MODEL ROCKET NEWS

Vol. 16, No. 1
Oct. 15, 1976

Vernon Estes . . . . . Publisher
Dane Boles . . . . . Editor
Bob Cannon . Dir. of Publications
Charlie Webb . . . . . Photographer
Ron McClaren . . . . . Staff Artist
Steve Garcia . . . . . Staff Artist

MRN TO BE PUBLISHED SIX TIMES YEARLY

At the request of thousands of Estes rocketeers we are happy to announce the publication of "Model Rocket News" six times yearly. The MRN will be available on even numbered months (see publication schedule) in your return mail orders. To receive your bi-monthly copy simply place an order or request the latest issue from Estes Industries; Att: MRN Editor, Penrose, Colo. 81240.

Future issues of MRN will be filled with free plans, tech reports, rocket news, contests, cartoons, construction tips, finishing ideas, and sensational articles on Space Shuttle, the Viking Lander, NASA activities, and Flying Saucers, just to name a few. We promise to make MRN more exciting than ever. If you're interested in contributing to MRN see page 28 for more details.

Due to the increasing costs of mailing, MRN will be mailed only very occasionally to Estes rocketeers. So, your best bet is to obtain MRN with an order or request it directly from the MRN editor.

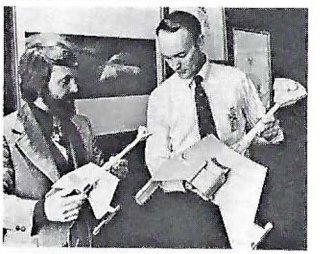
MRN PUBLICATION SCHEDULE

Vol.	No.	Month	Year
16	2	December	1976
17	1	February	1977
17	2	April	1977
17	3	June	1977
17	4	August	1977
17	5	October	1977

STAR TREK CREW AT SPACE SHUTTLE ROLL-OUT

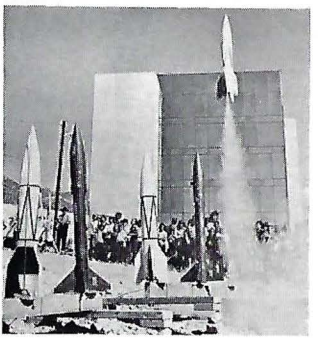
When the Space Shuttle Orbiter OV-101 "Enterprise" was rolled out at Palmdale, California on September 17, 1976, the bridge crew of the United Starship "Enterprise" was on hand. Left to right: Dr. John C. Fletcher, NASA Administrator; De Forest Kelly (Dr. McCoy); George Takei (Sulu); Michelle Nichols (Uhura); Leonard Nimoy (Spock); Gene Roddenberry (The Great Bird of the Galaxy); unknown person; Walter Koenig (Checkov). Photo by Bill Stine, Phoenix, Arizona.

SMITHSONIAN PRESENTATION



Apollo 11 Astronaut Mike Collins, now Director for The Smithsonian Institute's new National Air and Space Museum, and Dane Boles, Estes Director of Rocketeer Communications compare the Estes Klingon with the original Star Trek model during January presentation at Smithsonian. For the opening of the new Smithsonian addition Estes Industries presented flying models of both the Starship Enterprise and the Klingon Battle Cruiser to former Astronaut Collins.

DEDICATION OF THE INTERNATIONAL SPACE HALL OF FAME



Estes Industries invited to participate in dedication ceremonies of International Space Hall of Fame. See page 28 for article and photo story.

NARAM-18

NATIONAL ASSOCIATION OF ROCKETRY 18TH ANNUAL NATIONAL MODEL ROCKETRY CHAMPIONSHIPS

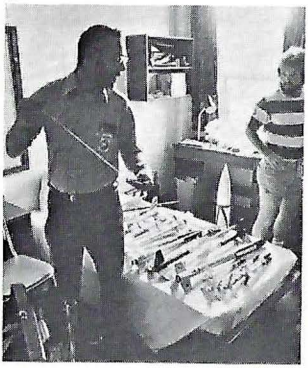
This year's Bi-Centennial National Championships, NARAM 18, were held at Allentown College, Center Valley, Pennsylvania. The host NAR Sections were S.P.E.A.R. (South Eastern Pennsylvania Establishment for the Advancement of Rocketry) and T.H.O.R. (Turk's Head Organization of Rocketry). Running from Sunday, August 1 through Friday, August 6 more than 150 NARAM-18 contestants participated in: Class 3 Streamer Duration, Pigeon Eggloft, Swift Rocket Glide, Single Payload, Plastic Model, Hornet Boost Glide, Class 1 Parachute Duration, Scale, and R&D.

