



PART III Detail Economic Analyses

**"DEPARTMENT OF ADMINISTRATION
1981-82 BUDGET PRESENTATION"**

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November 1, 1980

**Richard D. Lamm, Governor
Lee White, Executive Director**

DEPARTMENT OF ADMINISTRATION
1981-82 BUDGET SUBMISSION

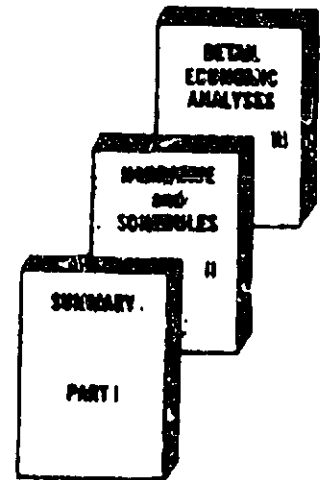
As depicted, the Department of Administration is transmitting to the Joint Budget Committee (JBC) the Department's budget request and justification in three parts for Fiscal Year 1981-82. The three parts are:

Part I -- "Summary" -- A brief recapitulation of the budget request, highlighting accomplishments, workloads, and fiscal controls.

Part II -- "Narratives and Schedules" -- the Standard forms and support data required by the JBC.

Part III -- "Detail Economic Analyses" -- Economic analyses to support and substantiate new resource requests. These analyses are submitted by this transmittal document.

This document is Part III.



PART III ECONOMIC JUSTIFICATION

This document contains the economic analyses and justifications that were prepared by this department for the FY 81-82 budget submission.

Various division directors prepared economic analyses, commencing in July 1980, for those new functions or expanded functions that were required in FY 1981-82. The requests from the various divisions were analyzed to determine if they met the following approval criteria established by the Executive Director:

- The requirement must be realistic, attainable, and practical.
- The function must provide a necessary service to either the citizens of Colorado or to other State agencies.
- Various options must be studied to determine the most efficient and economic method of providing the service.
- The new resource must provide a sufficient rate-of-return in succeeding time periods in order to warrant the investment.

The department prepared its draft budget using the above criteria for the new or expanded requirements submitted by the various divisions.

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MICROWAVE REPLACEMENT PROGRAM

PHASE V

SUMMARY

A multi-year project for the programmed replacement of obsolete equipment in the State's microwave systems has been developed by the Division of Communications commensurate with the Division's statutory responsibility to provide reliable cost-effective public safety communications for State agencies.

Funds were requested and appropriated in Fiscal Years 1975-76, 1976-77, 1979-80, and 1980-81 to complete the first four phases (81%) of this program.

Funds of \$1,076,559.00 are being requested in Fiscal Year 1981-82 for Phase V (19%) which will complete the total program.

The remaining segment of the system is obsolete and requires extremely large investments to maintain reliability. Replacement parts are expensive and difficult to obtain. Existing, obsolete equipment is no longer the type accepted by the Federal Communications Commission and must be replaced no later than 1985 pursuant to FCC Rules and Regulations, Part 94, Subpart C., Paragraph 94.61 (a), (see Appendix - Exhibit 6.).

Phase V is estimated to have a rate of return in excess of 21% which is well over the 8% figure established for continuing activities (see Appendix - Exhibit 3.)

NARRATIVE

State-owned microwave systems, including the segment for which replacement is requested during 81-82 originally developed as a result of the public safety radio needs of State agencies.

The Communications Division is charged by 43-5-124 and 24-30-901 through 24-30-905 CRS, 1973, as amended, with the responsibility for installation and maintenance of Public Safety two-way radio communications systems to fulfill the requirements of State agencies.

Implementation of Public Safety radio communications systems required selection and development of remote base station sites capable of providing the coverage required by State agencies. Implementation of these systems also required procurement of remote control circuits capable of interconnecting the remote base stations and the control or dispatch points. The result was two basic systems, one system for public safety radio broadcasting, and one system to interconnect the first system with its control points.

Federal Communications Commission regulations prohibit common carriers from providing Public Safety radio broadcast services. The State's needs in this area must therefore be provided by the State. However, the second system of remote control circuits may be provided by State-owned microwave, leased from common carriers or a combination of both.

Control circuit requirements were evaluated and either a State-owned microwave system installed or circuits leased from Mountain Bell, whichever provided the capability required with optimum reliability and minimum cost.

State-owned microwave systems were selected over leased systems in most applications. The State of Colorado now has 123 microwave terminals in service.

The system to be replaced in the fifth phase of the program consists of 16 sites that currently utilize obsolete RCA CW20 vacuum tube type equipment which was purchased and installed between 1961 and 1963 with an anticipated service life of 12-14 years. RCA CW20 equipment was designed and initially produced in 1950. It was removed from general production and manufactured only on a special custom order basis after 1963. All production of CW20 type equipment and replacement components ceased in 1968 (see appendix-exhibit 4).

NARRATIVE
CONT'D.

Manufacturer's replacement parts for the existing equipment have become increasingly difficult to obtain because the manufacturer's stock was not replenished for equipment no longer in production (see appendix - exhibit 5). This problem was compounded when RCA discontinued production of all types of microwave equipment in 1970.

Component parts of the original equipment supplied to RCA by other vendors were also designed to satisfy state-of-the-art requirements of the early 1950's. Consequently, they were discontinued by the original manufacturers as improvements in technology decreased demand. As a result, substitute replacement parts for existing equipment are either totally unavailable or are not economically feasible due to the special production runs required.

One example of replacement part procurement difficulties is as follows:

2C39B vacuum tubes, the heart of CW20 microwave equipment, were originally standard products of five different vacuum tube manufacturers at a cost of \$18.00 - \$20.00 each. These tubes are now available from one manufacturer only, on a special order basis at a cost of \$74.00 each. Individual tube orders are collected by the manufacturer and held until a feasible production level is assured. Scheduled delivery cannot be guaranteed. These tubes employ obsolete technology and may be totally discontinued at any time.

This particular component is but one example of replacement part procurement problems. Fifty-two percent of the original equipment manufacturer components critical to the operation of the system are no longer manufactured. We are operating obsolete equipment on borrowed time. Should one of the key system components become unavailable, an event which is highly probable, the system will be inoperative.

We are not requesting additional personnel as part of the microwave replacement program. We are now at a critical point where continued operation of the obsolete equipment with its increasing failure rate and maintenance problems will require additional maintenance personnel. Replacement of obsolete equipment will preclude asking for additional personnel and will increase available maintenance time.

This cost avoidance in the microwave subsystem will allow the division to more nearly meet the programmed level of maintenance in the other existing public safety subsystems.

