

ISTA Temperature Project – Data Summary

In the late summer of 2001, ISTA undertook a research project to monitor temperatures and relative humidity in an in-service, interstate Less-Than-Truckload (LTL) environment. Project parameters were selected to look for extreme high temperatures. The project used electronic data loggers. High temperatures above 140°F (60°C) were recorded; however the exposure time for lading in the trailers was small at the high temperatures. The data suggests that there is some heating effect, or increase in trailer interior temperature above the surrounding ambient temperature. Relative humidity was also measured and had extremes over 80% RH on some occasions. Data is presented graphically as temperature and relative humidity vs. time, and selected data as temperature exposure in minutes and in percent of trip total time.

ISTA Temperature Project –Data Summary

In August and September 2001, ISTA, The Association for Transport Packaging, undertook a project to identify and document temperature extremes in in-service LTL trailers as they traveled through hot climates in the United States Southwest. Data was collected in such a way as to emphasize high temperatures, and thus the data is not typical of vehicle temperatures in general. If a manufacturer distributed product throughout the US in a year-round basis, only a very small percentage of the product would be exposed to the temperature profiles reported in this study.

Data was collected using a small, battery-powered device that logs temperature and relative humidity at selectable time intervals. This Hobo® Logger is manufactured by Onset Computer Corporation, Pocasset, MA 02559, 800-564-4377, www.onsetcomp.com. Specifications include an accuracy of better than 2°F and a resolution of better than 1.5°F over a range of –4 to +140°F. Relative Humidity (RH) accuracy is ±5%. A total of seven trips were initiated, with data available for all trips except trip 4. Data was taken at 2.5-minute intervals. For analysis purposes some not applicable data was discarded. Loggers were attached to the walls of in-service trailers by use of adhesive-backed foam. Mounting was at approximate mid to high wall height, away from the door end of the trailer as allowed by lading and loading schedule. Loggers were somewhat removed and insulated from the actual trailer wall and sensed air temperature in the trailer at their position. The range and mix of temperatures and relative humidities in the trailer were not explored, only one typical location. An exhaustive monitoring of trailer temperature spectra was not possible under the experimental design. Temperatures both higher and lower might be present in any of the vehicles monitored.

ABF System, Ft. Smith, AK, provided transportation and logger mounting and removal, along with transportation. ABF is a major LTL carrier and ISTA member. Valuable assistance was provided by Dan Hill (Ft. Smith), Paul Cornelius (Dallas) and Matt Turrita (Phoenix). Logger retrieval and return was accomplished by the Dial Corporation in Scottsdale, AZ. Dial is an ISTA member. Valuable assistance was provided by Kim O'Connor and Joan Pierce. Without the help of these volunteers, the project would have been impractical. Project design and data analysis was conducted by Dennis Young and Associates, Inc., Grand Rapids, MI, under contract to ISTA. DYA, Inc. is an ISTA member.

The interpretation and use of this data should be undertaken with some perspective and caution. As stated above, this does not represent typical trailer temperatures, but rather a small data set collected by targeting known high temperature environments. The data set is too small to draw hard conclusions or establish absolute extremes, and users are cautioned to use the data accordingly. Data on local conditions was provided by the National Climatic Data Center

(NCDC) through subscription service. For more information see www.ncdc.noaa.gov. Since the trailers were moving during much of their monitored time and reporting weather stations are fixed-base, local conditions should be considered only approximate. An effort was made to approximate the trailer position and supply local data from reasonably close locations. The data indicates, without proving, that trailer heating is a factor in the temperature extremes reached and further that this effect is more pronounced when the trailer is at rest than when in motion. September 1-3 was Labor Day weekend in 2001, causing a situation where trailers in Trips 5 and 6 were at rest during part of the monitored time. August 11 was a Saturday and was monitored in Trip 2.

