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REPORT 806

CARGO CARRIER, M2P0

26 APR. 1944

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WAR DEPARTMENT

Report 806

CARGO CARRIER, M29C

26 April 1944

TECHNICAL STAFF
THE ENGINEER BOARD
Corps of Engineers, U. S. Army
Fort Belvoir, Virginia

Report 806

CARGO CARRIER, M29C

Project MES 429

26 April 1944

Submitted to

THE ENGINEER BOARD

Fort Belvoir, Virginia

and/or

The Chief of Engineers

U. S. Army

Washington, D. C.

FOR OFFICIAL ACTION

by

John A. Caldwell
Captain, Corps of Engineers

and

Glenn D. Ferguson
Major, Corps of Engineers

Transportation Development Branch

TABLE OF CONTENTS

SYLLABUS

1. From the results of the investigation and test of the M29C Cargo Carrier to determine its suitability for Engineer use, it is concluded that this special purpose amphibious vehicle has high cross-country mobility and is particularly suited for operation over swampy, muddy, and extremely rough terrain and for crossing small bodies of calm water; it is suitable for the same general applications in swamp, jungle, or rough terrain for which the 1/4-ton, 4x4 truck or the 3/4-ton weapons carrier is used under average conditions; the M29C Cargo Carrier's effective life can be increased by transportation on other vehicles on long moves over roads; its overall payload capacity can be increased by the use of the 1/4-ton amphibian trailer; its present stowage is commensurate with capacity and probable cargoes; and operation and maintenance require very lit , special training of personnel. Performance tests also revealed certain mechanical and structural defects which should be corrected.

2. General recommendations of this report are that the M29C Cargo Carrier be made available in all theater depots or pools for issue to Engineer troops and other units of armies or task forces requiring the movement of personnel, supplies, or tools over terrain unsuited for standard wheeled vehicles; that the basis of issue be determined by the type of mission of the unit, the type of terrain, and weather conditions and related factors, but that a sufficient number of vehicles be made available in the depots for essential distribution down to and including Engineer combat platoons; and that the 1/4-ton amphibian trailer be made available in the depots for issue with the M29C Cargo Carrier.

3. It is further recommended that the M29C Cargo Carrier be transported on other vehicles on long moves over roads, with the standard 2½-ton 6x6 LWB truck or standard Engineer utility trailers with improvised platforms, or similar vehicles, as the transportation; that further investigation be made of road transportation of the M29C Cargo Carrier; that improvement of the mobility of the 1/4-ton amphibian trailer in thin mud be given further consideration; and that the mechanical defects found as a result of the tests be corrected if they can be accomplished without a material delay in production.

CARGO CARRIER, M29C

I. SUBJECT

1. Scope. This report covers the study and test of the M29C Cargo Carrier to determine its suitability for use by Engineer organizations.

II. AUTHORITY

2. Directive. The authority for conducting this work is contained in the 1st Indorsement, dated 8 February 1944, from the Chief of Engineers to the Engineer Board, file CE 451.94 (2 Feb 44) SPENE, subject: Test of Cargo Carrier, M29C, by the Engineer Board (Work Order No. DME 3261). Appendix A contains the directive and correspondence relative thereto.

III. INVESTIGATION

3. General. It was directed that the subject vehicle be tested to determine its suitability for use by Engineer units, but that such tests be confined to those essential for determining the possible tactical and technical applications, desirable stowage arrangements, and the special training required (if any) to adapt the vehicle to Engineer specialized uses. Since it was necessary to determine tactical applications and special training requirements, the cooperation of the Engineer School was requested in the making of the tests. The Engineer School report and copies of related correspondence are contained in Appendix B.

4. Description. The M29C Cargo Carrier is an amphibious tracklaying vehicle with a payload capacity of 1,200 pounds inclusive of the driver. This, on an average, is equal to four people (including the driver) with field equipment, or the driver and 1,000 pounds of cargo. The vehicle is of relatively light construction, having a gross weight of 5,971 pounds and a ground contact pressure of 1.9 pounds per square inch, and was developed for use over terrain considered impassable to standard types of wheeled motor vehicles. Steering in the water is done with stern rudders operated from the driver's seat, supplemented when necessary with the regular steering mechanism for the tracks. The transmissions provide six speeds forward and two in reverse. The manufacturer's general specifications are listed on page 4. Figures A and B, respectively, show the vehicle with the top removed and with the top in place.

5. General Performance Tests. In order to determine the possible Engineer applications for the vehicle, limited performance tests were conducted in water and over all types of terrain available in the vicinity of Fort Belvoir. On land, the vehicle performed and handled satisfactorily at all speeds although it created considerable noise at speeds above 35 miles per hour. Optimum performance was obtained in off the road travel. It was found to be capable of making its own path by shoving over underbrush, saplings, and other minor obstacles. It was also found to be capable of going through swampy and muddy bottom land and marshes, and of climbing over logs, up steep banks, down and out of deep ditches, and other terrain normally impossible for any other known mechanized land transport to negotiate. Figures C to I, inclusive, show the vehicle crossing obstacles that would stop any of the standard types of military wheel vehicles. It was rarely stalled in mud, and in the few instances where this did occur, it came out under its own power when assisted with the front-mounted capstan. Figure J shows the capstan in use. After a little experience, it was found comparatively easy to enter and leave water deep enough to float the vehicle providing the slope of the banks were within reasonable gradients. Figure K shows the Cargo Carrier entering the water from a steep bank. That part of the tracks touching the soil always pushed the vehicle forward until either full flotation or firm footing was obtained. Soft sand and mud bars in the water were also found to be no barriers.

However, when full afloat, its maximum speed of four miles per hour, low freeboard, and relatively poor maneuverability makes it dangerous for anything but fairly calm water. On one occasion while in a swift stream, a low hanging limb struck the top of the craft causing it to capsize and sink. Further more, considerable care was necessary at all times to avoid striking submerged obstacles with the revolving tracks as this would probably capsize it. It was found adequate as a boat only for crossing narrow lakes and streams where the waves are low and the currents are slow. Figure L shows the cargo carrier afloat in calm water.

