

DEPARTMENT OF THE ARMY
ARMY CONCEPT TEAM IN VIETNAM
APO San Francisco 96243

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26 January 1967

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SUBJECT: Final Report - Evaluation of GOER Vehicles in Vietnam (ACL-90/67)

TO: Commanding General
United States Army Vietnam
ATTN: AVHGC
APO 96307

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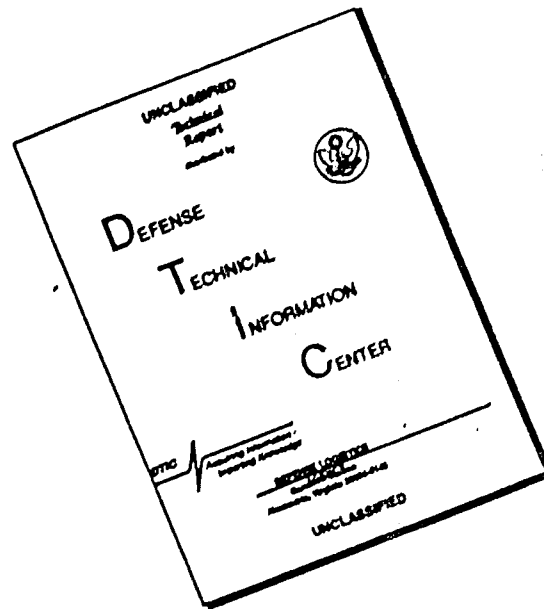
1. REFERENCES

- a. Message, USARV-R&D 51299, DTG 040501Z April 1966, subject: GOER Requirements (U).
- b. (C) Message, DA 762372, 28 April 1966, subject: GOER Requirements.
- c. (C) Message, CINCUSARPAC GPLO-SM 9306, 4 May 1966, subject: GOER Vehicle Requirements.
- d. (C) Message, USARV AVC-O&T 52205, 31 May 1966, subject: GOER Vehicle Requirements.
- e. Caterpillar Tractor Company Technical Representative Reports, subject: 8-ton GOER's in Vietnam, Contract No. DA-11-022-AMC-404 (T):
 - (1) 26 August 1966, Report Period: 11-21 August 1966.
 - (2) 1 September 1966, Report Period: 22-27 August 1966.
 - (3) 27 September 1966, Report Period: 4-10 September 1966.
 - (4) 28 September 1966, Report Period: 11-17 September 1966.

2. PURPOSE

Determine the suitability of GOER-type vehicles in the Vietnam environment and provide recommendations for their employment.

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AVIB-LED

26 January 1967

SUBJECT: Final Report - Evaluation of GOER Vehicles in Vietnam (ACL-90/67)

3. BACKGROUND

a. The GOER family of vehicles, developed and manufactured by the Caterpillar Tractor Company under the direction of the US Army Tank-Automotive Center, was extensively field tested in Europe as a cross-country logistical support vehicle. As a result of these field tests, the Department of the Army approved the 8-ton family of GOER vehicles for Army use, but type classification has not yet been completed for the cargo and tanker GOER vehicles and classification of the wrecker is being held in abeyance until August 1968.

b. At a staff conference on 11 February 1966, COMUSMACV stated that GOER vehicles could possibly be used at Cam Ranh Bay in view of the difficult road conditions and suggested that a small number of the vehicles in good operating condition be brought to Vietnam for evaluation.

c. A subsequent USARV request for GOER vehicles was approved by the Department of the Army. A total of 19 vehicles was deployed to Vietnam from CONUS and USAREUR: eleven 8-ton cargo carriers, seven 2500-gallon tankers, and one 10-ton wrecker.

d. Although originally scheduled for operation in the Cam Ranh Bay/Nha Trang area, the vehicles were diverted to Pleiku because of critical transportation support problems resulting from heavy monsoon rains in the central highland area of Vietnam. The 1st GOER Company was organized in Pleiku and placed under the operational control of the Pleiku Sub-Area Command. The company became fully operational on 11 September 1966 with the initial primary mission of supporting the 4th Infantry Division.

e. Department of the Army directed ACTIV to evaluate GOER vehicle operations in Vietnam and provide recommendations for their use to USACDC.

f. General data were collected for 3 months but data from drivers and maintenance personnel covered only 26 days.

