



**Kingdom of  
Saudi Arabia**

**Air Defense  
System**

**Boeing  
Litton  
Westinghouse**







## A Partnership for Saudi Arabia



The protection of Saudi Arabia's sovereign airspace is a demanding and complex undertaking. An effective air defense system must quickly detect and accurately identify all airborne threats over thousands of square kilometers of airspace. It must combine radar, communications, and command and control elements into an integrated national network tailored to the needs of the Kingdom. Only the latest technology and the finest production, support, and management capability can answer the challenge.

The team of Boeing, Litton, with its Saudi joint venture company Litton Saudi Arabia Ltd., and Westinghouse, with its Saudi joint venture company Wexico Systems and Services Ltd., was formed to offer this high level of experience and capability for the air defense needs of the Kingdom of Saudi Arabia. The team's accumulation of technical skills; years of design, production, and installation excellence; worldwide support activities; and its presence in the Kingdom of Saudi Arabia make it uniquely suited to the task.

The Boeing Company has extensive experience in the development of major missile, command and control, space, and military and commercial aircraft systems. From short-range air defense to the integration of a national ICBM missile complex, Boeing has repeatedly demonstrated its expertise in system design, production, and support on numerous major programs including:

- Roland - a tactical, mobile missile system for short-range defense against hostile aircraft.
- E-3A Sentry - the most advanced airborne radar early warning system in the world.
- Jet Transport - the largest producer of commercial jet aircraft with over 4,000 sold to almost 200 customers.

- Minuteman - systems integration of the United States ICBM missile system and production of over 2,000 missiles.

Litton Industries is a major producer of software and hardware for air defense systems, communications, displays, guidance and navigation equipment, and aircraft and ship-board electronics. For the U.S. Navy, Litton has total system integration and production responsibility for the DD-963 class of destroyers and general purpose assault craft. Recent highlights of Litton's experience include:

- The AN/TSQ-73 Missile Minder - a flexible command and control system for effective fire distribution of surface-to-air missiles.
- AN/ALR-59 - a passive detection system applicable to the E-3A Sentry
- AN/ALQ-125 - this tactical electronic reconnaissance system is employed on the U.S. Air Force's RF-4C aircraft.
- An integrated digital communications system for Saudi Arabia's air traffic control.

