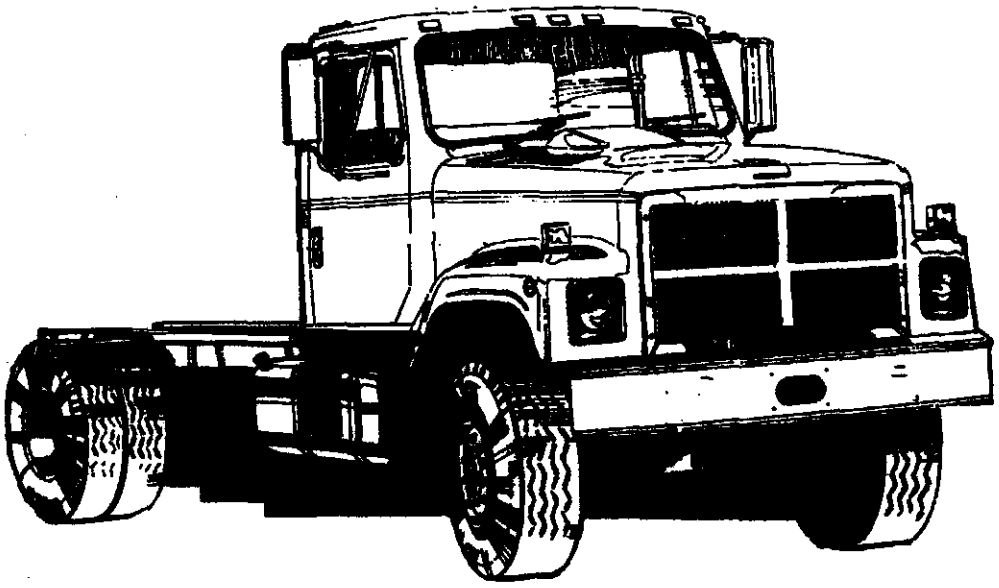
Project Number 48
June 1990

Vehicles for Fire Management



Roscommon Equipment Center

Northeast Forest Fire Supervisors
In Cooperation with
Michigan's Forest Fire Experiment Station

DNR

Acknowledgements

Participation in the National Wildfire Coordinating Group (NWCG) Fire Equipment Working Team (FEWT) Engine Study Subcommittee contributed greatly to this report. Members of that subcommittee during its Phase I - Cab & Chassis portion included:

J.P. Greene (Florida)
Charles Norberg (General Services Administration)
Jim Stumpf (USFS)
Ted Rex (BLM)
Tom Uphill (USFS)
Frank Winer (USFS)
Brian Hutchins (Michigan)
Larry Segretto (Formerly BLM)
Bill Legan (Ventura Co. FD)

Inquires, comments and suggestions regarding this project may be directed to:

Fire Protection
U.S. Forest Service, NA
5 Radnor Corporate Center, Suite 200
100 Matsonford Road
Radnor, PA 19087

Roscommon Equipment Center
c/o Forest Fire Experiment Station
P.O. Box 68
Roscommon, MI 48653

Disclaimer

Table of Contents

Introduction

Originally this project was to evaluate the differences between the imported "mini pickup trucks" of the early 1980's versus that of the mid size and full size pickup trucks. The manufacturers touted half ton payloads for the mini pickup trucks, making them comparable to the more standard truck. Many fire managers had concerns that the smaller versions would not hold up under the rigors of fire control. Evaluation of these vehicles for fire control use was needed to develop purchase specifications. The original mini pickup trucks have since faded from existence, but there was still a desire from fire managers to gain some knowledge on specifying a vehicle that meets their needs. About this time the National Wildfire Coordinating Group's (NWCG) Fire Equipment Working Team (FEWT) received an assignment to assess the feasibility of standardizing wildfire engines. FEWT assigned a subcommittee that recognized that fire agencies, nationwide, were finding problems with the truck cab and chassis available on the market. REC became heavily involved in NWCG's engine study and this project was broadened to include the full range of truck cabs & chassis that are used for wildfire control.

One of the goals of this project was to present specifications that could be used by agencies for their purchasing. A second goal was to help introduce purchasers to the art of writing specifications. This is an art that is developed by time, with a few mistakes along the way. We hope that this paper will present some hints that will make learning this art less painful.

Definitions

Just like forest fire control, truck manufacturers have their own terminology that they use to conduct business. REC Newsnote #3 "A Guide to Designing Forest Fire Tankers" discusses many of these terms in detail. Some important definitions needed for this report follow:

Payload and Weight Ratings:

One of the most important characteristics is how much load a truck will carry. More often than not, this is the specification's primary information. Pickup trucks that are equipped with a cargo box behind the cab are given a "payload" rating by the manufacturer. This tells the buyer the maximum amount of weight that can be loaded into the cargo area. Most other trucks are sold as cabs and chassis. That is, the frame is bare without a body behind the cab. For these vehicles, the manufacturer quotes the load rating by use of the gross vehicle weight rating (GVWR). The GVWR is determined by the manufacturer and is based upon the duty that is expected to be imposed upon the truck and its various components. The GVWR is the maximum operating weight, including all occupants, payload and the weight of the cab, chassis and components. For a commercial vehicle, these ratings are usually for highway use. The load ratings should not be exceeded.

For a truck that will pull a trailer, the gross combination weight rating (GCWR) is important. Truck tractors are good examples. The GCWR is the maximum load that can be pulled by and/or loaded on the truck. This would include the weight of the truck and the trailer, occupants and all cargo.

The Motor Vehicle Manufacturer's Association has divided trucks into eight groups,

based on the GVWR and GCWR. Figure 1 graphically defines these weight groups in terms of GVWR.

Dimensional Definitions:

Certain dimensions have standard definitions used by the manufacturer. Figure 2 helps define the axle, cab and frame relationships. For fire control three of these relationships are usually important. The wheelbase (WB), or wheelbase range, is common in the truck specification; the shorter the wheelbase the more maneuverable the vehicle. The cab to axle (CA) distance is necessary to specify if a pre-made or pre-designed body is used. This will help guarantee that the body will fit properly on the frame and around the wheel area. The cab to end of frame (CE) dimension is also important. It insures that a tank body will fit on the frame properly.

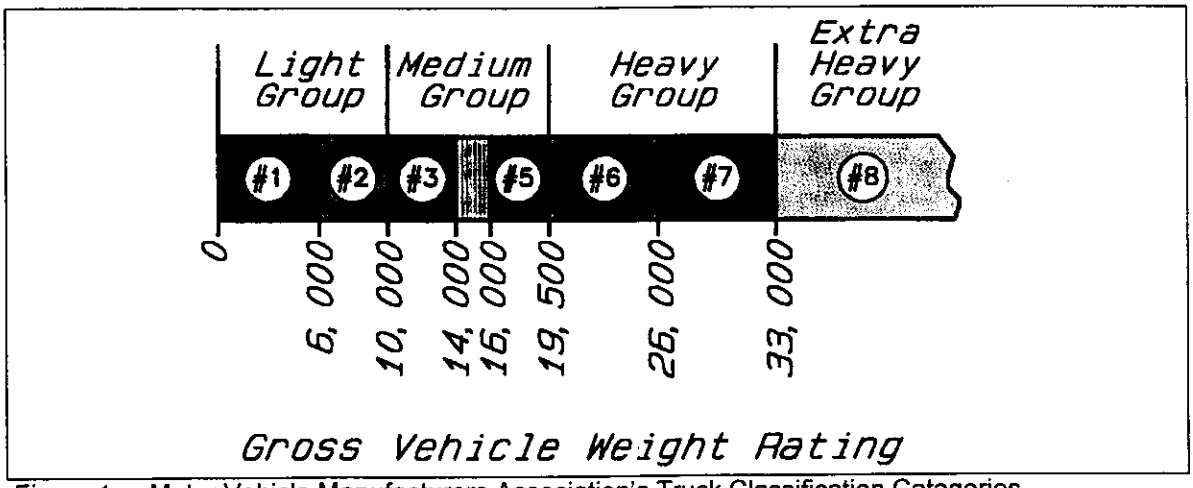


Figure 1. Motor Vehicle Manufacturers Association's Truck Classification Catagories

Design vs Performance Specifications

Specifications are the criteria built to guide the procurement of an item, in this case a vehicle. There are two types of specifications: design and performance. Sometimes a combination of these types may be used in a single specification. A performance specification defines the task that must be accomplished by the product. This is useful when the customer needs a specialized product that may not exist but for which he can define what it must do. A performance specification might say that a vehicle must climb a 10% grade at a minimum speed of 30 MPH at full GVWR. This does not define specifically how the manufacturer must make the vehicle, but what the customer expects it to do.

A design specification defines how a product must be made. For example, if the customer specifies the engine size, gear ratios and other powertrain components, then he has told the manufacturer how to build the product. It is the burden of the buyer to chose the components correctly so that the product meets his needs.

