مـــــركز محمـد بن راشـد
للـــــــــفضـــــــاء

MOHAMMED BIN RASHID SPACE CENTRE

The Arab world's first mission to explore Mars

Program Objectives

- Program goals announced by UAE's Government on 16 July 2014:
  - Complete Mars orbiter insertion by the UAE's 50th anniversary in 2021
  - Contribute to the development of the Science and Technology Sector in the UAE
  - Develop UAE Scientific Capabilities
  - Increase UAE's Contribution to the Scientific Community

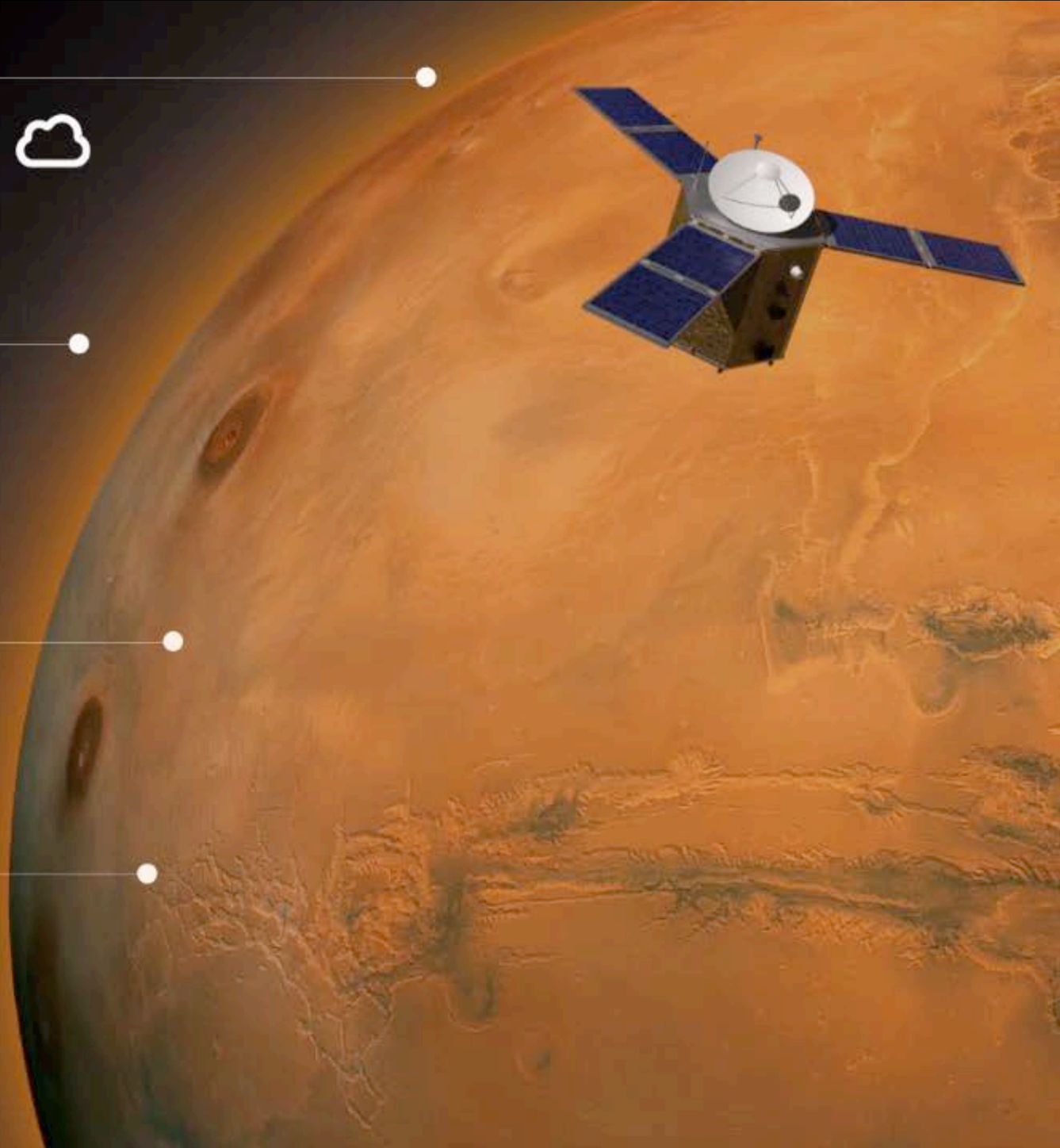
- Program Requirements
  - The mission should be unique, and should aim for significant discoveries.
  - The mission should have impactful contributions to the ongoing work of the global space science community, and should be of a great value to humanity.
  - The mission should help build a sustainable outer space exploration program in UAE.
  - The mission should include valuable contribution from UAE engineers and scientists.