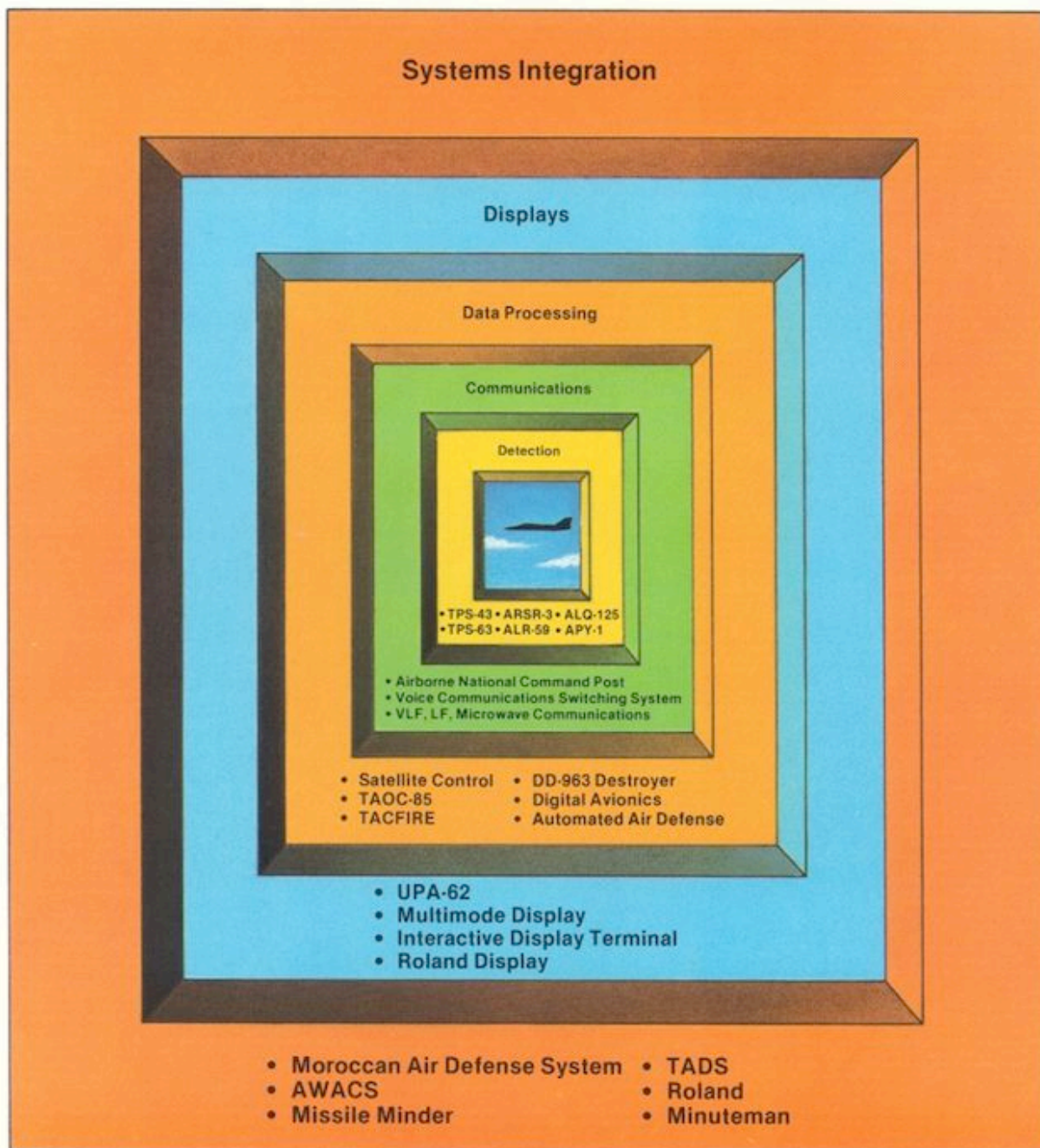
Westinghouse has produced over 36,000 radar systems for air, sea, space, and ground applications, including the world's first air defense radar system for the U.S. Army in the early 1940's. As a complete air defense systems supplier, Westinghouse also designs and produces displays, communications equipment, and militarized computers. Current developments include:

- Tactical Air Defense Systems - sold to over 16 nations.
- ARSR-3 - enroute air traffic control radar for the United States, Canada, and Switzerland.
- Nationwide Air Defense System - for the Kingdom of Morocco.
- Ground and Airborne Radars - TPS-43, TPS-63, TPS-65, APG-66, APY-1, EAR.

## Experience in Air Defense

Nationwide air defense demands expertise in many disciplines: threat detection, communications, data processing, displays, support, and systems integration. The team of Boeing, Litton, and Westinghouse is unsurpassed in its experience in these areas.

The examples on the following pages were chosen as typical of the team members' experience in areas relevant to air defense, but it is the whole of this experience that makes Boeing, Litton, and Westinghouse the best qualified team to provide Saudi Arabia with effective nationwide protection from airborne threats.





## Systems Integration

**E-3A Airborne Early Warning and Control System (AWACS)...**The Boeing E-3A Sentry is a revolutionary development in airborne command and control. This highly survivable system combines the most powerful airborne radar yet developed and advanced computer processing with the tactical mobility of an aircraft. USAF has accepted delivery on 19 E-3A aircraft and plans a total force of 34; NATO has authorized a procurement of 18 AWACS. As prime contractor to USAF and NATO, Boeing provides system design and integration and manufactures the aircraft, rotodome, and much of the electronics. Westinghouse produces the advanced radar system while Litton provides the E-3A Sentry with on-board test, monitor, and maintenance equipment.



