Opening remarks on thoughts on the Future-Target Fabrication Meeting-Las Vegas, 2017

Engine room of the Starship Enterprise

8000 miles$^3$ of fusion reactors on Altair 4

Robbie from Forbidden Planet
The necessary elements of a successful Program

Facilities

Targets

Theory, Computers, codes (HPC)

People

Diagnostics
The ICF program has had several phases: History is important: look forward but learn from the Past

- First Phase (early 1970’s – early 1980’s)
  - Nd:Glass (1.06μm), CO$_2$(10.6μm) drivers
  - Simple targets
  - ICF focus only
  - Towards the end of this phase
    - Short wavelength saves the program
    - First non-ICF experiment (x-ray laser)
The ICF program has had several phases: History is important: look forward but learn from the Past

- Second phase (mid 1980’s-late 1990’s)
  - Lasers dominate the program (NOVA)
    - ~1500 expts/yr
  - H-C program
  - Weapons work becomes ~50% of NOVA
  - HEDP begins
    - First Laboratory Astrophysics Conference
    - EOS
  - SSP and NIF
  - Pulse Power (Z) begins to be important
  - Targets becoming more complex and diverse
Secretary O’Leary announced NIF in late 1994
The ICF program has had several phases: History is important: look forward but learn from the Past

• Third phase (early 2000’s -2013)
  – NIF construction
  – NIC campaign ends (no ignition but alpha heating onset)
  – Pulse power becomes important driver
  – Target complexity continues to grow
  – Direct drive advances
NIF Groundbreaking: May 1997

Jeff Paisner
The ICF program has had several phases: History is important: look forward but learn from the Past

• Today:
  – Three viable approaches to Ignition
    - Laser indirect drive, Laser direct drive, magnetized targets
  – Three world leading facilities
  – Vibrant HEDP program
    - 1-2 articles/month in Science/Nature
  – Critical element of SSP
    - SSP importance has increased
    - US Dominance will be challenged!
  – Targets grow in complexity and diversity
Target fabrication has enabled the growth and importance of the field!

- Diameter, aspect ratio, surface finish, dopants, homogeneity, gas retention, engineering layers, shaped wall, foam lined...

- Complex shaped foils
- Embedded materials (no glue)
- Multi-foil assay, precision machining, thin glue, significant metrology

- Multi-foil stacks
- Simple
- Complex

- Foil
- CH ablator
- CH foam (200 mg/cc)
- CRF foam
- Shaped foil stacks
- Symmetry
- THD
- Nuclear Forensics
- Compton Radiography
Summary

- Laboratory fusion is a critical component of the National Stockpile Stewardship Program (SSP)
- Laboratory fusion is a grand challenge with an easily defined and recognizable goal
- The pursuit of laboratory fusion attracts, trains, and tests world-class scientists
- Laboratory fusion requires multidiscipline expertise and integration of broad areas of science and technology analogous to weapons design and testing
- The output of megajoule (MJ) fusion yields has many SSP applications
- Russia and China have aggressive programs that will challenge U.S. leadership in fusion science and technology
  - demonstration of fusion from outside the U.S. will be a “Sputnik” moment
Let's make ICF great again! Work together and GROW the Program!!! NO “zero net sum” thinking!