Safety Check-in for Scale Model Competition.
©1976 Alan Williams National Assn. of Rocketry

The week of NARAM was jammed with activities including special discussion groups, workshops, manufacturers presentations, guest speakers, slide shows, a special showing of the science fiction classic, "Silent Running", plus a terrific awards banquet.

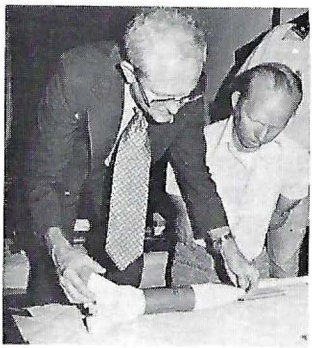
Representing the Estes team were Vern and Gleda Estes; Bill Simon, Research and Development Manager; and Dane Boles, Estes Director of Rocketeer Communications. Also assisting with the demonstrations and primarily responsible for the Estes builtups were Michael Del Vecchio and Paul Porzio, both of New York City.

Opening ceremonies were kicked off, or perhaps we should say launched, with



Bill Simon and Dane Boles prepare ESTES demonstration birds.
©1976 Alan Williams National Assn. of Rocketry

the lift-off of 13 Estes Renegades each painted with the colors and names of the 13 original American colonies. Manufacturers presented major demonstrations and

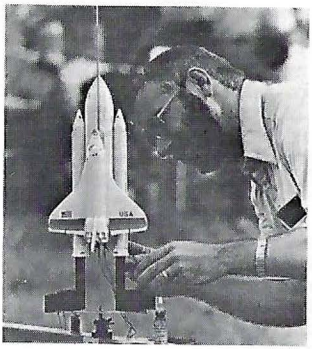


Mr. T. M. Davis, Plant Manager of Thiokol Corp. looks over Tom Hoelle's Genie Missle as Chief Scale Judge Don Larson explains its operation.
©1976 Alan Williams National Assn. of Rocketry

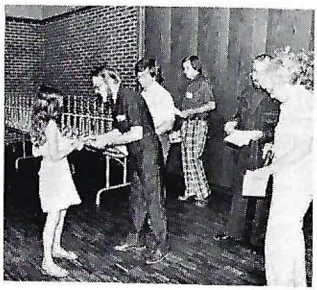
everyone had the pleasure of receiving a special welcome message from the Honorable Milton J. Shapp, Governor of Pennsylvania.

The Estes team participated in a number of demonstrations and presentations and provided each contestant with a special NARAM packet featuring a variety of model rocketry materials including: meet stickers, altitude computer, technical reports, and an emergency rocket repair kit.

Bob Biedron and John Langford watch as their Javelin Sounding Rocket model lifts off.
©1976 Alan Williams National Assn. of Rocketry



Bill Simon Prepares the ESTES Space Shuttle for flight during the Sunday demonstration flights.
©1976 Alan Williams National Assn. of Rocketry



Young Teresa Leahy was congratulated by Vern for one of her many placing flights in the contest.
©1976 Alan Williams National Assn. of Rocketry

As you can see from these photographs participating in NARAM is a very exciting experience. For more information on NARAM and how to join the National Association of Rocketry write to:

National Association of Rocketry Headquarters
Department E-7
P.O. Box 725
New Providence, NJ -7974

AURORA II

Build the AURORA II with Estes High Performance Parts and Accessories

WINNER JULY, 1976
DESIGN OF THE MONTH
CONTEST
By LEWIS M. JACKSON
Madison Heights, VA

