



# Everyday Ethics: Aerospace Research

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August 8, 2018

# Objectives

- Explore why ethics matters in NASA scientific research endeavors
- Identify sample ethical issues facing NASA researchers
- Introduce ethical responses to everyday challenges

# Why Ethics Matters

- Ethical research as a pre-requisite for good science
- Inherent knowledge and skill hierarchy between lay public and trained researchers
- Lay public may not know what constitutes credible research (e.g., reliability, reproducibility, etc.), and what would constitute data manipulation (e.g., p-hacking)
- Unethical research and reporting/publication practices can lead to the public dismissing research results and recommendations – detrimental to the whole scientific community

# Special Considerations for NASA

- Tax-funded scientific research – accountable to the public
- Internal values meet external obligations
- Public trust in scientists' knowledge, skill, and recommendations require researchers' commitment to honesty, transparency, and fairness
- Highly technical information may not be accessible to lay persons
- The public may not perceive or reap direct benefit from research (vs medical/clinical research)

# Everyday Research Ethics Principles

- Respect for persons, beneficence, justice (Belmont Report, 1979)
- The goal of research to generate new knowledge can never take precedence over the rights and interests of individual research subjects (Declaration of Helsinki, 1964)
- Emphasis on informed consent – think about the special challenges in the NASA setting
- Weigh the risks and burdens to individuals (also to the institution?)
- Question: can we allow scientists to take more risks if they provide consent? (Schimmerling, 2010)

# Risk Considerations

- Inherent risks and uncertainties -- acceptable risk levels?
- ALARA (As Low As Reasonably Achievable) + limiting exposure + formal appraisal of hazards + detailed records
- Acceptable risk level set *a priori*
- The operating limits for mission design and flight operations are set to correspond to the lower 95 % CI of the risk probability
- To ensure that mission designers and managers have recourse to a number of actions well before the permissible exposure limits is reached (Schimmerling, 2010)



# HEALTH STANDARDS FOR LONG DURATION AND EXPLORATION SPACEFLIGHT

Ethics Principles, Responsibilities,  
and Decision Framework

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# Other Special Considerations

- “Astronauts are not only employees, but also volunteers. They are not conscripted to serve on space exploration, but are participants in what will remain research as long as there are no permanent colonies in space” (Schimmerling, 2010)
- Mistakes can be costly, both in human lives and financially
- The ability to communicate potential problems among different research groups key to preventing and addressing pertinent safety issues
- Resources wasted if research not utilized or communicated appropriately



# Research Ethics at Different Levels

- Individual
- Team
- Organizational
- Societal/System
- Individual, team, and organizational levels have to go together – team and organizational ethics/culture help to define ethical norms for individuals

# Individual Level

- A researcher's own disposition (e.g., work ethic, attitude, drive, competitiveness, goals)
- Objectivity and conflict of interest -- specific NASA rules on gifts/COI
- Mindful how researcher-participant line can be blurry
- Familiarity with research standards (ethical and technical)
- Identity and role as a civil servant
- Avoid misconduct in communication of scientific or research results (fabrication, falsification, plagiarism)

# Example: Inflation Bias

- Selective reporting or p-hacking -- when researchers collect or select data or statistical analyses until nonsignificant results become significant (Head et al., 2015)
- Conducting analyses midway through experiments to decide whether to continue collecting data (Gadbury et al., 2014)
- Recording multiple response variables and outliers and deciding which to report postanalysis (John et al., 2012)
- Stopping data exploration if an analysis yields a significant  $p$ -value (Bastardi et al., 2011)
- Type 1 error – false positives hinders scientific progress; unreliable

# Team/Unit Level

- Team dynamics and power hierarchy
- Who is conducting the research, authorship credits
- Processes to ensure appropriate team cohesion that can provide good feedback loop for responsible and safe conduct of research
- From last lecture: organized skepticism?
- Mentorship and collegiality

# Organizational Level

- Clear, accessible, and enforced research guidelines
- Ames: Human Research Institutional Review Board (HRIRB); Office for the Protection of Research Participants(OPRP)
- How research ethics efforts are supported
- Educational and outreach activities for researchers
- Promote an open culture for discussing issues and asking questions – ethical cultures and communications
- How misconduct is prevented and handled at the organizational level

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## Ethics Training

### REQUIRED ON-LINE ETHICS TRAINING FOR ALL INVESTIGATORS WHO CONDUCT "RESEARCH WITH HUMAN SUBJECTS" (AS DEFINED IN THE COMMON RULE—26 CFR 25)

NASA Headquarters requires all investigators who conduct research that falls within the purview of the Common Rule to complete a prescribed course in ethics training.

