LEO Launcher & Logistics Inc™
957 NASA Parkway Num. 922
Houston, TX 77058
www.LEOLauncherLogistics.com
An Innovative Business Approach to Launches

Test, Verification, Qualification & Certification Program©

Purpose of this Test Plan is to certify the LEO Launcher & Logistics launch vehicle, the Chariot, for launching and inserting satellites into orbit.

Verification Methods:

- **Analysis**
- **Inspection**
- **Similarity**
- **Demonstration**
- **Simulation**
- **Test**
- **Review of Documentation**

Flight Phases and Vehicles to be verified:

1. **Takeoff**
2. **Flight of Boeing 747 carrying rocket with payload**
3. **Separation of Rocket from aircraft**
4. **1st 3 stages of Orion Rocket**
5. **4th stage – onorbit ASP rocket**
6. **Separation of payloads from rocket**
7. **Communication with aircraft, rocket, payload, ground control center**

Program

1. **Takeoff** -Verification of takeoff of the LEO Launcher Boeing 747 rocket carrying aircraft

    a. Verification of takeoff of Boeing 747 rocket carrying aircraft is by ***Analysis*** and ***Review of Documentation*** of Flight Plans; and
    b. Verification is also by ***Similarity*** with other similar Flight Plans for takeoff of a 747 loaded with more than 70,000 lb. of cargo.

2. **Flight** - Verification of the Flight of the LEO Launcher Boeing 747 rocket carrying aircraft from the takeoff airport, to its rocket launch destination

    a. Flight from the Airport after takeoff, and the flight to the Launch site, should be just a usual flight plan of a 747 carrying a 70,000 lb. load, to the middle of an ocean, to near the rocket's planned launch point. This is verification by ***Review of Documents (Flight Plans, etc.)***.
    b. The aircraft cruises at nearly 40,000 ft. altitude (max. altitude for a 747), at Mach 0.95, (max velocity for a 747), which is about 500 mph at 40,000 ft. This is verified by ***similarity*** to Millions of successful 747 flights, with a flight success rate of 99.9%.
    c. When the 747 and rocket arrive at the launch point, the plane performs a launch flight profile, pitching up to release the rocket (Patent Pending) (PP).
    This flight profile is verified by
        i) ***Analysis*** of the flight parameters, then
        ii) by a flight ***simulation*** of this flight profile, then
        iii) by performance of a ***test*** flight in this flight profile.

3. **Separation** of the Chariot Rocket from the carrier aircraft

    a. The Separation Mechanism verification is by
        i) ***Analysis*** of the design of the carrying mechanism, the "Cradle", and the release mechanism.
        ii) ***Test*** of the latched and unlatching mechanisms on the ground in laboratories and test stands,
        iii) then by Flight ***test*** by dropping a 70,000 lb. weight from the aircraft first while on the ground,
        iv) then while performing the patented flight Profile.

    b. This patented Separation Mechanism is to be ***Qualification tested*** to meet requirements.
    c. Then each Mechanism other than the Qualification Unit will be ***Acceptance tested,*** against a set of Verification Requirements standards.

4. Launch, Flight and performance of the 3-stage Orion Rocket, the **3 rocket motor stages**, made by Northrop Grumman

    a. The 3 rocket Engine stages' performances will each be verified the same way —
        i) by ***inspection of documentation*** of the previous 100's of tests and 200 successful flights of these rocket engines.
    b. By ***Acceptance tests*** of each of the rocket motors when they are received from the manufacturer.
    c. Then each rocket motor, then each 3-stage rocket stack will have selected ***components and integrated vehicle Health tests*** after they are integrated together into an integrated 3 stage rocket.
    d. Except for the Acceptance tests, most of this verification of the Orion rocket engines will be perfunctory, since by ***Similarity*** to previous flights, these rocket motors have already had 200 successful flights.

5. Launch, Flight and performance of the **4th stage** / onorbit maneuvering **ASP rocket** from Frontier

    a. The ASP liquid rocket engine design will be verified by ***Inspection, Analysis of the design,*** then ***Review*** and ***Analysis*** of the test data from the dozens of test firings and 20 flights of the ASP rocket engine.
    b. ***Analysis*** of the new parts of the ASP on-orbit design. Changes for LEO, larger fuel cells, will be rigorously ***analyzed,*** and then ***test*** fired 2 or 3 times.
    c. The verification of the ASP rocket engine itself will likely be perfunctory, since it has been ***tested*** and flown a number of times. This includes ***analysis of documentation***.

6. Separation of payloads from rocket

When the launch rocket attains the correct orbit, it is time to separate the Satellite or satellites from the rocket. Each separation mechanism is verified to insure its proper performance.

A ***Qualification analysis*** of the separation mechanism and its performance is made.

a. An ***inspection*** is performed on each separation mechanism, inspecting each moving part, comparing it to the qualification drawings.
b. Then, an ***Acceptance Test*** is performed on each unit to be used before each flight. This Acceptance procedure tests its proper performance, against standards.

7. Communications

a. Main Control Communications (MCC) ***test*** each system for throughput, communications parameters
   - Central Communications Station – ***test*** Function to Maintain, Log, Execute and provide Communications between all Project components including all Mobil SATCOM units, dedicated Stationary Communications Towers, other Airport Facilities, Aircraft, Rocket, New and Existing Customer and LEO Satellites, and external data streams as required.
   - Dedicated Communications Data-stream (Project Specific) - ***test*** MCC to/from Aircraft, MCC to/from Satellite, Aircraft to/from Rocket, Aircraft to/from Customer Satellite.

b. **Aircraft Systems** ***demonstration***
   - Aircraft Communications
   - Communication Flight Plan Execution from Aircraft to Rocket Launch, Emergency Contingencies, Aircraft Landing, Aircraft Return.
   - Communication supporting a safe Rocket Release and Orbital Launch.
   - Communication supporting Rocket Demolition and Mission Termination. point
   - Communication supporting Satellite release at Customer Orbit.
   - Communication between Aircraft and Customer Satellite for monitoring orbit.
   - Capabilities to and from support remote operations communications

c. **Rocket Communications - *Test*** Rocket Communications to support the following
   - Mission Communication between Aircraft, Main Communication Control
   - Mission Navigation and Guidance Control
   - Mission Logging
   - Appropriate bandwidths to support Data Streams between Payload and Ground

d. **Satellites** ***demonstration***
   - Communications Prior to Launch Operations
     - Mission Procedure ***Review***
     - Ground Checkout (***demonstration***) with Main Communications Control
     - Mission Clear for Launch
   - Communications During Launch Operations:
     - Satellite Power - Active during Rocket Launch
     - Communications with Aircraft and MCC
   - Communications after Launch
     - Continuous Orbital Monitoring and Placement of all Customer Satellites

Test, Verification, Validation, Certification Team Biographical Summary

Ken Robinson, MS, PE, 6 Sigma is the Lead Verification Engineer
Ken has been Verifying Spacecraft since 1980

- Verified Space Shuttle (STS) Guidance & Navigation GNC) software.
- Led and Performed Integrated Testing for STS Ground Based software at Mission Control Center.
- Verified International Space Station (ISS) spacecraft FGB, Node 1, Pressurized Mating Adapter (PMA-1).
- Verified Crew Quarters & Potable Water Dispenser for ISS.
- Tested GNC Safety SW.
- Taught Testing 5 years for the Non-Destructive Test Dept. (NDT) at San Jacinto College.
- Awards include Employee of the Year working at Boeing / Dynacs; Employee of the month and NASA STAR awards while working at Jacobs/Barrios. Excellence Group Award while working NASA's Mission Control Center for IBM.

John Martinec, BS, Senior Software Engineer
John performed space software development, integration, management, verification & test since 1968.

- NASA Mission Control Center computer software development and testing for flight controller monitor, trajectory analysis, command and control of NASA space missions during Apollo moon landings, Apollo-Soyuz, Skylab, Space Shuttle (and Space Station missions.
- Independent Verification & Test (IV&T) featured the full life cycle planning, requirements generation, scripting, analysis and certification throughout NASA manned ground and flight hardware and software performance.
- Personally performed the complete IV&T certification for a Shuttle Mission in NASA JSC Mission Control Center (MCC) Mission Operations Control Room (MOCR), including producing and performing the IV&T certification script for all elements of hardware at the complete array of MOCR flight controller consoles (e.g., displays, PBIs, SMEKs, etc.).
- Awarded NASA Outstanding Contribution Award for Space Shuttle system development, management, integration, IV&T and operations.

Professor Steve Rowland, BS., Physicist,

- Department Head of the Non Destructive Test Department at San Jacinto College.
- Teaches Testing of materials, rockets, tools, test methods in college for more than 15 years.
- Built & Test flew rockets for Southwest Research, for JS Government Agencies.

Hugo Richer BS, Electrical Engineering Science

- Designed, Built, Tested & Verified computers, software, and Control Centers-20 years.