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41 items enclosed

Air Force Research Laboratory
Propulsion Directorate
Test Facilities

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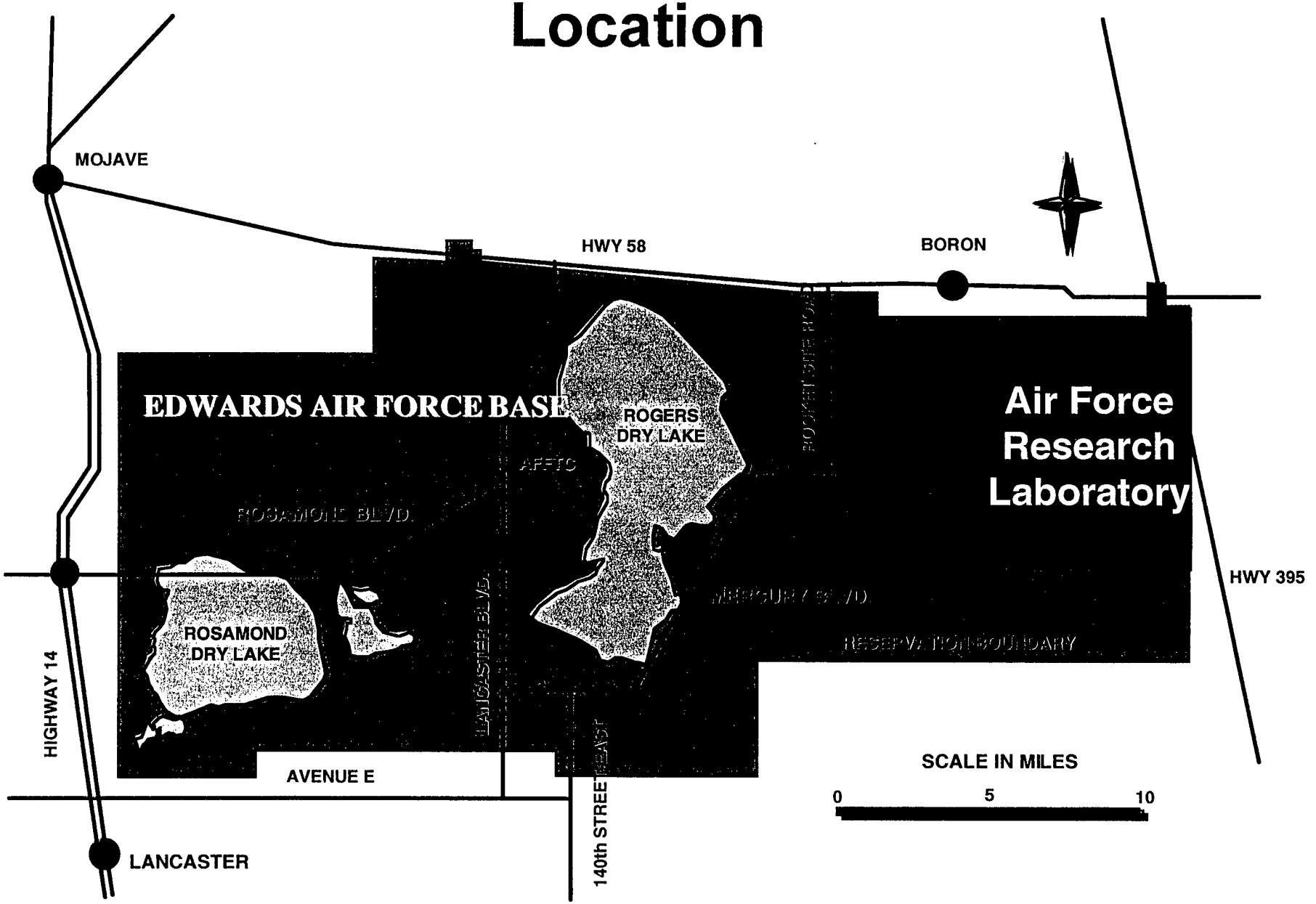
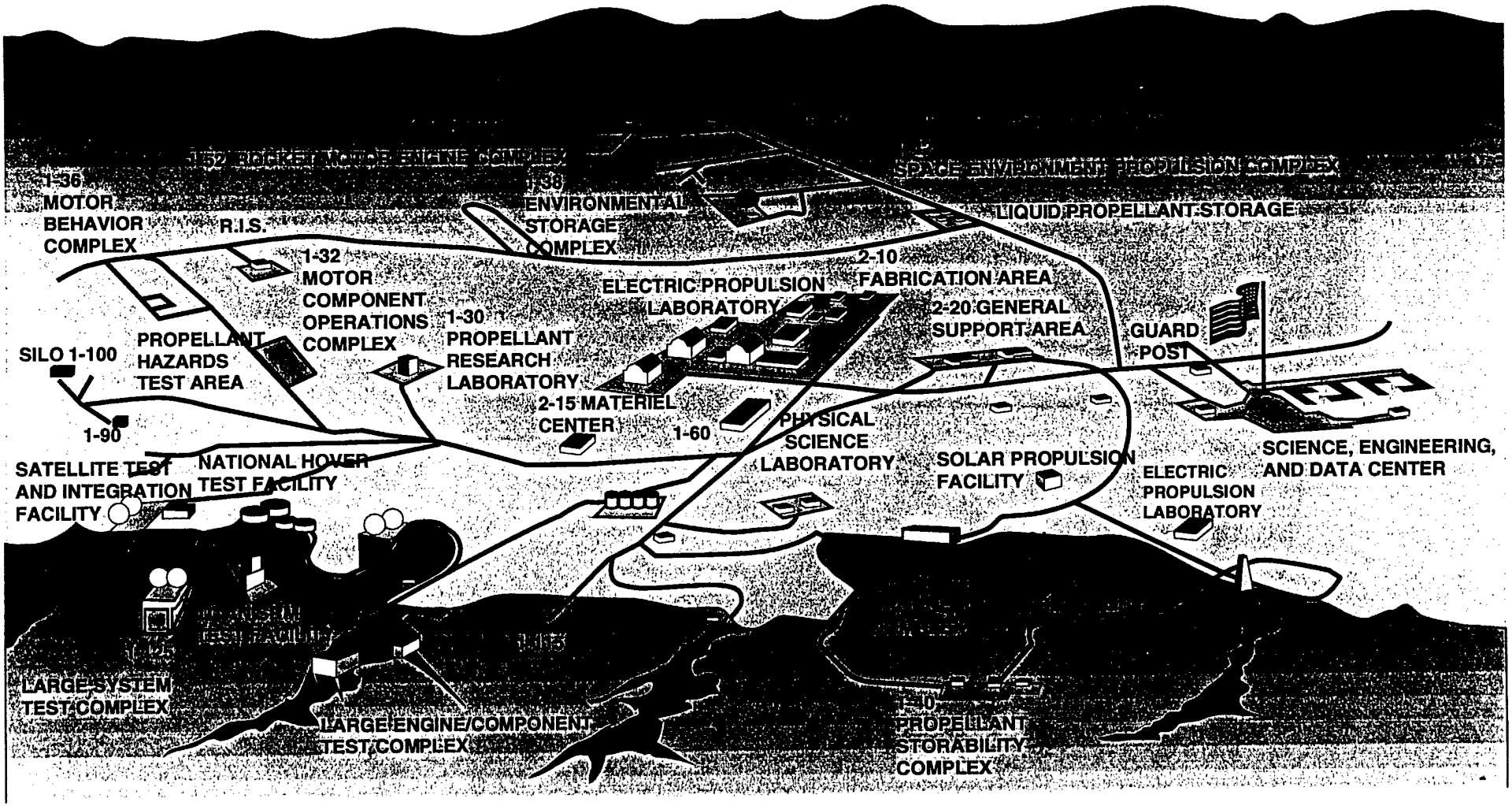
Air Force Research Laboratory Location



Air Force Research Laboratory
Propulsion Directorate Facilities



Propulsion Directorate

Satellite Propulsion

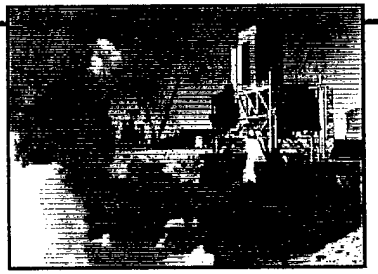
- To 5,000lb Thrust
- Horizontal Single Axis
- LOX/GOX/Hydrazine/NTO

Experimental Systems

- HEDM
- ATLAS
- SATURN V

- To 1,500,000lb Thrust
- Horizontal or Vertical Single Axis
- Dual Position (Expandable to Quad and 6,000,000lb Thrust)

Large Systems Complex



- SATURN V
- TITAN IVD
- TITAN 34D

- To 8,000,000lb Thrust
- Vertical Multi Axis
- Temp Conditioned 25° to 100°F
- Humidity Conditioned at 40%

Small Solid Components

- MM I / MM III
- MX
- SICBM
- KKV

- To 36,000lb Thrust
- Horizontal Single Axis (Spin Capable)
- Temp Conditioned 30° to 120°F

TO 10,000,000 LB THRUST
FIXED OR SPIN
HORIZONTAL OR VERTICAL ORIENTATION
ENVIRONMENTAL CONDITIONING
HIGH HAZARD

High Thrust (Solid and Liquid)

- TITAN IVD
- SUPER HIPPO
- R.R. TANK CAR

- To 10,000,000lb Thrust
- Horizontal or Vertical Multi Axis
- LOX/Hydrogen/Hydrazine/NTO

Large Solid Components

- SERGEANT
- STARBIRD
- VIPER
- F-16 LIVE FIRE
- MX
- BULL PUP

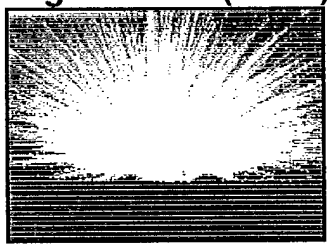
- To 300,000lb Thrust
- Horizontal and Vertical Multi Axis
- Temp Conditioned 30° to 120°F
- Spin Capable

Large Liquid Components

- ABRES
- SICBM
- PEACKEEPER
- STAR TECH

- To 300,000lb Thrust
- Horizontal and Vertical Single Axis
- Temp Conditioned 30° to 120°F
- LOX/GOX/Hydrogen/Hydrazine/NTO

High Hazard (Solid)

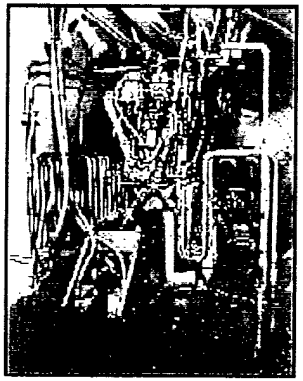


- 2.75 RAP
- MINI RPV
- MX
- F-16 HYDRAZINE TANK
- SHUTTLE STORAGE VESSELS

- To 4,000,000lb Thrust
- Horizontal Single Axis
- Temp Conditioned 30° to 120°F

Propulsion Directorate

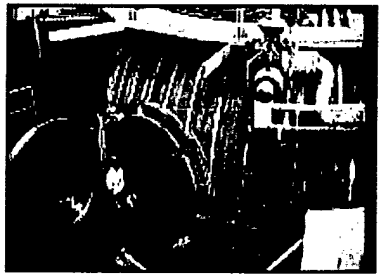
Satellite Propulsion



- MILSTAR

- 6 Hours at 125,000 Feet
- Horizontal Single Axis to 1,000lb Thrust
- LOX/GOX/Hydrogen/Hydrazine/NTO

Space Experiments (SPEF)



- CENTAUR
- STM/TTM
- MSTI
- GOSSAMER TORUS

- Continuous at 650,000 Feet (Sim)
- Temp Conditioned -300 to +400
- IR/UV Solar Simulation

TO 650,000 FEET SIMULATION
TO 60,000 LB THRUST (FIXED OR SPIN)
HORIZONTAL OR VERTICAL ORIENTATION
ENVIRONMENTAL CONDITIONING

Electric Propulsion

- ESEX
- ELITE

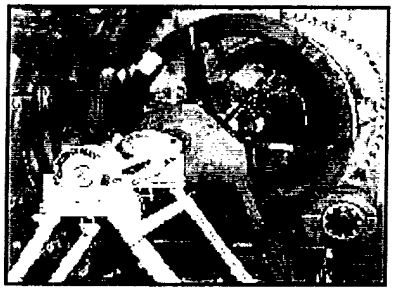
- Continuous at 650,000 Feet (Sim)
- Temp Conditioned -300 to +400
- IR/UV Solar Simulation

Space Propulsion (Liquid)

- AGENA
- JPL STORABLE PROPULSION
- STAR TECH
- XLR-132
- SKYBELT

- 20 Minutes at 110,000 Feet (Sim)
- Vertical Single Axis to 50,000lb Thrust
- LOX/Hydrazine/NTO

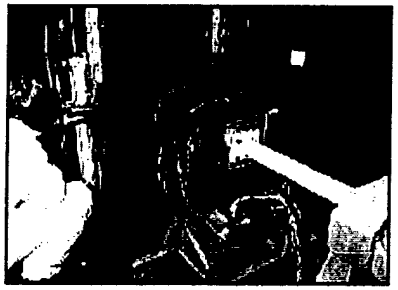
Space Propulsion (Solid)



- TRIDENT C4
- SICBM
- HAST
- PEACEKEEPER
- AIR AVG
- DELTA V

- 20 Min at 110,000 Feet (Sim)
- Horizontal Multi Axis to 60,000lb Thrust
- Fixed or Spin Capable

Space Propulsion (Solid)

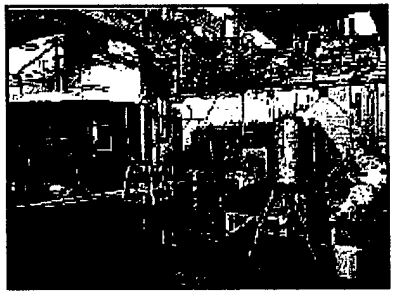


- KHIT
- AIS
- VIPER
- ASAS

- To 110,000 Feet (Sim)
- Horizontal Multi Axis to 50,000lb Thrust
- Contained Exhaust

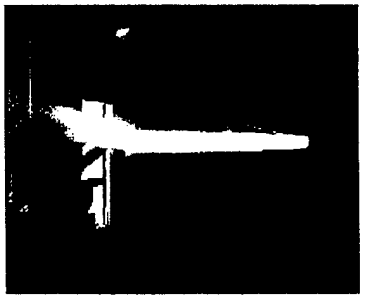
Propulsion Directorate

Flow Laboratory



- To 3,500 PSI and 16" Pipe
- 3 Isolated Water Systems
- To 32 GPM
- Flow and Mass Mixture Ratio
- Particle Sizing

Plume Studies



- SIDEWINDER
- SICBM
- SERGEANT
- VIPER

- Near IR/Visible/UV
- Horizontal or Vertical Orientation
- Temperature Mapping
- Particle Collection

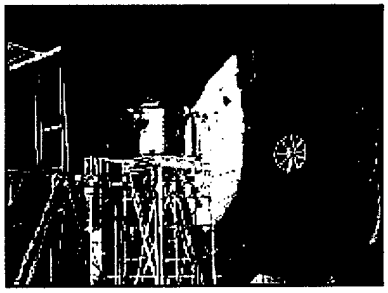
Silo

- MM

- Dual Silos
- 26 Feet Dia X 86 Feet Deep

VEHICLE FLIGHT/HOVER TESTING
REDUCED SMOKE PROPULSION STUDIES
SOLAR THRUSTER EXPERIMENTS
SATELLITE g LOAD STUDIES
TETHERED LAUNCH CAPABILITY

Solar Laboratory



- SOLAR THRUSTER

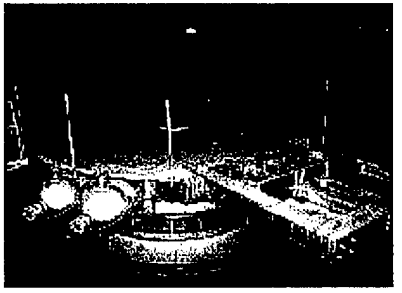
- To 5,000 F
- 24 X 32 Autotrack Heliostat
- 10,000 to 1 Concentrator
- Continuous at 0.1 PSIA

Hover Site

- KHIT
- KKV
- LEAP
- ASAT
- SCIT

- Enclosed Flight Bay (70 X 40 X 30)
- Temp Conditioned -20 to +130 F
- Static Test Stand (Pre-Flight)
- Cleanroom Integration Capability
- Optical Target 800 Meter From Bay

Centrifuge



- 2.75 RAP

- To 48 g at 21 Feet
- To 82 RPM
- To 30,000lb Test Article
- Temp Conditioned -300 to 500 F
- Humidity Conditioned to 95%

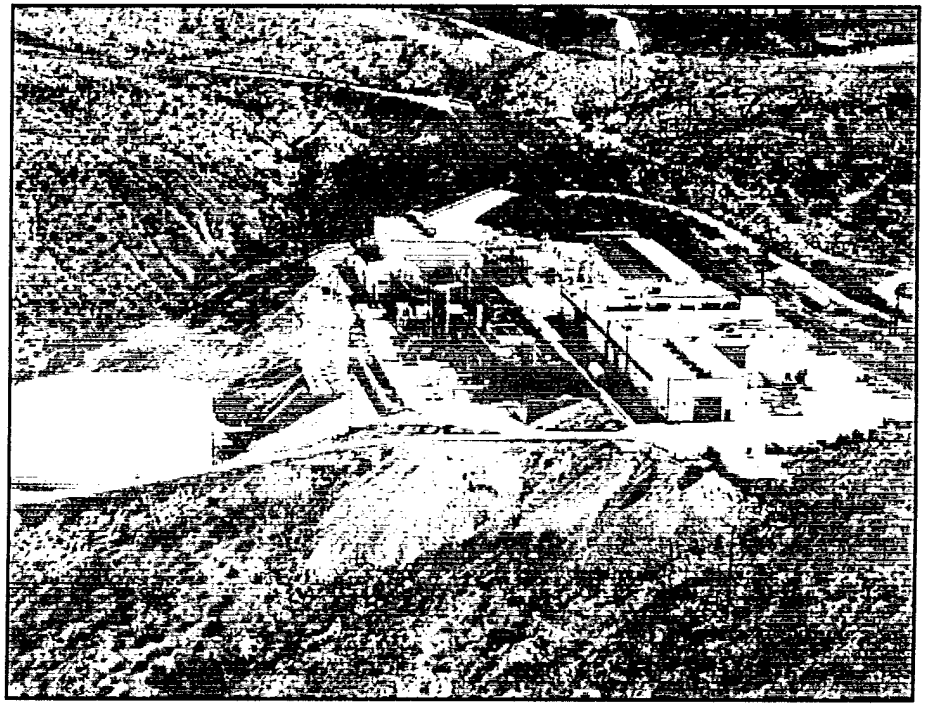
Satellite Engine Complex Area 1-14

GENERAL AREA CAPABILITIES:

- Propane-fired steam/vacuum system, up to 6 hours run time, 125 Kft simulated altitude
- Mechanical pump/diffusion system can be connected to C, D, E Chambers and Pump up to 700 Kft Simulated Altitude
- Two Data Acquisition Systems:
- 6000 psi GN2, Ample Water, LN2, LOX, GH2, Propane Tankage

CELL CAPABILITIES:

- Each Chamber / Stand Rated to 425 lb of 1.1 TNT Equivalent Liquid Propellant
- 4 Vacuum Chambers for Engine/Component Testing
  - A Cell - 1000 Lbf Thrust, 125 Kft Alt.
  - C Cell - 100 Lbf Thrust, 700 Kft Alt.
  - D Cell - No Thrust Stand, 260 Kft Alt.
  - E Cell - 300 Lbf Thrust, 260 Kft Alt.
- 2 Ambient Thrust Stands
  - B Cell - 15K Lbf Horizontal
  - D Cell - 5 Lbf HEDM Evaluation Stand



Testing History:

- Milstar Thruster
- Microcosm Low-Cost Engine
- Stoichiometric Gas Generator
- High Energy Density Materials Microthruster (HEDM)
- AeroAstro Low Cost Engine 1998
- X-34 Fastrack Injector 1997
- SSME Pre-Burner Injector 1997
- Atlas Vernier

Satellite Engine Complex Area 1-14

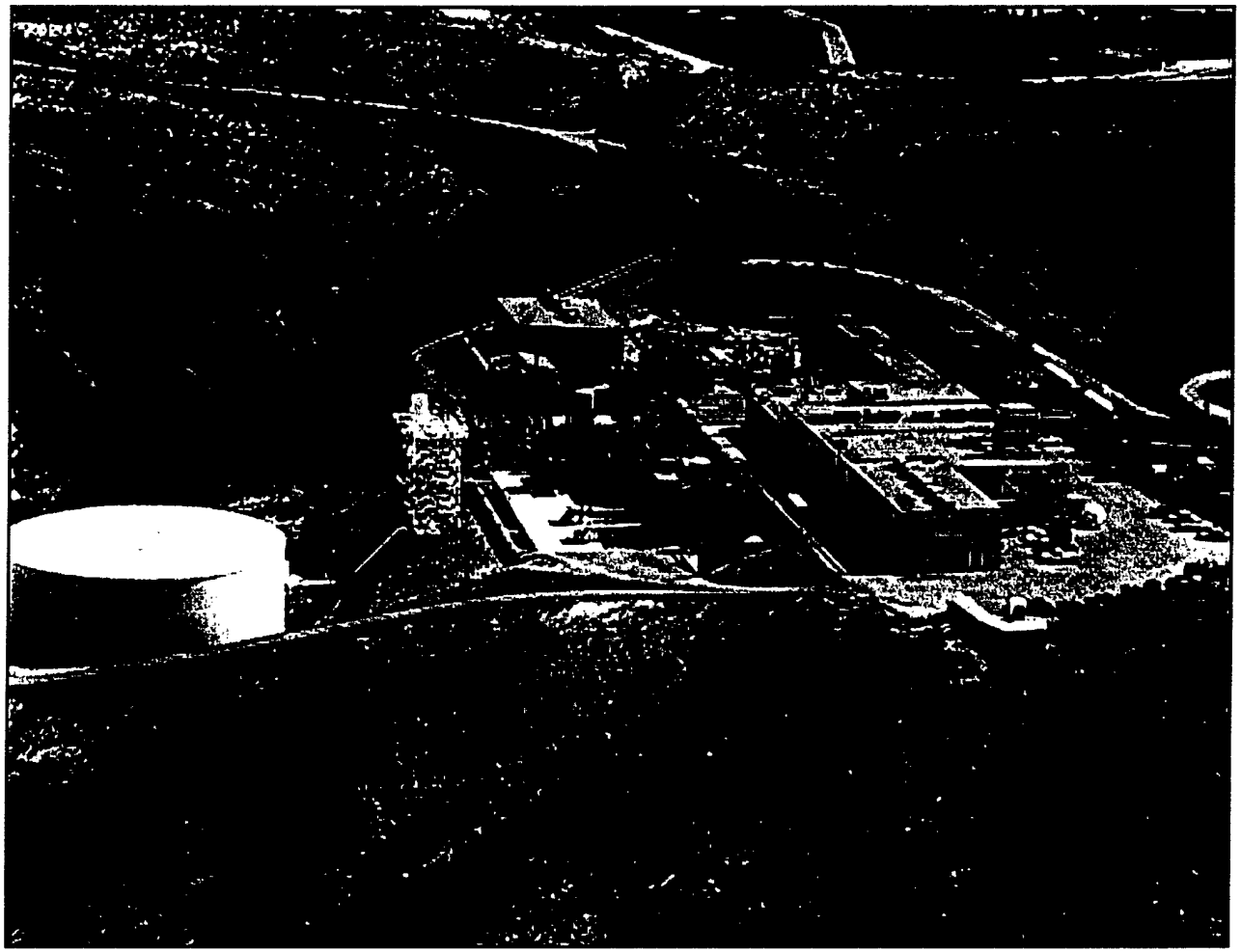
GENERAL AREA CAPABILITIES:

- Propane-fired steam/vacuum system, up to 6 hours run time, 125 Kft simulated altitude
- Mechanical pump/diffusion system can be connected to C, D, E Chambers and Pump up to 700 Kft Simulated Altitude
- Two Data Acquisition Systems
  - — DATUM: 192 ch/50K Samples/Sec Throughput
  - — CYBER: 64 Channels/100K Samples/Sec Throughput
- 6000 psi GN2, Ample Water, LN2, LOX, GH2, Propane Tankage
- Solar Laboratory
- 0 to 48 G Centrifuge
- Flow Laboratory

CELL CAPABILITIES:

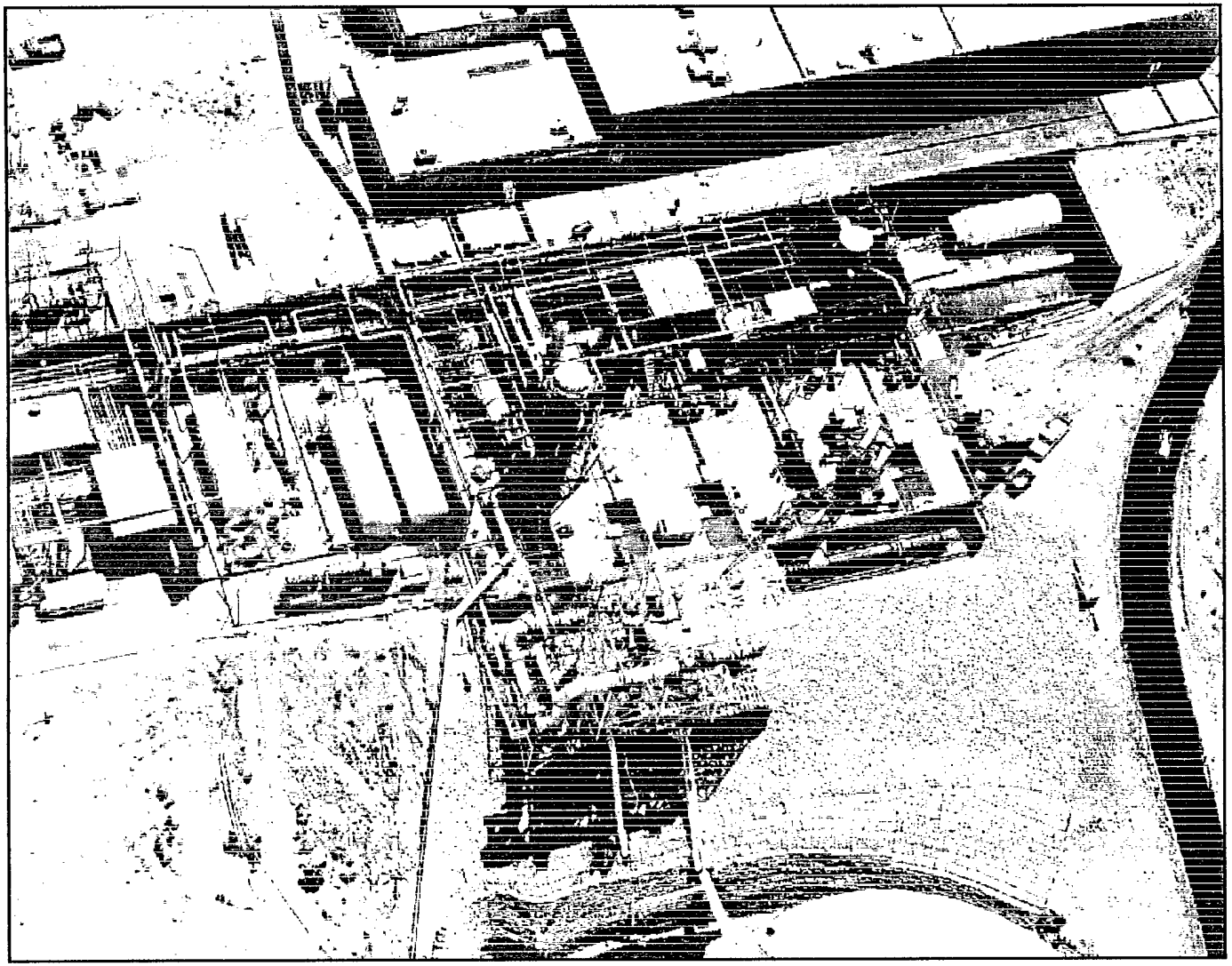
- Each Cell Rated to 425 lb of 1.1 TNT Equivalent Liquid Propellant
- 4 Vacuum Chambers for Engine/Component Testing
  - — A Cell - 1000 lbf Thrust, 8' x 31' 125 Kft Altitude, Stiochiometric Gas Generator
  - — C Cell - 100 lbf Thrust, 7' x 12', 700 Kft Altitude
  - — D Cell - No Thrust Stand in Chamber, 8' x 16', 260 Kft Altitude; MILSTAR Thruster Tests
  - — E Cell - 300 lbf Thrust Vertical Chamber, 9' x 20', 260 Kft Altitude
- 2 Ambient Thrust Stands
  - — B Cell - 15K lbf Thrust Stand, LOX/Hydrocarbon or LOX/LH2 ; Atlas Vernier, Microcosm LOX/RP-1
  - — D Cell - High Energy Density Material 5 lbf Thrust Stand for Evaluation of Candidate High Density Energy Materials (HEDM) Propellants, LOX/Hydrocarbon

Area 1-14



AIR FORCE RESEARCH LABORATORY

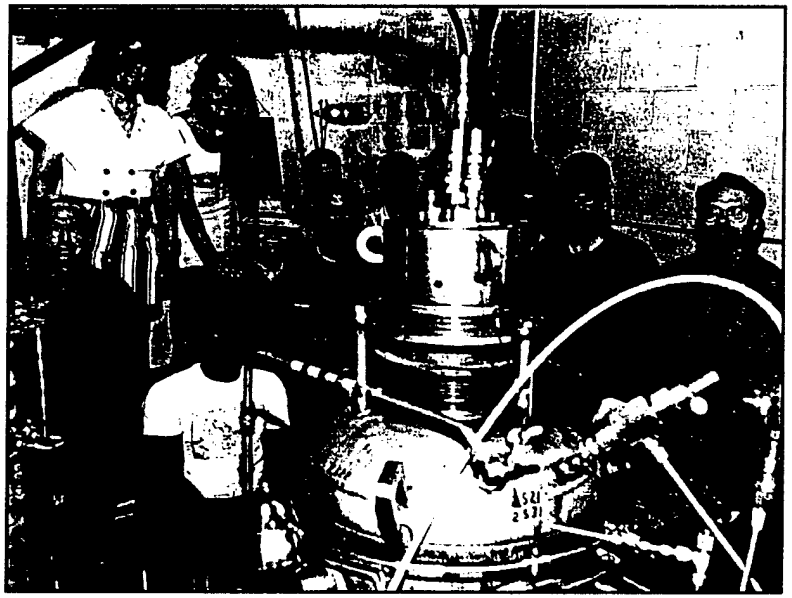
Area 1-14



Flow Laboratory Area 1-14

CAPABILITIES:

- Multi-Element Injector to 1100 PSI and 2800 GPM
- Single Element Injector to 2000 PSI and 32 GPM
  - — Modern Optical Design
  - — Flow Visualization
  - — Flexible Changeout
  - — Mass Patternization
  - — Simulation for Liquid
- Flow Checkout Facility
- Modern Optical Diagnostics
- Flow Visualization
- Flexible Change-Out Capability to Accommodate Different Kinds of Injectors
- Mass Patternization Via 27 Element Transversable Linear Array
- Simulation of Liquid Rocket Engine Manifold Cross Flow Effects
- Flow Checkout Facility to Verify Injector Design Prior to Hot Firing



PAST TESTING:

- XLR-132 Injector
- Microcosm Injector

FUTURE TESTING:

- Integrated Powerhead Pre-Burner Injector
- Rocketdyne Hybrid Injector
- Pac-Astro Injector
- Arcjet Platelet Injector
- X-34 Fastrack Injector 1997
- SSME Pre-Burner Injector 1997

Flow Laboratory,Area 1-14 High Pressure Injector Characterization Chamber Facility

GENERAL AREA CAPABILITIES:

- Unique facility Provides Full Scale, Single Element Windowed Cold Flow Injector Test Capability up to 2000 psi
- Injector Change-Out Capability to Test Most Injector Geometrys
- Simulate Engine Injector Manifold Cross Flow Effects
- Drop Size and Velocity Measurement Capability

LAB CAPABILITIES:

- 2000 psi, 10 ft3 Chamber
- Liquid Flow Rates to 32 GPM
- Modern Optical Diagnostics
  - Malvern Line-Of-Sight Fraunhoffer Diffraction Instrument
  - Aerometrics Phase Doppler Particle Analyzer
  - Coaxial Beam Particle Analyzer
  - Greefield Imaging Particle Analyzer
- Flow Visualization
- Spray Mass Distribution Measurements With 27 Element Traversable Array

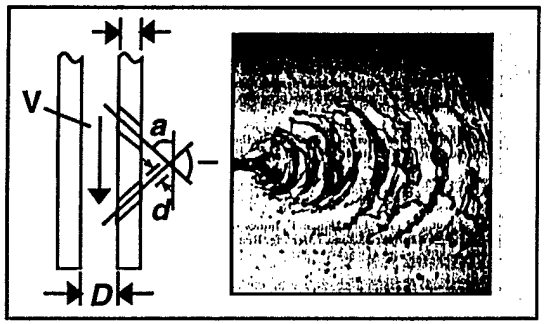
High Pressure Injector Characterization Chamber Injector Design Methodology

LASER DROPLET DIAGNOSTICS

GOALS

- Cost Effective Evaluation of Injector Designs
- Characterize the Effects of Injector Design Features on Performance and Stability

