How to Prepare a Technology Opportunity Sheet

A technology opportunity sheet (TOS) is a marketing document that is designed to give the reader information about the potential commercial uses and benefits of a NASA technology. The TOS needs to convey the message quickly and focus on the commercial uses and benefits of the technology. A TOS is designed so that it can be scanned quickly and still give the reader enough information so that the reader can make the decision to further research the opportunity and contact NASA or discard the information. To this end, the TOSs have a standard format and should convey similar information about each technology. Important information about the benefits and applications may also be repeated in some sections of the TOS.

A TOS is usually created before a patent is issued on the technology so it is important to keep the NASA patent attorneys in the loop and recognize that they must sign off on the final TOS before it is released publicly. The reasons for this are so that the TOS does not release any technical or market information that the attorney's wish to keep secret and that the TOS is a NASA document that will be entered into NASA's TechTracS system and the cognizant attorney needs to approve its public release.

TOS Format

The technology opportunity sheets created by MCTTC will be uploaded into the NASA technology-tracking program, TechTracS. The MCTTC documents will typically be cut and pasted into TechTracS section by section, rather than as a complete document. Because of this, it is important to maintain a common format that conveys similar information in each section of the TOS.

TOS Sections

Title
Introduction
Benefits
Potential Applications
Technology Description
Technology Development Status
Options for Commercialization
Contact Information

To make all of the TOS appear similar, please use the same font for all of the documents. Please use Times New Roman 12 pt plain font. Use bold only where indicated. Also make the document left justified.

1. Title

The title should contain the MSC control number and the title of the technology used in the technology disclosure documents. Use the same title because this is the title that is used in the NASA TechTracS system. If you use a different title it will make it more difficult to track back to the exact technology that is the subject of the TOS. Following is an example title:

MSC 23314-1 Flexible Multi-Shock Shield Technology

2. Introduction- Length: 2-4 sentences, Goal: Highlight most important commercial feature or use.

The biggest hurdle most NASA technologies have to overcome is their typical origin as a solution for a space-based problem. The introduction should give the reader an immediate understanding of the commercial use of the subject technology. Because there will be multiple potential applications and multiple commercial benefits, choose to highlight the most important one in the introduction so that the reader understands in the beginning of the TOS that the technology is being marketed because of its commercial appeal.

Because this section will highlight commercial uses or benefits, some of the information in other sections will be repeated. This is by design so that the most important commercial items get reinforced in the document.

An example of an introduction follows.

The Flexshield is a protective blanket made out of lightweight and flexible materials for easy and compact storage, transport, and deployment. The Flexshield can be made to stop almost any high velocity projectile including bullets and explosive fragments and can fit any shape however large or small. The overall blanket thickness can range from a fraction of an inch to many feet, depending on the mass and velocity of the projectile to be stopped. The Flexshield can be used as lightweight protection in items ranging from armored cars to airline cargo containers.

An important thing to note about this introduction is that it does not mention space or asteroids or this technology's potential deployment on space station. This is because the TOS is a marketing document to convince companies that this technology has a commercial use, not that it is really good space technology. A focus on space and NASA's application for the technology should be discussed only in the *Technology Development Status* section.

3. Benefits - Length: bullet for each benefit followed by 2-4 sentences describing why it is a benefit, Goal: Highlight most important benefits that set this technology apart from competing methods of solving the same problem.

The benefits section is designed to highlight the things that set this technology apart from competing technologies and give it market potential. The benefits section is

delineated by bullet points to make it easier for the reader to scan to the benefits that they deem most important. It is designed to be a list of the benefits the technology brings to the market, not just a listing the technical features that it has.

In this section it is important to use comparatives wherever possible to show how the NASA technology differs from and improves upon the standard commercial way of solving the same problem. It may be through these comparative statements that a potential licensee can see how the technology could replace something they are currently using. However, do not use specific brands or companies as comparisons. For instance, do not say a NASA insulation has a greater r-value than Owens-Corning fiberglass insulation. Say that the NASA insulation has a greater r-value than standard fiberglass insulation.