Measure the weather on Mars

Study impact of changes in the lower atmospher on the upper atmosphere

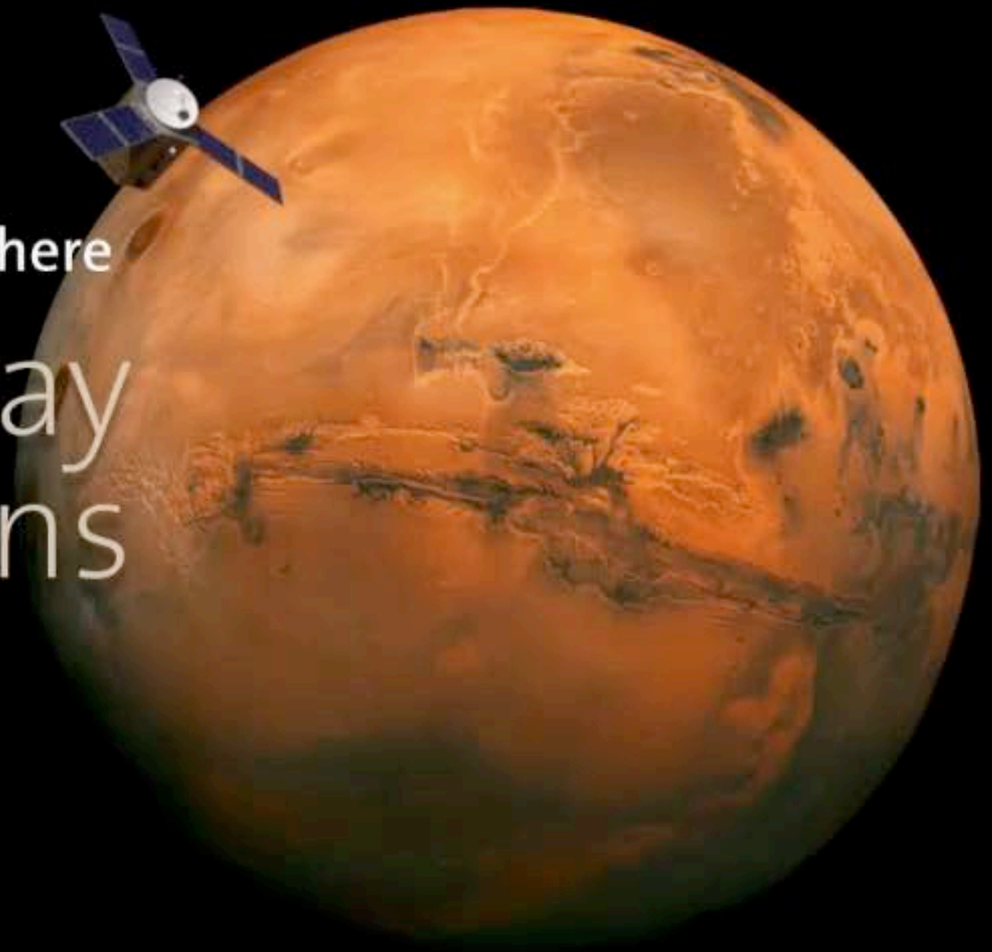
Study the erosion of the Martian atmopshere

