

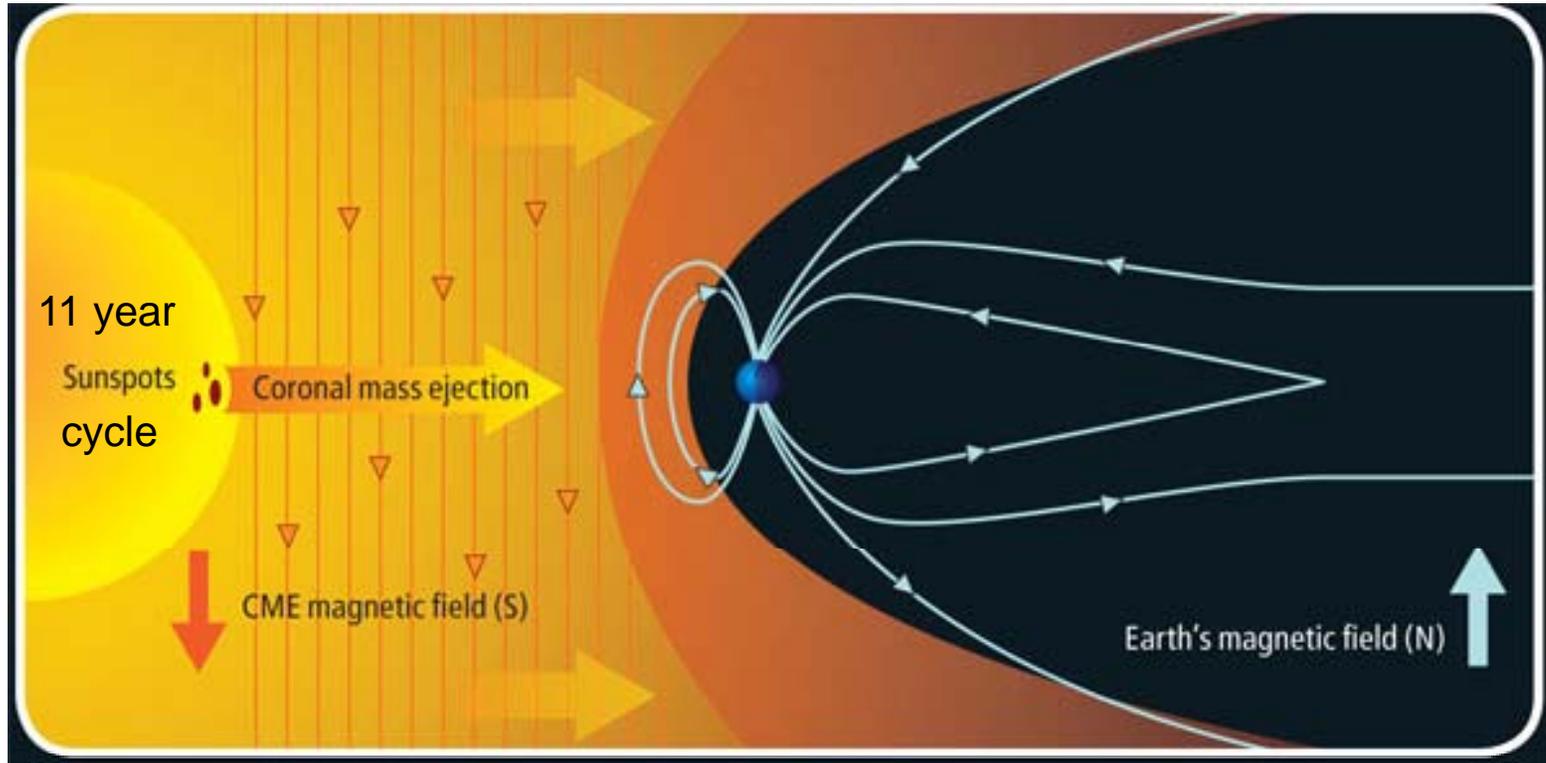
Homeland Security Missions



- Preventing Terrorism
- Border Security
- Immigration Enforcement
- Securing Cyberspace
- Disaster Resilience

DEC 2003 – HSPD7 assigned DHS national responsibility for critical infrastructure protection.

Extreme Space Weather – Not a New Problem



... but combination of ESW with a modern electric grid IS a new problem.

