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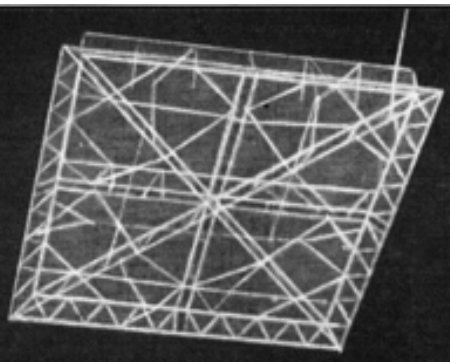


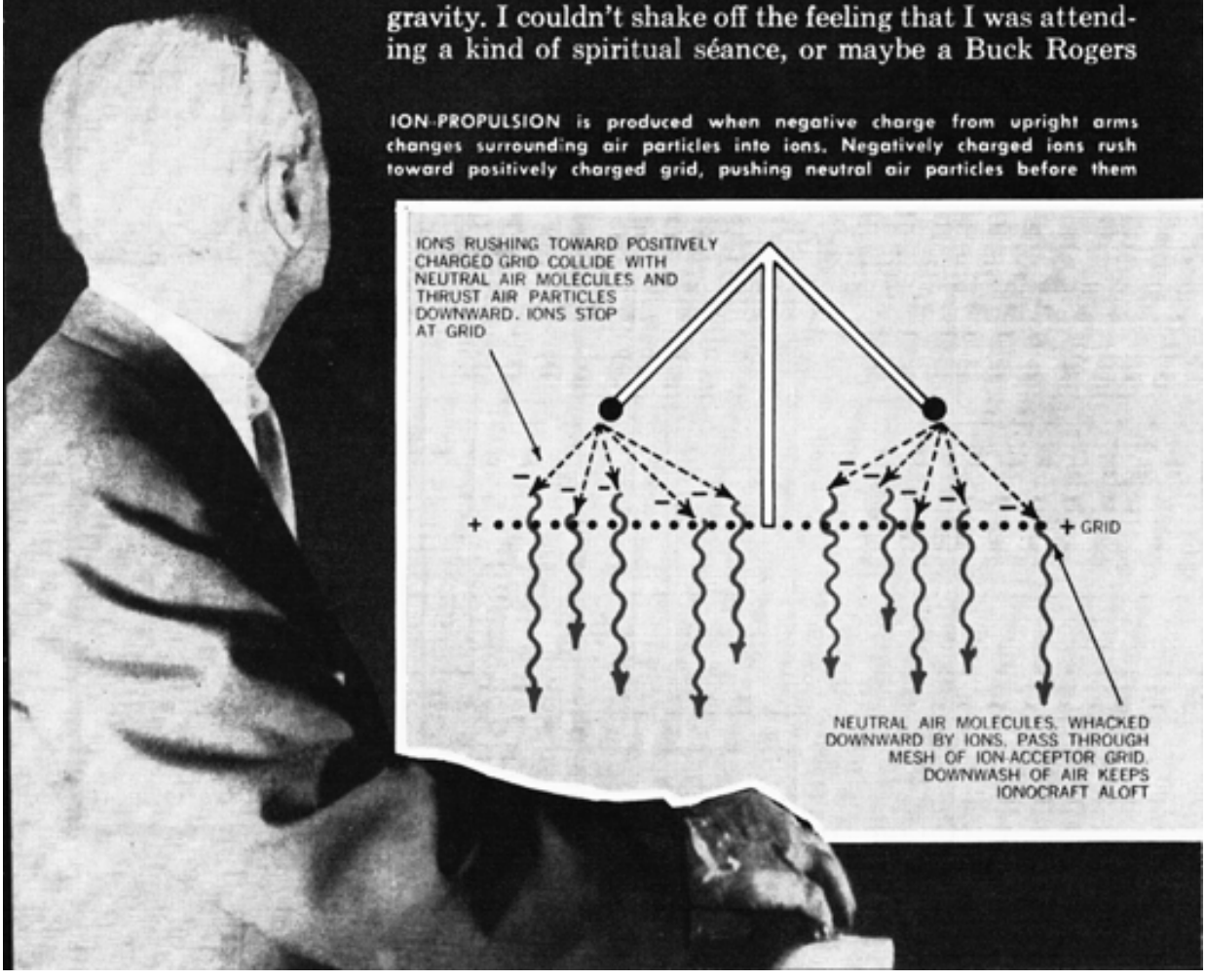
Major de Seversky's Ion-Propelled Aircraft

An ion-generated wind will lift and propel this incredible magic carpet of the future

By Hans Fantel

IT WAS DOWNRIGHT SPOOKY. Without a sound, the peculiar, spiky contraption rose straight up, hovered awhile, climbed higher. Then it did a few graceful turns, stopped again, and just sat there silently in midair.

