Asteroid Mining Mission

Do we send a spacecraft or do we “bring” the asteroid nearer earth and then send a smaller spacecraft?

Even if we brought the asteroid to an orbit nearer Earth, in what distance would it be safe to bring it in order to exploit?

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Let’s say we send a bot to the asteroid.Is it possible a swarm of robots to do the job collaborating with each other?These robots would be enough complex.More likely that a “mother spacecraft” gives directions.

– Swarm robots self organize to perform a specific task. That task command its self (eg stop asteroid rotation) is issued by a central controller (moherhship), the movements of each robot in order to achieve a task is collectively decided byt the robots themselves.

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Let’s stick to the scenario that a “mother spacecraft” maps the region at a specific radius around Earth or wherever it orbits to locate asteroids.In that case can asteroid trajectories be tracked?Yes, actually asteroid orbits are known more or less as happens with many space objects at least in our solar system.

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“Mother spacecraft” in orbit around Earth more unlikely.”Mother spacecraft” follows orbit of asteroid is discussed, but then again, there is a limit to one operation at a time.More “members of spacecraft family tree” needed to be considered.

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Consider some asteroids are traced (medium distance between them 966,000km!)

“Mother spacecraft” should be able to “decide” to which robot(s?) should be sent (based on Dr. Elvis equation or other similar equation probably).

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Which bot to send?The idea of swarm of robots is appealing.In swarm of robots “societies” occurs labor division, following the pattern of nature.What still is to be decided (from “mother”) in the end, is how many should be sent to one asteroid.”Mother spacecraft” programmed to “decide” or human intervene?(Generally, where human intervene?)

Ideally no human intervention should be required, the number of each robot type shuld be decided by the system it's self based on asteroid parameters.

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Bot held with some kind of hooks on asteroid surface?Could moons around some asteroids make the mission more difficult – the asteroid more difficult to reach?(!)Could the moons be put in another orbit not so near to the asteroid?Should the asteroid be left unexploited?Cost?

-Larger asteroids is possible to have moons.Certainly, we have excluded small asteroids (< 100m) from possible missions, so orbits of moons around large asteroids should be taken under consideration in the mission scheduling.

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Before sending robots to asteroid to exploit its surface calculations should be made regarding possible obstacles “on the road”.Maybe collision with other asteroids or other near-earth objects.

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Regard mission of sending bots begins successfully.

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Gravity assist to pick up speed followed by a change in trajectory leading to asteroid.

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In most of cases bots should be synchronized with rotation of asteroid aligned with its rotation axis (further investigation!).Questions arise if from that region the asteroid could be fully exploited – to put it more generally to what extend could it be exploited?

-Actually, the mass center of the asteroid is exactly placed on its rotation axis, that means that the largest quantity of its materials is placed on the rotation axis and tunneling near the rotation axis will probably supply us with more material than creating a hole anywhere else on the asteroid.

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Bot with some kind of hooks held on asteroid surface.”One bot working at a time?”First mine water and then metals (if in some asteroid we find both)?First metals, then water (further investigation!)?

-In any case, either mothership should give directions or - more preferably – robots of swarm should be able to “communicate” with each other (machine learning issues).

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Water mining procedure thoughts

-Protection of the electronics of the bot.

-“Vessel” to carry the water (water in compounds actually found on asteroids).

-Size, volume, weight of bot.

-Water processing.

* *Regarding protection of crafts and bots, there are many different ways to consider.Firstly, some kind of shielding of whole or specific part.It should be taken under consideration that the bigger the possible threat, the bigger the shield mass too.Secondly, a kind of active shielding involves sensors that are activated on possible threat approaching.Detection of threat is followed by actions like closing shutters or rotating the spacecraft.*
* *Use of carbon nanotubes could harden electronic components in space.*

Metal mining procedure thoughts

-Protection of robot in general (couldn’t metal mining even destroy it?)

* Tunneling with drill containing hole in the middle in collaboration with vacuum pump or turbine to gather material in “bag”

-“Vessel” to carry compound or pure metal?

* Bag: could be composed from nanotubes and have great resiliency.

-“Cleaning” metal procedures (separation procedures from compound (further investigation – use of earth-used techniques applicable more likely to some extent).

-Use of canopy so as not to produce debris and loose precious material.Use of bag (like vacuum cleaner or something).

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What to send back to Earth?The full mission?The robots operating the specific procedures?The “vessels”?(In last case, necessity for leveled mothership – “grandmother spacecraft” located on Earth(?)”mother robots” miners, etc. ”daughterly vessels” returning to Earth before robots – “return of robots ends mission).

**Random questions that arise**

-Robots and vessels can be reused?How many times each?Then?

Suggestion (without investigation): Recycling (How?)

-Should plant be created on larger asteroid surfaces or useless?(More leveled mothership?! :

“Great grandmother spacecraft” located on Earth  “Grandmother plant” on asteroid  “ Mother robots” operating minings, processing etc.  “Daughterly vessels” carrying the materials.

*Actually, quite utopic.Due to near-zero gravity.Some kind of hook attachment to the asteroid could possibly destroy the asteroid and cause huge amounts of debris.Use of canopy considerable though.*

“The important thing is not to stop questioning. ”( Albert Einstein)