



## **Outsourcing Desktop Initiative for NASA (ODIN)**

### **Due Diligence Briefing: Office of Biological and Physical Research (Code U)**

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# The Organizing Questions

## ...The OBPR Mission

Humans will extend the exploration of space. To prepare for and hasten the journey, OBPR must answer these questions through its research, principally on the ISS:

How can we assure the survival of humans traveling far from earth?

What must we know about how space changes life forms, so that humankind will flourish?

What new opportunities can our research bring to expand our understanding of the laws of nature and enrich lives on Earth?

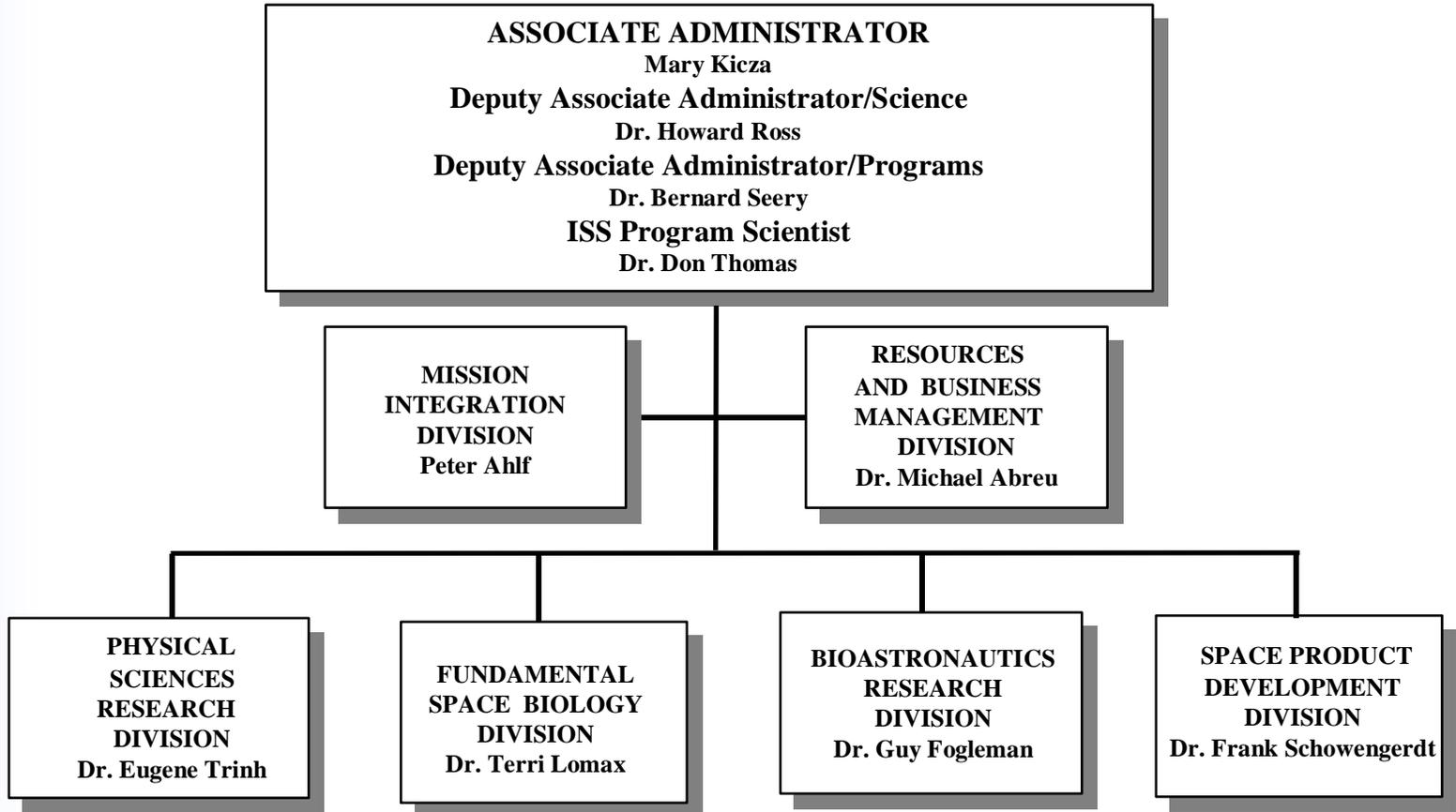
What technology must we create to enable the next explorers to go beyond where we have been?

How can we educate and inspire the next generations to take the journey?