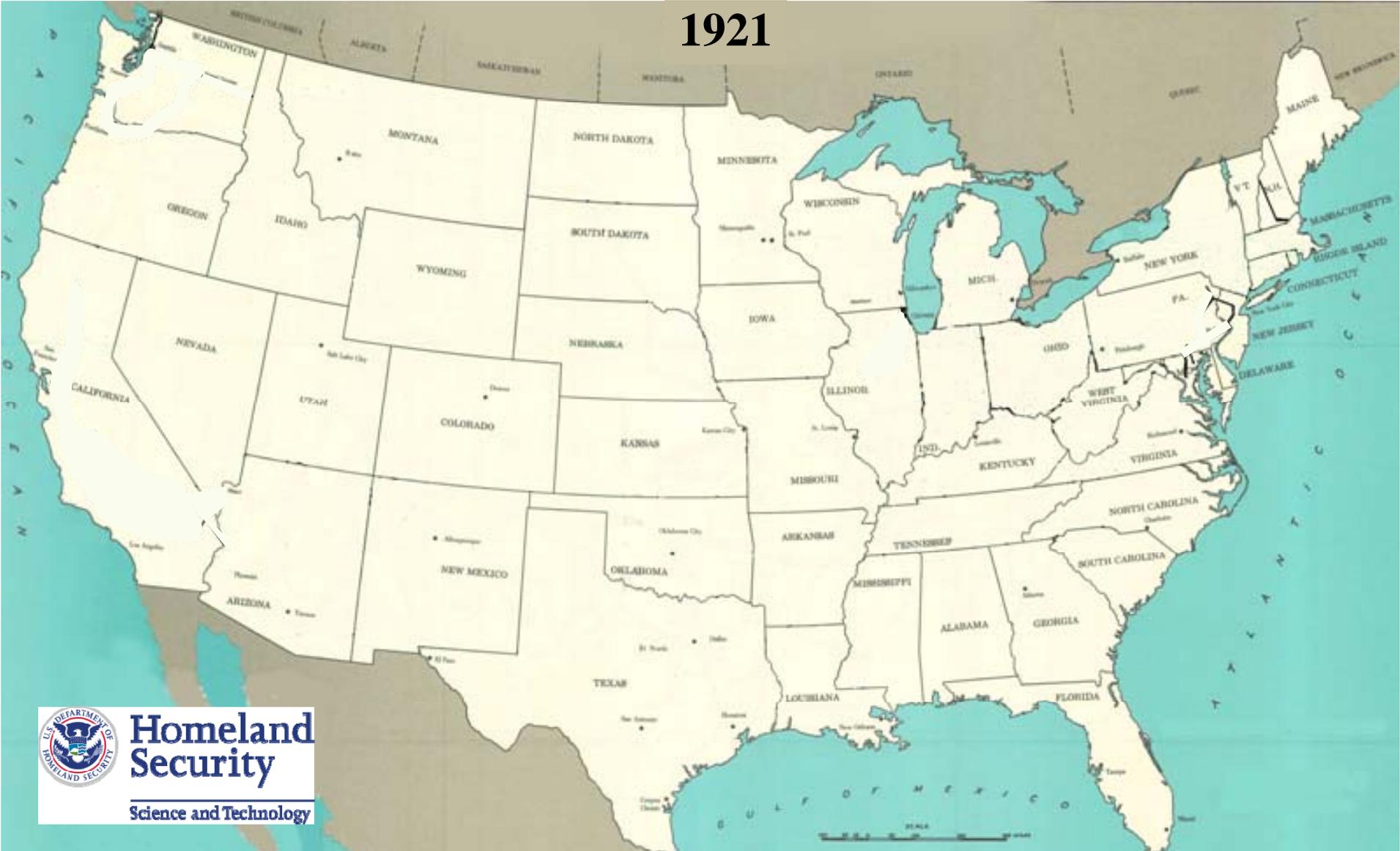


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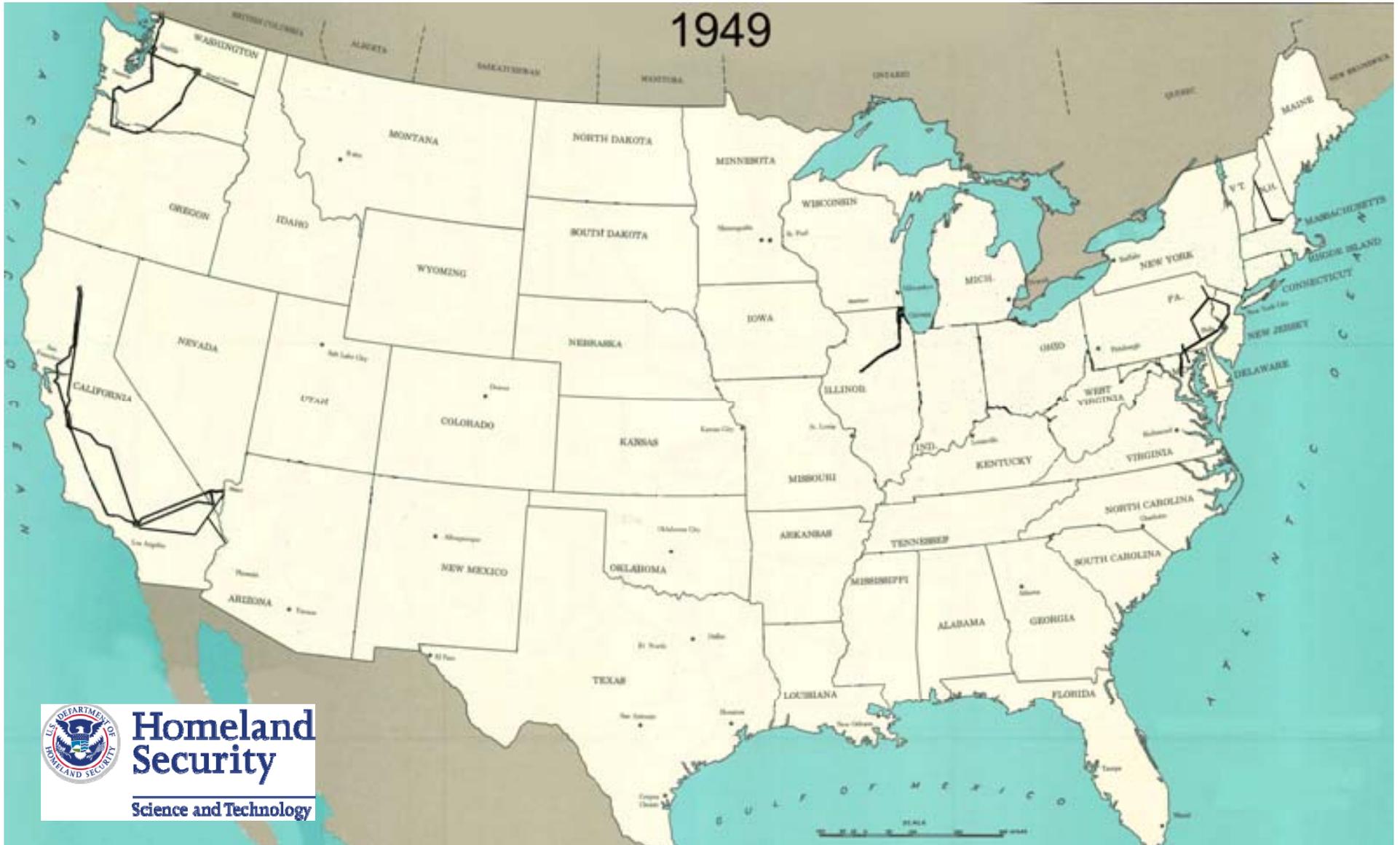
Science and Technology

