

Westinghouse/Airship Industries Joint Venture Targets Navy Program

By Kenneth J. Stein

Elizabeth City, N.C.—Formation of a new joint venture company, approved in June by the boards of Westinghouse Electric Corp. and Airship Industries, Ltd., London, is intensifying efforts centered here to develop advanced lighter-than-air radar platforms, particularly a proposed airborne early warning surveillance airship design for a U.S. Navy program.

Board approvals were concurrent with an investment by Westinghouse of \$3 million in Airship Industries shares—about a 3% interest—and the evolution into a formal joint venture of a teaming arrangement that was established last year to compete for Navy airship concept formulation studies.

The new company, Airship U.S.A., Inc., will be headed by Westinghouse's J. W. Phipps as president. Headquarters are expected to be established in the Washington, D.C. area.

Westinghouse invested about \$5 million more in the British company's airship technology development, and now has a seat on the Airship Industries board. A win in the Navy competition would prompt further investments over a three-

year period, according to Phipps. Focal point of Westinghouse-Airship operations is a huge hangar at the former Weeksville Naval Air Station, located about 3 mi. southeast of Elizabeth City Coast Guard Air Station/Municipal Airport.

Aerostat Test Facility

The hangar, which measures 984 ft. long and 295 ft. wide, with a maximum height of 246 ft., is occupied by TCOM Corp., a wholly owned subsidiary of Westinghouse, which uses it and a huge adjacent ramp area to design, fabricate, install and test low-altitude surveillance system (LASS), small tethered aerostat relocatable systems (STARS) and other aerostats for military surveillance radar and communications applications. If Westinghouse is successful in bidding on the Navy program, its airship will be designed by Airship Industries and built at Weeksville.

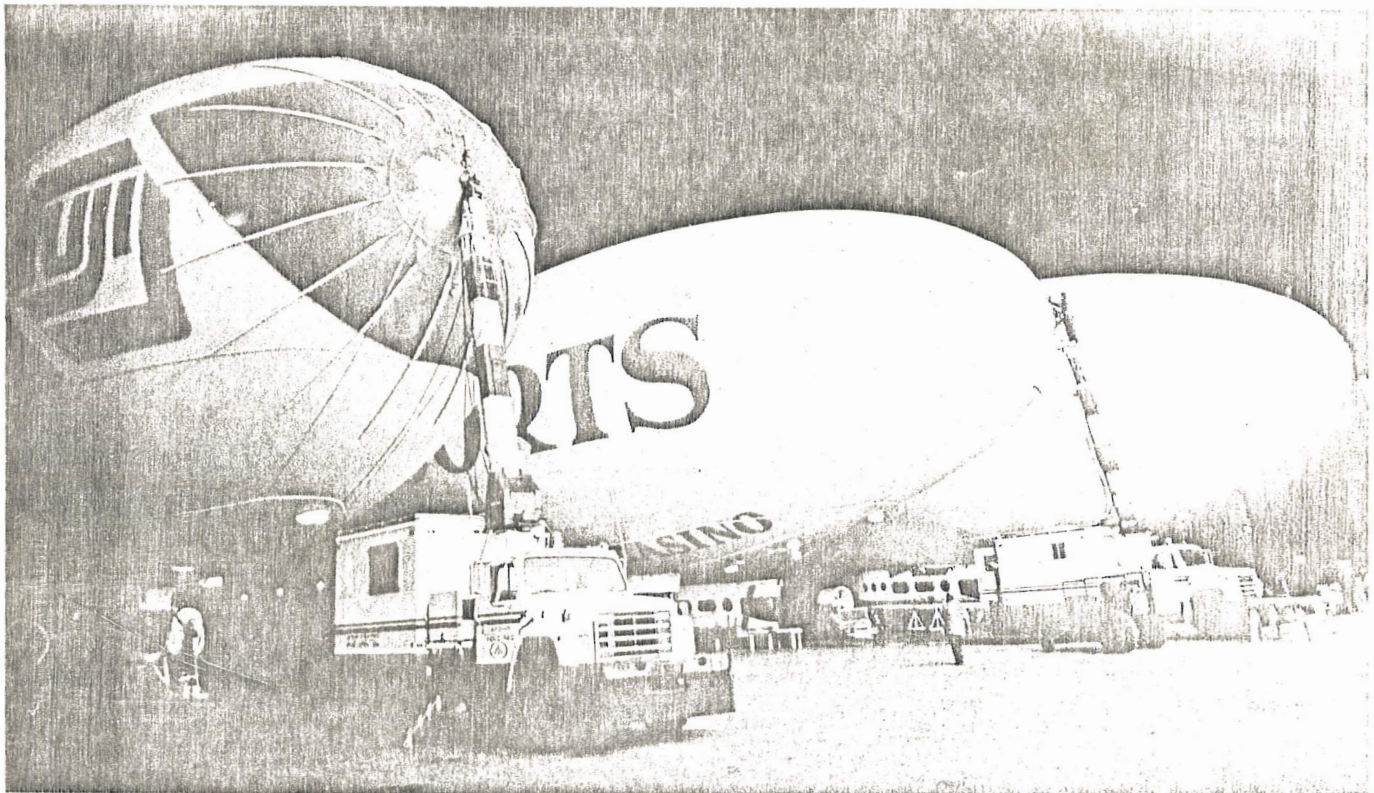
TCOM recently shipped to Saudi Arabia, under a \$12.6-million demonstration contract, a helium-filled 67-meter (220-ft.) long, aerodynamically shaped aerostat, or tethered balloon. The 11,500-cu.-meter (405,065-cu.-ft.) aerostat carries a modified AN/TPS-63 L-band coherent radar to an operating altitude of about 10,000 ft.

