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## APPLICATION OF THE CUB CADET 6x4 FIRE-RESCUE UTV APLIKÁCIA CUB CADET 6x4 FIRE-RESCUE UTV

György Kós, László Komjáthy

### Abstract

Cub Cadet. Originally designed as a machine. Whatever the bad road, it is rolling down the path, because of its narrow gauge, the roadblock is not hurt by passengers, and the flatbed, half a ton of load-bearing structure can carry different things. It is difficult to get stuck, with the central differential lock, halfway down practically everywhere you can go.

### INTRODUCTION

The story of the widely liked light weight off-road vehicles goes back to as far as 1893. This is when the Englishman Royal Enfield has made the first vehicle – later to be known as quads – the Royal Enfield Quadricycle 1893. This two-seater construction looked more like a pedal surrey carriage than the heavy machines of today, but the design of the later quads can be seen in traces already, e.g.: the arrangement of the four wheels and the handlebar. Technological advancements has caused the steering wheel to be industry standard in the case of vehicles with four or more wheels, whereas handlebars were generally used for motorcycles and motorized tricycles. In 1970 Honda has introduced the ATC90 (ATC=All Terrain Cycle meaning nearly all all-terrain motorized tricycles) which only had three wheels but in its concept and design resembled today's work quads.



1. picture. Honda ATC 90

The ATC has been a successful model with 7 more to follow (ATC70, ATC110, ATC185, ATC250R, ATC200E Big Red, ATC200X, ATC200ES Big Red) between 1970 and 1984.[1] Other Japanese manufacturers also introduced tricycles. The engineers of Suzuki started to work on a project in 1982 and one year later Suzuki introduced the world's first quad (in the traditional sense) the LT-125 Quad Runner. It's also important to mention 1985 when also Suzuki introduced the world's first sport-quad with a two-stroke engine, the Quadracer 250. From this date the design evolution of the sport and work-quads diverge. Legend has it that in the middle of the 1980s a few Kawasaki engineers during their lunch break were talking about how the agricultural sector is in need of a small robust all-terrain work vehicle. The vehicle – quickly sketched on a napkin –not only had to be easy to handle and durable but it had to have exceptional towing abilities. From this idea came the Multi-Use Lightweight-Equipment vehicle, abbr: MULE in 1988.[2] The Kawasaki MULE 1000 quickly became a favorite of American farmers and livestock farmers. There is a simple explanation to that. The MULE was much more comfortable and versatile than a work-quad and smaller and more practical than a pick-up truck.[3]





2. picture. Kawasaki Mule 500

## 1. CUB CADET 6x4

The Delta-Erdő is a Hungarian made Cub Cadet 6X4 UTV. The vehicle is very similar to the also American John Deere Gator 6X4. These kind of similarities are not uncommon in today's globalized machine manufacturing.[4]

Technical construction

TECHNICAL SPECIFICATIONS	
Own weight (with gas tank filled)	726 kg (1600lbs.)
Useful weight	454 kg (1000lbs.)
Length	2931 mm (115,4")
Width	1670 mm (65,75")
Height (without rollbar and lightbar)	1041mm (41")
Turning circle	6,77 m ( 22,2 ft.)
Engine	Kohler Command V-Twin OHV
Fuel	95 octane-rating petrol
Performance	20 LE
Electrical system	12 volt 8 Ah
Fuel tank	21,58 l ( 5,7 US gallon)
Drive formula	6X4 ( chain drive)
Max. speed	30 km/h



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## **2. PRACTICAL BACKGROUND OF THE USE OF CUB CADET 6X4 FIRE RESCUE UTV**

### **2.1. OPERATION**

The vehicle's relatively small maximum speed and its low center of gravity makes it safe to operate. Nevertheless be it a work carried out in any condition, during rescue and firefighting operations the intervening firefighters and the potential people to rescue both face certain consequential risks. For the successful rescue it is essential to strive for highest level of safety possible under the circumstances. During task carried out with the UTV, knowledge of the structure of the vehicle and the specific environment (vegetation affected by fire, hard terrain etc.) is indispensable.