*Above:  
E-3A Sentry in flight.*

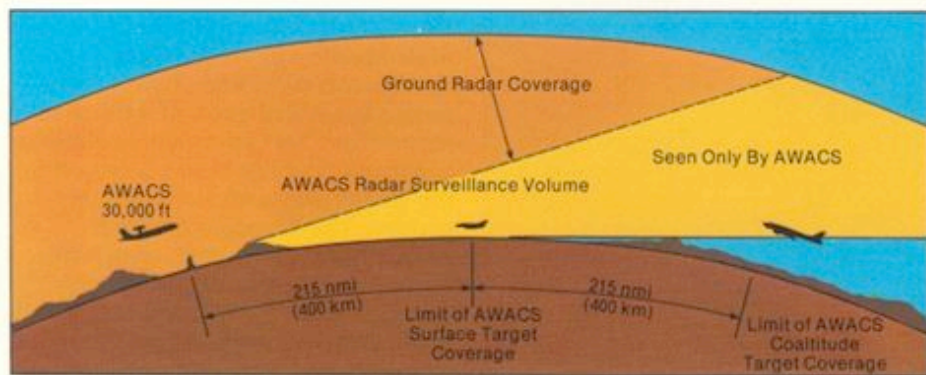


*Left:  
Multipurpose console for surveillance  
and weapon control.*

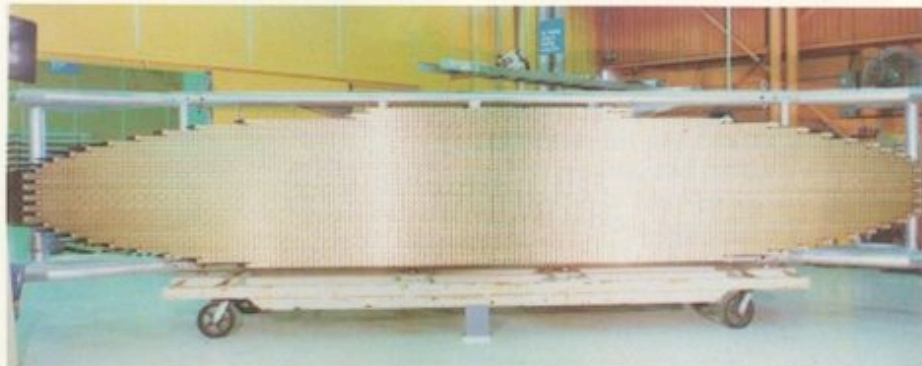
*Right:  
Boeing flight test center in Seattle,  
Washington.*



*Below:  
E-3A Sentry radar coverage.*



*E-3A Sentry radar antenna.*





## Systems Integration...

**National Air Defense System for Morocco...** Westinghouse is the prime contractor for this integrated nationwide air defense system. In addition to manufacturing much of the equipment, the company coordinates the work of many subcontractors and suppliers, manages site construction, and trains operator and maintenance personnel.

*Right:*  
*Moroccan operator at display console.*



*Above:*  
*Fixed radar control post.*



*Above:*  
*Large mainframe computer in data processing room.*



*Left:*  
*Westinghouse gap-filler radar sub-system.*



*Above:*  
*Missile Minder display.*



**AN/TSQ-73 Missile Minder...** Litton's Missile Minder provides flexible command and control for effective fire distribution of surface-to-air missiles. This advanced air defense command post has been purchased by the United States and several other nations. The Kingdom of Saudi Arabia has recently contracted with Litton for a system of Missile Minders linked by an integrated communications network. Litton provides all system hardware and software and complete support activities including spares, training, and depot maintenance.

