Technology Transfer

When, Why, Issues and Advantages

David F. Sutter
IREAP, U. of Maryland

Bruce P. Strauss
U.S. Dept. of Energy

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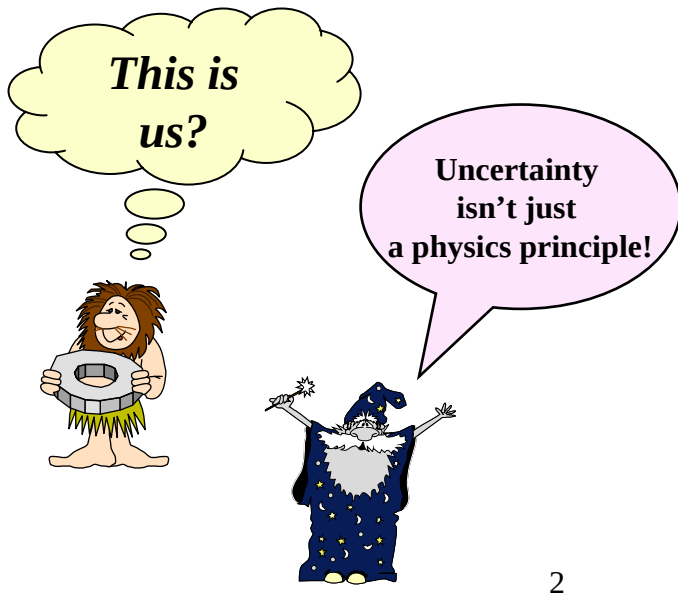
Introduction

Technology transfer is a big and very Complex topic!!

- **There exist many studies on who, what, when, why and how. [The Bibliography of the 2003 forum, Technology Transfer of Federally Funded R&D, lists 832 references]**

- **The focus of most of the literature is on moving high technology into the market place from**
  - **Industrial Development Laboratories**
  - **Nonprofit R&D centers**
  - **University Laboratories**
  - **Federally Funded Research Centers**

The focus of this talk will be on Federally Funded Research Centers!!



The Bigger Picture – *Motivation from the Top*

There is strong U.S. Government interest in Tech Transfer

- **The Federal Government is the biggest funding source in the U.S. ~$80 billion in FY 2002!**
  - **DOD, HHS (NIH), NASA, DOE, & NSF – the top five – provide 95% of the R&D funding!**
  - **The DOE GOCO labs [ANL, BNL, Fermi, LBNL, TJNAF, etc] and NSF are major players.**
  - **There is strong political pressure to get a marketplace return on the Federal R&D investment.**

- **There are Executive Orders, Agency Directives: & extensive legislation:**
  1. **The Bayh-Dole Act and**
     - **The University and Small Business Patent Procedures Act.**
     - **The Trademark Clarification Act.**
     - **Executive Order 12591.**
  2. **The Stevenson – Wydler Act.**
  3. **Acts creating SBIR, STTR, and CRADAS.**

What is Tech Transfer?

Technology transfer means different things to different folks – even among Experts!!

