms have not been evident and we are therefore hopeful that further occurrences will not take place.

Management Information

The following information gives the managerial and estimated financial status of the contract as of July 31, 1979.

Mr. Frank Mammano
August 27, 1979
Page 2

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	0	63,861
Task E	10,160	0	12,022
Task F	24,988	394	21,657
Total	<u>\$203,288</u>	<u>\$ 394</u>	<u>\$200,844</u>


b) Estimated cost to complete: \$2,404

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended* Total</u>
Principal Investigator R. W. Wallace	0	1925
Principal Research Engineer	0	209
Senior Research Engineer	0	189
Research Engineer	14	2654

d) Percentage of work completed: see Figure 1.

Respectfully submitted,

 R. W. Wallace
Principal Investigator

APPROVED:

R. W. Moss, Head
Communication Systems Branch

CB-AIDS TASK SCHEDULE

[illegible]

Notes:



1.  filled in portion indicates percentage of completion.
2.  indicates milestone event.
3. * indicates substantial external factors in subtask.

figure 1
CB-AIDS TASK SCHEDULE (continued)

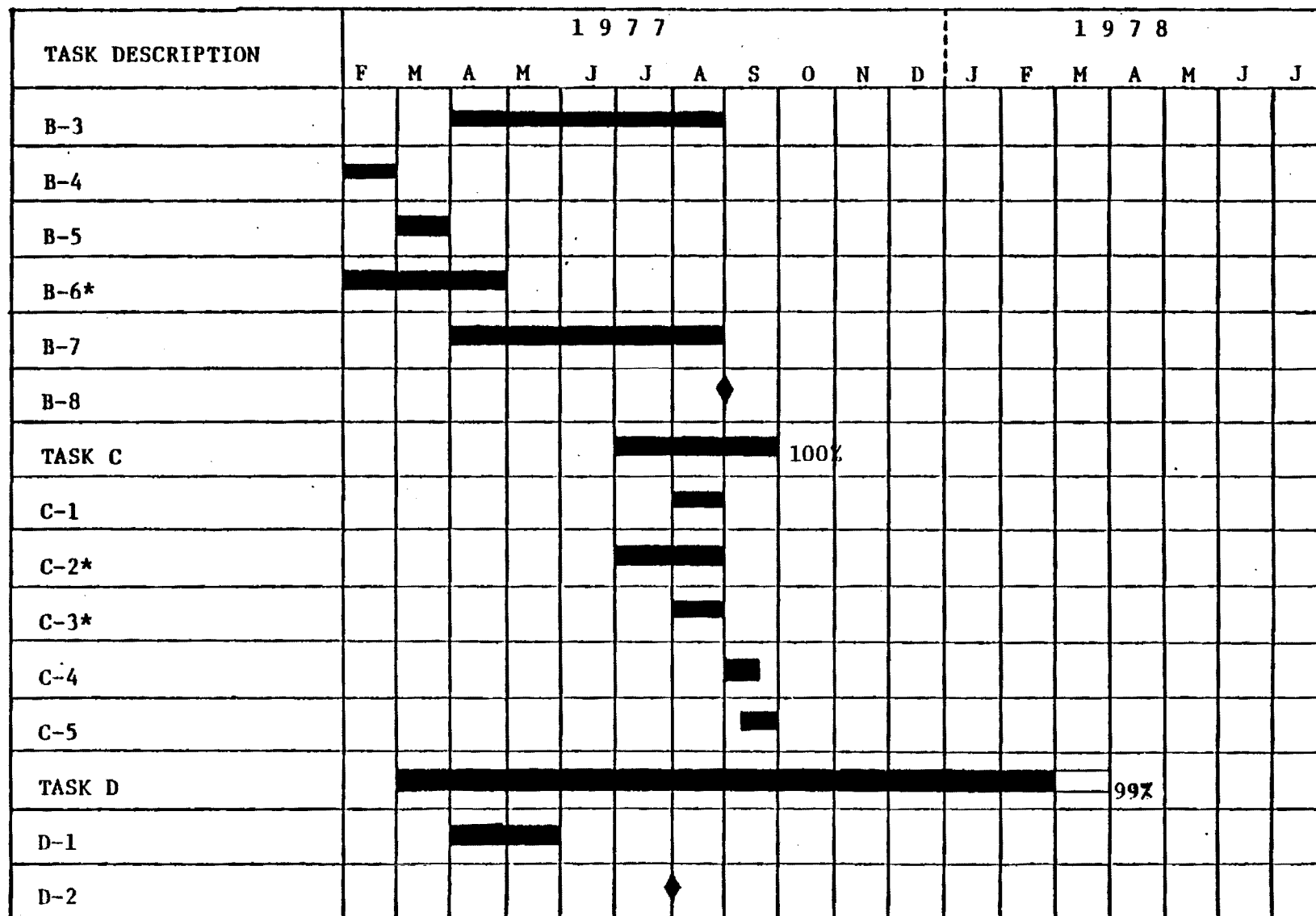
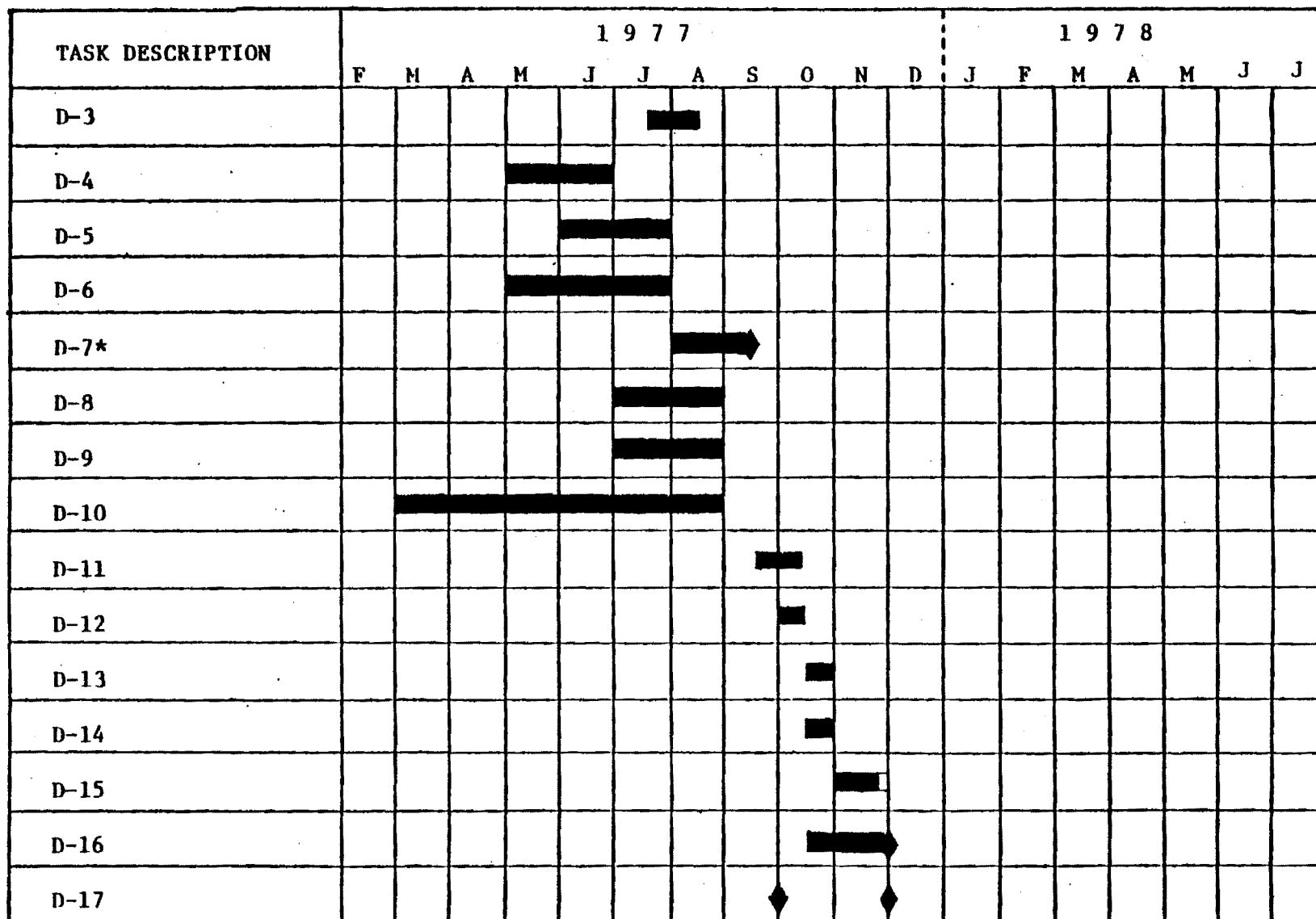
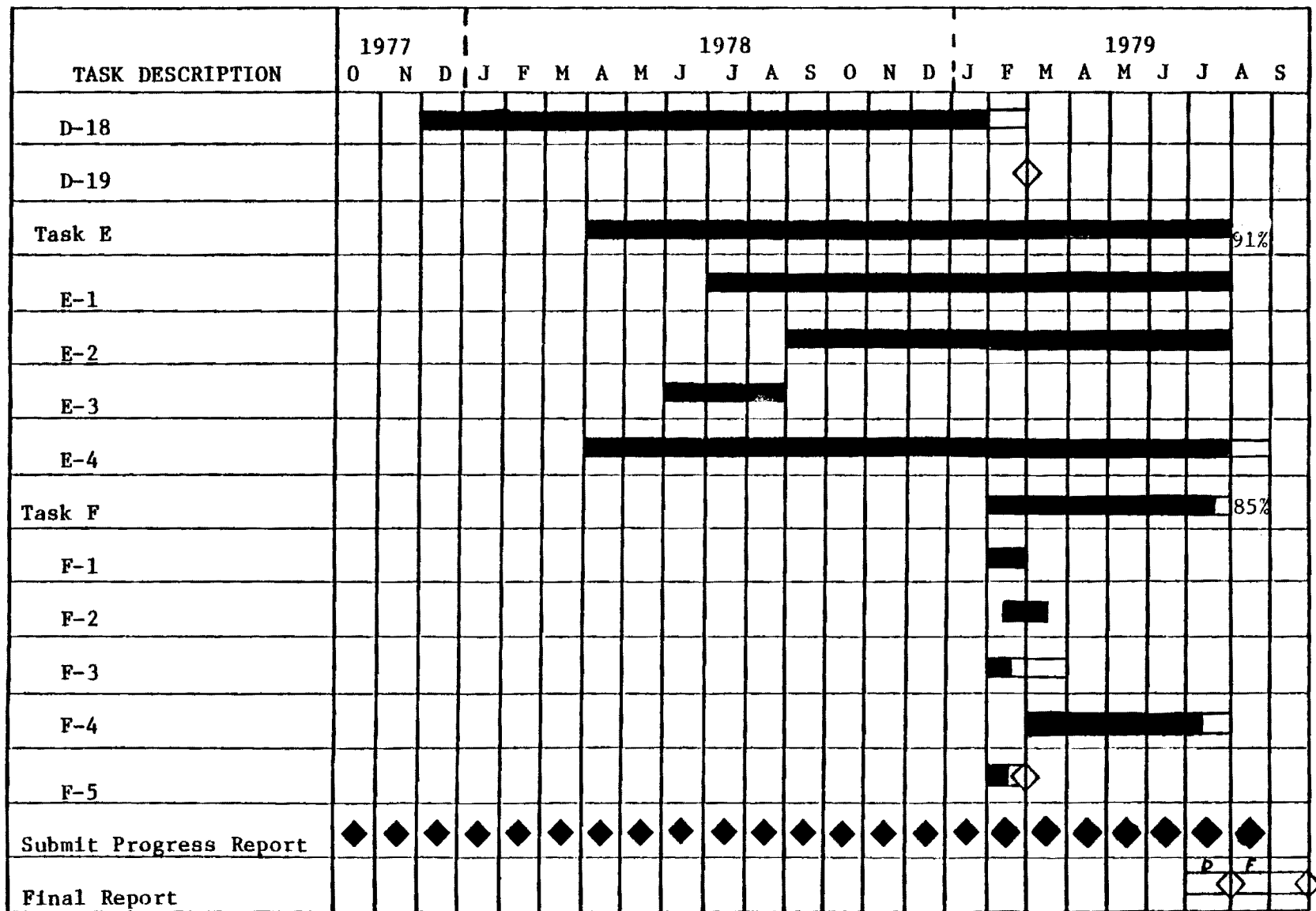