## Office of Biological and Physical Research (OBPR)



SpaceResearch.nasa.gov  
**OBPR**

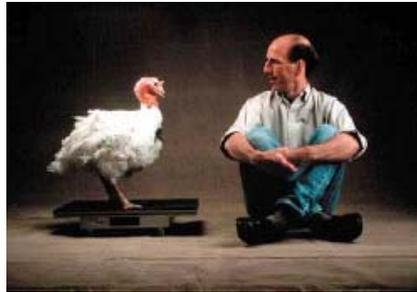
Office of Biological & Physical Research



# Office of Biological and Physical Research

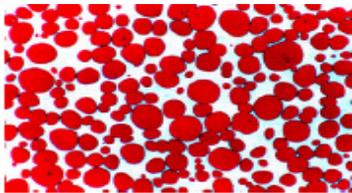
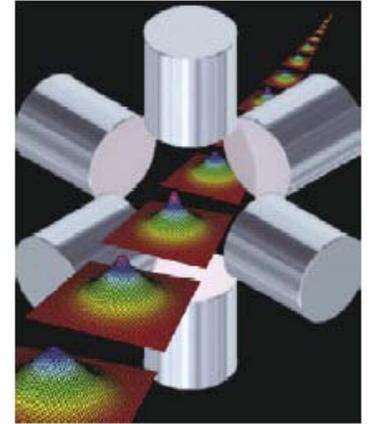
## Our Past Orbit: the past 5 years...

SpaceResearch.nasa.gov  
O  
B  
P  
R

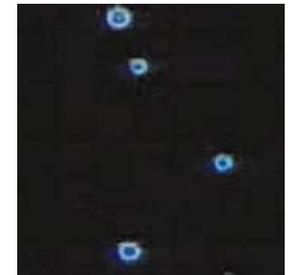
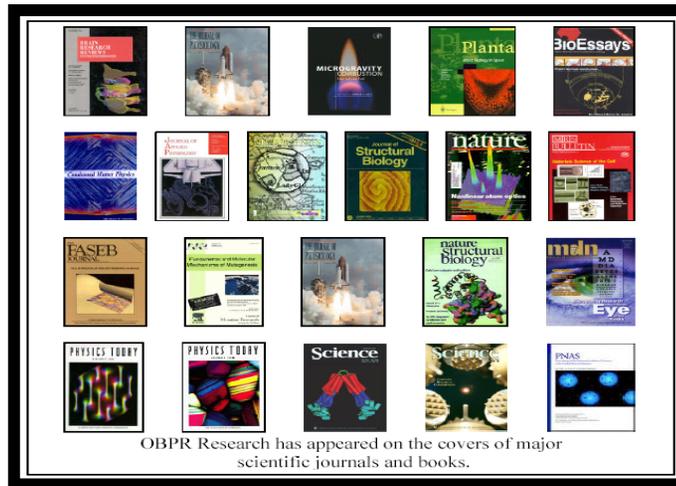


Experiments with mild vibrations suggest a possible countermeasure to astronaut bone loss and osteoporosis

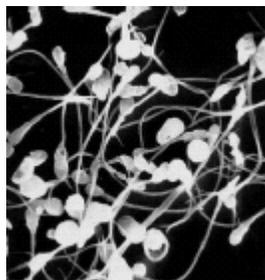
Atom Lasers: Nobel Prize in Physics – 2001



Liquid-Phase Sintering' results used by Kennametal to make their metal-cutting products without expensive post-sintering machining.



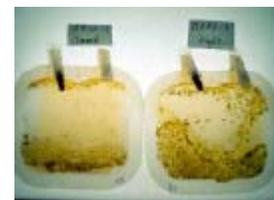
Weakest flames ever observed. Other combustion flight results used by the 2 US aircraft gas turbine engine manufacturers



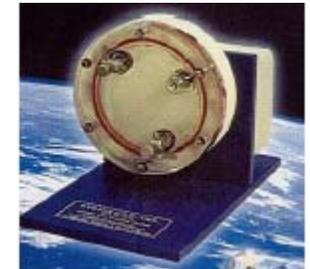
Gravity sensitive fertilization processes demonstrated



OBPR's cataract early detection device co-sponsored and highlighted by NIH to Congress



Bristol-Myers Squibb and BioServe demonstrated production of antibiotics is substantially greater in microgravity than on earth.