4. DEFINITION OF TERMS

GOER - The term "GOER" was coined and its use initiated by the US Army Armor Board. It pertains to the vehicle family developed and manufactured by the Caterpillar Tractor Company utilizing the principle of large diameter, wide base tires to obtain lower ground pressures and increased mobility over difficult terrain.

AVIB-LED

26 January 1967

SUBJECT: Final Report - Evaluation of GOER Vehicles in Vietnam (ACL-90/67)

5. DESCRIPTION OF MATERIEL

The three types of GOER vehicles evaluated were: the truck, cargo, 8-ton, 4 x 4, XM520E1; the truck, fuel tanker, 2500-gallon, 4 x 4, XM559; and the truck, wrecker, 10-ton, 4 x 4, XM553. The GOER front power unit is essentially the same for all three configurations and can be interchanged with facilities available at third echelon or higher maintenance shops. All GOER vehicles are amphibious and air transportable, and feature low pressure, high flotation tires, high ground clearance, vehicle articulation, all-wheel drive, high angles of approach and departure, low break angle, and a high horsepower-to-weight ratio. The basic characteristics of each type of GOER vehicle are described below.

a. 8-ton Cargo Truck

The 8-ton capacity of the cargo truck is based on a cargo density of 27.5 pounds per cubic foot. The cargo body is of a lightweight high-strength design with the load carried through the floor structure. In effect, the entire sub-floor structure is a shallow, triangular, fabricated beam. The cargo floor is constructed as a corrugated sandwich 2 inches thick; the sides are corrugated panels. Material is high-tensile steel. The floor of the cargo body will accommodate six standard military pallets, or one conex container and two pallets, or up to twenty-five 55-gallon drums standing on end. The two side doors and the rear door are interchangeable and large enough for loading pallets from either side or the rear. Conex containers are loaded from overhead. When closed, the doors are water tight. Bows and tarpaulin are provided to protect the cargo from the elements. When not in use, this equipment is stored in a separate compartment.

b. 2500-gallon Tanker

Three discharge hoses are provided for the tanker, one with a 100-gpm capacity and two with a 50-gpm capacity. There is another outlet with a maximum discharge rate of 300 gpm. The rear of the tanker body also has space available for two 55-gallon drums.

c. 10-ton Wrecker

The wrecker has a straight 17.75-foot boom with a 3-foot hydraulic extension and a traverse of 360 degrees with unobstructed operator visibility. A hydraulic pump driven from the engine crankshaft operates the hoisting mechanism. Extra stability for crane operation is provided by manually operated out riggers. The wrecker can be used for mobile tire servicing or for emergency field work and cargo handling. Space is provided for two spare tires and necessary tools.

AVIB-LED

26 January 1967

SUBJECT: Final Report - Evaluation of GOER Vehicles in Vietnam (ACL-90/67)

6. OBJECTIVES

a. Objective 1 - Mobility and Operating Effectiveness

Determine the mobility and operating effectiveness of GOER-type vehicles relative to standard military vehicles in the Vietnam environment.

b. Objective 2 - Reliability and Maintainability

Determine the reliability and maintainability of GOER-type vehicles in the Vietnam environment.

c. Objective 3 - Utilization

Determine the ways that GOER-type vehicles can best be utilized to satisfy theater motor transport requirements.

7. EVALUATION DESIGN

a. Setting of the Project

(1) Environment

All operations during the evaluation period were conducted in the central highland area of Vietnam during the latter part of the southwest monsoon season. This region is characterized by extensive plateau areas with the mountains giving way to more gently rolling terrain. The northern plateau is covered by dense tropical forests and jungle. The southern portion is typical savannah country with large open expanses covered by tropical grasses and open forests. The climate is tropical, hot, and humid with a heavy annual rainfall. Roads are few, poorly maintained, and narrow. During the evaluation period, all roads and off-loading areas were muddy. In areas where roads were non-existent or could not be completed because of the monsoon rains, mud was as much as 5 or 6 feet deep.

(2) Military Elements

The 1st GOER Company conducted the evaluation. This company is an element of the 27th Transportation Battalion, Qui Nhon Area Command. Data were also obtained from the 27th Transportation Battalion, from Headquarters, Pleiku Sub Area Command, and the 4th Infantry Division Support Command. Caterpillar Technical representatives provided copies of their reports during the period of the evaluation.

AVIB-LED

26 January 1967

SUBJECT: Final Report - Evaluation of GOER Vehicles in Vietnam (ACD-90/67)

b. Methodology

(1) Data Collection Methods

Data were collected through questionnaires, structured interviews, descriptive narratives, records maintained by participating units, and the observations of knowledgeable individuals.