Figure 1

CB-AIDS TASK SCHEDULE (continued)







Georgia Institute of Technology

ENGINEERING EXPERIMENT STATION

ATLANTA, GEORGIA 30332

15 October 1979

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, DC 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 31 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-9232 for the month of August 1979. During the month, work continued on Tasks E and F as reported below.

Task Effort

The effort on Tasks E and F continued with data collection and analyses and system monitoring. Approximately equal emphasis has been placed on both tasks.

System Status and Usage

During August a marked increase in system usage has occurred. This increase is a result of several factors, but basically because some earlier problems with both equipment and personnel have been resolved. Also, of importance is the fact that the third Remote Station is fully operational, providing increased total area coverage for the CB-AIDS system. Further, this unit, of itself, provides the best local area coverage of the three stations. This third Remote Station has been accessed by users at distances of 5 to 8 miles; voice quality has been reported as excellent. A summary of reported system usage for the month of August is provided in Table 1.

It is important to note that the incidences listed in Table 1 are only those which have been reported to us by system users. We have requested, from time-to-time, that our CB-AIDS users submit Incident Report forms even when they fail to access a Remote Station.

TABLE 1.
REPORTED INCIDENTS FOR CURRENT MONTH

Remote Station			Sequoyah	Shamrock	Columbia
INCIDENT TYPE	Accident w/injuries		0	0	0
	Accident		0	0	0
	Road Hazard		0	2	2
	Pedestrian Violation		1	1	3
	Traffic Violation		0	0	0
	Motorist Assistance		0	0	1
	Other		0	2	2
EQUIPMENT AND PERSONNEL	Remote Station Responded	Yes	100%	100%	100%
		No	0%	0%	0%
	DeKalb P.D. Answered	Yes	100%	60%	86%
		No	0%	40%	14%
	Contact *	Yes	0%	60%	87%
		No	100%	40%	13%
	Voice Quality	Good	100%	66%	82%
		Fair	0%	0%	18%
		Poor	0%	33%	0%

Total reported incidences this period: 14

*Denotes whether voice contact was maintained for full message transmittal

In some cases this is done; although in other cases, it is reasonable to assume that the user does not, for various reasons, submit the form as requested. Likewise, there will also be cases (although likely a smaller number) when the system is used and still the user forgets or for other reasons fails to submit an Incident Report.

To encourage increased usage, a memorandum was sent to all users alerting them of the additional Remote Station and its coverage area. Some of the earlier system problems were also discussed in the memo as well as our resolve to ensure a minimum of system problems in the future.

The area covered by the new Remote Station will also increase system usage by bringing new individuals into the program. For example, members of Capital City REACTS have not really been involved in the CB-AIDS program simply because the majority of their members do not live or travel in the area covered by the original two Remote Stations. Addition of the new station alters that situation because of its geographical location; interest has thus been expressed by Capital City REACTS personnel to become involved. To fulfill this request, additional Digital Adapters will be installed on CB radios of both Capital City REACTS personnel as well as other responsible users.

Work Planned for Next Month

During the coming month, work will continue on general data collection, installation of additional Digital Adapters, and monitoring effectiveness of the total CB-AIDS system.

Management Information

The following information gives the managerial and estimated financial status of the contract as of September 30, 1979.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	0	63,861
Task E	10,160	570	12,592
Task F	24,988	142	21,799
Total	\$203,288	\$ 712	\$201,596

Federal Highway Administration
15 October 1979
Page Three

b) Estimated cost to complete: \$1,692

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	0	1925
Principal Research Engineer	0	209
Senior Research Engineer	0	189
Research Engineer	25	2679

d) Percentage of work completed: See Figure 1.

