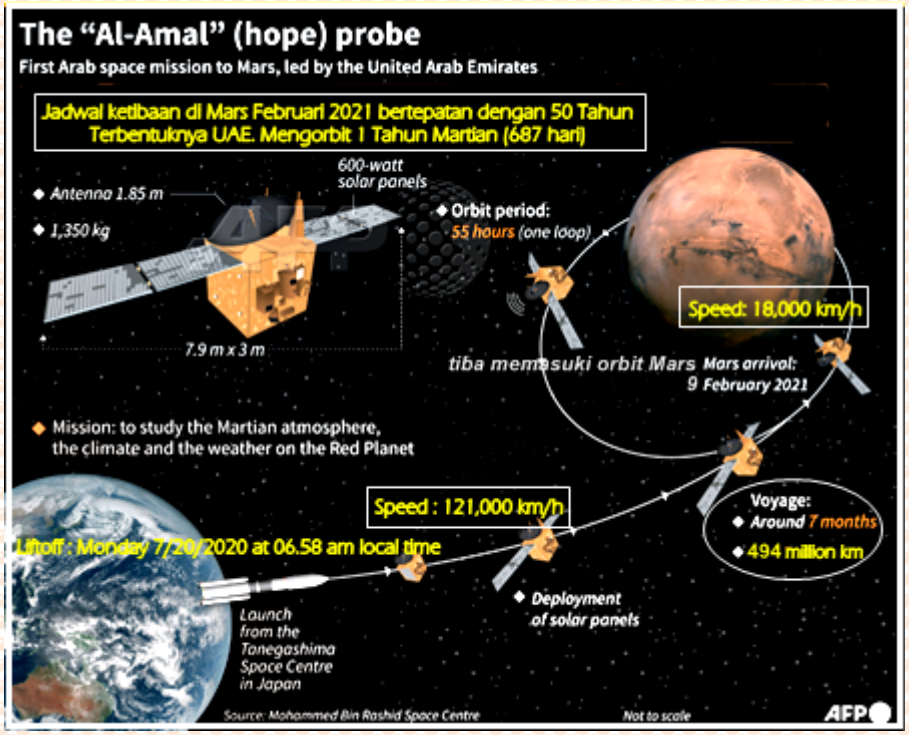
Arabs Tiba di Martian

United Arab Emirates Space Agency (Badan Ruang Angkasa UEA) dan the Mohammed bin Rashid Space Center telah melakukan kerjasama dengan Mitsubishi Heavy Industries dan Badan Ruang Angkasa Jepang untuk meluncurkan probe spacecraft ke Mars. Peluncuran spacecraft ini merupakan buatannya yang pertama, yang diberi nama "Hope" atau dalam bahasa Arab, Al-Amal. Al-Amal diluncurkan dari Tanegashima Island, Jepang, Senin, 20 Juli 2020 (setelah 2 kali ditunda sejak 15/7/2020). Program jangka panjang badan ruang angkasa dari UEA tersebut, adalah program negara Arab yang mempunyai 3 tujuan utama yaitu, mempelajari cuaca seluruh permukaan Mars dan pengaruh hidrogen dan oksigen dalam hubungannya dengan perubahan cuaca serta struktur dan variabel hidrogen dan oksigen di planet Mars. Proyek program pembuatan dan peluncuran probe (spacecraft) ke Mars dari UEA yang bernilai $ US200 juta ini adalah yang pertama kali dan uniknya, di bawah “komando” seorang wanita, yaitu Ms. Sarah al Amiri (34), sebagai head of science operation dan deputy project manager dari Emirates Mars Mission. Sarah al Amiri adalah Emirati Minister of State for Advanced Sciences.

Setelah melakukan “penerbangan” selama 7 bulan, yang dimulai sejak peluncurannya pada 20 Juli 2020, kini, sampailah probe Al-Amal di orbit Martian (sebutan lain Mars) pada 9 Februari 2021. Al-Amal “menerbangi” non stop jarak sejauh 494 juta kilometer (307 juta mil). Sedangkan ketika “HOPE” berada di orbit Mars, jarak antara Mars dengan Bumi sedang berada di jarak sejauh 190 juta kilometer. Jarak sejauh ini menjadikan berita “pendaratan” yang dikirimkan oleh Al-Amal baru diterima di Bumi 11 menit kemudian. Lamanya waktu penerimaan 11 menit itu menjadikan, kejadian yang dialami “HOPE” di saat kritis memasuki orbit Mars tidak bisa dikendalikan dengan segera oleh stasiun pengendali di MBRSC di Bumi. Oleh sebab itu di segmen kritis 27 menit, “HOPE” sendiri yang akan mengendalikan secara otomotis. Hanya ada 2 kemungkinannya dalam proses entry dan landing, dikendalikan secara otomatis dan berhasil, atau dikendalikan secara otomatis, namun gagal tanpa bisa di”back-up” segera oleh MBRSC.



