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MAR 11 1976
REPORT TO THE CONGRESS

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**BY THE COMPTROLLER GENERAL
OF THE UNITED STATES**



UNITED STATES
GENERAL ACCOUNTING OFFICE

MAR 11 1976
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Opportunities For Improving The Effectiveness Of Rapid Transit Grants

Urban Mass Transportation Administration
Department of Transportation

The Urban Mass Transportation Administration has awarded grants for new rapid transit system equipment without having sufficient information on the reliability of that equipment. As has been widely publicized, some transit systems are having increasing problems of reliability with new equipment or components.

The agency has no system to obtain information data on these transit problems nor does it help transit systems to resolve specific hardware problems.

The Urban Mass Transportation Administration should establish procedures requiring grantees to show that new equipment is reliable and that its use is justified. The agency should develop a system to collect and disseminate information for identifying current problems.

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MARCH 10, 1976



COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-169491

To the President of the Senate and the
Speaker of the House of Representatives

This is our report on how the Department of Transportation can improve the effectiveness of its grants for rapid transit equipment. It discusses the Department's need to be more concerned with the reliability and justification of rapid transit equipment purchased with Federal funds.

We made our review pursuant to the Budget and Accounting Act of 1921, (31 U.S.C. 53), and the Accounting and Auditing Act of 1950, (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget, and to the Secretary of Transportation.

A handwritten signature in black ink, appearing to read "Thomas A. Atch".

Comptroller General
of the United States

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ABBREVIATIONS

ATC automatic train control
GAO General Accounting Office
MTA Metropolitan Transportation Authority
NYCTA New York City Transit Authority
R&D research and development
UMTA Urban Mass Transportation Administration

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

OPPORTUNITIES FOR IMPROVING
THE EFFECTIVENESS OF RAPID
TRANSIT GRANTS
Urban Mass Transportation
Administration
Department of Transportation

D I G E S T

The Urban Mass Transportation Administration *UMTA* has provided grants to help purchase about 2,400 new railcars to rapid transit systems in U.S. cities. The cars are quiet, comfortable and appealing to the eye.

New York City's rapid transit system has received \$573 million in Federal assistance but has experienced problems with the reliability of its newer railcars.

The Urban Mass Transportation Administration provides limited direction to potential grantees during its grant approval process because it considers grantees to be more expert in technical matters through their mass transit operations experience. This practice resulted in the Urban Mass Transportation Administration approving

UMTA Res
--a grant of \$142 million for new cars for New York's rapid transit system without sufficient information on the reliability of that equipment and

--the inclusion of automatic train control equipment not planned for in the immediate future. (See p. 5.)

At the time of the grant approval, the Urban Mass Transportation Administration had not required grantees to provide evidence of the reliability of equipment or components to be purchased with Federal funds. Without such evidence, the agency has no information on the extent of the risk taken in funding new equipment.]

Anticipating future grants for equipment of increased technical complexity and the fact that Federal funds can now be used to help offset operating expenses, the agency should

require such evidence before making large Federal commitments. (See pp. 6 and 19.)

Including equipment not planned for immediate use on the railcars illustrates the agency's need to require justification for such equipment. It needs also to establish criteria to help grantees determine when expenditures for such equipment are appropriate. (See pp. 10 and 20.)

Many of the Urban Mass Transportation Administration's research and development projects are directed at industry problems. However, projects often involve building new railcars or components rather than resolving specific hardware problems. The agency also should help resolve these specific hardware problems when they seriously affect ongoing transit system operations.

The agency needs to develop an information collection and dissemination system on transit problems and to use the data as a basis for deciding which problems could and should be addressed under the Federal mass transit research and development program. (See pp. 12 and 20.)

The Urban Mass Transportation Administration should:

- Require grantees to provide evidence that new equipment meets specific reliability requirements before committing funds to assist in the purchase of the equipment.
- Require potential grantees to justify the need for, and use to be made of, technology new to a transit system and not to be used in the immediate future. This justification should be consistent with appropriate criteria established by the Federal agency.
- Develop an information collection and dissemination system so that current problems can be easily identified, classified and, when appropriate, acted upon through selected research and development activities

directed at solving existing technological problems such as those in a specific component, if that component is causing serious problems. (See p. 20.)

The Department of Transportation said that (1) the agency will provide for review and testing of equipment for which there is limited operational experience, (2) several offices in the agency and the Department's Transportation Systems Center will review equipment specifications to insure adequate justification of technological innovations, and (3) an investigation will be made into the potential of implementing a formal information system on current operational problems. (See p. 21.)

CHAPTER 1

INTRODUCTION

Mass transit has long suffered from insufficient capital needed to maintain and increase the effectiveness of the industry. The Congress recognized this as a national problem in passing the Urban Mass Transportation Act of 1964 (49 U.S.C. 1601) and subsequent amendments to increase the funding authority and scope of Federal assistance. In 1968, the Urban Mass Transportation Administration (UMTA), Department of Transportation, was given the responsibility of providing Federal assistance for developing efficient and coordinated mass transportation systems in urban areas.

Several programs were established to carry out the purpose of the act, the largest being capital facilities grants to State and local public bodies. These grants may be used to acquire and/or improve existing transit systems or to build new transit systems. Since July 1, 1973, Federal financial assistance has been set at a mandatory 80-percent level of net project costs--those costs which could not be reasonably financed from revenues; prior assistance was limited to two-thirds of the net project costs.

Through June 30, 1975, \$4.3 billion of capital assistance was approved for transit systems. As shown below, rail projects make up over 60 percent of this amount.

	<u>Number of grants</u>	<u>Amount of Federal grants</u> (000,000 omitted)
Bus	492	\$1,473
Rail	92	2,680
Other	<u>7</u>	<u>157</u>
Total	<u>591</u>	<u>\$4,310</u>

UMTA also sponsors a research, development and demonstration program directed toward providing knowledge about alternative technologies that can be used to improve mass transportation service. Through June 30, 1975, \$362.5 million was obligated in this program. Major projects undertaken include bus and rail technology and new systems and automation.

UMTA's EFFORT IN RAIL TRANSIT SYSTEMS

The development and purchase of rail equipment is inherently more capital intensive than similar efforts for other existing mass transit modes, such as bus systems. UMTA's funding commitments to rail transit systems reflect this characteristic and are aimed at enabling the Nation's larger cities to provide better mass transit systems through capital outlays for constructing, extending, maintaining or rehabilitating rail transit systems.

Rail transit systems operate in 12 cities¹ in the United States, and together carry over one-fourth of all the Nation's mass transit passengers. In addition, many cities are constructing or planning new or expanded rail services.

Capital grants totalling \$2.7 billion have been awarded to rapid transit systems and commuter railroads through June 30, 1975, to assist in (1) purchasing 2,360 rapid transit cars, 275 light rail cars, and 1,364 commuter railroad cars, (2) modernizing rail stations in 5 cities, (3) constructing completely new systems in two cities, and (4) constructing maintenance and garage facilities.

In the research and development (R&D) activity, UMTA sponsors rail transit R&D in four areas--rapid rail, commuter rail, light rail and rail supporting technology. UMTA's efforts in R&D through June 30, 1975, totaled about \$41 million for rapid transit, \$20 million for commuter and light rail, and \$36 million for supporting technology.

METROPOLITAN TRANSPORTATION AUTHORITY

Approximately \$745 million or 28 percent of the \$2.7 billion in Federal capital assistance for rail transit has been granted to the Metropolitan Transportation Authority (MTA), an independent authority created by the State of New York to develop and improve public transportation in the 12-county New York City metropolitan commuter district. Transportation facilities under MTA's jurisdiction include

¹Boston, Mass., Chicago, Ill., New York, N.Y., Philadelphia, Pa., and San Francisco, Calif., have rapid transit, commuter and light rail systems. Pittsburgh, Pa., has commuter rail and light rail systems. Detroit, Mi., and Washington, D.C., have commuter rail systems; New Orleans, La., Newark, N.J., and Shaker Heights, Ohio, have light rail systems; Cleveland, Ohio, has a rapid transit system.

rapid transit, commuter railroads, buses, vehicular bridges, tunnels, airports, parking and other facilities.

MTA's rapid transit systems include the New York City Transit Authority (NYCTA), the world's largest rapid transit system, and the Staten Island rapid transit line. MTA's commuter railroad systems include the wholly owned Long Island Railroad, the Nation's largest commuter railroad; three lines leased from Penn Central Railroad Company, the New Haven, and the Harlem and Hudson commuter service lines; and a segment of the Erie-Lackawanna Railway. As of June 30, 1975, MTA had a combined fleet of 8,475 railcars including 6,734 rapid transit and 1,741 commuter railcars. Another 854 railcars were on order--100 commuter railcars and 754 rapid transit cars.