Respectfully submitted,

For R. W. Wallace
Principal Investigator

RWW:gh

Approved:

R. W. Moss, Head
Communications Systems Branch

CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
Prepare Draft Program Plan and Schedule	■																		
FHWA Review	■																		
Prepare Final Program Plan		■																	
FHWA Authorization to proceed		◆																	
Receive Government Furnished Equipment	◆																		
TASK A	■■																		

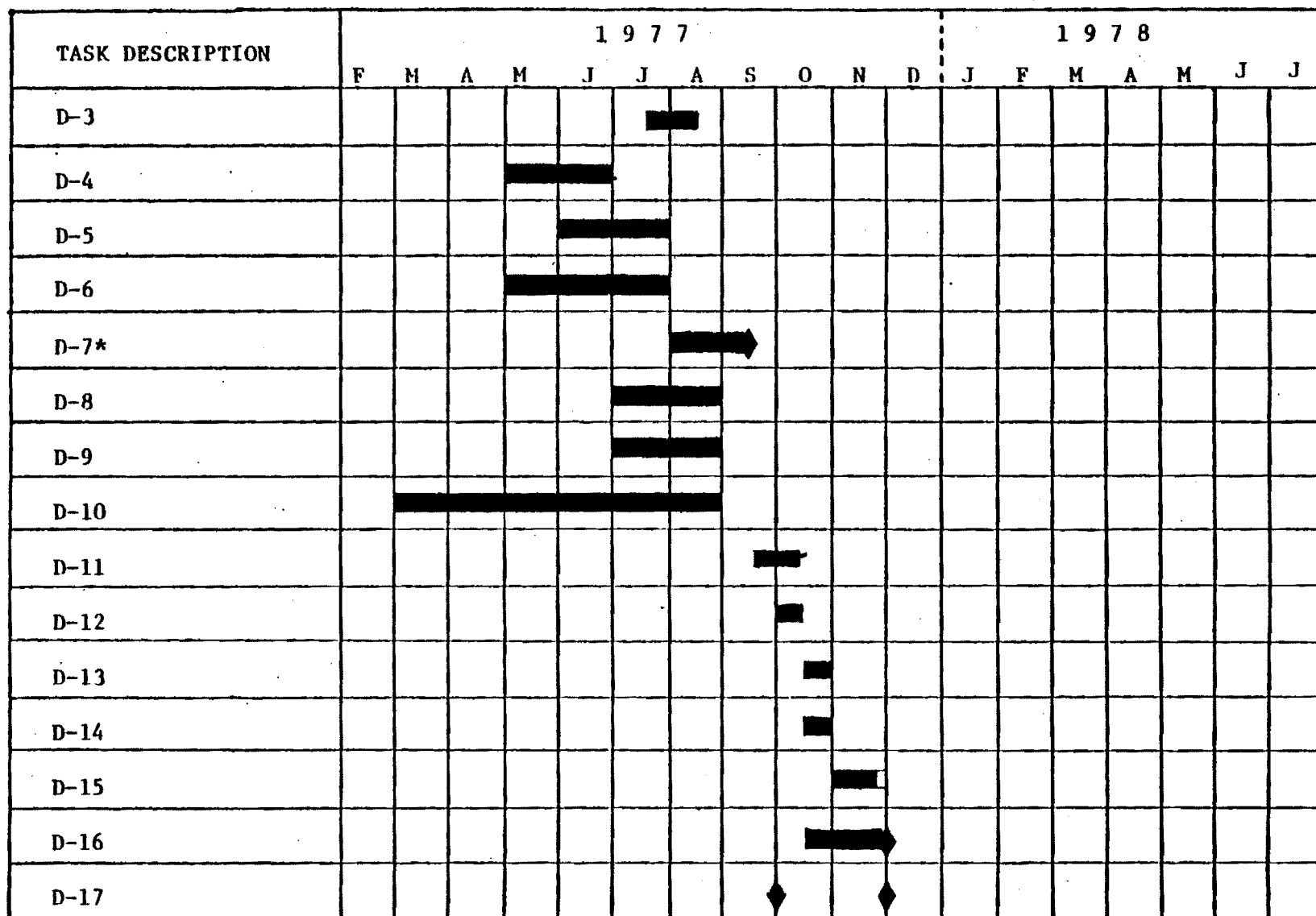
Notes:

1. ■■■■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978					
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
B-3																		
B-4																		
B-5																		
B-6*																		
B-7																		
B-8																		
TASK C																		
C-1																		
C-2*																		
C-3*																		
C-4																		
C-5																		
TASK D																		
D-1																		
D-2																		

Figure 1
CB-AIDS TASK SCHEDULE (continued)



[illegible]



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

November 26, 1979

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, D.C. 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 32 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of September 1979. During the month, work continued on Tasks E and F as reported below.

Task Effort

The effort on Tasks E and F continued with data collection and analyses and system monitoring.

System Status and Usage

During September the CB-AIDS system continued to be used at a moderate rate with a total of 12 reported incidences during the period. A summary of the reported incidences is presented in Table 1.

The Remote Stations located at Sequoyah High School (northeast station) and at Columbia High School (southeast station) continue to provide better coverage than is attainable at the east station (Shamrock High School). The Shamrock location has proved to be only reasonably satisfactory in regard to available coverage area throughout the pilot program evaluation period.

Several additional volunteers have been enlisted as CB-AIDS participants. As a result, a number of Digital Adapters will be installed during the early part of the coming month.

TABLE 1.
REPORTED INCIDENTS FOR CURRENT MONTH

Remote Station			Sequoyah	Shamrock	Columbia
INCIDENT TYPE	Accident w/injuries		0	0	0
	Accident		1	1	0
	Road Hazard		0	1	0
	Pedestrian Violation		0	1	1
	Traffic Violation		0	0	0
	Motorist Assistance		2	0	1
	Other		1	3	0
EQUIPMENT AND PERSONNEL	Remote Station Responded	Yes	100%	83%	100%
		No	0%	17%	0%
	DeKalb P.D. Answered	Yes	100%	80%	100%
		No	0%	20%	0%
	Contact *	Yes	100%	0%	50%
		No	0%	100%	50%
	Voice Quality	Good	75%	0%	100%
		Fair	25%	0%	0%
		Poor	0%	100%	0%

Total reported incidences this period: 12

*Denotes whether voice contact was maintained for full message transmittal

Work Planned for Next Month

During the next reporting period, work will continue on general data collection, installation of additional Digital Adapters, and monitoring the effectiveness of the CB-AIDS system.

Management Information

The following information gives the managerial and estimated financial status of the contract as of September 30, 1979.

a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	0	63,861
Task E	10,160	475	13,067
Task F	24,988	320	22,119
TOTAL	\$203,288	\$795	\$202,391

b) Estimated cost to complete: \$897

c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended* Total</u>
Principal Investigator R. W. Wallace	0	1925
Principal Research Engineer	0	209
Senior Research Engineer	0	189
Research Engineer	8	2687

d) Percentage of work completed: see Figure 1

Respectfully submitted,

for R. W. Wallace
Principal Investigator

APPROVED: 

R. W. Mořs, Head
Communications Systems Branch

CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978											
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J						
Prepare Draft Program Plan and Schedule	■																							
FHWA Review	■																							
Prepare Final Program Plan		■																						
FHWA Authorization to proceed		◆																						
Receive Government Furnished Equipment	◆																							
TASK A	100%																							
A-1*		■	■																					
A-2	■	■																						
A-3			■	■																				
A-4*			■	■																				
A-5				■																				
A-6				◆																				
TASK B	100%																							
B-1	■	■	■																					
B-2		■	■	■	■	■																		

Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

figure 1
CB-AIDS TASK SCHEDULE (continued)