2000 psi PRESSURE VESSEL



TYPICAL IMPINGING INJECTOR SPRAY

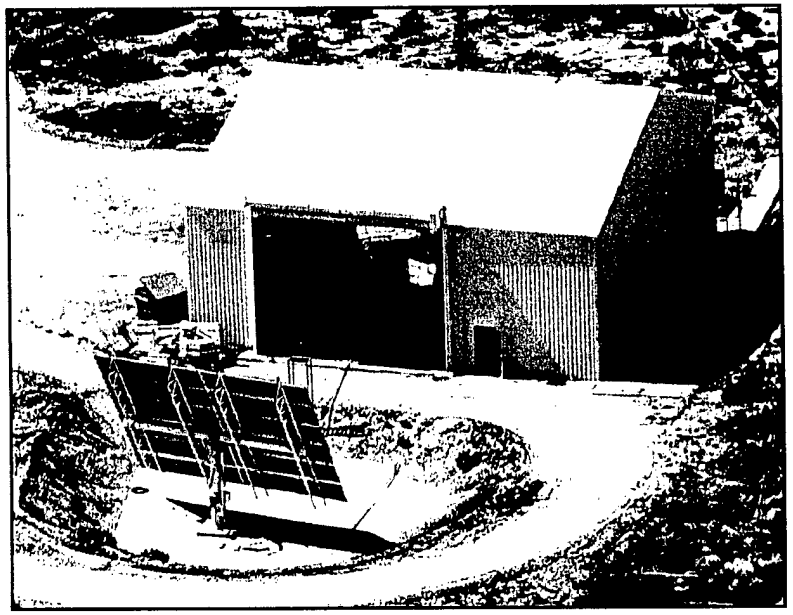
ACCOMPLISHMENTS

- In-House Testing 2000 PSI
- Atomization and Mixing Capabilities
- State of the Art Laser Measurements
- Manifold and Orifice Hydraulics

Solar Laboratory Area 1-14

CAPABILITIES:

- 10,000 : 1 Concentrator
- 32'x 2' Sun Tracking Heliostat
- 25 Kilowatt Concentrator, up to 5800 Degrees Fahrenheit
- 2.5 Gram/Sec Hydrogen or 5 Gram/Sec Helium Propellant Flow Rates
- 1lb Thruster Stand
- 30" x 30" Chamber
- 750 Kft Altitude
- 32 Channel, 10kHz, NEFF Data Acquisition System
- 6000 psi GN2



TESTING HISTORY:

- Black Body Cavity Receivers with Secondary Concentrators Attached
- Porous Disk Test Bed
- Solar Bi-Modal Cavity Receiver
- Video Flux Mapper, Water Filled Calorimeter
- Rhenium Tube Cavity Thruster
- Reticulated Vitreous Carbon Calorimeter

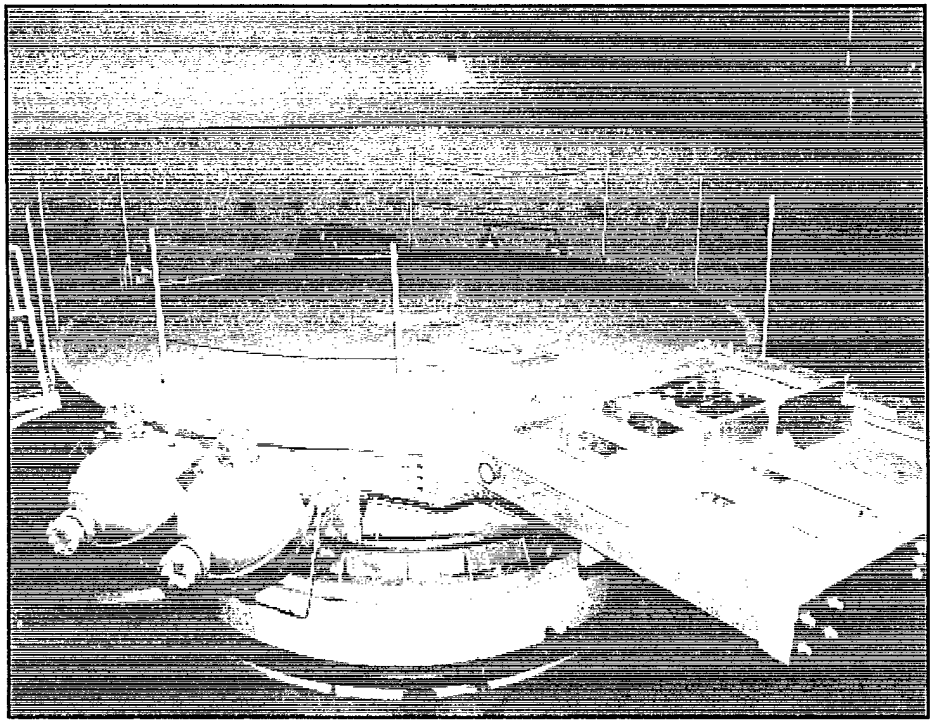
Rigidized Concentrators

1.2 meter Rigidized

Centrifuge Facility Area 1-14

CENTRIFUGE CAPABILITIES:

- Maximum G Range
  - — 0 TO 30 G at 13 Foot Radius
  - — 0 to 48 G at 21 Foot Radius
- 0 to 82 RPM
- Acceleration to 30 G in 5 Minutes
- 60,000 lb Total Capability
- Environmental Capability
  - — (-300 to +500 Degree F)
  - — 0 to 95 Percent Humidity



TESTING HISTORY:

- Solar Parabolic Dish
- 2.75 mm Rocket Assisted Projectile (RAP)

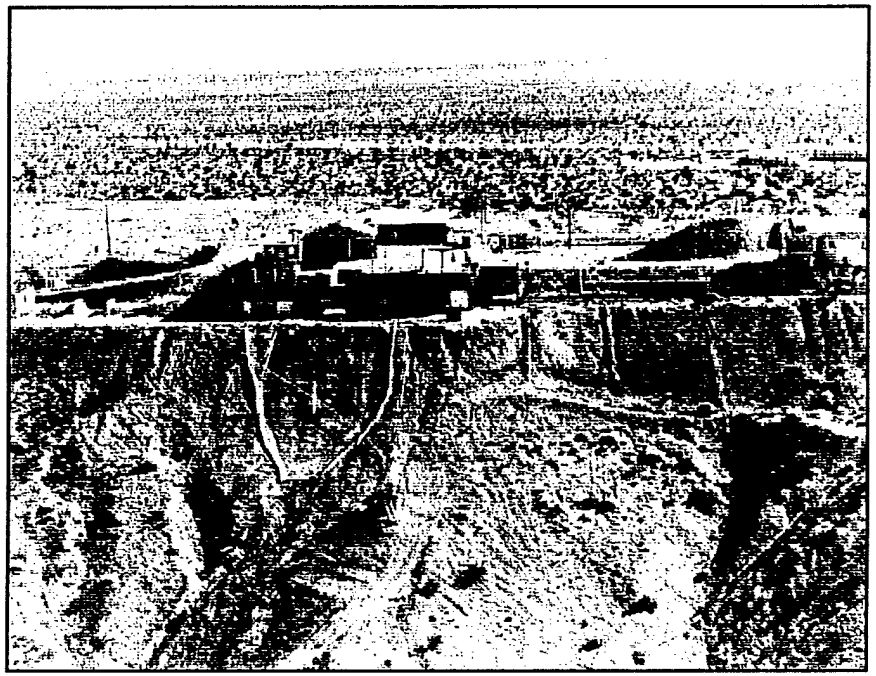
Solid Propellant Preparation
Cutting and Aging Facility, Area 1-21

GENERAL AREA CAPABILITIES:

- Originally Designed to Test Liquid Rocket Engines for Research Aircraft (X-15, X-1, X-2)
- 6,000 psi GN2 Cross Country Line
- 12 Inch Water Main
- 440 VAC Facility Power
- Mechanical Shop With 2 Ton Crane

TEST CELL CAPABILITIES:

- Cell 1 - 425 lbs. of 1.1 Solid Propellant
  - — Prepare Tensile Test Specimens
- Cell 2 - 100 lbs. of 1.1 Solid Propellant
  - — Rough Cutting Large Pieces of Propellant
- Cell 3 - 50 lbs. of 1.1 Solid Propellant
  - — Explosion Resistant Window
- Cell 4 - Office / Control Room for Cells 1, 2, and 3
- Cell 5 - 75 lbs. of 1.1 Solid Propellant
  - — Initial Weighing, Measuring, and Trimming
  - — Fragmentation Testing
- Cell 6 - Control Room for Cells 5 and 7
- Cell 7 - 425 lbs. of 1.1 Solid Propellant
  - — 4 Environmental Aging Chambers
- Cell 8 - 20 lbs. of 1.1 Solid Propellant
- Cell 12 - 100 lbs. of 1.1 Solid Propellant
  - — Environmental Propellant Storage



TESTING HISTORY

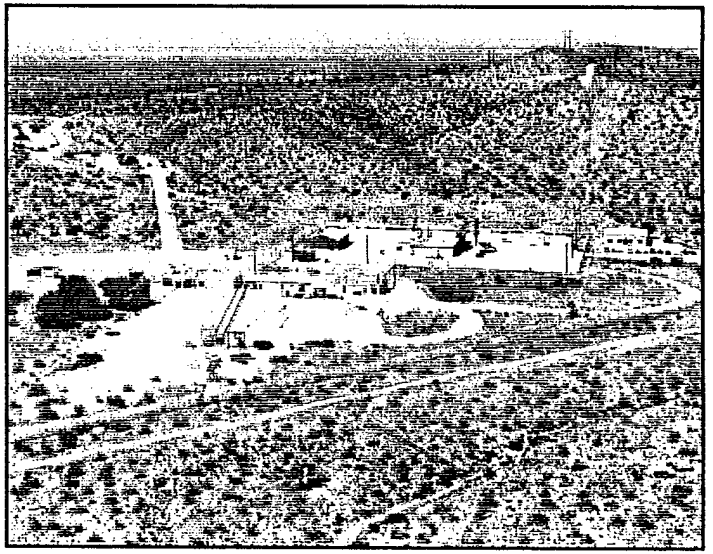
Solid Propellant Laboratory Complex Area 1-30

GENERAL AREA CAPABILITIES:

- Designed to Formulate, Mix, Cast, Cure and Study, High Energy Propellants
- Environmental Conditioning
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
  - — 50,000 Gallon Water Storage
- 440 VAC and 28 VDC Stand Power
- Data Acquisition and Control System
- Over 30 Mechanical Shop Buildings, Preparation Cells, and Test Stands

COMPLEX CAPABILITIES:

- Propellant Storage Bunkers, 10 Each
  - — Maximum 5,000 lb of 1.1 Propellant
- Propellant Aging Cells, 12 Each
  - — Heat and Humidity Controlled
- Propellant Processing Cells, 11 Each
  - — Processing Propellants, Binders, and Placticizers
  - — Maximum of 100 lb of 1.1 Propellant per Cell
- Propellant Evaluation Facility,
  - — Tensile Testing
  - — Strand Burning
- Propellant Test Stands and Cells



TESTING HISTORY:

- Microwave Burner 1986 - 1987
- Combustion Stability 1983 - 1987
- Sidewinder Reduced Smoke
- Maverick Reduced Smoke
- Rotating Valve 1981
- 40mm RAP 1972
- 20mm RAP 1973
- 30mm RAP 1974
- Titan Failure Study 1986
- PeaceKeeper Stage I 1976
- PeaceKeeper Stage II 1976
- PeaceKeeper Stage II Failure Study 1982
- PeaceKeeper Stage III Failure Study 1985
- HMX Studies (Hardened structure Munitions) 1974

Solid Propellant Laboratory Complex Area 1-30

GENERAL AREA CAPABILITIES:

- Designed to Formulate, Mix, Cast, Cure and Study, High Energy Propellants
- Environmental Conditioning
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
  - — 50,000 Gallon Water Storage
- 440 VAC and 28 VDC Stand Power
- Data Acquisition and Control System
- Over 30 Mechanical Shop Buildings, Preparation Cells, and Test Stands

COMPLEX CAPABILITIES:

- Propellant Storage Bunkers, 10 Each
  - — Earth Covered Bunker
  - — Above Ground Bunker
  - — Maximum 5,000 lb of 1.1 Propellant
- Propellant Aging Cells, 12 Each
  - — Heat and Humidity Controlled
  - — From (-65 to +500) Degrees F
- Propellant Processing Cells, 11 Each
  - — Processing Propellants, Binders, and Placticizers
  - — Speed and Temperature Controlled Mixers
  - — Blast Proof Windows or Remote Television Monitors
  - — Maximum of 100 lb of 1.1 Propellant per Cell
    - » Some Limited to 25 lb

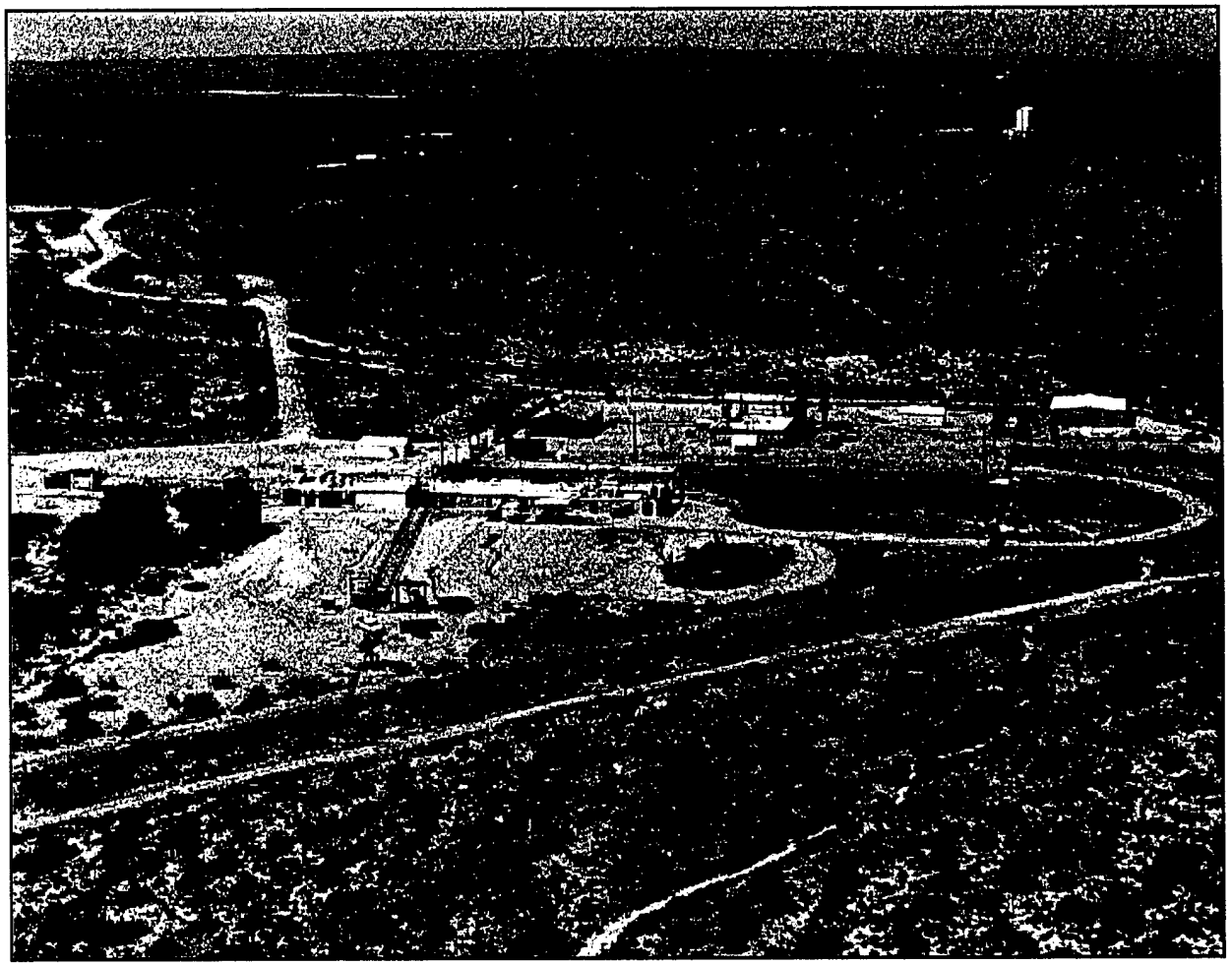
COMPLEX CAPABILITIES (Cont):

- Propellant Evaluation Facility
  - – Tensile, Friction, and Drop Weight Testing
  - – Rheometrics Mechanical and Stress Spectrometers
  - – Strand Burning
- Propellant Test Stands and Cells
  - – Test Cell 25
    - Pulling and Twisting Tensile Tester
  - – Test Cell 26
    - Combustion Bomb Window
  - – Test Cell 27
    - 60,000 Volt Electrostatic Discharge Testing
  - – Test Stand 34
    - Fluid Energy Mill
  - – Test Stand 44
    - Propellant Burn Sensitivity

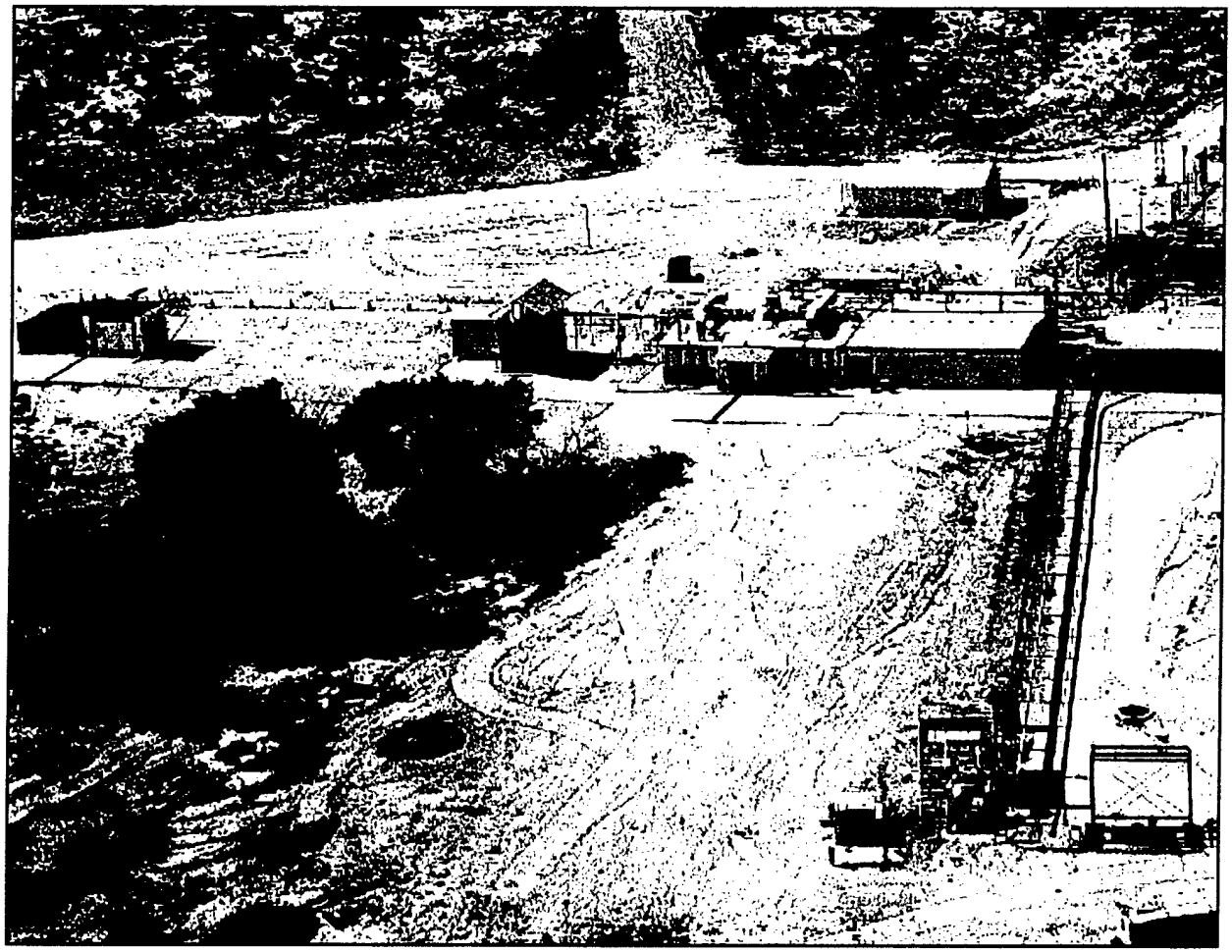
TESTING HISTORY:

- 20, 30, 40mm RAP 1972-1974
- Maverick
- Rotating Valve 1981
- Combustion Laser
- Sidewinder
- Rotating Valve
- PeaceKeeper 1976-1985
- Titan
- HMX Studies (Hardened Structure Munitions) 1974

Solid Propellant Laboratory Complex
Area 1-30



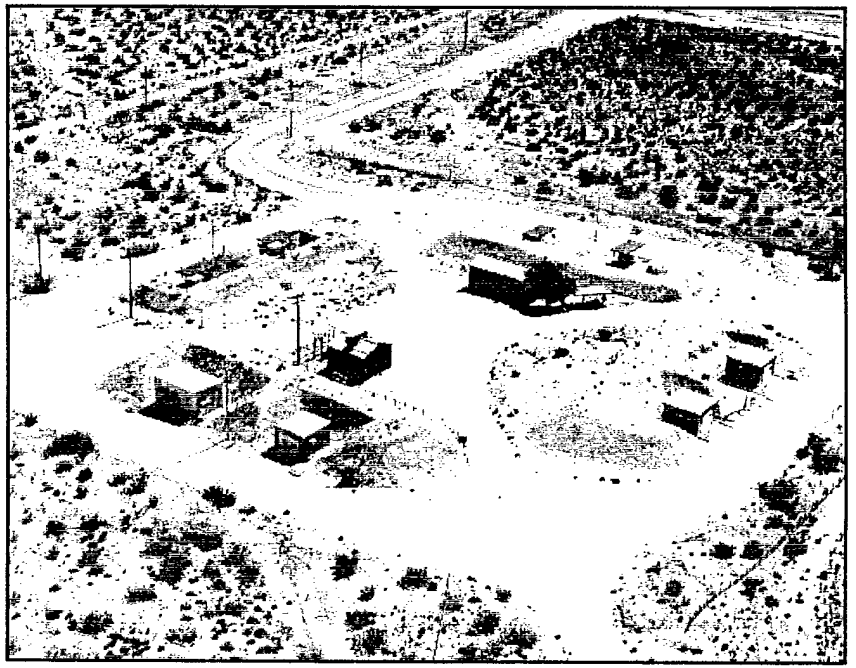
Solid Propellant Laboratory Complex
Area 1-30



Propellant Aging Cells Area 1-30

CELL CAPABILITIES:

- Ground Level 12 Environmental Aging Cells
  - — Each Cell is Approximately 64 Cubic Feet
  - — Temperature Control From -65 to +500 Degrees F.
  - — Humidity Control
- 2,400 lb of 1.1 TNT Equivalent Propellant Total for 12 Cells
- Remote Environmental Conditioning System
  - — Data Acquisition and Health Monitoring

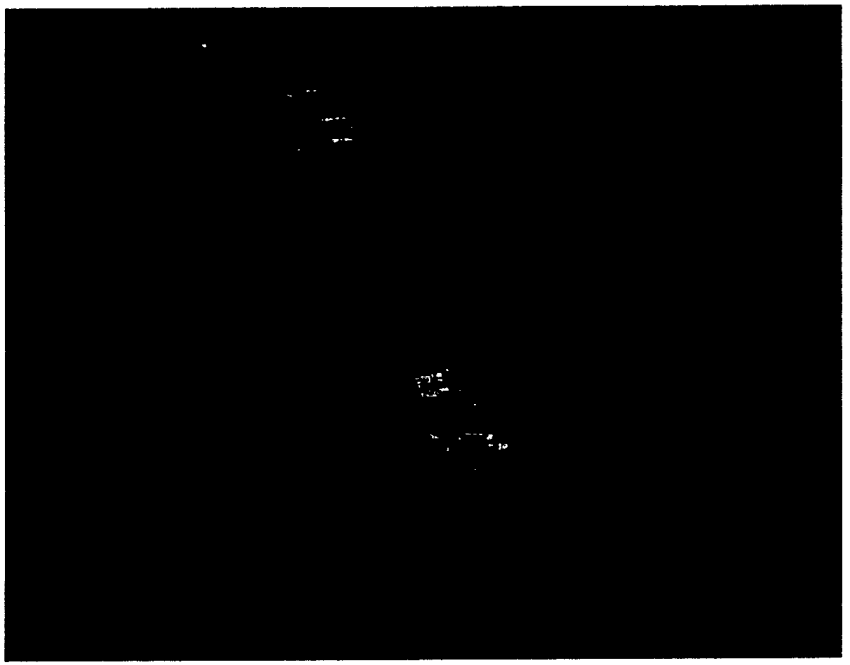


TESTING HISTORY:

Motor Component Complex Area 1-32

GENERAL AREA CAPABILITIES:

- Plume Diagnostics Analysis System
- High Hazard Motor / Propellant Testing
- Hydrogen Injector System
- Environmental Conditioning
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Data Acquisition and Control System
- Mechanical Shop With 2 Ton Crane
- Receiving and Inspection Station
  - — With 50 Ton Crane
  - — With Environmental Conditioning



TEST STAND CAPABILITIES: (CURRENT CONFIGURATION)

- Pad 1 - 250,000 Lbf Thrust, Horizontal
- Pad 2 - 150,000 Lbf Thrust, Horizontal
- Pad 3 - 10,000 Lbf Thrust, Horizontal
- Pad 5A / 5B / 5C - 36,000 Lbf Thrust, Horizontal

TESTING HISTORY:

- Sidewinder
- Minuteman
- Sparrow
- Shuttle
- PeaceKeeper
- HIPPO
- Small ICBM
- Taurus
- Titan
- Hydrogen Augmented Solid Rockets
- Ammonium Perchlorate

Motor Component Complex Area 1-32

GENERAL AREA CAPABILITIES:

- 6,000 psi GN2 Cross Country line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- 64 Channel Data Acquisition System and 128 Channel Control System
- Mechanical Shop With 2 Ton Crane
- Receiving and Inspection Station
  - —With 50 Ton Crane
  - —With Environmental Conditioning

TEST STAND CAPABILITIES:

- Ground Level Testing
- Environmental Conditioning

PAD 1 - Maximum Thrust 1,000,000 lbf.

- (Current Configuration) 250,000 lbf. Thrust
- 10 Ton Overhead Crane, 7,000 lb of 1.1 or 50K of 1.3 Solid Propellant

PAD 2 - Maximum Thrust 1,000,000 lbf.

- (Current Configuration) 150,000 lbf. Thrust
- 15 Ton Overhead Crane, 7,000 lb of 1.1 or 50K of 1.3 Solid Propellant

TEST STAND CAPABILITIES:

PAD 3 - Maximum Thrust 60,000 lbf.

- (Current Configuration) No Thrust, 1,000 lb of 1.1 or 5K of 1.3 Solid Propellant
- High Hazard Motor / Propellant / Gun Testing

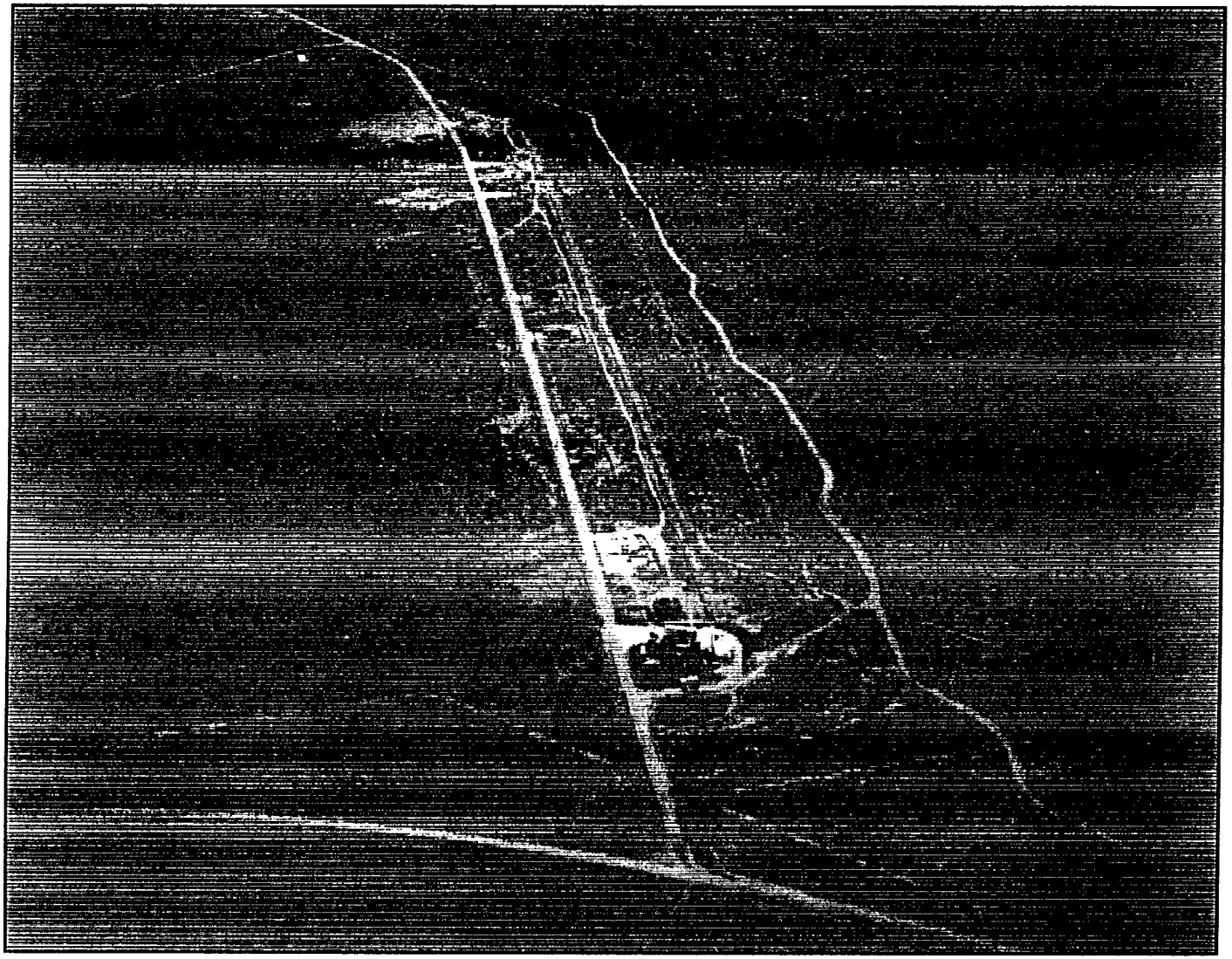
PAD 5A / 5B / 5C - Maximum Thrust 36,000 lbf.