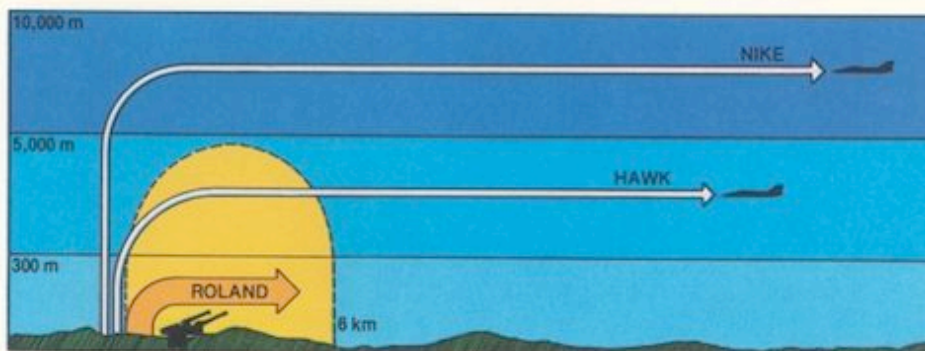
*Left:*  
*Operations shelter.*



**Roland Air Defense System...**The Roland missile system provides effective all-weather, low-altitude, short-range defense against aircraft in forward combat areas and at airfields. Boeing, as associate contractor to the U.S. Army for development and production, supplies Roland's propulsion, missile launchers, command transmitters, fire unit module, controls and displays, and support systems including crew training.



*Right:  
Roland closes air defense gap.*



*TADS*

**Tactical Air Defense System (TADS)...**Deployed worldwide, Westinghouse tactical air defense systems incorporate long-range surveillance and short-range, low-altitude radar, operations centers, and communications equipment. TADS can be set up in two hours, is transportable by helicopter, truck, or cargo aircraft, and can operate autonomously or as a part of a larger command and control network.

*Below:  
Underground Minuteman launch control center.*



**Minuteman Missile Network...**The Minuteman missile is the United States' first line of ICBM defense. The Boeing Company is responsible for the overall systems integration for Minuteman, which includes installation, assembly, and testing. Boeing also produced and delivered over 2,000 missiles and 144,000 end items of equipment, and integrated the activities of 15 major associate contractors and 150 subcontractors.

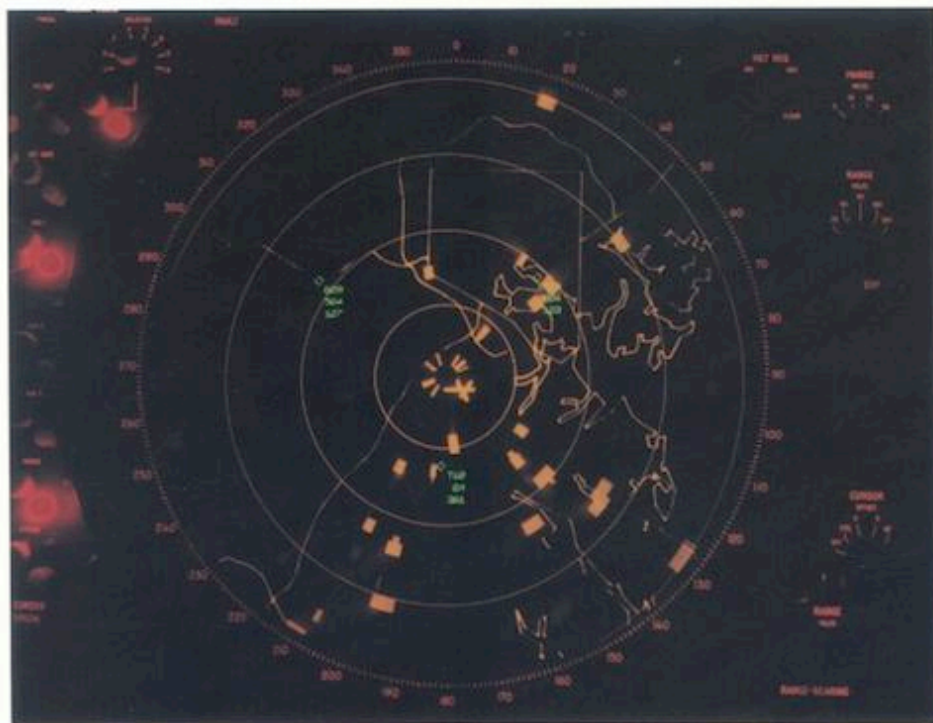
*Left:  
Minuteman test launch.*



## Displays

Boeing, Litton, and Westinghouse manufacture a wide variety of displays, from hand-held terminals to communications and control consoles.