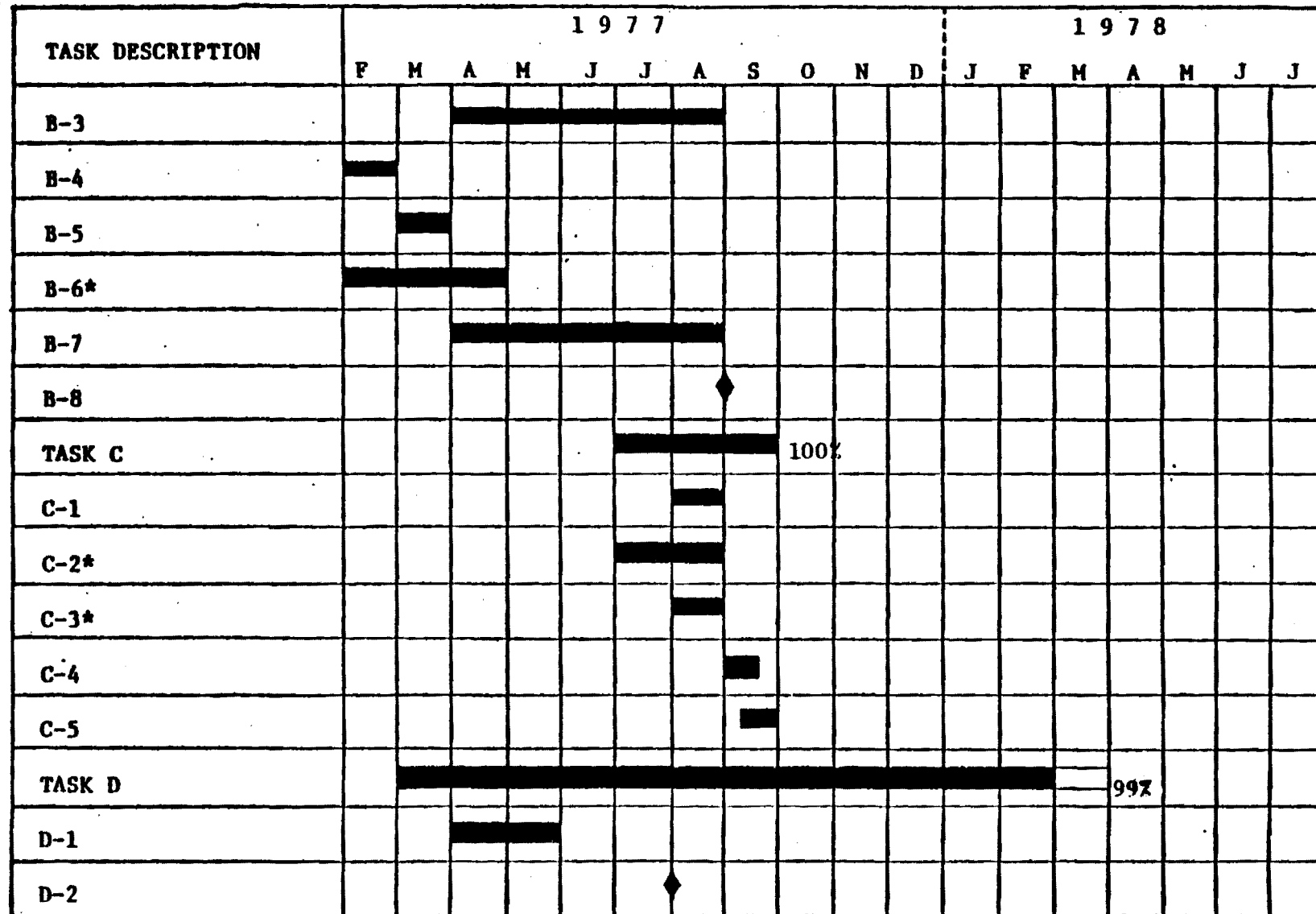
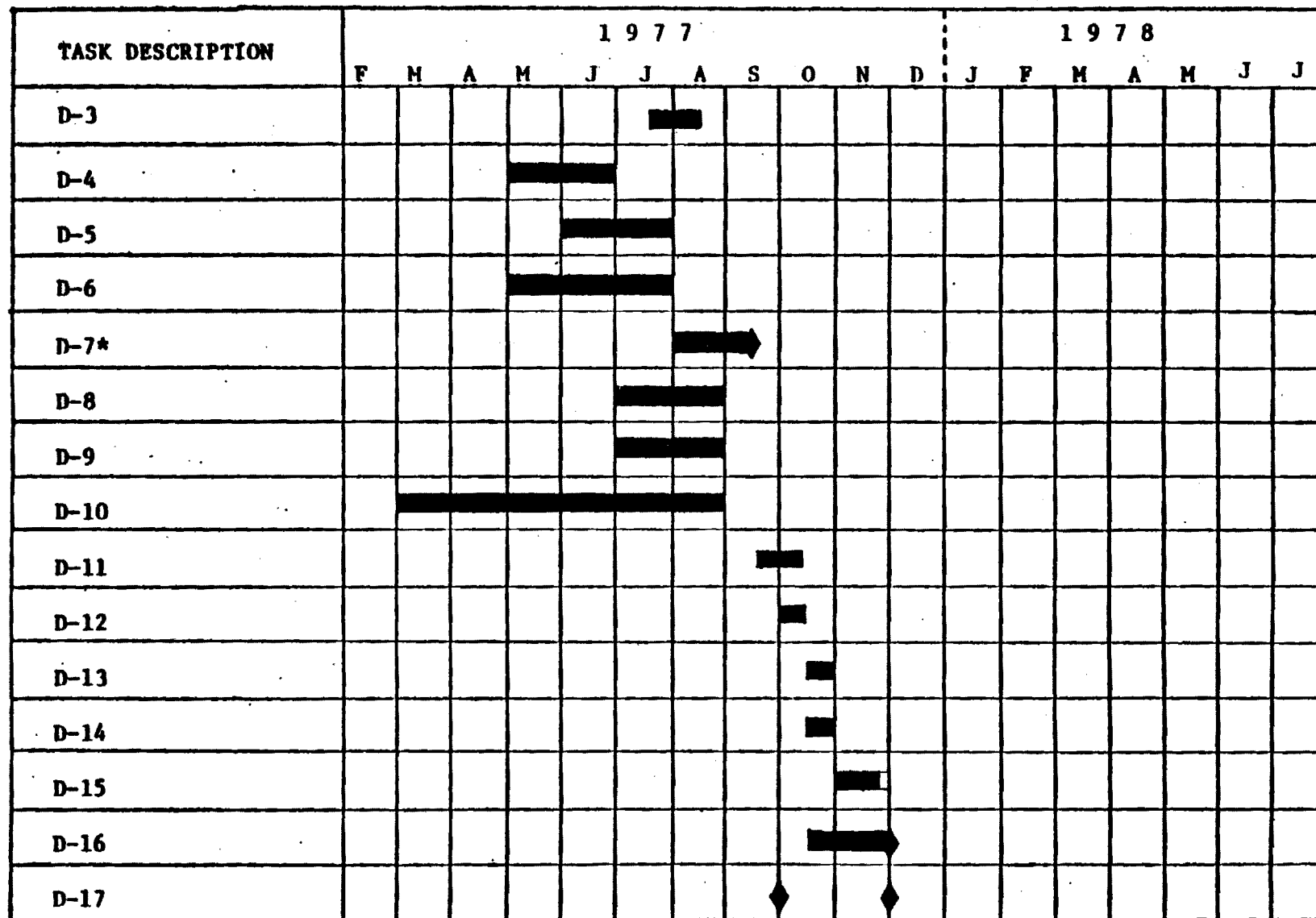


Figure 1
CB-AIDS TASK SCHEDULE (continued)



[illegible]

A-1740



Georgia Institute of Technology

ENGINEERING EXPERIMENT STATION

ATLANTA, GEORGIA 30332

7 December 1979

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, DC 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report No. 33 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of October 1979. During the month, work continued on Tasks E and F as reported below.

Task Effort

The effort on Tasks E and F continued with data collection and analyses and system monitoring.

System Status and Usage

During this reporting period the CB-AIDS system continued to be used to a reasonable extent with a total of 10 reported incidences during the period. A summary of the reported incidences is presented in Table 1.

During the month of October seven (7) additional Digital Adapters were installed in order to extend the present data base. It is hopeful that these additional users will make liberal use of the CB-AIDS system thus providing increased data on system performance.

Work Planned for Next Month

During the next reporting period, work will continue on data collection, system evaluation, and installation of additional Digital Adapters.

TABLE 1.
REPORTED INCIDENCES FOR CURRENT MONTH

Remote Station			Sequoyah	Shamrock	Columbia
INCIDENT TYPE	Accident w/injuries		0	0	0
	Accident		0	2	0
	Road Hazard		1	0	1
	Pedestrian Violation		0	0	0
	Traffic Violation		0	1	0
	Motorist Assistance		0	0	0
	Other		4	1	0
EQUIPMENT AND PERSONNEL	Remote Station Responded	Yes	100%	25%	100%
		No	0%	75%	0%
	DeKalb P.D. Answered	Yes	100%	100%	100%
		No	0%	0%	0%
	Contact *	Yes	40%	100%	100%
		No	60%	0%	0%
	Voice Quality	Good	40%	100%	100%
		Fair	20%	0%	0%
		Poor	40%	0%	0%

Total reported incidences this period: 10

*Denotes whether voice contact was maintained for full message transmittal

Management Information

The following information gives the managerial and estimated financial status of the contract as of October 31, 1979.