- 70 lb of 1.1 or 180 lb of 1.3 Solid Propellant
- Onboard Automatic Calibration System 99.9% Accuracy
- Pad 5A (Current Configuration) 12,000 lb Thrust,
  - —Plume Diagnostics Analysis System
- Pad 5B (Current Configuration), 10,000 lb Thrust
- Pad 5C 36,000 lbf. Thrust, Spin Capability,
  - —Hydrogen Injection System

TESTING HISTORY:

- Sidewinder
- Minuteman
- Shuttle
- Sparrow
- PeaceKeeper
- Taurus
- Ammonium Perchlorate
- Durandahl
- Small ICBM
- Pegasus
- HIPPO
- Minuteman
- 30mm RAP
- 20mm RAP
- Hydrogen Augmented Solid Rockets

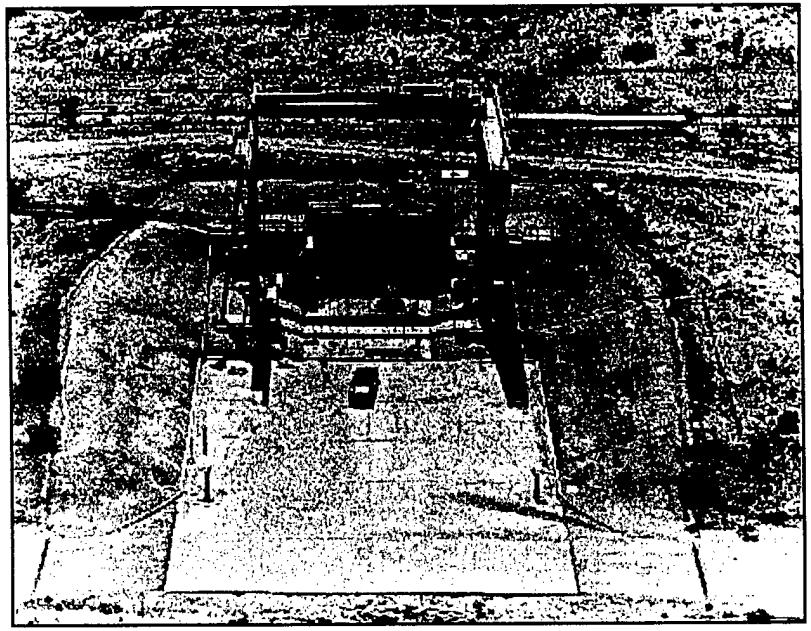
Motor Component Complex
Area 1-32



Large Motor Test Stand
Area 1-32 Test Stand 1

TEST STAND 1 CAPABILITIES:

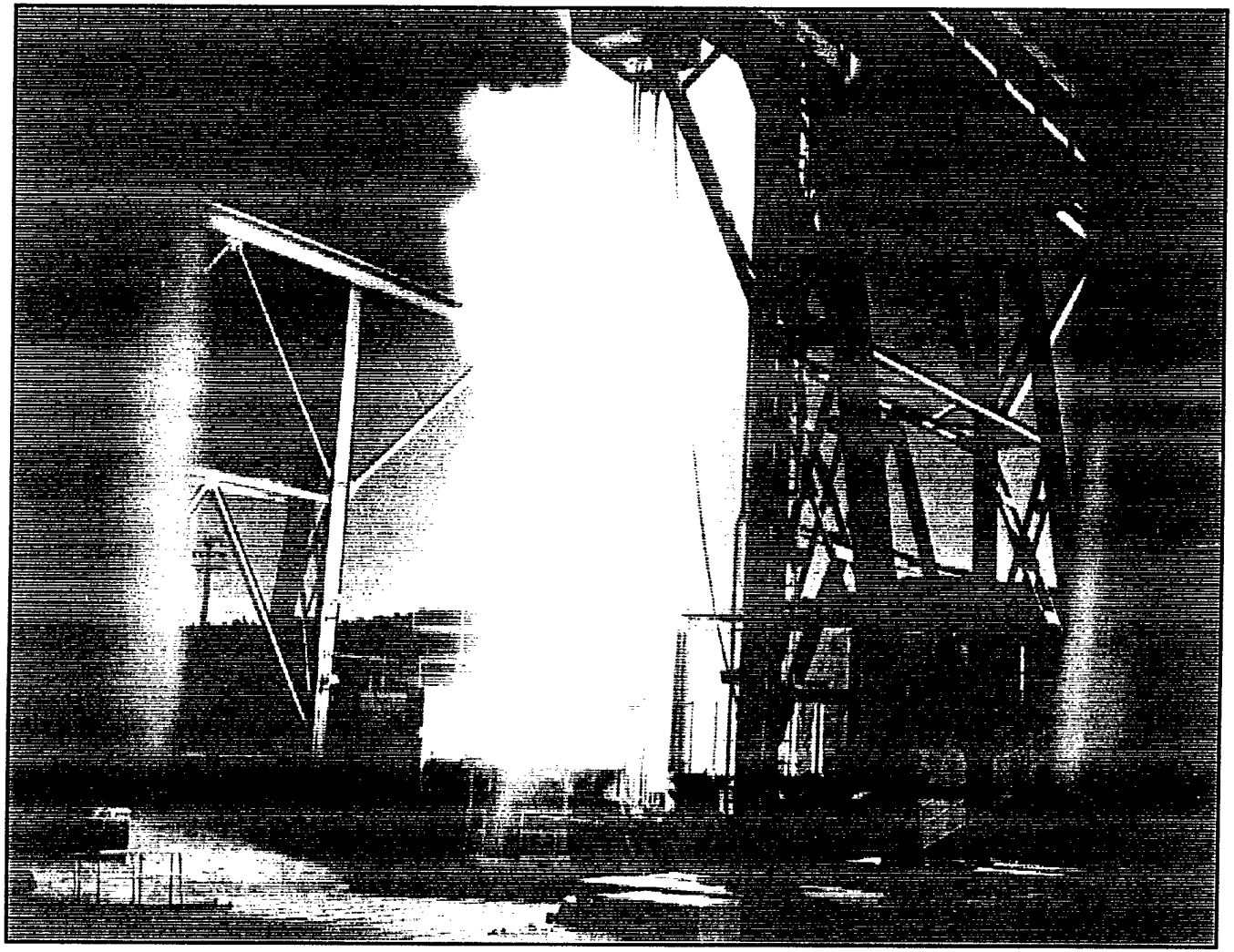
- Ground Level Testing
- Maximum Thrust 1,000,000 lbf. Horizontal or Vertical
  - — (Current Configuration) 250,000 lbf. Thrust
  - — Horizontal, Six-Component, Automatic Calibration
  - — 25,000 lbf. Side Force
- 30' x 45' Concrete Pad
- 7,000 lb of 1.1 or 50,000 lb of 1.3 Solid Propellant
- Environmental Enclosure (Temperature / Humidity)
- 10 Ton Traveling Overhead Crane



TESTING HISTORY:

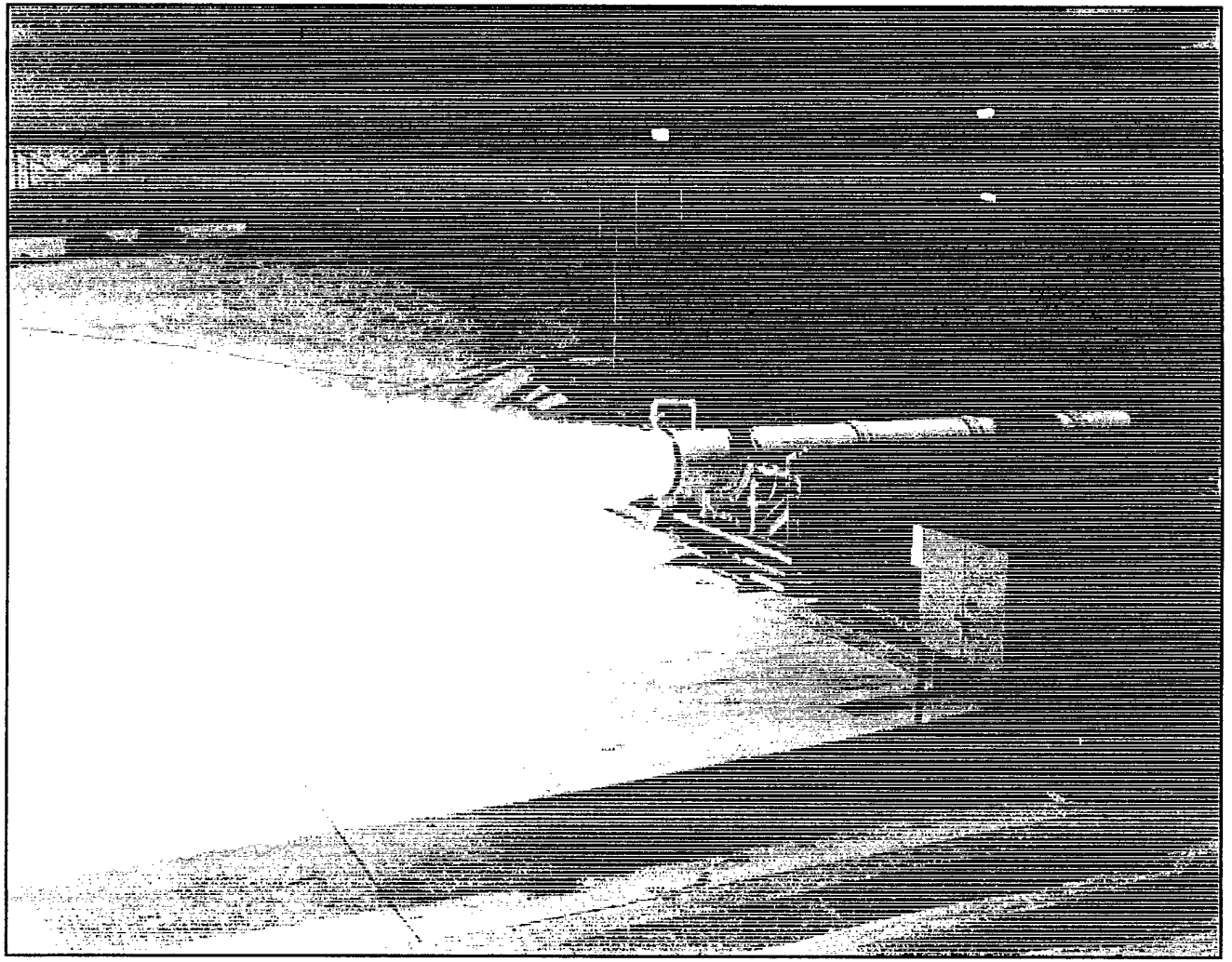
- Minuteman
- Titan
- PeaceKeeper
- Viper
- SuperBATES
- Trident

Large Motor Test Stand
Area 1-32 Test Stand 1



Thrust Vector Control (TVC) Test

Large Motor Test Stand
Area 1-32 Test Stand 1

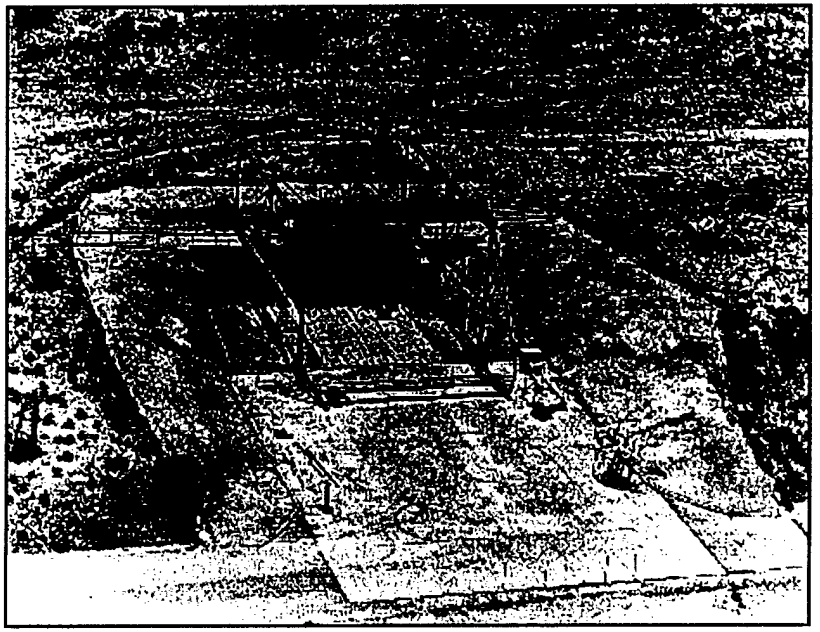


Nozzleless Booster 1985

Large Motor Test Stand
Area 1-32 Test Stand 2

TEST STAND 2 CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 1,000,000 lbf. Horizontal or Vertical
  - — (Current Configuration) 150,000 lbf. Thrust
  - — Horizontal Single Axis, Automatic Calibration
  - — 99.85 % Thrust Measurement Accuracy
  - — 1 to 4 Segments, up to 34 inch Diameter
- 30' x 45' Concrete Pad
- 7,000 lb of 1.1 or 50,000 lb of 1.3 Solid Propellant
- Environmental Enclosure (Temperature / Humidity)
- 15 Ton Traveling Overhead Crane



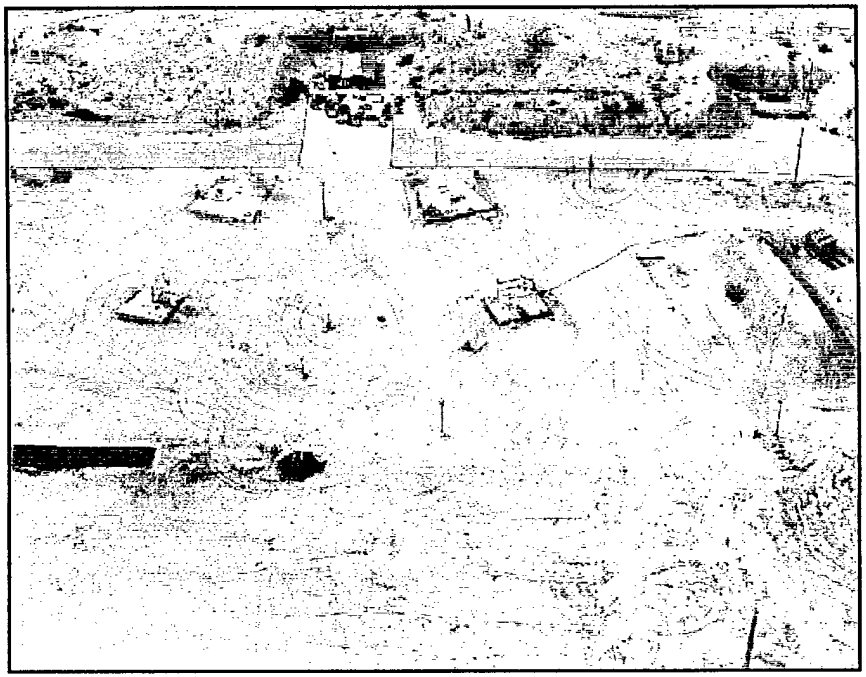
TESTING HISTORY:

- High Internal Pressure Producing Orifice (HIPPO)
- Small ICBM (TVC Shoot Off)
- 84" Diameter, Materials Testing Motor (CHAR)

High Hazards Test Stand
Area 1-32 Test Stands 3A, B, C, & D

TEST STANDS CAPABILITIES:

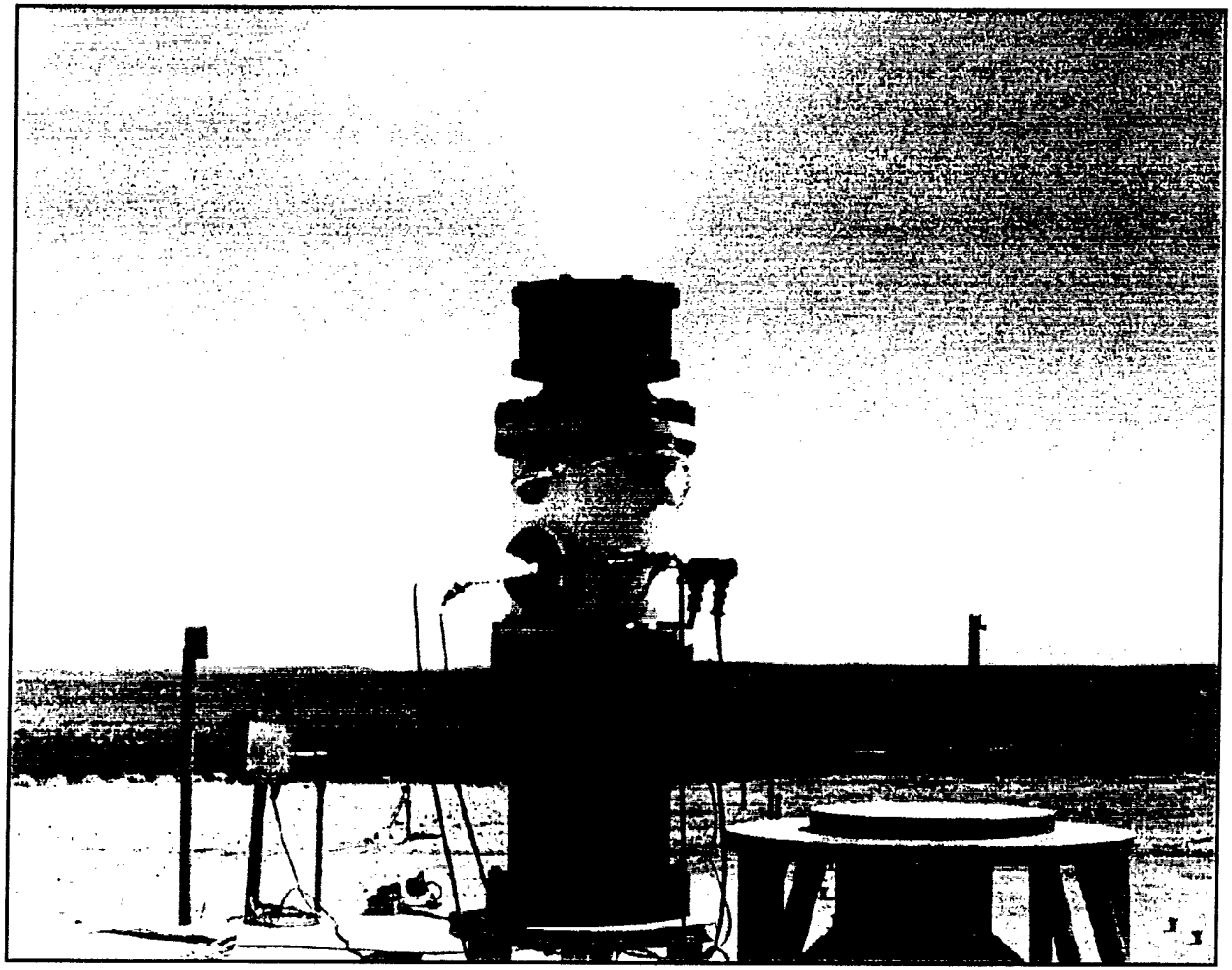
- Maximum Thrust 10,000 lbf, Horizontal
- (Current Configuration) No Thrust
- 1,000 lb of 1.1 or 5,000 lb of 1.3 Solid Propellant
- 2 Ton Traveling Overhead Crane
- Gun Target



TESTING HISTORY:

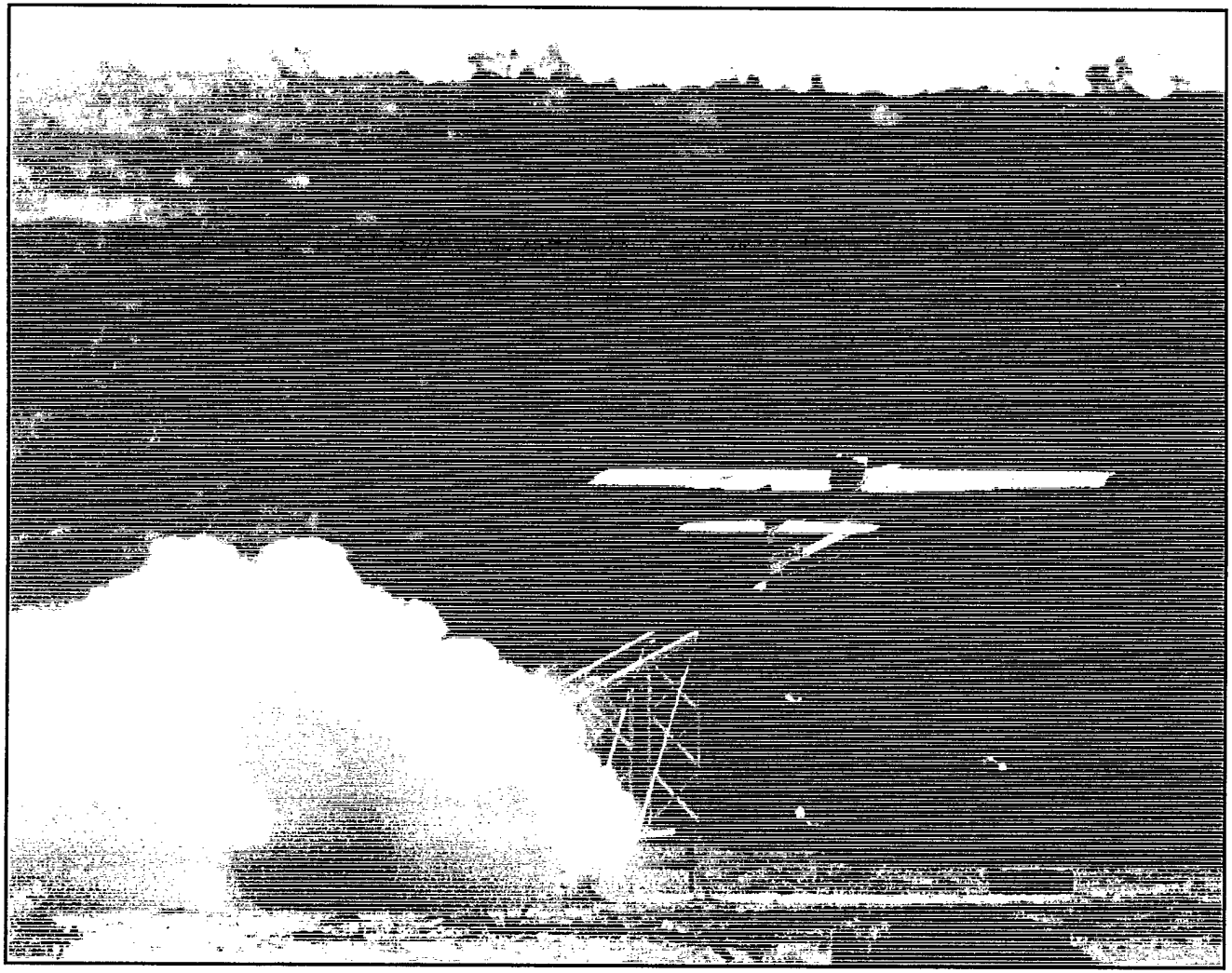
- Sidewinder
- Sparrow
- 30mm RAP
- 20mm RAP
- Ammonium Perchlorate
- Hot Gas Valve • Durandahl
- F16 Emergency Hydrazine Generator
- Minuteman Critical Diameter Definition

High Hazards Test Stand
Area 1-32 Test Stand 3A



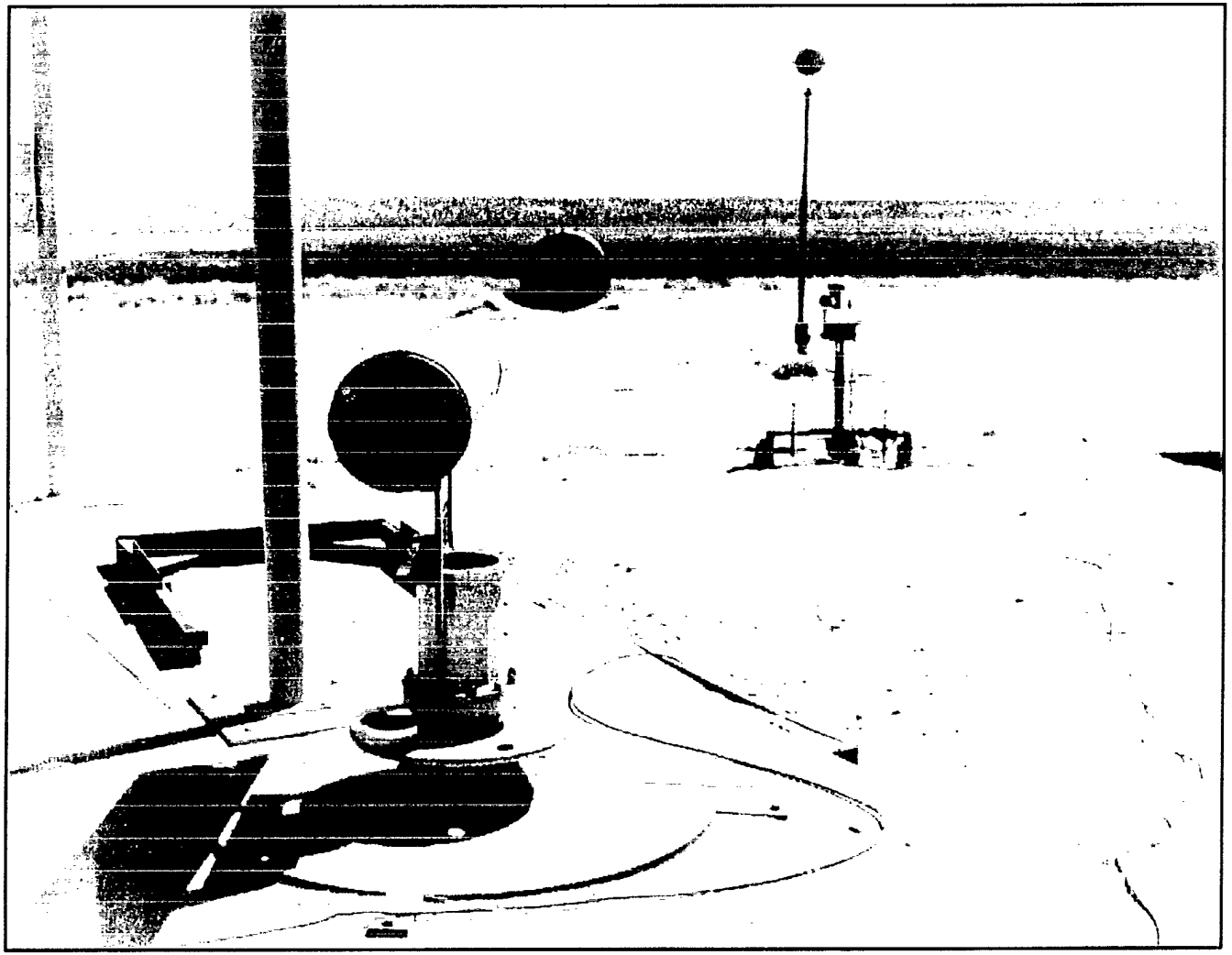
Integrated Stage Thrust Vectoring Test, 1982

High Hazards Test Stand 3A
Test Area 1-32



REMOTELY PILOTED VEHICLE

High Hazards Test Stand 3A
Test Area 1-32

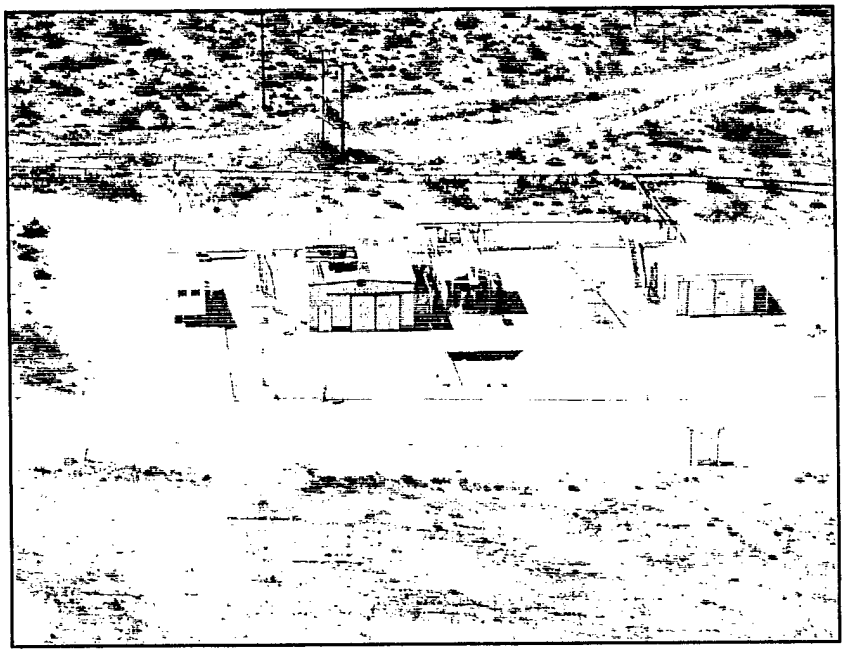


30mm ROCKET ASSISTED PROJECTILE (RAP)

15 & 70 lb BATES Motor Pads - Area 1-32 Pads 5A, 5B, & 5C

TEST STAND CAPABILITIES:

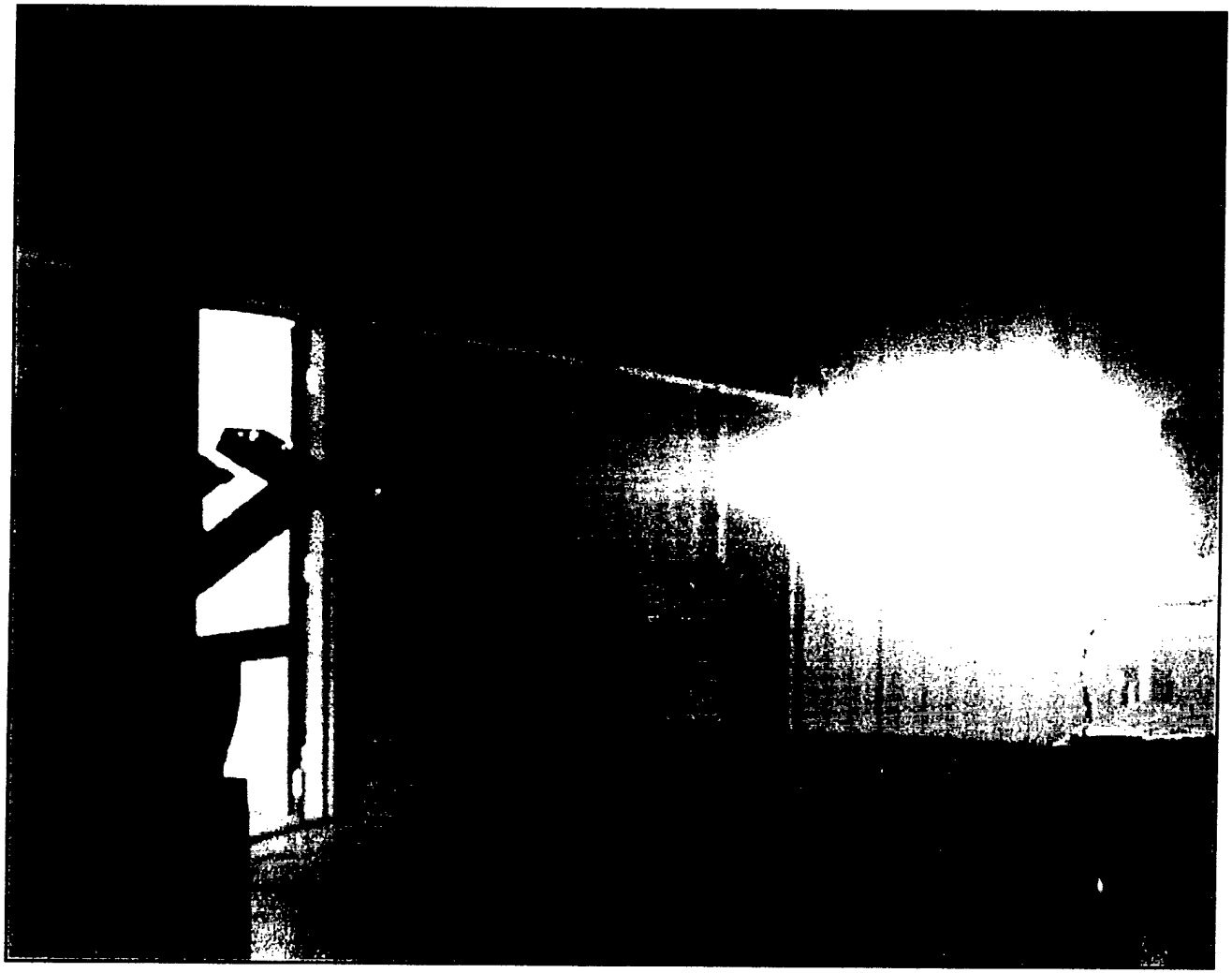
- 12K, 10K, 36K lbf Thrust Stands Horizontal
- 70 lb of 1.1 or 180 lb of 1.3 Solid Propellant
- Onboard Automatic Calibrating System 99.9% Accuracy
- One to Four Segments, Up to 14 Inch Diameter
- Test Stand 5A (Current Configuration) 12,000 lb Thrust
- Plume Diagnostics System
  - — Mean Particle Sizing
  - — Particle Capture
  - — Visible UV & IR
  - — Thermal Image Recording
  - — 3 Wideband IR Radiometers
  - — Near IR Fourier Transform Spectrometer
- Test Stand 5B (Current Configuration) 10,000 lb Thrust
- Test Stand 5C (Current Configuration) 36,000 lbf. Thrust
  - — Motor Spinning Capability
  - — Hydrogen Injection System



TESTING HISTORY:

- Sidewinder
- Sparrow
- Shuttle
- Minuteman
- Durandahl
- Titan
- PeaceKeeper
- Small ICBM
- 30mm RAP
- 20mm RAP
- Ammonium Perchlorate
- Hydrogen Augmented Solid Rockets

BATES Motor Pad
Area 1-32, Pad 5A



15 lb Bates / Plume Test

Motor Behavior Complex
Area 1-36

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 2 Foot Water Main
- 440 VAC and 28 VDC Stand Power
  - — Accessible for A and B Pads, Available for D Pad
- Mechanical Shop
  - — With 2 Ton Traveling Overhead Crane

TEST STAND CAPABILITIES:

- Ground Level Testing
- Storable and Solid Propellant
- 1-36A Pad, Maximum Thrust, 4M lbf., Horizontal
  - — 1M Lbs TNT Equivalent
- 1-36B Pad, Inactive
- 1-36D Pad, Explosive Detonation Studies
  - — 1M Lbs TNT Equivalent

TESTING HISTORY:

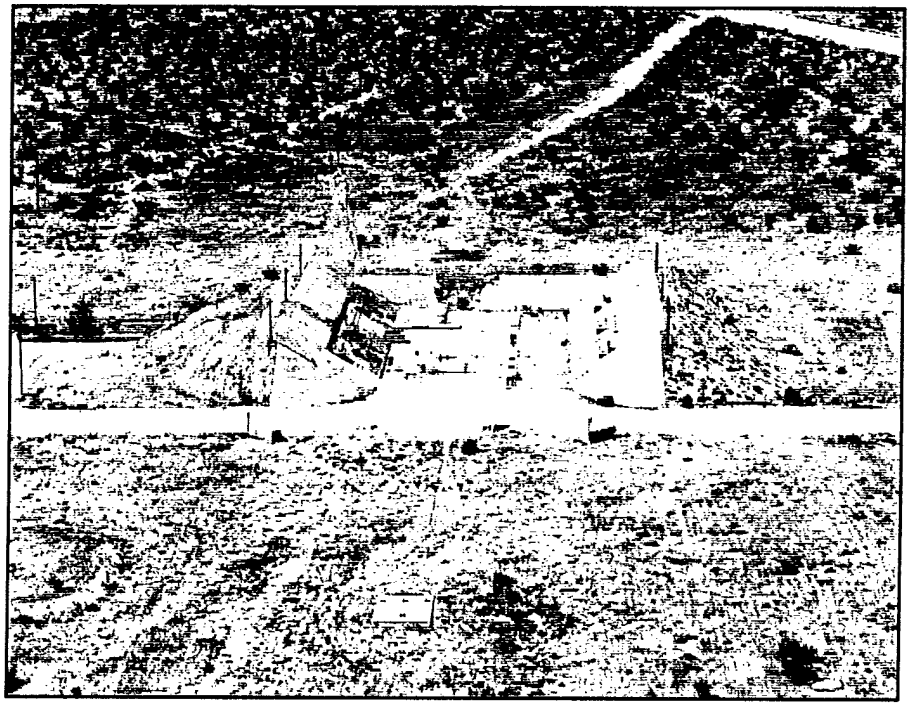
- PeaceKeeper Flight Termination Guidance

  Stage I / II / III 1980 -
- PeaceKeeper Advanced Development Program
- Titan III, 120 Inch Solid
- Ammonium Perchlorate
- Silo Fire Safety
- Solid Propellant Hazards Study (SOPHY)

