ZEL *by Rocketdyne*

The cover photograph shows the launch of a USAF F-100D, boosted from a simulated hard-site shelter by the Rocketdyne Zero-Length-Launch solid-propellant rocket motor.

ZERO-LENGTH-LAUNCH OF MANNED JET FIGHTER

In the event of an enemy missile attack, defending aircraft would have to get into the air quickly from airfields that may be destroyed or damaged. One solution to this problem has been demonstrated by North American Aviation, Inc. The Rocketdyne 130,000-pound-thrust Zero-Length-Launch Booster, attached to the underside of an F-100D supersonic jet fighter, boosted the manned 20-ton jet into the air from the simulated hard-site shelter in 1/10 second. After four seconds of boosted flight, the empty casing fell away and the aircraft, flying at 270 mph, was in fully controlled flight. Acceleration stresses on the pilot and aircraft were well within the safe range.

ROCKETDYNE, a division of North American Aviation, Inc., maintains its Solid Propulsion Operation at McGregor, Texas.

This 12,000-acre complex accommodates complete facilities for research, development, testing, and fabrication of solid-propellant rocket motors.

The M-34 Zero Length Launch (ZEL) Booster described herein is a fully qualified and operational unit. Its unique fabrication is based on a modular-charge design concept, using an extended, synthetic rubber and ammonium nitrate composite propellant. This type of construction offers a high degree of versatility in thrust, time, and total impulse delivered.

Similar rocket motors preceding the M-34 during seven years of booster development at the McGregor Plant include the PRODUCER series, one of which, the MEGABOOM, is being successfully applied to sled track applications.

Through the elimination of three propellant modules from the aft bank of the charge and a slight increase in nozzle throat diameter, the M-34 rocket motor becomes a 5-NS-100,000 unit.

Sequence camera records the first six seconds of the Zero Length Launch of a North American F-100D Super Sabre.

ADVANTAGES OF M-34 FOR WEAPON SYSTEMS

- Demonstrated performance and reliability.
- Manufactured from low-cost, readily available materials.
- Field storage as Class 2 explosive (fire hazard only).
- Rugged construction permits transportation over any terrain.
- Proven safety.
- Essentially flameless, noncorrosive, nontoxic exhaust gases.
- Reproducible ignition.
- Sharp thrust tail-off.
- Latitude in thrust-time programming.

