NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

October 17, 2013

17 – Electronic Devices Factual Report

Specialist's Factual Report
by Bill Tuccio, Ph.D.

1. EVENT

Location:	Johnstown, New York
Date:	May 24, 2013
Aircraft:	Piper PA-34-200T
Registration:	N31743
Operator:	Private
NTSB Number:	ERA13FA253

On May 24, 2013, at 1710 eastern daylight time, a Piper PA-34-200T, N31743, operating as Angel Flight 743, was destroyed during an in-flight breakup near Johnstown, New York. The certificated commercial pilot and one passenger were fatally injured; the second passenger was missing and presumed fatally injured. Visual meteorological conditions prevailed, and an instrument flight rules flight plan was filed for the personal flight, which departed Laurence G. Hanscom Field Airport (BED), Bedford, Massachusetts, and was destined for Griffiss International Airport (RME), Rome, New York. The flight was operated under the provisions of Title 14 *Code of Federal Regulations* Part 91.

2. DETAILS OF INVESTIGATION

The Safety Board's Vehicle Recorder Division received the following devices:

Device 1:	Shadin Fuel Flow Indicator
Device 1 Serial Number:	2331
Device 2:	Insight GEM-1200
Device 2 Serial Number:	1393

2.1. Shadin Fuel Flow Indicator Device Description

The Shadin Fuel Flow Indicator, part number 910532 T-D, is a digital fuel management system designed to provide fuel management information under real-time flight conditions to the flight crew. The unit is connected to engine fuel flow transducers. The unit is capable of transmitting fuel information to certain GPS receivers for additional

calculations and display of fuel management data. The unit can display engine fuel flow, fuel used, fuel remaining, and endurance.

The unit does not interface with an aircraft's fuel quantity indicating system. The unit requires the flight crew to enter the initial fuel on board the aircraft. All calculations and data provided by the unit are based on fuel flow.

2.1.1. Shadin Fuel Flow Indicator Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had sustained significant impact and water damage, as shown in figure 1. An internal inspection was performed revealing no internal damage. External power was applied to the unit and it started normally. The various display modes were examined and documented.

Figure 1. Shadin fuel flow indicator.

2.1.2. Shadin Fuel Flow Indicator Data Description

When the gallons remaining button was depressed it displayed "0.0." When the gallons used button was pushed it displayed the digits "4735" with no decimal point, as shown in figure 2. The calibration k-factor for each engine's fuel flow sending unit was set to 29.4 for both engines. The full fuel value of the unit was set to "123.0" gallons.

Figure 2. Shadin fuel flow fuel used indication.

2.2. Insight GEM-1200 Device Description

The Insight Avionics GEM-1200 engine monitor provides the crew with exhaust gas and cylinder head temperatures from each of the engine cylinders. The instrument can display, depending on the installation and engine type, up to 13 engine temperatures in a bar graph or digital display. Temperatures include exhaust gas temperature (EGT), cylinder head temperature (CHT) and turbine inlet temperature (TIT). The unit also operates in two modes, “Lean Mode” and “Monitor Mode”. The unit can record historical information as configured by the user. Historical and configuration information are retrieved and decoded using proprietary GEMCOM software and an infrared, wireless connection using a Hewlett Packard 200LX handheld device.

2.2.1. Insight GEM-1200 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had sustained significant impact and water damage, as shown in figures 3 and 4. The damage rendered the unit inoperable. A functioning surrogate unit was obtained and the memory chip from the damaged unit, shown in figure 5, was installed in the surrogate unit. Information was downloaded from the surrogate unit normally; however, certain configuration and time setting information from the accident unit could not be retrieved.

Figure 3. Insight GEM-1200 unit, as received.