(AW&ST Mar. 10, p. 239). A portion of the TCOM hangar is being used by the present U.S. subsidiary of Airship Industries for completion and hanging of Airship Industries' commercial airships, which use the Weeksville facility as an operations base.

Four airships are now in operation at the base in a fleet comprising two 52-meter (171-ft.) long Skyship 500s, each with a gross volume of 5,153 cu. meters (181,952 cu. ft.); and two Skyship 600s, a stretched version 59 meters (194 ft.) long, with a gross volume of 6,666 cu. meters (235,376 cu. ft.). Two Skyship 500s and one 600 are flown for extensive aerial advertising of commercial enterprises.

Newest addition to this fleet, the second Skyship 600, will be the first airship to be fitted with a fly-by-light control system developed for the airships by GEC Avionics, Rochester, England (AW&ST Sept. 6, 1982, p. 112).

The system, which incorporates autostabilization and autopilot capabilities, employs fiber optics cabling to link the gondola to lightweight electric control actuators, according to Roger Munk, Airship Industries technical director. Electric power for the actuators is derived from



Former Navy airship hangar at Weeksville, near Elizabeth City, N.C., is occupied jointly by TCOM Corp., a wholly owned subsidiary of Westinghouse Electric; Airship Industries, and Westinghouse. Airships seen above left include a Skyship 500 advertising Fuji film,

Resorts International's Skyship 600 and a new Skyship 600 that may introduce Airship U.S.A., Inc., markings of the new Westinghouse/Airship joint venture. TCOM aerostats are assembled farther back in the hangar. Westinghouse/TCOM low-altitude surveillance system

existing lighting system cabling. Prior to installation of the new control system at Weeksville, this Skyship 600 is being used to evaluate another potential military application, use of an airship as a possible "dark horse" candidate for the resupply/maintenance mission for the 13 AN/FPS-117 long-range and 39 new short-range radar stations of the joint U. S./Canadian North Warning System (AW&ST Dec. 9, 1985, p. 56).

Flight demonstrations with the Skyship 600, expected to total about 160 hr., began in mid-June, under a special arrangement between USAF's Electronic Systems Div., Hanscom AFB, Mass., and Naval Air Development Center, Warminster, Pa., according to R. Byron Smith, deputy program manager for logistics in the North Warning System program office at ESD.

Flight tests are directed toward demonstrating airship controllability, docking and mooring capabilities in surface winds of 20-25 kt. and, particularly, payload transfer capabilities, Smith said. Some of the effort involving tethering, docking and mooring has been subcontracted to TCOM.

"An airship is a very attractive candi-

date from some points of view," Smith said. Expectations, however, are that a mix of aircraft types, possibly including an airship, will eventually be used for the North Warning logistics mission, in response to actual conditions at each of the 52 sites.

