

# Welcome to the Pitch Contest!

Nuclear Energy Innovation Summit

ANS Student Conference at MIT

April 5<sup>th</sup>, 2013



**MIT CLEAN ENERGY PRIZE**

AWARDED BY: NSTAR & THE U.S. DEPARTMENT OF ENERGY



# Event Guidelines

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- Schedule for the hour
- Pitch Guidelines
- Judging Criteria
- Cash Prizes



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- Pitch Contest Judging Panel:
  - Emilio Baglietto, MIT
  - Mac MacFarland, Luminant
  - Christina Chase, MIT
  - Willy Sanchez, CoolChip

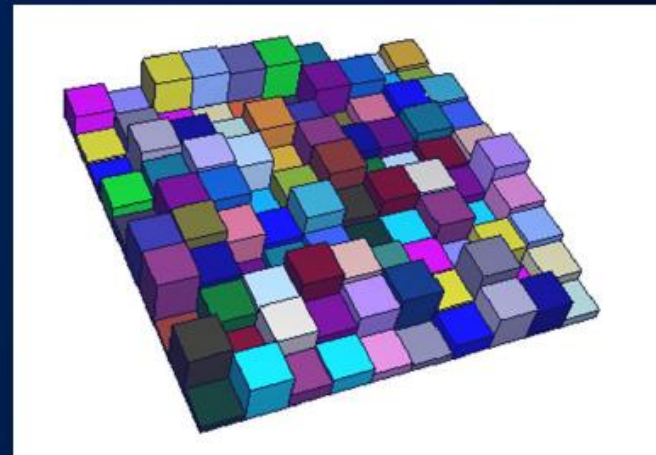
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90 seconds

# ZnO detector plate as a replacement to He3 Portal detector



First Glimpse: Aerial View of Ground Zero Taken from Washington Street the Day before the Official 9/11 Memorial Service Read More: [Http://www.dailymail.co.uk/news/article-2035883/9-11-Anniversary-Ground-Zero-Memorial-revealed-pictures-1st-time.html#ixzz2PRmURIOu](http://www.dailymail.co.uk/news/article-2035883/9-11-Anniversary-Ground-Zero-Memorial-revealed-pictures-1st-time.html#ixzz2PRmURIOu) Follow Us: @MailOnline on Twitter | DailyMail on Facebook. Digital image. The 9/11 Memorial at Ground Zero Revealed in Pictures for the First Time Read More: [Http://www.dailymail.co.uk/news/article-2035883/9-11-Anniversary-Ground-Zero-Memorial-revealed-pictures-1st-time.html#ixzz2PRmaAc51](http://www.dailymail.co.uk/news/article-2035883/9-11-Anniversary-Ground-Zero-Memorial-revealed-pictures-1st-time.html#ixzz2PRmaAc51) Follow Us: @MailOnline on Twitter | DailyMail on Facebook. N.p., n.d. Web.

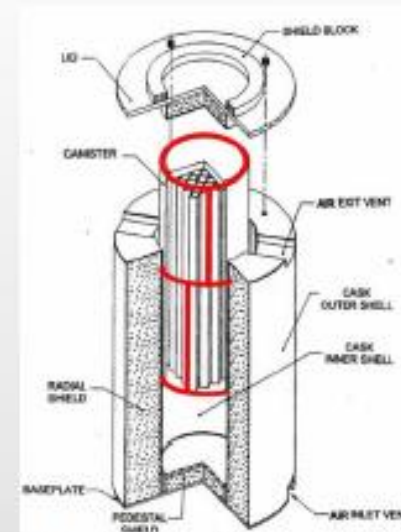
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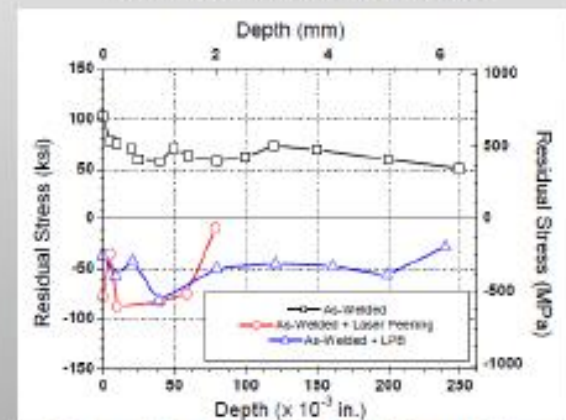
## Extending Used Fuel Canister Lifetime by Reducing Weld Residual Stresses with Low Plasticity Burnishing