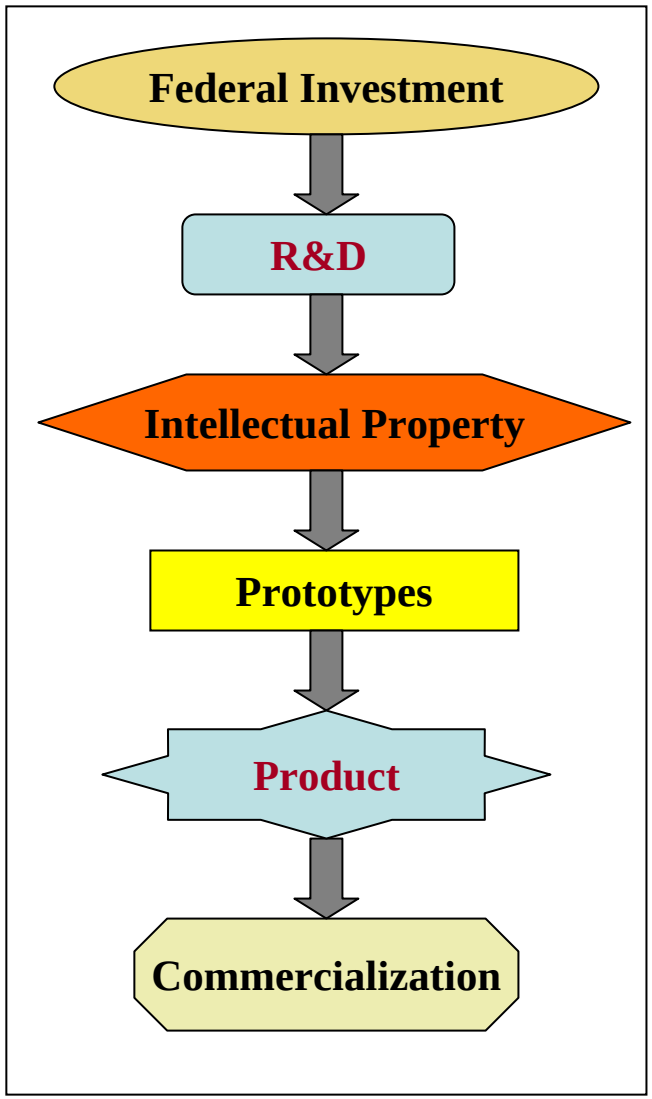
Consider the three different definitions from the Rand Forum, "Technology Transfer of Federally Funded R&D:"

- **"The process of utilizing technology, expertise, know – how or facilities for a purpose not originally intended by the developing organization. Technology transfer can result in commercial or product/process improvement."**
  -The National Technology Transfer Center

- **"The process by which existing knowledge, facilities or capabilities developed under Federal R&D funding are utilized to fulfill public and private needs."**
  – Federal Laboratory Consortium.

- **"The formal transfer of new discoveries and innovations resulting from scientific research conducted at universities and nonprofit research institutions to the commercial sector for public benefit."**
  - Association of University Technology Managers