It seemed like levitation – some trick to overcome gravity. I couldn't shake off the feeling that I was attending a kind of spiritual séance, or maybe a Buck Rogers



ION-PROPULSION is produced when negative charge from upright arms changes surrounding air particles into ions. Negatively charged ions rush toward positively charged grid, pushing neutral air particles before them

show, instead of an engineering demonstration.

The eerie scene took place in the big, barnlike laboratory of Electronatom, Inc., a research firm in Long Island City, New York, devoted to the development of a new kind of flying machine. I had been invited to watch a scale model being put through its paces by remote control. What we saw was by far the oddest aircraft since the Wright Brothers' motorized kite. It had no prop. No jet. No wings. In fact, it had no moving parts at all. Looking somewhat like an old-fashioned bedspring, the rectangular rig is the nearest thing to a magic carpet. It needs no runway, takes off vertically, and is expected to climb as high as 60 miles. It can crawl through the air like a snail, or go faster than a jet. Nobody yet knows its speed limit.

After a while, I closed my mouth. But David Yorysh, one of the project engineers, noticed my puzzlement.

"Any questions?" he grinned.

"Yes. What holds it up?"

"Ions," said Yorysh, as he launched into an explanation of a wholly new flight concept.

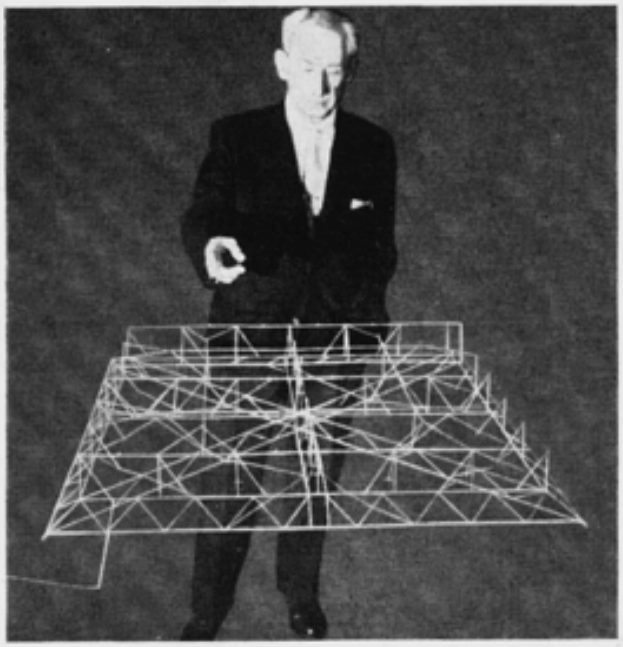
The magic carpet, called the Ionocraft, flies on pure electricity. It depends specifically on the fundamental principle of electricity that electric current always flows from negative to positive, and it uses two basic pieces of equipment to take advantage of this principle – tall metal spikes that are installed above an open wire-mesh grid. High negative voltage is shot from the spikes toward the positively charged wire grid, just like the negative and positive poles on an ordinary battery. As the negative charge leaves the spike arms, it peppers the surrounding air like buckshot, putting a negative charge on some of the air particles. Such negatively charged air particles are called ions, and these are attracted downward by the positively charged grid.

