



Technology Transfer Master Process

Section D

Background

The Technology Transfer Process Action Team (PAT) of the Integrated Weapon System Management (IWSM) Technology Insertion PAT developed the Technology Transfer Program Master Process in FY92. The Master Process intentionally describes the “what” and not the “how” of the transfer process, providing each organization the greatest latitude in developing the “how” that best fits their individual needs.

This section of the handbook describes the transfer process from the hierarchical perspective of senior Air Force leadership and from the perspective of the individual organization’s transfer focal points. We will not describe the details of the process from the bench scientist and engineer perspective. The lowest-level perspective requires the specifics of the “how” at each laboratory and center. Each focal point is encouraged to develop site-specific detailed process steps.

The Hierarchical Perspective

Figure D1 shows a simplistic form of the transfer process, which incorporates input, through-

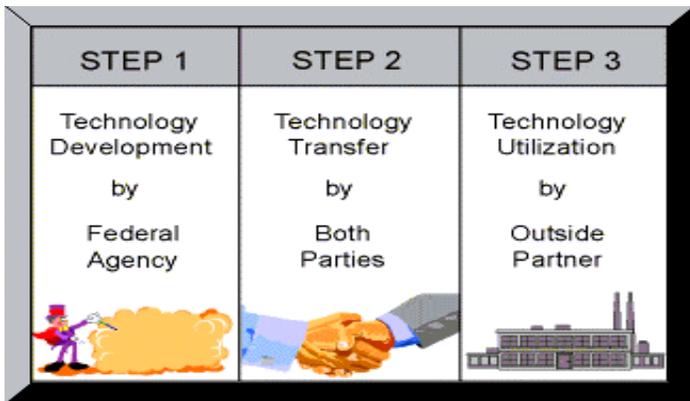


Figure D1

put, and output. Input is the technology development stage, throughput is the actual transfer, and output is the use of technology by the outside partner.

This is the simplest view of transfer. The Air Force develops a technology. The technology is transferred to an outside partner. The outside partner commercializes the technology. The Air Force controls Step 1 and part of Step 2. The outside partner controls part of Step 2 and all of Step 3.

Unfortunately, this simplistic depiction of the transfer process cannot be used effectively when discussing the various steps of a process. In order to understand the transfer process better and to discuss it adequately, we require a more detailed look at the process.

The Master Process Perspective

The Transfer PAT developed multiple layers of the process steps. Figure D2 shows the top view called the “Master Process.”

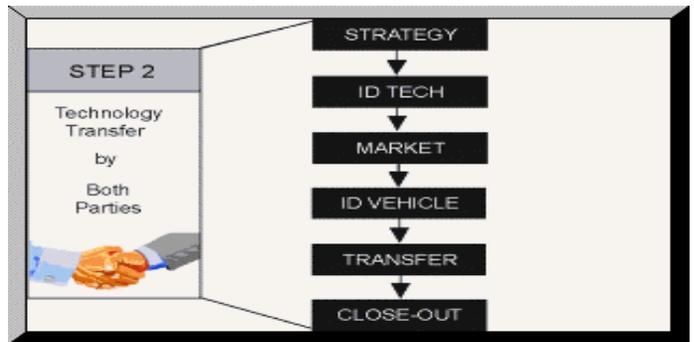


Figure D2

The Master Process

The Master Process is broken into six major steps. These steps refer to the entire process, not the exact sequence. AFRL headquarters accomplishes some of the steps, while others are completed by the S&Es who work the technologies that are transferred. Figure D3 shows each hierarchical groups’ view of the master process (shaded blocks indicate process steps).

