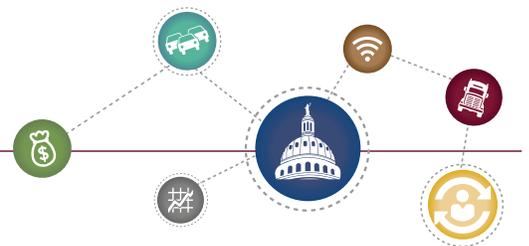


Moving Texas Exports

Examining the role of transportation in the electronic instrument export supply chain



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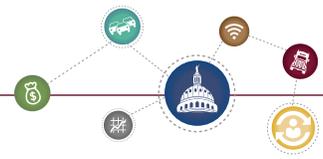
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Introduction

In 2014, U.S. exports of goods and services amounted to \$2.34 trillion, with Texas accounting for \$289 billion of that amount (1). Furthermore, in 2013, Texas' exports supported approximately 1.1 million jobs (2). There is no doubt that Texas' transportation system—its roads, rail, ports, pipelines, airports, and border crossings—facilitates export trade.

The freight transportation system of a state has a direct and indirect impact on international trade. The mode of transportation has a direct impact on the cost, efficiency, and reliability of moving export products to overseas markets. So too does the capacity of the transportation infrastructure. Freight infrastructure investments that increase system capacity could reduce travel times and costs, which can translate into increased economic productivity, as well as enhanced labor and market access. Better labor and market access, in turn, could contribute to increased

The objective of this series of papers is to describe the supply chains for six of Texas' major export commodities and identify the role of transportation in the supply chain.

economic competitiveness (3), which can result in increased exports. The Organization for Economic Cooperation and Development reported that most countries with high-quality infrastructure rank high in the world index for overall competitiveness (4). Specifically, quality infrastructure is a key indicator of international economic competitiveness because it determines the scale, volume, and efficiency of international trade. The objective of this series of papers is to describe the supply chains for six of Texas' major export commodities and identify the role of transportation in the supply chain. The study examined the transportation concerns of exporters, transportation policies and regulations affecting the costs of exports, and infrastructure concerns. This is the sixth paper in the series and documents the role of transportation in the electronic instrument (specifically, gas chromatographs and gas chromatographs–mass spectrometers) export supply chain and key transportation issues and concerns that were shared with the study team.



Background

Texas' electronics industry is an important and growing contributor to the Texas economy. The electronics industry is made up of four sectors:

- Semiconductors.
- Computer equipment.
- Communications equipment.
- Electronic instruments

The electronic instrument sector represents businesses that manufacture navigational, measuring, electro-medical, and control instruments. In 2014, the electronic instrument sector employed 22,702 Texans in 465 firms at an average annual wage of \$75,972. On a national scale, Texas ranked third in electronic instrument employment (all workers) and second in production workers. The sector exported an estimated \$6.8 billion of electronic instruments in 2014. Major export markets were Mexico, Canada, China, the United Kingdom, Singapore, and Saudi Arabia (5). Figure 1 shows that electronic instrument manufacturing in Texas is concentrated in the state's major metropolitan areas (i.e., Dallas/Fort

Worth, Houston/Beaumont, and Austin/Round Rock). These areas are not the only areas where electronic instrument manufacturers can be found but rather represent areas of high concentrations of electronic instrument manufacturing employment relative to the size of the local labor force (5).



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3rd
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(all workers)

