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INSCRIBING BODIES, INSCRIBING THE FUTURE: Gender, Sex, and Reproduction in Outer Space

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ABSTRACT: *This paper examines the ways in which gender, sex, and reproduction in the U.S. space program are represented as social, cultural, and scientific problems. In 1992, a married couple served on the crew of a U.S. space shuttle, prompting a flurry of public curiosity and controversy over the possibility of "celestial intimacy" between these astronauts. Ironically, countless missions prior to this historic flight had not raised similar issues of human desire and fecundity, attesting to the "legitimacy" of the heterosexual paradigm. Drawing on a range of data sources and theoretical perspectives, we analyze discourses and practices through which female bodies in particular are constructed as problematic, a gendered process which, in turn, renders sexuality and reproduction in space as controversial. We argue that contemporary institutional, cultural, and scientific accounts of gender, sex, and reproduction in space inscribe both contemporary* and *future scenarios, with potentially negative implications.*

INTRODUCTION: SPACE, THE "FINAL" FRONTIER

Millions of people have been exposed to the flights and fancies of space travel and habitation through cultural media like *Star Trek* and its successor, *Star Trek: The Next Generation.*[1] Offspring of the space race, these television shows have helped define the space age for generations of viewers, providing a key cultural link between events in the news about the latest space shuttle flight, scientific innovations, and possible human futures resulting from these activities. These shows often portray committed multicultural, multigendered crews working together to explore the universe in one politically liberal version of "a dream of a common language" (Rich 1978).

While dealing with the complexities of space travel and inevitable contacts with "nonhuman" races, the *Enterprise* crews also navigate intricate human relationships as they hurl through space at warp speed. Given the range of human emotions

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and interactions made possible by "going where no one has gone before," the *Enterprise's* mostly human inhabitants seem to get along remarkably well. Members of the crew fall in love, have sex, give birth, fight, get angry with each other, and still manage to live happily ever after at the end of each week's episode. Perhaps it is the Holodeck, that magical invention that allows fictional astronauts to create virtually any reality they wish and then to inhabit it for a brief while, that makes for such smooth intergalactic sailing.

In a twist on the "truth is stranger than fiction" maxim, this paper examines gender, sex, and reproduction in outer space. Unlike on *Star Trek*, where these issues are more or less taken for granted, in "real time" they are highly contested. In 1992, a married couple flew together on a U.S. space shuttle mission, generating a flurry of public curiosity and controversy over what the paparazzi termed "celestial intimacy." The National Aeronautics and Space Administration (NASA) was bombarded with questions about heterosexual sex and reproduction in space, topics which the agency seemed ill-equipped and unwilling to address. Not only are sex and reproduction perceived as topics which should not be discussed in polite society, they are also seen as contributing to a loss of legitimacy for NASA in an age of uncertain and ever-diminishing resources.

We argue that the emergent controversy over "sex in space" is shaped by intersecting and mutually reinforcing discourses about gender, sex, and reproduction in the contemporary United States. Our argument rests on three core findings. First, gender differences are constructed at multiple "spaces" within this domain; males bodies are equated with masculinity and are accepted as the norm, while female bodies are equated with femininity and are configured as problematic. Women astronauts are defined simultaneously as potential sexual partners for male astronauts *and* as potential reproducers in the interest of colonization. Second, sexual practices are framed exclusively within the heterosexual paradigm, which leaves few "spaces" for other sexualities. Third, sexuality is explicitly and invariably linked to reproduction, reflecting and reinforcing heterosexist assumptions about sexual behavior. Yet, reproduction in a space environment is potentially damaging to missions because human bodies are physiologically transformed by microgravity and radiation. Thus, as far as NASA is concerned, astronauts should neither copulate nor reproduce; within the heterosexual paradigm, preventing sex in space becomes a strategy for preventing reproduction in space. In short, contemporary accounts of sex and reproduction in space, like *Star Trek* and its progeny, inscribe human bodies and futures, and in so doing tell us a great deal about who "we" are at present.

A key theoretical concept informing our analysis is *inscription*. What exactly do we mean by "inscribing bodies, inscribing the future"? Within cultural studies, for example, inscription is defined as the act of "writing" culture onto bodies and/or subjectivities through a variety of social, cultural, and technical practices. In this process, bodies and subjectivities are seen, read, and produced as texts (Treichler and Cartwright 1992). For example, speculative and science fiction have been

important cultural "spaces" where new possibilities and freedoms are imagined. Space is constructed in these accounts as a site at which liberatory practices may (or may not) occur. Often, fictional humans depart a troubled Earth to begin again on another planet, although not without a fair amount of hardship and hard work in their new, intergalactic American Dream. It is precisely this vision of possibility and freedom that draws people to science fiction (Lefanu 1989; Kuhn 1990; Barr 1993) and also to the seemingly infinite possibilities offered by the space program.

Yet, we argue that inscribing the future has a negative and pernicious side, as well. Contemporary discourses and practices negate many types of future freedoms, both on Earth *and* in space. These inscriptions shape our lives profoundly, while they simultaneously shape what could, might, and should occur in space in an uncertain future. To cite one example, heterosexist framings preclude other sexualities by highlighting sex in space as a social and scientific problem for NASA, which must screen out homosexuality and other "deviant" practices in order to proceed with its agenda of exploration. Thus, we suggest that within these cultural "spaces," some inscriptions are disallowed while others are relentlessly pursued. Inscription, then, is a multifaceted practice imbued with both pleasures and dangers.

