

Black Brant XII Launch Vehicle (40.XXX)

General

The Black Brant XII rocket system (Figure F.7-1) is a four stage system used primarily to carry a variety of payloads to high altitudes. Its development is a spin-off of the Black Brant X development.



Figure F.7-1: Black Brant XII Launch Vehicle

Vehicle Performance

The first and second stage are the Mk 11 Mod 5 Talos rocket motor and the Taurus motor. The third stage is a modified Black Brant VC motor. The Black Brant nozzle is extended for exoatmospheric use and the tailcan has been changed to enclose the nozzle. The aft end of the tailcan has a restraining device to keep the Taurus and Black Brant connected while coasting. The Talos motor is 132 inches long with a diameter of 31.1 inches. It is fitted with a conical adapter for mating to the second stage and differential drag forces cause separation. Four fins are arranged at the aft end in a cruciform configuration and drive the roll rate to approximately one revolution per second at burnout. Each fin is 6.9 square feet in area .

The Taurus motor is 165 inches long with a principal diameter of 22.75 inches. The motor has the interstage adapter bolted to the forward end, which is then clamped to the aft end of the Black Brant motor. Each Taurus fin is 4.8 square feet in area. Normally, the fins are canted to provide two revolutions per second spin rate at Taurus burnout. The weight of the booster system (with hardware) is 3005 pounds, including 1678 pounds of propellant.

The 26 KS 20,000 Black Brant V rocket motor has been modified for use as the third stage of the Black Brant XII. The nozzle cone has been extended as has the tailcan, and the diameter at the aft end of the conical extension is 22 75 inches. The standard Black Brant V fin panels are used even though the tail assembly is different. The 26 KS 20,000 Black Brant V rocket motor produces an average thrust level of 15,596 pounds and an action time of 32.42 seconds. The primary diameter of the Black Brant V is 17.26 inches and it is 210 inches long. Loaded weight of the motor including hardware is 2,803 pounds which includes 2243 pounds of propellant.

The Nihka rocket motor, previously developed for the Black Brant X, is used on this vehicle system. The average thrust is 10,592 lb, with a total impulse of 188.434 lb-sec. The primary diameter is 17.26 inches and the length is 76 inches. The loaded motor weight of 898.5 lbs. which includes 694.7 lbs. of propellant

Payloads

The standard payload configuration for the Black Brant XII vehicle is 17.26 inches in diameter with a 3:1 ogive nose shape. Payload length and weight limits for the Black Brant XII are not defined as they are for the Black Brant V and specific limitations for this system will be determined as the situation warrants. Because of relatively high dynamic pressures, bulbous (larger than 17.26 inches) diameter payloads are carefully considered before flight on the Black Brant XII. For payloads weighing as little as 300 pounds, 1500 km apogee altitudes can be reached. The 500 km altitude region is attainable with 1150 pound payloads from sea level, when the launcher elevation is 85 degrees.

Standard hardware systems that are available for Black Brant V motors include payload separation systems including a High Velocity Separation System and despin systems. These units are "stackable" such that a great deal of flexibility exists in meeting experiment requirements. It should be noted that

because of the extreme range at even moderately high launch elevation angles, recovery of the payload may not be possible.

Performance Graph

The Black Brant XII launch vehicle configuration and apogee altitude and impact range at various launch elevation angles and payload weights are presented in Figure F.7-2.

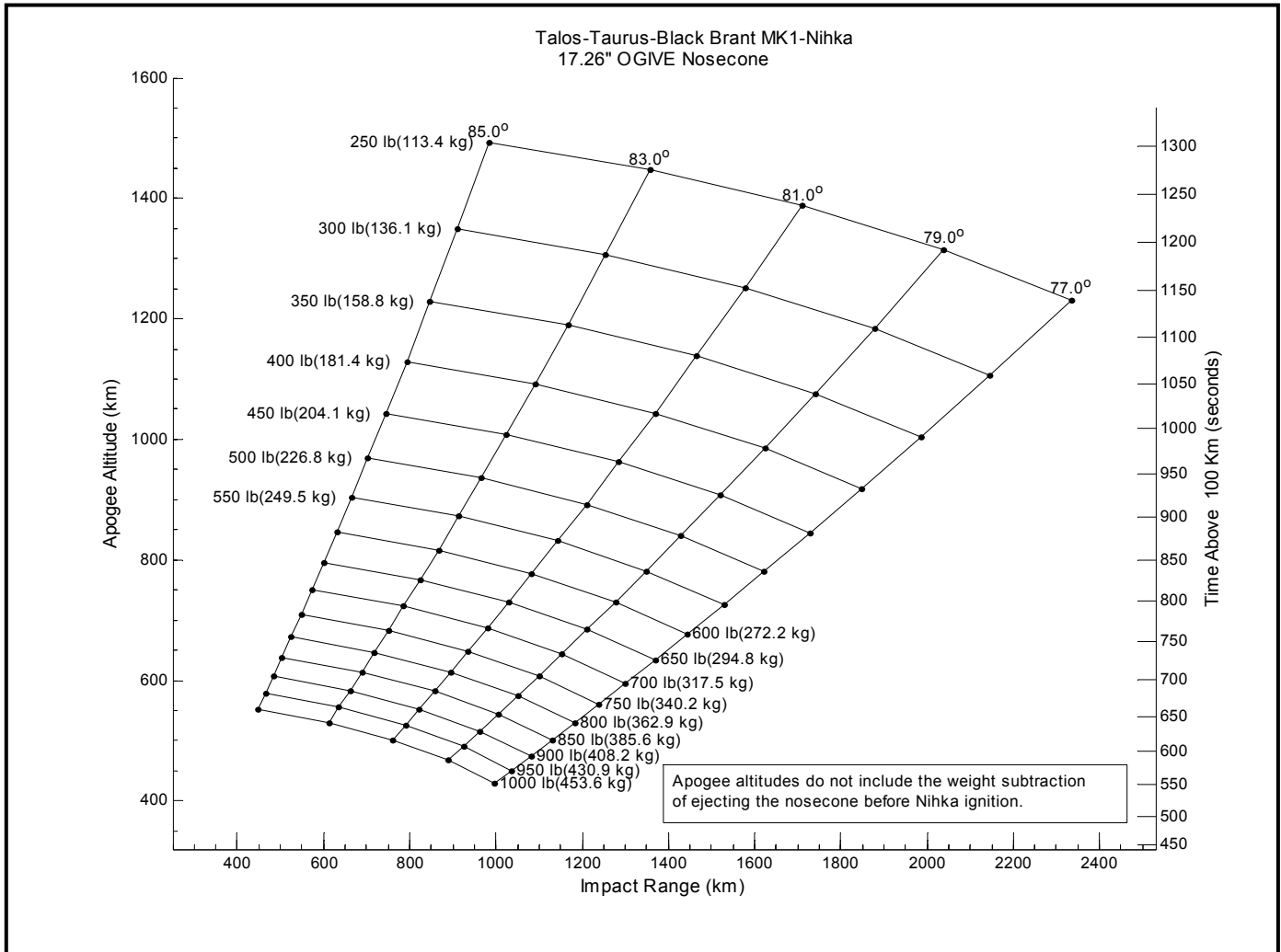


Figure F.7-2: Talos-Taurus-Black Brant MK1-Nihka Predicted Vehicle Performance