

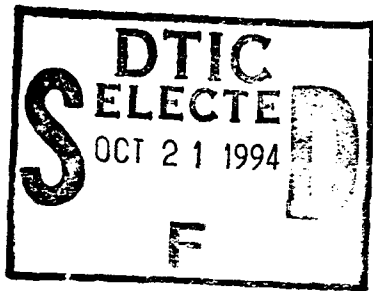
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**Pregnancy and Flying Duties
(Reprint)**



By

Kevin T. Mason

Aircrew Protection Division

August 1994

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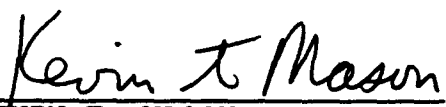
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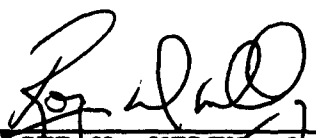
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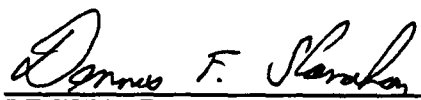


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<p>Some Army aircrew members want to fly during pregnancy. Current Army policy significantly restricts flying duties during pregnancy. There are multiple physical forces and biochemical exposures in the Army flying environment which may adversely affect the course of a pregnancy and the developing fetus. Noise, whole-body vibration, and acceleration forces are of particular concern. The adverse effects of these forces have been documented in animal models and by human observational studies.</p> <p>This paper discusses the issues and concerns surrounding pregnancy and flying for the lay aircrew member from the perspective of an aerospace medicine specialist and family physician. The literature supporting our current state of knowledge on the topic of pregnancy and flying is reviewed. Psychosocial and physiological complications of pregnancy are tabulated. Army policy for flying duties during pregnancy, old and new, are tabulated.</p>						
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The issues and concerns of pregnancy and flying are complex. Knowledge of the effects of the flying environment on pregnancy is incomplete. Numerous legal and ethical issues complicate study of the controversies. Until further information is available, the Army likely will maintain a conservative policy of restricting flying duties during pregnancy, primarily for the safety of the unborn child.

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Pregnancy and Flying Duties

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Joy of new life

One of my greatest joys has been delivering babies for aircrew members and their families. I was even lucky to have one delivery room with a window facing east. It seemed most kids like to come into this world between three and seven o'clock in the morning. So I have many memorable moments holding up a worried-looking newborn, eyes blinking and pupils constricting, with the first rays of morning sun flooding the room. As I said, a joyful time. There have been some sad moments — delivering miscarriages and stillborn infants. These events remind us of our inevitable mortality and that not all pregnancies are free of problems.

Since pregnancy and flying is a subject of controversy, balanced by evolving knowledge and policies, this article shares my current perspective on the issues and policies.

A look over our shoulder

In this century, women gradually entered certain occupations previously thought to be exclusively in the male domain, such as aviation, law enforcement, construction, and auto racing. Despite the accomplishments of pioneer aviatrixes in the 1910s through the 1930s, the bias against women entering aviation is reflected in the comments of others of the time. For example, Claude Graham-White said in 1911, "Women are

temperamentally unfit to fly and prone to panic in any calamity." In the 1930s, Amelia Earhart said, "Men do not believe us capable." In 1939, women were barred from U.S. air traffic control school. School administrators said, "No woman could keep her head in heavy traffic." Even after American women proved their capabilities as instructor and transport pilots in World War II, it was not until the early 1970s that we saw our first female airline command pilot and modern military pilot in the U.S. Today women are just now entering combat mission training in U.S. military aviation.

Until the last two decades, considerable mystique surrounded the female reproductive cycle, even in the medical community. This was due largely to the lack of knowledge and the inaccurate belief that women were fragile, most certainly so while pregnant. Standard medical care in developed countries into the early 1960s placed women on 10 days of strict bed rest after delivery. With maternal mortality remaining a significant problem well into this century, perhaps these precautions were warranted at the time, though not well supported by fact.

Since the 1960s, the veil of this mystique has gradually lifted. Analysis of hormones and other key biochemical processes, ultrasonic and fiberoptic imaging of the fetus, and other fetal monitoring devices are improving our understanding. Still, the effects of the workplace on the developing fetus are not

well known. Our scope of knowledge is limited by the small number of women in certain occupations and the medical-legal ethics against exposing humans, especially pregnant humans, to an environment with potential harmful effects.

Current issues and concerns

While the physiologic effects of flying are very well known, the specific effects of the aviation environment on pregnancy are not well known, but potentially harmful. Although pregnancy is a natural process, it is accompanied by psychophysiologic changes influencing all major body systems. Pregnancy may be unpredictably complicated by acute changes in health at any time, even when the pregnancy appears to be progressing normally with a low risk for complications. Multiple social and legal issues encircle pregnancy, some conflicting with flying or the study of pregnant women while flying. The rights of the spouses of pregnant women and the rights of the unborn child are argued in today's courtrooms, often in favor of the spouse and fetus. Many new national and international standards advocate the protection of the unborn child, regardless of the mother's or attending doctor's willingness to assume certain occupational risks.

