

# Dear NASA FTCSC:

## (Questions answered by Dr. Charles Bourland, NASA FTCSC Consultant and former Subsystem Manager for ISS food in the flight crew support Division at NASA Johnson Space Center.)

I am an eighth grade student in New Jersey and I am researching the future Martian colony regarding the viability of the water/food use. I hope you can help me with the following:

1. If the colony expects to utilize the water of the polar caps, how will it be moved to the base in the -200+ temperatures if melted on site or... if blocks of ice are transported how will they be cut? (lasers?)

I am not sure there are plans to use the polar ice as a source of water. Current theories suggest that liquid water may be available below the surface at around 1600 feet. If this proves to be correct then drilling for water may be the answer. [http://www.msss.com/mars\\_images/moc/june2000/](http://www.msss.com/mars_images/moc/june2000/)

2. Once the snow is melted how can you test the viability of the water to insure it is not contaminated with forms of viruses or bacteria that are not known to us? (Was that fossil really a bacterium from Mars found in Antarctica 2 years ago??)

There would have to be extensive tests to verify the safety of the water. The original tests may have to be done on Earth. NASA did this with the material returned from the Moon from the Apollo program. Advances in analytical technology may permit real time testing on Mars.

Yes, the fossil was judged to be made by a bacterium, but that is also in question.

<http://www.jsc.nasa.gov/news/releases/2004/J04-025.html>

3. What purification methods are planned? reverse osmosis, distillation, gamma radiation??

There are several options for purification. The Shuttle uses flash evaporation and distillation. The method will depend upon the resources available and the degree of treatment required.

4. If the purity of the water is questionable, what is the alternative? Could water be extracted from combining the 92% atmospheric carbon dioxide and hydrogen (from electrolysis of the water)? Then I'm not sure if methane gas will be another end product which could be burned or.....will water have to be shipped there?

Recycling water is always a viable option. NASA has lots of experience in recycling water by physical/chemical means as well as biological. If crops are grown they also assist in recycling water. Up to 95 percent of water can be recycled, that is you lose about 5% every time it is recycled.

My research is focused on several other topics regarding the food planning- am I correct to assume:

1. Freeze dried food menu will be used similar to the International Space Station? or...is a new form being planned?

Less than 50% of the food on ISS is freeze dried and is becoming less. Experience on ISS has shown that astronauts prefer other types of food preservation such as canned, thermostabilized, irradiated and intermediate moisture foods. Freeze dried foods offer a unique opportunity to save weight and recycle water, but if the astronauts do not eat it then it does not serve its purpose. The food systems for the transfer missions will most likely be different from the on planet portion. Frozen food may be an alternative on the transfer missions, since it can be used as an radiation shield. Recycling water will also be important for both missions.

2. Greenhouse pods are planned to grow necessary crops. Will they be above ground and be susceptible to micrometeorites or be planned for underground with moveable shields to open and close for sun and protection?...and what crops???? (fruits, vegetables, legumes and/or ???)

The list of proposed crops may be found at

<<http://advlifesupport.jsc.nasa.gov/Crops/index.html>><http://advlifesupport.jsc.nasa.gov/Crops/index.html>

Most of the scenarios have the facilities above ground.

3. Will a crew of Robonauts be utilized to construct the prefabricated colony prior to arrival of the human crew? If so, how many are needed?

Probably not on the initial Mars landing with humans, but it certainly will have possibilities for future missions.

4. The main diet will be vegetarian or will protein be in the form of organs and tissue? Are animals planned to be part of the colony or will organ/tissue cloning be used to duplicate animal protein?

Most of this is discussed in <<http://advlifesupport.jsc.nasa.gov>><http://advlifesupport.jsc.nasa.gov>. Some animal protein may be transported for food, but there currently no plans to raise animals since they compete with humans for food. Quail and fish have been considered.

5. Since the assignment is 3 years, what part will the food service have on preventing the psychological issue of isolation?

A Big Major part. Isolation changes people and if they don't like the food they may refuse to eat and jeopardize the mission.

6. And.....will the food be different from the travel time of 9 months each way in weightless environment compared to the ground based colony food?....or will the astronauts be in a suspended consciousness and fed with IV's???

There are no plans to have astronauts in suspended consciousness or hibernation. The transfer food will be different because preparation is difficult in zero G. They may grow a few salad plants in transit.

Thank you for taking the time to consider my questions. I look forward to your response!

**Catherine  
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