6. Towing Performance Tests. In order to determine whether the net payload of the Cargo Carrier could be increased by using a trailer therewith, tests were made by towing a 1/4-ton amphibious trailer loaded with 500 pounds of cargo. With the trailer, the maneuverability of the vehicle was, of course, decreased considerably, though little difference could be noticed on the gradeability or the ability to negotiate average terrain. At times, in extremely soft mud, the trailer sank low enough for the cargo box to plow and stall the prime mover. Although not tried, it is believed that skid pans or a toboggan runner on the trailer would improve this, but of course such a setup would be useable only in the swamp or in snow. In calm water, little difference could be noted in towing the trailer with the normal load of 500 pounds, although care was necessary to prevent capsizing the trailer which appears to be somewhat unstable. After the test with the normal trailer load, an extra 300-pound load

FIGURE A. The M29C Cargo Carrier prepared for land operation with rudders up and front splash shield back.

FIGURE B. The M29C Cargo Carrier with top up for rainy or cold weather.

MANUFACTURER'S VEHICLE SPECIFICATIONS
(As Supplied by the Studebaker Corporation)

Length, over-all	188-11/16 inches
Width, over-all	67 inches
Height (top and windshield folded)	51 inches
Track width	20 inches
Weight of vehicle (curb)	4771 pounds
Weight of vehicle (gross)	5971 pounds
Center of gravity above ground (loaded approximately)	24 inches
Ground pressure	1.91 lb per sq in
Ground clearance	10½ inches
Angle of approach	47 degrees
Angle of departure	36 degrees
Freeboard at gross weight (bow)	10½ inches
(stern)	8 inches
Propulsion in water	By tracks only
Speed in calm water	4 mph
Speed on level hard surface (maximum)	36.4 mph
(sustained)	25 mph
Gradeability (lowest gear, hard surface)	100%
(highest gear, hard surface)	10%
Fuel	Gasoline

FIGURE C. The M29C Cargo Carrier ascending a steep bank.

FIGURE D. The M29C Cargo Carrier descending the same bank shown by Figure C.

FIGURE E. The M29C Cargo Carrier approaching a log in the mud.

FIGURE F. The M29C Cargo Carrier going over the same log shown by Figure E.

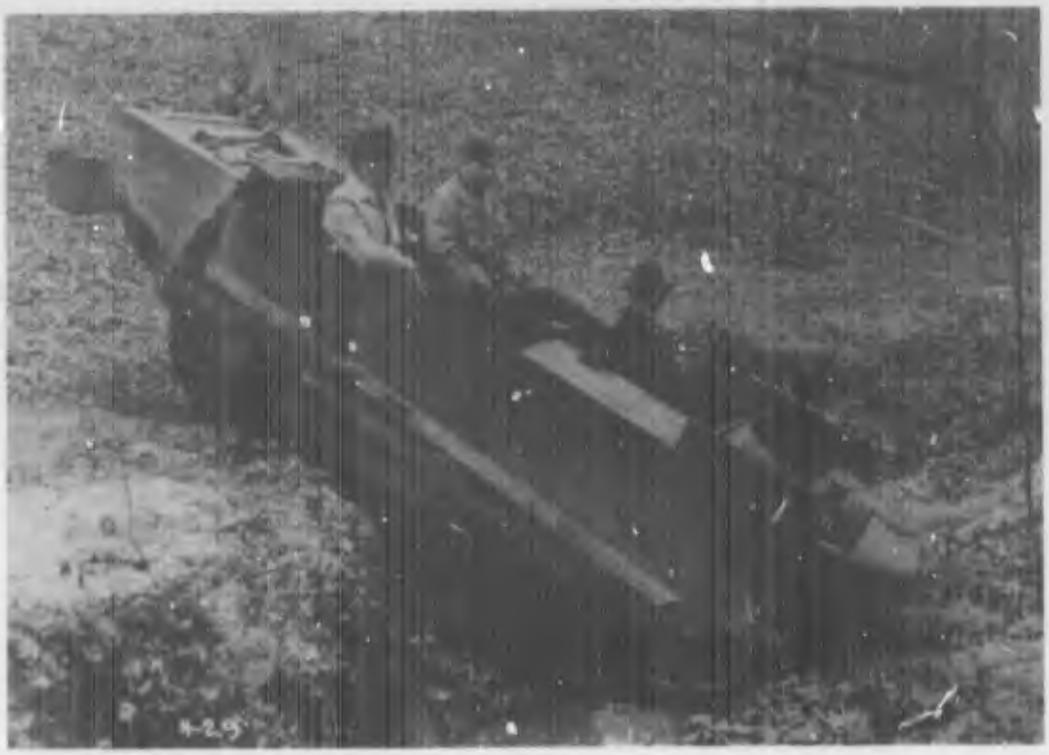

FIGURE G. The M29C Cargo Carrier nosed down into a ditch. The ditch is approximately 4 feet deep, 8 feet wide at the top, and 6 feet wide at the bottom. The bottom and sidewalls of the ditch were reasonably firm.

FIGURE H. The M29C Cargo Carrier in the same ditch shown by Figure G.

FIGURE I. The M29C Cargo Carrier coming up and out of the ditch shown in Figures G and H.

FIGURE J. Using the capstan to assist the tracks in pulling out of a mud hole. This mud is too soft to negotiate on foot.

FIGURE K. The M29C Cargo Carrier entering the water with rudders and splash shield in position.

FIGURE L. The M29C Cargo Carrier in still water. Note its low freeboard.

was carried by lashing empty 10-gallon gasoline cans to the trailer body to increase its buoyancy. The tests results obtained with the additional load were little different from those found with the standard load. The stability was not materially increased by the cans. A tarpaulin cover for the trailer was found to be essential to prevent water from splashing over the sides of the body.

7. Drawbar Pull and Gradeability Tests. Drawbar pull and rolling resistance tests were also conducted, and the listed results were obtained. All tests were conducted with a gross vehicle weight of 4,950 pounds (no payload except driver, and no trailed load).

Drawbar Pull

Traction Surface	Gear	Av. Drawbar Pull
Concrete	Low gear-low range	3,700 lb
Concrete	Low gear-high range	2,200 lb
Average mud	Low gear-low range	1,900 lb
Average mud	Low gear-high range	900 lb

Rolling Resistance

Rolling resistance on concrete - average, 300 pounds.

Gradeability

Gradeability test results indicate that under average soil conditions, grades up to 95 percent and side slopes up to 85 percent can be negotiated.