The Westinghouse-Airship Industries team was organized in 1985 to compete for concept formulation studies for Naval Air Development Center of the proposed large early warning surveillance airship that could accompany Naval task forces at sea, significantly extending their radar horizons.

Additional Studies

Competitive airship studies are being conducted by Boeing Military Airplane Co. and by Goodyear Aerospace teamed with Litton Industries and Sperry. Other contenders for the separate radar system development contract include Hughes Aircraft and RCA.

Airship Industries' airborne early warning design concept proposes a double deck gondola with a flight deck, AEW operations and communications facilities on the lower deck. The upper level will contain officers' and crew's quarters and galley/

mess facilities. Radar antennas will be housed within the airship envelope.

Airship Industries has completed feasibility studies on Sentinel, its military airship design of about 100,000-cu.-meter (3,531,000-cu.-ft.) volume, Munk said.

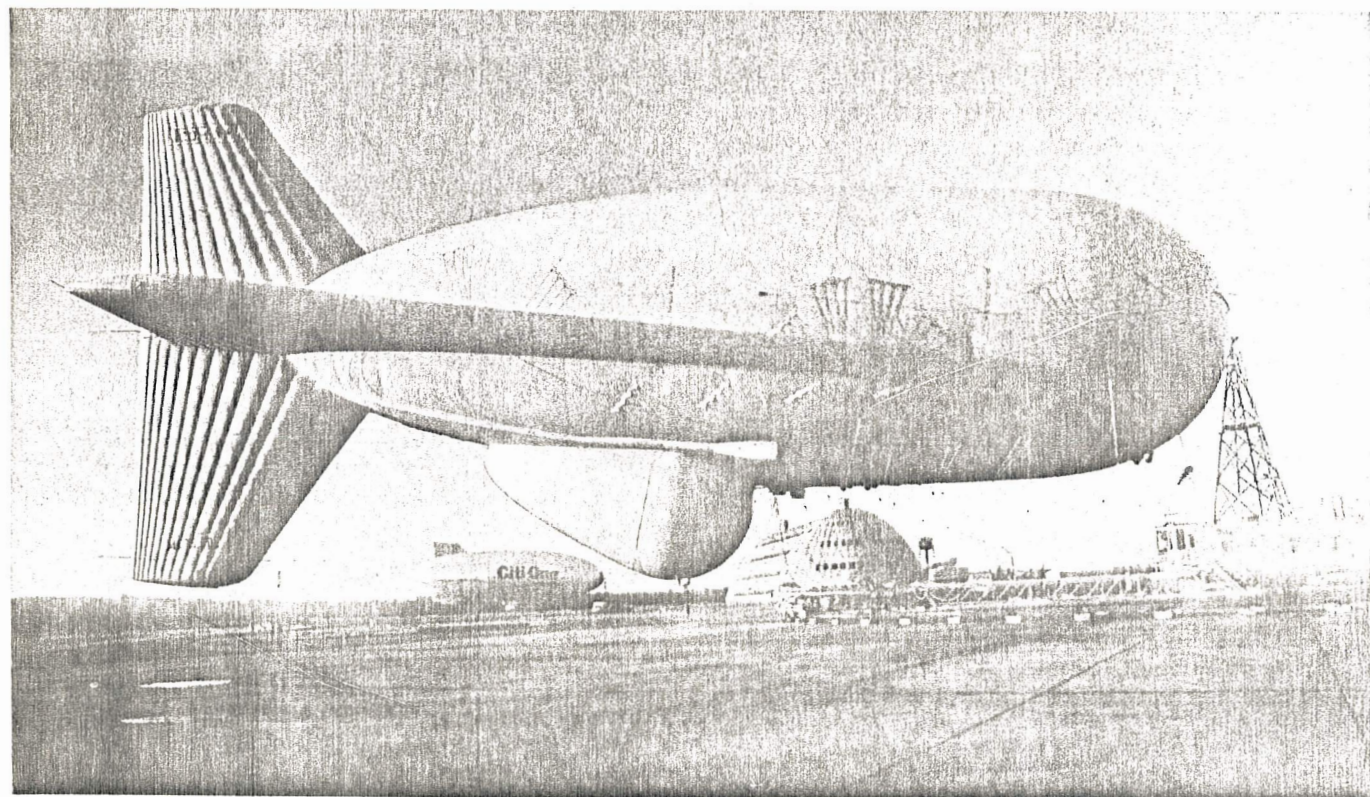
A full-scale Navy gondola is now being built at Weeksville.