Alhamdulillah, pada segmen tersebut, ”HOPE” berhasil memasuki orbit Mars dengan sukses, setelah “terbang” selama 7 bulan terus menerus tanpa henti dengan kecepatan 121.000km/h (75.000mil/h). Di saat memasuki atmosfer Martian, sebutan lain Mars, Al-Amal mengurangi kecepatanya menjadi 18.000km/h (11.200mph). Untuk mengurangi kecepatan itu diperlukan “pengereman” dengan menghidupkan (burn) roket dengan kekuatan daya dorong 6 x 120-Newton thrusters. Proses entry dan landing, adalah momen 27-minute orbit insertion yang tidak bisa di intervensi oleh Pengendali Misi Mohammed bin Rashid Space Center (MBRSC) di Bumi. Momen pembakaran mesin roket untuk pengereman juga termasuk di waktu 27 menit yang kritis bagi probe itu yang dikendalikan secara otomatis. Keberhasilan Al-Amal “melakukan” proses entry dan landing merupakan salah satu indikator kesuksesan misi yang dimulai digagas MBRSC sejak 2014. Al-Amal akan “bertugas” 2 tahun Bumi atau ±1 tahun Mars di Mars (A Mars year is 687 Earth days, 1 tahun Mars = 687 hari di Bumi).

Masuknya “HOPE” ke atmosfer Mars akan mengalami pengaruh gravitasi MARS. Tibanya Al-Amal di Mars yang akan dilanjutkan dengan pendaratan, menjadikan UAE, Arab Country, sebagai negara ke-5 yang sukses mendaratkan probe di Mars setelah Amerika, Rusia, Jepang dan Tiongkok. Hanya ada 2 negara yang berhasil melakukan program “penerbangan” ke Mars di “penerbangan” pertama kalinya dan

berhasil, yaitu NASA, Amerika dan kini UAESA. “HOPE” akhirnya berhasil merasakan gaya tasi yang baru, bukan gravitasi Bumi tempat di mana dia berasal. Inilah berita selengkapnya dari NASA SpaceFlight.com

UAE makes history as Al-Amal arrives at Mars for two-year mission - NASASpaceFlight.com

by Chris Gebhardt & Tyler Gray

The United Arab Emirates made history Tuesday, 9 February 2021, as they became the first Arab nation and only the second nation in history to succeed in placing a spacecraft into Martian orbit on their very first attempt.

The Al-Amal probe, which translates to “Hope” in English, began its 27-minute Mars Orbit Insertion burn at 15:30 UTC, (10:30 Eastern time in the United States). The burn placed the craft into an initial 40-hour, 1,000 x 49,380 km capture orbit of the Red Planet.

Al-Amal’s 27 minutes of nail-biting deceleration

Much has been made of the Seven Minutes of Terror, when a spacecraft plunges into the Martian atmosphere in a completely automated sequence that results in the craft either reaching the planet’s surface successfully or crash landing minutes before confirmation of what has happened reaches Earth.

But for the teams operating the Emirati Mars Mission, it wasn’t seven minutes of terror. It was 27 Minutes of Terror, the entire time during which Al-Amal’s six 120-Newton thrusters fired to reduce the spacecraft’s relative velocity to Mars by approximately 1,000 meters per second.

And just like the Seven Minutes of Terror entry and landing sequence, this 27-minute orbit insertion process for Al-Amal was completely automated. What’s more, given the approximately 190 million kilometer distance separating Earth from Mars, signals that the Mars Orbit Insertion burn had begun on time took ~11 minutes to transit the distance and be received.

During the entire orbit insertion process, the mission control team at the Mohammed Bin Rashid Space Centre was in monitor mode, unable to intervene or take control if the data indicated something had gone wrong.

Signals from the probe were received through NASA's Deep Space Network; the Madrid site in Spain, including its brand new dish, took up the mantle for primary communications with the craft.

NASA's MAVEN spacecraft also serves as a communications relay for Al-Amal as teams now work to confirm the orbit the probe inserts itself into as well as its overall health and initial science checkouts.

But those 27 minutes of engine firing were crucial, every single one of them, for Al-Amal to be captured into orbit of Mars. An issue with the thrusters or a premature shutdown would have resulted in the probe either missing Mars completely because it didn't slow down enough to be captured by the planet's gravity or entering a less than nominal orbit than intended.

Since its 19 July 2020 liftoff, teams refined Al-Amal's trajectory, allowing it to arrive at a precise target above Mars at the moment the burn is scheduled to begin.

The critical maneuver started on time at 15:30 UTC (10:30 EST), with confirmation of the burn's commencement arriving at Earth roughly 11 minutes later.

