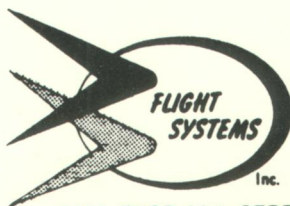


FLIGHT SYSTEMS, INC.

MODEL ROCKETRY

79



SPACEMODELING – A Hobby for ages 10 to adult

9300 EAST 68th STREET
RAYTOWN, MISSOURI 64133



FLIGHT SYSTEMS, INC.

9300 EAST 68th STREET
RAYTOWN, MISSOURI 64133

Thrusters!



Rockets!

Greetings from F.S.I.

Flight Systems, Inc. invites you to join the scientific world of rocketry. Model rocketry offers you a way to become a part of the new technological space age. By using the reliable commercially produced FSI thrusters, unlimited scientific experiments can be performed. FSI thrusters are excellent research tools and aid in gaining a thorough understanding of aerodynamics and jet propulsion principles as well as basic physics and meteorology. Never before has the model rocketeer been able to obtain such reliable and powerful rocket thrusters.

In this publication Flight Systems introduces many advanced products in model rocketry. The new full 80 Newton Second Thruster, incorporating the latest development in high velocity propellants is now available. New kits include the Black Brant, a 42" scale model of the Canadian sounding rocket, the Echo I, an advanced two stage design, and the EOS designed to be used as a demonstration rocket. New professional type launch systems are included. Some basic technical information is included that may be of interest to the beginner as well as the more advanced rocketeer.

Flight Systems, Inc. the leader of the rocket industry, seeks to provide the model rocketeer with new products and technological advances previously unavailable. The research and development department of FSI is unequalled in its field. Look to Flight Systems (F.S.I.) for new products and scientific breakthroughs.

Flight Systems fully supports the National Association of Rocketry. We welcome your ideas and suggestions for new products. Feel free to contact us if you have any questions concerning model rocketry or if we can be of assistance to you.

Yours truly,

Lonnie H. Reese, President

TELEPHONE

Area code 816-353-1616

ABOUT OUR ROCKETS

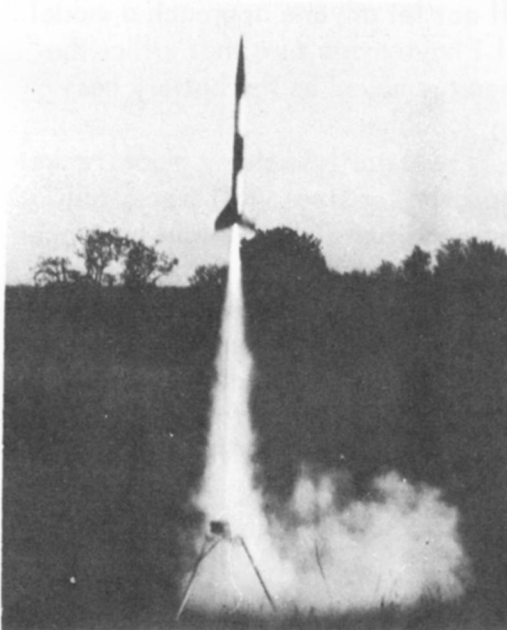
FLIGHT SYSTEMS, INC. model rockets are high performance solid fuel rockets capable of flights to extreme altitudes. They are launched from a launch stand using a 1/8" or 1/4" rod and a remote electrical firing unit. Once they reach the apogee of their flight, a parachute or streamer is deployed returning them safely to earth.

When operated in compliance with the Model Rocket Safety Code, they offer a very safe way to enjoy the thrilling sensation of launching a real solid fuel rocket. Many interesting and scientific experiments can be conducted using model rockets. Many schools incorporate the use of model rockets into their Science Departments to demonstrate and teach principles of rocket flight.

FLIGHT SYSTEMS, INC. model rockets can reach altitudes of many thousands of feet, consequently they should be launched in a relatively open area that is free of overhead obstructions. Launching in an open area minimizes the chance of losing the rocket. Model rockets should be operated in a manner which does not create a hazard to persons, property or aircraft.

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MODEL ROCKET SAFETY CODE

Solid Propellant

1. CONSTRUCTION - My model rockets will be made of light-weight materials such as paper, wood, plastic and rubber, without any metal as structural parts.
2. ENGINES - I will use only pre-loaded factory made model rocket engines in the manner recommended by the manufacturer. I will not change in any way nor attempt to reload these engines.
3. RECOVERY - I will always use a recovery system in my model rockets that will return them safely to the ground so that they may be flown again.
4. WEIGHT LIMITS - My model rocket will weigh no more than 453 grams (16 ozs.) at liftoff, and the engines will contain no more than 113 grams (4 oz.) of propellant.
5. STABILITY - I will check the stability of my model rockets before their first flight, except when launching models of already proven stability.
6. LAUNCHING SYSTEM - The system I use to launch my model rockets must be remotely controlled and electrically operated, and will contain a switch that will return to "off" when released. I will remain at least 15 feet away from any rocket that is being launched.
7. LAUNCH SAFETY - I will not let anyone approach a model rocket on a launcher until I have made sure that either the safety interlock key has been removed or the battery has been disconnected from my launcher.
8. FLYING CONDITIONS - I will not launch my model rocket in high winds, near building, power lines, tall trees, low flying aircraft or under any conditions which might be dangerous to people or property.
9. LAUNCH AREA - My model rockets will always be launched from a cleared area, free of any easy to burn materials, and I will only use non-flammable recovery wadding in my rockets.
10. JET DEFLECTOR - My launcher will have a jet deflector device to prevent the engine exhaust from hitting the ground directly.
11. LAUNCH ROD - To prevent accidental eye injury I will always place the launcher so the end of the rod is above eye

MODEL ROCKET SAFETY CODE (CONT.)

level or cap the end of the rod with my hand when approaching it. I will never place my head or body over the launching rod. When my launcher is not in use I will always store it so that the launch rod is NOT in an upright position.

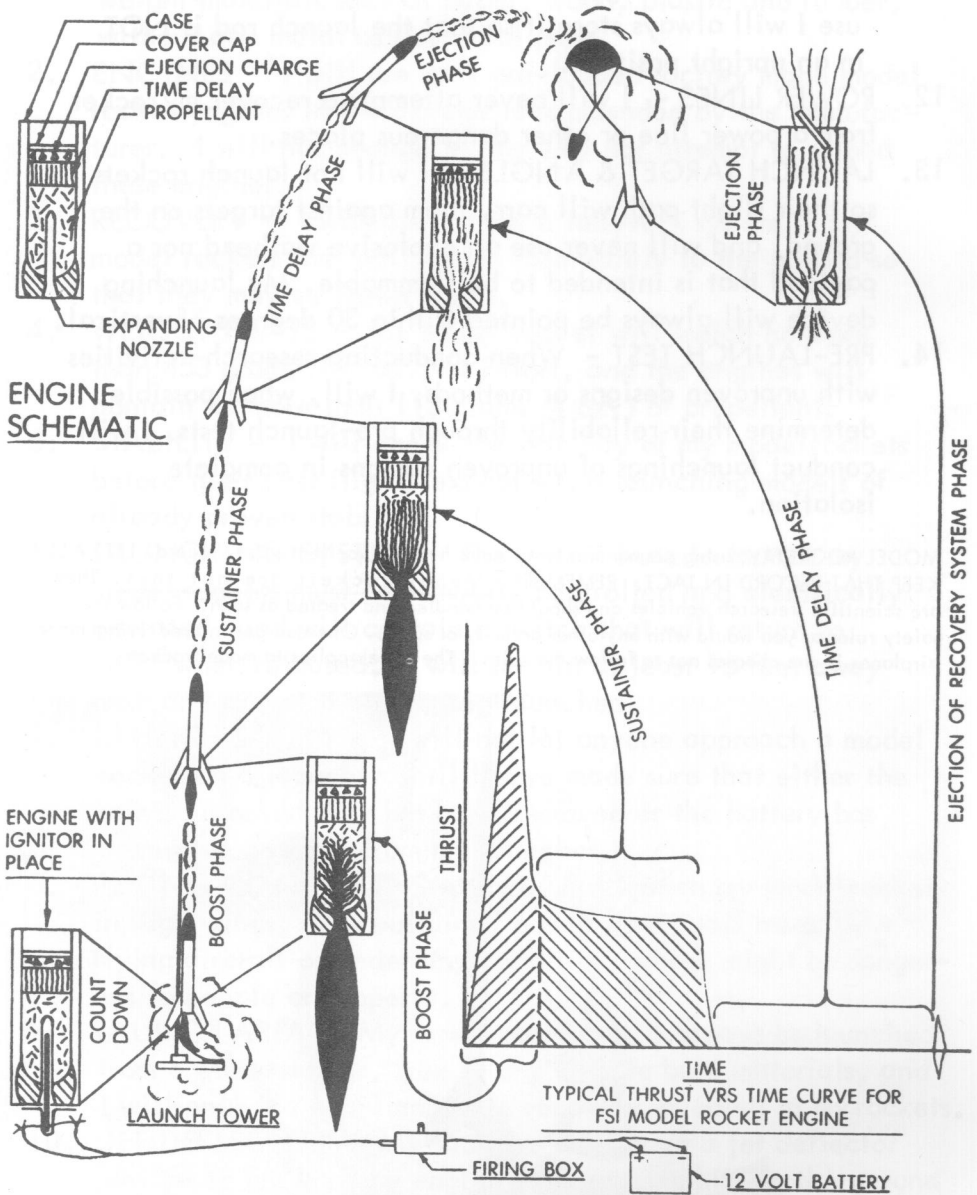
12. POWER LINES - I will never attempt to recover my rocket from a power line or other dangerous places.
13. LAUNCH TARGET & ANGLE - I will not launch rockets so their flight path will carry them against targets on the ground, and will never use an explosive warhead nor a payload that is intended to be flammable. My launching device will always be pointed within 30 degrees of vertical.
14. PRE-LAUNCH TEST - When conducting research activities with unproven designs or methods, I will, when possible, determine their reliability through pre-launch tests. I will conduct launchings of unproven designs in complete isolation.

MODEL ROCKETRY using premanufactured items has an excellent safety record. LETS ALL KEEP THAT RECORD IN TACT. REMEMBER - Model Rockets are not toys. They are scientific research vehicles and should be handled and treated as such. Follow the safety rules as you would with any other activity or sport. One can get injured flying model airplanes if one chooses not to follow the rules. The same applies to model rocketry.



INTERNAL BALLISTICS — EXTERNAL BALLISTICS

RELATIONSHIP OF ENGINE BURNING PHASES TO FLIGHT AERODYNAMICS



BALLISTICS

INTERNAL BALLISTICS - is the science dealing with the thermochemistry of combustion of the propellant in the engine and the accompanying physical phenomena of gas production and expulsion to produce thrust. Simply stated, it is the combustion of the propellant to produce a gas which then undergoes a change in enthalpy through the rocket nozzle to produce thrust.

EXTERNAL BALLISTICS - is the science dealing with the flight of the rocket after it leaves the launcher. As the engine is usually still thrusting at this time, we have the forces of engine thrust and the aerodynamic forces on the rocket body to consider.

MODEL ROCKET FLIGHTS

COUNT DOWN - The Model Rocket has been preflight checked and placed on the launch tower. The rocket engine ignitor has been placed in the core of the rocket engine. Wires from the firing box are connected to the engine ignitor and the battery. All systems are now go. The countdown is begun and the firing button is pressed when countdown reaches zero. The rocket engine ignites. Action on the thrust-time curve starts at the lower left hand corner.

BOOST PHASE - The propellant is now burning away from the engine core where it was ignited by the electric ignitor. In a well designed rocket engine, burning takes place only on the surface of the propellant. As the propellant burns out and away from the core, the burning area increases producing an increase in the volume of gas produced. This gas is ejected through the engine nozzle to produce thrust. Burning area continues to increase until all the propellant around the initial core is burned to the engine wall. This produces the high peaked thrust shown on the thrust-time curve.

Initial high thrust is necessary for stable rocket flights. The rocket must leave the launcher with sufficient velocity for aerodynamic control. This is achieved by the fins on the Model Rocket passing through the air at high speed. This keeps the model pointed in an upward direction.

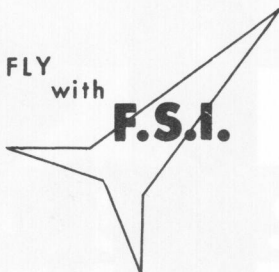
SUSTAINER PHASE - By now the propellant around the core has burned out to the core wall. The area of burning is now across the inside diameter of the engine case. Less gas for thrust is being produced. This is shown on the thrust-time curve by the lower thrust plateau.

During this portion of the flight, sufficient thrust must be produced by the rocket engine to keep the model rocket accelerating upward. Otherwise the model will lose aerodynamic control and pitch over and head back to earth.

TIME DELAY PHASE All the propellant in the engine is now consumed and the time delay material is ignited. No thrust is produced by the time delay material as shown on the thrust-time curve.

