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27 June 2011



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A Lab by Any Other Name...



- **Air Force Research Laboratory (AFRL)**
- **Propulsion Directorate**
- **RZ**
- **Edwards Research Site**
- **Detachment 7 (Det 7)**
- **Space and Missile Propulsion Division**
- **Phillips Lab**
- **The Rocket Lab**
- **The Rock**



USAF Structure



Major Commands (MAJCOMs)

Air Combat Command, Langley Air Force Base, Va.

Air Education and Training Command, Randolph AFB, Texas

Air Force Global Strike Command, Barksdale AFB, La.

Air Force Materiel Command, Wright-Patterson AFB, Ohio

Air Force Reserve Command, Robins AFB, Ga.

Air Force Space Command, Peterson AFB, Colo.

Air Force Special Operations Command, Hurlburt Field, Fla.

Air Mobility Command, Scott AFB, Ill.

Pacific Air Forces, Hickam AFB, Hawaii

United States Air Forces in Europe, Ramstein AB, Germany



Air Force Materiel Command



MISSION

Deliver war-winning ...

- Technology

- Acquisition

- Test

- Sustainment

... expeditionary capabilities to the warfighter



Air Force Research Laboratory

Mission: Leading the discovery, development and integration of affordable warfighting technologies for America's aerospace forces.





- **5,400 Gov't Employees**
- **3,800 On-site Contractors**

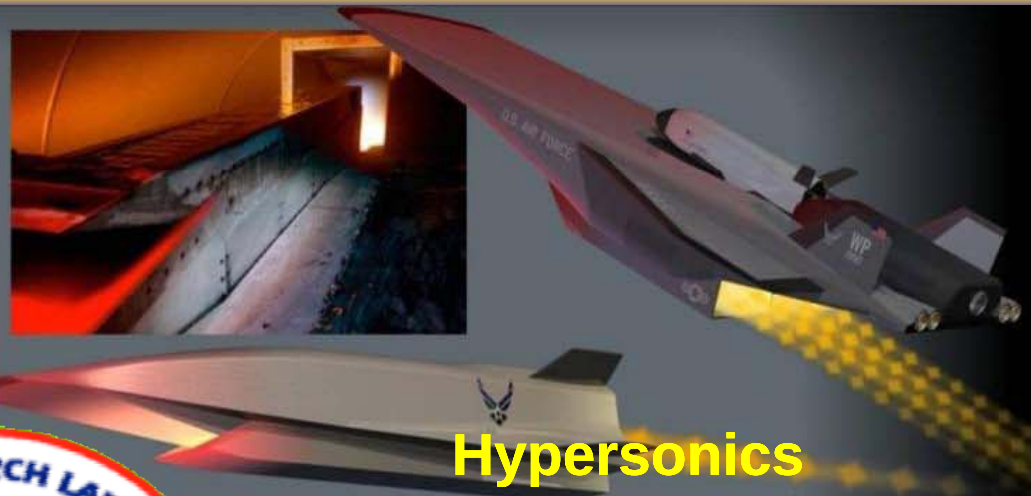
- **10 Major R&D sites across US**
- **40 Locations around the World**
- **10 Technical Directorates**
 - **Air Vehicles (RB)**
 - **Directed Energy (RD)**
 - **Human Effectiveness (RH) (711 HP Wing)**
 - **Information (RI)**
 - **Space Vehicles (RV)**
 - **Munitions (RW)**
 - **Materials & Manufacturing (RX)**
 - **Sensors (RY)**
 - **Propulsion (RZ)**
 - **AF Office of Scientific Research (AFOSR)**



AFRL Propulsion Directorate (AFRL/RZ)