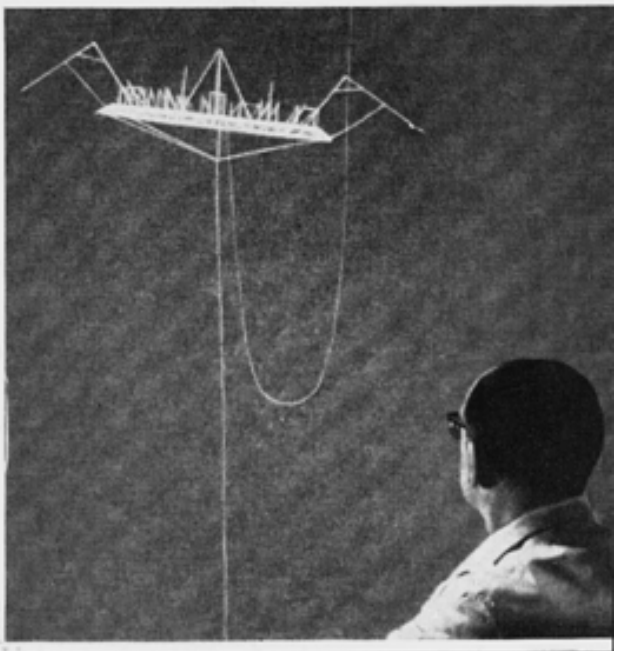
"Okay," I said. "But I still don't see what holds it up."

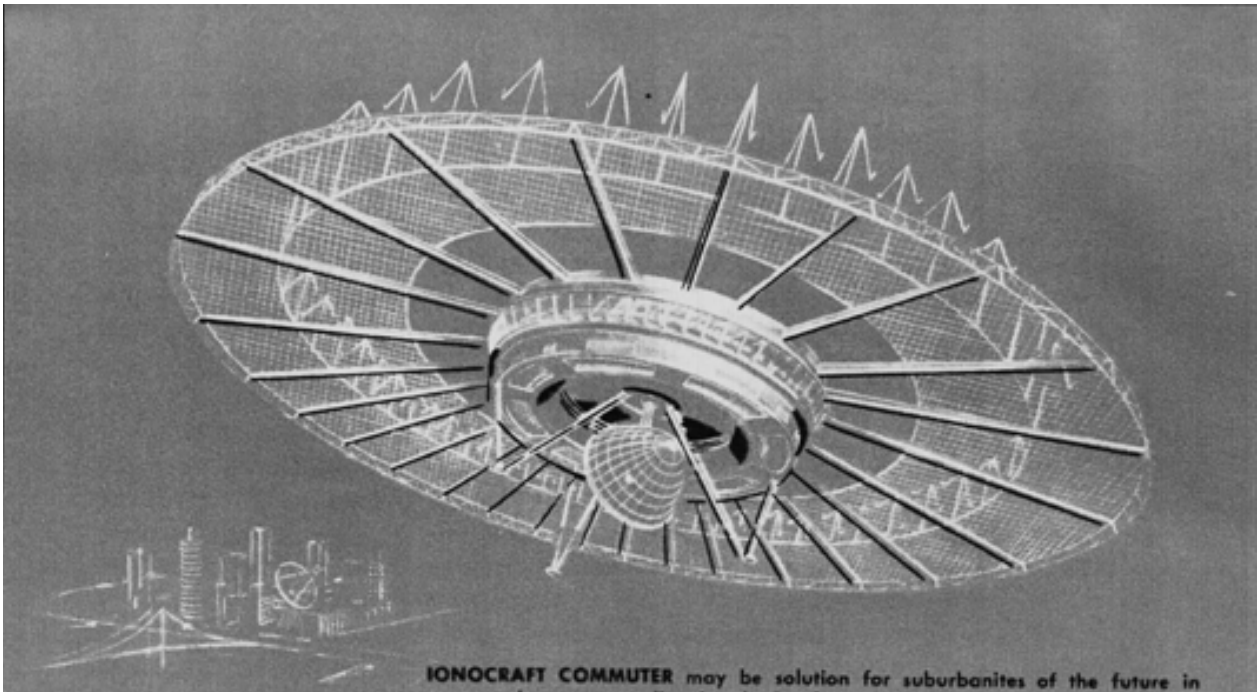
"I'm getting to that," Yorysh assured me as he spelled out the rest of the Ionocraft principle. In their mad rush from the ion emitter to the main

MAJOR DE SEVERSKY became interested in ion propulsion when he noticed air flow between two electrodes while working on another of his inventions

IONOCRAFT MODEL takes to air, completely unsupported except for downwash of air. Next step is to develop model that can carry its own power supply







IONOCRAFT COMMUTER may be solution for suburbanites of the future in congested areas, speeding hundreds of them short distances over heavy city traffic. Power would be supplied by chain of ground-based maser stations

grid, the ions bump into neutral air molecules—air particles without electric charge. The terrific wallop in these collisions hurls a mass of neutral air downward along with the ions. When they reach the main grid, the ions, being negative, are trapped by the positive charge on the grid. But the grid has no attraction for the neutral air particles that got bumped along. So the air flows right through the open grid mesh, making a downdraft beneath the ionocraft. The contraption rides on this shaft of air, getting its lift just like a helicopter—by sucking air down from the top.