Brad Black – MIT S.M. 2013

- The cancellation of Yucca Mountain will likely result in extended service periods for dry storage casks
- Many dry storage casks are susceptible to Stress Corrosion Cracking (SCC), which could eventually result in containment failure
- SCC requires the following:
  - Corrosive Environment- provided by deliquescence of airborne chlorides on canister surface
  - Susceptible Material- provided by the sensitized heat-affected zone of austenitic stainless steel welds
  - Tensile Stress- provided by the residual stresses from untreated welds
- Solution: Low Plasticity Burnishing (LPB)
  - Eliminates tensile stress by creating deeply penetrating compressive stresses below the threshold for SCC
  - Enhances surface finish which reduces the occurrence of pitting and crack initiation
- LPB is an affordable, highly practical, and readily available solution to the problem of extended service periods for dry storage casks



Typical Used Fuel Storage Canister with Weld Locations Highlighted



Effect of Low Plasticity Burnishing (LPB) on Residual Stresses in Welds



90 seconds

# Sea to Certainty

Repurpose naval reactors  
for vital services and rural/developing areas



PRESENTED BY

**Harry Lindner**

PRESENTED ON

**April 5, 2013**

PRESENTED AT

**American  
Nuclear Society  
Student  
Conference**

90 seconds



**Nuclear Engineering**  
THE UNIVERSITY OF UTAH



## Low-Activation Concrete:

eliminating the concrete component of radioactive waste

From this



to this



without this



- Over 4500 tons of reinforced concrete from every power reactor will become low-level radioactive waste upon decommissioning.
- By pre-screening concrete components we can completely eliminate reinforced concrete as a source of Low-Level Radioactive Waste.
- This process will reduce power plant construction costs by millions of dollars.



90 seconds

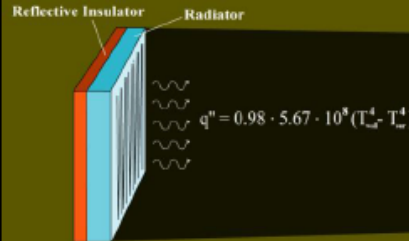
# A Low Temperature Gas Reactor for Near-Term Interplanetary Travel

Pablo A. Vaquer and Patrick J. Moo

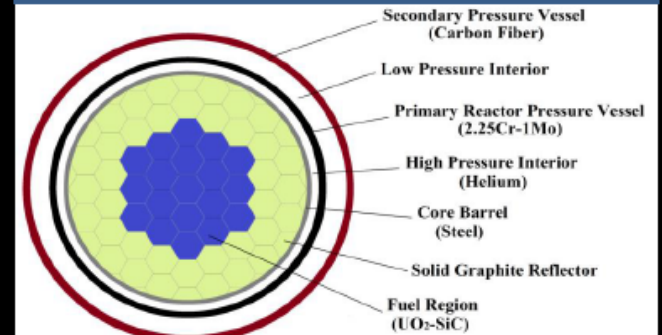
## Features

- **Light Weight**
  - Core Mass: 25.4 Tons
  - Helium Cooled
- **Safe**
  - Coolant Temperature Range: 120 K – 923 K
  - In accident passively cools by conduction and radiation
- **Energy Efficient**
  - $\eta_{th} = 69\%$