S&Es	Transfer Focal Points	T ² Mgmt Team
have responsibilities to do the actual transfer of the technology	have responsibilities in all six macro process steps (approximately 40 process steps at the local level)	has responsibilities at the command level
Strategy	Strategy	Strategy
Identify Technology	Identify Technology	Identify Technology
Market Technology	Market Technology	Market Technology
Identify Vehicle	Identify Vehicle	Identify Vehicle
Transfer Technology	Transfer Technology	Transfer Technology
Post-transfer Administration	Post-transfer Administration	Post-transfer Administration

Figure D3

Who Works the Various Steps

The S&Es are responsible for identifying technologies available for transfer, marketing and actually transferring the technology and follow up. As you can see, the Technology Transfer Management Team has command-level responsibilities in only three of the macro-process steps: strategy, marketing, and post-transfer administration. The transfer focal point has responsibilities in all six of the master process steps. Next, the transfer focal point's responsibilities are described for each of the six master steps.

Transfer Focal Point Process

This section describes the activities of the transfer focal point in terms of each of the six master process steps. Each focal point has the freedom to define how he or she will accomplish the responsibilities of each of these steps. Some of these, such as strategy, is an annual activity, while others, like post-transfer administration, occur for every transfer agreement.

Major Step A: Strategy

The strategy steps' purpose is to integrate technology transfer into the organization's technology investment strategy. The nine substeps of this process take the local technology strategies and the administration (overhead) requirements and coordinate them into a single command strategy.

Figure D4 depicts these nine substeps with the

numbering system of "A" for the master process step followed by the number of the substep.

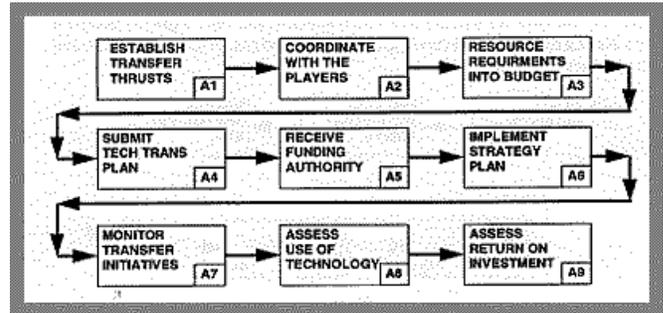


Figure D4

Strategy Process Steps

Each appropriate Air Force organization needs to establish an annual Business Plan (see Section K). That plan describes the local near-and-long-term plans for achieving local goals and objectives. It describes the role of all of the support functionaries at the location, such as legal, procurement, public affairs, and comptroller. The plan needs to be coordinated among all of the local players and management. This coordination will help achieve buy-in by those support people not assigned to the transfer focal point office and show commitment at your immediate management level.

The budgetary requirements for running the transfer program need to be stated and justified. At this time, there is no program element for transfer activities, hence all funding must come from the organization's internal funds. These requirements need to be folded into the local Biennial Planning, Programming, and Budgeting System (BPPBS).

The annual Business Plan is submitted to the Technology Transfer Management Team by 1 November each year. The Management Team will aggregate all the local plans into an Air Force technology transfer business plan for use at the headquarters level. The DDR&E Office incorporates portions of this plan for its biennial report to Congress. The focal point receives his or her funding from the local organization budget and implements local business plans in concert with the support from the focal point's organization. The focal point also monitors his or her

organization's ability to meet local transfer goals.

The last part of the strategy section is to make a preliminary determination of those technologies having the greatest potential in meeting industry needs and also support the organization's interest. This determination should be done in concert with feedback from previous transfer activities. This information will allow the focal point to provide efficient allocation of limited resources toward those technologies that appear to be in greater demand by outside partners, and also support the appropriate Air Force organization's mission requirements.

Major Step B: Identify the Technology

Identifying the technology provides a basis for the focal point to ascertain which technologies are available for transfer and which of those technologies have the greatest potential for transfer. Technologies in this context include products, processes, expertise, and unique equipment and facilities. By statute (Federal Technology Transfer Act of 1986), the first function listed of each ORTA is "to prepare application assessments for selected research and development projects in which that laboratory is engaged, and which, in the opinion of the laboratory, may have potential commercial applications." *Figure D5* depicts an approach to identifying the commercial potential of laboratory technologies.