"Aerodynamically, it works just like a chopper," Yorysh summed it up. "But instead of using a rotor and blades, we create the downward airflow electrically by means of an ionic discharge. The ions act on the air like a man treading water. They just push down."

The engineers working on the Ionocraft are the first to admit that their present rig is still a long way from any kind of practical aircraft. The model we saw measures only 1296 square inches and consists of about $5 worth of balsa wood and aluminum wire. But the principle holds an important promise for the future of aviation.

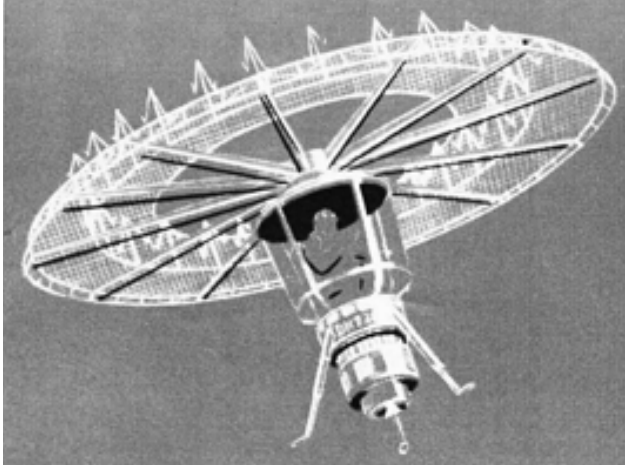
The problem now is improving efficiency —getting enough lift from a given grid area and a given amount of energy. Present models cannot yet lift their own electric generators. They get power through a feeder cable, dangling down like an umbilical cord. Ionocraft engineers tend to be close-mouthed on performance figures. But they will tell you that at present it takes 90 watts (30,000 volts at 3 milliamperes) to fly a two-ounce model. Translated into ordinary power-to-weight ratios, this works out to roughly .96 hp. per pound, as compared with a typical .1 hp. per pound of helicopter or .065 hp. for a pound of Piper Cub.

But Ionocraft designers are hard at work upping efficiency. One possible power-boosting technique is to pulse the power in short high-energy bursts rather than to apply steady voltage. They are also trying out various grid patterns and ion-emitter layouts to minimize energy loss through turbulence in the downdraft.

Despite such unresolved problems, the development crew almost bristles with optimism, and the most optimistic of all is the Ionocraft's inventor, Major Alexander P. de Seversky. No crackpot, Major de Seversky is a practical visionary who in many areas has been far in front of his field.

"We hope to fly a model with self-contained power, perhaps by the end of the year," he told me, confidently. "Ultimately, the ionic drive will prove more efficient than either propeller or jet as a method of aircraft propulsion.

"It will achieve lift at less expenditure of energy and fuel than any other existing



ONE-MAN IONOCRAFT could be tomorrow's traffic patrol car or, in combat, hovering vehicle for guerrilla wars, all but impervious to some minor grid damage

"The idea hit me as I was working on an electrostatic air-cleaning device which I had invented," the major recalled. "That gadget was designed to fight air pollution by electrically charging the particles in industrial smoke and then trapping them on a liquid electrode with the opposite charge." De Seversky noticed an air flow developing between the two electrodes, caused by the ionization process previously explained. "To an old flyer like me," said the major, "anything that stirs up a wind is a flying machine. So I began to develop the idea."

The major seemed concerned that the Ionocraft might be mistaken for a kind of space vehicle.