Motor Behavior Complex
Area 1-36, Horizontal Test Pad A

TEST STAND CAPABILITIES:

- Ground Level Testing
- Storable and Solid Propellant
- Horizontal Bermed Bare Pad
- Maximum thrust, 4M lbf.
- 1M Lbs TNT Equivalent
- Would Require New Data Acquisition and Control Facility



TESTING HISTORY:

- PeaceKeeper Flight Termination Ordinance Stage I / II 1980 -
- PeaceKeeper Ordnance Advanced Development Program
- Titan III, 120 Inch Diameter, Solid Strap On
- Minuteman Stage II
- Minuteman Stage III

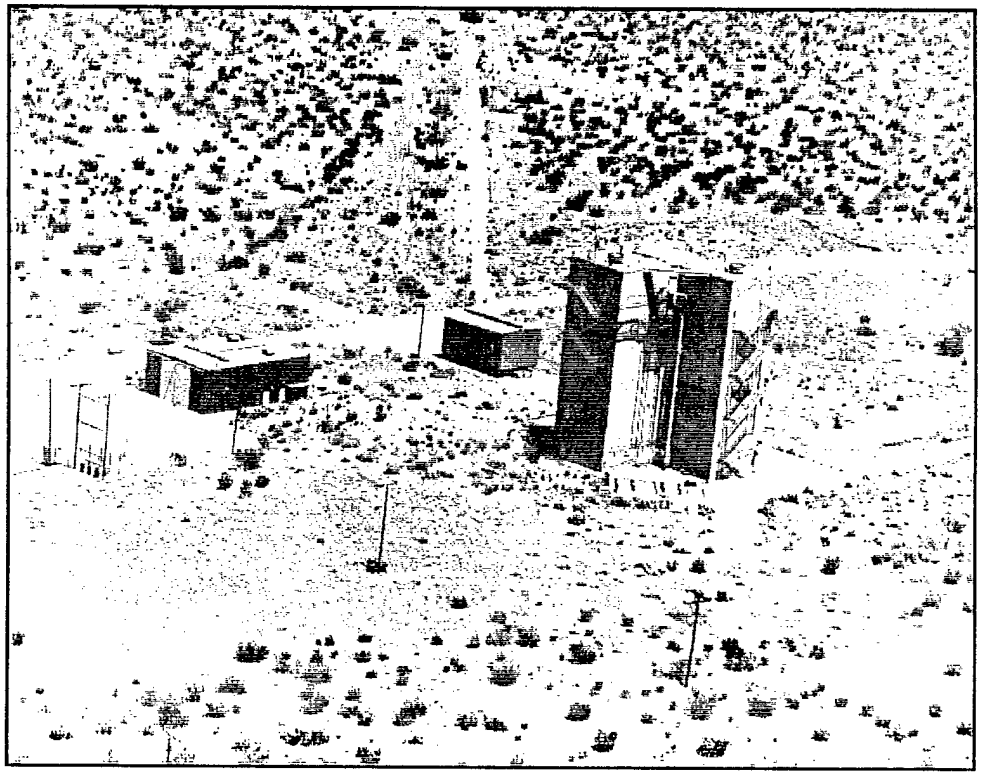
Motor Behavior Complex
Area 1-36, Vertical Test Pad B

TEST STAND CAPABILITIES:

- Ground Level Testing
- 1-36B Pad, Inactive

TESTING HISTORY:

- Titan III, 120 Inch Diameter, Solid Strap On



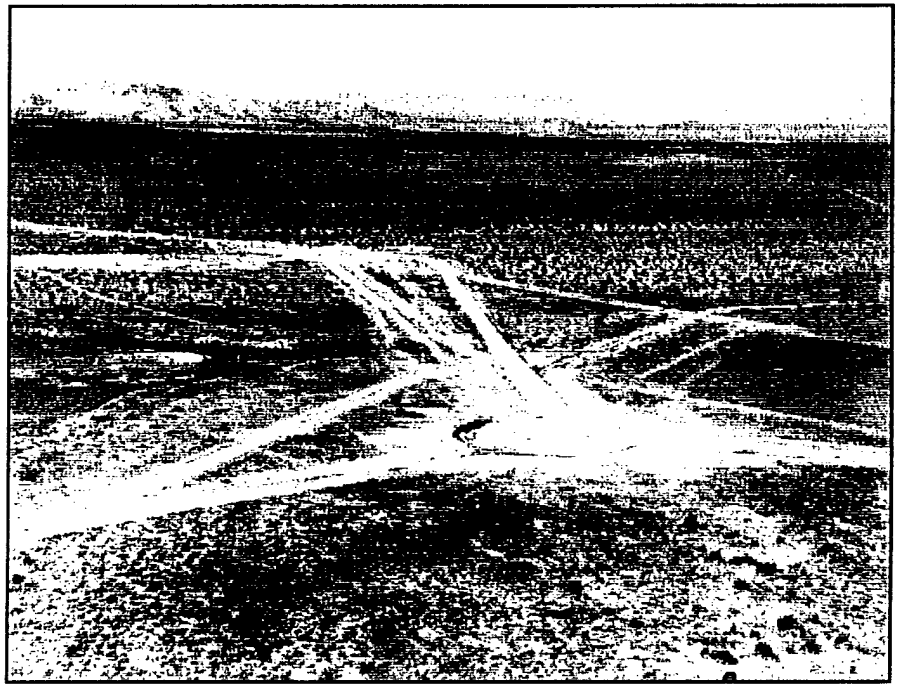
Motor Behavior Complex
Area 1-36, Detonation Test Pad D

1-36D FACILITY CAPABILITIES:

- Data Acquisition and Control System
  - — 24 Channel High-Speed Le Croy Digital Recorder, 300mHz
  - — 28 Channel High-Speed, Frequency Modulated Tape Recorder
  - — IBM PC Based LABVIEW Control System

TEST STAND CAPABILITIES:

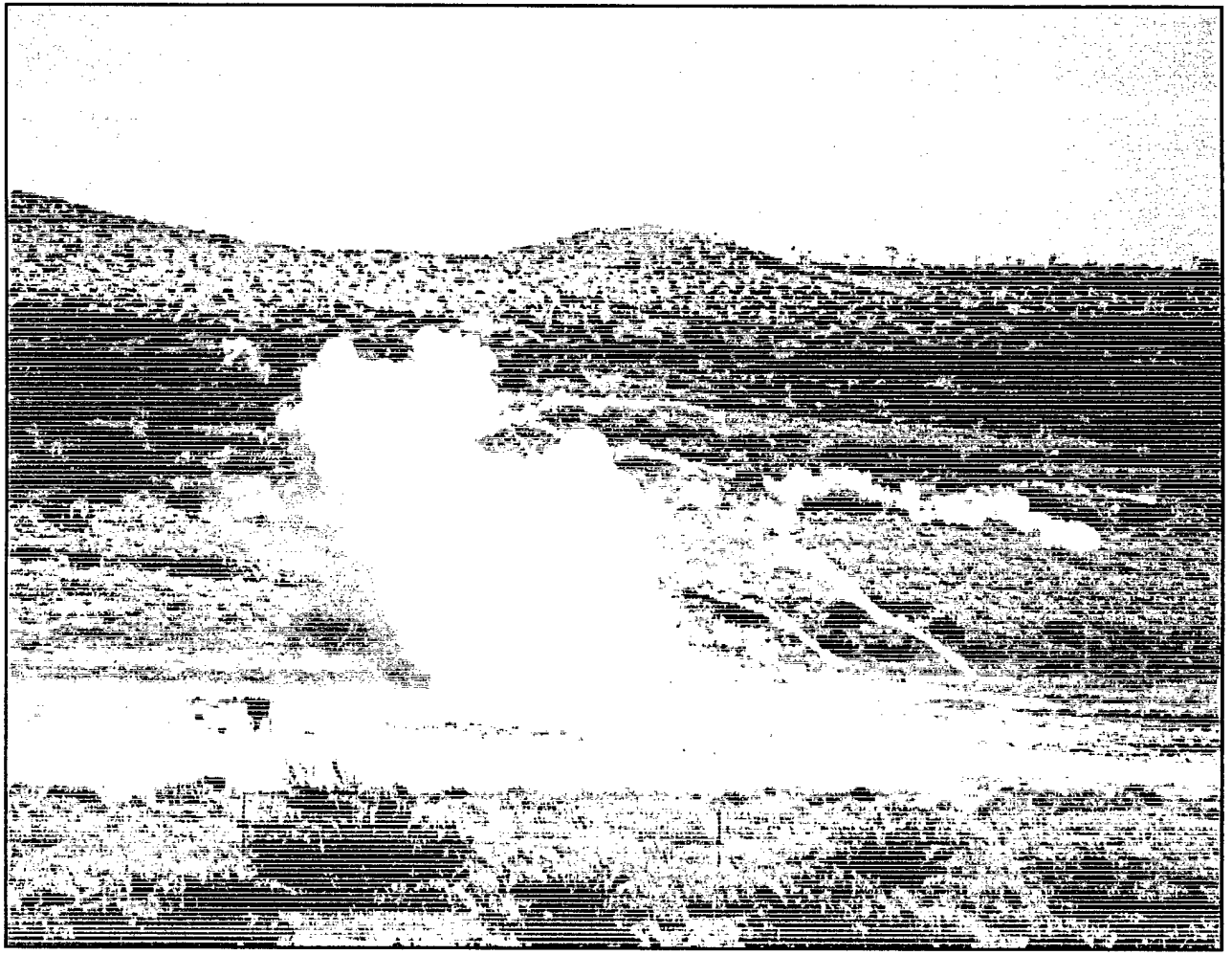
- Ground Level Testing
- Storable and Solid Propellant
- Detonation, High Hazard, and Explosive Studies
- 200 Foot Diameter Cleared Ground Pad
- 1-36D Pad, Maximum Explosive Capability
  - — 1M Lbs TNT Equivalent
- Ignition System
  - — Standard 28 VDC
  - — 5,000 VDC Explosive Bridgewire Circuit



TESTING HISTORY:

- PeaceKeeper Flight Termination Stage III
- Ammonium Percholorate
- Silo Fire Safety
- Space Launch Safety Studies
- Solid Propellant Hazards Study (SOPHY)
- Tool Drops on Minuteman Stage III

Motor Behavior Complex
Area 1-36, Detonation Test Pad D

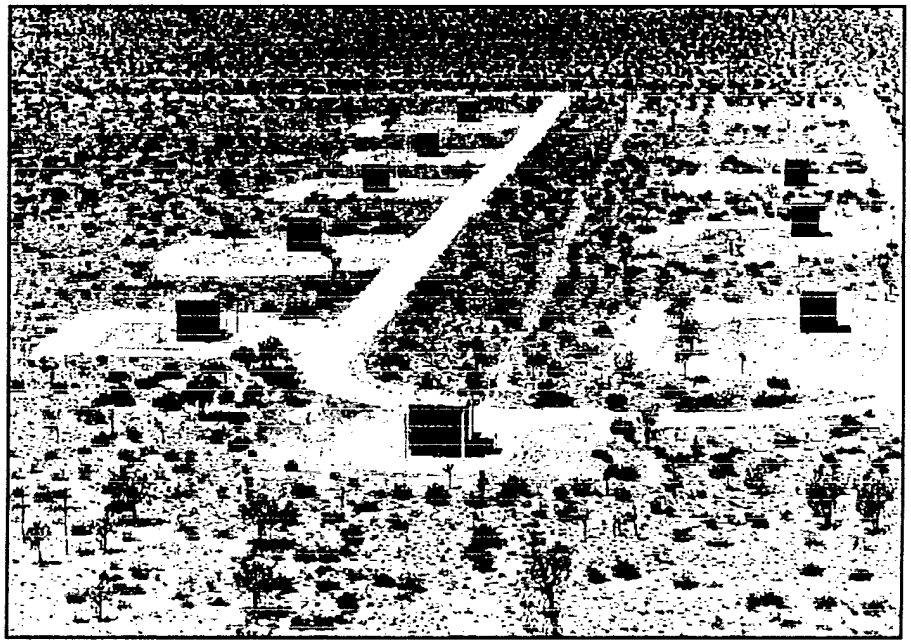


SuperHIPPO Motor Impact Studies 1992

Propellant Storage Area
Area 1-38

GENERAL CAPABILITIES:

- 9 Storage Buildings
  - — Each Building 24 Foot x 31 Foot
  - — 20 Foot Vertical Clearance
- Sited for 50,000 Lbs of 1.1 or 200,000 Lbs of 1.3 TNT Equivalent Propellant
- Environmental Capability
  - — Temperature
  - — Humidity



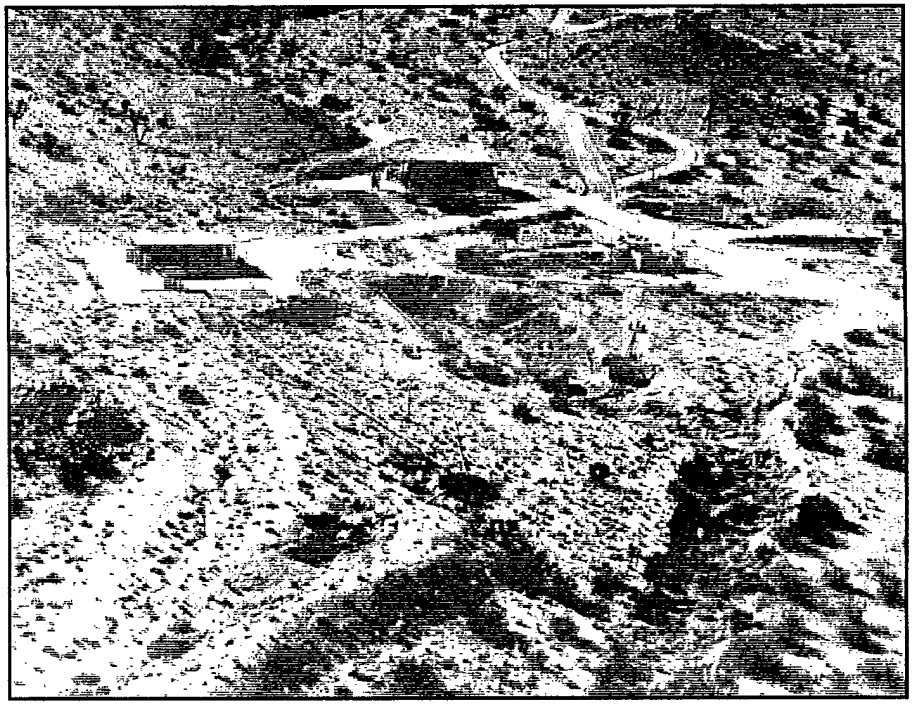
Liquid Propellant Aging Facility
Area 1-40

GENERAL AREA CAPABILITIES:

- Propellants Have Been Stored Since 1971
- 1,500 psi GN2 Cross Country Line
- 12 Inch Water Main
- 440 VAC Facility / Stand Power
- Mechanical Shop

TEST STAND CAPABILITIES:

- Pad A / B - Maximum Thrust 5,000 lbf.
  - — (Current Configuration) Inactive
  - — No Thrust Stand
  - — 2 Ton Overhead Crane Railing
- Pad C / D - Maximum Thrust 50,000 lbf.
  - — (Current Configuration) Inactive
  - — No Thrust Stand
  - — 2 Ton Overhead Crane Railing
- Mechanical Shop Aging Building
- Liquid Propellant Long Term Storage Studies
  - — CLF5 -- CLF3
  - — N2O4
- Firex System
- Portable Heating and Air Conditioning



TESTING HISTORY

- Bi-Propellant Oxidizer Feed System
- Tank Storability

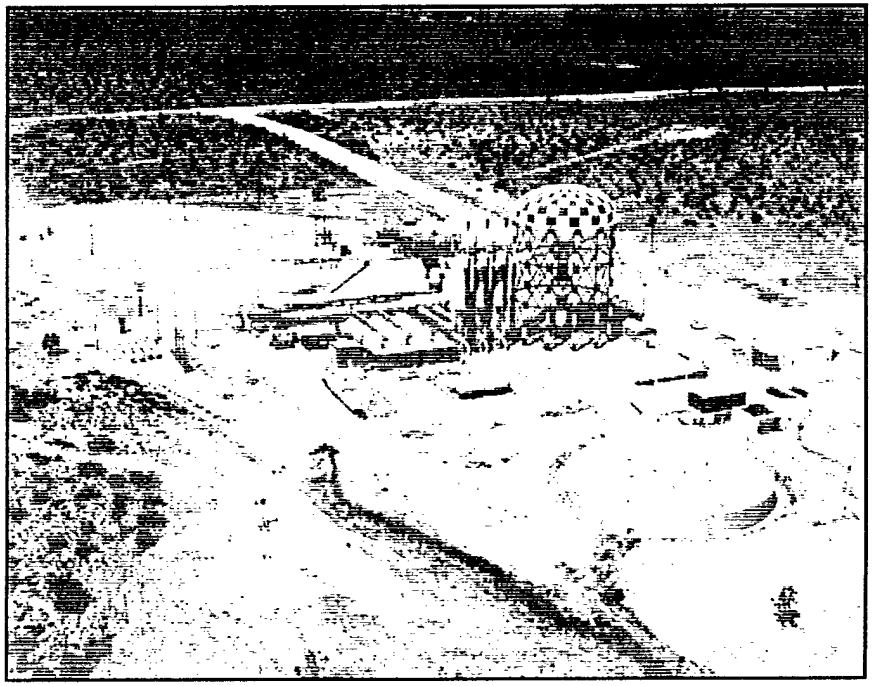
Space Environment Propulsion Complex Area 1-42

GENERAL AREA CAPABILITIES:

- Propane-Fired Steam / Vacuum System
  - — Altitude Simulation to 125,000 Feet (A,B,D Cells)
  - — Up to 1800 Seconds Duration
  - — Mass Flow 600Lb/Sec EWA 70
- Mechanical Pumped Vacuum Systems
  - — Altitude Simulation to 125,000 Feet E Cell
  - — Altitude Simulation to 650,000 Feet SPEF Chamber
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Data Acquisition and Control System
  - — 192 Channel, 100,000 Sample Per Second, Data System
  - — 256 Channel Programmable Logic Control System
- Mechanical Shop With 2 Ton Crane

TEST STAND CAPABILITIES: (CURRENT CONFIGURATION)

- Altitude Simulated Testing
- A Cell - 60,000 lbf. Thrust, Horizontal
- D Cell - 20,000 lbf. Thrust, Horizontal
- B Cell - 50,000 lbf. Thrust, Vertical
- SPEF Chamber, No Thrust



TESTING HISTORY

- Trident • Star 30 • ASAS • Agena
- XLR-132 • Centaur • EEC • Small ICBM
- Minuteman III • Composite Polar Boss • StarTech
- MSTI I / II / III • Viper • Hughes TTM/STM
- KEW (Kinetic Energy Weapon) • Gossamer Structures
- High Altitude Supersonic Target (HAST)
- TRSM Navy Third Stage Rocket Motor 1997

Space Environment Propulsion Complex Area 1-42

GENERAL AREA CAPABILITIES:

- Propane-Fired Steam / Vacuum System
  - 3 Parallel Stage, Ejectors, 9 Steam Bottles
  - 125,000 Feet Simulated Altitude (A,B,D Cells)
  - Up to 1800 Seconds Duration (9 Bottles)
  - Mass Flow Rates Approximately 600 Lb/Sec EWA 70
- Mechanical Pumped Vacuum Systems
  - 125,000 Feet Simulated Altitude E Cell
  - 650,00 Feet Simulated SPEF Chamber
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Data Acquisition and Control System
  - 192 Channel;, 100,000 Sample Per Second, Data System
  - 256 Channel Programmable Logic Control System
- Mechanical Shop With 2 Ton Crane

TEST CHAMBER CAPABILITIES:

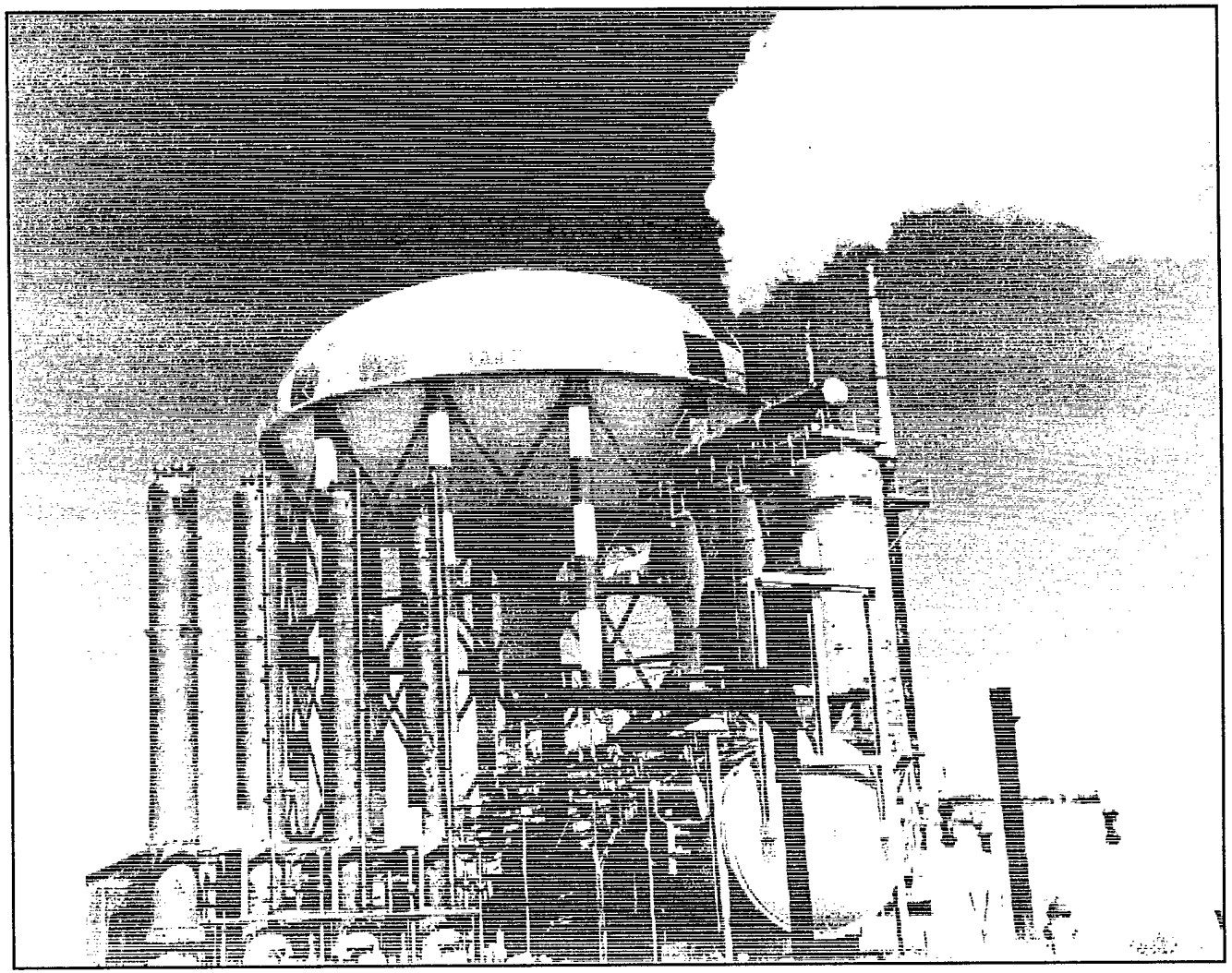
- Altitude Simulation Testing
- Environmental Conditioning
- A Cell - Maximum Thrust 60,000 lbf.
  - Chamber 12 Foot Diameter x 28 Foot Long
  - (Current Configuration) 50,000 lbf. Thrust, Horizontal
  - 66 Inch Diffuser (77 Inch Maximum)
  - Solid Motors up to 66 Inch Diameter x 18 Foot Long
  - 2 Each 5 Ton Overhead Cranes
  - 30K of TNT Equivalent Propellant

TEST CHAMBER CAPABILITIES (Cont):

- D Cell - Maximum Thrust 20,000 lbf.
  - Chamber 10.5 Foot Diameter x 25 Foot Long
  - (Current Configuration) 20,000 lbf.f Thrust, Horizontal
  - No Diffuser (55 Inch Maximum)
  - Solid Motors up to 48 Inch Diameter x 18 Foot Long
  - 5 Ton Overhead Crane
  - 30K of TNT Equivalent Propellant
- B Cell - Maximum Thrust 50,000 lbf.
  - Chamber 16 Foot Diameter x 28 Foot High
  - (Current Configuration) 4,500 lbf. Thrust, Vertical
  - 44 Inch Diffuser (44 Inch Maximum)
  - Solid Motors up to 48 Inch Diameter x 15 Foot Long
  - 30K of TNT Equivalent Propellant
- Chamber
  - Chamber 30 Foot Diameter
  - Solar Simulation
  - LN2 Cryogenic Panels

Space Environment Propulsion Complex Area 1-42

Space Environment Propulsion Complex Area 1-42

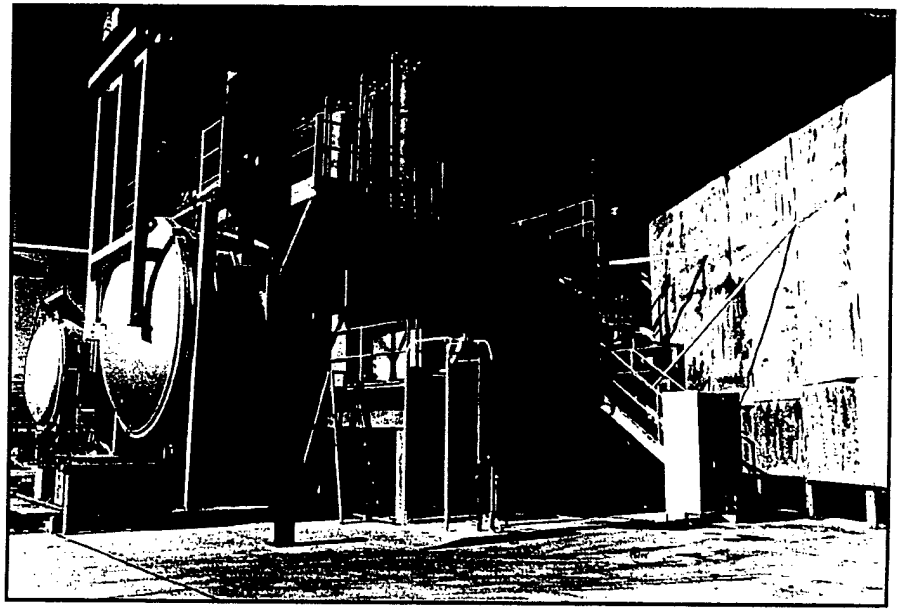


Area Steam Run

Horizontal Test Chamber Area 1-42, A Cell

TEST CHAMBER CAPABILITIES:

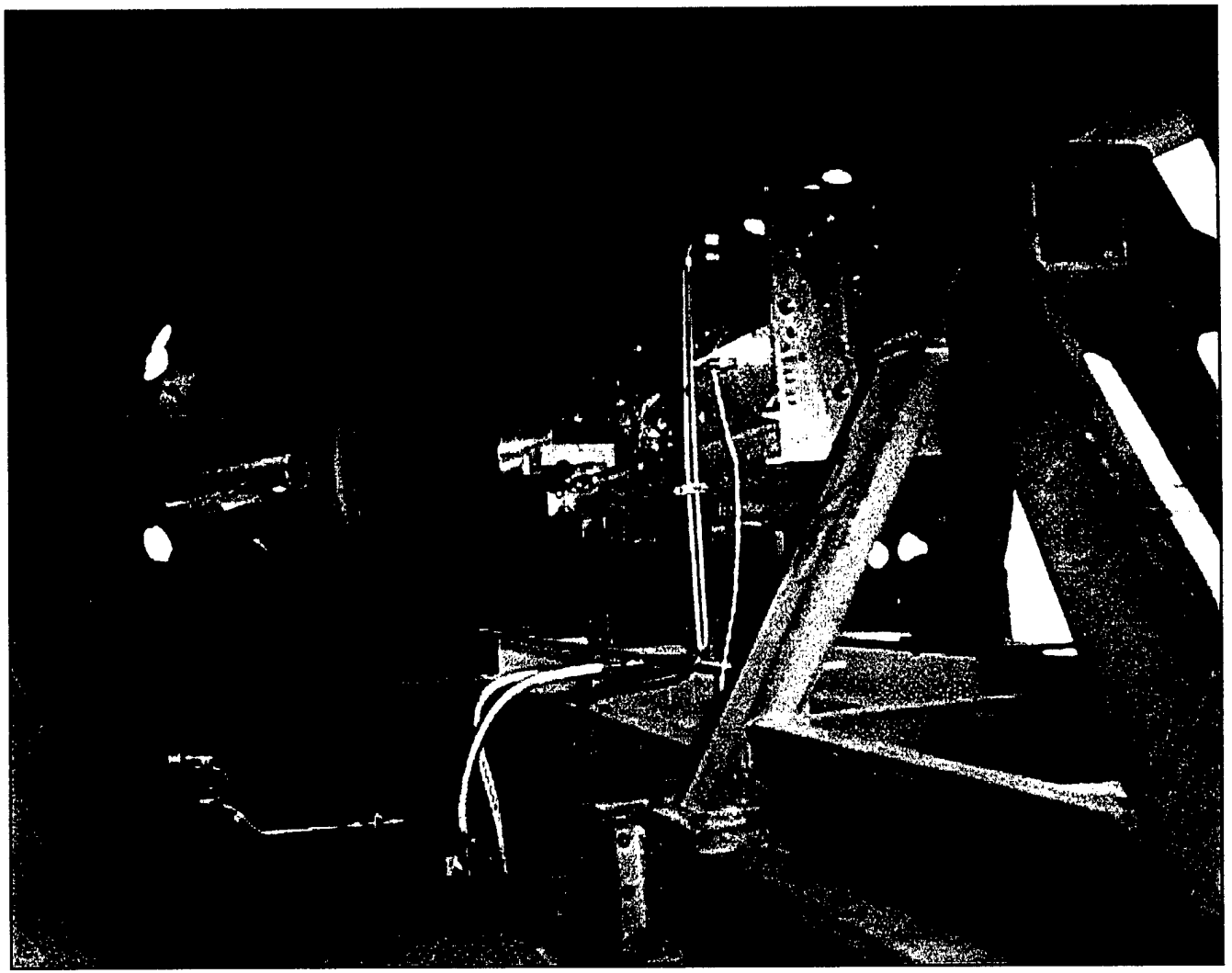
- Altitude Simulation to 125,000 Feet
- Maximum Thrust 60,000 lbf., Horizontal
  - — (Current Configuration) 50,000 lbf. Thrust, Horizontal
  - — Onboard Automatic Calibration System 99.9% Accuracy
  - — Motor Spin and IR Measuring Capability
  - — Six Component Capability
- Chamber 12 Foot Diameter x 28 Foot Long
  - — 2 Each, 5 Ton Overhead Crane
  - — Film Camera Portholes and In-Chamber Video
  - — 66 Inch Diffuser (77 Inch Maximum)
  - — Solid Motors Up to 66 Inch Diameter x 18 Foot Long
- Environmental Conditioning
  - — (-30 to + 120 Degrees F)
- 30K of TNT Equivalent 1.1 Class Propellant



TESTING HISTORY

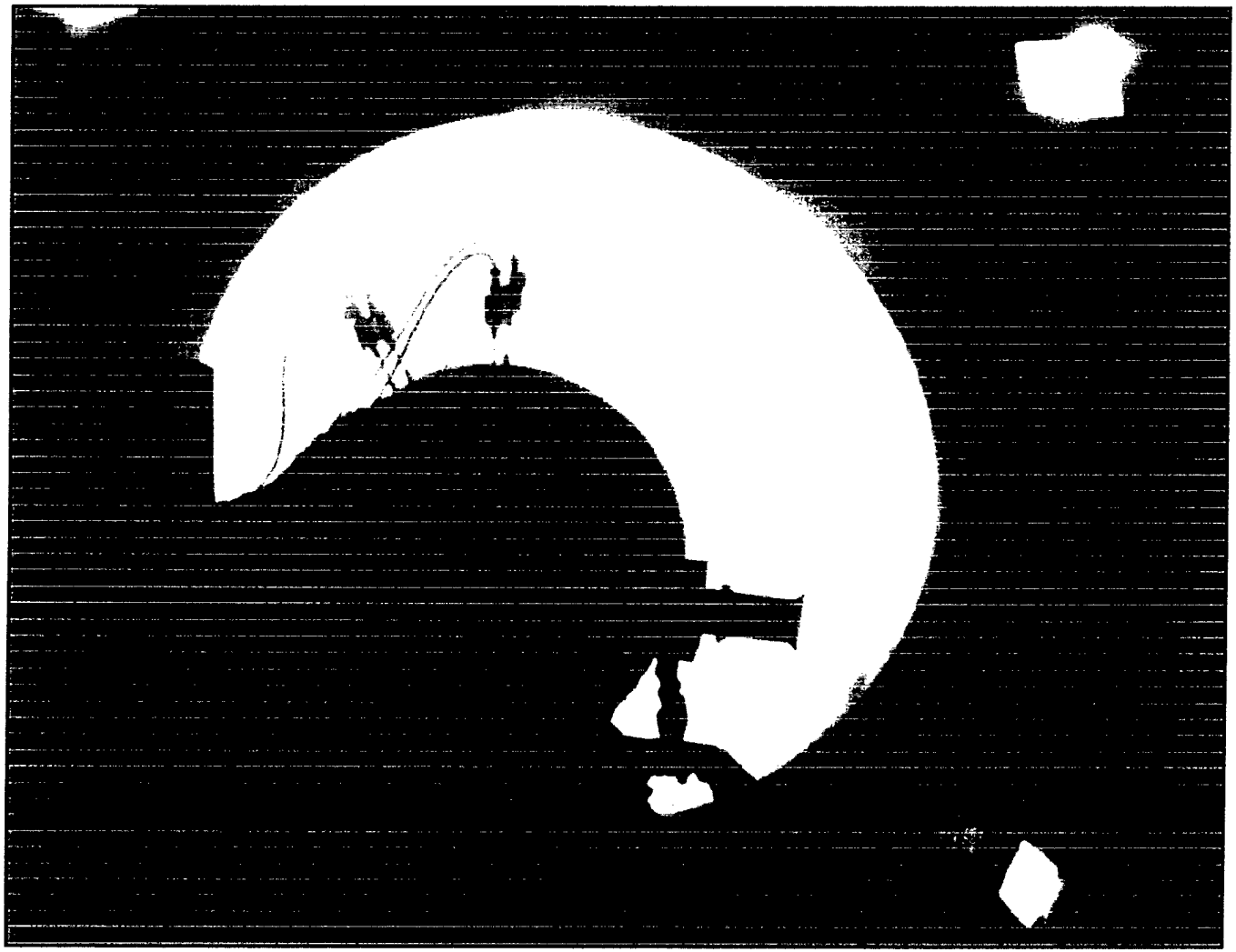
- Trident
- Composite Polar Boss 1990
- Minuteman III 1986
- Star 30
- Advanced Solid Axial Stage (ASAS)
- Extendible Exit Cone (EEC) 1980-1981
- High Altitude Supersonic Target (HAST) 1973
- Kinetic Energy Weapon (KEW)
- Advanced Integrated Stage (AIS) 1990
- Air Launched Space Booster 1979, 1983

