

Capstone Project – Final Presentation

Date: December 8th, 2025



AGENDA

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Executive Summary & Key Recommendations

2

Project Overview & Client Questions

3

Team Recognition / Sponsors

4

Sale Performance & Recommendations (VMR)

5

Future Demand Patterns, Risks & Opportunities

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Executive Summary – Call to Action

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Q&A and Discussion



Situations

- KLESK needs a unified way to explain past performance, anticipate shifts, and plan for growth.
- This project provides tools and insight to support visibility, foresight, and strategic action.



Key Questions

- What can we learn from historical custom and part-level sales & profit performance?
- What can we confidently forecast about future demand patterns and risks?
- How do we identify and plan for revenue growth opportunities?

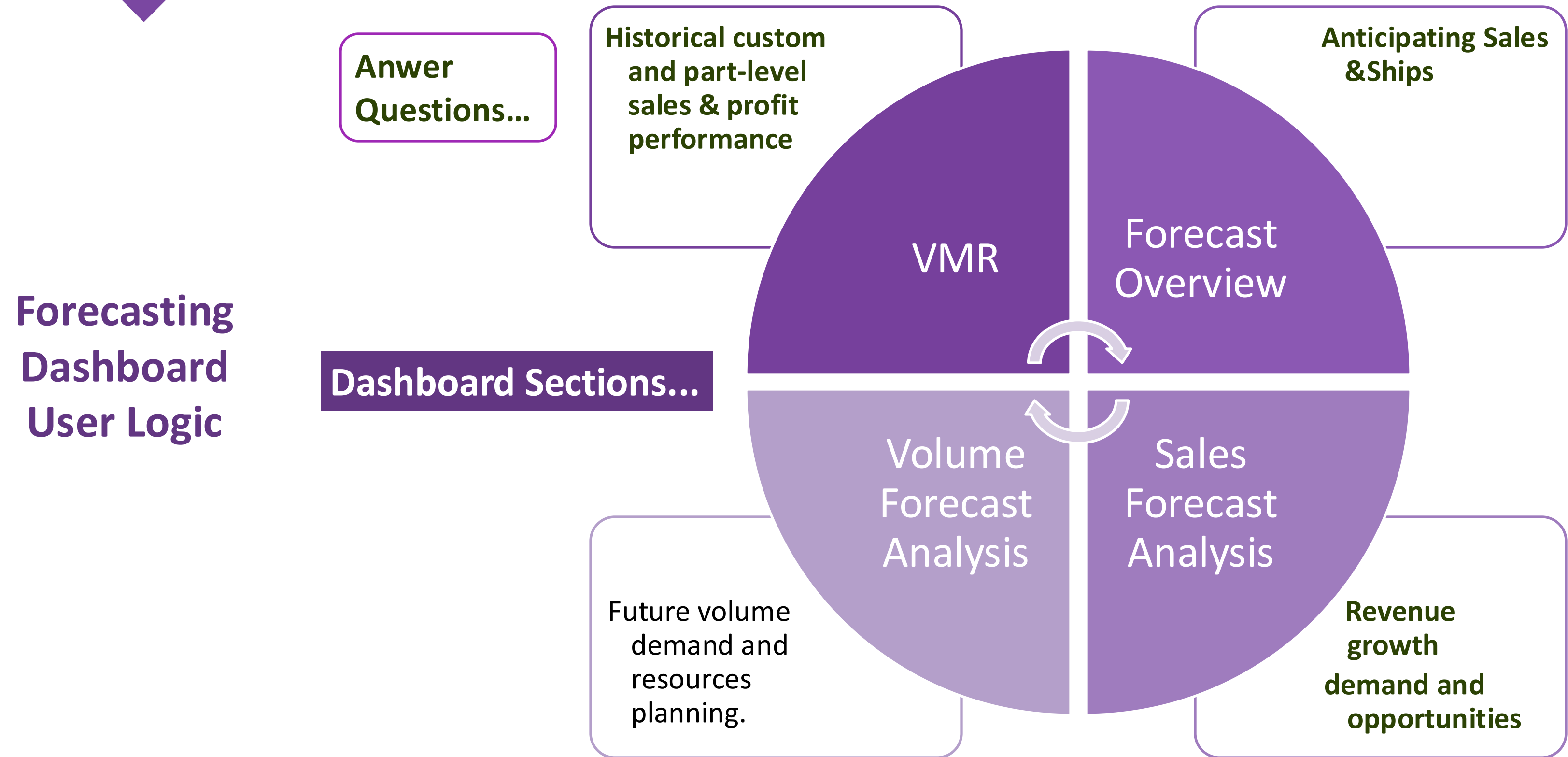


Recommendations

- **Institutionalize VMR Review**
Monthly waterfall-based reviews to monitor volume, mix, and rate drivers.
- **Strengthen Forecasting Use**
Quarterly forecast review to detect cycles early and engage accounts proactively.
- **Act on Underperforming & Downward-Trend Parts**
Apply targeted interventions such as pricing alignment, bundling, upsell strategies, or account outreach to stabilize volume and unlock incremental growth

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Project Overview & Client Questions