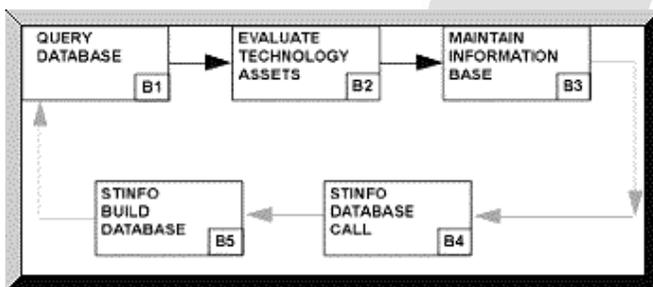


Figure D5

Identify Technology Process Steps

This assessment or identification process can be done internally within the organization or by an outside organization with market assessment expertise. There are various methodologies for market assessments in determining the commercialization

potential of a technology. Each organization needs to determine which method best suits their needs. However, whatever process is used, some of the attributes that should be considered include the following items:

- 1. Technology Strengths.** This attribute refers to the soundness of the technology in meeting Air Force needs. Technology soundness is judged in terms of Air Force experience with the technology, technical documentation of test data, and the degree to which the technology solved the problem it was designed to address. In short, does the technology work in the laboratory and in the field where it is to be used?
- 2. Technology Weaknesses.** A technology can be sound in achieving the results for which it is intended, yet possess weaknesses, particularly when considering potential commercial applications. For example, a weakness might be the lack of test data applicable in a commercial setting. Producers may need test data to design their products and possibly as a defense against potential product liability claims. The suitability of a technology as a candidate for technology transfer will be negatively influenced by the presence of technology weaknesses. To the extent that technology weaknesses must be overcome in a commercial use, they create technological uncertainties for potential investors.
- 3. Technology Ownership.** Ownership of the technology is a critical element in suitability for technology transfer. Under federal law, the Air Force may have a royalty free use of the technology for government purposes, but the commercial rights may reside with the contractor or other entities. In many cases, ownership rights may be in dispute. The ownership issue can serve as a significant barrier to commercializing the technology.
- 4. Ease of Replication.** Patent rights may not be a sufficient condition to commercialize a technology; even when other conditions are right. In many cases, reverse engineering and other methods can be used to design around the patent.

Also, patents in new technologies that are undergoing rapid incremental improvements are particularly vulnerable to obsolescence. In general the easier a technology can be replicated the less likely investors will find the technology an attractive investment opportunity.

- 5. Commercial Applications.** In general, private sector interest in a technology will be enhanced if the technology has a number of potential commercial applications or if the technology addresses an industry need. The Air Force technology will be of more interest to private investors if it represents a significant improvement over existing technologies.
- 6. Commercial Strengths.** The commercial strengths of a technology refers to its likely acceptance if introduced into the market, and its long term profit potential if successful. One important factor is the extent to which the technology provides an advantage (cost and/or quality) over existing technologies in the marketplace. Other advantages are potential market size, ownership protection size, ownership protection, and degree of novelty.
- 7. Commercial Weaknesses.** A technology may have patented commercial uses but may be more costly than competing technologies. Also, the market niche for the technology may be too small to attract significant private sector interest. Other commercial weaknesses might be disputes over ownership, potential product liability problems, and inadequacy of test data.
- 8. Market Sales Potential.** Economic research has shown that market potential is the key determinant of technology transfer. A sufficiently large profit potential can provide the incentive to overcome the numerous and often complicated steps to successful technology transfer. The chief indicator of market-pull forces used in this comparative analysis is the market sales potential of the technology. Technologies with large sales potential have a stronger market pull.