8. Transportation for the M29C Cargo Carrier. Limited tests were conducted to determine the feasibility of transporting the M29C Cargo Carrier on a standard Army 2½-ton 6x6 LWB cargo truck, and on a standard 2½-ton utility trailer. Figure 1, Engineer School Report, Appendix B, shows the Cargo Carrier loaded in a 2½-ton 6x6 truck. It was necessary to build a temporary platform on the trailer as shown by Figures 2, 3, and 4 of the same report. Although these loads appeared high, they handled fairly well at all speeds considered safe for the Engineer Board gravel test loop. The tests, however, were not sufficiently conclusive to consider the 2½-ton utility trailer as being satisfactory transportation. Some further investigation will be necessary to determine the most suitable type of platform to be used, and possible methods of loading. Further, it is not definitely known that the trailer drawbar will give satisfactory service with the high loading over rough roads or uneven terrain.

Tests were also made to determine whether the vehicle could be transported by air, using a mock-up of a C-54 cargo plane. With the stern cell (tank) removed, it is possible to load the vehicle in a C-54 cargo plane. The stern cell is bolted in place and can be

readily removed with the ordinary hand tools available in the field. The weight of the vehicle is well within the cargo capacity of the plane.

9. Mechanical and Structural Defects. The following mechanical and structural failures and operating difficulties were incurred during the tests:

a. Second gear in the main transmission failed.

b. The panels covering the top portion of the track were frequently ripped off or damaged by brush and other obstacles. Deflectors were installed which corrected this to some extent.

c. Difficulty was encountered in handling the vehicle on steep grades when the motor stalled, due to the fact that there is no method of braking other than with the two steering brakes.

d. The belt drive on the capstan slipped frequently on the heavier pulls.

e. The tracks can be thrown off when making sharp turns even when adjusted at the tension recommended by the manufacturer. Also, the excessive jumping of sprockets on sharp turns is apparently the way the track normally operates. This undoubtedly is caused in part by the driving sprocket on the tracks being in the rear.

f. The pintle hook is not entirely satisfactory. It is non-standard and too small to receive many of the standard lunettes including the one used on the 1/4-ton trailers.

g. The test model was supplied with only a hand-operated bilge pump.

IV. DISCUSSION

10. General. The M29C Cargo Carrier is an amphibious conversion of the T-24 Cargo Carrier. The T-24 is a comparatively lightweight vehicle designed for transporting cargo and personnel over snow and ice. As converted, it is useful for travelling across country through mud, swamps, small bodies of calm water, and up steep grades. As a boat, its use is limited to crossing small lakes and streams of calm water by the low freeboard (8 inches). It has a low water speed (4 miles per hour), and relatively poor maneuverability. The high cross-country mobility is due primarily to the low ground pressure combined with the traction that can be obtained in mud from a track equipped with grousers. The location of the center of gravity (center of vehicle, 24 inches above ground line), the available horsepower, and available gear ratios are also factors which contribute to the off-road performance. Performance on surfaced roads is considered good;

however, it cannot be compared to wheeled vehicles for this type of service. It is intended for use on terrain which is difficult or impossible for other types of mechanized transportation to traverse. Then too, as now designed, the track life of 1,000 miles (stated in the manufacturer's literature) limits its application to this type of service. In order to prolong the useful life, the cargo carrier could be transported in standard 2½-ton LWB cargo trucks. Limited tests also indicate that the vehicle can also be transported satisfactorily on a 2½-ton utility trailer, although an improvised or special platform and loading ramps will be required. Further investigations and tests are necessary before the 2½-ton utility trailer can be recommended without some qualifications as a transport.

The towing tests indicated that it was feasible to tow a 1/4-ton amphibious trailer with load on land and in water. The action of the trailer in mud also indicated that the drawbar pull required in mud could perhaps be reduced by use of a toboggan skid pan or sled in lieu of or as a supplement to the wheels. When towing the 1/4-ton amphibious trailer in water, care in stowing the load is essential to prevent shifting and capsizing of the vehicle. Any trailer, regardless of type, is a handicap to the towing vehicle, reducing both mobility and maneuverability. This is particularly true for cross-country travel. However, the use of a trailer with the M29C Cargo Carrier to increase the payload capacity should be of value under proper conditions.

11. Tactical Use. For tactical use, the M29C Cargo Carrier can serve as a reconnaissance vehicle as it is capable of carrying a machine gun for security purposes. It is not a combat vehicle, however, since it is unarmored and of very light construction.

12. Engineer Use. The M29C Cargo Carrier should be of material aid for Engineer reconnaissance, for moving small work parties with their tools, and for transporting small quantities of Engineer material. It serves the same purpose in swamps, mud, and extremely rough country as does the 1/4-ton 4x4 truck or the 3/4-ton weapons carrier under ordinary conditions.

13. Special Training Requirements. Very little special training is required for one to learn the operation and maintenance of the M29C Cargo Carrier. After a little instruction and experience, personnel familiar with the operation and maintenance of automotive type equipment, crawler tractors, or light tanks can operate and maintain the M29C.

14. Mechanical Weaknesses. While it was not the purpose of this investigation to determine the mechanical and structural defects of the subject vehicle, the following defects were apparent during the performance tests and are mentioned:

a. Stripping of the transmission gears, which occurred, is considered serious. The vehicle was abused considerably

during its test, but such failure indicates weakness. The transmission is a passenger car type and designed for direct drive for the majority of the time. Since the M29C not only must be operated in second speed or lower except on hard roads and since it does not have tires to cushion road shocks, it is believed that a heavier transmission is necessary for dependable operation.

b. Ripping off of the track panels occurred quite frequently due to the fact that the panels project from the sides of the vehicle and strike stumps, trees, and other objects. Deflectors, to prevent the panels from hanging on such obstacles, were installed and remedied the condition to some degree. It is understood from the manufacturer's representative that similar deflectors are now standard equipment.

c. Lack of a parking brake caused difficulty on steep hills when it was necessary to shift gears. Since both hands were needed to hold the track brakes, it was a hazardous job to shift gears, particularly, if the motor died. In several instances, the driver lost control of the vehicle and had to let it roll back to the bottom of the grade before he could start the motor.

d. Slippage of the belt drive on the capstan under severe pulls resulted in a damaged belt. Either a chain drive or shaft drive is needed.

e. Throwing of a track while turning too sharply resulted in a disabled vehicle. While this did not happen often, it is likely to occur frequently in the field, and should be remedied, if feasible, within reasonable limits.

f. The pintle hook on the test vehicle is non-standard, and a standard trailer lunette will not fit. It is understood from the manufacturer that production models are equipped with standard size pintles.

g. As supplied, the test model M29C Cargo Carrier was equipped only with a hand operated bilge pump. Past experience at the Engineer Board in the development and use of amphibious vehicles having metal hulls has indicated that a power driven bilge pump is absolutely essential for reasonably safe operation. The pump should be positively connected to the power take-off by shafts and universal joints or sprockets and chains, or both. V-belt drives are not dependable under these operating conditions and will never operate long under water. In the past, emergency underwater operation of the pump has often been necessary to take care of leaks in the hull developing from land operation. Since a heavier transmission is needed, the new type of transmission could also provide a power take-off for the pump, or the pump could be driven from a split-shaft type of take-off. If the

vehicle is to be amphibious, a power driven pump should be provided even at the expense of an increase in weight or sacrifice of payload capacity.