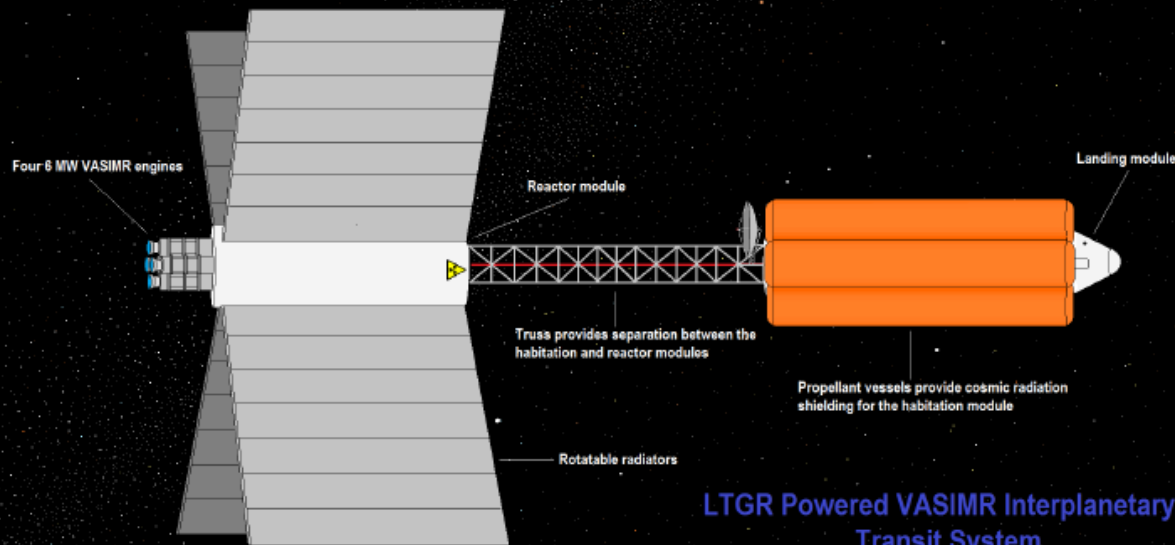
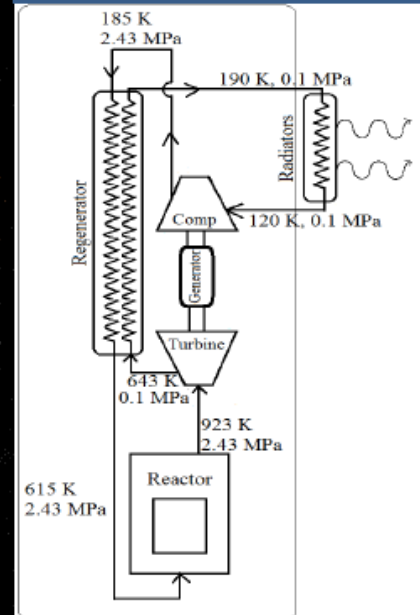
## Radiator Design



## Neutronics

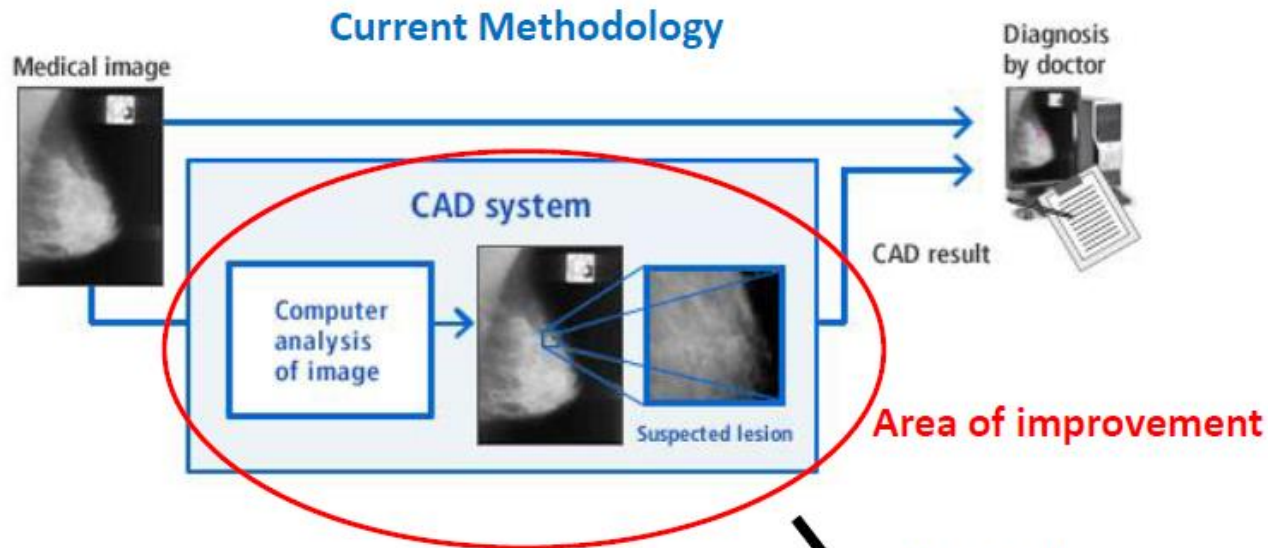


## Thermal Hydraulics



90 seconds

# One in Eight: A Novel Approach to Improving Computer Aided Detection in Mammography Screenings



**Proposal**

## [Facebook Launching Ads Based on Your Browsing History](#)

[www.switched.com/.../facebook-launching-ads-based...](#)



