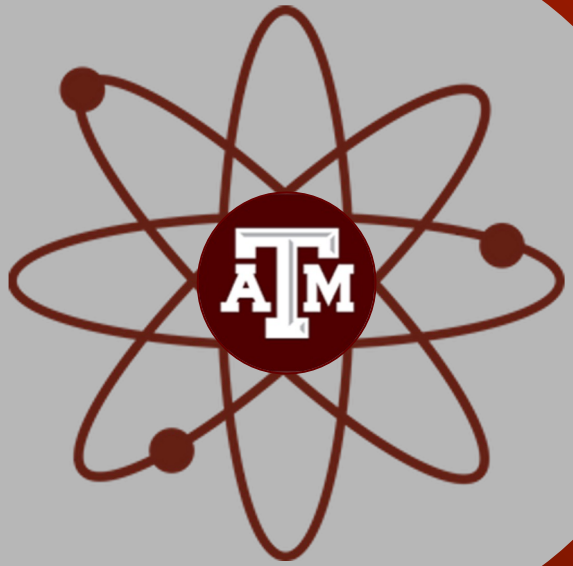



# Nuclear Aviation Project

# The Team

# Why Nuclear?

- Reliable
- Power dense
- Less need to refuel

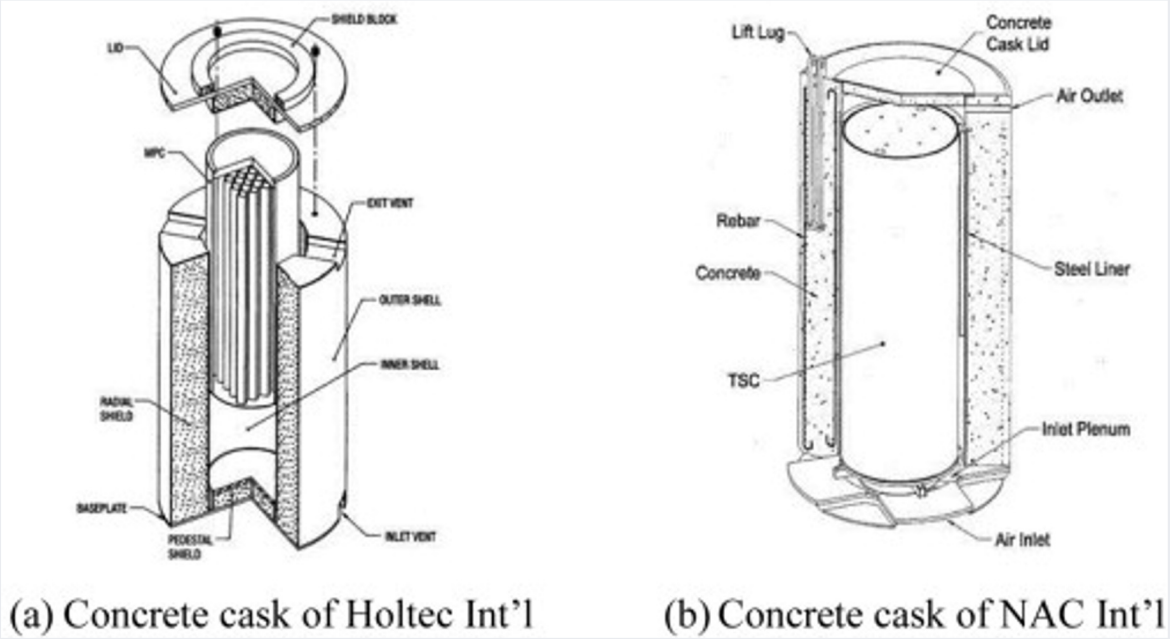
https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.vox.com%2Fenergy-and-environment%2F2017%2F3%2F27%2F15043522%2Fnuclear-power-future-innovation&psig=AOvVaw0V49-oufp5sK2aJ6f3pfXm&ust=1683055482540000&source=images&cd=vfe&ved=0CBIQjhxqFwoTCNCenbXsIP4CFQAAAAAdAAAAABAD