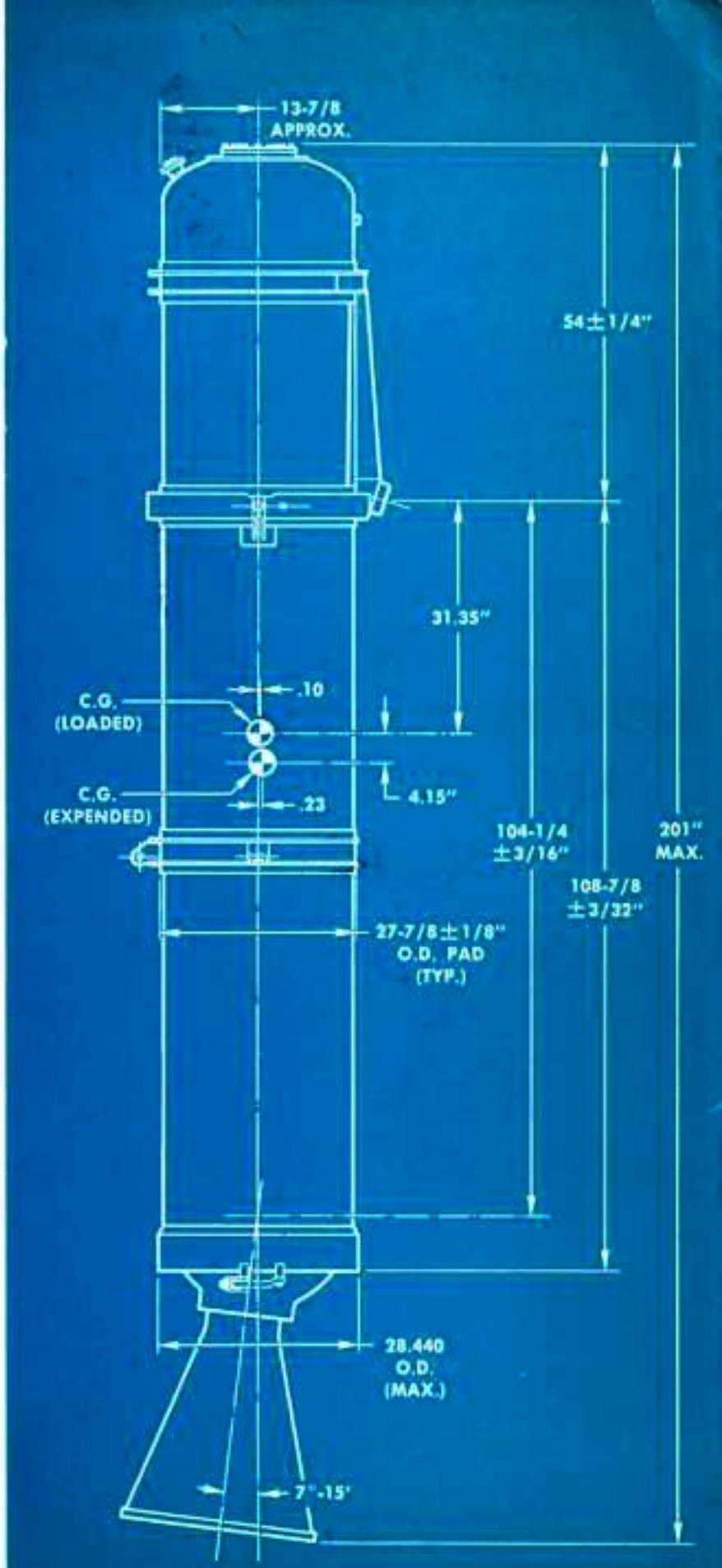
M-34 FEATURES

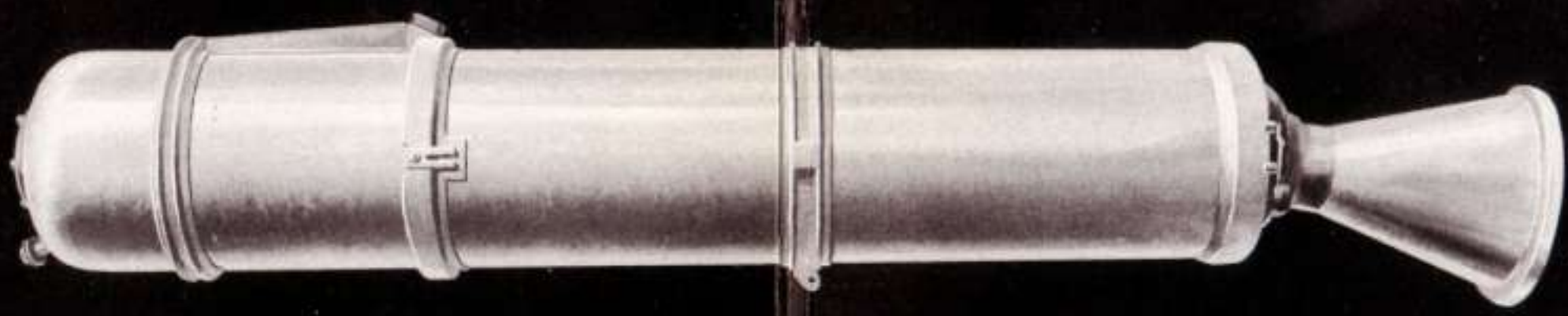
Has provision for:

- Attachment to object to be launched.
- Boresighting for correct orientation with parent vehicle.
- Thrust direction adjustment.
- Propellant temperature measuring devices.
- Easy insertion and quick arming of igniter.

VERSATILITY

The built-in modular charge concept of the M-34 rocket motor gives it many potential uses. For example, a 10-NS-52,000 unit has been designed for rocket sled application using propellant formulation RDS-127A and the M-34 rocket motor hardware.





M-34 ROCKET MOTOR

PERFORMANCE PARAMETERS

OPERATING TEMPERATURES	−65 F	70 F	130 F
AVERAGE CHAMBER PRESSURE, PSIA	940	1,250	1,490
AVERAGE THRUST, LB	85,600	115,770	138,000
ACTION TIME, SEC	6.04	4.68	3.99
TOTAL IMPULSE, LB-SEC	517,400	541,200	550,000
PROPELLANT SPECIFIC IMPULSE, LB-SEC/LB		191	
OVER-ALL SPECIFIC IMPULSE, LB/SEC/LB		100	
PORT-TO-THROAT RATIO		3.25	
NOZZLE EXPANSION RATIO		8.8	
NOZZLE THROAT DIAMETER, IN		8.94	
PROPELLANT WEIGHT, LB		2,830	
TOTAL WEIGHT, LB		5,400	
PROPELLANT FORMULATION		RDS135	

ENVIRONMENTAL DATA

STORAGE TEMPERATURE, F	−65 to 130 F
FIRING TEMPERATURE	As Specified by Customer (Within −65 F to 130 F Range)
ACCELERATION	Up to 15 g's
QUALIFICATION TEST	In accordance with MIL-E-25534

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