







Space, telecoms, TV and radio broadcast, defense, security/NDT, science

Traveling Wave Tubes, grid tubes, X-ray sources, klystrons, gyrotrons Space amplifiers, defense transmitters, atomic clock, ion thrusters



Large Instruments

Scientific applications for civil and defense markets

Couplers, energy storage, high power amplifiers Design, development and integration of systems

Radiology

Radiography, fluoroscopy, 3D dental imaging, veterinary, security/NDT

IIR, imaging units, flat digital detectors Complete imaging solutions





Main markets





RF & Microwave sources – Large Instruments 📀

Industry

Sterilisation

Industrial heating

Non Destructive Control

Laser

Communication

Space - Telecoms Uplinks and downlinks TV radio broadcast



Traveling Wave Tubes Grid tubes Space amplifiers Ion thrusters Atomic clock

Defense

Radars Counter-measures Missiles Datalinks

Traveling Wave tubes Transmitters Klystrons, CFAs,



Grid tubes X-ray tubes X-ray detectors

Science

Light sources Accelerators Thermo-nuclear Fusion High power lasers Therapy



Power tubes and amplifiers – klystrons, gyrotrons, tetrodes... Energy storage, couplers Accelerators



Radiology 📀

Radiography

General radiography RAD room (bone/chest) Tables and mobiles





Large-format flat digital detectors Portable (WiFi) flat digital detectors Digital X-ray imaging sub6systems

Radioscopy

Radiography / Fluoroscopy Surgical mobiles

- Cardiovascular
- Neurology, urology
- 3D dental imaging (CNCT)





Flat digital detectors Conventional imaging units CCD cameras Digital X-ray imaging sub6systems

Other applications

Veterinarian Radiology -Fixed and mobile equipment Security / NDT

- Industrial radiography
- Suspicious object control



Flat digital detectors X-ray tubes Conventional imaging units CCD cameras Associated software

THALES

Expertise unrivalled worldwide (









- Sustainable presence: over 60 years of experience in the design and manufacture of microwave tubes and image intensifiers
- **High technology**: 10 patents per year (167 valid industrial patents) - mastering key technologies -2D 3D electron trajectory in vacuum, very high tension, thin layer deposition, deposition of emitting materials...
- Know-How: mastering processes and manufacturing methods of products sometimes unique in the world
- **Expertise**: Design and delivery of prototype systems and related infrastructures for large programs
- Industrial means: significant industrial means, manufacturing, control and test equipment tailordesigned



2009 turnover breakdown (



THALES

2009 Turnover: 407 M€



2009 turnover breakdown (including Large Instruments) 📀

2009 turnover including Large Instruments: 430 M€



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⁶ Microwave & Imaging Sub-Systems

Key figures 📀



- 2009 turnover: 407 M€
- 10% of turnover dedicated to R&D
- 2 600 employees
- 40% of managers, engineers and highly qualified technicians
- 7 industrial sites (Production, R&D)
- 100 000 m² industrial surface, including 9 000 m² clean rooms
- **1 500** clients
- 13 sales offices in the world
- 167 valid industrial patents
 - 2 000 product references

World # 1 for microwave & imaging sub-systems for professional applications



Customer references (

THALES



Over 1 500 clients trust our technologies



International implantation (













Thales - Moirans (France) 📀







- Development and production of imaging solutions based on conventional imaging units or flat detectors
- The largest industrial capacity worldwide for the design and production of conventional imaging units
- 16 700 m² industrial surface, including 3 000 m² clean rooms
- ISO 9001 V 2000 ISO 13485 V 2003 ISO 14 001
- 350 employees
- 44 industrial patents

Image pre-processing software



Conventional imaging units



Flat detector and processing unit

World # 1 for X-ray imaging solutions



¹¹ Microwave & Imaging Sub-Systems

Trixell - Moirans (France)