Study seasonal climate cycles



We will study the Martian atmosphere

24 hours a day
Through all seasons

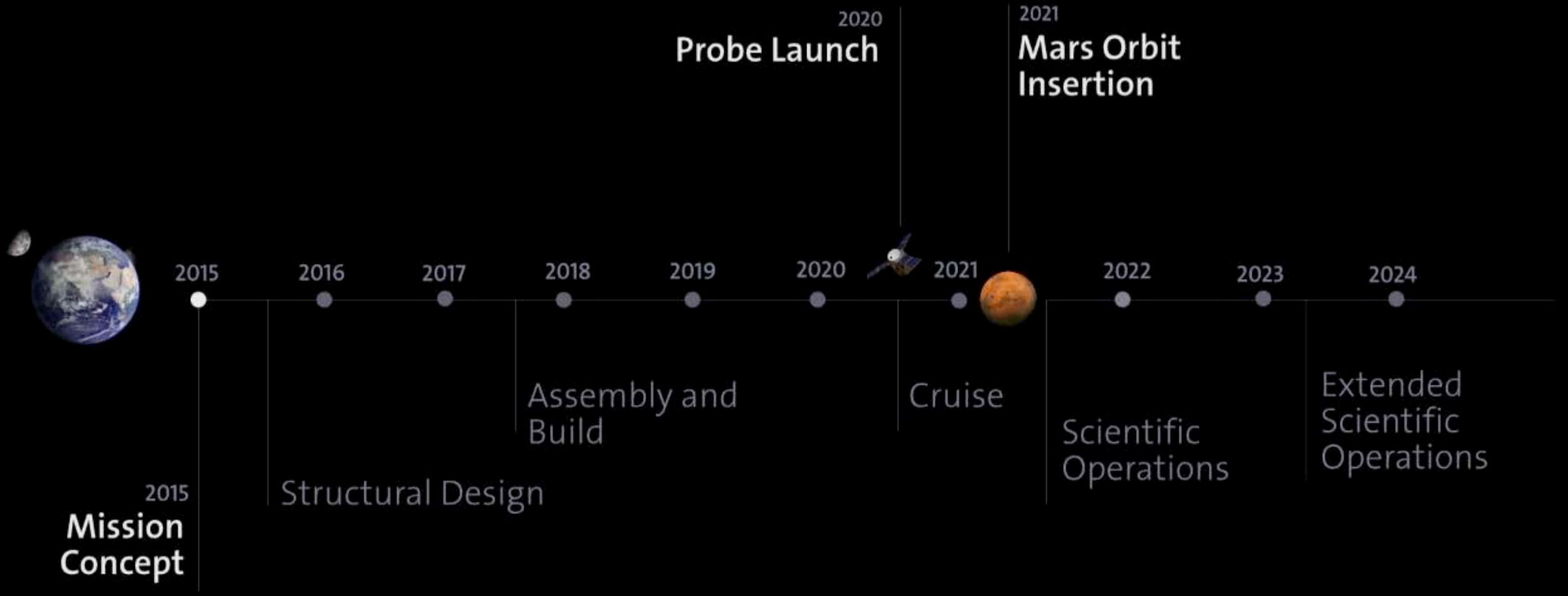


Academic Partners

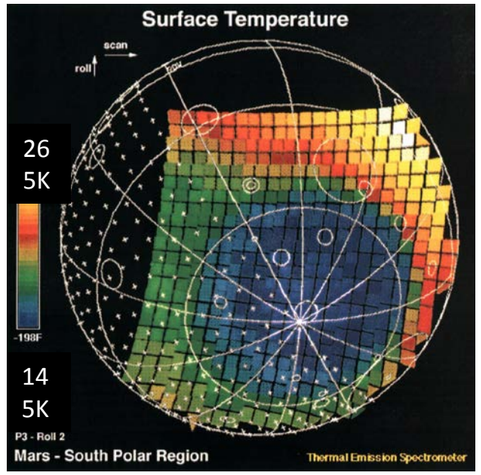
Partnerships to share knowledge

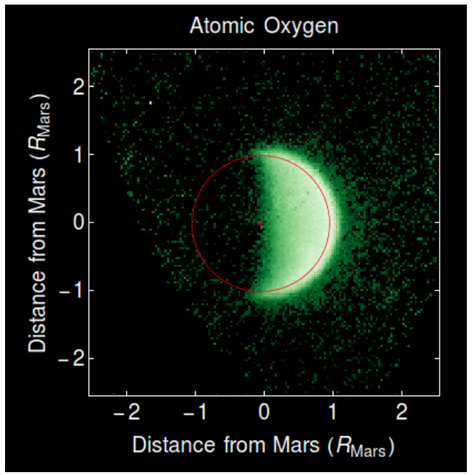

1000 GB of new
data about Mars

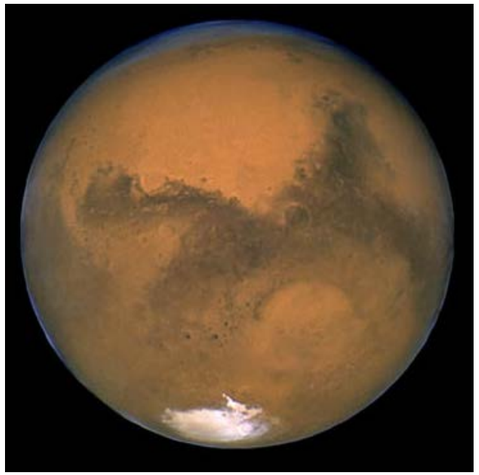
Scientific contribution to the development of knowledge about the Martian atmosphere


2020
Probe Launch
2021
Mars Orbit Insertion
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2015
Mission Concept
Structural Design
Assembly and Build
Cruise
Scientific Operations
Extended Scientific Operations