NARRATIVE
cont'd

An average vacuum tube type microwave station in the system proposed for replacement consumes \$2,839.00 labor and material annually with an average meantime between failures of 2500 hours. These costs will increase next year to an estimated \$3,177.00 with a probable 10% reduction in the meantime between failures. A typical transistorized microwave station of the type proposed as replacement equipment consumes an average of \$581.00 labor and material annually with a meantime between failures of 35369 hours. These costs will increase next year to an estimated \$622.00 per year.

It can be seen from this comparison that the obsolete equipment costs five times as much to maintain and we can achieve less than one tenth the reliability possible from transistorized equipment of the replacement type proposed.

Existing system costs and a comparison with the requested replacement system as service producing alternatives are detailed in the appendix.

Refurbishing existing equipment is not economically feasible even if replacement parts were available. This procedure was evaluated on a limited basis and found to cost a minimum of \$1,200.00 per station. While reconditioned stations exhibited a temporary improvement in transmission quality, maintenance costs and reliability over a one year period were not significantly improved. Even if benefits had proven to be significant, component parts are not available in the volume necessary for a major reconditioning program.

The existing obsolete equipment is not technically compatible with current state-of-the-art equipment and must therefore be replaced on a system-by-system basis to retain frequency control within Federal Communications Commission regulations. We cannot replace one station at a time or incoherent groups of stations to extend the project over a greater period of time even if the replacement parts and maintenance situation made it practical to delay replacement.

Existing equipment does not comply with technical standards established under Part 94 of the Federal Communications Commission Rules and Regulations effective in August of 1975. These same rules specify removal of all such equipment from service no later than 1985. However, authorizations to operate obsolete equipment during the interim period are subject to immediate revocation if interference is produced in adjacent systems which are in compliance with the new standards. The State could be forced to upgrade

NARRATIVE

cont'd

equipment or cease operation of existing obsolete equipment at any time (see appendix - exhibit 6). One objective of the replacement program initiated in 1975 was to comply with new regulations well within the interim conversion period.

The proposed replacement systems will not only provide the circuits needed now at lower long-range costs than the existing systems or leased circuits, but will increase our systems circuit capacity from 90 to 300 circuits. This increased capacity will not increase the cost of the basic microwave systems above the cost to replace existing facilities. Added circuit capacity is a side benefit of systems replacement, not a major justification factor.

However, if a fraction of the circuit service inquiries received to date materialize as formal service requests, the channel load on the systems to be replaced will more than double.

The only immediate alternative to replacement and continued operation of the State's microwave system is the lease of remote control facilities from the common carrier.

This alternative was considered, but eliminated for the same reasons that a State microwave system was initially developed.

1. Since the State must provide the Public Safety broadcast station, housing for the stations, antenna mounting structures, auxiliary power, support components, maintenance capability and remote site development whether control circuits are State-owned or leased, the comparatively minor additional investment in basic facilities and maintenance capability required to accommodate microwave system equipment make state owned microwave systems a cost effective alternative to leased control circuits.
2. Procurement, installation and maintenance of State-owned microwave control systems is more economical than recurring costs incurred with leased remote control facilities. For example, one full duplex control channel on the state's existing microwave system cost \$1.15 per circuit mile per month, including all operating costs, maintenance and equipment amortization. A comparable circuit, leased from the common carrier, costs \$4.09 per mile per month plus \$40.82 per month in termination charges.

NARRATIVE
cont'd

A 200 mile circuit on the state system costs \$2,760.00 annually, while a similar common carrier circuit would cost \$10,306.00 annually. These comparisons are based on current costs which includes State system costs which are inflated by the excessive maintenance required by existing obsolete equipment. The savings will become more dramatic as the State system is upgraded through replacement of obsolete equipment and the resulting decreases in maintenance and operating costs.

Rate Increases for service of the type described above requested by Mt. Bell were denied by the Colorado Public Utilities Commission on August 5, 1980. It is reasonable to assume that rate increases will be requested again in 1981.

3. It has been proven statistically that a microwave system dedicated to Public Safety services is more reliable than leased facilities. Maintenance statistics compiled from existing combination circuits show that state microwave systems are responsible for two percent of circuit failures while leased facilities are responsible for 30 percent of circuit failures. Meantime to restore microwave service is considerably shorter than leased services, particularly in mountainous terrain.
4. State owned microwave systems not only provide the minimum required circuit capacity at much lower cost but with greater reliability than leased circuits. They also have inherent spare capacity for additional circuits. Additional circuits may be added for data transmission, telemetry, or a multitude of other functions at extremely low cost compared to leased facilities.