UMTA assisted in purchasing 1,778 of these cars either in service or on order. Of these 1,778 cars bought with UMTA's assistance, 745¹ R-46 rapid transit cars and 633 M-1 and M-2 commuter railcars have modern high performance features such as automatic train control (ATC); 400 do not. ATC is the designation applied to a broad range of equipment used for such functions as collision protection, overspeed prevention, station stopping, and schedule design.

NEW YORK CITY TRANSIT AUTHORITY

NYCTA, which has received most of the Federal rail transit assistance to MTA, has both a rapid transit division and a surface bus division and lies entirely within the limits of New York City. As of June 30, 1975, NYCTA has been granted \$573 million for the rapid transit division which has 714 miles of track, 462 stations, and 7,000 passenger cars. Since March 1, 1968, NYCTA has had, by State statute, the same governing board as the MTA.

SCOPE OF REVIEW

Our review was made to determine how UMTA's policies and procedures could be made more effective in assisting a large rapid transit system--NYCTA--in meeting its transportation needs.

¹This excludes nine R-46 cars provided by the manufacturer at no cost to UMTA or NYCTA.

We made our review at UMTA headquarters in Washington, D.C., and UMTA region II field office in New York City; and the following organizations located in New York City: Tri-State Regional Planning Commission, MTA, NYCTA, Long Island Railroad, Metropolitan Region of the Penn Central Railroad Company, and the Office of the Comptroller, State of New York, Division of Audits and Accounts. We reviewed the applicable legislation, UMTA policies and procedures, and the project records and reports relating to the Federal grants. We interviewed responsible officials and examined pertinent records of the above mentioned organizations.

We have obtained UMTA and NYCTA comments on this report and, to the extent necessary, have included them in the report. Written comments received from the Department of Transportation, including UMTA, have been included as appendix I.

CHAPTER 2

OPPORTUNITIES FOR IMPROVING THE EFFECTIVENESS OF RAPID TRANSIT GRANTS

One of the major results of Federal financial assistance to rapid transit grantees has been the provision of about 2,400 new railcars. For the most part, these cars are quiet, comfortable and appealing to the eye. However, our review of NYCTA's rapid transit system indicated that there are certain areas that should be strengthened in UMTA's programs relating to the procurement and use of new railcars. In our opinion, UMTA should strive to improve the effectiveness of rapid transit grants by taking a more active role (1) in assessing the use to be made of grant funds during its grant approval process and (2) in solving current transit equipment problems.

The following matters illustrate basic problems in the Federal approach to urban mass transit assistance.

--UMTA provides only limited direction to potential grantees during the grant approval process, because UMTA considers the grantees to have more expertise in technical matters by virtue of their experience in mass transit operations. The following illustrates the need to reassess this practice.

UMTA approved a grant of \$142 million for new railcars, before similar predecessor cars were proven reliable.

In that same grant, UMTA approved the inclusion of automatic control equipment that, at the time of approval, was not planned for use for many years, and in some instances, not within the expected lifetime of the cars.

--Although UMTA has made some efforts to solve near-term industry problems, UMTA's practice has been to let the supplier and the customer solve specific reliability problems.

UMTA PROVIDES LIMITED DIRECTION DURING GRANT APPROVAL PROCESS

UMTA's role in developing a grantee's project generally is limited to a determination that sufficient Federal funds are available and that all statutory and administrative requirements for obtaining a grant have been met. These requirements relate to such factors as a determination of

grantee needs, protection of other transit systems, development of adequate transit plans, environmental impact, public hearings, employee protections, and civil rights insurances.

Although the requirements call for the identification and estimated cost of the facilities or equipment necessary to satisfy the local needs, UMTA does not require grantees to submit evidence that the facilities or equipment to be procured with grant funds have been proven reliable and can be effectively used in the system.

Over \$140 million committed for new railcars before similar cars proven in service

In 1970 NYCTA purchased 352 rapid transit cars, referred to as R-44 cars, with city and State funds. These cars represented a new concept in car design for NYCTA.

In 1971, before the R-44 cars were delivered, NYCTA discussed with UMTA the possibility of getting Federal assistance to purchase 745 modified R-44 cars, referred to as R-46 cars. NYCTA wanted the R-46 cars, which were substantially the same as the R-44 cars, to replace 1,000 35- to 40-year old cars. It has been NYCTA's policy for approximately 25 years to replace cars after they have reached 35 years of age.

In April 1972, when the first of the R-44 cars were placed in service, NYCTA submitted a formal application for \$142 million of UMTA assistance to purchase the R-46 cars. In June 1972 UMTA approved a \$63 million grant to assist in purchasing 320 R-46 cars. In the grant approval document UMTA stated:

"* * *we support the entire application and would fund the full amount requested (\$142,232,000) if sufficient funds were available in this fiscal year. While we cannot project with certainty that funds will be available in fiscal year 1973 or later . . . we anticipate some additional funds will be available * * *."

UMTA approved the grant for the R-46 cars without obtaining and evaluating performance data on the R-44 cars. The R-44 cars have subsequently proved to be a problem for the NYCTA. The cars break down more often than the less complex cars in its fleet, and are subject to undefinable problems. They are out of service more frequently than the older cars which the R-46 cars are scheduled to replace.

The R-44 performance data for the most part was not known before UMTA approved the original R-46 grant in June 1972. There were indications, however, which should have alerted UMTA to the R-44 problems and potential R-46 problems. For example, before UMTA approved the grant, public hearings were held by NYCTA, as required by UMTA, to get the public's view on the need for and desirability of the new cars. Charges were made at these hearings that the facts presented in the NYCTA grant application to UMTA relative to the performance of the R-44 cars, were untrue. Questions were raised about the reliability and safety of the R-44 cars, two of which were on

--the structural adequacy of the cars during general use, and

--the safety implications of locked end doors which limited the passage of passengers and train crews between cars.

An UMTA representative told us that the people commenting at public hearings were not experts, and that the comments were of no substance; therefore, they did not require any action by NYCTA or UMTA. We noted, however, that one of the individuals who commented on the reliability and safety problems mentioned above was an electrical engineer.

In addition, records show that NYCTA knew about certain R-44 structural defects from early tests made of the first R-44 cars before delivery in April 1972. In a December 1975 letter, NYCTA officials told us that the cars were structurally sound after certain modifications were made following preliminary car body testing, and that the locked end door system was safe. While we are not in a position to judge these issues, we believe that, as a minimum, UMTA should have required NYCTA to respond to the comments raised in the public hearings so that the record would be clear as to what actions the transit authority had or had not taken and why.

Additional information also was available on the performance of the R-44 cars at the time UMTA approved each grant amendment. For example, in September 1972 UMTA approved an additional \$40 million to help purchase 202 additional R-46 cars. At that time the R-44 cars were averaging 6,900 miles between failures while the balance of the fleet was averaging 18,000 miles between failures. In April 1973 when the second amendment was approved for \$38.8 million to help purchase the remaining 223 cars, the R-44 cars were experiencing failures every 7,500 miles compared to 22,000 miles for the rest of the fleet.

UMTA officials told us that little consideration was given to the performance of the R-44 railcars when UMTA approved the R-46 grant because each UMTA grant is treated separately having nothing to do with previous purchases. In their opinion, UMTA's task is to determine whether the local grantee had a legitimate need for UMTA funds. UMTA officials stated that UMTA had no direct responsibility for the soundness of the product purchased by the grantee and does not require that the product meet certain testing requirements.

One UMTA official stated that NYCTA probably had the most competent people in the field and that their expertise was superior to that of the Federal Government. Therefore, reliance on New York's judgment weighed heavily in approving its projects. UMTA accepted NYCTA officials' assurances that (1) the R-44 cars were not experiencing any insurmountable problems and (2) the cars had been tested and proven reliable. However, UMTA did not request or receive any detailed analysis or engineering reports on the problems encountered on the test results.

Another UMTA official said that if they had been aware of the problems with the R-44 cars and had followed sound procurement practices, the purchase of the R-46 cars would have been delayed. According to this official, UMTA does not normally find out about such problems because grantees are generally reluctant to inform UMTA for fear of losing Federal funds and UMTA has no feedback system except for information volunteered by the grantees.

Procurement practices of the Department of Defense, the National Aeronautics and Space Administration and the General Services Administration have shown that in areas involving the use of new technology, the acceptable procedure has been "fly before you buy." The military services and the National Aeronautics and Space Administration have long standing practices of requiring test and evaluation before production begins. For unproven technology this may include building and testing a prototype or testing the specific component using new technology on an existing system to see if engineering is correct.