If people are not earthbound, as aviation history and the space program have illustrated with often stellar successes, then neither is sociology. Adding a sociological spin to inscription, we focus on the social relations within which different types of inscriptions occur. We suggest that "space" is both an actual spatial site for certain practices and a symbolic and material screen onto which earthbound activities are projected and refracted. Yet, there is considerable traffic between Earth and space, not only in terms of shuttle and satellite missions but also symbolically via flights of the imagination. Much of the space program actually takes place on Earth, for example in the scientific, economic, and institutional planning required for each mission. Yet, as on Earth, humans in space interact with each other in myriad ways, solve a range of problems, cope with technical difficulties, and deal with orders from Mission Control. All of this collective activity takes place within the institutional context of NASA and the U.S. space program as well as the broader social, political, and economic context of international space travel. In short, a number of dimensions of space travel are open to sociological investigation. Sociology, in our view, should not end at the Van Allen Belt, that astrophysical "boundary" of intense ionizing radiation surrounding Earth.[2]

METHODOLOGICAL APPROACHES

To reiterate, the purpose of our research is to understand and interpret key themes regarding gender, sex, and reproduction in outer space. Since genders, sexualities, bodies, and the future are constructed by both individual and institutional actors in multiple discursive locations, we draw on a range of data sources. First, we conducted in-depth interviews with NASA officials and scientific consultants.[3]

Areas of inquiry included informants' professional history, perceptions of NASA's organizational structure and institutional commitments, and interpretation of sex and reproduction as scientific and/or social issues. Second, we analyzed several media sources, including daily newspapers, popular magazines, and television programs, for their interpretations and representations of sex and reproduction in space. Third, we critically viewed films and videos such as *The Right Stuff* and *Living and Working in Space.* Fourth, we conducted a literature review of scholarly scientific publications. And last, institutional publications such as scientific reports and public relations materials were obtained from space agencies, and their contents were coded and analyzed.

As symbolic interactionists, we are committed to grounding our theoretical claims within "the worlds of lived experience" (Denzin 1992). Data have been collected and analyzed through open and axial coding aimed at the discovery of basic social processes (Strauss and Corbin 1990).[4] This interpretive framework has allowed for: (1) the generation of concepts and conceptual understandings through writing theoretical and analytical memos; (2) the pursuit of a range of variation in data sources and interpretations; and (3) the utilization of the constant comparative method to contrast similar institutions and basic social processes (Strauss and Corbin 1990).[5]

DO WE BELONG IN SPACE?

This article would be incomplete without some discussion of the broader political framework of space travel within which discourses of gender, sex, and reproduction are situated. The prior Republican and the current Democratic administrations have, across two decades, reaffirmed a Presidential "Prime" Directive on national space policy by reissuing the following statement: "a fundamental objective guiding space activities has been, and continues to be, space leadership." This is a problematic goal, however, given a number of setbacks in the space program in recent years, including the explosion of the Challenger, the disappearance of the Mars Observer, and controversy over the malfunctioning Hubble space telescope launched in 1990.

Presently, it is unclear what effects the foiled Mars probe will have on the 1996 scheduled (but unfunded) two-year Mars mission. Yet, a humorous depiction of the missing Mars Observer on the back of a milk carton, usually reserved for exploited and/or missing children, ironically demonstrates the displacement and replacement of certain social issues by others. Such representations are situated within the crisis of shrinking federal allocations to the space program (Anderson 1994; Kay 1994). Also unclear at the present time is how controversy over the Hubble telescope will affect NASA in the long run. During the three-and-a-half years the $1.6 billion telescope was transmitting blurry images to Earth, NASA was on the receiving end of intense criticism as well. After the 1993 *Endeavour* mission in which astronauts successfully repaired the telescope, NASA apparently enjoyed

a resurgence of public confidence and legitimacy. According to Senator Barbara Mikulski, Chair of the NASA budget subcommittee, this new-found support might help the agency's reputation in Congress and win approval for the $30 billion international space station (Wilford 1994). Implementation of Space Station Freedom, with a projected completion date of the year 2000, has the potential to phenomenally impact the life sciences, future space habitation, and NASA's reputation.

Yet, space travel and/or colonization are more complicated than a "simple" organizational or federal decision regarding exploration and institutional expansion. Just as the fabulous seven astronauts/pilots from *The Right Stuff* quipped "No bucks, no Buck Rogers" (Wolfe 1979), NASA must continue to obtain and secure funding for these very expensive missions, as the Mars Probe and Hubble telescope snafus illustrate.[6] Fundraising often means developing collaborative enterprises with space programs in other countries. Due to long-range planning and financial commitments which are necessary precursors to any NASA mission, the organization often finds itself in a position of follow-through on space missions from which it cannot easily extricate itself. The European Space Agency (ESA) and the agencies of the Federal Republic of Germany (DARA), Canada (CSA), Japan (NASDA), and the former Soviet Union are all major investors in the planning of Space Station Freedom. These international alliances in the post-Fordist economy have already consolidated the decision for future space exploration and colonization. Indeed, international commitments are so deeply entrenched that one informant remarked, somewhat aptly given our topic, "even if we wanted to we couldn't pull out."

It is ironic that space, defined in the 1950s and 1960s as a site of Cold War military conflict, has become a site of postmodern international political and economic cooperation.[7] While space has often been conceptualized as that which will make our world bigger, space now has the potential to also make the world smaller by reconfiguring capitalism and nationalism. Potential colonization leads to new markets to be explored and developed in a post-Fordist, transglobal economy. The fact-based fiction depicted in the PBS video *Living and Working in Space* postulates some potential future marketing schemes, including the "Baby Bubble," a uterus-like technology attached to "Mom" and designed to tow a floating baby or small child; genetically engineered food like the "Mousepotato" that "will suit up and come directly to you;" hydroponic food grown without soil; hologram faxes; and "Astrotels" billed as economic places to stay. Just think of the possibilities for intergalactic commodity fetishism![8]

These political and economic issues are closely linked to constructions of sex and reproduction in space as social and scientific issues. For example, a reproductive biologist and NASA consultant began a 1992 talk by asking, "Do we belong in space? Should we reallocate earthly resources by exploring the outer limits of space?" This existential and political question, juxtaposed with another NASA consultant's disappointment in the space program's "overdue" galaxy colonization, illustrates the concerns and desires of those working in the space

program. In one informant's words, "If we can't conceive and reproduce [in space], how will we ever colonize?"

A prominent biologist (Grobstein 1988:162) echoed these sentiments and situates contemporary debates on the status of the "unborn" within future reproductive scenarios involving space travel and habitation: "The earthly stew, within its existing confines, is showing signs of unhealthy fermentation and rising pressure. The pressure might be relieved, before it becomes explosive, by broadened perspectives that direct it outward to the openness of space." There is a fascinating subtext operating in Grobstein's account related to intersections of gender, race, sex, science, bodies, reproduction, and colonization.[9] As Jennifer Terry (personal correspondence) has suggested, metaphors of rising pressure suggest a hydraulic model of sexual desire. But whose pressure is rising—that of the libidinous individual or that of the anxious society? And, is this pressure mainly related to biological reproduction or to sexual pleasure?