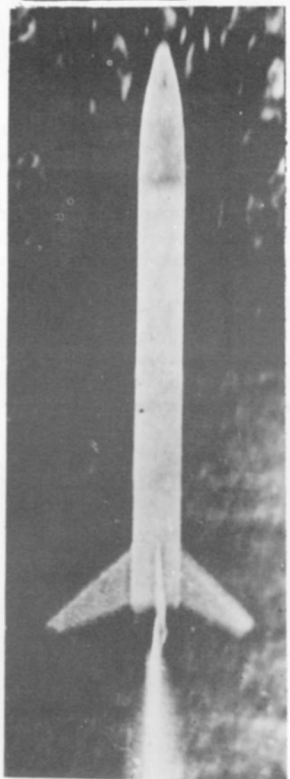
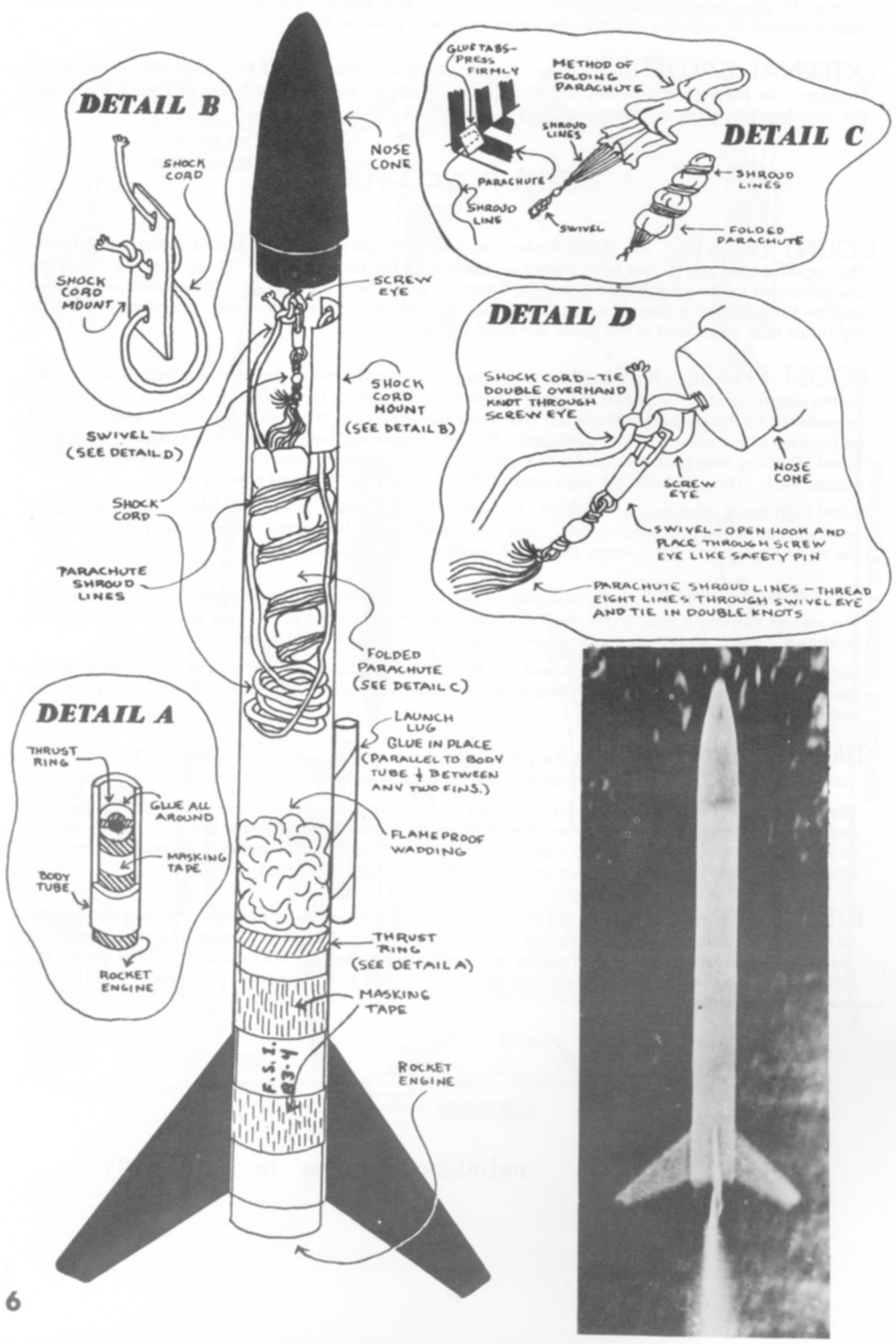
The Model Rocket is now coasting on the momentum which was stored in the system during the boost and sustainer phase of engine thrust. A well designed Model Rocket system should continue to coast to an altitude which is equal to twice engine burn out altitude. Gravity and aerodynamic friction on the Model Rocket begin to slow it down until the apogee of flight is reached.

EJECTION PHASE - When the Model Rocket is in the apogee of its flight, the time delay material burns through into the ejection charge. The ejection charge produces a large quantity of gas. This gas pushes the cover cap out of the engine and everything in the tube ahead is ejected. The ejected parachute unfolds and lowers the model rocket gently and safely to the ground. Many more flights can be made with the same model.



"PROFESSIONALISM IN ROCKETRY"

CUTAWAY DRAWING OF BASIC MODEL ROCKET



STARTER PACKAGE

Includes everything you need to build and launch your first model rocket. Fascinating, educational, scientific, hobby and sport.

- Includes: 1 Micro Rocket Kit
1 btl. White Glue
3 Assorted Rocket Engines
A4-4 B3-4 C4-4
1 Launch Stand
1 Electric Ignition System
1 Catalog and Technical Manual
1 Pkg. Flame Proof Wadding

Kit. No. SP-1

Ship Wt. 3 lb.



FLIGHT SYSTEMS, INC.

MICRO

A high performance kit designed by rocket engineers to introduce the newcomer to the thrills and excitement of model rocketry. Easy to follow instructions. Build, ready to launch in 15 minutes. This bird performs with the best. Altitudes to 3000'+

SPECIFICATIONS: Length ----- 11.5"
Body Dia. --- 0.903"
+Takeoff weight without engine ----- 1.6 oz. (30 gr.)
Recommended F.S.I. Engines: *A4-4, D4-6
B3-4, E5-6

Kit No. MRK-VIII
SHIPPING WT. 8OZ.



PENETRATOR

One of the finest flying rockets in the F.S.I. fleet. Streamlined aerodynamic shape cuts drag to a minimum. Altitudes in excess of 4000 feet can be reached using the powerful F.S.I. Rocket Engines.

SPECIFICATIONS: Length ----- 19.0"
Body Dia. --- 0.903"
+Takeoff weight without engine:----- 1.45 oz. (41gr.)
Recommended F.S.I. Engines: *A4-4, B3-4,
C4-4, D4-6,
D6-6, D18-6,

Kit No. MRK-I
SHIPPING WT. 8OZ.

+ All takeoff weights approximate.

* Suggested for lower altitude flights to facilitate recovery





F.S.I. 1/8 SCALE MODEL

CANADIAN SOUNDING ROCKET

BLACK BRANT II

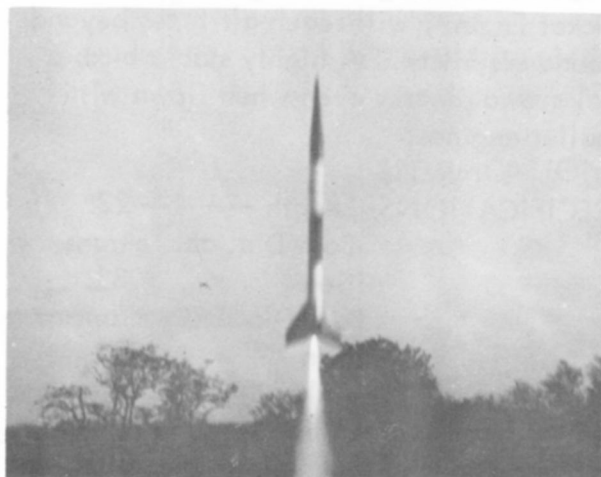
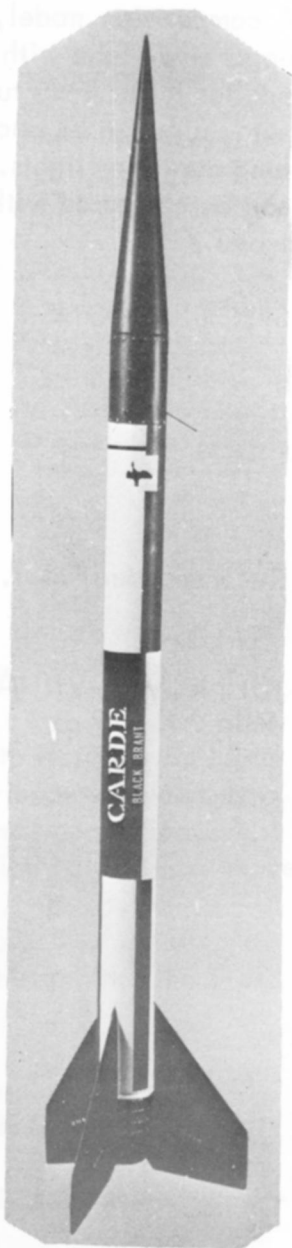
This sophisticated bird is unequalled for beauty and performance. Kit features include a 22" Nylon parachute, precut fins, precut balsa boattail, as well as scale decals.

SPECIFICATIONS:

Length----- 41.5 inches
Body Dia.-- 2.1 inches
Approx. Weight
without engine- 9.5 ozs.

Recommended F.S.I. Engines
F100-6
F100-8

CAT. NO. - MRK 14



FLIGHT SYSTEMS, INC.
9300 East 68th Street
Raytown, Missouri 64133

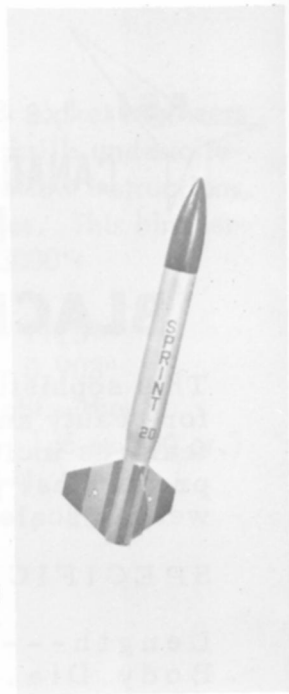
SPRINT

A competition model, the Sprint features a large upper body tube with a reverse transition to a smaller lower body tube. A large streamer or parachute can be packed in the upper body for long duration flights. The effect of base drag can be compared with that of a model like the Nova Kit.

SPECIFICATIONS: Length ----- 15"
 Body Dia. above transition 1.130"
 Body Dia. below transition 0.903"
 +Takeoff weight without engine: ---- 1.94 oz(55 gr.)

Recommended F.S.I. Engines: * B3-4 D6-4
 C4-4 D6-6
 C4-6 D18-4
 D4-4 D18-6
 E5-6

Kit No. MRK-VII
 Ship Wt. 9 oz.



NEW! ORBIT LONGER!

This rocket designed to make maximum use of the F.S.I. long thrusting (9 sec.) F7-6 Rocket Engine, will reach altitudes beyond ground visibility. A highly stable bird; a real crowd pleaser even when flown with smaller engines.

SPECIFICATIONS: Length ----- 22"
 Body Dia. above transition 0.903"
 Body Dia. below transition 1.130"
 +Takeoff weight without engine: --1.91 oz.(54gr)

Recommended F.S.I. Engines: * B3-4 C4-4
 D4-6 D6-6
 D18-4 D18-6
 E5-6 F7-6
 F100-8

Kit No. MRK-VI
 Ship Wt. 8 oz.



VOYAGER

The Voyager with its separate recoverable payload capsule is the high altitude scientific experimental vehicle of the F.S.I. Fleet. Experiments placed in the capsule are returned safely to earth with the capsule which is ejected and recovered separately from the main body of the rocket. To use Flight Systems D or E engines - order Conversion Kit C-20.

SPECIFICATIONS: Length -----22.5"
 Body Dia. ---1.130"
 +Takeoff weight without engine: 3.32 oz. (94 gr)

Recommended F.S.I. Engines: * D4-6 E5-6
 D6-6 F7-6
 D18-4 F100-8
 D18-6

Kit No. MRK-IV
 Ship Wt. 10 oz.



NOVA

Nova is a kit designed to test your building skill and give you experience with aerodynamic flow across a transition section. A sophisticated model surging to altitudes above 3500' with larger F.S.I. Engines. _____ Features include rugged birch plywood fins to withstand the shock of many landings.

SPECIFICATIONS: Length ----- 18"
 Body Dia. above transition 0.903"
 Body Dia. below transition 1.130"
 +Takeoff weight without engine:- 1.45 oz. (57 gr)

Recommended F.S.I. Engines: * B3-4 C4-4
 D4-6 D6-6
 D18-4 D18-6
 E5-6 F7-6

Ship Wt. 9 oz.

Kit No. MRK-III



+ All takeoff weights approximate.

* Suggested for lower altitude flights to facilitate recovery.

OSO

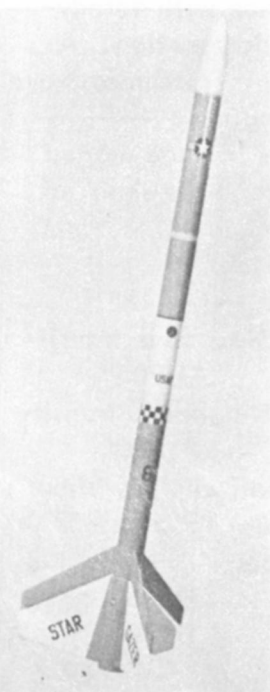
Propel heavy experimental payloads to extreme altitudes with this highly stable and majestic bird. Payload section and rocket body are recovered as one unit. Oso was designed to make use of an engine which was a break-through in model rocket engine design, the F100. Other recommended engines will also assure spectacular flights. Order Conversion Kit -C20 for using D engines.

SPECIFICATIONS: Length ----- 29"
 Body Dia. ---1.130"
 +Takeoff weight without engine:-----3.5 oz.(99 gr)
Recommended F.S.I. Engines: * D6-6 F7-6
 D18-4 F100-8
 D18-6
 Ship Wt. 10 oz.
 Kit No. MRK-V



STARGAZER

High performance two stage rocket. Unique fin design blends upper and lower fins into one smooth aerodynamic shape. 1st stage has tumble recovery. 2nd stage can be flown without booster stage. This bird streaks to altitudes of well over 4000 feet with the proven superior performance of Flight Systems' D and E series engines.



