GENERAL INFORMATION

The speed of sound (approx. 1090 ft. per sec. at 0 deg. C) was unreachable for many years. Unexpected things happened to planes and other craft that approached it. Even when the "sound barrier" was broken, much of the mystery remained.

This was largely because research aircraft had to get through the so-called "transonic region" quickly, or lose control and crash. Later studies showed that a violent increase in drag and the formation of shock waves caused the control loss.

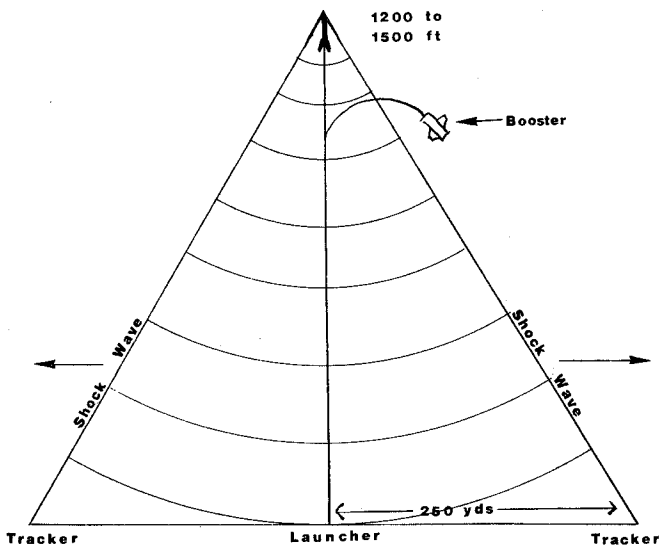
Rockets are valuable tools in supersonic research, because they can be easily fired into the transonic region. Since they rely more on ballistic forces than on control surfaces for guidance, control problems do not arise as readily. Shock waves and other effects of supersonic speeds are readily observable.

The Mach 1 System relies on the formation of shock waves to verify the speed of the vehicle. Observers have heard "sonic booms" during test flights. This is not the same order of "boom" as is heard when a plane passes; the small rocket produces a much smaller boom for a very short period of time. The wave is radiated in a cone with the apex at the nose of the rocket, as shown below. Only at the edges of the cone will the boom be loud enough to be heard. In tests, the vehicle produced booms sounding similar to the report of a small-caliber rifle, and a violent vibration was observed as the Dart went through the transonic region.

Observers must be stationed at least 250 yards from the point of launch to intercept the shock wave. The Dart will exceed the speed of sound for only a moment as the upper stage forces it through the transonic region; this should occur at an altitude of 1200 to 1500 feet.

The exact speed of sound depends on the altitude above sea level, the air pressure, temperature and other factors. The Mach 1 Dart cannot be guaranteed to exceed the speed of sound under all conditions.

The Mach 1 System was designed by professional aeronautic engineers, and it has been thoroughly tested. Since it accelerates to a very high altitude very quickly, any problems that might occur during the flight will happen at extreme altitudes and do not pose a safety hazard. When the proper safety proceedures are followed, the Mach 1 System is as safe as any other model rocket.



F.S.I.

Mach 1 System

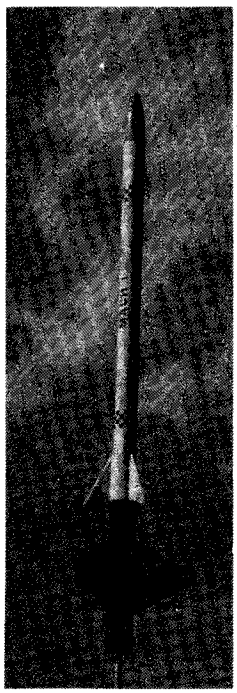
DART MRK-XVII

UPPER STAGE OF THE

Mach 1 System

When flown with the MACH 1 THRUSTER SYSTEM shown below

this vehicle has SUPERSONIC POTENTIAL



This kit includes all parts needed to build and fly the DART as a single-stage rocket. Engine not included.

RECOMMENDED ENGINES

A4-4
C4-4
D4-6
D6-6
D18-6
D20-7

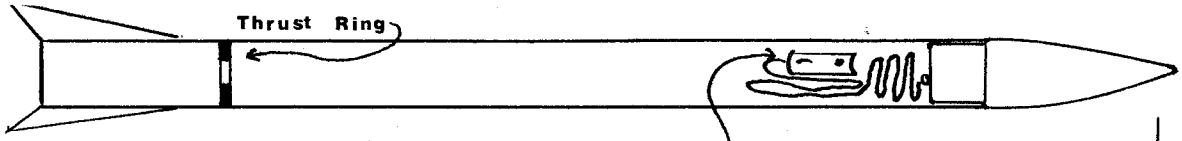
MACH 1 BOOSTER SYSTEM

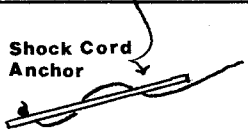
SPECIFICATIONS:

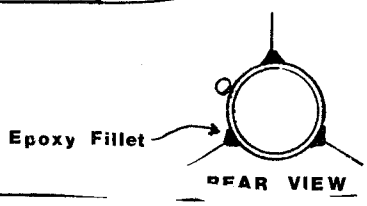
Length: 18.7 in.
Body Diameter: .903 in.
Approx. Liftoff Weight without engine: 1.3 oz.

