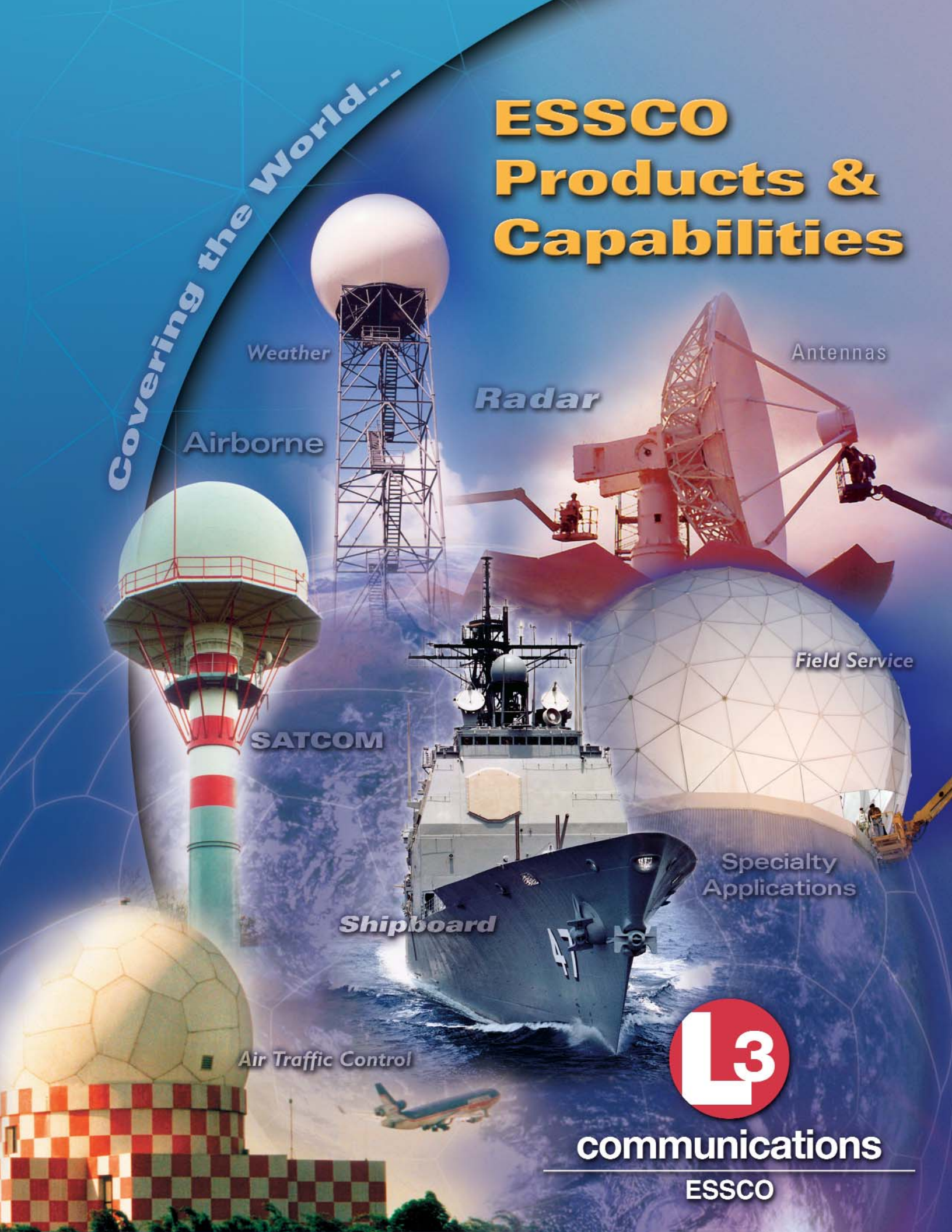
Covering the World...

ESSCO Products & Capabilities



L3 communications

ESSCO

Built to Protect. Designed to Endure.

Since 1961, L-3 Communications ESSCO has led the industry in the research and development of new radome technology. From pioneering research in the use of metal beams in radomes, to radome tuning technology, to the development of hydrophobic coatings, to the use of advanced composite materials — ESSCO has always been first to market new radome enhancements and continues to pursue advancements in electromagnetic and structural performance.

This constant pursuit of quality and excellence makes us the world's undeniable leader in ground-based radomes, large aperture millimeter wave antenna systems, and RF composite structures. When you need the latest safeguards for your antennas, count on ESSCO for total protection.

