

## Presentation to Small Business Forum

By Jesse Midgett  
CATTs Team Chair  
NASA Langley Research Center

Slides provided by Terry Taylor, Deputy Program Executive, Technology Transfer (Detail)  
Space Technology Mission Directorate  
NASA Headquarters

# 40+ Years of NASA Spinoffs



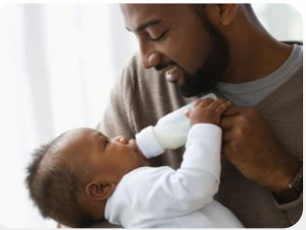
CMOS camera-on-a-chip technology used in nearly all digital cameras, including smartphones



International search-and-rescue system has saved 40k lives worldwide since 1982



Memory foam



Nutritional supplement used in over 90% of infant formulas



Ubiquitous aerodynamic innovations in airplanes and trucks



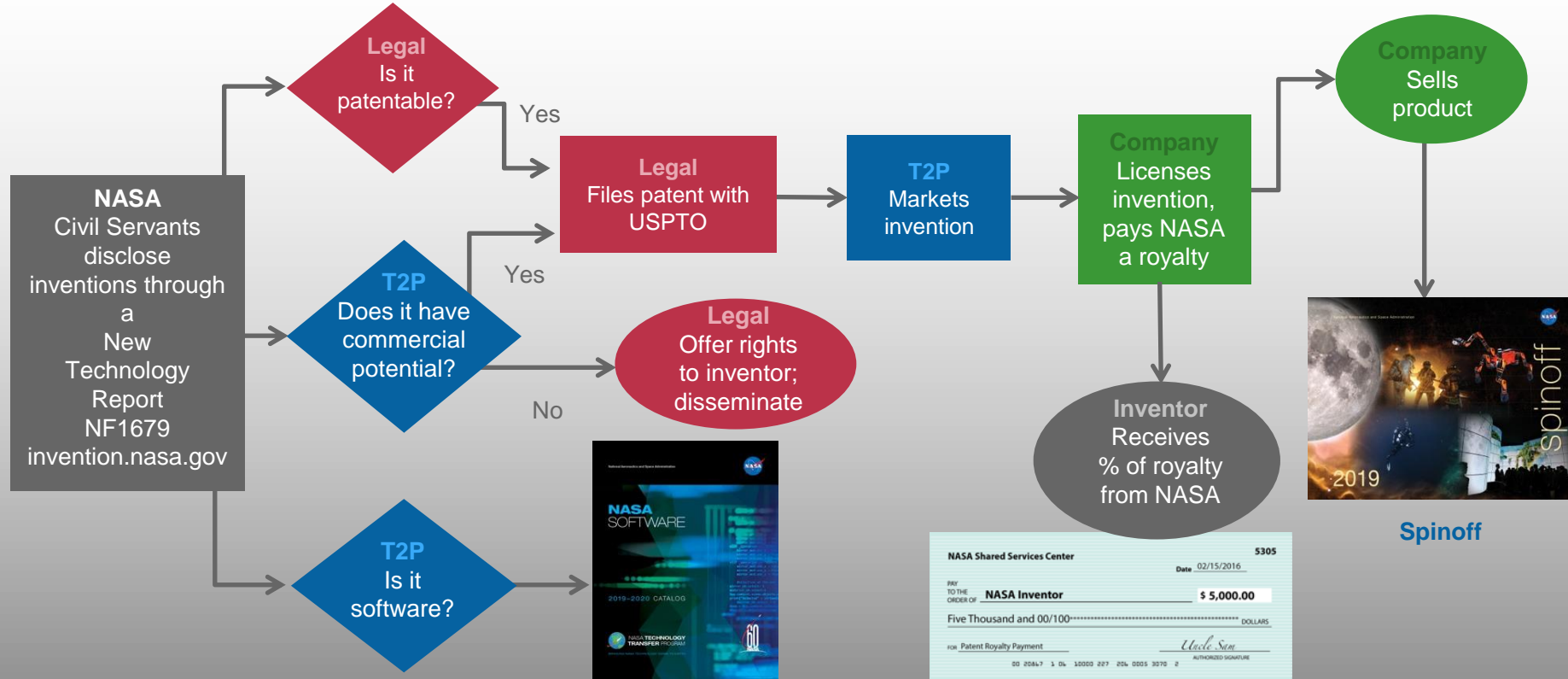
Voltage controller saves energy in nearly all load-bearing electrical machines