(a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	20,648	0	20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	0	63,861
Task E	10,160	861	13,928
Task F	<u>28,986</u>	<u>464</u>	<u>22,583</u>
Total	\$207,286	\$1,325	\$203,716

(b) Estimated cost to complete: \$3,570

(c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	0	1925
Principal Research Engineer	0	209
Senior Research Engineer	0	189
Assistant Research Engineer/ Research Engineer	21	2708

(d) Percentage of work completed: See Figure 1.

Respectfully submitted,

for R. W. Wallace
Principal Investigator

RWW:gh

Approved:

R. W. Moss, Head
Communications Systems Branch

CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978							
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J		
Prepare Draft Program Plan and Schedule	■																			
FHWA Review	■																			
Prepare Final Program Plan		■																		
FHWA Authorization to proceed		◆																		
Receive Government Furnished Equipment	◆																			
TASK A	■■■■■■■■■■■■ 100%																			
A-1*		■■																		
A-2	■■																			
A-3		■■■■																		
A-4*		■■■■																		
A-5			■																	
A-6				◆																
TASK B	■■■■■■■■■■■■■■■■■■■■ 100%																			
B-1	■■■■																			
B-2		■■■■■■■■■■																		

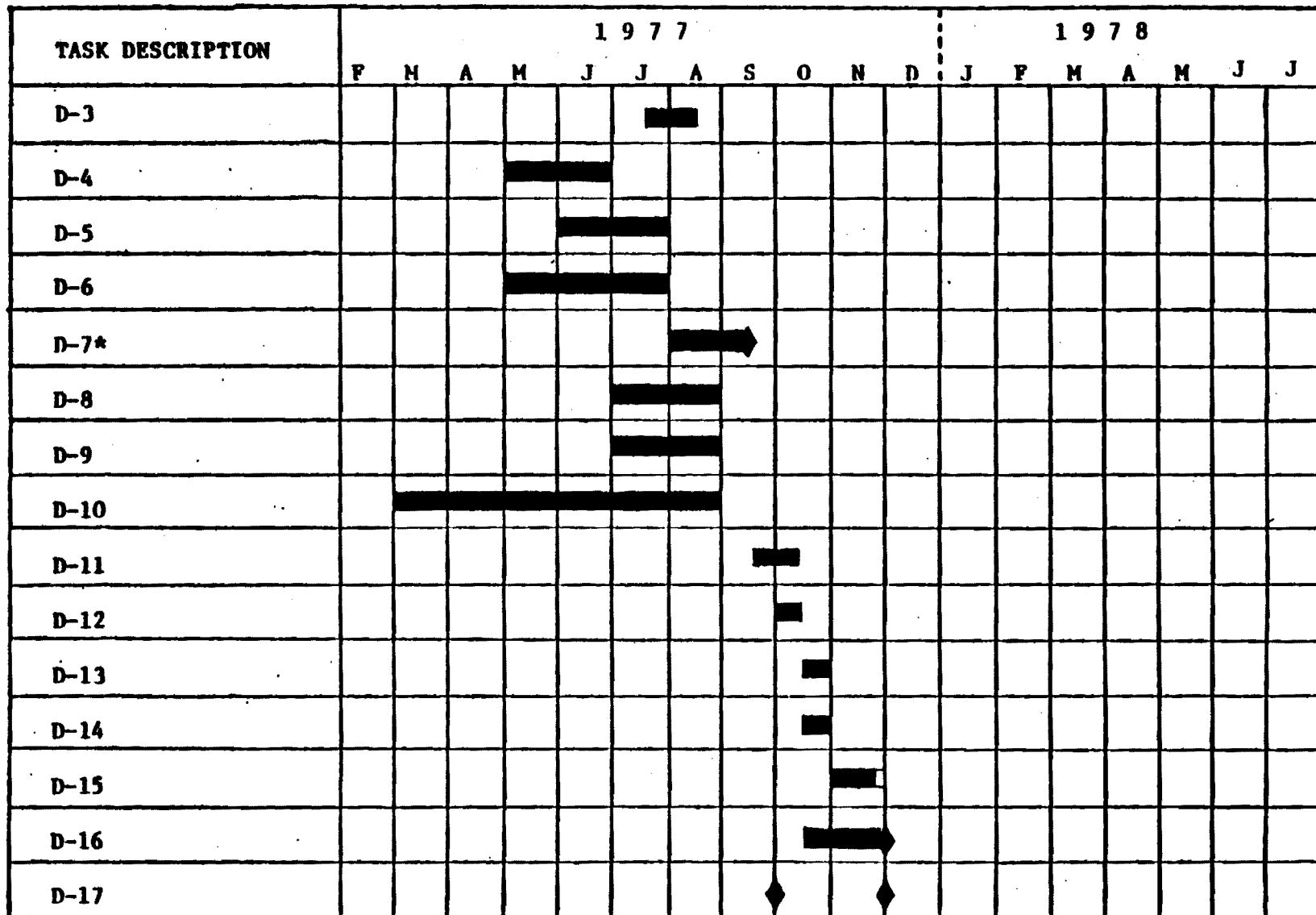
Notes:

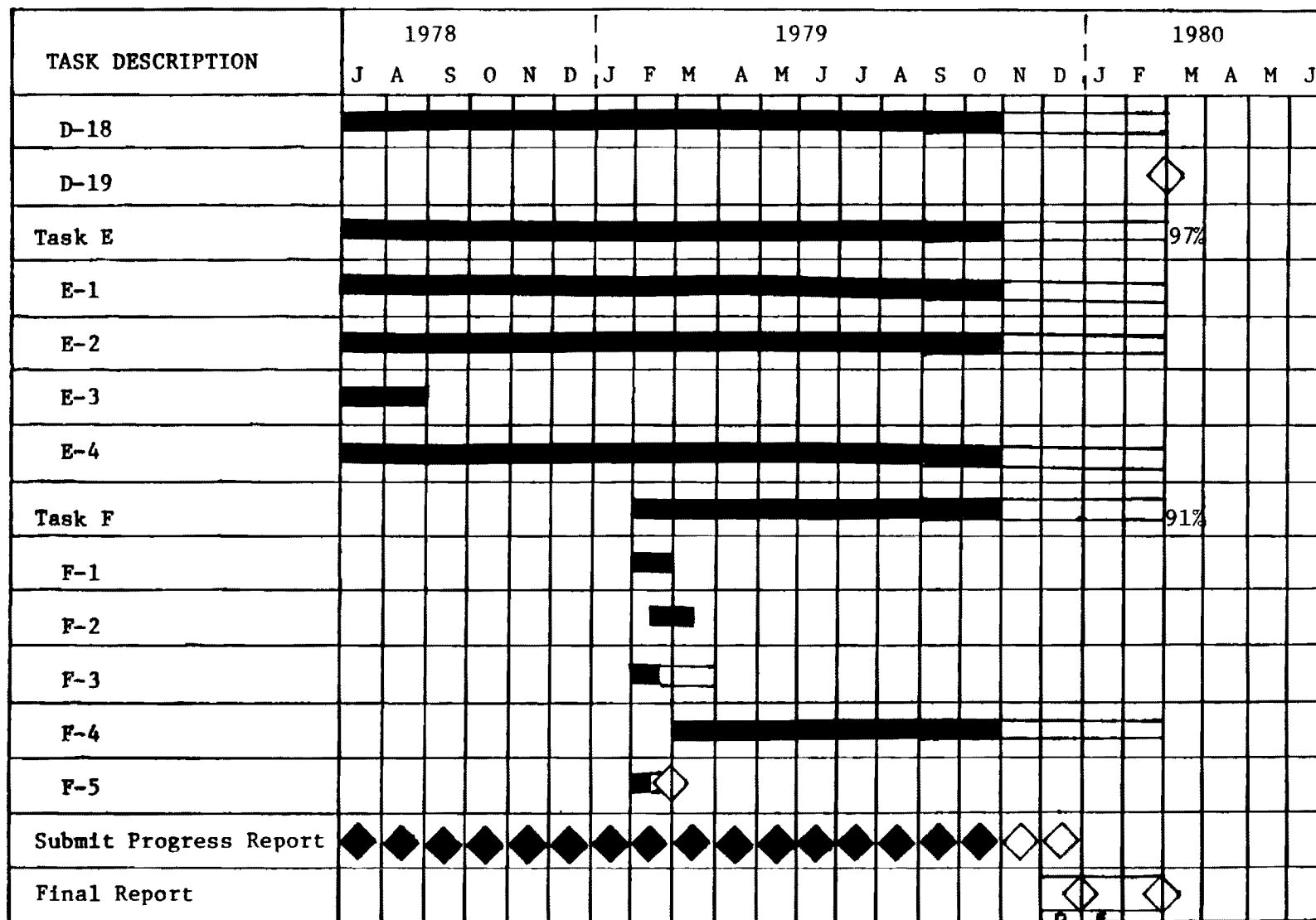
1. ■■■■■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

1000

TASK DESCRIPTION	1977												1978						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
B-3																			
B-4																			
B-5																			
B-6*																			
B-7																			
B-8																			
TASK C																			
C-1																			
C-2*																			
C-3*																			
C-4																			
C-5																			
TASK D																			
D-1																			
D-2																			

Figure 1
CB-AIDS TASK SCHEDULE (continued)







ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

8 January 1980

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, DC 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report #34 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of November 1979. During the month, work continued on Tasks E and F as reported below.

