

GEMINI

ONE TON

OFF-HIGHWAY VEHICLE

(GROUND EFFECT MACHINE IN NORTHERN INDUSTRY)





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GEMINI ★ ★

AVRO
★ ★ **GEMINI** ★ ★

ONE TON OFF-HIGHWAY VEHICLE

SEPTEMBER 1961

AVRO AIRCRAFT
A DIVISION OF A. V. ROE CANADA LIMITED
MALTON, ONTARIO, CANADA



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INTRODUCTION

Muskeg is a spongy, matty bog stretching in a belt from Newfoundland to Alaska and covering about one-seventh of the whole of Canada's land area. This half million square miles of muskeg, a legacy of the retreating ice of the Pleistocene Age, is one major problem area frustrating the development of Canada's Northland. Passable with vehicles during freeze up for about half the year, muskeg is reduced to a squelchy morass after thawing out in which wheeled vehicles quickly bog down. Some success has been obtained with tracked vehicles operating in muskeg as a result of the lower ground bearing pressure these vehicles exert. However, track wear and maintenance, higher initial cost and low speed of operation continue to plague tracked vehicles.

Avro Aircraft of Malton, Ontario, a Division of A. V. Roe Canada Limited, is proposing its GEMINI off-highway vehicle as one solution to the problem of transportation over muskeg.

The Avro GEMINI is an articulated twin vehicle embodying GEM (Ground Effect Machine) principles developed from the Company's VTOL (Vertical Take-off and Landing) research program. The GEMINI is propelled by four driven wheels in contact with the ground which are relieved of the normal

vehicle weight by the use of a ground cushion. The wheels of the vehicle are loaded only sufficiently to provide traction for propelling the vehicle. The amount of traction required with the ground cushion activated is greatly reduced since the vehicle is supported on a cushion (or bubble) of air giving a very low frictional resistance to motion. GEMINI is one of a family of GEM vehicles—larger versions using the same principle are possible.

GEMINI grosses 8,000 lb. with a payload of 1 ton. Cruising speed off-highway is 35 m.p.h. Overall dimensions are 26.5 feet long, 10 feet wide and 7 feet high.

The front unit of the twin vehicle contains the 250 h.p. gas turbine engine driving a fan mounted in the top of the vehicle. The fan supplies air which is ducted to slots around the base of each unit of the vehicle. The air curtain created, supplies and contains the air cushion beneath the vehicle. This cushion distributes the weight of GEMINI so effectively over muskeg that a footprint pressure only one quarter that of a human being is produced—with consequently a minimum of terrain sinkage.

Forward propulsion, stability and control are obtained from the four wheels in contact with the ground. Each



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wheel is powered by a separate hydraulic motor located in the wheel hub. The hydraulic motors are supplied from a central hydraulic pump driven by the gas turbine engine.

GEMINI is power steered through the articulated joint between the front and rear units of the vehicle. Similarly, the back of the vehicle can be broken hydraulically to permit the vehicle to follow abrupt changes in terrain contour.

Each of the four wheels can be raised or lowered independently to maintain the vehicle on an even keel on side slopes and to increase traction in deep muskeg.

GEMINI is amphibious enabling streams, rivers and small lakes to be crossed without delays.

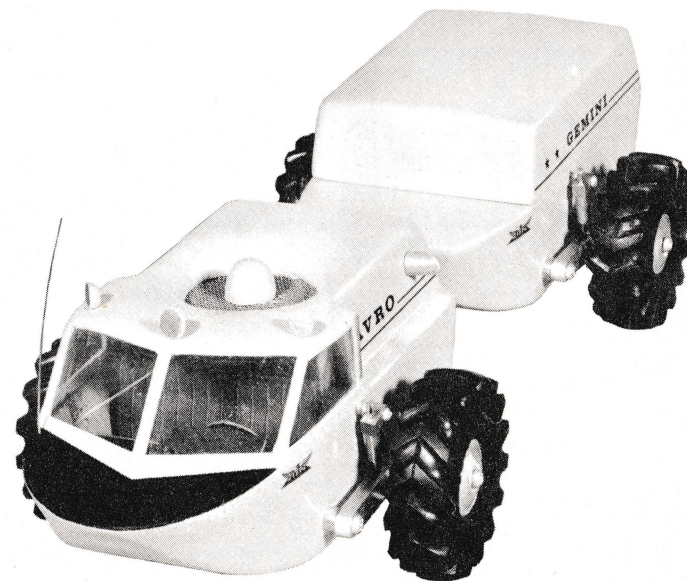
GEMINI differs from other GEM vehicles in using wheels for propulsion, stability and control instead of deflected air. The latter system is more costly in power and poses tricky stability and control problems in cross winds and along slopes.