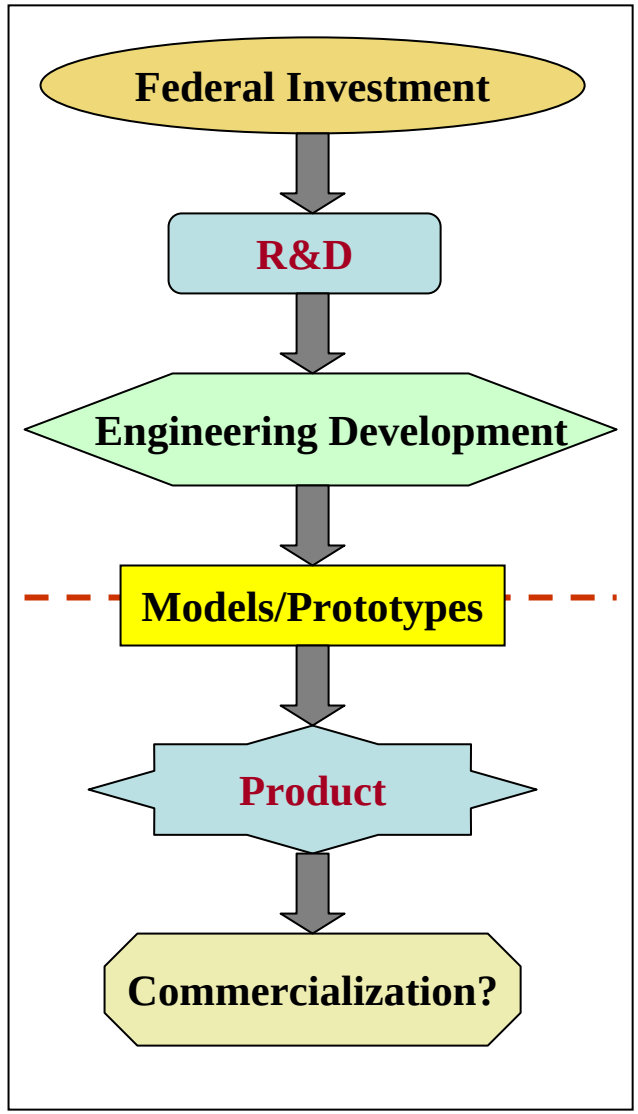
An Overview



Government & Industry View

National Labs

Industry



R&D Development Labs

What is Technology Transfer?

➢**It is a teaching/learning activity – *by whatever process!!***

The folks involved can follow this method used by many an old time teacher:

The teacher: *First - you tells 'em.*
Second - you shows 'em.
Third - you tells 'em and shows 'em
Fourth - you tells em and shows ''em what you's told 'em and showed 'em.

The students response: *First - they tells you.*
Second - , they shows you.
Third - they tells you and shows you.
Fourth - **They tells you and shows you what they's told you and showed you!!**
- Better than you did it!!

Federally Funded Science & Supporting Tech R&D

- **Almost all accelerator and technology R&D is funded through DOE/OS & NSF [There is some in DARPA & NIH] – i.e. Federally Funded!**

- ***Technology R&D "is us" - in two ways:***

  - **Being part of Federally funded R&D means each laboratory & R&D university grantee is mandated by the Government to engage in Technology Transfer in the formal sense described above.**

  - **BUT!!!! In big [and not so big] projects constructed in support of scientific research, the compelling tech transfer need is to get industry to mass produce high technology items not available in the market place.**

The process of technology transfer to industry for the purpose of cost effective mass production is the subject of the rest of this talk!!

Technology Transfer and Big Science Projects

- **The facilities constructed in support of scientific research, of interest here, are considered to be "megaprojects."**
  - **Mega projects are those with "from scratch" construction costs > 500 M$.**
  - **Examples: LHC, SNS, SLAC, Fermilab, RHIC, ITER, etc.**

- **The technology transfer process used in support of construction of scientific research facilities is a more limited, specialized process!**
  - **The technology R&D and underlying scientific advances usually have a project oriented goal – even if a generic one.**
  - **Commercialization is not a goal!! No market is expected to develop as a result of the project.**
  - **The public benefit is indirect; that is, it will derive potentially from the scientific output of the resultant research facility.**

Major Steps/Issues [These will be amplified in what follows]

- ***The Problem:*** **There is a project, *the AFLIC*, that needs many high tech TAMJI'S, an item that does not exist commercially.**

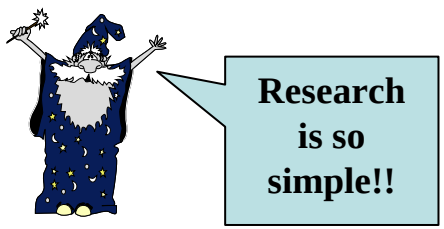
- ***Prerequisites:*** **This is primarily what the project must do up front before it is ready to go down the path of securing production of TAMJI's!**

– ***Alternatives (the when):*** **- Do in house.**
- Turn over to industry (No tech transfer).
- Do in industry as a build to print & process (tech transfer!!!).

- ***Who brings what?:*** **What does the project contribute? – the industrial vendor?**

- ***The process (the how):*** **How do we get from the need to the satisfaction?**

- ***Responsibilities:*** **Each entity must understand clearly what it has to do.**

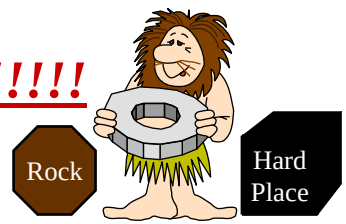


The Problem - or why you stay awake nights.