Ironically, physiological problems of space travel may constrain any plans to commence human colonization of space. For the immediate future, reproduction may well be confined to Earth, suggesting an ironic image of the Van Allen Belt as a postmodern birth control technology. Such desires and fears about reproduction lead to definitions of sexuality in which only relations between fertile males and females are considered salient. Next, we explore discourses of gender, sex, and reproduction as they operate to inscribe certain futures while precluding others.

(EN)GENDERING DIFFERENCE: "FEMALE" BODIES ON THE FINAL FRONTIER

Feminist studies of science and technology include theoretical and substantive work on the construction of gendered difference(s), including sexed and gendered bodies (Laqueur 1990; Terry 1990), reproductive theories (Tuana 1989), skeletons (Schiebinger 1987), sex hormones (Oudshoorn and Van Den Wijngaard 1991), and a range of other sites. In all of these examples, differences become reified through scientific representations and practices and are subsequently linked to gender(ed) inequities. We suggest that gender differences are also constructed assiduously across multiple sites in the space domain. This occurs through a process of inscription, in which genders and gendered sexualities are constructed through material and symbolic practices centered on women's bodies.

Female bodies are constructed against a backdrop in which male bodies are accepted as the norm, an inscription process shaped by the masculine context of space travel. More explicitly, space travel can be interpreted as a historically masculine project in that rocket design has in some ways modeled male anatomy. Space flight, in our reading, becomes the realization of penetration and colonization fantasies about the future.[10] This spirit of masculinity permeates almost all aspects of the space program including long-term political goals, engineering designs, assumptions about crew behavior, and life-sciences research protocols. The

masculine "nature" of space flight creates an institutional and ideological framework within which women not only are excluded but also are configured as highly problematic by virtue of their gender, bodies, sexualities, and reproductive capacities. Female bodies thus become the target of a range of practices within NASA aimed at reconfiguring women to fit into the space program. Below, we point to some specific ways in which women's bodies are inscribed through discourses of sexual difference.

We begin with a short story about tampons on the space shuttle. During a presentation, an informant relayed the following story:

> *Informant:* One time I asked Shirley Parker,[11] she is the director of the medical program [at NASA headquarters], and one day I asked her, do those women use Tampax or do they use pads? About four weeks later, I finally got this stuffy letter back saying I want you to know these women use tampons. I said thank you very much Shirley, it took four weeks to tell me that.

Later during an interview, we returned to the topic of tampons. Our transcript reads:

> *MC:* And tampons, that was so funny!
>
> *Informant:* Yeah, but you know, think about the storage. And you can't just jettison, a little thing flying around up there can be dangerous. You know they track space junk, it pits, it can destroy the spaceship.
>
> *MC:* Imagine some alien race finding this tampon floating in space some day, it will be like, what is this?
>
> *Informant:* Can you imagine? This life form, look it's got carbon in it, it's got nitrogen in it, it's got ...
>
> *MC:* That's right, they would think it was a life form!
>
> *Informant:* But I think the major issue she is reacting to, again, she is very protective of her crew, and these women are extremely, number one, they've had to work very, very hard to get on the astronaut core. And they don't want to be derailed now, they have worked so hard to get there, and *they're so sensitive to not measuring up ... about the issue of being female. And that yes, women are different and they do have cycles ... and it's been my impression that the women on the astronaut corps have tried to minimize the differences* [our emphasis].

As the tampon story illustrates, bodies are key sites at which gender differences are constructed in this domain. Women are seen as being different from men not only physiologically but also in terms of being taken seriously in a masculine environment. Yet. an important issue undergirding the tampon story is retrograde menstruation, a condition causing endometriosis in which menstrual blood reverses direction in a weightless environment and gets lodged in the uterus. Thus, although "periods" are one site of constructed gendered differences, menstruation

contains potentially dangerous consequences for women's health in a space environment. While we can and should be concerned about physiological constraints of space travel on women's bodies, it is critical to be suspicious of how these problems are interpreted and handled by NASA.

Gender differences emerge in other sites, as well. For example, pregnancy is seen as affecting female astronauts exclusively, despite the fact that sperm is still a necessary component of fertilization. This assumption leads to scientific research in which only female contraception is at issue. One scientist's research, for example, is geared toward preventing space pregnancies and controlling female hormones through contraceptive technologies. This type of research leads to another site for construction of sex differences—hormones. According to one [female] informant, women "are not stable entities," reflecting an egregious assumption that men are somehow more stable. Another important question regarding sex differences is who gets studied. Because only male astronauts went to space until the past decade, only male physiology (in both animals and humans) was studied. Male physiology has come to be seen as the standard by which female bodies have been evaluated and, unsurprisingly, found to be different. Thus, the prospect of long-term multigendered missions has made salient a host of issues related to bodies in space—including sex, reproduction, and pregnancy—all of which are constructed *"scientifically"* against the male norm as "female" problems.

Constructions of *social* and *cultural* differences between men and women are also common in this domain. According to one informant, "women and men have different brains" and, therefore, "think differently." Ironically reflecting cultural feminist assumptions, this scientist believes that women "think more broadly then men do and see things more clearly," which purportedly makes them better researchers. Multigendered crews are considered more harmonious, and performance levels are claimed to be better, if men and women are balanced in numbers. This raises the question of what types of work are expected of different crew members. More specifically, are women astronauts presumed to be better at emotion work (Hochschild 1983) or managing interpersonal relations than men? Further, if balance is better, why are there usually only one or two women among five to seven crew members on space missions?

Female astronauts thus have dual pressures operating on them. On one hand, they are judged by NASA engineers as problematic because their bodies differ from the male standard. Female bodies are defined as introducing contamination, or at least uncertainty, into an otherwise "stable" environment; their bodies must be configured to fit into the system in order to maintain mission homeostasis. Female astronauts must also prove that they are just as capable as men and should not be treated differently. According to one scientist, they prefer to be identified as "just another piece of hardware" to avoid being gendered.[12] Yet on the other hand, they are judged negatively by other NASA staff when they do not behave or act like women in essentialized ways. One consultant described the conflicting position in which female astronauts are placed by remarking, "I feel sorry for women who can't enjoy the fact that they're female." Another stated that "some

women are uncomfortable with their own sexuality.... They deny that they are different from men." Even if female astronauts themselves strive to avoid constructions of difference, discourses and practices within the space program continually inscribe bodies as gendered and female bodies as problematic.