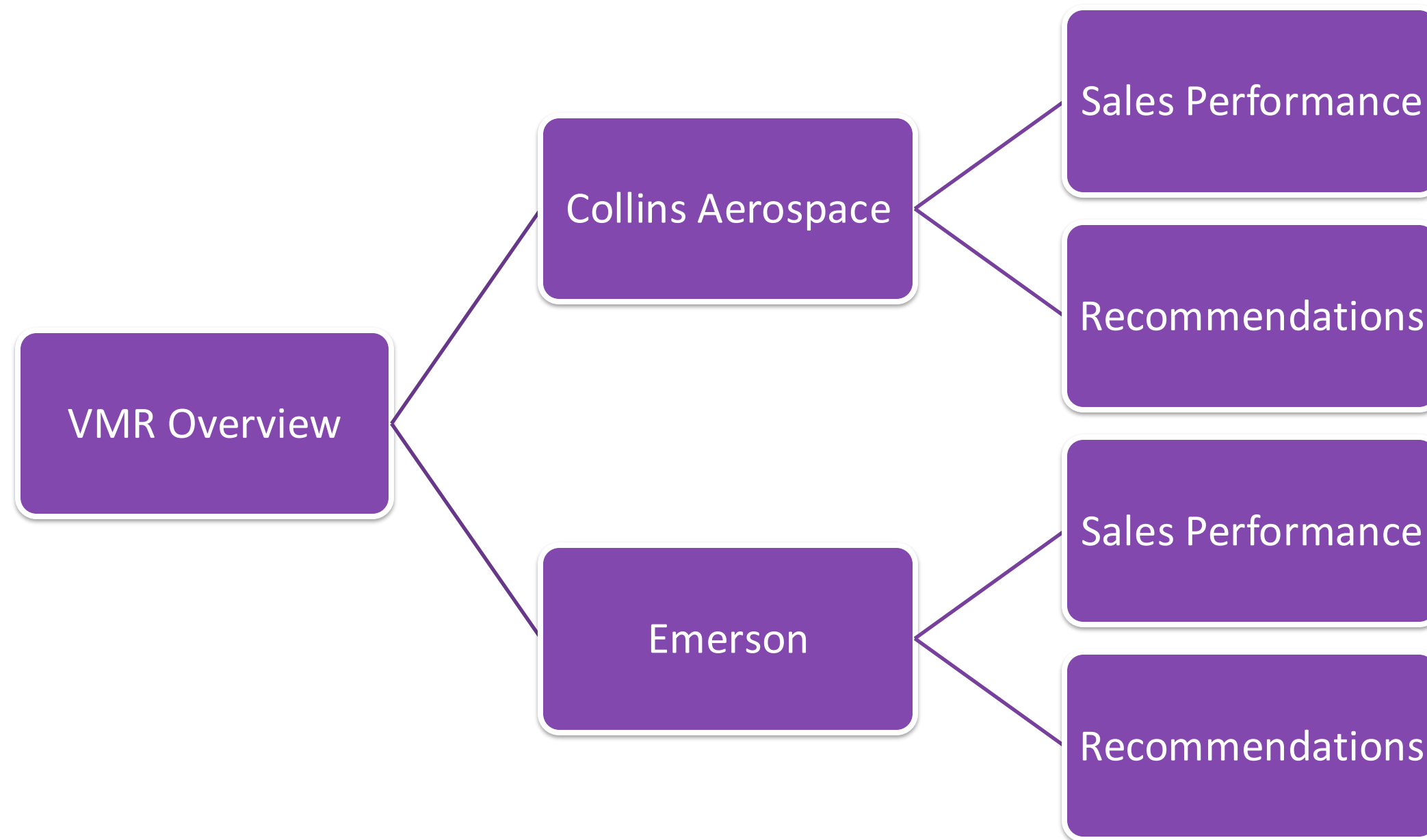


Forecast dashboards are designed to solve actual business questions, and the use can use the number from dashboards for higher executive need.

PROJECT TITLE: Performance & Forecasting: Customer and Part Number Volume, Rate and Mix
UST OPUS CAPSTONE – FALL 2025

3

Team Recognition / Sponsors



VMR Overview: Objectives and Structure

Objective

- Explain sales performance changes between two comparable periods (e.g., 2024 YTD vs.2025 YTD).
- Attribute total sales change to **Volume**, **Mix**, and **Rate** drivers.

Key Definitions V-M-R

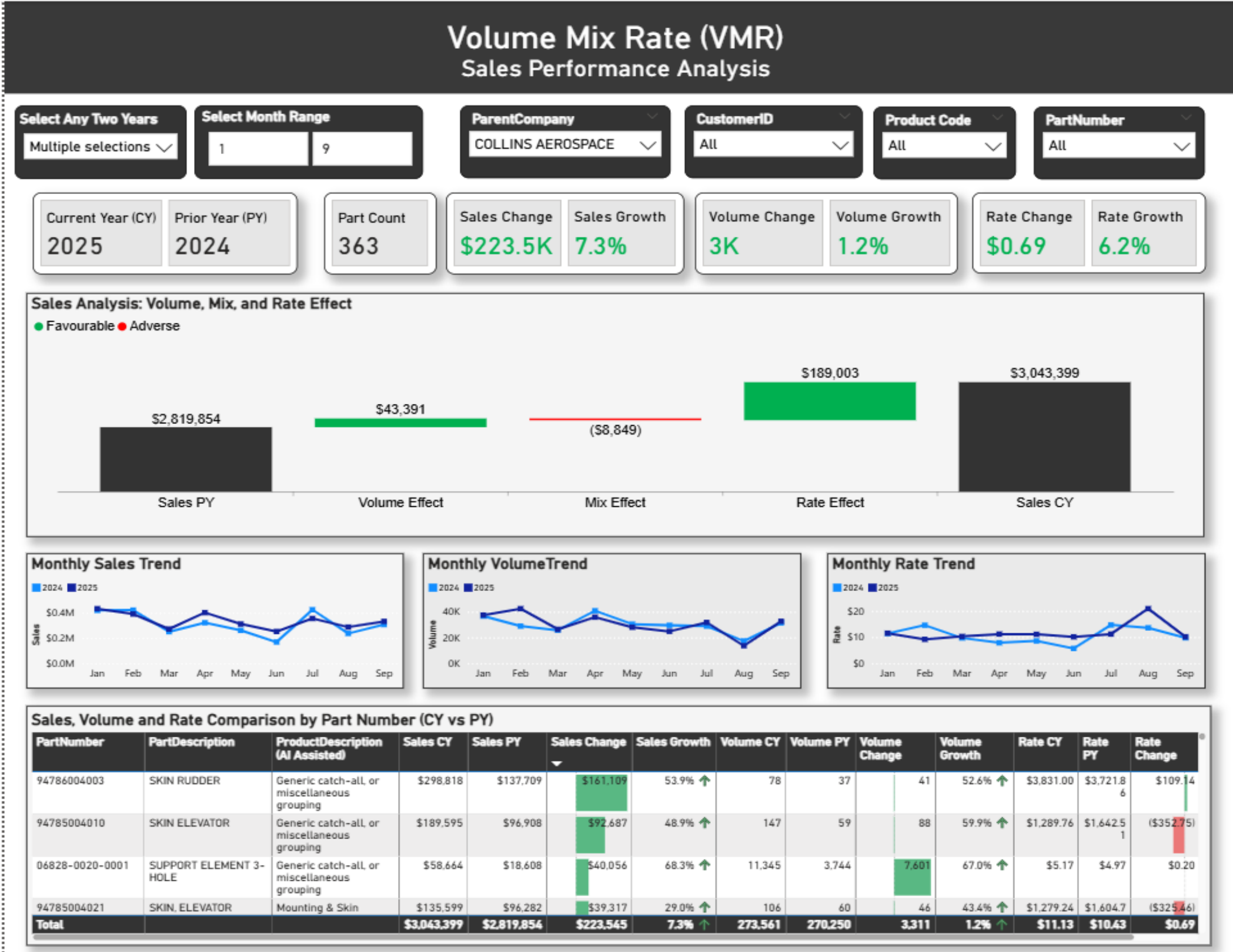
- V**olume**: Change in total units sold, valued at prior-period prices.
- M**ix**: Change in product or customer composition with different value profiles.
- R**ate**: Change in average selling price per unit (price effect).

