

Distributed Temperature Sensing (DTS) for Airports and Seaports

Airports and seaports are complex, high-value infrastructure hubs that operate continuously and handle large volumes of passengers, cargo, and critical assets. Ensuring safety, operational continuity, and asset protection is essential to maintaining efficient transportation networks.

Thermal risks—such as fire, overheating equipment, and electrical faults pose significant challenges across these environments. Early detection of such conditions is vital to prevent disruption, protect infrastructure, and ensure the safety of personnel and the public.



Distributed Temperature Sensing (DTS) using optical fiber technology provides continuous, real-time temperature monitoring over large extended areas.

This enables early detection of thermal anomalies and supports enhanced safety and operational efficiency.

Key Challenges

- **Large and complex environments:** Extensive infrastructure across terminals, runways, docks, and storage areas
- **High traffic volumes:** Continuous operation with minimal tolerance for downtime
- **Fire risk:** Fuel storage, cargo handling, electrical systems, and confined spaces
- **Critical infrastructure:** Power systems, tunnels, baggage handling, and automation
- **Harsh environments:** Exposure to weather, salt (seaports), and operational wear
- **Security and safety requirements:** Strict regulatory and operational standards

DTS Technology Overview

Distributed Temperature Sensing (DTS) systems use optical fibers as continuous linear temperature sensors. A DTS interrogator sends laser pulses through the fiber and analyses backscattered light (typically Raman scattering) to determine temperature along the fiber.

Key Benefits

- Continuous monitoring over long distances
- Real-time temperature data
- Passive sensing element with no power required
- Immune to electromagnetic interference

System Architecture

A typical DTS deployment across airports and seaports includes:

Zoned configurations for effective monitoring and alarm management

Fiber optic sensing cables installed along critical assets (cables, conveyors, tunnels, pipelines)

Redundant layouts for critical infrastructure

Communication interfaces to:

- SCADA and operational control systems
- Building Management Systems (BMS)
- Fire detection and alarm systems
- Security and monitoring platforms

DTS interrogator units located in control rooms or equipment buildings

Integration enables:

- Automated alarms and alerts
- Activation of fire suppression systems
- Equipment shutdown or isolation
- Enhanced situational awareness

Key Factors for Successful Deployment



Cable routing: Placement aligned with critical assets and risk areas



Mechanical protection: Protection against physical damage / environmental exposure



Environmental suitability: Resistant to moisture, salt exposure (seaports), and temperature variations



Zoning strategy: Logical segmentation for efficient monitoring



Integration planning: Coordination with safety, control, and security systems

Key Applications in Airports

Cable and Electrical Infrastructure Monitoring

Airports have extensive electrical distribution networks. DTS supports:

- Monitoring of cable trays and tunnels
- Detection of hot spots in power cables and connections
- Prevention of electrical faults and fire incidents

Tunnel and Underground Infrastructure Monitoring

Airports often include tunnels for utilities, transport links, and services. DTS provides:

- Continuous fire detection along tunnels
- Early identification of overheating equipment
- Integration with ventilation and safety systems

Fuel Storage and Handling Areas

Fuel systems present significant fire and safety risks. DTS enables:

- Monitoring of pipelines and storage areas
- Detection of abnormal temperature rises
- Early warning of potential fire events

Baggage Handling Systems

Automated baggage systems rely heavily on conveyors and sortation equipment. DTS enables:

- Detection of overheating motors, rollers, and bearings
- Identification of belt misalignment and friction
- Early fault detection to prevent system disruption

Terminal and Facility Monitoring

Large terminal buildings require comprehensive safety systems. DTS can be deployed to:

- Monitor roof spaces and concealed areas
- Provide linear heat detection in large open areas
- Enhance fire detection coverage in complex environments



Key Applications in Seaports

Container Handling and Storage Areas

Ports manage large volumes of goods, often stored in high-density configurations. DTS enables:

- Fire detection in container stacks and storage zones
- Monitoring of temperature-sensitive cargo areas
- Early identification of thermal anomalies

Conveyor Systems for Bulk Materials

Many ports handle bulk materials such as coal, grain, or minerals. DTS supports:

- Fire detection along conveyor belts
- Monitoring of idlers, bearings, and drive systems
- Prevention of equipment failure and fire incidents

Power and Electrical Infrastructure

Seaports rely on extensive electrical systems. DTS provides:

- Monitoring of cable routes and substations
- Detection of overheating connections
- Improved reliability of critical power systems

Jetty and Pipeline Monitoring

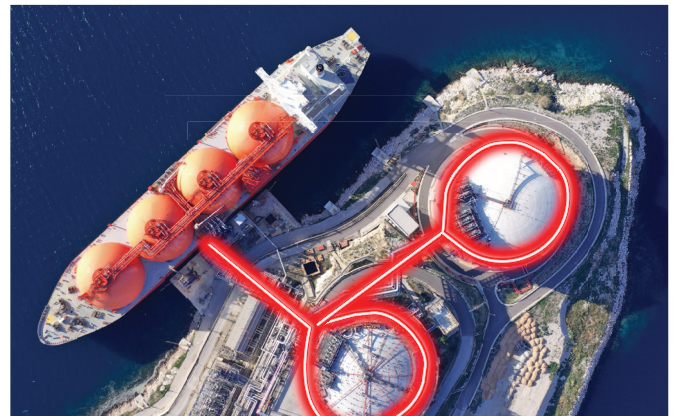
Pipelines transport fuels and other materials across port facilities. DTS enables:

- Continuous temperature monitoring along pipelines
- Detection of abnormal thermal conditions
- Support for leak detection strategies (in combination with other technologies)

Tunnel and Underground Infrastructure

Similar to airports, seaports often include tunnels and underground systems. DTS provides:

- Linear heat detection for fire safety
- Monitoring in difficult-to-access areas
- Integration with emergency response systems



Key Benefits

- **Comprehensive coverage:** Continuous monitoring across large and complex sites
- **Early detection:** Rapid identification of thermal anomalies and fire risks
- **Improved safety:** Protection of passengers, personnel, and assets
- **Reduced downtime:** Faster fault detection and response
- **Low maintenance:** Passive sensing with long operational life
- **High reliability:** Suitable for harsh and demanding environments
- **Scalable solution:** Applicable across diverse infrastructure elements

Conclusion

Distributed Temperature Sensing provides a versatile and reliable solution for monitoring airports and seaports. Its ability to deliver continuous, real-time temperature data across large and complex environments enables early fault detection, improves safety, and supports efficient operations.

As transportation infrastructure continues to expand and evolve, DTS is becoming an increasingly important component of modern safety and asset monitoring strategies.