Task Effort

The effort on Tasks E and F continued with data collection and analyses and system monitoring.

Work Planned for Next Month

During the next reporting period, work will continue on data collection and system evaluation.

Management Information

The following information gives the managerial and estimated financial status of the contract as of November 30, 1979.

(a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	0	63,861
Task E	10,160	325	14,253
Task F	28,986	217	22,800
Total	\$207,286	\$ 542	\$204,258

(b) Estimated cost to complete: \$3,028

(c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	0	1925
Principal Research Engineer	0	209
Senior Research Engineer	0	189
Assistant Research Engineer/ Research Engineer	17	2725

(d) Percentage of work completed: See Figure 1.

Respectfully submitted,

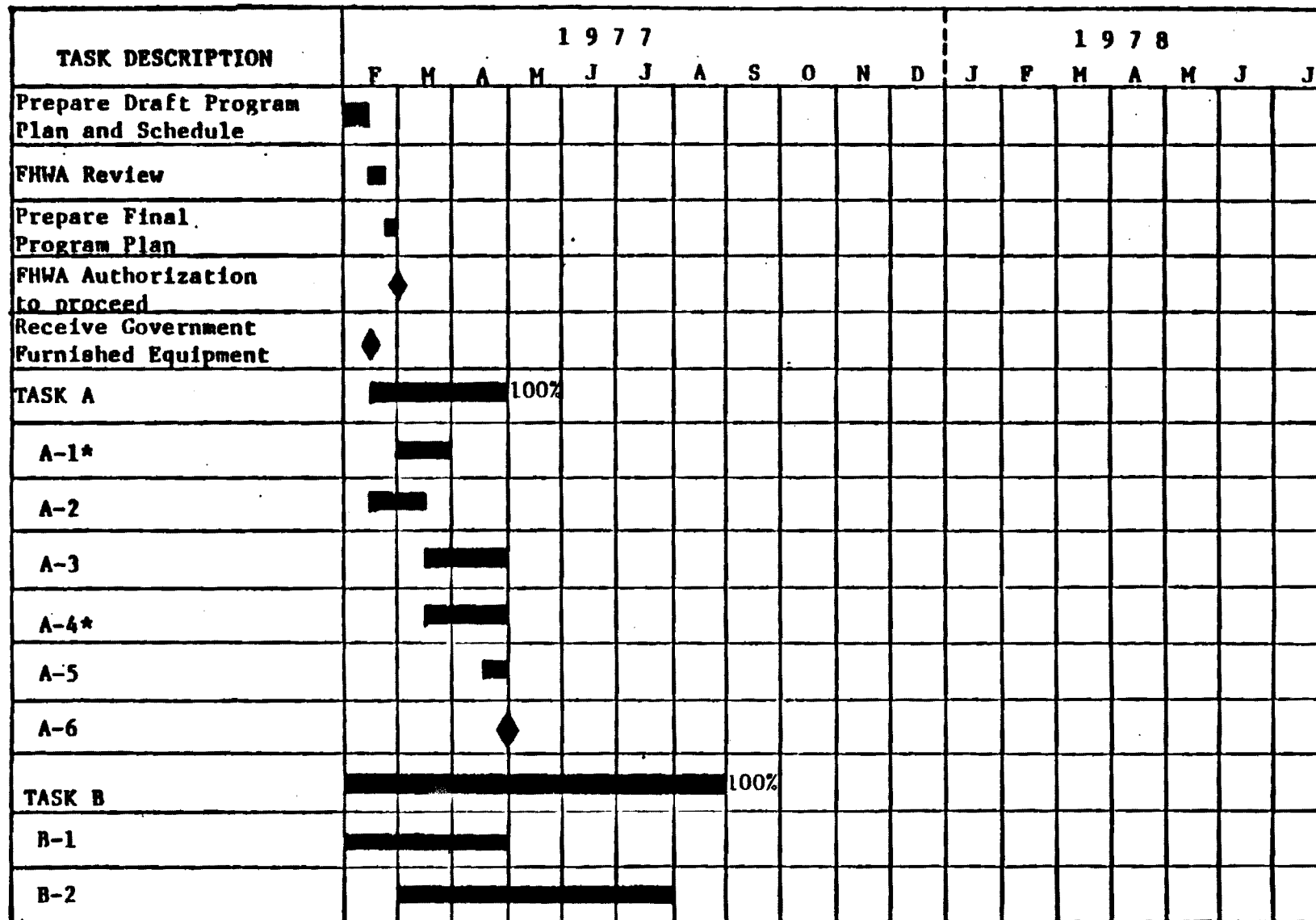
R. W. Wallace
Principal Investigator

RWW:11

Approved:

R. W. Moss, Head
Communications Systems Branch

CB-AIDS TASK SCHEDULE



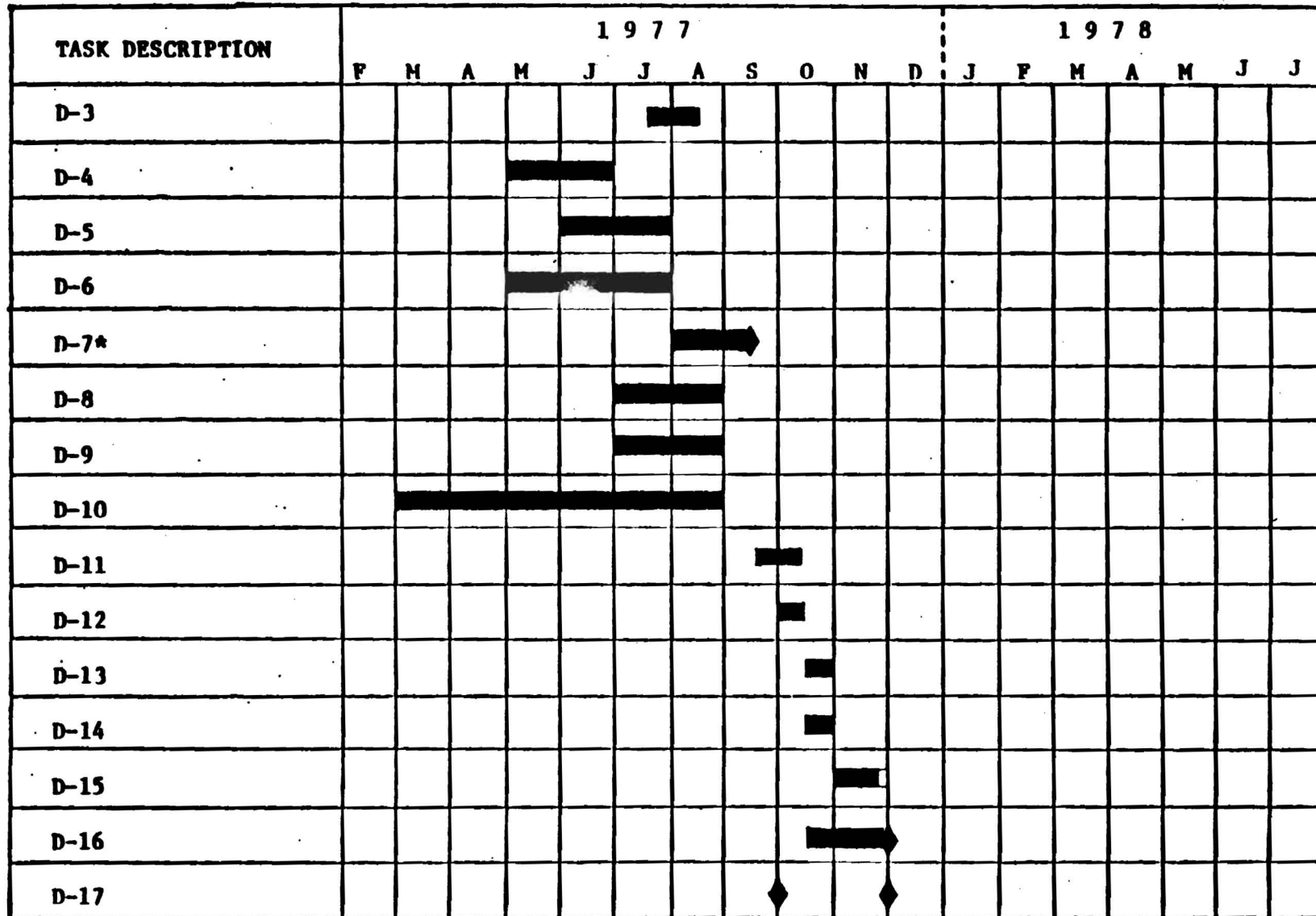
Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