Following is an example of a benefits section (the bullet title should be bold):

- ***Projectile proof****: A Flexshield with a total thickness of 60 cm has been tested to stop a 2 cm solid sphere projectile of 2017 grade Aluminum traveling at a velocity of 7,000 meters/second. Thinner Flexshields could protect against more typical lower velocity threats. Flexshield can protect against very high velocity impacts whereas many other ballistic blanket technologies fail above impact velocities of 500 meters/second.*
- ***Versatility****: The Flexshield can be utilized as a protective wrap, a vertical drape, a flat cover or a structure itself by either inflating it or using supports. Other more rigid ballistic protection technologies do not have the field versatility of Flexshield.*
- ***Stowage & Transportability****: The Flexshield blanket can be folded up upon itself for a very compact, lightweight package. Solid armor plate is much heavier and difficult to package for shipping and transport.*
- ***Scalability****: There is no limit to the scaling capability of the shield. Flexshield can be less than an inch thick or yards thick and made into very large blankets. The application and the threat are the defining factors.*
- ***Material Diversity****: A variety of materials and geometry can be implemented to custom design the shield to best fit the required application. This allows for Flexshield designs to utilize new materials innovations and use materials best suited to the application and threat. Flexshield designs are not dependent on any single material or supplier.*

Again, it is important to note that the bulleted benefits do not mention the space use of the technology and how NASA uses the technology. This is in keeping with the goal of the TOS to highlight the commercial uses and benefits of the technology. Additionally, for most of the benefits listed there is a comparison with current methods on the market.

4. Potential Applications - Length: bullet for each application followed by 2-4 sentences describing why it is an appropriate application, Goal: Highlight potential commercial markets and uses where this technology could compete.

For many technologies commercial use is not immediately obvious. This section will help the reader quickly see how the technology could fit into the commercial market. It is important in this section to describe how this technology could be used in commercial applications, not just the general market in which it plays.

For each bulleted application, it is important to expand upon the bullet and give specific uses and why the NASA technology would be a good fit for the specified application. Just giving a general market, like automotive or biotechnology, is not specific enough. With this document the reader needs to be quickly shown some real potential applications. The company can get creative with uses once they have learned more about the technology. This document should make that leap easier by outlining some use for the technology.

An example of a Potential Applications section follows (the bullet title should be bold):

- ***Protective Covering****: Due to the scalability, the Flexshield can be used to wrap everything from fuel depot tanks and oil and gas pipelines to cables and wires. Because the Flexshield is portable and field deployable, it does not have to be permanently attached to the structure it is protecting.*
- ***Bullet/Ballistic Proof Vehicles****: The Flexshield installed behind a vehicle's body panels could prevent bullets and explosion shrapnel from entering the interior of the vehicle. If used in VIP, military and money transports the Flexshield could offer penetration protection at a lower weight than traditional armors.*
- ***Explosive Ordinance Demolition Department****: The Flexshield could be used as blast-resistant blankets, armor rings, etc. to cover suspected devices and minimize potential danger. Because Flexshield shows excellent projectile stopping power at very high velocities and energies, it could offer additional protection from shrapnel caused by an explosive device.*
- ***Personal Fire Protection Shelter****: When constructed of Nextel fabric, foam and/or batting, the Flexshield can provide a nearly flame and heatproof barrier/shelter that can be used by fire fighters and other rescue safety crews. This additional flexibility of use sets the Flexshield concept apart from most other ballistic blankets.*

Again notice that the space application for the technology is not covered. This is because the focus of the TOS is on the commercial, and likely terrestrial, markets for the technology. The applications used in the example are specific and give specific reasons why the technology could perform in those applications. The market uses would not have been adequately covered by a more general market like "bullet proof armor" as a catch all for the various uses.

It is important to mention all of the potential commercial markets and uses where there is a reasonable chance for success. This does not mean every potential use, but the ones where successful commercialization is a real possibility. Additionally, if there are a great many applications and uses for the technology, mention only the top 5-7. Do not get into a long litany of every reasonable market. The TOS should be concise,

no more than 3 pages, and give the reader enough information to decide whether or not further investigation or thinking is warranted.

5. Technology Description - Length: 3-5 paragraphs, Goal: give a layman an understanding of the principles behind the operation of the technology.

The technology description area should not be a deeply involved scientific description of exactly how the technology works. It should give the reader an understanding of the principles behind the technology's operation and what the technology does. It will be drawn in large measure from the invention disclosure that describes the technology's operation.