15. Engineer School Report. Appendix B contains a copy of the report by the Engineer School covering their part of the joint investigation. It will be noted that the conclusions drawn and the recommendations made in Paragraphs 10 and 11, respectively, Section V of that report, do not differ fundamentally from the recommendations made in Paragraphs 16, 17, 18, and 19.

V. CONCLUSIONS

16. General Conclusions. It is generally concluded that:

a. The M29C Cargo Carrier is a special purpose vehicle having high cross-country mobility, is particularly suited for operation over swampy, muddy, and extremely rough terrain, and, being amphibious, is also suitable for crossing small bodies of calm water.

b. Due to the comparatively short serviceable life (particularly the treads), the use of the vehicle should be confined to terrain and applications where it is not feasible to use standard wheeled vehicles, such as swamp, jungle, and deep snow.

c. Since the use of the vehicle should be confined to operations and terrain unsuitable or more often impossible for using standard wheeled vehicles, a number of the vehicles should be available to each theater commander for issue to armies, special task forces and other units; the number issued per unit to be dictated by the terrain, type of mission, anticipated weather, and other factors governing the operations.

17. Specific Conclusions. It is further concluded that:

a. The M29C Cargo Carrier has comparatively low freeboard, low water speed, and relatively poor water maneuverability, and therefore, its use as a boat is confined to crossing small bodies of calm water.

b. Due to comparatively high mobility of the M29C Cargo Carrier in swamp, jungle or rough terrain, it is suitable for the same general applications under those conditions as the 1/4-ton 4x4 truck or the 3/4-ton weapons carrier are used under average conditions.

c. The over-all payload capacity of the Cargo Carrier can, when operating anywhere except in thin mud, be effectively

increased by using it with the 1/4-ton amphibious trailer, although the trailer will necessarily decrease to some extent both maneuverability and mobility. However, the mobility of the trailer in thin mud can probably be improved by using a skid pan or toboggan in lieu of or as a supplement to the trailer wheels.

d. The 1/4-ton amphibian trailer should also be made available in theater depots or pools for issue as required with the Cargo Carriers.

e. The effective life of the vehicle can be increased by transporting it on other vehicles for longer moves over roads. The standard 2½-ton LWB 6x6 cargo truck and possibly the standard Engineer 2½-ton utility trailer are suitable for this purpose. A carrying platform and loading ramp will have to be developed or improvised for the 2½-ton utility trailer.

f. The M29C Cargo Carrier can be readily loaded and transported in a C-54 cargo plane if the stern cell (tank) is first removed, and this can be easily accomplished in the field with standard hand tools.

g. Inasmuch as stowage space commensurate with the capacity of the vehicle is already provided, and since military cargoes will normally consist of supplies and small tools of all types, no special stowage arrangements need be provided.

h. The operation and maintenance of the vehicle is fundamentally little different from the operation and maintenance of standard types of automobiles, trucks, crawler tractors, and light tanks, and these functions can be easily mastered by personnel trained for those types of equipment.

i. The listed mechanical and structural defects were apparent in the test vehicle and should be corrected in the production models providing it is possible to do so without causing unreasonable delays in deliveries.

(1) The transmission should be heavier, and designed to operate in either gear for extended periods of time.

(2) The capstan should have a positive shaft or chain drive.

(3) The track and track drive should be improved to reduce the tendency to jump sprockets and to reduce the probability of being thrown off entirely, as well as to increase track life.

(4) The track panels should be more rugged and be provided with guards. (It is understood from the manufacturer's representative that this is being done.)

(5) An emergency or parking brake should be provided.

(6) A standard type and size of pintle hook should be provided.

(7) A power driven bilge pump should be provided.

VI. RECOMMENDATIONS

18. General Recommendations. It is recommended that:

a. The M29C Cargo Carrier be made available in all theater depots or pools for issue to Engineers as well as other units of armies or task forces confronted with the problem of moving personnel, supplies, or tools over terrain which is unsuited to the operation of standard wheeled vehicles.

b. The basis of issue be determined by the type of the mission of the Army, task force, or other unit; the type of terrain; the expected weather; and other factors governing operations of this nature, but that sufficient quantities be made available in the pools to make possible, when essential, distribution downward to and including Engineer combat platoons.

c. The 1/4-ton amphibian trailer be made available in the theater depots or pools for issue with the cargo carrier where requirements and operating conditions make it advisable.

19. Specific Recommendations. It is further recommended that:

a. The M29C Cargo Carrier be transported on another vehicle when making long moves over roads, and that the standard 2½-ton 6x6 LWB truck, standard Engineer utility trailer with improvised platform, or other vehicle of similar size and type, be used as the transport until more definite recommendations are made.

b. Further study be given to the transportation on roads of the M29C Cargo Carrier.

c. Further study be given to the improvement of the mobility of the 1/4-ton amphibian trailer in thin mud.

d. The following mechanical and structural defects be corrected, provided that this can be accomplished without a material delay in production:

(1) Provide a main transmission designed to operate continuously in either gear, and sufficiently rugged to withstand full torque of the motor under all operating conditions.

(2) Provide a chain or shaft drive for the capstan.

(3) Improve the track and track drive mechanism so as to reduce the tendency to jump sprockets and the probabilities of throwing the tracks. Also increase, if feasible, the useful life of the tracks.

(4) Provide guards on track panels. (It is understood from the manufacturer's representative that this is being done.)

(5) Provide a suitable emergency or parking brake.

(6) Provide a standard pintle.

(7) Provide a power driven bilge pump having a capacity of at least 30 gallons per minute.

Submitted by:

John A. Caldwell,
Captain, Corps of Engineers,
Transportation Development Branch.

Glenn D. Ferguson,
Major, Corps of Engineers,
Transportation Development Branch.

