Black Brant XI Launch Vehicle (39.XXX)

General

The Black Brant XI rocket system is a three stage system used primarily to carry heavy payloads to high altitudes. Its development is a spin-off of the Black Brant XII development. The first and second stages 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 during second stage coasting. This motor configuration makes up the first three stages of the Black Brant XII.

Figure F.6-1: Black Brant XI Launch Vehicle

Vehicle Performance

The Talos motor is 132 inches long with a diameter of 31 inches. It is fitted with a conical adapter for mating to the second stage. Differential drag forces cause separation. Four fins are arranged at the aft end in a cruciform configuration and drive the vehicle to approximately one revolution per second burnout roll rate.

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. 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 motor case wall is thicker which permits use with significantly higher thrust lower stages. The standard Black Brant V fin panels are used even though the tail assembly is different. The modified Black Brant V rocket motor produces an average thrust of 17,025 pounds with an action time of 26 9 seconds. The primary diameter of the Black Brant V is 17.26 inches and it is 223 inches long. Loaded weight of the motor is 2,847 pounds which includes 2,198 pounds of propellant.

Payloads

The standard payload configuration for the Black Brant XI vehicle is 17.26 inches in diameter with a 3:1 ogive nose shape. Payload length and weight limits for the Black Brant XI are not defined as they are for the Black Brant V and specific limitations for this system will be determined as the situation warrants. For payload weights of 700 pounds, apogee altitudes of 500 km can be expected. A payload of 1200 pounds will reach 350 km. Both values use a launcher elevation angle of 85 degrees from a sea level launch location.

Standard hardware systems that are available for Black Brant V motors include aft recovery systems for 750 lb. or 1000 lb. recovered weights, Ogive Recovery System Assembly (ORSA) for the same weight ranges, 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.

Performance Graph

The Black Brant XI launch vehicle configuration and apogee altitude and impact range at various launch elevation angles and payload weights are presented in Figure F.6-2 on the following page.

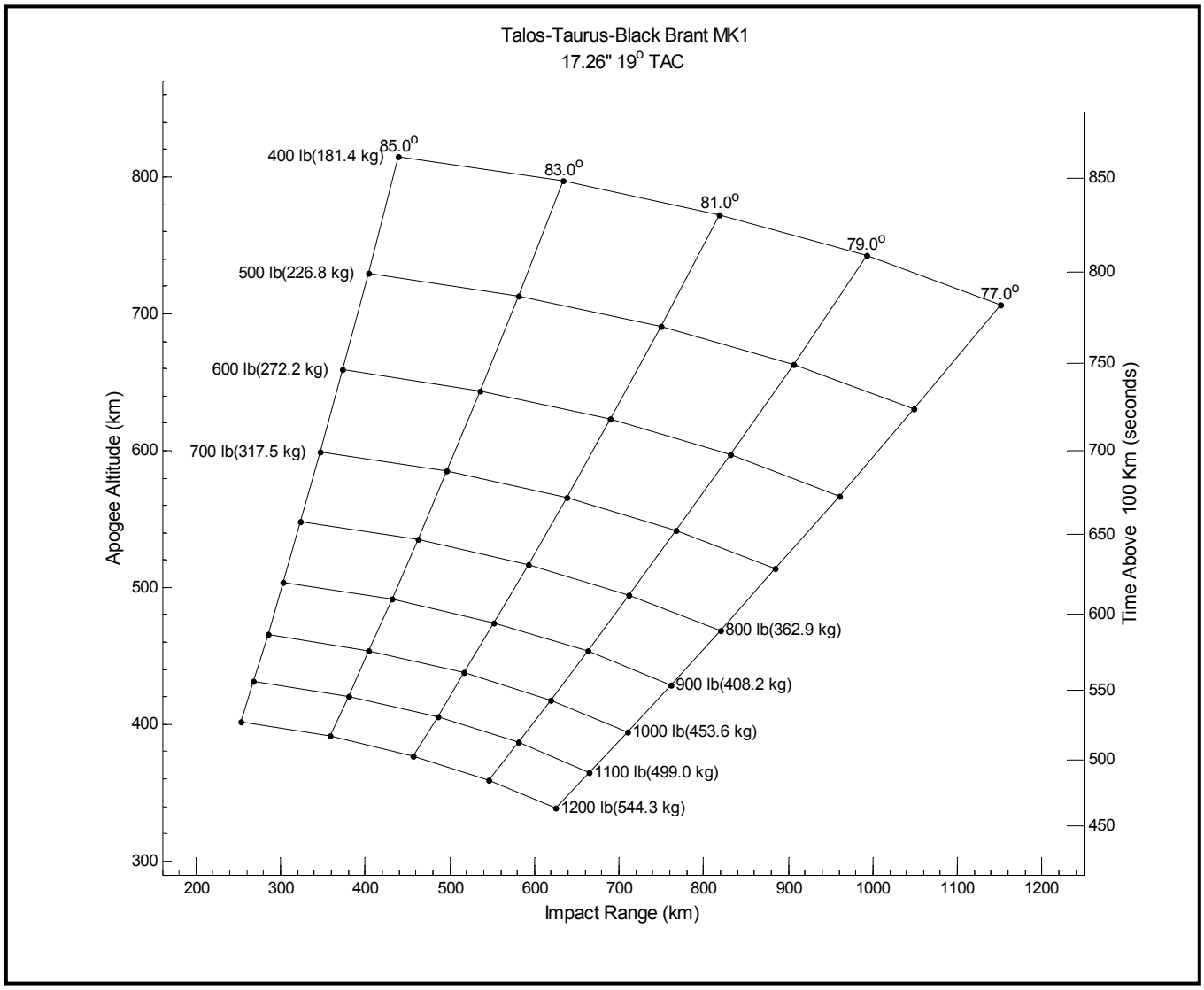

Figure F6-2: Talos-Taurus-Black Brant MK 1 Predicted Vehicle Performance