Horizontal Test Chamber
Area 1-42, A Cell



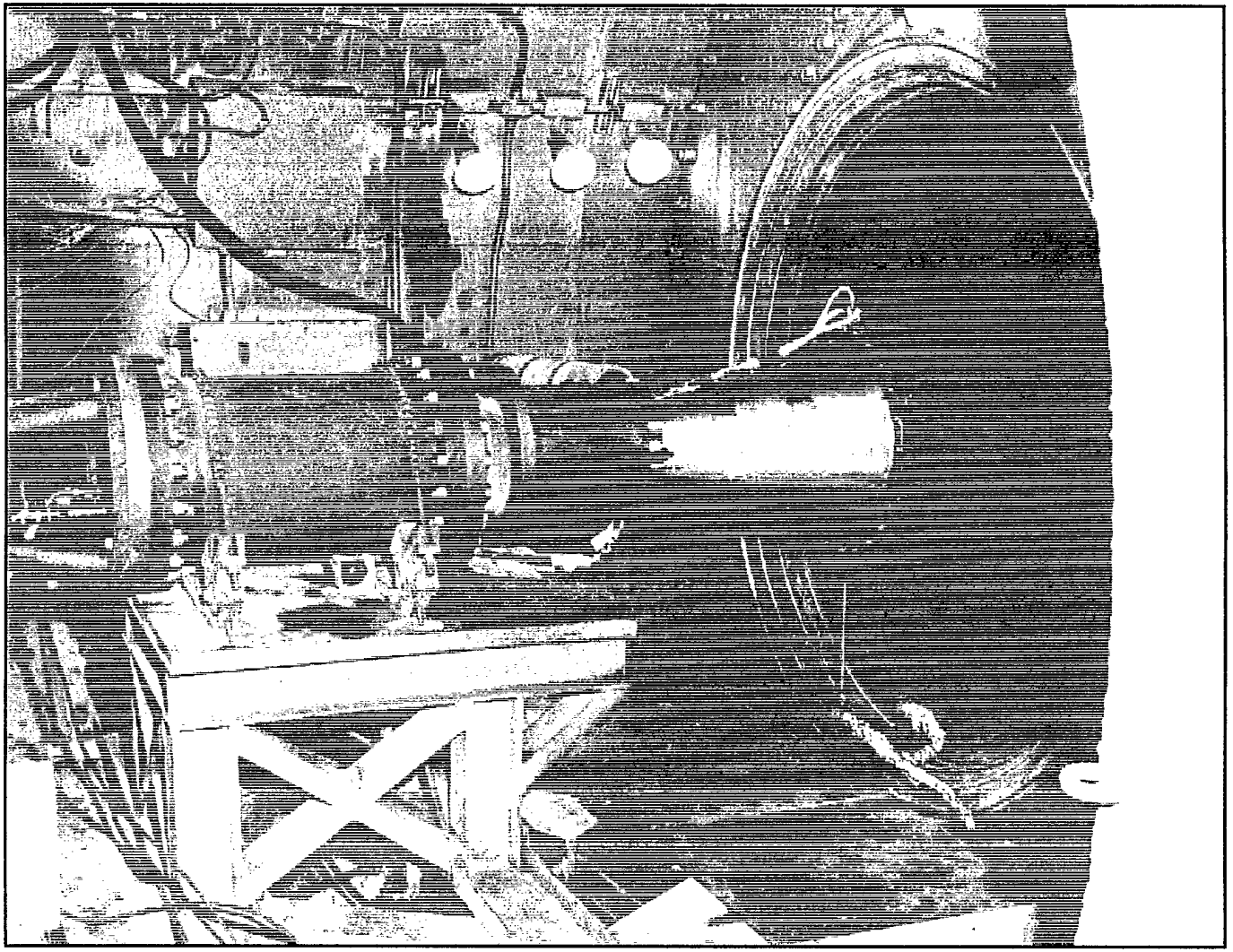
70 lb. Spin BATES

Horizontal Test Chamber
Area 1-42, A Cell



Minuteman III, Stage 3, 1986

Horizontal Test Chamber
Area 1-42, A Cell

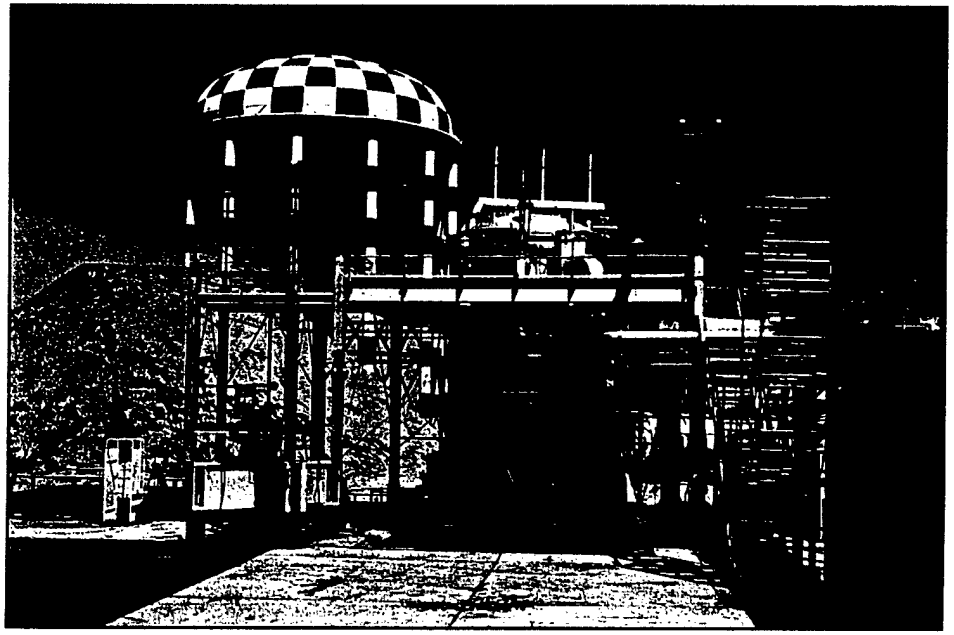


Bell Aerospace Extendible Exit Cone (EEC), 1977

Vertical Test Chamber Area 1-42, B Cell

TEST CHAMBER CAPABILITIES:

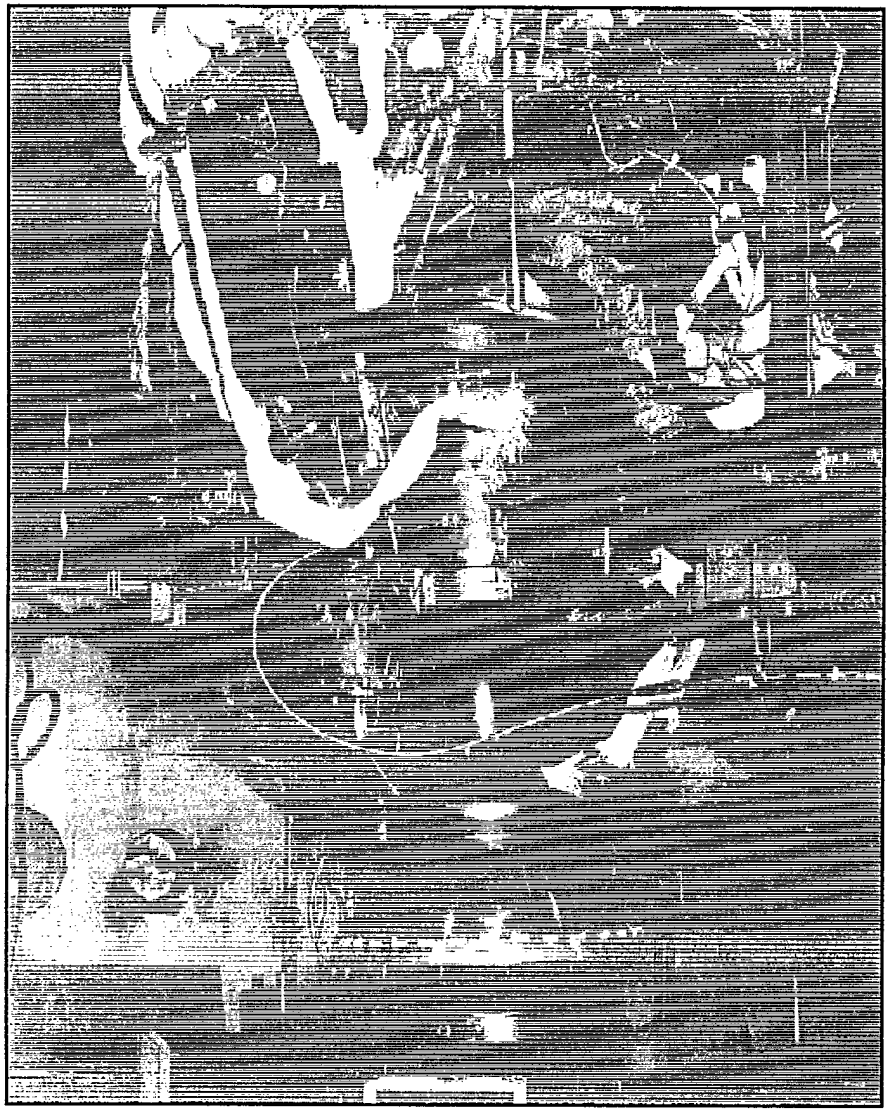
- Altitude Simulation to 125,000 Feet
- Maximum Thrust 50,000 lbf., Vertical, Nozzle Down
  - — (Current Configuration) 4,500 lbf. Thrust
  - — Onboard Automatic Calibration System 99.9% Accuracy
  - — Motor IR Measuring Capability
  - — Six Component Capability
- Chamber 16 Foot Diameter x 28 Foot High
  - — Film Camera Portholes and In-Chamber Video
  - — 44 Inch Diffuser
  - — Solid Motors Up to 48 Inch Diameter x 15 Foot Long
- 30K of TNT Equivalent 1.1 Class Propellant



TESTING HISTORY

- StarTech 1981
- XLR 132 1983-1992
- Trident C4 1974
- Agena 1975-1976
- TRSM Navy Third Stage Rocket Motor 1997

Vertical Test Chamber
Area 1-42, Chamber B



Agena Engine
1975-1976

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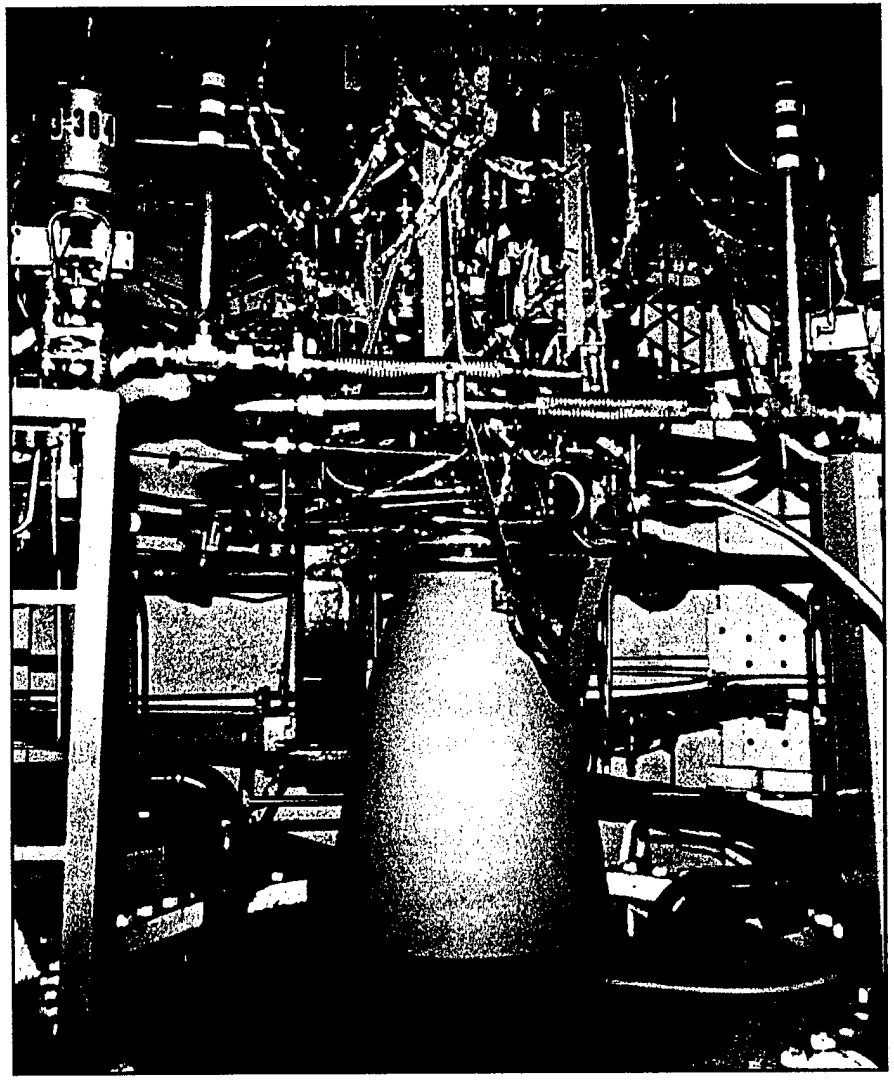
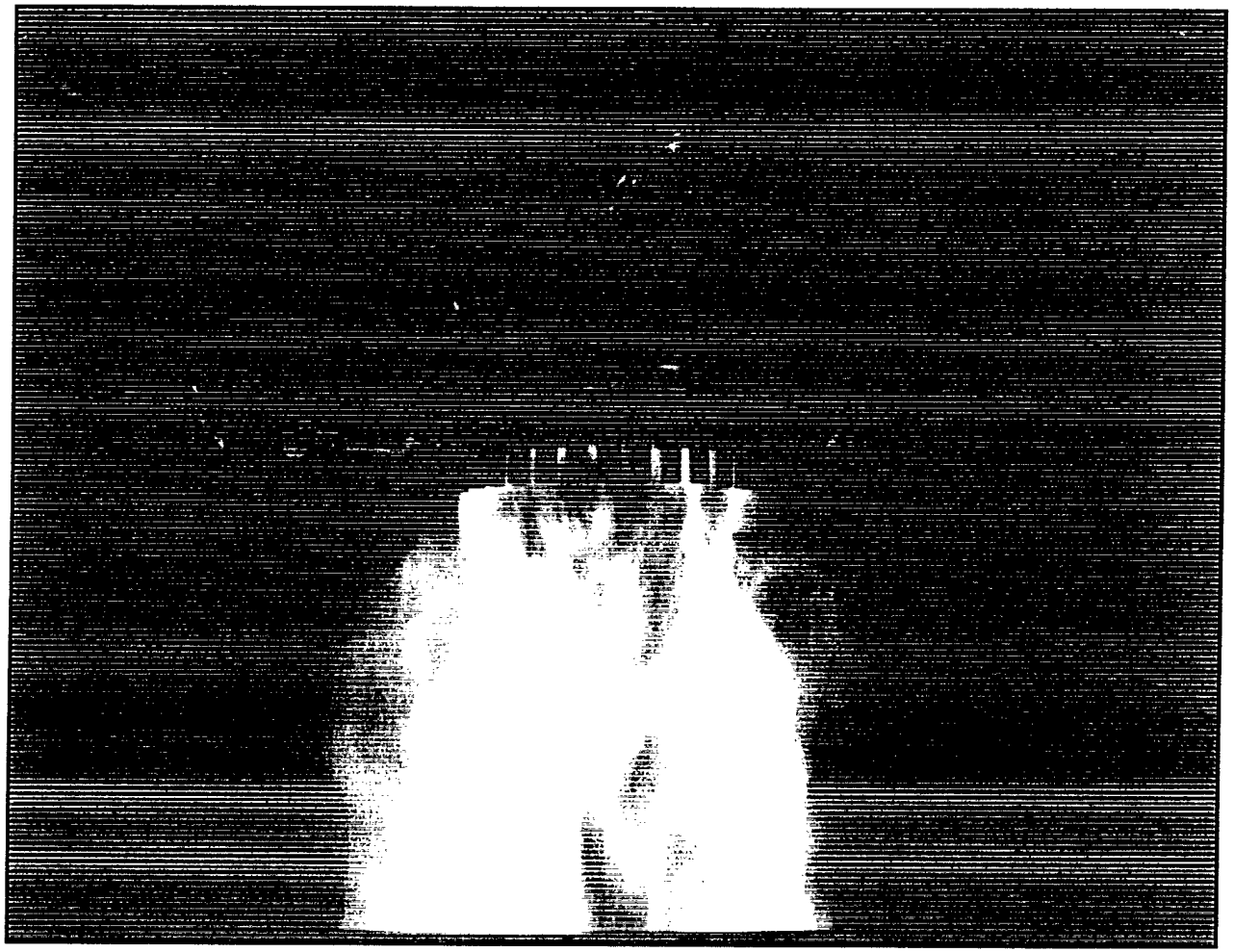
Vertical Test Chamber
Area 1-42, Chamber B



XLR-132 Engine,
1983-1992

Vertical Test Chamber
Area 1-42, Chamber B

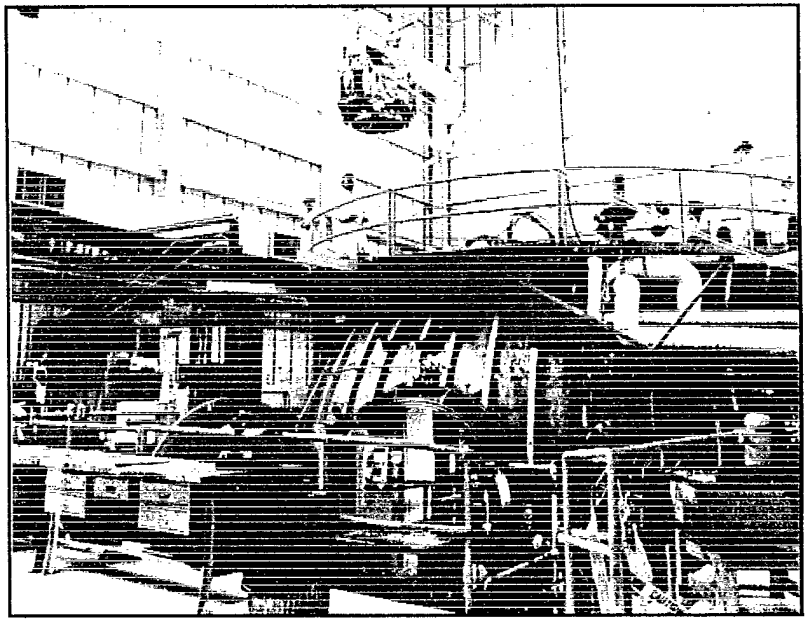


XLR-132 Engine,
1991

(SPEF) Test Sphere Area 1-42, C Cell

TEST SPHERE CAPABILITIES:

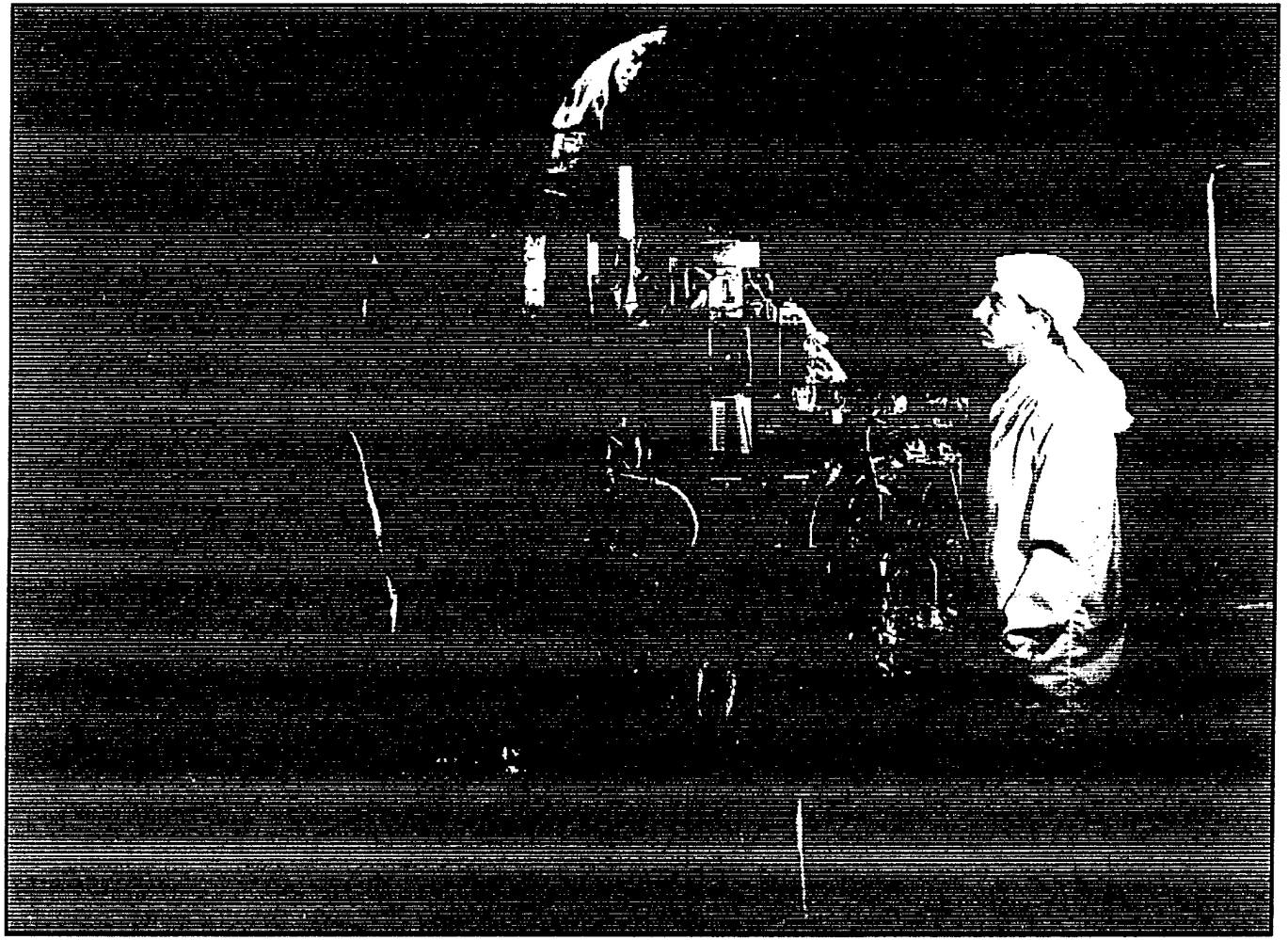
- Mechanical Pumped Vacuum System
  - Altitude Simulation to 650,000 Feet
- SPEF Operations Building
  - Houses the Test Sphere and Control Center
  - 60 Feet x 110 Feet x 51 Feet High
  - 60 Ton and 10 Ton Traveling Overhead Cranes
- Sphere 30 Foot Diameter
  - 19 Foot Diameter Removable Top Hatch
  - 8 Foot Diameter Side Access Hinged Door
  - LN2 Cryogenic Shroud to (-190 Degree C)
    - 20 Foot Diameter x 22 Foot High (With End Caps)
  - Radiant Heat IR Simulator (200 Watts/Square Foot)
  - Earth Albedo Simulator (Maintain +/- 5 Degree C)
    - 18 Foot Diameter Aluminum Disk With 99 Heater Elements
  - Film Camera Portholes and In-Chamber Video
  - Test Article Maximums
    - 100,000 Lbs, 16 Feet x 16 Feet x 20 Feet
  - 30K of TNT Equivalent 1.1 Class Propellant
- Data Acquisition and Control
  - 150 Channel Temperature Data System
  - 256 Channel Programmable Logic Control System



TESTING HISTORY

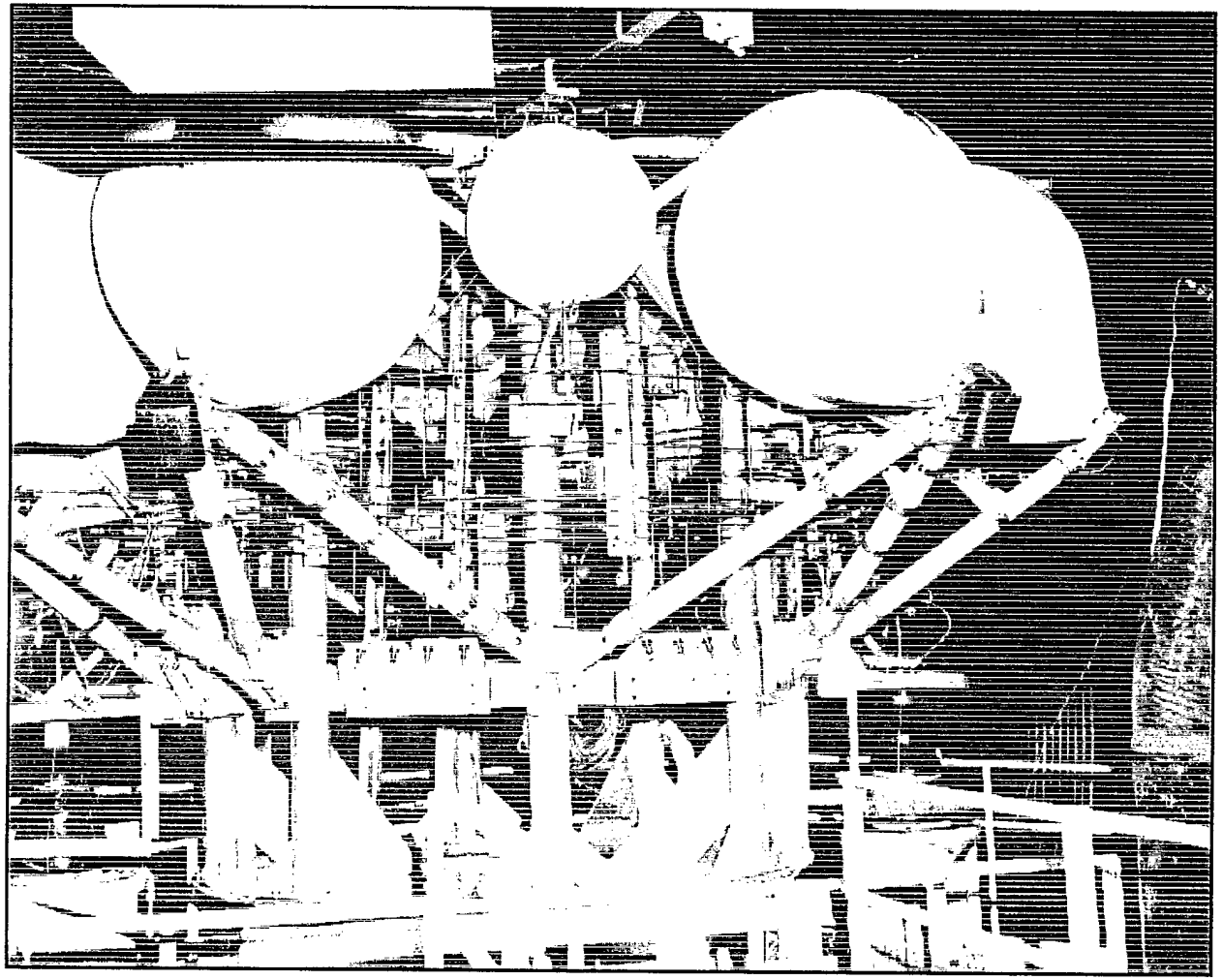
- Hughes TTM And STM
- Gossamer Structures
- Miniature Sensor Technology Integration (MSTI) Satellite I / II / III
- Centaur 1966
- Direct Chemical Laser (DCL) 1970-1974
- LASER Program (MESA) 1970-1974

(SPEF) Test Sphere Area 1-42



MSTI II, 1995

(SPEF) Test Sphere Area 1-42, C Cell

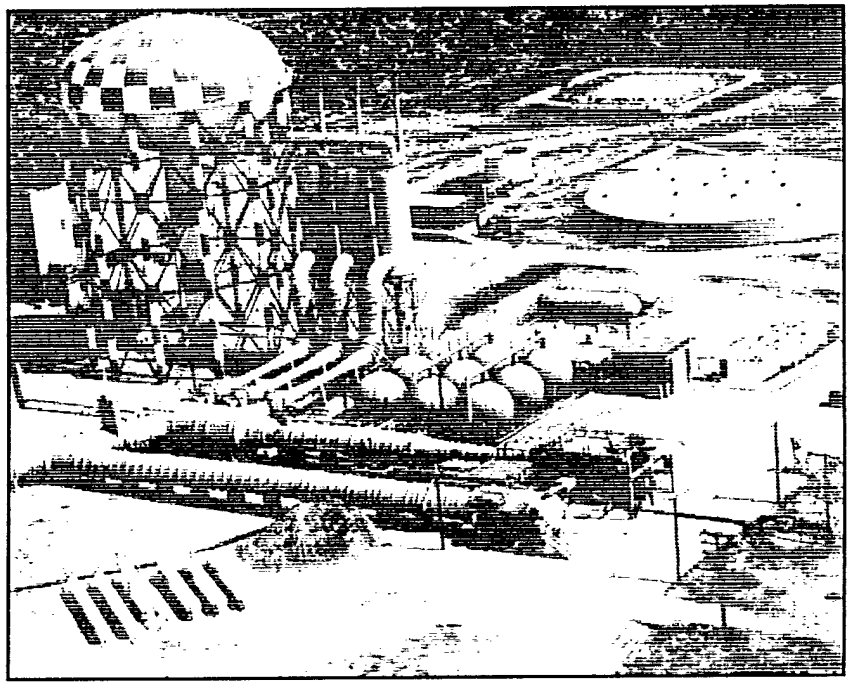


Hughes TTM/STM 1980

Horizontal Test Chamber Area 1-42, D Cell

TEST CHAMBER CAPABILITIES:

- Altitude Simulation to 125,000 Feet
- Maximum Thrust 20,000 lbf., Horizontal
  - (Current Configuration) 20,000 lbf. Thrust, Horizontal
  - Onboard Automatic Calibration System 99.9% Accuracy
  - Motor Spin and IR Measuring Capability
  - Six Component Capability
- Chamber 10.5 Foot Diameter x 25 Foot Long
  - 5 Ton Overhead Crane
  - Film Camera Portholes and In-Chamber Video
  - No Diffuser (55 Inch Diffuser)
  - Solid Motors Up to 48 Inch Diameter x 18 Foot Long
- Environmental Conditioning
  - (-30 to + 120 Degrees F)
- 30K of TNT Equivalent 1.1 Class Propellant



TESTING HISTORY

- Small ICBM
- Kinetic Energy Weapon (KEW)

Large Motor Operations Complex
Area 1-52

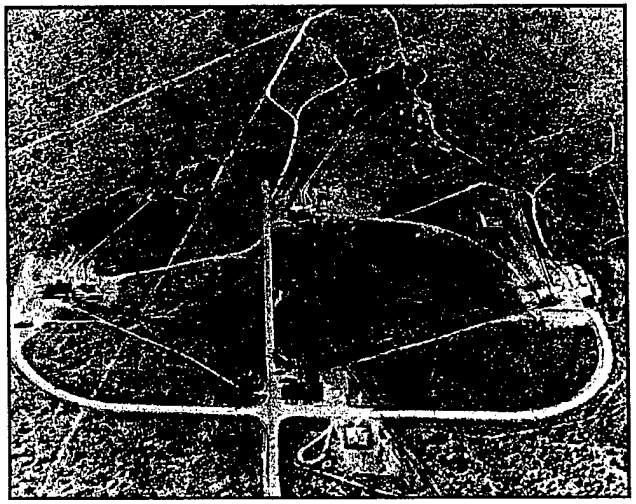
GENERAL AREA CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 8 Inch Water Main
- 440 VAC Facility and 28 VDC Stand Power
- Mechanical Shop
- 2 Assembly Buildings

TEST STAND CAPABILITIES:

(Current Configuration)

- Pad A - 50,000 lbf. Thrust
  - Horizontal or Vertical Firing
  - Liquid Engines or Solid Motors
- Pad B - No Thrust Stand
  - Horizontal or Vertical Firing
  - Solid Motors
- Pad C - 5,000 Lbf. Thrust
  - Hydrostatic Bearing Test Rig
  - Horizontal Orientation
  - Liquid Hydrogen Operations
- Pad D - No Thrust Stand
  - 250 Horsepower Commercial Air Conditioning System
  - Refrigerant Operations