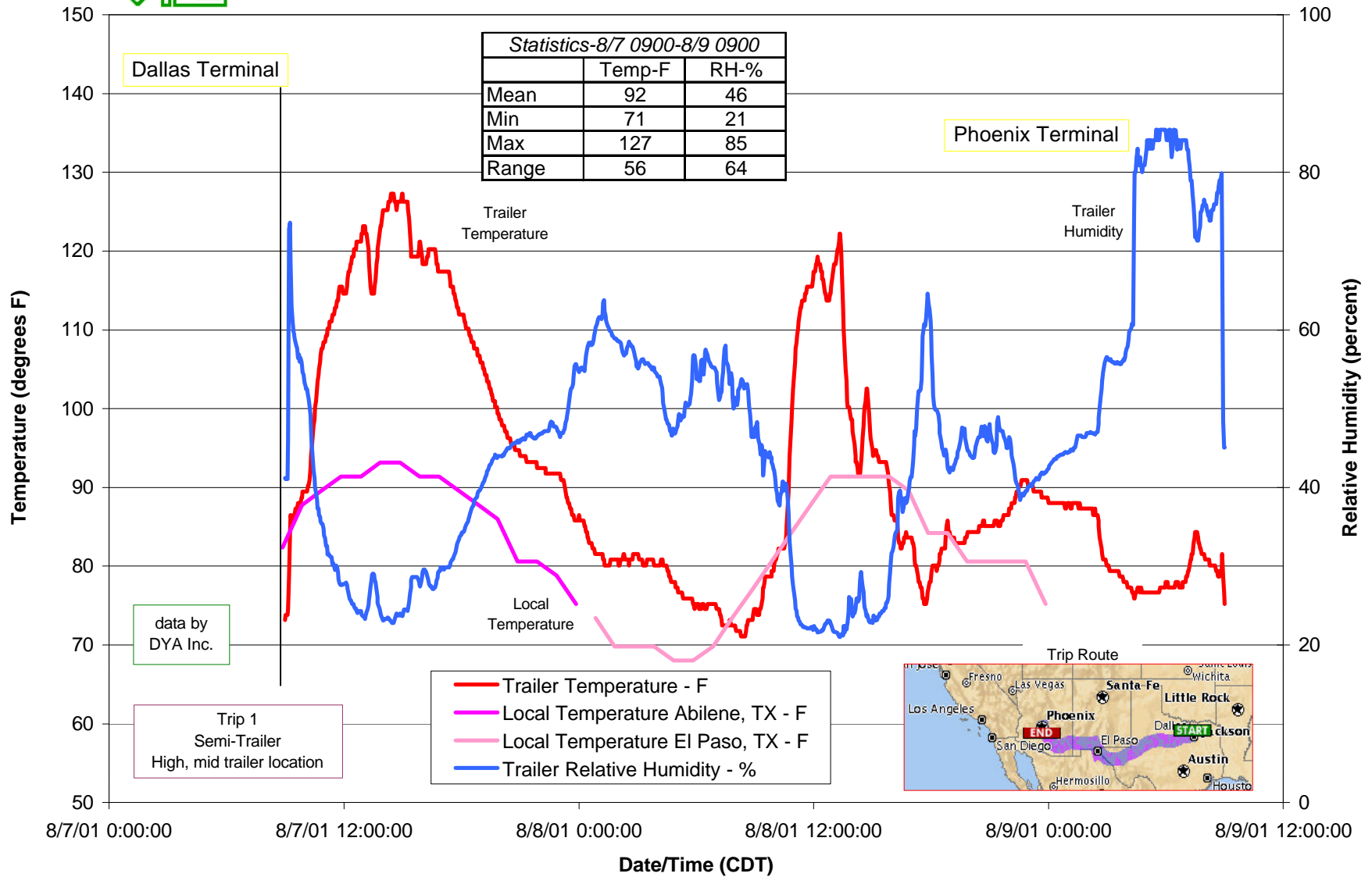
While extremes of temperature were recorded in this small-sample study, the user should be cautious about selecting these extremes for long-term soak testing of packages or products. Note that normal diurnal cycles, cooler at night, warmer during the day, prevail. Peak temperature is usually in mid afternoon, and these peaks are short-lived. As examples, some data sets were analyzed by the temperature exposure method and data is provided. Note that exposure times are very short for temperatures above 100°F.

For users desiring additional analysis of this data, ISTA will make the entire data set available, including the original raw logger data, the original raw climatic data, the proprietary software required to export ram logger data, and all spreadsheet and graphic data analyzed. Media is CD-ROM. The price for ISTA members is \$100 and for non-members \$200. Contact ISTA headquarters to order or for more information at 517-333-3437, www.ista.org.