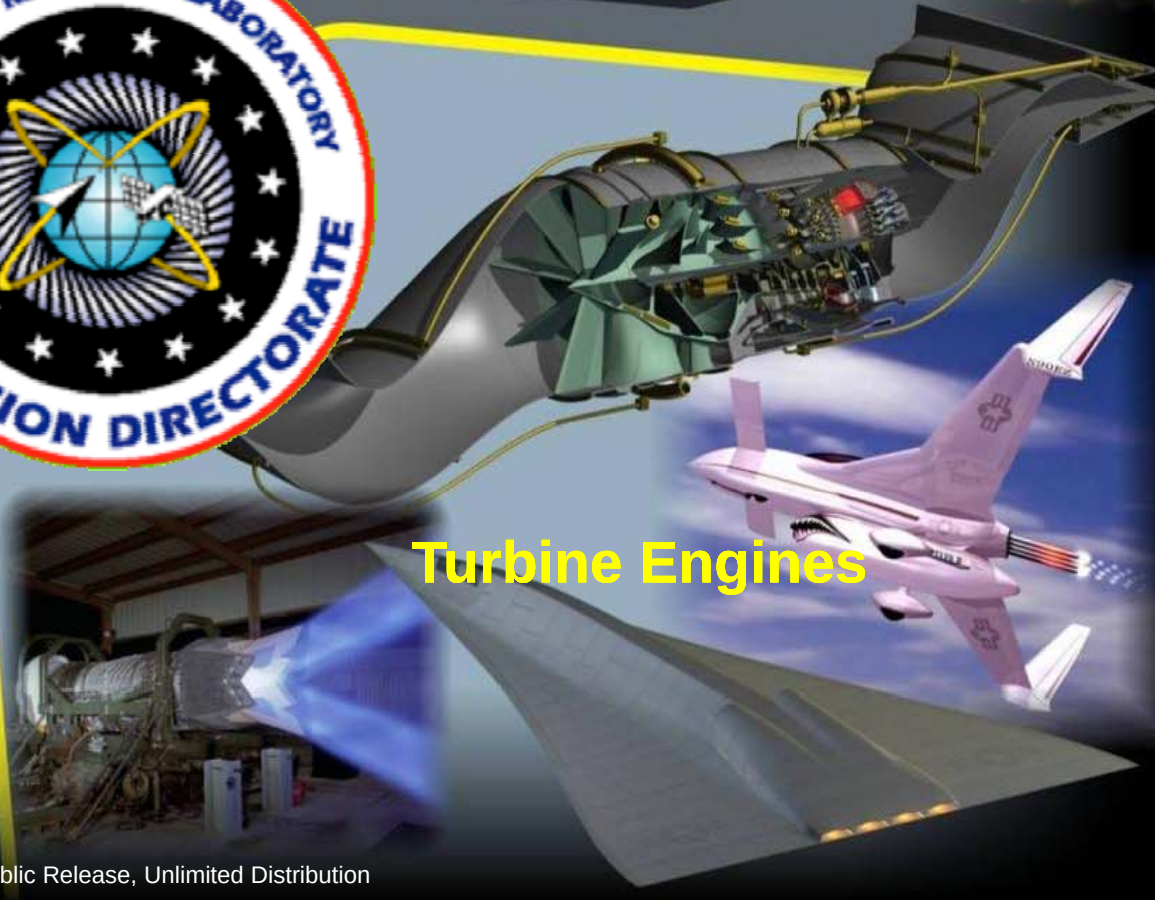
**Space & Missile
Propulsion**



Hypersonics



**Energy, Power &
Thermal**



Turbine Engines



People

Total Personnel : 468

CIVIL SERVICE	Total	M.S.	Ph.D.
Scientists and Engineers	109	21	46
Technicians	24	0	0
Administrative	29	0	0
CO-OPs	10	2	2
Student Support (S.T.E.P., etc..)	5	0	0
Palace Acquire	1	0	0
TOTAL CIVIL SERVICE	178	23	48
CONTRACTORS	Total	M.S.	Ph.D.
Scientists and Engineers	70	15	9
Technicians	156	0	0
Administrative	16	0	0
TOTAL CONTRACTORS	242	15	9
ACTIVE-DUTY MILITARY	Total	M.S.	Ph.D.
Scientists and Engineers	26	16	1
Technicians	15	0	0
Pgm mgrs/Admin	1	0	0
TOTAL ACTIVE DUTY MILITARY	42	16	1
RESERVISTS	Total	M.S.	Ph.D.
Scientists and Engineers	4	1	1
Technicians	2	0	0
TOTAL IMAs	6	1	1