ASSUMPTIONS

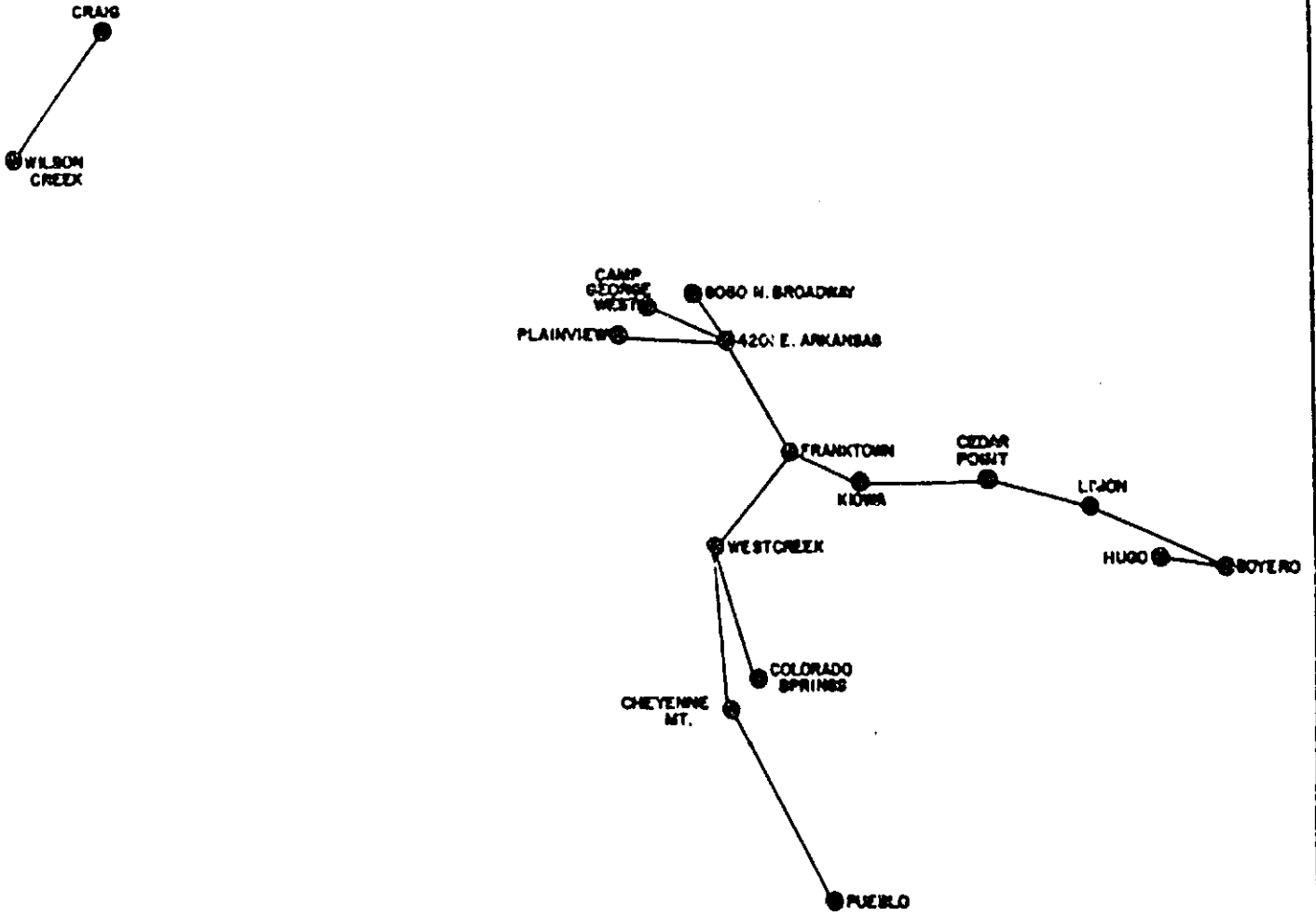
1. The State will continue to be responsible for the provision of Public Safety Communications services to State agencies.
2. Technology will continue to advance, but systems to supplant existing methodology are not expected to become a reality within the next 10 years.
3. Procurement, installation and maintenance of State-owned microwave control systems will continue to be more reliable and economical than leased remote control facilities.
4. Spiralling costs of common carrier services and the trend toward privately owned systems to offset these costs will enhance the potential value of the State-owned microwave system.
5. Replacement components for the existing system, many of which are now no longer available, will become totally unavailable.
6. Federal Regulations requiring replacement of obsolete systems with State-of-the-art hardware are not likely to be restricted.
7. House bill 1726 modifies Section 6, Part 2, of Article 75 of Title 24 CRS 1973 (24-75-201.1) to restrict the level of general fund spending over the next several years. Funding for large projects will become more difficult to obtain.

RECOMMENDATION

The Department of Administration recommends that an appropriation be requested for Fiscal Year 81-82 to complete the replacement program initiated in FY 75-76.