# 1 Fuel life cycle

# Colorado Plateau

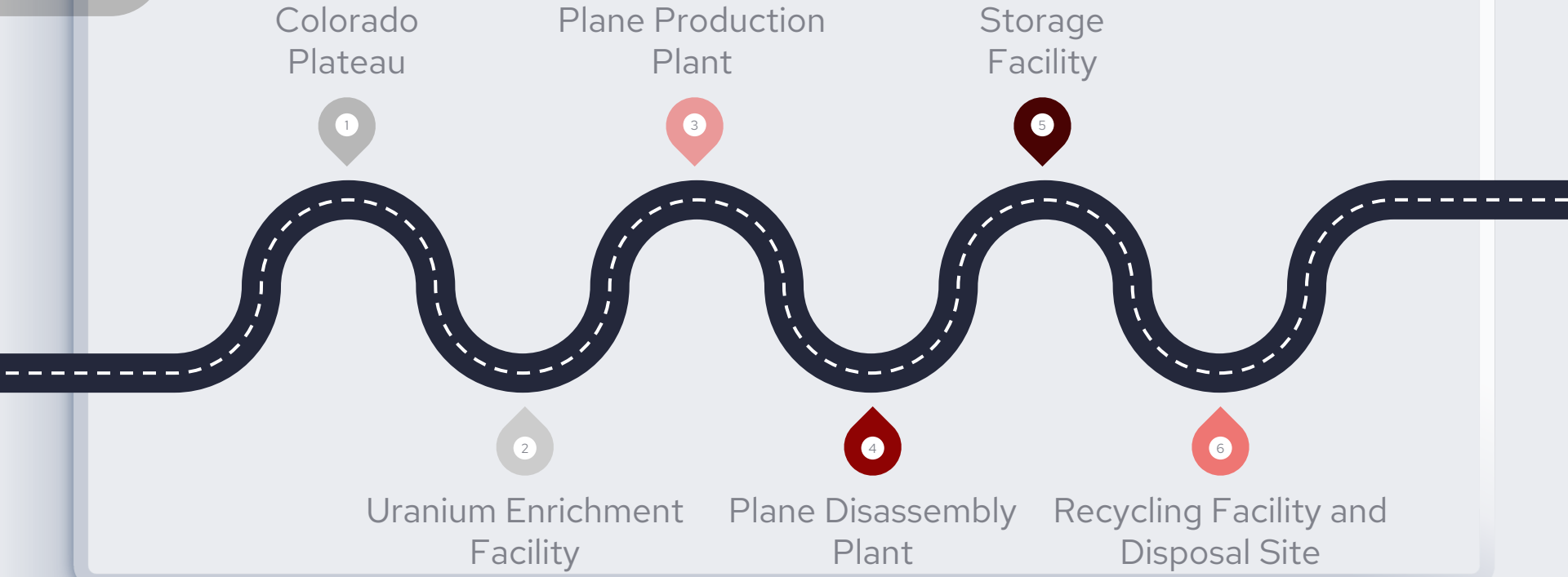
Created by: Cephas; Work has been cropped;https://commons.wikimedia.org/wiki/File:Colorado_Plateau_Shrublands_map.svg