- **Project AFLIC is a approved for funding and has *successfully* carried out an intensive program of R&D to develop advanced technology devices that improve performance and lower cost.**

- **One of these items is the TAMJI. 3000 are needed for the project, plus spares. [*The number is important!!*]**
  - **The R&D for the project has successfully built and tested working models of a TAMJI – maybe even "prototypes."**
  - **There is no known commercial market for TAMJI's!!**
  - **There is no known company that has TAMJI's technology.**

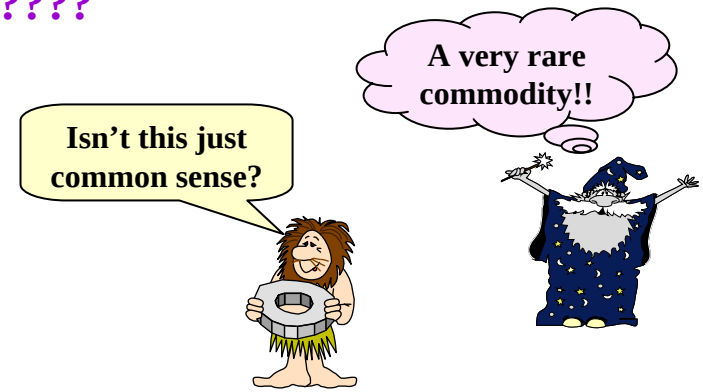
    - i.e. the SPECIFIC technology doesn't exist in industry!!!!!



The Problem: How does project AFLIC get 3000 TAMJI's built on specification , cost and schedule???

Prerequisites – for the Project, Whatever Path Chosen

- **The R&D for TAMJI's must be complete!!**
  - **Do not go to procurement, let alone tech transfer, if you don't know what you are doing!!! [no change orders allowed !].**
  - **How good is your in house review process????**



- **Documentation must be complete:**
  - **Blue prints.**
  - **Working models and prototypes.**
  - **Specifications, tolerances, etc.**
  - **Performance criteria.**
  - **Specialized testing, acceptance conditions and tests.**

- **Selection of a qualified list of candidate vendors - Do not delegate this to your Procurement Office!!**

- **Identify your key personnel who are going to work with the vendor, and at the vendors site, ahead of time – include technical *and* procurement specialists.**

- **Schedule – when does the project really need TAMJI's. Include time contingency.**

Alternatives – *The Hard and Dangerous Choices*

- ***Build TAMJI's in house*** **– example: the Tevatron superconducting magnets.**
  - **Pros: + Maintain intellectual ownership and control of high tech processes.**
    + Appears to simplify the technology transfer – "our people."
  - **Cons: - Requires hiring a big production staff – where do they go at the end?**
    – The needed in house manufacturing expertise and production equipment will have to be acquired.

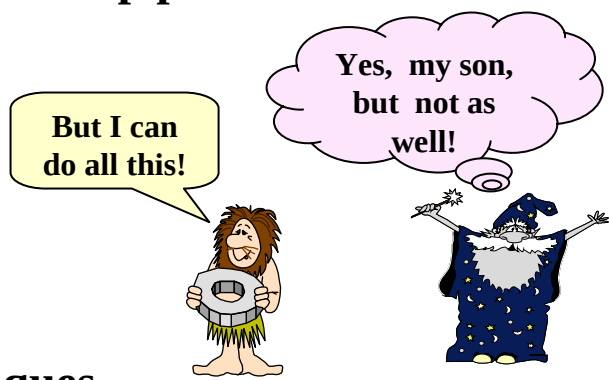
- ***Build TAMJI's in Industry*** **– Example: The SSC superconducting magnets.**
  - **Pros: + The entire problem is turned over to the industrial experts in design & production.**
    + The big production staff goes away at the end! Specialty tooling is a deliverable.
  - **Cons: - Intellectual ownership of the design is turned over to industry. The Project expects a product built to performance specifications.**
    - The industry will have to go through a learning process and it *costs*!!!!!!