- Trixell is a JV created in 1997 between Thales (51%) Philips (24,5%) and Siemens (24,5%)
- Trixell designs and manufactures flat detectors for the new digital radiology systems
- 8 000 m² of industrial surface, including 2 000 m² clean rooms
- ISO 9001 V 2000 ISO 13485 V 2003
- 410 employees
- 30 industrial patents



Digital flat detectors

World # 1 for digital flat detectors

THEFEL

STET - Shanghai (China) 📀





- Shanghai Thales Electron Tubes (STET) is a JV created in 1996 between Thales (51%) and Shanghai Medical Instruments Group (49%)
- STET manufactures conventional imaging units mainly for the Chinese market
- 5 000 m² industrial surface, including 300 m² clean rooms
- ISO 9001 v 2000
 - 100 employees



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9" conventional imaging unit

China # 1 for X-ray imaging

CMT Medical Technologies - Yoqneam (Israel) 📀





- CMT Medical Technologies is a Thales subsidiary since April 2009
- CMT is an expert in the development of digital X-ray imaging subsystems
- 2 245 m² industrial surface
- ISO 9001:2000, ISO/IEC 90003:2004, EN ISO 13485:2003
- 90 employees





World expert in clinical X-ray imaging



dpiX - Colorado Springs / Palo Alto (USA) 📀





- dpiX is a JV between Thales, Philips, Siemens andt Varian
- Design and production of high-resolution amorphous silicon sensor arrays
- 31,100 m² industrial surface, including 4,200 m² clean rooms
- ISO 9001:2000, ISO 14001
- 248 employees

Flat detectors based on amorphous silicon sensor arrays

The world's leading source for high-resolution

amorphous silicon sensor arrays for radiology



¹⁵ Microwave & Imaging Sub-Systems















- Pixium flat digital detectors designed for all X-ray exams: Bone/Chest RAD rooms, tables, mobiles
- Pixium RAD 4600: the benchmark in large-format digital detectors
- Pixium Portable 3543: the world's first wireless (WiFi) digital detector
- Complete digital X-ray imaging subsystems







Digital flat detectors

Innovative solutions designed for all X-ray exams



¹⁷ Microwave & Imaging Sub-Systems

Microwave & Imaging Sub-Systems

- Conventional imaging units and Pixium digital flat detectors for radioscopy applications: RF, surgical mobiles - cardiovascular, neurology, urology - 3D dental imaging (CBCT)
- Pixium RF 4343: the world's first multipurpose, largeformat, real-time detector
- Conventional imaging units: available in many formats and versions
- Complete digital X-ray imaging sub-systems

Digital detectors and X-ray imaging workstations

One out of every two exams worldwide uses a Thales detector

Pixium RF 4343

and its processing unit





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Radiology: from X-ray detection to imaging solution





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¹⁹ Microwave & Imaging Sub-Systems

Veterinary radiology (





- Flat digital detectors, designed to be used at examination tables (small animals) or carried onsite (horses...)
- Fast image acquisition process and excellent image quality
- Benefits of digital radiography applied to veterinary medicine





User-friendly solutions based on digital flat detectors



Security & Non Destructive Control (NDT) 📀



Detectors and X-ray generators for Non Destructive Control and security

Applications: real time control of luggage in ports and airports, industrial quality control



Ruggedised solutions tailored for multiple demanding industrial applications



Portable cabled detector

X-ray generators

Medical radiology expertise applied to NDT & Security









Vélizy (France) 📀



- Design and production of Traveling Wave Tubes, klystrons, gyrotrons, generators, space amplifiers, defense transmitters, energy storage...
- 32 000 m² of industriel surface, including 3 000 m² clean rooms
- ISO 9001 v 2000 ISO 14 001
- 890 employees (central services included)
 - 34 industrial patents







Transmitter for radars



THALES

Coupler

World # 1 for space and science tubes Europe # 1 for telecom and defense tubes





- Production of grid tubes, x-ray sources, TWTs and various sub-assemblies
- 25 000 m² of industrial surface, including 200 m² clean rooms
- ISO 9001 v 2000 ISO 14 001
- 370 employees
- 27 industrial patents