The technology description should describe the how the technology works in general terms and give performance specifications where available. If the technology description goes into too much detail the attorney may reject it as being too detailed. The key is to make the technology's principles of operation understandable to a layman. Reliance on too much jargon substitutes for understanding and translation.

The format of this section is narrative. In addition to just describing aspects of how the technology works, it is important to relate that back to application of the technology in the commercial marketplace. This aspect of the technology description may restate some of the points of the Potential Applications section but is helpful in giving a meaningful description of the technology that goes beyond a listing performance parameters.

An example of a technology description follows:

The Flexshield is unique in that it is designed to contain and protect against not only the initial impact, but also, all of the debris particles that are created from the collision. It is a sandwich of alternating layers of flexible bumpers, or shield layers, and resilient support layers. The multi-layered structure is then encapsulated in a protective cover. The bumpers serve to shock and consequently, disrupt the impacting particle. They can be constructed out of various extremely strong, yet flexible fabrics such as Nextel, Kevlar, Spectra, fullerene-coated fabrics or other ceramic fabric material. The support layers are typically formed from lightweight, open-cell foam and are designed to merely separate the bumpers from each other. However, a ceramic flexible foam or batting (such as Nextel) could be used, which would provide an even more effective shield. The material, number of layers and thickness of support layers will all depend on the required application and the desired protection level.

By using lightweight, flexible and resilient materials, the shield can be folded up, compressed to further reduce storage volume requirements and easily transported. The Flexshield is easily deployed by simply unfolding it and attaching it to the front of the object being protected with the use of Velcro, snaps, straps, bungee cords, or other similar types of attaching mechanisms. Overall weight and volume depend on the size and thickness required and the materials used.

The encapsulating protective cover can be of any appropriate material for the application. For example a weatherproof and UV protective cover would be used to allow for use of the Flexshield outdoors in a permanent manner. A cover could be painted in a camouflage pattern and have optically reflective or absorptive coatings applied, or painted to match and compliment the protected structure.

The fact that the Flexshield is transportable and adaptable means that it can be used as an inflatable or quickly assembled command or lookout post in military, refinery, or emergency situations where explosions are possible. For occasions where VIP's are exposed, it can serve as a temporary protective barrier or hidden from view, yet instantly inflated at first sign of trouble. The Flexshield could serve as a cover over airline cargo containers for bomb blast resistance or as an anti-ballistics barrier in armored vehicles. When constructed out of Nextel materials, the shield can become a quickly deployable, single or multi-person fire blanket/shelter able to withstand heat up to 2400°F. A forest fire fighter could carry the shelter in a backpack or it could be air dropped. Such a shelter could be folded up and, combined with oxygen, made available in high-rise towers or other structures where it is difficult for fire fighters to get to quickly.

The technology description focuses on the commercial uses and applications of the technology. The example description makes it clear that the Flexshield structure can use different materials in a sandwich structure that varies in thickness and overall size. It does this and reemphasizes the various uses that the technology has in the marketplace.

6. Technology Development Status - Length: 5-7 sentences, Goal: Describe why NASA developed it, what the development status is, and what the patent status is.

The technology development status is the section of the TOS where people will go once they have their interest heightened by the other sections of the TOS. It is in this section that the NASA use is described. Also describe the NASA state of development and state of patenting.

The NASA use can usually be covered in 3-4 sentences. It will describe in general terms why NASA developed the technology and the problem that it is expected to solve. This will give the reader an understanding of where NASA is coming from in the development of the technology. Just give the bare bones description of NASA's use for the technology. Do not make it seem as if the technology is narrowly designed for use in space.

Devote another sentence or two to describe the actual state of development for the technology. Has a prototype been built, tested, and is it still in existence? Has the technology been deployed? Is the technology still in an early state of development and is NASA still interested in development partners? This information should be in the technology disclosure and/or available from the inventor.

Also describe the patent status of the technology. If the technology has had a patent applied for, state that, but do not give the patent application number. If a patent has

been granted on the technology, state that and do give the patent number. Giving the patent number will allow the reader to look up the patent on their own if they choose to.

An example of a Technology Development Status follows:

Spacecraft must be protected from micro-meteors and orbital debris traveling at velocities averaging between 7.5 and 8 km/s. Therefore, innovators at NASA's Johnson Space Center developed the Flexible Multi-Shock Shield technology to protect the International Space Station, the Mars Lander, and other NASA satellites and probes.