by Amar Toor - in 370 Google+ circles - More by Amar Toor  
Apr 19, 2010 - Share As part of its ongoing effort to sharpen its **advertising** acumen, Facebook will soon unveil a new **advertising** system that expands ...

## [Google Extends Ad Targeting Based on Browsing History. Good or ...](#)

[www.webpronews.com/google-interest-based-adverti...](#)



by Chris Crum - in 1,028 Google+ circles - More by Chris Crum  
Jun 25, 2011 - Remember Google's interest-based **advertising**? You know, where they serve you **ads** based on your **browsing history**, and allow advertisers to

## [Amazon Starts Selling Ads Based on Your Browsing History | TIME ...](#)

[techland.time.com/.../amazon-starts-selling-ads-based-on-your...](#)

Jun 28, 2011 - Amazon has teamed with San Francisco company Triggitt to resell **ad** inventory space targeted at specific user demographics in real time, using ...



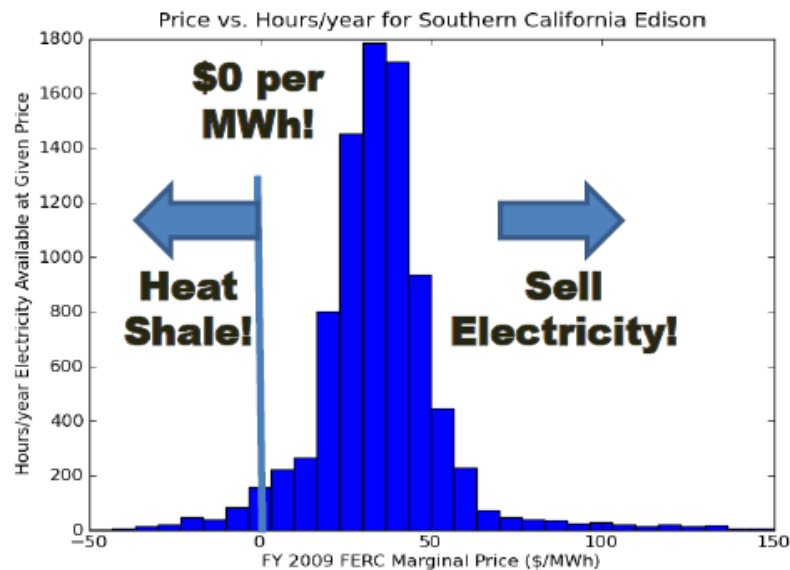
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# Low-Carbon Variable Electricity Minimum CO<sub>2</sub> Hydrocarbon Production

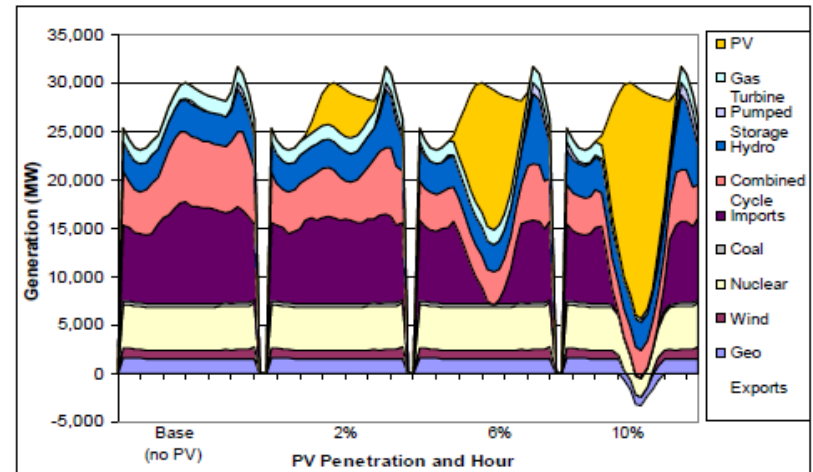
Daniel Curtis (Presenting)  
Charles Forsberg  
MIT NSE