When a performance specification is used, the manufacturer or vendor accepts more of the burden if the product does not meet the customer's expectations as defined by the specification. When the customer "designs" the product, he accepts the burden. Many variables can affect the choice of specifications, including an agency's knowledge.

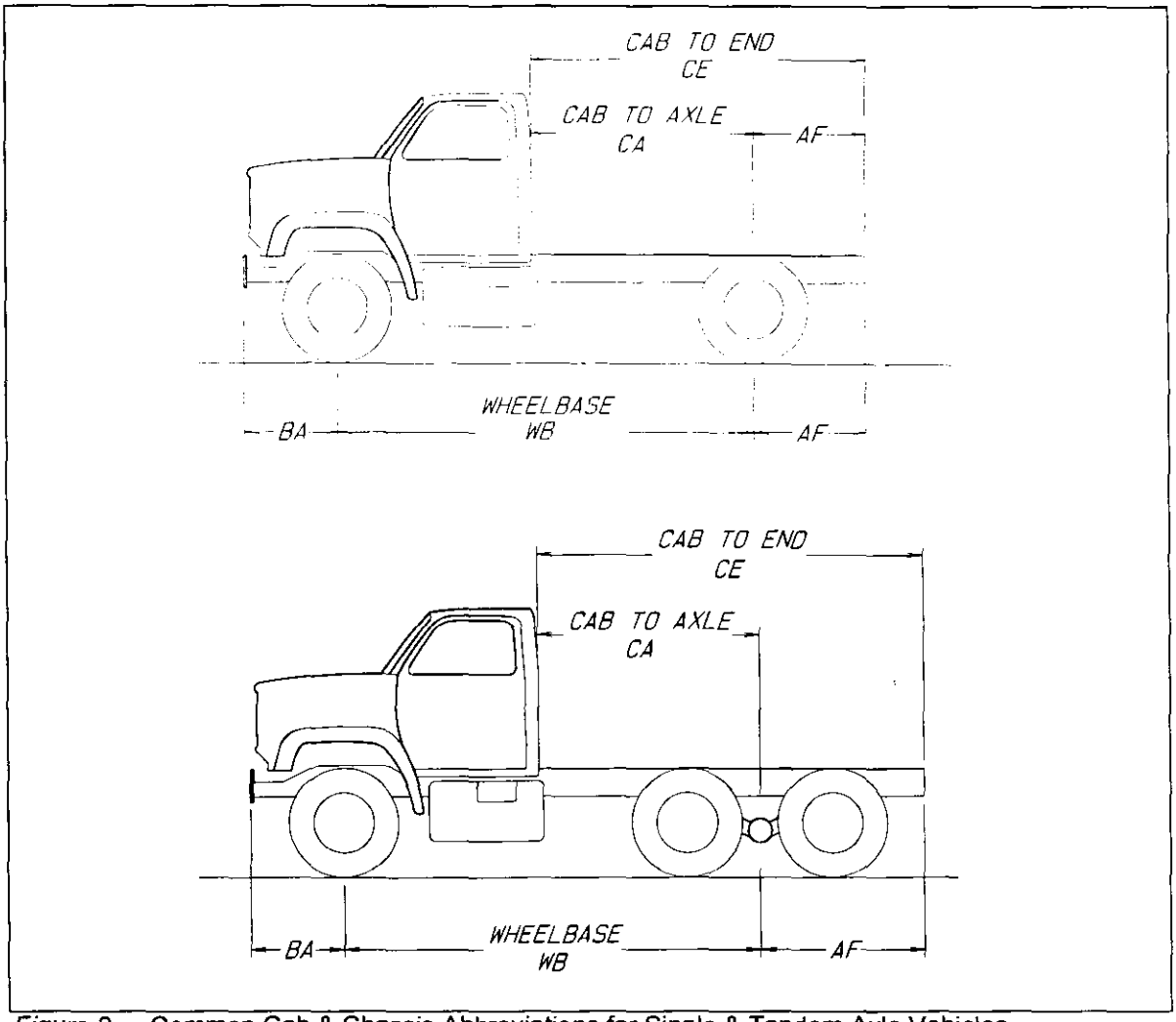


Figure 2. Common Cab & Chassis Abbreviations for Single & Tandem Axle Vehicles.

Assessment of Wildfire User's Needs

In 1987, NWCG's National Engine Study made a national survey of state, federal and some local wildfire agencies, to determine desired qualities for wildfire vehicles. This needs analysis was based on a cross section made of vehicle users, fleet managers, fire managers, mechanics and engineers. Important characteristics were tabulated and a profile of user's needs was developed. Twenty one features and nine options were identified as being important to the specification. Appendix A contains a report on these needs that was distributed to the state and federal agencies and interested truck manufacturers. The "Problem Highlights" and the "Profile of User Needs" sections of the report can be used as a checklist when writing truck specifications. Secondly, they help verify the needs of the fire service.

The Engine Study Subcommittee presented this list of problems and needs to twelve truck manufacturers in a half day session in 1988. Information exchanged as a result of this meeting resulted in the following general conclusions:

- *Agencies use a high number of light duty (pickup) trucks but fire control is such a small segment of this market, there is little chance that manufacturers will change these vehicles to better suit our needs.*

- *Medium duty group vehicles are frequently used by wildfire control. The survey found many problems with this weight range of trucks, including lack of all wheel drive options from the primary manufacturer, and poor ground clearance. The National Engine Subcommittee decided to write specifications for these size classes only.*

- *Agencies purchased few extra heavy duty vehicles. In general agencies were able to purchase vehicles that met their need in this size category.*

The next three sections elaborate in more detail the needs of the above groups.

Truck Specifications By Class

The most important need of an engine user is to have a vehicle that carries the required water capacity for the job. Once this is identified the size of the truck needed becomes much clearer. Figure 3 shows the generalized range of water capacity for various GVWR. Please note that there are many variables that can affect the water capacity of a truck. These include the duty such as on or off highway use and the frequency of use. It also includes the weight of other needed items such as the tank, fire accessories, occupants and stored items. Use the graph in Figure 3 for initial estimates only.

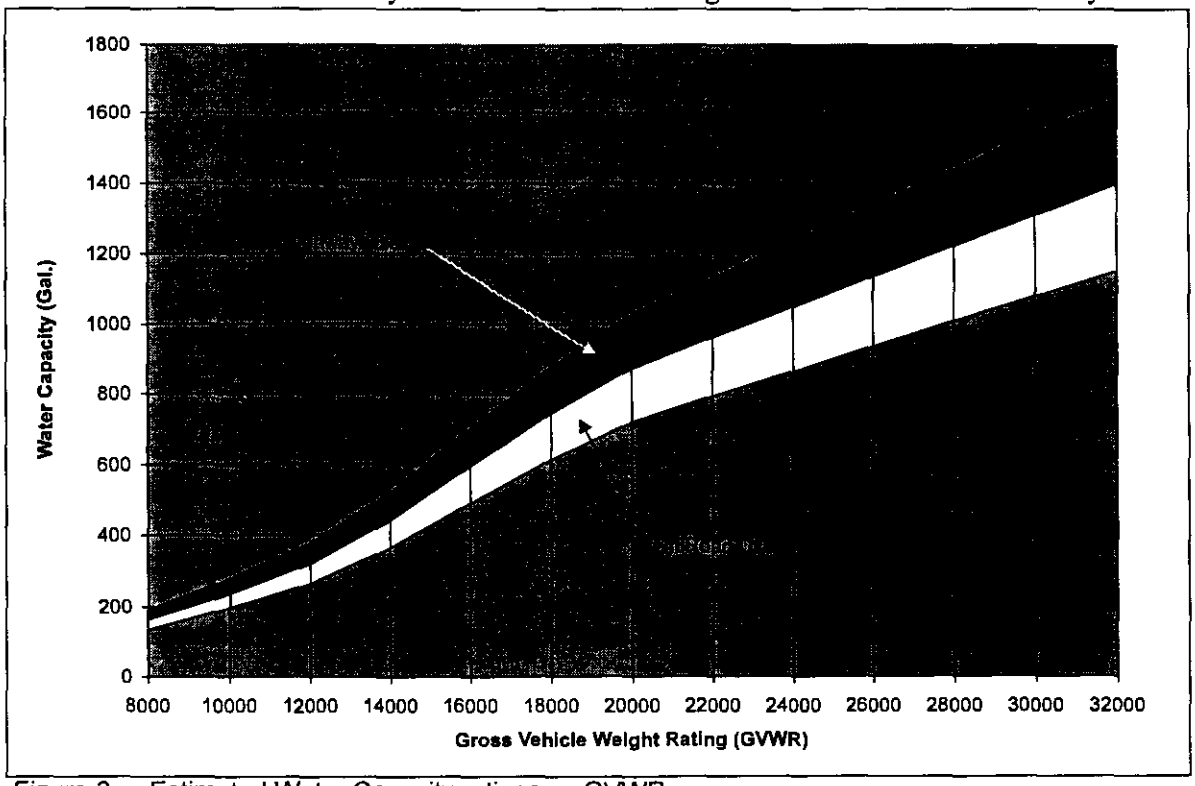


Figure 3. Estimated Water Capacity ratings vs GVWR

Light Duty (Group 1 and 2):

The trucks that make up group 2, and much of what is available in group 3, are the so called pickup trucks. Marketing of these vehicles has moved away from the truck user towards the domestic car market. Recent designs have increased the operator comfort, some of which has come at the expense of ruggedness and durability. Fuel economy concerns have resulted in light duty components. The majority of users operate with little or no payload a majority of the time and manufacturers seem to have taken this into account when determining the duty cycle and load ratings of these vehicles. Ground clearance is quite low; in short, these vehicles "aren't what they used to be" and most truck body manufacturers will support this notion.