### **2.2. Operations after dark**

To light the environment and make the vehicle visible there are: 2 x 37,5 watts white halogen lights, 2 x 21 watts red brake lights, 2 x 5 watts red position lights and, 4 x 21 watts turn-signal lights on board. There is no horn or siren on the vehicle. The UTV is equipped with a 1 watt 36 piece red-blue LED emergency vehicle lightbar. The signs written on the vehicle are also made from reflective material for better visibility. In the case of operations carried out after dark when its needed a handheld search light can be used powered by the dashboard cigarette lighter.

### **2.3. OSH regulations**

1. The vehicle's function: A rescue vehicle made for special firefighting, rescue and scouting tasks. Its primary use is rescuing lives and remediation in areas which are inaccessible by traditional vehicles and methods, because of hard terrain.
2. Personnel conditions: Because of the lack of a rescue vehicle control training accepted by the authorities, DELTA-FIRE has established the following set of conditions: The vehicle can be operated by a person, over 18, who took part in at least 40 hours firefighting base-training, has a medical certificate proving his abilities for the rescue, has extensive



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knowledge of the vehicles operation, the OSH and safety regulations, has at least a type „T” driving license, and partakes in regularly organized trainings.

3. Threats: During operations carried out with the multipurpose rescue-vehicle the main source of danger comes from the surroundings of the mission (areas affected by fire and smoke, hypothermia caused by cold conditions etc.). Additional sources of danger could be the parts of the power transmission system, cardan and chain drives and the hot parts of the combustion engine.

4. Protective equipment, and devices:

Individual protective equipment:

- safety glasses
- five-fingered gloves
- protective boots
- protective clothing in accordance with the task

Collective safety equipment:

- emergency stop button
- cover of the power transmission system
- engine cover
- (12 kg powder extinguisher)

During the operation all personnel is required to use the safety equipment properly!

5. The vehicle on startup:

The dangers during startup are the turning and moving parts

6. Operating the vehicle:

- Check the level of fuel and look for possible leaks in the fuel system. Operations can only be commenced with full fuel tank.
- Check the tires. (Look for puncture, check tire pressure).
- Check the integrity of the car-body parts (Look for breaks or cracks).
- Check the oil level.
- Check if the controls function properly.
- Check if the turning of the steering gear is unimpeded.



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- Check if the objects in/on the vehicle are fixed properly.
- Check if there is a fire extinguisher.
- Check if the brakes are functioning properly.
- Wear the required individual protective equipment!

If all necessary conditions are met, there is no danger or exclusionary reason, personal conditions are provided the vehicle can be operated. The engine uses 95 octane rating petrol. The fuel tank is under the seat. During cold start fuel mixture enrichment is necessary. The engine can be started with the turning of the ignition key. Until the engine warms up it has to be run on low REV.

7. Safe operation of the vehicle: It is forbidden to open the cover of the power transmission system or the engine during operation! The personnel are seated next to each other. It is important to arrange the weight evenly. When releasing the gas pedal the REV automatically drops and the vehicle stops. Slowing the vehicle can be reached by stopping the gas. To stop the engine, turn the ignition key to the opposite direction.
8. Troubleshooting: In case of a dangerous malfunction the vehicle has to be stopped. Mechanical and electrical faults can only be repaired by a qualified mechanic. During the repairs an „UNDER REPAIR, OUT OF ORDER” sign has to be put on the vehicle on a visible place and the operations management has to be informed that the vehicle cannot be used on operations! During the mounting and dismounting of certain components the mechanic is working in the danger zone. The faulty or worn out security equipment and any part which with its deterioration can cause danger has to be changed or repaired immediately. If the towing of the vehicle is necessary, the tow bar on the front or on the end of the vehicle has to be used.
9. Maintenance: After operation the vehicle has to be turned off. It has to be cleaned of dust, and mud. Ice has to be melted. The intactness of the pack has to be inspected. The fuel tank has to be filled and the vehicle has to be put in operational state. For the repair works only the hours of operation can give information. In every 100 hours of operation the oil has to be changed and in every 10 the air-filters have to be checked and cleaned.