CB-AIDS TASK SCHEDULE (continued)

TASK DESCRIPTION	1977												1978						
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
B-3																			
B-4																			
B-5																			
B-6*																			
B-7																			
B-8																			
TASK C																			
C-1																			
C-2*																			
C-3*																			
C-4																			
C-5																			
TASK D																			
D-1																			
D-2																			

Figure 1
CB-AIDS TASK SCHEDULE (continued)



[illegible]



ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

A-1940

28 January 1980

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, DC 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report #35 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter reports the activities on Contract No. DOT-FH-11-9232 for the month of December 1979. During the month, work continued on Tasks E and F as reported below.

Task Effort

The effort on Tasks E and F continued with data collection and analyses and system monitoring.

Work Planned for Next Month

During the next reporting period, work will continue on data collection and system evaluation.

Management Information

The following information gives the managerial and estimated financial status of the contract as of November 30, 1979.

(a) Cumulative costs:

<u>Category</u>	<u>Planned Total</u>	<u>Current Month</u>	<u>Cumulative Total</u>
Task A	\$ 20,648	\$ 0	\$ 20,648
Task B	68,782	0	62,329
Task C	17,939	0	20,367
Task D	60,771	0	63,861
Task E	10,160	760	15,013
Task F	28,986	410	23,210
Total	\$207,286	\$1,170	\$205,428

(b) Estimated cost to complete: \$1,858

(c) Key personnel man-hours expended:

<u>Position/Name</u>	<u>Man-Hours Current Month</u>	<u>Expended Total</u>
Principal Investigator R. W. Wallace	0	1925
Principal Research Engineer	0	209
Senior Research Engineer	0	189
Assistant Research Engineer/ Research Engineer	24	2749

(d) Percentage of work completed: See Figure 1.

Respectfully submitted,

RW R. W. Wallace
Principal Investigator

RWW/pf

Approved: _____

R. W. Moss, Head
Communications Systems Branch

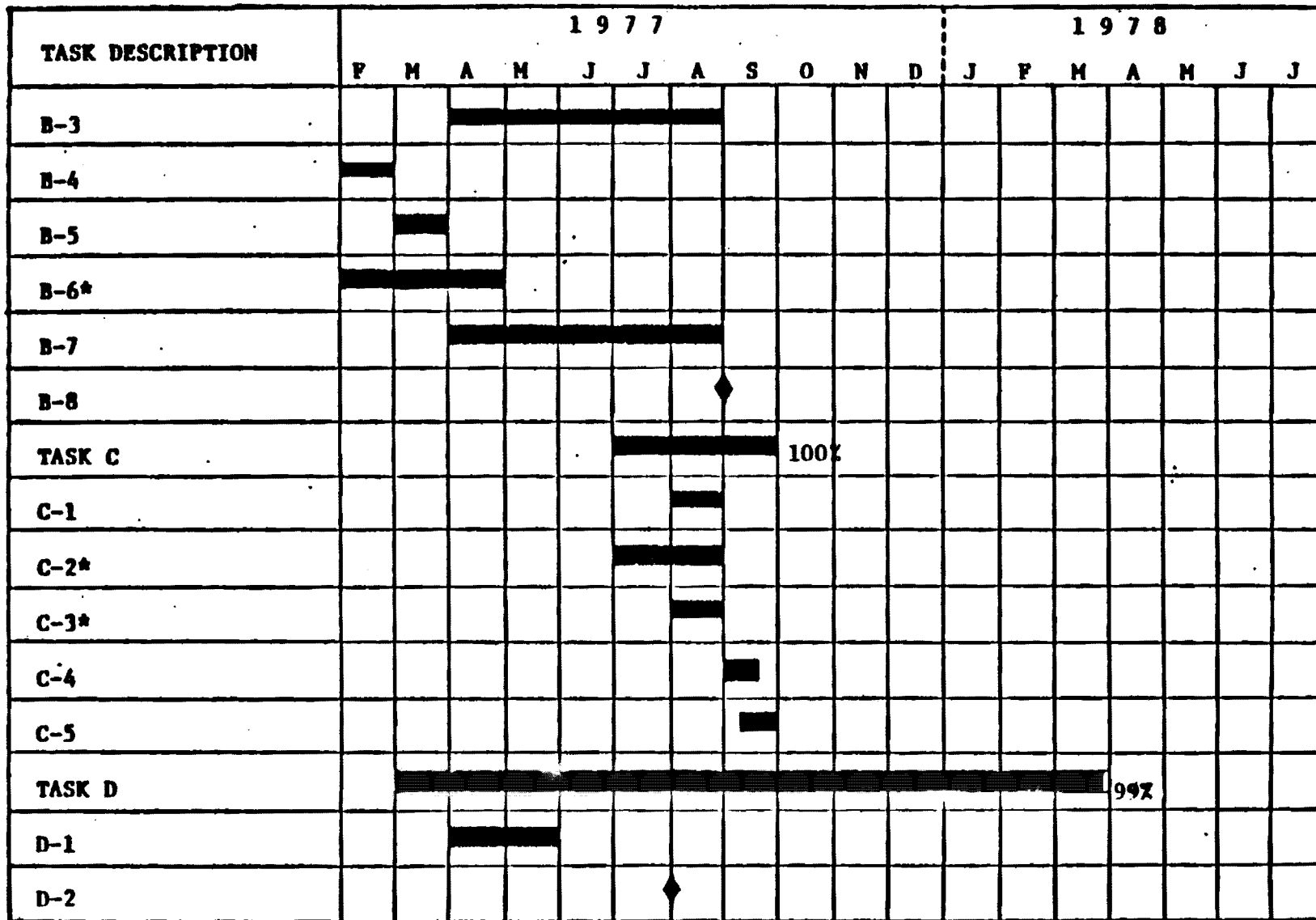
CB-AIDS TASK SCHEDULE

TASK DESCRIPTION	1977												1978											
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J						
Prepare Draft Program Plan and Schedule	■																							
FHWA Review	■																							
Prepare Final Program Plan		■																						
FHWA Authorization to proceed		◆																						
Receive Government Furnished Equipment	◆																							
TASK A	100%																							
A-1*		■																						
A-2		■																						
A-3			■																					
A-4*			■																					
A-5				■																				
A-6				◆																				
TASK B	100%																							
B-1		■																						
B-2		■																						

