WALKING MANIPULATOR

A reconfigurable mobile manipulator for in-orbit-servicing

Overview

The Walking Manipulator (WM) is a product line enabling robotic on-orbit servicing and reconfiguration. Optionally the Walking Manipulator itself is reconfigurable to provide increased reliability and additional functions.

It is designed to support launch loads and is fully compatible with the connect/disconnect product.

WALKING MANIPULATOR

Compared to a fixed or tracked manipulator, a walking manipulator offers a much wider range of motion over a spacecraft with a lower mass and higher reliability, depending on the number of fixation sites.

With a very compact footprint, a WM can move payloads or carry payloads over large distances. With its end effector it can use cameras to inspect and tools to make repairs.

These characteristics also enable cost effective assembly of large structures such as space telescopes..

The modularity of the WM allows maintenance and change out of failed limbs rather than the whole manipulator.

Product Family

The Walking Manipulator is a seven joint symmetrical robotic arm, equipped with standard interconnects as end-effectors. Its joints consist of frameless hollow shaft motors coupled to harmonic drives. The product described in this document deals with the regular (baseline) version of the WM.

However the number of joints can be adapted to user needs, as well as joints power (torque). Likewise limb lengths can be adapted to customer needs.

WALKING MANIPULATOR Specifications

It is ITAR/EAR free.

Dimensions

Max length fully extended: 1,620mm

Maximum reach: 1,200mm

Limbs average diameter: 148.5mm

Mass: 32.5kg (inc. HOTDOCK® end-effectors)

Torque and speed

7 active joints

Joints torque:

- 175Nm (joints 1-3-4-5-7)
- 260Nm (joints 2-6)

Joints maximum rotational speed: 0.15 rad/s

Joints range:

- -175deg to +175deg (joints 1-3-4-5-7)
- -175deg to +45deg (joints 2-6)

Electrical Power

Power consumption: 35W (stationary) to 200W (peak while operating max payload)

Sensors: position, torque, temperature at every joint

APPLICATIONS

- In-orbit servicing
- In-orbit reconfiguration
- Equipment Manipulation
- Equipment traverse
- Inspection and repair

FEATURES

- Fully symmetrical, relocatable arm
- End-effectors equipped with Standard Interconnects
- Highly customizable

SERVICES AVAILABLE

Standard Walking Manipulator product
Product customisation
Training for Walking Manipulator operations
Ground operation of WM

For more information please visit:
https://www.spaceapplications.com/

or contact us:
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OTHER SERVICES

Payload Integration

Operations preparation, planning execution

Astronaut training

Spavcecraft ground segment

Mission / System Simulator

ABOUT SPACE APPLICATIONS SERVICES

Space Applications Services NV/SA is an independent Belgian company founded in 1987, with a subsidiary in Houston, USA.
Our aim is to research and develop innovative systems, solutions and products and provide services to the aerospace and security markets and related industries. Our activities cover manned and unmanned spacecraft, launch/re-entry vehicles, control centres, robotics and a wide range of information systems.

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Payload Handling

GM: 10kg under 1g (without gravity compensation)

FM: 200kg in 0g

Data transfer during manipulation

Spacewire / Ethercat / Can data buses available through the arm (end-effector to end-effector)

Electrical Power Transfer during manipulation

Power transfer through the arm (end-effector to end-effector) possible – tested up to 150W, theoretically up to 1kW.

Thermal Transfer

No thermal transfer provisioned through the arm. Thermal (fluid) transfer through the HOTDOCK® end-effectors, then routed through external pipes can be envisaged (specific study required).

Environmental Characteristics

Temperatures	
Active Config. Passive Config.	-40°C / +70°C -120°C / +180°C
Target Orbits	LEO, GEO,
Life in LEO	7 years Extendable to 15 years

Option 1: Extension to carry a P/L during a traverse using a HOTDOCK® attachment point on the middle joint of the arm. Allows accommodating small payloads / ORU (with dimensions 0.5m x 0.5m x 0.5m

Option 2: double arm + torso solution, aka "MAR": to carry and move payloads along a large structure. Allows accommodating moderate size payloads (with dimensions 1.2m x 1.2m x 1.2m). TRL4 in development for ESA

Customisation

Please contact us for customisation or special applications such as:

- Scale-up or scale-down of the baseline configuration
- Different limbs/joints configuration
- Tool caddy

Operations control work stations

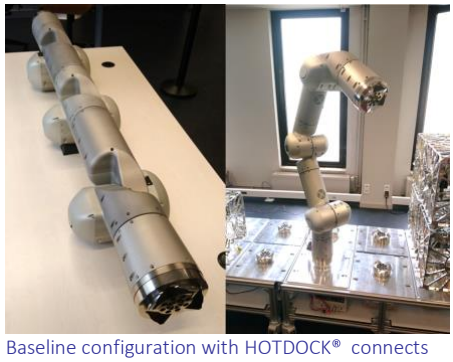
Software deployable on TBD standard computers allowing from ground or on-orbit (IVA) control:

- Prepare, plan and execute operations
- Diagnose faults

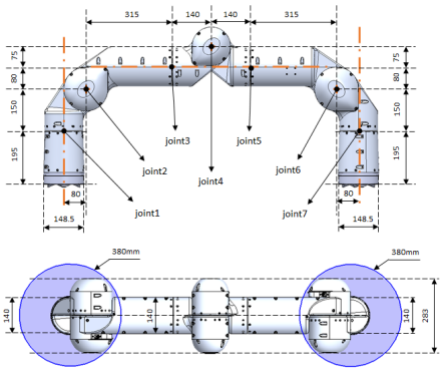
Operations control station options

Anthropomorphic and intuitive arm/hand exoskeleton based operations with/without haptics. TRL5 in development for ESA.

CONFIGURATIONS

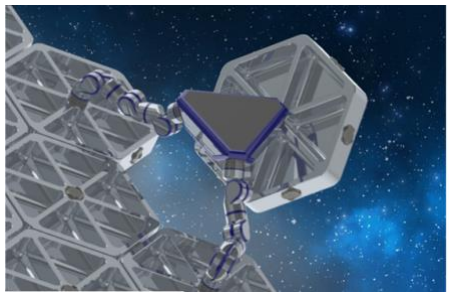


Baseline configuration with HOTDOCK® connects



Baseline dimensions

Option 1: payload attach during traverse



Option 2: dual arm configuration

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