1946  Contract-Army Air Force/Fairchild to study Nuclear Energy for Propulsion of Aircraft (NEPA) to be conducted at ORNL.

1948  AEC/MIT Lexington Project - Big feasibility. Recommended 15 year $1 Billion development program.

AEC/North American Aviation (NAA) - Feasibility study of nuclear rockets and ramjets.

1950  AEC/USAF-Aircraft Nuclear Propulsion (ANP) Program - Establish feasibility in 3-5 years of materials, shielding, power plant, airframe design.

1951  ANP - Increased objective to include nuclear powered flights.

AEC/AF/GE - Direct cycle turbojet, compressor, reactor, turbine.

AEC/AF/Pratt Whitney (Rocketdyne) - Indirect cycle turbojet, compressor, Li-air heat exchanger, turbine.

1953  LANL, Nuclear rocket study - nuclear rocket ICBM (R. Bussard, R. Shrieber)


AF/AEC/GE Nuclear Ramjet Study, Austin Corbett

1955  LANL, Nuclear Rocket Rover Program, R. Shrieber

AF/AEC/NAA - PLUTO SLAM (nuclear ramjet), use BeO, UO₂, N. Rasor

1956  AF/AEC/NAA - Contract Pied Piper (SNAP) Nuclear Power for satellites based on UZrH₁.₈₄ thermal reactor and Hg Rankine Turboalternator.

ANP div. cycle HTRE-1, H₂O mod. air cooled, 150 h

1957  Sputnik launched by USSR

NAA Pied Piper critical, later known as SNAP

SNAP-1 isotope (Hg Rankine) 100 Watts, program starts, (Martin Marietta)

ANP, Li-air concept downgraded to "adv. res. prog."

1958  ANP/HTRE 3 operates, (GE/INE) with solid mod.

AEC/ANP, GE invents Thermionic ignited mode
1959

AEC/AF - SNAP Advanced Reactor Program (NAA)

Inv. of multcell (flashlight) thermionic fuel element (TFE); N. Rosor

AEC/AF, SNAP Advance Reactor Program Invention of Boiling Rb reactor - Welch; NAA

Rover Rocket test; KIWIA, reactor test (LANL - Nev)

SNAP operates at 50 kWt for > 6000 hours (NAA)

SNAP - 3,Pb -Te radioisotope demo (M²)

ÅR/AEC/LNL/Marquardt, Pluton nuclear ramjet start

NASA-Aerojet, AEC, NAA, SNAP8 600 kWt Hydride Reactor with 30 kWt Hg turbine, conv. program start - H Finger / J. Wetch.

AF/AEC Rover Program - KIWIA, A1 & 3

1960

SNAP10 (100-200 W_e) solid conduction, program start

AF/AEC, Tory -2, Nuclear ramjet tests. Jackass Flats Nevada, LNL

1961

NASA/AEC, Rover - KIWIB Tests, LNL, Nev.

AF/AEC, SNAP -2 runs at 50 kW, / 1220 degrees Farenheit, 11,000 hours

DOD/AEC, SNAP -3B, 9A RTG's launched in Transit Navigational National Satellites

NASA - Manned Lunar Landing given top priority

AF/AEC, ANP program discontinued

AF/AEC, SNAP10 (200 W_e) -> SNAP10A (500 W_e)

AEC Thermionic Tech Dev., GE vs GATECO

1945-1957: Research culminating in USSR's launch of Sputnik
1958-1972: Competition with USSR ending with Apollo 11
1973-1983: Near Earth Applications beginning with launch of Apollo 17
1984-1993: SDI Program
1990-1993: SEL Program
1993: "Mission to Earth?"
Area I

Bowl
Five test stands were originally constructed in the Bowl area. Vertical Test Stand #1 (VTS1) is historically significant in that it is a copy of a German World War II test facility at Peenemünde.