2nd
production
workers



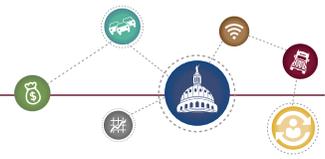
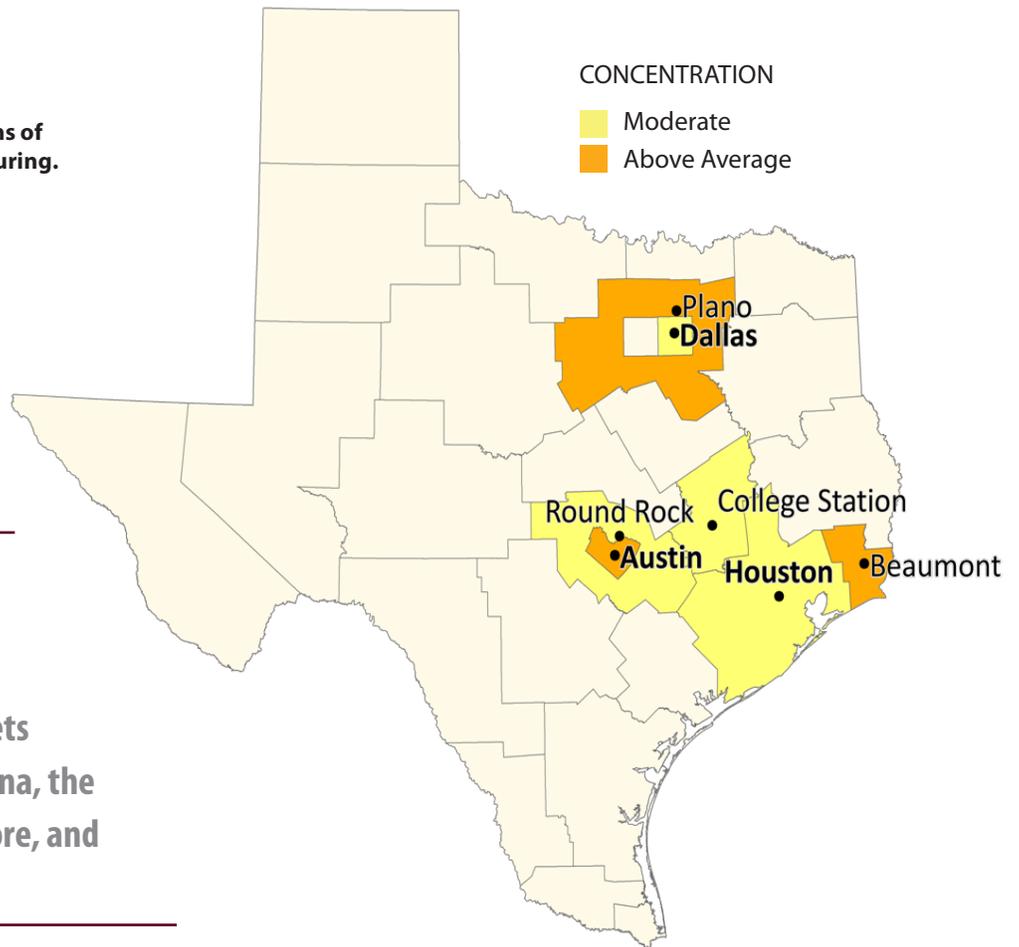
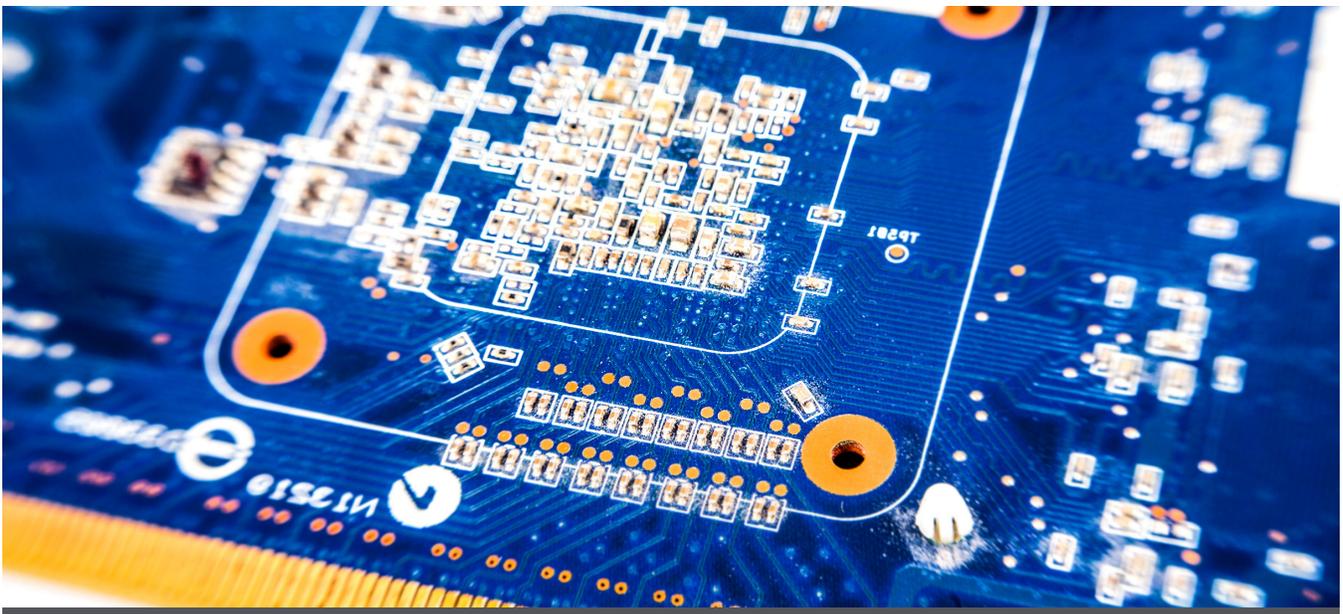