CP ≈ 3.25" from rear of B Tube

Flight Systems, Inc.
9300 East 68th Street
Raytown, Missouri 64133







PARTS LIST

Qty	Description	Qty	Description
1	.903 x 16" Body Tube	1	Streamer Assembly
1	Nose Cone	1	Thrust Ring
3	Fins	1	Shock Cord
1	Eye Screw	1	Shock Cord Mount
1	Snap Swivel	2	Launch Lugs
		1	Flame Proof Wadding

ASSEMBLY OF THE MACH 1 DART

1. Check to be sure that all parts are present.

2. Round the leading and trailing edges of the fins, and sand them smooth.

3. Using the Fin Placement Guide, mark one end of the body tube with a pencil. Glue the fins to the body tube at the points marked with white glue. Complete this step carefully, checking as you proceed to be sure that the fins are straight , and properly aligned perpendicular to the body tube.

4. Once the fins have dried completely, apply a good quality "5 minute" epoxy to form fillets along the area where the fins join the body tube. It is most important that these fillets be extremely strong. Therefore two or three layers of epoxy should be applied. Wipe any spilled epoxy off the body tube immediately.

5. Subsonic Configuration: (If you plan to attempt supersonic flight disregard this instruction. See Supersonic Configuration below)
Run a line of glue inside the back end of the body tube and insert thrust ring. Using an engine casing of the size you plan to fly with, push the ring into the tube until about 1/4 inch of the engine is projecting from the rear of the rocket. Remove the engine casing. Attach the launch lugs to the rocket body approximately 1 inch from the top and bottom of the body tube. Be sure they are accurately aligned with the body of the rocket.

   Supersonic Configuration:
Mark a 21x95 mm engine (D18,D20, or E5) one inch from the nozzle end. Run a line of glue inside the back end of the body tube and insert the thrust ring. Push the ring into position with the engine casing you have just marked. Be sure that 1 inch of the engine projects from the rear of the rocket. See the cutaway illustration in the Thruster System instructions. Launch lugs are not used on the Dart when attempting supersonic flight. (See Thruster System instructions for placement of launch lugs on on first stage booster)

6. Attach the eyescrew to the base of the nose cone. Thread the shock cord through the shock cord mount as shown. Glue the mount into the top of the rocket body as shown, pressing it down firmly. For minimum body tube distortion "5 minute" epoxy should be used for this operation. Use a pencil or similiar instrument to press the shock cord anchor down.

7. Sand the entire rocket lightly with fine sandpaper. Fill the fins and nose cone with sanding sealer, sanding lightly after each application las dried. Finish with a light application of enamel or aircraft dope. Flat black is recommended for easier tracking.

FLYING - Subsonic Configuration

1. The Dart should not be flown in winds above 10 MPH. Because of its high - speed configuration, it needs a strong initial impulse to obtain needed aceleration for proper stability. Flights with smaller engines are possible, but care must be taken.

2. Push a 2 inch square of wadding into the top of the rocket.(F.S.I. wadding) Attach the streamer cord to the streamer using the adhesive label furnished reinforce one end of the streamer. Punch hole in label and tie cord to this. Tie the snap swivel to the free end of the streamer cord. Attach this streamer assembly to the eye screw in the nose cone with the snap swivel. Tie the shock cord to the eye screw. (A small amount of white glue on the knot will insure against it becoming untied. Carefully roll the streamer and insert it into the body of the rocket. Remember if it fits too tightly you may not get a recovery ejection so you may wish to roll the streamer into two rolls or sections. Insert the nose cone.

3. Wrap masking tape around the engine casing until a force of about 10 lbs. is required to push it into the rocket body.(See instructions with engines) Insert the engine. Your rocket is now ready for launch.

4. The LP-2 launch stand is recommended for launching this vehicle in its subsonic configuration. Check the area to be sure it is clear of flying aircraft. Always use a countdown to be sure that spectators are aware of the launch. Follow the instructions which came with you engines for connecting the firing system and for launching this vehicle.

FLYING - Supersonic Configuration

1. See the RX-1 Thruster System instructions for preparing the engines and recovery system.

2. Caution: The Mach 1 should be flown only from a launch stand using a 1/4 inch diameter launch rod. The F.S.I. LP-2B Launch Stand is recommended. Do not fly this vehicle from a smaller launch pad. Deflection at the base of the flight path and a non-vertical flight can result.

3. Observers should be stationed as shown in the illustration, at least 250 yards from the launch site in order to hear any sonic boom which might occur and to watch the entire flight from the best vantage point. Be sure to have someone watching the booster stage after staging occurs. The booster will tumble back to the ground slowed by its fins, but it is rather heavy and will be travelling faster than a rocket with a parachute or streamer recovery system.