SKILL LEVEL 3

PARTS LIST

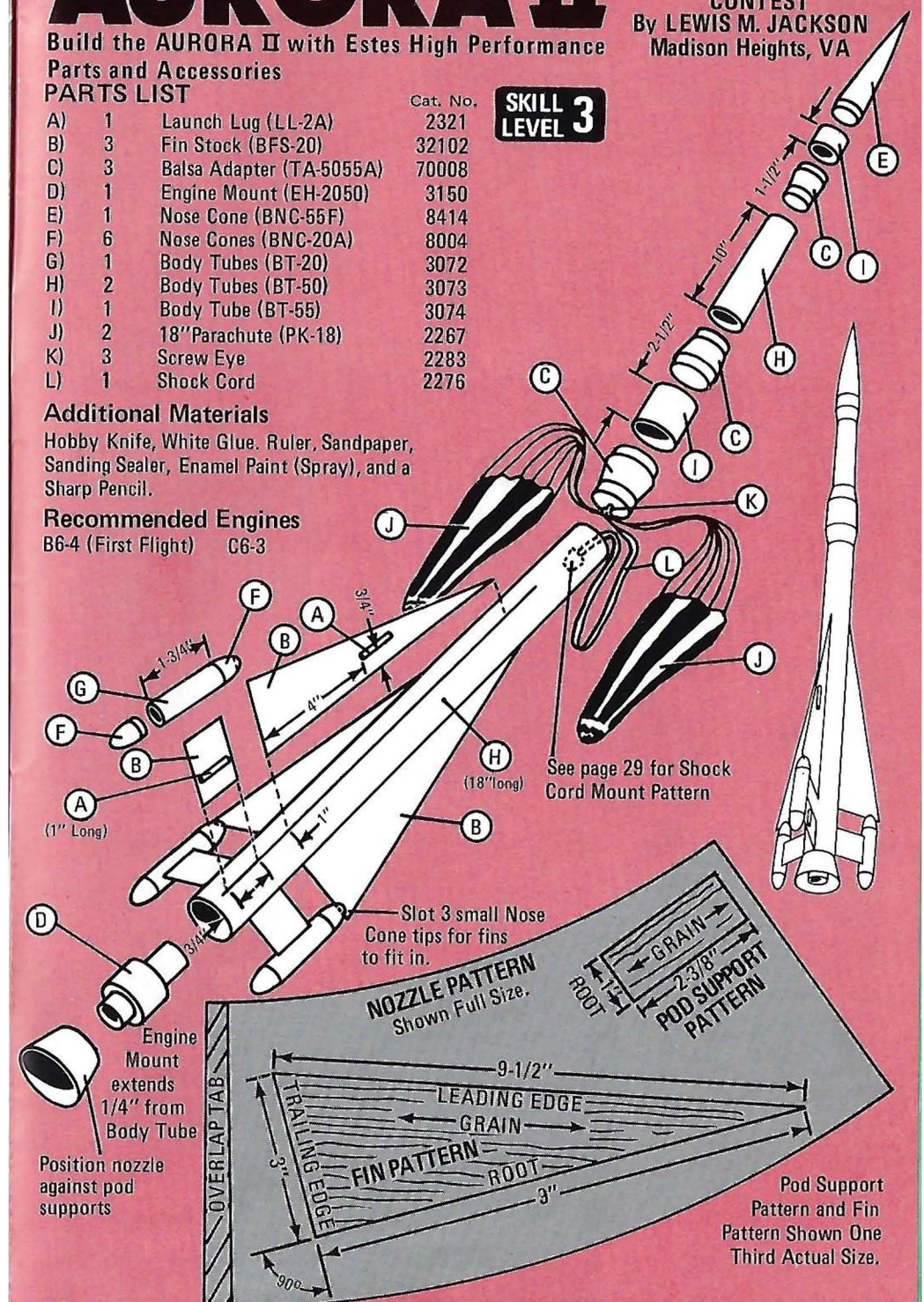
			Cat. No.
A)	1	Launch Lug (LL-2A)	2321
B)	3	Fin Stock (BFS-20)	32102
C)	3	Balsa Adapter (TA-5055A)	70008
D)	1	Engine Mount (EH-2050)	3150
E)	1	Nose Cone (BNC-55F)	8414
F)	6	Nose Cones (BNC-20A)	8004
G)	1	Body Tubes (BT-20)	3072
H)	2	Body Tubes (BT-50)	3073
I)	1	Body Tube (BT-55)	3074
J)	2	18"Parachute (PK-18)	2267
K)	3	Screw Eye	2283
L)	1	Shock Cord	2276

Additional Materials

Hobby Knife, White Glue. Ruler, Sandpaper, Sanding Sealer, Enamel Paint (Spray), and a Sharp Pencil.

Recommended Engines

B6-4 (First Flight) C6-3



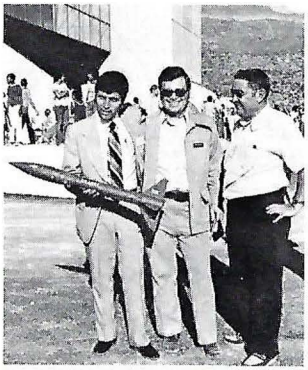
ESTES IN THE NEWS...