Do light vehicles still have a place in wildfire control? Agencies that have tasks other than just fire control, certainly have a use for these vehicles. But the NWCG Engine Study Subcommittee determined that none of the currently available vehicles in these classes met the profile developed by the users. The manufacturers had little interest in providing options that would help meet the needs of the wildfire user. After-market modifications of the suspensions and other components in these size classes were inconsistent and generally risky business. They decided not to attempt further resolution of the problems of these size classes.

Options are becoming fewer as pickup manufacturers utilize the packaging approach more and more. If the vehicle is being used to carry a loaded water tank a majority of the time, choose a vehicle with the highest GVWR or payload rating. This will be about 9200 pounds GVWR for the single rear tire versions. Rear dual tires are an option that can increase the payload rating. All wheel drive is readily available. If the vehicle is to be used off the road, consider reducing the available payload by twenty percent.

Medium and Heavy Duty (Groups 3,4,5,6 and 7):

The NWCG Engine Subcommittee determined that these truck groups presented the most potential for beneficial use for wildfire control. The subcommittee identified eight major problems that the current high production, medium duty class trucks pose to wildfire users. During 1989, the subcommittee developed performance based specifications for trucks in these classes. The first generation of these specifications are reproduced in Appendix B.

The Engine Study group is striving for a consolidated procurement among federal, state and local agencies, to provide a suitable market for manufacturers to build a vehicle that meets these specifications - as of this writing no vehicle currently does. The specification is built on the user needs as determined by the NWCG User Survey. The specifications can be used in either of two ways: 1) An agency can attempt to use all or part of these specifications to negotiate their own purchase; 2) The National Engine Study Group has developed a way for state and local agencies to purchase vehicles with these specifications through the federal General Services Administration (GSA), along with federal wildfire agencies. The "group" buying is aimed at reducing per unit cost and to entice manufacturers to design vehicles that meet fire control needs. Remember that specifications are dynamic. They will be redefined as problems are found or conditions change. Check with the General Services Administration Automotive Engineering Center in Washington D.C. for current specifications. These are listed as Federal Performance Standard 2201A, Wildland Equipment and Trucks.

Extra Heavy Duty (Group 8):
Few wildland fire agencies use vehicles in this class for engines. Most of the extra heavy duty trucks used by states are 6x6 military units acquired through Federal Excess Personal Property. For this reason, we have chosen not to spend time on these vehicles.

Conclusions

Engines are the biggest investments that wildfire agencies make. In most cases there are actually two big investments made in the process: purchase of a cab & chassis and the cost of the fire apparatus. Identify the tasks and the apparatus that is needed to accomplish that task. Then identify the size of vehicle that fits right for the job. If you are fortunate, a cab & chassis exists to meet your needs. Appendices A & B can be used as checklists to help identify special characteristics needed for your vehicle. The final specifications will be important because they largely determine the value of your new investment in a wildfire control engine.

Lastly, state, local and federal government agencies should consider the GSA Wildland Equipment and Trucks Specification (2201A) especially if they intend to operate off the highway.

Appendix A — Wildfire Truck Cab & Chassis Needs

A Report of the National Engine Study

June 15, 1988
National Wildfire Coordinating Group
Fire Equipment Working Team

WILDFIRE TRUCK CAB AND CHASSIS NEEDS

The majority of fire responses made in the U.S. are to wildland fires, not structural fires. Wildland fire suppression tactics are quite different from structural fire tactics and, requires different equipment. Vehicles used in wildland fire suppression must operate reliably under a wide variety of extreme conditions.

The wildland fire community, consisting of federal, state and local agencies, is currently encountering severe difficulties in obtaining vehicles that perform satisfactorily in this adverse environment. This wildland fire fleet is conservatively estimated to number 25,000 trucks. Problems encountered include: unavailability of all-wheel drive in certain size classes, inadequate suspension systems, and overloaded electrical systems. These problems were identified as early as 1973 by the GSA-sponsored National Fire Equipment Conference and were reaffirmed by that group in 1985.

Under the auspices of the National Wildfire Coordinating Group — an interagency advisory body — a wildland fire engine study committee was formed to seek remedies to these performance problems. Composed of federal and state representatives, this committee first convened at the Boise Interagency Fire Center in the summer of 1986. At that meeting, a decision was made to develop a federal specification/standard for wildland fire engine cab and chassis units that could be used by all agencies, including state and local organizations. This specification would be tailored to the special needs of the wildland fire community and would, in essence, consolidate the agencies' purchasing.

Prior to the development of the specification, both quantitative and qualitative data were required to judge both the market size and the specific truck needs of the agencies. To this end, two surveys were executed: one aimed at fleet managers to ascertain the number of vehicles in use, and the other at a cross-section of users and managers to determine performance needs. The results of these surveys are presented later in this paper.

Our purpose is to present the needs of the wildland fire community to you, the automotive manufacturers, and to develop a mutually advantageous relationship.

OPERATIONAL ENVIRONMENT

Throughout the year a wildland fire problem exists somewhere in the United States. Annually 2,500,000 acres and 250 associated structures are burned. Wildland fire is a year long business with varying seasons, climactic conditions and weather differences. In the South, Southwest, and Northeast, fires burn in the spring. In the summer months the West and Alaska burns. Fall fires are common in the Northeast, Southeast and California. Fires in California and the Southeast are common in the normal winter months.

The ingredients of fire spread include air temperature, relative humidity, wind, and vegetation. All of these elements are interrelated. Ambient temperatures ranging from 90 to 110 degrees are not uncommon conditions for wildfire.

The environment in which wildfires are fought is dry and dusty. The oxygen in the air is diminished by high levels of smoke, dust and other particulate matter. This environment is hard on firefighters and equipment — both require a good airflow to operate at maximum efficiency.

Across the country, wildland fires burn in different topography. In the East and Alaska, the lay of the land is often flat with some limited access. In some of these areas too much water exists in the wrong locations and thick undergrowth and downed timber further hampers access.

The mountainous regions of the West provide a different set of topographical obstacles. Steep, rocky terrain with heavy continuous timber stands limit access to fires. Soil types vary from adobe to volcanic, silt, and sand, creating an array of dust and access problems. Fire suppression activity takes place on paved highways, paved mountain roads, dirt logging roads, jeep trails, fire breaks and in areas with no roads at all. Fire equipment must have the versatility to react to all road bed changes.

Equipment used for fire suppression must respond to many short runs at maximum performance. Travel of long distances (over 200 miles) is not uncommon in the mobilization of resources to meet regional needs. Mountainous environments require long down-grade and upgrade equipment runs. These circumstances put braking and cooling systems to their maximum test.

Logging and fire access roads are narrow with few turnouts, requiring the equipment to make close radius and side hill turns or to back long distances. Tree limbs and rock overhangs adjacent to access ways create very limited vertical clearances.

Poor roads and off-road use create concerns about high centers of gravity with present fire equipment. Overall maneuverability is often hampered by trees, rocks and other obstacles. Close, quick turns are needed for access to and egress from fire assignments.

Vehicles of all sizes function under similar conditions. More than ninety percent of the time fire equipment is operated at the maximum GVWR. At least one half of the use is at highway speed. The remainder of the time is spent operating on unpaved secondary roads or totally off-road.

While used in suppression activity, vehicles have an extreme duty cycle at idle speeds. They function as standby or primary power plants for pumps and associated accessories resulting in a low mileage life cycle.

Fire vehicles are used intermittently because of the emergency nature of the operation. Even with periodic use the vehicles are kept fire ready, fully loaded. This increases the potential for suspension, tire, and electric component problems. Electrical loads are extremely high, especially at idle. The electrical system operates two-way radios, warning lights, vehicle lights, alley lights, electric hose reels, external speakers and other accessories.

As a result of the extreme environmental conditions encountered in wildland fire suppression, equipment failures are common, and some recurrent problems can be identified.

PROBLEM HIGHLIGHTS

I Smaller Vehicles (10,000 - 16,000 GVWR)

- The lower profile and narrow width make these smaller vehicles desirable. Wildfire control needs this size class, but certain capabilities need to be increased.

1 All-wheel drive is unavailable from primary manufacturers in the upper range of this size class. Users are currently having to "make do" with generally unsatisfactory conversions. This is considered to be one of the major equipment issues confronting wildland fire users.

