TELEDYNE ENGINEERED SYSTEMS SEGMENT OVERVIEW
Teledyne Technologies is focused on companies, technologies, and specialized products with a high barrier to entry, that are advanced technically, and are not likely to commoditize. Our products span the globe and can be found from deep space to deep sea.
Teledyne Technologies Markets
2019 Sales ≈ 3.2B\(^{(a)}\)

**Markets\(^{(b)}\)**
- U.S. Government: 23%
- Commercial Imaging and Machine Vision: 27%
- Offshore Energy: 8%
- Other Marine Instrumentation\(^{(c)}\): 5%
- Analytical and Electronic Test and Measurement\(^{(d)}\): 20%
- Commercial Aerospace: 8%
- Other Industrials\(^{(e)}\): 9%

**Sales by Geography\(^{(b)}\)**
- U.S. Commercial: 30%
- Europe: 23%
- Asia Pacific: 22%
- MEA and Other: 3%
- Other: 3%
- U.S. Government: 19%
- Other Industrials\(^{(e)}\): 3%

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(a) Total revenue reflects annualized sales for 2019
(b) Includes Marine Instrumentation for offshore energy and hydrographic survey, Engineered Systems for energy and power generation, and other product lines
(c) Includes Environmental Instrumentation and electronic Test & Measurement Instrumentation
(d) Other includes commercial electronics for microwave and satellite communications, industrial interconnect systems and other product lines
(e) Other Industrials include commercial electronics for microwave and satellite communications, industrial interconnect systems and other product lines
Teledyne Technologies - Engineered Systems Segment

Teledyne Technologies Quick Facts

- TDY Stock Symbol
- ~29% of revenues from Aerospace and Defense
- $3.2B in 2019 revenues, financially strong
- 100+ countries exported to
- Developed first chip-scale atomic clock
- Developed hardware on the furthest objects still operating in space
- 58 Successful Technology Company Acquisitions
- 65+ years of experience
- 10,000+ employees
- Provide monitoring worldwide to protect air and water quality
- Develop X-Rays with higher quality images and lower X-Ray dose
- Support oil and gas exploration and production around the globe

Develop avionics systems for large passenger aircrafts

Developed hardware on the furthest objects still operating in space
Teledyne Technologies Four Segments

- Instrumentation
- Digital Imaging
- Aerospace & Defense Electronics
- Engineered Systems
Teledyne Technologies, Inc.

### Instrumentation
- Marine, environmental, and industrial mission-critical, harsh environments
- Measurement & monitoring instruments
- Power & communications for distributed instrumentation networks
- Electronic test & measurement equipment

### Digital Imaging
- Industrial, government and medical applications
- Micro Electro-Mechanical Systems (“MEMS”)
- High-performance sensors, cameras and systems
- Visible, infrared, ultraviolet and X-ray spectra

### Aerospace and Defense Electronics
- Government and commercial applications
- Sophisticated component, subsystem, & communications electronics
- Defense electronics
- Data acquisition & communications for aircraft
- Harsh environment interconnects
- Components & subsystems for wireless & satellite communications
- General aviation batteries

### Engineered Systems
- High-reliability defense, space, environmental, & energy applications
- Systems engineering, integration, test, deployment, and operations
- Complex manufacturing capability & composite parts production
- Hydrogen/oxygen generators, thermoelectric converters & radioisotope power systems
- Small turbine engines

### Research and Development
Teledyne Technologies Four Segments

- Instrumentation
- Digital Imaging
- Aerospace & Defense Electronics
- Engineered Systems
Engineered Systems Quick Facts

- Provide Radiological Testing for Nuclear Plants
- 346K Square feet of manufacturing space
- Supplied power source for Curiosity Rover
- Partnering in Space since the birth of the Space Program
- Safely destroy chemical weapons for the government
- Host hyperspectral and scientific payloads on the ISS
- Design and build SWCS vehicles for Navy SEALs
- Develop real-time threat testing software, EADSIM
- Provide subsea power solutions for maritime applications
- Responsible for operations on the International Space Station
- Provide composite parts for aviation
- Participating in ITER international nuclear fusion project
- Host hyperspectral and scientific payloads on the ISS

Teledyne Technologies - Engineered Systems Segment
Teledyne’s Values are the foundation for all actions and relationships with our customers, partners, employees and community.
Engineered Systems Segment
Companies & Locations

- TELEDYNE BROWN ENGINEERING
- TELEDYNE ENERGY SYSTEMS, INC.
- TELEDYNE ADVANCED ELECTRONIC SOLUTIONS
- TELEDYNE TURBINE ENGINES