The head of a task force, created by NYCTA to attempt to solve reliability problems with the R-44 cars, told us that the R-44 car was experiencing problems primarily with the braking system. As discussed on page 14, one of the primary reasons for R-44 car breakdowns and removal from service is brake system failure. Although the brake system in the R-44 car had been used in commuter rail and rapid transit systems before, it was totally new to NYCTA's system. UMTA's Office

of Research and Development sponsored the development of a state-of-the-art-car which incorporated the best in existing, off-the-shelf-technology. Although this technology had already been proven, extensive testing was done on the state-of-the-art-car before it was given a revenue test in five different cities because this existing technology had never been tested and proven as an integrated system. The same holds true for the R-44 cars. If a prototype car, incorporating the new braking system along with other new components, had been tested, it might have led to a better understanding of the risks involved in applying this technology to NYCTA's rapid transit system.

In their December 1975 letter commenting on this report, NYCTA officials stated that prototype testing was not required for the complete R-44 car because (1) NYCTA had satisfactorily used most of the components in prior cars, (2) most of the components were in satisfactory use elsewhere, (3) some of the newer items had been tested, and (4) a functional mockup had been made during the design review. However, NYCTA recognized the importance of prototypes in discussing why some of their older cars (the R-42 cars) are, in fact, more reliable. As they pointed out to us, the R-42 cars benefited from the 6,000 more or less identical cars which preceded them, while the R-44 cars include new equipment components which had not been on previous cars in NYCTA's system. NYCTA recognized that these new components were responsible for the higher rate of failure.

UMTA does not require grantees to test prototypes before placing an order for mass production. Reliance is placed on the grantee to perform and/or require what it believes is adequate to procure sound reliable equipment. However, UMTA officials in the Office of Research and Development recognize that a fly before you buy policy is needed. In commenting on this report, these officials said they had been trying to persuade the transit industry to recognize the value of prototype car testing.

At a rapid transit conference in April 1975, a representative of a major railcar builder said that the present procurement process for mass transit vehicles is not geared toward the production of reliable railcars. Specifically, he said that there is a need for prototype cars, definite reliability levels by the transit authorities, and standardization of equipment similar to the Department of Defense and the airline and trucking industries. Further, he said it is difficult to produce a reliable railcar when the Nation's transit authorities each request different cars developed from different specifications.

Industry predictions show that over 4,000 new rapid transit and commuter railcars will be produced within the next 5 to 10 years. Undoubtedly many of these cars will be purchased with UMTA assistance. If these cars follow recent trends, they will be more complex, more costly and less reliable than existing cars. Considering the potential for large individualized railcar purchases for different systems and the trend to incorporate new innovations, UMTA should reassess its role of providing financial assistance to grantees who wish to purchase equipment with unproven components or untried combinations of components without first obtaining specific evidence that the railcars are reliable.

Over \$3.4 million approved for
equipment not planned for immediate use

An advanced feature of the R-46 cars is the ATC equipment. We estimated the cost of this equipment on the R-46 cars to be about \$5 million. UMTA's share was about \$3.4 million.

ATC uses sophisticated controls to move the train from station to station without manual operation by the motorman who acts primarily as a safety monitor and supervisor of automatic equipment. ATC has four major functions: (1) automatic train protection--overspeed protection and collision prevention, (2) automatic train operation--speed regulation and programmed station stops, (3) automatic train supervision--direction of train movement and scheduling, and (4) communication--relaying information between the different parts of the system.

An ATC system requires carborne equipment (on board the car) as well as wayside (along the track and/or at central control points) equipment.

NYCTA's R-44 cars were the first in the present fleet to have any carborne ATC equipment. They have both automatic train protection and automatic train operation capabilities. For this carborne equipment to be used, companion equipment must be installed along the wayside; NYCTA had not yet done this. NYCTA officials informed us that, at the time the R-44 and R-46 cars were designed, plans were underway for a Second Avenue subway, a high-speed Queens trunk line and certain extensions to existing lines which would be ATC equipped. Also, as funds became available, NYCTA planned to purchase and install wayside ATC on existing lines. NYCTA internal plans, which had not been approved by the city at the time the R-44 and R-46 cars were ordered, called for

its BMT¹ Division to be equipped and ready for automatic operation by 1990 and the IND¹ Division to be ready by the year 2020. There was no current plan for the third division, the IRT.¹

Based on these plans for assigning the R-46 cars, 554 cars, or 74 percent of the total, were to be used on the IND Division and therefore would not use the carborne ATC equipment until the year 2020 when the cars would be over 40 years old. Since the current estimated life of a railcar is about 35 years, ATC equipment on these cars would never be used. The other 26 percent of the cars, 191, to be assigned under the plan to the BMT Division, would use the equipment by 1990 when the cars would be about 15 years old.

During our review, NYCTA officials said that even though the ATC equipment will not be used for many years, cars with ATC were purchased so that the new cars would be compatible with the new subway lines, planned or under construction, which would be ATC equipped. The most important expansion of service which was being planned was the Second Avenue subway (which has stopped construction) and three other lines which were expected to be operational in the early 1980s. According to NYCTA officials the R-44 and R-46 cars were not planned for exclusive use on these new lines since most probably the new lines would have their own new cars. Even so, the officials wanted all NYCTA's new car purchases to be capable of interchangeable use on the new lines.

UMTA officials said they relied heavily on the judgment of NYCTA personnel for approving R-46 cars with ATC equipment. Further, they added that NYCTA considered it cheaper to install the equipment in the cars at the time of manufacture rather than to add it at a later date. This judgment, was not based on any cost-benefit study. UMTA, nevertheless, accepted NYCTA's judgment without any backup support.

In their December 1975 letter, NYCTA officials stated that new plans now call for wayside ATC to be placed on a BMT line during 1978-80. Further, they stated that although the new Second Avenue subway line has been postponed because of lack of funds, a new high-speed Queens line with a new tunnel under the East River, is continuing. NYCTA officials told us that the Queens fleet, which is to consist of both R-44 and R-46 cars, will be operating on the new line by 1982.

¹The Brooklyn Manhattan Transit (BMT), the Independent (IND), and the Inter-Borough Rapid Transit (IRT) are more commonly referred by their acronym rather than their full name.

Although we recognize that implementation of the new plans would allow for earlier use of the ATC equipment, such plans were made subsequent to the time UMTA gave approval to NYCTA to purchase ATC. We are not questioning the benefits and improvements that can be obtained with ATC. However, it does not appear to be the best use of Federal funds to buy equipment components which may not be used soon after delivery and, in many cases, within the expected lifetime of the cars. Therefore, UMTA needs to establish criteria to help determine when expenditures for new equipment which would not be used in the near term are appropriate.

The passage of the National Mass Transportation Assistance Act of 1974 (49 U.S.C. 1601) authorizing funds for transit systems to help meet operating expenses, and the availability of 80-percent Federal funding for capital acquisitions, may encourage grantees to include equipment components which, while desirable, may not represent the most effective use of Federal funds at the time. Therefore, UMTA should review more closely the basis of each grantee's stated transit system needs and grantee decisions to procure equipment to meet such needs.

UMTA RESEARCH AND DEVELOPMENT EFFORTS NEED TO
SYSTEMATICALLY FOCUS ON CURRENT INDUSTRY PROBLEMS

The transit industry is having major problems with new rapid transit car reliability. Such problems can result from poorly written specifications, from the inability of manufacturers to meet the specifications, or from inadequate quality control. UMTA has no information collection system to identify or categorize transit car problems, nor does UMTA believe it should resolve specific hardware deficiencies. UMTA's research and development (R&D) program has been criticized by the transit industry in the past for being too devoted to futuristic technology rather than to short-term activities.

The issue of how great an effort UMTA should make in solving current industry problems can be debated. However, we believe that UMTA must develop a system to identify these problems to find out what they are and must categorize them to help determine if they are quality control problems, which UMTA does not believe are within its purview, or if they are technological problems common to many transit systems. In the latter case, we believe that UMTA should help resolve the problems even if some of them relate to a specific component.

Problems with the R-44 railcars
in New York

We noted that NYCTA was experiencing a large number of problems with the reliability of the R-44 railcars, even after 3 years of service. These cars represent about 4 percent of the total fleet, yet they account for 10 percent of all the delays attributed to car failure.

Although NYCTA officials stated that it is not unusual for new equipment to experience break-in problems, the R-44 car had considerably more failures than its predecessor R-42 car. After its first full year of service the R-42 cars experienced breakdowns on the average of once every 40,000 miles while the R-44 cars had averaged a breakdown every 7,500 miles.