# Storage cask




(a) Concrete cask of Holtec Int'l (b) Concrete cask of NAC Int'l

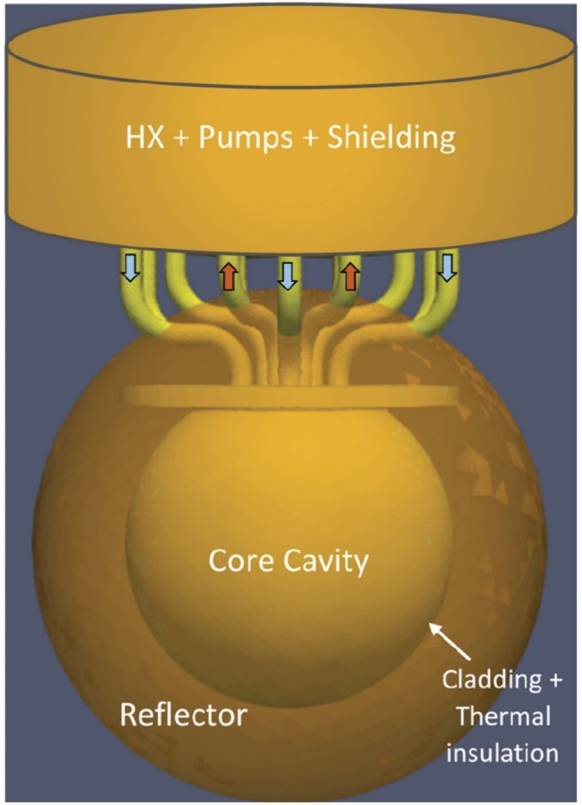
# Uranium Life Cycle



# 2 Reactor

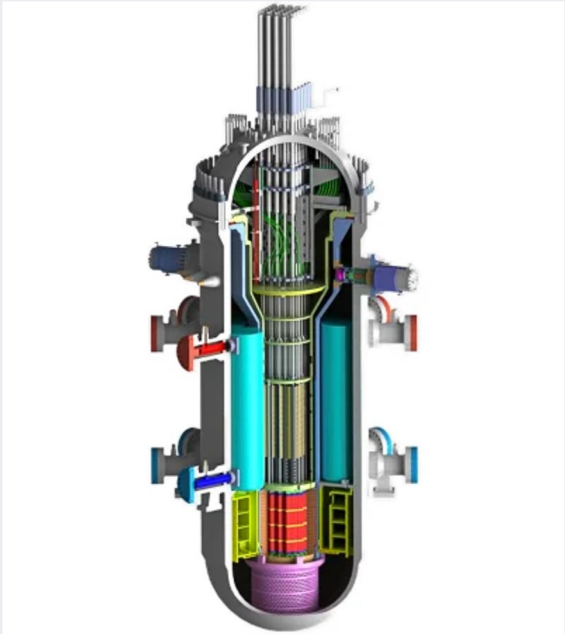
# Reactor

- Molten Salt Reactor
- Lithium-7 Hydride Reflector



# Reactor

- HALEU (~20%)
- Small Modular Reactors



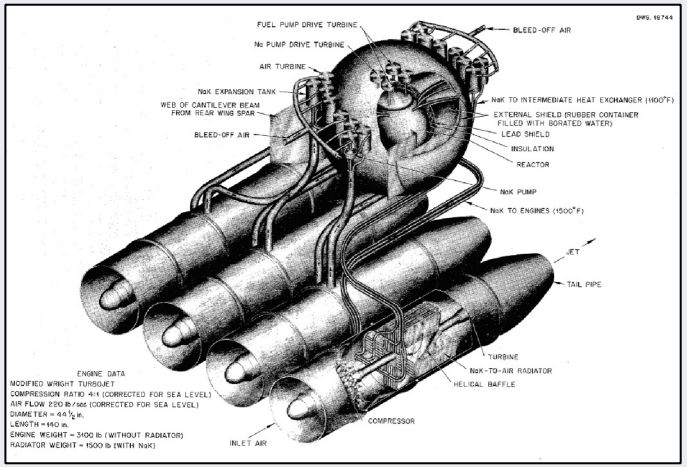
https://www.google.com/url?sa=i&url=https%3A%2F%2Feepower.com%2Fnews%2Fsmall-modular-reactor-developers-gain-traction%2F&psig=AOvVaw3wPxV0ViuD_Pc3sruNBhD4&ust=1685461349793000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCLDuyYzvmv8CFQAAAAAdAAAAABAE

# 3 Plane Engine and Structure

# Reactor Engine System

## History:

- Inspired by NB-36 and HTRE-3
- Very similar to traditional turbojet engine
- Reactor used as heat source
- Let off nuclear debris in air




https://www.innovationnewsnetwork.com/molten-salt-reactors-technology/23371/

# Reactor Engine System

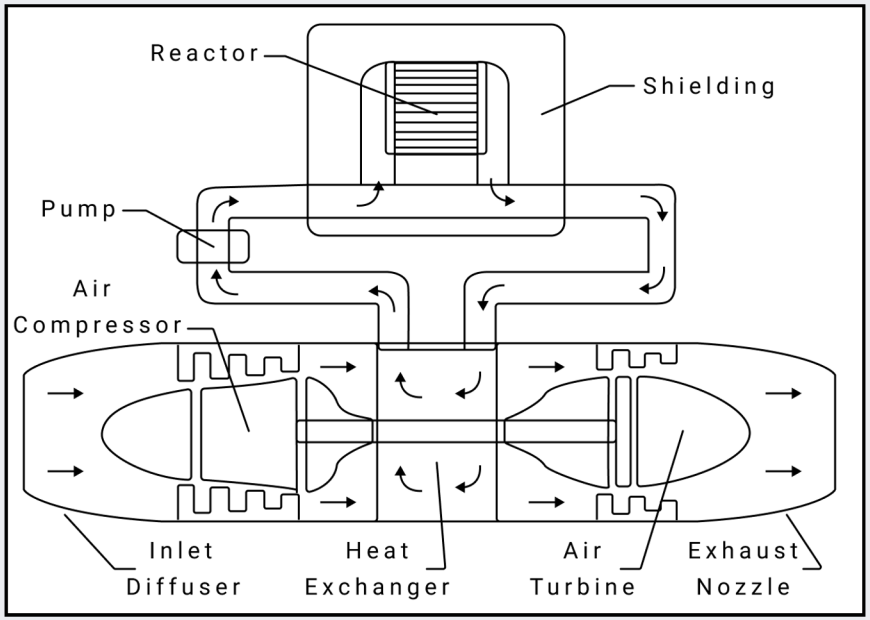
**Heat Source:**

- Reactor heats up molten liquid salt
- Molten salt heats up liquid lithium
- Liquid lithium travels to heat exchanger in engine

**Engine:**

- Turbofan engine
- No traditional combustion chamber
- Heat exchanger instead
- Heats up compressed air to produce thrust

# Reactor Engine System



# Reactor Engine System

**Benefits:**

- No contrails or emissions
- No nuclear wake
- Fuel replacement every 8 years
- Create electricity for airport

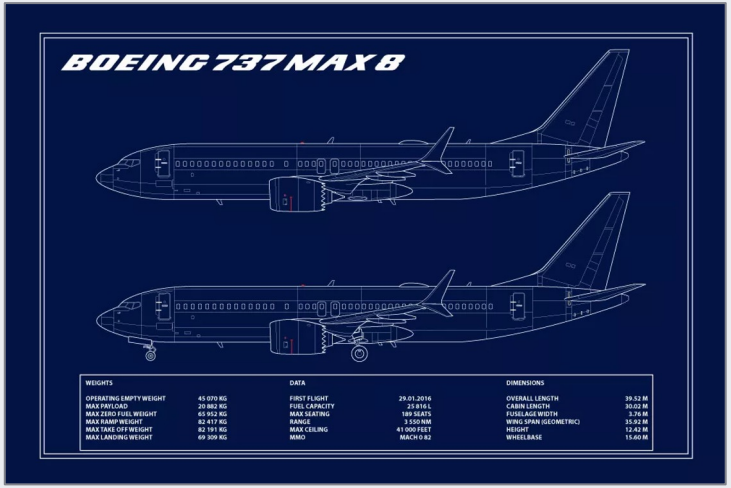
**Considerations:**

- Less thrust than traditional engine (14,000 to 18,000 lbf)
- System heavier than traditional system