"Airship Industries can build a non-rigid ship of 100,000 cu. meters displacement with no technological advances required," James W. Currie, Westinghouse's airship program manager and manager, Operations and Support Div. of TCOM, said. "However, you don't need 100,000 cu. meters. The naval job can be done with a displacement lower by a significant factor.

"AI is building modern airships with all the capabilities the Navy is seeking, differing only in size," he said.

A civil version of the large airship is also contemplated.

Skyship envelopes and gondolas are fabricated of modern materials such as Kevlar, Tedlar and Fibrelam, according to Capt. Peter Buckley, Airship Industries vice president-manager of flight operations and chief pilot. Power for the Skyship 500s and 600s is obtained from dual



(LASS) aerostat, which provides a tethered platform for a modified AN/TPS-63 L-band radar, is shown (above right) moored to its tower and 98-ft.-radius monorail, which allows the moored aerostat to weathercock freely. The 67-meter (220-ft.) long aerostat has a vol-

ume of 11,500 meters (406,000 cu. ft.), and normally operates at an altitude of about 10,000 ft., tethered by a Kevlar cable that carries electric power up and radar signals down to ground processing equipment. Note Skyship 500 in background.

Porsche 930-series engines driving variable pitch ducted propellers through modified Westland Lynx helicopter transmissions. The propeller ducts can be rotated through 200 deg., providing vectored thrust for takeoff and maneuvering.

For its proposed Navy design, Airship Industries expects to employ Italian-design lightweight aluminum diesel engines, made by CRM of Milan, for extended cruise, augmented for sprint speeds by gas turbines, probably from General Electric, Buckley said.

The CRM diesels have a weight to power ratio of 2 lb. per hp., and also provide water recovery capability for ballast, Munk said.

The Navy airship is intended to be capable of accompanying a task force at sea, providing radar coverage from its operating altitude of about 10,000 ft. that will extend considerably the radar horizon, complementing the role of Navy/Grumman E-2C Hawkeye aircraft. High-speed targets as small as cruise missiles will be readily detectable.

TCOM's LASS, tethered at about the same altitude, can detect fighter aircraft out to about 150 naut. mi. with its TPS-63 radar.

The Navy airship also would provide electronic warfare/electronic support measures capabilities and communications connectivity. Antisubmarine warfare is considered a secondary role.

One issue to be resolved involves the perception of the airship's role in the operational picture. The surface Navy regards the airship as an organic element in a surface task force—part of the fleet—and the air Navy recognizes it primarily as an aircraft.

Survivability of an airship platform is considered good, partly because its radar and infrared signatures can be minimized, and partly because even a square hit by a missile could pass right through the envelope with little loss of lift.

The radar, however, like any emitter, could be vulnerable to antiradiation weapons and would have to shut down in their presence to avoid presenting a target.

Study contractors were asked to look at production quantities of 20, 50 and 100 airships, with unit prices reportedly falling in the area of \$65 million.

Current industry studies were extended through September, 1986, but the Navy is reportedly truncating second phase work in an effort to get proof-of-concept contracts under way before the first quarter of Fiscal 1987.

Concept formulation studies were completed last December, followed by program extensions that provided for more detailed analysis.

All of the radar contractors have concluded that a large active phased-array system will be needed. Proof-of-concept programs, however, are expected to utilize

an "interim radar," such as the TPS-63 system used in TCOM's LASS aerostats or, possibly, a complete E-2C radar suite.

TCOM's aerostats make use of modern materials, including a composite of du Pont Tevlar, Mylar and Dacron for the balloon envelope and a tether cable made of Kevlar that permits the aerostat to operate at altitudes in excess of 10,000 ft.

The tether for a LASS system, which has a 60,000-lb. break strength, contains conductors that carry three-phase 3,500-v. power up to the radar on the aerostat, and also provides lightning protection.

