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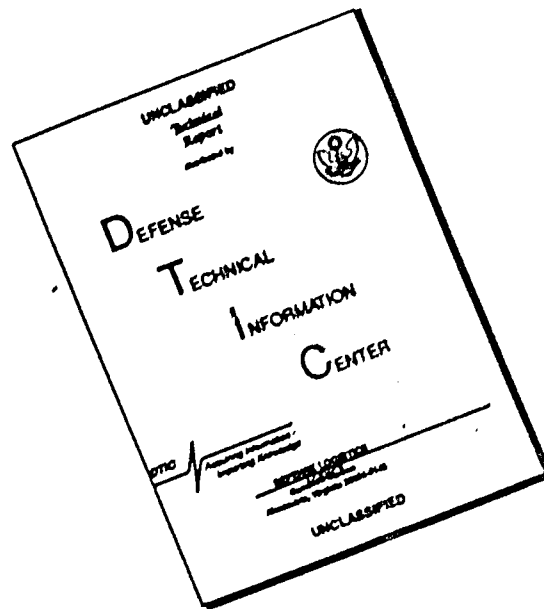
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DEVELOPMENT

OF

1/4-TON 4x4 UTILITY TRUCK, M151 SERIES

CATALOGUED IN
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The original 1/4-ton 4x4 utility truck, widely known as the jeep, was adopted as the standard light vehicle of the Armed Forces in July 1941. During and after World War II the jeep became so popular that a large number of tactical functions other than those for which it had been designed were assigned to it. In order that it might perform these additional functions, numerous modifications were made in the vehicle that resulted in many design complications and a considerable increase in weight.

When in 1948 a military requirement was established for a quantity of replacement 1/4-ton 4x4 trucks, limitations on funds prevented the initiation of a developmental program to explore the deficiencies of the original model and produce a vehicle of more modern design. As an expedient, the military characteristics were revised only to the extent of specifying a 24-volt electrical system (in place of the original 6-volt system), provision for deep-water fording, the required degree of radio-interference suppression, larger tires, provision for arctic operation, and other special features; in all other respects, components of the commercial jeep then in production were specified. The revised model, produced by the firm that designed the wartime jeep, was eventually adopted as a standard item with the designation M38 despite inherent deficiencies that included insufficient space, discomfort to personnel, and a low payload-to-weight ratio. In 1952 the M38 truck was superseded by the M38A1, which had a longer body, a more powerful engine, and a higher-capacity fuel tank with only a nominal increase in weight.

Meanwhile, in January 1951 the basic program that had been deferred in 1948 had been approved. A new set of military characteristics for a general-purpose 1/4-ton 4x4 truck with a utility-type body was approved at this time and, on the basis of these characteristics, a contract for studying new designs was awarded to a different manufacturer the following March. This contract resulted in two proposals, one for the development of a vehicle quite similar to the M38 and M38A1, the other for a truck of a quite different design. The second proposal was accepted, and the military characteristics were

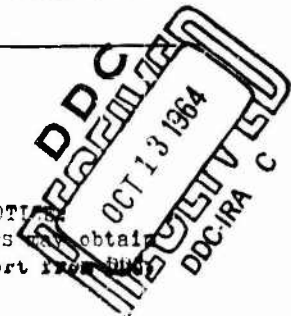
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- 10-58 TIR 11-1-2A3(1) 3/4-ton 6x6 Utility Truck, XM408

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revised accordingly in May 1952. A contract for six pilot models of the new vehicle, which was named the XM151, was awarded the following month.

The contractor for the XM151 built three prototypes, tested them for approximately 30,000 miles, and modified its design on the basis of these tests. The six pilot models were then fabricated and delivered on schedule in June 1954. These vehicles were driven a total of 116,000 miles under all kinds of road and climatic conditions in operational tests by Aberdeen Proving Ground (APG) and Continental Army Command (CONARC) that ended early in 1956. The tests disclosed that the XM151 possessed many advantages over the M38A1. Among those listed in the final report on the pilot-model tests at APG, which were held from July 1954 to April 1955, were:

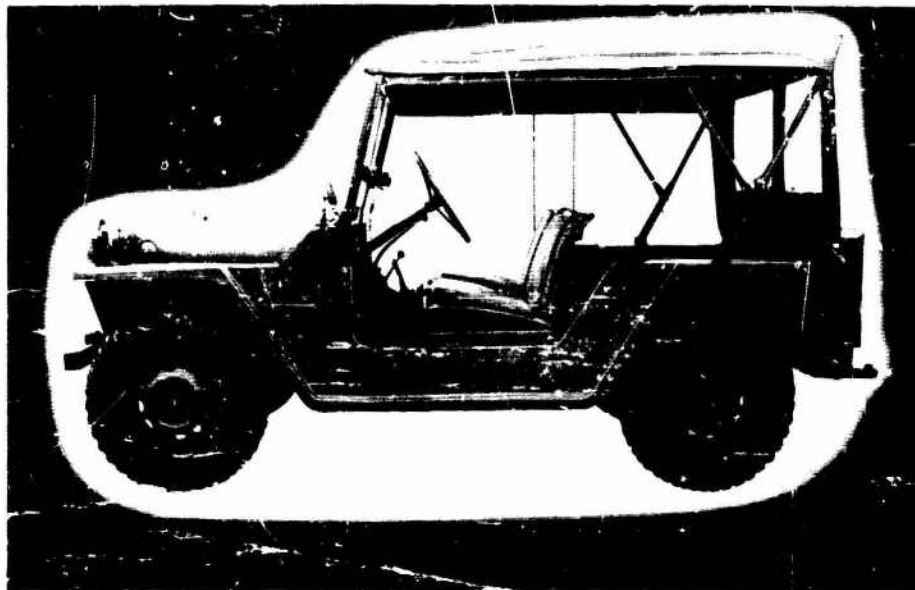
- a. Improved performance
- b. Superior riding qualities
- c. More cargo space
- d. Considerably less weight
- e. Increased stability
- f. Greater ease of steering and better maneuverability

This report further stated that the performance and durability of the new truck's engine were especially commendable. A supplemental arctic test of another pilot, held in January-March 1955 at Fort Churchill, Manitoba, Canada, showed that the general functioning of the XM151 in low ambient temperatures (20 degrees to minus 45 degrees Fahrenheit) was satisfactory and that its cross-country mobility on ice, snow, and frozen muskeg was equal to that of the M38A1. On the other hand, both APG and CONARC found numerous deficiencies that required modification or redesign of major components in the vehicles tested.

In March 1956 the contractor for the XM151 was authorized to build four new vehicles in which these deficiencies would be overcome. Two of the new vehicles were to be XM151E1's (with a steel body and frame), and the other two were to be XM151E2's (with an aluminum body and frame). The four modified trucks were scheduled for delivery and test in 1956.

The XM151E1 and XM151E2 1/4-ton 4x4 utility trucks, like the M38A1 jeep that they may shortly supersede, are intended for use on all types of road as well as for cross-country purposes. They travel at a maximum speed of 63 miles per hour, have a highway cruising range of about 300 miles, and are capable of fording water crossings to a depth of 20 inches (6 feet with a special fording kit). Although they weigh considerably less than the M38A1, the new trucks can carry the same pay load as the standard vehicle — 1,200 pounds on paved roads, 800 pounds on cross-country terrain; they also have the same towing capacity.

Both the XM151E1 and the XM151E2 have a unitized body and frame, and the only real difference between the two models is that the former is constructed of steel, the latter, of aluminum. As a result of this difference in construction, however, the XM151E1 weighs 2,273



1/4-TON 4x4 UTILITY TRUCK, M151 (XM151E1)

pounds, while the XM151E2 weighs only 1,995 pounds. The original steel model, XM151, weighed 2,140 pounds, but subsequent changes in design to improve the performance of the vehicle added 133 pounds. The new weight of the steel version, however, is still 15 per cent less than that of the M38A1.

The XM151-series truck is slightly wider and lower than the M38A1. More important, its center of gravity is 1.8 inches closer to the ground, with the result that it is more stable. The unitized construction (body panels, reinforcements, braces, and undercarriage all welded together) makes it unusually strong and rigid, while independent wheel suspension, utilizing variable-rate coil springs (in the rear only), insures a smoother ride for the four persons accommodated. A canvas top is furnished to inclose the otherwise open body. Side curtains and doors are also available as a kit.

The new 1/4-ton truck is powered by a new high-compression short-stroke gasoline engine, which develops almost the same horsepower as that of the M38A1 despite the fact that the power plant (including clutch and transmission) is some 200 pounds lighter. It is a 4-cylinder in-line, 4-cycle, water-cooled engine known as Ford Model XM-151-E. A four-speed synchromesh transmission is employed with this engine. In addition, a single-speed transfer assembly transmits power to the front axle. In normal driving the front-axle

drive is disengaged, but in fording operations and whenever the driving is difficult, as on mud, snow, sand, ice, or steep grades, it is desirable to engage it. This can be done simply by moving a transfer clutch lever forward. A compression spring, which forces the clutch into engagement when the teeth on the mating parts are synchronized, makes it unnecessary to declutch or slow down the truck when moving the transfer lever.