EMM Instruments





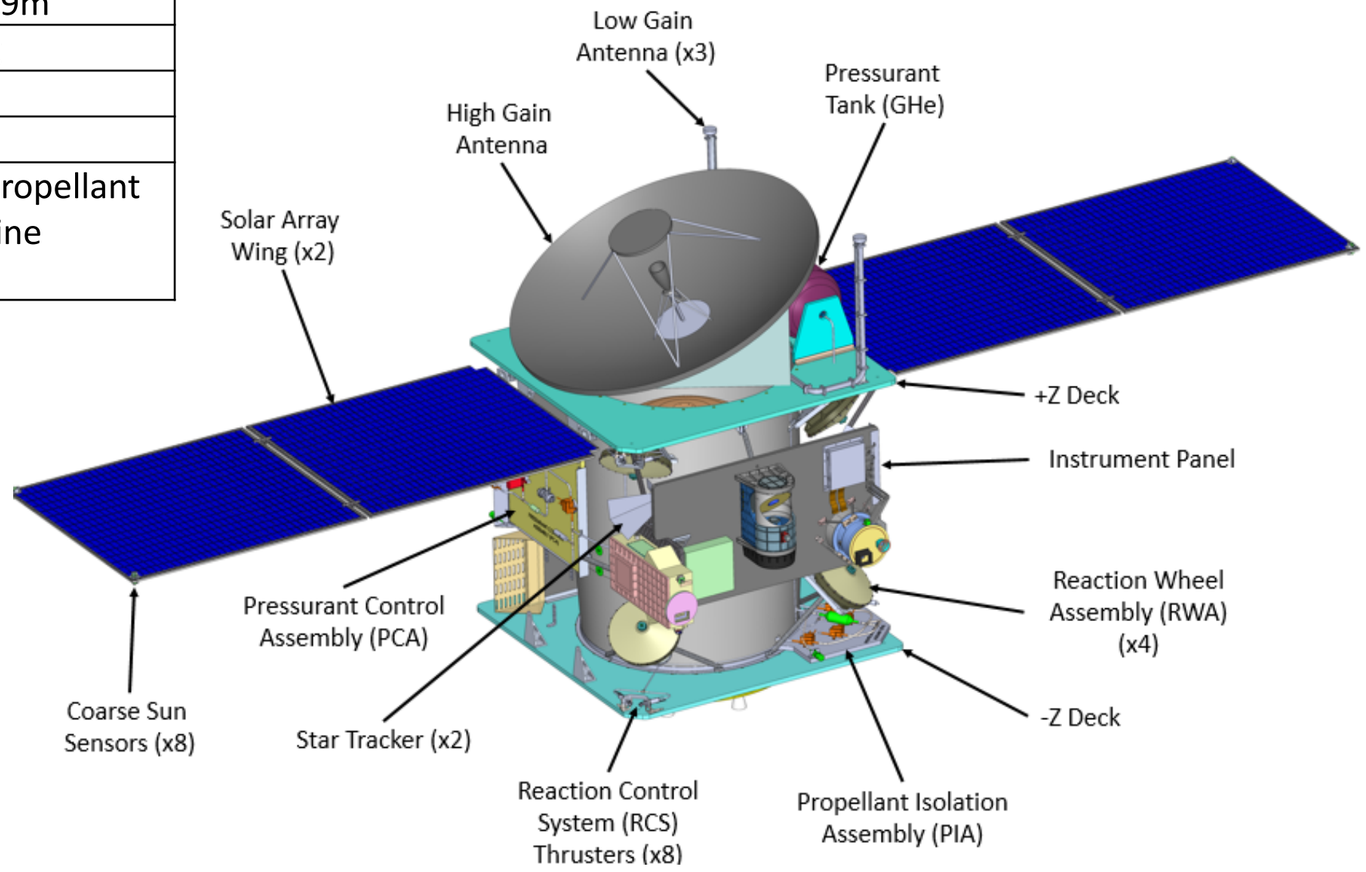


EMIRS (ASU/MBRSC)	**EMUS (LASP/MBRSC)**	**EXI (LASP/MBRSC)**
Fourier Transform IR Spectrometer	Ultra Violet Imaging Spectrometer	Imager with 12 MP camera with 6 bandpass filters (VIS/UV)

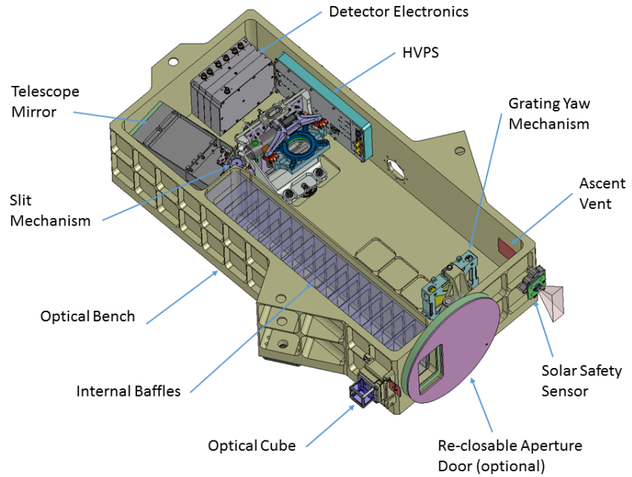
Spacecraft – Hope Probe

- Spacecraft Design is Low Mass and High Heritage

Technical Specifications	
S/C Dimension	3m x 7.9m
Wet Mass	1500kg
RF Band	X Band
Power Requirement	477 W
Propulsion Type	Monopropellant Hydrazine System



EMUS



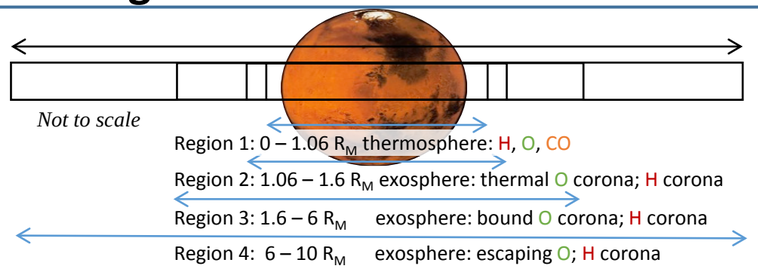
Instrument Description

- Far ultraviolet imaging spectrograph that will characterize the escape of hydrogen and oxygen from Mars and the state of the Mars Thermosphere.
- It consists of a single telescope mirror feeding a Rowland circle imaging spectrograph with a photon-counting and locating detector.
- The EMUS spatial resolution of less than 300km on the disk is sufficient to characterize spatial variability in the Martian thermosphere (100-200 km altitude) and exosphere (>200 km altitude).

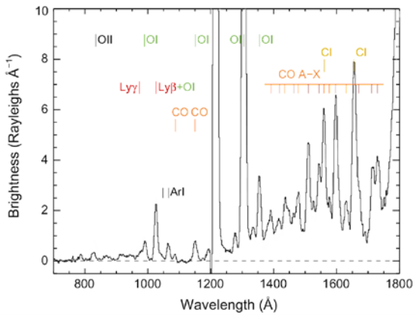
Instrument Specifications

Specification	
Field of view	(0.18°, 0.25°, 0.7°) × 11.0°
Wavelength range	100 – 170 nm
Spectral resolution	1.3, 1.8, 5 nm
Spatial resolution with narrow slit	0.14° × 0.20°
Detector photocathode	CsI

Science Targets

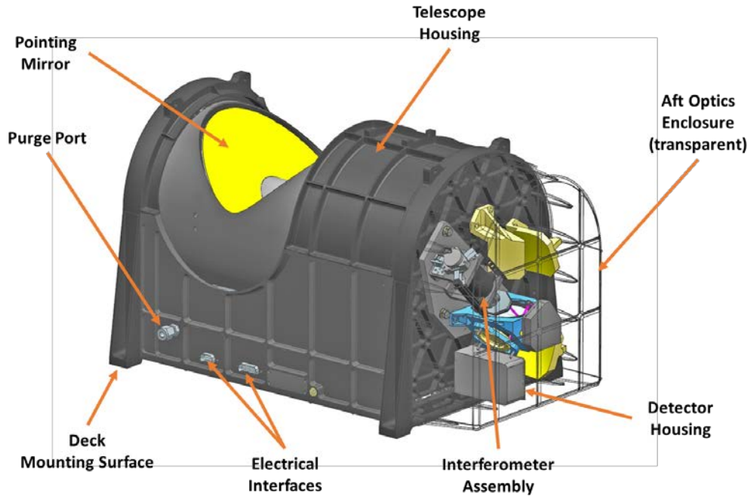


Targets	Wavelength
H	102.6, 121.6 nm
O	130.4, 135.6 nm
CO 4PG	140-170 nm



FUV spectrum of Mars
[Feldman. Icarus 214.2 (2011): 394-399]