2 Suspension; GVWR should be increased in the pick-up configuration. These vehicles may carry in excess of 3500 lbs of water, pumps, equipment, personnel, etc. We presently add springs, shocks, overloads, etc. and frequently damage axles and frames.

II All Vehicles (10,000-32,000 GVWR)

- The following comments apply to all categories of vehicles:

1 Braking: Service: Increased capacities are needed due to operation near GVWR on steep grades for sustained periods. Off road use increases demands further.

Parking/Emergency: Must stop and hold on maximum grades after sustained downgrade operation.

2 Electrical: Have high load demands in accessory equipment. Need on-board electrical systems which exceed truck-related requirements.

- Uses: Light bars pull up to 100A, hose reels pull 50A, auxiliary pump starters pull 30A, all simultaneously. Other uses include winches, work lights, off-road lights.

3 Ground Clearance: Problems are encountered primarily in vehicles up to 26,000 GVWR, as most undercarriage damage occurs in light to medium trucks. All vehicles, however, may encounter logs, rocks, brush, etc., which damage and tear out fuel and brake components, exhaust assemblies, and drive trains. Up to 50% of our use is off road. Major vehicle component failure on the fireline can be life threatening.

4 Cooling: Adequate in many geographical areas. However, there are needs for increased capabilities in mountainous regions resulting from use on/off road, and steep grades requiring extended climbing at maximum load capabilities. There is also a need for increased cooling when a PTO is used, particularly when driving a pump.

- Recommend that an optional package be made available for this purpose.

5 Fuel: We need extended range, as vehicles come from different areas to the fire scene. Upon arrival, they must be available for immediate extended duty. Additional fuel on board is required for fire operations, i.e., PTO pumping, fire line construction, and return to fuel supply points.

6 Exhaust: The placement of the entire system should consider our use of PTO's, overheating, and ground clearance issues. Wildland vegetation is often ignited by exhaust systems.

PROFILE OF USER NEEDS

As stated earlier, a survey of users was conducted to identify specific wants and needs of trucks in wildland fire use. Over 1100 responses were tabulated in six size classes by GVWR as follows: 1) less than 10,000 lbs; 2) 10,001 — 16,000 lbs; 3) 16,001 — 20,000 lbs;
4) 20,001 — 26,000 lbs; 5) 26,001 — 32,000 lbs; and 6) above 32,000.

The survey of user needs and desires indicates the following features are needed for wildland fire vehicles:.

Survey Results by Size Class

DESCRIPTION	1	2	3	4	5	6
*Four Wheel Drive- A majority of users indicate the need for four wheel or all wheel drive.	90%	80%	65%	60%	50%	0%
*Limited Slip- Users need the maximum amount of traction in all categories.	desired in all types					
*Ground Clearance- A major consideration. Users want underbody clearance, including mufflers, fuel tanks, etc., to be no less than:	15"	15"	15"	24"	24"	24"
*Axle Clearance- Axle clearance for rough terrain use should be no less than:	12"	14"	15"	15"	15"	15"
*Underbody Protection- Protection of vital systems such as fuel, brake, exhaust, etc. from contact with rocks, ruts and brush is a major need.	Yes					
*Wheelbase- Short wheelbase vehicles are needed for maximum maneuverability.	120"	145"	145"	145"	145"	145"
*Cab to Axle- Again, short vehicles are needed.	60-83"		83-107"		107-126"	
*Standard Cab- Users indicate preference for standard cabs rather than tilt cabs.	standard cab					

DESCRIPTION	1	2	3	4	5	6
*Vehicle Height- Low profile and low vertical center of gravity is a major concern for rough terrain operation.			low profile			
*Predominate Grade- Users indicate that normal operations will frequently encounter sustained grades of:	7%	7%	7%	7%	7%	7%
*Maximum Grade- Short pitches, and on occasion, sustained grades will be encountered in excess of:	15%	15%	15%	15%	15%	15%
*Highway Use- Although rough terrain is a primary consideration, the vehicles will be driven at highway speeds more than half the time.			50% +			
*Electrical- These vehicles carry heavy electrical loads from radios, emergency lights, hose reel motors, etc. Loads require alternator capacities in excess of:			100 + Amps			
*Batteries- Dual battery systems are Dual System needed for added storage capacity to handle idling operations.			Dual System			
*Fuel Type- Users voice a preference for the indicated fuel types:	Gas	Gas/Dsl		Diesel		
*Range- Wildland fire use requires the indicated mileage range and Hours pumping time capabilities:			350 miles minimum Hours			
	5	5	8	12	12	8
*Service Brakes- Brake systems must be capable of handling maximum load at all times, sustained steep grades, off road operations, etc.			Maximum capability			
*Park/Emergency Brakes- Brakes are required for holding on steep grades as well as providing true emergency stopping capability.			Maximum capability			
*Retarders- Users of the larger vehicles have a need for retarding capability for use in mountainous terrain.	No	No	Yes	Yes	Yes	Yes

DESCRIPTION	1	2	3	4	5	6
*Transmissions- Users want a number of gear choices. The majority desire the control features of manual transmissions.	Manual		Manual with 2 speed axle			
*Suspension- Springs and shock absorbers are a major concern. Shock loads and torsional loads from rough terrain are encountered in the majority of operations. Users need heavy springs and single or dual shocks.	Very heavy duty					
OPTIONS — A substantial number of users indicated needs for the following features. The number is large enough to consider these as optional items.						
*Extra Cooling- High ambient temperatures, standing and pumping or standing by at idle, high altitudes, require extra cooling capacity.	Desired in all types					
*Automatic Transmissions- A substantial number of users prefer automatics, if available with appropriate capabilities. Transmission coolers are a necessity.	20 to 30% desired					
*Air-Conditioning- Many would like this capability to filter dust and smoke, and provide relief from heat.	50 to 60% desired					
*Winches- Many need this feature for vehicle rescue, moving rocks and logs, etc.	35 to 50% desired					
*Power takeoff- This capability is needed to power fire pumps, winches, hydraulic pumps, etc. Some users require high power capability.	40%	60%	65%	70%	80%	80%
*Rollover Protection- This feature is desired by many for rough terrain operations.	40%	50%	50%	50%	50%	30%
*Brush Guards- need to guard vehicle cabs and bodies from brush in rough terrain.	60%	50%	50%	40%	35%	30%
*Crew Cab- A number of users need to carry a full firefighting crew on the vehicle.	7%	20%	30%	35%	40%	10'%
*Gauges- Users indicate a preference for gauges over failure lights or other less precise indicators. Tachometers are wanted.	Desired in all types					

EXPECTED MARKET

The known wildfire cab and chassis market consists of the U.S.D.A. Forest Service, U.S. Department of Interior (Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, Bureau of Indian Affairs), and the 50 state forestry agencies. Fleet managers of these agencies were surveyed in September of 1987 to determine the size of the wildfire engine fleet. Table 1 summarizes the results.

TABLE 1. CURRENT FLEET - STATE AND FEDERAL WILDFIRE AGENCIES.

GVWR RANGE	4x2	4x4	TOTAL
< 10,000	672	2145	2817
10,001 – 16,000	486	1115	1601
16,001 – 20,000	447	142	589
20,001 – 26,000	1027	430	1457
26,001 – 32,000	813	262	1075
Over 32,000	257	14	271
TOTAL	3702	4108	
TOTAL INVENTORIED FLEET SIZE			7810

These numbers are very conservative. The survey did not include the largest segment of the wildfire fleet — the 20,000 rural and municipal fire departments. Available information about this group is lacking. We know that they generally have at least one specialized vehicle committed to wildfire use. We estimate that the total U.S. wildfire fleet to be 25,000 to 30,000 in number.

The survey also asked the agency fleet managers to assess their future fleet replacement needs. Table 2 summarizes anticipated purchases for the above groups for the next 5 years. The average vehicle is replaced every 9 to 11 years.

TABLE 2. FIVE YEAR REPLACEMENT SCHEDULE - STATE AND FEDERAL WILDFIRE AGENCIES.

GVW RANGE	4x2	4x4	TOTAL
< 10,000	448	1465	1913
10,001 – 16,000	261	712	973
16,001 – 20,000	293	76	369
20,001 – 26,000	259	84	343
26,001 – 32,000	288	132	420
Over 32,000	86	23	109
TOTAL	1635	2492	
TOTAL NO. UNITS-NEXT 5 YEARS			4127

Casual interpretation of the fleet replacement numbers in the above table might conclude that there is low demand for all-wheel drive vehicles in the 16,000 to 26,000 lbs GVWR range. A more correct interpretation would be that the anticipated purchase is low because of the lack of availability from primary manufacturers. We believe there is a market for vehicles that meet our special needs.

A coordinated purchasing system has been developed so that federal, state, and local fire agencies can purchase through the General Services Administration. It is our intent to develop a limited number of specifications for vehicles that can be obtained through this system. Marketing and purchasing of this equipment through GSA should be relatively simple.

