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#### **Abstract:**

PIAP is a Polish designer and producer of EOD/IEDD robots (INSPECTOR, EXPERT, SCOUT, EXPLORER device). Since 2000, PIAP is a permanent supplier of mobile robots and robotic devices for Special Forces (Police, Army, Border Guard, and Government Protection Bureau). A growing terrorism threat and development of techniques used by terrorists increased the demands for the equipment supporting missions of Special Forces.

To meet these requirements PIAP's engineers constantly work on new intelligent devices, which will make easier tasks of Special Forces.

## Detailed research information:

### *INSPECTOR - inspection and neutralisation robot*

Within the class of heavy robots, INSPECTOR stands out from competitors with its enormous towing power, lifting capacity of the manipulator, and ability to operation in difficult conditions and various terrains.

Unique features of INSPECTOR robot

- The INSPECTOR can tow vehicles left in any gear of a mass of up to 1500 kg.
- Front caterpillars (remote control of tilt angle) increase traction abilities, longitudinal stability and enable smooth motion on stairs, as well as highly uneven terrain.
- The manipulator is able to lift 30 kg on extended arms and 60 kg on folded arms.
- The turn of the manipulator's base amounts as much as 400°.
- Constant spatial orientation of the object placed in the gripper, irrespective of the movement of other manipulator arms, enables precision manipulation of hazardous devices.
- Control system of the robot enables to control all of its drives at the same time.



**Figure 1: INSPECTOR robot**

### ***EXPERT - neutralization and assistance robot***

Designed specially to be used in all means of transport such as airplanes, buses, trains, ships, and inside small and cramped places. The robot is equipped with a gripper, able to reach up to 3 meters.

Unique features of EXPERT robot

- The construction combines two contradictory needs: small mobile platform enables manoeuvres in tight places and simultaneously the manipulator has big range and load.
- Front caterpillars (remote control of tilt angle) ensure stability of the structure during surmounting high obstacles and stairs.
- Foldable lateral stabilizers enable solid lock of the mobile platform, what allows safe lifting of considerable loads and precise operation of the robot manipulator even during maximum lateral reach of its arm. Stabilizers can be dismantled what makes the mobile platform 8 cm thinner.
- Range of the manipulator with the gripping device amounts to 3 meters. Exceptionally long reach of the upper arm allows inspection of space both at the level of overhead lockers for passenger luggage and under passenger seats.
- EXPERT is equipped with 6 cameras. Four colour cameras are placed on the gripper, in back and front of the robot and on the manipulator (the main camera that may be turned completely around by 360° and 90° up and down). Additionally two colour cameras are placed on the sides of the front caterpillars, what enables the inspection of, e.g. place under seats.
- Control system of robot enables to control of its all drives at the same time.
- Auto diagnosis system constantly checks if there are any faults and shows special warnings on a supplementary LCD screen.
- Most of the robot and manipulator's cables are routed inside the structure, thus reducing the risk of damage.



**Figure 2: EXPERT robot**

### ***SCOUT robot***

The Robot SCOUT basic moving assembly consists of hybrid system (caterpillars-wheels), but if necessary, moving wheels can be, dismantle. Solid construction of small dimensions and small weight with dynamic driving system provides high manoeuvrability and high speed of the robot (10 km/ hr). Application of the robot can be multiplied by mounting additional devices on its mobile base i.e.: manipulator with a grip, cameras, additional front caterpillars, handle and cabling for recoilless disrupter, digital camera and cabling for recording the vision and microphone signals, chemical contamination detector, X-ray device, fibre-optic cable with active automatic roller.

Unique features of SCOUT robot:

- The small robot dimensions enable for swift inspections of hard to reach areas and rooms;
  - The robot wheels are easy to dismantle. This allows for a limitation of the robot's overall dimensions and operation in spaces that are hard to reach;
  - The very low robot weight enables for its transport in a typical military knapsack; Thanks to the drives used, the robot efficiently travels across area unevenness and obstacles of inclination angle up to 45°;
  - The module robot structure enables for an easy and swift replacement of any additional equipment;
  - The robot is able to carry loads with its manipulator – from 2 kg (with the manipulator fully extended) up to 5 kg (with folded manipulator);
  - Both the robot and the manipulator may be controlled from the operator's station (in a form of a small and light weight-suitcase);
  - The optional use of the optic fibre transmission enables for robot's operation at significant distances, even in an environment of high electromagnetic noise level;
- SCOUT robot can be adapted to various applications:
- use by special squads: neutralization of explosives, negotiations with terrorists, recording of operation course, taking Roentgen images,
  - use by commercial firms: inspection of ventilation ducts, inspection of areas exposed to chemical or biological pollution, support in location of defects in places difficult to access by a man.



**Figure 3: SCOUT robot**

### ***IBIS robot***

IBIS is a robot for pyrotechnic and combat missions. It is designed especially for operations in difficult and diverse terrain (including sand, snow, rocks). High speed of the robot enables taking dynamic actions. Robot's manipulator provides big range of activities and applications. Precision drive system gives fluidity of the movement of every part of the robot, even during fast ride.

Unique features of IBIS robot

- High speed of the robot (8,5 km/h.),
- Mobile platform with six-wheel drive,
- Each wheel is powered with independent drive,
- Longitudinal axis of front wheels is able to turn in wide range,
- Wheel arms used in robot's suspension, provide very good grip to the ground,
- Huge lifting capacity of the robot's arm (15 kg – unfolded arm, 30 kg - folded arm),
- The range of manipulator with gripper is over 3m.
- Possibility of robot remote control by fibre optic cable.
- Robot's control system enables independent and simultaneous steering of it's e



**Figure 4: IBIS robot**