EMIRS



Instrument Description

- EMIRS is the 5th generation ASU built FTIR spectrometer with OTES, Mini-TES (2x), MGS-TES and MO-TES heritage
  - Simple, FTIR spectrometer w/ pointing mirror
  - Acquires 9 interferograms every 4 seconds
  - Space and internal blackbody provide 1.5% absolute calibration
  - Electronics compress and packetize science and housekeeping data

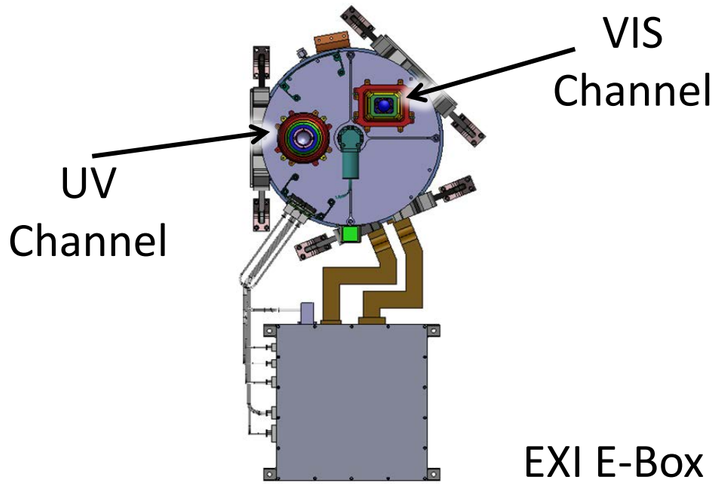
Instrument Specifications

Specification	
Instantaneous Field of view	6 mrad
Spectral Resolution	5 cm-1
Spectral Range	6-40+ µm
Spatial Resolution	<300 km resolution
Observation Capability	Observe ½ of Mars within ½ hour of observing ~60 observations per week (~20/orbit)

Science Targets

Measurement Required	Science Need
Relative radiance of dust absorption bands	To characterize dust.
Relative radiance of ice absorption bands	To characterize water ice clouds.
Relative radiance of H_2O vapor absorption bands	To track the Martian water cycle.
Absolute radiance of CO_2 absorption band	Track the thermal state of the Martian atmosphere.
Radiance at 1300 cm^{-1}	Boundary condition for the lower atmosphere.

EXI



Instrument Description

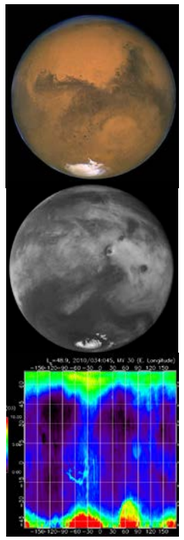
- 12 Mpix CMOS Imager with re-closeable door and filter wheel
- 6 filter band-passes
  - UV1: 220±5 nm CW, ≤30 nm FWHM
  - UV2: 260±5 nm CW, ≤30 nm FWHM
  - UV3: 320±5 nm CW, ≤30 nm FWHM
  - Blue: 437±5 nm CW, ≤20 nm FWHM
  - Green: 546±5 nm CW, ≤20 nm FWHM
  - Red: 635±5 nm CW, ≤20 nm FWHM

Instrument Specifications

Specification	UV	VIS
Focal Plane Format	12.6 MP 4:3 format 4096x3072 @5.5 um	
Technology	CMOS	
Dynamic Range	12-bit, 13,500 e full well	
Lens System	48 mm, f/3.6	51 mm, f/4.25
Field of View	19.0°	25.8° by 19.2°
Pixel Angular View	23 arcsec per pixel	22 arcsec per pixel
Plate Scale	0.85 mm/°	0.9 mm/°
Distortion @9.35°	+6%	-2%
Ground coverage at apoapsis and priapsis	Full Disk	
Ground resolution at apoapsis / priapsis	4.9 /2.3 km per pixel	4.6 / 2.2 km per pixel
Filter Spectral Bands	UV1: 205-235 nm UV2: 245-275 nm UV3: 305-335nm	Blue: 427-447 nm Green: 536-556 nm Red: 625-645 nm