Figure 1. Regional Concentrations of Electronic Instrument Manufacturing.

Source: (5).



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Electronic Instrument Export Supply Chain

To identify the export supply chain for a manufactured product in Texas, the study team contacted the Texas Association of Manufacturers and the Austin Regional Manufacturers Association, among other stakeholders.

The Austin Regional Manufacturers Association helped the study team secure the participation of a former employee of an electronic instrument manufacturer. This former employee helped researchers map out the supply chain for analytical instruments and the transportation issues that impact the export competitiveness of the supply chain for the analytical instruments.

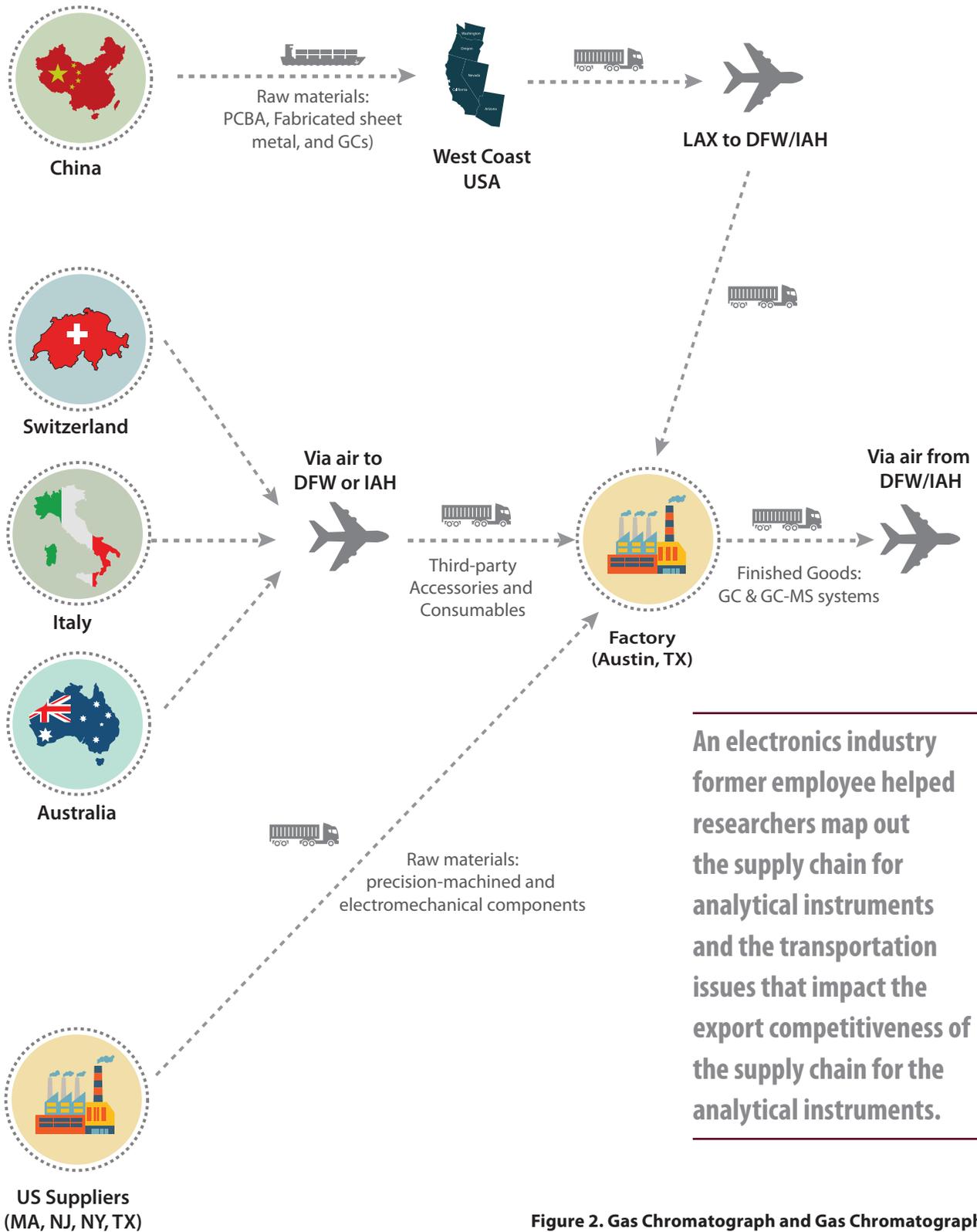
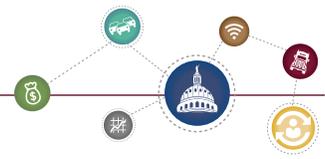
This manufacturer produces industrial process controls and gas chromatography products in Austin, Sugar Land, and Houston. The former employee provided information about the distribution of gas chromatographs and the manufacture (assembly, testing, and export) of gas chromatographs–mass spectrometers from the company’s Austin factory (see Figure 2).