(2) Analysis Methods

Data collected were subjected to descriptive, comparative, qualitative, and quantitative analysis to meet the project objectives.

(3) Unit drivers and mechanics responded to vehicle operator questionnaires prepared by ACTIV, and the two unit officers complete unit leaders' questionnaires. The 44 vehicle operator questionnaires returned to ACTIV yielded input upon which to evaluate the mobility and effectiveness of GOER-type vehicles. The commanding officer of the 1st GOER Company furnished a unit historical background and other data relative to the unit. A driver of a GOER tanker related a typical mission description on which three GOER tankers were used. This historical background and mission description provided a qualitative insight upon which to base a portion of this evaluation.

c. Limitations and Variables

Primary limitations encountered during the evaluation were the time available to accumulate statistical data concerning performance and maintenance and the number of vehicles available in country. The area of operations prevented an evaluation of performance covering all types of terrain, particularly beach clearing operations.

8. DISCUSSION

Two GOER vehicles, a cargo truck and a tanker, arrived at Cam Ranh Bay about 15 July 1966. After a short period of operation in the Cam Ranh Bay area, these two vehicles were shipped to the Pleiku area via Qui Nhon. Prior to shipment, the two GOER's operated well in sand without lowered tire inflation pressure and had no trouble traversing a winding sandy road to a radio tower on top of a 700-foot hill which most 4-wheel drive jeeps could not traverse.

AVIB-LED

26 January 1967

SUBJECT: Final Report - Evaluation of GOER Vehicles in Vietnam (ACL-90/67)

The two GOER vehicles arrived in Pleiku on 24 August 1966. The 1st GOER Company initiated training on this date and continued until 11 September 1966 when the unit became operational. Seventeen GOER vehicles arrived at Qui Nhon from USAREUR on 4 September 1966 and were conveyed to Pleiku on 8 September 1966.

The 1st GOER Company provided direct support to the 4th Infantry Division from 11 September 1966 until approximately 20 September 1966. Monsoon weather existed throughout this period and the GOER vehicles were the only vehicles which consistently hauled all classes of supply into the division base camp under their own power. Two GOER vehicles were on an extended dispatch to the 4th Infantry Division base camp for the sole purpose of hauling water and rations because of existing poor weather and terrain conditions.

a. Mobility and Operating Effectiveness

During the evaluation in the Pleiku area the GOER vehicles negotiated terrain that stopped tanks. Although most roads in the Pleiku area are negotiable by standard tactical vehicles, certain limited stretches (0.5 to 10 miles) were in such poor condition that they could only be negotiated by the GOER vehicles during the monsoon season.

Only two individuals of the 1st GOER Company had more than one year's experience on GOER vehicles while the remainder had only one to two months' experience. Of the 44 GOER operators, 32 were qualified to operate the cargo truck, 30 the tanker, and 7 the wrecker. Most of the time 25 operated cargo trucks, 14 the tankers, and 5 the wrecker.

For on-road operations, over 90 percent of the operators stated that GOER vehicles had satisfactory speed, power, and steering. On gear shifting to higher and to lower gears, 93 percent and 74 percent, respectively, stated that shifting was easy. All operators unanimously rated the GOER vehicle as too bouncy on the highway. Vehicle operators generally considered the width as satisfactory for driving on Vietnamese roads (86 percent) and crossing Vietnamese bridges (74 percent). In comparing the GOER vehicles to standard cargo vehicles, drivers rated the GOER's as follows: superior (52 percent), about the same (21 percent), and inferior (27 percent). The average highway speed was rated as follows: higher (7 percent), about the same (50 percent), and lower (43 percent), in relation to most cargo vehicles.