Atmospheric Data

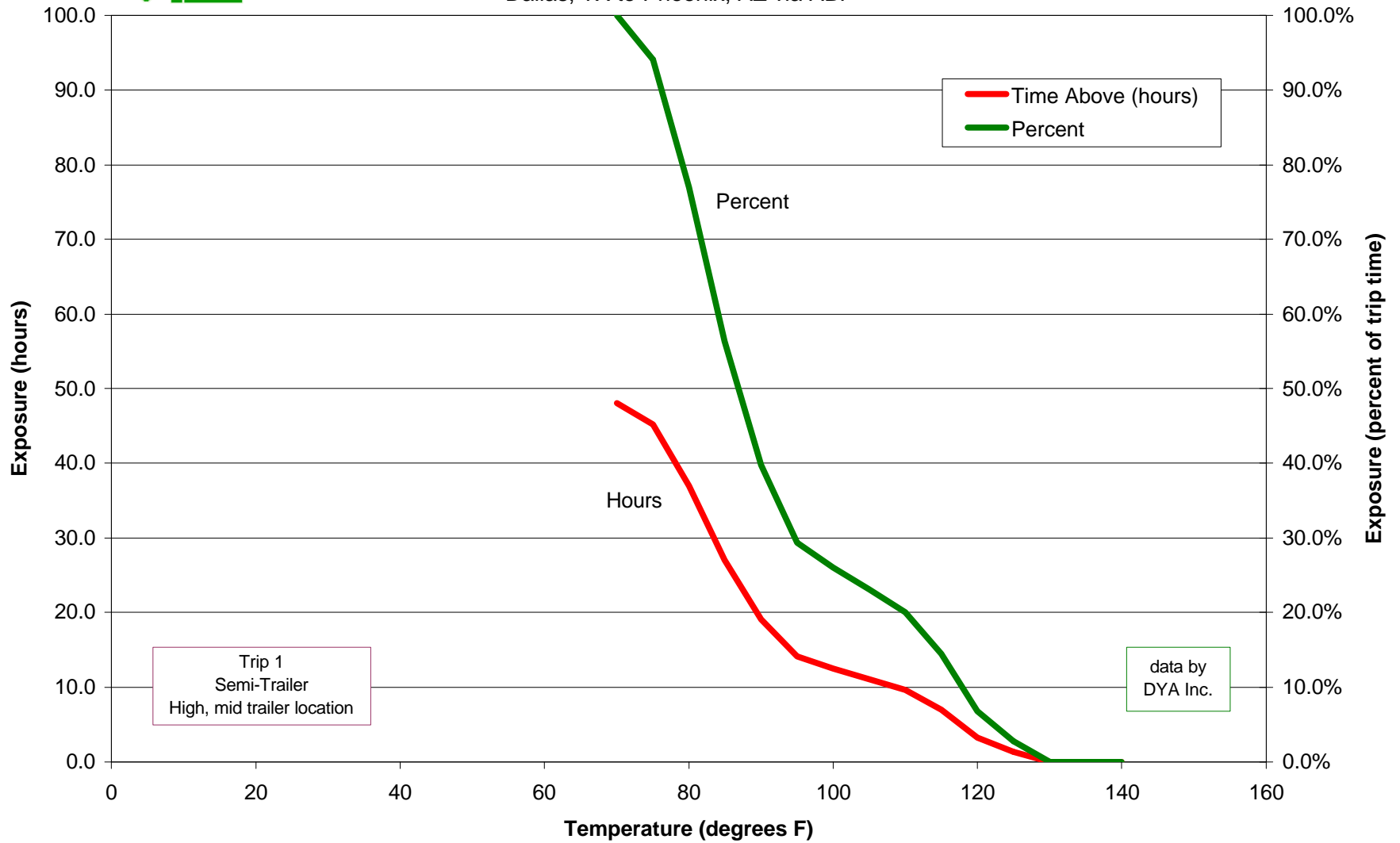
Dallas, TX to Phoenix, AZ via ABF





ISTA Atmospheric Project