A **gas chromatograph** is an analytical instrument that performs chemical analysis by vaporizing samples without decomposing samples.

A **mass spectrometer** is an analytical instrument that “identifies and quantifies the components of a chemical sample by measuring the abundance of ions and their mass-to-charge ratios”.

The combination of a **gas chromatograph–mass spectrometer** allows for robust chemical analysis (i.e., both identification and quantification).





An electronics industry former employee helped researchers map out the supply chain for analytical instruments and the transportation issues that impact the export competitiveness of the supply chain for the analytical instruments.

Figure 2. Gas Chromatograph and Gas Chromatograph-Mass Spectrometer Export Supply Chain (Case Study).

Source: Adapted from (6).

Distribution of Gas Chromatographs

The case-study company in Austin serves as a distributor of gas chromatographs to the company's markets in the United States, Canada, Central America, and South America. A company-owned factory in China manufactures the gas chromatographs. The gas chromatographs then take the following route to get to the factory in Austin:

- Shipped by sea to the West Coast ports of Los Angeles and Long Beach.
- Trucked to Los Angeles International Airport (LAX).
- Shipped by air to either Dallas/Fort Worth International Airport (DFW) or George Bush Intercontinental Airport (IAH) in Houston.
- Trucked to the factory in Austin.

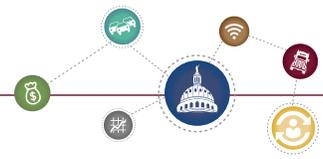
The Austin factory then distributes the orders. The orders are trucked to DFW or IAH, from where they are shipped by air to customers in the United States, Canada, Central America, and South America.



In 2012, DFW and IAH were in the top five Texas ports for electronic exports in terms of value of international shipments at \$11.4 billion and \$3.7 billion, respectively.

Source: (5).