APPENDICES

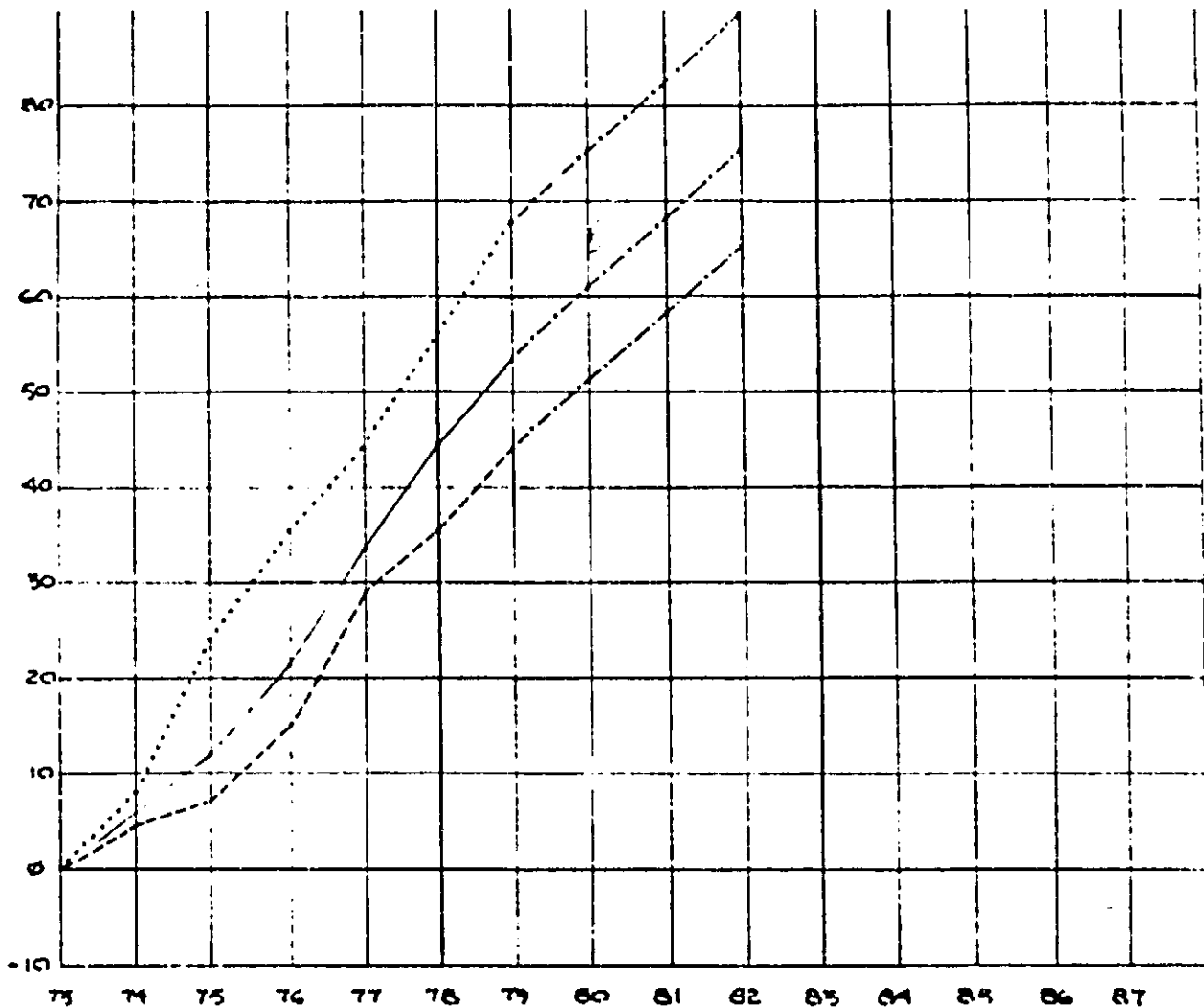
EXHIBIT 1



LEGEND

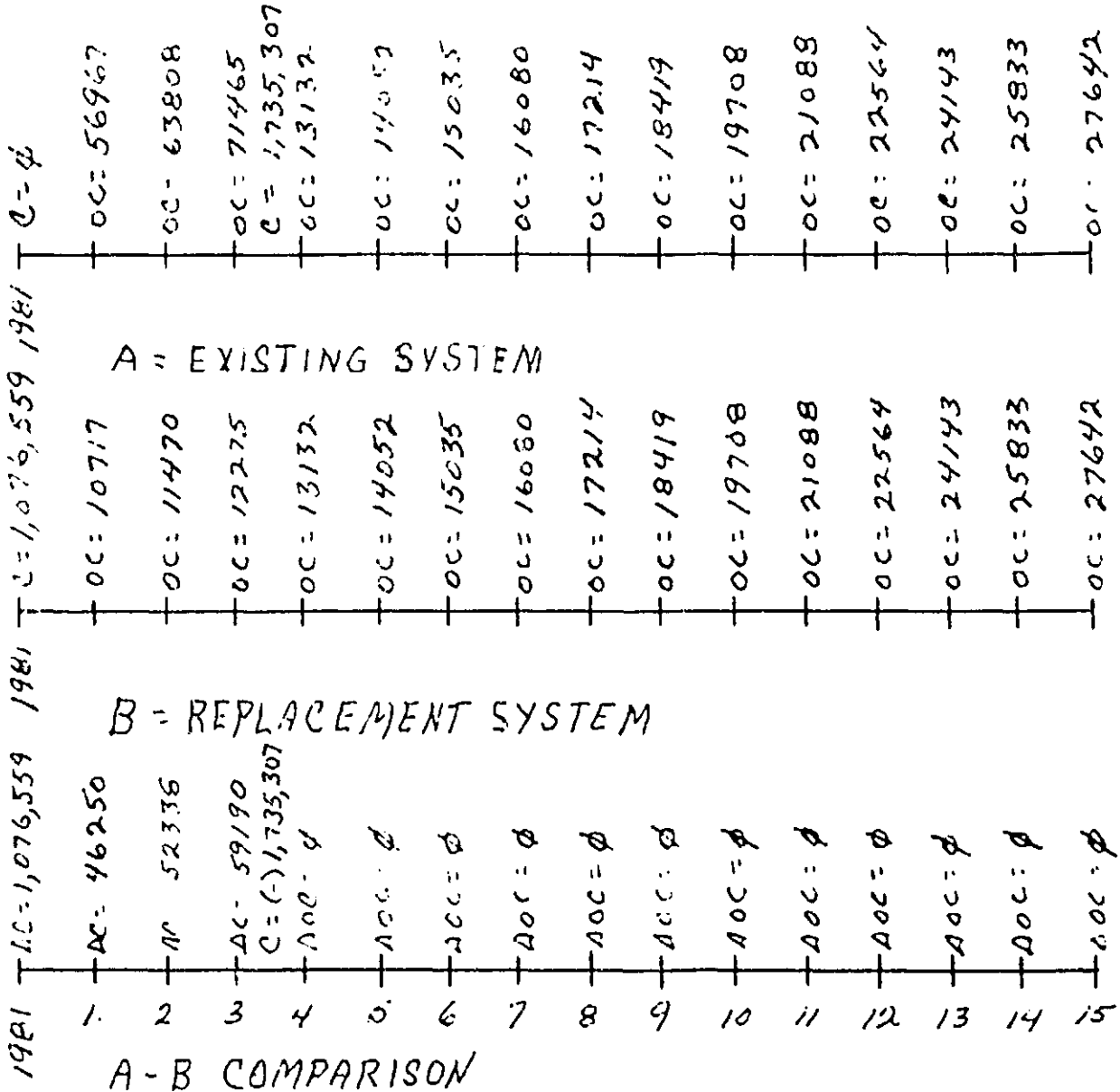
● - MICROWAVE STATION

SCALE		PROJ. TITLE	
DATE		DWG. TITLE	
DRAWN BY	CHECKED BY	MICROWAVE REPLACEMENT PROGRAM - PHASE V (1981 - 82)	
PROJ. NO.	DWG. NO.		
		SHEET	6



	ACTUAL COSTS	PROJECTED COSTS
LABOR	-----	-----
PARTS	-----
TOTAL SYSTEM	-----	-----

SCALE		PROJ. TITLE MICROWAVE REPLACEMENT PROGRAM - PHASE III	
DATE JULY 1979		DWG. TITLE MAINTENANCE COSTS EXISTING MICROWAVE SYSTEM	
DR. BY	CR. BY		
PROJ. NO.		DWG. NO.	SHEET 6



$PW = 1,076,559 - 46250(P/F, i; 1) - 52338(P/F, i; 2) - 59190(P/F, i; 3) - 1,735,307(P/F, i; 3)$
 $1,076,559 = 46250(P/F, i; 1) + 52338(P/F, i; 2) + 59190(P/F, i; 3) + 1,735,307(P/F, i; 3)$
 i FOR 20% EQUATION = 1,113,359
 i FOR 25% EQUATION = 989,278
 $i = 20\% + 5\% \left(\frac{1,113,359 - 1,076,559}{1,113,359 - 989,278} \right) = 21.5\%$
 ROR = 21.5%

SCALE		PROJ. TITLE	
DATE		MICROWAVE EQUIPMENT REPLACEMENT - I	
DEC 1980		DWG. TITLE	
DR. BY	CK. BY	TIME DIAGRAM	
		RATE OF RETURN	
PROJ. NO.	DWG. NO.	SHEET	
		6 OF	

Colorado State Patrol
4201 East Arkansas Ave.
Denver, Colorado 80222



Attention: Mr. E. Yess
Principal Supply Officer

Gentlemen:

November 20, 1970

Please refer to your letter of November 13, 1970 regarding quantity (4) Mixer Cavity gasket for CW-20 Microwave Receiver.

We are also unable to identify this item by the Part Number 501506 given in your letter. The CW-20 microwave is no longer being manufactured and very few replacement parts are available.

Since you reference the CW-20 receiver mixer cavity gasket, I am assuming that you may have reference to the replacement RF leakage gasket mentioned in the CW-20 Instruction Book on Page XI-16. In hopes that this is the gasket you need, we are attaching RCA Drawing No. 8483281 which contains the manufacturing details of this item. We can not supply this item, but you may be able to have the item made up locally.

Thank you for your continued interest in our products.

Very truly yours,

P. E. Stout
Microwave Sales

cc:

J. A. Long
H. S. Wilson



SUBPART C—TECHNICAL STANDARDS

§ 94.61 Applicability.

(a) The technical standards of this subpart shall govern, effective July 1, 1976, the issuance of authorizations for new stations and changes in authorized stations as specified in § 94.45. Stations authorized prior to this date not meeting the provisions of this subpart may continue to be authorized for operation under previous technical standards as shown in § 94.02 through July 31, 1985. Except as provided in § 94.65, effective August 1, 1985, all stations will be required to operate in accordance with the provisions of this subpart.