AVIB-LED

26 January 1967

SUBJECT: Final Report - Evaluation of GOER Vehicles in Vietnam (ACL-90/67)

For off-road operations, almost all vehicle operators rated the GOER as having satisfactory mobility for cross-country operations in mud and brush. All operators noted that ground clearance of the GOER was satisfactory in the Vietnam highlands. Of 43 GOER operators responding, 12 never got stuck, 25 seldom, 5 occasionally, and 1 frequently. In comparison with other military wheeled vehicles, most operators rated the GOER as being easier to control, having better traction in deep mud, and providing easier travel over rough terrain in comparison to standard cargo vehicles. For cross-country travel in Vietnam, 65 percent of the operators rated the GOER as better than any other cargo vehicle, 27 percent as better than most wheeled cargo vehicles, 4 percent about the same, and 4 percent worse than most other wheeled cargo vehicles. Driver response on maintenance requirements of GOER vehicles was 45 percent more, 48 percent about the same, and 7 percent less than standard cargo vehicles.

b. Reliability and Maintainability

From 11 September to 6 October, the average vehicle availability was 17 out of 19 GOER vehicles assigned to the unit. The average length of haul (round trip) was 70 miles and the average operational day was 14 hours. During this 26-day period, the first GOER Company hauled 1,081 tons of class I through V cargo 7,626 miles, 891 troops 857 miles, and 328,000 gallons of fuel 4,853 miles. By 12 December 1966, the 1st GOER Company had accumulated a total of 47,331 miles and delivered a total of 3283 tons of cargo, 1000 personnel, and 990,686 gallons of fuel.

The GOER cargo trucks carried an average of 7½ tons per trip with a maximum load of 12 tons, both on and off-road. During the period from 11 September to 6 October, approximately 90 percent of operations were on-road with the remaining 10 percent off-road.

The 1st GOER Company received almost no support from other sources for the maintenance of its vehicles. A 1-year supply of repair parts initially provisioned by the contractor was brought to Vietnam with the GOER vehicles. Two technical representatives from the Caterpillar Company assisted maintenance personnel of the unit in performing all maintenance on the vehicles. On 12 December 1966 the company still had 14 GOER's operational. Of the five non-operational vehicles, one tanker had been wrecked and was awaiting repair, one tanker was in organizational maintenance, and three cargo trucks were awaiting parts, two for engines and one for steering.

The major problem initially encountered in maintaining the GOER was the high usage of fan belts. Adjustment of the fan belt was difficult, but the installation in all GOER's of a new adjustment arm by Caterpillar technical representative should remedy this problem.

AVIB-LED

26 January 1967

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The 1-year concurrent repair (furnished by Caterpillar) parts stock, deployed with the GOER vehicles to Vietnam, was determined by the contractor from his data and data gathered during previous tests. While the 1st GOER Company did not maintain formal accounting of parts usage because of non-availability of supply and maintenance personnel, the unit did record and log parts used to maintain and repair the GOER vehicles. From these records and logs the recorded data could assist in establishing valid supply requirements for spare parts. Until a formal supply account is established for repair parts, the 1st GOER Company receives its maintenance materials directly from the contractor.

c. Utilization

Officers of the 1st GOER Company, in responding to questionnaires prepared by ACTIV, recommended that the GOER vehicle not be used to replace any standard vehicles presently used in Vietnam. However, the officers did recommend that GOER vehicles be authorized in addition to standard vehicles as special purpose vehicles. All officers who were queried on GOER vehicles recommended that they be used in direct support of tactical forces.

In the opinion of all officers queried, 10 GOER vehicles should constitute an operational platoon. Unit officers recommended two platoons per GOER transportation company with the ratio of cargo trucks to tankers as 1 to 1 and 1 wrecker per 20 vehicles. The battalion commander recommended three platoons and two GOER wreckers. Two wreckers are required to provide flexibility in task organization of GOER convoys and to insure effective maintenance support of GOER operations.

Because of the size and unique operational characteristics of the GOER vehicles, two men are required with each vehicle whenever operating and, therefore, four men per vehicle are required for a 20 to 24 hour operational capacity. This requires 40 drivers per platoon or 120 drivers per 3-platoon company, a driver strength that approximates a standard 3-platoon transportation truck company. The standard company has proved to be effective for operations and command and control purposes.

During the evaluation, all individuals of the 1st GOER Company were TDY to the unit and only one administrative vehicle, without radio equipment, was available part-time to accomplish the local vehicular administrative requirements. The company at times had to use a GOER cargo truck to get its potable water in 5-gallon cans. As of the drafting of this report, the 1st GOER Company had no approved TD or TOE. During the evaluation the company was without the necessary administrative supplies for its internal support, such as mess equipment, typewriters, filing cabinets, field safe, etc.

AVIB-LED

26 January 1967

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Another problem area encountered was the loading and off-loading of the GOER cargo trucks. The cargo doors are designed specifically with a width to receive standard palletized cargo. Problems were encountered when pallets shifted and became asymmetrical and hence too wide for mechanized loading through the doors. In most instances when this occurred, the asymmetrical pallets had to be hand loaded to allow full loading of the cargo vehicle. During interviews, individuals expressed the thought that a 6-inch or more widening of the door would resolve this problem.

