

CYBERNETIX: A ROBOTIC SOLUTION FOR LAUNCHING OPERATIONS OF CALLISTO VEHICLE

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Abstract:

CYBERNETIX has been chosen by CNES to design and supply a ground robotic system for CALLISTO operations ahead and after flight at lift-off pad and landing zone in French Guyana space center.

CALLISTO is the demonstrator of the program of recovery and reuse of space launch system core stage. The robotic system will be used to carry and to connect or disconnect a set of electric harnesses and flexible Hoses including fluidic and electrical supply to CALLISTO vehicle before takeoff and after landing.

The aim is to avoid exposing humans on site and to allow faster repetitive operations.

Several technical challenges are present. The two most important ones are the extreme environmental conditions such as the ground temperature and the short time intervention with high precisions.

The architecture proposed is based on CYBERNETIX experience with similar equipment. It consists in using a mobile carrier equipped with a dexterous arm to ensure the connection/disconnection tasks. The whole system is remotely controlled from a command control station.

The solution is using the implementation of COST equipment such as a BROKK 110 mobile carrier equipped with a STAUBLI TX2-90 electric arm.

The robot will allow to carry the gas lines (nitrogen and helium) and the electrical harnesses (power and data) near to the vehicle connection/disconnection location (before take-off or after landing).

The connectors stored on the carrier will be handled by the arm one by one in remote operation mode to ensure the connection operation. At opposite, the disconnection of all connectors will be done simultaneous by traction via cables connected to connectors. After disconnection, the robot will be evacuated to the rear zone in automatic mode.

The BROKK robot will be equipped with perception means (video) to assist the operator during the movements of the robot as well as for the final phases of connection/disconnection.

Obstacle detection sensors will secure the movements of the mobile machine and thus avoid collisions with the vehicle (especially feet and leg of the vehicle).

An inertial measurement unit (IMU) implanted on the base of the BROKK 110 will allow the proper localization of the robot.

A remote control station located at the control center allows the operator to remotely operate the robot as well as the arm and to acquire all the information from the sensors present on the equipment (gas detection, temperature, obstacle detection, ...). An automatic mode control will be implemented for the evacuation of the robot in safe zone after disconnection.

A challenging project for CYBERNETIX that is only possible to be achieved due to CYBERNETIX know-how on the robotics, automation and dexterous manipulation fields. This program is once again the proof that robots are essential today, thanks to them we can go faster, further, while being better protected.

CALLISTO is supposed to be flown as much as 10 times over a 6 month period. It will be operated in 2024.