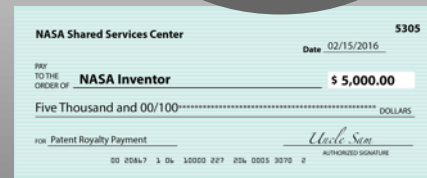
Precision GPS enabled self-driving tractors that are now used to work the majority of the world's farmland.

# NASA Technology Transfer Overview

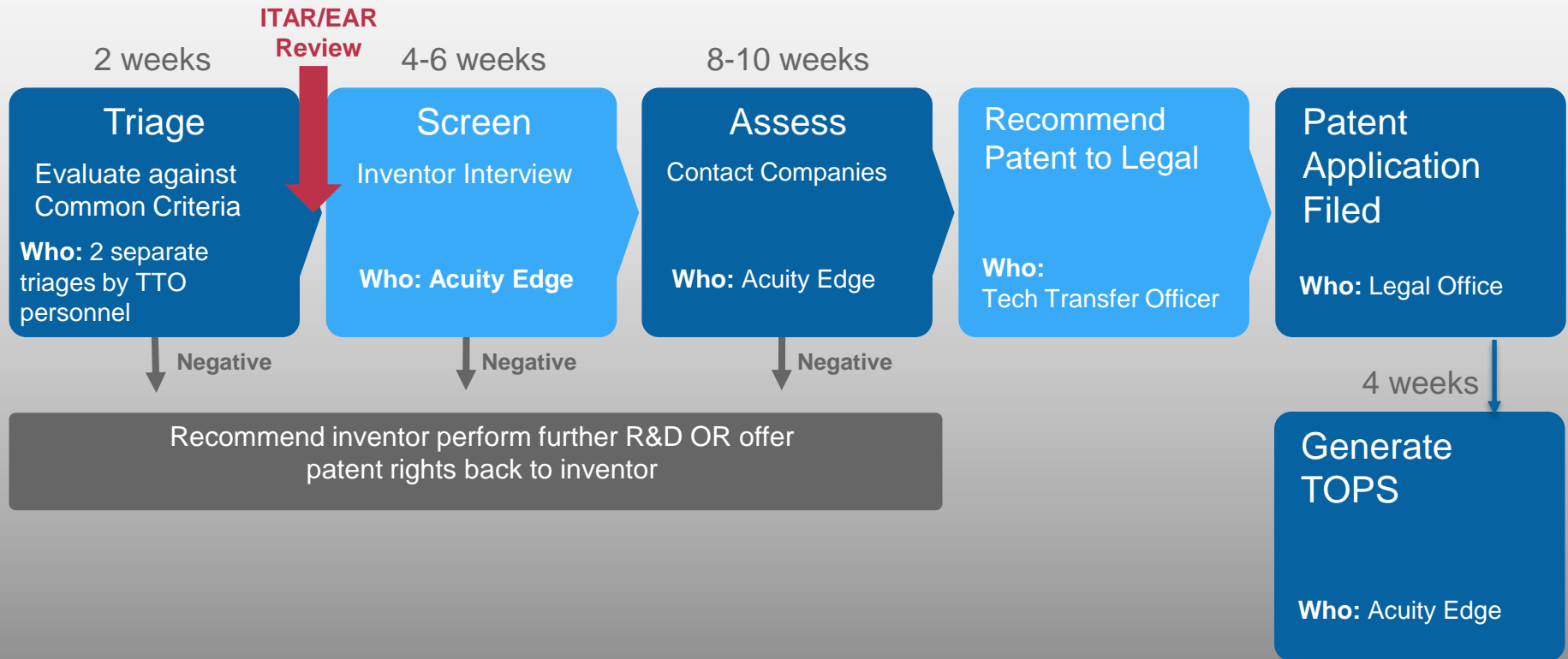
Finding commercial applications for NASA developed technology