Forwarded by:

Grant E. Beverly,
Lt. Colonel, Corps of Engineers,
Acting Director, Technical Division III

APPENDIX A

DIRECTIVE AND PERTINENT CORRESPONDENCE

HEADQUARTERS, ARMY SERVICE FORCES
WASHINGTON 25, D. C.

RWH/jgb
6091

SPRMD 451 2 Feb 1944

MEMORANDUM FOR THE CHIEF OF ENGINEERS:

Subject: Test of the Cargo Carrier, M29C, by the Engineer Board.

1. A Cargo Carrier, M29C, is being shipped to the Engineer Board, Fort Belvoir, Virginia, at an early date. This vehicle is a modification of the Cargo Carrier, M29, which permits this vehicle to swim in calm water. A copy of a descriptive booklet on this vehicle under its experimental name "T24" is attached for your information along with a manuscript of TB 9-772-1 (in two volumes).

2. For your information, this vehicle will go into production during April of this year for theater pools and pilot models are presently being shipped to certain theaters for test in those theaters.

3. It is desired that this vehicle be tested to determine its suitability for use by various organizations of the Corps of Engineers. Automotive test is not desired and it is contemplated that your tests will be confined to possible tactical or technical uses, stowage arrangements, and special training to adapt this vehicle to your specialized uses.

4. It is further desired that your report be submitted along with recommendations as to your training requirements within thirty (30) days after the receipt of this vehicle at the Engineer Board.

For the Commanding General:

LEE A DENSON
COLONEL, G.S.C.
Director, Requirements Division.

2 Incls:
#1 - Booklet - General Information U.S. T-24, Light Cargo Carrier
#2 - TB 9-772-1 (in 2 volumes)

CE 451.94
(2 Feb 44) SPENE
CM 78485

Subject: Test of Cargo Carrier, M29C, by the Engineer Board (Work Order No. DME 3261).

1st Ind.

Office, C. of E., 8 February 1944.

To: The President, The Engineer Board, FORT BELVOIR, VIRGINIA.

1. Forwarded.

2. It is desired that the subject vehicle, Cargo Carrier, M29C, be tested to determine its suitability for use by Engineer organizations. The tests should be confined to possible tactical or technical uses, stowage arrangements and special training to adapt the vehicle to Engineer specialized uses.

3. It is also desired that a report be submitted along with recommendations as to training requirements within thirty (30) days after receipt of the vehicle.

By order of the Chief of Engineers:

WILLIAM J. NEW,
Major, Corps of Engineers,
Chief, Equipment Development Branch,
Engineering & Development Division.

2 Incls.
n/c

HEADQUARTERS, ARMY SERVICE FORCES
WASHINGTON 25, D. C.

RWH/jgb
6091

SPRMD 451 10 Feb 1944

MEMORANDUM FOR THE CHIEF OF ENGINEERS:

Subject: Test of the Cargo Carrier, M29C, by the Engineer Board.

1. Reference is made to memorandum from this Headquarters dated on or about 2 February 1944, file and subject as above.

2. A representative of the Studebaker Corporation, Mr. F. J. Trench, will call on the Engineer Board, Fort Belvoir, Virginia, in connection with the test of the Cargo Carrier, M29C. You are authorized to request of Mr. Trench such assistance as you may require in connection with driver training and maintenance of the Cargo Carrier, M29C, while it is under test by the Engineer Board. For your information, Mr. Trench will, at the same time, be available to the Chemical Warfare Board and to the Signal Corps Board and, accordingly, can not spend full time with the Engineer Board.

3. It is desired that suitable clearance be made for Mr. Trench in order that he may call upon the Board with a minimum of inconvenience.

For the Commanding General:

LEE A DENSON,
Colonel, G.S.C.
Director, Requirements Division.

cc: Studebaker Corp.,
attn: Mr. E. M. Douglas

CE SPENE

Subject: Test of the Cargo Carrier, M29C, by the Engineer Board. (Work Order No, DME 3273).

1st Ind.

Office, C. of E., 15 February 1944.

To: The President, The Engineer Board, FORT BELVOIR, VIRGINIA.

1. Forwarded.

2. It is requested that arrangements be made to provide Mr, Trench with suitable passes while engaged at the Engineer Board.

By order of the Chief of Engineers.

/s/
WILLIAM J. NEW,
Major, Corps of Engineers,
Chief, Equipment Development Branch,
Engineering and Development Division.

EB 400.1 (MES 429)

2nd Ind.

Engineer Board, Fort Belvoir, Virginia, 3 Mar 1944

To: Chief of Engineers, U. S. Army.

1. Request of the 1st indorsement has been complied with.

2. Mr. A. C. Soellinger of the Studebaker Corporation reported to this office on 23 February 1944 in lieu of Mr. Trench, for the purpose of instructing personnel in the use and operation of the subject vehicle.

For the President:

/s/

W. J. Matteson,
Colonel, Corps of Engineers,
Executive Officer.

APPENDIX B

ENGINEER SCHOOL REPORT AND PERTINENT CORRESPONDENCE

WAR DEPARTMENT
THE ENGINEER BOARD
CORPS OF ENGINEERS, U. S. ARMY
FORT BELVOIR, VIRGINIA

400.1 (MES 429) 12 February 1944

Subject: Tests of Cargo Carrier M29C.

To: The Commandant, The Engineer School, Fort Belvoir, Virginia.
(THRU: The Commanding General, Fort Belvoir, Virginia)

1. The Engineer Board has been directed by the Chief of Engineers to test the subject vehicle for "possible tactical or technical uses, stowage arrangements and special training to adapt this vehicle" to "Specialized uses" of the Corps of Engineers. It has been directed that a report be submitted within 30 days after receipt of the vehicle.

2. Inasmuch as special training requirements and possible tactical uses are within the scope of the test to be conducted, the cooperation of the Engineer School is requested in carrying out the investigation. The Transportation Development Branch of the Board, Major Glenn D. Ferguson, Chief, has been designated in charge of tests.

3. It is requested that the Engineer Board be informed as to whether the school desires to cooperate in these tests, and if so, the name of the officer(s) to be designated from the School.

4. The M29C Cargo carrier is an amphibious track laying vehicle, and has not as yet been received by the Engineer Board.

For and in the absence of the President:

/s/ W. J. Matteson
/t/ W. J. Matteson,
Colonel, Corps of Engineers,
Executive Officer.

Forwarded by 1st Indorsement.

Subject: Tests of Cargo Carrier M29C.

400.1 (MES 429) 2d Ind.

