National Aeronautics and
Space Administration

Multiple Aspects of Innovation*

AIAA Houston Section Innovation Workshop

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**Views expressed in this presentation may not be those of the author's employer, NASA*

Science and Technology are great engines of economic growth.

"...the real wealth of our nation is not physical — jewelry, gold, large cash accounts, lots of land — but metaphysical, what stems from the human mind — creativity, imagination, innovation, inventiveness." — *Forbes*

Innovation to Strengthen NASA's Legacy of Excellence

- Administrator Charles Bolden
  - Supervisors and leaders to be intentional in enabling an environment of creativity, innovation, and extraordinary contribution
  - Supervisors and employees determine best approach for employee to engage in innovative activities
- Deputy Administrator Dr. Dava Newman
  - NASA recognizes innovative behaviors of workforce
- Agency Executives Performance Requirements Critical Element
  - Lead Innovation
- Innovation feeds into stature of NASA
  - The Best Place to Work: Four Years in a Row

Innovation a Way of Life at JSC

- **JSC Vision: Lead a global enterprise in human space exploration that is sustainable, affordable, and benefits all humankind**
  - We understand innovation/technology needs for human space missions
  - Keeping humans safe and mentally/physically healthy and productive in space requires innovations
- **Excitement in successfully carrying out human space missions fuels innovation**
  - Humans world-wide become part of NASA excitement
  - Astronauts are a great source of inspiration throughout the world

Innovation Initiatives at JSC

- JSC 2.0 Initiative reinventing Center - lean, agile, adaptive to change
- Exploration Integration and Science Directorate combine “new product development” functions – Architecture, Integration, Flight Projects (AES, STMD), Technology, Science, Partnerships
- Early Stage Innovative initiatives – Mars Days with Andy Weir (author of “The Martian”), ICA projects
- Hands-on Integrated Development – Morpheus, Robotics
- Streamlined Flight Processes – 1E Flight Cert., RISE, 5x 2015 Flight Projects
- Commercial Partnership Efforts - Pumps and Pipes, Deep Space Deep Oceans, SpaceCom 2015

(Dr. Douglas Terrier)

Innovation Invention

Satisfy need/desire…
Imagination….
Inspiration…
Idea ……
Motivation…

Identification & Capture

. Unique/New Features
. Benefits/Value
. Advantages

Evaluation

.Technology/Software Viability Assessment
. Commercial Potential Assessment
. Patent or Copyright Potential

Transfer

[Patent Copyright License]

. Patent or copyright (IP Rights)
. Customer Needs or Desires
. Marketing Opportunity
. Manufacturing and Cost-benefit Analysis
. License for Commercialization

From Innovation/Invention to Market

FY2015 T2 Program Activity Summary

TECHNOLOGY TRANSFER PROGRAM

Identify

120 New Technology Report (NTR) Training Sessions Conducted

4311 Active Contracts with New Technology Clause Tracked

1093 Contracts with New Technology Clause Closed

1552 NTRs Processed and Certified

Protect

126 U.S. Patent Applications Filed

119 U.S. Provisional Patent Applications

118 U.S. Patents Issued

12 PCT and Foreign Patent Applications

0 Foreign Patents Granted

1144 Active Patents

Market

462 Tech Briefs Published

610 Technology Opportunity Sheets Created

733 Software Catalog Titles Published

196 QuickLaunch Patents Advertised

100K+ Social Media Followers

License

2104 Software Usage Agreements

14 Joint Ownership Agreements

23 New Evaluation Licenses

33 New Commercial Licenses

6 New Licensing Initiatives

Monitor

316 Active Licenses Maintained

$2,936,123 Royalties Collected

52 NASA Spinoff Stories Published

68 Patents Abandoned

14 NASA Technology Transfer System (NTTS) System Upgrades

3M T2 Portal Page Views in FY2015

24M Spinoff Website Page Views in FY2015

150K Software Catalog PDF Downloads in FY2015

Solar-Powered Refrigerator

NASA Johnson Space Center

SunDanzer Refrigeration, Inc.
El Paso, TX, Tucson, AZ

Originating Technology/NASA Contribution

- NASA missions often require refrigeration for biological sample preservation and chemical and food storage. On the International Space Station, power is chiefly provided via solar panels.
- JSC obtained three patents related to this technology.

Partnership

- This battery-free solar refrigeration technology was licensed to SunDanzer Refrigeration, Inc., and has the potential to reduce the cost and increase the availability of vaccines delivered to the more than 2 billion of the poorest, neediest people in remote regions around the world.