Manufacture of Gas Chromatographs–Mass Spectrometers

The case-study Austin company serves as a manufacturer of gas chromatographs–mass spectrometers. The order typically consists of the gas chromatograph, the mass spectrometer, a desktop computer, third-party accessories (e.g., an autosampler and pumps), consumables (e.g., syringes and columns), and spare parts (e.g., printed circuit board assemblies). Since customers expect to place a single purchase order for a single consolidated shipment and a single invoice for the entire order, the factory performs order consolidation and fulfillment in Austin. The result is a more complex supply chain for the export of gas chromatographs–mass spectrometers.

The supply chain for the gas chromatograph component is explained in the previous subsection. The manufacturer assembles and tests the mass spectrometer component in its Austin factory. Some raw materials for the mass spectrometer are imported from China and U.S. suppliers in Massachusetts, New York, New Jersey, and Texas.

For example, some raw materials—printed circuit board assemblies and fabricated sheet metal—take the following route from China to the factory in Austin:

- Shipped by sea from factories in China to the West Coast ports of Los Angeles and Long Beach.
- Trucked to LAX.
- Shipped by air to DFW or IAH.
- Trucked to the factory in Austin.

Typically, other raw materials for the mass spectrometer (e.g., precision-machined and electromechanical components) are trucked from U.S. suppliers to the Austin factory.

The third-party accessories and consumables required to complete the gas chromatograph–mass spectrometer order are:

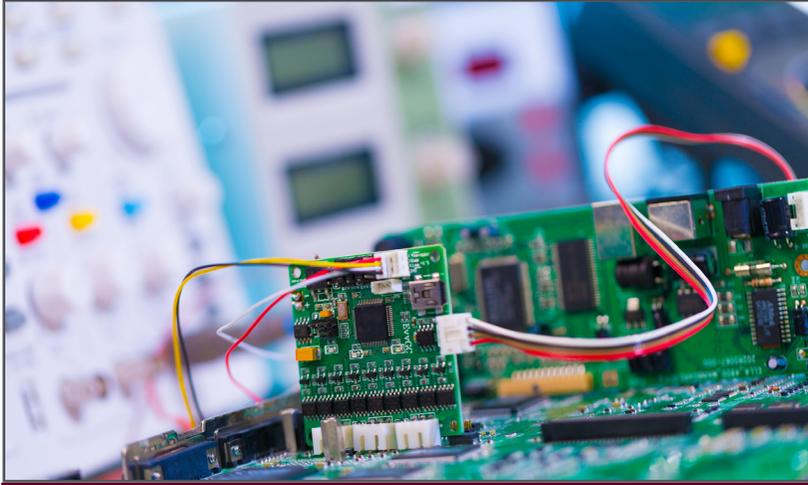
- Shipped by air from Switzerland, Italy, and Australia to DFW or IAH.
- Trucked to the factory in Austin.

Once the gas chromatographs–mass spectrometers are assembled, the final order is:

- Consolidated at the Austin factory.
- Trucked to DFW or IAH.
- Shipped by air to customers in Europe and Asia.

The case-study Austin company serves as a manufacturer of gas chromatographs–mass spectrometers. The order typically consists of the gas chromatograph, the mass spectrometer, a desktop computer, third-party accessories, consumables and spare parts.





Transportation Issues

As mentioned previously, the study team worked with a former employee of an electronic instrument manufacturer to map the export supply chain for gas chromatographs and gas chromatographs–mass spectrometers from its Austin factory. Figure 2 shows that the export supply chain for these two instruments relies predominantly on ship, truck, and airplane. Rail is not used in the export supply chain of these instruments.

Raw materials, third-party accessories, and consumables are flown into Texas’s two largest urban areas and then trucked to Austin. Export orders are trucked back to DFW and IAH to be shipped by air. The manufacturer thus relies on the state’s congested urban transportation system to receive raw materials and move the assembled instruments to global markets.

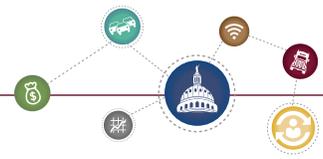
This section of the document highlights a number of transportation concerns documented and expressed by industry that may add costs to the gas chromatograph and gas chromatograph–mass spectrometer export supply chain.