Headquarters Engineer School, Fort Belvoir, Virginia, 23 February 1944

To: The President, The Engineer Board, Fort Belvoir, Virginia.

Through: The Commanding General, Fort Belvoir, Virginia.

1. The following officers have been appointed as a committee to cooperate with the Engineer Board in the tests to be conducted with the Cargo Carrier M29C.

Major R. M. La Forge, CE, Dept of Weapons and Tactics
Captain L. E. Cohn, CE, Research Department
Captain R. G. Davis, CE 1114th Engr Combat Group
Captain K. W. Kennedy, CE, Dept of Training Publications.

2. Captain Cohn will act as liaison officer for the Committee.

For the Acting Commandant:

/s/ Howard Ker

/t/ HOWARD KER,
Colonel, Corps of Engineers,
Executive Officer.

WAR DEPARTMENT
THE ENGINEER BOARD
FORT BELVOIR, VIRGINIA

23 February 1944

400.1 (ES 429)

Subject: Tests of Cargo Carrier M29C.

Through: The Commanding General, Fort Belvoir, Virginia.

To: The Commandant, The Engineer School, Fort Belvoir, Virginia.

1. Reference is made to letter dated 12 February 1944, above subject.

2. You are advised that the subject vehicle has been received and that preliminary inspection indicates, the possibility of its advantageous employment, by Engineer Bridge Companies and Ponton Units.

For the President:

/s/

W. J. Matteson,
Colonel, Corps of Engineers,
Executive Officer.

HEADQUARTERS THE ENGINEER SCHOOL
OFFICE OF THE COMMANDANT

Fort Belvoir, Virginia
31 March 1944

400.1 (MES 429)

Subject: Tests of Cargo Carrier, M29C.

Through: Commanding General, Fort Belvoir, Virginia.

To: President
The Engineer Board
Fort Belvoir, Virginia

1. Reference is made to letter your office, above subject, file 400.1 (MES 429), dated 12 February 1944.

2. Transmitted for your information are two copies of "Report on M29C Cargo Carrier" prepared by the Research Department, the Engineer School.

3. It is requested that a copy of the report of the technical staff of the Engineer Board on the subject vehicle be furnished for study by the Engineer School.

For the Commandant:

/s/ James M. Parrish

/t/ JAMES M. PARRISH
Captain, Corps of Engineers
Secretary.

Incl.
"Report on the M29C Cargo Carrier."
(2 copies)

AG 400.112 1st Ind.

Hq Ft Belvoir, Va. (Date) 31 Mar 44
To: President, Engr Bd, Ft Belvoir, Va.

Inc. n/c /s/ DC

HEADQUARTERS THE ENGINEER SCHOOL

OFFICE OF THE COMMANDANT

In reply refer to:

Fort Belvoir, Virginia
23 March 1944

Subject: Report on the M29C Cargo Carrier.

Through: Chief, Research Department.

To: The Commandant,
The Engineer School,
Fort Belvoir, Virginia.

1. Pursuant to directive memorandum dated 23 February 1944, this committee has cooperated with the Engineer Board in tests of the Cargo Carrier, M29C.

2. The committee submits herewith its report on the project.

R. M. LaForge

R. M. LaFORGE
Major, CE
Staff and Faculty

R G Davis

R. G. DAVIS
Captain, CE
1114th Engr C Gp

K. W. Kennedy

K. W. KENNEDY
Captain, CE
Staff and Faculty

L. E. Cohn

L. E. COHN
Captain, CE
Staff and Faculty

REPORT ON THE M29C CARGO CARRIER

CONTENTS

Section I

INTRODUCTION

1. AUTHORITY. - Authority for this report is contained in letter from Headquarters The Engineer School, Office of the Commandant, dated 23 February 1944, subject: "Committee for Tests of Cargo Carrier M29C."

2. PURPOSE. - The purpose of the project has been to cooperate with the Engineer Board in tests of the Cargo Carrier M29C for possible tactical or technical uses, stowage arrangements, and special training to adapt this vehicle to specialized uses of the Corps of Engineers.

3. SCOPE OF INVESTIGATION. - The scope of investigation on this project has included a study of the technical and descriptive literature available on the vehicle, examination of the vehicle and of its capabilities, consultation with the Engineer Board, tests to indicate the suitability of the standard 2½-ton 6 x 6 long wheel base cargo truck and of the 2½-ton pole type trailer as transporting vehicles and the use of the 1/4-ton cargo trailer, amphibian.

Section II

GENERAL

4. DESCRIPTION OF THE VEHICLE. - a. The M29C Cargo Carrier is a tracked amphibian vehicle characterized by extreme mobility in difficult terrain. It owes its mobility to its light weight and to its wide tracks. Originally designed for use in snow, it has been modified for amphibian purposes by mounting a water-tight cell on the front and rear of the vehicle to give additional buoyancy to the hull. It is an excellent vehicle for transporting light cargoes up to 1200 pounds including the driver or for carrying four men including the driver. It will operate in mud, swamps, deep water, or snow as well as on hard surfaced roads.

b. The following specifications are of interest:

Length, overall	188 11/16 in.
Width, overall	67 in.
Height - Top and windshield folded	51 in.
Track width	20 in.
Weight of vehicle (curb)	4771 lb.
Weight of vehicle (gross)	5971 lb.
Ground pressure (per sq. in.)	1.91 lb.
Center of gravity above ground (loaded) (approx.)	24 in.

Freeboard:	
At curb weight (bow)	12 in.
(stern)	13½ in.
At gross weight (bow)	10½ in.
(stern)	8 in.
Propulsion in water	By tracks only
Speed in calm water	4 mph
Speed on level hard surface - sustained	25 mph
Durability	1000 miles

5. PROCUREMENT. - The committee has been informed that the M29C Cargo Carrier has been adopted for procurement and that large scale production will commence in the near future.

Section III

TESTS CONDUCTED

6. LIMITATIONS. - The following principle limitations of the vehicle are apparent from the specifications presented above:

(1) The vehicle has a relatively small pay load. After allowing for a crew of two men, the pay load is reduced to approximately 800 pounds.

(2) The free board of the vehicle is not sufficient for use in rough water or in surf. This characteristic immediately eliminates the M29C Cargo Carrier from consideration for use in landing operations.

(3) Its speed in water is too slow for the vehicle to be practical in streams where there is much current or where there is a strong wind.

(4) Its durability is very limited according to the manufacturer's specification. Experience at the Engineer Board indicates that the 1000 mile estimate is very conservative but it nevertheless does serve as an indication of the durability to be expected.