"This is not a spacecraft," he explained emphatically to forestall any possible misunderstanding. "It's an airplane, designed to operate within the atmosphere. But it

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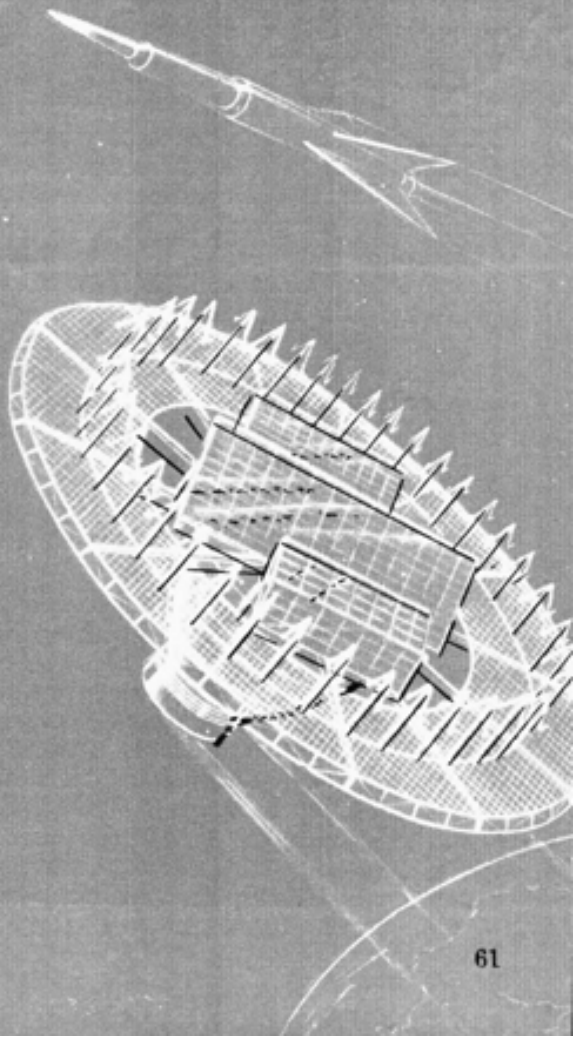
form of aircraft. In fact, it will prove the most efficient method of converting electricity into motion."

Coming from a man of de Seversky's background, such a statement has an almost prophetic ring. A leading aircraft designer and ace flyer for the past 50 years, de Seversky's ideas have often been ahead of their time—sometimes to the embarrassment of other aviation experts. Losing his right leg during his first flying mission in World War I didn't deter him from downing 13 enemy aircraft in later flights. After coming to the United States from his native Russia, de Seversky developed bombsights and course computers during the 1920s that were the forerunners of today's inertial guidance systems.

Worked with Billy Mitchell

Later he pioneered the design of the cantilever-skin stressed wing that is now in general use. He was a consultant to General Billy Mitchell in the historic airplane-versus-battleship tactical experiments of the 1920s, and as a special consultant to the U.S. Chiefs of Staff helped formulate basic concepts of air strategy in World War II. He also contributed to the designs of the P-35 and P-43 which led to the development of the P-47 Thunderbolt, one of America's most effective wartime fighter planes. Now a trim and sprightly man of 70, he still likes to take out experimental jet planes for a spin.

ANTI-MISSILE IONOCRAFT, powered by sunlight, could hover indefinitely in upper atmosphere, then home in on incoming warhead and blast it out of sky



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will be able to do things that no present type of aircraft can accomplish."

Pointing out the potential advantage of Ionocraft over conventional planes or helicopters, de Seversky ticked off a whole string of radical notions:

High-altitude flight. Helicopters whirl their blades in utter frustration at altitudes where the air gets thin. Beyond 20,000 feet, they get almost no lift. By contrast, experts calculate that the Ionocraft can kick up (or rather, kick down) enough air to stay aloft at 300,000 feet.

Unlimited size. The bigger it gets, the better it flies. Efficiency increases with grid area. Disturbing airflow around the grid edge becomes proportionately less important in larger craft. The reason: Grid area increases faster than circumference with growing size. "We'll be able to build them as big as a city block," claimed de Seversky.

High speed. No practical speed limit has yet been determined. The ions themselves flashing from emitter to grid impart to the air very high-velocity impulse. Aerodynamic grid drag would be the chief speed-limiting factor. But streamlining of the grid edge and careful contouring of the craft, could minimize air drag.

Safety. No moving parts in propulsion and no wear, mean less chance of failure, simpler maintenance.

Steering with Voltage

Steering control is accomplished by applying different voltages to various parts of the craft. The part with the high voltage gets more lift, hence tilts up. The form of the Ionocraft doesn't matter. Any shape will fly, but de Seversky assumes that round models in the form of a flying saucer will be the most easily maneuverable.

By a simple joystick control, the pilot can lift any edge of the craft, producing pitch and roll as if the Ionocraft had elevators and ailerons. He can put the craft into any flight attitude—nose up or down, or banking to either side. Like the tilt of a helicopter rotor, this inclination pushes the craft forward, rearward, or sideways.