TESTING HISTORY

- Liquid Fluorine Engine. 1969
- Graphite Overwrap Vessel, 1990
- Minuteman III, PAN Nozzle, 1989-1991
- Short Length SuperHIPPO, (SLSH), 1977-1983
- Minuteman III, Stage 3, Advanced Nozzle, 1983-1991
- Minuteman III, Stage 2, 1983-1989
- PeaceKeeper, Stage 3, 1982
- Bull Pup, 1982
- F-16 Hydrazine Tank Test
- Titan Cook Off, 1985
- STAR TEC, 1984-1985
- Kevlar Tank Tests, 1986
- Linear Areospike SR-71 Experiment LASRE, 1996
- Turbopump Component Technologies 1989-1996
- R134a Carrier Dual Use Technologies 1996-1997

Large Motor Operations Complex
Area 1-52

GENERAL AREA CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 8 Inch Water Main
- 440 VAC Facility and 28 VDC Stand Power
- 192 Channel Data Acquisition and 256 Channel Control System
- Mechanical Shop
- 2 Assembly Buildings

TEST STAND CAPABILITIES:

- Ground Level Testing
- Environmental Conditioning
- Pad A - Maximum Thrust 1,000,000 lbf.
  - (Current Configuration) 50,000 lbf. Thrust
  - Horizontal or Vertical Firing
  - Assembly Building
  - 77,000 lbs of TNT Equivalent Propellant
- Pad B - Maximum Thrust 1,000,000 lbf.
  - (Current Configuration) No Thrust Stand
  - Horizontal or Vertical Firing
  - 77,000 lbs of TNT Equivalent Propellant

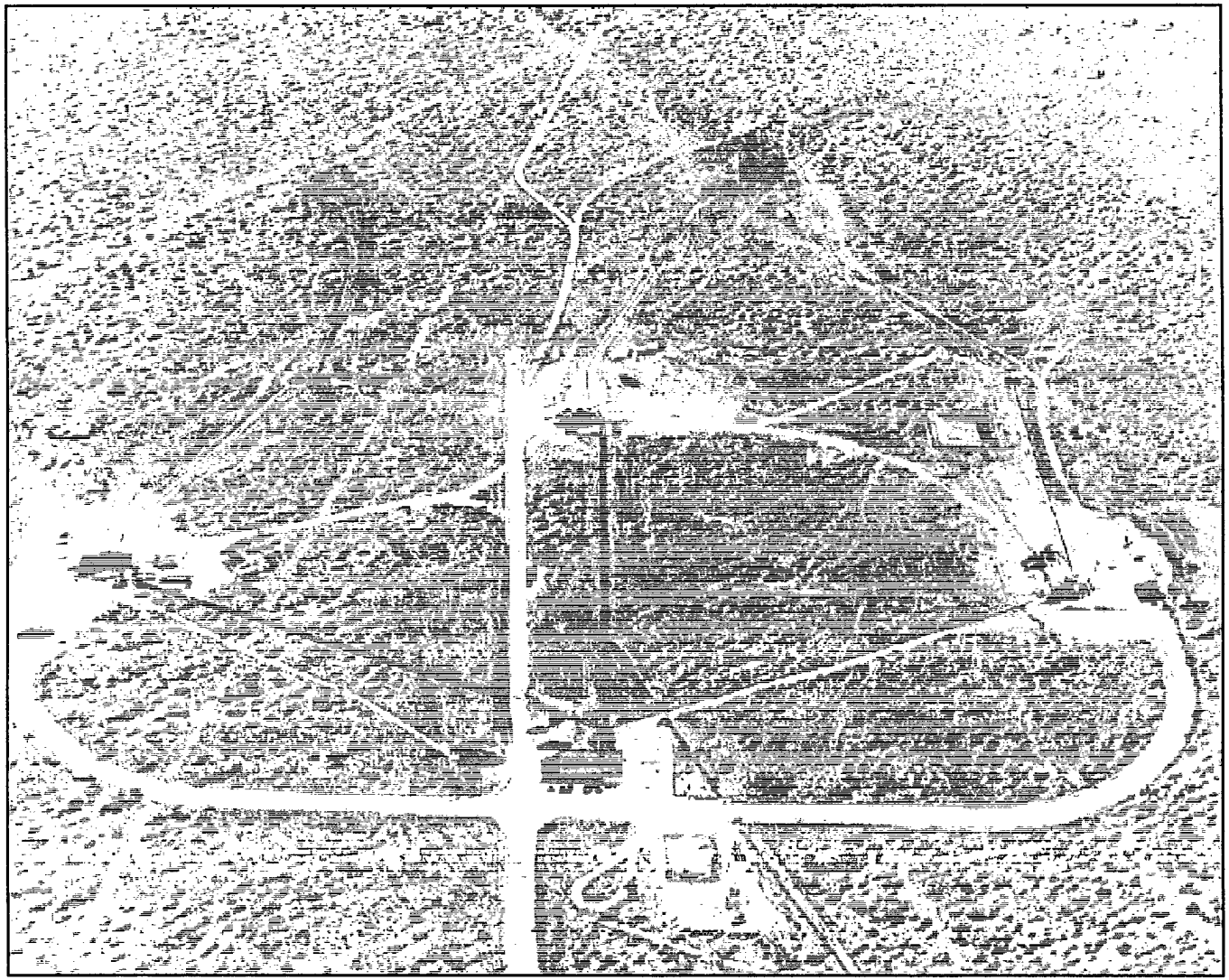
TEST STAND CAPABILITIES (Cont):

- Pad C - Maximum Thrust 1,000,000 Lbf.
  - (Current Configuration) 5,000 lbs. Thrust
  - Horizontal Orientation
  - Hydrostatic Bearing Test Rig
  - 70,000 lbs of TNT Equivalent Propellant
- Pad D - Maximum Thrust 1,000,000 lbf.
  - (Current Configuration) No Thrust Stand
  - 250 Horsepower Commercial Air Conditioning System
  - 70,000 lbs of TNT Equivalent Propellant
  - C/D Stand Assembly Building

TESTING HISTORY

- Liquid Flourine Engine. 1969
- Minuteman III, Pan Nozzle, 1989-1991
- Short Length SuperHIPPO, (SLSH), 1977-1983
- Minuteman III, Stage 3, Advanced Nozzle, 1983-1991
- Minuteman III, Stage 2, 1983-1989
- Graphite Overwrap Vessel, 1990
- PeaceKeeper, Stage 3, 1982
- Titan Cook Off, 1985
- STAR TEC, 1984-1985
- Bull Pup, 1982
- F-16 Hydrazine Tank Test
- Kevlar Tank Tests, 1986
- Linear Areospike SR-71 Experiment LASRE, 1996
- Turbopump Component Technologies 1989-1996
- R134a Carrier Dual Use Technology 1996-1997

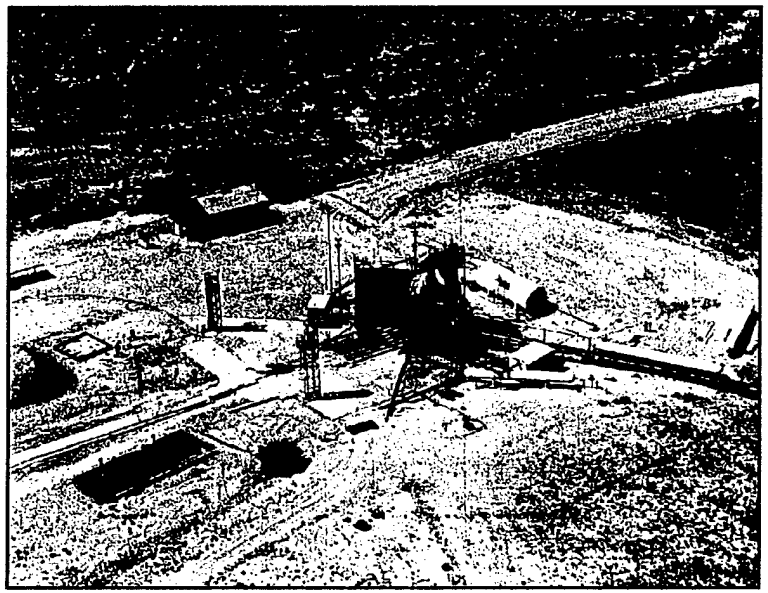
Large Motor Operations Complex
Area 1-52



Rocket Motor Test Stand
Area 1-52, Test Stand A

TEST STAND A CAPABILITIES:

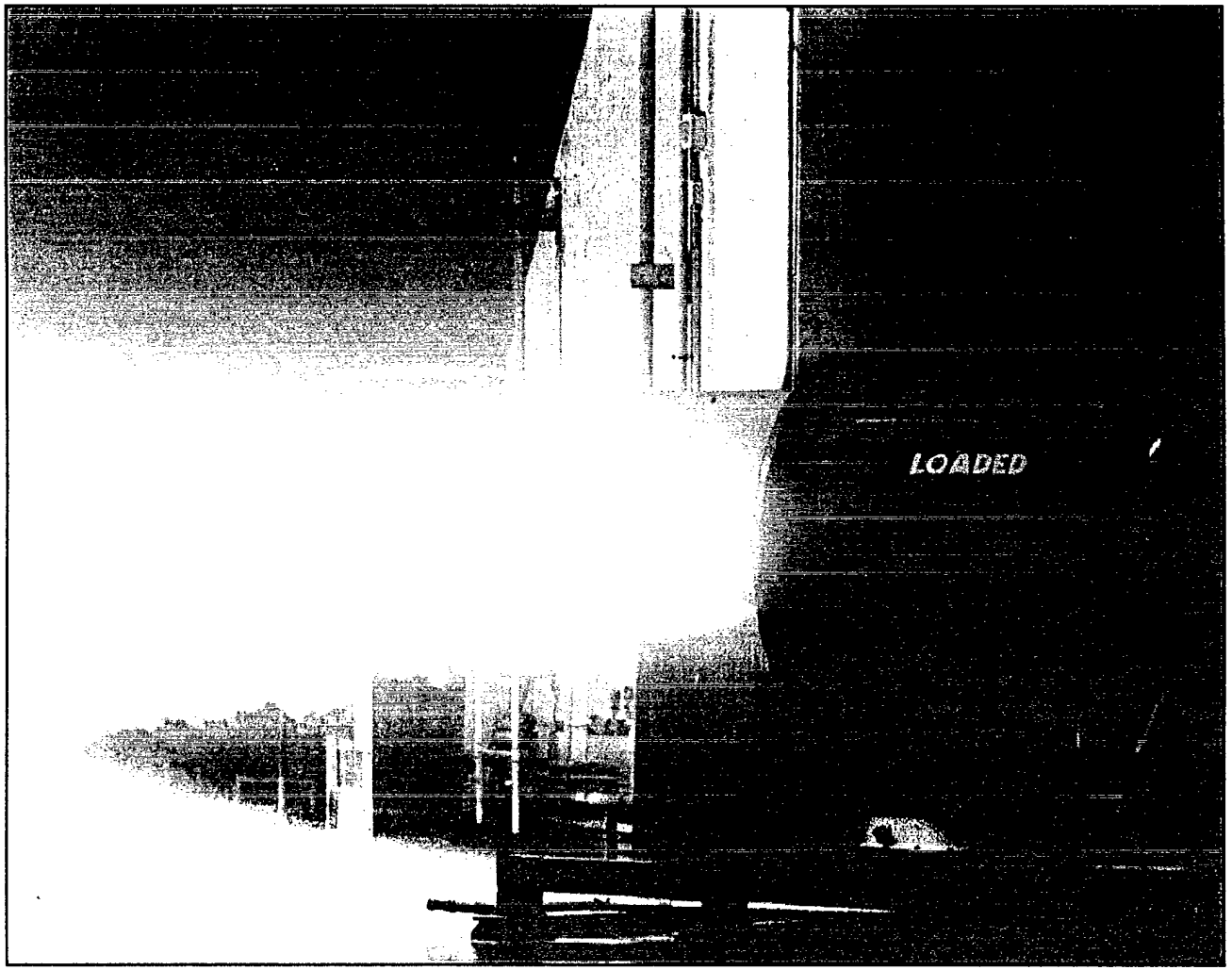
- Ground Level Testing
- Storable, Cryogenic, and Solid Propellant
- 30' x 45' x 5' Concrete Pad
- Horizontal or Vertical Firing
- Maximum Thrust 1,000,000 lbf.
- (Current Configuration)
  - 50,000 lbf. Thrust Stand
  - Horizontal, Single Axis
- 77,000 lbs of TNT Equivalent Propellant



TESTING HISTORY

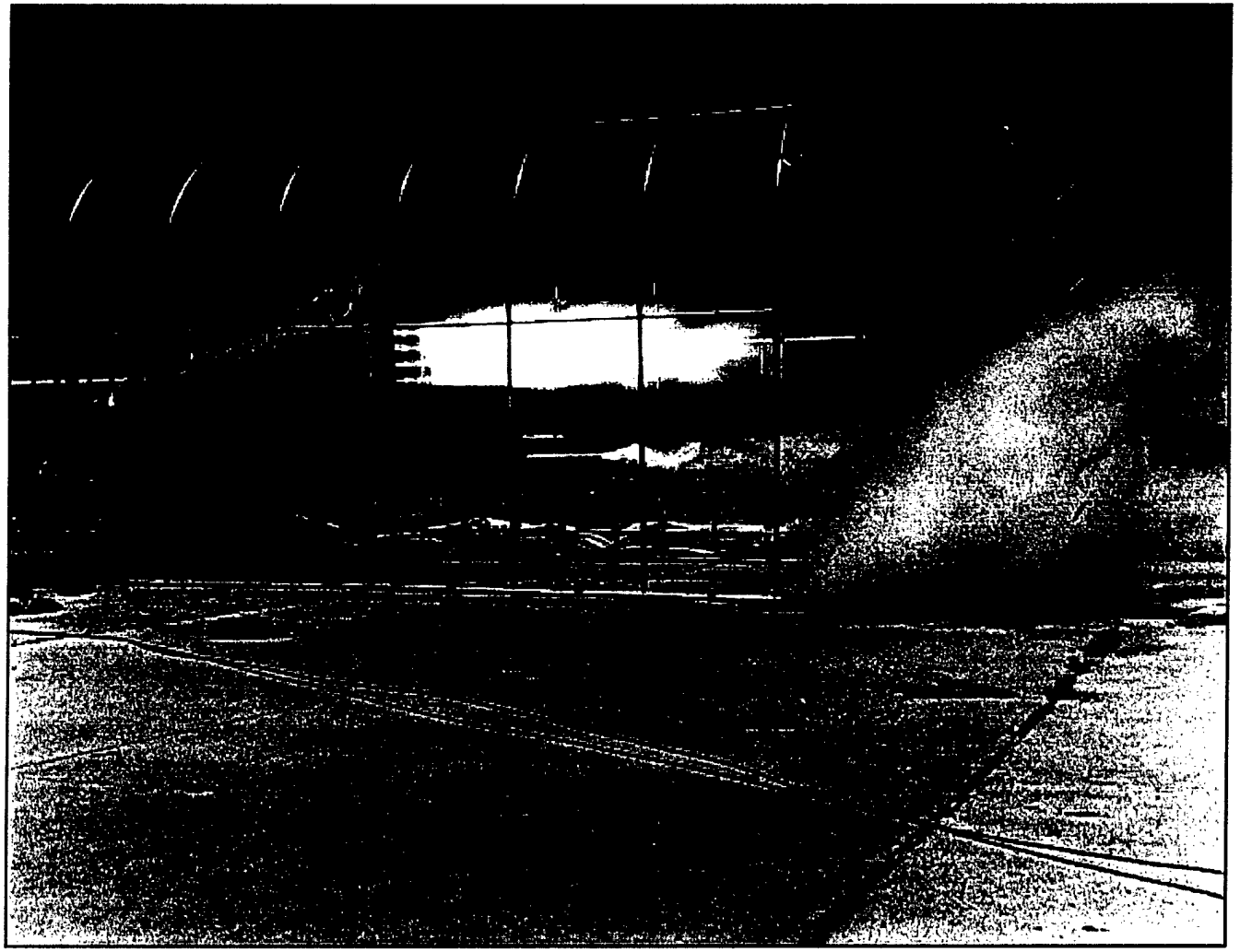
- Liquid Fluorine Engine. 1969
- Minuteman III, PAN Nozzle, 1989-1991
- Short Length SuperHIPPO, (SLSH), 1977-1983
- Zirconium Replacement Studies, 1983-1985
- Minuteman III, Stage 2, 1983-1989
- Small ICBM (SICBM) 1989
- F-16 Hydrazine Tank Test
- Motor Influence 1977
- Joint Live Fire 1986
- Linear Areospike SR-71 Experiment LASRE, 1996

Large Motor Operations Complex, Pad A



Minuteman III, Stage 3, 1985

Large Motor Operations Complex, Pad A

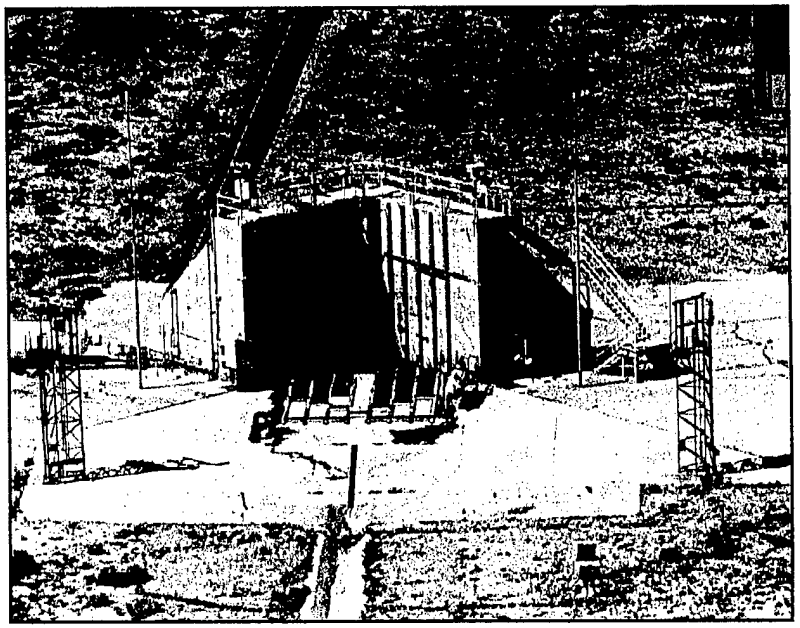


Linear Aerospike SR-71 Engine, 1997

Large Motor Test Stand
Area 1-52, Test Stand B

TEST STAND B CAPABILITIES:

- Ground Level Testing
- Storable and Solid Propellant
- 30' x 45' x 5' Concrete Pad
- Horizontal or Vertical Firing
- Maximum Thrust 1,000,000 lbf.
- (Current Configuration)
  - No Thrust Stand
- 77,000 lbs of TNT Equivalent Propellant



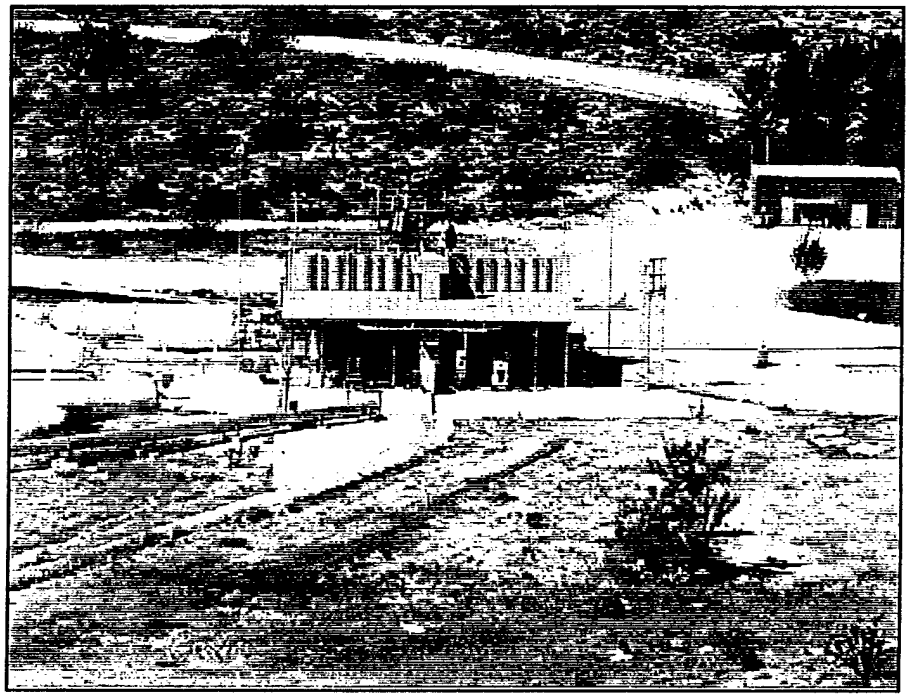
TESTING HISTORY

- Special High Performance Ignition Technology (SHIPIT). 1983
- Minuteman III, Stage 3, Advanced Nozzle, 1983-1991
- Minuteman III, Stage 2, 1983-1989
- PeaceKeeper Design Margin, 1988
- PeaceKeeper, Stage 3, 1982
- CHAR Motor 1980
- Titan Cook Off, 1985
- Bull Pup, 1982
- 84 Inch CHAR Motor, 1980-1981

Large Motor Test Stand
Area 1-52, Test Stand C

TEST STAND C CAPABILITIES:

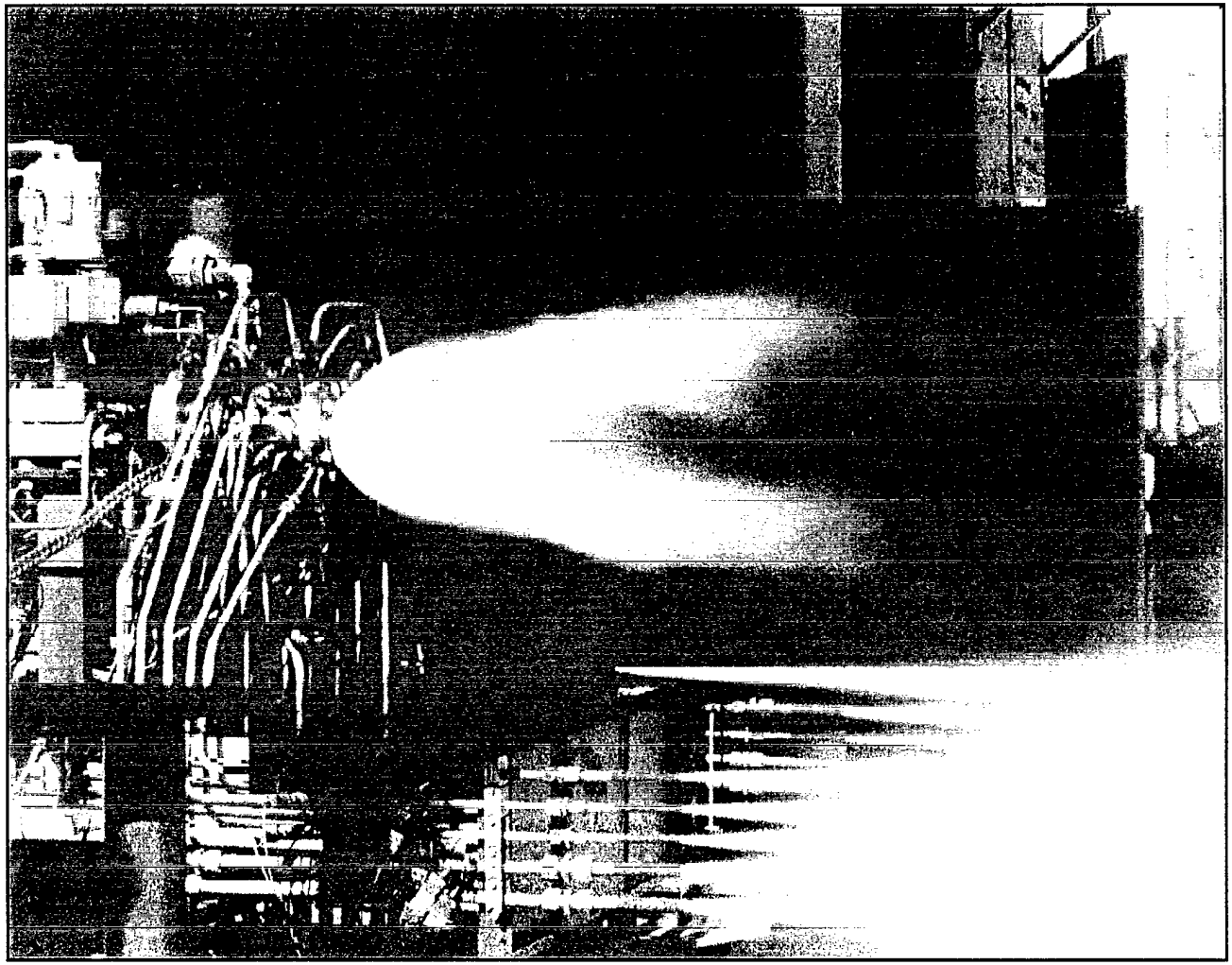
- Modified for High Pressure Cryogenic or Steel Bearing Material Testing
- Ground Level Testing
- Storable, Cryogenic, and Solid Propellant
- 28' x 30' x 5' Concrete Pad
- Horizontal Orientation
- Maximum Thrust 1,000,000 lbf.
- (Current Configuration)
  - 5,000 Lbf Thrust Stand
  - Hydrostatic Bearing Test Rig
- 77,000 lbs of TNT Equivalent Propellant
- Hydrogen Burn Stack; 16 Lb/Mass Per Second



TESTING HISTORY

- Nose Tip Testing, 1972-1980
- Graphite Overwrap Vessel, 1990
- STAR TEC, 1984-1985
- Turbo Pump Component Technologies 1989-1996
- R134a Carrier Dual Use Technologies 1996-1997

Large Motor Operations Complex, Pad C

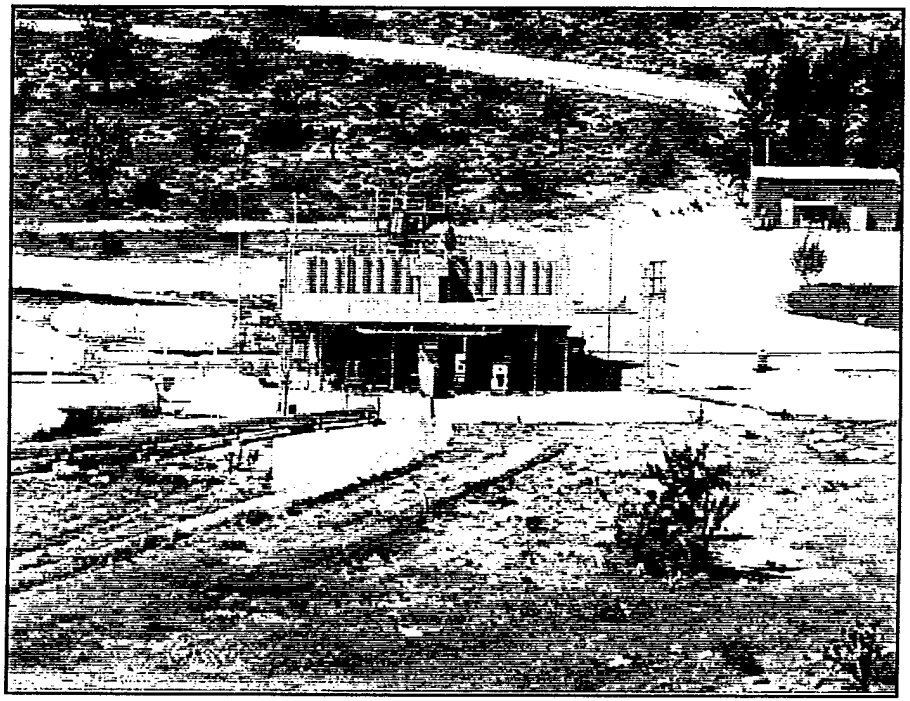


ABRES Nosetip Chamber Assembly, 1972 - 1980

Large Motor Test Stand
Area 1-52, Test Stand D

TEST STAND D CAPABILITIES:

- Modified for High Pressure Commercial Air Conditioning Testing
- Ground Level Testing
- Storable, Cryogenic, and Solid Propellant
- 28' x 30' x 5' Concrete Pad
- Horizontal Orientation
- Maximum Thrust 1,000,000 lbf.
- (Current Configuration)
  - No Thrust Stand
- 77,000 lbs of TNT Equivalent Propellant



TESTING HISTORY

- Kevlar Tank Tests, 1986
- Carrier Air Conditioner (ARPA), 1996

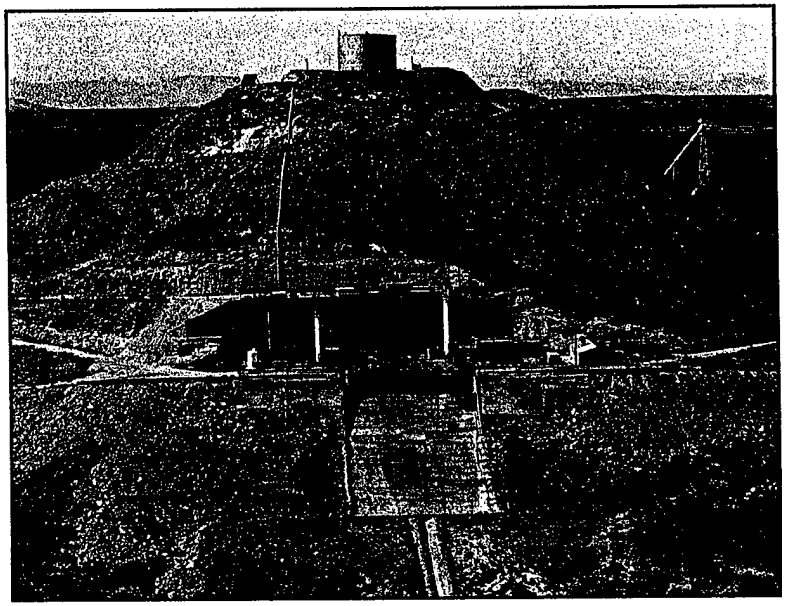
High Thrust Facility
Area 1-56

GENERAL AREA CAPABILITIES:

- 6,000 psi GN2 Cross Country Line, 6,000 psi
- 6 Inch Water Main
- 1 Million Gallon Deluge Water Storage
- 440 VAC and 28 VDC Stand Power
- SHOPS:
  - Control Sta., 5,000 Sq. Ft.
  - Mechanical, 2 ea., 5,000 Sq. Ft.
- Currently Configured for LOX Hybrid Rocket Testing
- TEST RESTRICTIONS: 3 to 7 Knots Wind Corridor

TEST STAND CAPABILITIES:

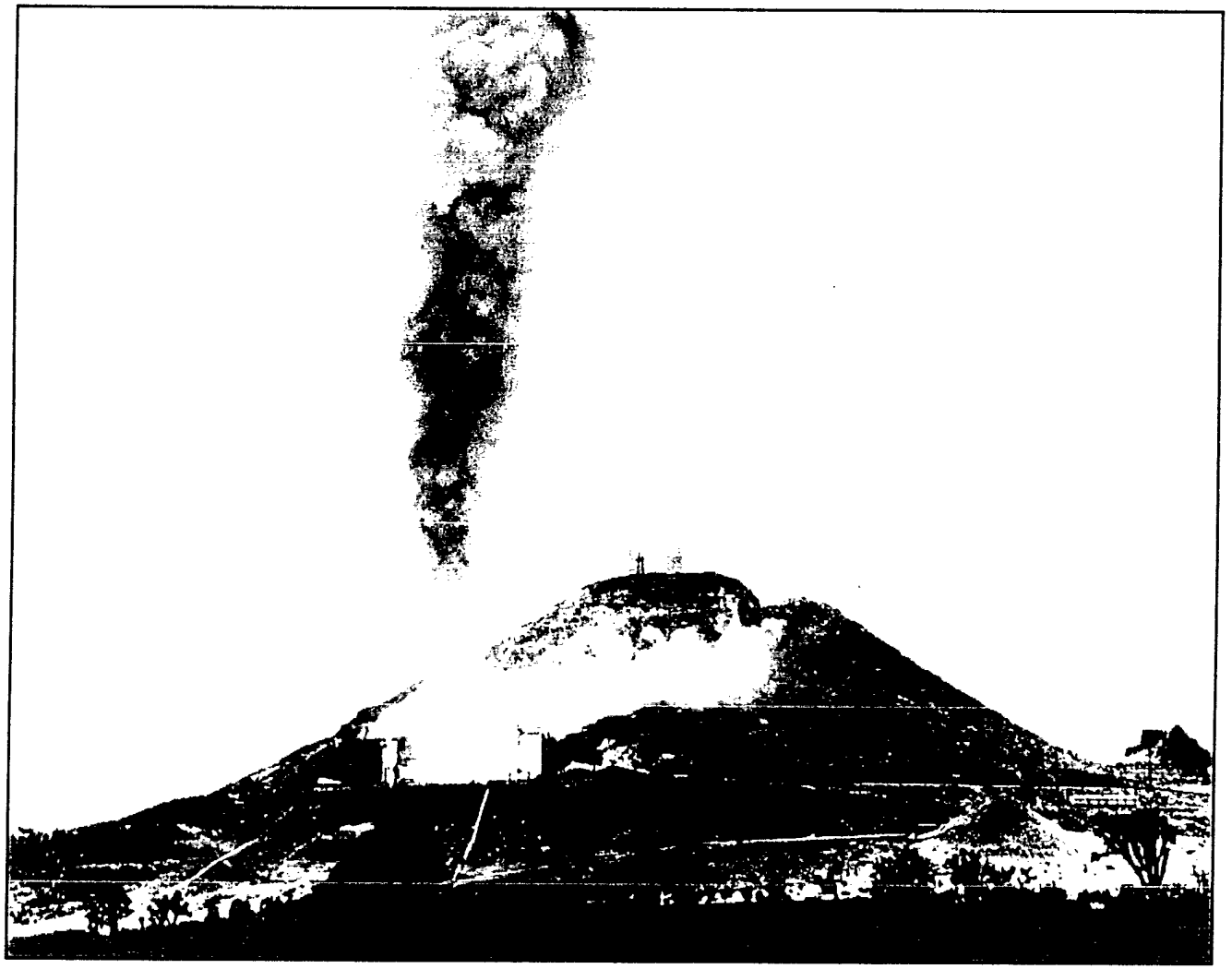
- Ground Level Testing
- Cryogenic; Storable; Solid
- Maximum Thrust, 10,000,000 lbs
  - Current Configuration
    - 450,000 lbf Thrust, Vertical, Nozzle Up, Six-component
    - 400,000 lbf Thrust, Horizontal, Six-Component
      - Maximum Downward Displacement 15 Degrees
- 2,500,000 lbs Class 1, TNT Equivalent
- GN2 Vessels, 4 ea., 270 cu. ft., 6,600 psi
- Run Vessels, 2 ea, 9,000 and 12,000 gal.