History & Accomplishments:
- First large rocket engine test site activated at SSFL in 1949
- Developed the first use of tube-wall thrust chamber design for the Navaho Program in 1953
- Supported the first launch of the Redstone in 1953

Programs: Navaho, Redstone, Thor, Jupiter, Atlas, Saturn-V

Test Stand Activity:

<table>
<thead>
<tr>
<th>Prep. Stand</th>
<th>VTS-1</th>
<th>VTS-2</th>
<th>VTS-3</th>
<th>HTS-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>July, 1949</td>
<td>655 Tests</td>
<td>Test Records Unavailable</td>
<td>419 Tests</td>
<td>1,933 Tests</td>
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</table>

Canyon
The Canyon area test stands were constructed in the mid-to-late 1950s as a site for LOX/RP engine testing supporting the Redstone, Thor, and H-1 engine programs. Three test stands were erected in this area. Originally, the area was known as the "TRE," an acronym for Transition Reliability Equipment.

History & Accomplishments:
- Activated in 1954

Programs: Redstone, Saturn V/L-B, Jupiter, Thor

Test Stand Activity:

<table>
<thead>
<tr>
<th>Canyon I</th>
<th>Canyon II</th>
<th>Canyon III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activated</td>
<td>Activated</td>
<td>Activated</td>
</tr>
<tr>
<td>October, 1954</td>
<td>June, 1955</td>
<td>February, 1957</td>
</tr>
<tr>
<td>629 Tests</td>
<td>606 Tests</td>
<td>4,384 Tests</td>
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</tbody>
</table>

CTLI
Component Test laboratory I was constructed in the mid-1950s to perform gas generator, turbopump, inducer, bearing, and seal testing. The facility was equipped with motor drives, dynamometers, and the propellant systems to support the programs. The programs supported include Thor, Atlas, Saturn I/Saturn V, SSME, and Free Electron laser. The facility had seven multi-position test cells that generated 100s of tests annually during peak years.

CTLI
Components Test laboratory III was constructed in the late 1950s in order to perform component testing of turbopumps, gas generators, and small scale engines including reaction control thrusters at altitude conditions. In the 1970s, one of its four test modules was modified for high energy chemical laser testing. The laser program used an ejector system requiring 1,000 pounds per second steam flow provided by two LOX/Alcohol steam generators using Atlas sustainer engine injectors. The programs supported at this facility included Apollo, Thor, Atlas, Saturn V, J-2 experimental X-10, Gemini, and high energy laser development.

CTL-V
This one-of-a-kind facility was built in 1956 for the Rover Program to conduct testing for the hydrogen pump system of the Nucleonics nuclear reactor. In the 1960s, 25,000 HP Electric Motor Drives and Dynamometers were acquired from Wright Patterson and installed to support pump testing for the J-2 and F-1 engine programs. Other programs supported include SSME, and DEMAG (German LOX pump).

Special thanks to Rocketdyne Archives & William Preston Bowling for this historical information on SSFL's areas.
Area II

ALFA
Three test stands were constructed in the ALFA area of the SSFL, and activated in 1955. The stands were initially constructed to conduct engine testing in support of the Navaho, Thor, RS-27 and Atlas programs. Over the years, the facilities have been continuously modified and modernized, and are currently being used for ongoing reliability & verification testing, and acceptance testing of the Delta launch vehicle RS-27A engine.

History & Accomplishments:
- Activated in 1955
- Supported first manned orbital flight of Atlas-Mercury in 1962
- MA-3 first launch, 10-11-1960, and last launch 2-24-1995

Programs: Navaho, Atlas, Thor, Jupiter, Delta

Test Stand Activity
ALFA I Activated July, 1955 1080+ Tests
ALFA II Activated June, 1955 370 Tests
ALFA III Activated November, 1955 1385+ Tests

BRAVO
The BRAVO test area was initially constructed for testing of Atlas engines. It was modified shortly after construction to perform testing of large components. Its most significant test event was the testing of F-1 engine turbopumps and several F-1 thrust chamber ignition tests. It was later modified for turbopump and vernier engine testing for the RS-27 and Atlas programs.