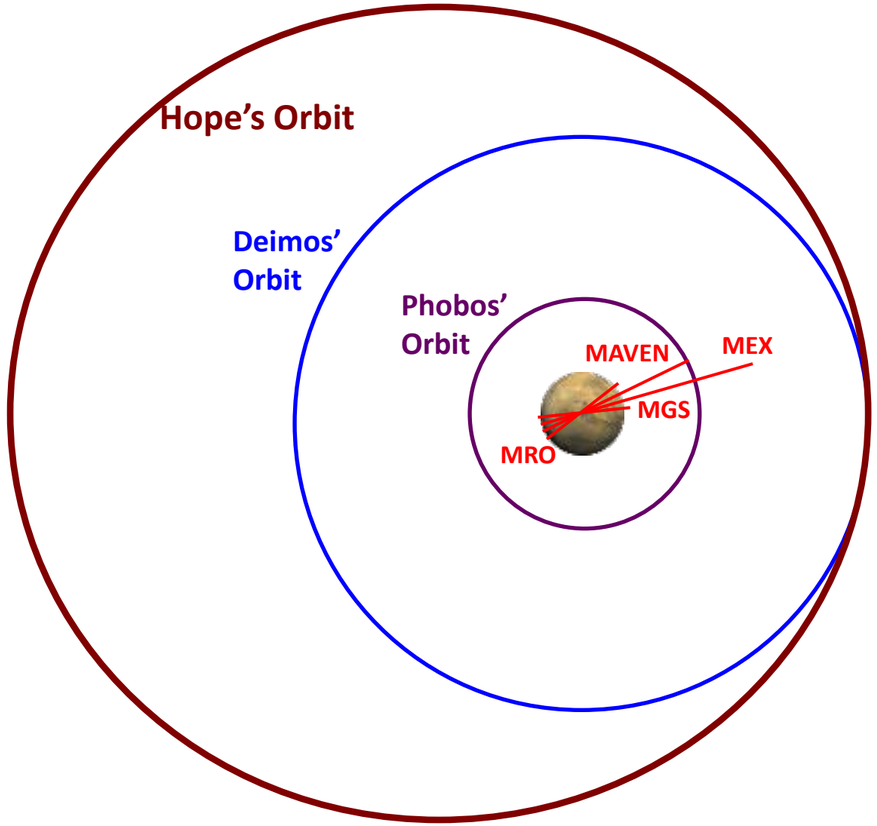
Science Targets

Science Product	Spatial Resolution	Image Wavelengths
Dust Column-integrated optical Depth	≤ 10 km	220 and 635 nm
Water Ice cloud Column- integrated optical depth	≤ 10 km	320 nm
Ozone Column-integrated abundance	≤ 10 km	260 nm
Color images of Mars	≤ 10 km	437, 546, and 635 nm



Science Orbit

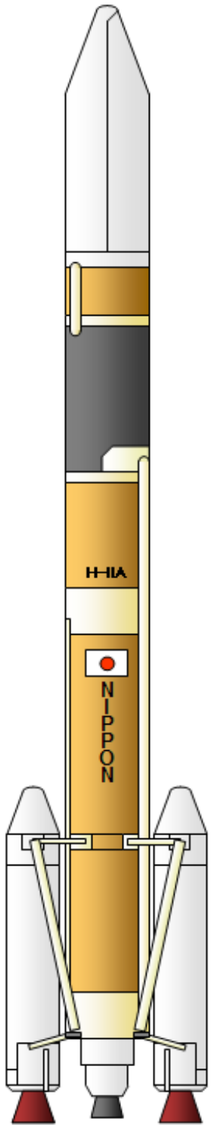
- EMM's target orbit is exciting! No spacecraft has flown an orbit like it. Further, it is low-risk, simple to fly, and produces excellent opportunities to collect EMM's science.



Key Features:

- Periapse altitude: 20,000 km
- Apoapse altitude: 43,000 km
- Orbital period: 55 hours
  3 orbits per week
  ~2.24 sols
- Inclination: 25 deg
- Periapse placed near equator:
  AOP: 177 deg
- Primary science collection
  starts ~May 2021