DEDICATION OF INTERNATIONAL SPACE HALL OF FAME

Several months ago Estes Industries was invited to participate in the dedication ceremonies of the International Space Hall of Fame. We, of course, accepted with great enthusiasm and here's the story –

Dateline — Alamogordo, New Mexico - Oct. 5, 1976: A list of 35 famous individuals, instrumental in the history and development of the Space Age, was read today by Mr. Frederick C. Durant III, Assistant Director for Astronautics of the National Air and Space Museum of the Smithsonian Institution, as they were inducted into the International Space Hall of Fame.

The International Space Hall of Fame will honor the space pioneers of many nations by displaying the records, artifacts, and memorabilia of their achievements. The facility will also be utilized for major national and international educational and scientific conferences.



Harrison Schmitt, Apollo 17 astronaut, receives Estes Honest John from Bob Cannon, Education Director for Estes Industries. G. Harry Stine, curator pro tem for the ISHF looks on.

Among the honored inductees were: Neil Armstrong, Yuri Gagarin, Robert Goddard, Will Ley, Hermann Oberth, Konstantin Tsiolkovski, and Wernher Von Braun.

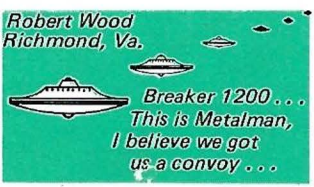
Prominent among the many dignitaries present were Harrison Schmitt, astronaut/geologist who explored the moon on Apollo 17, the Honorable Joseph Montoya, Governor of New Mexico, and Mr. G. Harry Stine, noted science writer, aerospace engineer, and early pioneer of the model rocket industry.

Estes Industries provided special model rocket launchings as official salutes to the space pioneers honored on this occasion. A one minute biographical sketch was read for each inductee, at the end

Estes and Damon Corporation personnel presented scale Maxi-Brutes and Patriots to dignitaries attending the opening ceremonies. Left-to-right: U.S. Sen. Joseph Montoya (N.M.), U.S. Sen. Robert C. Byrd (W.V.), Bob Cannon, Education Director for Estes Industries, and Mr. Leonard Fuhrer, V.P. for Damon Corporation.

of which we sent up a special model rocket in his honor. Most of the kits launched were later presented to dignitaries attending the ceremonies.

Robert Wood
Richmond, Va.



THE IDEA BOX

Easy Hand Held Paint Stand

By bending a coat hanger to the shape shown, you can make a painting stand you can paint almost any model rocket on. FOR REGULAR ENGINE BIRDS insert the end of the wire into an empty engine casing, then all this into the engine mount. FOR D-BIRDS insert D-casing over regular casing. *Tom Baker*
Phoenix, AZ. 85021

Easy, Neat Masking Job.

Stick Masking tape to a clean surface a few times before placing it on a painted area. This will prevent it from peeling the paint off when it is removed.
Dean Kavalkovich
Monroeville, PA 15146

LET'S HEAR FROM YOU.

Got any good ideas for MODEL ROCKET NEWS articles, technical information, cartoons, anecdotes, club news of unusual interest, etc.? Then why not submit them to us for possible publication? Our constant aim is to make MRN a better, more interesting magazine, and you might be just the type of contributor we need.

If you send us photos, please make sure that you pack them between cardboard sheets so that they won't get creased in the mail. All contributions become the property of Estes Industries and cannot be returned. Address all material to: MRN Editor, Estes Industries, Penrose, Colorado 81240.

Should your article or photos be used in MRN, we'll reward your efforts and talent with an Estes merchandise certificate, the amount of which will be determined by the MRN editorial staff.

Hope to hear from you soon!

