

ROBEX – Space Science

2.6 Landing Site Selection for future missions

Landing site selection is part of mission planning. As soon as the payload and rocket type is decided the landing site selection starts. Technical requirements, scientific goals, payload, instruments, and landing site need to fit together for a successful mission.

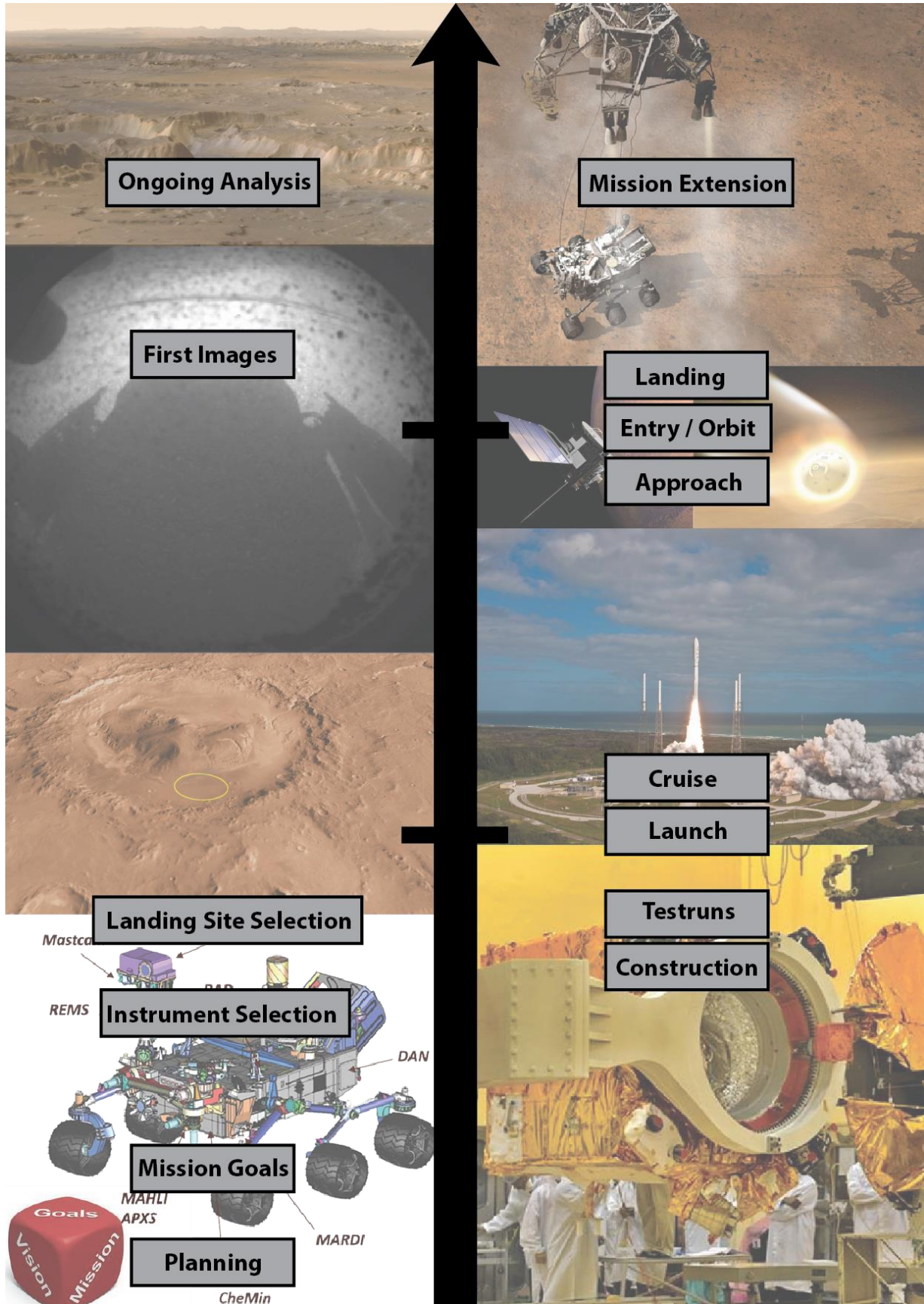
Proposals of landing sites for upcoming planetary missions are often open to the public. The proposals need to fit the goal of the mission and have extensive background research done (e.g. mappings, 3D models, analysis of surface features). A landing site should have multiple coverages of high resolution imagery of various instruments. A detailed analysis of landing site is the foundation of any proposal. The site must fulfill all technical and scientific requirements. This includes landing ellipses, terrain elevation, slopes, and roughness, outcrops, composition, and many more. A committee of researchers will read and rank the proposed landing sites until the best candidate is found. This process can take up to several years!

Mission planning is a long term activity, because planetary missions have incredible long timelines (up to 30 years). How is that possible?

Often researchers work for years on a mission proposal, when the proposal is finally selected more research needs to be done and the proposed instruments need to be built. This process can easily take up to 10 years. When the mission is finally launched it takes several months or even years to travel to the planetary body of interest (Moon: 3 days, Mars: 9 months, Saturn: 7 years). The instruments are working and obtaining the first data after about 15 years (sometimes less, sometimes more) of planning, building, and traveling. Most of the technical challenges are overcome by that time, but the scientific analysis has not even started. Due to the large amount of data that are provided by new missions it takes researchers years to analyse all obtained images.

This is a rough overview about the most important milestones of a mission timeline. The whole timeline can easily take up to 30 years.

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To get an idea about mission timelines check out the following webpages:

- NASA Cassini mission at Saturn: <http://saturn.jpl.nasa.gov/interactive/missiontimeline/>
- NASA Dawn mission: <http://www.jpl.nasa.gov/infographics/infographic.view.php?id=11047>
- NASA MSL mission at Mars: <http://mars.nasa.gov/msl/mission/timeline/>
- General Mission Timeline 1957 till today: <http://nssdc.gsfc.nasa.gov/planetary/chronology.html>

Task:

1. The process of landing site selection.
 - a) Explain which parameters are essential for selecting a landing site in general (technical and scientific).
 - b) List and explain which measurements need to be available at the landing site to classify the planetary surface (at least 6). Which instruments and methods would you use to obtain the needed information?
2. Pick ONE of the following mission papers and study it thoroughly. Sum up the mission goals and discuss the feasibility of the mission, possible problems, challenges, advantages, and disadvantages (700 to 1000 words).
 - a) Balloons by J.A. Jones and J.J. Wu
 - b) Lake Explorer by E.R. Stofan et al.
 - c) Cave Crawler by C. Lange and A. Seeni

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PDF Balloons by J.A. Jones and J.J. Wu, PDF Lake Explorer by E.R. Stofan et al., PDF Cave Crawler by C. Lange and A. Seeni