Bioreactors: Over 25 patents and over 6000 units in the US Marketplace

Office of Biological & Physical Research



# Office of Biological and Physical Research Biomedical Risks Humans Face in Space

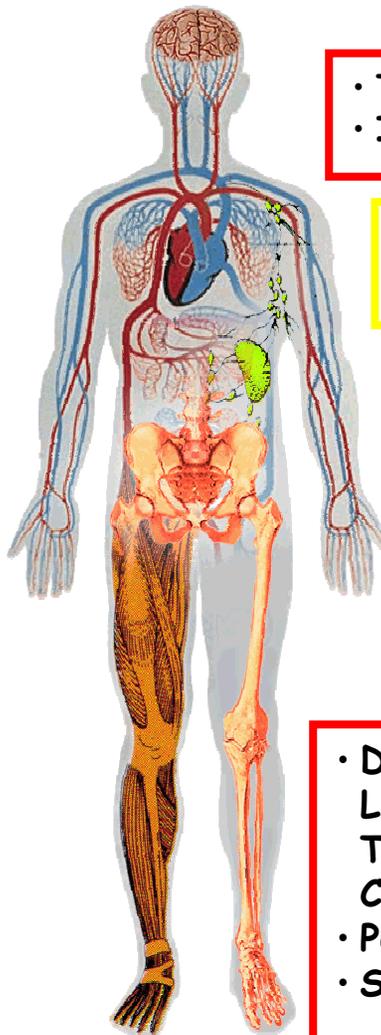
## Effects of Radiation

- Carcinogenesis (38)
- Synergistic effects with microgravity or environmental factors (40)
- Late degenerative tissue effects (39)

## Physiological Changes

- Carcinogenesis due to immune system changes (23)
- Occurrence of serious cardiac dysrhythmias (13)
- Acceleration of Age-Related Osteoporosis (9)

- Manifestation of previously asymptomatic cardiovascular disease (16)
- Toxic Exposure (44)



## Medical Practice Problems

- Trauma & Acute Medical Problems (43)
- Illness & Ambulatory Health Problems (46)

- Renal Stone Formation (12)
- Toxic Exposure (44)



## Behavior and Performance Problems

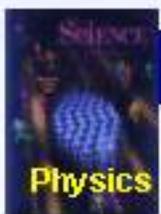
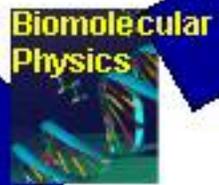
- Disorientation and Inability to Perform Landing, Egress, or Other Physical Tasks, Especially During/After G-Level Changes (33)
- Poor Psychosocial Adaptation (18)
- Sleep & Circadian Rhythm Problems (19)



Research for Science and Exploration



"The common ideas of physics have been applied over distances ranging from the realm of string theory to the furthest reaches of the universe. The results have allowed an understanding of a staggering variety of phenomena and lay the foundation for further research as we probe new frontiers at all distances." (NRC/BPA report)

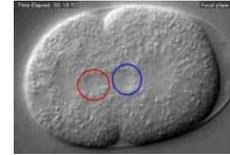
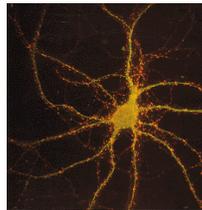


OBPR Physical Sciences Research Discipline Elements

# *What must we know about how space changes life forms, so that humankind will flourish in space?*

## **Does space affect life at its most fundamental levels, from gene to cell?**

- Cell-to-cell communication
- Intra-cellular functions
- Signal transduction
- Cell cycle and growth
- Genomics
- Proteomics



## **How does long term exposure to space affect organisms?**

- Physiology
- Growth
- Metabolism
- Behavior



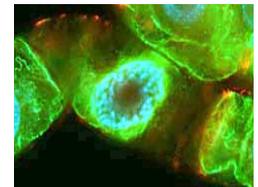
## **How does space affect development and life cycles of organisms?**

- Reproduction
- Critical periods
- Life span effects



## **How do systems of organisms and their interactions change in space?**

- Microbial populations
- Species interactions
- Crew health/life support implications





# Office of Biological and Physical Research

## Examples of Public & Educational Outreach

### Space Research Newsletter



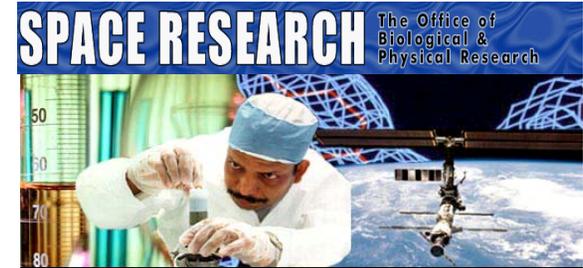
Quarterly newsletter for the Office of Biological and Physical Research. It contains articles, news and events on OBPR research activities.