SPECIFICATIONS: Length ----- 23"
 Body Dia.--0.903"
 +Takeoff weight without engines:---1.94 oz.(55gr)
Recommended F.S.I. Engines: 1st stage 2nd stage
 * B3-0 * B3-4
 C4-0 C4-6
 D6-0 D6-6
 D18-0 D18-6
 E5-0 E5-6

Kit No. MRK-II
 Ship Wt. 9 oz.

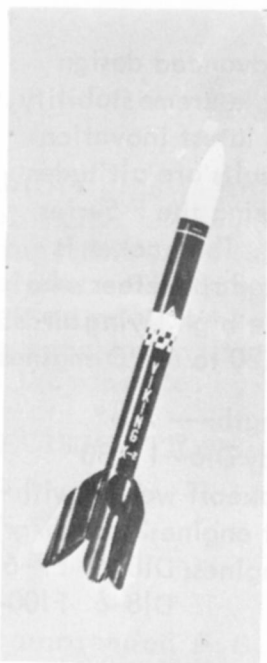
VIKING I

An advanced design rocket. New and superior type of stabilizers permit maximum stability with minimum drag. The lower drag coefficient results in greater altitudes than have been possible with the more conventional flat fin designs. This rocket is great in competition and sport flying. Explore the sky with the Viking Series by Flight Systems, Inc.

SPECIFICATIONS: Length -----20"
 Body Dia. ---0.903"
 +Takeoff weight without
 Engine: ---1.6 oz. (30 gr.)

Recommended F.S.I. Engines: *A4-4 D4-6
 B3-4 D6-6
 C4-4 D18-6
 C4-6 E5-6

Kit No. MRK-IX
 Ship Wt. 9 oz.



VIKING II

Another of the Viking Series rockets, this model makes a fine display rocket as well as a highly stable flying model. This bird, designed by F.S.I. rocket engineers is a high performance vehicle which will soar thousands of feet into the sky with little effort. Parachute recovery or streamer recovery as with other F.S.I. rockets. Be a contest winner. Fly with F.S.I.!!!

SPECIFICATIONS: Length --- 16"
 Body Dia. - 0.903"
 +Takeoff weight with-
 out engine: 1.5oz (30gr)

Recommended F.S.I. Engines: *A4-4 D6-6
 B3-4 D18-4
 C4-4 D18-6
 D4-4 E5-6
 D4-6

Ship Wt. 8 oz.
 Kit No. MRK-X

+All takeoff weights approximate.

*Suggested for lower altitude flights to facilitate recovery.

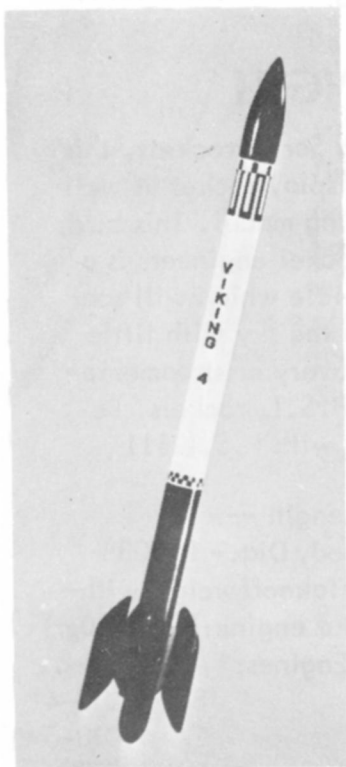
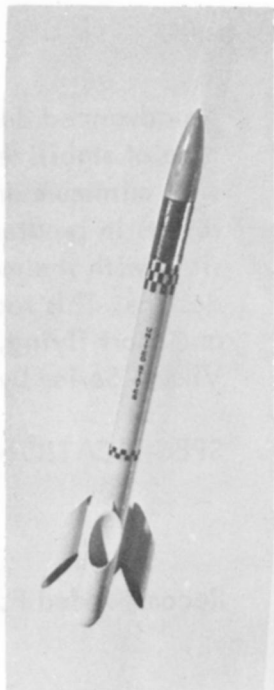
VIKING III

Included in this kit are all of the features found in the Viking I and II, with the addition of extended stabilizers. Extreme stability even in less than ideal flying weather are characteristic of this superior rocket. Altitudes to 3500 feet.

SPECIFICATIONS: Length -----15"
Body Dia. ---0.903"
+Takeoff weight without engine: ---1.5 oz. (30gr.)

Recommended F.S.I. Engines: *A4-4 D4-6
B3-4 D6-6
B3-6 D18-6
C4-4 E5-6

Kit No. MRK-XI
Ship Wt. 9 oz.



VIKING IV

The big brother of the advanced design Viking rockets. Features extreme stability, and low drag due to the latest innovation in stabilizer design. Results are altitudes to 4000 feet and more using the F Series rocket engines by F.S.I. This rocket is designed for the advanced rocketeer who wants the finest in stable high flying birds. Order Conversion Kit C20 to use D Engines.

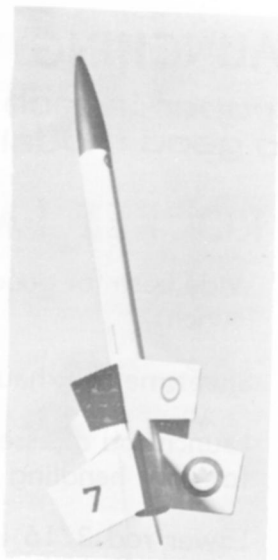
SPECIFICATIONS: Length --- 20 $\frac{1}{4}$ "
Body Dia- 1.130"
+Takeoff weight without engine: 2. loz (57gr)
Recommended F.S.I. Engines: D18-4 F7-6
D18-6 F100-8

Kit. No. MRK-XII
Ship Wt. 10 oz.

+All takeoff weights approximate.

*Suggested for lower altitude flights to facilitate recovery.

ECHO 1



An advanced 2 stage bird capable of flights to extreme altitudes. Utilizing the superior F.S.I. D18-0 booster engine, the Echo I opens a new dimension in two stage rocket performance. A payload section may be added for high altitude experiments. Echo I may also be flown as a high performance single stage rocket. Enter contests and win with this stable bird.

SPECIFICATIONS: Length-----20.5"
Body Dia.----1.34"
Aprox. takeoff-weight
without engines--3.5 oz.

Recommended F.S.I. engines: 1st stage 2nd stage
D18-0 A4-4

Kit No. MRK-15

C4-6

D4-6

D6-6

Payload section - PL15

EOS

Stability plus is an apt description for the EOS. Designed for demonstration flying, this bird lifts off with majesty and realism. The long thrusting F.S.I. engines produce spectacular flights that are sure to thrill all who are present at the launch site.

SPECIFICATIONS: Length ----- 42.5 "
Body Dia.
Above trans. - - 1.34"
Below trans. - - 1.64"
Aprox. takeoff wt.
without engines: 4.25 oz.

Recommended F.S.I. engines: D6-4 F7-4
For D engines D18-4 F100-6

Kit No. MRK-16

For F engines

Kit No. MRK-16F



LAUNCHING SUPPLIES by FSI

Proper launching equipment is very important to good model rocket flights.

ROCKET LAUNCH PAD

Wide base for good solid support during launch.

Sheet metal exhaust deflector.

Launch rod disassembles into two pieces for easy handling and storage.

Lower rod $3/16$ inch diameter. Upper rod $1/8$ inch diameter.

The heavy lower rod prevents launch rod whip during rocket launching.

Launch rod 30 inches long.

Part No. LP-1

Ship Wt. 1 lb. 10 oz.

NEW!

LP-1 and LP-2 launchers are now available with $1/8$ " diameter rod.

Ask for: LP-1A

LP-2A

ELECTRIC IGNITION

Ready for you to push the firing button on your next count down.

All parts factory assembled

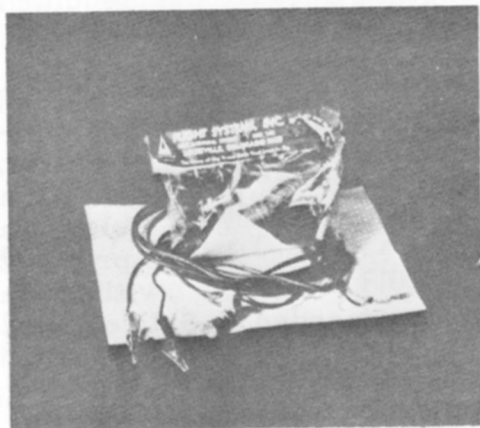
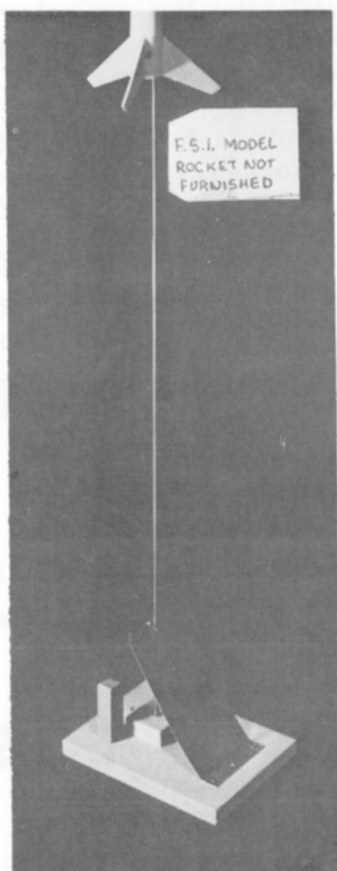
"MICRO-GATER" smooth nose firing clips.

Push button firing switch. Battery terminal clips.

Includes:
16 feet of firing cable

Part No. EC-101

Ship Wt. 1 lb.



COUNT DOWN 5,4,3,2,1, IGNITION ADJUSTABLE BASE LAUNCH PAD

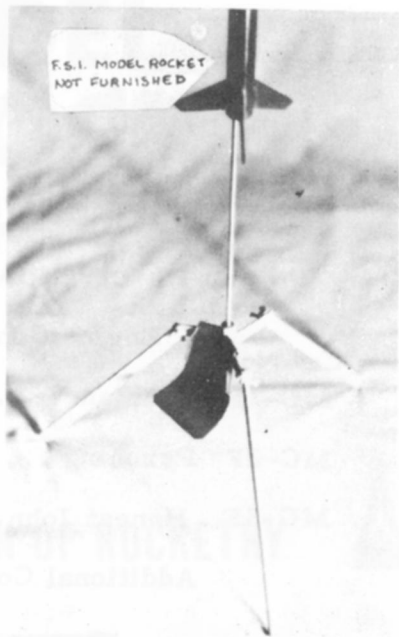
Professional type launcher. All heavy steel construction - no wood parts.

Tripod legs are adjustable so launch rod can be positioned vertically on uneven ground or tipped for wind conditions.

Large diameter lower rod ($3/16''$) prevents launch rod whip during rocket launching. Upper rod $1/8''$ diameter.

Two piece rod makes storage and handling easier.

Part No. LP-2
Ship Wt. 1 lb. 14 oz.

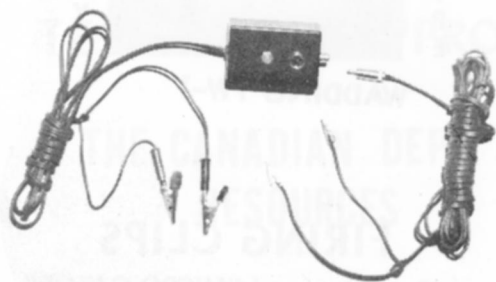


PROFESSIONAL FIRING PANEL

A professional quality launch control! Features push button switch, continuity check light, removable firing line for completely safe disarming of firing system, 25' of firing line; 5' of power cord, micro clips, and battery clips. This launch system comes completely assembled. May be used with any launcher.

Part No. EC 102

Ship Wt. 1 lb. 4 oz.



FLY WITH FS1

NEW!

FLY your ESTES **MAXI-BRUTES**
with **DEPENDABLE F.S.I. POWER!**

F Engine Conversion Kits for:

Cat. No.

MC-1F German V-2\$2.25

MC-2F Pershing\$2.10

MC-3F Honest John.....\$2.25

Additional Conversion Kits listed on page 40.

ENGINE IGNITORS

For A, B, C, D, and E engines
(except D18) - 20 per pkg.

Cat. No. 1A-10 _____

For D18 and F7 engines -
16 per pkg.

Cat. No. 1A-20 _____

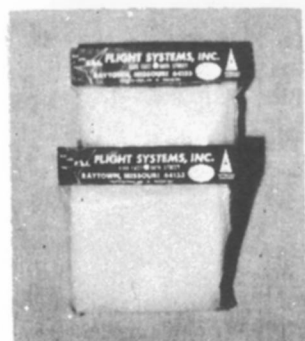
For F100 engines - 8 per pkg.

Cat. No. 1A-30 _____

Flame Proof WADDING

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WADDING FW-1

LAUNCH LUGS

1/4" I.D. x 2" Part No. LL-12
Pkg. of 3

1/8" I.D. x 3" Part No. LL-23
Pkg. of 3

FIRING CLIPS

Smooth nosed "MICRO-GATOR"
clips

Part No. FC-12



F.S.I. MODEL ROCKET ENGINES

APPROVED by

THE NATIONAL ASSOCIATION OF ROCKETRY



REGISTERED with

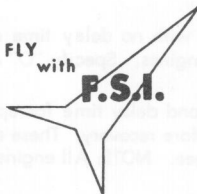
THE CALIFORNIA STATE FIRE MARSHALL



TESTED and APPROVED by

THE CANADIAN DEPT. OF ENERGY, MINES, AND
RESOURCES

FLY
with
F.S.I.