7. TESTS CONDUCTED BY THE COMMITTEE. - Tests conducted by the committee consisted of general observation of the vehicle's capabilities in operation in extremely difficult terrain and an investigation of means for minimizing two of the major limitations discussed in the preceding paragraph.

a. Operation of this vehicle was observed by the committee in demonstrations which involved cross-country travel with very steep grades, soft mud, deep water, underbrush and hard-surfaced roads. The M29C was found to be surprisingly mobile over terrain normally considered impassable to transportation.

b. By the use of a truck or a trailer to transport the M29C Cargo Carrier, most of the wear which will unnecessarily shorten its life may be eliminated. Test loadings indicate that the truck, cargo, 2½-ton, long wheel base, 6 x 6, serves as an excellent transporter for the vehicle. With regards to both bulk and weight, the M29C is a good load for the 2½-ton truck. (See figure 1.)

c. Limited tests indicate the feasibility of loading the M29C on a standard 2½-ton pole type trailer with only slight modifications to the trailer. Although the load is fairly high above the ground, it appears to ride very well and seems to be stable enough for field use. (See figures 2, 3, and 4.)

d. The committee found that the 1/4-ton amphibian cargo trailer is an ideal companion vehicle for the M29C. Its use permits the M29C to transport an additional 500 pounds or more of cargo over land and in deep water. (See figures 5 and 6.) The following points were noted in the tests conducted with the 1/4-ton amphibian cargo trailer:

(1) It reduces the maneuverability of the towing vehicle, especially when backing. This, of course, applies to any trailer.

(2) The cargo should be stowed well to the rear of the trailer in order to overcome the extra weight of the drawbar in the front and in order to give additional freeboard to the front of the trailer.

(3) Cargo should be stowed in such a manner that it cannot shift. Otherwise it is very likely to shift during land (and particularly cross-country) operations with the result that the trailer will list to one side when afloat.

(4) When the trailer is to be towed in deep water, the tarpaulin furnished with it should be put on. This prevents the trailer from shipping water and makes it even more seaworthy than the vehicle towing it. If the load in the trailer projects above the sides, a larger tarpaulin will have to be used.

(5) The capacity of the 1/4-ton trailer afloat can be materially increased by improvised means. In a test conducted by the committee, ten empty gas cans were lashed to the bottom of the trailer and a load of 800 pounds was towed with ease afloat in deep water.

(6) The loaded 1/4-ton trailer did not appear to affect the M29C Cargo Carrier's ability to negotiate extremely steep grades.

(7) Tests indicated that the 1/4-ton trailer could be towed by the M29C through any type of terrain that the tracked vehicle

could negotiate by itself except very fluid mud. Under such conditions the 1/4-ton trailer sinks in over the wheels and the front end of the trailer body pushes mud like a bulldozer blade. It is believed that by attaching a skid plate underneath its body, the trailer will be enabled to float on fluid mud and will thus be able to travel wherever the M29C can travel.

(8) The pintle on the model used for these tests was not standard and it was necessary to improvise a towing arrangement which did not prove satisfactory. However, the committee has been informed by the Engineer Board that the production model of the M29C is to be produced with the standard pintle.

Section IV

ENGINEER USES

8. GENERAL. - a. Tests of this vehicle indicate that under the conditions for which it has been designed, it is the most practical piece of transportation now available for hauling light cargo and small numbers of personnel. The use of the 1/4-ton trailer greatly increases its value by nearly doubling its pay load.

b. Under conditions favorable for its operation, the M29C serves as a general purpose vehicle which will operate where others cannot. As such, it is a valuable substitute for other pieces of U.S. light transportation, such as the 1/4-ton truck or the 3/4-ton weapons carrier or command car. Under normal conditions it is not as satisfactory as the other vehicles and should not be used where other type vehicles may be employed.

9. ENGINEER USES. - Engineer uses for this vehicle are general rather than specialized. In swamps, mud, or deep water where normal transportation cannot operate the M29C would be extremely satisfactory for engineer reconnaissance, for movement of small work parties with their tools and for transporting small quantities of engineer material. It would serve as a substitute for other transportation.

Section V

FINDINGS AND RECOMMENDATIONS

10. FINDINGS. - a. The M29C Cargo Carrier is well suited for engineer use as a general purpose vehicle only when operating in the terrain for which it has been designed, i.e. mud, swamps, calm water, and cross-country on steep grades with poor footing. It should not be considered as a general purpose vehicle for all types of terrain.

b. The carrier shows good performance in terrain normally unsuited to general purpose vehicles - in most adverse conditions of

FIG. 1. M29C Cargo Carrier loaded in a 2½-ton truck.

FIG. 2. M29C Cargo Carrier loaded on a 2½-ton pole type trailer.

FIG. 3. M29C Cargo Carrier loaded on a 2½-ton pole type trailer.

FIG. 4. M29C Cargo Carrier loaded on a 2½-ton pole type trailer.

FIG. 5. M29C Cargo Carrier towing a standard ¼-ton trailer in deep water.

FIG. 6. M29C Cargo Carrier and ¼-ton trailer emerging from the water.

mud, in swamps, even when broken by stretches of deep water, in cross-country moves with grades in excess of 30%, and in calm water. Based on the literature available on the vehicle and on its characteristics under the conditions listed above, it appears to be very suitable for snow and ice operations.

c. The M29C Cargo Carrier is slow in the water and has a very limited freeboard. These characteristics preclude its use at sea in landing operations, on swift rivers, in a high wind, or in rough water of any type.

d. The 1/4-ton amphibian cargo trailer is a good companion vehicle for the carrier. It almost doubles the pay load of the M29C and appears to be capable of carrying a load when towed through any type of terrain that the carrier can negotiate alone with the exception of extremely fluid mud. It is believed that a skid plate attached just below the axle of the trailer would overcome this exception.

e. Based on the manufacturer's estimate of 1000 miles durability for the vehicle it appears desirable to provide some means of transporting it for long moves on roads or in normal terrain just as the bulldozer is transported in engineer units. Two types of standard vehicles were tested for this purpose - the 2½-ton cargo truck, long wheel base, 6 x 6 and the 2½-ton pole type trailer. Based on limited tests, the carrier appears to be a satisfactory load for both vehicles.

f. In tests conducted by the committee, the vehicle stalled only once when not towing a trailer. This resulted from loss of traction caused by bellying on a stump. The carrier was able to extract itself by use of the power capstan mounted on the bow.

g. The pintle on the vehicle examined by the committee was non-standard and unsatisfactory. It is understood that standard pintles will be used on the production model.

h. As a general purpose vehicle, the Cargo Carrier is suitable for hauling many supplies required by engineers such as rations, water, gasoline, mines, explosives, ammunition, tools and weapons. Special stowage arrangements are not advisable.

i. It is too small for transporting bulky road and bridge materials such as sand, crushed rock, and lumber. (See figure 7.)

j. A machine gun could be mounted to fire from the carrier for security of reconnaissance parties. The M29C is not a combat vehicle, however, since it is unarmored and of very light construction.

k. The vehicle is very simple to operate and drivers can be easily trained in a short period of time.

l. Organic engineer maintenance personnel are capable of performing second echelon maintenance on the M29C with a minimum of instruction.

