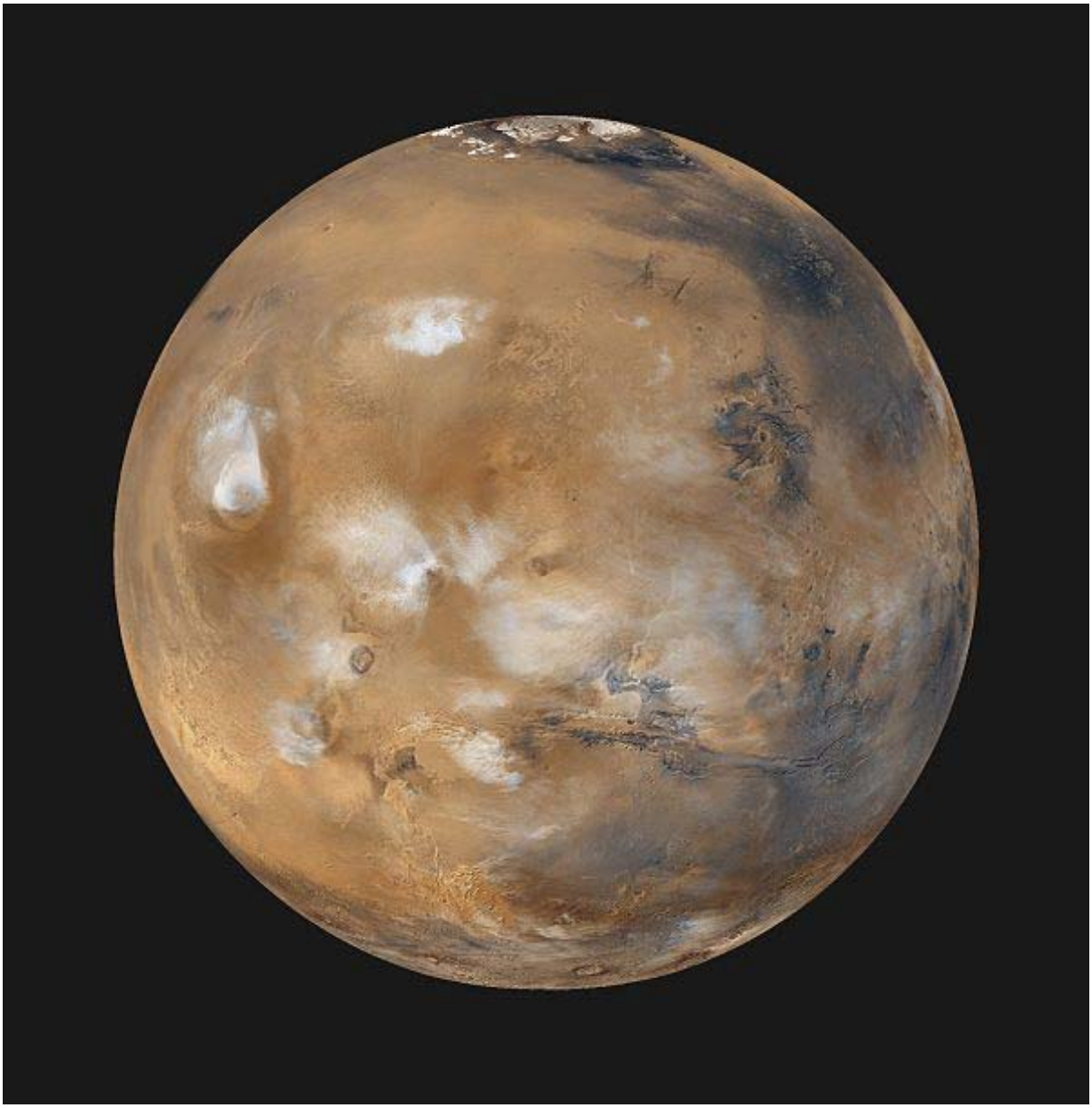

Open debate about the possibilities of a manned trip to Mars

Carlos González Pintado

Introduction

It seems that the idea of a manned trip to Mars has reappeared with unprecedented strength lately. It began with the USA announcement of attempting such a trip during the decade of the 30´s. That announcement triggered others from, not only some countries with the supposed technology and economical power, but also from private enterprises, commercial and investment groups and, probably, a few speculators, all of which have brought the date down to the decade of the 20´s.