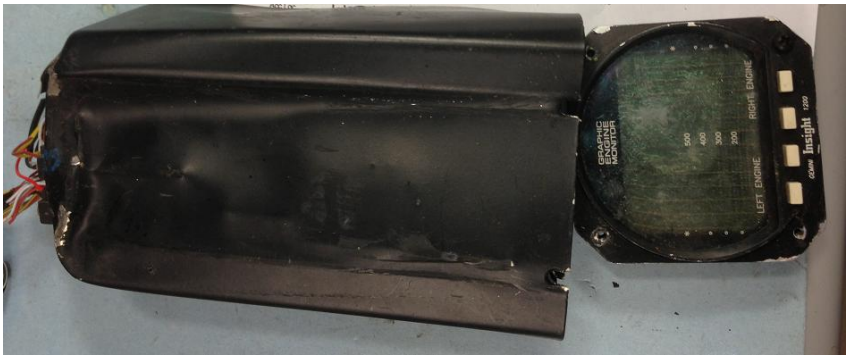
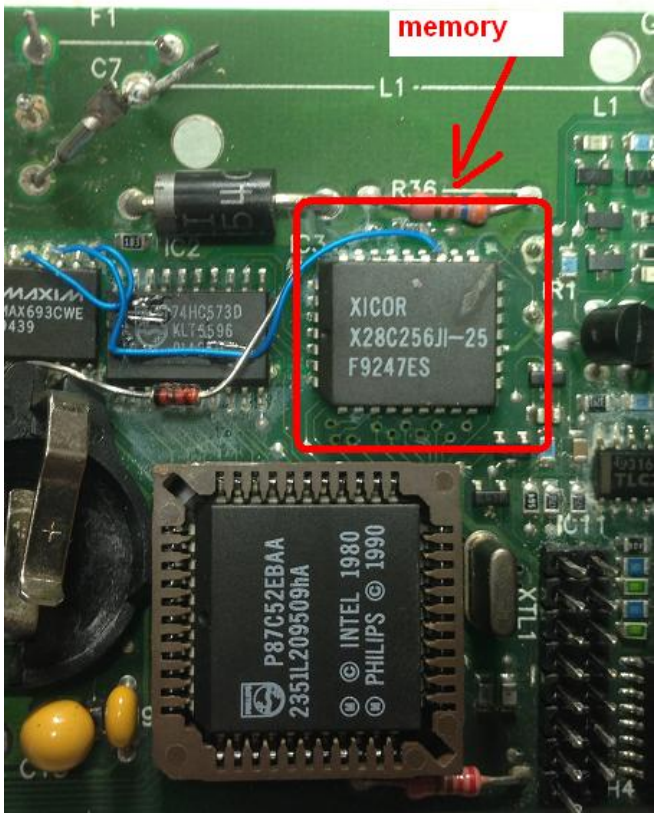


Figure 4. Insight GEM-1200 unit - internal inspection.

Figure 5. Memory chip in damaged Insight GEM-1200.



2.2.2. Insight GEM-1200 Data Description

The data extracted included 7 flights numbered from 654 through 660 by the GEM-1200 data download software. The algorithm used by GEM to assign flight numbers is not dependent upon takeoff and landings; rather, the flight numbers are assigned based upon logical states, such as power cycles to the GEM unit.

Each flight downloaded had a GEM assigned date and each datapoint had a GEM assigned time. Due to unit damage, the accuracy of the dates and times could not be determined; as such, for the rest of this report, dates and times are reported as “GEM reported time.” The 7 flights downloaded were on May 9, 2013, and May 24, 2013, GEM reported time.

2.2.3. Insight GEM-1200 Parameters Provided

Table 1 describes data parameters provided by the GEM-1200.

Table 1: Insight GEM-1200 Data Parameters

Parameter Name	Parameter Description
RCHT # (degF*)	Right Engine Cylinder Head Temperature, cylinder 1-6
LCHT # (degF)	Left Engine Cylinder Head Temperature, cylinder 1-6
REGT # (degF)	Right Engine Exhaust Gas Temperature, cylinder 1-6
LEGT # (degF)	Left Engine Exhaust Gas Temperature, cylinder 1-6
RTIT1 (degF)	Right Engine Turbine 1 Inlet Temperature
LTIT1 (degF)	Left Engine Turbine 1 Inlet Temperature
RTIT2 (degF)	Right Engine Turbine 2 Inlet Temperature
LTIT2 (degF)	Left Engine Turbine 2 Inlet Temperature

*Degrees Fahrenheit.

3. PLOTS AND TABULAR DATA

Each of the figures 6 through 12 show each of the flights 654 through 660, respectively. Across all flights, the left engine EGT-4 recorded a constant value of 32 degF, and TIT2 for both engines recorded a constant value of 32 degF. Across all flights, the right engine CHT-2 recorded either 0 degF or erratic values. In flights 654, 655, 656, and 658, the left engine CHT-2 recorded erratic values. Some of the erratic right and left engine CHT-2 values exceeded the 500 degF maximum value of the vertical CHT plot scales.

Figure 6 shows flight number 654 that occurred on May 9, 2013 between 1647:11 and 1853:53 GEM recorded time; a duration of 2 hours and 6 minutes.

Figure 7 shows flight number 655 that occurred on May 9, 2013 between 1908:59 and 1947:23 GEM recorded time; a duration of 38 minutes.

Figure 8 shows flight number 656 that occurred on May 24, 2013 between 1538:39 and 1542:59 GEM recorded time; a duration of 4 minutes.

Figure 9 shows flight number 657 that occurred on May 24, 2013 between 1604:13 and 1613:43 GEM recorded time; a duration of 9 minutes.

Figure 10 shows flight number 658 that occurred on May 24, 2013 between 1615:50 and 1638:50 GEM recorded time; a duration of 22 minutes.

Figure 11 shows flight number 659 that occurred on May 24, 2013 between 1643:54 and 1654:06 GEM recorded time; a duration of 10 minutes.

Figure 12 shows flight number 660 that occurred on May 24, 2013 between 1838:49 and 1955:43 GEM recorded time; a duration of 1 hour and 17 minutes.

Tabular data used to generate figures 6 through 12 are included as Attachment 1 in electronic comma-delimited value (.CSV) format.

Figure 6. Insight GEM-1200 Flight 654.

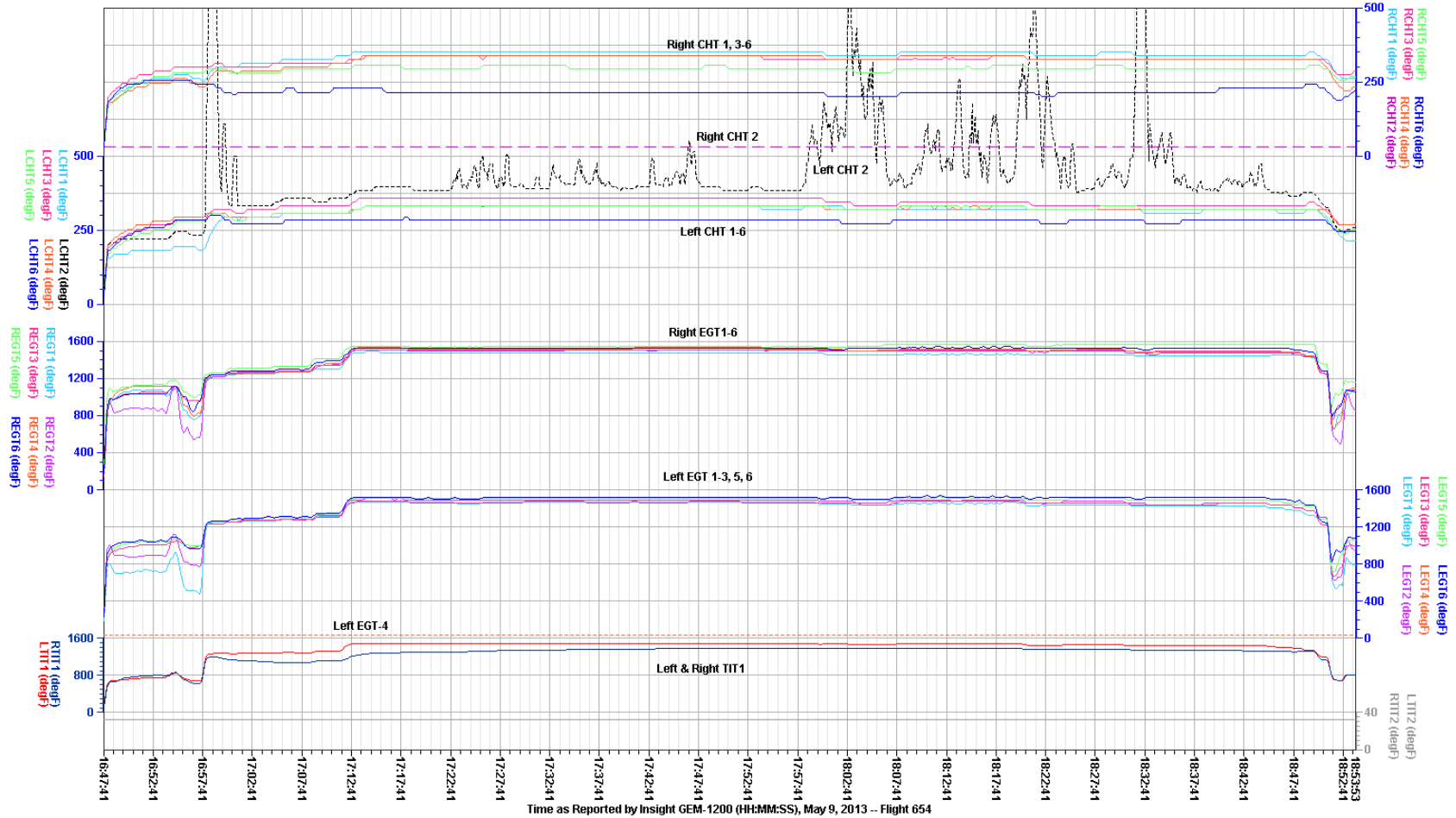


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Figure 7. Insight GEM-1200 Flight 655.

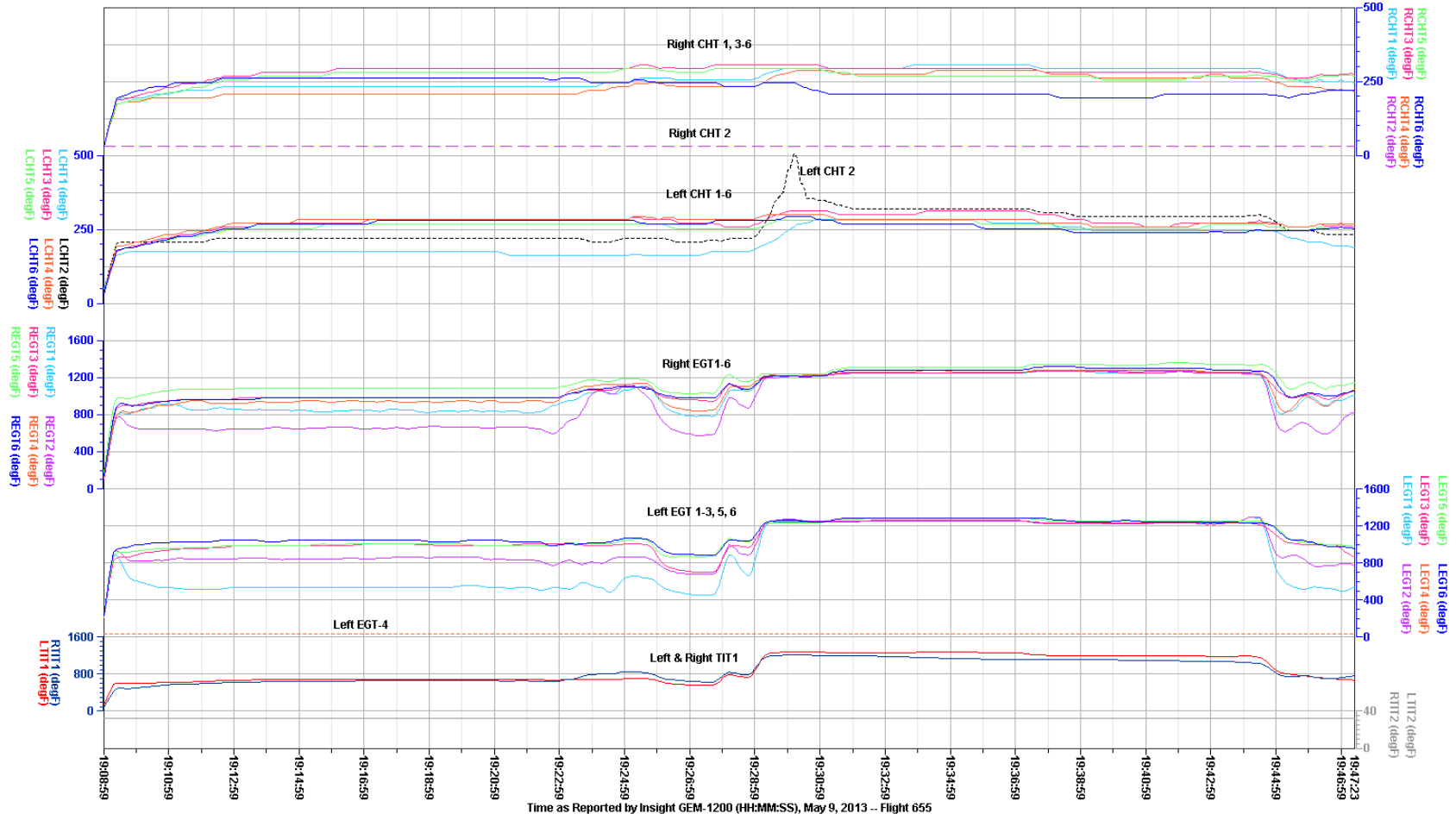

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Figure 8. Insight GEM-1200 Flight 656.

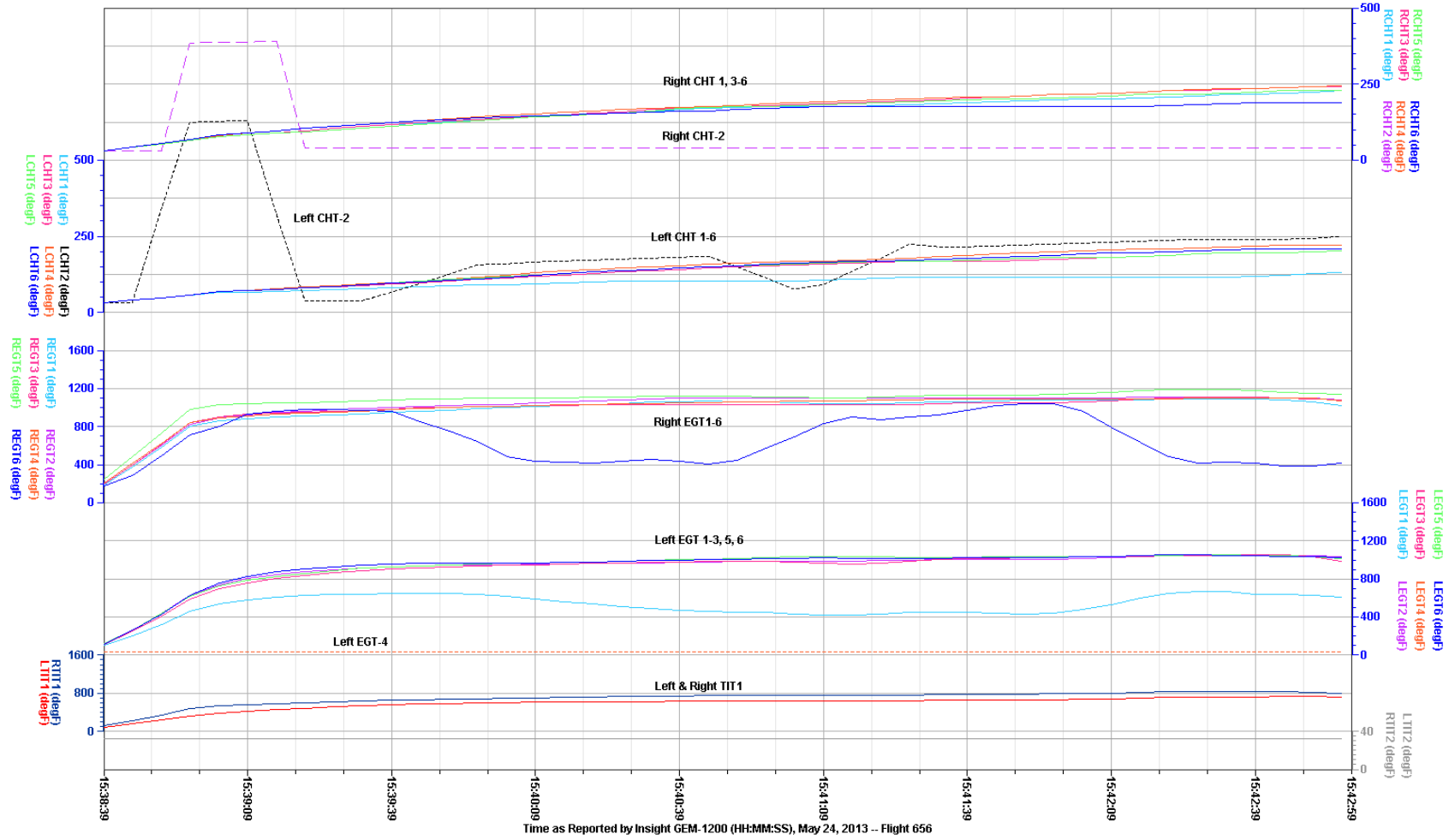

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Figure 9. Insight GEM-1200 Flight 657.

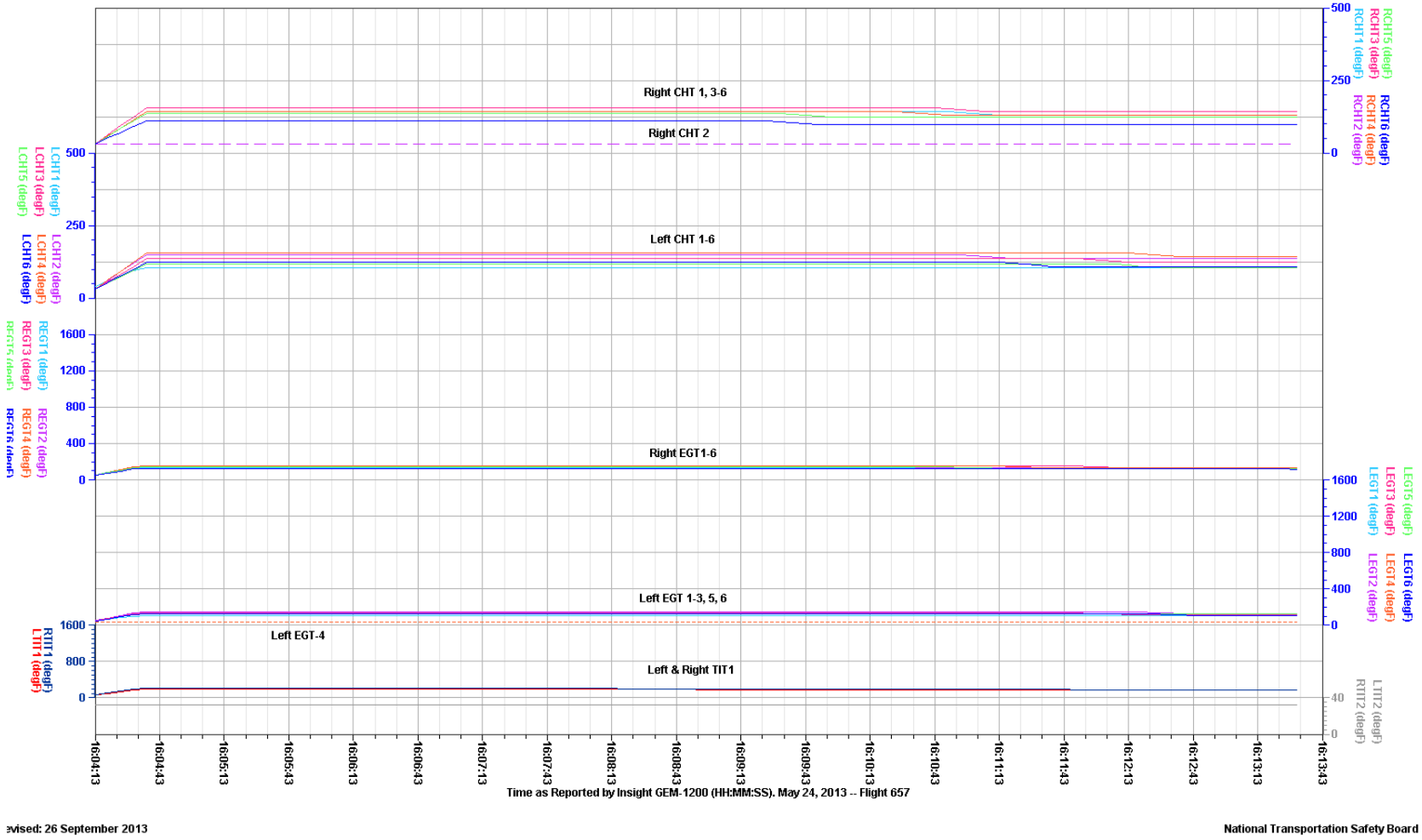

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Figure 10. Insight GEM-1200 Flight 658.

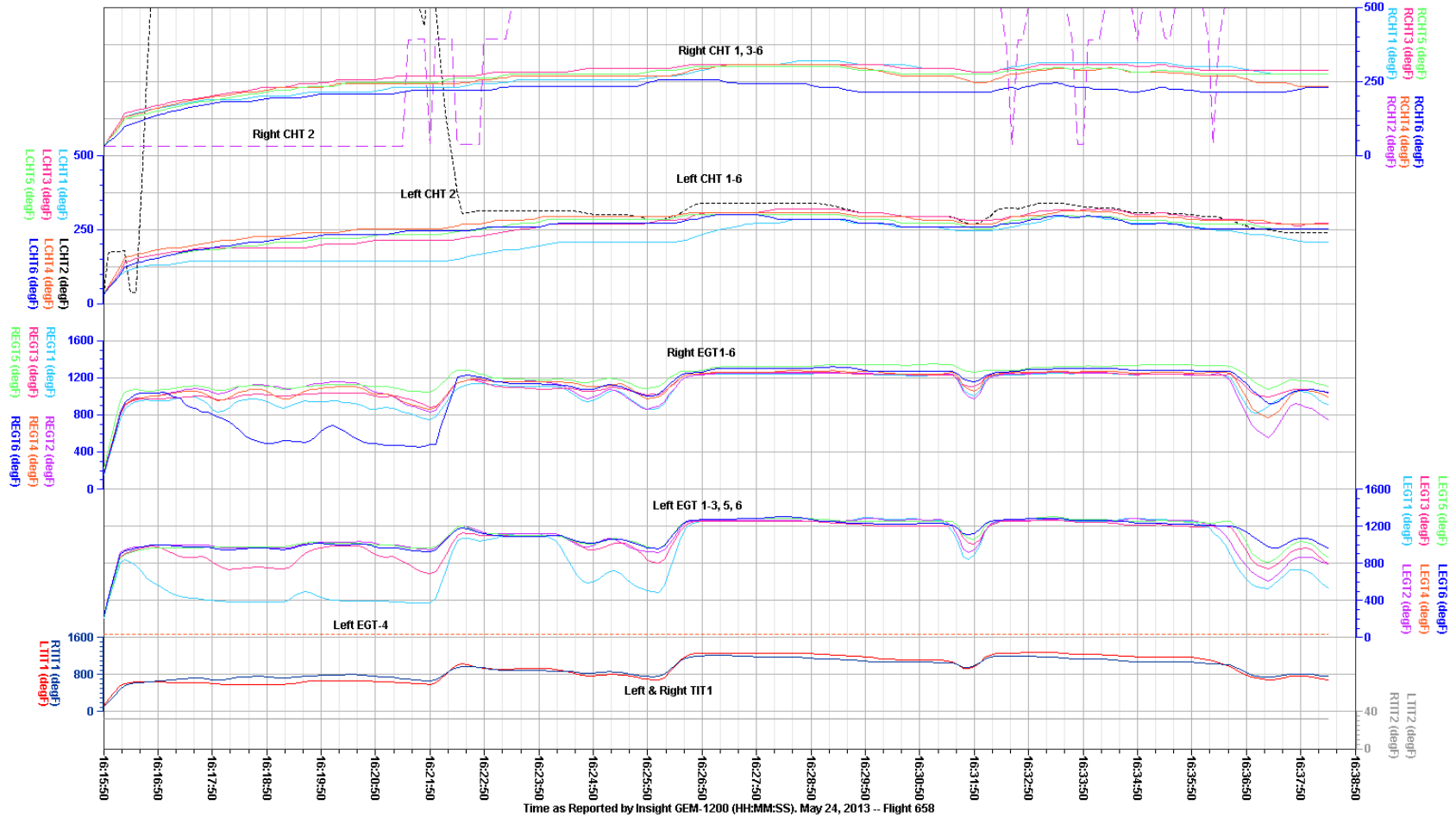

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Figure 11. Insight GEM-1200 Flight 659.

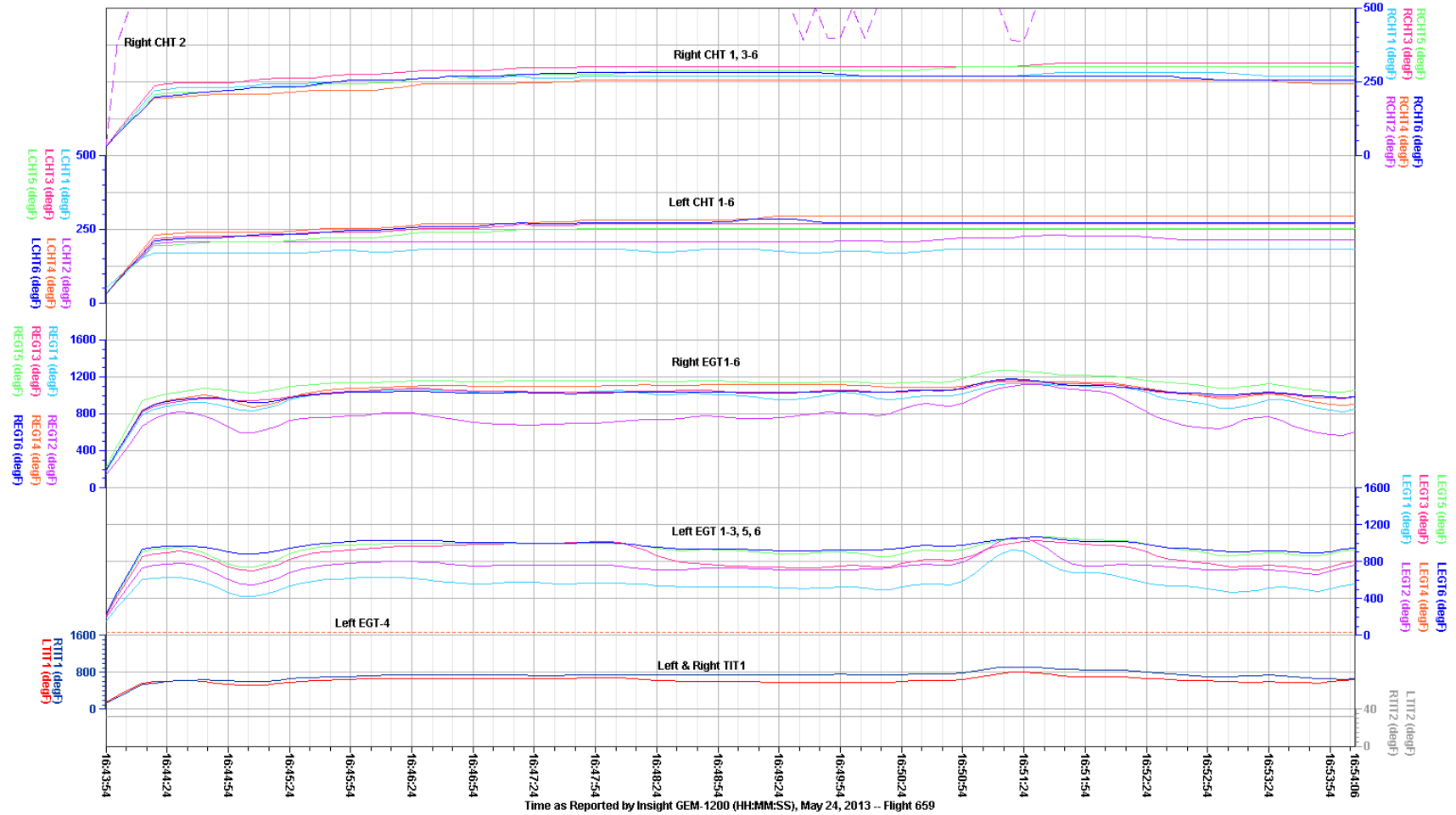

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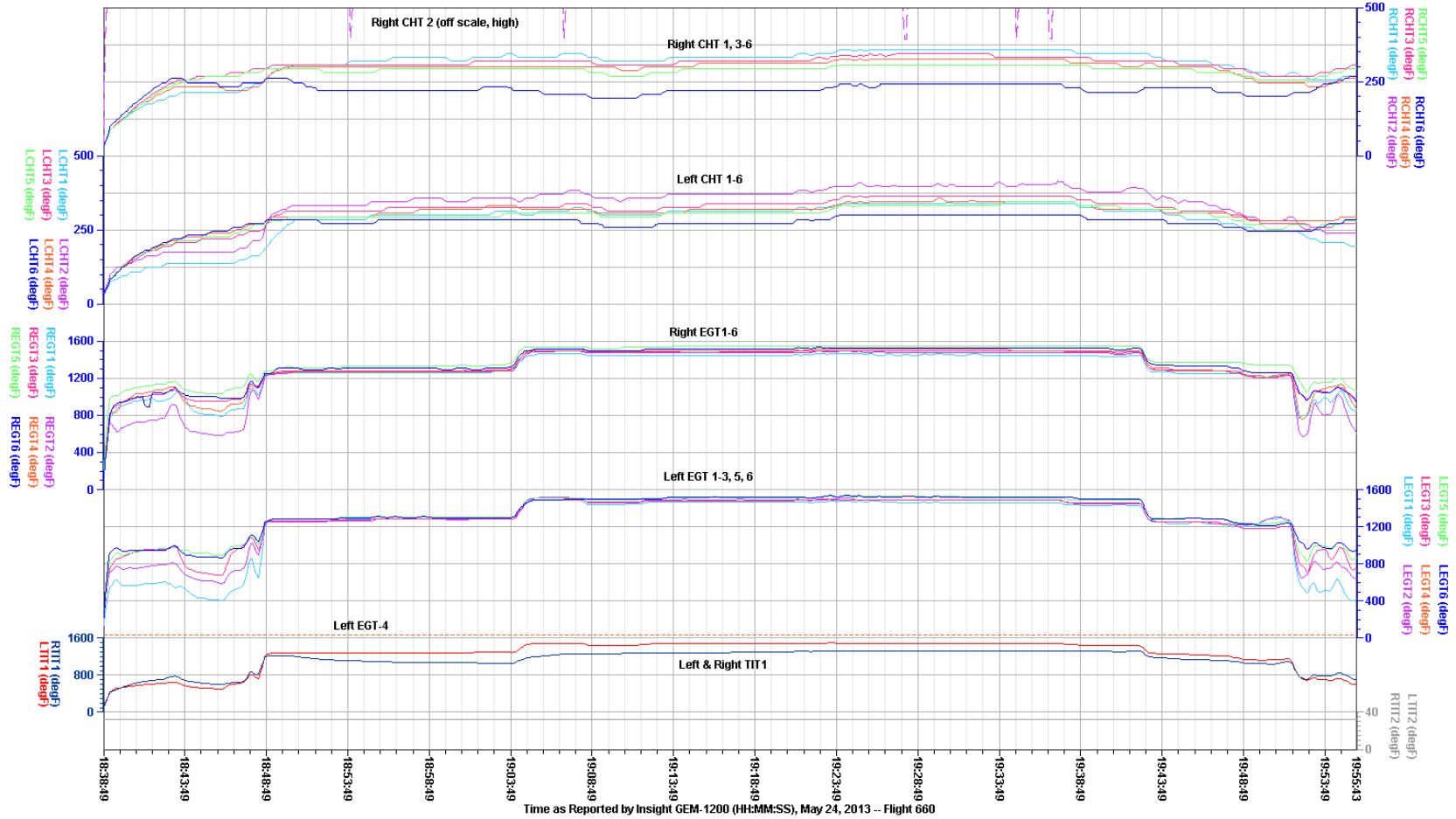
Figure 12. Insight GEM-1200 Flight 660.



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