These constructions are grounded historically, as well, in NASA's refusal to consider women candidates as astronauts in the 1950s and 1960s when the space program was being launched. Penley (1992:204) cites a 1973 *Ms.* magazine exposé about NASA's efforts to keep women out of the space program. Of the 25 highly qualified women pilots with advanced degrees who tested alongside the men, "the women pilots had been found to be more resistant to radiation, less subject to heart attacks, and better able to endure extremes of heat, cold, pain, noise, and loneliness." Yet, not a single woman was selected for the Mercury missions.[13] Clearly, sexism was at issue in the selection process, as illustrated in the following excerpt taken from a 1960 correspondence between the Director of Life Sciences at NASA and the head of a major biomedical research foundation: "We discussed these matters with regard to the opposite sex almost a year ago.... I still do not understand the value of this operation.... Perhaps I am just one of the old school who favors keeping them barefoot and pregnant!"

And that, of course, is the crux of the matter; women astronauts continue to be defined in "naturalized" terms emphasizing their sexual nature and procreative function. Below, we explore more explicitly some key linkages between discourses of gender and sexuality.

PREVENTING AND ENVISIONING SEX IN SPACE: IN THE PRIVACY OF YOUR OWN (CORNER OF THE) SPACECRAFT

There is a wide array of physical, mental, and spiritual practices which fall under the rubric of human sexuality, including (but not limited to) masturbation, heterosexual intercourse, viewing or writing erotica, oral and anal sex, and sado-masochistic activities. Given this range of practices, pondering sexual inscriptions in space might suggest titillating opportunities for future expressions of desire. For example, many a science fiction writer has filled his or her multigalactic creations with erotic (re)visions of sexual possibilities (Russ 1975; Piercy 1991; Datlow 1992). However, here on Earth, NASA's negligible institutional attention to issues of human sexuality fails to consider the range of sexual possibilities. Quite the contrary. Because NASA constructs human sexuality as inextricably connected to reproduction, sexuality in space is framed and reified to mean only heterosexual penis-vagina intercourse. As explored below, historically, NASA has resisted discussing the potential reconfigured sexual practices which a physically and socially innovative space environment may permit or encourage.

As our aim is to analyze NASA's responses to questions concerning human sexuality in space, here we focus on how the agency has constructed sex in space and some possible implications of these limited constructions.[14] Ironically, exploring the terrain of lesbian and gay studies has been tremendously useful in

developing our interpretive framework. Struggling to resist canonization, lesbian and gay studies can be defined as "focusing on the cultural production, dissemination, and vicissitudes of sexual meanings. Lesbian and gay studies attempts to decipher sexual meanings inscribed in many different forms of cultural expression while also attempting to decipher cultural meanings inscribed in discourse and practices of sex" (Abelove, Barale, and Halperin 1993). We draw on these theoretical tools to analyze sexual inscriptions in space.

In September 1992, the first married couple went on a NASA mission amid a flurry of media attention. The couple, married in secret, disclosed their newlywed status to NASA only *after* their selection and training for the mission. According to informants, NASA subsequently decided it would be too costly to reorganize the flight crew. Yet the fact that NASA even considered reorganizing the mission indicates its nervous anticipation of the ensuing controversy. Several articles in daily newspapers attempted to address the unique social issues (such as privacy and sexual activity) implied by NASA's "decision" to include spouses on the same mission.[15] It was only after NASA admitted to sending the first married astronauts into space together that newspapers had the revelation: there is a possibility of sexual activity in space!

Heterosexist assumptions undergirding this coverage are evident. Many other extended and cramped space explorations preceded the 1992 flight, but these were predominately "manned." The media and NASA have chosen to frame sex in space as conceivable only when conception is a possibility. Not only does this ignore the prospect of lesbian or gay activity in space, but it also does not address unmarried sexual activity, as mixed-gender crews have been going to space for several years now. Heterosexual sex was described in these initial news articles through pop psychological discourse; one psychiatrist remarked "sex is a normal part of human behavior. It happens in offices. It happens in the Antarctic. It happens where you have males and females together." Does this inscription of the future help create a "space" where only certain types of sexual relations will be tolerated, understood, accepted, and/or possible?

Although to our knowledge NASA has no written policy on homosexuality in the space program, organizational strategies can be seen as indicators of a latent agenda. Instead of operating under a "don't ask, don't tell" military model, NASA officials asked a flight crew surgeon, also a psychiatrist, if there was a way to screen out homosexuals. Replying that homosexuality was not a "psychiatric disorder," the surgeon stated that screening would be impossible. She also suggested during an interview that "there are probably thousands of high-achieving military homosexuals in NASA." Sexuality tropes such as these are prevalent in space discourses and many have become mythologized within the NASA community.

For example, one informant related to us a story of an Apollo mission.[16] After this mission had successfully landed, the two male astronauts made their way to the press conference holding hands and greeted reporters by stating, "We would like to announce our engagement." Indeed a campy and comical way to break the post-mission tension, this story plays on the fear that these astronauts, after hours

of constant companionship, would become romantically linked. Could there be a strategy behind NASA's use of mixed crews for long-duration missions? It is likely that *not* sending women on missions would be challenged as sexist and discriminatory in this "postfeminist" era. However, NASA could also be trying to abate what it perceives as negative implications of homosexuality by sending men and women together on long missions.

NASA's reaction to media coverage, as represented and depicted by our respondents, has been mixed. For instance, a NASA consultant talked about the paradoxical relationship between NASA and the media:

> I think the press has trivialized the true value and rationale of the effort. I feel that the press has trivialized that. And I think of the devotion, the 18 hour work days some of these people put in ... and I'm thinking, to have them trivialized like that and what they've devoted their time to. It kind of hurts my feelings and I don't feel good about it. But on the other hand, the other side says, look, any kind of awareness that you can put into the public, hey look, marketing, Fifth Avenue does this all the time. What sells products? SEX! Actually, a lot of people have become more aware of biology in space; a lot of people have ... of course they get over that part and start thinking about these other things. And so I think it has raised public awareness of what NASA's trying to do.

As this informant hinted, NASA must position and keep itself in the public eye. Hilgartner and Bosk (1988) described the dynamic and competitive processes which bring certain policy issues into the finite "carrying capacity"[17] of the nation's attention span. NASA, like other federal agencies, struggles for its share of the limited resources allocated to scientific and social problems, about which priority decisions must be made. Can or should NASA try to use the media focus on sex in space to its advantage? Although it is clear that NASA does not want to taint the image of professional NASA scientists as highly educated women and men dedicated to their work, the agency certainly uses media attention to remain in the public carrying capacity.

