

BREMACH - FSV project (Flexible Security Vehicle)

The FSV/ramSAEd is a compact multi-purpose 4x4 vehicle able to move on rails (train-railways and underground-subway), roads, and off-road developed on [BREMACH T-REX chassis](#). FSV (Flexible Security Vehicle) is a project funded by Finmeccanica Company, and it is characterized by a thermal-engine propulsion, but includes the feasibility study of a hybrid solution. Instead the ramSAEd project (ramSAEd stands for RApid Multi-function Sensors And Effectors Deployer – Situation Awareness Enhancer) should integrate the electrical hybrid propulsion.

The program would address current issues such as the electrification of transport (motor-wheels embedded in each wheel), making the vehicle eco-compatible and sustainable, moreover such an electric system will permit to the vehicle the mobility in all the situations where a standard internal combustion engine doesn't work due to the lack of oxygen (i.e. inside a gallery full of smoke). In particular, it will achieve a vehicle able to move independently on rails (the vehicle is designed also to move easily on the rail tracks of underground and gauge can be adjusted), and in case, even on normal roads, damaged streets thanks to the power of its propulsion. The vehicle is able to pass from road to rail and viceversa without any additional external tool.



Vehicle exhibited on railways, at Montichiari ([Brescia, Italy](#))



FSV/ramSAEd intends to provide the Civil Defence (main end-user of project) of a flexible and highly technologic tool, able of carrying out a thorough analysis directly in the crisis area. The main characteristic of the vehicle are the following:

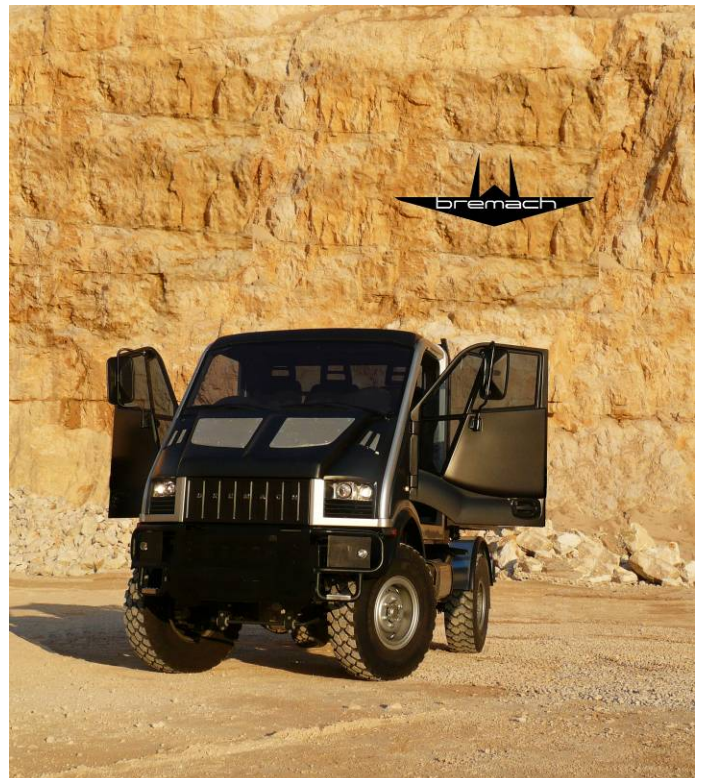
- high flexibility: that is the capacity to adapt to the various kinds of event (missions), 4X4 drive; bi-modal (rail and road). Typical events pertaining to the Civil Defence are: earthquakes, hydro-geologic event, floods, industrial accident (NBCR), environment emergency, hostile weather conditions, large road accident, missing people.
- modularity: that is the suitability to specific/generic scenarios;
- autonomy;
- easy transportability (by aircraft, train and ship).

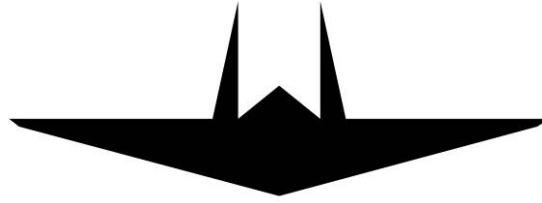
The vehicle main features are the following:

- weight approximately equal to 6 tons (with a carrying capacity from 1.5 to 3 tons);
- crew composed by a maximum of three men;
- a kit allows to remotely control the vehicle in a place foreclosed for man (e.g. chemical threat, etc.) up to a maximum distance of 1 km (by using a wireless connection) and 10 km (by using a wired connection, e.g. inside tunnels);
- capability to operate inside the following temperature range: from -25° to +60°C;
- engine aspiration placed in an elevated location, ford-proof reservoir, waterproof wiring, front hydraulic winch, off-road equipment, drawing hook.