Additional requirements for vehicles with the characteristics needed for wildfire should be expected within the following groups:

- U.S. Military - administrative functions and wildfire control
- Airports - off-runway fire support
- Utility companies
- Oil and mineral exploration firms
- Natural Resource Agencies for Forestry, Wildlife, Fisheries and Law Enforcement

CONCLUSION

Wildland fire fighting requires specialized trucks which are capable of carrying full capacity loads off the road or at highway speed. The total fleet including municipal and rural fire agencies exceeds 25,000 vehicles with an average replacement schedule of 10 years. The wildland fire community is large with many trucks in use and, when considering the collateral uses in other endeavors, it bears marketing consideration.

We believe you will realize that the extent of this effort and the level at which it took place shows the seriousness of our need. Further information can be obtained by contacting study members. Comments concerning potential vehicle specifications should be forwarded to:

Charles Norberg
G.S.A. — FCAE
Suite 4
Crystal City Mall
Crystal City, VA 22033
(703) 603-1217

Appendix B — Federal Performance Standard 2201A

Federal Performance Standard 2201A
February 1, 1990

Wildland Equipment & Trucks (Wet Program)

Cabs, Chassis Wildland Fire Use, 4x2, 4x4, Diesel Engine, 10,000 GVWR to 26,000 GVWR.

1. Scope, Purpose And Class

1.1 Scope. This document covers new, commercially produced diesel engine drive, four wheel, two wheel drive, 4x2 and four wheel, two front and two rear wheel drive, 4x4 cabs and chassis of the type shown in Table I.

1.2 Application. This standard is to be used for the competitive procurement of new cabs and chassis intended for use in Wildland (off-road) Fire Suppression. Procurement shall be in accordance with the Federal Property Management Regulations (FPMR) and the Federal Acquisition Regulations (FAR) (see notes 6.1.)

1.3 Purpose. The purpose of this document is to achieve a practical degree of standardization within the Federal fleet for Wildland Fire Control vehicles. This standard provides performance minimums for the various sizes of cabs and chassis, general requirements and equipment.

1.4 Coverage. The vehicles covered by this standard are listed in Table I.

1.5 Intended Standardization Coverage. This document does not include all varieties of the Commodity, but is intended to cover those primarily to be used by the Federal Government.

1.6 Classification. Vehicles are divided into "classes" in accordance with the parameters of Table I.

1.7 Ordering Data. Agencies are advised to review the requirements specified in Para. 6.2 for inclusion in their requisitions. Purchasers should select the required vehicles(s) from Table I. For the most expeditious requisitioning of these vehicles, use GSA Form 1781, Motor Requisition. Inspection/acceptance shall be as specified in Section 4.

Delivery preparation shall be as specified in Section 5. Shipment shall be as specified in the contract.

2. Referenced Documents

2.1 Issues of Documents. The following documents of the issue in effect on data of invitation for bids or requests for proposal, form 2 part of this standard to the extent specified herein.

Federal Standard No. 595A - Colors (1984 Printing)

Activities outside the Federal Government may obtain copies of Federal Standards, Specifications, and handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20602.

3. Requirements

3.1 Design. The vehicle specified shall be complete with all necessary operating accessories customarily furnished together with such modifications and attachments as may be necessary to enable the vehicle to function reliably and efficiently in sustained operation. The design of the vehicle and optional equipment shall permit ready accessibility for servicing, replacement, and adjustment of component parts and accessories with minimum disturbance of other components and systems. The vehicle shall be constructed with due consideration to the nature and distribution of the load to be sustained, and to the service to which the apparatus is to be subjected when placed in service. All design, operational and material features must fully comply with applicable Standards as stated in 40 CFR 205, and 49 CFR 571, including additional pertinent acts, amendments, and standards in effect on the data of manufacture whether or not specifically referenced herein.

3.1.1 Modifications. Agency will mount up to a 1,000 gallon water tank, custom heavy duty service body and various firefighting apparatus for use as an off road emergency fire engine. Travel will be over improved roads, unim-

proved roads and, frequently where there are no roads. Fifty percent of travel will be where there are no roads in an adverse environment of heavy smoke, excessive dust and ambient temperatures of 120 degrees Fahrenheit. Reliability, safety and serviceability are critical. The cab and chassis provided shall be able to be completed as emergency fire engines which meet all applicable Federal Motor Carrier Safety Regulations and Federal Motor Vehicle Safety Standards in effect on the date of manufacture. Because serviceability and down time are vital to the emergency nature of the intended use of these vehicles, O.E.M. parts cataloging is preferred.

3.2 Materials. The materials shall be new with quality conforming to the best current engineering and manufacturing practices. Materials shall be free of defects, suitable for the intended service. Virgin materials are not required and recovered materials are not excluded in manufacturing.

3.3 Vehicle equipment and accessories. The vehicle components, assemblies, and accessories to be delivered under the contract shall be new and shall meet or exceed the requirements of this specification. Unless a waiver is obtained, they shall comply with all Environmental Protection Agency Regulations applicable to the specified vehicle on the data of manufacture. All chassis items shall be as represented in the manufacturer's current technical data. Technical data shall be limited to specifications and technical material, identical to that furnished to the authorized company representatives for selection of vehicle models and components, or on file by the company as being engineered for the particular application, prior to aware of contract for a vehicle. The component parts of the vehicle need not be the products of the same manufacturer.

3.31 Special equipment. In addition to the standard vehicle and components required herein, each vehicle shall be furnished, when required by solicitation, with special equipment as specified.

3.4 Vehicle lubrication. The vehicle shall be fully equipped with accessible lubrication fittings in accordance with the manufacturer's standard practice.

3.5 Vehicle weight, rating and dimension.

3.5.1 Curb weight. Curb weight shall include weight of chassis and cab with all chassis attachments, accessories, equipment, including a full complement of fuel, lubricant and coolant.

3.5.1.1 Gross vehicle weight rating. Gross vehicle weight rating, (GVWR) shall not be less than specified (see Table No. I).

3.5.1.2 Payload. Shall be as specified in Table I. Payload for vehicle designed primarily for off-road use should be calculated by subtracting the curb weight from the GVWR. Payload for vehicles designed primarily for on road use should be calculated by multiplying the GVWR by 0.85, then subtracting the curb weight to yield rated payload.

3.5.2 Ratings. Vehicular ratings shall be the manufacturer's current published ratings. Component and vehicular ratings shall not be raised to meet requirements of this specification. If published ratings are not available, verification of ratings must be sent to the engineering office of the procuring activity.

3.5.3 Dimensions. Cab to axle (CA) dimension shall be as specified in the ordering documents and will be as per the options specified in Table I.

3.5.3.1 Overall Width. The overall width of the vehicle, exclusive of mirrors, lights, reflectors and tires shall be not more than 96 inches. The width over the tires shall be not more than 100 inches.

3.6 Frame. The frame shall be capable of withstanding the strain of rigorous off road service and shall be provided with adequate crossmembers so designed and constructed to support the gross weight of the vehicle with its load. The frame, as supplied by the manufacturer, shall not be altered, either to be increased or decreased in length, other than to remove excess length of frame rails behind the rear spring hangers, which will not affect the original wheelbase. The frame design and material shall be capable of withstanding the maximum stress imposed under extreme and sustained conditions of torsional stress vibrations and shock loadings.

3.7 Power unit, diesel.

3.7.1 Diesel engine. The engine shall be a liquid cooled diesel type. Engines furnished shall be rated in accordance with SAE J1349.

TABLE 1

VEHICLE CLASS	A	B	C	D
GVWR	10,000	14,450	20,000	26,000
Drive	4x4	4x2 or 4x4 (as specified)	4x2 or 4x4 (as specified)	4x2 or 4x4 (as specified)
Payload	4,200 See 3.5.1.2	7,800 See 3.5.1.2	10,000 See 3.5.1.2	12,000 See 3.5.1.2
Ground Clearance	14"	14"	15"	18"
Axle Clearance	8"	8"	10"	10"
Cab/axle	NTE 60"	60,72,84 (See 3.5.3)	60,72,84,102,120 (See 3.5.3)	84,102,120,144 (See 3.5.3)
Vehicle Height	NTE 80"	NTE 80"	NTE 95"	NTE 95"
Fuel	Diesel	Diesel	Diesel	Diesel
Transmission	To be determined (See 3.14.3)	To be determined (See 3.14.3)	To be determined (See 3.14.3)	To be determined (See 3.14.3)
Road speed (min (under load)	60	60	60	60
Low speed (max)	2.5	2.5	2.5	2.5
Brake	Hydraulic	Hydraulic	Air	Air
Brake, park	At wheels or axles	At wheels	At wheels	At wheels
Fuel tank capacity	25	60	80	100

3.7.1.1. **Engine starting.** The engine shall start satisfactorily without devices that are not self-contained on the vehicle at temperatures down to 0 degrees F. A 12 or 24 volt starting system with 12 volt direct current (dc) lighting system shall be furnished.