Dallas, TX to Phoenix, AZ via ABF



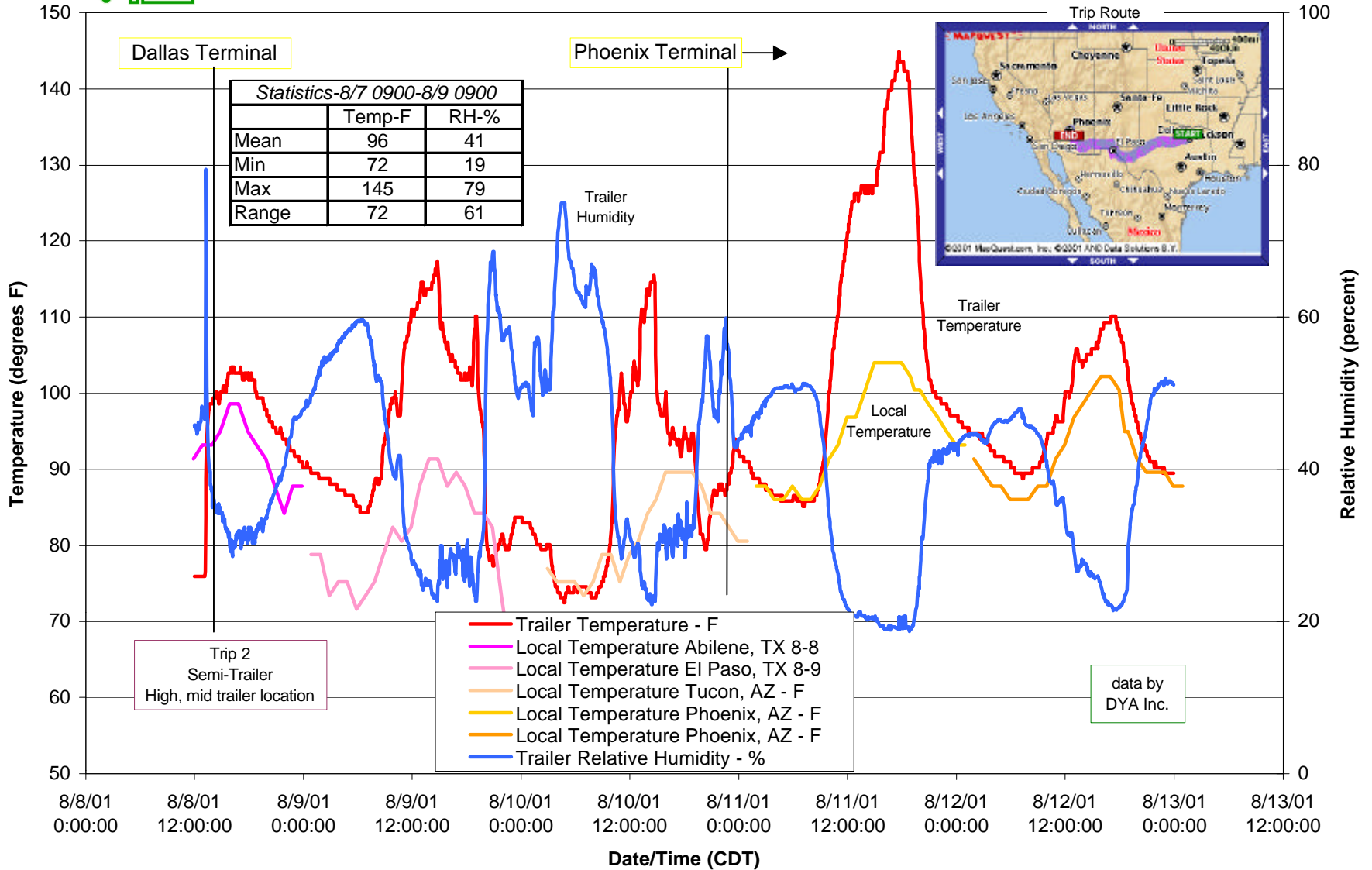
Trip 1
Semi-Trailer
High, mid trailer location

data by
DYA Inc.



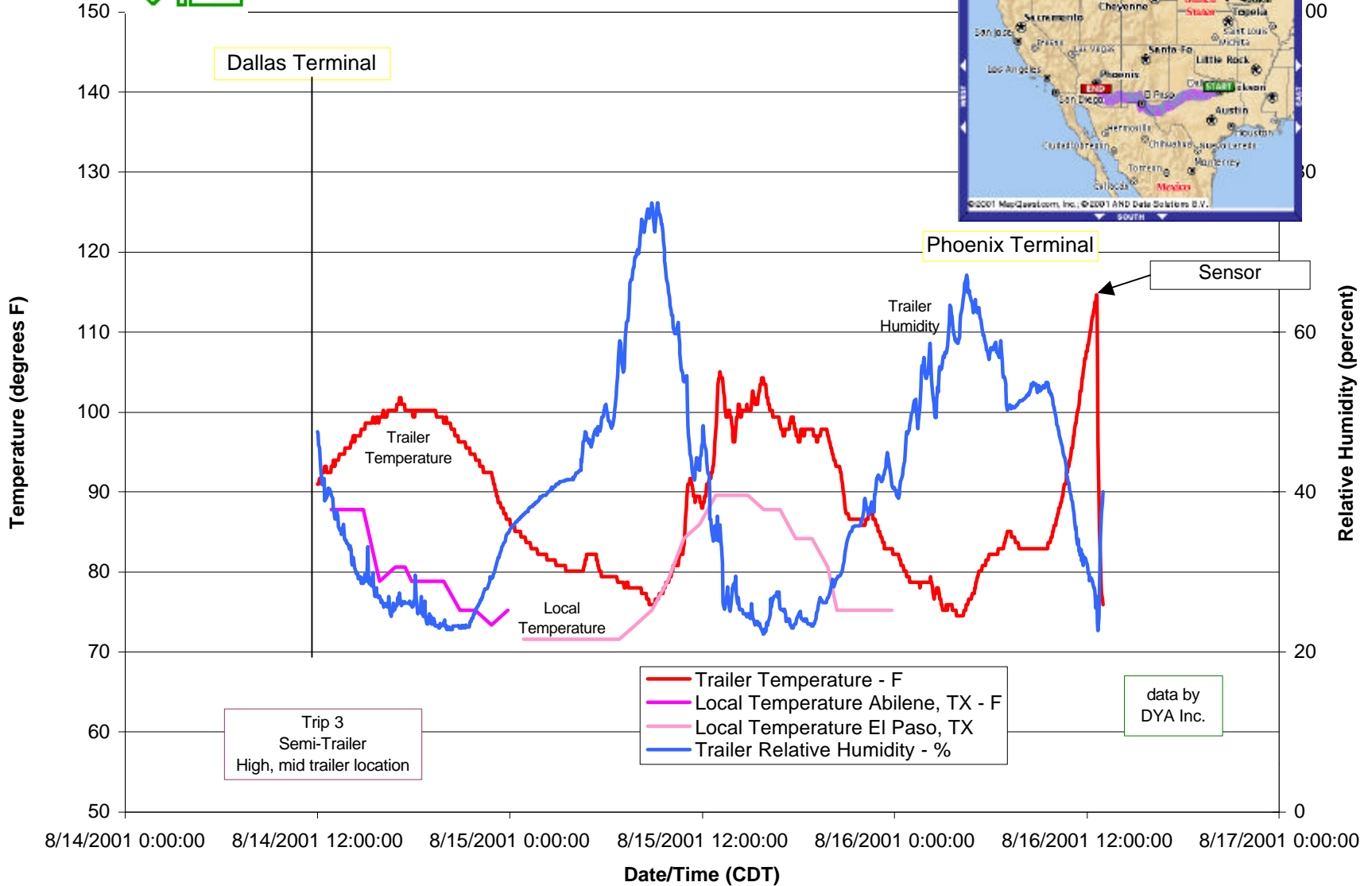
Atmospheric Data

Dallas, TX to Phoenix, AZ via ABF and Stationary in Phoenix



Atmospheric Data

Dallas, TX to Phoenix, AZ via ABF

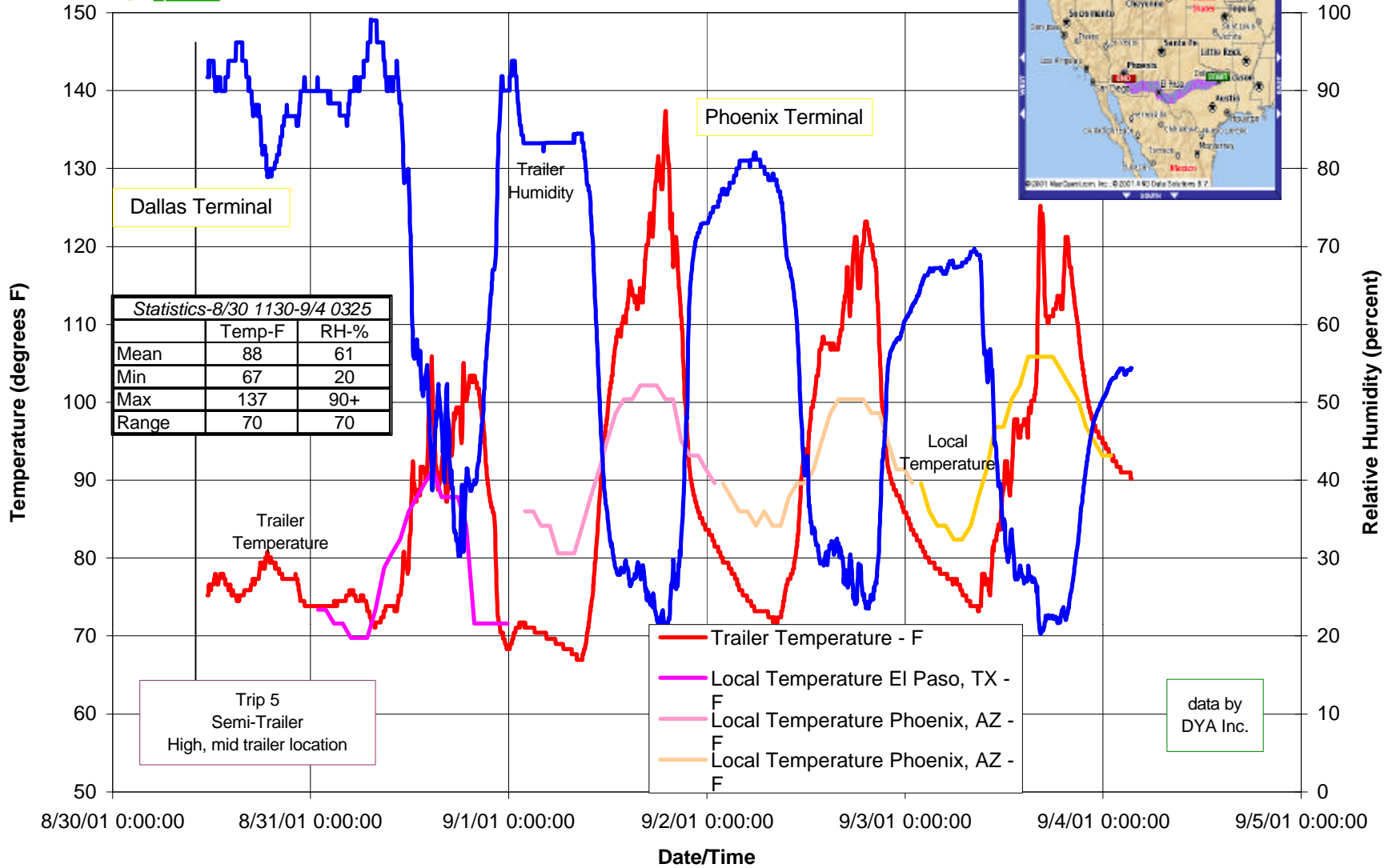




Atmospheric Data

Dallas, TX to Phoenix, AZ via ABF and Stationary in Phoenix

Trip Route

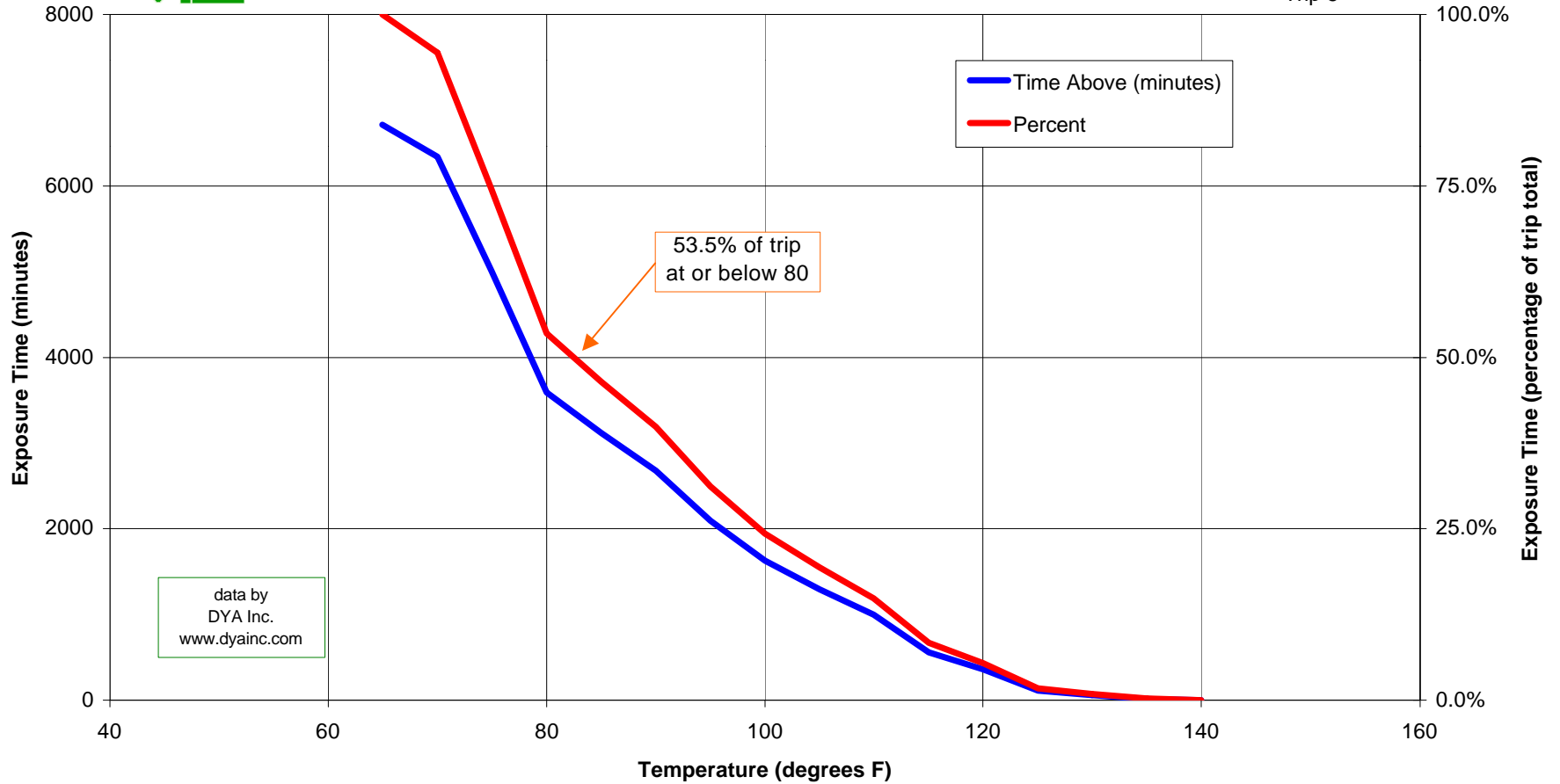




Temperature Exposure

Dallas to Phoenix via ABF

Trip 5

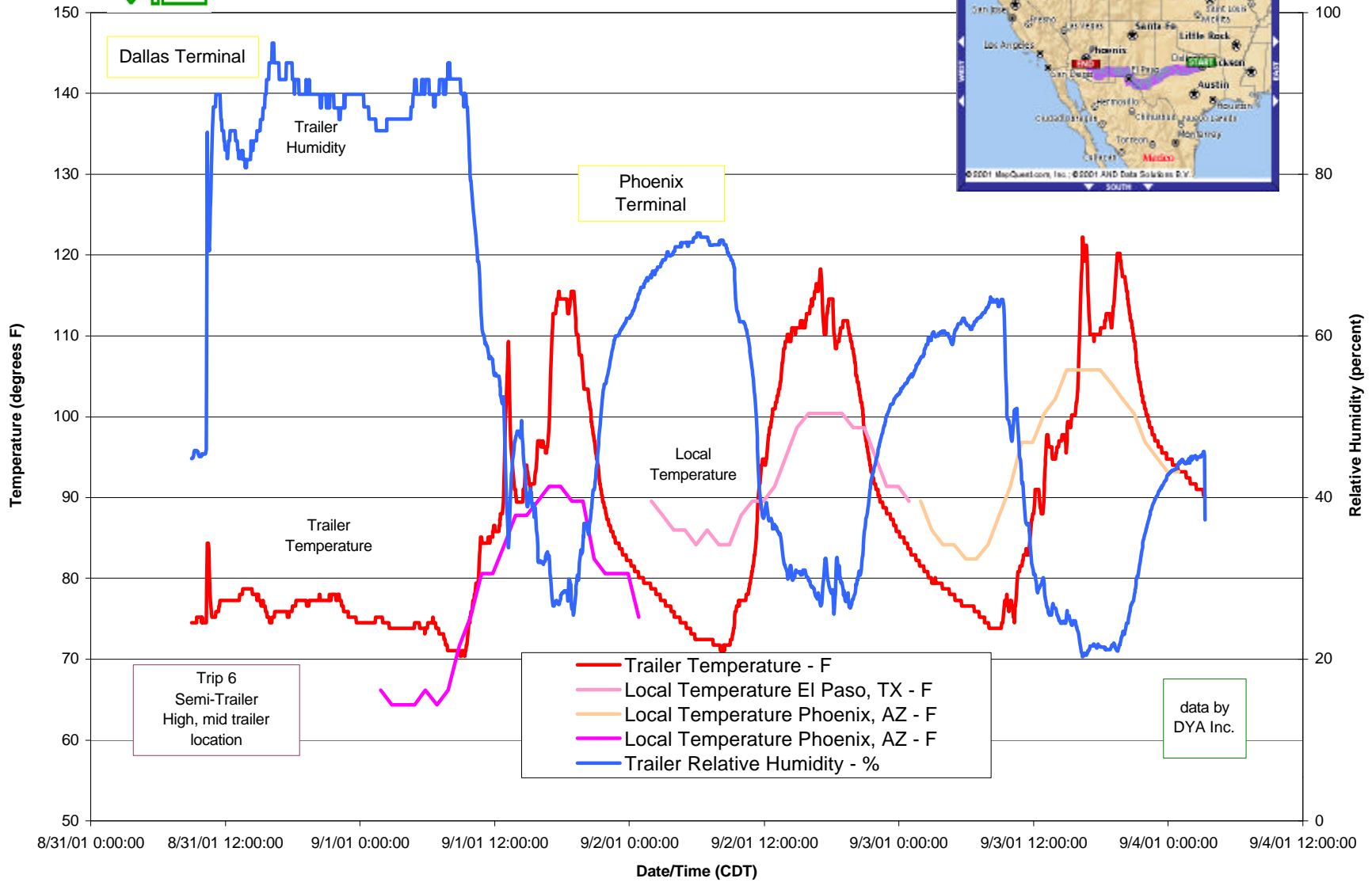


Atmospheric Data

Dallas, TX to Phoenix, AZ via ABF and Stationary in Phoenix



Trip Route

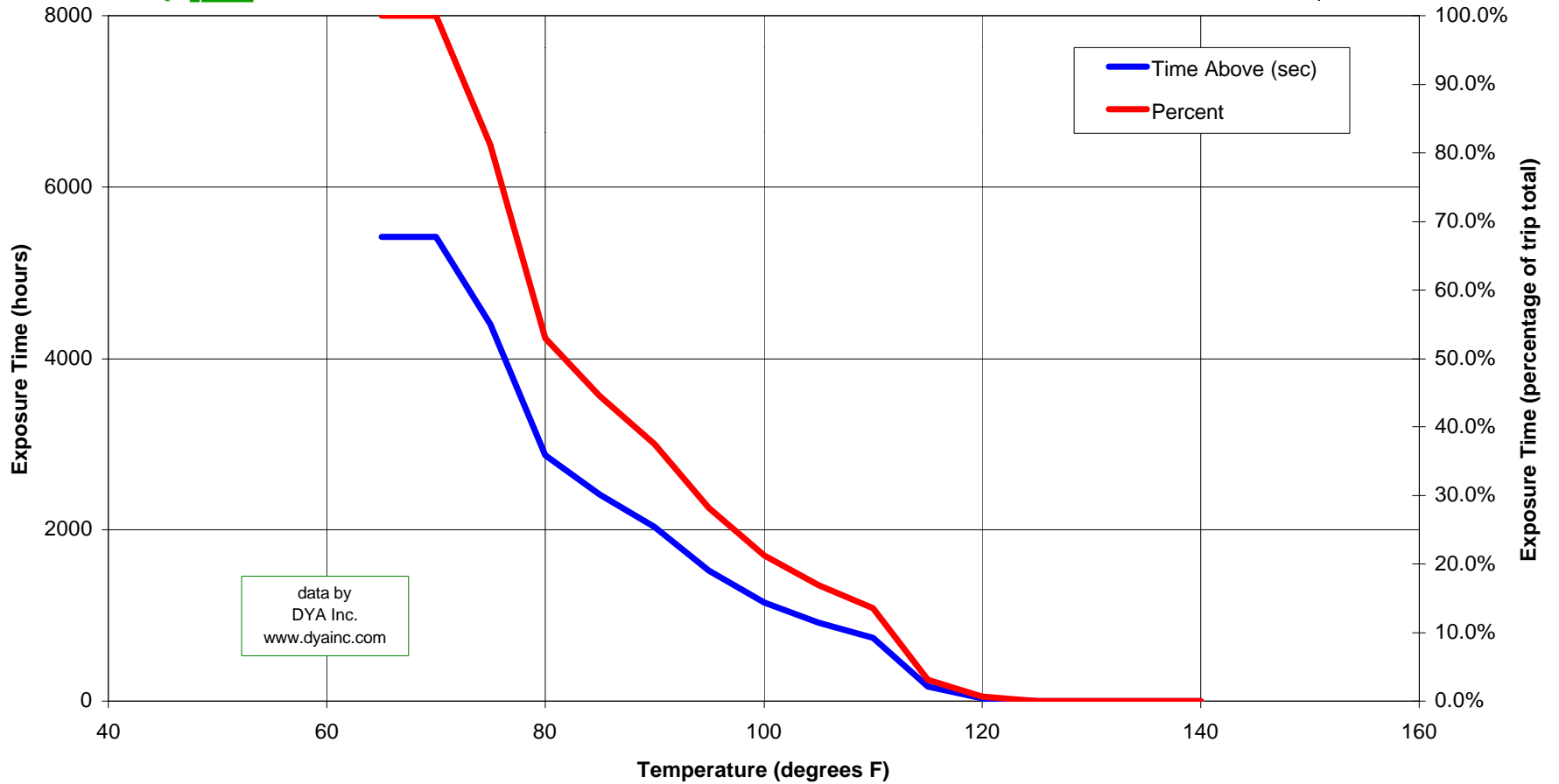




Temperature Exposure

Dallas to Phoenix via ABF

Trip 6



data by
DYA Inc.
www.dyainc.com

Atmospheric Data

Dallas, TX to Phoenix, AZ via ABF



Trip Route