NASA Software Catalog

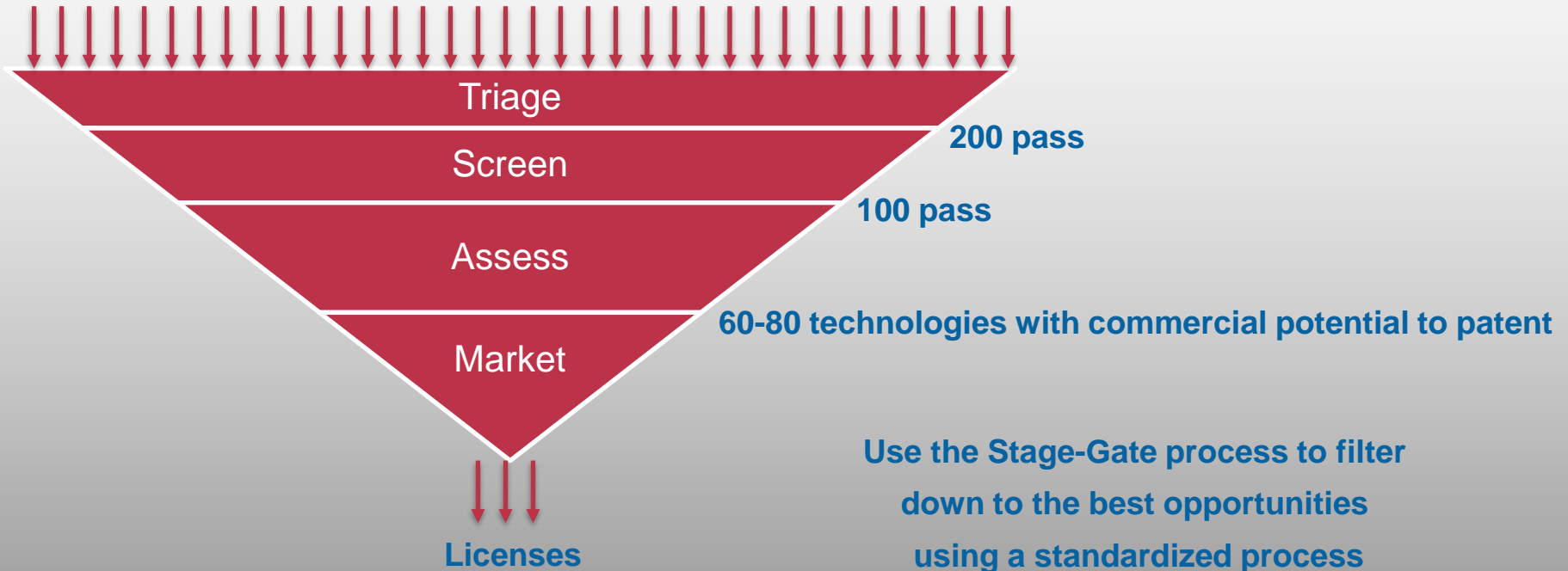


# How NASA Decides What to Patent (Agency Process)



# Stage-Gate - Sample “filtration” process

500 NTRs with at least 1 Civil Servant Received per Year



**Only commercially promising technologies continue forward**

# Existing T2 Product Service Line Contract



**Incumbent:** Acuity Edge of Durham, NC – certified HUBZone company

**Period of Performance:** July 11, 2018 to July 11, 2023

**Ceiling:** \$4M initially, increased to \$12M in October 2020 to provide coverage thru July 2023

**Work Location:** all remote, no on-site support

## **Centers supported:**

- All but JPL - Evaluate and provide documented evidence of commercial potential for NASA invention disclosures (aka New Technology Reports) and assist NASA in making informed patenting decisions. Deliverables: Technology Screening and Assessment Reports, and one-pager front and back, marketing fact sheets called Technology Opportunity Sheets (TOPS) for NASA patents
- HQ Support – follow up on Agency Patent Licensing Inquiries, Data Entry, Data Integrity, testing of new database functionality, inquiries from general public
- MSFC Support – perform marketing and licensing of MSFC patent / software portfolio to industry