West Coast Port Issues

A number of key inputs in the gas chromatograph and gas chromatograph–mass spectrometer export supply chain are imported from China by ocean vessel to West Coast ports. The reason for selecting ocean vessel is that it presents the lowest-cost freight mode. Given already relatively lengthy travel times by ocean, any delay in port/customs clearance of imported components adds to the time (and thus cost) of the supply chain. The situation is further aggravated by occasional labor disputes at these West Coast ports. Lengthy ocean travel times, compounded by port/customs clearance delays and port strikes, can thus result in significant delays to the distribution of gas chromatographs and the production of gas chromatograph–mass spectrometers (6).

Direct International Flight Availability

The Austin-Bergstrom International Airport has only three direct international flights: to London, Cancun, and San Jose del Cabo/Los Cabos. Another direct international flight to Frankfurt is scheduled to begin service in June 2016 (7). DFW and IAH handled approximately 60 percent of Texas cargo activity (by landed weight) in 2014. This is mostly attributed to the number of direct international flights serving these airports (8). For example, DFW provides nonstop service to 52 international destinations worldwide (9). A lack of direct international flights results in most freight forwarders trucking electronic instruments from Austin to DFW or IAH. This adds costs to the export supply chain and can delay international departure by one to three days (6).



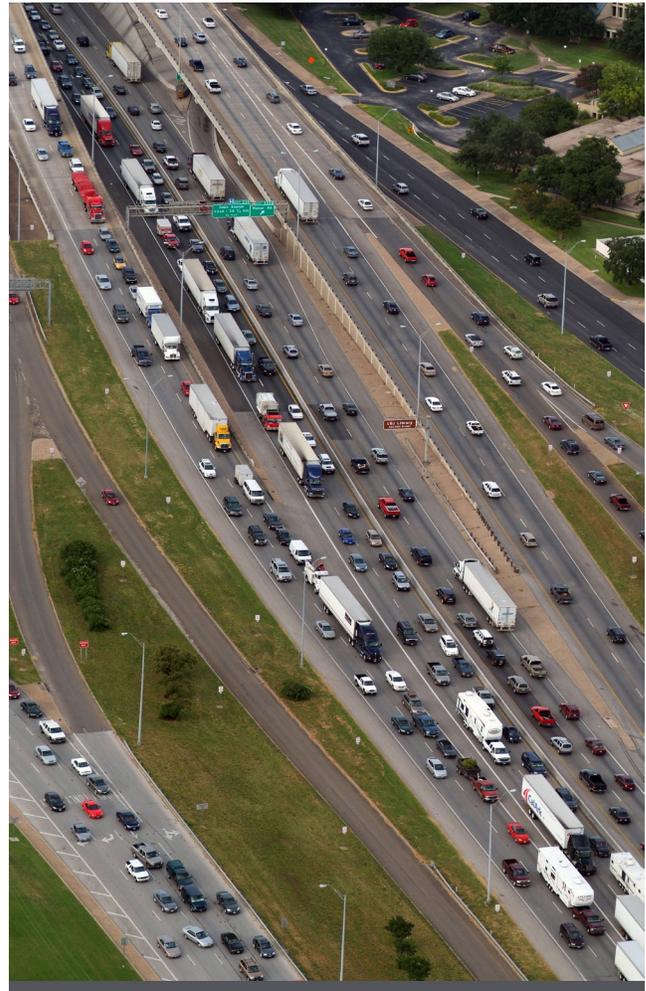
Free Trade Zone/Bonded Warehouse

The electronic instrument manufacturer has to pay import duties on the accessories (e.g., autosamplers and pumps) and consumables (e.g., syringes and columns) imported from Europe. No value is added to these items at the factory in Austin. These items are solely imported to consolidate and fulfill the gas chromatograph–mass spectrometer export orders. A foreign trade zone / bonded warehouse would allow for these accessories and consumables to be imported, consolidated with the other items to fulfill the export order, and re-exported without the intervention of customs and therefore the levying of import duties (6).

Landside Access to Airports

Trucking companies do not have many alternatives besides IH 35, US 290, and IH 10 to access DFW and IAH from Austin. All three of these highways are highly congested in the urban areas and near the airports. Industry pointed out that a number of investments in connectors north and south of DFW have improved access to the airport, but DFW is land constrained with very little room for expansion (10).