*Below:*  
Dual-color, dual-persistence PPI display is one option available in the AN/UPA-62.



*Right:*  
The Westinghouse AN/UPA-62 universal plan position indicator (PPI) is a versatile, low-cost, solid-state display. Over 1000 have been sold to 18 countries.



*Above:*  
Display for Boeing Roland air defense system. Boeing has provided design and integration of displays and controls on such programs as E-3A Sentry, B-1 aircraft avionics, Airborne Command Post, and Minuteman.

*Right:*  
For use in the field, Litton produces the hand-held Interactive Display Terminal. Litton is also developing an Interactive Computer Presentation Panel.



*Right:*  
The Westinghouse multimode display presents TV raster, graphics, radar video, PPI, or combination data.





## Data Processing

**Satellite Control...**Litton designs, develops, maintains, and tests all operational software for the United States Air Force Satellite Control Facility. Litton's extensive software experience also includes design and development efforts for the NAVSTAR Global Positioning Systems Network of 24 satellites and the U.S. Air Force's Space Defense Command and Control System.

**Air Traffic Control and Air Defense...**Litton designs hardware and software elements of the United States Marine Corps' TAOC-85 (Tactical Air Operations Central - 1985). TAOC-85 will perform air defense missions, air traffic control, data hub/data exchange, air track management, and other airspace management tasks.

**Shipborne Tracking...**For the DD-963 class destroyers, Litton hardware and software provides long-range target location, tracking, and identification. Litton also provides data processing for DDG-993, DDG-994, DDG-995, and several other classes of U.S. Navy destroyers, as well as the CG-47 class guided missile cruiser.



*Above:  
DD-963 Destroyer.*



*Above:  
Shipboard guidance and control system.*



*Above:  
Litton provides software for TAC-FIRE, a major U.S. Army command and control program.*



*Left:  
Data processing room in the air defense operations center of a nationwide air defense system supplied by Westinghouse.*

**Digital Avionics Information System...**Westinghouse provides the AN/AYK-15A computer for the U.S. Air Force Digital Avionics Information System (DAIS). As a result of programs like DAIS and the computer and processing needs of the company's larger systems efforts, Westinghouse has become one of the largest suppliers of computers to the U.S. military.



*AN/AYK-15A.*



## Communications

**E-4B Airborne National Command Post...**The E-4B National Command Post was designed by Boeing to provide emergency communications continuity in the event of nuclear attack. A modified 747, the E-4B aircraft contains all the command, control, and communications equipment necessary to maintain military and government control including 13 separate external communications systems. Boeing supplies the aircraft and, as prime contractor, integrates and manages all other aspects of the program including design, development, and system test.



*Above:  
E-4B airborne communications  
system.*

*Right:  
Tower in line-of-sight microwave  
communications network for a nation-  
wide air defense system.*



*Below:  
616A modem.*



**Low and Very Low Frequency Communications...**Westinghouse has provided the U.S. Air Force with its total low frequency and very low frequency communications requirements since 1964. Current programs in this area include the 616A modem and a new 100-kW transmitter for significantly increased power output.



**Voice Communications Switching Systems (VCSS)...**Litton provides this integrated communications system for the U.S. Federal Aviation Administration and the Kingdom of Saudi Arabia. Long a leader in the field of communications, Litton also has experience in radio frequency and fiber optic communications and has developed an Advanced Communications Control System for the U.S. Navy.

*Left:  
The Voice Communications Switching  
System is used for air traffic control.*



## Detection

**AN/TPS-43...**The Westinghouse TPS-43 is the most widely used long-range tactical surveillance radar in the world. It provides range, azimuth, and altitude information out to a range of 445 kilometers. Westinghouse has produced and delivered over 100 of these radars to 17 nations including Saudi Arabia. This radar will continue to evolve for many years to come, keeping pace with technical advances.



