Development History US-Space Plane Systems “*Advanced Lifting Body Air Vehicles*”.

 A Superior Dual Purpose Air and Space Vehicle

The requirements set forth by modern military planners for a superior sub-orbital strike aircraft was presented by the Pentagon to US-Space Plane Systems (formally Aviation Dynamics Corporation) for a conceptual design that could fulfill a multitude of difficult requirements. The primary requirement is the aircraft must accommodate eight to ten passengers and be instantly deployable with orbital access. A requirement was also submitted by the US Marine Corp for an orbital assault personnel aircraft. A project called SUSTAIN where the capabilities needed were much more demanding was examined. They presented 27 requirements including amphibious landing and takeoff. The solution was a two craft system consisting of a large suborbital mother ship capable of carrying large cargo loads comparable to current C17 cargo aircraft with an operational range of five thousand nautical miles at near orbital speeds, and a smaller orbital vehicle that could be “air launched” from a mother ship or ground launch from a conventional rocket launch vehicle.

Based on the requirements presented it was decided to consider a lifting body vehicle design to address these requirements. If developed, the vehicle and system could deliver superior performance far exceeding the requirements set forth. The result would be a superior high speed and altitude (Sub-Orbital and Orbital) all purposemilitarycapable craft, to address future needs of joint commanders and military planners well in to the 21st century. And to serve as a deterrent by future aggressors and rouge nations, by providing as a fast response, offensive air system that is extremely difficult to defend against.

First, development of the smaller orbital “A” model air frame took place in 1989. The method for determining the new aero shape is based upon careful evaluation of early lifting body vehicles tested at the Hugh L Dryden Flight Research Center. Archived Flight Data was obtained and evaluated by US-Space Plane Systems chief designer Jon Stephenson from test flights and test pilot recommendations on the lifting bodies tested at Dryden. Of the three early 1960s lifting bodies tested, all displayed similar flight characteristics. However each craft had its own superior attributes as well as flaws. For example one craft had better roll stability than another. One craft had better pitch control. Another could be trimmed more easily than another at supersonic speeds. The lift to drag ratio of all the 60s lifting body air vehicles was different. However, all exhibited changing values as speed and angle of attack increased and decreased.

In summary, no single lifting body displayed superior flight dynamics that would enable a single design to function as a practical multi roll craft. The solution was to combine all the best qualities of all the former aircrafts into a singular design and engineer out many of the undesirable characteristics.

The anticipated result would be a craft with excellent aerodynamic stability, superior speed, maneuverability, payload capability and foremost, a stealthy profile.

The new shape was finalized in April of 1998. Once the shape was established and scaled test models were built and flown. It was discovered that the physical shape could be altered to address a host of aviation and aerospace needs. One example would be a craft with a large payload capacity versus a craft only needing a small payload compartment for a warhead. The shape of the craft would be easily altered to address that particular need. Another example would be a craft needing hypersonic speeds versus a craft needing slow and loiter speed for a resonance mission. The shape could again be adjusted for the mission required and not compromise the qualities of the basic design. The result produced multiple shaped crafts that could fulfill specific performance requirements. This was a tremendous breakthrough for the design team and opened up the possibility of providing vehicles for customers with land, air, sea and space applications in mind. These new “Advanced Lifting Body” air vehicles are now showing superior flight dynamics in many areas of critical flight performance. One example of the new design is the ability of complete stall recovery back to strait and level flight with no input from control surfaces. Another attribute of the design is that all our LB crafts can operate from water, a capability not exhibited by current supersonic aircraft. Flights involving remote piloted scale models were conducted where the vehicles performed water takeoffs and landings with 100% success.

The water test evaluations revealed the craft’s have satisfactory stability in rough water and ocean swell environments. The swells also help the craft in takeoff mode by providing a natural ramp for takeoff. Our airframe development program has included CFD computer analysis and virtual wind tunnel simulations at different test values. The conclusion of our analysis is that is our lifting body design has excellent stability and controllability in the pitch, roll and yaw attitude, far superior than the LBs of the nineteen sixties. Also the addition of our patented “chine” system applied to the LB airframes, further improvement in roll and overall stability was achieved. Based upon this progress, US-Space Plane Systems has proceeded to begin work on the next generation of air vehicles.

At present we have performed 50 Lifting body flights over a span of eight years. Much more testing will be peformed. We have only begun to scratch the surface of this remarkable technology. If we are successful, the needs of military planners and the awaiting commercial air and space industries will have a new tool to move human travel well into the 21st century.

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