Extensive use of lightweight aluminum alloys in the construction of GEMINI allows the maximum ground cushion depth to be developed for the minimum power.

GEMINI generates its own electric and hydraulic power for vehicle services and provides a heated and air conditioned environment for the crew.

Over highways and other firm terrain, GEMINI operates in a conventional manner using the four driven wheels only, with the ground cushion unit "off".

GEMINI is aimed at breaking the muskeg barrier which separates the developed southern fringes of Canada from the vast mineral wealth of the far Northland. In this role, GEMINI will combine ground transportation for exploration and survey crews with the utility of a one ton truck.





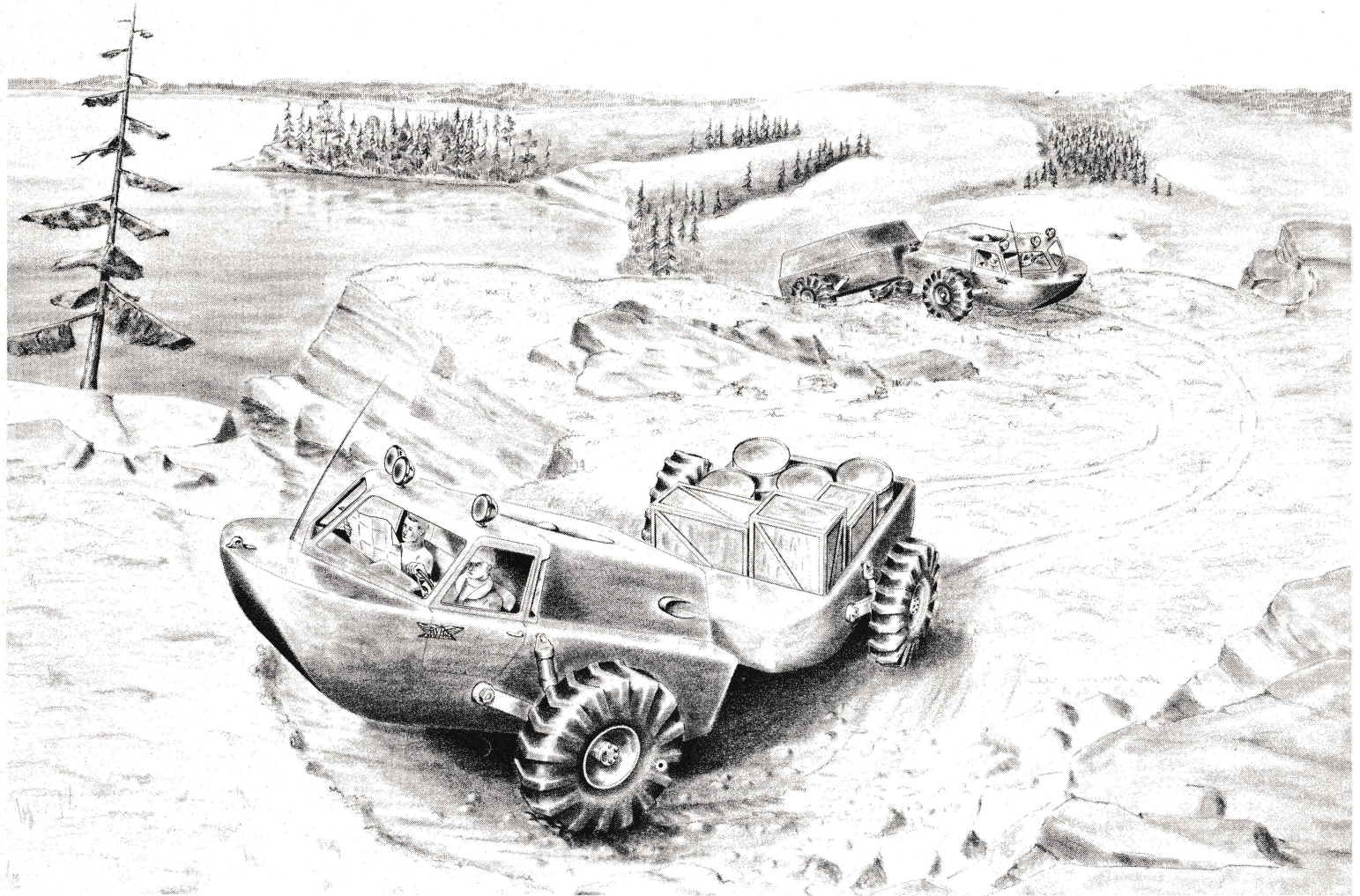
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DATA