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### **3. NECESSARY LOGISTICS, SERVICE**

It is not enough to have the right rescue device, or vehicle if we are not able to take it to the place of the damage. For this task fire services and other disaster recovery services around the world primarily use small light-weight hovercrafts. They are mainly used in areas where large hovercrafts could not maneuver, in rivers far from open waters, in lakes, marshlands or swamps.

#### **3.1. Necessary logistics**

Because of its low maximum speed the vehicle its use in road traffic is limited. Because of that for greater distances it has to be transported to the site by a transporter vehicle. Generally they can be transported with a trailer connected to a fire engine or a small rescue vehicle. If the trailer is equipped with a ramp the vehicle can climb up on its own to the trailer. In case if there is no ramp a loader is needed for the trailer, to put on and take off the vehicle. Because of its dimensions for the towing of the vehicle a type „E” driving license is not necessary

#### **3.2. Service**

In areas with rudimentary infrastructure where trained personnel to operate and maintain larger vehicles is inaccessible oil companies still prefer to use hovercrafts. Because of the vehicles technical solutions and design they are easy to integrate into fleets operated by fire services. They do not require special, costly trainings and qualifications, so I think, the background to maintain a UTV is given at any Hungarian fire service.



#### 4. TACTICAL USAGE IN AREAS WITHOUT SOLID PAVEMENT ROADS

UTVs are wheeled vehicle and thus are made for land use. From a firefighters perspective they are to be used in agricultural settings, to rescue operators working in forestry, or hikers, to get people in rural settings to get medical help, or in the putting out of wildfires. It generally true that UTVs are best to use on bad (loose or muddy) terrain conditions. They are especially suited for operations in areas where large traditional rescue vehicles (which often can't handle terrain conditions) cannot be operated. The traction of tires in swampy and muddy terrains is largely decreased. To the 2. 3. axlean additional rubber caterpillar track can



3. picture. Size differences of vehicles  
Cub Cadet 6X4 Fire Rescue, Iveco-Magirus 130 D9, Renault Kerax 410  
4x4  
(source: author)

be applied for better terrain riding capability. It has a limited suitability for riding on steep slopes ( $20^\circ <$ ). During operations carried out in dry sand we have to take into consideration the formation of dust. In black field soils of the lowlands during the autumn and winter with high precipitation terrain conditions can arise which are impassable for wheeled vehicles. The several hectares large connected areas of sticky muddy terrain is a problem even for travelling by foot. In my experience this can cause mud so deep that it's hard to travel by foot.

#### 4.1. Tactical usage in urban environment

In those areas with solid pavement and suitable roads where the operation of traditional fire engines and rescue vehicles is possible its small size and its high degree of mobility can be an advantage.[5] It can be used successfully eg.: on mass events for either fire or medical services. In urban areas affected by natural disasters its suitable for movement on roads covered by debris or on roads limited by parades or processions, and in the case of floods the transportation of materials or objects used in flood protection (e.g.: sand, sandbags).



4. picture. Distribution of sand on a narrow, snowy and icy street with a Cub Cadet 6X4 FIRE-RESCUE and a John Deere AMT 626

## 5. SUMMARY

With this model a new vehicle category is made, the Utility Terrain Vehicle, UTV. Naturally other motorcycle manufacturers reacted to the market's needs and the UTV set out to conquer the world. Because of its area of application the motorcycle factories were soon joined by significant agricultural machine manufacturers (e.g.: John Deere, Bobcat, Kubota etc.), lawn



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mower manufacturers (e.g.: Cub Cadet) and today also Husqvarna (known primarily for its chainsaws) has UTVs on their product palette. Their design is very versatile. Typically equipped with 2 or 3 axles, with room enough for 1-6 persons. Quite similarly to quads the separation of sport and work UTVs is also noticeable. The application are for work UTVs is very wide. Today in addition to agriculture, they are used by the field of forestry, the building industry, the military etc. and by several law enforcement and emergency services

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