In designing the XM151 series, interchangeability of parts within the vehicle and ease of maintenance were stressed to the greatest practicable extent. Among the components that are interchangeable are front and rear differential carriers, all wheel bearings and seals, all service-brake shoes and drums, front-axle shafts, rear-axle shafts, and front seats. The front-suspension cross member is removable, permitting the servicing of all the front suspension and drive parts as a unit.

The two XM151E1 pilots were delivered in February 1957 for initial testing at APG and Detroit Arsenal. After brief engineering tests, the one at AFC was sent to the manufacturer for modification, but it was returned in July to APG, where tests were continued until March 1958. The two XM151E2 pilots were delivered in July 1957 and were scheduled for testing at APG and Fort Knox (US Army Armor Board).

On 11 July 1957 the XM151E1 was classified standard as the M151, and the M38A1 and M38A1C (an M38A1 modified for mounting a 105-mm or 106-mm recoilless rifle) jeeps were reclassified as limited standard. However, in sanctioning the adoption of the new vehicle CONARC stipulated that, before the beginning of quantity production, the steel XM151E1 and the aluminum XM151E2 must be user-tested and compared to determine the best version for the Army and, furthermore, that any defects disclosed by these tests must be corrected.

After the XM151E1 was made standard, the aluminum version of the new truck was redesignated the M151E2. This vehicle was scheduled for 7,600 miles of endurance testing by APG. After it had been driven 3,054 miles, however, numerous cracks, which had developed in its body and structural members, necessitated stopping the tests on 13 August 1957. The final APG report on the M151E2, issued in February 1958, recommended that, because a major redesign would be required to make this version acceptable, it be considered unsatisfactory.

The final engineering-test report on the M151 (XM151E1), covering 30,878 miles of durability operation, was published in June 1958; it recommended the correction of a number of specific deficiencies. Since this truck has been submitted to the Ordnance Industrial Division for production engineering, however, no further developmental work by the Research and Development Division is planned.

PRINCIPAL CHARACTERISTICS

Type	utility truck
Crew	1
Passengers	3
Cargo space	9.6 sq ft

Pay load	
Highway	1,200 lb
Cross-country	800 lb
Weight (M151)	
Net	2,273 lb
Gross highway	3,473 lb
Gross cross-country	3,073 lb
Weight (M151E2)	
Net	1,995 lb
Gross highway	3,195 lb
Gross cross-country	2,795 lb
Towing capacity	
Highway	2,000 lb
Cross-country	1,500 lb
Axle load (M151)	
Empty	
Front	1,305 lb
Rear	970 lb
Axle load (M151E2)	
Empty	
Front	1,130 lb
Rear	865 lb
Dimensions	
Length	131.25 in
Width	62.3 in
Height	
Over-all	70.5 in
Reducible	52 in
Height of pintle	17.8 in
Ground clearance	11.12 in
Wheel base	85 in
Tread	
Front	53.1 in
Rear	53.1 in
Suspension	variable-rate coil springs (rear only)
Wheels	magnesium, drop-center
Tires	nondirectional cross- country
Size	7.00x16
Pressure	15 psi (front), 25 psi (rear)
Body	open, integral with frame
Communications	none
Engine	water-cooled, gasoline
Make and model	Ford YM-151-E
cylinders	
Number	4
Bore	3.875 in
Piston stroke	3 in
Piston displacement	141.5 cu in
Arrangement	in-line
Compression ratio	7.5:1
Brake horsepower	71 @ 3,800 rpm
Torque	128 lb-ft @ 1,800 rpm
Oil capacity	5 qt

Electrical system	two 24-volt batteries
Transmission	synchronesh
Gear ratios	
First speed	5.712:1
Second speed	3.179:1
Third speed	1.674:1
Fourth speed	1:1
Reverse	7.497:1
Transfer-case gear ratio	1:1
Axles	
Type	hypoid, semifloating
Gear ratio	4.86:1 (to be changed to 5.17:1)
Fuel capacity	17.3 gal
Brakes	
Service	hydraulic
Parking	mechanical
Armament	none
Air transportability	Phase I (parachute)
Performance	
Maximum speed	63 mph
Maximum grade-climbing ability	60%
Fording depth	
w/kit	72 in
w/o kit	20 in
Turning radius	17.9 ft
Cruising range	300 mi (approx)
Angle of approach	62°
Angle of departure	35°

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