Perhaps media attention to the broader goals of the space program is an unintended consequence of the way NASA has handled the sex controversy. Yet, NASA may be seen as partially responsible for the media frenzy by making certain aspects of missions so mysterious while foregrounding other issues. In other words, NASA may be an ambivalent participant in seducing the media by not explicitly revealing sexual information. By simultaneously releasing nonsexual data and withholding sexual information, NASA stripteases the media into wanting more. Yet, the way the media addresses sexuality and space travel often frustrates or "trivializes" NASA as an organization. For instance, one NASA informant feels the media taint the "scholarly approach" of scientific research on sexuality in space because the media is "obnoxious and only interested in the prurient aspects" of NASA's studies.[18] These reactions are related to privacy discourses deployed by NASA and other actors.

In *Star Trek*, everyone on the colossal *Enterprise* has their own personally configured (and quite nicely decorated) living quarters. On an extended NASA mission, it is likely that there will be eight people living in a capsule the size of a bathroom. Because of these spatial constraints, NASA consultants and scientific researchers often create and discuss what we call *privacy discourses*. Such discourse evokes images of isolation, retreat, seclusion, solitude, and confidentiality. NASA employs multiple privacy discourses as a rationale to avoid researching and talking about sex and reproduction in space. Privacy discourses are a "modern" notion related to the historical emergence of a private sphere within which most "normal" sexual activity is presumed to take place. Yet, as Foucault (1978:35) argued, "what is particular to modern societies, in fact, is not that they consigned sex to a shadow existence, but that they dedicated themselves to speaking of it ad infinitum while exploiting it as *the* secret." There are three distinct ways NASA exploits the modern notion of private sexuality.

First, there are varying opinions about the possibility, probability, and inevitability of sexual activity occurring on NASA missions. One NASA spokeswoman stated, "given the close quarters on the shuttle, you can pretty well conclude that there has not been sex on the shuttle. There's just no privacy."[19] However, many believe that a Mars mission lasting up to two years or a three- to six-month assignment on the space station would challenge cosmic abstinence. Even though space and privacy are limited, having sex could be managed in a system of coordinated effort or "negotiated order" (Strauss 1991). In the words of a NASA crew surgeon, "because every mission is planned exactly to the minute, an enterprising crew could figure out how to have privacy." Sex under these conditions may become a group activity since the multiple occupants of the craft affected by other astronauts' behavior may well be involved in sexual planning. What would be the new socially acceptable way to have sex? Clear it with the mission commander and then have scheduled time during which other crew members know exactly what is going on? This scenario gives new meaning to notions of "group sex."

Even if an ingenious crew could figure out ways to "do it," there is some doubt that NASA would discuss publicly any data gleaned from such activity. The second type of privacy discourse is thus related to the mythic custom in which many Americans learn, think, and talk about (or around) sex. There is a quality about discussions of sex and their alleged threat to privacy that pollutes the pure, uncontaminated image of the space professional. This threat to professionalism is illustrated in the comments of a NASA consultant: "You know, these are highly committed, professional, academic nerdy scientists like myself, who value their privacy as citizens ... and they don't want to be made into spectacles." This informant believes it is NASA's duty to protect the sexual privacy of the crew from the media.[20] In this framing, sexuality is inscribed as pure spectacle—prurient, entertaining, and clearly not serious.

Finally, privacy discourse is ostensibly used to protect the identities of particular crew members in research protocols. Since there is only a handful of female

astronauts, maintaining confidentiality in scientific studies is extremely difficult, if not impossible. As one consultant speculated, what would happen if research showed that a female astronaut had extremely high levels of testosterone and the media picked up on this "deviation" from "accepted" norms of womanhood? This deployment conflates the gender, sexuality, and physiology of "normal" female bodies. Thus, NASA, fearing the possibility of sex/gender transgression, insists that research findings could be traced back to the individual subject. While allegedly protecting the identities of crew members, this privacy discourse also serves to shield the agency itself from any negative publicity a "masculine" female crew member might arouse.

The deployment of privacy discourses by key actors in this domain and NASA's attempts to create life-sustaining outer-space environments offer a rich opportunity to extend Goffman's (1961) concept of the "total institution."[21] Originally developed to theorize the role of asylums and prisons, total institutions are organizations which isolate members from participation in social interaction in alternative locations, and instead structure everyday life within a confined environment. Members cannot escape from the bureaucratic authority of the institution, and their identities are partially reconstructed to meet organizational demands. Yet Goffman notes that bureaucratic authority is never complete; an "inmate culture" may emerge despite the totalitarianism of an organization.

NASA, as a total institution, demands that astronauts subscribe to certain rules and discursive dictums. Even though these rules may be linked to critical issues concerning their survival, they are developed within a highly ideological milieu. NASA both exists as part of a broader social domain in which there are enduring beliefs concerning sexuality and also produces particular belief systems about sexuality. In addition, NASA as an institution exerts a great deal of control over what activities can be considered and pursued in the space environment, particularly in the "closed" space of a shuttle. What is witnessed in NASA's management of media attention is an effort to maintain ideological control over definitions of human sexuality; these definitions will precede us into the future. In short, privacy discourses used to divert continuing discussions of sexual desires and practices in space maintain a belief in the private, secret, and off-limits nature of human sexuality.

As suggested above, ingenious and determined crew members may create an inmate culture around sexuality, thus resisting NASA's limited vision and daring to express counter-hegemonic desire. For example, in an environment of negotiated "group sex," astronauts may reconstruct notions of romantic and/or sexual desire as not necessarily requiring spontaneity. These interstellar expressions of desire, including those which might lead to pregnancy, would likely require significant bodily manipulations and reconfigurations. For example, "lovemaking in zero gravity is likely to bring a great many reactions, with couples catapulting off the walls and floors, and careening into the airlocks of their tiny cubicle during the heat of passion" (Walter 1992:145). As we explore below, in confronting the adverse conditions of space, NASA has experimented with manipulating gendered bodies and, in doing so, has reconstructed sexuality and reproduction.