(b) Frequencies in the following bands are available for assignment to stations in the Private Operational-Fixed Microwave Service:

FREQUENCY BAND (MHz)	
952 to 960.....	(1)
1850 to 1990.....	(2) (1a)
2130 to 2150.....	(3)
2150 to 2160.....	(1)
2180 to 2200.....	(1)
2450 to 2500.....	(1)
2500 to 2690.....	(2)
6525 to 6575.....	(1a)
6575 to 6625.....	(3), (1a)
6625 to 3875.....	(3), (7), (1a)
12,200 to 12,500.....	(3)
12,500 to 12,700.....	(3), (8)
13,200 to 13,250.....	(9), (10), (1a)
18,360 to 19,040.....	(1), (10), (17)
21,200 to 22,000.....	(10), (11), (12), (13)
22,000 to 23,600.....	(10), (17), (13)
21,000 to 31,200.....	(8)
38,600 to 40,000.....	(2), (1a)
Bands above 40,000.....	(1a)

¹ Frequencies in this band are shared with stations in the International Fixed (in Puerto Rico and the Virgin Islands) and International Control Services. (Part 23)

² Frequencies in this band are shared with stations in the International Control Service. (Part 23)

³ Frequencies in this band are shared with stations in the Multipoint Distribution Service. (Part 21)

⁴ Frequencies in this band are shared with mobile and radiolocation stations in other services, and must accept harmful interference that may be experienced from operations of industrial, scientific, or medical (ISM) equipment operating on 2450 MHz.

⁵ Frequencies in this band are shared with earth stations in the Fixed Satellite Service (Part 25), space stations in the Broadcasting Satellite Service (Part 25), and with stations in the Instructional Television Fixed Service (ITFS) (Part 74). Stations licensed under Part 94 are restricted to the three group H channels, 2650-2656 MHz, 2663-2669 MHz and 2674-2680 MHz; and the three response frequencies, 2696.9375, 2687.9375, and 2688.9375 MHz.

⁶ Frequencies in this band are shared with Earth (Earth-to-space) stations in the Fixed Satellite Service. (Part 25)

⁷ (Reserved)

⁸ Frequencies in this band are shared with space (space-to-Earth) stations in the Fixed Satellite Service. (Part 25)

⁹ This band is shared with fixed and mobile station operations authorized under other services.

¹⁰ Frequencies in this band are shared with fixed stations in the Domestic Public Radio Services. (Part 21)

¹¹ Frequencies in this band are shared with space (space-to-Earth) stations in the Earth Exploration Satellite Service. (Part 25)

¹² Authorizations are normally granted only to common carriers (Part 21) in the band segments 21.2-21.8 GHz and 22.4-23.00 GHz, and to operational-fixed users (Part 94) in the segments 21.8-22.4 GHz and 23.0-23.6 GHz. Cross-service assignments for these users may be made only upon a showing that no interference-free frequencies are available in the appropriate band segments.

¹³ This frequency band is shared with U.S. Government Stations.

¹⁴ Frequencies in this band are shared with stations in the Television Auxiliary Broadcast Service (Part 74), the Local Television Transmission Service (Part 21) and the Point-to-Point Microwave Service (Part 21).

¹⁵ This band is not available for operation by persons whose sole basis for eligibility in this service is established under § 90.75(a)(1) for licensing in the Business Radio Service. (Part 90)

¹⁶ Available on developmental basis only under Subpart E of this part.

¹⁷ Assignments will not be made in the band segments 18,360-18,680 MHz or 18,920-19,040 MHz unless a showing is made that there are no available frequencies in the band segments 18,680-18,700 MHz and/or 18,700-18,920 MHz. All assignments in any band segment will be for the highest available frequency.

¹⁸ These frequencies are assigned for use within a rectangular service area to be described in the application by the maximum and minimum latitudes and longitudes. Such service area shall be as small as practicable consistent with the local service requirements of the user. The use of these frequencies is subject to the terms and conditions set forth in § 21.711. These frequencies shall be assigned only where it is shown that the applicant will have a reasonable projected requirement for a multiplicity of service points or transmission paths within the area.

[§ 94.61(b) footnote 15 amended eff. 12-3-79; V(79)-1]

§ 94.63 Interference protection criteria for operational-fixed stations.

(a) Before filing an application for new or modified facilities under this part the applicant must perform a frequency engineering analysis to assure that the proposed facilities will not cause interference to existing or previously applied-for stations in this service of a magnitude greater than that specified in the criteria set forth in paragraph (b) of this section, unless otherwise agreed to in accordance with § 94.15(b). In addition, when the proposed facilities are to be operated in the bands 18,630-19,040 MHz, 21,200-21,800 MHz, 22,400-23,000 MHz, 31,000-31,200 MHz, or 38,600-40,000 MHz, applicants shall follow the prior coordination procedure specified in § 21.100(d) of this chapter as regards stations in the Domestic Public Radio Services and when the proposed facilities are to be operated in the bands 2655-2690 MHz or 12,500-12,700 MHz, applications shall also follow the procedures in § 21.706 (c) and (d) and the technical standards and requirements of Part 25 of this chapter as regards licenses in the Communication-Satellite Service. (See also § 94.77)

(b) The interference protection criteria for operational-fixed stations, other than those licensed under the provisions of § 94.90 are as follows:

(1) To long-haul analog systems, employing frequency modulated radio and frequency division multi-

Mr. A. J. Anderson
Administrative Officer IV
Division of Communications
2452 West Second Avenue
Denver, Colorado 80223



Dear Mr. Anderson:

August 11, 1977

Please accept my apologies for this belated reply to your letter of May 31, 1977, in reference to the RCA, Model CW20 Microwave equipment product line.

We are most happy to note that your state-wide system of RCA CW20 has performed notably well for the past 20 years; however, we must agree with your plan to replace the system with a state-of-the-art, solid-state line. Twenty years of performance from tube-type equipment is unusual in itself, and obviously, the State of Colorado Communications activities should be commended for a superb and effective maintenance performance.

The CW20 series main-frame production was terminated during the latter part of 1965. Production of CW20 sub-assemblies and other support items continued until early 1968, when the product line was 100% replaced by the RCA CW60 and CW62 series, which was of course a solid-state design. In 1970, industry-wide microwave sales projections revealed a relatively static market potential of low volume for succeeding years, and we elected to withdraw from the microwave field completely, rather than invest heavily in what appeared to be a very limited growth activity.