Radar video signals are conducted down through the tether to processing equipment in a nearby shelter.

The mooring system permits operators to launch and retrieve the LASS aerostat, anchored forward to a small mooring tower above the machinery enclosure and aft to a 98-ft. radius I-beam monorail that surrounds the tower, allowing the aerostat to weathervane freely into the wind.

Aerostat sites in the U.S., including Cudjoe Key and Cape Canaveral, Fla., as well as the Weeksville test site, are designated as airspace Restricted Areas from the surface up to altitudes ranging from 10,000-15,000 ft.

The 3,000-lb. AN/TPS-63 coherent radar on board the LASS aerostat is a gap-filler system built for the U.S. Marine Corps and export applications, according to Thomas G. Ioerger, TCOM deputy programs manager, low altitude surveillance systems. Modifications include replacement of the original antenna with a 13 x 25-ft. parabolic reflector, mounted behind the radar avionics, and extension of the radar processing range.

The radar, with its antenna, is housed completely within a ventral bubble, which may be opened to provide full access to the system by technicians using a cherry picker on the mooring system and a work platform attached to the radar.

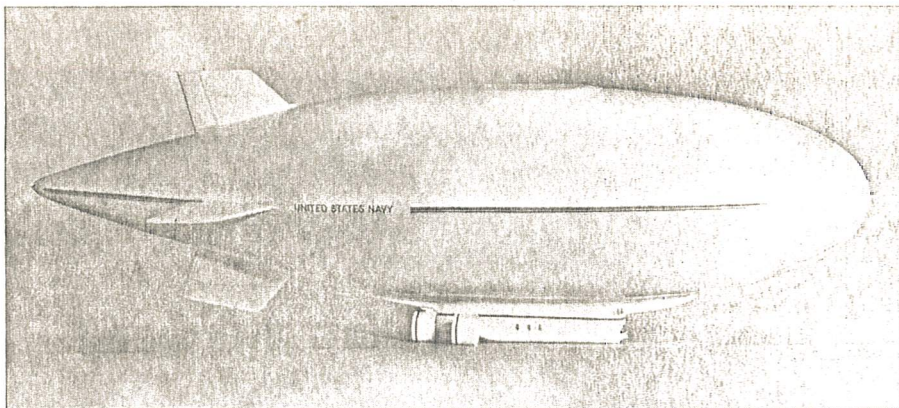
The L-band system is mounted on a stabilized gimbal and has its own north reference, he said.

The system provides 60 db. of clutter rejection, Ioerger said. A digital target extractor is located at the ground site. With installation of VHF/UHF voice transceivers on the aerostat, ground controlled intercept (GCI) relay capability can be added, he said. An identification friend or foe (IFF) system uses the same antenna.

An aerostat installed in the Bahamas is used by the U.S. Customs Service to provide coverage of the islands and the Florida keys.

LASS systems can remain aloft for 30 days at a time, limited by two primary considerations, avionics reliability and helium permeability of the aerostat, according to TCOM.

The uninterrupted service envelope varies from about four weeks for the larger aerostats such as LASS to about two



Model of proposed Airship U. S. A., Inc., candidate for Navy surveillance program shows a larger-scale Airship Industries design, powered by three ducted propellers and expected to use lightweight diesel engines during long-range cruise and gas turbines for sprint. Note two-level gondola, which accommodates operations, communications and flight deck (windscreen bulge, forward) on the lower level, with crew quarters planned for the upper level. Active phased-array radar antennas would be housed within the envelope.

weeks for the smaller 25-meter (82-ft.) long STARS types, with a typical volume of 700 cu. meters (24,717 cu. ft.).

Westinghouse TCOM has three principal customers for transportable tactical STARS systems—USAF, U.S. Coast Guard and the Army.

STARS aerostats operate at altitudes of about 2,500 ft., carrying different equipment for each of the services.

The Coast Guard employs a Litton APS-504 radar, while the Army version of STARS utilizes the Westinghouse APG-66 radar from the General Dynamics F-16 fighter, incorporating modifications including a larger, 3 x 10-ft. antenna.

The Air Force STARS is not a radar system, but an extremely low frequency communications link in a "reconstitutable broadcast system." □