- 9. Government Benefits.** By statute, the Air Force may receive financial return from technology transfer activities. Depending upon the source of the funds, this revenue may be used for further R&D, rewarding laboratory employees, education and training, or incidental expenses for licensing inventions. In addition to receiving a financial return, the Federal Government may benefit through lower acquisition costs from building a larger industrial base through multiple applications of the technology. Examples of intangible benefits from technology transfer may include public good and a more competitive economy. Additionally, the Air Force inventor receives 20 percent of royalty generated by the patent license.

It is recommended that a preliminary assessment be conducted first before a detailed analysis is conducted. A Likert-type scale ranging from 1 (low) to 5 (high) can be used to rate the attributes for each of the technologies being assessed. A low rating (1 or 2) would indicate that the attribute is a negative factor in technology transfer. A high rating (4 or 5) would indicate a positive factor in technology transfer. The exceptions to the rule are attributes 2 (Technology Weaknesses), 4 (Ease Of Replication) and 7 (Commercial Weaknesses). Since these are negative factors the rating scale is reversed. A high rating would indicate that the attribute is a favorable factor. For example, a high rating on “Technology Weaknesses” would indicate that the technology would have few technology weaknesses. A similar interpretation is given to “Commercial Weaknesses”. A high score would indicate few commercial weaknesses; likewise, a low score would indicate many commercial weaknesses. A high score for “Ease of Replication” would indicate that the technology cannot be easily replicated.

The preliminary assessment will provide a rank order or grouping of those technologies with the highest to lowest commercialization potential. Those technologies with high technology transfer potential are good candidates for a more in-depth

analysis of the attributes listed above. A more in-depth analysis will provide valuable information for developing a commercialization plan for a particular technology. Based on the analysis of the attributes listed above, the commercialization plan could consider areas such as technology soundness and innovation, stage of technology development, commercial potential, manufacturing and production requirements, financial potential, and transfer options. The commercialization plan provides the technology developer and laboratory management with critical information on the technology's potential and necessary steps to accomplish the transfer. The degree of findings will vary depending on factors such as maturity or uniqueness of the technology and type and size of market but in any case the analysis will add value to the technology from the information that is obtained. Based on the market analysis conducted in Step B, the target audience(s) for the technology can be more readily identified in which to focus marketing activities. This helps the focal point use his or her



limited resources more effectively for those efforts that will have higher payoffs. Marketing strategies include, but are not limited to, placing ads in technical/trade association magazines, printing brochures, hosting technical symposia, participating at trade shows, working with state and local government organizations, and interfacing with technology brokers.

Marketing may be highly focused on a specific technology or it may be very broad in scope on the organization's overall capabilities and expertise. However, experience has shown that the more focused the marketing campaign, the more effective it is in generating interest from qualified sources.

Major Step C: Marketing

The purpose of the marketing steps is to promote those technologies with high commercial potential. These steps also help coordinate and synergistically help the laboratories and centers pool their marketing through the Technology Transfer Management Team. *Figure D6* depicts four steps that represent an approach to marketing laboratory technologies that have commercial potential.

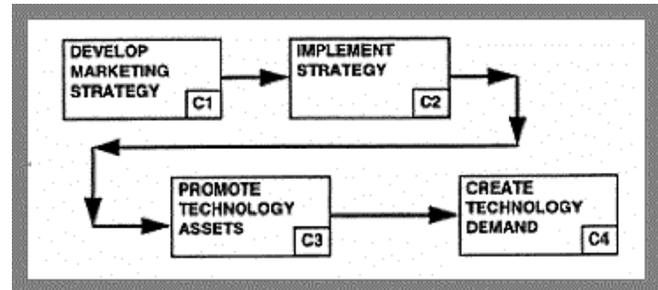


Figure D6. Marketing Process Steps

As shown in step C4, creating technology demands is a result of industry needs determined in the technology assessment phase (Section F).