The initial question was: Is a manned trip to Mars in the decade of the 30´s feasible? The question now seems to be: Is a manned trip to Mars in the decade of the 20´s feasible?

Obviously, I will not pronounce myself in a sense or another and I leave to the criteria of the reader the conclusions she/he deem appropriate. At the end of this write-up I will express my thoughts on the subject.

I hope you enjoy reading it as much as I´ve enjoyed writing it.

Problems

- **Determine the type of mission.**
- **Crew.**
- **Great economical impact.**
- **Large amount of consumables.**
- **Need for physical exercise.**
- **Radiation.**
- **Space ship dimensions.**
- **Conflicting social relations.**
- **Latency of communications.**

Possible solutions

- **Reduce weight.**
- **Happiness Chip.**
- **Exercise.**
- **Hibernation.**
- **Innovative design.**

Final conclusions

- **Final conclusions**

Problems

- **Determine the type of mission.**

a. One way only trip?

- Crews will be composed of four members. These settlers will increment at a rate of four every two years.
  - ***"With due respect"***. This first option is a nonsense and it doesn´t have a solid base. Moreover, it breaks every safety rule for this type of mission.
  - What is the crew configuration?
    - A pilot/navigator/engineer.
    - A geologist/exobiologist/anthropologist.
    - A MD/orthopedic surgeon/general surgeon.
    - A psychologist/psychiatrist.
    - We did it. We have a crew of super-specialists with expertise in multiple branches of knowledge. So far so good but..... Who substitutes any of them in case of problems?
  - Social problems.
    - How can they survive in such a hostile environment and such reduced quarters for 24 hours/day 7 days/week during the trip, landing, settlement and the two years of waiting for the next crew? (Even in the everyday life of a standard family who love each other, discussions and frictions arise even though they do not stay together constantly). Moreover, the crew must, necessarily, be mixed and that increments the problems. Thanks God they have a psychologist/psychiatrist who, obviously, would diagnose her/himself if the need be. Is this efficient? Would being a man or a woman be important?
    - What type of social/governmental organization will be used? Who will the leader be? Will they have some type of a Constitution or will it be the Dictatorship of the most intelligent and experienced? It seems logical that, in the beginning, the leader be the most suitable but… How and who will she/he be elected?
  - Colonization.
    - Obviously, colonization requires reproduction.
    - Will they assume that their progeny will never be able to travel to Earth?

    - How will they face the problem of genetic diversity? Such a reduced colony will, most probably, produce sickly descendants.
- It would be tedious to enumerate all the contradictions about this option so I´ll let the readers generate their own judgment. As for me, this sounds more like a sci-fi movie (and a bad one to say the least) that something real so I will not consider it.

b. Two way trip but no landing?

- This second option is a contradiction. You just don´t attempt such a long trip to circularize the planet and return to Earth. It is similar to flying to Honolulu and return to your home without leaving the aircraft.
- A trip to our Moon, which is next door compared to Mars, took an incredible amount of people, effort and knowledge and it was finally possible because there were no economical issues and it was a necessity to reestablish the US lost prestige.
- The actual economic situation has changed priorities and, now, technology is not the most important fact. I will get back to this issue later in the write-up.

c. Surface landing and exploration?