Independent Research Lab owned by Teledyne
Engineered Systems Segment HQ
Huntsville, Alabama
Teledyne Scientific’s Central Research Laboratory

Government, Customer, and Teledyne funded R&D

- **Materials**
  - Structural and functional

- **Electronics**
  - MEMS/III-V semiconductor fab
  - RF/mm Wave/Mixed-signal ICs

- **Information Sciences: Technical Thrusts**
  - Autonomous Systems
  - Sensor Exploitation
  - Neuroscience and Neurotechnology
  - Cyber Security & Anti-Tamper

- **Optical Systems**
  - Information science
  - Image processing
  - Neuroscience

We differentiate ourselves from competitors by having a customer and company-sponsored applied research center that augments our product development expertise.
Engineered Systems Facilities

- TBE Lab Facility
  Knoxville, TN

- TBE Plant 1 – Huntsville, AL – Cummings Research Park

- TBE Test and Demonstration Facility
  Oak Ridge, TN

- TBE Plant 1

- Teledyne Turbine Engines
  Toledo, OH

- Teledyne Energy Systems
  Hunt Valley, MD

- Teledyne Advanced Electronic Solutions
  Lewisburg, TN

- TESI Sparks Facility
  Sparks, MD

► Approximately 1.4 million square feet in 8 locations in 5 states

► Manufacturing square footage totaling 346,000 including 200,000 in Huntsville, Alabama

► ~1,400 employees
Teledyne Brown Engineering
Quality Focused

- AS9100D, Third-Party Registered (Aerospace)
- ISO 9001:2015, Third-Party Registered
- SEI CMMI Maturity Level 4
- NASA SSP-41173 Compliant
- NQA-1 – Nuclear Quality Assurance System 2008/2009a
- 10CFR50 Appendix B – QA Criteria for:
  - Nuclear Power Plants
  - Fuel Reprocessing Plants
- ASME Nuclear Stamps and Certificates:
  - N Stamp, Nuclear Components, #N-2983
  - NPT Stamp, Nuclear Partialss, #N-2984
  - U Stamp, Pressure Vessels, #33,360
  - NS Certificate, Nuclear Supports, #N-3874
  - National Board - R Stamp, Repairs, #R-2240
- ASNT Level III Certified
- NAVSEA Note 5000
- P-9290 Certification for Deep Submergence Systems
- Nadcap Certified
  - Welding
  - Non-Destructive Testing
  - RT, PT

*Certificates shown are for TBE only and are not applicable to every program.*
Teledyne Brown Engineering Recognition

2019
R&D100 Award Winner for Xenon International

2017
Bechtel’s Large Business Subcontractor of the Year Award

2019-2017
Raytheon’s Supplier Excellence Award
3, 4, & 5 Stars

Awarded 3 Times
James S. Cogswell Outstanding Industrial Security Achievement Award from Defense Security Service (DSS)

*Certificates shown are for TBE only and are not applicable to every program.
### Full Life Cycle Capabilities

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**Full-Spectrum Engineering and Advanced Manufacturing**

- **Engineered Systems** – Concept definition and prototyping through product lifecycle.
- **Engineering Services** – Support the customer at any phase of the lifecycle.
- **Hardware Manufacturing** – Design and analysis through fabrication, assembly and test, production, and installation and operations.
Manufacturing, Inspection and Test
High Bay Manufacturing Building

- 22,466 Total sq ft
- Building Capabilities
  - Machining
  - Assembly
  - High Bay Lift (2 20-Ton Cranes)
- New Equipment
  - 6 Axis Machine
  - 5 Axis Machine
Teledyne Technologies - Engineered Systems Segment

High Bay Manufacturing Building

► SNK (2018 model)
  • X travel 246”
    - Part length 312”
  • Y travel 150”
    - Part width between columns 133”
  • Supports 40,000 lbs billet
  • 6,000 RPM spindle

► Niigata 1250s (2018 model)
  • X travel 86.6”
    - Part length 98.4”
  • Y travel 69.7”
    - Part height 78.7”
  • Supports 25,000 lbs billet
  • 15,000 RPM spindle

► Niigata 1000s (2011 model)
  • Bed geometry same as 1250s
  • 8,000 RPM spindle
  • Supports 25,000 lbs billet

► Viper (2010 model)
  • X travel 180”
  • Y travel 85”
  • 6,000 RPM spindle
  • Supports 27,000 lbs billet
Mission Systems