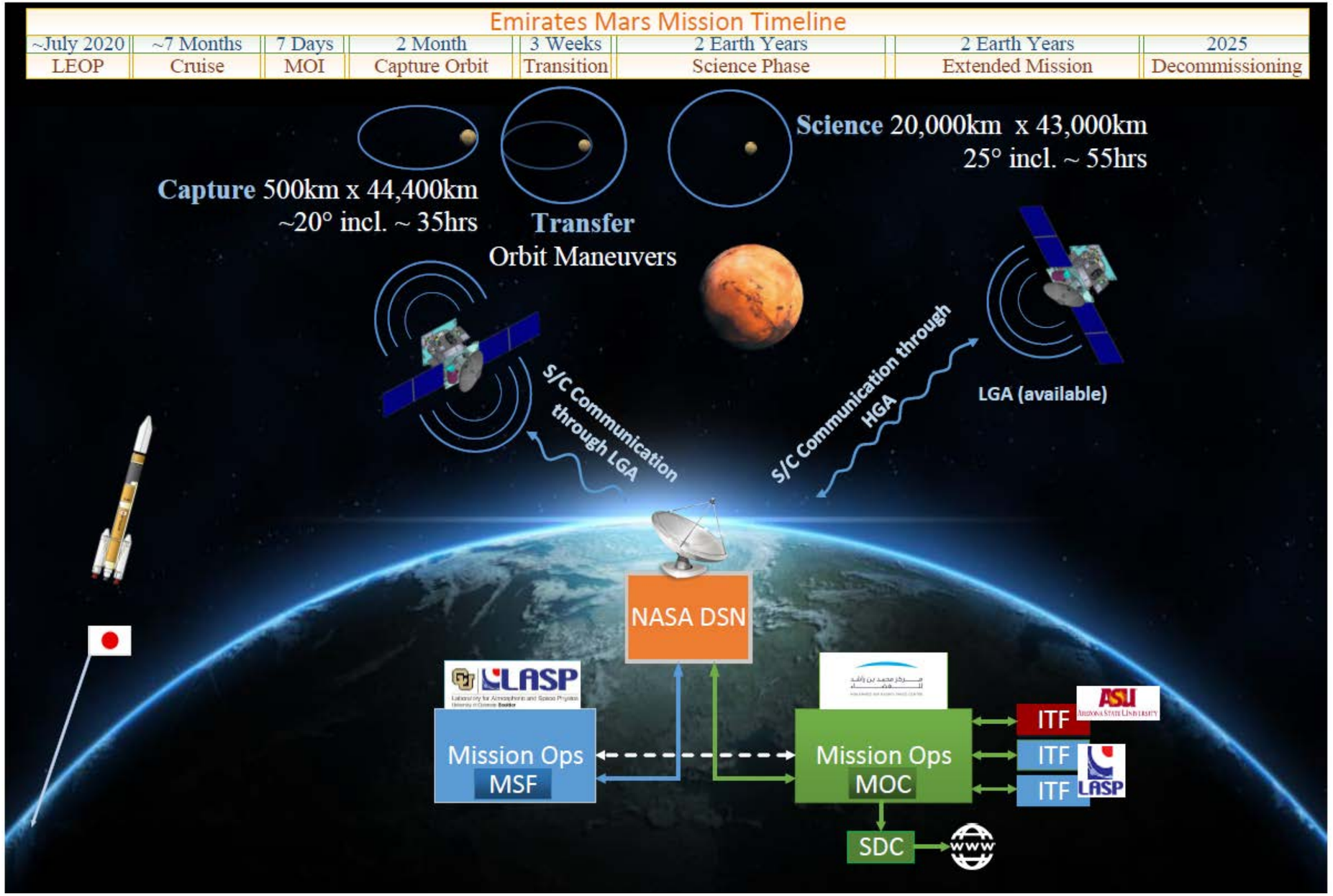
EMM Launch Segment



- Mitsubishi Heavy Industries, LTD (MHI) H-IIA launch vehicle
- Tanegashima Space Center, Yoshinobu Launch Complex

Launch scheduled for summer 2020

Mission Architecture Diagram

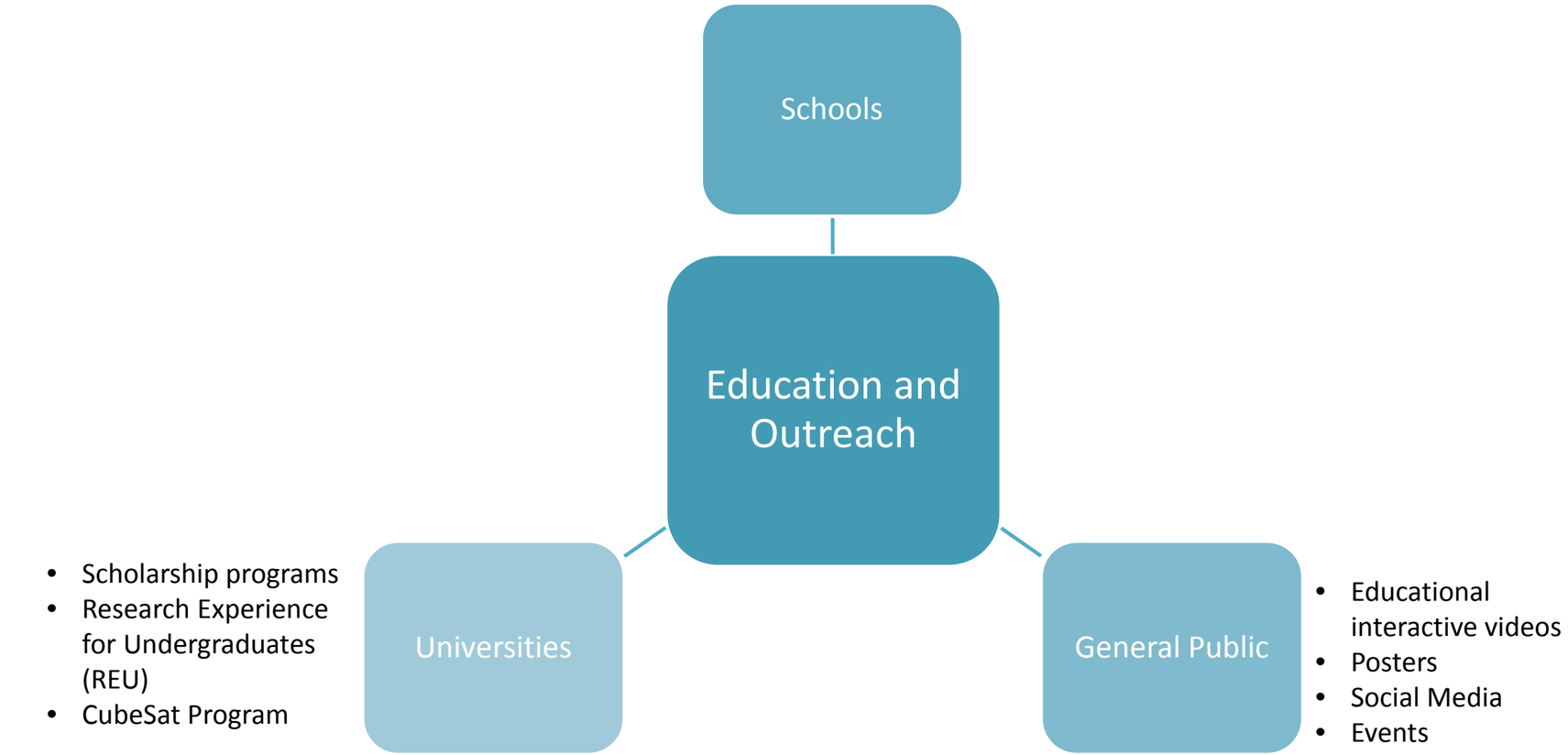


Educational objectives of the Mission

Objectives:

- Promote space science education in the UAE
- Build capabilities in STEM fields
- Increase awareness
- Enable educators and teachers to get involved in the mission