DIMENSIONS:	LENGTH, OVERALL	26.5 FEET
	WIDTH, OVERALL	10 FEET
	HEIGHT	7 FEET
	GROUND CLEARANCE, MAX.	2 FEET
	APPROACH AND DEPARTURE ANGLE	45 DEGREES
	PAYLOAD VOLUME	6 CUBIC YARDS
WEIGHTS:	GROSS VEHICLE WEIGHT	4 TONS
	EMPTY WEIGHT	2.25 TONS
	PAYLOAD	1 TON
SPEED:	CRUISING, OFF-HIGHWAY TO	35 M.P.H.
POWER:	ONE 250 H.P. GAS TURBINE ENGINE SHAFT DRIVING AIR CUSHION FAN IN FRONT UNIT. THIS GAS TURBINE ALSO DRIVES HYDRAULIC PUMP WHICH POWERS THE HYDRAULIC MOTORS LOCATED IN EACH WHEEL HUB.	
STEERING:	HYDRAULIC JACKS STEERING THROUGH THE ARTICULATED JOINT BETWEEN FRONT AND REAR UNITS OF THE VEHICLE.	
SUSPENSION:	HYDRAULIC SHOCK STRUTS SUPPORTING SWINGING ARM STUB AXLES AT EACH WHEEL, EACH OF THE FOUR WHEELS CAN BE INDEPENDENTLY RAISED AND LOWERED HYDRAULICALLY.	