# Reactor Plane Structure

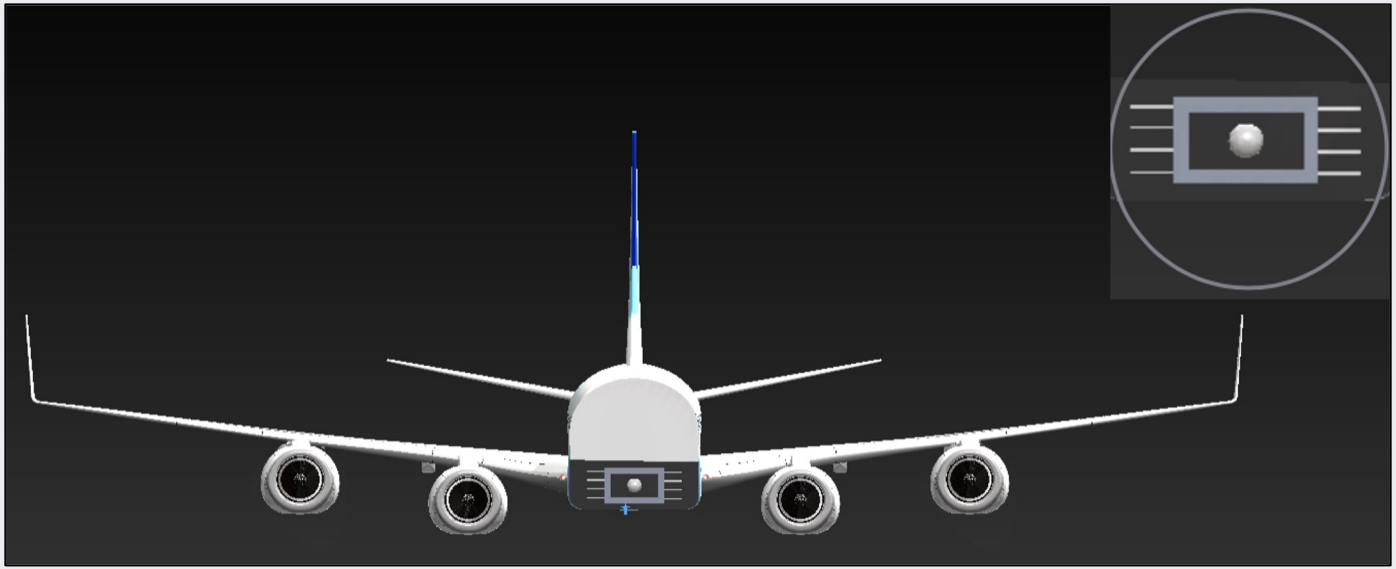
## Design Requirements:

- More engines needed
- Reactor heavily protected from collisions
- Shielding for passengers
- Fit into current airport infrastructure
- Based numbers of Boeing 737 MAX 8




https://aeroprints.de/produkt/boeing-737-max-8/?lang=en

# Reactor Plane Structure



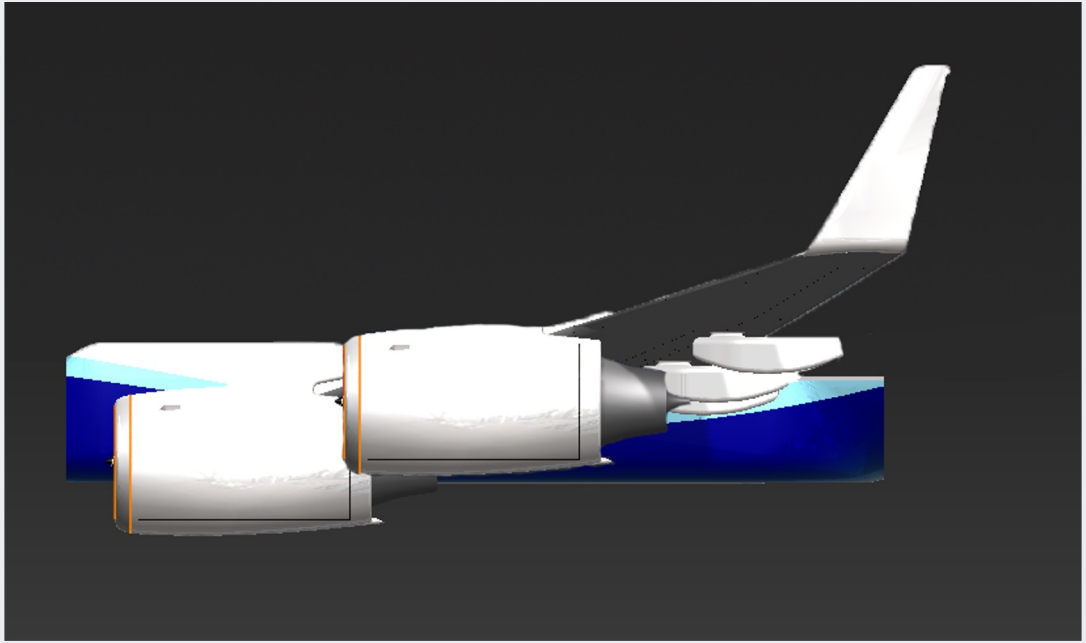
# Reactor Plane Structure

https://aviationweek.com/mro/aircraft-propulsion/cold-soak-software-fix-expanded-leap-1b-engines