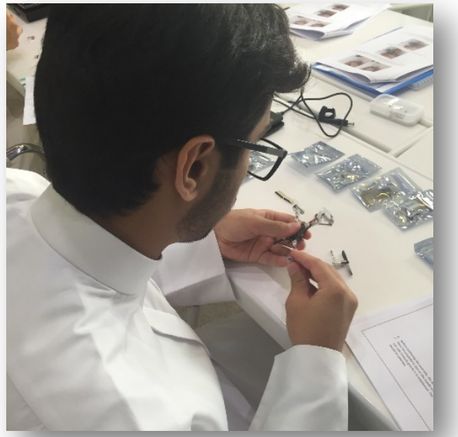
Target Segments



- Scholarship programs
- Research Experience for Undergraduates (REU)
- CubeSat Program

- Educational interactive videos
- Posters
- Social Media
- Events

School initiatives



- Curriculum
- Teachers Workshops
- Space Camp
- CanSat Program

→ Teachers Ambassador Program

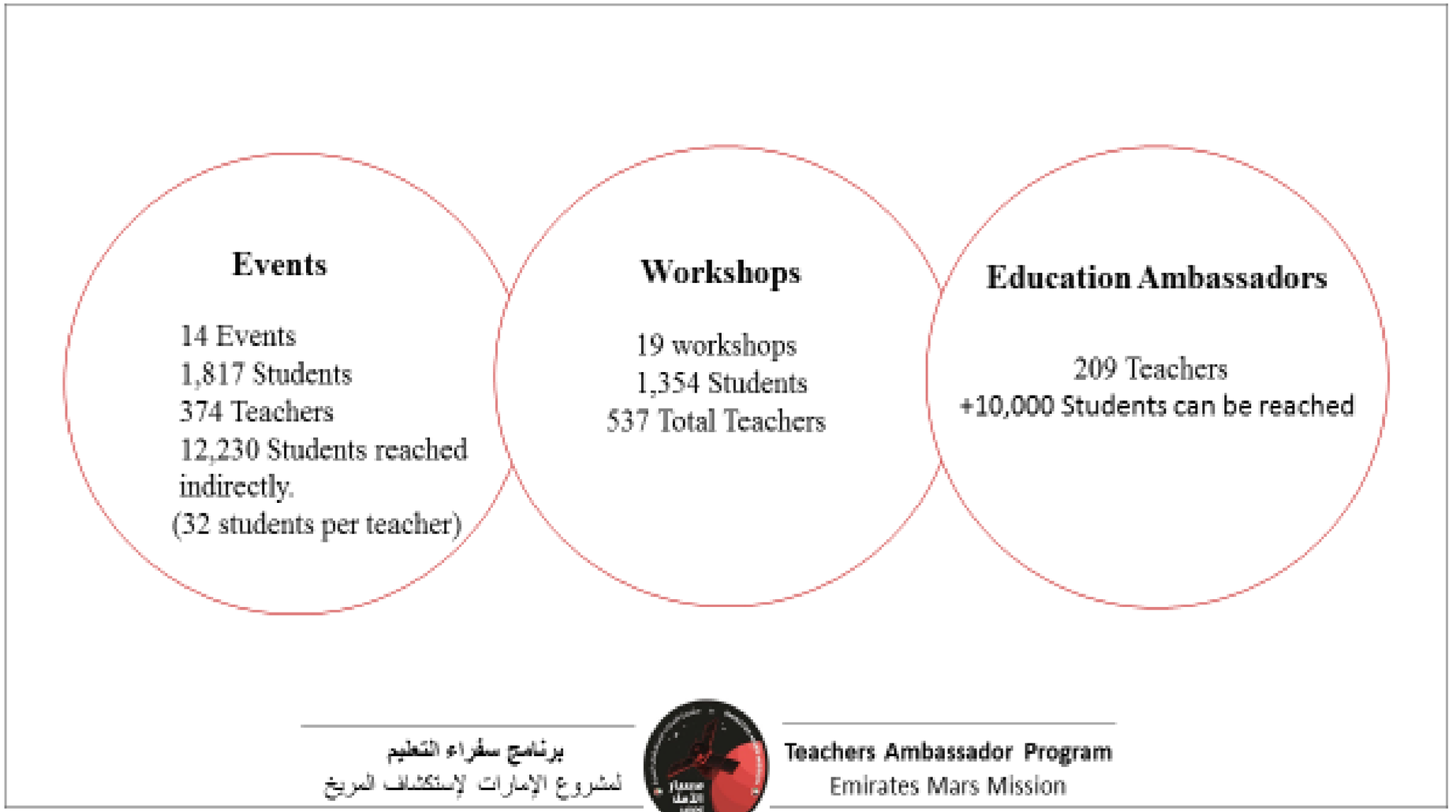
Teachers Ambassador Program

Program Objectives:

- Create a dynamic community for STEM teachers to represent their schools at EMM educational initiatives.
- Enable and equip ambassador teachers with the knowledge and material required to educate the next generations of scientists and engineers.

Roles of the Ambassador

- Communicate with other teachers about Space science and EMM
- Implement some of the activities in schools


Events
14 Events
1,817 Students
374 Teachers
12,230 Students reached indirectly.
(32 students per teacher)
Workshops
19 workshops
1,354 Students
537 Total Teachers
Education Ambassadors
209 Teachers
+10,000 Students can be reached
برنامج سفراء التعليم
لمشروع الإمارات لإستكشاف المريخ
Teachers Ambassador Program
Emirates Mars Mission

Emirates Mars Mission [Hope Probe]