NYCTA officials believe that direct comparisons between R-44 cars and older cars should not be made. They believe that new standards of measurement are needed for cars that are designed for high-speed automated operation and which require more sophisticated equipment than older cars. According to NYCTA, the relatively new additional equipment necessary for high-speed automated operation is responsible for the higher rate of failures.

We recognize that the equipment on the R-44 cars and R-46 cars is more sophisticated than that on predecessor cars, and that this new equipment is a major cause of the failures. We do not agree, however, that comparisons should not be made. They demonstrate that the R-44 cars are performing more poorly than older cars because of this new sophisticated equipment, and that this points to (1) the need to test and perfect this technology before mass production of rapid transit cars begins and (2) an area in which UMTA should consider its role in helping to solve current transit problems.

The R-44 cars do not compare well with other cars in NYCTA's fleet. The R-44 cars fail about twice as often as cars 35 to 40 years old. The R-44 cars do not compare favorably with the entire balance of the fleet, either. During their best month of operation, the R-44 cars averaged 12,000 miles between failures while the rest of the fleet averaged 18,000 miles. During their worst month, the R-44 cars averaged 4,000 miles between failures compared to 20,000 miles for the balance of the fleet.

The effect of this poor performance is demonstrated in the availability of the R-44 car for revenue service. During July 1974 a comparison of car availability showed that 19 percent of the 300 R-44 cars was unavailable for revenue service while only 14 percent of the 841 35- to 40-year old cars was unavailable. Six months later, during December 1974, 22 percent of the R-44 cars was unavailable for service while 12 percent of the older cars was unavailable. Also, a sample of car availability records for December 1974 showed that on 19 of 21 weekdays there were not enough R-44 cars operating to meet the scheduled requirements because they were broken down and out of service. During this time, NYCTA found itself with a shortage ranging from 8 to 62 cars even after they used the available R-44 spares or back-up cars.

Because of NYCTA's concern about the reliability of the R-44 cars, it formed a task force in June 1973 to attempt to solve the problems. The task force investigated various problems with the brakes including stuck brakes and brakes being applied for no apparent reason.

Modifications were made to the R-44 cars based on the task force's work. As a result of normal debugging procedures, over 160 modifications were made to all of the cars by the end of 1974, but the problems persisted.

Ninety-eight percent of the breakdowns of the R-44 cars were due to failures of the air brakes, car body components (especially car doors), electrical components (especially traction motors), and miscellaneous electrical parts.

Even though the brake used on earlier cars had proven reliable, a different type of air brake was installed in the R-44 cars. Transit officials said that the new brake was installed because it could be used with ATC while the earlier brake could not. They stated that the circuitry for the air brake on the new R-46 cars and the modified R-44 cars had been simplified; therefore, they hoped it would be less problem prone.

NYCTA officials said that several problems have been difficult to resolve in the R-44 car because they appeared when the car was in service, but could not be confirmed when the car reached the maintenance shop. This means that when a car was reported to have a failure while in service, the failure would not happen again when the car was taken in for inspection. Causes for over 40 percent of the failures reported in 1974 could not be identified. These failures included the following:

<u>Component</u>	<u>Failures without identified causes</u>		<u>Failures with identified causes</u>	
	<u>Number</u>	<u>Percent of total failures</u>	<u>Number</u>	<u>Percent of total failures</u>
Electrical	74	4	318	18
Car body	260	15	460	26
Brakes	376	21	241	14
Truck	17	1	15	1
Air conditioning	-	-	5	-
Total	<u>727</u>	<u>41</u>	<u>1,039</u>	<u>59</u>

As of March 1975 the performance of the R-44 cars had improved only marginally. With 36 months and over 35 million miles of revenue service, the cars were averaging only 7,900 miles between breakdowns.

Other indications of railcar problems

Various reports, studies, and articles in industry periodicals indicated that problems with new railcars are also being experienced by several other transit systems including commuter railroads with similar cars. Some of these problems involve ATC, air brakes, door openers and electrical equipment. Frequent problems with these components have caused delays and have had an impact on the overall system's performance. In addition, there have been serious accidents attributable to these components including instances of brake failure, a train overrunning its station stop because of ATC malfunction, and doors opening while trains were moving and closing on passengers as trains left the station. (None of these accidents has occurred on the NYCTA system.)

At the Long Island Railroad, officials told us that their new M-1 commuter railcars were experiencing problems with the automatic train operation equipment, brakes, air conditioners and motor alternators. Long Island Railroad personnel stated that some of these problems will continue to exist until better components are developed.

On Penn Central's New Haven commuter trains, 20-year old cars are out of service less frequently than the new high performance M-2 cars. In 1974, about 23 percent of the M-2s was out of service on a daily basis as compared to only 11 percent for the older cars.

The San Francisco Bay Area Rapid Transit system, after 1 year of operation, was experiencing a 30 to 60 percent failure rate of the vehicles placed into service during a normal day.

In their December 1975 letter, NYCTA officials stated that all new cars recently purchased throughout the United States are experiencing mechanical and electronic problems, and that new rapid transit systems not yet in operation will likewise experience many problems. They also stated that they believe that the cars NYCTA purchased have caused the least problems of any new cars bought recently by any rapid transit system in the country.

Industry comments on
current problems

Representatives of the mass transit rail industry have expressed concern about the problems and breakdowns in equipment experienced by transit systems. At a Rapid Transit Conference, sponsored by the American Public Transit Association in April 1975, industry representatives said that there were numerous problems currently facing their industry.

During the conference participants made the following comments.

- There is a need for reliable equipment.
- There is a need for standardized equipment.
- Too many systems use complex technology that does not work.
- New technology should be proven before it goes into production and use.
- There is a lack of accurate, dependable performance data available on today's cars.
- The Federal Government should
 - become a tougher reviewer of grant applications,
 - not ignore cost-benefit studies,

- press for improved quality control, and
- press for reliable and standardized equipment.

UMTA's role in resolving technical problems

We discussed the focus of UMTA's R&D program and the impact of it on industry problems with two responsible groups in the UMTA--the Office of Research and Development and the Office of Transit Management.

The Office of Research and Development administers the R&D program. R&D officials told us that many of their projects are aimed at tackling specific problems which the industry is experiencing; e.g., doors, propulsion, noise, and ride quality. The advanced concept train and advanced subsystems development program are two such projects. These projects are long term. In other areas, the R&D program is both near term and industry responsive. The energy storage car and gas turbine-electric commuter car projects are direct responses to NYCTA's expressed needs. Research is being sponsored in such areas as noise abatement, tunneling techniques and crashworthiness of vehicles.

UMTA R&D officials believe that operators are experiencing increasing problems with particular subsystem reliability. However, they believe that UMTA cannot play the principal role in resolving such vendor-purchaser problems. The problems encountered by a vendor in delivering cars meeting transit authorities' specifications have always been considered to be the domain of supplier and customer. Also, R&D officials said that if UMTA were to resolve specific hardware deficiencies, they would be engaging in product improvement on behalf of the vendors involved. This, they believe, does not seem to be a proper role for the Federal Government. According to these officials, insurance of better reliability upon delivery can be achieved through better written specifications by the grantee and through requirements for adequate prototype testing prior to production.

While we understand UMTA's position, and agree that better specifications and prototype testing are needed, we believe that the Office of Research and Development should do more to assist in obtaining reliable equipment. This may mean resolving specific hardware deficiencies if these deficiencies represent continual problems within various transit systems. Federal funds pay for 80 percent of a grantee's railcar purchases. The customer that has to live with the product is not only the local transit authority, but also the Federal Government. UMTA has a fiduciary responsibility to the tax payer to see that its funds are spent effectively.

R&D officials told us that the practice today appears to be for grantees to specify increasing levels of performance and reliability but vendors are not prepared to meet such requirements. The grantee simultaneously imposes more stringent warranty requirements on the vendor who simply increases the price of his product to cover the cost of replacing his components for the life of the warranty. This in our view is not an acceptable or prudent process.

The process of developing subsystems capable of achieving greater reliability is an R&D process. UMTA officials have stated that only after reliability has been demonstrated should these subsystems be specified for production. We agree, but it would seem that to accomplish this objective it might be necessary for UMTA to sponsor research to improve a specific component.

The UMTA Office of Transit Management is responsible for improving local transit operations. A transit management official saw no problem with UMTA financing research to develop workable components for today's cars. He noted that it would seem to be a reasonable investment, for example, to develop a trouble-free traction motor. However, the office has no formal reporting system to keep track of current problems and must obtain this information through informal contacts with local transit authorities and industry representatives.