X-ray sources

World # 1 for industrial and broadcast tubes



²⁴ Microwave & Imaging Sub-Systems

Ulm (Germany) 🔶





- Design and production of traveling wave tubes, space amplifiers and ion thrusters
- 13 400 m² industrial surface, including 1 300 m² clean rooms
- ISO 9001 v 2000 ISO 14 001
- 400 employees
- 32 industrial patents



Space amplifier



Traveling Wave Tubes



Ion thruster

World # 1 for space tubes – Europe # 1 for defense tubes









Radio and hadron therapy 📀

TH 8.35



- High-power RF sources for radiotherapy and medical particle accelerators
- Thales klystrons are installed in hundreds of linacs
- A safe and reliable operation that is indispensable in hospitals

Tetrodes















World's first manufacturer of TWTs and amplifiers for satellites

Products designed for all commercial and military applications: TVHD, radio, data, telecoms, internet, earth observation and navigation

The most complete range on the market, from L to V band, with power up to 275 W, with the highest level of reliability demanded by our customers





Conduction-cooled TWT



Radiation-cooled TWT



TWT-based amplifier cooled by direct radiation into space

More than half of all images and data transmitted worldwide go through a Thales tube







- **Ion thruster**: Thales has developed a new ion propulsion system for position control of satellites, in partnership with DLR (Germany). First project: SmallGeo
- Atomic clock: Time/Frequency standard designed to synchronize several systems (ex: telecoms).
 Production of the first magnetic deflection tubes which are at the heart of atomic clocks.





Atomic clock



Ion thruster

THALES

Innovative solutions for the Space industry



Telecommunications (









- Leader in TWTs for commercial (TVHD...) and military (multimedia data links...) telecom uplinks
- Thales tubes contribute to reliability and performance of telecom systems in the whole world since 60 years ago
- A Product offer unique in the world
 - Ku band range, until DBS
 - Only manufacturer to offer a 750W DBS tube
 - Complete Ka band range



Only manufacturer in the world to offer a 750W DBS tube and a complete Ka band range



Defense 📀



- World leader for transmitters and tubes (TWTs, klystrons) for radars, electronic counter-measures, missiles and data links
- These transmitters cover a large range of frequencies, from C to EHF band, with power up to several hundreds of kW



A strong development capacity and a large portfolio to cover all Defense requirements







- High power tubes for amplification in radio and TV transmitters
- Long-lasting, high reliability products
- Close partner of broadcasters for new transmitters based on digital radio standard (IBOC, DRM...)



Grid tubes (tetrodes)

The benchmark supplier of grid tubes to major operators in many countries









A complete range of grid tubes for numerous industrial applications: induction and dielectric heating, laser CO2 and plasma cutting

High performance, high reliability products

Distribution agreement with Richardson for industrial tubes



Tens of thousands of Thales tubes are used daily in industrial equipment worldwide



RF power tubes (RF Sources for particle accelerators and fusion reactors Thales power tubes contribute to high-tech scientific applications in the areas of particle physics, nuclear physics and fusion Solutions to expand the state-of-the-art -Tetrode Gyrotron **Klystron** IOT

Thales, a long-standing partner to the most prestigious laboratories and research centres

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High-power subsystems (







- RF power couplers for particle accelerators
- RF amplifiers (SSRF, IHEP, PAL, IN2P3...)
- MegaJoule Laser Energy Storage System (CEA)



Thales's expertise in RF, high tension and complex system integration serving large instruments



Large Instruments (









Design and delivery of prototype systems and related infrastructures for large programs

- MegaJoule Laser Experimental Hall Equipment and Integration (CEA)
 - Support structures
 - **Opto-mechanics interface**
 - Pumping
 - Vacuum and fluids
- Turnkey supply of the CEA radiography machine accelerator (AIRIX)
- On-demand test or logistic equipment based on various technologies:
 - Submarine rudder test facility
 - Handling equipment for missile assembly
 - Airborne drop systems
 - All multi technologies projects







