Exploring a Nuclear Physics Career Outside of Academia

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June 17, 2008
... When Things Don’t Go as Planned

GOSH, LOOK
AT ALL THE
DINOSAUR
BONES WE
DISCOVERED.

LET'S GLUE THEM TOGETHER
SO WE CAN SEE HOW THEY
FIT. THEN YOU CAN DRAW
A RECONSTRUCTION OF THE
ACTUAL DINOSAUR.

AFTER THAT, WE'LL WRITE UP
OUR FINDINGS, AND GET
THEM PUBLISHED IN A
SCIENTIFIC JOURNAL.

THEN WE'LL WIN
THE NOBEL PRIZE,
GET RICH, AND
GO ON TALK SHOWS.

WHAT ABOUT
BABES? WHEN DO
WE GET THOSE?
Step 1: Get Out of the Cave

- Are you focused on small world of research
- Many opportunities for PhDs outside of academia
- Need a broad knowledge
  - not just knowledge of some small esoteric field
  - develop this NOW

Non scholae, sed vitae discimus.
We learn not for school but for life.
– Seneca
Do You Know This Man?
The Story so Far…

PhD, Nuclear Physics, electron scattering, 1990

Postdoc, photon scattering, 1990–1994

NSF-JSPS Fellow, photon scattering, 1994–1996

Visiting Asst. Prof, 1997–1999

Visiting Asst. Prof, 1999–2000

Senior Scientist, 2000–2006

Science Advisor, DOE / NNSA Office of Emergency Response, 2006–present
What I Learned by Getting a PhD

- Discipline
- Self motivation
- Openness to new ideas
- How to write
  - Good technical writing
  - Know your audience
- How to give a talk*

- ... and some physics

* Some attendees tonight may disagree
Sword Master vs. Tea Master

All roads lead to Rome.

Via Appia
Writing

- Writing skills will be useful in any career
  - Proposal writing
    - not just for science → non-profits?
  - Writing articles
    - not just for Phys. Rev. Letters! → Journalism?
- Thesis writing is excellent practice

Television has raised writing to a new low
  - Samuel Goldwyn

I can’t believe it! Reading and writing actually paid off!
  - Matt Groening

Typos are very important to all written form. They give the reader something to look for so they aren’t distracted by the total lack of content in your writing.
  - Randy K. Milholland
Service

- Military
- Government
- Teaching
  - College
  - High school
- Non-profits

Thomas Jefferson High School for Science and Technology
Arlington, VA
81% of teachers have a master’s or PhD
#1 Rated High School in US.

Make service your first priority, not success and success will follow.
  – Author Unknown
Teaching

- The U.S. needs good teachers

- Get experience now
  - As a grad student
  - As a post doc

- Innovate

Docendo discimus. We learn by teaching.
– Seneca
Teaching at a Small College

- Very competitive
- It's very hard work (especially initially)
- Many “teaching” schools require research for tenure
What Teaching has Taught Me

- How to manage people
  - How to make rules and stick to them
  - How to treat people fairly (treat every one the same)
- How to explain ideas to non-scientists
  - Explain to policy makers
- Project management
  - Planning
  - Setting deadlines and keeping them
  - Producing deliverables
- ... and a lot of physics!
Outside the Box Ideas

- Foreign fellowships (NSF, JSPS, etc.)
- Internships (Washington DC, etc.)
- Insert yours here
Where to Look

For Federal jobs:

For teaching (and other academic) jobs:

For academic and industry (including government contractor) jobs:

For industry (including government contractor) jobs in the DC area:
Research Facilities

- FFRDCs
  - DOE National Labs
- UARCs
- Military research facilities
- Others…

[Logos of various research facilities including APL, PennState ARL, Los Alamos National Laboratory, New Brunswick Laboratory, and Uniformed Services University of the Health Sciences.]
Work with a Different Crowd

- People with many different
  - backgrounds
  - educations
  - ideas
People Skills

- The result is important not necessarily the process
  - Other people’s ideas may be better
  - Don’t need* to micromanage
- Be open to learning new things
- Don’t pretend to know more than you do
- Give credit where credit is due
- Maintain humility
- Your non-scientist boss may have good boss qualities
  - Management skills
  - Strategic thinking

* sometimes you do
Perception of PhDs

- “Eggheads”
- Can’t do anything except science
  - Can’t manage people
  - Can’t do operations
- No link to reality → “Ivory Tower”

- How to overcome this…?

... Become well a rounded person*

* and get a high power laser pointer
## Science vs. Operations / Policy / Applications

<table>
<thead>
<tr>
<th>Ultimate arbiter</th>
<th>science</th>
<th>policy</th>
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<tbody>
<tr>
<td>Mother Nature</td>
<td>Gray → uncertainties</td>
<td>Consensus or decision maker</td>
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<table>
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<tr>
<th>Making decisions</th>
<th>science</th>
<th>policy</th>
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<tbody>
<tr>
<td>Gray → uncertainties</td>
<td>YES</td>
<td>Need a yes or no</td>
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<tr>
<th>Final answers</th>
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<th>policy</th>
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<tbody>
<tr>
<td>Proposal for more data</td>
<td>Need decision now</td>
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Advancement

- There are no “senior scientists” in government
- ... and the few that there are come out of academia
Back to School

- Consider certifications
  - Certified Health Physicist
  - Project Management Certification
- Certifications lend credibility
- Your employer may help pay

We now accept the fact that learning is a lifelong process of keeping abreast of change.
– Peter Drucker
What is Applied Physics?

- It depends on what the application is!
- Operations
  - Using science to get things done
- Engineering
  - Making things smaller, better, lighter, cheaper …
What is “High Energy?”

Tevatron ~ TeV

$^{60}$Co irradiator facility ~ MeV
<table>
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<tr>
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<th>Field Deployer</th>
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<tr>
<td><strong>Not Portable</strong></td>
<td>![Image 1]</td>
<td>![Image 2]</td>
</tr>
<tr>
<td><strong>Portable</strong></td>
<td>![Image 3]</td>
<td>![Image 4]</td>
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**What Does “Portable” Mean**
My Day Job

- Manage two technical programs (applied and R&D)
  - Call for proposals → Proposal review
  - Project oversight
- Manage an operational team
  - Manage the budget
  - Define training and goals
  - Ensure proper equipment
- Help write policy
- Point of contact for a foreign technical exchange
- Deploy in emergencies
  - Training
  - Stand a watch bill
- Try to keep up on happenings in science and current events
Lessons from Boyd

- People → Ideas → Hardware
- Decide whether to be somebody or to do something
Lessons from a Thesis Advisor

Remember, you are doing the experiment on yourself.

Don Geesaman, Argonne National Lab
Parting Thoughts

- Be flexible (things change)
- Keep current on science
  - Not just physics

Computer (1980s)

Manhattan Skyline (pre 2001)