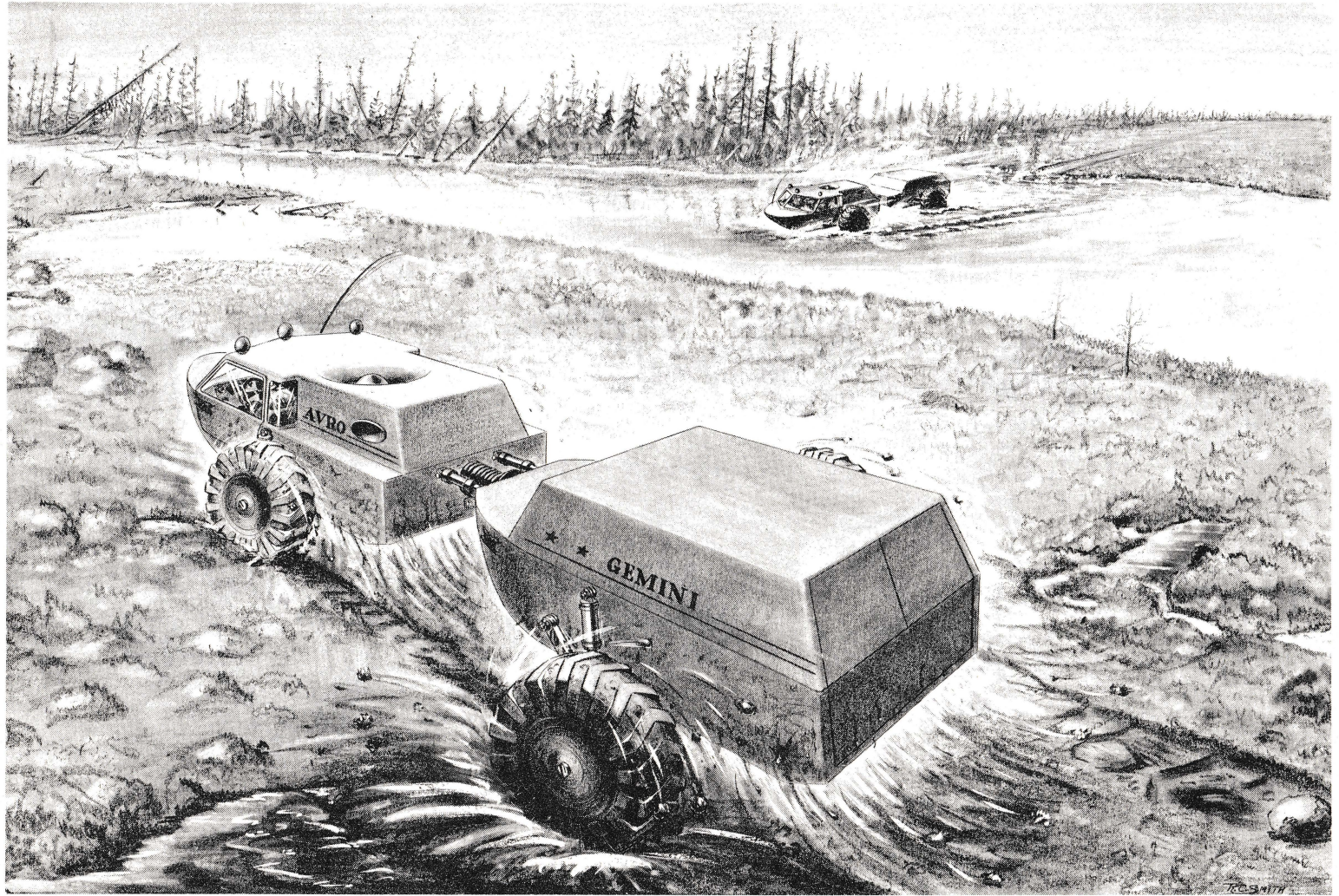


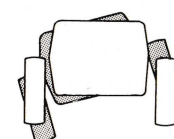
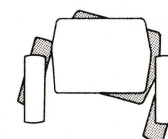
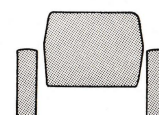
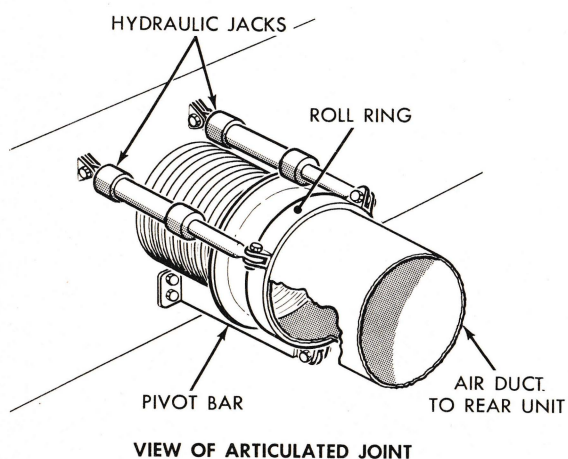
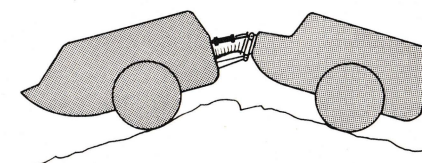
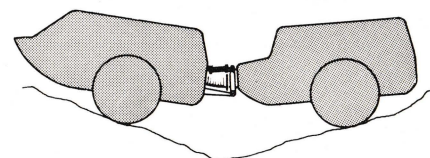
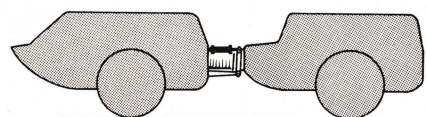
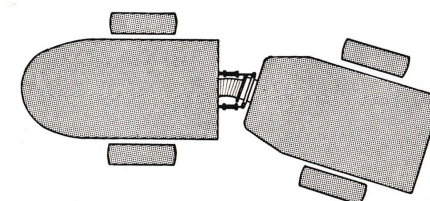