3.8 Oil Filter. The oil filter shall be of the full-flow type that is recommended or approved by the engine manufacturer, so constructed and mounted that no special equipment or skill will be required in changing the filtering element.

3.9 Air cleaner. A dry type air cleaner with dash mounted service indicator shall be furnished.

3.10 Emission controls. Unless waived, vehicles and engines shall comply with the regulations of the Environmental Protection Agency governing Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines in effect on the date of manufacture.

3.11 Fuel system. The fuel system furnished shall conform with Federal Motor Carrier Safety Regulations 393.65-393.67 and include fuel tanks equipped with an electrical fuel level sensing device with gauge visible to the seated operator. Fuel tank(s) shall have not less than the capacity per Table I. Truck filler opening shall be so located to provide ready access to filler opening when using standard type fuel delivery nozzle, without obstruction by any portion of mounted body or equipment. When dual fuel tanks are furnished, a fuel tank selector valve identified to indicate which tank is furnishing fuel, shall be installed. A selective switch to operate fuel gauge readings shall be installed on the instrument panel adjacent to the fuel gauge. The switch positions shall be identified to indicate which tank reading is being taken. Fuel tank equalizing lines are not permitted. A fuel pump with all necessary regulating and controlling attachments, accessible and readily removable fuel filter(s) and a water/fuel separator/filter with drain valve, shall be furnished.

3.12 Cooling system. The cooling system shall be liquid pressurized force circulation type. It shall consist of the necessary components of sufficient design and capacity to maintain the engine at the engine manufacturer's specified optimum safe temperature under all operating conditions specified herein, without any loss of coolant. Optimum engine temperature shall be maintained with the vehicle loaded to the GVWR and continually operating under load

while standing in ambient temperatures ranging from -20 degrees to 125 degrees F. The cooling system shall be suitable for operating with permanent type anti-freeze solutions and its temperature be thermostatically controlled.

3.12.1 Drain outlets. Easily accessible drain outlets shall be provided on all vehicles to allow complete cooling system drainage.

3.12.2 Silicone rubber hoses. Silicone rubber radiator and heater hoses shall be furnished.

3.12.3 Power plant heaters and fuel warmer. When specified (see 6.2), a coolant heater, an engine oil heater, and a fuel warmer shall be provided. Unless otherwise specified (see 6.2), a battery heater shall be provided when power plant heaters are specified. Heaters shall operate on 110 volt alternating current (ac) and shall b wired through a junction block to a single three pronged (male), weatherproof slave receptacle for receiving external power and grounding vehicle. A three wire connecting cable, 25 feet long and of adequate line capacity to supply power for all heater units simultaneously, shall be furnished. Connecting cable shall include a matching female connector at the vehicle end and a standard three pronged (two power plus one ground) male connector at the other end. Electrical apparatus shall conform to Federal Motor Carrier Safety Regulation 393.77(c)(7). Electrical insulation of connecting cable shall withstand normal operating stresses in low ambient air temperatures (down to minus 60 degrees F) without cracking or loss of dielectric capacity. All heater lead wires shall be installed without interfering with vehicle component operation and without loose excess wire. Provisions for stowage of the cable shall be provided in the vehicle cab. Heaters shall be furnished as follows:

(a) Coolant heaters, 1,500 watt minimum rating, shall be installed in the engine block or in the lower coolant inlet hose. Engine thermostat with an operating range of 170 degrees F to 195 degrees F shall be installed.

(b) Immersion type engine oil heater, 300 watt minimum rating, with 170 degrees F to 195 degrees F thermostat, shall be installed in the oil pan.

(c) Battery heater shall have a capacity adequate to maintain the battery electrolyte at a temperature of not less than 10 degrees F during vehicle exposure in ambient air temperature as low as minus 60 degrees F, and shall embody a thermostat to limit the temperature of the electrolyte to not more than 80 degrees F.

(d) A fuel warmer or preheater shall be provided to prevent clogging of fuel filters due to wax crystallization in the fuel. The fuel warmer shall use engine coolant to transfer sufficient heat to the diesel fuel to heat it from an inlet temperature of minus 40 degrees F to an outlet temperature of plus 9 degrees F. with a flow rate not less than the maximum fuel demand f the engine fuel system. A coolant shutoff valve shall be provided for the coolant inlet side of the fuel warmer unit.

3.13 Exhaust system. The exhaust system tubing shall be heavy duty aluminized steel or stainless steel, of such size as recommended by the engine manufacturer to avoid undue increase in back pressure, and shall be located in such a manner and shall include heat shields or deflectors as necessary to avoid undue heating of fuel system components, batteries, wiring, chassis components and tires. Exhaust system components forward of the rear axle must not be lower than any other body component.

3.14 Power train and performance.

3.14.1 Power unit, diesel. The power unit furnished for the specified vehicle shall be capable of withstanding the maximum stress imposed under extreme and sustained conditions of torsional stress, vibrations and shock loadings.

3.14.2 Clutch. The chassis manufacturer's heaviest duty clutch available for the engine and chassis model offered shall be furnished with torque capacity exceeding maximum gross engine torque.

3.14.3 Transmission. Manufacturer's selective manual or automatic type transmission shall be furnished.

3.14.3.1 Transmission, manual. Unless otherwise specified, a manual type transmission shall be furnished.

3.14.3.2 Transmission, automatic. When specified, (see 6.2) the vehicle shall be provided with automatic transmission. The transmission shall include a hydraulic torque converter and have an oil cooler outside of engine cooling system. (Ref. Par. 3.12)

3.14.4 PTO Opening. Transmission shall be provided with a standard (Class A) or H.D. (Class B&C) PTO opening in accordance with SAE J704. PTO opening shall have Type V clearance envelope in accordance with SAE J772.

3.14.5 Four wheel drive.

3.14.5.1 Drive hubs, front wheels. When a 4x4 is specified, a manual front wheel locking hub to disengage the front wheels from the power-train shall be provided on all front axles.

3.14.6 Drive line components. The drive line components shall be of sufficient capacity and design to transmit the maximum torque of the engine developed through the lowest intervening gear reduction.

3.14.7 Two-speed rear axles. When supplied, a multi-speed axle shall be equipped with electric or air shift, operable from the driver's position.

3.14.7.1 Differential, rear. When specified, (see 6.2) differentials shall have special traction, No-Spin or equal.

3.14.8 Drain plugs. Drain plugs installed in manual transmissions and rear axles shall be of the permanent magnetic type.

3.15 Performance

3.15.1 Speeds and gradeability. High and low speed requirements shall be met with trucks loaded to specified GVWR and be referenced at an altitude of 5,000 feet.

3.15.1.1. Gradeability. The vehicle shall ascend continuous grades specified in Table II. Gradeability shall be verified with calculations in accordance with SAE J688.

TABLE II

Miles per Hour	Percent of Grade
50	1.25
25	7.0
5	15.0

3.15.1.2 Low speed. Low speed for vehicles with manual transmissions shall be not more than 2.5 mph. Speed shall be calculated with the engine operating at not less than 35 percent of recommended governed R.P.M.

3.15.1.3. Maximum geared speed. The maximum geared speeds at engine governed speed shall not be less than 60 mph. Conformance to geared speed specified shall be determined by calculating in accordance with the following formula:

$$\text{Maximum geared speed (MPH)} = \frac{\text{Governed Speed (RPM)}}{\text{Total gear reduction X Tire Factor (see note below).}}$$

NOTE: Tire factor must relate to the size of tires furnished by the tire contractor in accordance with this specification. Unless other conditions are noted in the contract, computations should be made for normal atmospheric pressure, normal ambient air temperature and still, dry air.

3.16 Suspension. Vehicle shall be equipped with a suspension system of adequate strength to sustain the GVWR imposed by the fully loaded vehicle in off-road use without evidence of overload or permanent set. Auxiliary rear springs shall be provided on all units.

3.16.1 Spring stops. The manufacturer's standard spring or axle stops shall be provided. The front stops shall prevent the axles from striking the engine oil pan, or other components under all conditions of operation.

3.16.2 Shock absorbers. Heaviest-duty hydraulic, double-acting, shock absorbers available for chassis model and axle offered shall be furnished on all front axles and rear axles.

3.17 Wheels, rims, tires and tubes. Rim and tire ratings shall conform to Tire and Rim Association recommendations for the type and size of tires furnished. Tire size and load range (ply rating) shall be the same for all tires on each vehicle.

3.17.1 Wheels. Disc type wheels shall be furnished.

3.17.2 Tires. Unless otherwise specified (see 6.2), all tires furnished including the spare (see 3.17 4), shall be truck type, tube or tubeless, with standard highway tread design on front and nonmilitary (crossbar at right angle to center line of tread not permitted), mud and show type on rear, 4x2; and mud and snow on front and rear of all 4x4s.

3.17.3 Inner Tubes. When tube type tires are furnished, the inner tubes shall be of the type for the tires furnished in accordance with recommendations of the Tire and Rim Association, Inc.