Nuclear Oil Shale

## An Array of Distributed Reactors



## Large Fractions of Intermittent Renewables Will Reduce Electricity Supply Security UNLESS...



## Necessary Future Work

- Optimization of Reactor Placement
- Reference Design, Safety Analysis of Steam Lines
- New Large – Area Security Strategy
- Analysis of Interconnected Reactor Safety Systems

California Spring Electricity Demand and Production with Different Levels of Photovoltaic Electricity Generation

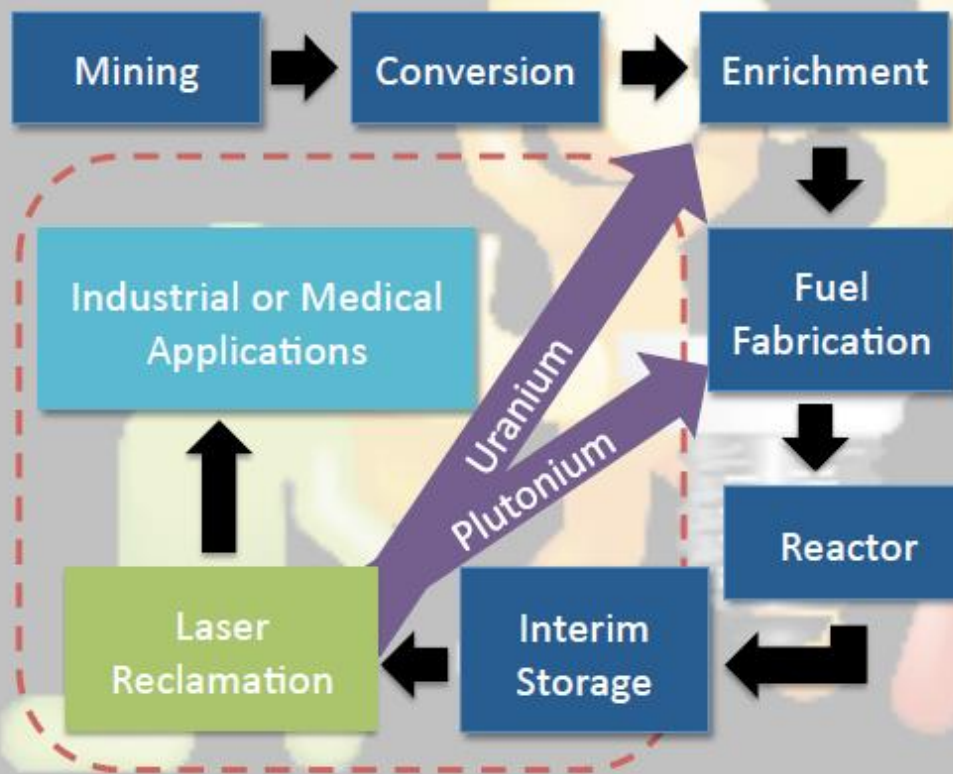
... High Flexibility *Variable*, Low-Carbon Electricity Generators are Developed!

90 seconds

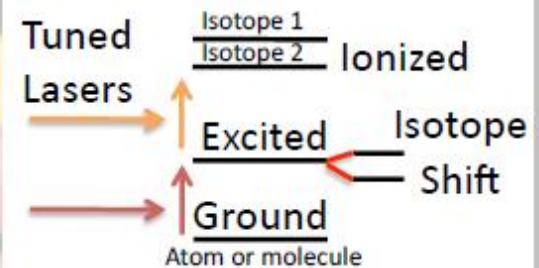
# Laser-Reclamation of Isotopes by Separation and Extraction from Spent nuclear fuel (RISES)

Phyllis Ko

Timothy Jacomb-Hood



## Laser Separation Theory



## Benefits

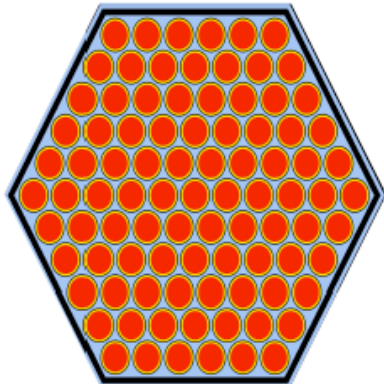
- Actinides can be reused in industry and medicine
- Reduce amount of high-level waste in long-term storage
- Less radioactive waste than chemical separations due to precise lasers capable of elemental/isotopic selectivity