ESSCO...covering the world with:

- **Radomes**
  SPACE FRAME | SANDWICH | SPECIALTY APPLICATIONS
- **Low Radar Cross Section (LRCS) and Frequency Selective Surface (FSS) radomes**
- **Advanced composite radomes, reflectors, and structures**
- **Precision antenna systems**
- **Worldwide turnkey design & installation solutions**
- **Engineering and consulting services**

ESSCO — Committed to Quality

30-ft. (9.1m) sandwich radome – air traffic control

14-ft. (4.3m) composite radome – shipboard communications

93-ft. (28.3m) metal space radome undergoing water test – SATCOM application

62-ft. (18.9m) camouflaged sandwich radome – military radar

18-ft. (5.5m) solid laminate radome

Turnkey Solutions

In a time of ever tightening budgets, ESSCO understands the need to provide greater overall value to our customers. Over forty-five years of leadership and professionalism in the radome business provide the foundation for a tradition of innovation. ESSCO has applied that experience to develop a complete range of solutions to meet your program needs, including foundation design, towers, civil works, installation, and site project management. This culture has generated a unique team-driven process that helps our customers achieve overall lower program costs with greater end-user satisfaction.

Design

At ESSCO, our customers' performance requirements come first and our staff of design, electromagnetic, and manufacturing engineers work with our quality and field service technicians to ensure that product designs comply with customer specifications. This fully integrated design approach leads to the continuous improvement of existing products and to the development of new market offerings.

Quality

ESSCO was the first ground-based radome supplier in the world certified to ISO 9001 and meets the requirements of MIL-Q-9858A. As a worldwide supplier to the U.S. Government, NATO, and other worldwide government agencies, we recognize that quality and reliability are vitally important to the overall missions that these agencies are responsible for. We attained ISO certification at our Ireland facility in 1994 and in the USA in 1996, and we continue to improve our quality system and maintain our certification.

Value

Our philosophy regarding design, test, and manufacturing is to provide value to our customers by delivering the best-performing radomes and antenna systems in the world at a fair, competitive price. This culture requires quality in all aspects of our business, with processes being done right the first time and defects and waste eradicated from operations.

Our electromagnetic and structural engineers combine their talents and insights to optimize design and performance. Our material engineers consult with our process and manufacturing specialists and our field service professionals for inputs that produce refinements to all of our engineering designs and manufacturing processes.

On the test and evaluation front, ESSCO has developed highly accurate computer models that enable us to simulate specific antenna applications and accurately predict electromagnetic (EM) performance. Testing done on our focused beam range and our 2,000-foot (609.5m) EM test range, in addition to independent test evaluations, have validated our predictions on a scale model and operating systems basis.

The entire product improvement process results in ESSCO constantly seeking ways to provide greater value and more cost-effective solutions for our customers.

World's Leading Manufacturer and

35-ft. (10.7m) diameter oblate radome for digital air surveillance radar application

For over forty-five years, ESSCO has delivered and installed over 5,000 radomes in more than 80 countries. No other radome company can match our record of longevity, reliability, advanced product development, manufacturing support, quality, test & evaluation, and in-depth field service capabilities.

Radome Benefits

- ***Protection against the elements*** — ESSCO radomes protect radars and other antenna systems from wind, rain, snow, ice, blowing sand, salt, solar radiation, and freezing temperatures. ESSCO radomes not only protect the antenna against the elements, they are also "RF transparent," resulting in predictable, repeatable, and reliable antenna performance. In fact, extensive test measurements performed by the U.S. Federal Aviation Administration (FAA) show that radar performance had no degradation with an ESSCO radome.
- ***Improved performance*** — Radome protection ensures that critical system alignments are preserved, pointing and tracking accuracy is improved, and peak performance is achieved 100% of the time. This is critically important for applications such as air traffic control, gun fire control, military radar, remote sensing, and high-speed tracking.
- ***Reduced maintenance and downtime*** — With a properly designed ESSCO radome, antenna maintenance costs and downtime are significantly decreased. Environmental effects of salt atmosphere, sand penetration and erosion, dust infiltration, ultraviolet radiation, acid rain, and humidity are kept outside the system. And degradation of rotating mechanisms, covers, seals, and gaskets is dramatically reduced.
- ***Cost-effective*** — Operating in a "zero" wind environment, a radome-enclosed antenna is generally the most cost-effective solution available, as it can lower the cost of the antenna design and reduce operating and life cycle costs. Studies indicate that the downtime for a radome-protected antenna averages as little as twenty minutes per year and that savings in the original cost of the antenna can equal or exceed the cost of a radome. The benign environment of a radome means maintenance is required less often, is accomplished in less time, and requires fewer personnel.