A search of the U.S. Army Aviation Epidemiology Data Register shows there were about 480 female aviators in our peak aviator work force in the calendar year of 1989. About 25 per year were restricted from flying duties due to pregnancy from 1988 to 1992.

The U.S. Army Aeromedical Consultant Advisory Panel (ACAP) regularly reviewed the issue of pregnancy in aircrew members since young women first entered the

Army aviation force. Dozens of consultants have been involved to include aircrew members, flight surgeons, aerospace medicine specialists, and obstetricians of both genders. The medical literature has been reviewed continuously. This aeromedical review process has provided a basis for updating aeromedical policy.

Table 1 summarizes the major issues and concerns addressed by the ACAP. The key aviation stressors involve hypoxia, noise, whole-body vibrations, acceleration forces, high environmental temperatures, and toxins.

We are sure fetuses can tolerate moderate levels of hypoxia up to physiologic equivalents of 10,000 feet altitude above mean sea level. Fetuses have been monitored in airline cabins with cabin altitudes up to 8,000 feet without adverse effects. Above an altitude of 10,000 feet above mean sea level, some studies show increased risk for infant morbidity and mortality. Additional caution is required since anemia is common in pregnancy. Anemia increases the physiologic altitude, increasing the degree of fetal hypoxia at a given exposure altitude. Smoking while pregnant, besides the direct harmful effects of chemicals in the smoke, also increases the physiologic altitude.

Our aviation environment, especially rotary-wing cockpits, is rich with high decibel, low and high frequency sounds which damage hearing. The uterus and amniotic fluid may accentuate low frequency sounds, and only weakly attenuate high frequency sounds, perhaps by no more than 10 decibels as determined with direct measurement inside the uterus in the third trimester of pregnancy. The unborn child is more susceptible to hearing damage than adults for a given sound pressure exposure. Since children are devel-

oping language and listening skills, they cannot tolerate the same degree of hearing loss as adults and still function normally. The effects of high decibel noise on the fetus are not completely known, but studies in Scandinavian countries and Canada link a three-fold increase in infant hearing loss to occupational noise exposure during pregnancy as low as 90 decibels. We must assume the fetus is exposed to harmful sound levels in Army aviation, and the fetus is without the benefit of hearing protection available to the mother.

Rotary-wing aircrew are exposed to significant levels of whole-body vibrations. Whole-body vibrations damage fetal animals, causing developmental failures and birth defects. Whether the suspension systems of the human uterus and amniotic fluid protect or accentuate whole-body vibrations is unknown. The effects of whole-body vibration on the development of the human fetus are unknown, but some studies have shown women with occupational exposure to whole-body vibrations are at increased the risk for miscarriage and birth defects. Some caution is even warranted in Synthetic Flight Training Simulators with the "seat shaker ON" mode.

It is thought the fetus is protected partially from injury when exposed to acceleration forces in the first trimester. But in the second and third trimester, there is an increased risk for uterine rupture, separation of the placenta from the uterine wall, and fetal mortality. These notions were developed from study of pregnant women and animal models in X-axis forces (forward-backward) found in motor vehicle accidents. The effects of high Z-axis (up-down) acceleration forces, and seat and restraint systems on pregnancy are unknown in aviation mission profiles and mishaps. Theoretically, with Z-axis forces, the uterus would be forced downward into or

across the edge of inflexible pelvic bones, increasing intrauterine pressures and accentuating the risk for injury. The highest risk for injury might be in the third trimester when the restraint system would ride over the uterus at different angles than designed. As with X-axis forces, uterine rupture and placental separation from the uterine wall with exposure to otherwise minor Z-axis forces are possible.

High environmental temperatures are common in Army aviation. Pregnant women have decreased tolerance to heat in all stages of pregnancy. Body temperatures greater than 101 degrees Fahrenheit may cause structural or functional damage to the fetus. It is suspected heat exposure may cause certain major central nervous system defects.

The effects of aviation toxins, such as hydrocarbons, carbon monoxide and other combustion byproducts, on pregnancy are unknown. Theoretically, the greatest harm would occur during the first trimester when the embryo, and later fetus, are at greatest risk for toxic injury.

There are potential electromagnetic hazards in our operational environment that may harm the developing fetus. While it is thought the levels of electromagnetic radiation exposure in aviation and the workplace are safe, studies on this potential hazard are ongoing and controversial.

Other aviation concerns related to the health of the mother include the common medical complications of pregnancy, such as fatigue, nausea, vomiting, frequent urination, fluid retention, weight gain and change in body habitus, acute bleeding, and anemia. The main concern is some complications occur unpredictably with acute incapacitation, even during an otherwise normal or low risk

pregnancy. For example, one in 5 to 10 pregnancies ends in miscarriage generally with the acute onset of pain and heavy bleeding.

Policy, old and new

The old policy prohibited flying duties of any kind while pregnant. It resulted in the status of "Duties not to include flying" for greater than 180 days, resulting in medical termination from aviation service. This required requalification at the waiver authority level after recovery from the pregnancy.