FLIGHT SYSTEMS, INC. MODEL ROCKET ENGINES



All FSI model rocket engines are **SAFETY APPROVED** and **CONTEST CERTIFIED** by the National Association of Rocketry.

NFPA

All FSI Model Rocket engines comply with the National Fire Protection Association code for Model Rocketry, No. 41L-1968.

ELECTRIC IGNITORS - Electric ignitors are included with all FSI rocket engines.

ENGINE CLASSIFICATION CODE - Total impulse limits set by the National Association of Rocketry (NAR) and the Federation Aeronautique Internationale (FAI).

ENGINE MARKING CODE

E5-6
 |
 |—— Delay Time (sec)
 |
 |—— Average thrust (Newtons)
 |
 |—— Total impulse from table at right

ENGINE CLASSIFICATION CODE

ENGINE TYPE	TOTAL IMPULSE Newton Seconds	TOTAL IMPULSE Pound-Seconds
A	1.26 to 2.50	0.29 to 0.56
B	2.51 to 5.00	0.57 to 1.12
C	5.01 to 10.00	1.13 to 2.24
D	10.01 to 20.00	2.25 to 4.48
E	20.01 to 40.00	4.49 to 8.96
F	40.01 to 80.00	8.97 to 17.92

ENGINE SELECTION

Which Engine Should I Use?

FLIGHT SYSTEMS, INC. produces a variety of engines for model rocketeers to choose from. These fall in several broad categories of uses. FSI has NAR Safety Approved & Contest Certified Model Rocket Engines in all sizes A through F.

INITIAL THRUST - All FSI engines have a high initial thrust so that aerodynamic stability of Model Rocket is obtained when model leaves the launch rod.
 Note: Initial thrust is the high peak on the thrust-time curve.

SUSTAINER THRUST - Thrust necessary to keep Model Rocket accelerating after initial thrust of engine. Note: Sustainer thrust is the lower plateau on the thrust-time curve. Recommended maximum weight of rocket system is based on amount sustainer phase of engine can accelerate after initial boost phase.

LONG THRUSTING - Engine with normal initial thrust but with a long sustaining thrust for very high altitudes and much realism in Model Rocket flights. Use D4-x, E5-x, F7-6. Specify delay time in place of x. See table of delay times manufactured for each engine designation.

LOAD LOFTING - Engine with large total impulse but very short burn-time for lofting heavy models to altitude. Use F100-x. Specify "O" time for booster engine or "B" for delay time engine.

ZERO DELAY TIME - Engine with no delay time or ejection charge. Used for lower stage engines and ignition of upper stage engines. Specify "O" after dash in code number, example: D6-O.

DELAY TIME - Use 6 and 8 second delay time for upper stage on staged models or for models which are to descend from apogee before recovery. These engines are B3-6, C4-6, D4-8, and D6-8. Use other delay times for recovery at apogee. **NOTE:** All engines with delay time have ejection charges.

MEMO

FSI PRESENTS

the Mach 1 System

a model rocket system with the ability to
BREAK THE SOUND BARRIER

THRUSTER SYSTEM

INCLUDES:

Special Engines for both stages

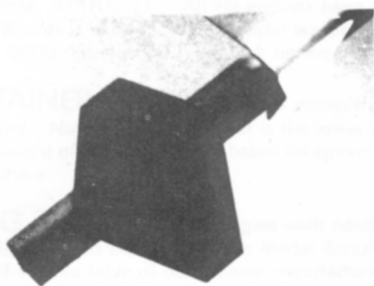
Booster Stage

Electric Match ignitor

Complete instructions

RX-1

For the MACH 1 DART
Includes Special Engines



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

DART

Upper Stage

An excellent contest or sport rocket in its own right. Includes everything necessary to fly the DART as a single stage model, except the engines. Complete instructions and information on supersonic flight are included with the DART.

Recommended engines for subsonic flight:

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

For supersonic attempts use thruster system at left.

MRK-XVII



HEAVY DUTY LAUNCHER
LP-2B
1/4" ROD

NEW!

NEW!

20B for Black Brant, Mach I, all heavy models - long rod

MAVERICK!

A payload rocket designed for the Loadlifter E60 and F100. Maverick is capable of carrying heavy payloads to extreme altitudes.

The high stability of the Maverick makes it a very spectacular demonstration model when flown with the F7-6 thruster.

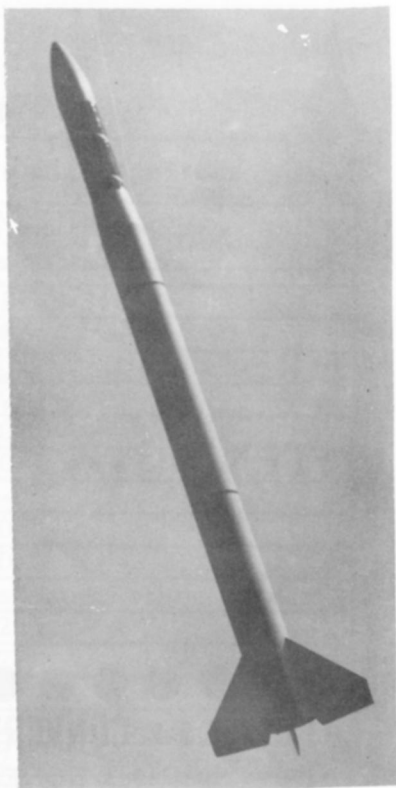
Recommended engines:

	SPECIFICATIONS:
E60-4	Length ----- 29"
E60-6	Body Dia.
F100-8	Above trans.-- 1.34"
F100-10	Below trans.-- 1.64"
F7-6	Aprox. takeoff-weight without engines--3.5 oz.

with C60 conversion kit:

D18-4
D20-5

MRK - XVIII



NEW!

NC - 122 Nose Cone

For RT-12 Body tube

Shipping Wt. 7.oz.



SPECIFICATIONS:

Length of cone- 2.75 inches
Weight (aprox)- .4 oz.
Fits Tube I.D.- 1.30 inches

From the desk of...
LONNIE REESE

We value our reputation as the technological innovator of the model rocket industry, and we are always testing and experimenting to improve our old products and introduce new ones.

One factor in our leadership has always been our customers' responses and needs. Our new "Loadlifter" engines are in direct response to our customers' suggestions.

With this catalog we have completed development of our new engines. We want to continue producing unique rocketry products, but we need your help. Please take a minute to write to us soon. We are always open to good ideas and suggestions. We endeavor to answer all of the letters we receive.

Lonnie H. Reese
President, Flight Systems
(Missouri)

P.S. We are very sorry, but we cannot accept collect phone calls.

**WE'RE
LISTENING...**



LATEST F.S.I. CONVERSION KIT - Cat. No. MC-3F

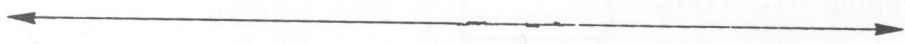
Converts Estes HONEST JOHN model rocket to use F100 Engines.



NEW! E60 ADAPTER

Heavy-duty phenolic sleeve fits into engine mount ahead of E60 engine casing. Makes use of E60 engines possible in rockets set up for F100 motors. Will not burn or deteriorate.

Cat. No. EMA-60



FLY
with

F.S.I.

MODEL ROCKET ENGINES



Shipped (3) engines per package with ignitors

FSI ENGINE DESIGNATION	FSI ENGINE DESIGNATION
Single or Upper Stage	Booster Stage
A4-4	A4-0
B3-4	B3-0
B3-6	C4-0
C4-4	D4-0
C4-6	D6-0
D4-4	D18-0
D4-6	E5-0
D6-4	*F100-0
D6-6	Boost and Rocket Glider
D18-4	A4-2
D18-6	B3-2
E5-4	C4-2
E5-6	D4-2
*F7-4	D6-2
*F7-6	E5-2
*F100-4	*F7-2
*F100-6	
*F100-8	
*F100-10	

*F engines are NOT mailable.

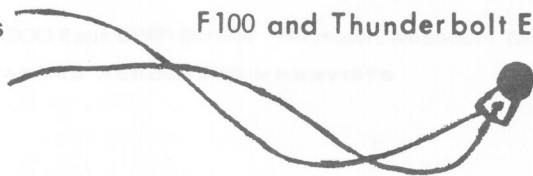
See instructions on last page of this catalog before ordering.

ENGINE PERFORMANCE DATA ON PAGES 22, 23, 24, & 25

Shp. Wt.- A thru E engines-8 oz. per pkg.

F engines-1 lb. per pkg. Thunderbolts-9 oz. ea

M-100 ELECTRIC MATCH for quick, efficient ignition of
12" Copper Leads F100 and Thunderbolt Engines

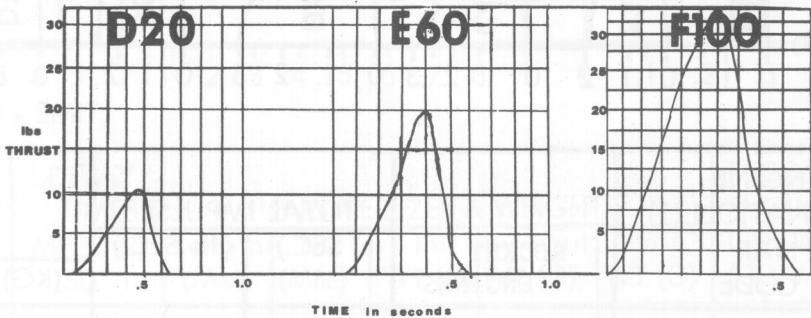


Cat. No.

M-100

THE "LOADLIFTERS" ARE HERE!

FROM
FLIGHT SYSTEMS, INC.
THE PROFESSIONAL ROCKET PEOPLE



NAR Designation: D20
Time delays: 0, 3, 5, 7 sec.
Total Impulse: 15 nt/sec
Max Thrust: 10 lbs.
Thrust Time: .6 sec.
Engine Size: 21 x 95 mm.

FSI Designation: E60
Time Delays: 0, 4, 6 sec.
Total Impulse: 30 nt/sec
Max Thrust: 20 lbs.
Thrust time: .6 sec.
Engine size: 27 x 100 mm.

NAR Designation: F100
Time Delays: 0, 4, 6, 8, 10 sec.
Total Impulse: 50 nt/sec
Max Thrust: 35 lbs.
Thrust time: .5 sec.
Engine Size: 27 x 150 mm.

pack of 3 engines
with ignitors

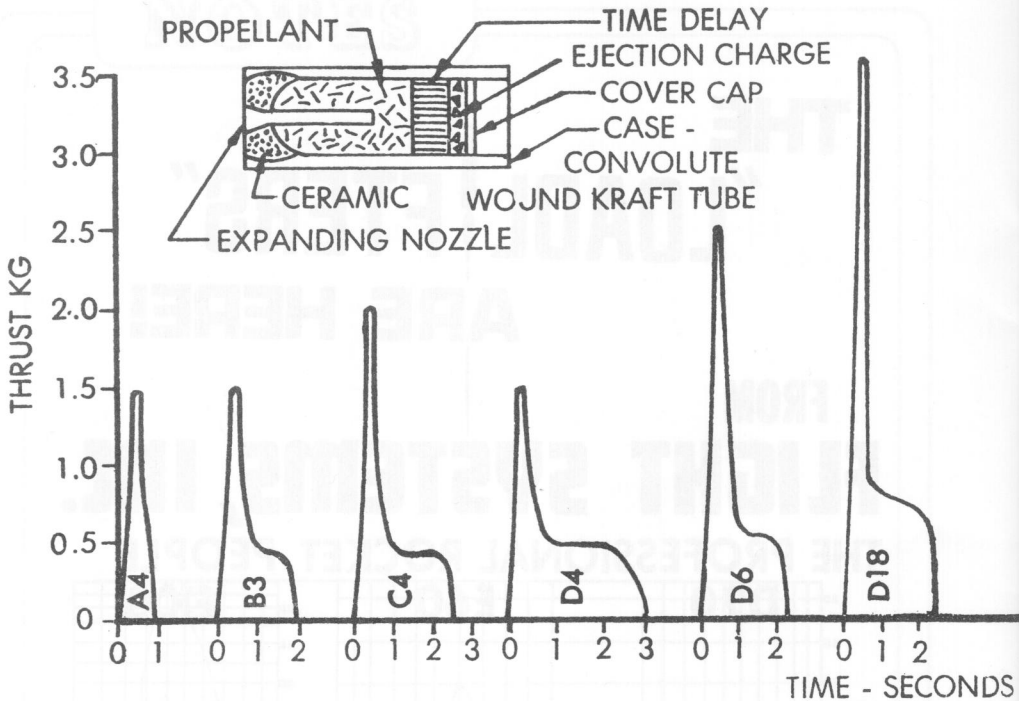
pack of 3 engines
with ignitors

pack of 3 engines
with ignitors

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

PRODUCTS FOR ADVANCED AEROSPACE HOBBYISTS

ENGINE SCHEMATIC



ENGINE DESIGNATION (1) NAR CODE	ROCKET ENGINES	TOTAL IMPULSE		THRUST-MAX	
		(N SEC.)	(lb SEC.)	(KG)	(OZ)
A4-x		2.5	.56	1.5	53
B3-x		5.0	1.1	1.5	53
C4-x		9.0	2.0	2.0	71
D4-x		11.0	2.5	1.5	53
D6-x		14.0	3.2	2.5	88
D18-x		20.0	4.5	3.6	127
E5-x		22.0	5.0	2.5	88
F7-x		60.0	13.5	3.5	7.7 lb
F100-x		50.0	11.3	16.0	35 lb