In 1972, eighteen of the largest transit systems joined in establishing the Transit Development Corporation to serve as a catalyst for action, to provide a forum for conducting R&D programs, and to be a communications bridge between industry and Government. The Corporation's purpose is to pursue R&D projects with immediate foreseeable use.

Until recently, the Corporation has been critical of UMTA R&D efforts. In March 1975, a Corporation spokesman made the following observations.

- UMTA reaches principally for long-range high-risk technology to develop futuristic transportation modes.
- A measure of UMTA funds should be channeled to unsophisticated problem areas in need of solutions today.

However, this same spokesman said in November 1975 that UMTA's Office of Research and Development appears to be redirecting some of its efforts to solve near-term problems. He believes UMTA is becoming more responsive to current problems.

In commenting on this report, UMTA officials stated that they have determined that 85 percent of the projects listed in the Corporation's "Five-Year Plan" which specifies programs they believe are needed, are either being addressed by UMTA or are being planned. UMTA stated that they maintain formal contact with the Corporation and a continuing dialog with transit operators and equipment manufacturers in carrying out their R&D programs.

CONCLUSIONS

UMTA has been awarding grants without sufficient information on the reliability of the equipment to be procured with grant funds. UMTA's current requirements for developing and approving grant applications should be strengthened to provide better insurances that reliable railcars will be provided to the public.

The statements made at the public hearings about the safety and reliability of the R-44 cars, and the R-44 car performance data available at the time UMTA approved the R-46 grants may not have been conclusive evidence as to possible reliability problems with the R-46 cars. We believe, however, that the evidence was sufficient to warrant a delay in funding all or part of the R-46 grant until (1) prototype testing of the new components on the R-46 cars was complete and cars met reliability criteria or (2) it was demonstrated that the R-44 cars could perform at least to the level of the other cars in the fleet. The military services have long followed the fly before you buy principle that has since become a standard procurement practice.

UMTA, however, has not established a requirement for grantees to provide evidence of the reliability of equipment or equipment components new to the grantee's transit system which are to be purchased with Federal funds. Instead, UMTA has relied solely on the local transit authorities to insure that reliable equipment is purchased. Without such evidence, UMTA has no information on the extent of the technological risk being taken with the result that (1) equipment designed to meet certain performance levels may fail to do so without costly and time-consuming retrofitting and (2) Federal funds may be used inefficiently. Anticipating future grants for equipment of increased technical complexity and the fact that Federal funds can now be used to help offset operating expenses, UMTA should require such evidence before making large Federal commitments.

We realize that innovations are needed to improve efficiency, maintainability and reliability in the long run and that prudent risks must be taken. We believe, however, that equipment purchased primarily with UMTA funds that incorporates increasingly complex new technology should be proven reliable before mass production.

The inclusion of the ATC equipment on the R-46 cars also illustrates the need for UMTA to require justification for new components which do not have an immediate use. With UMTA grants available to cover the majority of acquisition costs and to assist in operating expenses, grantees may become inclined to purchase equipment which may be desirable, but not represent the most effective use of Federal funds.

Many of UMTA's R&D projects are directed at near-term problems. However, these projects often involve building new cars such as the gas-turbine electric commuter car rather than resolving specific ongoing hardware problems. While the former projects undoubtedly will be beneficial to the transit industry, UMTA should help resolve specific hardware problems when they seriously effect transit system operations. UMTA's research efforts should complement its capital grant program in attempting to solve equipment problems before the transit authorities buy large quantities of problem-prone, expensive cars.

Because UMTA has no systematic method to determine what problems exist and because some of the problems might be the result of inadequate quality controls, UMTA needs to develop an information collection and dissemination system to obtain data on transit problems and to classify such data to provide a basis for deciding which problems could and should be addressed under UMTA's R&D program.

RECOMMENDATIONS

We recommend that the Secretary of Transportation require the Administrator of UMTA to:

- Establish procedures requiring grantees to provide evidence, based on prototype testing or other means, that new equipment meets specific reliability requirements before UMTA will commit funds to assist in the purchase of such equipment.
- Require potential grantees to justify the need for and use to be made of technology which is new to a given transit system and will not be used in the immediate future. This justification should be consistent with appropriate criteria established by UMTA.

--Develop an information collection and dissemination system so that current problems can be easily identified, classified and, when appropriate, acted upon through selected UMTA R&D activities directed at solving existing technological problems such as those in a specific component if that component is causing serious problems for transit systems.

AGENCY COMMENTS AND OUR EVALUATION

In a December 30, 1975, letter (see app. I), the Department of Transportation generally agreed with our recommendations and said that specific actions have been taken to improve the reliability of rail systems development and to insure that innovations are made after careful evaluation and justification.

In commenting on this report, UMTA officials stated that UMTA has increased the extent of its review of grant applications. They further stated, that within its limited staff capabilities, UMTA reviews specifications, and works with applicants to insure that full consideration of reliability and need are given to planned procurements. The Department agrees that a formal information system on current operational problems would be desirable and will investigate the potential of implementing such a system.

According to the Department, (1) UMTA has introduced new procedures to reduce reliance upon grantee representations of the reliability of desired purchases; (2) prior to actions on capital grant applications which propose using new technology, the Office of Research and Development must provide a technological evaluation which the Office of Capital Assistance takes into consideration; (3) railcar specifications are evaluated and concurred with by experts at the Department's Transportation Systems Center in Cambridge, Massachusetts; and (4) UMTA has initiated Safety and Systems Assurance reviews of new systems to evaluate the technological decisionmaking process to insure that a reliable system will be acquired.

Furthermore, UMTA has been encouraging grantees to include adequate prototype provisions in procurement specifications and to allow for adequate testing and debugging of new equipment before it is put into service. UMTA has also made its Pueblo, Colorado, test track facilities available to grantees virtually at no charge in the interest of producing reliable equipment.

We believe that these actions are positive steps toward insuring that Federal funds are spent for reliable transit equipment. However, UMTA should do more than encourage grantees to allow for adequate prototyping, testing and debugging of new equipment. It should require evidence that specific reliability requirements have been met before approving large Federal grants.



OFFICE OF THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

ASSISTANT SECRETARY
FOR ADMINISTRATION

December 30, 1975

Mr. Henry Eschwege
Director
Resources and Economic Development
Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Eschwege:

This is in response to your letter of October 23, 1975, requesting comments on the General Accounting Office's (GAO) draft report entitled "Opportunities for Improving the Effectiveness of Rail Rapid Transit Grants." The Urban Mass Transportation Administration has reviewed the report in detail and has agreed to take certain actions in each of the areas cited by GAO as recommendations.

I have enclosed herein two copies of the Administration's reply.

Sincerely,

William B. Davis
for William S. Heffelfinger

Enclosure
(two copies)

Department of Transportation
Statement on GAO Report

- I. Title: Opportunities for Improving the Effectiveness of Rail Rapid Transit Grants
- II. GAO Findings and Recommendations:

The GAO conducted a review of the use of Federal funds to construct 745 new rapid transit cars, (known as the R-46 cars) for the New York City Transit Authority (NYCTA). The GAO found that one of the major results of the Urban Mass Transportation Administration's assistance to rail rapid transit and commuter rail systems has been the provision of about 4,000 new railcars. The report stated that for the most part, these cars are quiet, comfortable and appealing to the eye.

The New York City subway system has received \$573 million in Federal capital grant assistance for a variety of activities, including new subway construction and rail car purchases. This system has experienced some problems with the reliability of its newer railcars.

The GAO report observed that the Urban Mass Transportation Administration provides only limited direction to potential grantees during its grant approval process, because it considers the grantees to have more expertise in technical matters by virtue of their experience in mass transit operations. GAO maintained that this practice has resulted in approving a grant of \$142 million for new rapid transit cars for New York's subway system without sufficient information on the reliability of equipment to be procured and, in that same grant, the inclusion of expensive automatic train control equipment which will not be used in the foreseeable future.

The report also stated that the Urban Mass Transportation Administration's practice has been to direct its research and development efforts at advanced transit concepts, although carriers are experiencing more practical problems with equipment.

Based upon its review, GAO has recommended that the Secretary require UMTA to:

- (1) Establish procedures under which grantees, when purchasing unproven equipment or equipment components, must provide evidence, based on prototype testing or other means, that such equipment meets specific reliability requirements before UMTA makes large Federal Commitments.

- (2) Require grantees to justify the need for and use to be made of technology which is new to a given transit system.
- (3) Direct UMTA's R&D efforts to include short-range technology which will apply today's technology to find solutions to current mass transportation problems.
- (4) Develop an information-collection system so that current problems can be easily identified, classified and acted upon.