(RE)CONFIGURING BODIES: HUMAN REPRODUCTION IN A SPACE ENVIRONMENT

Sex and reproduction are discussed within space discourses as if they were inevitable: "If you can do it in the back seat of a '57 Chevy, you can do it anywhere" and "when people have sex, the woman is going to get pregnant." Yet, these activities may in fact be highly problematic in space, not only socially as we have discussed but also physiologically. A number of scientists (Smith 1990; Fowler 1991; David 1992) have argued that there are often very serious problems affecting human bodies in space, and that almost all of the human body's functions and processes may be affected.

More specifically, space motion sickness, muscle atrophy, bone loss, and an array of other problems have all been recorded during space flights (Fowler 1991). Of course, since much of this data is based on flights in which mostly men served as crew members, its relevance to female bodies is questionable. As one might expect, such major physiological changes have potentially serious consequences for the short- and long-term health of crew members. Yet, questions are raised not only about the damaging effects of travel and/or habitation *in* space but also about potential problems when astronauts reenter Earth's atmosphere and "normal" levels of gravity.

Most scientists seem to agree that the major causes of physiological problems are microgravity and radiation (Monga and Gorwill 1990), from which the space shuttle and space suits can only minimally protect astronauts.[22] However, because there have not until recently been extensive long-term flights (at least in the U.S. program), data on these problems are limited. To some degree, NASA is operating blindly with inadequate experiential data and no solid scientific evidence about the long-term impacts of space travel and habitation. In answer to the question of whether astronauts can survive several months in weightlessness without physical deterioration that would endanger a mission or their health, the response from a growing choir of space life scientists is a collective "we don't know." Interestingly, it is life scientists who may be most committed to getting a space station built, as it will likely provide an opportunity to conduct serious experiments on space physiology.[23]

Related to these physiological changes is a host of psychological problems, including loneliness, boredom, homesickness, and so on, especially when astronauts "suddenly realize they're a long way from home with people that they're not getting along with" (Smith 1990). Chandler (1989) points to anxiety, sleep disturbances, territorial behavior, withdrawal, and depression as possible responses to the stresses resulting from prolonged confinement and isolation. They suggest that impaired cognition, motivation, and performance may result in lowered morale, mission failure, and even death. They also cite data from both U.S. and Russian missions which detail "psychological" problems, including a Skylab mission in which astronauts refused to work for a day because they were annoyed with NASA, diaries of Soviet cosmonauts which revealed feelings of boredom and

depression during a 34-week mission, and reports from Soviet and Czech cosmonauts of interpersonal tension among crewmates related to lack of privacy and sociopolitical differences.

These accounts raise compelling questions about the limits of the "complementary sexes" model proposed by NASA as leading to more harmonious, productive work. Psychological disturbances raise the specter of sexual violence, racial violence, and other serious interpersonal conflicts resulting from stress induced by long missions. It is somewhat disturbing to us that sexual behavior in space is assumed to be "total consenting adult free-choice sex." Given contemporary gendered power dynamics, this seems naively idealistic. Yet, an interesting research question is presented by the possible effects of weightlessness on expressions of sexual and other types of violence. For example, how would physical/bodily deterioration affect an individual's capability to overpower, force, and/or injure another astronaut? What does force look like in a 0-gravity context? Despite these concerns, issues of sexual violence are rarely raised with respect to long-term travel, and when we mentioned this possibility to informants they seemed vaguely puzzled.

Because of these physiological and psychological effects, humans are seen as "a frustrating piece of hardware for the engineers to deal with." Humans are "messy" and cause endless misery for NASA engineers who often "have their hands full keeping human beings alive." Yet, the impact of space travel on bodies suggests that humans are anything but another piece of hardware.[24] Human bodies represent biological constraints on space travel, just as space travel reconfigures bodies. Not only must NASA keep this particular piece of hardware alive, but human bodies must also be *controlled* in order to enable effective space travel. Therefore, the agency must investigate the effects of flight on human bodies in order to continue sending people to space, a task it seems to undertake only as a necessary evil. As one informant remarked, "there's extraordinary science to be done, but *not* in the life sciences. The only purpose of life-sciences research is presumably to gauge the effect of long-term missions on human beings."

For example, in late 1993, the *Columbia* returned from a record-setting 14 days in orbit devoted entirely to biomedical and life sciences research, only the second such mission in several years. The "balanced" seven-member crew, including two women and five men, studied the role of weightlessness in transforming human bodies[25] The astronaut researchers subjected themselves to a range of tests, such as being "dizzied by spinning chairs and whirling dots, jabbed with needles, and dropped by bungee cords" (*New York Times* 1993a). Because NASA is concerned about finding ways to counterbalance the effects of 0-gravity, the crew also exercised rigorously and "took turns cycling around the world" (*New York Times* 1993b). After the *Columbia* landed, the crew was removed on stretchers in order to slow the effects of the return to a 1-gravity environment. For several weeks, they continued to undergo testing in order to determine how long it takes for bodies to readapt.

Although the *Columbia* crew "set a new standard for productive space life sciences research" according to the mission ground controller, it is interesting to note what was not studied on this 14-day mission. In all media accounts of the *Columbia's* quest for biomedical knowledge, none mentioned reproductive or sexual research such as fertility, sterility, menstruation, and ejaculation. Either these problems were not a focus of the mission or NASA has not discussed them publicly. It seems somewhat odd (but not really surprising) that a mission devoted exclusively to life-sciences research would not address the effects of space travel on reproductive physiology.

In this case, what is *not* talked about in the media coverage is cause for further analysis, as reproduction will likely be affected by space travel. Yet, there is little "hard" evidence about the effects of radiation and microgravity on female reproduction because there have been so few studies of women astronauts.[26] There is some evidence that space flight affects male fertility, particularly sperm development (Warren 1989). Radiation and a microgravity environment may mutate sperm, not only during space flight but after an astronaut returns to Earth. This has some interesting implications. One informant remarked that male astronauts could freeze their sperm before space flight and then use it later if and when they choose to reproduce.[27] Assuming that female fertility is also affected, women astronauts do not have the option of freezing eggs for later use in reproduction, suggesting that use of some Earth-based reproductive technologies may be limited in a space environment.

Space pregnancy is also presumed to be risky, and solutions to the "problem" of female fertility include sending only men to space (which raises discrimination and equality issues), sending only post-menopausal women to space (an option rarely discussed by NASA), and researching female contraception in space in order to prevent pregnancy. The latter practice is seen by one scientist as a way of "decoupling" sex and reproduction, enabling female astronauts to be "sexual beings" while avoiding the consequences—both physiological and sociopolitical—of reproduction.[28] However, this informant's "decoupling" discourse makes sense only within a heterosexist framework in which fertile females have sex with fertile males.