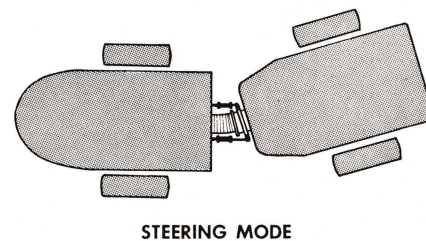
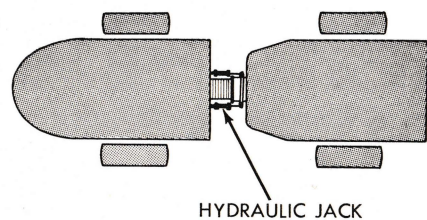
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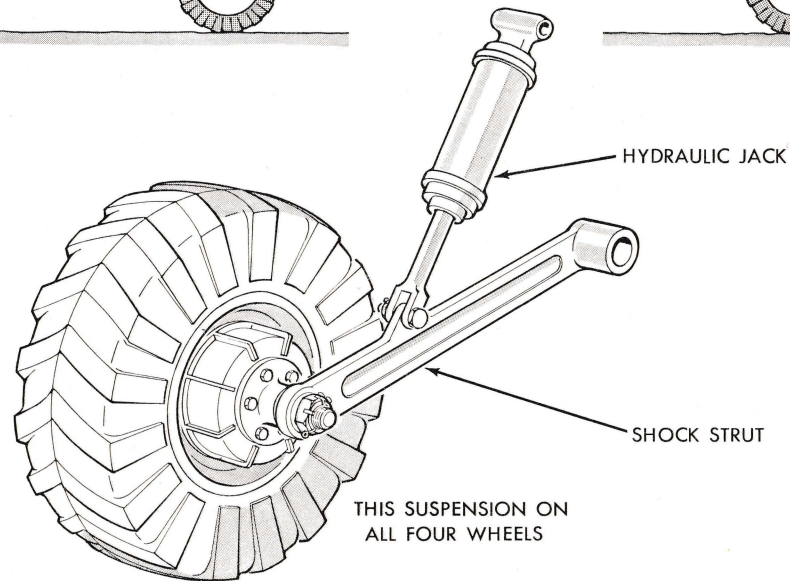
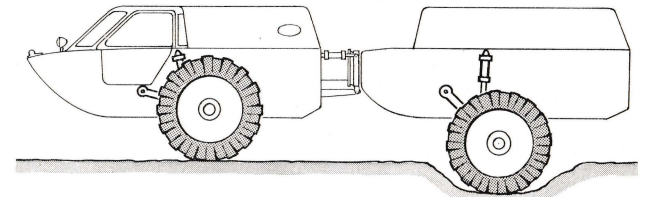
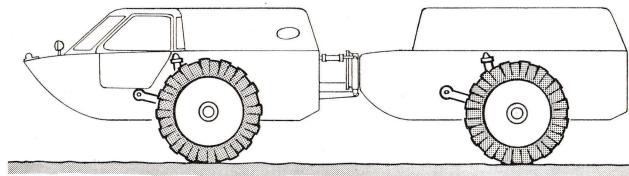
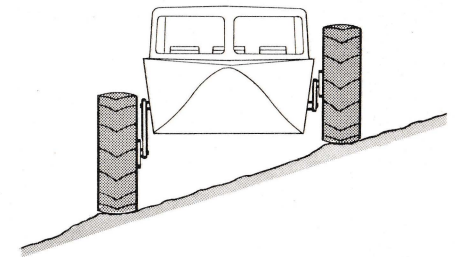
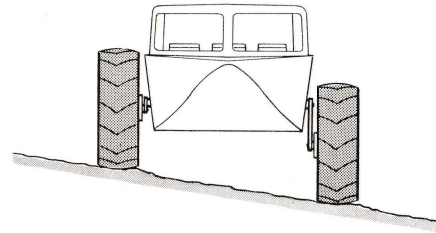
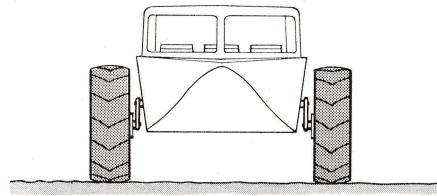


