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Ministerstwo Nauki  
i Szkolnictwa Wyższego

# Program Europejskiej Agencji Kosmicznej E3P i szanse udziału dla polskich podmiotów zaangażowanych w robotykę

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*Spotkanie branżowe na temat europejskich programów w obszarze  
robotyki kosmicznej  
19 września 2019 r. Polska Agencja Kosmiczna oddział w Warszawie*

## 01 \ Struktura E3P 2.

1. Humans in Low Earth Orbit
2. Humans beyond LEO + ExPeRT
3. Lunar robotic exploration + SciSpacE
4. Mars robotic exploration

- SciSpace:**
- Science support and utilisation of the acquired resources for ISS, Lunar Gateway, and access to ground-based research platforms; science data archiving
  - Payloads development and launch for ISS
  - Science support to Lunar and Mars robotic missions
  - Development of science payloads for operation on the Gateway

**Humans in LEO (Cornerstone 1)**

- European elements operation, maintenance, and evolution; technology demonstrations
- ISS resources management; CSOC obligations
- Regular ESA astronaut flight opportunities
- Support to commercial utilisation

**Mars robotic exploration (Cornerstone 4)**

- ExoMars 2020 mission: Phase E/F
- ExoMars 2016 and 2020 extension until 2023
- Earth Return Orbiter: start of Phase B2/C/D
- Sample Fetch Rover: start of Phase B2/C/D
- Sample Transfer Arm: start of Phase B2/C/D

**Humans beyond LEO (Cornerstone 2)**

- European Service Modules: ESM2 completion; ESM3/4 procurement ; 5/6 schedule protection
- I-HAB and ESPRIT: start of Phase B2/C/D
- Cis-lunar transfer vehicle (CLTV) Phase A/B1/B2
- Preparation of Lunar Gateway operations support

**Lunar robotic exploration (Cornerstone 3)**

- Science and technology payloads on missions of opportunity (e.g. Phase D2/E/F of PILOT / PROSPECT)
- European large logistics lander (EL3) Phase A/B1/B2
- Commercial lunar products and services (e.g. comsat)
- Space resources: ISRU payload Phase B1/B2

- ExPeRT:**
- Development of future exploration scenarios and system studies
  - Corresponding enabling technologies studies: propulsion, energy, robotics and artificial intelligence, guidance, navigation and control, advanced life support, in space manufacturing, ISRU, radiation, communication...
  - Support and expand Spaceships initiatives

**02/** Podział środków przy założeniu, że budżet na E3P2 wyniesie 1980 M EUR (do 2026 r.)

<b>Programme activities</b>	
SciSpaceE	9%
CS#1: "Humans in LEO"	36%
CS#2: "Humans beyond LEO"	16%
CS#3: "Lunar Robotic exploration"	8%
CS#4: "Mars Robotic exploration"	27%
ExPeRT	4%
<b>Grand TOTAL</b>	<b>100%</b>

## 03/ ExPeRT.

ExPeRT	
For some occasions ExPeRT has been used as "GSTP extension"	Avoid "a-la carte" activities to ensure integrated and coherent approach which will enable the development of ESA future missions together with its related critical technology.

*Lessons learnt and actions from E3P2*

## 03/ ExPeRT.

### Mission Concepts for robotic exploration

- Moon Robotics
- Mars Robotics
- Small Vehicles

### Mission Concepts for Human exploration

- Deeper Space Vehicles
- Surface Habitat
- Crew mobility

### Mission Studies for robotic exploration

- European Large Logistic Lander
- Lunar Communication and Navigation
- Mars Robotics mission studies

### Mission Study in support to Human exploration

ExPeRT sub-Element	%	(M€)
Mission Studies	25	20
Technologies	65	52
Spaceship Initiatives	5	4
International collaboration/collaboration with emerging countries	5	4

*Table 2: Indicative ExPeRT budget for E3P Period 2*

## 03/ ExPeRT.

### Enabling technologies for future exploration missions

#### Technology areas list

Propulsion

Novel energy systems

**Robotics**

Artificial Intelligence

Advanced life support solutions

In space manufacturing

Space Resources/ISRU

Radiation protection

Communications

**Subsurface sampling/deep drilling**

#### Spaceship EAC and Spaceship ECSAT

ExPeRT sub-Element	%	(M€)
Mission Studies	25	20
Technologies	65	52
Spaceship Initiatives	5	4
International collaboration/collaboration with emerging countries	5	4

*Table 2: Indicative ExPeRT budget for E3P Period 2*

## 04/ Harmonogram E3P.

Cornerstone activities		2020	2021-2022	2023-2025
CS#1	ISS	Continuity	Investment	Continuity
CS#2	ESMs	ESM3	Batch A	Batch B
	Gateway elements	Phase B2	Phase C/D	Phase C/D/E
	Cis-lunar Transfer Vehicle	Phase A/B1	Phase B2	Phase C/D
CS#3	Opportunities	Phase A/B/C/D	Phases A/B/C/D	Phases A/B/C/D
	European Large Logistics Lander	Phase A/B1	Phase B2	Phase C/D
CS#4	ExoMars	Phase D/E	Phase E/F	---
	MSR	Phase B2	Phase C/D	Phase C/D

### MSR (udział ESA)

- Earth Return Orbiter (ERO)
- Sample Fetch Rover (SFR)
- Sample Transfer Arm (STA)

Timeline of development in each cornerstone; development risks are spread over the 3 years of E3P2 and beyond



## 05/ E3P Period 1 - wykonawcy

Gateway Science	C	TBD	TBD
Lunar Surface Science	OC/DN	TBD/Open University/INFIN-LNF	TBD/UK/IT
Parabolic Flights	DN/CCN	NOVSPACE	FR
Luna Resources			
Pilot	DN	ADS-D	DE
Prospect	DN	LEONARDO	IT
ExoMars			
PRIME - 2018 MISSION	DN	TAS-I	IT
ROVER VEHICLE LEAD	DN	ADS UK	UK
OHB - CARRIER MODULE LEAD	DN	OHB	DE
DM PARACHUTE ASSEMBLY SYSTEM	DN	TAS-F	FR
Mission Management Software Instruments Layer	DN	SCISYS	UK
EXPERT			
STABLE	OC Parallel Contract	LEONARDO/OHB	IT/DE
MSR SAMPLE FETCH ROVER	OC Parallel Contract	ADS-UK/TAS-I	UK/IT
MSR Orbiter (ERO)	OC Parallel Contract	TAS-I/ADS-F	IT/F
HERACLES	OC Parallel Contract	ADS-D/TAS-I	DE/IT
ISRU	OC Parallel Contract	SASB/OHB	BE/DE
MELISSA PILOT PLANT	DN	Univ. Barcelona	ES
MELISSA Foundation	DN	MELISSA Foundation	BE
MELISSA: HIGHER PLANT COMPARTMENT	DN	ENGINSOFT	IT
MELISSA: Bio-Rat	DN	RUAG	CH
LOW-EROSION 20KW HALL EFFECT THRUSTER (HET)	OC	SITAEI	IT
Autonomous Navigation SW for Rover	DN	ADS-UK/TAS-I	UK/IT



DZIĘKUJĘ ZA UWAGĘ.