Reporting & Implementation:

- **Dynamic filters** (Period comparison, Customer and Part Segments)
- **Waterfall chart** for Volume/Mix/Rate
- **Power BI integration** scalable for future enterprise integration

The project team has implemented the client-defined VMR framework in Power BI with robust, scalable calculation logic designed to support future expansion across KLESK's entire book of business.

VMR Overview: Volume-Mix-Rate (VMR) Dashboard Snapshot



VMR dashboard is designed for clarity and interactivity, combining high-level KPIs, visual breakdowns (waterfall and trend charts), and detailed tables with dynamic filters to enable comprehensive Volume, Mix, and Rate analysis across any two periods.

VMR: Collins Aerospace- - Sales Performance Analysis

- Years: **CY 2025 vs PY 2024**; Months **1–9**
- ParentCompany: **COLLINS AEROSPACE** | CustomerID: **All** | Product Code: **All** | PartNumber: **All**
- Part Count: 363

Select Any Two Years

Multiple selections ▾

Select Month Range

1

9

ParentCompany ▾

COLLINS AEROSPACE ▾

CustomerID ▾

All ▾

Product Code ▾

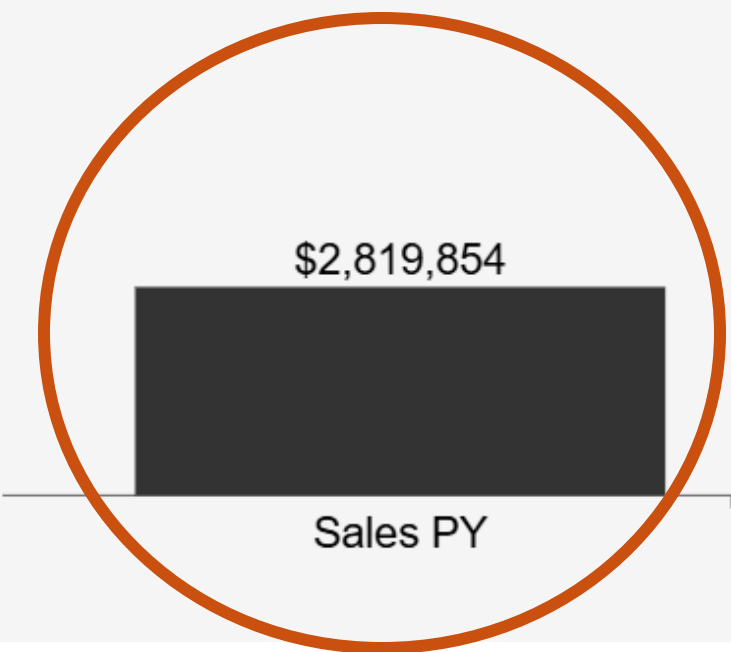
All ▾

PartNumber ▾

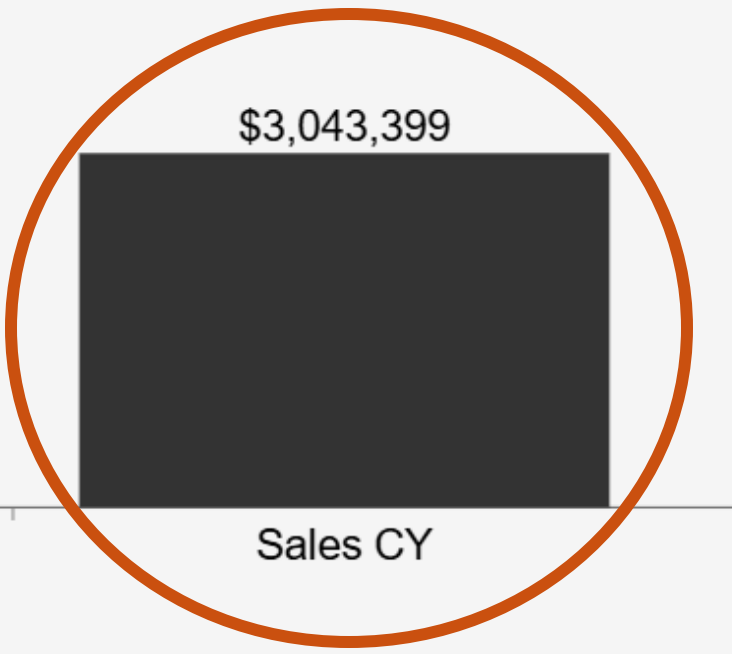
All ▾

Sales Analysis: Volume, Mix, and Rate Effect

● Favourable ● Adverse



Sales Change = Sales CY – Sales PY = \$223.5K



Collins' sales increased by \$223.5K from \$2,819,854 in the prior year (2024) to \$3,043,399 in the current year (2025).