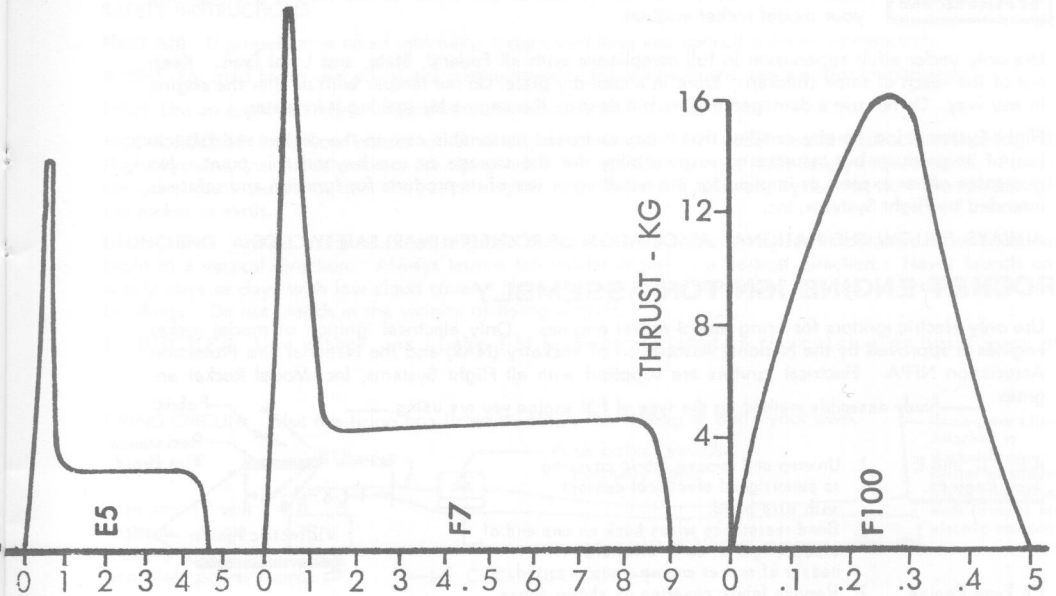
*** NOTES:**

1. In place of "x" substitute desired delay time from column of "Delay Times Manufactured."
2. "O" Delay time is for booster engines. Booster engines do not contain an ejection charge.
3. Recommended weight is based on amount sustainer phase of engine can accelerate after initial boost phase.

TYPICAL THRUST vs TIME CURVES

for

FLIGHT SYSTEMS, INC. MODEL ROCKET ENGINES



THRUST TIME (SEC.)	DELAY TIMES* MFG. (2) (SEC.)	ENGINE SIZES & WEIGHTS					RECOMMENDED MAXIMUM LIFT OFF WT. (3)* (GRAMS)
		Length (MM)	Dia (MM)	Init WT (G)	Burnout WT (G)	Prop WT (G)	
.7	0, 2, 4	70	21	22	15	3.9	90
1.8	0, 2, 4, 6	70	21	26	15	7.8	125
2.5	0, 2, 4, 6	70	21	30	15	11.7	150
2.9	0, 2, 4, 6	70	21	32	15	13.4	125
2.2	0, 2, 4, 6	70	21	32	15	13.4	150
2.3	0, 4, 6	95	21	43	21	19.0	175
4.5	0, 2, 4, 6	95	21	45	21	21.0	150
9.0	2, 4, 6	150	27	110	50	50.0	225
.5	0, 4, 6, 8, 10	150	27	110	50	50.0	400

TD-406



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

MODEL ROCKET ENGINE INSTRUCTIONS

WARNING

Read the instructions on both sides of this sheet before installing or igniting your model rocket engines.

Use only under adult supervision in full compliance with all Federal, State, and Local laws. Keep out of the reach of small children. Store in a cool dry place. Do not tamper with or alter the engine in any way. Do not use a damaged engine but destroy the engine by soaking it in water.

Flight Systems, Inc. hereby certifies that it has exercised reasonable care in the design and fabrication of its products but assumes no responsibility for the storage or use beyond this point. No guarantee either express or implied for the handling or use of its products for function and safety is intended by Flight Systems, Inc.

ALWAYS FOLLOW THE NATIONAL ASSOCIATION OF ROCKETRY (NAR) SAFETY CODE

ROCKET ENGINE IGNITOR ASSEMBLY

Use only electric ignitors for firing model rocket engines. Only electrical ignition of model rocket engines is approved by the National Association of Rocketry (NAR) and the National Fire Protection Association NFPA. Electrical ignitors are supplied with all Flight Systems, Inc. Model Rocket engines. — Study assembly method for the type of FSI engine you are using. —

A, B, C, D, and E Type Engines.

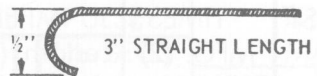
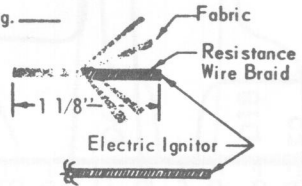
1. Unwrap and remove fabric covering to permit good electrical contact with wire braid.
2. Bend resistance wires back on one end of electric ignitor so it will hold in nozzle of rocket engine when inserted.

F7 Type Engine.

1. Remove fabric covering as shown above.
2. Bend resistance wires back on one end of electric ignitor so it will hold in the nozzle of an F7 engine when inserted.

F100 Type Engine.

1. Remove fabric covering same as above.
2. Bend electric ignitor as shown so the ignitor will stay in place in the rocket engine nozzle.



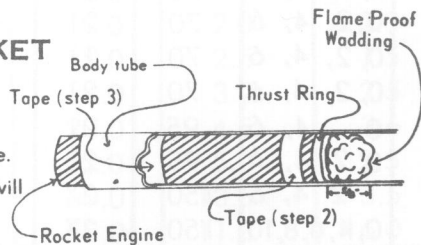
CAUTION — PLAY IT SAFE

Never place an electric ignitor in a rocket engine until you are at the launch site and ready to place your rocket on the launcher.

NEVER FAIL IGNITOR — If properly installed — If you have a fully charged 12 volt battery with a low resistance firing circuit — If your microgator clips are clean at contact with resistance wire.

PLACE ENGINE IN MODEL ROCKET

1. Notice that Model Rocket engine is a loose fit in body tube or engine mount. Engine must fit very tight in body tube or engine mount so that ejection charge for recovery system will not dislodge engine.
2. Wrap masking tape around front of engine until it will slip freely into body tube. This will align engine properly.
3. Wrap masking tape at rear of engine where it enters body tube. Use enough wraps so that a force of approximately 10# is required to push engine into tube.
4. Follow launching instructions on other side of this sheet.



DO NOT POINT ENGINE NOZZLE TOWARD ANY PART OF BODY

MODEL ROCKET LAUNCHING INSTRUCTIONS

SAFETY INSTRUCTIONS

FIRST AID If propellant is taken internally, induce vomiting and consult a doctor immediately.

BURNS For mild burns use a first aid burn ointment. For severe burns, see a doctor immediately.

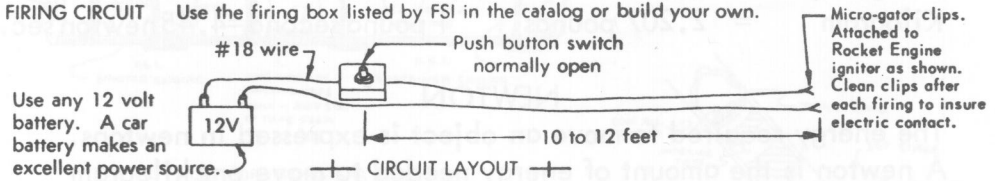
FIRES Use an approved fire extinguisher or water to put out fire.

MODEL ROCKET Build your model rocket exactly as shown on the model rocket instruction sheets. All Flight Systems, Inc. model rockets are designed in full compliance with NAR Safety requirements. Never use metal parts around or near the rocket engine. Always use a recovery system to slow the descent of the rocket to earth.

LAUNCHING Always use a launcher to guide the rocket until sufficient speed is obtained to stabilize its flight in a vertical direction. Always launch the model rocket in a vertical direction. Never launch on windy days or days with low cloud cover. Never launch in an area close to trees, overhead wires, or buildings. Do not launch in the vicinity of flying aircraft.

LAUNCHER Use either one of the FSI launchers listed in the catalog or build your own.

FIRING CIRCUIT Use the firing box listed by FSI in the catalog or build your own.

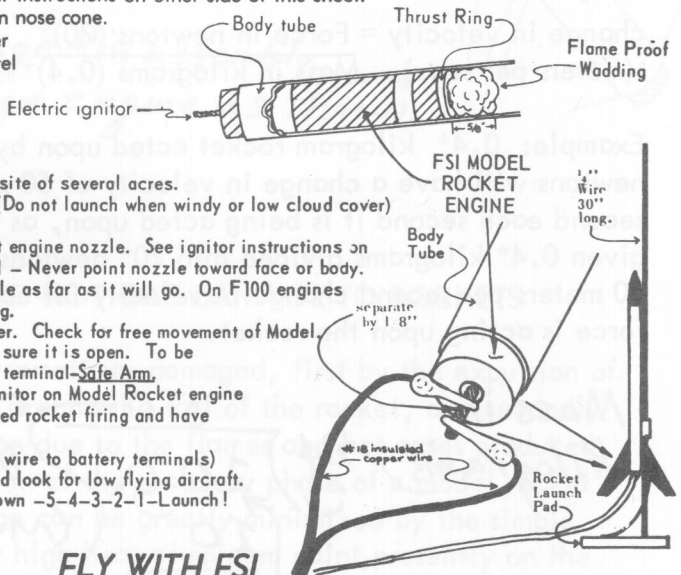


PREFLIGHT INSTRUCTIONS

1. Tamp a 5/8" wad of flame proof cotton over thrust ring.
2. Engine has been installed per instructions on other side of this sheet.
3. Tie shock cord to screw eye in nose cone.
4. Fold and install parachute per instruction sheet. Snap swivel to screw eye in nose cone.
5. Install nose cone.

COUNT DOWN CHECK LIST

1. Select a large clear launching site of several acres.
2. Check wind and cloud cover. (Do not launch when windy or low cloud cover)
3. Set up launcher and firing box.
4. Place electric igniter in rocket engine nozzle. See igniter instructions on other side of sheet. **CAUTION** - Never point nozzle toward face or body. Push electric igniter into nozzle as far as it will go. On F100 engines leave 3/8" of igniter protruding.
5. Place Model Rocket on launcher. Check for free movement of Model.
6. Check electric circuit to make sure it is open. To be safe, remove wire from battery terminal-Safe Arm.
7. Connect microgator clips to igniter on Model Rocket engine
8. Warn persons present of intended rocket firing and have them retire to a safe distance.
9. Arm electric circuit. (connect wire to battery terminals)
10. Check area again for safety and look for low flying aircraft.
11. If area is safe - Start count down -5-4-3-2-1-Launch!



FLY WITH FSI

METRIC and ENGLISH MEASUREMENT

Much technical information concerning model rockets is expressed using metric measurements. Therefore it is desirable that the rocketeer understand the relationship between the metric and english system of measurements. The following table expresses that relationship.

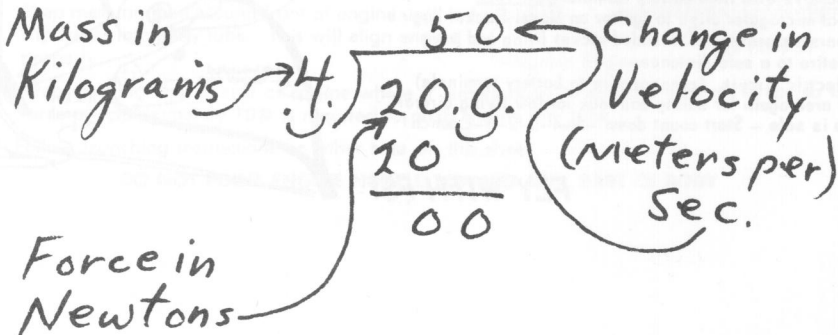
Millimeter	= .03937 inches	Newton	= 0.225 pounds of force
Centimeter	= .3937 inches		
Meter	= 39.37 inches	Newton second	= 0.225 pound sec.
Meter	= 3.281 feet		
Gram	= 0.0353 ounces	Ounce	= 28.35 grams
Kilogram	= 35.3 ounces	1 pound of force	= 4.45 newtons
Kilogram	= 2.207 pounds	1 pound second	= 4.45 newton sec.

NEWTON

The energy required to move an object is expressed in newtons. A newton is the amount of energy needed to move one kilogram with a change in velocity of one meter per second each second it is being acted on by the force.

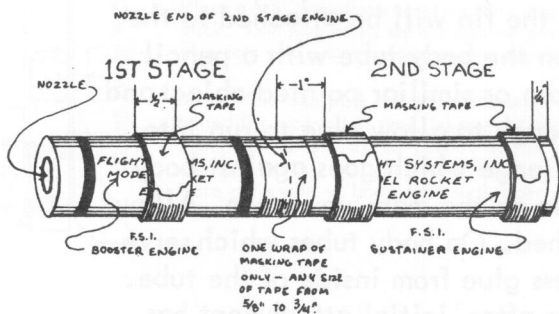
$$\text{change in velocity (meters per sec.)} = \frac{\text{Force in newtons (20)*}}{\text{Mass in kilograms (0.4)*}}$$

Example: 0.4* kilogram rocket acted upon by a force of 20* newtons will have a change in velocity of 50 meters per second each second it is being acted upon, as per the formula given 0.4* kilograms divided into 20* newtons of force equals 50 meters per second change in velocity for each second this force is acting upon the rocket.