- 4 engine plane
  - 59 inch intake
- Fuselage separated into top and bottom
  - Wings connected to bottom half
  - Strengthen bottom
    - Protects reactor from collision

# Reactor Plane Structure

# Reactor Plane Structure



# Reactor Plane Structure

**Benefits:**

- Protects nuclear reactor upon impact
- Protects passengers from radiation
- Produces similar thrust
- Engine and reactor maintenance

**Considerations:**

- Heavy from shielding and extra engines
- Changes to runway
- Improvement in composites and aerodynamic technology necessary

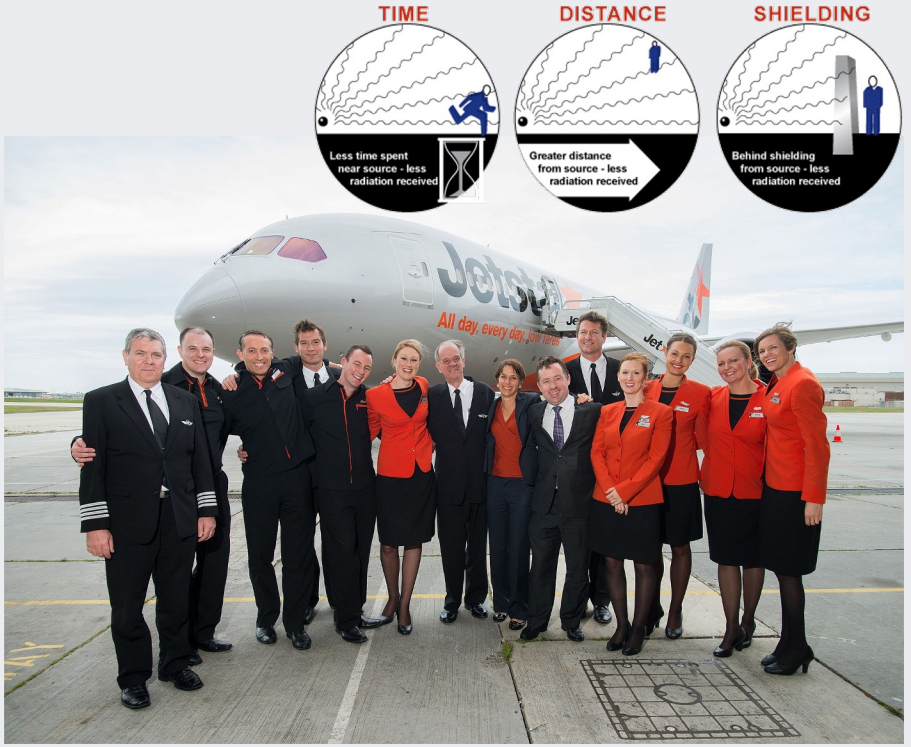
# 4 Human Factors

## Safety and Policy

# Safety

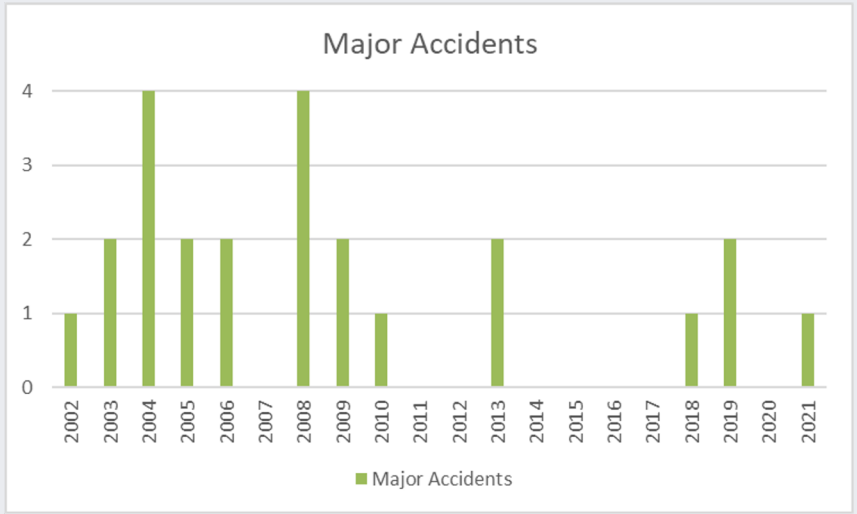
## Preemptive Safety Measures

- Safe Distances
- Contact
- Reactor Shut Off
- Crash Training
- Mitigating Radiation Exposure