VMR: Collins Aerospace- - Sales Performance Analysis

- Years: **CY 2025 vs PY 2024**; Months **1–9**
- ParentCompany: **COLLINS AEROSPACE** | CustomerID: **All** | Product Code: **All** | PartNumber: **All**
- Part Count: 363

Select Any Two Years
Multiple selections ▾

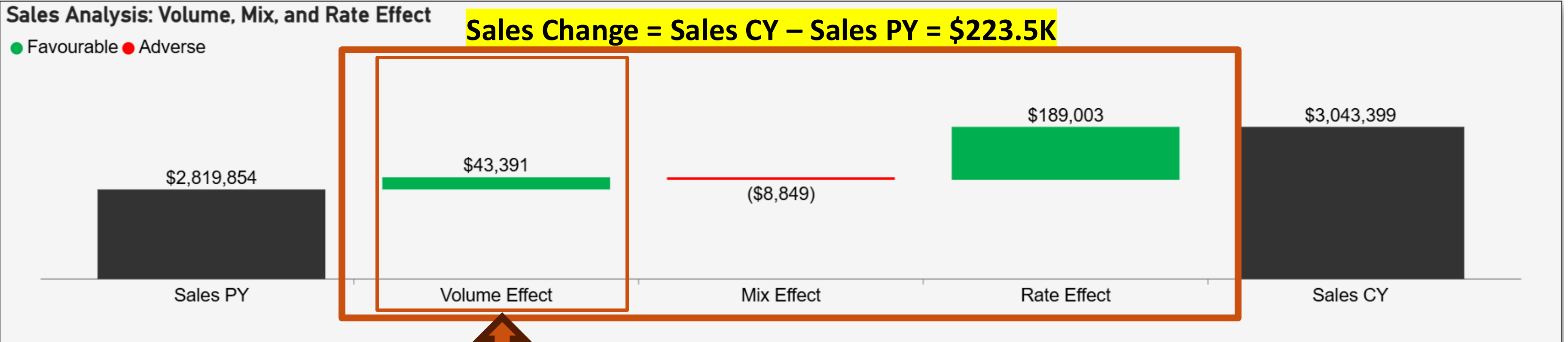
Select Month Range
1 9

ParentCompany
COLLINS AEROSPACE ▾

CustomerID
All ▾

Product Code
All ▾

PartNumber
All ▾



The Volume Effect contributed **\$43,391** to the overall sales increase

VMR: Collins Aerospace- - Sales Performance Analysis

- Years: **CY 2025 vs PY 2024**; Months **1–9**
- ParentCompany: **COLLINS AEROSPACE** | CustomerID: **All** | Product Code: **All** | PartNumber: **All**
- Part Count: 363

Select Any Two Years
Multiple selections ▾

Select Month Range
1 9

ParentCompany ▾
COLLINS AEROSPACE ▾

CustomerID ▾
All ▾

Product Code ▾
All ▾

PartNumber ▾
All ▾

Sales Analysis: Volume, Mix, and Rate Effect

● Favourable ● Adverse

Sales Change = Sales CY – Sales PY = \$223.5K



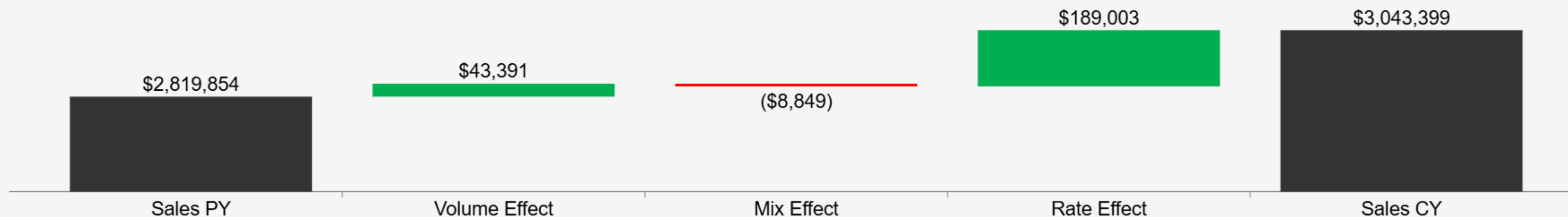
Price changes added **\$189,003** to sales (favorable), while product mix reduced sales by **\$8,849 (adverse)**, so pricing was the main driver of the overall increase.

VMR: Collins Aerospace- - Sales Performance Analysis

Current Year (CY) 2025		Prior Year (PY) 2024		Part Count 363	Sales Change \$223.5K	Sales Growth 7.3%	Volume Change 3K	Volume Growth 1.2%	Rate Change \$0.69	Rate Growth 6.2%
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Sales Analysis: Volume, Mix, and Rate Effect

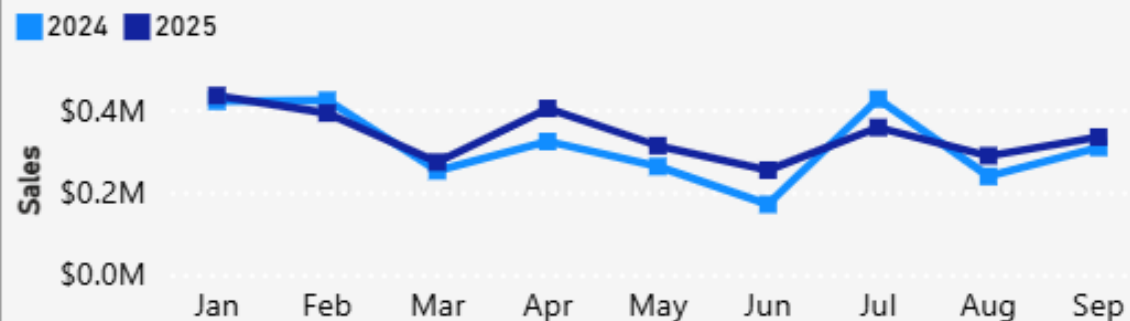
● Favourable ● Adverse



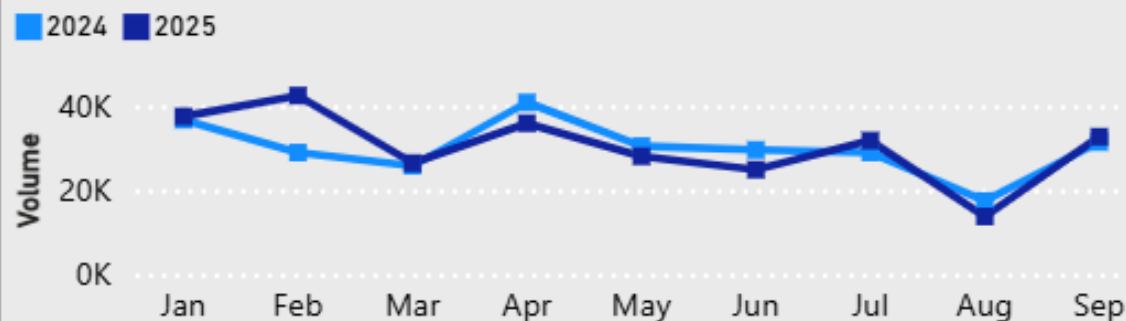
Sales grew by \$223.5K (7.3%), driven mainly by a 6.2% increase in rate, while volume growth was modest at 1.2%, showing that price improvement was the primary driver of overall performance.