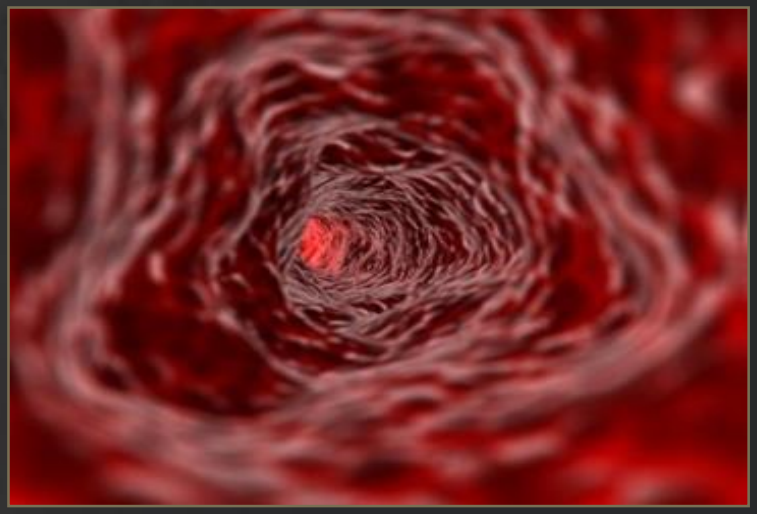
Product Outcome

- JSC has three patents in solar-powered refrigeration technologies.
- NASA's Invention and Contributions Board named JSC's solar-powered refrigerator the Agency's Commercial Invention of the Year in April 2012.
- SunDanzer products start at $579.

Treating Hardened Arteries of the Heart

NASA Johnson Space Center

Meridian Health Systems
Houston, Texas



Originating Technology/NASA Contribution

- NASA develops miniature, noninvasive medical diagnostic and treatment tools for use on future long-duration missions.
- JSC developed a noninvasive, low-cost tool for atherosclerosis treatment using millimeter wave/microwave electromagnetic energy.

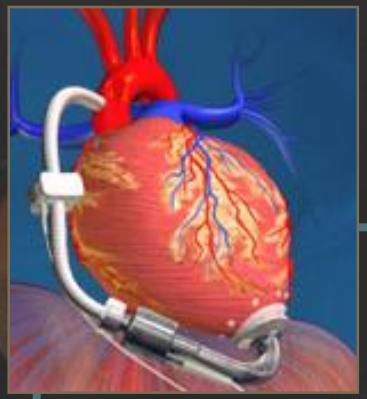
Product Outcome

Current research being done with animal arteries (parts, not live animals) to compare microwave and millimeter wave band operation and to optimize design features such as antenna size, transmitted power, and pulse repetition rate.

Ventricular Assist Device (VAD)

NASA Johnson Space Center

Methodist DeBakey Heart Center and ReliantHeart, Inc.
Houston, Texas



Originating Technology/ NASA Contribution

- A NASA engineer received a heart transplant performed by Drs. DeBakey and Noon after suffering a serious heart attack.
- Six months later, that engineer returned to work at NASA determined to use space technology to help people with heart disease.

Partnership

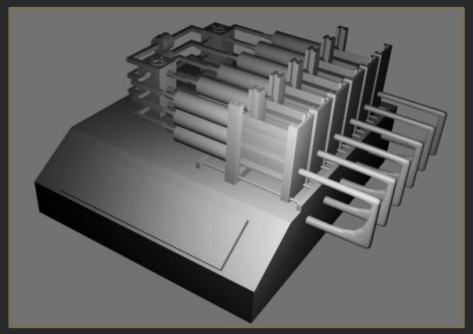
- A relationship between NASA and Drs. DeBakey and Noon was formed, and the group worked to develop a low cost, low-power implantable VAD.
- NASA fluid dynamics software developed to model and analyze propellant flow through space shuttle rocket engines was used in the development of a very small heart pump.

Product Outcome

- NASA patented the technology and licensed it to Methodist and MicroMed.
- The technology is in its fifth generation. 440 implants conducted worldwide
- Currently, ReliantHeart is the industry partner with *Methodist DeBakey Heart Center*
- Numerex Corp. is making this technology wireless, allowing for continual remote monitoring of data for clinicians, doctors, and technicians.

Self-Contained Device Isolates Biological Samples for Molecular Analysis

Pipette-free technology enables analysis outside of laboratory settings



Self-contained device for isolating DNA, RNA, proteins, and cells without using pipettes or centrifuges

- **Compact and portable**: Contains DNA and RNA isolation kits in a book-sized (10 x 10 x 2 inches) unit
- **Self-contained**: Requires no auxiliary equipment (e.g., centrifuges, pipettes, syringes) to isolate desired targets
- **Versatile**: Enables isolation of not only nucleic acids but also other biological molecules, proteins, cells, and bacteria via different preloaded membranes and reagents
- **Safe**: Prevents hazardous chemicals required for PCR analysis from contaminating sensitive environments
- **Effective**: Offers sensitivities similar to those obtained using standard isolation methods

Concluding Remarks

- **Innovation is key to staying in the game**
  - Key to having continued success
  - Key to economic and social development
- **I stimulate my innovative thinking by asking questions such as;**
  - Why is the shape of the drums circular?
  - How will you design two robots that can communicate more than 70 % through their body gestures/language?
  - What comes after this universe? If there are more universes, then what comes after those?
- **Challenge yourself; you will be surprised how innovative you are!**
  - Participate in 'Age of Innovation'

Important Contact Information

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https://invention.nasa.gov/index.php

https://techport.nasa.gov/home

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