345KV+ Transmission Growth

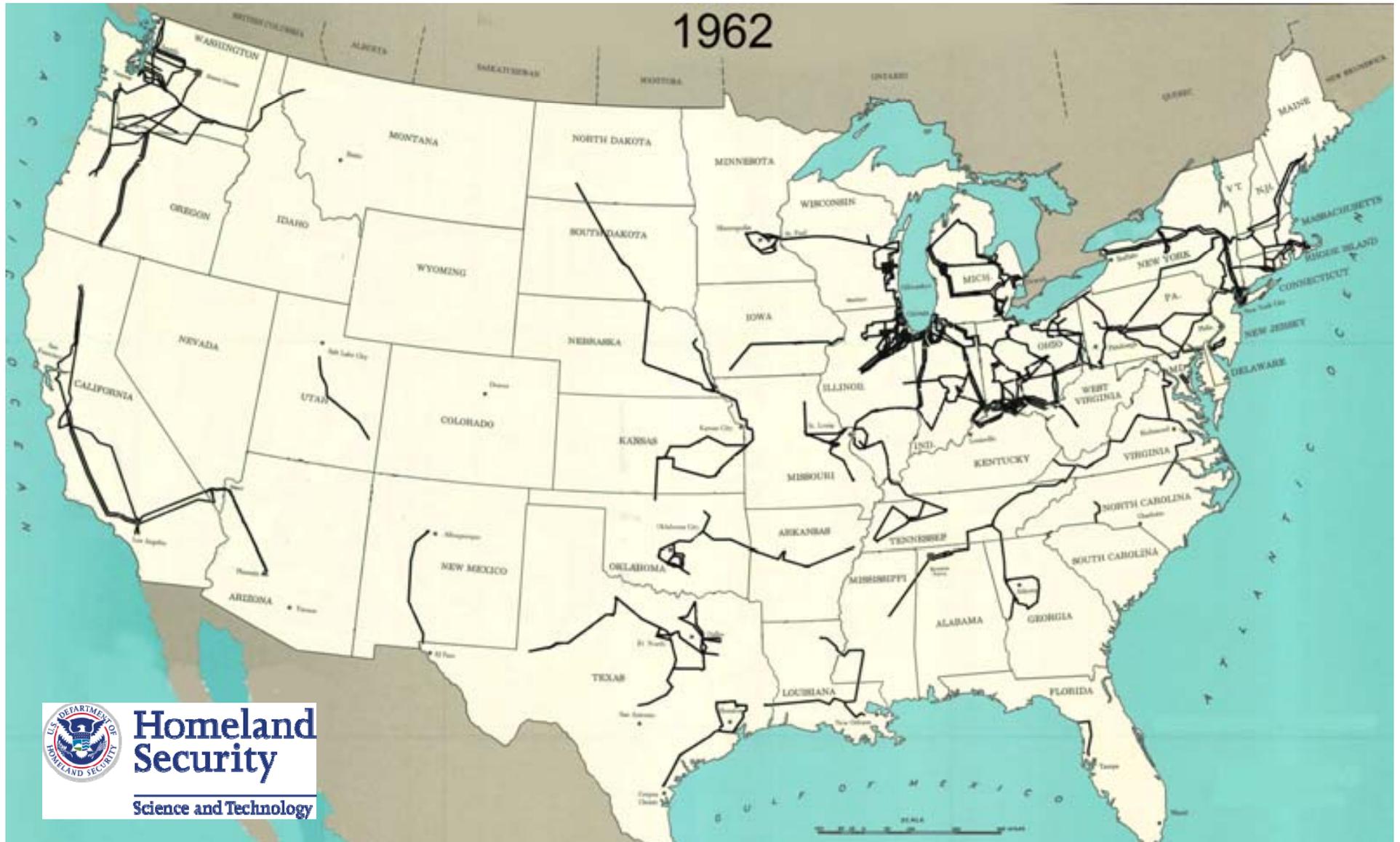
1921



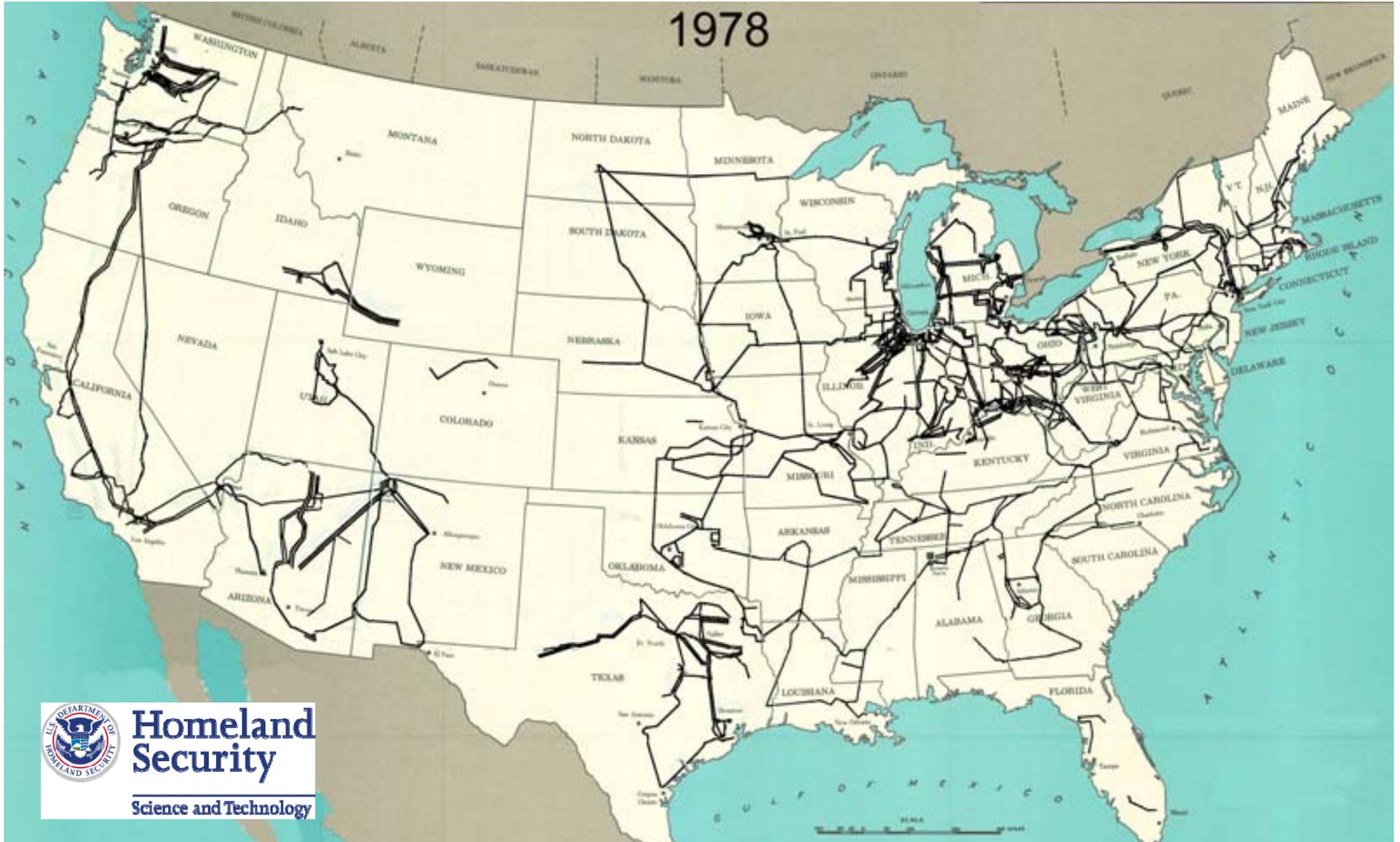
345KV+ Transmission Growth