The Corporate Communications Branch, AFRL/XPTC, portrays a positive image of the Air Force Research Laboratory among its key stakeholders and the public. The branch implements an AFRL-wide marketing plan; coordinates external and internal marketing activities; produces corporate marketing products such as brochures, exhibits, displays and videos; and educates external audiences about the laboratory. A superb example of a marketing product is the *AFRL Technology Horizon*[®] magazine. This quarterly publication highlights AFRL technologies and collaborative opportunities. The Corporate Communications Branch provides an excellent opportunity for increasing exposure on a corporate scale to technologies and resources available for transfer.

Major Step D: Identify Vehicle

The purpose of identifying the transfer vehicle is to match the best transfer agreement vehicle with the needs of the outside partner and the Air Force. Not all the transfer vehicles are appropriate for all technologies and all conditions. Section I contains a

listing of the most used transfer mechanisms. *Figure D7* shows the various steps involved in identifying the most appropriate transfer mechanisms that meets the needs of the partner and are in the best interest of the Air Force.

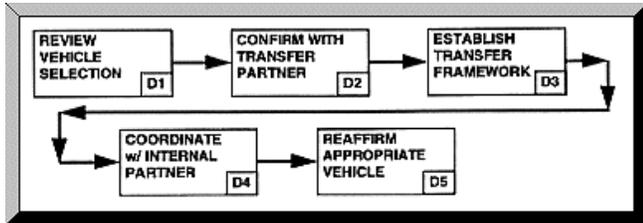


Figure D7

ID Vehicle Process Steps

Once the focal point understands the needs of the outside partner and the complexities of the technology to be transferred, he or she is in a better position to help determine the most appropriate transfer vehicle. The initial negotiations occur by virtue of agreeing on the transfer vehicle. As the transfer details are worked out for the technology itself, many financial and legal issues are identified. This situation gives the focal point the opportunity to enlist the help and support from the organization's comptroller and legal offices. By having this Air Force team work together during these initial negotiations, the focal point is able to establish common goals.

There are numerous factors that need to be considered when selecting an appropriate transfer vehicle or mechanism. Some of these factors include the maturity and type of the technology, the type and size of the industry or company, economic and budgetary factors, and type of applicable Air Force program (e.g., Dual Use Science and Technology (DUS&T) SBIR.) There are so many variables in selecting a mechanism that there is no cookbook approach. For illustrative purposes, some of the factors to consider are briefly described below.

The maturity and type of the technology.

If the technology is mature and is patented, a patent license agreement may be appropriate. If the technology is early in its development, a CRADA may be more appropriate. Of course this does not exclude other mechanisms such as CTAs, EPAs, etc. Factors

to consider for the type of technology may include its complexity and whether it is a new innovation or an improvement to an existing product. A complex new innovation may require a substantial amount of capital and possibly involve a license agreement and a CRADA to further the technology. An improvement to an existing product may require less investment on behalf of the partner and maybe a Commercial Test Agreement would be appropriate to validate the product improvement.

The type and size of the industry or company. Consider whether it is a high- or low-tech industry working new or mature innovations. The key factor is the degree of risk involved in taking the technology to market. Although small companies may not have the financial resources they are often willing to take greater risks than large companies with a set product line. This will have bearing on the type and amount of contributions involved in a CRADA and licensing fee and royalty rate of a license agreement. A small company may contribute more in-kind services and fewer dollars in a CRADA or may be willing to pay the licensing fee and receive a larger royalty rate than a larger company. Depending on the Air Force's requirements, various mechanisms and structures may be most appropriate.

Economic and budgetary factors. If there is a large market for a technology and/or there are multiple uses for a technology, there is greater likelihood that financial resources would be available to the potential partner for commercialization. Available financial resources will affect the terms and conditions of a CRADA, if appropriate, and also the type of license. If there are multiple uses, maybe a nonexclusive license is the most appropriate or a field of use license. In addition, small companies may be better able to obtain venture capital in a well-defined market making the terms and conditions of a transfer mechanism more lucrative for the Air Force. In relatively small markets, technical assistance may be the most appropriate to more fully utilize Air Force technology.