In particular the [T-REX](#) 4x4 vehicle is able to:

- Preserve its advanced mobility in night and day conditions;
- Reduce the crew stress during the missions (i.e. high ergonomics);
- Have brake capabilities, according to the current normative;
- Have a minimum steering radius of 6.5 m and a ground clearance of 290m;





Prototype with thermal propulsion

In case of thermal engine (FSV version):

- Have a power/weight ratio not less than 24 CV/ton;
- Have maximum speed of 130 km/h (in flat road), 25 km/h (in reverse direction), 40 km/h (on railways) and minimum speed of 2.4 km/h;
- Have an acceleration from 0 to 80 km/h in 20/30s;
- Approximately 250 km of autonomy (in a flat road at about 75% of maximum speed);
- Maximum slope of 100% (longitudinal) and 16% (transversal);
- Maximum obstacle height (single-step overcoming): 0.4 m;
- Maximum ford deepness: 1 m;
- in case of hybrid propulsion the maximum speed is supposed to be approximately 105 km/h;

The suite of payloads includes an optical head for observation at night and daytime, NBCRE sensors and other detection devices.

The optical head, consisting of an observation system based on technology E/O, IR and laser for video assessment of the operative situation, can perform the situation awareness. A broadcasting satellite on-the-move link, that is a radio satellite link that can work in motion, sends the information in real-time to the centre of remote control and monitoring of civil protection.

The optical head includes, in particular, the following sub-elements:

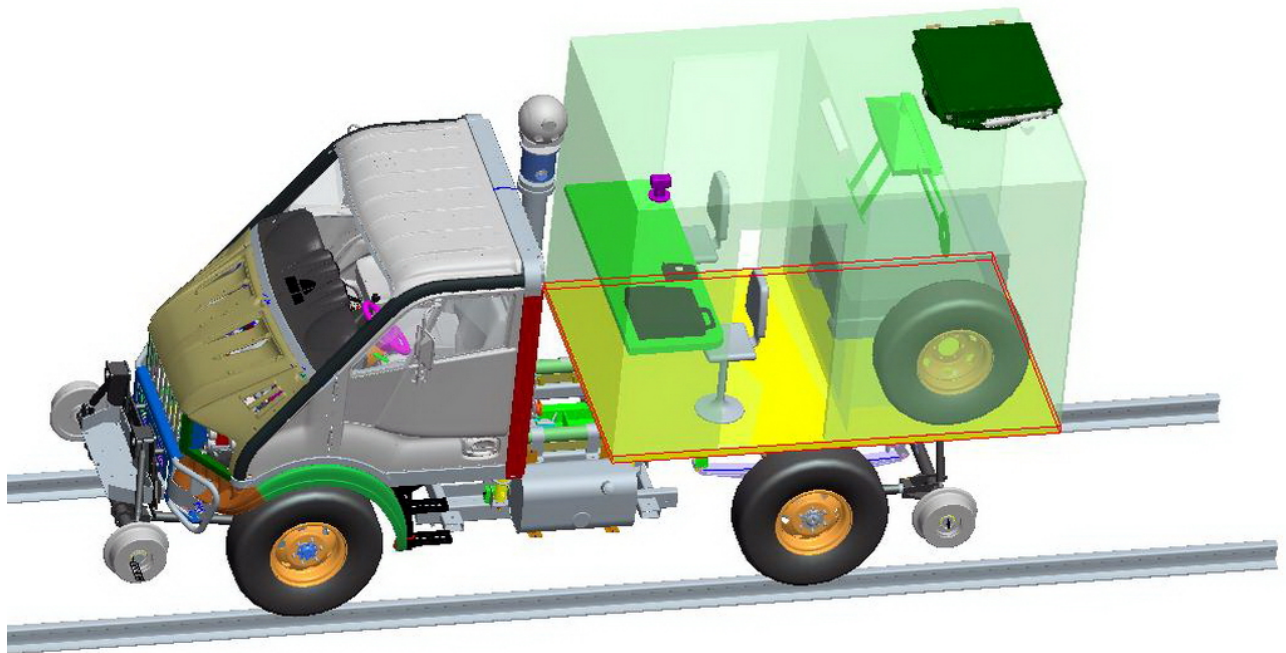


- advanced optical system;
- data managing and visualization (control station);
- power supply;
- a liftable rod (to raise the optical head up to approximately 3.5 m);
- command and control system;
- positioning and navigation system;
- communication system.

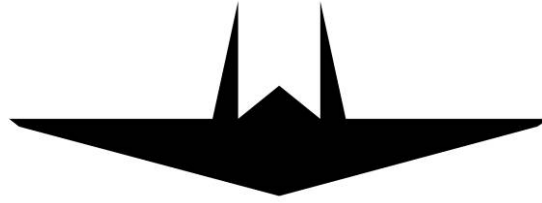
The vehicle is equipped with a weather station and a NBCR module (a rugged case with portable tools for analysis) able quickly to discover and identify a broad spectrum of threats. This module, characterized by an open architecture, is capable of easily integrate the new sensors that technology will make available. It is particularly effective when attached to the remote control kit of the vehicle. In fact the operators, staying indoors, can control the vehicle directly inside the area of crisis without risking their lives. Besides a mini-version of this module could be integrated even on the integrated terrestrial robots.

In fact the ramSAEd systems carries remotely controlled UGV (Unmanned Ground Vehicle with the ability to safely evacuate the wounded and disabled in uneven terrain and in the presence of stairs) and UAV (Unmanned Air Vehicle), with their Ground Station, and an anthropomorphous robotic arm (for the precise manipulation at distance) with its ground station.

The UxV Ground Station allows to control and guide the unmanned vehicle deployed by the vehicle. At the same time it must be able to manage the sensor suite that is integrated into the robots payloads.



Model of vehicle layout



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