# Technology Transfer Website & Sample TOPS



Link to NASA Technology Transfer Program

<https://technology.nasa.gov>

Link to NASA's Patent Portfolio of 1400 patents:

<https://technology.nasa.gov/patents/>

Link to NASA's Software Catalog of 831+ free software codes:

<https://software.nasa.gov/>

Link to NASA's Spinoff Success Stories

<https://spinoff.nasa.gov>



Mechanical and Fluid Systems

## Tension Element Damping (TED) – With Hydraulics for Large Displacements

Disruptive modal coupling damps large structure vibrations using small footprint devices

NASA engineers developed a new approach to mitigating unwanted structural vibrations that cause maintenance issues and compromise the performance and safety of large, tall structures. NASA's method is fundamentally different from conventional passive and active vibration damping methods used today. TED uses disruptive modal coupling between two different structures, each with their own vibrational behavior, to provide vibration damping for one or both of the structures. This novel reactive vibration damping method uses feedback from the vibrational displacement itself, such as the tension and compression cycles from the movement of the vibrating structure (like a wind turbine or tower), to disrupt the vibration. Line tension is provided by either hydraulic, pneumatic, or magnetic means to suit the application and the size/displacement of the vibration. Compared to conventional spring dampers, TED devices are simple in design, lightweight, very effective, and have a smaller footprint.

National Aeronautics and Space Administration

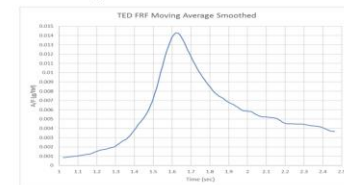


### BENEFITS

- Spatially efficient: damps vibration in large structures with a smaller footprint than previous damping methods
- Adaptable: responds to changing vibration amplitudes
- Effective: may increase wind turbine reliability
- Adjustable: damping can be tuned in two dimensions
- Reliable: Unlike conventional springs and dampers, reactive damping will not impose rogue loads

### THE TECHNOLOGY

The Rotational Tension Element Damper (RTED) uses a controlled tension line, backed by hydraulics, to damp large displacements in large structures. NASA built RTED prototypes that have been successfully tested on a 170-foot long wind turbine blade in test beds at the University of Maine. In this case, the RTED device damps the vibration of the large, tall turbine blades relative to a stationary anchor structure on the ground using a line and spring coupled to both the blade and the anchor, and controlled by a spool fitted with a one-way clutch. When force is applied, from heavy wind for example, the resulting movement of the tall structure triggers the necessary tension and compression cycles in the system to engage the rotating damper. The reaction force interferes with the rotation speed of the spool and disrupts and damps the vibration in the tall structure. The figure below shows test data for the RTED used on the wind turbine.



This graph of frequency response function test data through time shows the effective damping response of the RTED for a wind turbine blade.

### APPLICATIONS

The technology has several potential applications:

- Wind turbines
- Solar arrays
- Liquid nitrogen gas (LNG) platforms
- Commercial space mobile launchers
- Towers
- Industrial process stacks and equipment

### PUBLICATIONS

Patent Pending

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

National Aeronautics and Space Administration  
Agency Licensing Concierge  
Marshall Space Flight Center  
Huntsville, AL 35812  
205-568-7425  
Agency Patent Licensing@mail.nasa.gov  
<http://technology.nasa.gov/>  
[www.nasa.gov](http://www.nasa.gov)  
SP-2011-02-0287-102

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.  
MFS-2011-1  
MFS-1016-110