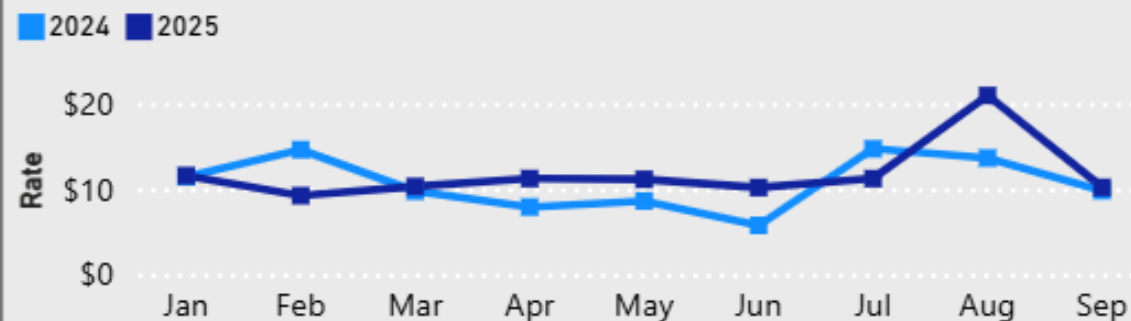
Monthly Sales Trend



Monthly Volume Trend



Monthly Rate Trend



Sales, Volume and Rate Comparison by Part Number (CY vs PY)

PartNumber	PartDescription	ProductDescription (AI Assisted)	Sales CY	Sales PY	Sales Change	Sales Growth	Volume CY	Volume PY	Volume Change	Volume Growth	Rate CY	Rate PY	Rate Change
94786004003	SKIN RUDDER	Generic catch-all, or miscellaneous grouping	\$298,818	\$137,709	\$161,109	53.9% ↑	78	37	41	52.6% ↑	\$3,831.00	\$3,721.86	\$109.14
94785004010	SKIN ELEVATOR	Generic catch-all, or miscellaneous grouping	\$189,595	\$96,908	\$92,687	48.9% ↑	147	59	88	59.9% ↑	\$1,289.76	\$1,642.51	(\$352.75)
06828-0020-0001	SUPPORT ELEMENT 3-HOLE	Generic catch-all, or miscellaneous grouping	\$58,664	\$18,608	\$40,056	68.3% ↑	11,345	3,744	7,601	67.0% ↑	\$5.17	\$4.97	\$0.20
94785004021	SKIN, ELEVATOR	Mounting & Skin	\$135,599	\$96,282	\$39,317	29.0% ↑	106	60	46	43.4% ↑	\$1,279.24	\$1,604.70	(\$325.46)
Total			\$3,043,399	\$2,819,854	\$223,545	7.3% ↑	273,561	270,250	3,311	1.2% ↑	\$11.13	\$10.43	\$0.69

Sales, volume, and rate trends stayed relatively stable month to month, with overall growth driven by a few high-performing parts

VMR: Collins Aerospace- - Sales Performance Summary

- **Sales Growth Overview**

Sales increased by \$223.5K, a 7.3% rise compared to last year, driven mainly by pricing adjustments.

- **Impact of Rate Effect**

Rate Effect contributed \$189K, about 85% of growth, demonstrating successful price strategy implementation.

- **Volume and Mix Effects**

Volume growth added \$43.4K from 3,000 units; Mix Effect reduced sales by \$8.8K due to product shifts.



Collins' sales grew 7.3% mainly because prices improved (rate +\$189K \approx 85% of growth), with a small boost from volume and a slight drag from product mix.

VMR: Collins Aerospace- - Recommendations

- **Establish Monthly VMR Reviews**

Set up monthly VMR review process using waterfall charts and variance alerts to maintain visibility and improvement.

- **Leverage Pricing Strategy Further**

Since 85% of growth came from rate effect, continue refining pricing models and explore dynamic pricing to maximize revenue.

- **Boost Volume Growth**

Volume added \$43.4K, but there's room for improvement. Consider targeted marketing or expanding production capacity to increase unit sales.

- **Address Mix Effect Losses**

Mix effect reduced sales by \$8.8K due to product shifts. Analyze product portfolio and customer preferences to optimize mix and reduce negative impact.

- **Diversify Growth Drivers**

Current growth is heavily price-driven. Invest in innovation and customer experience to create sustainable, long-term growth beyond pricing adjustments.