zebra

HONORABLE MENTION MAY 1976
DESIGN OF THE MONTH CONTEST
By MARK JOHNSON Placerville, CA

SKILL LEVEL 2

Build the ZEBRA with Estes High Performance Parts and Accessories

PARTS LIST

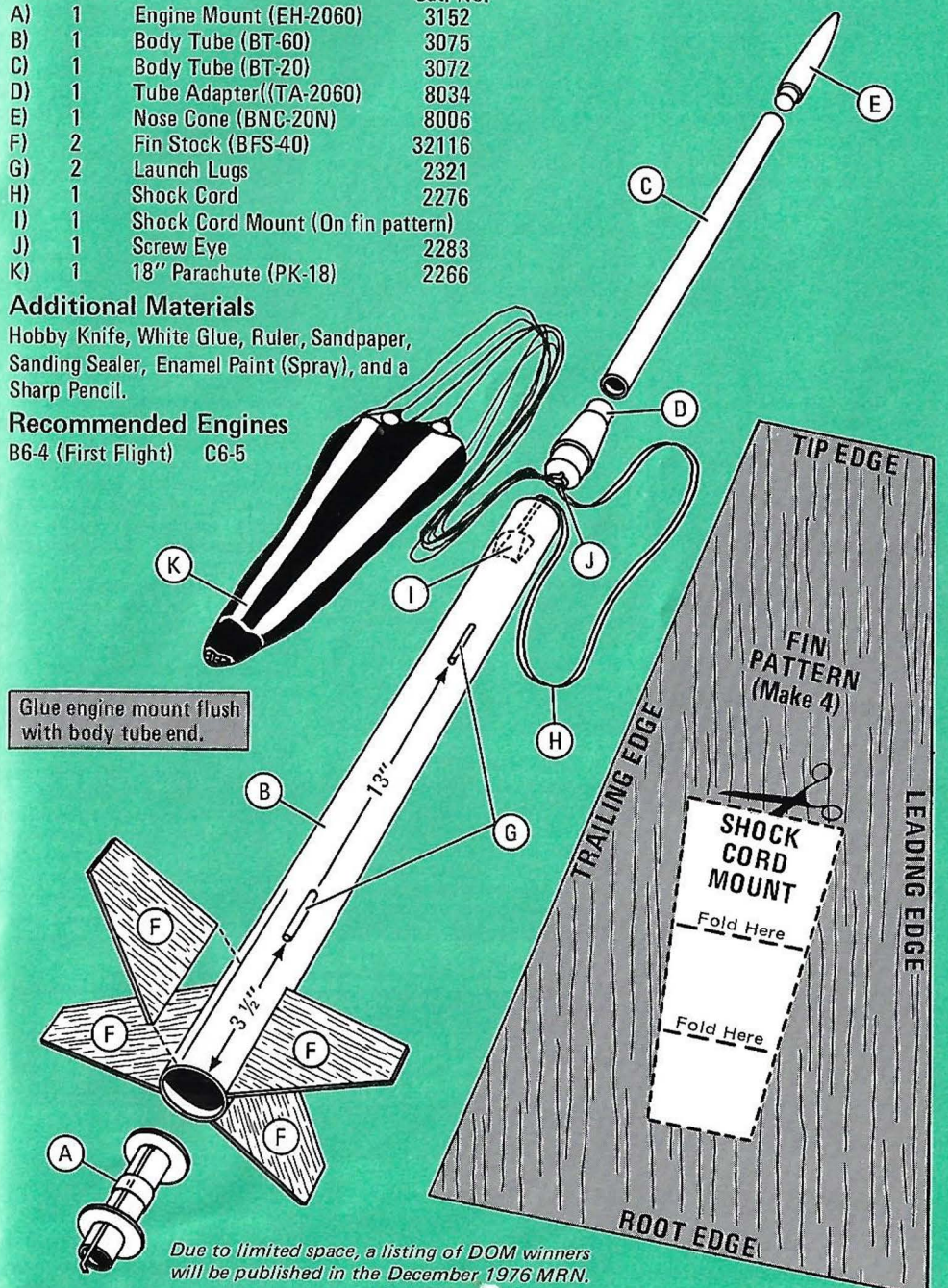
			Cat. No.
A)	1	Engine Mount (EH-2060)	3152
B)	1	Body Tube (BT-60)	3075
C)	1	Body Tube (BT-20)	3072
D)	1	Tube Adapter((TA-2060)	8034
E)	1	Nose Cone (BNC-20N)	8006
F)	2	Fin Stock (BFS-40)	32116
G)	2	Launch Lugs	2321
H)	1	Shock Cord	2276
I)	1	Shock Cord Mount (On fin pattern)	
J)	1	Screw Eye	2283
K)	1	18" Parachute (PK-18)	2266

Additional Materials

Hobby Knife, White Glue, Ruler, Sandpaper, Sanding Sealer, Enamel Paint (Spray), and a Sharp Pencil.

Recommended Engines

B6-4 (First Flight) C6-5



Due to limited space, a listing of DOM winners will be published in the December 1976 MRN.