III. DOT Comments on Findings and Recommendations:

The GAO study made a number of findings relating specifically to the New York car procurement and generally to the UMTA program. Following are our responses to these points. In considering these points it is very important to note that the GAO report addresses a rail car procurement which occurred over 40 months ago, at a time when the level of the Federal transit assistance program and the UMTA staff size were considerably less than today.

UMTA provides limited direction during grant approval process.

As the demand for UMTA assistance has grown and competition among competing requests has intensified, UMTA has increased the extent of its review of grant applications. UMTA does conduct reviews, within its limited staff capability, of specifications for all construction, equipment, and vehicle purchases. However, UMTA continues to rely heavily upon local agencies for much expertise in technical matters because, in the final analysis, the local agencies must live with the operating results of their decisions. As noted, below, we are working with applicants to insure that full consideration of reliability and need is given before approval to proceed is given. This process of consultation and review continues to draw heavily on local experience, but insures a full consideration of options.

Over \$140 million committed for new railcars before similar cars proven in service.

The UMTA review of the specifications for the New York City Transit Authority R-46 car order revealed no significant reason to doubt the reliability of the cars. It should be noted that the NYCTA operates nearly 7000 rapid transit cars and possesses the largest transit operating engineering staff in the world. Given UMTA's staff limitations in 1972 only minimal evaluation of the R-44 tests was made before proceeding with the R-46 order.

In effect, UMTA relied on assurances from the NYCTA in this 1972 car order. Now, however, new procedures reduce such reliance upon grantee representations. Under current practice UMTA is taking a number of steps relating to pre-production and production testing.

While UMTA encourages grantees to use the most advanced, proven concepts available -- to secure the best possible service, reliability and productivity -- it is important that such innovations are made in the context of careful evaluation and justification. Towards this end, UMTA has initiated Safety and Systems Assurance reviews of new systems in order to (a) make a constructive contribution to the local technical management process in terms of safety and system assurance, and (b) evaluate the current technical decision-making process to assure that an operationally reliable system will be acquired. One such review was recently conducted in Atlanta, and it is anticipated that similar reviews will be conducted in the future at all existing and planned rail properties. These reviews are a focal point of UMTA's effort to improve the reliability of new and existing rail systems development.

Over \$3.4 million approved for equipment which may not be used.

Automatic train control equipment was included as part of the R-46 order in the expectation that it would be used on lines planned for construction in the immediate future, such as the Second Avenue and the Queens lines. The prospect of achieving substantial labor savings through automatic train control operations on these new lines made the inclusion of the control equipment on the new cars, whose useful life should extend into the early 21st century, well worth the modest \$3.4 million initial investment. Unfortunately, the City of New York has experienced major financial problems since this decision was made in 1972; construction of new lines, and installation of ATC control equipment on existing lines has been delayed. However, it is far too early at this point to pass final judgement on the wisdom of including automatic train control in the cars.

UMTA research and development efforts directed at advanced concepts, not current industry problems.

While GAO supports UMTA's major rail R&D programs directed toward state-of-the-art design and advancement of technology for cars of the future, the report advocates devoting some portion of the R&D program funds to solving current reliability problems. In fact, the UMTA rail R&D program does deal with near-term solutions to current problems identified in an industry survey and is designed to come to grips with practical problems of reliability and maintainability by means of improved design. The results of UMTA's Rail R&D projects are intended to be made available for incorporation in cars and equipment in the near term (within the next five to eight years), both through retrofit on existing cars and incorporation in new cars.

By implication, the GAO position is that UMTA should become directly involved in remedying technical or manufacturing deficiencies in products delivered by vendors to UMTA grantees. UMTA does not consider it a proper Federal R&D role to engage directly in specific product improvement on behalf of the specific vendors involved. The problems encountered by UMTA grantees can result from a poorly written specification, from the inability of the manufacturer to meet the specification, or from a lack of quality control. Their solution is a matter to be worked out by the vendor in consultation with the grantee. UMTA can assist in some cases by making available the facilities and procedures of the Transportation Test Center, and by provision of supplementary capital grant funds where appropriate.

When experience with unreliability of specific subsystems becomes sufficiently widespread as to constitute a generic problem, UMTA can, and does, undertake development of improved designs.

Projects such as the Advanced Concept Train and the Advanced Subsystems Development Program were structured to tackle specific problems that the industry was experiencing: doors, propulsion, noise, and ride quality, for example.

UMTA maintains a formal contract with the Transit Development Corporation for the purpose of obtaining industry input concerning rail technology R&D, and R&D staff members spend considerable time in direct discussions with representatives of rail properties in order to maintain close liaison and to assure the relevance of ongoing R&D projects. (Attachment 1 is a detailed discussion of R&D program efforts in advancing near-term research.)

Industry comments on current problems.

UMTA has used extensive industry inputs in designing its various R&D programs. A continuing dialog with operators and manufacturers is carried out as these programs proceed. In inaugurating the rail program, the industry, through the then Institute for Rapid Transit and American Transit Association (since combined to form the American Public Transit Association, (APTA)), was asked to state its R&D needs and priorities. The program was then structured in accordance with UMTA goals as well as industry's needs.

In a September 1975 speech at the annual meeting of APTA, the UMTA Administrator invited APTA to co-sponsor a conference on UMTA's R&D priorities. UMTA is now working with APTA to establish an agenda for this meeting, which is scheduled for the spring of 1976. Attachment 2 is an excerpt from the New Orleans speech which more fully develops this effort at industry - UMTA cooperation in R&D work.

Recently UMTA conducted a public hearing on rail transit procurement practices. Rail car costs, reliability, and related topics were discussed, and the comments of fixed guideway transit operators and developers, transit suppliers, consultants and other interested parties were solicited. It is anticipated that these comments will assist UMTA in determining steps to be taken to resolve these and other issues related to the procurement and the maintenance of urban rail systems equipment, and to the subject of UMTA collection of information on operating performance.

Considerable debate has arisen over the issue of vehicle standardization, and UMTA is actively investigating the steps which can be reasonably taken in this area. (See Section IV.) It must be noted however, that in striving to achieve commonality in the rapid rail area, consideration must be given to physical constraints and to the peculiar requirements of individual transit properties.

UMTA's role in resolving technical problems

In keeping with UMTA's belief in prototype testing approximating the "fly before you buy" technique cited by GAO, the Rail Transit Test Track and related facilities at the DOT Transportation Test Center in Pueblo, Colorado has been constructed. To date, UMTA has invested approximately \$25 million in a test facility which is used for, among its many activities, the testing and evaluation of prototype cars prior to pre-service tests on the grantee's own system. The facility allows testing away from the hazards of interfering with day-to-day revenue operations. Test procedures as well as facilities are available to enable effective diagnosis and cure of major problems. This facility is available to grantees or to vendors to solve specific problems with subsystems after purchase, as well as for the testing of new UMTA developed vehicles.

UMTA encourages grantees to allow for adequate testing and evaluation of new equipment. Simultaneously, UMTA encourages the taking of prudent risks in specifying new technology where the benefit seems worth a modest risk.

In order to accomplish generic improvement, UMTA is carrying forth a rail development program. New standards for reliability and maintainability have been specified. This has been a key outgrowth of the State-of-the-Art car effort. Once proven in an R&D phase, these subsystems are available to the industry for inclusion in production cars.

IV. Status of Corrective Action:

Following are UMTA actions in each of the areas cited by the GAO as recommendations:

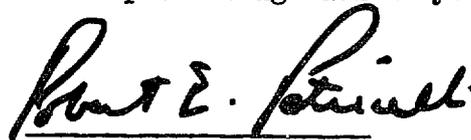
1. Reliability, Review and Testing: UMTA is requiring grantees to give careful attention to reliability, as well as to timely introduction of proven new technological improvements, as they prepare specification for transit rolling stock and equipment.

UMTA is establishing procedures for the review and testing of equipment or components for which there is limited operational experience. On November 10, 1975, the UMTA Administrator issued a directive which requires that, prior to either positive or negative actions on capital grant applications which propose the use of new technology, the Office of Research and Development (URD) must provide a technological evaluation. This evaluation will be considered by the Office of Capital Assistance (UCA) and subsequent action on the proposed request will be coordinated with URD.

Rail car specifications are now referred to the Manager of the Safety Program, Office of Transit Management to the Director of the Rail Technology Divison, URD, and through URD, to the Transportation Systems Center at Cambridge, Massachusetts, for evaluation and concurrence. This procedure adds expertise to the project management function of the Office of Capital Assistance. Additional staff positions are contemplated in UCA to aid in engineering analysis.