### Countdown to Launch



Dr. Khalid Alshibli, Project Scientist, talks to students about the Mechanics of Granular Materials (MGM) experiments and hardware during the Countdown to Launch (STS-107)

### OBPR Web Site



[SpaceResearch.nasa.gov](http://SpaceResearch.nasa.gov)

### Educational Conference



Educators at the National Science Teachers Association (NSTA) annual conference take part in a workshop using an air track to simulate how weight is determined in a microgravity environment.



## Code U Activities That Establish IT Requirements

- Substantial external involvement in the program occurs from several different communities including the following: NASA field centers, domestic and foreign universities and scientists, foreign governments and space agencies, other Federal agencies, foreign and domestic industrial concerns, and external advisory groups of distinguished scientists. Congressional and Administration interest and involvement in the program is high.
- Requirements include but are not limited to connectivity to all of the above listed contacts.
- The functions of this organization are vital to both national and international interest. Response time is critical to the success of the OBPR goals and objectives.

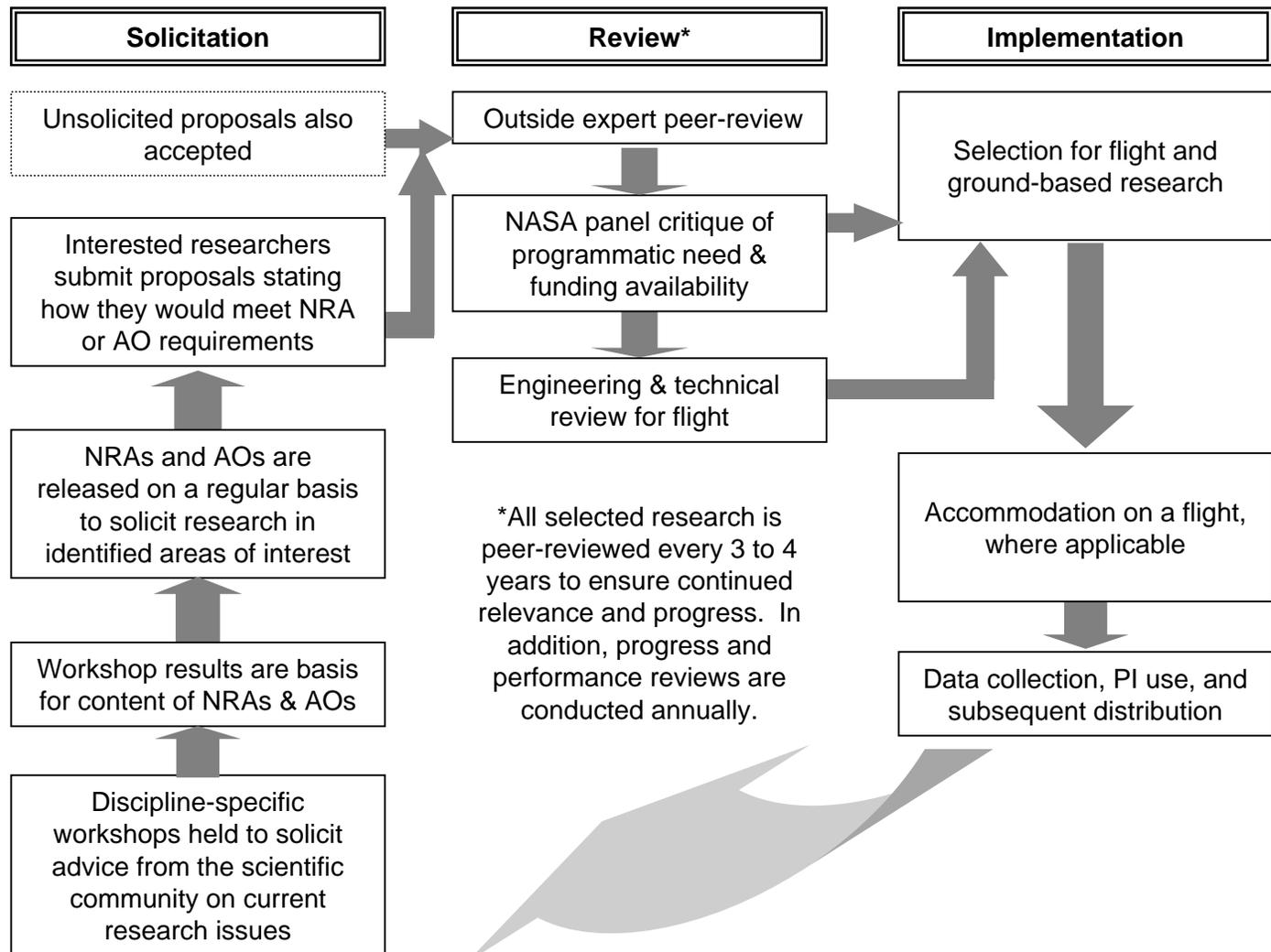


## Research Divisions Activities and Environment

- Roles and Responsibilities
  - Reliance on IT for coordination, implementation and fast response:
    - Science Management/Peer Review
    - Strategic Planning
    - Program Advocacy
    - Program External Coordination
    - Budget Formulation
    - Education and Outreach
- Distributed Management Environment Places Emphasis on IT Throughout the Organization
  - HQ directs and coordinates the Research Programs between off site peer review contractor, multiple NASA Centers, Science Institutes, and international partners
  - Electronic communication between branches of the organization is critical to success



## OBPR Science Acquisition and Funding Process





## Resources and Business Management

- The Resources and Business Management Division has three cross-code responsibilities which include budget development/execution, legislative/policy, and all code administrative work.
  - **Budget:** The budget work demands extremely high reliability in our computing systems as well as a large amount of memory capability due to the large presentations that are developed to support budget justification. In addition, our analysts must have fast, reliable connectivity to the NASA Centers in order to provide timely response to budgetary actions as well as reliable connectivity within HQ. The majority of the budgetary actions and flow of information is performed using the transfer of large spreadsheet files via e-mail.