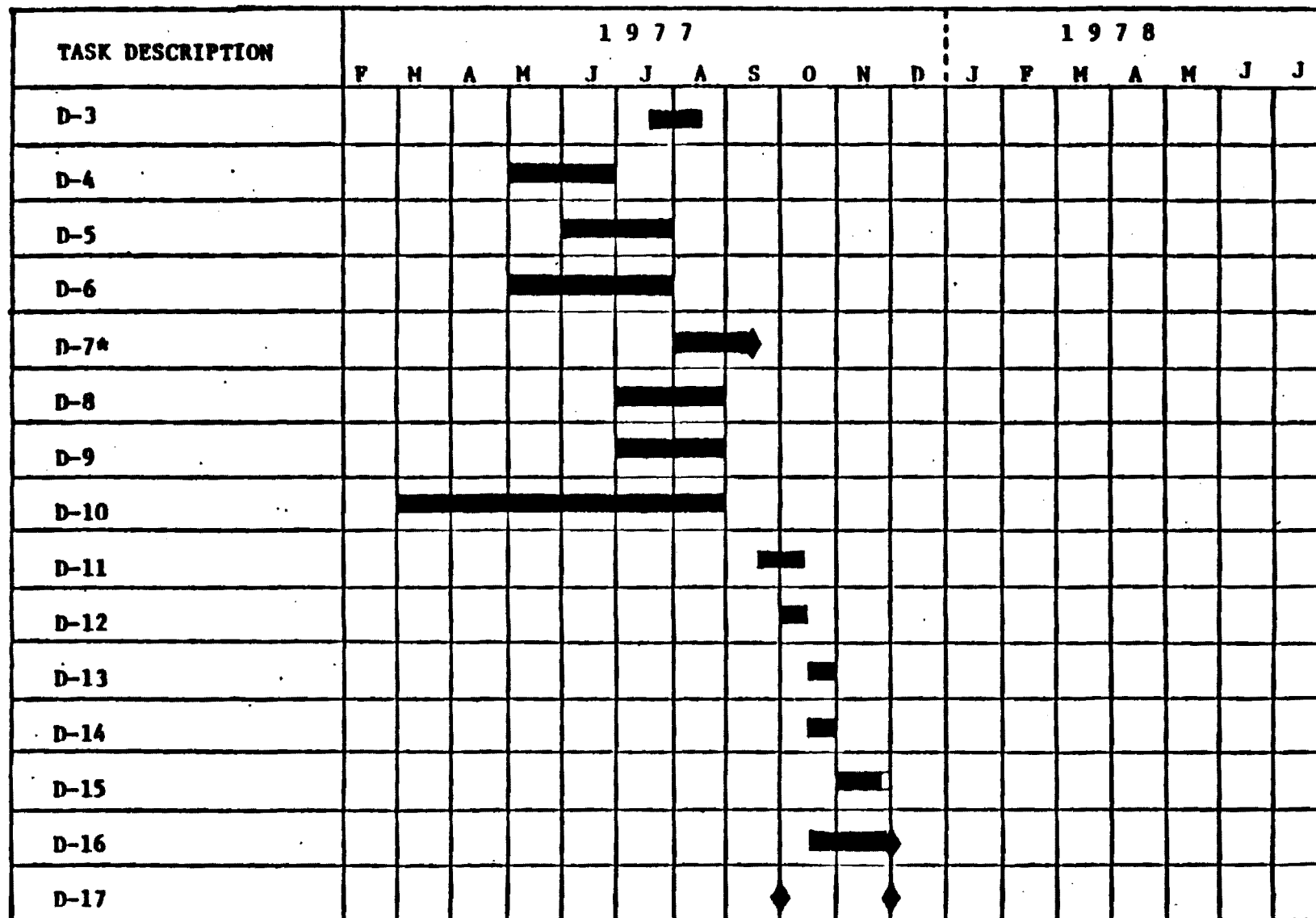
Notes:

1. ■ filled in portion indicates percentage of completion.
2. ◆ indicates milestone event.
3. * indicates substantial external factors in subtask.

figure 1
CB-AIDS TASK SCHEDULE (continued)



1



TASK DESCRIPTION	1978						1979												1980					
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
D-18	[Solid bar from Jan 1978 to Dec 1979]																							
D-19	[Empty]																							
Task E	[Solid bar from Jan 1978 to Dec 1979] 99%																							
E-1	[Solid bar from Jan 1978 to Dec 1979]																							
E-2	[Solid bar from Jan 1978 to Dec 1979]																							
E-3	[Solid bar from Jan 1978 to Feb 1978]																							
E-4	[Solid bar from Jan 1978 to Dec 1979]																							
Task F	[Solid bar from Jan 1979 to Dec 1979] 99%																							
F-1	[Solid bar from Jan 1979 to Feb 1979]																							
F-2	[Solid bar from Feb 1979 to Mar 1979]																							
F-3	[Solid bar from Jan 1979 to Mar 1979]																							
F-4	[Solid bar from Mar 1979 to Dec 1979]																							
F-5	[Solid bar from Jan 1979 to Feb 1979]																							
Submit Progress Report	[Diamond markers from Jan 1978 to Dec 1979]																							
Final Report	[Diamond marker in Jan 1980, Diamond marker in Feb 1980]																							



Georgia Institute of Technology

ENGINEERING EXPERIMENT STATION

ATLANTA, GEORGIA 30332

5 September 1980

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, DC 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report #36 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter report documents the efforts under the phase of Contract DOT-FH-11-9232 directed to preparing the CB-AIDS system for transition to the Georgia Department of Transportation for their use under the RUSH program. The transition effort involves several specific tasks including repair of a number of Digital Adapters, modification to the three Remote Stations, and design and fabrication of a "mini" Central Control Unit.

It should be noted that this monthly letter is the first such letter since Report No. 35 which was prepared on 28 January 1980. During this almost eight-month intervening period, project activities have been essentially nil because of the conditional status regarding the manner in which the CB-AIDS system was to be utilized.

During this reporting period a number of tasks have been either completed or are well underway. The required number of defective Digital Adapters have been repaired, the "mini" CCU has been designed with fabrication to begin soon, and modification of the Remote Stations is proceeding satisfactorily.

During September, modification of the Remote Stations will be completed as well as fabrication and checkout of the new Central Control Unit. Other important tasks scheduled for September include packaging of the Channel 9 crystal filters (the filters have been ordered and

received), repair of the defective telephone coupler, and design and fabrication of transmitter "shut-down" device. Coordination with Georgia DOT will be maintained, especially as the time approaches for system installation.

Respectfully submitted,

Charles S. Wilson
Project Director

CSW/kr

APPROVED:

R. W. Moss, Chief
Communications System Division

CONTRACTOR COST CORRELATION DATA:

Report 36 for the period: 1 August to 31 August 1980
Contract DOT-FH-11-9232

CURRENT MONTH ACTUAL COSTS:

\$4,578

CUMULATIVE TOTAL COST TO DATE:

\$211,864

ESTIMATE TO COMPLETE:

\$5,321



Georgia Institute of Technology

ENGINEERING EXPERIMENT STATION

ATLANTA, GEORGIA 30332

8 October 1980

Federal Highway Administration
Office of Research
Traffic Systems Division HRS-32
Washington, DC 20590

Attention: Mr. Frank Mammano
Contract Manager

Subject: Monthly Progress Report #37 - Contract No. DOT-FH-11-9232
"Motorist Aid Citizens Radio Service (CB) as a Wide Area
Communications System" (CB-AIDS) Georgia Tech Project A-1940

Gentlemen:

This letter report documents the efforts under that phase of Contract No. DOT-FH-11-9232 directed to preparing the CB-AIDS system for transition to the Georgia Department of Transportation for their use under the RUSH program. The transition effort involves several specific tasks including repair of a number of Digital Adapters, modification to the three Remote Stations, and design and fabrication of a "mini" Central Control Unit.

During this reporting period, progress continues in the CB-AIDS system modification program. The majority of tasks have been completed with the remainder well underway. At present major emphasis is being directed to the completion of the Central Control Unit and the automatic transmitter shut-down device. Both systems have been designed, fabricated and tested. The present effort is being directed to final packaging.

The principal task yet to be performed is packaging of the Channel 9 crystal filters. The majority of parts required for fabrication have been received; the reed relays (required for RF signal switching) have yet to be delivered but are expected shortly. Once the relays are received, final packaging of the crystal filters can be quickly completed.

Discussions with Georgia DOT personnel regarding the transition process have been conducted on several occasions. However, they have yet to make a final decision as to where the Remote Stations will be located for use under the RUSH program. Georgia Tech personnel will continue to interact with DOT personnel as their plans are finalized.

During October the remaining tasks under the transition program will be completed. At that time equipment transfer to Georgia DOT will be accomplished in accordance with contract requirements.

Respectfully submitted,

C. S. Wilson
Project Director

CSW/pf

Approved:

R. W. Moss, Chief
Communications Systems Division

CONTRACTOR COST CORRELATION DATA:

Report 37 for the period: 1 September to 30 September 1980
Contract DOT-FH-11-9232

CURRENT MONTH ACTUAL COSTS:

\$3,444

CUMULATIVE TOTAL COST TO DATE:

\$215,308

ESTIMATE TO COMPLETE:

\$1,877