- ***Have industry build to print and to process*** **– Example: RHIC& LHC superconducting magnets.**
  - **Pros: + Intellectual ownership of the design is retained –by the project & its experts!**
    + The big production staff goes away at the end! Specialty tooling is a deliverable.
  - **Cons: - The burden is on project AFLIC to adequately transfer technology.**
    - A significant commitment of project staff is needed to monitor and communicate.

Who Brings What to the Process

- ***The Project:*** **1. High capability technical support.**
  2. The most intimate knowledge of TAMJI's!!
  3. A capability to build additional models & prototypes.
  4. A powerful in house market need - don't discount this; it is called *motivation!!!!!!!!*

- ***The Industry:*** **1. High quality industrial engineering capability.**
  2. The specialized knowledge and tools to set up production and make 3000 TAMJ's.
  3. Ways to lower cost:
    a. Materials.
    b. Parts count.
    c. simplification.
  4. Quality control organization & techniques.
  5. The experienced staff of folks who work production lines – they own the standing army!!!



The Process – What the project has to do!!

- **Identify and select well qualified companies – don't leave this to the procurement staff.**

- **Getting the best companies on board means knowing the procurement process and working the system – *the project does not have to accept the lowest bidder if he is not technically qualified, but you have to set this up ahead of time!!!***

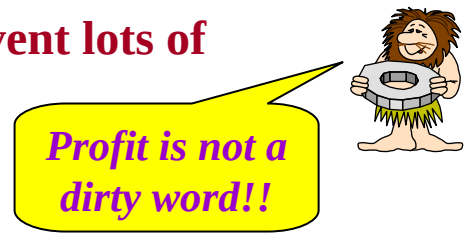
- **Getting the technology transferred – this is a simple statement, but a challenging amount of work.**

- **Monitoring the process [to the bitter end]– your people at his place! Do not assume that every thing is going smoothly!**

- **Setting up for completion of delivery – *the all important close out and your final acceptance of the product marks the end of technology transfer.***

Responsibilities

- ***The originating organization:***
  - **Retains the intellectual ownership - the design is yours! Do your homework!!!! If the industry builds TAMJI's to your print and agreed upon process, and they don't work, you are screwed!!!**
  - **Defines the process and final technical acceptance conditions and tests and carries them out. This is the projects special quality assurance and protection. Do this through out the project, not just at the end!!!**
  - **Pay on time! – few things bug a vendor than slow payment of invoices. This is part of maintaining good relations, and these prevent lots of problems and smooth the handling of those that arise.**



- ***The industrial vendor(s):***
  - **Analyzing, understanding, formally accepting and carrying out the build to print and to process – this is the vendor's main line of responsibility and protection [A prenuptial agreement!].**
  - **Quality control – developing the plan, getting it approved by the Project, implementation, and documentation. Good quality assurance is how the vendor ensures that each & every item gets accomplished successfully.**

Technology Transfer = Communications x 3 !!!!!!

- **GOAL – No surprises.**
- **Presentations –** ***Have your Prerequisites done!***

  1st – To all potential vendors → Clarity !!!

  2nd – To the selected vendor(s) → Clarity, Detail, Thoroughness.
- **Tours – of Project's facilities.**
  - **R&D and preproduction facilities.**
  - **To the selected vendor(s) – to their technical folks and to the Project's**
    - ✓ **In detail: how and why you did what you did –** ***this action is critical !!!***
    - ✓ **Test facilities & procedures for acceptance of production TAMJI's**
- **Production Plans:**
  - **VENDOR: presents detailed plans to produce 3000 TAMJI's plus spares.**
    - ✓ **Suggest design modifications for production.**
    - ✓ **Provides production details, details and details.**
    - ✓ **Presents the quality control plan and procedures – the what and how!**
  - **PROJECT – Review! Review! Review!** ***This is your last chance!***

Continued

Technology Transfer = Communications X 3 (cont.)