90 seconds

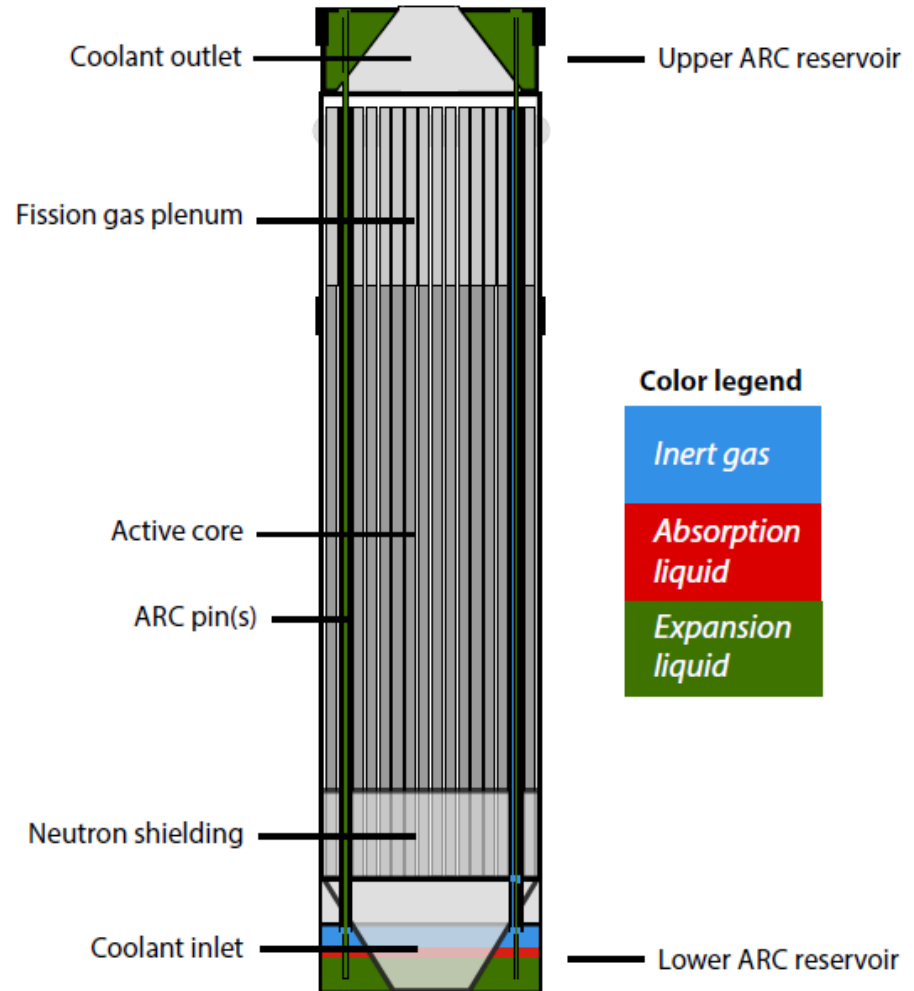
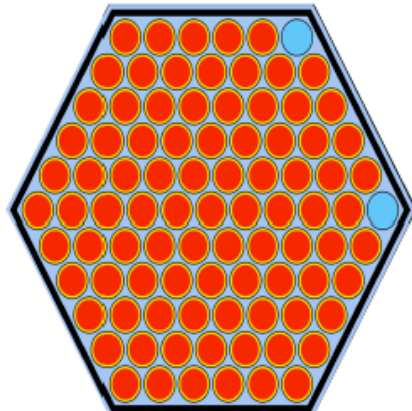
# The ARC system

## Fixing large fast reactors

Standard assembly



Safe ARC assembly



90 seconds

# Carbon Credits for Spent Nuclear Fuel



- Geologic disposal of 70,000 MTHM SNF.
- Deep sequestration of 15 GT CO<sub>2</sub>, avoided by 70,000 MTHM.
- Area of protected rainforest required to avoid 15 GT CO<sub>2</sub> from land use change.