Facilities



Bench-level Labs



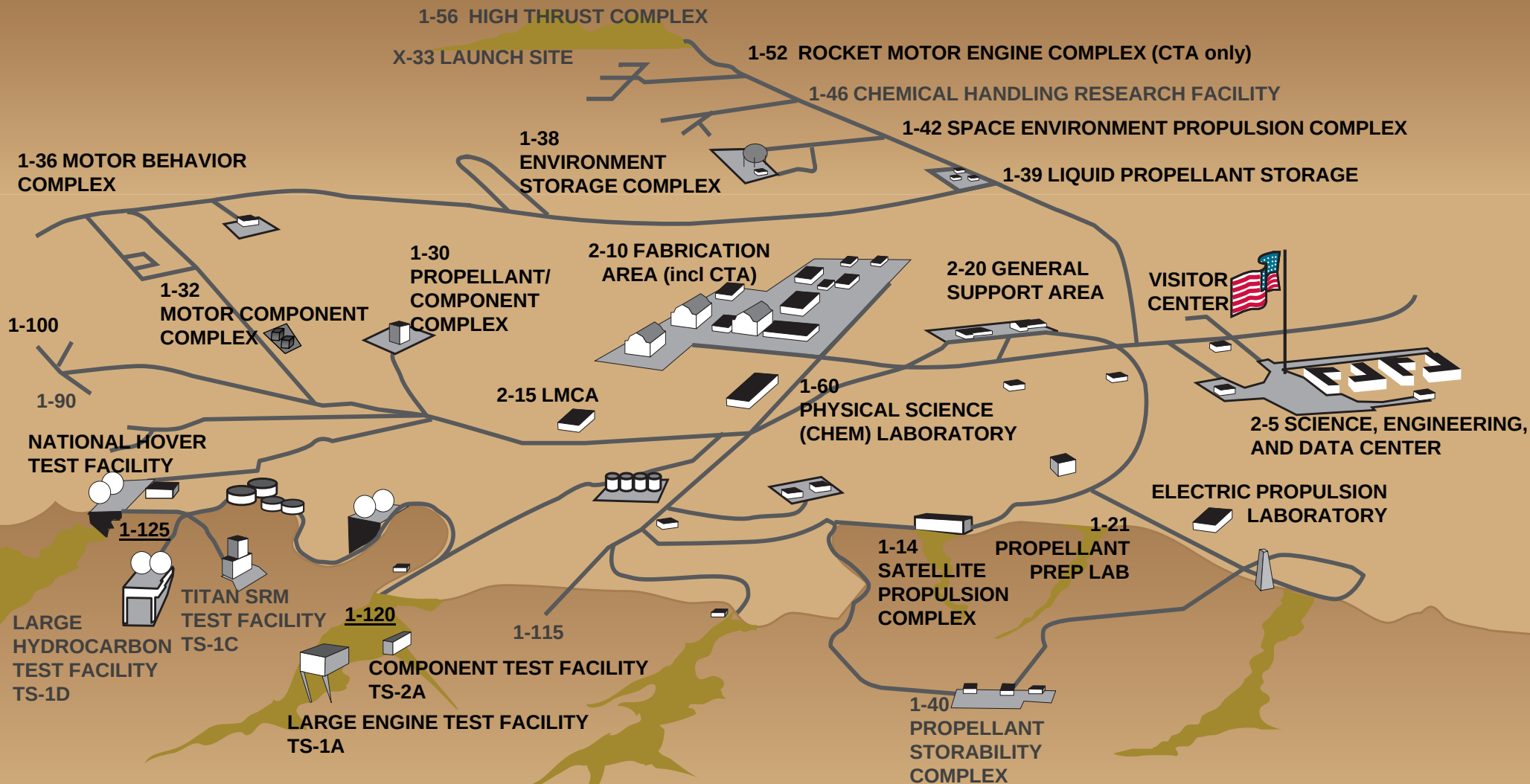
High Thrust Facilities

- 19 Liquid Engine stands, up to 8,000,000 lbs thrust
- 13 Solid Rocket Motor pads, up to 10,000,000 lbs thrust

Altitude Facilities

- From micro-newtons to 50,000 lbs thrust





KEY: ACTIVE AREA (black); INACTIVE AREA (grey); CTA=Contractor Technical Agreement



History of the Rock

- **1939 – Rocket research begins at Power Plant Lab, Wright Field OH**
- **1947 – Edwards AFB selected for rocket testing**
- **1959 – Rocket scientists move from WPAFB to Edwards**





History of the Rock

- **AF Thor Intermediate Range Ballistic Missile (IRBM)**
 - **1958 – 1961 at Test Stand 1-1**