J. F. Bruno, the technical director of de Seversky's staff, spoke of a passenger gondola in future models, suspended from gimbals below the main grid so that it remains level regardless of how the main deck is tilted. Location below the main grid also shields passengers from the high-energy flow. But, even if the passengers somehow got into the ion stream, it wouldn't electrocute them unless they were "grounded" to the main grid. "It would be just like birds sitting on a wire," said Yorysh, the man in charge of electronic design.

Until patents for the Ionocraft were firmly nailed, de Seversky kept his ideas carefully under wraps. That's another reason no full-scale prototype has yet been built. But even present scale models set the imagination buzzing. Manned craft are envisioned for:

Commuter transport. With no size limit, you can pack trainloads of people into this VTOL craft, relieve traffic congestion around urban centers. The same type of craft used as long-distance transport—possibly at supersonic speeds—would not need big airports with long runways.

Airborne traffic monitors. Hovering above bridges and major intersections, or patrolling above highways, one-man Ionocraft would provide a panoramic view of traffic conditions, radio information to ground traffic-control centers.

Grid Is Hard to Hit

Military reconnaissance and rescue. Without moving parts, the Ionocraft is less vulnerable to small-arms fire than helicopters. The open grid makes a poor target. Most bullets would whizz right through it. Even if the grid is hit, the electric charge would be maintained despite damage to some portions. Unlike a copter with shattered blades, the Ionocraft would not crash.

Weather observation. While satellites like Tiros look down on the atmosphere from outer space, Ionocraft could sail right into the weather-making air layers, providing valuable supplemental information. Being steerable, Ionocraft would not drift with the wind like weather balloons, but could hold a position over crucial areas, making local forecasts more reliable.

Skyborne antenna. Kept aloft indefinitely in a fixed position by a ground-based energy supply, Ionocraft could also act as a skyborne antenna, extending the range of defense radar. "It would be like raising the DEW-line 60 miles up into the air," suggested de Seversky, "adding 15 to 25 minutes warning time against missiles."

Anti-missile machine. Always alert to military tactics, de Seversky believes that Ionocraft could be used as missile interceptors. Normally the craft would hover at high altitudes, scanning the horizon for a 700-mile range. As soon as it spotted and identified a hostile missile through an infrared detection system, the Ionocraft would hurl itself at the enemy rocket on a collision course and blow it out of the air.

When practical craft are built, their designers expect to have a choice of several power supply systems now under develop-

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ment for NASA's space program. Some of these include:

Gas-turbine generators. Several firms, notably General Electric and Allis-Chalmers, have come up with compact, lightweight, kerosene-fueled turbines, originally intended as power sources for spacecraft. These may be used to generate electricity aboard Ionocraft.

Fuel cells. These are chemical reactors producing electricity like a storage battery, but drawing their chemicals from external supply tanks. NASA is currently testing fuel cells converting hydrogen and oxygen to electricity, with drinking water as a byproduct.

Solar cells, directly converting sunlight to electricity—the present energy source of most satellites. When high-efficiency solar cells are available, they may keep Ionocraft aloft for indefinite periods.

Power from Boiling Mercury

Sunflower—a code name for another project aimed at deriving electric power directly from sunlight. It employs an umbrella-like reflector that focuses the sun's heat to boil mercury, which expands through a turbine and drives an electric generator. (Solar-power supplies would be back-stopped by other kinds of power generators to take over whenever no sunlight is available.)

Microwave radiation. Concentrated beams of high-frequency radio waves may transfer energy from ground stations to the Ionocraft if the craft is to be used as a hovering platform in fixed position. Raytheon has pioneered this type of energy transmission through its Amplitron tube and has recaptured as much as 72 percent of the radiated energy at the receiver site. High-power laser beams may be similarly used for transmission.

Experimental hardware has already been produced for each of these off-beat power-supply systems.

None of the men working on the Ionocraft will be pinned down to any production timetable. "It's a pretty wild project," admitted technical director Bruno, a veteran of 20 years in the missile business. "But that's what they said when we started working on rockets."

Major de Seversky, whose own career goes back to the beginnings of aviation, views his invention in historical perspective: "We are exploring an entirely new principle of flight. We're just at the spot where the Wright Brothers were in 1903. We are just beginning to see the possibilities." ★★★