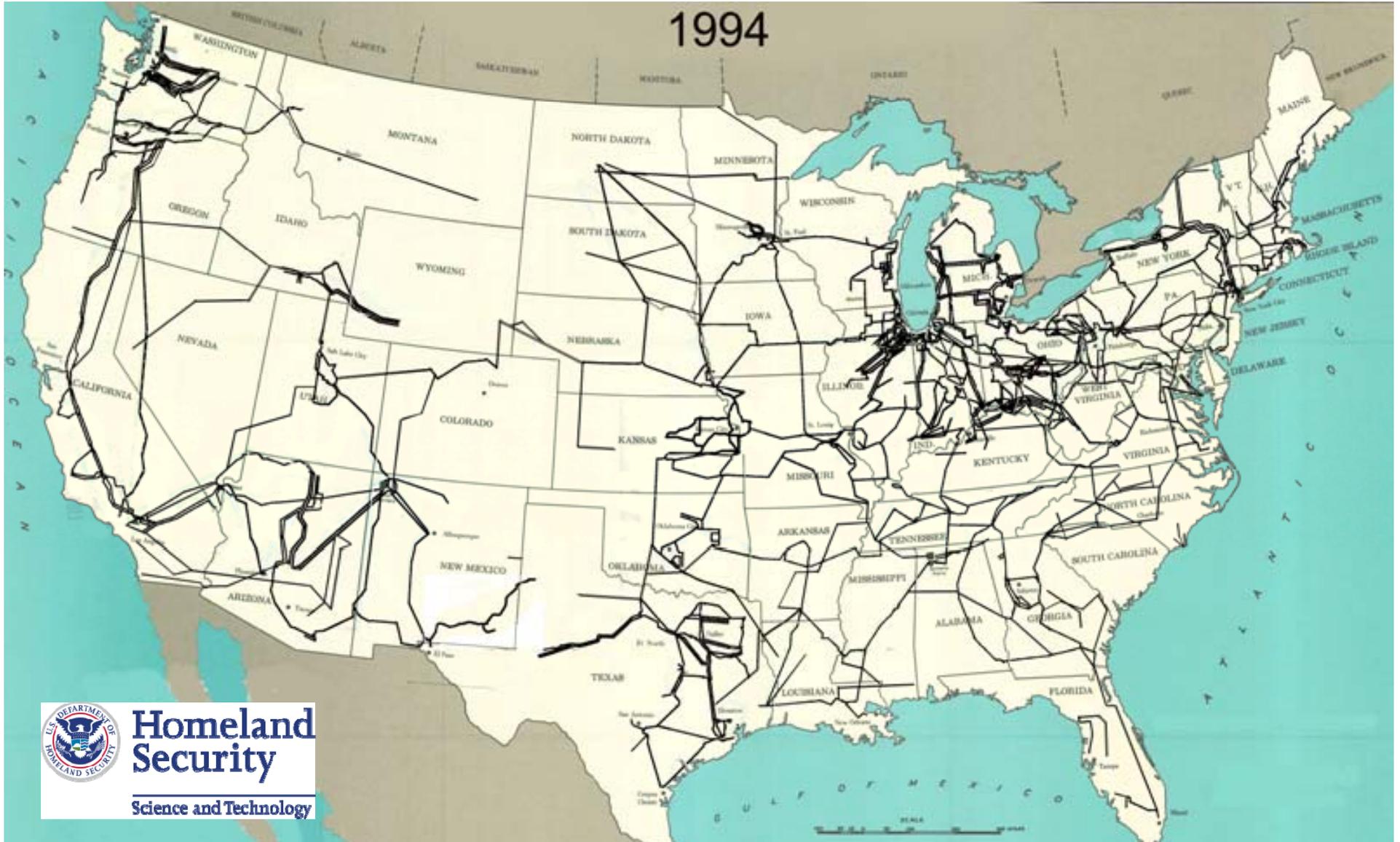
345KV+ Transmission Growth



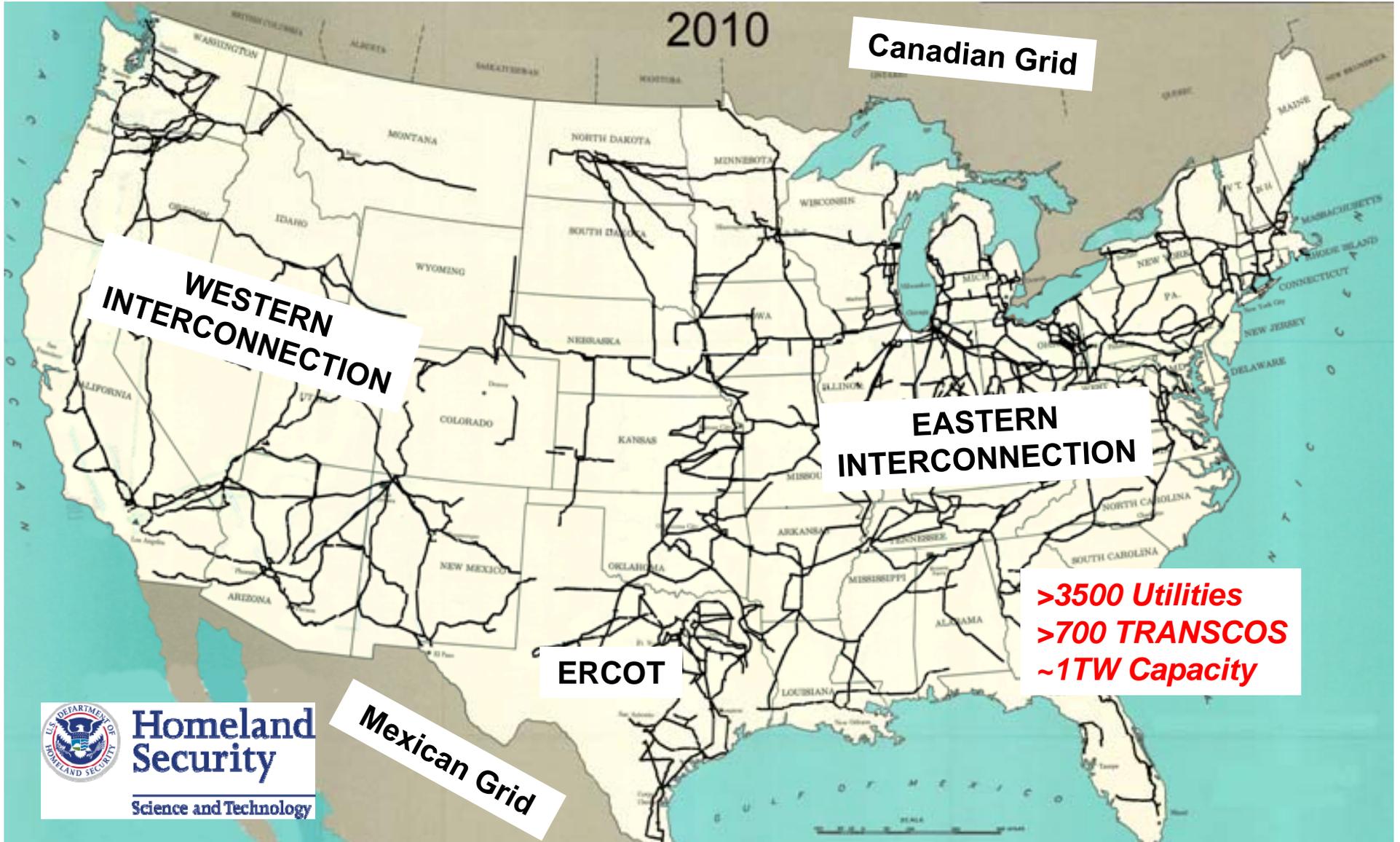
345KV+ Transmission Growth