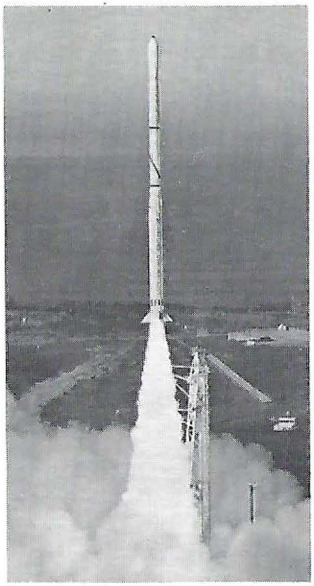
Technical Note Tn-6

SPACE BOOSTERS

By Dean Black of Simi Valley, California.

Spaceflight is one of the oldest dreams of man. However, spaceflight today is no longer a fantasy but a nuts-and bolts reality. Here, for the serious rocketeer, is a summary of the nuts and bolts.

Rocket propulsion engineers generally think in terms of three types of rockets: solid fueled, hydrogen fueled, and non-hydrogen liquid fueled. Of these, the solid fueled rocket motors are by far the simplest and cheapest.



They also have the lowest performance. A typical solid fueled engine has a fiberglass motor case, a single graphite lined nozzle and a center-burning propellant grain made up of two-thirds ammonium perchlorate and one-sixth each of aluminum powder and rubber binder. High propellant density keeps physical size small.

At the other extreme is the hydrogen fueled stage which is complex and costly. Hydrogen fuel has a low density so it requires large tanks. LOX/hydrogen engines contain thousands of parts and take many years to design and develop. The payoff comes from high performance which is significantly better than for any other chemical rocket type.

Intermediate between simple solid fueled stages and high performance hydrogen fueled stages are the third and last group, the non-hydrogen liquid fueled stages. Members of this group of liquid fueled stages are only slightly less complex and costly than liquid hydrogen fueled stages since both require sophisticated turbines and turbopumps. But performance of liquid fueled rockets not using hydrogen fuel is only slightly better than that of solids. Consequently, use of these intermediate liquid propellant types is declining except in cases where both the uncontrollability of solids and the non-storeability of hydrogen are unacceptable. While this type of stage is usually pump fed, the Delta stage and LEM are examples of pressure fed systems. The propellant combinations commonly used in non-hydrogen liquid fueled stages have liquid oxygen, nitrogen tetroxide, or nitric acid as an oxidizer and kerosene or some derivative of hydrazine as a fuel.

Table 1 is a performance summary of the three general classes of rocket propulsion stages. Performance figures are for best present-technology upper stages in the 15 ton total weight class. All liquid fuels are assumed to be pump fed.

Net specific impulse is simply the total impulse, minus losses, divided by total stage weight. It is the single best measure of performance capability. Runout velocity is the maximum change in velocity which can be imparted by a stage carrying minimum (i.e. zero) payload; it determines the minimum number of stages required for a given mission velocity. Typically, successive stages are sized such that each stage will add about half its runout velocity to the overall payload velocity. Of the three stage types, all are used as upper stages, but hydrogen is not used as a sole first stage fuel because of the excessive physical volume required for its tank. The superior performance of U.S. space boosters over similar sized Soviet boosters is due almost entirely to the use of hydrogen fueled upper stages in the U.S. vehicles. Performance of first stages is always lower than that of similarly fueled upper stages primarily because of lower nozzle expansion ratios to accommodate atmospheric back pressure.

The performance values in Table 1 are based on upper stages used in current NASA and Soviet vehicles. These stages were developed in the early nineteen sixties. It is anticipated by engineers that the 1980s will see solid fueled stages with specific impulses of about 297 seconds and propellant fractions of 94 percent. A similar increase in LOX/hydrogen perform-to 470 seconds of specific impulse and a 90 percent propellant fraction is anticipated. These figures represent net specific impulse improve-

Table 1: Performance Summary of Principal Rocket Stage Types

PROPELLANT				STAGE		
Type	Specific Impulse (sec)	Density (9m/cc)	Loss*	Propellant Fraction	Net Specific Impulse	Runout Velocity (mph)
Solid	290	1.8	.0125	.90	258	14,465
Liquid (Non-Hyd.)	310-352	1.0-1.2	.025-.030	.91-.92	277-312	16,345-18,465
LOX/Hyd.	444	.35	.050	.865	365	18,530

*Losses due to off-axis thrust vectoring, propellant boiloff, tank residuals, etc.

ments of about 9% and even larger increases in runout velocity.

Figure 1 shows the breakdown by stage type of all NASA standard launch vehicles. Note that all three stage types are used with about equal frequency.

