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The Apollo program and the rockets that took humanity to the moon (9-D6.2)

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PAVING THE WAY: THE INFLUENCE OF EARLY RESEARCH AND DEVELOPMENT PROGRAMS
ON APOLLO, SATURN, AND LEGACY SYSTEM DEVELOPMENT.

Abstract

As we celebrate the 50th anniversary of the Apollo landings in 2019, a review of historical research and development programs provides insightful context for key decisions that led to the success of the first human landings on the surface of the Moon. Prior to the founding of the National Aeronautics and Space Administration (NASA) in 1958, the predecessor National Advisory Committee for Aeronautics (NACA) conducted early research followed by the establishment of the NASA research centers. The Langley Memorial Aeronautical Laboratory (LMAL), founded in 1917, began the transition from aeronautics to space as early as the mid-1940s. The LMAL eventually became NASA's Langley Research Center and celebrated 100 years of aerospace achievements in 2017.

As with many complex system development programs, early research, testing, and training provided a crucial foundation for key design and development decisions in the Apollo/Saturn V era. Among the key technical considerations enabled by early research include stability and control of rockets, design of re-entry capsules, trajectories for the Apollo missions, and development of the Apollo lunar lander.

Among the historical programs and achievements that can be discussed are: 1. Establishment of the Pilotless Aircraft Research Division (PARAD) to pioneer research into aerodynamics, guidance, navigation, and control of rockets at supersonic and hypersonic speeds. 2. Establishment of the Auxiliary Flight Research Station at Wallops Island and conduct of the Scout rocket program, which conducted 113 flights and provided critical ascent and re-entry aerodynamic data. 3. Construction of new test facilities and research into low lift-to-drag ratio ballistic entry capsule concepts that led to Project Mercury. 4. Formation of the NASA Space Task Group (STG) and initiation of Project Mercury. 5. Conduct of the Lunar Orbiter Project as a pathfinder for Apollo. 6. Development of the Lunar Orbit Rendezvous (LOR) concept. 7. Development and testing of Apollo Lunar lander concepts at the Lunar Lander Research Facility.

The paper will trace these historical programs leading to the foundation for design and development of the Apollo crew capsule, the Saturn V launch vehicle, and the Lunar lander. Through the lens of these historical developments, we can also see the influences on more recent space exploration programs, including the Space Shuttle, the Viking landings on Mars in 1976, today's development of the Orion crew capsule and Space Launch System (SLS), and support for commercial rocket and crew system developments in the United States.