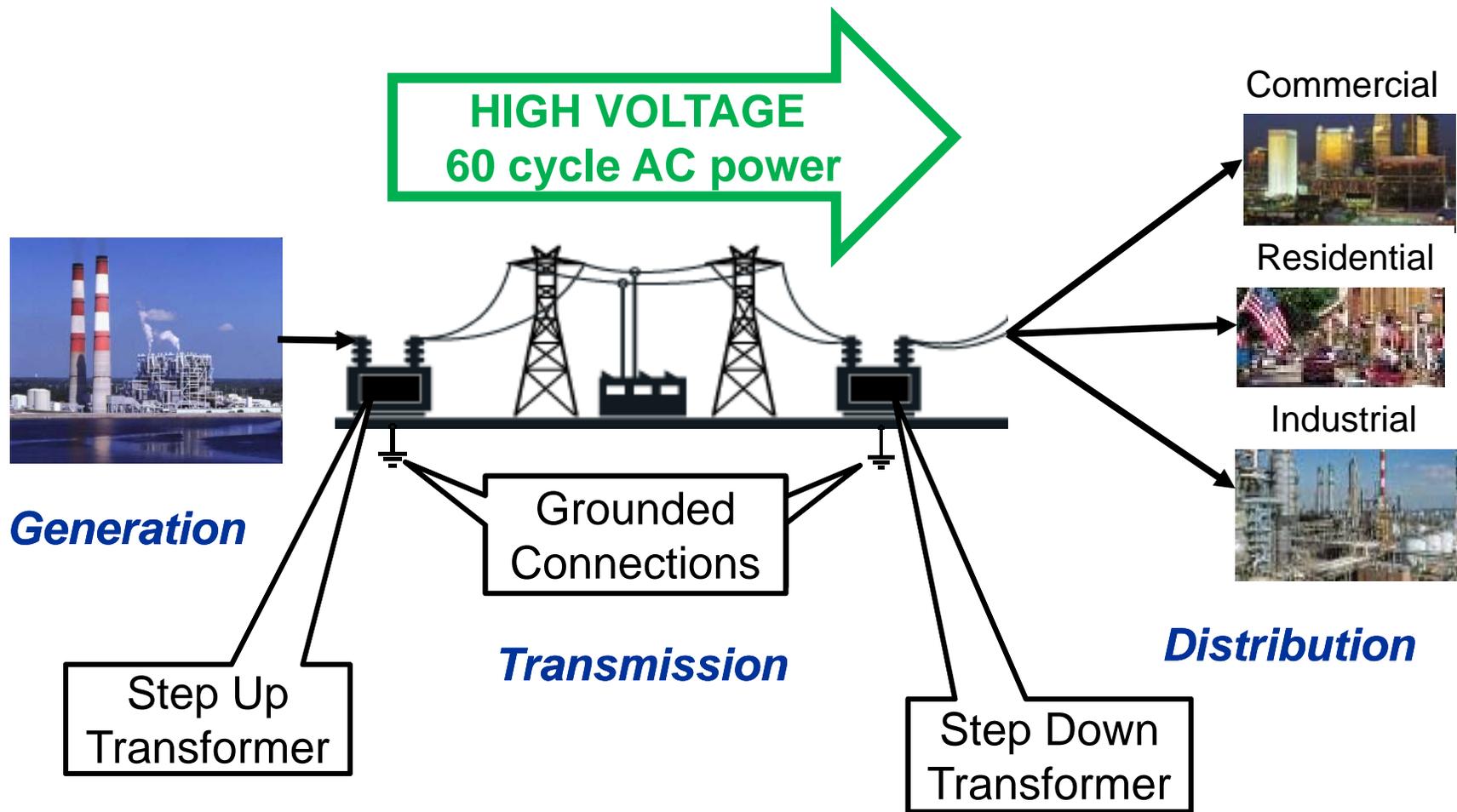
345KV+ Transmission Growth



345KV+ North American Grid



Normal Grid Operating Conditions



Homeland Security