**ARSR-3...**The ARSR-3 (above), an enroute air traffic control radar, is a long-range surveillance system capable of detecting both large and small aircraft. The system was designed to operate 24 hours a day, seven days a week and to function with only minimal operator and maintenance personnel. This capability was proven during a 2½ month long demonstration test during which the ARSR-3 set new levels of reliability operating continuously without a single failure.



**AN/ALQ-125 Tactical Electronic Reconnaissance (TEREC) System...** Employed on the U.S. Air Force's RF-4C aircraft, TERC's primary mission is to establish and maintain the hostile electronic order of battle over a large tactical area by detecting and identifying enemy emitters. Used mainly against ground threats, this wide-band passive detection and location sensor is data linked to aircraft and command centers for immediate strike and tactical mission planning.

**AN/TPS-63...**The TPS-63, produced by Westinghouse, is a medium-range radar. In a command and control system, it serves to fill gaps in the coverage of long-range primary radars. A dualized version of this radar, the TPS-65, is used in military air traffic control as an airport surveillance radar. The TPS-63 and TPS-65 are mobile systems and can be deployed and operational in one hour.



**AN/ALR-59 Passive Detection System...** Employed in the U.S. Navy E-2C and designated for application to NATO's E-3A Sentry aircraft, the ALR-59 provides long-range passive surveillance and early warning of airborne and surface threats.



## Experience in Integrated Logistics Support

Logistics support is an integral part of an air defense system. The team has comprehensive support experience including equipment and maintainability analysis, and personnel requirement determinations. We can provide all needed spares, manuals, automated test equipment, and repair and maintenance depot capability. Multilingual instructors are available to train operator and maintenance personnel in the classroom and at on-site locations. Audio-visual studios can provide instruction courses and manuals in film or videotape.

*Right:  
Audio-visual training of customer personnel.*



*Above:  
Air defense systems are demonstrated and integrated at the Westinghouse command and control simulation laboratory before being shipped to the customer.*



*Left:  
Automated test equipment in a Westinghouse maintenance depot.*



*Above:  
A multilingual videotape for training is produced in one of our television studios.*

*Right:  
Boeing-built operational trainer for U.S. Army Multiple Launch Rocket System.*





## Experience as a Team... Experience in Saudi Arabia

Boeing, Litton, and Westinghouse have worked together throughout the years on many successful programs. Boeing and Westinghouse, for example, have been partners for 25 years, starting with BOMARC in the 1950's and continuing into the 1980's with the E-3A Sentry. Other team efforts of the three companies include the E-4B, B-52, TAOC-85, cruise missile, and MX missile. For Saudi Arabia, we contribute to the Army's command, control, and communications system (Litton provides the Missile Minder and Westinghouse the Defense Acquisition Radar); provide communications for air traffic control; provide the TPS-43 for the Royal Saudi Air Force; and supply jet aircraft to Saudia.



*Above:  
Boeing's E-3A Sentry is equipped with the Westinghouse AN/APY-1 radar and Litton onboard test, monitor, and maintenance equipment.*

*Below:  
Boeing's BOMARC missile system utilized the world's first operational pulse doppler airborne radar, which was designed and produced by Westinghouse.*



*Above:  
The Boeing Company is the leading supplier of commercial jet aircraft to the Kingdom of Saudi Arabia.*

*Below:  
Litton's LN-35 inertial navigation element guides and controls this Boeing cruise missile.*



*Above:  
This Boeing B-52 is the first line strategic bomber of the United States Air Force. The B-52 carries a Westinghouse electro-optical viewing system, was the testbed for Westinghouse's advanced multimode radar, EAR, and will soon be equipped with a Westinghouse tail warning radar.*





The Boeing logo, consisting of the word "BOEING" in a stylized, italicized, red sans-serif font.

## **The Team for Saudi Arabian Air Defense**

The programs and systems depicted in this booklet present the unmatched experience of Boeing, Litton, Litton Saudi Arabia Ltd., Westinghouse, and Wexico Systems and Services Ltd. in all phases of air defense systems. The team is proud of this experience and confident of its ability to meet the air defense needs of the Kingdom of Saudi Arabia.