- This seems to be the most logical election. As previously mentioned, you don´t go to an unknown destination to remain inside the aircraft and then return home.
- Exploration, study and on-site analysis. This is the way to go. Otherwise, we already have remotely operated robot vehicles that can do this type of job, but real time decisions must be taken by humans.
- This third option is the most reasonable if we take into consideration the necessary economical investment. So, from here on, I will assume this option as the logical one and treat the rest of the essay towards it.

d. Conclusion 1. <u>Surface landing and exploration.</u>

- **Crew.**

  a. **This kind of trip can´t be attempted with a small crew:**

     - The ship must have a landing and survival module which will separate from the parent craft after MOI (Mars Orbit Insertion) and be used to descent the investigators to the surface and serve as quarters for them while in the planet. Obviously, this module must be fairly large and with plenty of consumables as it will be the home for several astronauts for a fairly amount of time. This means for, at least, a navigator and a couple of pilots on the overall crew. (Three members, not counting the investigators).
     - Two engineers. One for the main craft and another for the landing/survival module. (This adds up to a total of five crew members already).
     - Surface investigators (geologists, exobiologists, etc.). (Seven crew members already).
     - MD/surgeon. In such a long trip, getting sick seems something normal even if the cause is mild and treatable from Earth (sore throat, cough, cold, etc.). But what about a serious accident like a broken bone or a cardio-vascular disease which requires surgery? A super-specialist surgeon capable of treating these diseases is needed (we are not going to debate the problem of being the super-specialist the one having the problem). (This comes up to eight crew members).
     - Psychologist/Psychiatrist. A very large crew, plus reduced space, plus inevitable mixed crew members, plus duration of the trip, plus being conscious of not having the possibility of receiving immediate help if the need be, plus…. Here also, we have the problem that the psychologist/psychiatrist, him/herself, could need treatment. (This comes up to nine crew members).

  b. **Conclusion 2.** <u>Large crew. (Not valid for an ORION module which can only handle six person and has an extreme reduced space).</u>

- **Grate economical impact.**

  a. **International consortium.**

     - Obviously, the actual economical situation prohibits the assumption of the costs for such a trip by a single Country.
     - There´s neither a Space race anymore nor the necessity to establish a prestige which everyone knows about.
     - The ISS is a very clear cooperation example which should be extrapolated to any new Project.

  b. **Rights depending on the contribution.**

     - It seems logical that in an international cooperation Project, those with the higher GDP make the higher contribution (or whoever is more interested). Will that be China in a few years?
     - Who will define the most relevant crew members? (Commander?, Prime investigator?, Prime navigator?, Super MD/Surgeon?, etc.). The nation with the highest contribution?
     - Let´s just add a few more questions: Who will be responsible for the definition of the flight plan? Where will the mission be launched from? Who will prepare the flight plan? How long will the mission be? What type of investigation will be prime? Etc. The nation with the highest contribution?

  c. **Conclusion 3.** <u>A global negotiation is needed</u>

- **Large amount of consumables.**

  a. **Logistics.**

     - Repair parts, Medicines, O^2, Hygiene, Survival (food, water, etc.).
     - Residuals. (Dump into space? Recycle?).
     - General materials (Surgery, Tools, Common utensils, etc.).

b. **Conclusion 4.** Ship must be very large.

- **Need for physical exercise.**

a. **Exercise machines.**

- Exercise is indispensable to minimize loss of muscular or bone mass when in no gravity. The need for exercise is up to six hours/day.
- Even with a tight schedule and taking into consideration sleep periods, a machine per each three crew members is necessary.

b. **Conclusion 5.** Ship requires more and more room.

- **Radiation.**

a. **During the trip, the crew will be exposed to both, solar and cosmic radiation.**

- Working cloths with extra radiation protection.
- Ship with extra radiation protection.

b. **Conclusion 6.** Ship keeps getting heavier and, thus, bigger.

