An all-woman crew to Mars: a radical proposal

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Abstract

It is logical to propose that if a human mission is flown to Mars, it should be composed of an entirely female crew. On the average, women have lower mass and take less volume than males, and use proportionately less consumables. In addition, sociological research indicates that a female crew may have a preferable interpersonal dynamic, and be likely to choose non-confrontational approaches to solve interpersonal problems.

1. Introduction

Recently, a proposal has been made that a NASA space-shuttle mission should be flown with an entirely female crew [1]. This proposal has attracted an unexpected amount of opposition [2,3].

In this article, I would like to suggest that this opposition may in fact be counter to logic; that in fact, the American and Russian space programs made an error right from the beginning: women are more logical candidates for space missions. I suggest that the proposal should be taken seriously that a Mars mission should be flown with a entirely female crew.

The concept of a single-sex space mission is hardly new – after all, Americans have sent 27 humans to the moon, all of them male, and the vast majority of the flight experience on the Russian Mir space station is with crews that were entirely male. In fact, out of the 278 astronauts who have flown on NASA missions (as of April 1999), only 31 have been female.

It is therefore apparently not the idea of a single-sex crew, but the idea of a specifically female crew that incites opposition.

If I were to suggest that the crew of a Mars mission be entirely male, the suggestion might be considered ‘politically incorrect,’ but it would hardly be considered impossible – after all, there have been dozens, probably even hundreds, of proposals for all-male missions to Mars.

2. Advantages of female crews

In the human species, women are on the average smaller than males: women use less oxygen, consume less consumables, produce less carbon dioxide. They have lower mass and take up less volume. The argument for an all-female crew is simple: such a crew would require considerably less support in the way of consumables, and allow a smaller spacecraft. This would produce a considerable savings in cost.

The reduction in body mass and the associated reduction in spacecraft mass and consumables is not the only argument for an all-female crew to Mars. For such an extended mission, which in many scenarios has a duration of up to three years, psychological compatibility and crew dynamics become critical issues in the crew selection.

It is difficult to quantify the interpersonal and crew-dynamic issues, and to separate out the effects of biology from culture. Statistics show that all-woman groups are far more likely to choose non-confrontational approaches to solve interpersonal problems, and most definitely are more likely to deal with a situation without resorting to violence – which could be a big problem on a Mars journey, where the crew must live in close quarters for 2–3 years. For example, in America, a male is about eight times more likely to commit a violent crime than a woman [4]. This difference is remarkably consistent across different cultures. Statistics from three dozen...
human communities around the world, from Denmark to Zaire, show that, with a single exception, the probability that a single-sex murder has been committed by a man instead of by a woman ranges from 85–100% [4].

Numerous sociological studies have shown that women, in general, are more cooperative, and less given to hierarchical social structures [5,6] – all properties which may very well be highly desirable on a long-duration space mission. (Lest it appear that I am advocating some sort of genetic determinism, let me hasten to add that there is no evidence that the behavioral differences between groups of men and groups of women are based on intrinsic genetic differences, and not due to the different cultural expectations and training of men compared with women.)

In an article in Space Policy, Sykora et al. [7] also argue that women tolerate long-duration exposure to stress better, and have better patterns of coping with it. As they point out, this factor also suggests that a female crew would be preferred for a long duration mission.

The NASA experience on the Russian Mir spacecraft seems to confirm this: of all the American-born astronauts sent to Mir, the sole female astronaut, Shannon Lucid, despite having the longest stay on Mir, apparently had the least difficulty interacting with the Russian crew [8] or adapting to the return to a gravity environment.

3. Osteoporosis

A possible counterargument to the otherwise persuasive arguments for a female crew is the supposed increased susceptibility of females to osteoporosis. Since bone calcium loss is a significant effect of microgravity, might not a male crew be preferred on these grounds alone?

Humans typically lose from 1 to 2% of their calcium (depending on the person, countermeasures, etc.) per month in space. There are indications that the rate of loss slows down with mission duration. Exercise and other countermeasures can help to decrease the loss.

Generally speaking, women are more susceptible to osteoporosis than men. They are at a higher risk because by the time women achieve their peak bone mass (mid–30's) they end up having 10 to 30% less bone mass than men have at their peak bone mass. After this peak, men and women both lose bone. For a period of a few years during menopause, women lose bone at a faster rate than men; however, this difference in bone loss rate can be treated with estrogen-replacement therapy.

It is not all clear that bone calcium loss in microgravity and bone loss due to osteoporosis are similar effects, and no difference in bone loss between men and women has yet been confirmed in spaceflight data. The longest duration space flight by a woman, Shannon Lucid [8] seems to have had, in fact, a lower bone loss than long duration flights by men. Since Lucid’s total flight time of 233 days in space included a duration comparable to that required for a mission to Mars, it is very likely that differences in bone-loss rate between males and females is a non-issue.

It is also plausible to suggest that the same methods used to mitigate post-menopausal osteoporosis in women on the ground may very well be applicable to bone-loss in space; in this case, a female crew would actually be preferred, because of the considerably wider base of experience on the effects of these chemical countermeasures.

In any case, a mission to Mars is very likely to use an artificial-gravity spacecraft, such as a tether, in which case the purported problem will not be relevant. For these reasons, I suggest that the argument against an all-female crew based on the supposed hazard of osteoporosis lacks credible support.

4. Conclusion

In conclusion, a Mars mission is unlikely to require raw physical strength, the one characteristic for which human males are, on the average, more highly endowed than females. The quantifiable advantages of lower body mass and decreased use of consumables alone would suggest that a female crew would be preferred to a male crew in any long duration mission; the issues of interpersonal dynamic, although difficult to quantify, at a minimum suggest that an all-female crew would in no way be worse than an all-male crew, and very likely may be better.

So: would an all-women crew be the ideal personnel for a Mars mission?

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References