3.17.4 Spare wheel and tire. When specified, one inflated spare wheel, tire and tube (if applicable), shall be furnished with each vehicle. Size and tread shall match that provided on rear of truck.

3.17.5 Tire chain clearance. There shall be no interference which will prevent use of tire chains on all driving wheels in accordance with SAE J683.

3.17.6 Wheel-tire balancing. All wheel-tire assemblies of the vehicle shall be balanced.

3.17.7 Radial tires. When specified, (see 6.2) unit shall be steel belted radial tires, front and rear.

3.18 Brakes. Full air brakes or booster hydraulic brakes shall be furnished. (See Table I)

3.18.1 Service brakes.

3.18.1.1 Air brakes. When provided, full air brakes shall be furnished with all necessary components, including but not limited to, the following:

1. Air compressor having a capacity of not less than 12 (cfm), at rated pressure.

2. Reservoir(s) with not less than 2,000 cubic inches total capacity, each tank equipped with drain valve automatic moisture ejector, and with safety and check valves between the compressor and last reservoir tank.

3. Spring type parking brake.

4. Dash mounted air reservoir pressure gauge and low air pressure warning buzzer.

5. Air dryer, desiccant type with heater and automatic moisture ejector.

3.18.1.2. Hydraulic booster brakes. When provided, the vehicle shall be equipped with vacuum or hydraulic assisted, hydraulic actuated four-wheel service brakes. Vacuum assisted brakes shall have a minimum 1000 cubic inch total vacuum reserve, and "low vacuum" warning indicator light or device in cab.

3.18.2 Parking brakes. Parking brakes shall be an independent and separate system from the service brake system and shall be applied to rear wheels or axles.

3.18.3 Brake performance. The parking brakes shall be capable of controlling and holding the vehicle in either direction, forward or reverse, loaded to its GVWR on a 20 percent grade, free of ice and snow. Service brakes shall conform to requirements of SAE J992 and J257.

3.18.4 Brake protection. Brake system components, including lines, shall be placed to offer maximum protection from physical damage by off-road obstructions. Brake lines must be of a heat resistant material or placed in a manner such that they will not deform or fail from vehicle heat sources, especially during sustained operation under load while standing.

3.19 Controls and mechanisms.

3.19.1 Controls. Controls shall be complete and conveniently accessible to the operator. Lever controls shall be designed and located to permit easy entrance and exit to and from the operator's compartment. Instruments and controls shall be identified as to function and installed in a manner facilitating easy removal for servicing.

3.19.2 Steering mechanism. The chassis shall be equipped with manufacturer's standard power steering mechanism. The steering mechanism shall be capable of controlling the direction of the fully loaded vehicle under all operating conditions. Means shall be provided for rapid and easy adjustment to compensate for wear in the steering mechanism. Easily accessible means of lubricating the system shall be provided. Steering components shall be protected to the maximum extent possible from damage by forward motion of the vehicle in the operating terrain.

3.19.3 Backup alarm. When specified, (see 6.2) vehicle shall be provided with an audible pulsating signaling device (electrical or mechanical) to caution personnel when the vehicle is in reverse gear operation. System to be in accordance with OSHA Standard 1926.

3.20 Electrical.

3.20.1 Lighting. Vehicle shall be equipped with a complete 12 volt lighting system. The electrical supply source shall be as specified in 3.7.1.1 and 3.20.2.

3.20.2 Alternator. A 12 or 24 volt alternator and voltage control shall be provided with a capacity not less than 120 amps.

3.20.3 Starter system. A key ignition switch shall be provided. A high torque, minimum current draw starter motor of heaviest duty available for the model and engine offered shall be furnished with compatible solenoid and wiring.

3.20.4 Wiring and devices. All wiring shall be harness type (in looms), grease and oil resistant, moisture proof, routed in protected locations neatly, securely fastened with insulating cable straps, and all apertures properly grommeted for passing wiring. Wiring shall conform to SAE J1292.

3.20.5 Electromagnetic interference suppression. Vehicle shall be electromagnetic interference suppressed in accordance with SAE J551.

3.21 Chassis equipment. The chassis equipment, etc., shall be complete and shall include, but shall not be limited to, the equipment specified herein.

3.21.1 Bumpers. A front bumper shall be provided for all vehicles. Bumper mounting brackets shall be attached to frame.

3.21.2 Fenders. Front fenders shall be provided on all cab types.

3.21.3 Engine hood. The engine hood shall be so fitted to prevent water leakage from natural precipitation, shall be readily removable, and shall open sufficiently to provide easy access to components in the engine compartment.

3.22 Cab. All cabs shall be the conventional type of all metal or metal and reinforced fiberglass construction with insulation, floor mats, glove compartment and domelight(s). Unless otherwise specified (see 6.2) a full-width adjustable seat upholstered in heavy duty tan vinyl shall be provided. Cabs shall be provided with dual sun visors and driver's compartment ventilation other than a window. Doors shall be equipped with key-operated locks and shall have crank operated window regulators. A rear window shall be provided. The cab roof shall be of one piece construction or, if welded, shall give the appearance of one piece with weld seams being continuous, waterproof and free from visible seams, bumps or protrusions. Full length drip molding shall be mounted above doors.

3.22.1 Seatbelts and anchors. Seatbelt assemblies, attachment hardware, and retractors for the front outboard belts shall be furnished, for driver and each occupant.

3.22.2 Glass Glazing shall be clear and conform to Federal Motor Carrier Safety Regulation 393.60. Tinted glass shall be furnished when specified (see 6.2).

3.22.3 Instruments, lights, etc. The instruments shall be the manufacturer's standard, easily accessible for maintenance, and shall include, but not be limited to, panel lights, interior dome lights, speedometer and recording odometer accurate within 5 percent, lighting control switches and indicators, fuel shut-off, low air pressure warning devices when air brakes are furnished, tachometer, voltmeter, oil pressure, engine temperature and fuel gauges, vacuum indicator when hydraulic brakes are furnished, as well as heater-defroster controls and hour meter. All gauges and controls shall be in-dash mounted.

3.22.4 Windshield wipers. The wiper system furnished shall be the manufacturer's standard and shall include, but not be limited to, intermittent speed.

3.22.5 Mirrors, rearview. Outside rearview mirrors furnished shall be dual western type, swing out, extendable, bracket mounted, independently adjustable mirror heads of the largest size appropriate for vehicle model offered. Mirrors shall be securely mounted to cab or to cab doors and free of vibration. The flat portion of the mirror shall have an area not less than 50 square inches.

3.22.6 Heater and defroster. Hot water, fresh air type heater shall be capable of heating cab interior to 75 degrees Fahrenheit when outside ambient temperature is 0 degrees Fahrenheit. The defroster must keep windows clear at 0 degrees Fahrenheit. Refer to SAE J382. Dash mounted panel controls convenient to the driver, shall be provided. Discharge outlets shall be provided to direct heater air flow to floor and to defroster louvers by blowers. Cab compartment ventilator system other than windows shall be provided.

3.22.7 Air conditioning. When specified, OEM factory installed air conditioning shall be furnished. Air conditioning shall be capable of cooling cab interior to 65 degrees F when outside ambient temperature is 125 degrees F, without chassis engine operating temperature exceeding manufacturer's recommended level for continuous uninterrupted operation.

3.22.8 Crew cab. When specified, (see 6.2) in addition to the requirements of 3.22, the vehicle shall be equipped with a four door cab having two full width seats with backs. The front seat shall be adjustable. Manufacturer's standard fastenings and three pairs of seat belts shall be installed in the rear seat. When a crew cab is furnished, the cab-to-axle dimension shall be measured from the back face of the crew cab.

3.23 Tools. Each vehicle shall be furnished with the manufacturer's standard tools including, but not limited to, hydraulic jack of sufficient capacity to lift wheel of fully loaded vehicle to height necessary to permit removal and replacement of wheel and tire assembly, jack handle, and lug nut wrench. Stowage space with secure mountings shall be provided.

3.24 Paint, finish or color. Exterior color shall be specified from the current Federal Standard No. 595. The interior finish shall be manufacturer's standard compatible color with the exterior.

3.25 Standard and additional requirements.

3.25.1 Rustproofing. When specified, (see 6.2) the vehicle shall be rustproofed in accordance with Federal Standard 297. When specified, tropical rustproofing in accordance with Federal Standard 297 shall be furnished.

3.25.2 Towing devices. Not less than two hooks, loops or pins for towing the vehicle shall be furnished on the front of the vehicle. When specified, (see 6.2) not less than two hooks, loops or pins for towing shall be furnished on the rear of the vehicle.

3.25.3 Sound level. The interior sound level shall conform to Federal Motor Carrier Safety Regulation 393.94. The vehicle exterior sound level shall conform to the Environmental Protection Agency Noise Emission Standards for Transportation Equipment, Medium and Heavy Trucks.

3.25.4 Weight distribution. The distribution of GVW for the purpose of establishing suspension, axle and tire capacities shall be determined with the payload uniformly distributed over the load area. A vehicle with a crew cab shall have the weight distribution determined with 600 pounds of the payload in the rear seat.