The access roads to IAH are highly congested, and it is often confusing to navigate to the airport (11), which could be addressed by improving signage. Some believe that IAH is already operating beyond the cargo capacity it was designed for (10). It will become increasingly difficult to serve increasing air cargo at the airport.



Congestion on IH 35

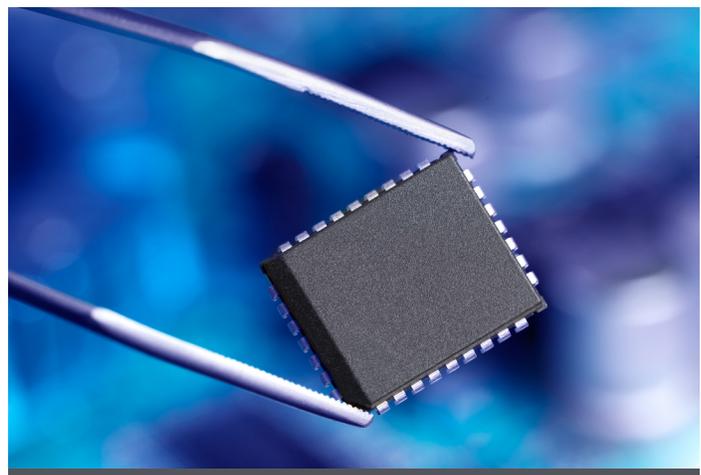
As mentioned previously, components are shipped by air to DFW or IAH and then trucked to Austin. Most freight forwarders truck electronic instrument exports from Austin to DFW or IAH. Using DFW requires raw materials and export orders to be trucked on IH 35. IH 35 is the most-congested interstate corridor in Texas, with 20 segments appearing on Texas's list of 100 most-congested roadways in 2015 (12).

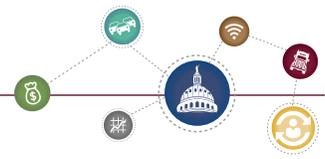
Research by the Texas A&M Transportation Institute shows that congestion on IH 35 amounted to 6.7 million person-hours of truck delay in 2014 (see Table 1). Congestion on IH 35 results in lost productivity and imposes costs on the trucking industry in the form of wasted fuel and increased operating costs.

TEXAS AREA	MILES OF ROADWAY	TOTAL ANNUAL PERSON-HOURS OF DELAY (THOUSANDS)	ANNUAL PERSON-HOURS OF TRUCK DELAY (THOUSANDS)	ANNUAL VEHICLE-MILES OF TRAVEL (VMT) (MILLIONS)	HOURS OF DELAY PER MILLION VMT	HOURS OF DELAY PER MILE
Total	558	38,425	6,674	14,090	2,727	68,860
Austin	56	12,844	2,520	2,569	5,000	230,413
Dallas/ Fort Worth	97	15,585	2,255	3,732	4,176	161,172
Denton/ Lewisville	33	3,500	483	1,120	3,125	105,971
Laredo	9	287	88	149	1,921	32,946
San Antonio	52	4,015	536	2,008	2,000	76,865
Temple	18	596	141	441	1,353	32,692
Waco	23	412	182	593	695	17,568
Rural	270	1,186	469	3,479	341	4,395

Table 1. Congestion Measures for IH 35 in 2014.
Source: (13)

Furthermore, reliability/predictability of shipments is critical to the manufacturing sector. Because demand already exceeds capacity on certain segments of the IH 35 corridor, an incident can shut down the highway for several hours. This can result in significant delays to production (in the case of raw materials) or delays in international departures for export orders.