- Modeling and Simulation/Test and Evaluation
- Situational Awareness
- Missile Targets
- Weapon Systems Engineering and Integration
- Software Development
- Medical Modeling & Planning Logistics
- Hypersonic Modeling
Hypersonic Modeling Capabilities

Thermodynamic and Fluid Dynamic Modeling and Radiation Transport for Hypersonic Vehicle Thermal Response and Signatures

Body Heating and Ablation

Far-Wake Flow and Radiation

Near-Body Gas Dynamics and Radiation

Shock, Chemistry, and Ionization

Teledyne continues to expand the capabilities of our tools to address evolving threats
Objective Simulation Framework (OSF)
Tactical Range Air Defense Missile (TACRAM)
Maritime Systems

- Maritime Systems Design, Development and Integration
- Marine Hardware and Vehicles
- Depot Maintenance, Logistics
- Offshore and Harbor Security Monitoring Systems
- Communications/ISR/Imaging
- Deep Submergence Systems Certification
- Missile Launch Systems
Maritime Vehicles

- LDUUV
- Defense Systems
- Autonomous Underwater Vehicles (AUVs)
- 6000m AUV
- Unmanned Surface Vehicles (USVs)
- Marine Surface & Diving Vessel
- Surface Vessel / Inland & Coastal
- Deep Floats
- Gliders
- AUWs
- Deep Towed System
- Towed Vehicles
- Mid-towed System
- Remotely Operated Vehicles (ROVs)
- Inspection Class ROVs
- MiniROVs
- Floats
- Surface Towed
A Sea of Solutions
SWCS: Shallow Water Combat Submersible
Pluto Gigas
Gun Mission Modules (GMM)
Airborne Mine Neutralization System (AMNS)
AQS-20 Minehunting Sonar System
Glider
Geospatial Solutions

- Multi User System for Earth Sensing Platform (MUSES)
- TCloud Amazon Cloud Data Management System
- Hosted Payloads from Low-Earth Orbit
- Payload Operations as a Service
- Hyperspectral Imagery
MUSES: Multi-User System for Earth Sensing
**TCloud Data Management**

1 – White Sands Complex (WSC)
2 – Johnson Space Center (JSC)
3 – Marshal Space Flight Center (MSFC/HOSC)
4 – Teledyne Payload Operations Center

- **VPN Connection**
- **Commands**
- **Telemetry/Data**
Hosted Payloads
Payload Operations
Low Earth Orbit Hyperspectral Imagery

VEGETATION INDEX
- Vegetation
- No Vegetation

SUSPENDED MATTER

DISSOLVED ORGANIC MATERIAL
Engineered Systems

Mission Systems

Maritime Systems & Manufacturing

Geospatial

Space Systems

Energy & Environment

Energy Systems
Hunt Valley, MD

Advanced Electronic Solutions
Lewisburg, TN

Turbine Engines
Toledo, Ohio

Teledyne Brown Engineering
Huntsville, AL
Space Systems

- Space Flight Hardware
- Ground Support Equipment
- Mission Planning and Control Center Operations
- Payload Integration Testing and Astronaut Training
Systems and Support in Space
LVSA: Launch Vehicle Stage Adaptor
MO&I: Mission Operations and Integration
Microgravity Science Glovebox
Engineered Systems

Mission Systems

Energy Systems
Hunt Valley, MD

Maritime Systems & Manufacturing

Advanced Electronic Solutions
Lewisburg, TN

Geospatial

Turbine Engines
Toledo, Ohio

Space Systems

Energy & Environment

Teledyne Brown Engineering
Huntsville, AL
Teledyne Technologies - Engineered Systems Segment

Energy and Environment

- Hardware and Process Systems Design, Integration, Testing, Analysis, and Fabrication
- Radiological Laboratory Services
- Chemical, Biological, Radiological and Nuclear Hardware and Systems
- Petro/Chemical Plant Laboratory Operations and Services
- Renewable Energy Evaluation and Implementation
- Classified Laboratory
Radiological and Classified Laboratories
Laboratory Management and Operations
Nuclear Hardware
Chemical and Biological Systems
Teledyne Turbine Engines

- Small Turbine Engines for Tactical/Strategic Cruise Missiles, Decoys, Targets, and UAVs
- Turbine Engine Test Facility Services
- Advanced Turbine Engine Manufacturing Center
Engineered Systems

Mission Systems

Maritime Systems & Manufacturing

Geospatial

Space Systems

Energy & Environment

Turbine Engines
Toledo, Ohio

Energy Systems
Hunt Valley, MD

Advanced Electronic Solutions
Lewisburg, TN
Teledyne Advanced Electrical Solutions