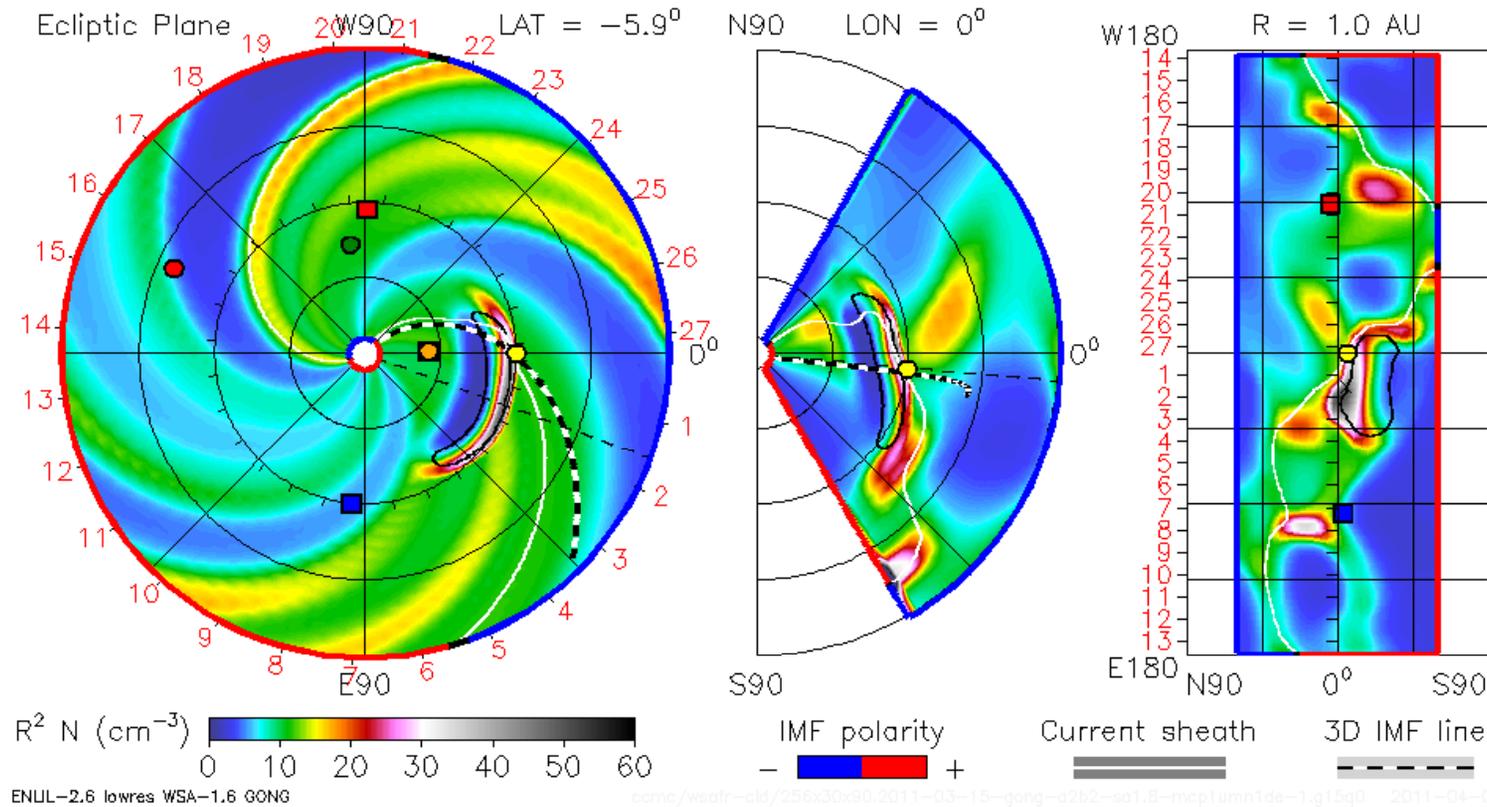
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NASA Model - Tells If CME Will Hit or Miss