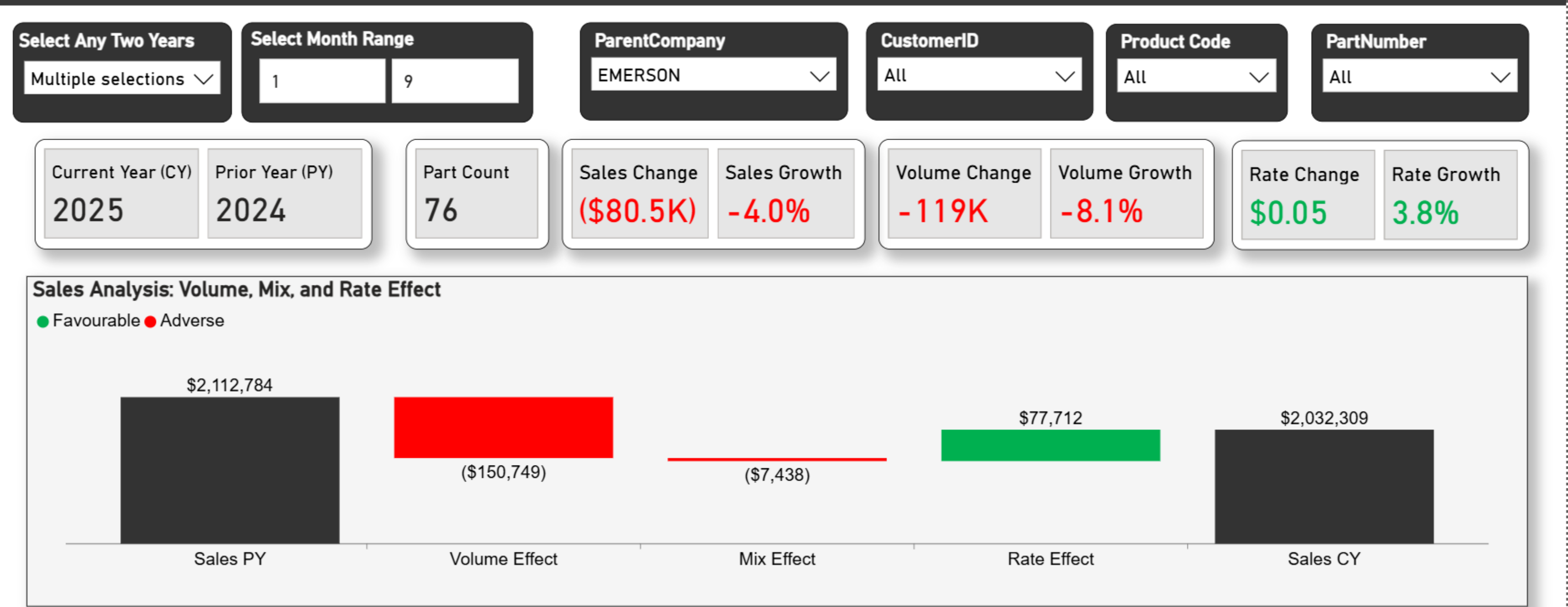
Focus on strengthening pricing strategies while improving volume growth and optimizing product mix to ensure balanced and sustainable sales performance.



EMERSON: RECOMMENDATIONS

Strategic advice to enhance performance and growth

VMR: Emerson - Sales Performance Overview



- **Sales Growth Overview**

Sales decreased by \$80.5K, a 4.0% decline compared to last year, mainly due to lower shipment volumes.

- **Impact of Rate Effect**

Rate Effect contributed +\$77.7K, showing that price adjustments helped offset some of the decline.

- **Volume and Mix Effects**

Volume Effect reduced sales by \$150.7K from 119K fewer units; Mix Effect further reduced sales by \$7.4K due to product composition changes.

VMR: Emerson - Recommendations

- **Establish Monthly VMR Reviews**

Set up monthly VMR review process using waterfall charts and variance alerts to maintain visibility and improvement.

- **Recover Volume**

Focus on increasing shipments through targeted promotions and improved supply chain efficiency.

- **Preserve Pricing Gains**

Maintain the positive rate effect by continuing strategic pricing without heavy discounting.

- **Improve Product Mix**

Promote higher-margin products to offset mix-related losses.

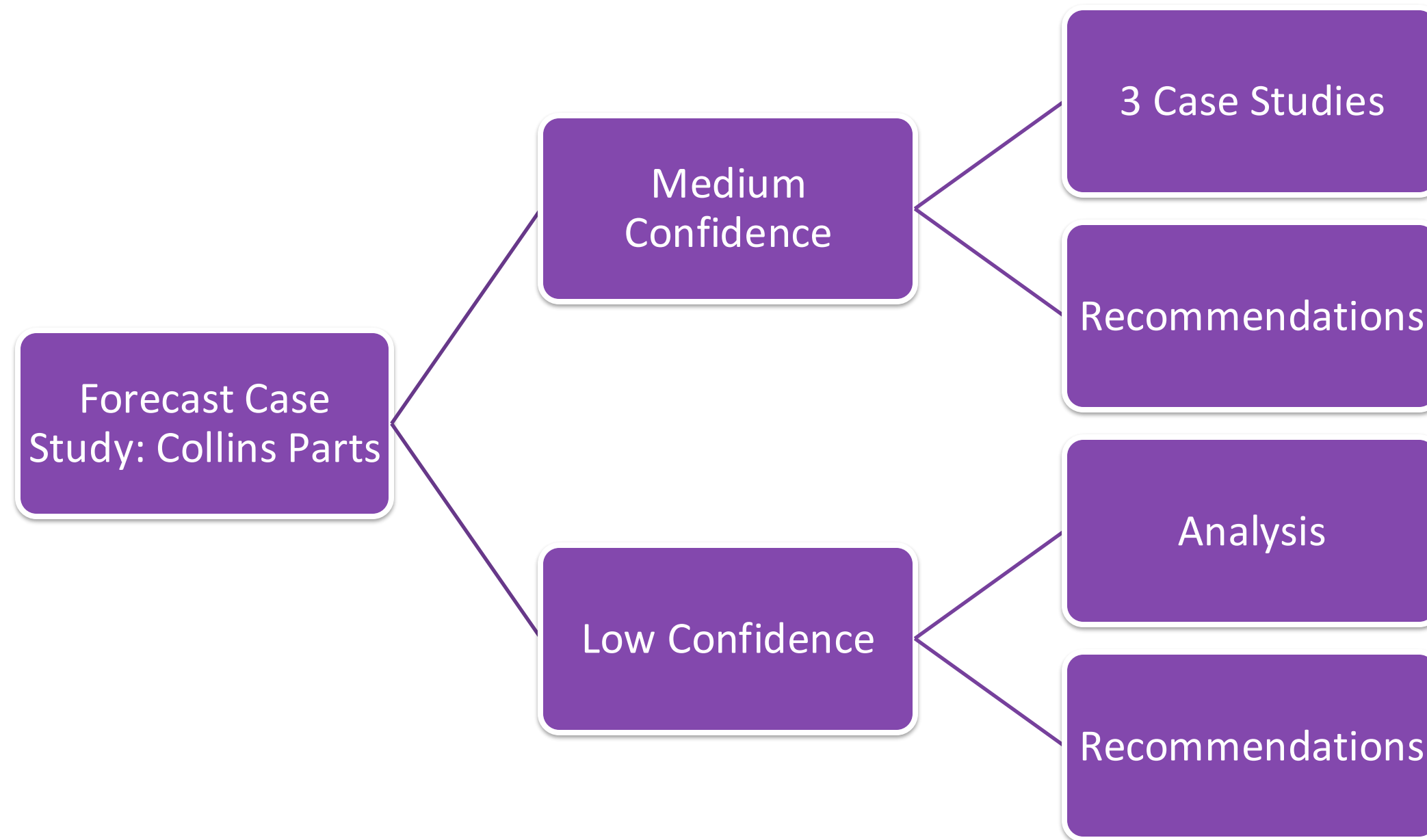
- **Strengthen Demand Planning**

Align inventory and production to prevent future volume shortfalls.