4. Check to be sure there no aircraft in the area.

5. Follow the instructions which come with the RX-1 Thruster System for setting up and launching the Mach 1.

TODAY
1993

JANUARY

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B203

DART

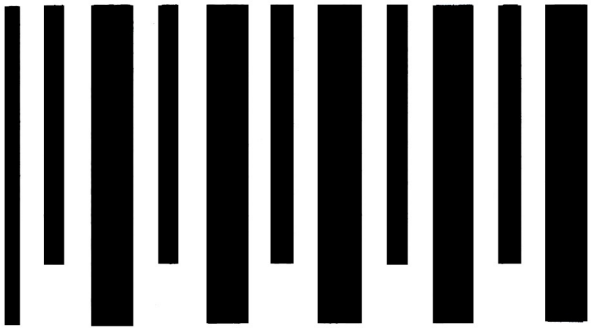
UNITED STATES

USA NASA

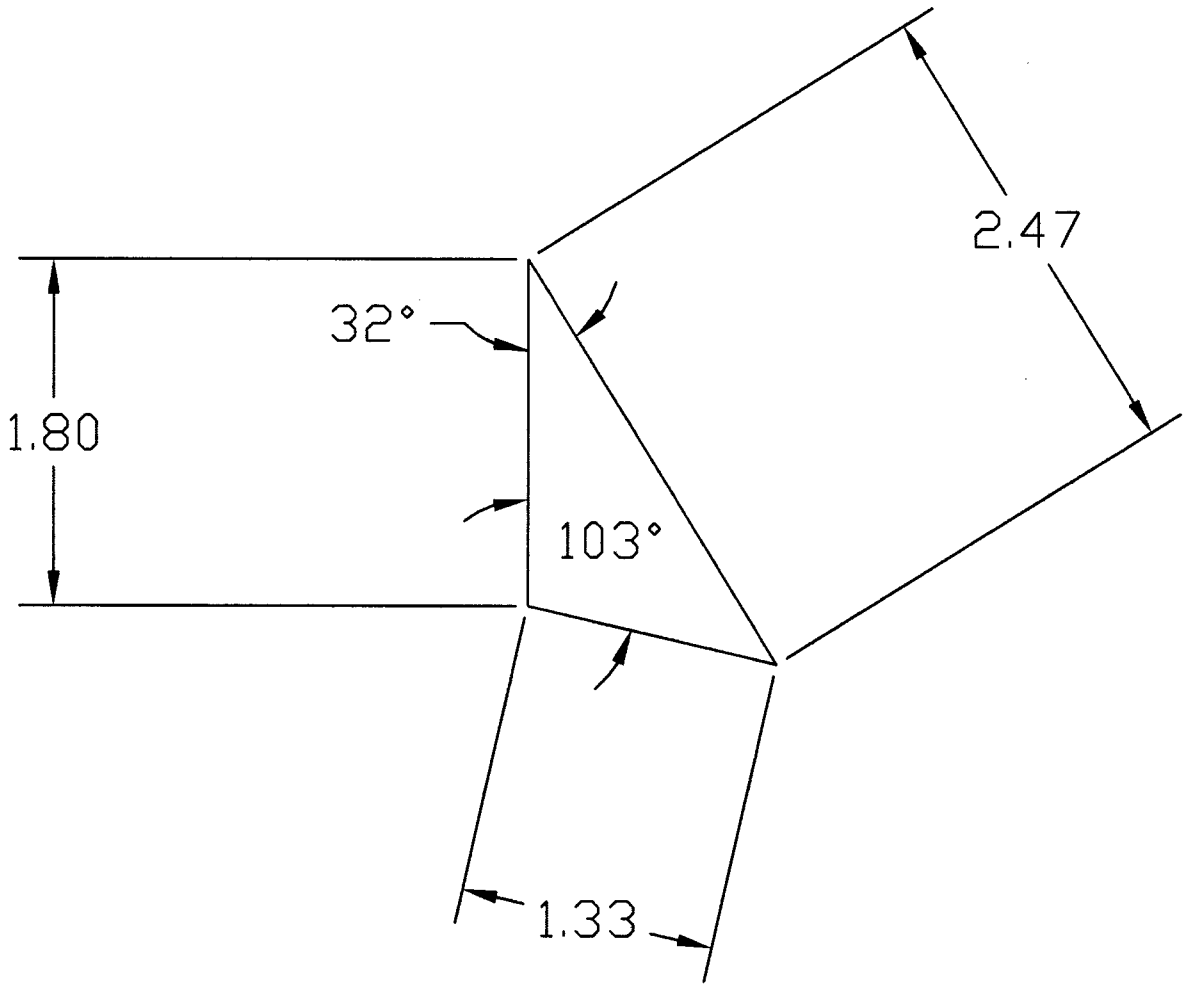
DART

UNITED STATES

USA NASA



1/16" PLYWOOD



FSI	DART	FIN PATTERN