History & Accomplishments:
- Activated in 1956

Programs: Atlas, Thor, F-1 Engine Predecessor, F-1 Engine

Test Stand Activity
Bravo I Activated August, 1956 4894 Tests
Bravo II Activated April, 1956 209 Tests
Bravo III Activated August, 1956 Test Records Unavailable

COCA
Area II was undeveloped prior to 1954, when the land was purchased by North American Aviation (NAA), a predecessor company to Rockwell who owned the land from 1954 to 1958. Three test stands were initially constructed at the COCA area in 1956 to support the development of the Navaho and Atlas engines. In December 1958, the property was deeded from Rocketdyne to the U.S. Air Force (USAF) and was operated as USAF Plant 57. In 1963, two of the original stands were demolished and replaced by two large engine test stands for testing the second stage of the Saturn-V launch vehicle. In 1973, the property transferred ownership from the USAF to NASA. In 1974, further test stand modifications were made to accommodate Space Shuttle main Engine component development. Later modifications enabled testing the SSME engine system.

History & Accomplishments:
- Activated in 1956
- Saturn-V Battleship Tank stage testing with 5 J-2 engine configurations
- Space Shuttle Main Engine 320-second duration tests
- Large high pressure LOX/LH2 component, testing at more than 10,000 psi

Programs: Navaho, Atlas, J-2, Saturn-V Second Stage Battleship (five J-2s), SSME, Delta IV E1V Tanks

Test Stand Activity
Coca I Activated July, 1956 244 Tests
Coca II Activated November, 1956 127 Tests
Coca II Activated October, 1956 102 Tests
Coca IV Activated 1963 No Records Available
Area II (cont.)

CTL II
Component Test Laboratory II was constructed to provide for production acceptance testing of turbopumps and gas generators. This activity was discontinued in the early 1960s. The facility has most recently been utilized for final assembly of Atlas and Delta engines.

DELTA
The Delta site was first constructed for Thor engine testing and later modified for the Lance J-2 programs. The area has also been used for the loading of propellant for Peacekeeper Stage IV.

History & Accomplishments:
- Activated in 1957
- Altitude Testing of the J-2 Engine


Test Stand Activity

| DELTA I     | Activated February, 1957 | 105 Tests |
| DELTA II    | Activated July, 1957     | 462+ Tests |
| DELTA III   | Activated September, 1957 | Test Records Unavailable |

PEACEKEEPER LOADING FACILITY - PLF
- Tests were conducted for the United States Army and United States Air Force by Rocketdyne for such missiles as Redstone, Minuteman, and Peacekeeper. These missiles are nuclear missiles and are not part of the space program. They are in fact, thermo-nuclear weapons which are integral to Missilier activities.
- Minuteman missiles contain three cylinders, and each cylinder contains one thermo-nuclear warhead, totalling three thermo-nuclear warheads for each Minuteman. The Peacekeeper missile is also known as The One Hundred City Bomb: Peacekeepers contain ten cylinders, each of which contains ten thermo-nuclear warheads totalling one hundred thermo-nuclear weapons, thus the named identity of One Hundred City Bomb.
- Much fuel was used during the testing of these missile engines which resulted in the release of multiple carcinogenic contaminants to the air, water, and soil in the area, (consisting of an open field lab and surrounding hills including Santa Susana Mountain Range, Simi Hills, and the Santa Monica Mountains), as well as increased risk of exposure pathways to residents, workers, agriculture, flora, and fauna.

Area III

CTL-IV (STL-IV)
Components Test Laboratory IV, later renamed Space Technology Laboratory IV, specializes in small pressure and pump fed engine testing with storable propellants at simulated conditions up to 100,000 ft. The facility was constructed in 1956 to support development testing of auxiliary engine used to assist jet aircraft in going supersonic. The Burro Flats area in which this facility is located was a popular site for filming western picture in the early years. The programs supported include Lunar Excursion Module, Coaxial Lance, Mariner Mars/Viking, Gemini, Peacekeeper, XLR-132, and TRANS Stage Engine. Also Condor, MOL, Agena Auxiliary, AR Engines for F-86 and F-100 aircraft, and NOMAD. At peak, this facility performed 100's of tests annually.
History of Projects by Area at Santa Susana Field Laboratory

Area IV

Building 4009 & 4709 Substation
Visible from Areas II & III
- SGR Critical Facility - Sodium Graphite Reactor low power critical experiment from 1958-1967

Operational Use & History:
Constructed in 1958, originally intended to house the OMR Critical Facility and the SGR Critical Facility. The OMR was a low-power critical experiment facility for testing reactor geometries and fuel elements in a reactor moderated and cooled by organic liquids. The SGR was a low-power critical experiment facility for testing fuel and sodium configurations in a reactor cooled by sodium and moderated by graphite. Both OMR & SGR operated from 1958-1967. A 45-foot stack was used to discharge exhaust and a leach field is located to the north of the facility, which was serviced by Substation 4709.