The technology has been developed into a prototype and has been tested for shielding against hypervelocity objects. For other applications the technology would need to be modified and tested further. The technology was developed by the National Aeronautics and Space Administration, United States of America. A patent application has been filed for this technology.

7. Options for Commercialization - Length: 2-3 Sentences, Goal: Reinforce that the technology is available for license and perhaps joint development if appropriate.

This section is pretty standard and will be pretty much the same from technology to technology. An example of the standard language follows.

This technology opportunity is part of the NASA Technology Transfer Program, the goal of which is to stimulate development of commercial applications of NASA developed technology. NASA is seeking industrial partners to continue the testing effort and license the technology for commercialization.

8. Contact Information

The contact information for all of the JSC TOSs is the same. It is the technology and commercialization office at JSC.

NASA Technology Transfer & Commercialization Office
NASA Johnson Space Center
Mail Code HA
Houston, Texas 77058
Phone: (281) 483-1749
Fax: (281) 244-8452
Email: commercialization@jsc.nasa.gov

Putting all of the sections together results in the following complete TOS.

Title

MSC 23314-1 Flexible Multi-Shock Shield Technology

Introduction

The Flexshield is a protective blanket made out of lightweight and flexible materials for easy and compact storage, transport, and deployment. The Flexshield can be made to stop almost any high velocity projectile including bullets and explosive fragments and can fit any shape however large or small. The overall blanket thickness can range from a fraction of an inch to many feet, depending on the mass and velocity of the projectile to be stopped. The Flexshield can be used as lightweight protection in items ranging from armored cars to airline cargo containers.

Benefits

- **Projectile proof**: A Flexshield with a total thickness of 60 cm has been tested to stop a 2 cm solid sphere projectile of 2017 grade Aluminum traveling at a velocity of 7,000 meters/second. Thinner Flexshields could protect against more typical lower velocity threats. Flexshield can protect against very high velocity impacts whereas many other ballistic blanket technologies fail above impact velocities of 500 meters/second.
- **Versatility**: The Flexshield can be utilized as a protective wrap, a vertical drape, a flat cover or a structure itself by either inflating it or using supports. Other more rigid ballistic protection technologies do not have the field versatility of Flexshield.
- **Stowage & Transportability**: The Flexshield blanket can be folded up upon itself for a very compact, lightweight package. Solid armor plate is much heavier and difficult to package for shipping and transport.
- **Scalability**: There is no limit to the scaling capability of the shield. Flexshield can be less than an inch thick or yards thick and made into very large blankets. The application and the threat are the defining factors.
- **Material Diversity**: A variety of materials and geometries can be implemented to custom design the shield to best fit the required application. This allows for Flexshield designs to utilize new materials innovations and use materials best suited to the application and threat. Flexshield designs are not dependent on any single material or supplier.

Potential Applications

- **Protective Covering**: Due to the scalability, the Flexshield can be used to wrap everything from fuel depot tanks and oil and gas pipelines to cables and wires. Because the Flexshield is portable and field deployable, it does not have to be permanently attached to the structure it is protecting.
- **Bullet/Ballistic Proof Vehicles**: The Flexshield installed behind a vehicle's body panels could prevent bullets and shrapnel from entering the interior of the vehicle. If used in VIP, military and money transports the Flexshield could offer penetration protection at a lower weight than traditional armors.

- **Explosive Ordinance Demolition Department**: The Flexshield could be used as blast-resistant blankets, armor rings, etc. to cover suspected explosive devices and minimize potential danger. Because Flexshield shows excellent projectile stopping power at very high velocities and energies, it could offer additional protection from shrapnel caused by an explosive device.
- **Personal Fire Protection Shelter**: When constructed of Nextel fabric, foam and/or batting, the Flexshield can provide a nearly flame and heatproof barrier/shelter that can be used by fire fighters and other rescue safety crews. This additional flexibility of use sets the Flexshield concept apart from most other ballistic blankets.

Technology Description

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up to 2400^{o}F. A forest fire fighter could carry the shelter in a backpack or it could be air dropped. Such a shelter could be folded up and, combined with oxygen, made available in high-rise towers or other structures where it is difficult for fire fighters to get to quickly.

Technology Development Status

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Options for Commercialization

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Houston, Texas 77058
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Fax: (281) 244-8452
Email: commercialization@jsc.nasa.gov