TESTING HISTORY

- Extended Length SuperHIPPO (ELSH)
- Big Dumb Booster (Low Cost, High Thrust, Space Shuttle Alternative)
- AMROC Hybrid 1995
- Railroad Tank Car (Propane Relief Valve)
- X-33 Launch Facility 1997

High Thrust Facility



Extended Length Super HIPPO, 1985

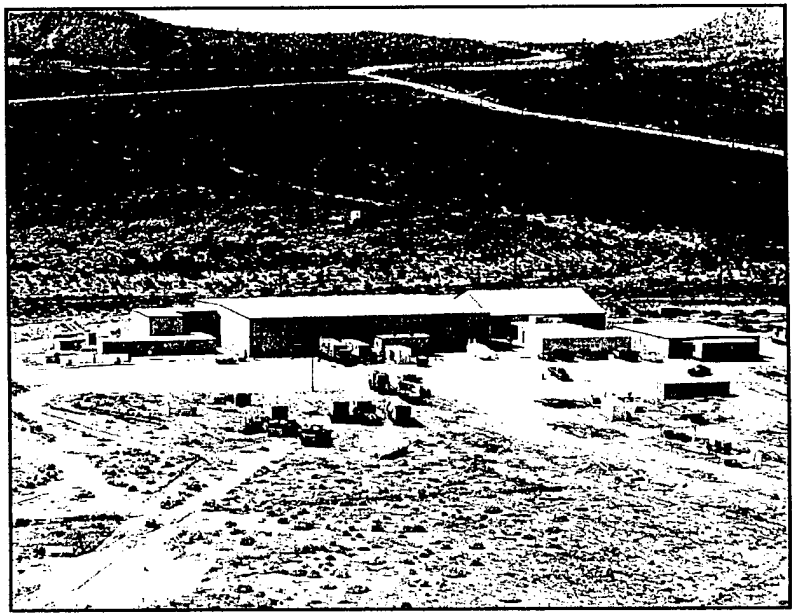
Satellite Test & Integration Facilities Area 1-90

DESIGNED CAPABILITY:

- Designed to Hold Three Small Satellites Simultaneously
- 10,000 Parts Per Million Clean Room Capability
- Controlled Temperature 70 to 78 Degrees
- Relative Humidity Control
  - 30 to 50 Percent
- Static Discharge Protection
- Sealed Corridors Between Buildings
- One-Ton Capacity Overhead Crane With Load Attenuating Devices
- 34,900 Square Feet of Test Area
  - Altitude Simulations
  - Vibration Table
  - Telemetry Ground Station

CURRENT CAPABILITY:

- Facility Inactive
- Equipment Removed



TESTING HISTORY:

- Miniature Sensor Technology Integration (MSTI) - MSTI 1, MSTI 2 & MSTI 3
- Advanced Concept Architecture Test (ACAT) - ACAT Vehicle
- Summer Undergraduate Research Fellowship Satellite (SURF SAT)

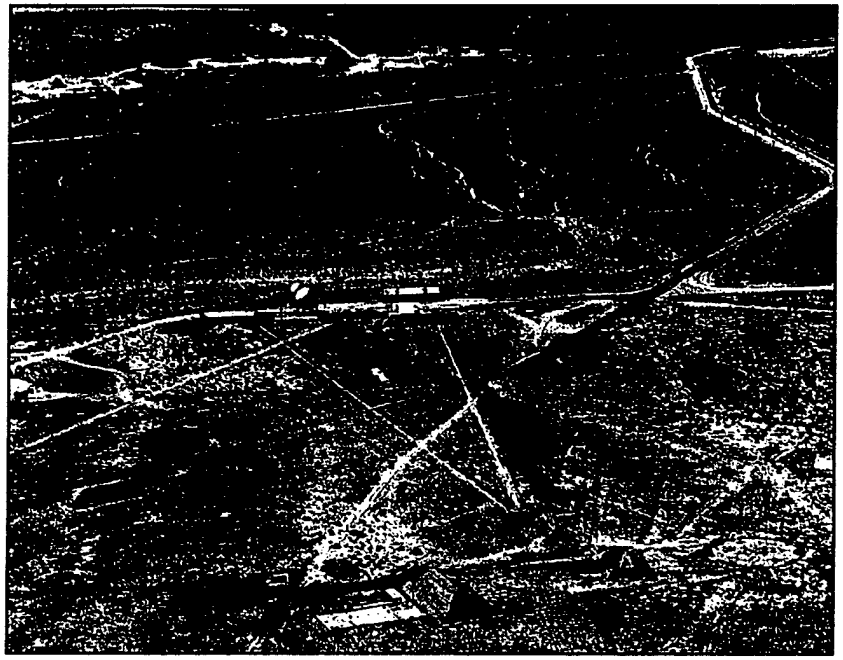
Blast Hazard Complex
Area 1-90, Test Pad 1-90

FACILITIES CAPABILITIES:

- Blast Hazard Capability Converted to Satellite Test and Integration Complexes

TEST STAND CAPABILITIES:

- Historic
  - Ground Level Testing
  - Liquid Propellant
  - Bare Pad
  - 150,000 Lbs TNT Equivalent



TESTING HISTORY:

- Titan I, 1st Stage
- Saturn S4B
- Blast Hazard Studies for Apollo Program

Blast Hazard Complex
Area 1-90, Test Pad 1-95

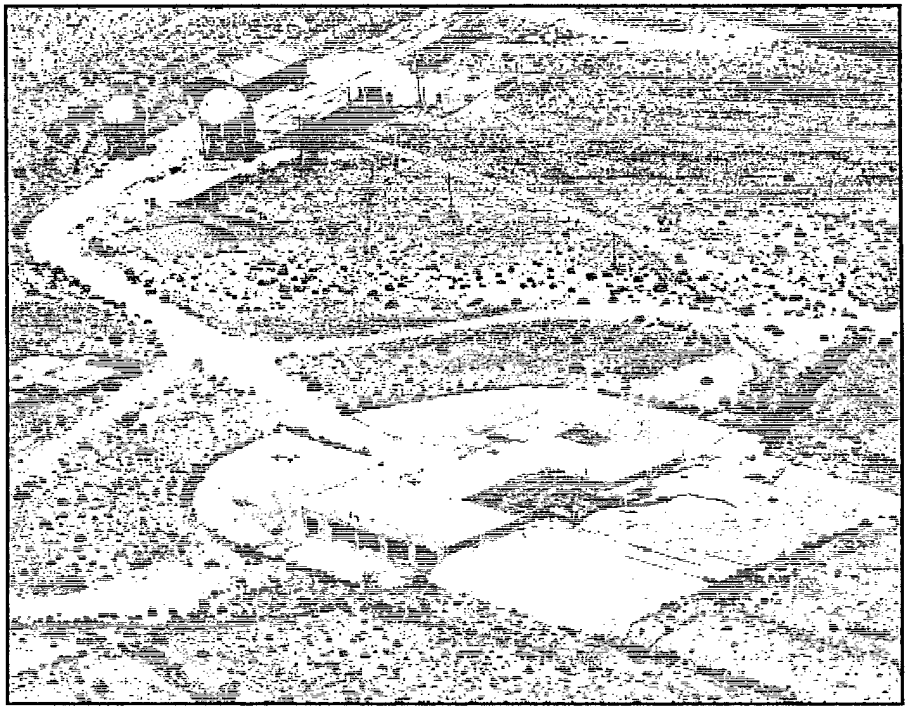
FACILITIES CAPABILITIES:

- Blast Hazard Capability Converted to Satellite Test and Integration Complexes

TEST STAND CAPABILITIES:

HISTORIC:

- Atlas First Loading of LOX and RP-1 Propellants



TESTING HISTORY:

- Atlas Propellant Loading

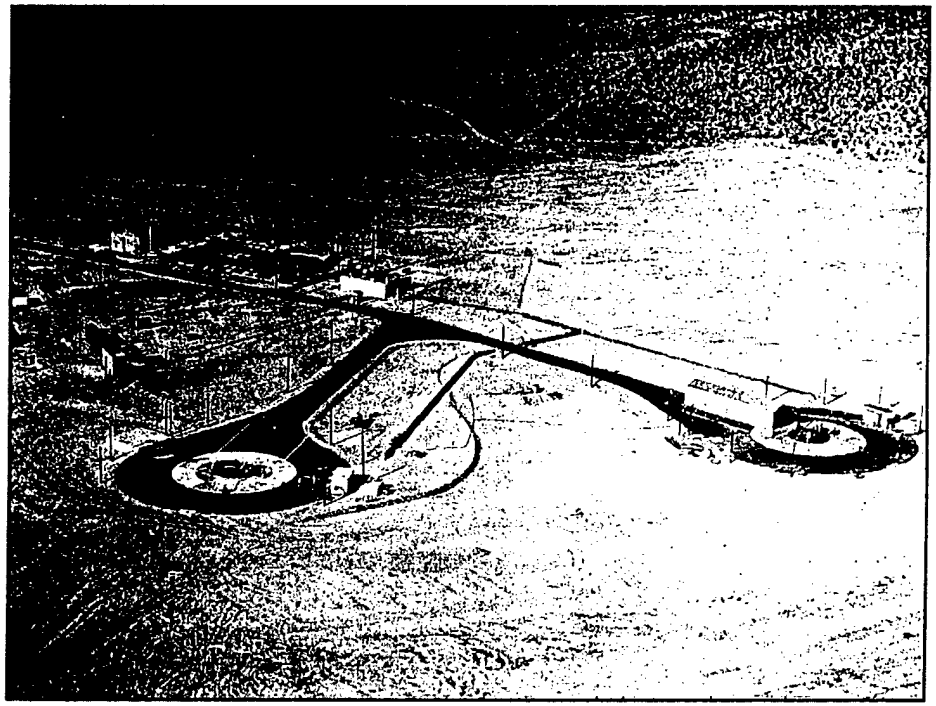
Silo Complex Area 1-100

FACILITIES CAPABILITIES:

- Facility Inactive
- GN2, Power Available
- Mechanical Shop

TEST STAND CAPABILITIES:

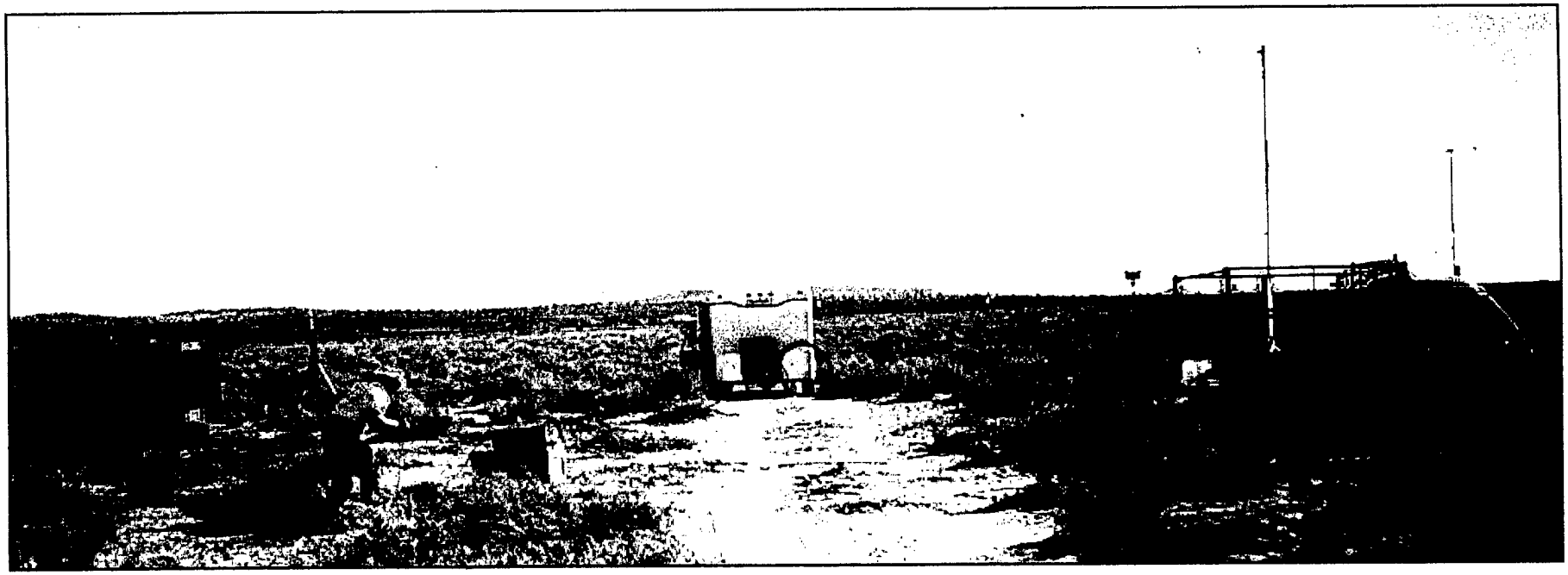
- Two Silos, 26 Feet in Diameter
  - 86 Feet Deep
- Silos are Inactive



TESTING HISTORY:

- Minuteman Tethered Launch
- PeaceKeeper Tethered Launch
- Leonid Storm 1997

Silo Complex Area 1-100



LEONID STORM METEORITE SHOWER, NOV 1997

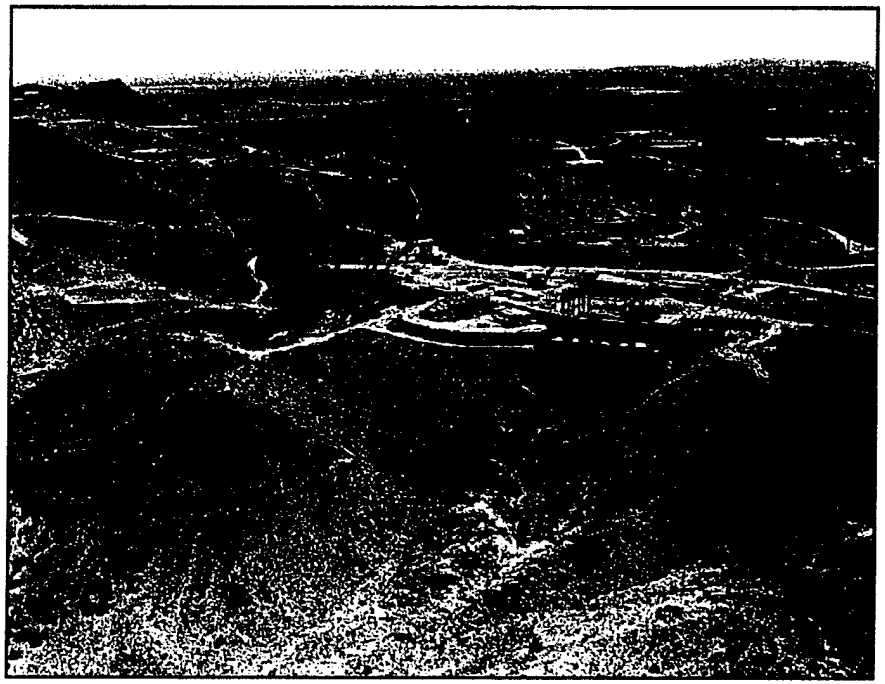
Large Engine Component/System Test Complex
Area 1-120

GENERAL AREA CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
  - Can be Pumped up to 10,000 psi
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- 3,000 psi Stand Hydraulics
- Ground Level Mechanical Shop
  - With 5 to 10 Ton Traveling Overhead Cranes
- Additional Mechanical Shops Beneath Test Stand
  - Small Fabrication / Repair
- Data Acquisition and Control System
  - 320 Channel, 100,000 Sample Per Second

TEST STAND CAPABILITIES: (CURRENT CONFIGURATION)

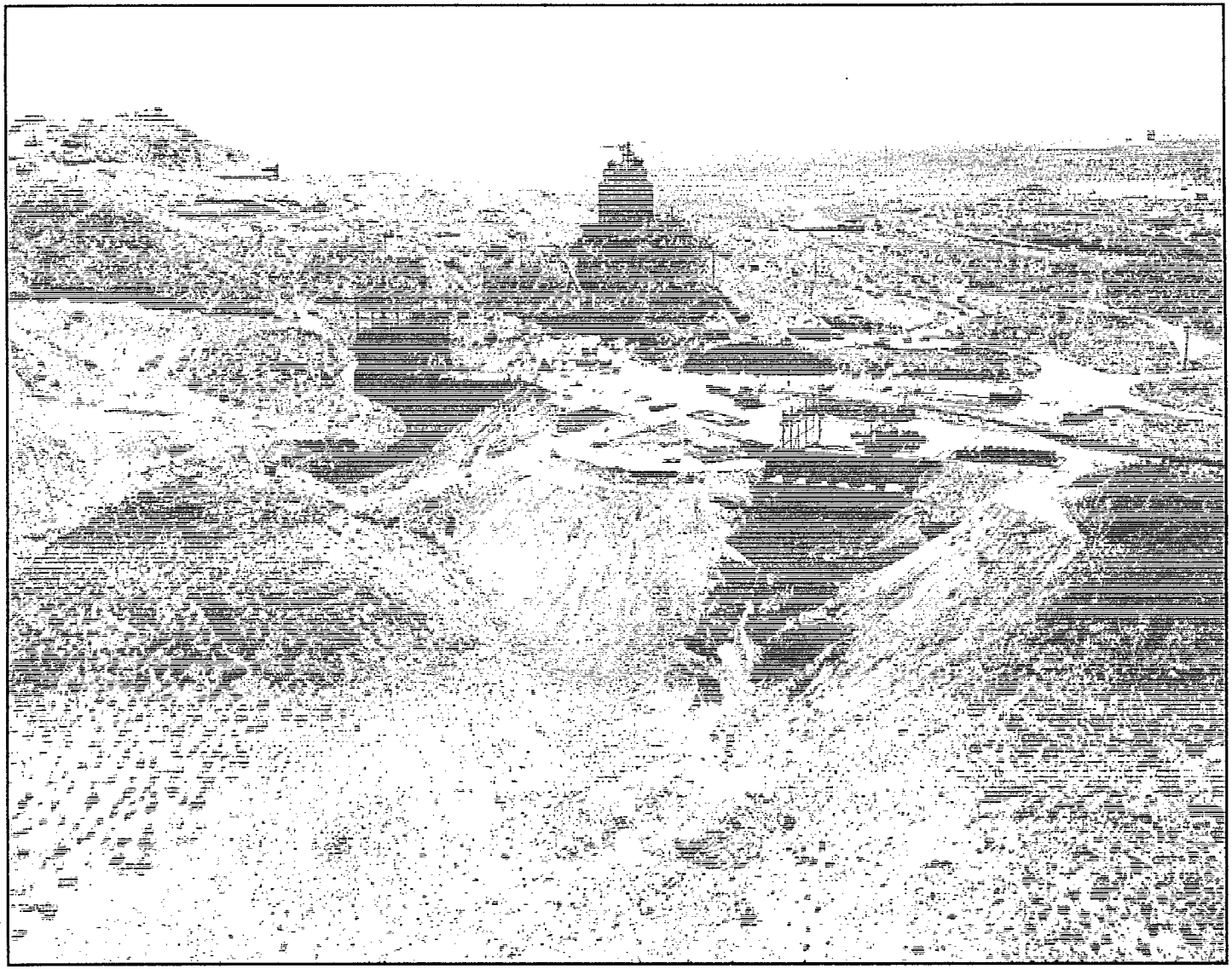
- Ground Level Testing
- Test Stand 2 - A, 1.5M lbf Thrust, 15 Degree Down
  - GN2 Run/Storage; 6,000 psi, 5010 Cubic Feet
  - LO2 Run Tank; 8,500 psi, 2,000 Gallon
  - LH2 Run Tank; 6,000 psi, 3,800 Gallon
- Test Stand 1 - A, 1.6M lbf Thrust, Nozzle Down
  - GN2 Run/Storage; 4,500 psi, 2850 Cubic Feet
  - LO2 Run Tank; 165 psi, 75,000 Gallon
  - LH2 Run Tank; 165 psi, 90,000 Gallon
- Test Stand 1 - B, Inactive, Nozzle Down



TESTING HISTORY

- F-1 Thrust Chamber (5,000 Firings)
- F-1 Moon Rocket Tests
- Atlas (System) Tests
- F-1 Engines
- RS-68 EELV 1998

Large Engine Component/System Test Complex
Area 1-120



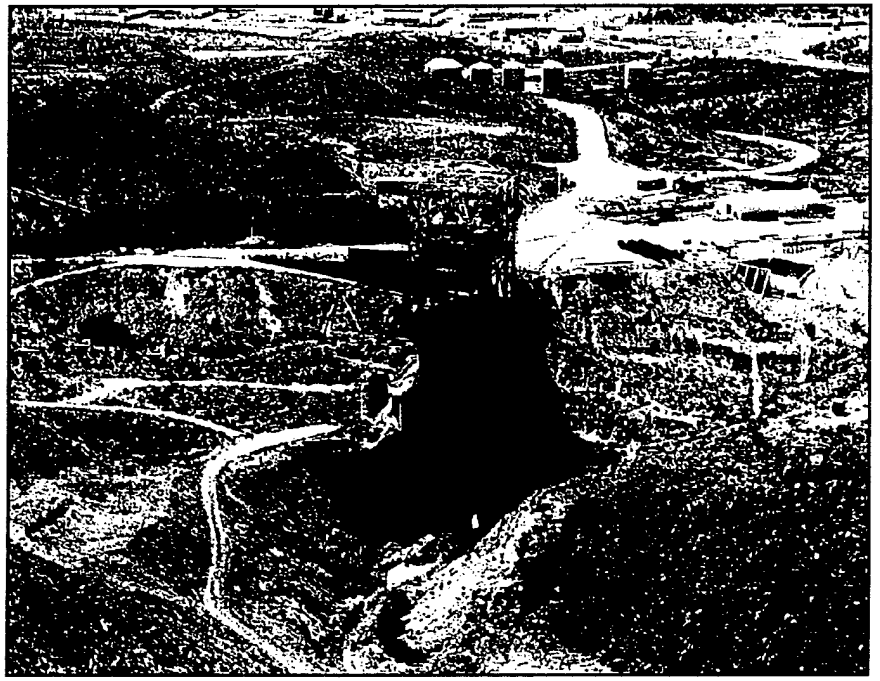
Large Engine System Test Stand, Area 1-120, Test Stand 1-A

FACILITIES CAPABILITIES:

- 4,500 psi GN2 Line, 2850 Cubic Feet Storage
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- 3,000 psi Stand Hydraulics
- Access to the 2A Mechanical Shop
  - With 10 Ton Traveling Overhead Cranes
- 800,000 Gallon Deluge Storage
  - 1,000,000 Gallon Catch Basin
- Data Acquisition and Control System
  - 320 Channel, 100,000 Sample Per Second
  - High Speed FM and Oscillograph Recording

TEST STAND CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 4,000,000 lbf, Nozzle Down
  - (Current Configuration) Thrust Stand
    - 1,600,000 lbf Axial Thrust
- LO2 Cryo Run System; 75,000 Gallon, 165 psi
- Fuel Run System; LH2/RP-1, 90,000 Gallon, 165 psi
- 20,000 lb TNT Equivalent of 1.1 Propellant



TESTING HISTORY

- Atlas (System) Tests
- F-1 Moon Rocket Tests (750 Firings)
- RS-68 EELV 1998

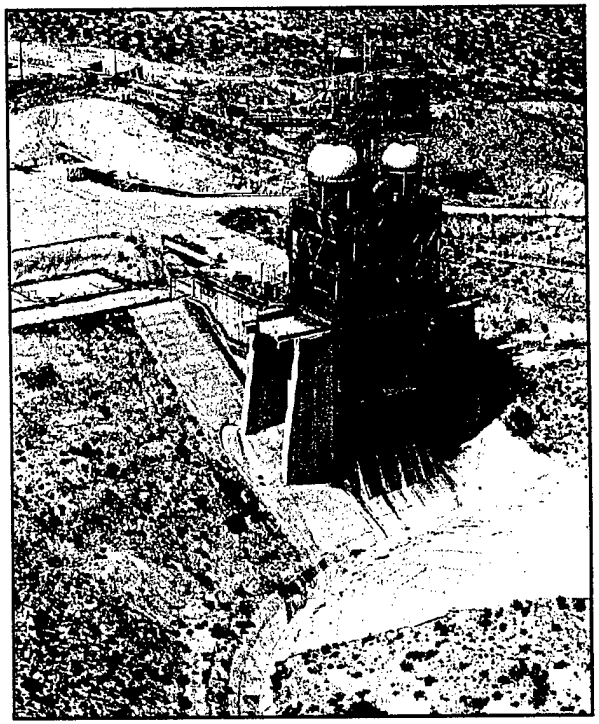
Large Engine System Test Stand, Area 1-120, Test Stand 1-B

FACILITIES CAPABILITIES:

- 4,500 psi GN2 Line, 2850 Cubic Feet Storage
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Mechanical Shop
- Additional Mechanical Shop Beneath Test Stand
- 800,000 Gallon Deluge Storage
  - 3,000,000 Gallon Catch Basin
- Data Acquisition and Control System(Proposed)
  - 320 Channel, 100,000 Sample Per Second
  - High Speed FM and Oscillograph Recording
  - 256 Channel Programmable Logic Control

TEST STAND CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 6,000,000 lbf, Nozzle Down
  - (Current Configuration) Inactive, No Thrust Stand
- 100,000 lb TNT Equivalent of 1.1 Propellant
- 10 Ton Traveling First Story Crane
- 5 Ton Jib Crane on Top of Stand



TESTING HISTORY

- F-1 Engines (980 Tests)

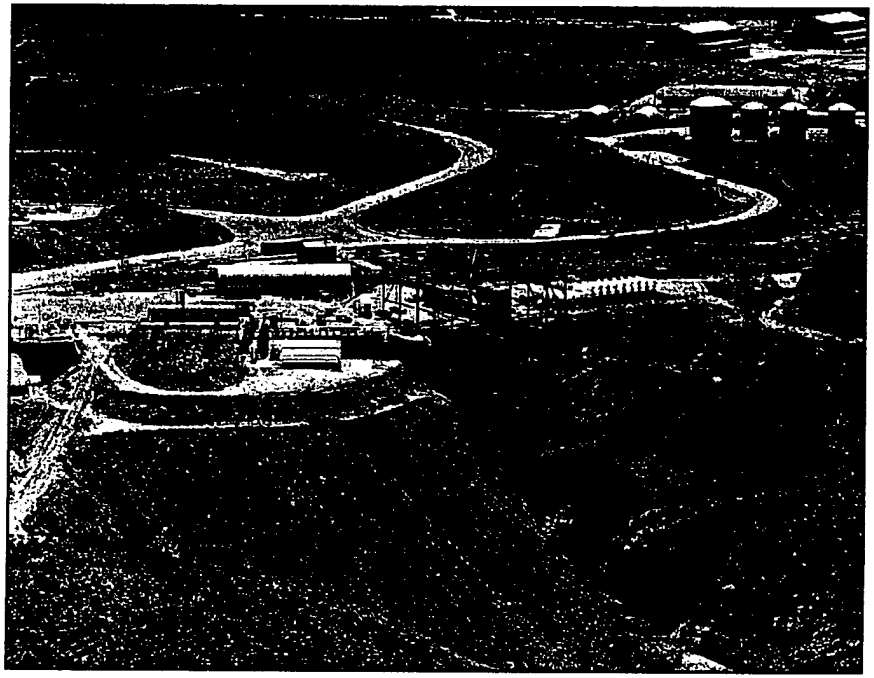
Large Engine Component Test Stand, Area 1-120, Test Stand 2-A

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- 3,000 psi Stand Hydraulics
- Mechanical Shop
  - With 5 Ton Traveling Overhead Crane
- Data Acquisition and Control System
  - 320 Channel, 100,000 Sample Per Second
  - High Speed FM and Oscillograph Recording
  - 256 Channel Programmable Logic Control

TEST STAND CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 2,000,000 lbf, 15 Degree Down
  - (Current Configuration) Thrust Stand
  - 1,500,000 lbf Axial Thrust
- 20,400 lb TNT Equivalent of 1.1 Propellant
- GN2 Storage; 10,000 psi, 940 Cubic Feet
- GN2 Storage; 6,000 psi, 5010 Cubic Feet
- GH2 Storage; 10,000 psi, 1600 Cubic Feet
- GH2 Storage; 6,000 psi, 2350 Cubic Feet
- GHe Storage; 6,000 psi, 400 Cubic Feet
- LH2 Storage; 100 psi, 28,000 Gallon
- LO2 Storage; 30 psi, 26,000 Gallon
- LO2 Run Tank; 8,500 psi, 2,000 Gallon
- LH2 Run Tank; 6,000 psi, 3,800 Gallon
- RP-1 Run / Storage 6,000 psi, TBD Gallon



TESTING HISTORY

- F-1 Thrust Chamber (5,000 Firings)

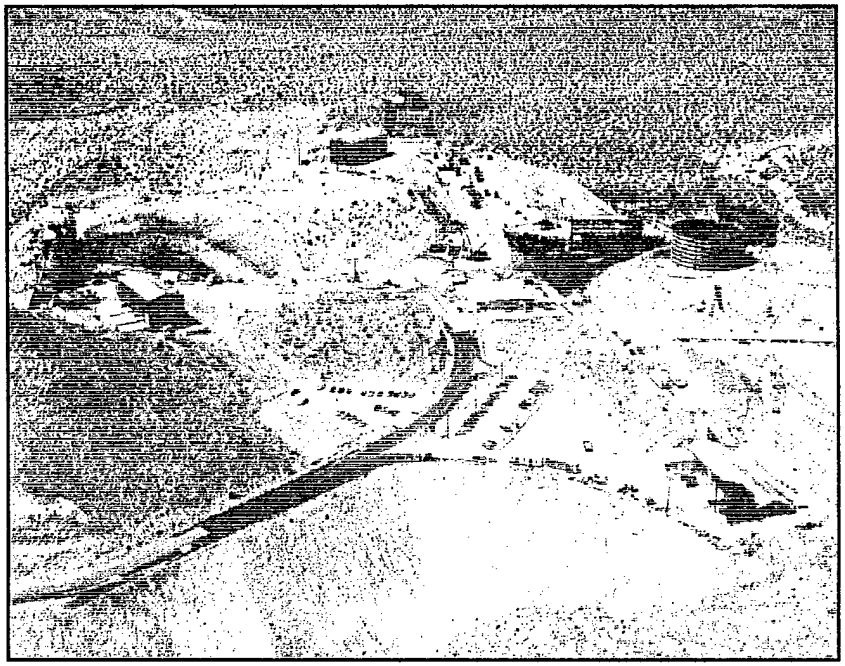
Large Systems Complex Area 1-125

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 3 Mechanical Shops
  - With 25 Ton Traveling Overhead Cranes
  - With Environmental Conditioning

TEST STAND CAPABILITIES:
(Current Configuration)

- Ground Level Testing
- Test Stand 1 - C 1.6M Lbf Thrust, Nozzle Down
- Test Stand 1 - D Inactive, Nozzle Down
- Test Stand 1 - E Inactive, Nozzle Down
  - Modified for Hover Testing Requirements



TESTING HISTORY

- Titan 34D
- Titan IV
- Saturn V
- H1 Engine
- SRM Booster
- SRMU Booster
- Kinetic Kill Vehicle (KKV Prototype and Advanced)