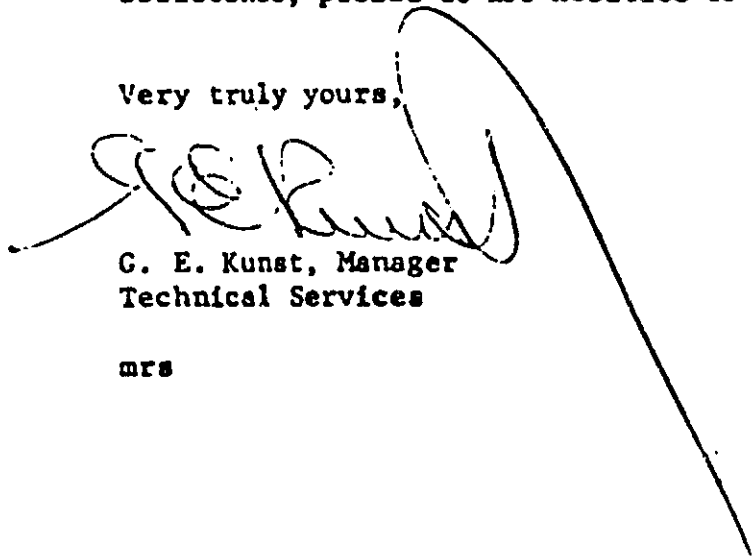
As far as replacement parts are concerned, RCA's corporate policy establishes replacement parts support guidelines for all of its manufactured products, depending on an assessment of its useful life. In the case of the microwave line, a ten-year parts support program was established, and under this guideline, many replacement components would essentially become unavailable beginning in 1975. As a practical case, we will probably have a small random quantity of replacement items on hand for the next several years, even though the parts support term has expired. These would of course be "isolated items", and by no means could you at this time continue to support your systems with full replacement parts support.

One of the points in your letter requests "our estimate of CW20 systems that have been replaced". Since we terminated all new sales activity in this field during 1970, I cannot give you factual information on this phase. From personal experience of 28 years in the communications field with RCA, since most of our microwave customers are also customers of this division, I can at this date only recall two systems that are still in service, excluding your own. Of these two, I have no knowledge as to whether or not the original systems configurations are 100% intact or have been partially replaced. I can state, however, that both customers made heavy and unusual investments in spare components and subassemblies many years ago that enabled them to properly maintain the system through this time frame.

I trust this information will enable you to finalize your replacement equipment plans. It would appear that your system is now functioning; however, it would also appear that you are on "dangerous ground" as it relates to continuing communications capability. Should a failure occur other than one of an extremely minor nature, a 90% probability exists that you could not restore the affected circuit, by any means short of outright equipment replacement on an emergency and very costly basis.

Thank you for your interest, and if we can be of further assistance, please do not hesitate to call on us.

Very truly yours,



G. E. Kunst, Manager
Technical Services

mrs

COMPUTER OUTPUT MICROFILM

SUMMARY

An original 1973 Management Services study on Computer Output Microfilm (COM) has been updated several times and each time, since 1975 has indicated the state could save money with an in-house COM system.

The in-house COM system will save \$65,000/year and provide a rate of return of 480%.

Therefore, Central Services requests approximately \$173,275 in additional spending authority to install COM in Fiscal Year 1981-82. Only \$173,275 is being requested in Fiscal Year 1981-82 because, due to training, ordering and installing equipment and phasing in customers, we will be operating only a partial year. Also, since Central Services is a revolving fund, the additional spending authority of \$173,275 will not impact the general fund.

NARRATIVE

Management Services completed a study in May 1973 on Computer Output Microfilm (COM). COM is a term referring to the process of placing information generated by a computer directly onto film in the form of a micro image, typically 1/24 or 1/42 of its original size. The study indicated that the state almost had enough volume at that time to consider an in-house COM system. The volume in 1973 was 109,000 originals/month.

Management Services updated the data in the 1973 study in 1974 at which time the volume was 266,834 originals and 24,012 duplicates/month. Also the update indicated that the state should proceed to install an in-house COM system since the volume was sufficient to support it.

Since 1974 the COM volume has grown to 28,224,606 originals or eleven times the 1974 volume and 2,348,241 duplicates or ten times.

In 1979 and 1980 Central Services again updated the 1973 report by performing economical analyses using the most current data available. Also Central Services formed a Committee in 1979 of all major users and drafted a request for proposal (RFP). The Committee also discussed the in-house system and all concerns were discussed and resolved.

The current data indicates an in-house COM system will save the state \$65,000 per year once fully implemented and possible additional savings as agencies convert more paper reports to microfiche. Also microfilm saves space and archives storage costs.

The rate of return is 480% as attached.

ASSUMPTIONS

1. The current COM users will continue to use microfiche to reduce computer, paper, and storage costs.
2. Increasing costs for storage necessitate placing more information on microfiche.

RECOMMENDATION

The Department of Administration recommends the implementation of an in-house COM system to reduce costs and to promote greater usage of microform formats.

Rate of Return Analysis

Install in-house COM unit for a cost of \$374,000 and a yearly savings of \$65,520

Service Bureau Costs/Year

0	33,107	33,107	33,107	33,107	33,107	33,107	33,107
0	1	2	3	4	5	6	12

L = 0

Proposed In-House Costs

15,000	27,647	27,647	27,647	27,647	27,647	27,647	27,647
0	1	2	3	4	5	6	12

L = 74,000

$$\Delta C \text{ Costs} = \Delta S \text{ Savings}$$

$$\Delta C \ 15,000 = \Delta S \ 5,460 (P/A_{i,12}) + 74,000 (P/F_{i,12})$$

$$\text{Use } i = 40\% \quad 15,000 = 5,460 (2.456) + 74,000 (.0176)$$

$$15,000 = 13,410 + 1,302$$

$$\underline{15,000 \approx 14,711}$$

Therefore, interest rate is approximately 40% for one month period or 480% for a year.

ROR = 480%

Current
MSC Costs

<u>Month</u>	<u>Frames</u>	<u>Originals</u>	<u>Duplicates</u>	<u>Cost</u>
July, 1979	2,180,075	11,431	192,196	\$28,846.00
August, 1979	2,132,470	10,817	182,212	27,880.00
September, 1979	2,452,201	13,648	253,419	35,928.00
October, 1979	2,102,514	10,732	188,417	27,693.00
November, 1979	2,004,584	10,621	188,735	25,980.00
December, 1979	2,517,740	14,282	232,753	34,462.00
January, 1980	2,566,167	13,630	176,131	29,642.00
February, 1980	2,015,447	10,647	144,755	23,910.00
March, 1980	2,878,457	15,544	230,165	36,095.00
April, 1980	2,366,163	11,977	163,418	27,494.00
May, 1980	2,320,512	11,779	148,132	25,778.00
June, 1980	<u>2,688,276</u>	<u>13,377</u>	<u>247,914</u>	<u>36,454.00</u>
	28,224,606	148,485	2,348,247	\$360,162.00
Current Month/Average	2,352,051	12,374	195,687	<u>\$30,014.00</u>
Projected monthly average for 1981-82 considering 8% material price increase per contract and 8% growth				<u>\$33,107.33</u>
Annual MSC Costs = \$33,107.33 x 12 =				<u>\$397,288.00</u>

