Ground Processing and Launch Facilities

• Historical examples
  – Early Launch Facilities
  – Saturn I
  – Saturn V
  – Russian

• Modern examples
  – Shuttle
  – Delta IV Heavy
  – DC-XA
Cape Canaveral circa 1950
Map of Cape Canaveral
“ICBM Row”
LC-5 – Mercury-Redstone
LC-5 Emergency Crew Escape System
Atlas Support Gantry
LC-14 – Mercury-Atlas
Titan II Access Tower Operation
LC-34 Schematic
Saturn I Launch Pedestal
LC-34 Launch Pedestal Under Construction
LC-34 Flame Deflector
LC-34 Blockhouse
LC-34 Service Structure
Saturn I Erection Process
Aerial View of LC-34
Aerial View of LC-34
Aerial View of LC-34
S-I Stage Rotation
S-I Stage Rotation
Assembly of Saturn I
SA-201 Launch
LC-37 Concept
LC-37 Under Construction (1963)
Barge Transport of Launch Vehicle Stages
Aerial Transport of Stages
Saturn V Launch Facility
Cape Canaveral Siting Map
Launch Sites Considered for Apollo

- Cape Canaveral
- Offshore from Cape Canaveral
- Mayaguana Island in the Bahamas
- Cumberland Island, Georgia
- A mainland site near Brownsville, Texas
- White Sands Missile Range in New Mexico
- Christmas Island in the mid-Pacific south of Hawaii
- South Point on the island of Hawaii
Early Mobile Launch Complex Concept
Concept of an Off-Shore Launch Facility
Merritt Island Launch Area (MILA)
Map of KSC and CCAFS
Competition for MILA Launch Sites

[Map showing launch sites and proposed locations]
Rail-Based Nova Launch Concept
Barge-Based Saturn V Launch Concept
Barge-Based VAB (Enclosed)
Interior Concept of VAB
Early Construction of VAB
VAB and LCC Under Construction
VAB from Turning Basin
Interior of Launch Control Center
Interior of Launch Control Center
Early Concept of Mobile Launch Platform
West Virginia Strip-Mine Coal Shovel
Crawler-Transporter
Cutaway of Crawler-Transporter
Saturn V Mobile Launch Platforms
MLP Transport Tests
Interior of VAB

[Diagram of Vertical Assembly Building with steps for operations]

FLOW CHART

1. Booster enters low bay
2. Engine service platform is moved to high bay
3. L/A is moved into high bay
4. ESP positioned in high bay
5. Booster arrives on transporter
6. Booster is raised to vertical position
7. Booster is transferred to ejection bay & erected on L/A
8. Booster with engine shroud & engine nozzle extensions attached
9. I/D enters in transfer aisle
10. I/D placed on platform in high bay
11. Booster check out performed with I/D
12. I/D stage arrives on transporter
13. I/D stage raised to vertical position
14. I/D stage erected on dolly & moved into checkout bay
15. I/D stage is checked out
16. I/D stage moved out of checkout bay to transfer aisle
17. I/D stage moved upward transfer aisle to high bay
18. I/D stage transferred to ejection bay & mated with preceding stage
19. I/D stage is mated to preceding stage
20. I/D is mated to upper stage S-DES
21. Assembled vehicle is checked out
22. Vehicle assembly proceeds to launch pad
S-IC Stage in VAB Transfer Aisle
S-IC – S-II Stacking
S-II – S-IVB Stacking
S-IVB – Instrument Unit Stacking
IU – Apollo Spacecraft Stacking
Apollo–Saturn V Completed Stack in VAB
S-1C T-0 Disconnects
Building the LC-39 Launch Pads
LC-39 Crawlerway and Stacks
SA-501 at LC-39A
LC-39 Mobile Service Structure
LC-39 Mobile Service Structure
Complex 39 Launch Mounts
Ground Processing and Launch Facilities
ENAE 791 - Launch and Entry Vehicle Design

Expenditures for LC-39

[Graph showing expenditures over time for LC-39, with various milestones and expenditures labeled such as "Cumulative Authorization" and "Actual Obligations".]
Saturn V Vehicle Checkout Flow

SATURN V CHECKOUT SCHEDULE MILESTONES

- S-IC ERECTION
- VEHICLE MATING
- VEHICLE POWER ON
- LAUNCH VEHICLE SYSTEMS TEST #1
- LAUNCH VEHICLE SYSTEMS TEST #2 (SWING ARMS)
- SPACECRAFT MATE
- LAUNCH VEHICLE SYSTEMS TEST #3
- S-II & S-IVB LOW BAY CHECKS

- SPACE VEHICLE SYSTEMS TEST #1
- SPACE VEHICLE SYSTEMS TEST #2
- SIMULATED FLIGHT TEST
- TRANSFER TO PAD

- RF COMPATIBILITY TEST
- PROPellant TANKING TEST
- SIMULATED FLIGHT TEST
- COUNTDOWN
Soyuz Launch Site
Energia in Horizontal Integration
Energia Transported to Pad
Energia at Pad
Energia Erection
Energia on Pad
Shuttle Landing Facility
Transport to Orbiter Processing Facility
Payload Bay Inspection in OPF
SSME Removal/Installation
Transfer to Vehicle Assembly Building
Attaching Hoisting Fixtures
Attaching Orbiter to Shuttle Stack
Shuttle Rollout
Delta IV Heavy Horizontal Integration
Delta IVH Horizontal Integration Facility
Delta IV Heavy Transporter
Delta IV Heavy at LC34 Blockhouse
Delta IV Heavy Arrives at LC-34
Delta IV Heavy Module Interconnects
Delta IV Heavy at Pad
Delta IV Heavy Rotation
Delta IV Heavy Rotation
Delta IV Heavy at Pad
DC-XA on Launch Pad