11. RECOMMENDATIONS. - Based on limited tests conducted by the Engineer School in collaboration with the Engineer Board, it is recommended:

a. That the M29C Cargo Carrier be issued to engineer units for reconnaissance and for movement of small work parties in terrain where normal transportation is unsatisfactory.

b. That the following principles govern in issuing the vehicles:

(1) Task Forces. (a) The carriers should be made available in quantity to engineer as well as other units of task forces operating or planning to operate where mud and water or snow and ice conditions predominate.

(b) When use of the M29C by engineer troops is advisable, sufficient vehicles should be assigned to make possible distribution down to and including the combat platoon. The exact quantity should be based on the mission of the task force, the type of terrain and the weather to be expected.

(c) 1/4-ton trailers should be issued with the cargo carrier. The desirability of issuing transporting vehicles would depend on the same factors given in the preceding sub-paragraph.

(2) Field Armies. (a) Since there may frequently be periods in normal terrain when mud and water or snow and ice cause wheeled traffic to be roadbound, a pool of M29C Cargo Carriers with transporting vehicles and 1/4-ton trailers should be available within each field army in theaters of operations. The carriers should be issued with operators to units within the army as required on a temporary assignment basis.

c. That further study be conducted of the following:

(1) Means of transporting the carrier.
(2) Use of the 1/4-ton trailer in conjunction with the M29C including the skid-plate modification suggested herein.

d. That a number of these vehicles be issued with 1/4-ton trailers for complete tests to selected engineer units in the field that are located in terrain suitable for such tests.

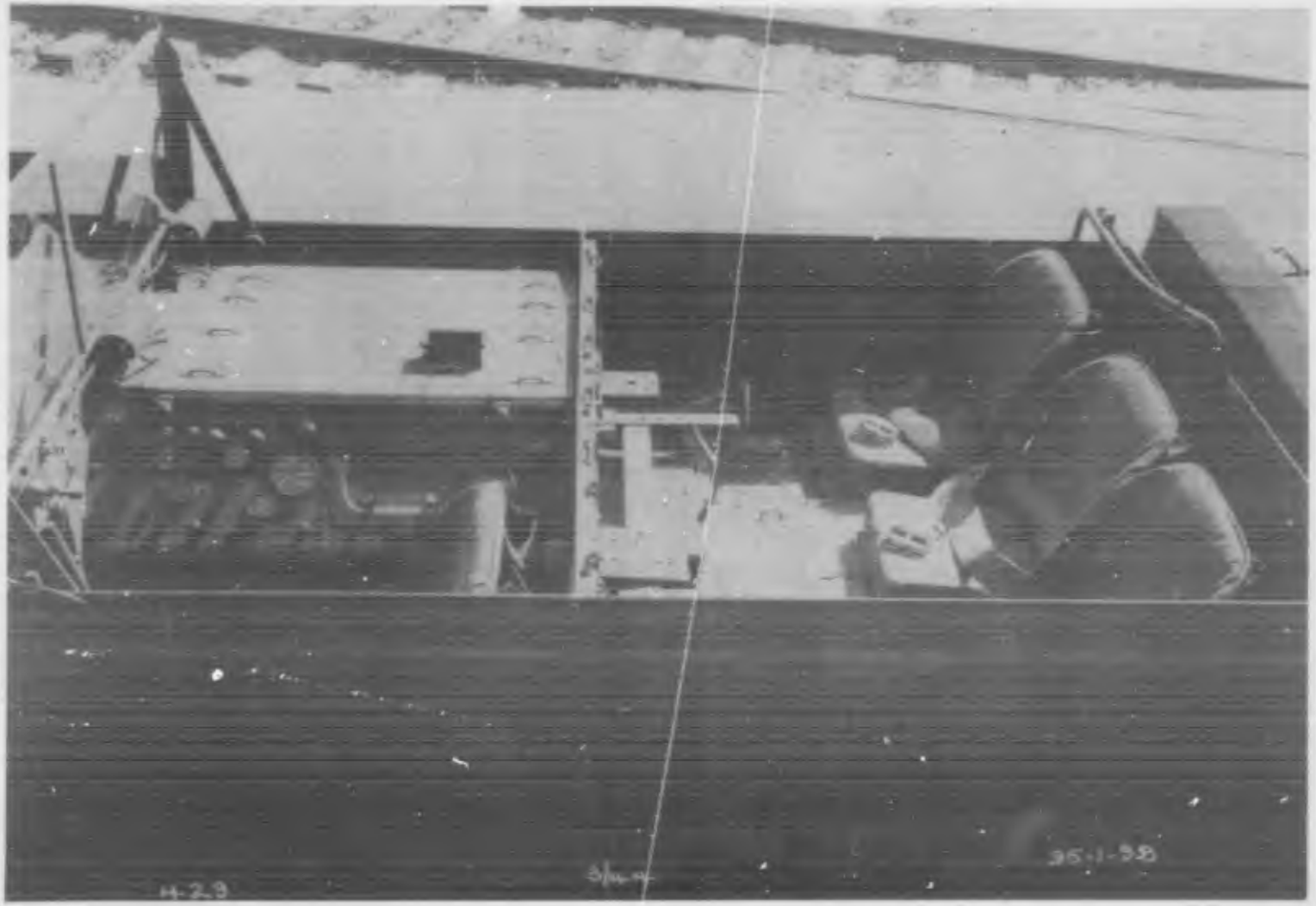

FIG. 7. Interior view of the M29C Cargo Carrier.

Changed to UNCLASSIFIED

Classified

Cancelled

Date 12/2/59

By authority of eh, ME

5/5/58