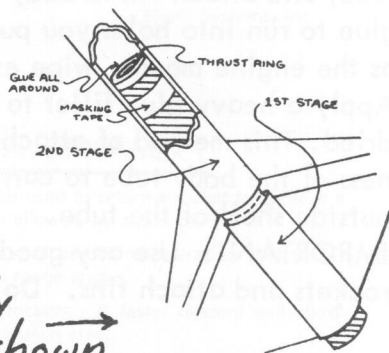
STAGING ENGINES FOR MULTI-STAGE ROCKETS

STAGED ROCKET ENGINES— FOR THE 1ST STAGE USE A F.S.I. BOOSTER ENGINE AND FOR THE 2ND STAGE USE A F.S.I. SUSTAINER OR SINGLE STAGE ENGINE, DO NOT ALTER THIS ARRANGEMENT. INSERT INTO THE NOZZLE OF THE 2ND STAGE ENGINE THE ENGINE IGNITOR SUPPLIED WITH EACH F.S.I. ROCKET ENGINE. NOW LAY BOTH THE 1ST AND 2ND STAGE ENGINES ON A FLAT SURFACE AND BUTT THE 1ST STAGE AGAINST THE 2ND STAGE ENGINE AND WRAP THE BUTT JOINT WITH ONE ONLY LAYER OF MASKING TAPE (FOLLOW DETAIL E DIRECTIONS). NOW TAKE THE TAPED ENGINES AND WRAP SUFFICIENT MASKING TAPE AROUND THE 2ND STAGE ENGINE AT THE 2 LOCATIONS SHOWN ON DETAIL E TO INSURE A FIRM FIT OF 2ND STAGE ENGINE TO 2ND STAGE BODY TUBE. NOW PUSH TAPED ENGINES INTO 2ND STAGE BODY TUBE UNTIL THEY TOUCH THRUST RING. NOW WRAP THE 1ST STAGE ENGINE WITH MASKING TAPE (SEE DETAIL E) USING ONLY ENOUGH TAPE TO LIGHTLY SECURE 1ST STAGE SECTION TO 1ST STAGE ENGINE.



METHOD FOR STAGING ENGINES

Detail E



Slide 1st stage fin assembly onto 1st stage engine as shown. →

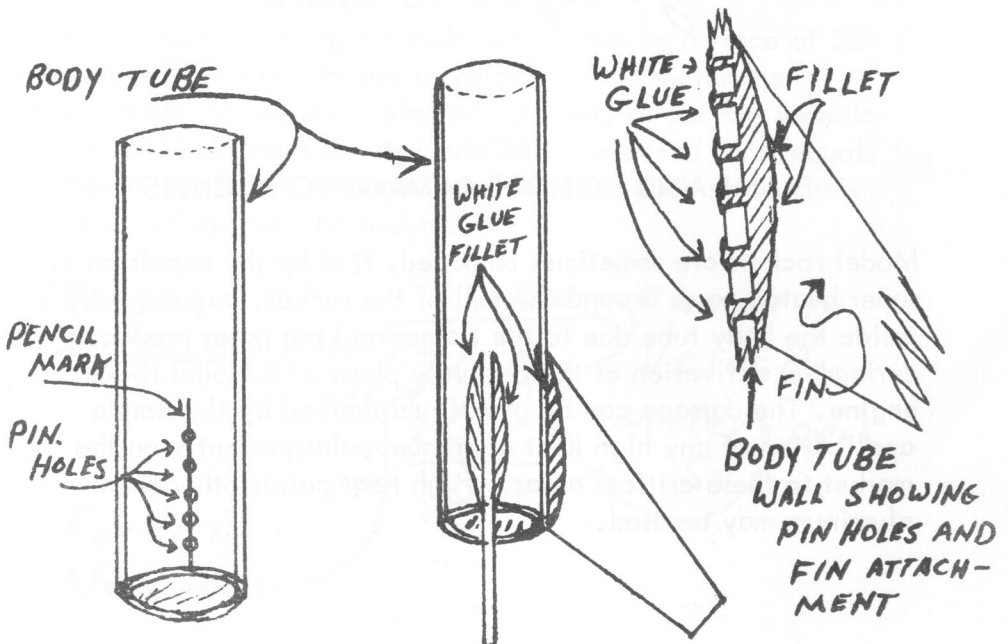
FLAME AND HOT GAS DAMAGE TO ROCKETS

Model rockets are sometimes damaged, first by the expulsion of super heated gases around the tail of the rocket, and secondly inside the body tube due to the flames and hot gases produced during the activation of the recovery phase of a model rocket engine. The damage can be greatly minimized by the simple application of any high heat aluminum paint, presently on the market, to these critical areas. High heat paints other than aluminum may be used.

STABILIZER FIN ATTACHMENT

When the fins on a model rocket receive abuse they tear loose along with the outer shell of the body tube. Forces acting upon the model during staging on multi-stage rockets as well as the stresses incurred during liftoff have torn fins from body tubes. Usually the outside of the tube tears rather than the glue letting go. The following will help to deter this problem. Before attaching fin, locate the place where the fin will be attached to the body tube. Mark this location on the body tube with a pencil mark, (FIG. 1). Take a straight pin or similar pointed object and punch a series of holes large enough to allow glue to run into them. Apply glue to root of fin (edge which goes against body tube) and attach fin to body tube on the mark you made. Allow glue to run into holes you punched. On body tubes which serve as the engine mount, wipe excess glue from inside of the tube. Apply a heavy glue fillet to fins after initial attachment has dried. This method of attaching fins allows the whole thickness of the body tube to carry the strain rather than just the outside shell of the tube.

IMPORTANT: Use any good quality white glue to build rockets and attach fins. Do not use airplane type cement.



SELECT-A-CHUTE by FSI

An eight sided (octagonal canopy) one mil plastic brightly colored red and black panels.

Panels are marked so that seven sizes of canopies from 10" to 16" can be made.

Try an 8 panel parachute on your next rocket flight - discover for yourself the advantages of an 8 panel parachute over the commonly used 6 panel parachutes.



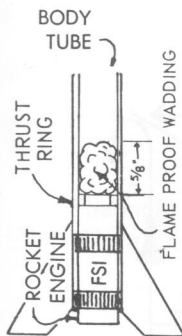
PARACHUTE RECOVERY SYSTEM

KIT P-12 --- **55¢**

SELECT-A-CHUTE KIT INCLUDES CANOPY 16" TO 10" RED & BLACK

8 SHROUD LINES AND TAPES AND SWIVEL.

KIT PC-12 --- **20¢**
CANOPY ONLY



IMPORTANT PREFLIGHT STEPS FOR PERFECT RECOVERY

1. Place a 5/8" long flame proof wadding plug above engine mount. Tamp in place with a stick. This plug keeps the hot ejection gases from melting the plastic parachute. It also acts as a piston to force out the parachute recovery system.
2. Do not fold and pack the parachute until ready to launch. A parachute which has been folded for a period of time, takes a set and will not unfold easily when the recovery system activates. Talcum powder maybe sprinkled on the parachute before packing to aid in opening; especially on new parachutes.
3. Place parachute in body tube with open canopy end toward rocket engine.

Flight Systems, Inc.

STREAMER RECOVERY SYSTEM

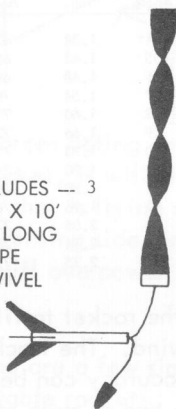
KIT S-12

STREAMER KIT INCLUDES --- 3
STREAMERS 2" WIDE X 10'
LONG

ONE 4" STICKY TAPE
SHROUD LINE & SWIVEL

KIT S-12 --

65¢



WHY USE A STREAMER?

A streamer is a drag device used to return a rocket to earth at a faster rate of descent than allowed by a parachute.

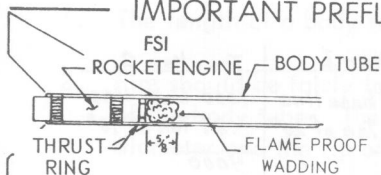
On windy days a faster rate of descent is desired so that rocket will not drift out of launch range area.

Use for very high flying rockets. A faster descent will allow rocket to be recovered in launch area.

All models designed by Flight Systems, Inc. have plywood fins. The stronger plywood fins will withstand the shock of faster descent landings.

**KIT S-13 STREAMER KIT INCLUDES 2
STREAMERS 3" X 10' --- 65¢**

IMPORTANT PREFLIGHT STEPS FOR PERFECT RECOVERY



1. Place a 5/8" long flame-proof cotton plug above engine mount. Tamp in place with a stick. This cotton plug acts as a barrier. It keeps the hot gasses from the ejection charge from burning the streamer. It also acts as a piston to force out the recovery system.
2. Make sure streamer bundle slides freely in body tube. Snap shroud line swivel to eye in nose cone.
3. Put sufficient masking tape around rocket engine so that engine is a very tight fit in body tube. Engine must fit tight enough so that it will not be ejected when recovery charge activates.

FLY WITH FSI

FLIGHT SYSTEMS, INC.

TRACKING

A proven method of measuring altitude is by triangulation. A simple elevation tracking device can be made as in illustration A. It is a simple matter to determine approximate altitude if the distance between the tracker and launcher is known and the angle between the ground and the line of sight to the rocket is known. The tangent of the angle is found in a trigonometry table of tangents. The tangent is multiplied by the distance to the tracker to find the altitude. See example-

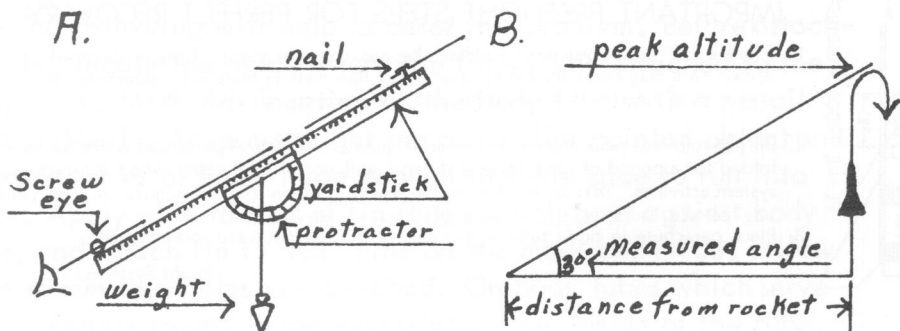
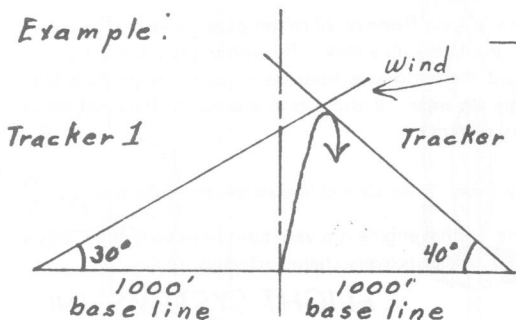


TABLE OF TANGENTS

Angle	Tan.	Angle	Tan.	Angle	Tan.	Angle	Tan.	Angle	Tan.	Angle	Tan.
1*	.02	15	.27	28*	.53	41	.87	54*	1.38	67	2.36
2	.03	16	.29	29	.55	42	.90	55	1.43	68	2.48
3	.05	17	.31	30	.58	43	.93	56	1.48	69	2.61
4	.07	18	.32	31	.60	44	.97	57	1.54	70	2.75
5	.09	19	.34	32	.62	45	1.00	58	1.60	71	2.90
6	.11	20	.36	33	.65	46	1.04	59	1.66	72	3.08
7	.12	21	.38	34	.67	47	1.07	60	1.73	73	3.27
8	.14	22	.40	35	.70	48	1.11	61	1.80	74	3.49
9	.16	23	.42	36	.73	49	1.15	62	1.88	75	3.73
10	.18	24	.45	37	.75	50	1.19	63	1.96	76	4.01
11	.19	25	.47	38	.78	51	1.23	64	2.05	77	4.33
12	.21	26	.49	39	.81	52	1.28	65	2.14	78	4.70
13	.23	27	.51	40	.84	53	1.33	66	2.25	79	5.14
14	.25									80	5.67

Since wind will interfere with accuracy by causing the rocket to tilt into the wind, the tracker should be located 90° to the wind. The tracker should be from 500' to 1000' from the launcher. Greater accuracy can be had if two or more trackers are used and the average of the two or more results are used (See example.)

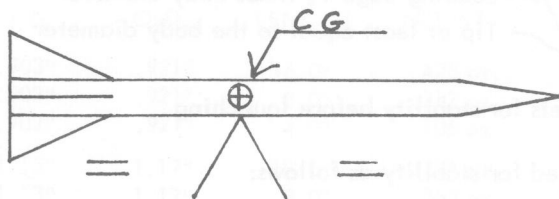
Example:



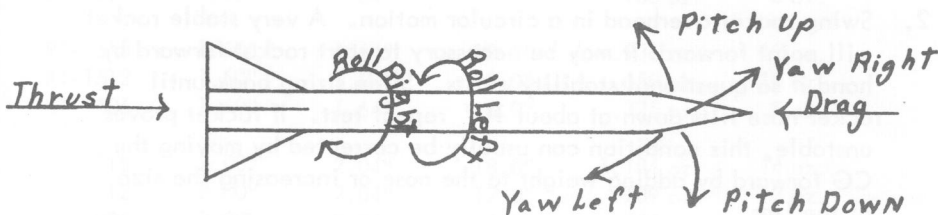
Tracker 1	Tracker 2
1000' base line	1000 base line
.58 Tan of 20°	.84 Tan of 40°
8000	4000
5000	8000
58000	84000
580'	710' average
840'	altitude
1420	1420
	14

STABILITY:

A rocket must be aerodynamically stable to fly. It is necessary to determine the CG (Center of Gravity) of a rocket in order to determine if it will be a stable vehicle. The CG is the balance point of a rocket.



The main forces acting on a rocket are Thrust, Drag, Pitch Up, Pitch Down, Yaw Right, Yaw Left, Roll Left, and Roll Right.