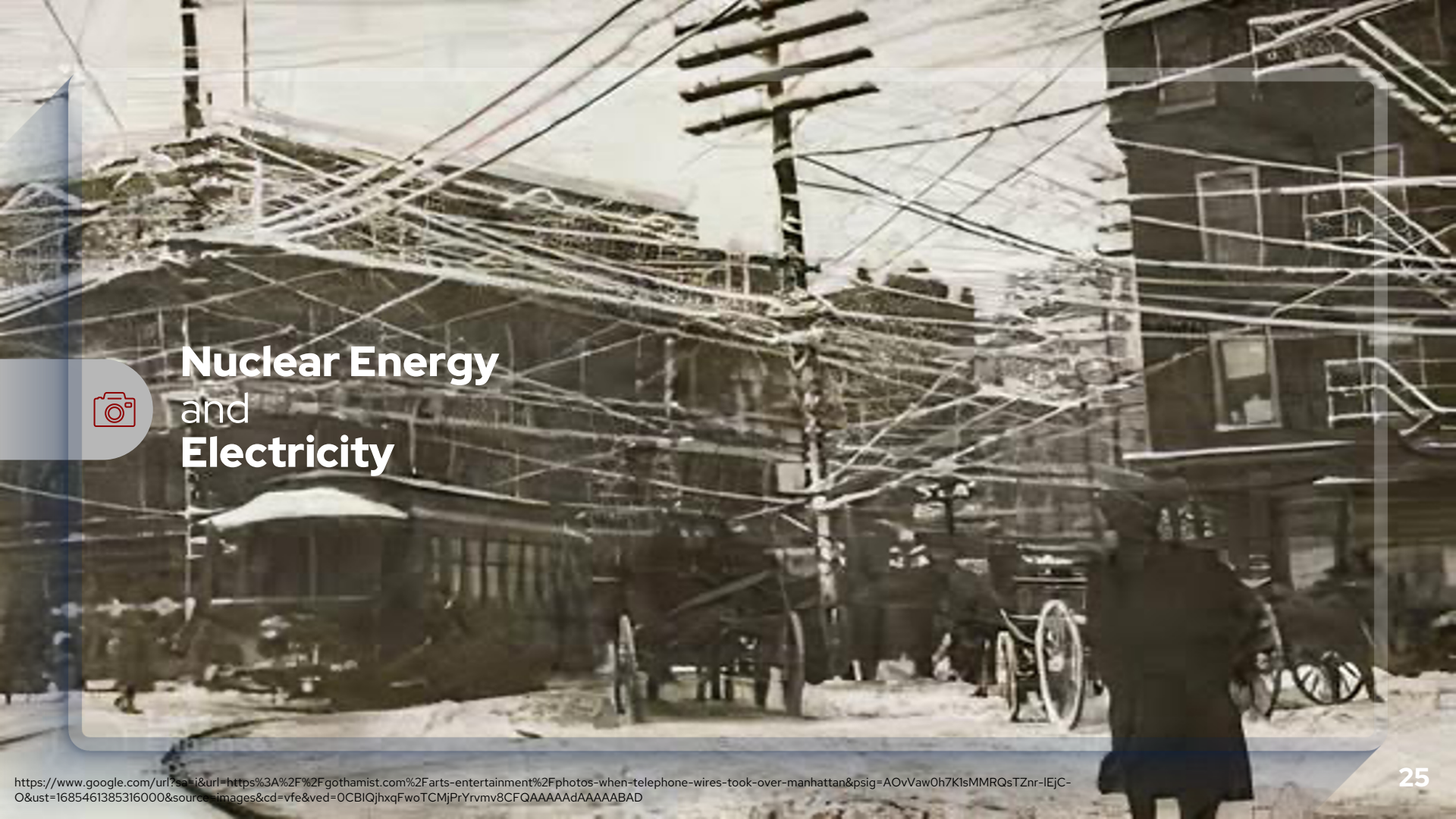

https://www.nde-ed.org/NDEEngineering/RadiationSafety/safe_use/controlling_exposure.xhtml
https://commons.wikimedia.org/wiki/File:787_Dreamliner_cabin_crew_and_pilots_%281%29_%2815%29.jpg

# Safety




**In the event of a crash:**

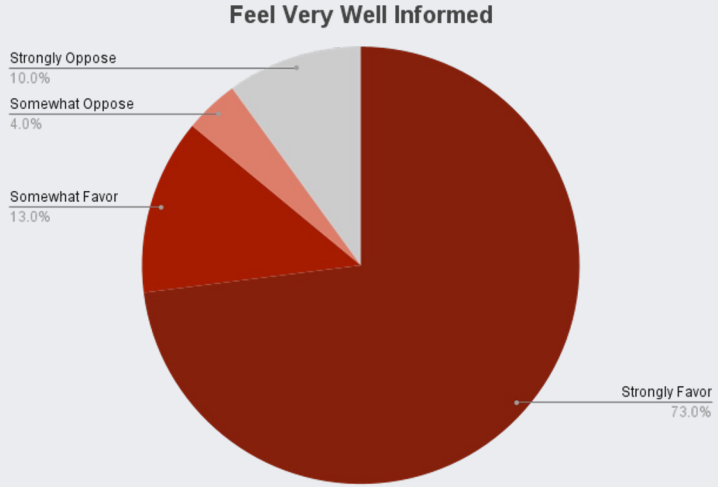
- Designated Stress/Break Points
- Reactor Housed in the Hull
- Crash Safety Team
- Reinforced Reactor Housing