The burn completed on time at 15:57 UTC (10:57 EST), with an Earth signal receive time coming at 16:08 UTC (11:08 EST). Slightly more than 400 kg of the 880 kg of fuel onboard the craft was used during the braking maneuver. With a successful burn, Al-Amal entered its preliminary orbit of 1,000 x 49,380 km and will now spend the next three months adjusting itself into its primary, equatorial science orbit of 22,000 x 43,000 km.

However, it should not be misrepresented how difficult placing an object into orbit of Mars is. There is absolutely no room for error, and because of the communication delay, teams on Earth cannot take manual control if there is an issue.

Globally, just more than 50% of all Mars missions fail. To date, only two nations have succeeded in placing a mission at Mars successfully on its very first attempt, that being the Indian Space Research Organisation and their Mars Orbiter Mission in September 2014 and now the United Arab Emirates.

Successful arrival in Mars orbit now marks the start of a scientific mission that is highly important to future human exploration initiatives on Mars.

Al-Amal's mission

Announced in July 2014, the Emirates Mars Mission was built and is operated by the Mohammed Bin Rashid Space Centre in cooperation with the University of Colorado-Boulder, Arizona State University, and the University of California, Berkeley in the United States.

A flight of international cooperation, the mission carries three main objectives, to:

1. understand the climate dynamics and the global weather map of Mars through characterizing the planet's lower atmosphere,
2. explain how weather changes the escape of hydrogen and oxygen through correlating the lower atmosphere conditions with the upper atmosphere,
3. understand the structure and variability of hydrogen and oxygen in the upper atmosphere and why Mars is losing them to space.

Al-Amal undergoing checkouts prior to launch.
(Credit: Mohammed Bin Rashid Space Centre)

In this regard, Al-Amal will be "the first true weather satellite" at Mars and will provide the first complete picture of the Martian atmosphere and its layers.

To achieve its primary scientific goals, the Al-Amal orbiter features three major scientific instruments developed by the Mohammed Bin Rashid Space Centre and partnering universities.

The first of these experiments is the Emirates Mars Infrared Spectrometer, or EMIRS, which was developed by Arizona State University. EMIRS consists of an interferometric thermal infrared spectrometer that will serve to examine and characterize the distribution of ice, water

vapor, and dust in the lower Martian atmosphere, as well as observe temperature patterns. The instrument primarily features a rotating mirror with a spatial resolution of 300 kilometers that can make up to 60 scans of the Martian surface per week.

The second major instrument is the Emirates eXploration Imager, or EXI, which consists of a multi-band camera capable of taking high-resolution images of Mars' surface. Built by engineers at the University of Colorado's Laboratory of Atmospheric and Space Physics, EXI will measure the properties of ice, water, aerosols, dust, and ozone in the Martian atmosphere via a selector wheel-based mechanism with six discrete bandpass filters for spectral imaging (three ultraviolet and three RGB bands).The camera itself carries a spatial resolution of more than 8 kilometers, with a maximum frame-rate of 180 frames per second at full resolution.

Lastly, Al-Amal hosts a far ultraviolet spectrometer, known as the Emirates Mars Ultraviolet Spectrometer (EMUS), which was jointly-developed by the Laboratory of Atmospheric and Space Physics and the Mohammed Bin Rashid Space Centre.The instrument will examine emissions in the 100-170 nanometer wavelength range in order to accurately measure the rate at which gaseous hydrogen and oxygen escape from the Red Planet's atmosphere into space.

EMUS is capable of conducting observations using different spectral resolutions so as to distinguish the emissions of interest from other "bright" emissions and resolve carbon monoxide emissions as well. The spacecraft was built by 150 Emirati and 200 partnering U.S. engineers and scientists, with the majority of construction taking place at the University of Colorado's Laboratory for Atmospheric and Space Physics in Boulder, Colorado.

Al-Amal has a cubical main structure, stands 2.9 meters tall, has a width of 2.37 meters, and has a mass of approximately 1,350 kilograms fully fueled.Power is supplied from two solar arrays generating a potential maximum of 600 watts while communications are enabled via a 1.85 meter high-gain and a smaller low-gain radio antenna that allow up to 1.6 megabits per second (Mbps) of bandwidth. For propulsion and maneuverability, Al-Amal uses six 120-Newton thrusters and eight 5-Newton reaction control system thrusters, both of which burn hydrazine monopropellant. The six 120N engines are responsible for large velocity changes — like the Mars Orbit Insertion — while the eight 5N thrusters perform fine-tuned maneuvers.Star trackers and an onboard reaction wheel system are also used to orient the probe, assisting in pointing the high-gain antenna towards Earth.

The mission is slated to remain operational in Mars orbit for one Martian year or 1,374 Earth days — the length of its primary mission. Like most of the Mars probes that have gone before it, Al-Amal is expected to still be functioning at the end of its primary mission and could potentially receive an extension beyond the current plan.

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Source: NASASpaceFlight.com