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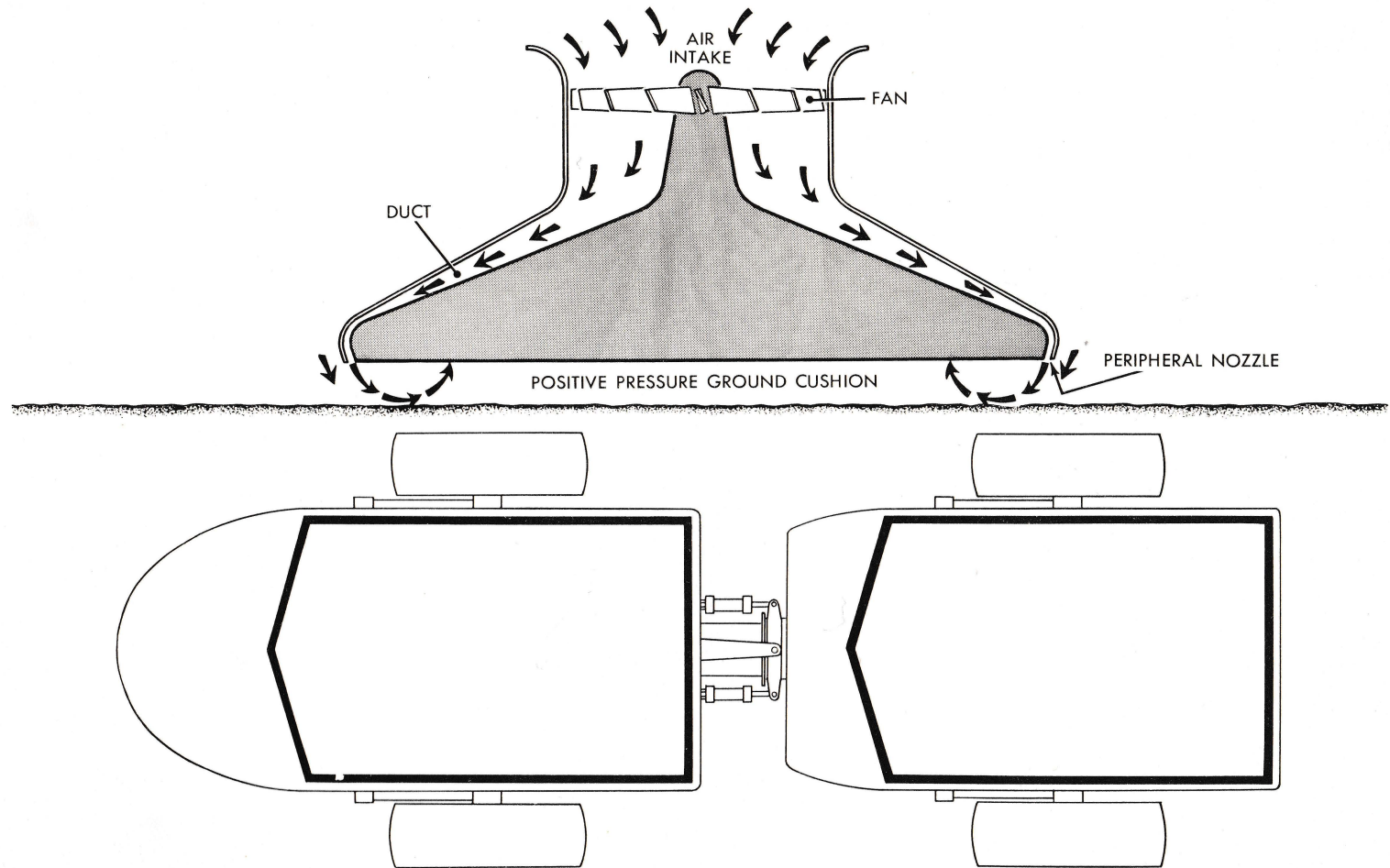




ARTICULATED JOINT



WHEEL SUSPENSION



BOTTOM PLAN SHOWING ARRANGEMENT OF PERIPHERAL NOZZLES

GROUND CUSHION PRINCIPLE