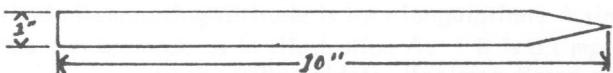


As long as forces acting on the fins of a rocket are great enough to offset forces trying to turn rocket, it will fly straight. There is little side force on the fins or nose of a rocket that is flying straight. Any disturbing forces will try to turn the rocket, thus increasing side forces on the nose and tail. In a properly designed rocket the fins will overpower the nose and swing the rocket back on its intended flight path.

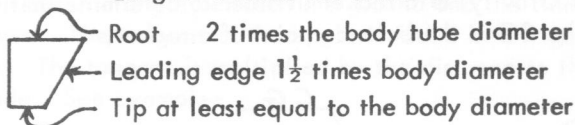
The following are a few simple rules the beginning rocketeer should follow in designing a stable rocket:

1. The length of a body tube should be 8 to 10 times the diameter.
2. Fins should be fairly large. The root should be about twice the diameter of the body tube. The leading edge should be $1\frac{1}{2}$ times the body tube diameter and the tip of the fin should be at least equal to the diameter.
3. The fins should be placed as far back on the rocket as possible (fins should never be placed ahead of the CG)
4. The rocket should balance at least $\frac{1}{8}$ of its length ahead of the fins.

STABILITY CONT.



Length 10 times the diameter



Root 2 times the body tube diameter

Leading edge $1\frac{1}{2}$ times body diameter

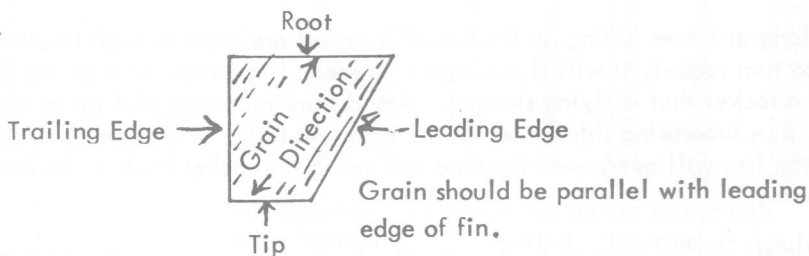
Tip at least equal to the body diameter

Always check rockets for stability before launching.

Models may be tested for stability as follows:

1. Take an 8 to 10 foot string. Tie a loop in end of string. Place loop around rocket body tube and slide until a balance point (CG) is established. Tape loop to body tube at this point.
2. Swing rocket overhead in a circular motion. A very stable rocket will point forward. It may be necessary to start rocket forward by hand if so questional stability exists. Slide string back until rocket nose tilts down at about 10° repeat test. If rocket proves unstable, this condition can usually be corrected by moving the CG forward by adding weight to the nose or increasing the size of the fins.

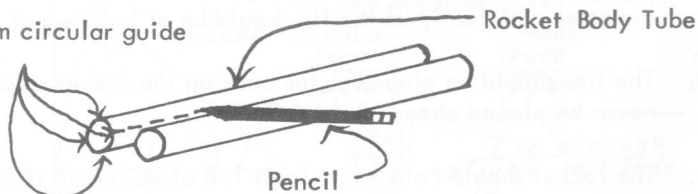
FINS:



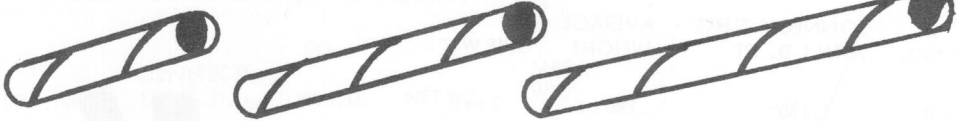
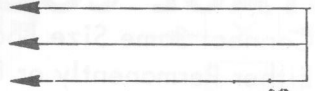
Marking Fin Placement on Body Tubes

1. Place body tube on circle of same size mark either lines for 3 fin design or 4 fin design. Lay body tube on flat surface and use another body tube or other guide to mark the straight line.

Lines marked from circular guide



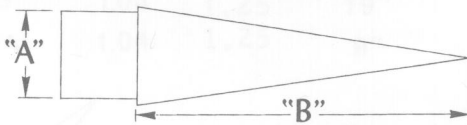
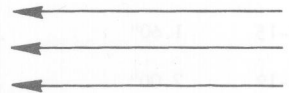
BODY TUBES



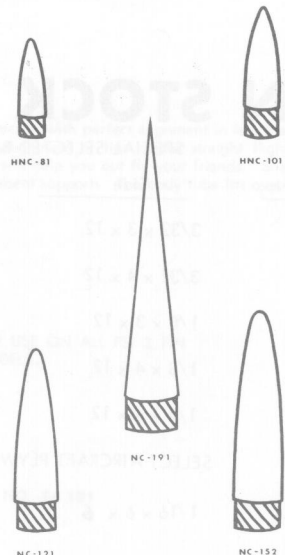
CAT. NO.	I. D.	O. D.	LENGTH	NET WT.	SHIP WT.
* HRT-816	.903"	.921"	16.0"	.425 oz.	12 oz.
* HRT-808	.903"	.921"	8.0"	.212 oz.	8 oz.
* HRT-804	.903"	.921"	4.0"	.106 oz.	6 oz.
* HRT-1018	1.13"	1.17"	18.0"	.725 oz.	12 oz.
* HRT-1009	1.13"	1.17"	9.0"	.363 oz.	10 oz.
* HRT-1004	1.13"	1.17"	4.5"	.182 oz.	7 oz.
RT-1218	1.30"	1.34"	18.0"	.738 oz.	12 oz.
RT-1209	1.30"	1.34"	9.0"	.369 oz.	9 oz.
RT-1204	1.30"	1.34"	4.5"	.185 oz.	6 oz.
RT-1518	1.60"	1.64"	18.0"	.936 oz.	12 oz.
RT-1512	1.60"	1.64"	12.0"	.650 oz.	10 oz.
RT-1506	1.60"	1.64"	6.0"	.325 oz.	8 oz.
RT-1918	2.00"	2.04"	18.0"	1.184 oz.	14 oz.
RT-1912	2.00"	2.04"	12.0"	.789 oz.	12 oz.
RT-1906	2.00"	2.04"	6.0"	.393 oz.	10 oz.

* Heavy Duty tubes for engine mounts, or any application requiring an extra measure of strength.

NOSE CONES



Precision Machined, Lightweight Balsa
Except as Noted



CAT. NO.	"A" I. D.	"B" NOSE CONE LENGTH	AVERAGE NET WT.	SHIP WT.
* HNC-81	.903"	2.8"	.50 oz.	7 oz.
* HNC-101	1.13"	3.5"	.50 oz.	7 oz.
NC-121	1.30"	5.3"	.60 oz.	7 oz.
NC-152	1.60"	6.0"	1.00 oz.	10 oz.
NC-191	2.00"	10.7"	2.00 oz.	12 oz.

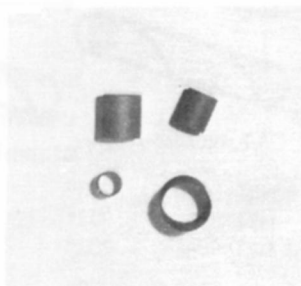
* Hardwood nose cone when extra weight is needed up front.
Extra durability. Easy finishing.

STAGE COUPLERS

Connect Same Size Body Tubes
Either Permanently or for Staging.

CAT. NO.	CONNECTS TUBES WITH I.D. OF	AVERAGE WEIGHT	SHIP WT.
PSC-10	1.130"	.180 oz.	3 oz.
SC-12	1.300"	.035 oz.	2 oz.
SC-15	1.60"	.072 oz.	2 oz.
SC-19	2.00"	.110 oz.	3 oz.

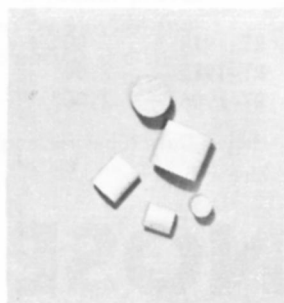
*Heavy Duty Phenolic Coupler-High Heat Resistance.



BALSA BULKHEADS

Connect Body Tubes of the Same Size.
Build and Connect Payload Sections.
Any Application Requiring Complete Blockage of Tubes.

CAT. NO.	CONNECTS TUBES WITH I.D. OF	AVERAGE WEIGHT	SHIP WT.
BB-8	.903"	.090 oz.	2 oz.
BB-10	1.130"	.125 oz.	3 oz.
BB-12	1.300"	.140 oz.	3 oz.
BB-15	1.60"	.185 oz.	3 oz.
BB-19	2.00"	.288 oz.	4 oz.



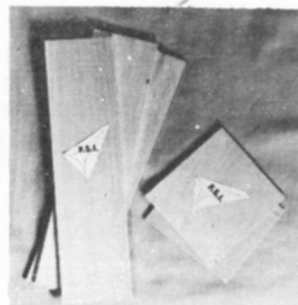
FIN STOCK

SPECIAL SELECTED BALSA FIN MATERIAL

Cat. No.	Size	Ship Wt.	Price
SB-1	3/32 x 3 x 12	6 oz.	3 for \$1.00
SB-2	3/32 x 4 x 12	6 oz.	3 for 1.30
SB-3	1/8 x 3 x 12	7 oz.	3 for 1.10
SB-4	1/8 x 4 x 12	7 oz.	3 for 1.55
SB-5	1/4 x 4 x 12	8 oz.	2 for 1.35

SELECT AIRCRAFT PLYWOOD FIN MATERIAL

PFM-1	1/16 x 6 x 6	8 oz.
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TRANSITION SECTIONS

Connect Rocket Body Tubes of Different Sizes - Balsa Except as Noted.

CAT. NO.	(X) CONNECTS TUBE I.D. to	(Y) TUBE I.D.	NET WT.	SHIP WT.
*HTS-810	.903"	1.130"	.18 oz.	4 oz.
TS-1215	1.300"	1.60"	.24 oz.	4 oz.

*Hardwood Transition.

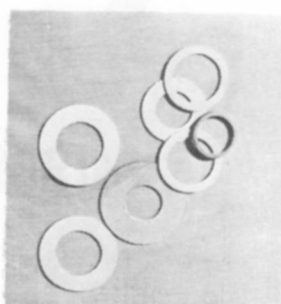


CENTERING RINGS

ULTRA LIGHTWEIGHT PRECISION CUT PLYWOOD EXTRA STRONG

Cat. No.	CENTERS .903 I.D. TUBE in.	I.D. Tube	Ship Wt.	Set of 2
*CR-810		1.13" I.D. Tube	2 oz.	
CR-812		1.30" I.D. Tube	2 oz.	
CR-815		1.60" I.D. Tube	2 oz.	
CR-819		2.00" I.D. Tube	2 oz.	
	CENTERS 1.13 I.D. TUBE in.	I.D. Tube		
CR-1015		1.60 I.D. Tube	2 oz.	
CR-1019		2.00 I.D. Tube	2 oz.	

*Heavy Cardboard

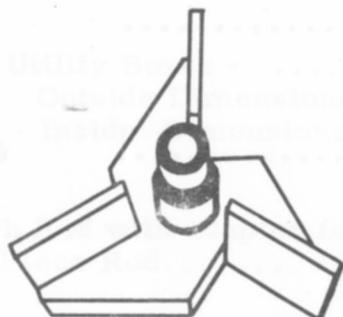


PHENOLIC TUBING

CAT. NO.	ID	OD.	LENGTH
PT 19	1.04	1.25	19"
PT 9A	1.04	1.25	9"



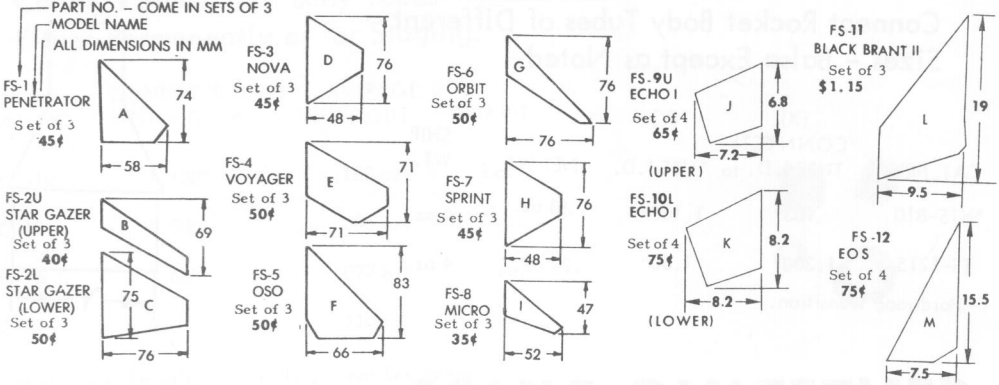
FIN ALIGNMENT FIXTURE - Places fins on a 3 fin model with perfect alignment in less than one minute. Perfect alignment of fins means straight flights with less aerodynamic drag. This one detail in model building will help you out fly your friends. Snap clothes pins (not furnished) are used to hold fins to upright alignment supports. The body tube fits over a central spindle.



FOR USE ON ALL FSI 3 FIN MODELS.

CAT. NO. FA 101

F.S.I. FINS For replacement parts or building your own models. Fins are precut and sanded. Fins A thru I are 1/16" 3 ply birch plywood. Fins J thru M are balsa.



MISCELLANEOUS ITEMS

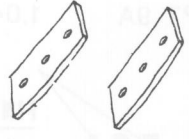
Thrust Rings (2 per pkg.) -
Cat. No. TR-1 for .903 dia. tube.....
Cat. No. TR-2 for 1.130 dia. tube



Shock Cord (flame resistant covering)
Cat. No. S-1 (10 ft. per pkg.).....



