

## ***General Motors Test of Lead Cobalt Battery and MARS II Electric Car***

On October 31, 1967, just after Arizona Public Service and completed a 2,000 mile trip from Detroit to Phoenix in a **MARS II** Electric Car on October 6, 1967, EFP received an order for a **MARS II** from General Motors. The Car was picked up from EFP's shop in Ferndale Michigan (a Detroit suburb) and taken to Buffalo, New York for over six months of testing by Cornell Aeronautical Laboratory, Inc. Cornell issued its 138-page report in February, 1969. Excerpts from that report are on the next pages.

The remarkable thing about this test was that the Lead Cobalt Battery drove the MARS II 146 miles on a charge - on pure battery power.



***THE MARS II ELECTRIC CAR  
146 miles range powered by patented Lead Cobalt Batteries***

# TECHNICAL REPORT

## AN EXPERIMENTAL EVALUATION OF THE MARS II ELECTRIC AUTOMOBILE

by: James E. Greene

**CAL No. VJ-2623-K-1**

Prepared For:

GENERAL MOTORS CORPORATION  
GENERAL MOTORS ENGINEERING STAFF  
GENERAL MOTORS TECHNICAL CENTER  
WARREN, MICHIGAN 48090

CONTRACT NO. CC-140

FEBRUARY 1969



**CORNELL AERONAUTICAL LABORATORY, INC.**

OF CORNELL UNIVERSITY, BUFFALO, N. Y. 14221

# MARS II ELECTRIC CAR

WITH

## 120 VOLT, 27-kWh TRI-POLAR LEAD-COBALT BATTERY

General Motors/Cornell Aeronautical Laboratory test report VJ-2623-K-1, Feb. 1969

Table 2  
FIXED-THROTTLE RANGE TEST RESULTS

GEAR	THROTTLE STEP	LOCATION	RANGE (MILES)	DURATION (HOURS)	AVE. SPEED (MPH)	AMBIENT TEMP (°F)	BANK 3 DISCHARGE AMP-HRS	AVE. <sup>1</sup> BANK CURRENT (AMP)	NOMINAL SPEED VARIATION	NOMINAL BANK CURRENT VARIATION
3	4	OVAL TRACK	146.8	6.74	21.8	66-73	226	33.6	18-24	32-44
2	6	OVAL TRACK	94.1	3.22	29.3	65-68	189	58.7	23-32	58-78
2	6	ON-ROAD	125.1	3.98	31.3	84-85	220	55.3	23-36	44-66
3	6	ON-ROAD	91.0	2.45	37.2	58-62	195	79.6	34-43	65-95
4	6	ON-ROAD	83.9	1.88	44.5	73-74	192	102.0	40-51	90-122

(CONTINUATION)	INITIAL SPECIFIC GRAVITY @ 77 °F	DISCHARGE SPECIFIC GRAVITY @ 77 °F	RECHARGE SPECIFIC GRAVITY @ 77 °F	BANK 3 RECHARGE AMP-HRS	RECHARGE A.C. KWH	RECHARGE DURATION (HOURS)	MILES <sup>2</sup> AH	MILES <sup>3</sup> Δ SG	MILES <sup>4</sup> KWH	COST <sup>5</sup> MILE (¢)
		1.286 (80)*	1.060 (80)	1.285	235	49.1	19.0	.650	650	2.99
	1.282 (80)	1.097 (83)	1.284	-	44.8	18.0	.498	509	2.10	.95
	1.286 (83)	1.082 (94)	1.287	-	~ 50	-	.569	614	2.5	.80
	1.278 (80)	1.102 (83)	1.284	206	42.9	17.0	.467	517	2.12	.94
	1.282 (90)	1.113 (96)	1.285	-	42.2	16.5	.436	496	1.99	1.00

1 DISCHARGE AMP-HOURS ÷ DURATION

2 RANGE ÷ DISCHARGE AMP-HOURS

3 RANGE ÷ (INITIAL SPECIFIC GRAVITY - DISCHARGE SPECIFIC GRAVITY)

4 RANGE ÷ CHARGER INPUT A.C. KILOWATT-HOURS

5 BASED ON 2¢ PER KWH

NOTE - SPECIFIC GRAVITY MEASURED IN CENTER CELL OF BATTERY NO. 15

\* NOMINAL ELECTROLYTE TEMPERATURE (°F)