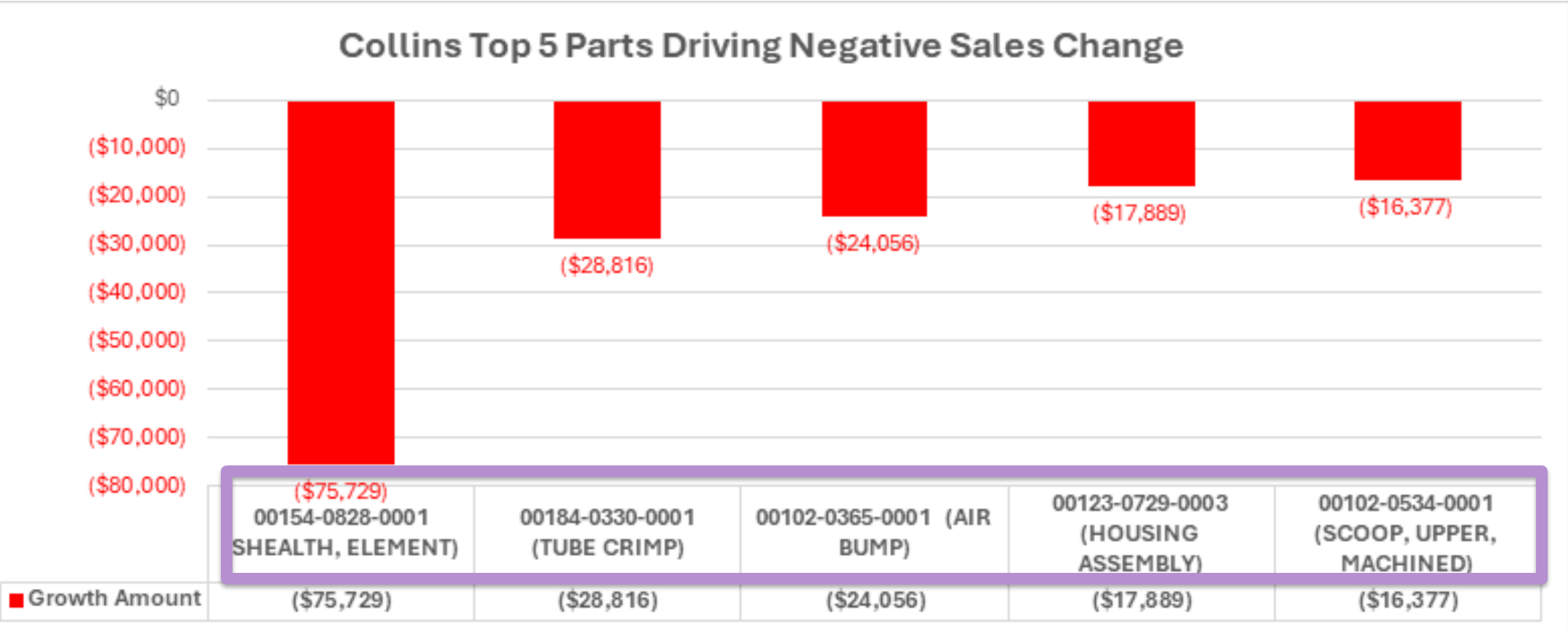
To reverse the sales decline, prioritize recovering shipment volumes while maintaining pricing gains and improving product mix for sustainable growth.

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Future Demand Patterns, Risks & Opportunities (Forecast)