85-ft. (25.9m) diameter metal space frame radome for SATCOM application

Radome Types

ESSCO offers radomes — in sizes ranging from 1.5 to 200 feet (0.5 to over 45.7m) in diameter — in an array of products that includes space frame, sandwich, and specialty composite

Installer of Ground-Based Radomes

57-ft. (17.4m) sandwich radome – weather

77-ft. (23.4m) sandwich radome with large equipment access doors

68-ft. (20.8m) metal space frame radome top cap lift

Submarine radome

8-ft. (2.4m) radome – shipboard communications

Courtesy of USN

options. We also produce custom-shaped radomes, including cylinders, flat walls, and cubes, as well as radomes that mimic barns, church steeples, or other architectural structures. With our breadth of expertise in different radome types, we can provide objective opinions and trade-offs for specific applications so that our customers can select the radome that best meets their requirements.

Specialty Applications

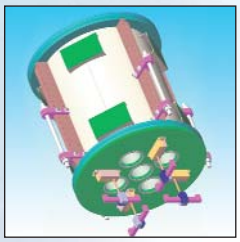
ESSCO has a long history of producing advanced composite radomes and reflectors that are custom-designed and manufactured to your specific requirements. Using our total quality approach, these precision components and subsystems meet the same high standards of quality we apply to all our products.

We specialize in high frequency, structurally demanding, critical tolerance applications using advanced composite materials such as carbon fiber, Kevlar®, and quartz. We also use core materials, such as honeycomb, polyisocyanate, and thermo-formable foam, to design and fabricate parts that meet your performance, weight, strength, and cost goals. All ESSCO composite products are made using pre-preg materials that are oven or autoclave cured to ensure that uniformity, density, and tolerances of parts are maintained during the production process. ESSCO composite reflectors have typical surface accuracies of five mils (0.005 inch or 0.127mm) rms. Using various types of sandwich construction and multi-layered Frequency Selective Surfaces (FSS), we can customize your radome to perform at one or more frequency bands.

ESSCO has designed radomes to survive ballistic impacts, nuclear environments, and other extreme conditions. Proprietary technologies include hydrophobic coatings, electromagnetic tuning, and FSS and low Radar Cross Section (RCS) radome designs. We have manufactured numerous ground-based and airborne reflectors for programs such as Milstar, NESP, and Predator, including 90-inch (2.3m) diameter and three-piece, 96-inch (2.4m) diameter reflectors. Other products include radomes for the E2 Advanced Hawkeye, 15-foot (4.6m) radome/docking covers for AEGIS class ships, 6-foot (1.8m) phased array radome covers for programs such as COBRA and AN/SPQ-9B, 14-foot (4.3m) diameter radomes for the AN/WSC-6(V) 9 System (low RCS environment), and 5-foot (1.5m) diameter advanced composite radomes for the Communications Data Link (CDL) Terminal for reconnaissance/surveillance aircraft carriers. The CDL radome is a high-performance design capable of operating in multiple SATCOM frequency bands through Ku-band.

Typical sandwich radome installation

Precision Antenna Systems

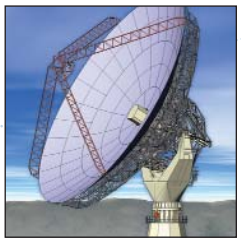


Feeds

36-ft. (11m) telemetry command destruct system

Transportable remote sensing antenna

Compact range reflector



120-ft. (36.6m) EHF antenna system

Precision Antenna Systems

For over four decades, ESSCO has been designing and building turnkey precision antenna systems with reflector sizes ranging from 6 to 120 feet (1.8 to 37.5m) and capable of operating in the SHF, EHF, and submillimeter wave bands. Most ESSCO antenna systems are custom-engineered for a specific requirement and typically provide state-of-the-art performance for demanding aerospace, scientific, and defense applications.