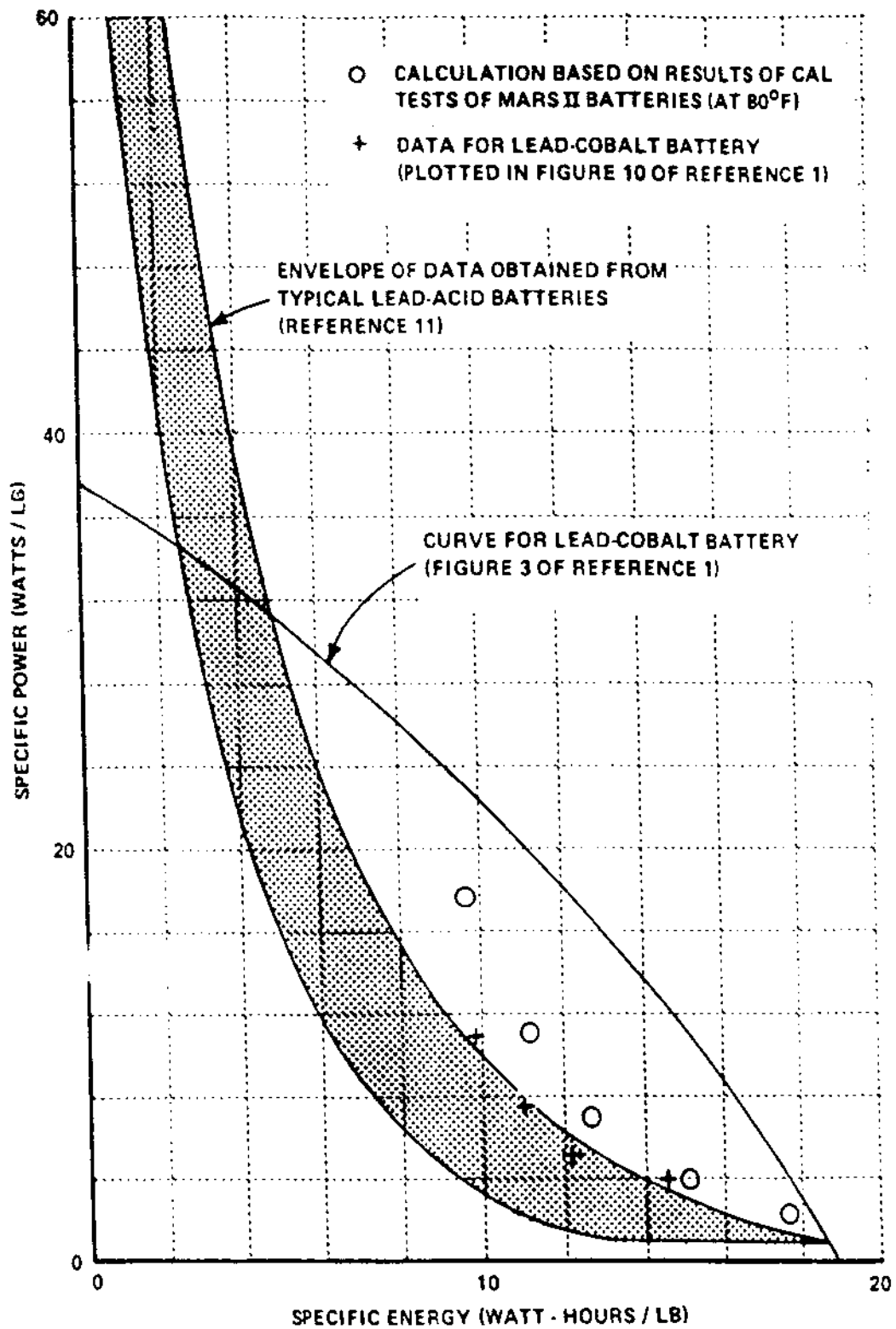


Figure 48 BATTERY SPECIFIC POWER VS SPECIFIC ENERGY



bt-1h

#24860

**General Motors Engineering Staff**

General Motors Technical Center  
Warren, Michigan 48090

28

ORDER No. **ES-30093**

**PURCHASE ORDER**

This number must appear on all invoices, packing slips, and Bills of Lading.  
**INVOICES TO BE RENDERED IN DUPLICATE**

Electric Fuel Propulsion, Incorporated  
366 West Eight Mile Road  
TO Ferndale, Michigan 48220

Attn: Mr. Robert R. Aronson

DATE 10/31/67

QUANTITY	DESCRIPTION	PRICE
1	1968 Mars II Electric Car Plus Accessories	\$5,450.00 421.00
	(Spec SP268) and warranty (W-FL-67-1)	\$5,871.00
	Body Color: Silver Blue Ampere Hour Meter Charging Receptacles for 1000-amp charger White side-wall tires radio Cigarette lighter	
	CONFIRMING-Mr. Aronson	