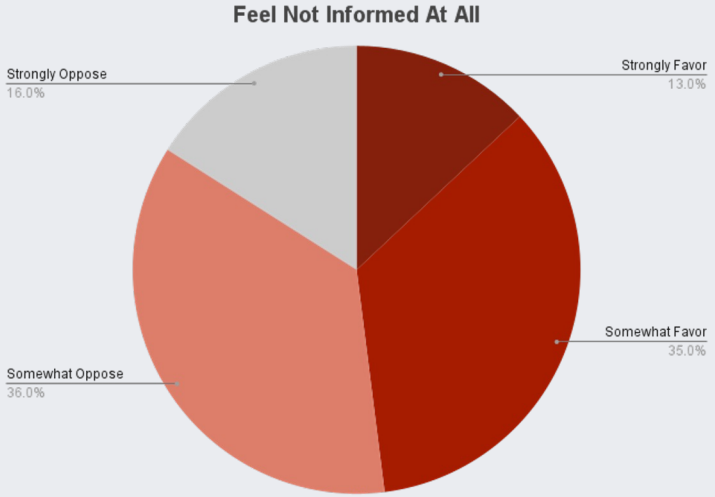


# Nuclear Energy and Electricity

https://www.google.com/url?sa=i&url=https%3A%2F%2Fgothamist.com%2Farts-entertainment%2Fphotos-when-telephone-wires-took-over-manhattan&psig=AOvVaw0h7K1sMMRQsTZnr-lEjC-O&ust=1685461385316000&source=images&cd=vfe&ved=0CBIQjhxqFwoTCMjPrYrvmv8CFQAAAAAdAAAAABAD

# Social Education




Strongly Favor  Somewhat Favor  Somewhat Oppose  Strongly Oppose

# Policy

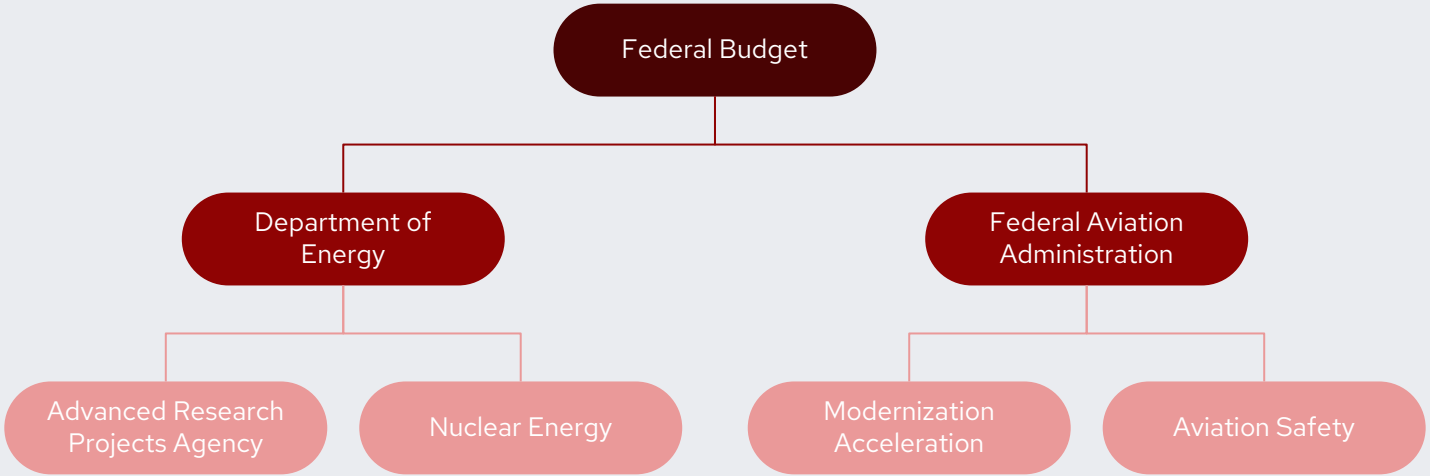
**American Nuclear Infrastructure Act of 2021**

- Global leader
- Unique Licensing for Non Electric Applications
  - New Rulemaking
  - Technology Inclusive Regulatory Framework created by NRC