The course is provided at no cost to NASA Centers through the Collaborative Institutional Training Initiative (CITI) offered by the University of Miami <https://www.citiprogram.org/>.

Successful completion of either one of the following two discipline tracks will satisfy the Headquarter' requirement. However, it is recommended (not mandatory nor monitored) that the investigator complete both training programs:

- Biomedical Sciences , and/or
- Behavioral and Social Sciences.

A certificate of successful completion will be issued directly to the investigator by CITI. A copy of the certificate must be included with all research protocols submitted to the NASA Ames Office for the Protection of Research Participants, M/S 243-2, c/o [Sheryl.E.Baca@nasa.gov](mailto:Sheryl.E.Baca@nasa.gov), phone (650-604-6764).



# Office of the General Counsel



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## Related Topics

## Ethics Program

The NASA General Counsel, [Sumara M. Thompson-King](#), is the Designated Agency Ethics Official. She is the primary officer designated by the NASA Administrator to administer NASA's ethics program. [Adam F. Greenstone](#) is NASA's Alternate Designated Agency Ethics Official. The NASA Headquarters Ethics Team is within the General Law Practice Group. The Ethics Team is responsible for day to day management of NASA's ethics program, including support to Center ethics counselors and resolution of all NASA Headquarters' ethics issues. In addition, all Center Chief Counsel are responsible for ethics program implementation at their respective Centers.

You may contact a member of the HQ Ethics Team by e-mail to [ethicsteam@hq.nasa.gov](mailto:ethicsteam@hq.nasa.gov) or by phone at (202) 358-0550. You may contact a [Center Ethics Official](#) by e-mail or by the phone number listed.

### Ethics Resources

- [Appropriated Funds](#): When can you use NASA's appropriated funds.
- [Ethics Frequently Asked Questions](#): Brief answers to frequently asked questions concerning gifts, conflicts of interest, use of government property, and other common ethics areas.
- [Ethics Training](#): Schedule for upcoming classes.

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## Law / Ethics

### Common Rule

The Common Rule is a federal regulation which is promulgated as part of the regulations (i.e., in the code of Federal Regulations or CFR) of each United States cabinet department or agency which does human research.

### Ethics Training

NASA Headquarters requires all investigators who conduct research that falls within the purview of the Common Rule to complete a prescribed course in ethics training.

### Belmont Report

NASA is also guided in its human research by the "The Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects of Research" of April 18, 1979.

### Declaration of Helsinki

The Declaration of Helsinki was developed by the World Medical Association as a set of ethical principles for the medical community regarding human experimentation, and it is widely regarded as a cornerstone document of human research ethics.

### Voluntary Informed Consent

The Importance of Voluntary Informed Consent (from Ames Procedural Requirements document APR 7170.1)



National Aeronautics and Space Administration

Page Last Updated: Feb. 1, 2018

Page Editor: Yael Kovo

NASA Official: Brian Dunbar



# Societal/System Level

- Going beyond NASA – other macro factors
- Funding (e.g., earth science vs space exploration vs international space station)
- Working with private industries – “Tipping Point” solicitations, Small Business Technology Transfer (STTR) program
- Political environment affects how individual researchers’ or research teams’ ability to conduct research or disseminate results
- Public opinions may affect support for NASA research

# Example: Working with Private Industries

- “Tipping Point” solicitations
- Small Business Technology Transfer (STTR) program
- Sending supplies through commercially developed vehicles may be cost saving for the government
- Companies compete for multimillion-dollar contracts
- Aggressive and ambitious schedules
- Quality control -- accelerated schedule might leave little room for additional tests that would otherwise reveal critical weaknesses
- Distributive justice meets beneficence/non-maleficence

# Multi-Level Considerations

- Under-representation of minority communities in scientific research (both as researchers and participants)
- System-level funding restrictions may lead to different hiring considerations, cutting corners
- Competitiveness for funding and publication pressures (p-hacking and funding for peer review processes)
- Example: “NASA uses a peer review process to evaluate and select research proposals submitted in response to these research announcements.” How may funding pressure affect commitment to independent peer-review processes?

# NASA Research in the Broader Climate

- How people think about risks and privacy
- Technological advances in other areas (e.g., AI)
- Genetically altering humans for safer space travel (e.g., to enhance radiation resistance, reduce oxygen needs)

# Everyday Ethics Responses

- Everyday responses require thinking about research in broader contexts
- Ask fundamental questions of why we are doing what we are doing (e.g., are our research priorities aligning with public interests?)
- Align incentives and motivators at different levels to promote ethical reflection and conduct

# Take Home Lessons

- Everyday ethics is not just about avoiding research misconduct
- Internal values (individual, team, organization) and external obligations to the public
- Ethical responsibility to the research community – build on past research, make knowledge available for future research

# Thank You

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