October 15, 1980

COM COSTSFull Year Operation
Projecting Costs Effective 10/01/81Personnel

<u>Grade</u>				
54	1.0	Computer Programmer A	\$14,592.00	
42	1.0	Principal D.E.O.	10,884.00	
36	3.0	Senior D.E.O.	28,224.00	
28/32	3.0	D.E.O. A/B	24,408.00	
56-2	.34	Admin. Officer I-B	5,471.00	
41	.25	Vehicle Driver	2,682.00	
			<u>\$86,261.00</u>	
		Projected 7.5% increase 7/1/81	6,470.00	
			<u>\$92,731.00</u>	
		PERA 12.2	11,313.00	
		Insurance	<u>4,123.00</u>	
				<u>\$108,167.00</u>

Operating Expenses

Interest	\$19,923.00	
Maintenance	27,900.00	
Supplies		
Silver 545 x 64.80) Considering 8%	35,316.00	
Diaz 1426 x 64.80) price increase	92,405.00	
Chemicals 3000) + 8.0% growth	3,000.00	
Depreciation	30,000.00	
Overhead (direct & indirect)	10,400.00	
Vehicle	2,000.00	
Printing	750.00	
Postage	1,200.00	
Supplies (office)	600.00	
Telephone	<u>108.00</u>	
		<u>\$223,602.00</u>
(In-House) Grand Total		<u>\$331,769.00</u>

Savings

Service Bureau Costs	\$397,288.00	
Central Services' In-House Costs	<u>331,769.00</u>	
		<u>\$65,519.00</u>

FIELD MOBILE MAINTENANCE

PUBLIC SAFETY PROGRAM

SUMMARY

Mobile radio units operating in the state land mobile radio network receive maintenance from 13 shops operated by the Division of Communications. Each shop is responsible for an assigned area and provides maintenance for all equipment located within that area. The Field Maintenance Program proposes to add 35 additional Maintenance sites that would operate on a scheduled basis. Maintenance provided from these locations would reduce round trip travel time for most mobile units to a maximum of one hour.

The equipment cost to establish the program is \$162,900.00. Travel expense is estimated to be \$11,200.00. The total program cost is \$174,100.00.

In 1981-82, we are requesting a pilot program of only one site at a cost of \$13,500.00. See attached Exhibit 1 for an explanation of the method of operation of the pilot program.

NARRATIVE

The Field Maintenance Program will allow the Division of Communications to provide periodic maintenance of mobile communications equipment, at 35 maintenance locations in addition to the 13 permanent maintenance shops that now exist

This program, described below, is supported by the state, county and city agencies that participate in the State Telecommunications System.

At the present time there are 3625 state and local government mobile radio units operating on systems licensed to the State of Colorado. Ninety-four percent or 3407 are maintained by Communications Division Technicians.

An average unit requires maintenance on three occasions per year, two of which are scheduled for preventative maintenance inspection and frequency certification.

Preventative maintenance inspections increase system reliability and reduce equipment down time through isolation and correction of minor defects before they become catastrophic failures. However, preventative maintenance inspections are also expensive to mobile users in terms of public availability, vehicle operating costs, and man hours lost transporting mobile equipment to and from our fixed maintenance sites for inspection.

These inspections remove public safety vehicles from their area of responsibility for as much as a day at a time due to the travel distances involved. For a small town, this may mean the loss of their entire police force or ambulance service until the unit returns.

Communications Division operating procedures have been analyzed to determine the feasibility of establishing a transient field mobile maintenance program in order to achieve the preventative maintenance inspections without any attendant loss of equipment availability and the high transportation costs to the mobile user.

Several plans were investigated to facilitate a field preventative maintenance program for mobile equipment.

Specialized mobile service vans were investigated and rejected because they are not economically feasible for our operation. Equipment for mobile vans is expensive, difficult to transfer from one vehicle to another, and requires a vehicle style that is not suitable for a large portion of the operation. An expensive prohibitive duplication of our vehicle fleet would be necessary.

The use of special mobile service trailers was investigated and rejected due to cost and safety considerations.

The last option considered which was subsequently selected utilizes special, highly portable additional test equipment in conjunction with existing vehicles and garage facilities.

The proposal would establish thirty-five transient maintenance sites, in addition to the existing thirteen fixed maintenance sites now in service. The transient sites were selected to reduce the round trip travel time to a maximum of one hour for most of the mobile equipment users who require our service.

All transient maintenance sites, with the exception of one, would be assigned to cities and towns where we currently perform preventative maintenance on fixed station equipment. This arrangement minimizes the increase to our vehicle mileage, our operating costs or travel time. Mobile units would be assigned maintenance at each transient site and scheduled for inspection at a time coincident with the fixed equipment scheduled for preventative maintenance inspection.

No additional technician personnel would be required for implementation of this program as the labor time required per mobile unit would not increase.

Implementation of this program will require procurement of special portable mockups, portable power sources, additional communications monitors and other test equipment necessary to facilitate simultaneous operation of the existing fixed maintenance sites and the proposed transient maintenance sites.

Structural accommodations would be provided by agreement in existing state or local government facilities at the designated sites. Standard benches, electrical service and lighting would be installed in facilities available, such as at a Highway garage, fire station, etc.

Implementation of the field mobile maintenance proposal is requested in our budget for Fiscal 81-82. Without these funds, the program cannot be implemented.

ASSUMPTIONS

1. Field mobile maintenance would save mobile radio users an estimated 164,256 miles traveled and 3,035 man hours cost each year. Benefits to the general public would most certainly be increased by reducing the amount of time that public safety units are removed from their assigned area. A specific dollar value for this benefit cannot be easily determined. Additionally, the program will have a positive impact on energy conservation by reducing mileage of state and local government vehicles.
2. The following field mobile maintenance service criterion will be established:
 - a. Field sites will be established only for preventative and minor failure maintenance by appointment.
 - b. All preventative maintenance services now performed at our fixed maintenance sites will be performed at the field maintenance sites except services on radar or vascar units.
 - c. All installations and removals will be performed at our fixed maintenance sites. Fire trucks will be the only exception.
 - d. All failure maintenance will be performed at our fixed maintenance sites. Minor failures which can be tolerated by the user may be held for repair until the next scheduled technician trip to the field site. Our technicians will not travel to the field site solely to repair a mobile failure or return a unit repaired.
 - e. Mobile equipment failures found to be defective beyond the scope or minor field repairs will either be taken back to the fixed maintenance site by our technician for repair and picked up after repair at our fixed maintenance site by the user, or be scheduled for repair on a date that the user can bring the equipment to our fixed maintenance site.
 - f. All fire trucks will be maintained at their assigned locations.
 - g. Arrangements may be made for maintenance of some ambulances and very large snowplows at their assigned location if the assigned

location is more than 15 miles, one way, from the nearest transient of fixed maintenance site. The feasibility of such arrangements will be evaluated and authorization granted on an individual basis.