ESSCO antenna systems are used for high rate precision tracking in telemetry, command destruct, imaging radar, and non-imaging radar applications in L- through W-bands. Many of these systems employ very high power transmitters and sophisticated monopulse feed systems. ESSCO SHF/EHF antenna systems employ advanced quasioptical feed networks and can operate simultaneously at several bands in the microwave and millimeter wave range.

ESSCO antenna systems are also used for remote sensing in the S- and X-bands, and for C/X/Ku/EHF SATCOM and EHF radio astronomy applications. Many systems are designed to track at or below earth rates or for precision tracking of GEO, MEO, and LEO objects. ESSCO precision antennas are known throughout the industry for providing extremely accurate reflector surfaces in the range of 25 to 50 microns rms as well as providing total systems solutions that demonstrate unparalleled levels of absolute pointing accuracy and dynamic tracking accuracies that are measured in arc-seconds. Many ESSCO antenna systems are used for demanding non-cooperative target acquisition and tracking applications.

ESSCO antenna systems can be supplied enclosed in our radomes to extend the viewing season and to allow operation in all weather conditions, but versions of our systems that can operate outdoors without radomes are also available. Many of the smaller diameter systems can be supplied in a fly-away transit case configuration or are mounted on transportable trailers that have been certified for worldwide air transport on a variety of USAF platforms.

ESSCO turnkey antenna systems are supplied with the reflector, pedestal, feed systems, microwave/baseband RF electronics, sophisticated antenna control systems, foundations and civil works, plus installation and radome, where applicable.

Typically, ESSCO provides every component that makes up the antenna system, as well as the on-site installation support. We can also supply individual component parts of a system based upon your requirements — from feeds to replacement surface panels to upgrades of your existing system. Special applications of ESSCO's antenna technology include SHF/EHF compact range reflectors for both exposed and enclosed facilities. These can be built using existing ESSCO designs or to customer specifications and are available in sizes from 10 to over 100 feet in diameter (3–30m).

Our team will help you evaluate your particular configuration to determine whether to continue with or replace existing equipment and to ensure the best value and performance for your application over the near and long term. For antenna refurbishment projects, we consider everything from foundations, towers, reflectors, and controls to instrumentation and radomes. Additionally, we take into account age, expected usage, environmental conditions, visual inspection, existing documentation, and system downtime in evaluating system performance.

Services & Support

Worldwide Service

ESSCO field service professionals have been installing, inspecting, and maintaining radomes and antenna systems for more than four decades. Our staff of highly qualified technicians and engineers has experience in installing these systems at thousands of sites around the world, giving ESSCO one of the largest databases of site conditions that might be encountered, which in turn translates to lower overall risk to our customers. We train all of our technicians to the highest standards and follow all OSHA and local safety regulations. Our crews work in environments from arctic to tropic to desert, installing radomes and antennas on towers as high as 600 feet (182.9m) and at some of the world's most challenging locations.

From full turnkey installations of radomes and antennas to site inspections through periodic maintenance, ESSCO's field service crews can support all your system's needs.

Consulting / Special Services

As part of our commitment to providing world-class radome and antenna systems, we offer a wide variety of custom services and support, including:

- ***Structural analysis*** — We offer structural analysis consultation using finite element modeling for radome, antenna, and advanced composite applications.
- ***Electromagnetic analysis*** — If you need precise electromagnetic predictions for radomes and antenna systems, our electromagnetic engineers can provide them to you.
- ***Foundation services*** — A proper foundation is critical to the performance of an antenna and a successful radome installation. ESSCO can provide the complete foundation design, verify an existing design, or build to your specifications.
- ***Inspection and repair services*** — We are especially well qualified to inspect, evaluate, and, if needed, repair existing systems. We can also make recommendations on how to extend the life of an older system.
- ***MIL-Spec documentation*** — If standard documentation is insufficient for your needs, ESSCO has extensive experience in supplying MIL-Specification-level documentation.

ISO-Certified

As a major supplier for commercial, government, and military customers, our quality assurance program attains the highest level of quality and is certified to ISO 9001:2000 in the USA and Ireland.

The technical data and software on pages 1-4 and 6 are considered as Technology Software Publicly Available (TSPA) No License Required (NLR) as defined in Export Administration Regulations (EAR) Part 734.7-11.

The technical data on page 5 has been released into the public domain in accordance with International Traffic in Arms Regulations (ITAR) 22 CFR 120.11(6).

ESSCO Radomes... Built to protect. Designed to endure.

communications

ESSCO

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