History of the Rock



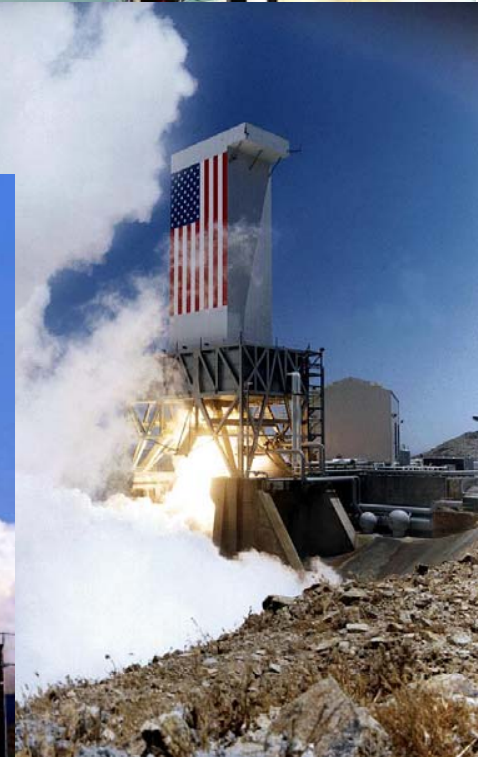
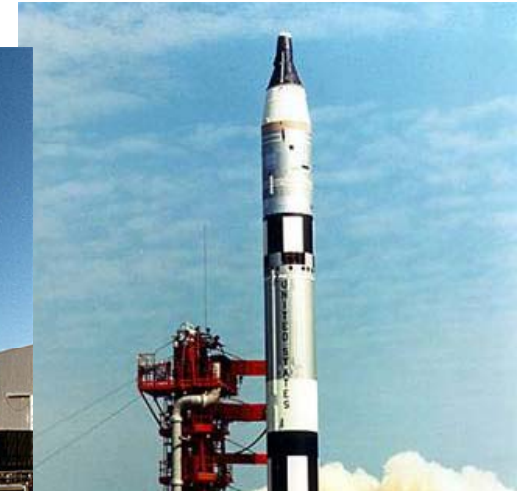
- **AF Atlas ICBM/Launch Vehicle**
 - Early 1960s on Test Stand 1-95





History of the Rock

- Titan I & II ICBM
 - Test Stand 1-3 in Early 1960s
- Titan IV solid rocket booster
 - 1980s – 1990s in Area 1-32 and

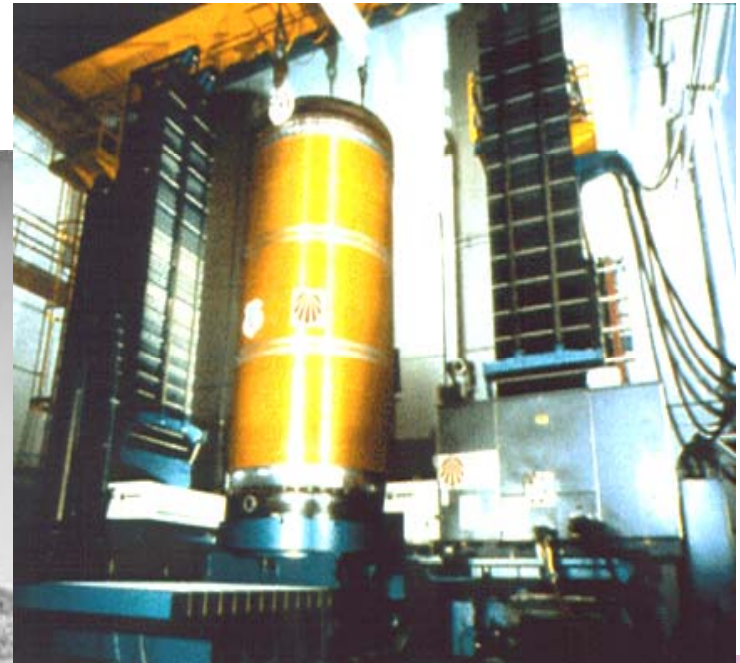




History of the Rock



- AF Minuteman I, II and III ICBMs





History of the Rock

- F-1 engine testing for the Saturn V Rocket that put Men on the Moon





History of the Rock

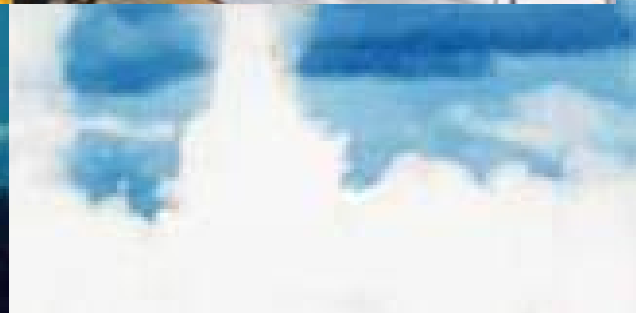
- AF Peacekeeper (PK) ICBM





History of the Rock

- AFRL/PR Technology Spin Off to Other Ballistic Missiles





History of the Rock



- AF Technology Spin-off





What Have We Done Lately?