Values Used:

<u>Past SNF inventory:</u>	<u>Carbon Capture w/Coal</u>
-33% efficiency	- 20 tons CO <sub>2</sub> /MWD <sup>†</sup>
-31 Gw d(th)/MTHM	- 1240 km <sup>2</sup> /GT CO <sub>2</sub> <sup>†</sup>
-232 MTHM/Borehole	<u>Deforestation</u>
-200 m ditch/Borehole.	-125.000 km <sup>2</sup> /GT CO <sub>2</sub> <sup>†</sup>

\*Stauffer et al. "A System Model for Geologic Sequestration of CO<sub>2</sub>" Env. Sci. and Tech. 2009

\*\* Nepstad et al. "The End of Deforestation in the Brazilian Amazon," Science, vol. 326, no. 5958, pp. 1350–1351, Dec. 2009.

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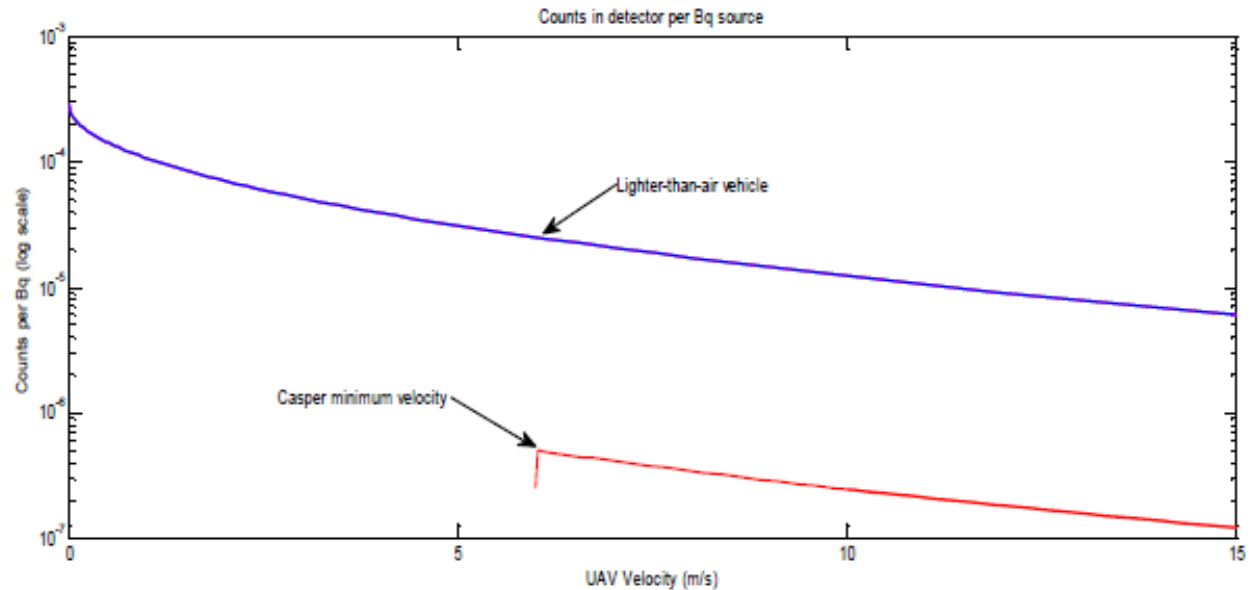


UNITED STATES MILITARY ACADEMY  
**WEST POINT**

## *Unmanned Lighter Than-Air Vehicle For Remote Radiological Survey*

Current Airborne Detection can only find if a street is hot, it cannot isolate a source to a particular building.

That information is currently found by manned survey teams.



- Purpose: Radiological mapping for urban areas affected by radiological disasters, accidents or weapons of mass destruction
- Premise: CsI Scintillator detector, integrated with video and GPS data, continuously transmitting to a control station.
- Advantages: Low, slow, and cheap: take advantage of the  $1/r^2$  relationship between distance and detected counts.
- Availability: Commercial, off-the shelf (COTS) technology, can be made now

# Get Involved!

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- Become involved with the Nuclear Energy Innovation Summit next year!
- We're trending on Twitter: @NukeInnovators
- Contact this year's organizers to get involved in the future:
  - Will Boyd (wboyd@mit.edu)
  - Sam Shaner (shaner@mit.edu)
  - Matt Ellis (mellis13@mit.edu)
  - Jacob DeWitte (jdewitte@mit.edu)



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