**Nuclear Energy Innovation Capabilities Act of 2017**

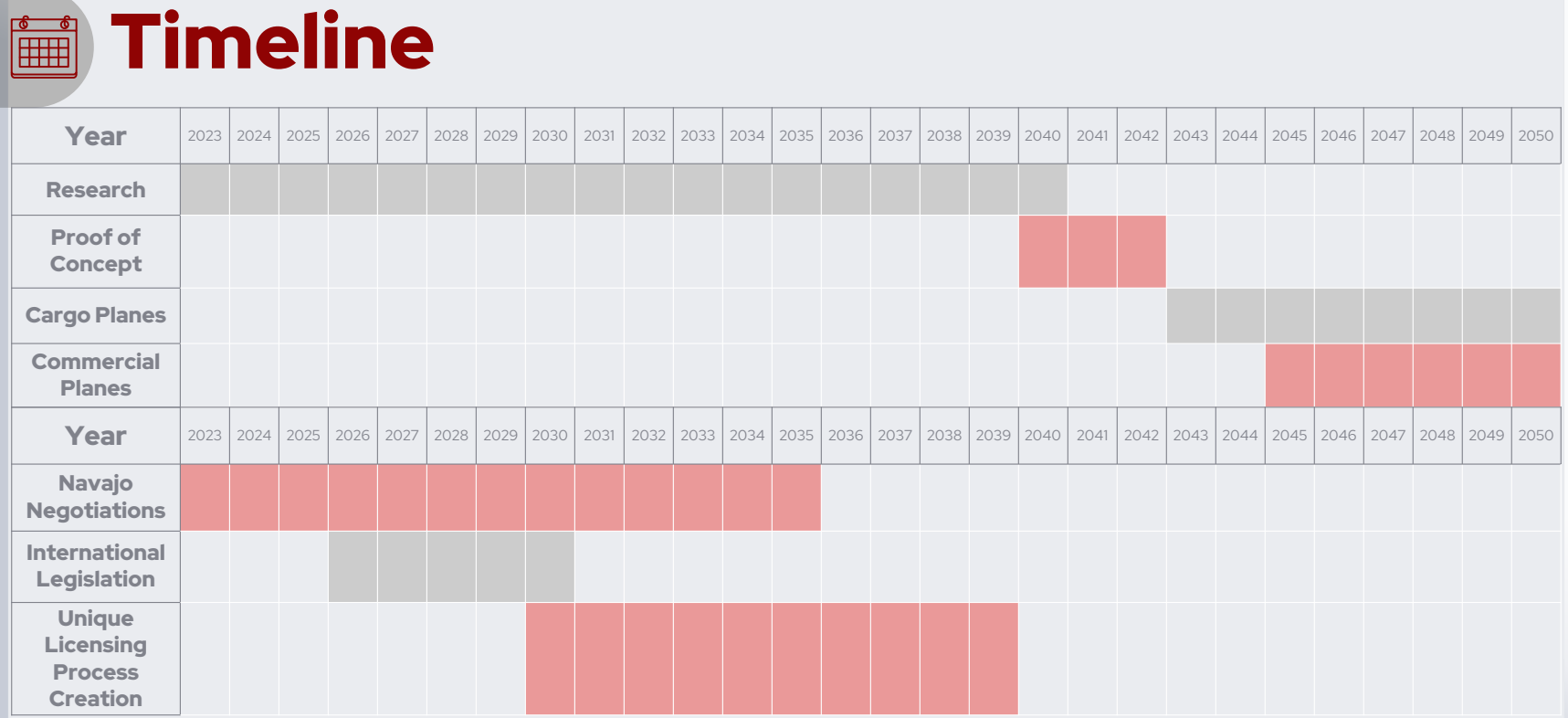
- DOE assist NRC in the goals outline in the bill
- Non Electric integration of nuclear energy
- Advanced nuclear technology

# $ Governmental Budgets



# 5 Timeline

# Timeline


Year
2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
Research
Proof of Concept
Cargo Planes
Commercial Planes
Year
2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
Navajo Negotiations
International Legislation
Unique Licensing Process Creation

# 6 Finance

# Fuel Savings

**Boeing 737**

**$188.9 Million**

**Boeing 747**

**$2.7 Billion**

# 7 Environment

# In-Flight Impact

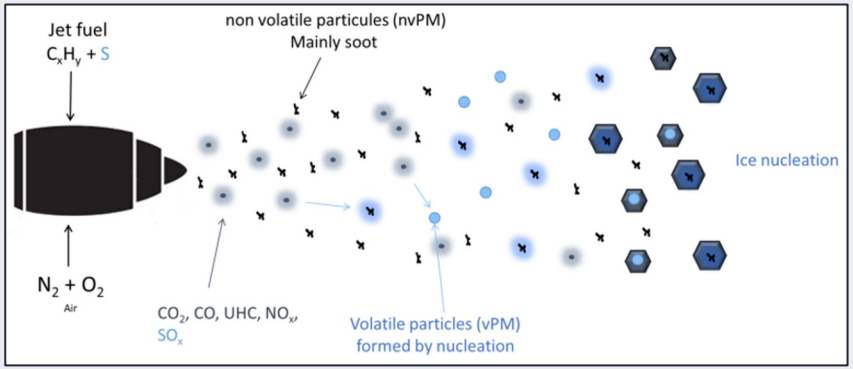
**Indirect Heating**

- No soot particles
- No CO2 emissions

↓

**No Contrails**

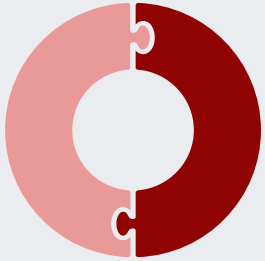
- No catalyst for nucleation
- Reduced Non-CO2 emissions



# Uranium Mining Impact

## Mining

- Radioactive Uranium Dust
- Radon Gas



## Milling

- Contaminated Radioactive Slurry

# Radiation Impact

**In-flight Radiation**

- Negligible radiation escapes into atmosphere

**On-Ground Radiation**

- Safety is the priority
- Extra precautions taken to prevent accidents

# Looking to the Future

**Legislation needs to start NOW**

- Lower the cost barrier for research
- Decrease the hazard of nuclear energy
- Grow industry to meet demand

# Thanks!

## And Gig'em

Thank you again for your consideration!