Building 10 SNAP8 Experimental Reactor Facility
Visible from Areas II & III
- Experienced a melting of fuel rods resulting in a loss of 80% of its fuel in 1964

Hot Lab Bldg, Q20
Visible from Areas II & III

Building 4022 Radioactive Material Disposal/Handling Facility
Visible from Areas II & III

Building 24 SNAP Testing Facility
Visible from Areas II & III

Building 59, SNAP8DR
Visible from Areas II & III
- Experienced a melting of fuel rods resulting in a loss to onethird of its fuel in 1969

Sodium Reactor Experiment (SRE)
Visible from some of Areas I, II & III
- First power-producing reactor
- Experienced a significant melting of fuel rods in 1959; estimated release over a two-week period: 240 times worse than Three Mile Island. Today’s controversy as to whether or not a meltdown actually happened is disputed by surviving employees of the SRE, firemen testimony (who were later trucked to Area I, ordered to shower, and told to take their contaminated clothing home for their wives to launder immediately), See: Worker testimony in Employee folder, on accompanying disk and other supplemental information.

Sodium Burn Pits & Sodium Ponds
Visible from Areas II & III
These disposal areas were used for waste dumping, burial, and ignition of contaminated sodium and other waste generated at Area IV.

*Area IV consisted of numerous buildings and was home to no less than ten experimental nuclear reactors, none of which were housed in protective containment structures. The full scope of Area IV’s history is extensive and fascinating, but falls beyond the scope of this book. While the workers of Area IV’s contributions to the Cold War remain undisputed, it is important to acknowledge their efforts here as valiant contributors to our Nation’s position of leadership during the Cold War. Any failure to bring adequate attention to this Area or its workers is due only to the amount of space available in this book, as well as its intention to acknowledge the unsung heroes of SSFL’s Areas I, II and III. Positively no effort to diminish the contributions of Area IV Heroes is intended or implied.
This book was created for inclusion in the Cold War Patriots' Legacy Project Time Capsule.

It was typeset in Futura Font, used by North American Aviation, and in this sign left on the Moon by our Astronauts in 1969. Futura is a geometric sans-serif typeface designed in 1927 by Paul Renner. It's based on geometric shapes that became representative visual elements of the Bauhaus design style of 1919-1933. Commissioned by the Bauer type foundry, Futura was commercially released in 1927.
City of
Los Angeles
State of California

RESOLUTION

WHEREAS, the launching and successful operation of the world’s first nuclear reactor power system in space, the Snap 10A,

represents an historic milestone in the Nation’s space and atomic energy programs; and

WHEREAS, since the nuclear system was launched on April 5, 1963, more than 700 miles into space, it has operated for more than a month generating electricity to power extensive test instrumentation and scientific apparatus aboard the spacecraft; and

WHEREAS, the SNAP program (Systems for Nuclear Auxiliary Power) is designed to develop reliable, long-lived sources of electrical power for satellites and space vehicles, and for other uses on land and at sea; and

WHEREAS, the SNAP 10-A was developed for the Atomic Energy Commission by a leading San Fernando Valley firm, Atomics International, of Canoga Park.

NOW, THEREFORE, BE IT RESOLVED by this action of the Los Angeles City Council, in behalf of all the people of Los Angeles, that Atomics International of Canoga Park, be heartily congratulated for its successful launch of the pioneering SNAP 10-A and be extended best wishes for success in all future operations in this challenging space age.

Resolution by

I HEREBY CERTIFY that the foregoing resolution was adopted by the Council of the City of Los Angeles at its meeting held May 20, 1963.

[Signatures]

Thomas D. RIphagen
Councilman 3rd District

[Signatures]

[Signatures]

[Signatures]

City Clerk

[Signature]