2011-04-10 18:05:16

2011-03-15 +26.75 days

● Mercury ● Venus ● Earth ● Mars ■ Messenger ■ Stereo_A ■ Stereo_B

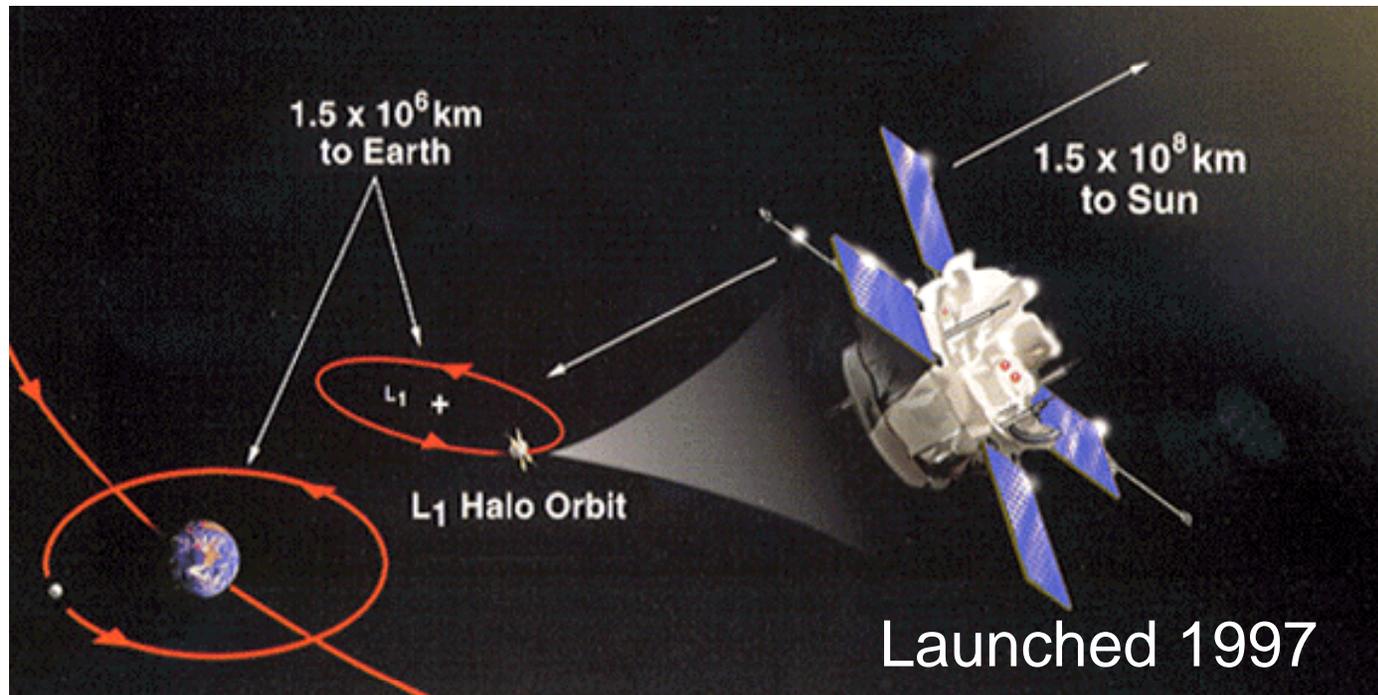


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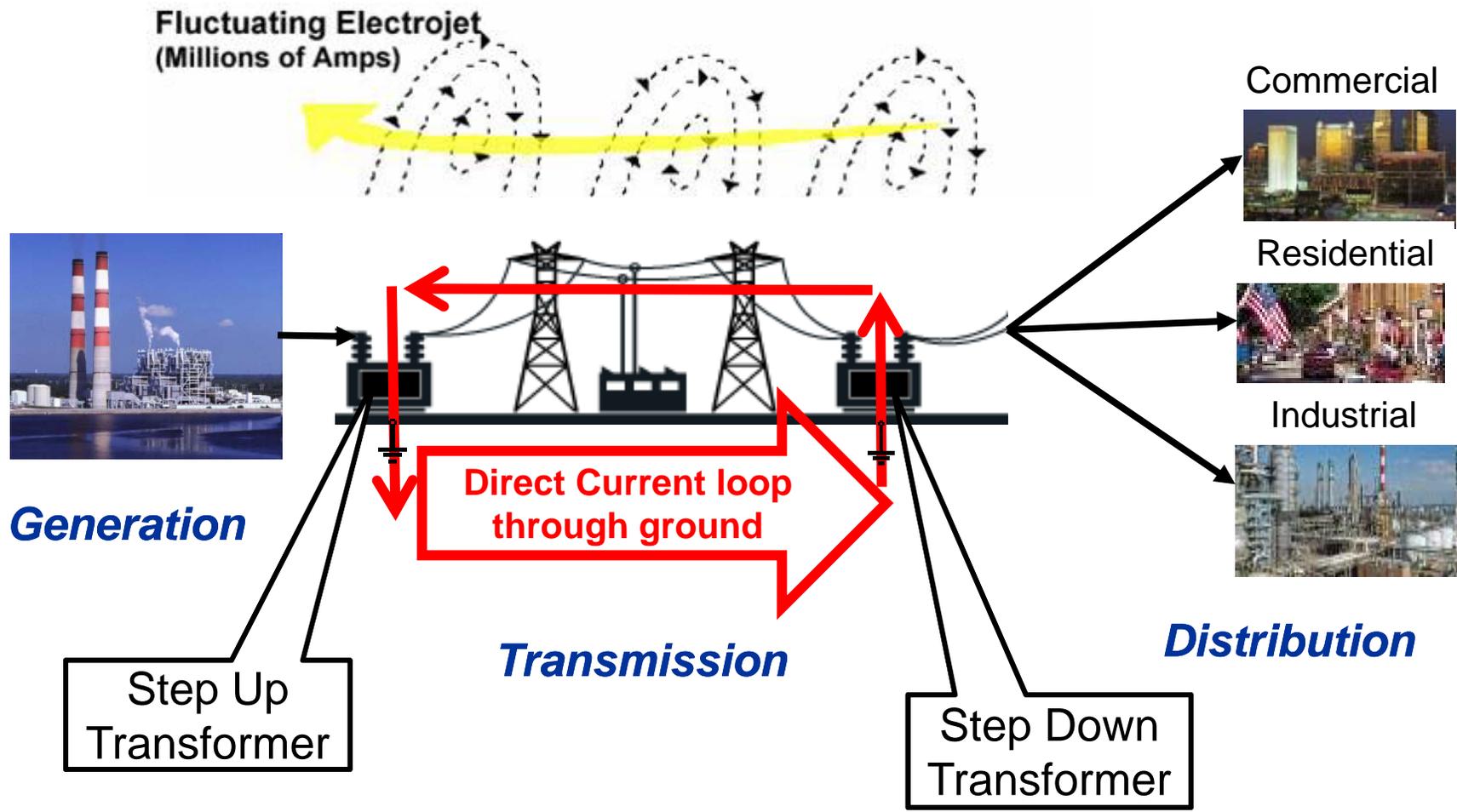
Provides about 18 to 30 hours warning