Shock Cord Anchors (6 per pkg.)
Cat. No. SA-6.....



Snap Swivels (6 per pkg.)
Cat. No. SS-10.....



Eye Screws (6 per pkg.)
Cat. No. ES-21.....



Nylon Parachutes (black for easier tracking)

- Cat. No. NP-20... (20" dia.).....
- Cat. No. NP-22... (22" dia.).....
- Cat. No. NP-24... (24" dia.).....



Select-A-Chute (with shroud lines, tapes, & swivel)

- Cat. No. P-12.....

Streamer Kit

- Cat. No. S-12 (3 streamers 2" x 10')....
- Cat. No. S-13 (2 streamers 3" x 10')....



Blast Deflector (for LP-2 launch stand)

- Cat No. FD-1.....



F.S.I. Glow Labels (5 per pkg.)

- Cat. No. GS-5.....



F.S.I. Chrome Labels (4 per pkg.)

- Cat. No. CL-4.....



NEW!

Body Tubes - Lightweight, Heavy Duty Type for Large High Powered Rockets

Cat. No.	I.D.	O.D.	Length	Wt. Net
HT-225	2.25	2.34	18"	2.5 oz.
HT-225A	2.25	2.34	22"	3.0 oz.
HT-114	1.14	1.22	16"	1.1 oz.

Laminated Utility Boxes -

Outside Dimensions- 3"x2"x4"

Inside Dimensions- 2 7/8"x1 1/2"x3 7/8"

- 1/8" Launch Rod with adapter for F.S.I. Launch Stands.
Two Piece Rod.....

Fly your MODELS with dependable F.S.I., SUPER POWER ROCKET ENGINES

For ESTES Rocket Models

Conversion Kit C-55

** No. C-55F

Avenger K-38

Cherokee D K-47

Sandhawk K-51

Arcas K-26

Interceptor K-50

Estes BT-55 body tube

Conversion Kit No. C-60

** No. C-60F

Big Bertha K-23

Cobra K-10

Scrambler K-37

Farside X K-12

Omega K-52

Saturn V K-39

Mercury Redstone K-41

Estes BT-60 body tube

Conversion Kit No. C-70

** C-70F

Gemini-Titan K-21

Little Joe II K-30

Estes BT-70 body tube

Conversion Kit.

** No. C-101F

Saturn V K-36

Saturn IB K-29

For CENTURI Rocket Models

Conversion Kit, No. 13

Recruiter KC-30 ** No. 13F

Laser X KC-50

Long Tom KC-4

Series 13 body tube

Conversion Kit, No. 16

Quaser KC-7 ** No. 16F

Centurion KC-2

Nike Smoke KS-15

Series 16 body tube

Conversion Kit, No. 20

Orion KC-8 ** No. 20F

Mercury Redstone KS-1

Series 20 body tube

For FLIGHT SYSTEMS INC.

Rocket Models

To convert from F series engines

to A through E series engine

sizes.

Conversion Kit, No. C-20

Voyager MRK-IV

Oso MRK-V

Viking 4 MRK-XII

F.S.I. 1.130 (1 1/8") body

tube

FSI CONVERSION KIT

Engine

Compartment

Mount

Ring

Glue all

around

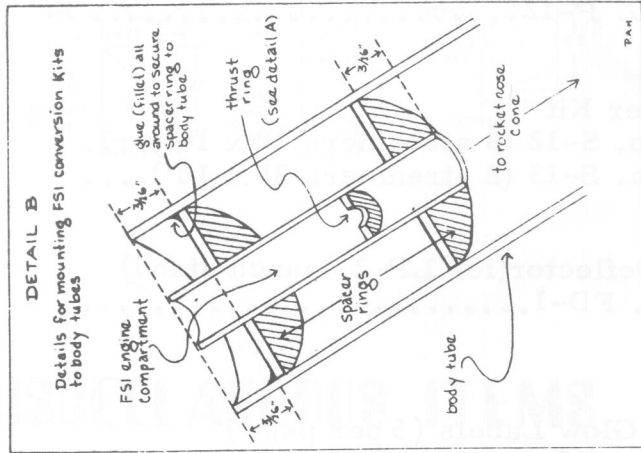
FSI

FLIGHT SYSTEMS, INC.

FLY YOUR MODELS WITH DEPENDABLE F.S.I., SUPER POWER ROCKET ENGINES

CONVERSION KITS

"PROFESSIONALISM IN ROCKETRY"



FLY with

F.S.I.

** F following the kit number converts the listed kit to use F.S.I.'s "F" series engines.

IMPORTANT

PLEASE READ THIS INFORMATION before ordering merchandise

* F engines are not mailable. They will be shipped prepaid by United Parcel Service (U.P.S.) or Merchants Delivery to areas served by these carriers. If these carriers do not deliver to your area, contact us before ordering F engines. Thunderbolts-See pg. 22

No C.O.D. orders accepted. Flight Systems will not be responsible for UNINSURED ORDERS. Add \$.20 for insurance if desired. Due to the high cost of postage and handling add \$1.25 for handling on orders of less than \$7.00.

Canadian customers please add \$2.25 to your order for Shipping, Handling on orders under \$15.00.

Missouri Residents add 4% tax

Manufacturer's and distributor's only obligation shall be to replace such quantity of the product proven to be defective. User shall determine the suitability of the product for his intended use, and assume all risk and liability in connection therewith.

WARNING: NO MERCHANDISE WILL BE SHIPPED WITHOUT
DISCLAIMER SIGNATURE

All items other than F series engines are sent postpaid.

—————→ DEALER INQUIRIES INVITED. ←————

Watch for new products as we add to our available line.

Prices subject to change without notice.



EFFECTIVE
15 JAN 79

PRICE LIST

Page #	Catalog #	Description	Price
7	SP-1	Starter Package	19.95
8	MRK-8	Micro Kit	3.25
8	MRK-1	Penetrator Kit	3.90
9	MRK-14	Black Brant II Kit	21.95
10	MRK-7	Sprint Kit	5.15
11	MRK-6	Orbit Kit	5.45
11	MRK-4	Voyager Kit	5.60
12	MRK-3	Nova Kit	5.40
12	MRK-5	Oso Kit	5.70
13	MRK-2	Stargazer Kit	4.60
13	MRK-9	Viking I Kit	3.80
13	MRK-10	Viking II Kit	4.05
14	MRK-11	Viking III Kit	4.15
14	MRK-12	Viking IV Kit	5.30
15	MRK-15	Echo I Kit	6.90
15	PL-15	MRK-15 Payload Section	1.00
15	MRK-16	Eos D Kit	8.65
15	MRK-16F	Eos F Kit	8.95
16	LP-1	Launch Pad	4.85
16	LP-1A	Launch Pad	4.85
16	LP-2A	Launch Pad	7.45
16	EC-101P	Ignition System (Partially Assembled)	7.85
16	EC-101A	Ignition System (Assembled)	10.20
17	LP-2	Launch Pad	7.65
17	EC-102P	Ignition System (Partially Assembled)	10.35
17	EC-102A	Ignition System (Assembled)	13.05
18	MC-1F	V-2 Conversion Kit	2.85
18	MC-2F	Pershing Conversion Kit	2.70
18	MC-3F	Hon. John Conversion Kit	2.85
18	FW-1	Flameproof Wadding	1.00
18	1A-10	Ignitors	1.30
18	1A-20	Ignitors	1.25
18	1A-30	Ignitors	1.20
18	LL-12	Launch Lugs (1/4")	.45
18	LL-23	Launch Lugs (1/8")	.50

Page #	Catalog #	Description	Price
18	FC-12	Firing Clips	.45
20B	RX-1	Mach 1 Thruster System	7.95
20B	MRK-17	Mach 1 Dart Kit	3.25
20B	LP-2B	Heavy Duty Launcher	8.35
20C	MRK-18	Maverick Kit	7.85
20C	NC-122	Nose Cone	1.30
20D	MC-3F	Hon. John Conversion Kit	2.85
20D	EMA-60	Engine Adapter	.80
21	M-100	Electric Match Igniter	.90
21	A4-0,4	Rocket Engines	1.80
21	B3-0,4,6	Rocket Engines	1.90
21	C4-0,4,6	Rocket Engines	2.10
21	D4-0,4,6	Rocket Engines	3.20
21	D6-0,4,6	Rocket Engines	3.30
21	D18-0,4,6	Rocket Engines	4.25
21	D20-0,3,5,7	Rocket Engines	4.35
21	E5-0,4,6	Rocket Engines	4.40
21	E60-0,4,6,8	Rocket Engines	10.05
21	F7-4,6	Rocket Engines	11.50
21	F100-0,4,6,8,10	Rocket Engines	11.50
31	P-12	Select-A-Chute Kit	1.00
31	PC-12	Chute Canopy only	.50
31	S-12	Streamer Kit	1.10
31	S-13	Streamer Kit	1.10
35	HRT-816	Body Tube	.85
35	HRT-808	Body Tube	.65
35	HRT-804	Body Tube	.50
35	HRT-1018	Body Tube	1.00
35	HRT-1009	Body Tube	.80
35	HRT-1004	Body Tube	.70
35	RT-1218	Body Tube	1.20
35	RT-1209	Body Tube	.95
35	RT-1204	Body Tube	.80
35	RT-1218	Body Tube	1.45
35	RT-1512	Body Tube	1.20
35	RT-1506	Body Tube	.85
35	RT-1918	Body Tube	1.95
35	RT-1912	Body Tube	1.70
35	RT-1906	Body Tube	1.40

Page #	Catalog #	Description	Price
35	HNC-81	Nose Cone	1.40
35	HNC-101	Nose Cone	1.60
35	NC-121	Nose Cone	1.80
35	NC-152	Nose Cone	2.60
35	NC-191	Nose Cone	3.95
36	PSC-10	Phenolic Stage Coupler	.70
36	SC-12	Stage/Tube Coupler	.40
36	SC-15	Stage/Tube Coupler	.65
36	SC-19	Stage/Tube Coupler	.70
Not Shown	SC-8	HRT-816 Tube Coupler	.35
Not Shown	SC-10	HRT-1018 Tube Coupler	.40
36	BB-8	Balsa Bulkhead (coupler)	.65
36	BB-10	Balsa Bulkhead (coupler)	.70
36	BB-12	Balsa Bulkhead (coupler)	.85
36	BB-15	Balsa Bulkhead (coupler)	.95
36	BB-19	Balsa Bulkhead (coupler)	1.30
36	PFM-1	Plywood Fin Stock	.85
37	HTS-810	Transition Section	1.50
37	TS-1215	Transition Section	1.60
37	CR-810	Centering Rings	.45
37	CR-812	Centering Rings	.70
37	CR-815	Centering Rings	.80
37	CR-819	Centering Rings	.90
37	CR-1015	Centering Rings	.85
37	CR-1019	Centering Rings	.95
37	PT-19	Phenolic Tube (18")	1.50
37	PT-19A	Phenolic Tube (9")	1.05
37	FA-101	Fin Alignment Fixture	3.85
38	FS-1	Fin Set	.75
38	FS-2	Fin Set (combined upper and lower)	1.45
38	FS-3	Fin Set	.75
38	FS-4	Fin Set	.80
38	FS-5	Fin Set	.80
38	FS-6	Fin Set	.80

Page #	Catalog #	Description	Price
38	FS-7	Fin Set	.75
38	FS-8	Fin Set	.65
38	FS-9U	Fin Set	.80
38	FS-10L	Fin Set	.90
38	FS-11	Fin Set	2.05
38	FS-12	Fin Set	1.00
38	TR-1	Thrust Rings	.40
38	TR-2	Thrust Rings	.45
38	S-1	Shock Cord	1.25
38	SA-6	Shock Cord Anchors	.45
38	SS-10	Snap Swivels	.65
38	ES-21	Eye Screws	.65
39	NP-20	Nylon Parachute (20")	4.40
39	NP-22	Nylon Parachute (22")	4.65
39	NP-24	Nylon Parachute (24")	4.85
39	FD-1	Blast Deflector(Discontinued)	
39	HT-225	Heavy Duty Body Tube	2.30
39	HT-225A	Heavy Duty Body Tube	2.50
39	HT-114	Heavy Duty Body Tube	1.50
39	CL-4	FSI Chrome Mylar Labels	.40
40	C-55	Conversion Kit	.95
40	C-55F	Conversion Kit	1.05
40	C-60	Conversion Kit	1.05
40	C-60F	Conversion Kit	1.10
40	C-70	Conversion Kit	1.15
40	C-70F	Conversion Kit	1.25
40	C-101F	Conversion Kit	1.75
40	13	Conversion Kit	.95
40	13F	Conversion Kit	1.05
40	16	Conversion Kit	1.05
40	16F	Conversion Kit	1.10
40	20	Conversion Kit	1.15
40	20F	Conversion Kit	1.25
40	C-20	Conversion Kit	.90



FLIGHT SYSTEMS, INC.
 9300 EAST 68TH STREET
 RAYTOWN, MISSOURI 64133



9300 EAST 68th STREET
RAYTOWN, MISSOURI 64133

Order Form

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MODEL ROCKETRY

SEND TO:

NAME _____
 ADDRESS _____
 CITY _____ STATE _____ ZIP _____

Qty.	Cat. No.	Description	Price Each	Cost

Disclaimer: Flight Systems, Inc. hereby certifies that reasonable care has been exercised in the design and fabrication of our products. We assume no responsibility for their storage and/or use beyond this point.

Signature: _____
 Adult

COLUMN TOTAL	
MISSOURI RESIDENTS	
ADD 4% TAX →	
ADD \$1.00 TO ALL ORDERS	
FOR HANDLING AND SHIPPING. →	
ADD \$1.50 TO ALL ORDERS UNDER	
\$7.50.	
TOTAL	





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