Based upon an ongoing and thorough review of the issues and concerns of flying while pregnant, a new policy has been issued for the management of pregnant Army aircrew members. Tables 2 and 3 summarize the old and the new U.S. Army aircrew member pregnancy and flying duties policy.

The new policy minimizes the administrative burdens of medical termination from aviation service, gives the commander greater flexibility in keeping pregnant aircrew members at higher levels of training and proficiency, speeds the return to unrestricted aviation service after delivery, and still meets the intent of protecting the mother and unborn child based on current medical knowledge and ethical/legal constraints.

The absolute pregnancy success rate among Army aircrew members is unknown. One reason is that our aircrew health database mostly contains reports of pregnancies that went past 28-weeks gestation, and even then, the information often provided is limited to dates of delivery. The new policy requires flight surgeons to report the outcomes of all pregnancies and pregnancy complications involving cockpit aircrew members. This is

one step to help answer many questions posed by the aviation line and medical community concerning pregnancy outcomes in the aviation and military environment. It also will help formulate future policy.

Departure

The issues and concerns of pregnancy and flying are complex. Knowledge about the effects of physical forces and toxins found in the aviation environment on pregnancy is not complete, but the potential for fetal injury and death is real. Pregnant women cannot be used as "guinea pigs" in Army aircraft to deny or verify these effects. It is difficult to balance the conflicting requirements and recommendations of the patient, family, unborn child, command, and medical community. Legal and ethical considerations conflict as well. Despite these hurdles, it is the opinion of the ACAP that a better balance has been achieved by the new policy.

Table 1.
Issues and concerns in pregnancy and flying.

General military duties	Limited deployability Restricted physical training and environmental exposure Restricted wearing of military equipment
Aviation duties	Hypoxia High decibel noise Whole-body vibration, significant in rotary wing aircraft Acceleration forces and restraint system issues in mishap Increased heat exposure Aviation toxins
Social & legal issues	Spouse rights when objecting to flying duties Fetus rights to protection from harmful environments Tort liability in event of adverse pregnancy outcome Restrictive guidelines in the conduct of human research
Common complications in the first trimester, 0-12 weeks gestation	Morning sickness, 1 per 2 pregnancies Miscarriage and/or acute bleeding, 1 per 5-10 pregnancies Fetal malformations Fainting and fatigue Decreased heat tolerance
Common complications in the second trimester, 13-24 weeks gestation	Ectopic (outside womb) pregnancy, 1 per 50-130 pregnancies Miscarriage and/or acute bleeding, 1 per 5-10 pregnancies Diabetes of pregnancy, 1 per 120-300 pregnancies Anemia Fainting and fatigue Decreased heat tolerance
Common complications in the third trimester, 25 weeks gestation to delivery	High blood pressure Pretoxemia or toxemia of pregnancy, 1 per 10-50 pregnancies Premature labor and/or acute bleeding Rupture of placenta, 1 per 200-500 pregnancies Decreased respiratory capacity Anemia Fainting and fatigue Decreased heat tolerance Blood clots in veins Heartburn (gastritis, esophagitis) Backaches
Other complications	Kidney and gall bladder stones Genitourinary tract infections, 1 per 3-10 pregnancies Twins, increased complication rates

Table 2.
Past policy for pregnant U.S. Army aircrew prior to 27 January 1993.

Time line->	Date of diagnosis to 4-6 weeks after delivery
Class 1/1A	Disqualified
Class 2/2F/2S/3	DNIF. For Class 2/2F, DNIF with termination from aviation service (permanent medical suspension) since DNIF is for greater than 180 days (AR 600-105 and DOD Pay Manual). Requalification 6 weeks after delivery.
Class 4 (ATC)	FFD unless medical complications or hospitalization will prohibit/interfere with ATC duties

- * DNIF is "duties not to include flying."
- ** FFD is "full flying duties," with or without restrictions.

Table 3.
New policy for pregnant U.S. Army aircrew effective 27 January 1993.

Time line->	Date of diagnosis to 12 weeks gestation	13 weeks gestation to 25 weeks gestation	26 weeks gestation to delivery	Delivery to 4-6 weeks after delivery
Class 1/1A	Disqualified			
Class 2/2F/2S/3	Uncomplicated pregnancy: Temporary FFD with restriction to SFTS; an exception is from 13 weeks to 25 weeks gestation may fly FFD with restriction to multiengine, nonejection seat, fixed-wing aircraft with dual pilot status and cabin altitude ≤10,000 feet.			DNIF
	Complicated pregnancy: DNIF with termination from aviation service (permanent medical suspension) if DNIF is for greater than 180 days (AR 600-105 and DOD Pay Manual). Requalification, with or without waiver, upon resolution of condition.			
Class 4 (ATC)	FFD unless medical complications will prohibit or interfere with ATC duties			

- * DNIF is "duties not to include flying."
- ** FFD is "full flying duties," with or without restrictions.

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