In an attempt to resolve some of the issues involved in the question of standardization and form the basis for a formal UMTA position on the subject, UMTA has issued a RFP for a thorough study of the potential of rail car standardization.

2. Technology Justification: The review of equipment specifications by several UMTA offices and the Department's Transportation Systems Center - - none of which occurred for the R-46 order (in part because several of these organizations had no rail expertise at that time) - - is intended to insure full justification.
3. Short Term R&D: UMTA's R&D efforts are becoming increasingly concerned with short-range programs which apply today's technology to present problems. The attached develops this point in detail.
4. Information System: UMTA agrees that a formal information collection system on current operational problems would be desirable, and will investigate the potential of implementing such a system.



Administrator
Urban Mass Transportation Administration

Attachment

APPENDIX

UMTA RESEARCH AND DEVELOPMENT IN RAIL TECHNOLOGY

GAO's comments and recommendations which affect the rail transit technology program conducted by UMTA's Office of Research and Development fall into the following categories. UMTA's detailed response is given under each heading.

Developing Futuristic Transit Modes vs. Solving Immediate Operational Problems

A continuing dialogue has been underway with the transit operating industry in an attempt to be responsive to problems as they are perceived. Such a dialogue has included the industry in the formulation of the Urban Rapid Rail Vehicles and Systems program, in the structuring of major areas of the Rail Supporting Technology effort, in a determination that perhaps 85 percent of the projects listed in the Transit Development Corporation's "Five-Year Plan" are either being addressed or are in planning, and in the pledge to hold an open meeting at UMTA to gain industry views on UMTA R&D priorities.

Projects such as the Advanced Concept Train and Advanced Subsystems Development Program were structured to tackle specific problems which the industry was experiencing: e.g., doors, propulsion, noise, and ride quality.

In other areas, the program is very much both near-term and industry-responsive in orientation. The Energy Storage Car and Gas Turbine-Electric Commuter Car projects are direct responses to the expressed needs and priorities of the NYMTA. UMTA's work on AC propulsion was in response to the R&D requirements of Cleveland Transit. The light rail vehicle project synthesized the immediate needs of all U.S. light rail operators.

The Supporting Technology Program attempts to strike a balance between long and short term needs. The UMTA facilities at Pueblo were constructed and made operational in record time in response to a perceived need for an available, unencumbered test center.

Directed research has been intensively responsive to major problems cited by the industry and by the safety agencies in Government. Examples are: a new light rail vehicle, a program for assessing and dealing with noise abatement, a comprehensive tunneling activity designed to reduce costs and increase advance rates, and work in the safety area dealing with crashworthiness, obstacle detention, and smokeless cable.

The most "futuristic" product of the URRVS program is the Advanced Concept Train. It is a steel wheeled, steel rail vehicle which operates on existing transit lines, can utilize existing power sources, and is intended for near term use.

It is important to look back a few years and recall that the program started with a collection of diverse projects responsive almost exclusively to site-specific needs. The program was re-directed toward national objectives. With limited resources, the problems of half a century of neglect were segregated and UMTA began in earnest a vehicle-oriented improvement effort. The program to develop a baseline definition of available technology the State-of-the-Art Car, a next generation prototype (ACT-1), and advanced subsystems and components (ASDP), was structured with the help of the transit industry.

A number of events have occurred which have caused the needs of the industry and progress of the program to get out of step. First, the length of time required to accomplish the ACT-1 and ASDP programs was seriously underestimated both by the Government and by the industry.

Second, the in-process hardware procurements of the industry proved to be largely unreliable. Third, the lack of any clear delivery system for improved rail car technology has tended to reclassify ACT-1 as a long-term project although it began as a short-term effort.

A retrospective view of the development of URD's program demonstrates that there is no portion of the UMTA Rail Program which is not directed at the solution of current identified technical problems, and that UMTA has been highly responsive to the expressed needs of the industry.

The constituency of TDC (prior to its formation) was surveyed on what were the problems of the rail transit industry. The results of that survey were used to help formulate the R&D program.

TDC's predecessor, the Institute for Rapid Transit, was instrumental in formulating the concept of a baseline definition (SOAC), a next generation vehicle (ACT-1), and a concurrent subsystems program (ASDP).

IRT, in fact, was interested in managing the URRVS Program on our behalf. Although IRT was unsuccessful in the competition, UMTA awarded the successor group, TDC, a grant contract to provide continuing advice and guidance on the program.

As part of a continuing dialogue with TDC, we reviewed their Five-Year Plan for R&D projects of interest to them. We discovered that approximately 85 percent of the items listed are either underway or programmed for the next few fiscal years. Some projects, we felt, were best accomplished by industry or were not of interest to the Government.

UMTA Should Assist the Transit Industry in Obtaining Reliable Equipment; Too Many Systems Use Complex Technology that Does Not Work; New Technology Should be Proven before it Goes into Production and Use; Grantees Should be Required to Justify the Need for and Use to be Made of Technology New to a Given Transit System

Obviously the operators' primary concern is providing service. They must have vehicles that are relatively trouble-free. Technology is secondary to the provision of that service. The process of developing subsystems capable of achieving greater reliability is an R&D process. Only after that reliability has been demonstrated should it be specified for production cars. The current practice of requesting ever-increasing reliability from existing components and attempting to demand its achievement through warranty provisions simply escalates the price of the equipment and capitalizes maintenance costs without solving the problem.

While the operators seem to be experiencing increasing problems with particular subsystem reliability in resolving such vendor-purchaser problems UMTA cannot play the principal role. Such problems can result from a poorly written specification, from the inability of the manufacturer to meet the specification, or from lack of quality control.

Problems encountered by a vendor in delivering cars meeting authority generated specifications have always been considered to be the domain of supplier and customer. UMTA's R&D program, not having been a party either to the generation or to the approval of specifications, could not take responsibility for failure to meet contractual requirements. Also, if UMTA were to resolve specific hardware deficiencies, we would be engaging in product improvement on behalf of the vendors involved. This does not seem a proper role for the Federal Government.

BEST DOCUMENT AVAILABLE

Assurance of better reliability upon delivery can be achieved through better written specification and through requirements for adequate prototype testing prior to production. In the case of problems arising after purchase, URD makes available the facilities at TTC for resolution of problems by the parties concerned. Test facilities, procedures, and personnel stand ready to assist should either a transit authority or a vendor elect to use them in resolving specific difficulties. The Pueblo facility is available to grantees virtually at no charge in the interest of producing reliable equipment. Utilization by the industry has been slow in coming, although we do see a positive trend. UMTA can only make the facility and the procedures available; it cannot insist upon utilization. (UMTA recognizes TTC is not a substitute for the actual system for which the equipment is designed. However, TTC offers an unexcelled opportunity for major debugging, limited fine tuning, and for reliability or endurance running away from the problems and hazards of revenue service operations.)

UMTA makes active and positive efforts to improve reliability of components and subsystems. For example, the ACT-1 and ASDP programs are tailored to meet reliability goals not heretofore imposed on suppliers.

ACT-1 and ASDP attempt to step out ahead of current problems by defining more stringent requirements and allowing sufficient time and funds to meet the objectives prior to making the systems available for production.

Furthermore, these efforts, while not available concurrently with R-46 generation equipment, are certainly on the near-term horizon of the next five years.

Once proven in an R&D phase, these subsystems are available to the industry for inclusion in production cars.

Where the specification sets forth a desirable objective not yet attained in commercial practice, the solution may be Federally sponsored research prior to approval of production hardware. The practice today appears to be for grantees to specify increasing levels of performance and reliability while vendors are not prepared to meet such requirements. The grantee simultaneously imposes more stringent warranty requirements on the vendor, left with no alternative (other than not to bid), simply increases the price of his

product to cover the cost of replacing his available components for the life of the warranty.

URD is attempting to develop generic subsystems, and even a total vehicle, which will meet perceived reliability requirements.

The industry itself, in specifying equipment, must balance the desire to achieve reliability using existing hardware with the benefits attainable from taking prudent risks with improved technology. To date, the life cycle of rail cars and the size of the market have not permitted absolute certainty regarding the reliability of new equipment prior to purchase.

While encouraging grantees to allow for adequate testing and debugging of new equipment, UMTA also encourages them to take risks (though very circumspect ones) in specifying new technology where the benefit seems worth a modest risk. Especially in such cases, UMTA encourages use of existing test facilities for the proving out of prototype equipment prior to approval of production quantities.

GAO's recommendation requiring grantees to justify the need for or use of new technology seems to be an over-reaction to the image of technology failure on BART or in Morgantown. It is not a failure of technology but of implementation.