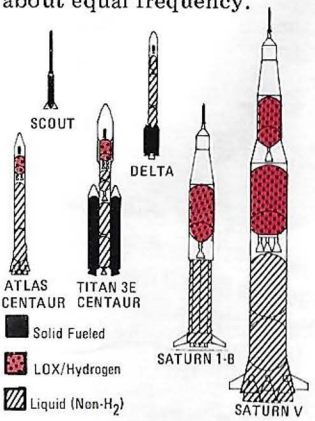


Figure 1. NASA Standard Launch Vehicles

The Space Shuttle will also use all three types of propulsion systems. Shuttle's three 500,000 lb. thrust main engines burn LOX and hydrogen and deliver a specific impulse of 455 seconds. Shuttle's main engines are supplemented during the first two minutes of flight by two 3,000,000 pound thrust solid fuel boosters strapped to the large external propellant tank. Shuttle's third propulsion systems is the Orbital Maneuvering System which is contained in the Orbiter and burns nitrogen tetroxide and monmethyl hydrazine as propellants. Shuttle's three propulsion systems are illustrated in Figure 2. Specifications and performance of Shuttle and other NASA, USAF and Soviet standard launch vehicles are given in Table 2.

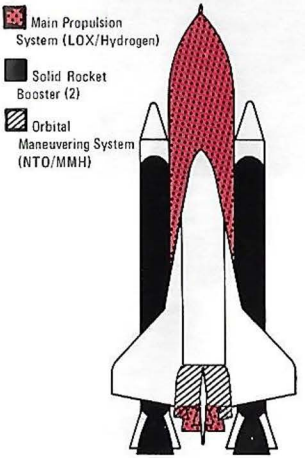
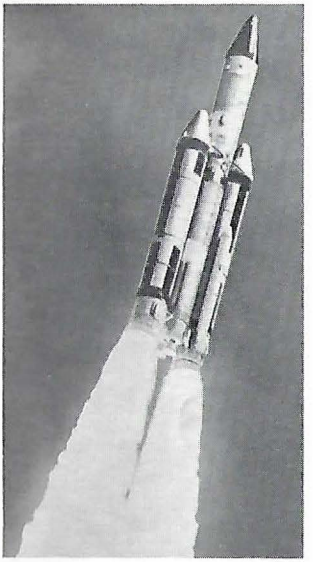


Figure 2: Space Shuttle's Three Propulsion Systems



The four smaller standard NASA launch vehicles (Figure 1) have optional solid fueled last stages. For Delta, Atlas-Centaur, and Titan 3E-Centaur the optional kick stage is a Thiokol TE 364-4 solid rocket motor weighing something over one ton.

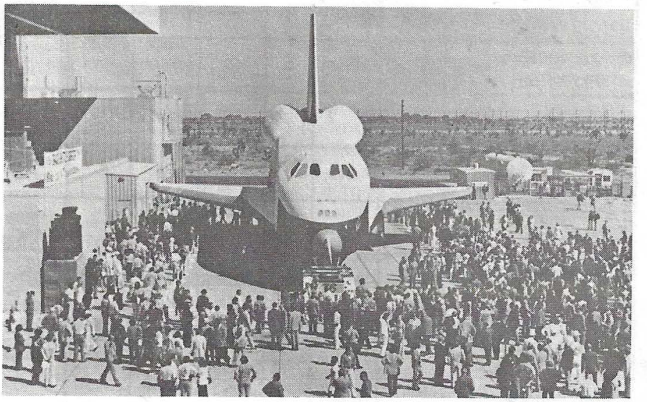
Table 2: Standard U.S. and Soviet Launch Vehicles