TERMS <b>Net 10 days</b>	F.O.B. <b>S. P.</b>	DELIVERY REQUIRED <b>1/15/68</b>	SHIP VIA <b>Their Delivery</b>
SHIP TO <input checked="" type="checkbox"/> GENERAL MOTORS ENGINEERING STAFF TECHNICAL CENTER 12 Mile and Mound Rd. Warren, Michigan 48090 Max. Clearance Rec. Door 12' 6"		MICHIGAN STATE SALES TAX STATEMENT—LICENSE 00-00205 1 <input type="checkbox"/> SUBJECT TO SALES TAX 2 <input checked="" type="checkbox"/> TAX EXEMPT—INDUSTRIAL PROCESSING 3 <input type="checkbox"/> TAX EXEMPT—STORES ACCOUNT 4 <input type="checkbox"/> APPLICABLE TAX WILL BE PAID BY PURCHASER 5 <input type="checkbox"/> EXEMPT—RESALE	

ON THE REVERSE SIDE HEREOF ARE THE TERMS AND CONDITIONS TO WHICH SELLER AGREES BY ACCEPTANCE OF THIS ORDER

This order is not binding until accepted. Acceptance must be executed on acknowledgment copy which MUST be returned to Buyer. This order, including the terms and conditions hereon contains complete and final agreement between Buyer and Seller and no other agreement in any way differing any of said terms and conditions will be binding upon Buyer unless made in writing and signed by Buyer's authorized representative.

General Motors Engineering Staff  
General Motors Technical Center

ISSUE INVOICE TO

**GENERAL MOTORS ENGINEERING STAFF**  
GENERAL MOTORS TECHNICAL CENTER  
WARREN, MICHIGAN 48090  
ATTENTION: ACCOUNTING DEPT.

PURCHASING AGENT  
BUYER I. R. Hansen

**PLEASE RETURN THE ATTACHED ACKNOWLEDGMENT COPY PROMPTLY**



GL-RB  
#24860

**General Motors Engineering Staff**

General Motors Technical Center  
Warren, Michigan 48090

ORDER No. **ES-37741**

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all invoices, packing slips,  
and Bills of Lading.

**INVOICES TO BE  
RENDERED IN DUPLICATE**

DATE **4-16-68**

**PURCHASE ORDER**

TO **ELECTRIC FUEL PROPULSION INC.  
366 W. 8 MILE  
FERNDALE, MICHIGAN 48220**

QUANTITY	DESCRIPTION	PRICE
4	GOODYEAR RADIAL PLY TUBELESS TIRES #165 SR 15 G-800	\$ 26.00/EA. NET
6	6 VOLT 290 A-HR BATTERIES USED IN 1968 MARS II CAR ES-63000 PART NO. 5SH-25 (WET CHARGED)	36.00/EA. NET

CONFIRMING - DON SWANSON

TERMS <b>1% 10 DAYS</b>	F.O.B. <b>S.P.</b>	DELIVERY REQUIRED <b>ASAP</b>	SHIP VIA <b>TRUCK</b>
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NOTE SHIPPING ADDRESS		MICHIGAN STATE SALES TAX STATEMENT—LICENSE 00-00205
SHIP TO <b>GENERAL MOTORS ENGINEERING STAFF TECHNICAL CENTER 12 Mile and Mound Rd. Warren, Michigan 48090</b> Max. Clearance Rec. Door 12' 6"	<input type="checkbox"/> GM PARTS FABRICATION <b>GENERAL MOTORS ENGINEERING STAFF 6400 East 12 Mile Rd. Warren, Michigan 48090</b>	1 <input type="checkbox"/> SUBJECT TO SALES TAX 2 <input checked="" type="checkbox"/> TAX EXEMPT—INDUSTRIAL PROCESSING 3 <input type="checkbox"/> TAX EXEMPT—STORES ACCOUNT 4 <input type="checkbox"/> APPLICABLE TAX WILL BE PAID BY PURCHASER 5 <input type="checkbox"/> EXEMPT—RESALE

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General Motors Engineering Staff  
General Motors Technical Center

*J.P. Hansen*  
PURCHASING AGENT

ISSUE  
INVOICE  
TO

**GENERAL MOTORS  
ENGINEERING STAFF  
GENERAL MOTORS TECHNICAL CENTER  
WARREN, MICHIGAN 48090  
ATTENTION: ACCOUNTING DEPT.**

BUYER **R. BROADBRIDGE**

**PLEASE RETURN THE ATTACHED ACKNOWLEDGMENT COPY PROMPTLY**