- **Space ship dimensions.**

a. **Surgery/sick bay, Workshop, living quarters, Closet to attend to personal hygiene and change clothes, Toilettes, Exercise machines, Logistics warehouse, etc.**

b. **Energy.**

- Solar panels?
  - Gigantic size.
- Energy cells?
  - The advantage is the Production of water as a by-product.
  - The inconvenience is they need great amounts of liquid Oxygen and Hydrogen which means very large containers.
- Nuclear cells?
  - Extra protection against radiation needed.

c. **Landing/survival module.**

d. **Motors.**

e. **Fuel tanks/containers.**

f. **Recycling.**

g. **Enough room to move around without hitting each other.**

h. **Conclusion 7.** <u>The ship needs incredibly big dimensions and that means construction in low Earth orbit. This implies tenths of launches and a group of trained engineers to assemble the craft in zero gravity.</u>

- **Conflicting social relations.**

a. **Very long trip.**

b. **Normal everyday life problems for a fairly large group of persons, living with small room space, not being family related, without intimacy, and all of these 24 hours/day x 7 days/week.**

c. **Once the trip reaches Mars, dividing the crew into two groups when time comes to land in the planet.**

d. **How will these two groups adapt to living separated during the surface investigation period?**

e. **Conclusion 8.** Obviously, these are some of the reasons to have a Psychologist/Psychiatrist as a member of the crew..

- **Latency of communications.**

a. **One of the greatest problems. May be the most important due to its difficulty to circumvent.**

b. **The crew cannot depend on Earth´s mission control responses if they encounter an urgent problem.**

c. **It has no solution, at least not yet, unless we find new means of communication not dependant on the light speed.**

d. **Conclusion 9.** The ship must have (as close as possible) cybernetic intelligence and it should be able to perform auto diagnosis and fault prediction. Moreover, the crew engineers must know every of its systems, instruments and equipment by heart.

Possible solutions

1. Reduce weight

a. **Prior to the manned trip, send several robotic missions with habitability modules that can be remotely assembled. This would reduce the dimensions of the landing module.**

b. **As part of these previous missions, send tools, consumables and equipment for analysis and investigation.**

c. **Exercise by electrical stimulation?**
   i. It could probably work for loss of muscular mass but what about bone mass?

d. **Send a second ship with the consumables necessary for the return trip.**

e. **Make a shorter duration trip.**

   i. Use fusion motors.
      - This could reduce weight of consumables and fuel but we are still far from getting a usable commercial fusion motor.
      - If we ever develop such a motor, we will have to take into consideration the increase in radiation and thus increase the ship´s protection which would increase weight.

f. **Solution 1.** <u>No doubt we can reduce weight but, will the percentage be significant?</u>

2. Happiness Chip

a. **Implant in the brain of the crew members, a chip the size of a human cell, working at 100 Tflops, to increase memory capacity and process speed.**

i. This chip could be programmed to eliminate anxiety or rage and it would help in making the trip easier for all.
ii. This type of chip was designed and developed a few years back and testing in humans has already taken place although information about the results has not been published.

b. Solution 2. Moral Implications?

3. Exercise

a. Solution 3. Machines seem essential for the time being.

4. Hibernation?

a. We are far from a practical hibernation yet.
b. Induced coma? Suspended animation?

c. Solution 4. Not possible unless an enclosure with induced gravity is available to avoid physical damage.

5. Innovative design

a. The solution comes from the science fiction movies.

i. Ships equipped with gravity generators.
ii. Ships with rotating enclosures that would serve two purposes. Stabilization and simulated gravity.
iii. An enclosure with especial suction devises to use as surgery room (in case of no gravity).

iv. A technological system which would allow communications not restricted to light speed. (This is sometimes called "Ansible" by the sci-fi writers and uses the sub-ether?)
v. Use of nanotechnology for medicine?
vi. Use of robots for surgery?
vii. And, again, a cybernetic intelligent ship that can auto diagnose itself and predict failures with enough time in advance for the engineers to repair them.

b. Solution 5. Not possible at the moment.

Final Conclusions:

Send six to ten ships simultaneously

a. Share the load.

b. Crew could be much larger and individuals could be interchanged in cases of social problems.

c. Increased backup in cases of impending failures.

d. Ships could be a lot smaller.

e. I am sure that the manned Mars trip will be a reality in the future but I am also sure I won´t see it.

The opinions in this write-up are mine and do not express those of any official organization (private or governmental) or any other entity of any kind.