While UMTA does not advocate the random introduction of new technology, we believe that systems should be encouraged to find ways to perform more efficiently. Efficiency can often be improved by adopting new technology. It would be ideal if we had decades to explore the nuances of every proposed advancement before committing ourselves to it. The real world of vehicle procurement dictates a life cycle of perhaps 30-50 years. Thus, opportunities for a second chance are few and far between. Rather than following a negative policy, against innovation, grantees should be encouraged to take prudent risks which, even if they are initially troublesome, hold promise of life cycle savings.

We would like to conclude our comments on the topic of reliability with an objection to GAO's apparent disapproval of complex technology. Complexity and reliability are not necessarily mutually exclusive. The only reason for advocating new technology is the possible life cycle benefit to be obtained through greater efficiency, energy saving, maintainability, reliability, etc. Problems in design of new technology usually can be solved through adequate testing.

ROUTING SLIP

2/25/78

TAN: 702912
 DATE: 12/26/78

Index	1st Catalog	KY 1/26/79
Abstract	Initial Q.C.	to 2/26/79
Final Q.C.	2nd Catalog	to 2/26/79

Such testing, and retrofitting should be accomplished prior to revenue service. For large systems, such as aircraft, this process of tradeoff analysis, design, prototype, and test can take up to eight years. Rather than condemning technology, the necessary time and budget should be allocated to the task.

UMTA Should Adopt DOD's "Fly Before You Buy" Policy; For Unproven Technology This Policy Should Require Building and Testing a Prototype

UMTA agrees and its R&D staff has long been vocal in trying to persuade the industry to recognize the value of prototype car testing. The pressures of getting into service quickly or of obligating funds quickly have too often taken precedence over the lengthening of schedules and increased cost necessarily involved in prototype exercises.

UMTA has been striving to convince the transit operators of the wisdom of including adequate prototype provisions in procurement specifications. Such provisions should require some minimum number of prototype cars, a predetermined test program such as defined in UMTA/TSC Uniform Test Procedures, and sufficient time to conduct the program prior to approval for start of fleet production.

Where UMTA has been successful in influencing grantees results have tended to foster two benefits identified by GAO as desirable, namely standardization and prototype testing (e.g., in the case of the Standard Light Rail Vehicle).

In keeping with UMTA's belief in prototype testing approximating the "fly before you buy" technique cited by GAO, and in keeping with our dedication to near-term objectives, we constructed the Rail Transit Test Track and related facilities at the DOT Transportation Test Center in Pueblo, Colorado. To date, UMTA has invested approximately \$25 million in a test facility second to none for debugging and evaluating prototype cars prior to pre-service tests on the grantee's own systems. The facility allows testing away from the hazards of interfacing with day-to-day revenue operations. Test procedures as well as facilities are available to enable effective diagnosis and cure of major problems.

This facility is available to grantees or to vendors to solve specific problems with subsystems after purchase, as well as for the testing of new UMTA developed vehicles.

Equipment Should Be Standardized

Standardization is an objective of the R&D program. We have demonstrated the benefits to be achieved from such a policy with the Light Rail Vehicle. In striving to achieve commonality in the rapid rail area, consideration must be given to physical constraints and to the peculiar requirements of individual properties. Nevertheless, the inertia of the operators is substantial, and is overcome by a concerted effort to gain a thorough understanding of the possible benefits from standardization. Responses to an UMTA Request for Proposals (RFP) are now being prepared by industry. The selected contractor will ascertain possible benefits of standardization, and will work with industry to develop a family of specifications for standard cars. If Phase I of the study can support a case for standard cars, Phase 2 requires the development of specifications for those cars. To assure a meaningful project, the operating authorities, through TDC, will provide industry input under contract to UMTA.

In addition, an intra-UMTA committee is evaluating all aspects of the problem in support of a policy being formulated by the Administrator.

GAO States that UMTA needs to develop an Information Collection System to obtain data on Transit Problems and to Classify such data to provide a Basis for Deciding which problems could and should be addressed under UMTA's R&D program

As part of the rail program, we are in the process of collecting complete performance data on the SOAC and ACT vehicles, on ASDP subsystems, and on recent vehicles in operation in the cities. Such data is extremely useful for comparing specifications and hardware. However, even more data on reliability and maintenance actions on fleets of cars is desirable.

The problem of inadequate information, nevertheless, remains a serious one. The suggestion made by GAO has been discussed from time to time. There is some inertia in the industry because of inadequate, nonuniform, or absent record keeping; reluctance of vendors to have proprietary data released; and legal difficulties in areas which could be construed to have safety implications or in which proprietary information is involved.

The suggestion is a good one. UMTA's R&D office will attempt to formulate such a data collection program. The recent history of equipment performance may have changed industry's reluctance to the point where such a project could succeed.

EXCERPT FROM SPEECH BY UMTA ADMINISTRATOR
ROBERT E. PATRICELLI, BEFORE THE AMERICAN
PUBLIC TRANSIT ASSOCIATION
NEW ORLEANS, LOUISIANA, SEPTEMBER 30, 1975Relations with the Industry, Suppliers and Consumers.

I would like finally to say that we will be looking in the year ahead for ways to broaden our contracts with the full range of our constituency interests--the transit industry, suppliers, consumers, and State and local government officials. I want to do more with APTA in this regard.

While this can be done in many different ways, it might be useful for me to suggest a specific place to start. One of the constant criticisms made about our program has to do with R&D hardware priorities. The allegation is often made that the program is too devoted to futuristic technology with only risky long term application, and not sufficiently to short term, high pay-off activities. I believe that criticism is less justified now than it was a few years ago, but I want to take yet another step in assuring that our R&D priorities are derivative of the real needs of the industry and the public.

To that end, therefore, I would solicit APTA's interest in co-sponsoring with us a conference on our R&D priorities. I would like it to be an occasion in which industry, academic, governmental and consumer interests could work with us in shaping a responsive research and demonstration agenda. While initially such a conference might be called on a one-shot basis, if it succeeds, we might consider doing it annually as part of our research and demonstration planning and budgeting cycle.

OTHER GAO REPORTS RELATING TO UMTA'S ROLE DURING
THE APPROVAL PROCESS OF CAPITAL FACILITIES GRANTS

Increased Cost of Implementing Commuter Ferry System
On San Francisco Bay, RED-76-40, November 11, 1975

UMTA has awarded nearly \$25 million in Federal funds to the Golden Gate Bridge, Highway and Transportation District to assist in developing and implementing a commuter ferry system for the San Francisco Bay. The cost of the system has more than doubled since initial estimates were made in 1970.

GAO recommended that UMTA develop criteria to assist in evaluating the cost-benefit aspects of the alternatives available within individual projects, improve the extent of written justification for management decisions, and insure that maximum competition is obtained for construction contracts awarded by grantees.

Procurement of Rail Passenger Cars for the New Haven
Railroad, RED-76-15, September 17, 1975

UMTA granted Connecticut \$49.6 million to assist in purchasing 100 passenger cars from General Electric for \$63.9 million. The procurement contract did not adequately protect Federal interests and the Government probably will incur interest costs of about \$2 million by funding the contractor in advance.

Although UMTA acted to protect the Government, GAO believes that the agency's interpretation of its directives, patterned after the Federal procurement standards for grantees, resulted in limiting the direction the agency provided in this grant. Federal agencies currently are reviewing these standards. GAO recommended that more specific grantee contracting procedures be developed

Problems with the Procurement and Reliability of Small
Buses, RED-75-391, July 2, 1975

UMTA has provided Federal assistance to transit system grantees for procuring capital equipment. Many of these grantees were having problems and delays procuring small (30-foot) buses and many small buses purchased with Federal funds were not reliable and have been or will be replaced after a few years' use. GAO recommended the adoption of standard specifications and the early development and implementation of reliability requirements for UMTA-funded buses.

PRINCIPAL OFFICIALS
RESPONSIBLE FOR THE ADMINISTRATION OF
ACTIVITIES DISCUSSED IN THIS REPORT

	<u>Tenure of office</u>	
	<u>From</u>	<u>To</u>
SECRETARY, DEPARTMENT OF TRANSPORTATION		
William T. Coleman, Jr.	Mar. 1975	Present
John W. Barnum (acting)	Feb. 1975	Mar. 1975
Claude S. Brinegar	Feb. 1973	Feb. 1975
John A. Volpe	Jan. 1969	Feb. 1973
ADMINISTRATOR, URBAN MASS TRANSPORTATION ADMINISTRATION		
Robert E. Patricelli	Aug. 1975	Present
Judith T. Connor (acting)	Jul. 1975	Aug. 1975
Frank C. Herringer	Feb. 1973	Jul. 1975
Carlos C. Villarreal	Apr. 1969	Feb. 1973

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