General design of the cargo body made bulk cargo loading very difficult and in some cases impossible. Bulk cargo, such as lumber, concertina wire, and POL bladders required loading with a crane or the wrecker. The only other alternative, besides hand loading, was to drop cargo over the side of the vehicle with a fork lift. This could cause damage to the cargo and vehicle. Maximum cargo space was not utilized. The T-shaped body was not adaptable for quick easy loading, but widening of side doors should make the GOER cargo truck acceptable in its present configuration.

Loading GOER's and standard vehicles under similar conditions showed that loading the GOER takes longer than loading standard trucks. One example of this loading took place in Kontum where two fork lifts were available. One fork lift loaded ten 2½-ton trucks before one GOER was completely loaded. Although the capacity of the GOER is more than twice that of a 2½-ton truck, the time and effort expended on loading detracts from this advantage. Caterpillar representatives have indicated that modification of the doors on the cargo GOER should alleviate this problem.

The GOER tankers were designed to act as "retail" refueling vehicles, and hence have pumps and associated filtering equipment. The GOER tankers have been used in the Pleiku area almost exclusively for bulk or wholesale delivery, making the pumping equipment redundant. The commander of the Pleiku Sub-Area Command recommended that consideration be given to eliminating this equipment to permit increased fuel carrying capacity. In one instance, however, on 11 December 1966, the GOER tankers refueled helicopters directly to support a very successful air assault operation.

During the evaluation no circumstances arose that required the swimming capability of the GOER. Also, because of the limited operational area of the 1st GOER Company, no data were generated with which to evaluate the GOER in the coastal plain or the delta areas of Vietnam.

AVIB-LED

26 January 1967

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9. FINDINGS

a. The GOER vehicle provided the capability of negotiating roads and cross-country terrain virtually impassable to standard vehicles during the monsoon season and hence accomplished missions where standard tactical vehicles failed.

b. The GOER was used successfully in direct support of tactical units engaged in operational areas where access by standard vehicles was limited by terrain conditions.

c. Average vehicle availability during the evaluation was over 80 percent.

d. The GOER had a very bouncy ride.

e. Asymmetrical palletized loads could not be easily loaded on the GOER cargo truck.

f. No maintenance support outside of company resources was provided for the GOER vehicles.

g. Integrated employment procedures for the GOER vehicles were not formally established during the evaluation.

h. Because the GOER vehicle was evaluated only in the central highlands, no data were gathered on its capabilities in the coastal and delta areas of the Republic of Vietnam (RVN).

10. CONCLUSIONS

a. The GOER vehicle can successfully provide direct support to tactical units operating in the severe climatic and geographic conditions encountered in Vietnam.

b. Engineering changes are necessary to reduce the bouncy ride of the vehicle.

c. Modification of cargo doors is necessary.

d. Based on over 80 percent availability during the evaluation, the GOER vehicle is reliable.

e. Employment of GOER vehicles requires consideration of special maintenance support.

AVIB-LED

26 January 1967

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f. Planning for employment of GOER vehicles in Vietnam should be initiated.

g. The GOER should be evaluated in the coastal and delta areas of RVN.

11. RECOMMENDATIONS

It is recommended that:

a. The GOER vehicles be employed in RVN in the direct support role.

b. Engineering studies and modifications be made to:

(1) Reduce the bouncy ride of the vehicles.

(2) Increase the width of the cargo doors on the GOER truck.

c. An approved TDA and the necessary critical materials, equipment, and personnel be furnished to a GOER unit prior to the unit's deployment and evaluation in other areas.

d. Specific maintenance organizations be assigned to support GOER units.

e. Consideration be given to:

(1) The immediate authorization to deploy at least one GOER company to RVN during FY 68.

(2) The deployment of sufficient GOER units to support tactical operations in extreme geographic and environmental conditions as encountered during this evaluation.

(3) A study of the long range force structure requirements for GOER unit distribution.

f. An evaluation of GOER vehicles be conducted in the coastal and delta regions of RVN to:

(1) Determine their effectiveness in these areas.

AVIB-LED

26 January 1967

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(2) Determine whether the vehicle is suitable for operations in these areas.

Alton L. Woodruff
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for

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Distribution