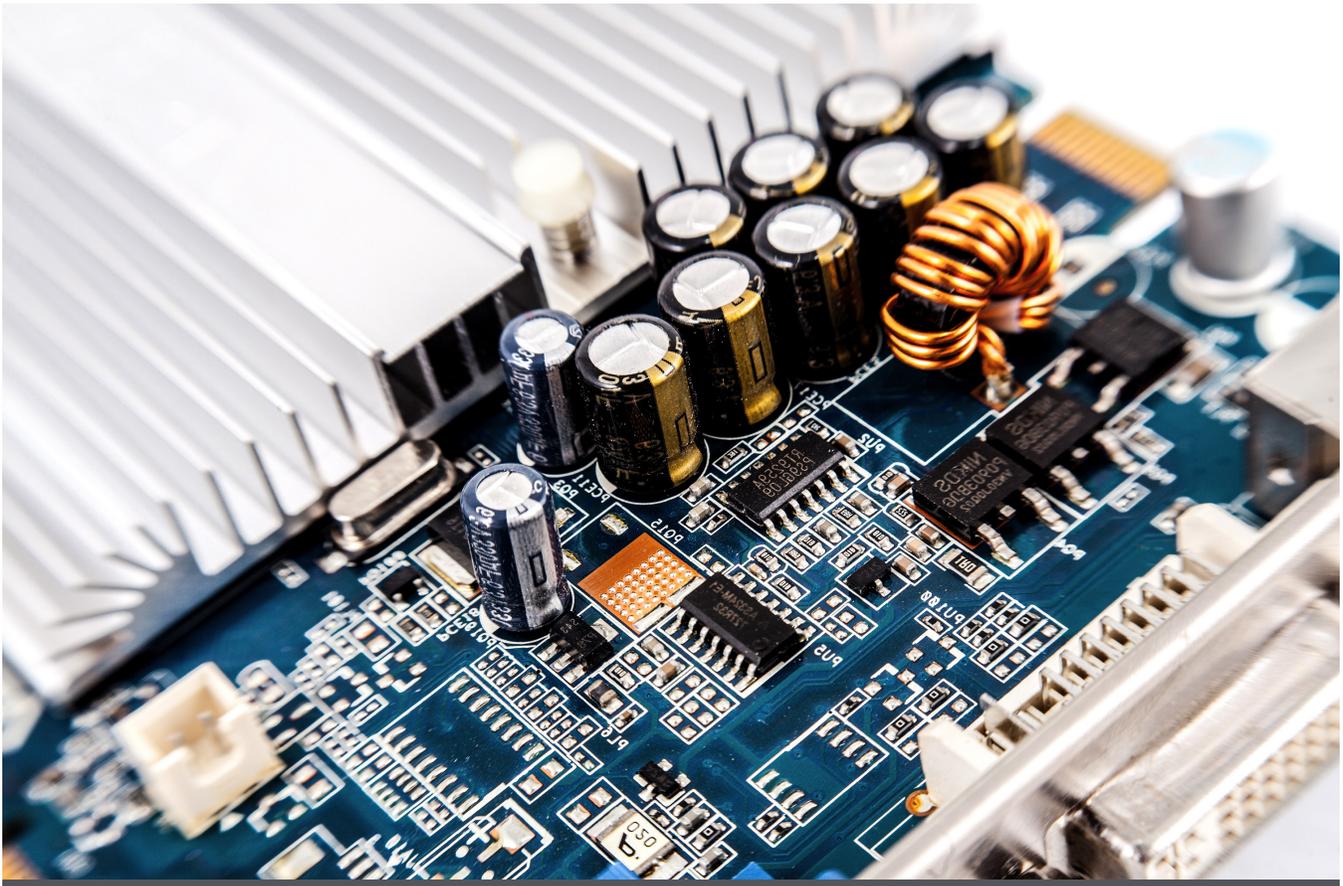




Key Findings

The following are the key findings from this research:

- Long ocean travel times, delays in port/customs clearance, and labor disputes at West Coast ports add time (and thus cost) to the supply chain.
- A lack of direct international flights results in freight forwarders trucking electronic instruments from Austin to DFW or IAH.
- A free trade zone/bonded warehouse in Austin would allow for accessories and consumables to be imported, consolidated, and re-exported without the levying of import duties, thereby reducing supply chain costs.
- Access roads to IAH are very congested, and it is often confusing to navigate to the airport.
- Components and exports are trucked between Austin and DFW on IH 35. IH 35 is the most-congested interstate corridor in Texas with 20 segments appearing on Texas's 100 most-congested roadways in 2015.



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