Recent Technical Achievements

- Transitioned 200W Hall Thruster to TacSat-2
- Integrated Powerhead Demo – reusable LH2-LOX liquid rocket engine
- Atlas V Solid Rocket Motor upgrade demo
- Responsive spacelift analysis
- Advanced carbon-carbon materials
- Solid rocket motor aging & surveillance
- Missile Defense Agency Multiple Kill Vehicle free-flying “Hover” demo





What Are We Doing Now?



Hydrocarbon Boost



Multi-mode Satellite Propulsion

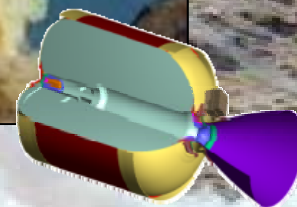


Upper Stage Engine Technology

Advanced Solid Motors



"Green" High-Performance Monopropellants

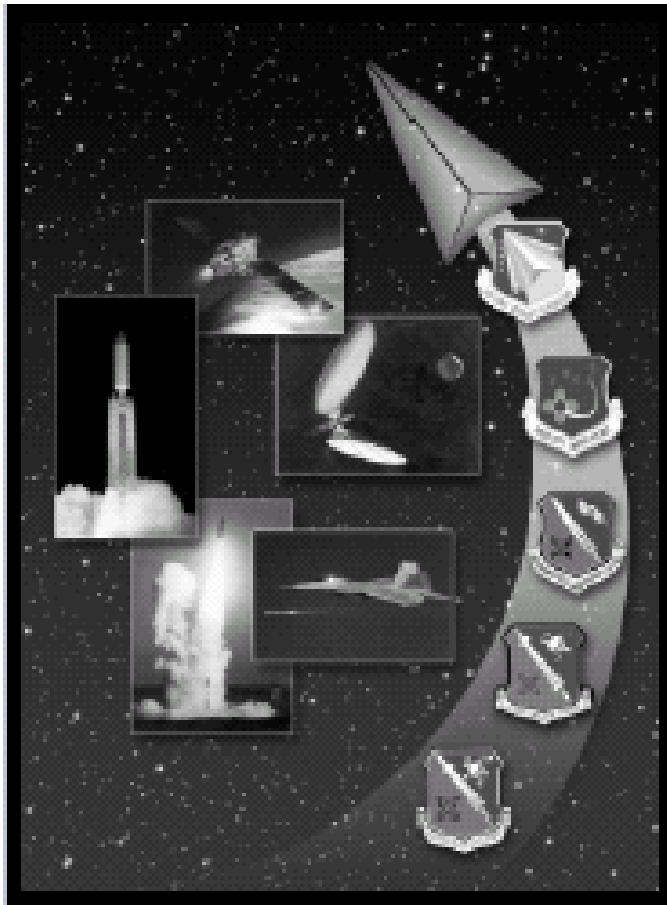


All-electric Orbit Transfer



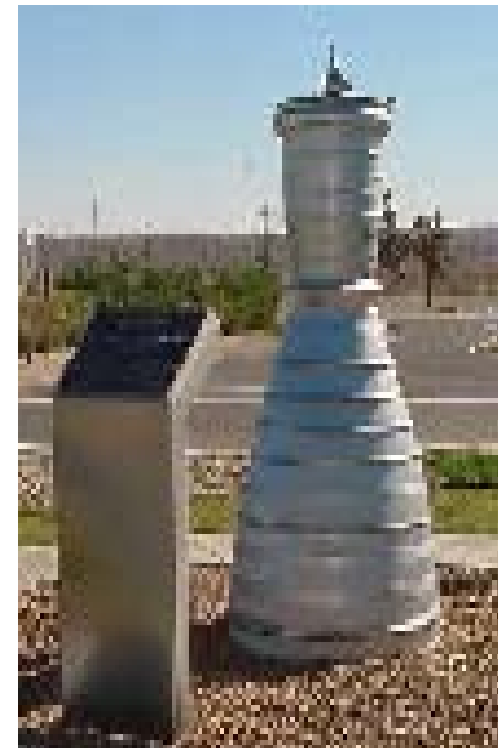


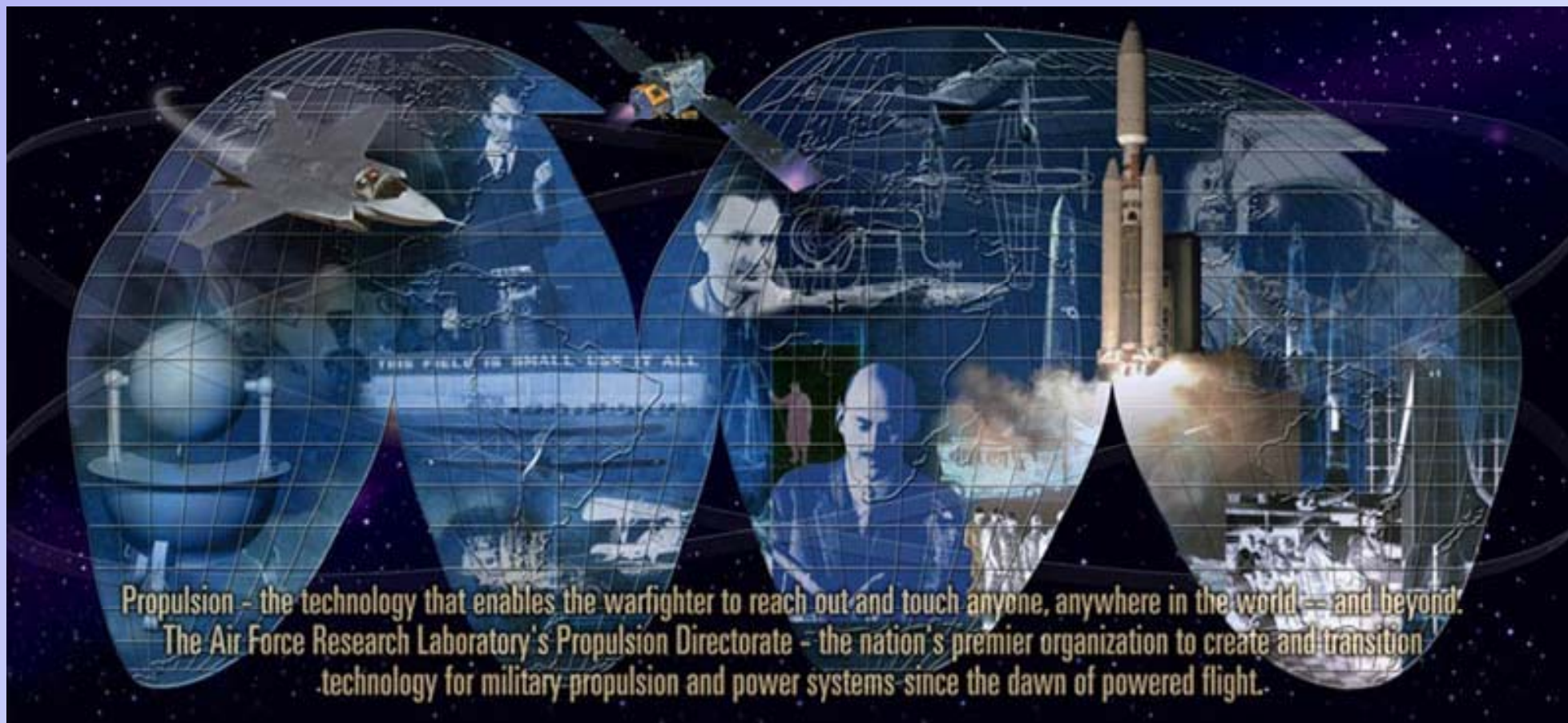
AIAA's 1st Historical Aerospace Sites (2000)



1. Rocket Site
2. Aerojet Pasadena, CA
3. Goddard First Auburn, MA
4. Dutch Flats San Diego, CA
5. Tranquility Base
6. Huffman Prairie, OH and Kitty Hawk, NC

“Helped to Advance the Arts, sciences and technology of aeronautics and astronautics, and promoted the professionalism of those engaged in these pursuits.”
-AIAA





QUESTIONS?

AFRL

THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