ACE - Tells If CME Will Be Strong or Weak



Provides about 20 to 45 minutes warning

Geomagnetic Induced Current (GIC) Conditions



AC transformers can be damaged by DC

Extremely High Voltage Transformers



**345 KV - most
500 KV - some
765 KV - least**

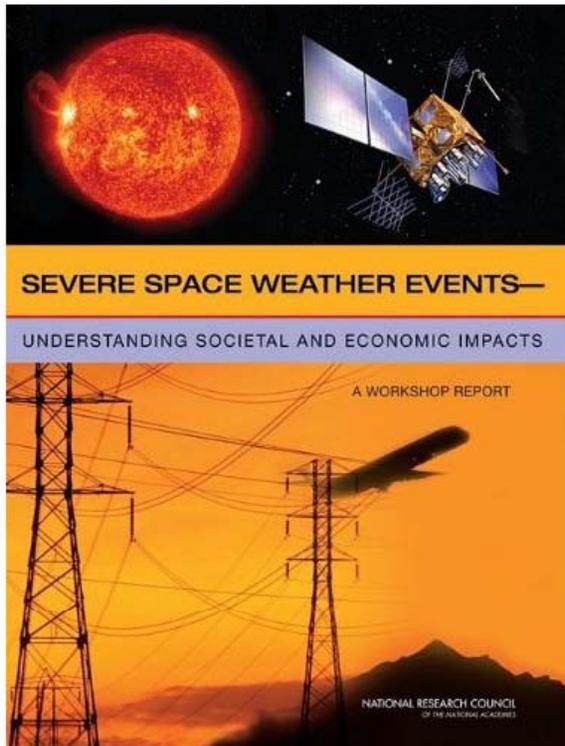


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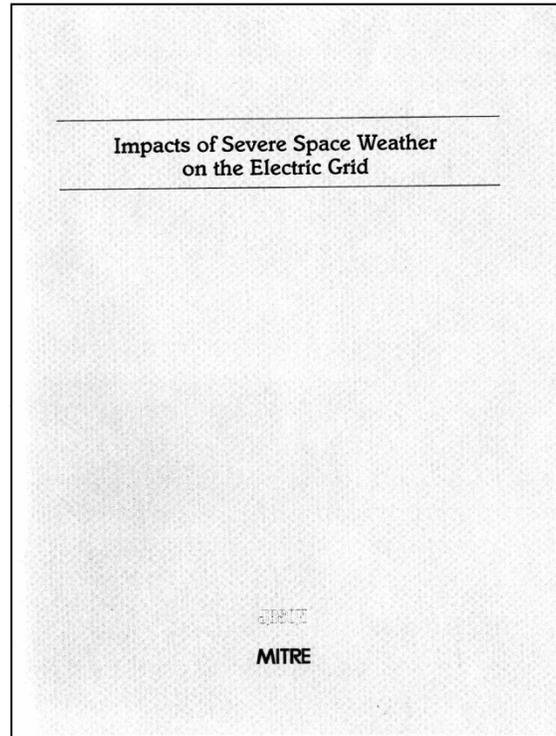
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US grid has about 2000 EHV transformers

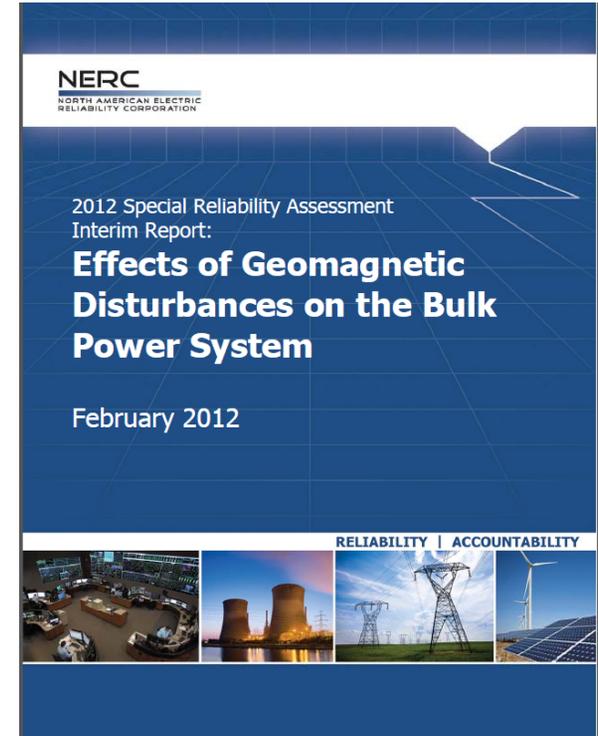
Space Weather Impact Studies



NAS 2008



JASONS 2011



NERC 2012



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Security**

Science and Technology

14 MARCH 2012

A Drill to Replace Crucial Transformers (Not the Hollywood Kind)



Scott Dalton for The New York Times

CenterPoint Energy workers installed emergency replacement transformers on Wednesday in Texas City, Tex., near Houston.

By MATTHEW L. WALD
Published: March 14, 2012

The electric grid, which keeps beer cold, houses warm, and city traffic from turning to chaos, depends on about 2,100 high-voltage transformers spread throughout the country.

Green
A blog about energy and the environment.
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But engineers in the electric business and officials with the [Department of Homeland Security](#) have long been concerned that transformers are vulnerable to disruptions from extreme weather like [hurricanes](#), as

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