Type of applicable Air Force program.

There are numerous methods of transferring

technology under various Air Force programs. For example, the DUS&T program involves Innovative Assistance Instruments such as Technology Investment Agreements or Other Transactions. The SBIR program involves contract agreements. Grants are another instrument which may contribute to technology transfer.



When all the parties agree in principle, the focal point reaffirms the appropriateness of the transfer vehicle. During the discussions, the scope of the transfer may have changed or the amount of intellectual property rights may have changed.

At the end of these process steps, the transfer is ready to be executed.

Major Step E: Transfer

The purpose of the transfer process is to execute the transfer. These steps, as shown in *Figure D8*, ensure the Air Force and the outside partner comply with all the applicable public laws and guidance. The process formalizes the transfer in writing and commits both the Air Force and the outside partner to the transfer effort.

First, agree on the purpose and desired results of the transfer. At this time, the focal point should get the outside partner to quantify his or her expectations of the benefits of using the technology. This step also helps the Air Force state their expectations on what they are receiving in return for the transfer.

Then the agreement is formally coordinated among all the Air Force participants. This coordination provides Air Force participants with a written commitment of their responsibilities of the transfer

and outlines what to expect in return for completing the transfer. This process is the Air Force's last formal chance to negotiate the terms of the transfer agreement.

To ensure the transfer agreement is in compliance with public law, the Air Force completes its review for legal sufficiency. At this point, both the outside partner followed by the Air Force official authorized to commit the Air Force, sign the transfer agreement. The Air Force has a review and approval cycle for every transfer agreement. The TEO has authorized all Air Force Research Laboratory Directorates and the AFMC center commanders review and approval authority. If the authority has not been delegated, then the agreement (if a CRADA) must be forwarded through AFRL/XPTT to AFRL/CC for review and approval.

Note: If the outside partner is not considered "domestic," refer to Section N on Non-Domestic Partnerships.

Once the formal transfer has been executed, the focal point monitors the transfer process over the term of the agreement to ensure that all obligations (other than future royalty payments, if applicable) by the parties are met. The focal point is also required to report all formal transfer agreements to the Technology Transfer Management Team. The transfer may be a simple one-time interchange, or it may take anywhere from several months to several years to complete. It is important that the focal point maintain rapport with the scientists and engineers in order that he or she is kept informed as things materialize during the course of the agreement. The focal point may act as a facilitator in modifications, or terminating the agreement if necessary.

Throughout the life of the transfer, the Air Force may collect revenues generated by the transfer. Not all transfers generate revenue. However, if revenues are generated, these revenues are defined as either "reimbursable" or as "other." Reimbursables are those funds used to cover the Air Force's costs associated with the transfer (facility use, scientist or engineer's salary, etc.). The outside partner pays the

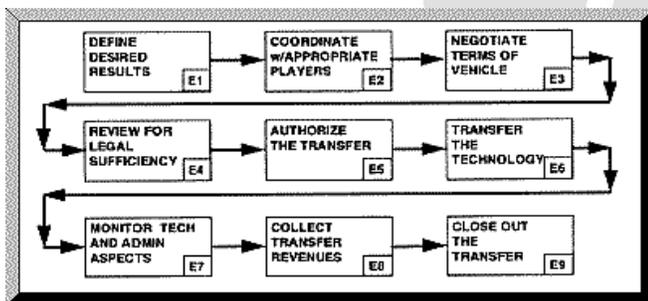


Figure D8. Transfer Process Steps

reimbursables directly to the comptroller of the organization. Other revenues are royalties and license fees. The outside partner usually pays these revenues to the central Air Force patent office. The patent office then forwards a royalty check to the Air Force scientist or engineer who is listed as the inventor on the patent (maximum of \$150 thousand per year). Then the patent office forwards a check for the balance of the payment to the comptroller of the organization where the invention originated.