Space pregnancy is considered physiologically (and socially) dangerous precisely because so little is known about it, and it is constructed by scientists and others as pathological in multiple ways. One informant remarked that "childbirth is a particularly traumatic experience, there is usually some blood loss. Now, let's suppose that there are complications, don't forget you have six to eight people in an environment no bigger than a bathroom and you have a life support system that has been designed to take care of these people." Pregnant women may have different needs than other crew members in terms of nutrition, oxygen, water, and physical space, all of which may be in short supply on long-term missions. One informant believes that space pregnancies may also threaten crew social dynamics because other crew members may resent the pregnant astronaut. Male astronauts may be "particularly resentful" as they are, in the words of an informant, "especially bad at coping with kids."

In addition, animal studies have indicated that while ovulation, copulation, and fertilization may occur in space, there are potentially serious implications for resulting offspring (Santy, Jennings, and Craigie 1989). According to one informant, a reproductive scientist, embryos and fetuses may be impaired during space flight. The physical movement necessary for fetal development on Earth may be impossible in a weightless environment. If fetuses experience the same physiological deconditioning that adults do, this could severely impact fetal growth and development. This raises a possibility that fetuses which develop in a space environment may be unable physiologically to return to Earth once they are born. Would fiscal, material, and moral responsibility for "space babies" then fall on the astronauts who birth them, or on the country, corporation, or movie star who sponsored the mission? Scientific accounts of sexual reproduction thus stress the problematic nature of female bodies and raise a number of intriguing questions about the construction of sex differences in outer space.

In short, NASA has chosen to define reproduction and sexuality as synonymous and interchangeable. A simplified relationship would look like this: sexuality = men fucking women = reproduction. There are two contradictory readings here. First, NASA's long-term political goals include colonization of space as discussed earlier, which requires propagating the human species in a space environment. Given current reproductive conditions, female bodies are a necessary "space" for the creation and maintenance of fetuses. In such a reading, heterosexual sex becomes a necessary means through which reproduction is accomplished, especially given the limited use of assisted reproductive technologies in space. In this framing, NASA's reluctance to talk about sex seems somewhat puzzling. If the agency wants to colonize, it needs women and it needs heterosexual sex.

Yet a second reading, drawing on the above data on reproduction, tells us that there is a fundamental problem with NASA's colonization goals. At this particular historical moment, reproduction in space is highly uncertain and NASA fears its physiological and social consequences. But if reproduction in space becomes a viable practice, then women will become commodities, valued for their role in potential colonization. Historically, colonizing activities on Earth have generally required women's participation in masculine voyages of discovery and conquer. It is possible that in future colonization efforts, heterosexual intercourse would be encouraged while other expressions of desire might be actively discouraged. Thus, NASA's activities may create a "brave new world" shaped by the sexual and reproductive traffic in women (Rubin 1975).

IF WE CAN PUT A MAN ON THE MOON, WHY CAN'T WE...?

We have argued that gender, sexuality, and reproduction are imbricating and mutually constitutive discourses within the U.S. space program. Within the masculine framework of space flight, gender differences are constructed and deployed across multiple sites. Female bodies are essentialized in opposition to a male norm, leading to notions of masculinity and femininity as "natural"

categories. These differences are construed as fundamental and constrain the ways sexuality and reproduction are understood and explored. Sexuality is discursively located in complementary male and female bodies, reflecting and reinforcing the heterosexual paradigm. Reproduction is then articulated as a natural and inevitable outcome of sexual activity defined in terms of male-female intercourse. On their surface, these constructions are consistent with NASA's long-term goals of colonizing space. Yet, because reproduction is physiologically problematic *and* because sexuality means many different things despite NASA's narrow ideological framing, sex and reproduction are contested and will likely remain so in the future.

We have also suggested that these discourses are situated within a broader set of practices in which human bodies and futures are inscribed. These include scientific research, mission planning, public relations activities, crew management, and other key sites. Inscription is a powerful tool for analyzing the dynamic, porous relationship between Earth and space, including the activities and meanings which mediate the symbolic and vehicular traffic. Space is alive with possibilities, yet it is also an embattled domain and no future is certain. What we have attempted to show in this paper is that conservative theories and praxis on Earth propel us towards some futures while eclipsing the possibility of others.

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NOTES

1. A majority of our informants, including scientists, consultants, and NASA personnel, became interested in space flight through science fiction novels, the original *Star Trek*, and media coverage of early space program successes, including Armstrong's walk on the moon. One reproductive scientist described herself as a "Trekkie," while a former NASA flight surgeon reminisced about watching the moon landing when she was 16 years old with "tears streaming down her face."

2. We would like to stress the role of the sociologist as a needed (and so far absent) actor in the space domain. There are few social scientists involved in decision making within the space program. It seems to us that sociologists are especially well equipped to ask (and answer) questions about human interaction, social conflict, contested domains, and gendered inscriptions in a space environment. While this is of course a self-serving plea from a couple of Trekkies whose friends routinely raise curious eyebrows at the nature of this project, it is also a serious request for inclusion of multiple and diverse actors in these practices which inscribe the future. Although space exploration and eventual habitation

continue to reflect both local and global power relations, future scenarios remain to be seen. Reframing our introduction, we might ask: **Is** Space the final frontier? And how shall that frontier be shaped?

3. Unfortunately, our attempts to interview payload and mission specialists were met with great resistance and outright refusal. A mission specialist is an astronaut who is permanently on staff as a member of the flight crew and may fly more than one mission. A payload specialist is an astronaut who usually flies just one, often highly specialized mission. For example, a certain type of life scientist, such as a bone researcher, may be brought in to serve on a specialized life-sciences mission dealing with bone decalcification.

4. Open coding involves naming and categorizing phenomena through close examination of data, while axial coding links data in new ways by making analytic connections between categories.

5. As this research continues, efforts will be made to identify negative cases, defined as conditions under which phenomena may have different implications. Negative cases add to depth and density of understanding by emphasizing the range of variation of developing theories.

6. According to Walter (1992), in 1992 space shuttle missions cost an estimated $2 billion each, or approximately $400 million per shuttle-launched human.