Large Systems Complex Area 1-125

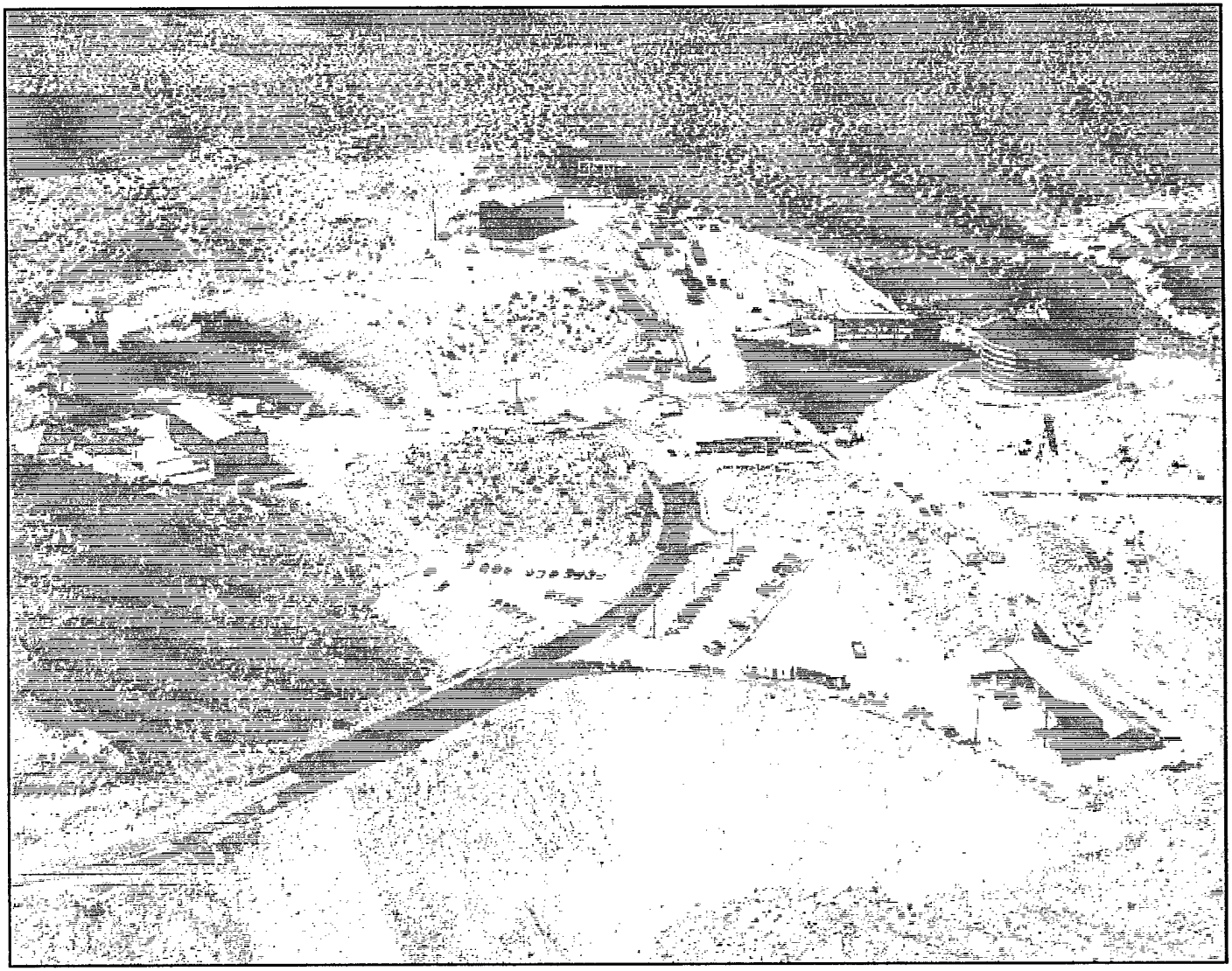
GENERAL AREA CAPABILITIES:

- Commissioned in the Early 1960'S
- Integral Testing for Most Major United States Booster Systems
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- 3 Mechanical Shops (High Bay Assembly Buildings)
  - 94 Wide X 115 Tall X 50 High
  - With 25 Ton Traveling Overhead Cranes
  - With Environmental Conditioning
- Two Story, Central Operations Center
  - NEFF 620, 512 Channel, 50,000 Sample Per Second Data Acquisition System
  - Programmable Logic Control System

TEST STAND CAPABILITIES:

- Ground Level Testing
- Test Stand 1C Supported Rocketdyne F-1 Engine Tests Through 1974
  - — Maximum Thrust 6M lbf.
  - — Test Stand Idle Since 1974, Re-activated 1986
  - — Current Configuration
    - For TITAN IV Support
    - 1.6M lbf, Six-component Thrust Stand
      - —Vertical, Nozzle Down
  - — Other Programs; TITAN 34D, SRM and SRMU Boosters
- Test Stand 1D Supported Rocketdyne F-1 Engine Tests Through 1974
  - — Maximum Thrust 6M lbf., Vertical, Nozzle Down
  - — Test Stand Idle Since 1974
- Test Stand 1E Supported Rocketdyne H-1 Engine Tests Through 1975
  - — Test Stand Idle Since 1975
  - — Modified for Hover Testing Requirements
    - Added Adjacent Target Test Stand
    - Vehicle Integration Facility, With a Clean Room
    - Propellant Storage and Handling
    - Range Support for Fueling and Handling KKV's
  - — Supported KKV (Prototype and Advanced)

Large Systems Complex
Area 1-125



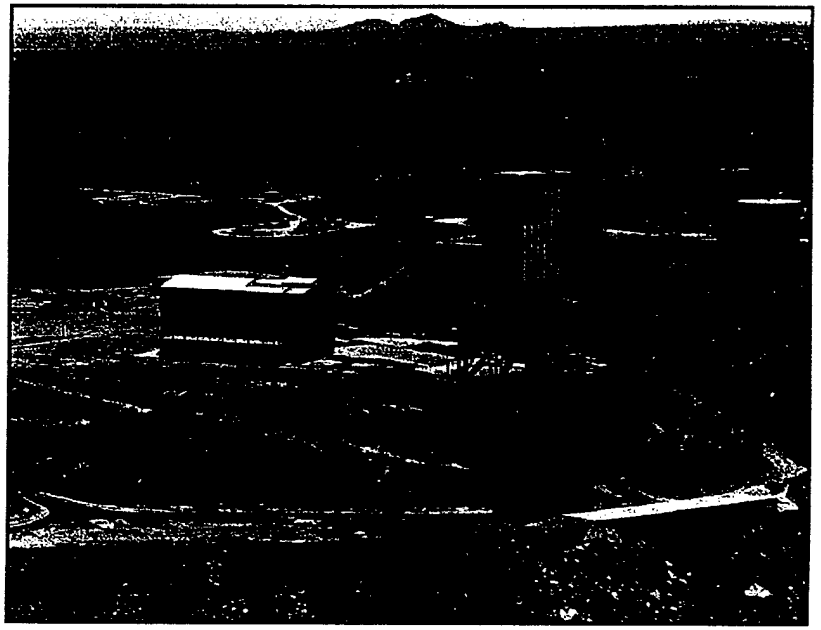
Titan SRM Test Facility
Area 1-125, Test Stand 1-C

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Mechanical Shop
  - With 25 Ton Traveling Overhead Crane
  - With Environmental Conditioning
- 3,400,000 Gallon Deluge Storage
  - Cooling Water can be Pumped at 168,000 gpm
  - 800,000 Gallon Catch Basin
- Modified 1988 for Titan 34D
  - Current Configuration for Titan IV

TEST STAND CAPABILITIES:

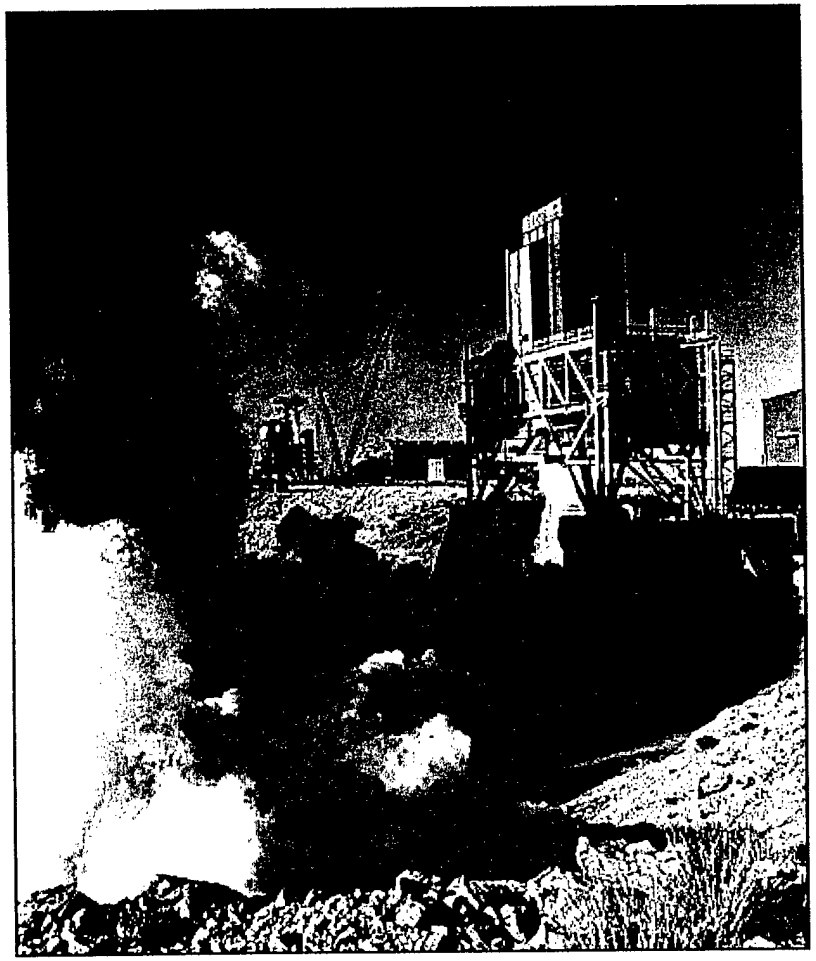
- Ground Level Testing
- Multi-story Environmental Conditioning
  - 25 to 100 Degrees F, 40 Percent Relative Humidity
- Maximum Thrust 6,000,000 lbf., Nozzle Down
  - (Current Configuration) 6 Component Thrust Stand
    - 2,500,000 lbf. Thrust Takeout
    - 1,600,000 lbf. Axial Thrust
- 690,000 lb of 1.3 Propellant



TESTING HISTORY

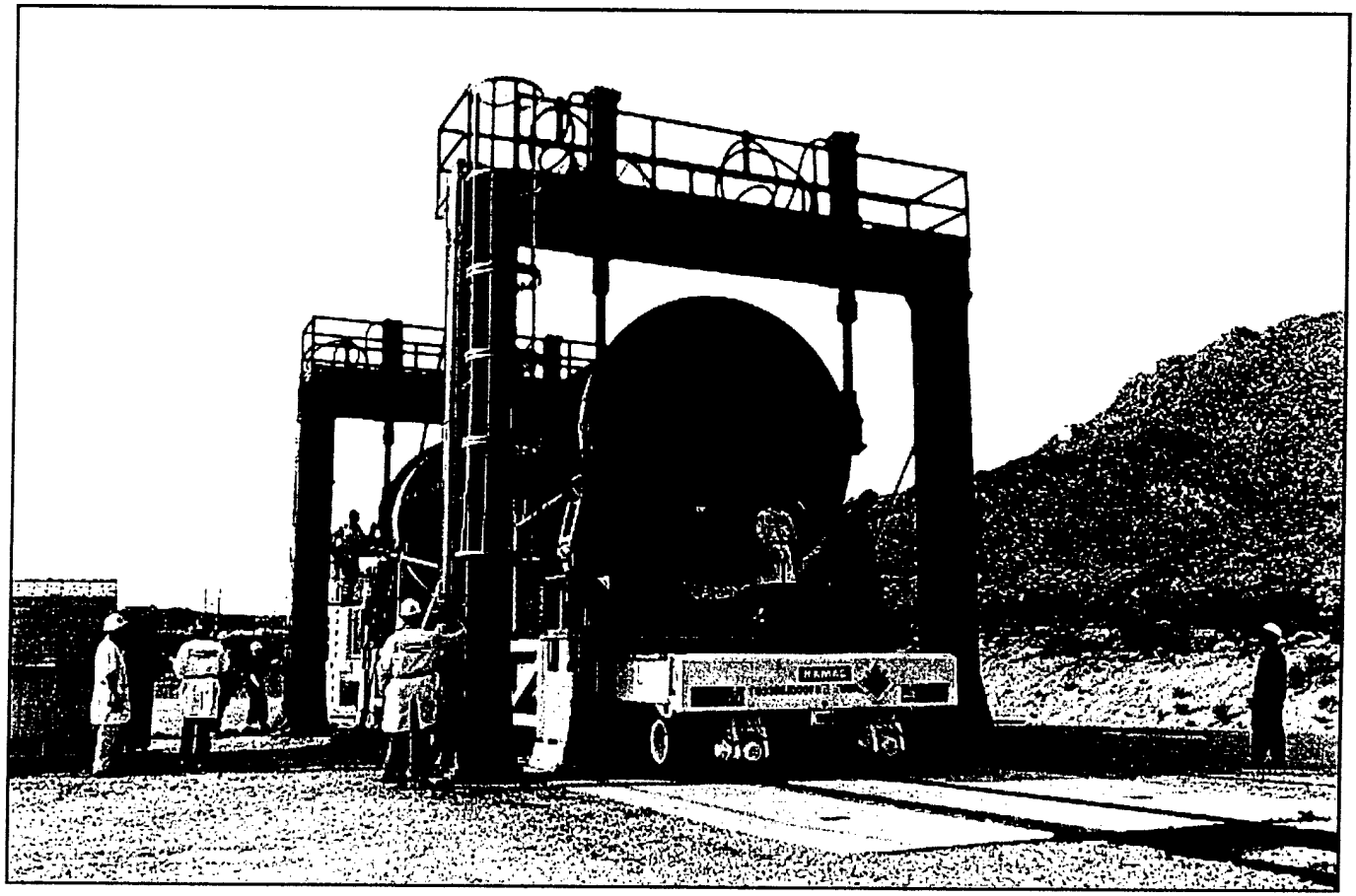
- Titan 34D, 1987
- Titan IV
- Saturn V
- SRM Booster
- SRMU Booster, 1992, 1993, 1999

Area 1-125, Test Stand 1-C



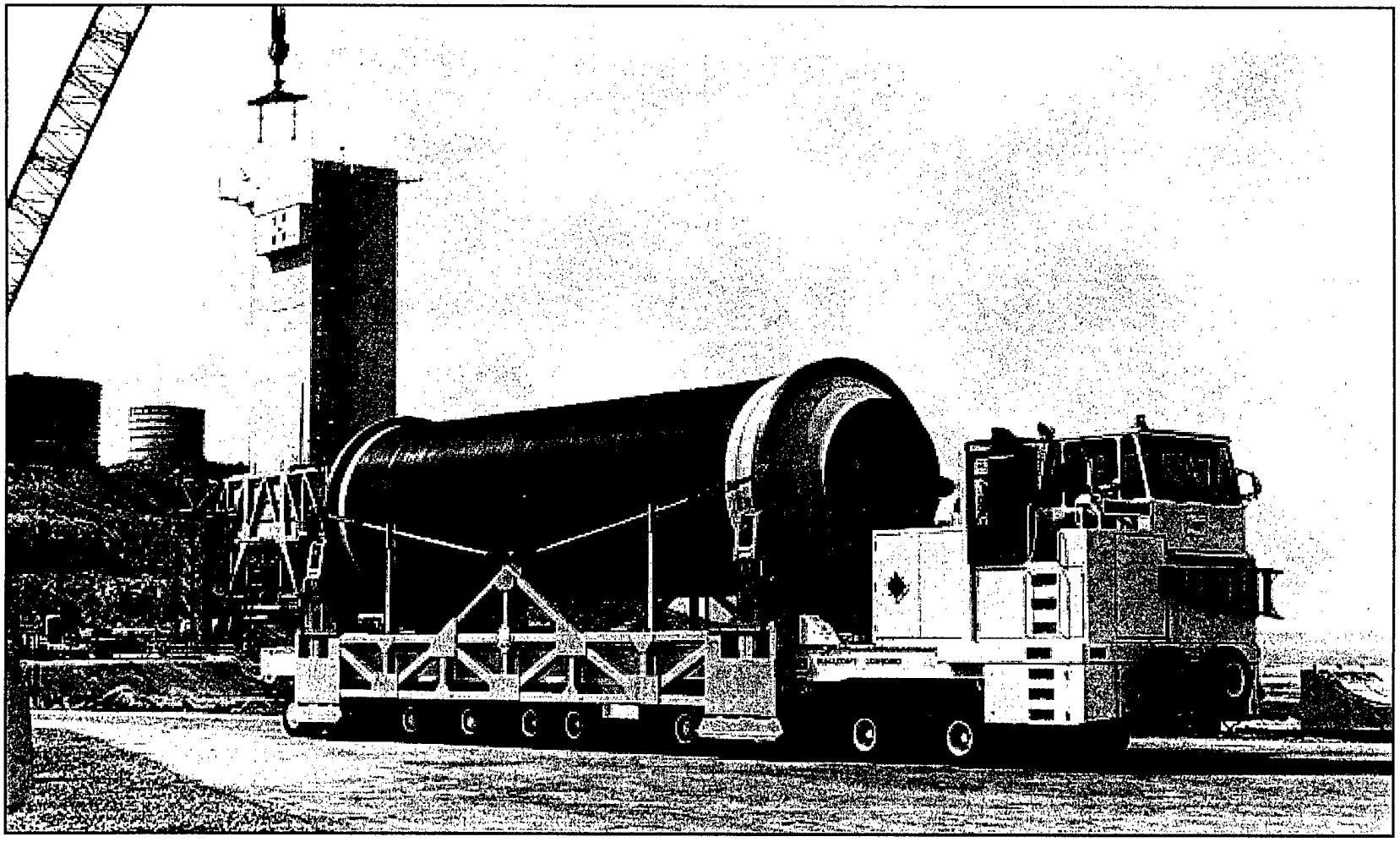
- Successfully Fired T34D SRM, 15 June 1987

Area 1-125, Test Stand 1-C



Titan IV SRMU Booster Railhead Delivery to AFRL, 1993

Area 1-125, Test Stand 1-C



Titan IV SRMU Booster Test Stand Delivery, 1993

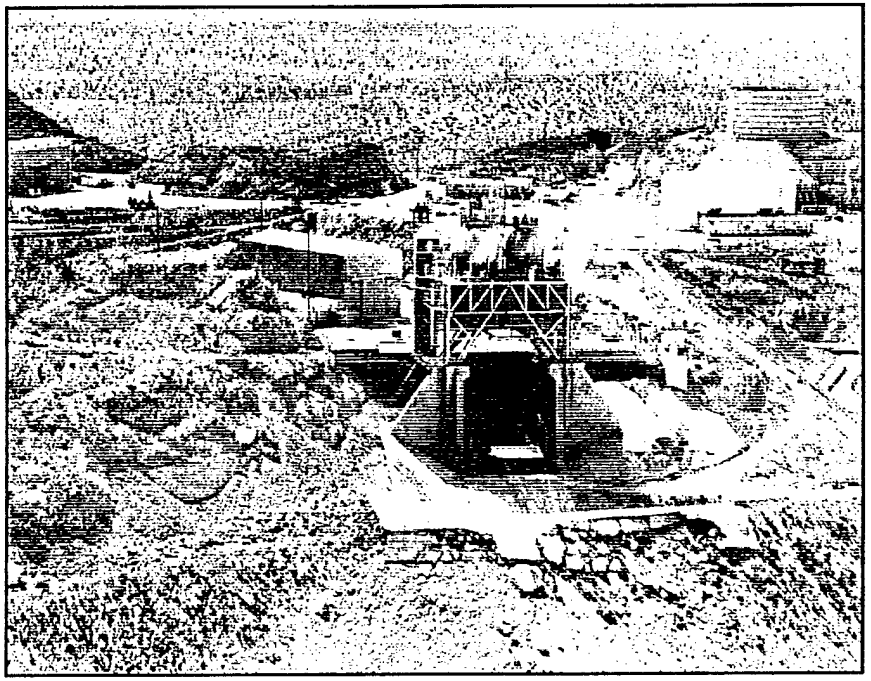
Large Systems Complex Area 1-125, Test Stand 1-D

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Mechanical Shop
  - With 25 Ton Traveling Overhead Crane
  - With Environmental Conditioning

TEST STAND CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 6,000,000 lbf., Nozzle Down
  - (Current Configuration) Inactive, No Thrust Stand
- 760,000 lb of 1.3 Propellant



TESTING HISTORY

- Saturn V

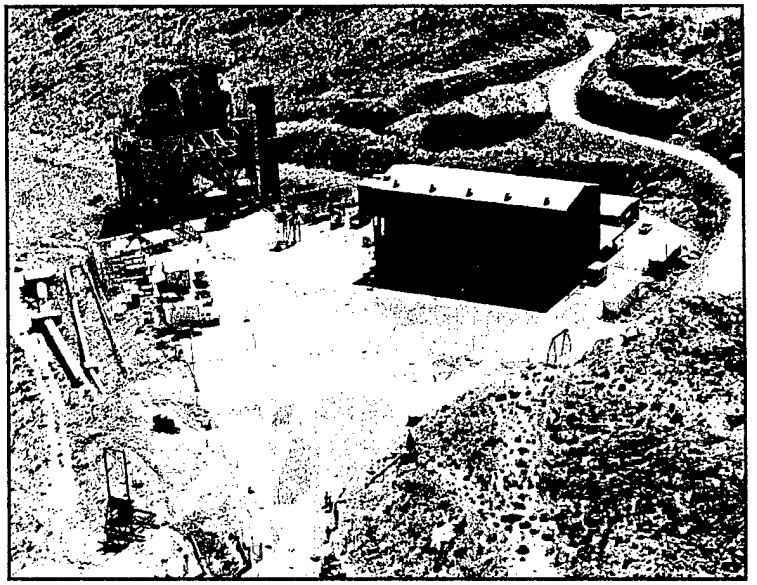
National Hover Test Facility
Area 1-125, Test Stand 1-E

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Target Test Stand
- Vehicle Integration Facility, With a Clean Room
- Propellant Storage and Handling
- Range Support for Fueling / Handling KKV's at Remote Sights

TEST STAND CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 6,000,000 lbf., Nozzle Down
  - (Current Configuration) Inactive, No Thrust Stand
- 690,000 lb of 1.1 Propellant
- Mechanical Shop Converted to Hover High Bay and Control Room
  - Kinetic Kill Vehicle (KKV) Free Flight Environment
    - Low Cost
    - Recoverable
    - Repeatable
    - Observable
  - Integrated Instrumentation Systems
    - Video Trajectory Tracking
    - Telemetry Uplink and Downlink
    - Precision Laser Velocity and Positioning Measuring System
    - Center of Gravity and Moment of Inertia Measurement



TESTING HISTORY

- 11 Different Vehicle Configurations
- Liquid and Solid Propellant Systems
- 26 Static Tests
- 16 Free Flight Tests

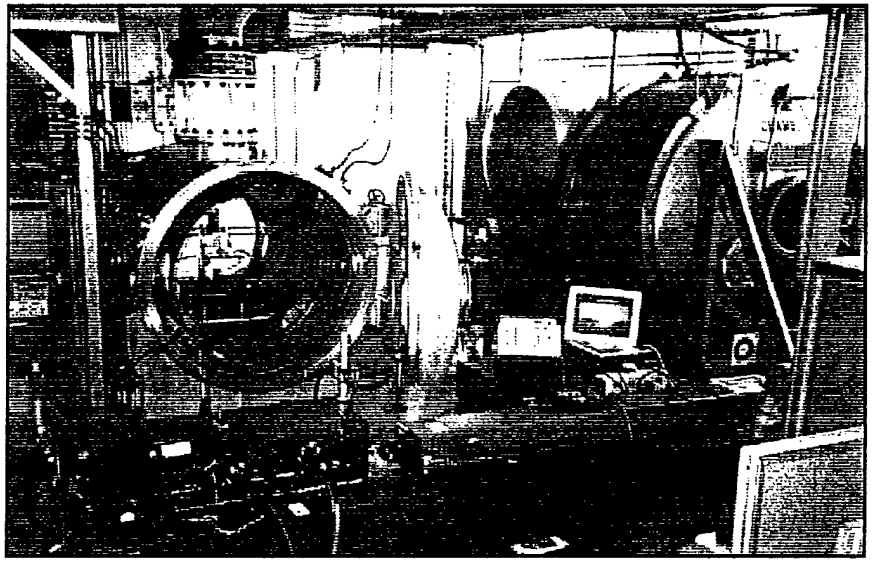
Electric Propulsion Laboratory

GENERAL AREA CAPABILITIES:

- Mechanical, Diffusion, Turbomolecular, and Cryo Pumped Vacuum Systems
- Data Acquisition and Control System

TEST CELL CAPABILITIES:

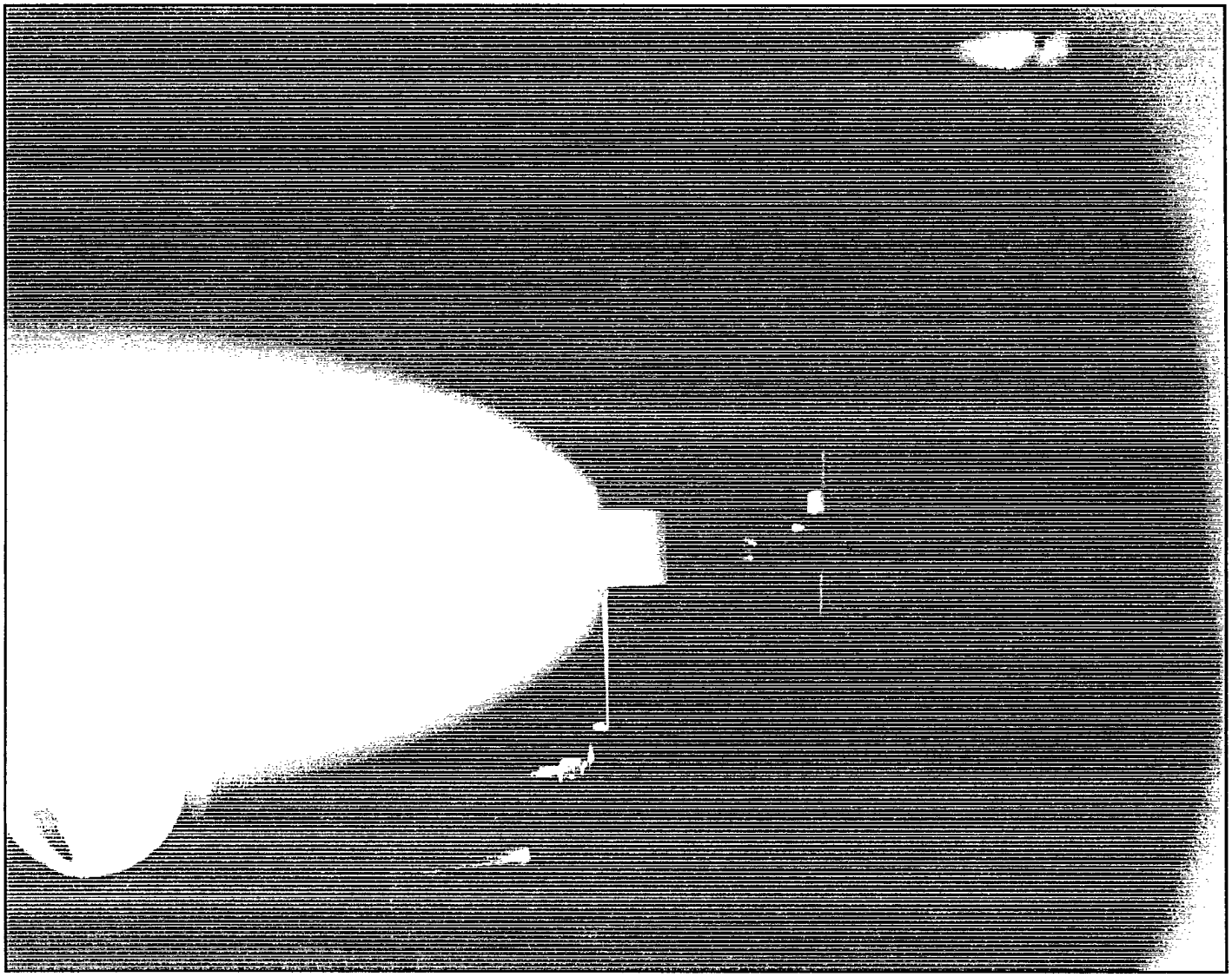
- Two 600 Cubic Foot Arcjet Chambers
  - 8 Foot Diameter x 12 Foot Long Chamber
  - 50 kWe
  - 10-2 TORR Vacuum
  - Pumps 250 mg/sec Propellant
- 200 Cubic Foot Pulsed Plasma Chamber
  - 5 Foot x 8 Foot Long Chamber
  - 20 MWe Pulsed
  - 10-5 TORR Vacuum
- 2000 Cubic Foot Chamber (Planned)
  - 10 Foot Diameter x 20 Foot Long Chamber
  - 30 kWe
  - 10-6 TORR Vacuum
  - High Power Hall Thrusters



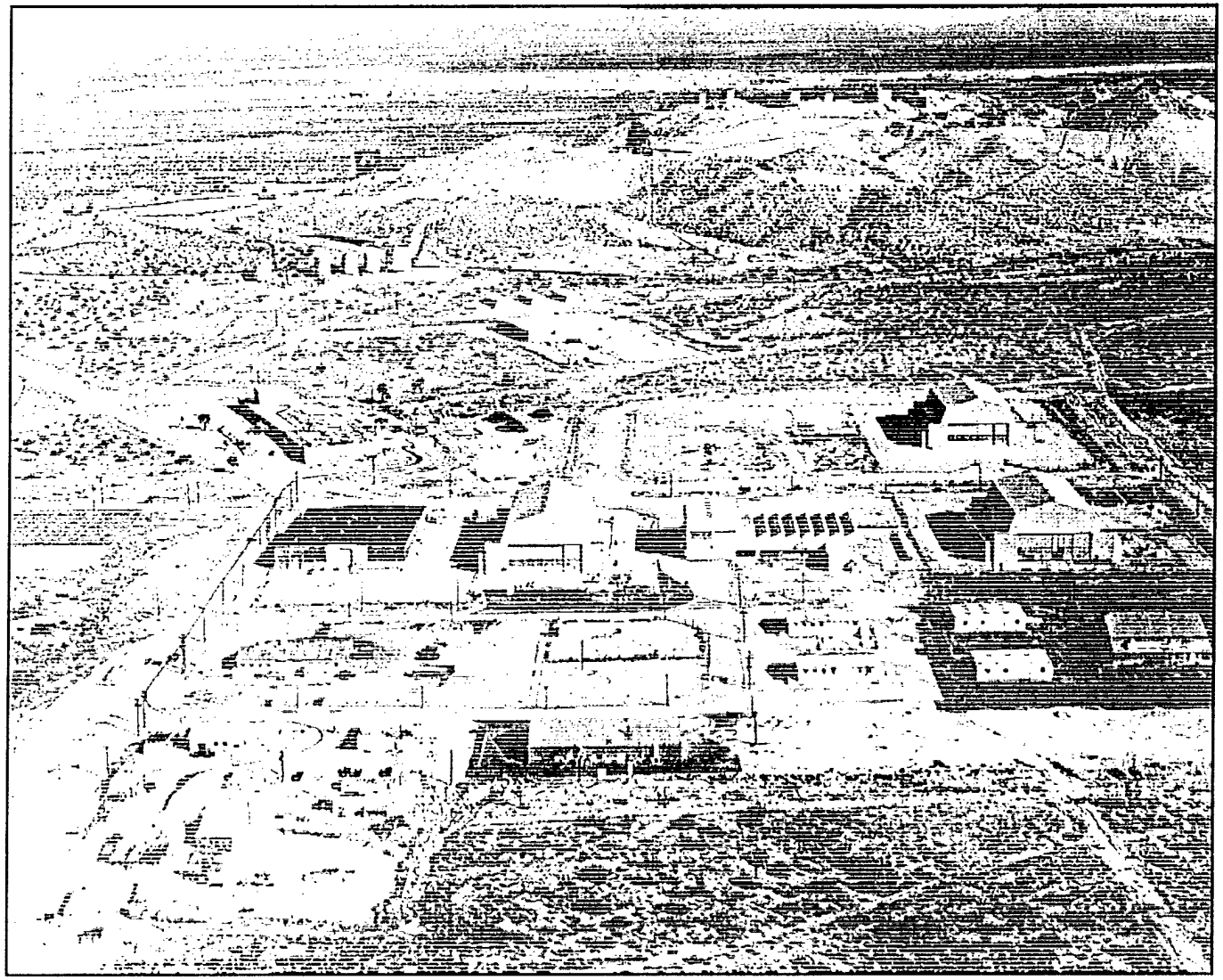
HISTORY:

- Ammonia 1995
- Teflon 1985-1996
- Hydrogen 1993-1996
- Carbon Based Propellant (Methane) 1995
- Electric Space Experiment (ESEX) 1995
- Collaborative efforts with; Loin Aerospace, NASA Lewis, and 6 Universities

Electric Propulsion Laboratory



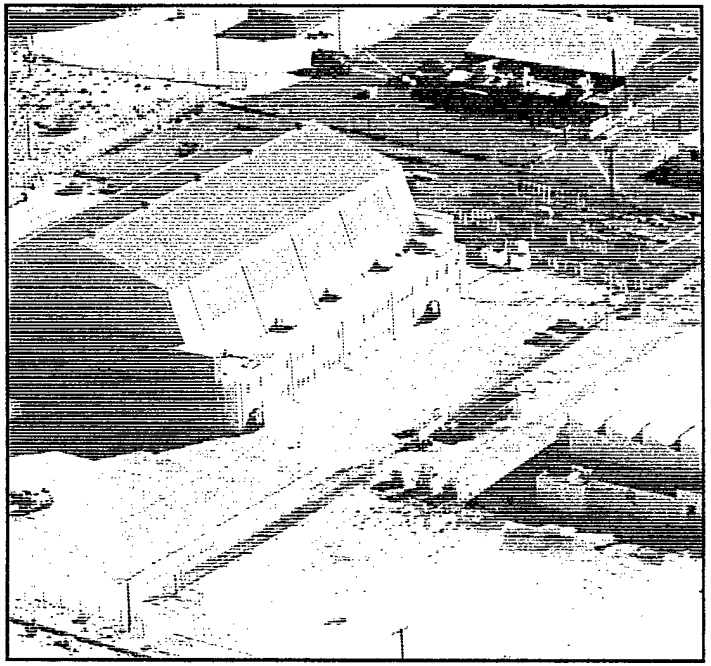
Air Force Research Laboratory
Fabrication Area



AFRL Fabrication Area
Missile Assembly Building
Building 8419

BUILDING CAPABILITIES:

- Four 25 Ton Overhead Cranes
- 17,000 Sq Ft of Work Space Under Crane Span
- Building is 60 Ft to Peak
- 40 Ft of Vertical Work Space Under Crane
- 8,000 Sq Ft of Office Space Adjacent to Work Space
- Building Originally Built for Missile Assembly
  - Currently Used for Welding and Fabrication Work
- Full Service Machine, Weld, and Fab Shops Nearby
- Building Within Fenced Area and Within Air Force Research Laboratory Restricted Area



HISTORY: