"EGGHEADS" IN DEFENSE AGAINST COMMUNISM

The quality of this space age military power and the rapidity with which we can achieve it depends fundamentally upon the kind of mind power we possess. Today, more than ever before, we need for national survival the disciplined and resourceful mind which makes possible intellectual performance of the highest order.

In my view it is a national disgrace that the term "egghead" as a synonym for intellectual excellence has become a derogatory expression. Let me tell you that it is the "eggheads" who are saving us — just as it was the "eggheads" who wrote the Constitution of the United States. It is the "eggheads" in the realm of science and technology, in industry, in statecraft, as well as in other fields, who form the first line of freedom's defense against communism.

General Bernard A. Schriever (1959, 37)

weightlessness? Where would the propellant exactly be in the propellant tank at that time? How to ensure that a gas bubble would not cover the propellant outlet thus preventing the second stage from proper ignition? Sloshing and vortexing of propellants in the tanks further complicated problems of attitude control and produced undesired loads on rocket structure.

One-and-One-Half-Stage Design

The uncertainty of the ignition of the second rocket stage under conditions of a free-fall environment (weightlessness) led to the selection of a conservative "one-and-one-half-stage" design for the Atlas. All Atlas's three engines started simultaneously at liftoff. Two side booster engines were jettisoned after two minutes of powered flight, while the third sustainer engine continued acceleration of the vehicle with the entire propellant tanks until the engine cut off. Interestingly, the concept of the first Soviet ICBM R-7 (SS-6) would be somewhat similar, with four side boosters.

Rocketdyne's Engines

As with any complex technological system, the performance characteristics of the Atlas power plant improved as the development progressed. The first development test vehicles, Atlas A, B, and C, used the MA-1 engine system consisting of the two XLR43-NA-3 booster engines and XLR43-NA-5 sustainer engine. The Atlas D, the first deployed ICBM, had the MA-2 engine system (LR-89-NA-3 boosters and LR105-NA-5 sustainer). The MA-3 system for the Atlas E and F ICBMs followed. The MA-5 system was a version of the MA-2 used for space launches. Thrust and specific impulse of the Atlas engines steadily progressed as shown in the following table:

Engine system	Sustainer (S) Booster (B)	Thrust, lbf (total)	Specific impulse, s
MA-1 (Atlas A,B,C)	S	54,000	210
MA-2 (Atlas D)	S	57,000	213
MA-3 (Atlas F,E)	S	57,000	214
MA-5 (launchers)	S	60,000	220
MA-1 (Atlas A,B,C)	B	300,000	245
MA-2 (Atlas D)	B	309,000	248
MA-3 (Atlas F,E)	B	330,000	250
MA-5 (launchers)	B	377,000	259

M. Gruntman, *Blazing the Trail. The Early History of Spacecraft and Rocketry*, AIAA, Reston, Va., 2004. Page 236