A Robotic Vision

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Timeline / Budget

TIMELINE

In order to achieve a successful trip to Mars, a few factors must be considered. This timeline will discuss the following three topics:

Launch Date:

I have chosen May 2018 as the most appropriate launch window for my ***Robotics Mission to Mars*** (RMM). Having a launch date several years in the future will hold multiple benefits. For example, the machinery required to launch this mission's payload into Low Earth Orbit (LEO) and then Beyond Earth Orbit (BEO) is not, at this point, a viable technology. The extended time frame will provide NASA an appropriate cycle for development and implementation of the Space Launch System (SLS) necessary for RMM. The engineering and manufacturing of OSV-1 and the companion autonomous Miniature Aerial Vehicles (MAV) will require a significantly less development window; but will require precision coordination and appropriate field testing between OSV-1, the MAV's, and the Ensemble tool set.

RMM will launch from Kennedy Space Center on Wednesday, May 23rd, 2018. The SLS will be launched at an appropriate time that will be determined when the actual launch window date becomes closer. Once the SLS has placed the RMM spacecraft into LEO, the RMM spacecraft will remain in LEO for approximately 48 hours while in preparation for Trans-Mars Injection (TMI) *[1]*. Upon entering TMI, the spacecraft will travel to Mars on a Hohmann Transfer Orbit *[2]* that will take approximately nine (9) Earth months to complete.

Landing Date:

After a brief nine (9) Earth month sojourn through space, the RMM spacecraft will arrive at the prescribed destination; Mars. The approximate travel time will place the RMM spacecraft into Mars orbit sometime in February 2019. Upon arrival the RMM spacecraft will maneuver into geosynchronous orbit around Mars in order to prepare for descent to the Martian planetary surface.

The RMM spacecraft will spend approximately 28 Sols in geosynchronous orbit while calibrations are performed on OSV-1, the MAV's, and Ensemble; these calibrations will be required in order to accommodate the real time functionality between OSV-1, the MAV's and Ensemble. Once parameters set forth by the NASA operations team have been satisfied, descent to the Martian surface will then take place. The RMM spacecraft will release the RMM rover module into the Martian atmosphere with a trajectory that will take it into the Northern Martian Hemisphere. The RMM rover module is set to make surface contact on March 24th, 2019.

Overall Mars Duration:

Once the RMM rover module has made surface contact, the core RMM mission will begin. The initial mission parameters have been set at 180 Sols. The core mission has been designed in such a way that all operations coincide with the Martian seasonal cycle. The core RMM mission will commence as the Martian Spring begins and will continue through completion of the seasonal cycle. Depending on the level of success obtained during the initial 180 sol mission, an extension may be granted based on requirements set forth by the NASA operations team.

Return Launch Date / Return Date

This RMM mission will not have a return launch date or return date. OSV-1 and the MAV's have been designed to collect data points that can be recorded and measured while *in situ*. All data will be composed and stored in a computer mainframe that can be accessed by the NASA operations team while the RMM mission is in full operation. This RMM mission has not been designed to collect samples for return study and will therefore not require a return launch date or return date.

BUDGET

The Budget presented for my ***Robotics Mission to Mars***, will address the following three questions:

How will the mission be funded?

In 2012, the National Budget will distribute $18.7 billion for NASA operations *[3 - page 151]*. The U.S. Government has estimated that NASA will spend $4.3 billion on Space Operations in 2012 *[3 - page 151]*. In 2018 the National Budget will distribute, an estimated, $23.2 billion for NASA operations. From this 2018 National Budget, NASA will spend $5.33 billion on Space Operations. In order to project a 2018 National Budget for NASA, I calculated an estimated future budget allocation utilizing an annual 4.0% rate of inflation over 6 years.

My RMM will carry an estimated cost of $1.35 billion, which will be an estimated 25.3% of the Space Operations funding and 5.8% of the overall 2018 National Budget for NASA operations. All costs can be offset in a number of different ways. For example, NASA may opt to include private sector and / or international partners to help with the funding of the RMM mission; an investment cap of 30%, or $405 million, will be place on funding received from external sources. The remainder of the funding for this RMM mission will then come from the 2018 National Budget.

What is the breakdown of mission funds?

This simplified breakdown of the mission cost will include all items necessary to complete the RMM mission. The following table will include initial Production Cost of each mission item, an estimated Launch Cost where applicable, and the percentage of the estimated $1.35 billion mission budget. All costs listed will be given in millions of U.S. Dollars.

Launch Item	Production Cost	Launch Cost	% of Budget
Space Launch System	$350		25.93%
Fuel Module	$50		3.7%
OSV-1 / MAV	$150	$300	33.34%
RMM Spacecraft	$100	$300	29.63%
RMM Rover Module	$100		7.4%
TOTAL COST	$750	$600	100%

What is the justification for spending these funds?

The justification for this NASA expenditure is quite simple; we need to go to Mars! This mission, and all future Mars missions, is necessary to keep the United States as the global leader in space exploration. Countries such as China and India are knocking on the back door and are poised to take our place. We need to continue to push our technological limitations. Going to Mars is just the thing to provide this much needed motivation.

References

[1] – ***"Getting There"*** – Date: Unknown
Deborah Hutchings, Aerospace Scholars, NCAS and CAS Program Manager
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[2] – ***"Basics of Space Flight"*** – Section 1, Chapter 4: Interplanetary Trajectories – Date: Unknown
Jet Propulsion Laboratory – California Institute of Technology
http://www2.jpl.nasa.gov/basics/bsf4-1.php

[3] – ***"Fiscal Year 2012 Budget of The U.S. Government"*** – February 14, 2011
Office of Management and Budget
http://www.whitehouse.gov/sites/default/files/omb/budget/fy2012/assets/budget.pdf