After each successful transfer, the focal point submits a success story to the Technology Transfer Management Team. These success stories are forwarded to laboratory management, SAF/AQR, Air Force Technology Transfer Team, DDR&E, and others to give the Air Force positive exposure.

Major Step F: Post-Transfer Administration

The purpose of the post-transfer administration steps, as shown in *Figure D9*, are to internally document lessons learned transfer activities, advertise the successful transfer, reward and recognize the Air Force participants, and provide feedback to the investment strategy. These steps track success against the goals set in the investment strategy and the business plan. They provide accountability and the feedback of performance measures as well as lessons learned and public relations.

In addition, during the post-transfer administration, the laboratory technical point of contact maintains a relationship with the outside partner. Together they make adjustments to the terms and conditions of the transfer vehicle as appropriate. The laboratory focal point assists in formalizing any substantive changes to the transfer vehicle.

Each focal point needs to track the transfer process at his or her organization. This tracking includes local performance measures for managing the process. Together with the local performance measures, the focal point will be able to pinpoint successful activities that need to be continued and

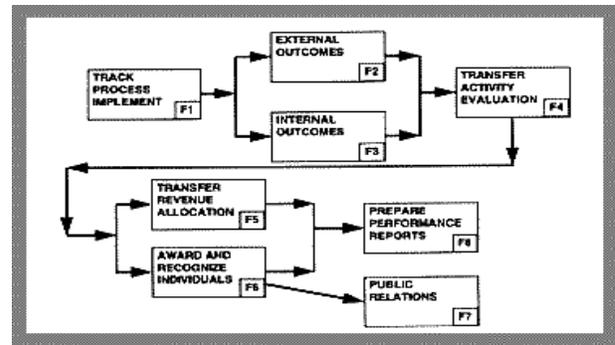


Figure D9

Post-Transfer Administration Process Steps

activities that need to be changed or eliminated. This information will help the focal point develop future transfer strategies to maximize meeting organizational goals.

The focal point should also be working with the local comptroller office and the organizational commander for distribution and expenditure of the collected revenues. Many of these revenues can be used to help fund the ORTA and activities such as paying for incidental administrative expenses, regarding technical employees, promoting scientific exchange, and funding technology education and training.

The focal point has the responsibility to ensure those organizational people involved in making transfer a success are adequately recognized for their efforts. The command encourages each focal point to establish a local awards program to supplement the command awards program (refer to Section Q).

The local public affairs office has the responsibility to publicize successful transfer agreements. Every successful transfer needs to have a success story written and submitted to the Technology Transfer Management Team. This information will give the command an up-to-date source of success data to use in command brochures, senior leadership presentations, and in the focal points' organization and laboratory headquarters marketing campaign.

Finally, the focal point has the responsibility to report transfer activities in the organization's annual business plans. The focal point must maintain

information databases for response to Office of Management and Budget (OMB) and Secretary of the Air Force (SAF) inquiries into local transfer activities. This reporting requirement includes Defense Technology Transfer Information System (DTTIS) that is operated by DTIC. The Technology Transfer Management Team will attempt to answer all inquiries using the command transfer tracking database. When they do not have the required information, it will be requested from each focal point. Included in the responsibility to report transfer activities in the database format, the focal point is to provide a one-page fact sheet (*Atch G3-page 1 and Atch G4-page 1*) to the Technology Transfer Management Team when the transfer agreement is implemented. The agreement title and CRADA number, partner information and color graphic picture are in the top one-third of the fact sheet. The body of the fact sheet must have an objective statement, a benefit section (for the AF and the partner) and a small information descriptor. Your local Public Affairs (PA) office must clear the fact sheet. The footer of the fact sheet should provide the focal point contact information and identify your local PA office clearance number and the date cleared.



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