- Complex SMT, circuit card assemblies
- Complex module level & Backplane circuit card integration
- Box level assembly and integration
- Complex engineering and manufacturing solutions
Engineered Systems

Mission Systems

Maritime Systems & Manufacturing

Geospatial

Space Systems

Energy & Environment

Energy Systems
Hunt Valley, MD

Advanced Electronic Solutions
Lewisburg, TN

Turbine Engines
Toledo, Ohio

Teledyne Brown Engineering
Huntsville, AL
Teledyne Energy Systems, INC. (TESI)

- Advanced Power/Energy Solutions for Harsh Environments
- Electrical Power Generator Cooling via Hydrogen Gas
- Fuel Cells
- Electrochemical Energy Conversion
- Classified Specialized Battery Facility
- Cell Development/Battery Solutions
- Battery Power
Mars Curiosity Rover

Nuclear Power Source by Teledyne Energy

Photo taken with Teledyne DALSA imaging hardware.

12 Teledyne DALSA and E2V image sensors

- Chemcam
- Two right nav cams
- Right mast cam
- Two left nav cams
- Mars Hand Lens Imager (MAHLI)
- Two pairs of rear hazcams
- Two pairs of front hazcams
- Robotic arm
- Alpha particle x-ray spectrometer
- Mars Descent Imager (MARDI)
Seafloor Power
Why Teledyne

Teledyne distinguishes itself by solving the most difficult challenges in markets that require the utmost in precision, performance and reliability.

We are the best option when:

- High degree of complexity and quality is required
- Close partnership is required
- Long-term supply and financial stability are essential
- Stringent specifications exist
- On-time delivery is a must
- The end product will encounter harsh environments

We’re probably not your best choice if your application is:

- Technically simple
- Able to be completed by many suppliers
- Solved with commodity solutions
- Driven by low price as your primary goal
Teledyne Technologies - Engineered Systems Segment

Teledyne Technologies

DIGITAL IMAGING

INSTRUMENTATION

AEROSPACE & DEFENSE ELECTRONICS

ENGINEERED SYSTEMS
Teledyne Aerospace and Defense Electronics

Sophisticated electronic components and subsystems and communications products

- Defense electronics
- Harsh environment interconnects
- Data acquisition and communication equipment for aircraft
- Wireless and satellite communications
Teledyne Technologies Four Segments

Instrumentation  
Digital Imaging  
Aerospace & Defense Electronics  
Engineered Systems
Teledyne Instrumentation

- Monitoring and control instruments for marine, environmental, industrial and defense
  - Electronic test and measurement
  - Power and communications connectivity devices for distributed instrumentation systems and sensor networks deployed in mission critical, harsh environments
  - Marine navigation instruments, imaging, and a broad array of underwater vehicles
  - Subsea pipeline corrosion monitoring detectors, pressure and temperature sensors and flow integrity monitoring solutions
Teledyne Technologies Four Segments

- Instrumentation
- Digital Imaging
- Aerospace & Defense Electronics
- Engineered Systems
Teledyne Digital Imaging

- High-performance sensors, cameras, and systems within the visible, infrared, ultraviolet, and X-ray spectra
  - Medical applications
  - LIDAR systems
  - Industrial uses

- Research laboratories for government programs and business
  - Materials research
  - DARPA/IARPA
  - Advanced Imaging
Teledyne Imaging Sensors Products

- Infrared and visible sensors
- Detector packaging
- Focal plane electronics
- Standard camera products
- Custom cameras
- Laser eye protection & sensor protection

Compact Camera Electronics

High Speed (1600 Hz) LWIR Camera for Lab Instrumentation

Custom Visible & IR Arrays for DoD Space Applications

High Performance Tactical LWIR Arrays

1-D Photodiode Array

320x256 Array

Thermoelectrically Cooled Packaging

Micro-Cam™ Infrared Microscope Camera

Aircrew Laser Eye Protection

Sensor Protection Filters

Space Flight Packaging NASA JWST 4 Mpixel

Photodiode

16 Million Pixel Astronomy Arrays
Teledyne Technologies Four Segments

- Instrumentation
- Digital Imaging
- Aerospace & Defense Electronics
- Engineered Systems
Engineered Systems

- Innovative Systems Engineering
- Integration
- Advanced Technology Development
- Manufacturing Solutions
- Modeling and Simulation
- Full Systems Lifecycle Capabilities