The criterion listed will be followed without exception to provide an economically feasible field maintenance program.

The primary disadvantages to the Division of Communications are increased technician travel time and increased scheduling problems. However, our primary responsibility is and always has been to provide the most efficient, reliable and economical service possible to the public safety communications user. The program proposed is a positive step toward improving that service.

RECOMMENDATION

It is recommended that an appropriation be authorized in Fiscal Year 81-82 to implement the field maintenance "Pilot Program" in the Fort Collins area.

FIELD MAINTENANCE
PUBLIC SAFETY PROGRAM

SUMMARY "PILOT FACILITY"
(Pilot Facility Field Maintenance Program)

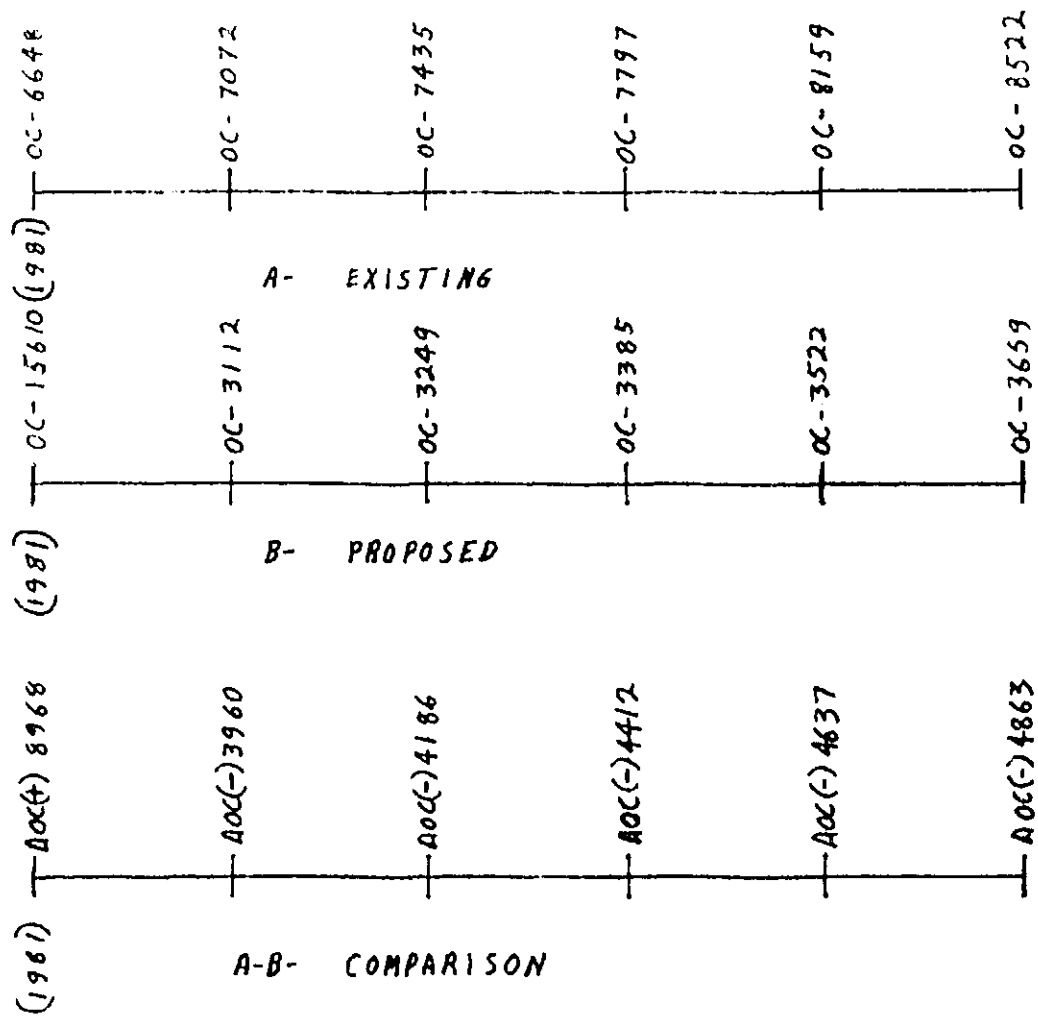
Fort Collins area mobile radio units operating in the state land mobile radio network receive maintenance at the Division of Communications fixed repair facility in Greeley.

The field maintenance "Pilot Program" proposes to establish an additional field maintenance site in Fort Collins that would operate on a scheduled basis. Maintenance provided from this location would reduce round trip travel time for most mobile units from three hours to one hour.

The equipment cost to establish the pilot program is \$12,650; Travel expense is estimated at \$850.00 per year. The total initial year program cost is \$13,500.00.

User savings projected for the initial service year are as follows:

4,690 mile per year	\$.20 per mile	\$ 938
200 man-hours per year	\$18.00 per hour	<u>3,600</u>
		\$4,538 per year



$$PW = 8968 - 3960(P/Fi_1) - 4186(P/Fi_2) - 4412(P/Fi_3) - 4637(P/Fi_4) - 4863(P/Fi_5)$$

$$8968 = 3960(P/Fi_1) + 4186(P/Fi_2) + 4412(P/Fi_3) + 4637(P/Fi_4) + 4863(P/Fi_5)$$

FOR $i = 30\%$ EQUATION = 10256
 FOR $i = 40\%$ EQUATION = 8491

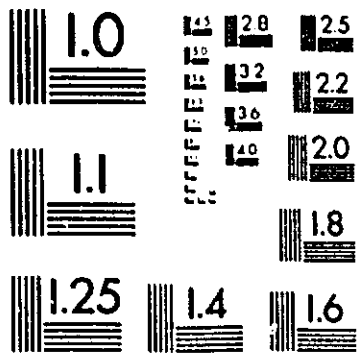
$$i = 30\% + 10\% \left(\frac{10256 - 8968}{10256 - 8491} \right) = .30$$

R.O.R = 30%

SCALE		PROJ. TITLE	
DATE		FIELD MAINTENANCE "PILOT PROGRAM"	
AUG. 1980		DWG. TITLE	
OR. BY		TIME DIAGRAM	
CK. BY		RATE OF RETURN	
PROJ. NO.		DWG. NO.	SHEET
			6 OF



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