- **PROJECT – Give serious consideration to suggested changes:**
  - ✓ **To reduce parts count**
  - ✓ **To simplify parts and assembly**
  - ✓ **Cost saving and/or better materials.**

- **Configuration control – The essential and absolute path to staying on the same page!!**

- **Limited Production Runs –** ***An essential in any scenario - getting to the page!!!***
  - **For the Project – build 5 or more TAMJI's in house before solicitations.**
  - **For the production vendor(s) – initial limited runs of ~ 30 or so.**
    - **Depends on acceptance & test of design changes.**
  - **Both: plan for possible additional short runs – How successful earlier runs?**

- **Production – communications and feedback –** ***talk to each other. NOW!!!!!!!***
  - **On delivery – Immediate acceptance tests!**
    - **Review the accompanying quality control documents – the ubiquitous travelers.**

- **AT the END - Execute the Production Close Out Plan conscientiously and quickly!**

Final Stage

Technology Transfer is complete when the last TAMJI is accepted!!!!

NO!

Success???

YES!

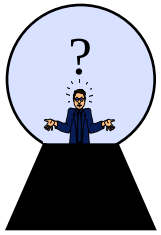
Commiseration!
Negotiation?
Legal Action

Project – Pay Them

Champagne
[D.P. or better!]


OK, I STAND CORRECTED.
OUTSOURCING CAN GET WORSE...
PAC To IPAC

Back Up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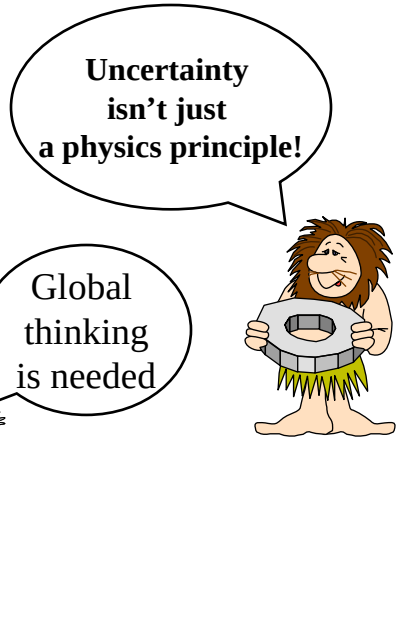
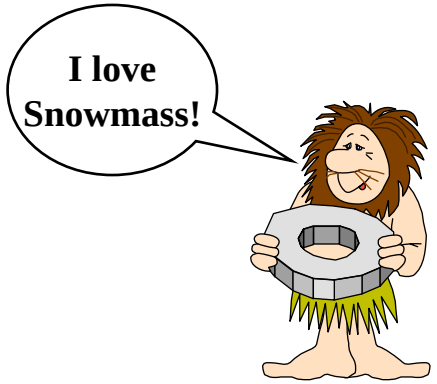
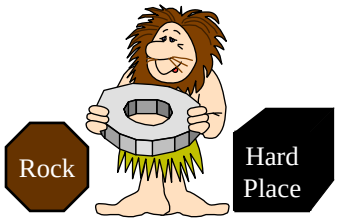

Uncertainty
isn't just
a physics principle!
Global
thinking
is needed

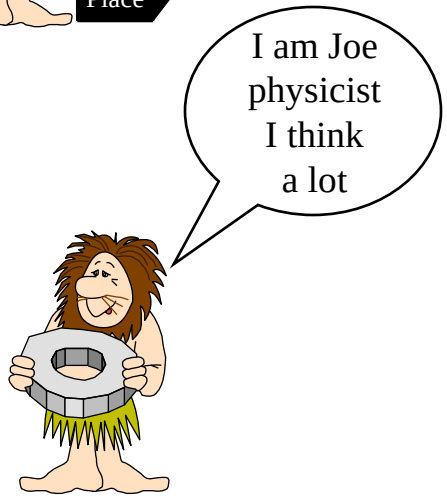

I love
Snowmass!


Fog


Rock
Hard
Place


The Future is Clearer!
It's above 500 GeV!


We are
working
hard!


I am Joe
physicist
I think
a lot