3.25.5 Static side stability. Due to the primarily off road severe service use on uneven terrain, the following maximum tip over angle shall be adhered to: With the vehicle loaded to its maximum GVWR, and with the payload centered on the center line of the vehicle, 18 inches above top of frame, the vehicle must be capable of being placed on a 35 degree side slope without rollover.

4. Quality Assurance Provisions

4.1. Responsibility for inspection The contractor is responsible for the performance of all inspection requirements as specified herein. The contractor may use his own or any other facilities suitable for the performance of the inspection requirement specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility for assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, whether indicated or actual,d nor does it commit the Government to acceptance of defective material.

4.2 Government verification. Quality assurance operations performed by the contractor will be subject to Government verification at unscheduled intervals. Verification will consist of observation of the operations to determine that practices, methods and procedures of the contractor's inspection are being properly applied. Failure of the contractor to promptly correct product deficiencies discovered shall be cause for suspension of acceptance until correction has been made or until conformance of product to specification criteria has been demonstrated.

4.3 First production vehicle inspection. The first vehicle of each class in each drive configuration produced under the contract shall be inspected by the contractor at his plant under the direction and in the presence of Government representatives. The purpose of the inspection shall be to determine vehicle conformance to the contract. Acceptance of the first production vehicle shall not constitute a waiver by the Government of its rights under the provisions of the contract.

4.3.1 Vehicle weight. The first production vehicle shall be weighed to determine the curb weight and distribution of the curb weight on front and rear axles. The total imposed loading on front and rear axles shall be computed by the contractor and verified by the Government, using the curb weight, the operator weight at 200 pounds and the payload required to provide the specified GVW. The calculated imposed loads on the front and rear axles shall be compared to the suspension, axle and tire load capacity ratings to determine if these components are of adequate capacity to meet contractual requirements.

4.3.2 Road test. The first production vehicle of each class in each drive configuration shall be road tested by the contractor with payload. d The road test shall be for not less than 10 miles at all speeds up to 60 mph.

4.3.3 Production sample. Upon acceptance of the first production vehicle, it shall remain at the manufacturing facility as a production sample, and shall be the last vehicle shipped on the contract. The contractor shall maintain the vehicle in a serviceable condition for the duration of the contract.

4.4 Failure. Failure of the first production vehicle to meet requirements of the contract shall be cause for the Government to refuse acceptance of all vehicles under contract until corrective action has been taken.

4.5 Inspection of production vehicles. The contractor's inspection system shall, as a minimum, assure that the vehicle conforms to the physical and dimensional requirements and is capable of meeting performance requirements herein. For each vehicle under contract, the contractor shall make available to the Government, at the point of final acceptance, records acceptable to the Government indicating that the servicing and adjusting required have ben accomplished. For civilian agencies, GSA Form 1455 or an approved equivalent form shall be used.

5. Preparation For Delivery

5.1 Vehicle processing. The vehicle shall be processed for shipment, from the manufacturer's plant to the initial receiving activity, in accordance with the manufacturer's standard commercial practice.

6. Notes

6.1 Intended use. The vehicles covered by this document are intended for the mounting of special bodies or equipment for use in wildland firefighting.

6.2 Ordering data. Acquisition documents should specify the following:

(a) Title, number and date of this document.
(b) Class or item number of vehicle required (see Table I)
(c) Paint color, exterior (see 3.24)
(d) Rustproofing, (see 3.25.2)
(e) Tropical rustproofing, (see 3.25.2)
(f) Rear towing devices, (see 3.25.3)
(g) Tinted glass and windshield (see 3.22.2)
(h) Power plant heaters, (see 3.12.3)
(i) Delete battery heater, (see 3.12.3)
(j) Wide base tires (3.17.1)
(k) Tires: tube or tubeless (3.17.2) (3.17.4)
(l) Spare tire
(m) Backup alarm (see 3.19.3)
(n) Individual driver & passenger seats, (see 3.22)
(o) Crew cab, (see 3.22.8)
(p) Steel belted radial tires (see 3.17.7)
(q) Steel belted radial tires (see 3.17.7)
(r) Four wheel or two wheel (drive) (see Table I)
(s) Automatic transmission (see 3.14.3.2)
(t) Special traction - differential (see 3.14.7.1)

6.3 Procurement requirements. Invitation for bids, contracts, or orders shall contain the following requirements (see 6.3.1 through 6.5).

6.3.1 Domestic warranty. The contractor, on vehicles used within the fifty States of the United States and the District of Columbia, hereby warrants vehicle to be free from defective material and workmanship as follows:

The entire vehicle (except tires and tubes, if warranted by their manufacturers and normal maintenance services) shall be warranted for one year from the date of service or 12,000 miles road travel, whichever may occur first. Engine and power train components (as covered by the vehicle manufacturer's standard warranty to the general public for the current year of manufacture), shall be warranted at 50 percent of the normal charge for parts and labor imposed by the dealer or other authorized facility from 12,001 to 50,000 miles. Provided, however, that if the contractor receives from any supplier or subcontractor any additional warranty on the whole or any component of the vehicle, either in the form of greater time and/or mileage or otherwise and including any pro-rata type arrangement, or if the contractor generally extends to his commercial customers a greater warranty coverage than provided the Government under this contract, the Government shall receive corresponding warranty benefits (to start at date of service including the cab and chassis).

The warranty shall include the furnishing (without cost to the Government, f.o.b. contractor's nearest dealer or branch, or to the original destination, if desired by the Government) of new parts ad assemblies to replace any that prove to be defective within the warranty period. In addition, when the replacement of the defective parts or assemblies takes place at the contractor's plant, branch, or dealer facility, transportation costs shall be borne by the contractor. On vehicles procured f.o.b. destination and delivered by the driveaway method, when authorized by the Government, warranty limitation will be in addition to the mileage accumulated by such driveaway method.

6.3.2 Export warranty. The contractor, on vehicles used outside the fifty States of the United States and the District of Columbia, warrants the entire vehicle (except tires and normal maintenance services) to be free from defective material and workmanship, for one year from date of service or 12,000 miles road travel, whichever may occur first. On vehicles delivered to the Government by driveaway method, the 12,000 miles warranty limitation will be in

addition to the mileage accumulated by such driveaway method. This warranty shall only include the furnishing of new parts or assemblies to replace any returned to the contractor by the Government which prove to be defective.

The replacement parts or assemblies shall be delivered by the contractor to the port of embarkation in the United States designated by the Government. The contractor shall not be required to bear the cost of the labor involved in correcting defects in vehicles used outside the fifty States of the United States and the District of Columbia.

6.3.3 Repair parts and service. As the continuous operation of the vehicles contemplated by this specification is of utmost importance, it is necessary that the successful bidder be in a position to render prompt service and to furnish replacement parts. Accordingly, bidders shall indicate the extent of their ability to render prompt service by furnishing a list of branch offices or agencies where complete stocks of repair parts are maintained and can be secured within a reasonable time after ordering by part number from the manufacturer's parts book and at such discount as may be quoted from year to year by the manufacturer of the vehicle purchased under this specification.

6.3.4 Manuals, operating and servicing. The successful bidder shall furnish two operator's handbooks and two lubrication charts, if the charts are not in the handbooks, with each vehicle. One parts book, a shop repair manual and line set ticket for vehicle and all special equipment shall be furnished with each vehicle.

6.3.5 Loading. When shipment is to be made by rail, water, or truck, the vehicle shall be prepared and loaded for shipment in accordance with the best commercial practice. When shipment is to be made by rail on Government Bill of Lading, freight cars shall be loaded so that the Government will obtain the most advantageous freight rate.

6.3.6 Servicing prior to loading. Servicing prior to loading shall be in accordance with GSA Form 1455, Motor Vehicle Preshipment Inspection and Servicing Requirements. Unless shipping regulations prohibit, the crankcase shall be filled to the operating level with high quality lubricating oil of the correct viscosity for the "run-in" period as recommended by the engine manufacturer. In addition, the fuel tank shall be filled with 10 gallons of fuel, and the cooling system shall be filled with a 50-50% mixture of water and ethylene glycol antifreeze (that will also protect aluminum blocks). Vehicles which are shipped with drained crankcase, half-filled transmission, etc., shall have a warning clearly indicated on a tag securely attached to the steering wheel or clearly marked on the windshield that the crankcase and transmission must be filled prior to running the engine.

6.3.7 Servicing for driveaway delivery. When driveaway by Government personnel is specified in the invitation for bid, the contractor shall perform all the servicing operations specified in 6.3.6.

6.4 Statement of Origin or Bill of Sale. A manufacturer's Statement of Origin or Bill of Sale showing the applicable delivery order number is required for each vehicle procured under specification. Unless otherwise specified, such documents shall be forwarded to the consignee.

6.5 Preproduction conference. When requested by the contracting officer, a meeting of the contractor, contracting officer, a representative of the ordering agency, and the specification manager shall be held prior to the start of construction of the unit.