7. Of course, some countries shape space activities more than others. As Chris Gray has reminded us (personal communication), for any country capable of launching satellites (e.g., the United States, Russia, Israel, France), space becomes the "high ground, and it is a military issue first and foremost."

8. Space is also open and seemingly available for creative advertising executives to broadcast their products. For example, Arnold Schwarzenegger's promotional media blitz prior to the release of his less-than-successful movie *Last Action Hero* (1993) included an advertising arrangement with Space Marketing Corporation. The proposed deal included rights to an area on the fuselage and booster of a rocket, and marked the first time a U.S. space mission attempted to displace costs by obtaining commercial sponsorship.

9. Grobstein has pointed to potential genetic problems with small founder populations, including the need for such populations to "carry more genotypes than phenotypes." He stated (1988:159) "enter the unborn in the frozen state. Transport of frozen preembryos would minimize required space and resources and, if the preembryos were carefully selected from Earth's genetically diverse human population, could enlarge and diversify the gene pool of the new colony." Thus, not only enter frozen embryos but also potential genetic selection and eugenics. Grobstein here raises the possibility of a mapped Human Genome which would enable selection of healthy, fit specimens and the specter of a genetically engineered race of humans intentionally designed for living and reproducing in space.

10. Obviously, this is not the only reading of space flight. Many femininsts (Petchesky 1987; Stabile 1992) have commented on readings in which manned space capsules are seen as wombs containing fetus-like spacemen.

11. A pseudonym.

12. Being "marked" by gender has serious implications for female astronauts when male gender is largely "unmarked." According to an informant, many women are afraid of losing their jobs or being denied the opportunity to serve on long-term missions because they are defined as "potentially pregnant" by mission planners.

13. See also Kozloski and Mackowski (1990) for details about the women who did not make it into space during this era.

14. We have addressed the particular social, political, and scientific issues concerning human sexuality more explicitly in our paper, "Lust in Space: Sexuality and Gender on the Final Frontier," presented at the 1994 meeting of the American Sociological Association, Los Angeles, CA.

15. Both the *New York Times* (2/11/92) in "Recipe for Love: A boy, a girl, a spacecraft" and the *San Francisco Examiner* (3/1/92) in "Sex in Space? NASA Blushes at the Thought" construct this hard-breaking news story as an opportunity to explore the issues of sex and reproduction in space.

16. Apollo missions began as part of the space race in 1961. After Soviet astronaut Yuri Gagarin orbited the earth, President Kennedy increased federal allocations sixfold. The Apollo missions were aimed at a moon landing in 1967 (Walter 1992).

17. Hilgartner and Bosk's term **carrying capacity** is an attempt to explain how certain issues become defined as social problems. In their analysis, carrying capacity is the finite space and attention span that a society, an organization, or individuals possess to focus on and care about social problems. Social problems float in and out of carrying capacity; the ability for a problem to remain in the carrying capacity will increase its likelihood of being allocated public monies and time.

18. An added irony of NASA media relations revolves around the role of the media in introducing and inspiring the celestial careers of crew members. Historically, NASA's public relations arm has constructed space heros for the American public. For instance, in the late 1950s and early 1960s, the seven Mercury astronauts and their wives were raised to the level of celebrity through a *LIFE Magazine* contract. A contemporary example of paparazzi attention is Mae Jemison, an African-American woman astronaut who has been featured in the pages of *MS* and *Interview* magazines. She was also named one of *People Magazine's* 50 most beautiful people for 1993. In a cameo on *Star Trek: The Next Generation*, Jemison appears to transcend the limitations of NASA's space program.

19. This comment illustrates what seems to be a particularly Western, middle- to upper-class assumption that all sexual activity requires privacy. However, due to diverse spatial, cultural, and familial configurations on Earth, many people often have sex in the presence of other people.

20. There is reason to believe that it is the **sexual** nature of potential astro-interactions which evokes privacy discourses. For example, the privacy of the Mercury crew in the 1960s appeared to be of less concern to NASA than contemporary missions. Consider the bombardment of physiological and psychological tests these astronauts endured, humorously depicted in images of *The Right Stuff* actors with enemas protuding under their hospital gowns.

21. Here we are especially indebted to Matt Schmidt for his insight and suggestions.

22. There are exceptions, however. A physiologist and former NASA consultant remarked, "the focus on microgravity as the root cause of everything is misplaced. Anyone with common sense can tell you that there's more going on in the space environment than microgravity."

23. One informant, a neurophysiologist who has served as a consultant to NASA in the past, believes the United States is inadequately prepared for sending humans into space "because we don't really understand the complexity of the biological problems." He feels that NASA is uninterested in doing science, especially the life sciences, and that "like any government agency it only wants to secure a high budget."

24. Casper (1994) has argued that human and nonhuman are not dichotomous categories but are rather contingent and situational identities which emerge through heterogeneous practices. In addition, cultural studies of science and technology include a burgeoning interest in cyborgs, or entities produced at intersections of humans and nonhumans (Haraway 1985). Cyborg perspectives explore the traffic across these boundaries and the spaces between categories. Cyborg anthropology, for example, takes quite seriously the notion that technologies contribute agency in every realm of "human" activity, and are central to the fabrication of genders, sexualities, identities, politics, and a range of other experiences (Downey, Dumit, and Williams 1992). We hope to explore in more detail constructions of human, nonhuman, and cyborgs in the space domain. For example, if we take these issues seriously, then we must also consider the materials, technologies, astrophysical bodies, and research animals that make the social world(s) of the space program possible.

25. The crew also included two physicians, a biochemist, and the first veterinarian astronaut. In addition to studying "the entire human anatomy, from head to toe," the crew also conducted research on 48 white rats (*New York Times* 1993a). Martin Fettman, the veterinarian, beheaded and dissected six rats in what was "the first animal dissection in space." The rats' tissue will be preserved for further analysis of the effects of microgravity.

26. Increased accessibility of Russian space records following the tranformation of Eastern Europe may eventually provide more data on reproduction, as Russian women have been travelling to space longer than have American women.

27. See Moore and Schmidt (1994) for a detailed analysis of "technosemen" and its use in reproductive practices.

28. One such consequence is that female astronauts who reproduce in space could be held liable if a pregnancy or subsequent birth endangered a mission. This somewhat chilling example of pregnancy constructed as a felony is an interesting corollary to pregnancy constructed as pathology.

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