## Resources and Business Management, cont'd

- **Legislative/Policy:** The legislative/policy function is performed primarily within HQ but also involves connectivity to the NASA Centers. This function demands the development and transferability of large text files with embedded pictures/diagrams which demand high memory storage. Again, the legislative/policy function must respond to actions in a timely manner and uses e-mail connectivity to do so.
- **Administrative:** This function is less demanding for computation capability than the other two functions. However, several database connections are needed, such as the OBPR travel database and NODIS.



## The Enterprise Users and Information Technology

- Enterprise Performance Depends on:
  - Heterogeneous computing environment; cross platform compatibility for applications and server architecture essential
  - Integrated desktop, server, and network reliability: significant loss of productivity when any of these key elements is inoperable
  - Large amounts of remote storage with backup (GB+/person)
  - Remote access: dial-up (travel) and high speed access [e.g. via xDSL, cable modem, etc.] (home)
  - Threat protection, but not in exchange for significant performance loss
  - Desktop and applications ease of use; server and network resources easily accessed
  - High speed B/W laser, high speed color laser
  - Quick response technical support



## Communications Tools

- Electronic Mail
  - Primary method of information/data sharing and distribution
  - MIME attachments are primary method of data transfer
- Video Conferencing (nascent)
  - Distributed work and computing environment demands multi platform video conferencing in lieu of travel
- World Wide Web
  - Intranet and public Web sites are a primary interface with employees and external customers
  - Employee research tool and front end for many data sources
- FTP
  - Large file transfers



## Applications

- Office Productivity Suite, Mail Client, Calendaring, miscellaneous
  - Primary: spreadsheets, word processing, presentations, electronic mail (MS Office and Eudora)
  - Secondary: Illustration, electronic forms
- Databases (some with Web front ends)
  - Local and Remote access for both internal and external customers (taskbook and mailing list)
- World Wide Web
  - Browser which Includes various plug-ins for specialized content viewing (pdf, flash, quicktime et al.)
  - HTML authoring software; limited Web content development and site maintenance
  - PDF creation software



## Applications cont'd

- Multimedia Presentations for Program Advocacy
  - Develop multimedia content: static images, digital video/sound
  - External presentations incorporating digital video, images sound and are *de rigueur*
  - Sophistication level often beyond capability of standard hardware and office suites, requiring specialized software/hardware
    - Video capture
    - Image manipulation
    - Image scanning
    - CD-ROM/DVD writer for limited presentation distribution
  - “In-house” capability required for quick turnaround