Vehicle Name	User Agency	Thrust (lb)	Length (ft)	Diam (ft)	Weight (lb)	Orbital Pay. (lb)	Escape Pay. (lb)	Comment
Scout	NASA USAF	107,000	75.1	3.75	47,200	425	80	All Solid Fueled
Cosmos Launcher	USSR	163,140	110	6.6	105,000	1000	—	352 sec Isp 2nd Stage
Atlas F	USAF	387,000	76	10	262,500	3,400	—	Solid fueled kick stage
Delta	NASA USAF	550,000	116	8	297,000	5,600	1,060	Most used U.S. booster
Titan III B	USAF	520,000	161	10	342,000	8,000	—	Agena Upper Stage
Atlas Centaur	NASA	430,000	131	10	325,000	11,300	1,250	First to use Hydrogen
Soyuz Launcher	USSR	1,124,000	160	27	720,000	16,500	3,000	Most used Soviet booster
Titan III C, D, E	USAF NASA	2,400,000	127-160	30	1,300,000-1,416,000	29,000-33,000	2,750-8,400	Various Upper Stages
Saturn 1-B	NASA	1,640,000	224	22	1,290,000	41,000	—	Used for Orbital Apollo
Proton Launcher	USSR	3,200,000	225	34	2,200,000	50,000	14,500	Space Station Launcher
Saturn 5	NASA	7,570,000	363	33	6,262,500	260,000	103,000	The Moon Rocket
TTS	USSR	11,000,000	350	56	9,000,000	350,000	40,000	3 Flights All Failed
Shuttle	NASA USAF	3,070,000	184	45	4,587,000	65,000	12,000	Reuseable (1980)

ROCKET NEWS

Penrose, Colorado, Vol. I, No. 1, October 15, 1976

U.S. SPACE SHUTTLE MAKES FIRST APPEARANCE



Palmdale, Calif., — On a stretch of sunbaked desert 60 miles east of Los Angeles, the doors of a giant dust-colored hangar were opened last September 15th, and America's latest entry in the evolving business of space exploration was rolled out for inspection by members of the press, NASA space officials, and visiting dignitaries.

Costing $6.9 billion, the Space Shuttle (named Enterprise in honor of the Star Trek vehicle) has the general look of today's wide-bodied jet, 122 feet long and about the size of DC-9 jetliner, with a 78-foot wingspan. It weighs in empty at 150,000 pounds and can lift 65,000 pounds into earth orbit. In the comparatively roomy pressure compartment, there is ample space for up to seven persons, including three crewmen, a payload master and three scientists. In the event the Space Shuttle is needed for a space rescue mission, it can bring as many as ten people back to earth

At launch from Cape Canaveral, the orbiter will be attached to the side of a 154-foot-high tank that will provide extra power before dropping away and parachuting into the ocean for recovery and reuse.

After an actual mission, the orbiter will re-enter Earth's atmosphere, protected from the 2,300° F re-entry heat by an elaborate cover of specially designed tiles that interlock over the craft, and it will land on 10,000 feet runways which have been specially built at Cape Canaveral and at Vandenberg Air Force Base, Calif.

The Space Shuttle can be outfitted for another flight in as little as two weeks, or can be readied for a space rescue mission launch from standby status in just 24 hours.

Apart from its being completely reuseable (up to 100 missions, perhaps more) Enterprise and its sister ship will be extremely economical. They will deploy and retrieve weather, communications, and Earth resources satellites which will enable scientists to study solar power. From Space Shuttle will come space stations, orbiting factories, launch platforms for other vehicles such as deep orbit satellites or planetary probes. And instead of costing $600 to lift one pound of payload into orbit aboard Apollo; the Space Shuttle will lower the cost to $150 a pound.

Will it really work?

For all the design and research that goes into a vehicle, there is always that moment of truth when it is asked to perform. On October 4, 1957, the Soviet Union launched Sputnik I, a tiny unmanned satellite, the very first of its kind ever. Suddenly in the eyes of the world, Russia was Number One in science; Sputnik I was a public relations coup quite possibly unmatched in history.

A few weeks later, the U.S. Navy (this was long before NASA) had readied on the launching pad a tiny grapefruit-shaped satellite to match the Russian feat. With newsreel cameras rolling and the eyes of the world focused on the launch, the countdown proceeded to T minus two. . . T minus one. . . "Liftoff!" Whereupon the rocket tipped over and the whole thing exploded on the launch pad. The U.S. was even further humiliated! In January, 1958, an Army space team headed by Werner Von Braun managed to get a satellite into orbit, but by then the damage to America's reputation as a scientific leader was done, not to be truly recaptured until a decade later when Neil Armstrong uttered those immortal words, "One small step for a man. . ."

Estes Industries is betting the Space Shuttle will work -- and will perform everything required of it and then some. The reason: when the designs for Space Shuttle were finalized, Estes engineers set about designing a working model, faithful in scale . . . detail . . . and aerodynamics.

In flight after flight, the Estes Industries flying model Space Shuttle has proven itself a superb vehicle -- exciting to build . . . thrilling to watch in flight . . . and a handsome decoration for bookshelf or desk when not in use.

Estes now has the Space Shuttle in stock, and if you order now, you can have it in plenty of time for Christmas.