Forecast Analysis: Collins Aerospace-Parts With Downward Trends

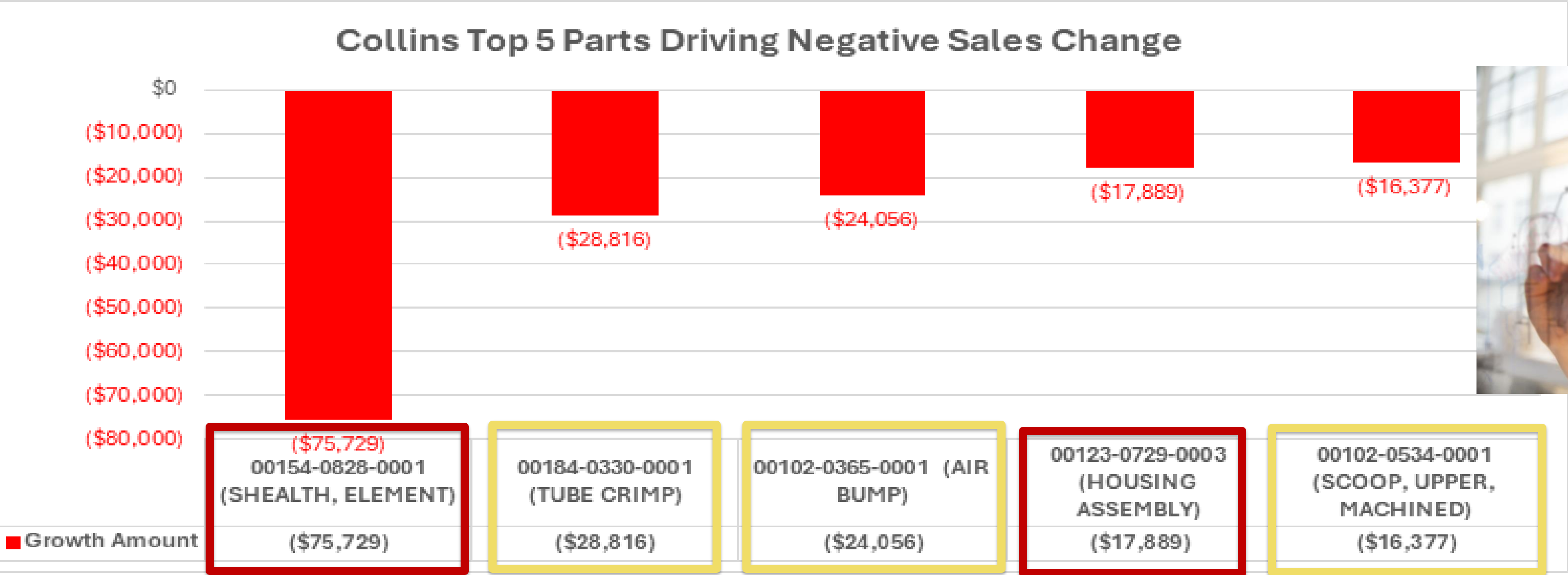


Why Downward Trend Parts?

- Showing downward demand or underperformance present **targeted improvement opportunities**
- Parts currently showing downward pressure or forecast uncertainty are **high-priority intervention candidates**
- Low-confidence and downward-trend parts are **signal flares**: the data highlights where corrective action can yield disproportionate return if acted upon early.

Focus attention on parts trending downward.
These segments require deliberate intervention — renewal conversations, product positioning, or stocking adjustments — to prevent erosion and unlock rebound potential.

Forecast Analysis: Collins Aerospace-Parts With Downward Trends



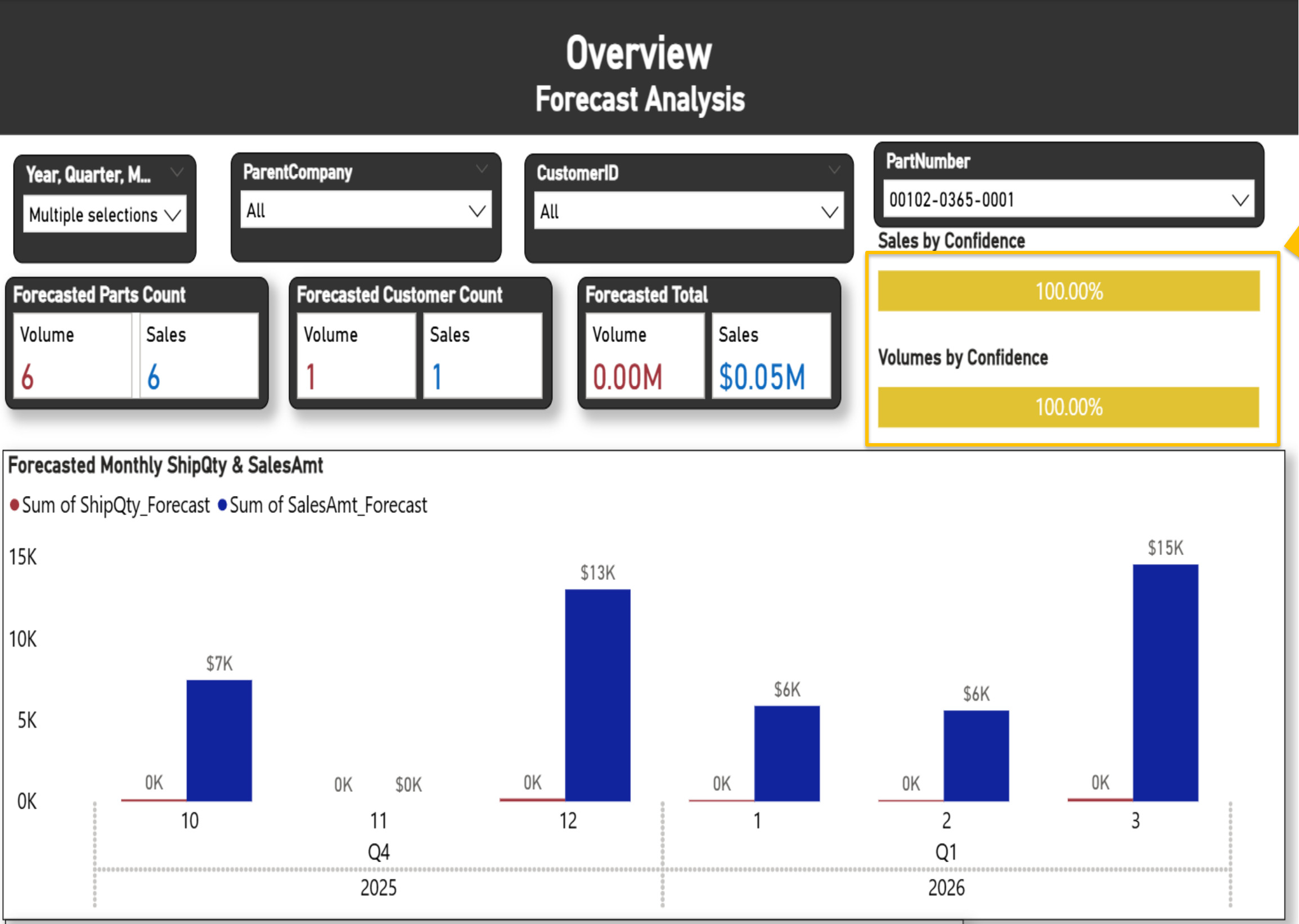
◆ Low Confidence Parts

◆ Median Confidence Parts

Although all five parts show negative growth, their confidence levels differ—low-confidence parts should be interpreted and acted on differently than median-confidence ones.



Forecast Analysis: Collins Aerospace- Medium Confidence Parts



Median Confidence ensures trustworthy forecasts.

The part shows a gentle but consistent downward trend across multiple Q1 cycles, suggesting demand has passed its peak and may be entering a lower phase of its multi-quarter seasonal cycle.

Monitor for continued softening—this part may be entering a long-term low in its multi-year cycle.

Forecast Analysis: Collins Parts- Medium Confidence Parts

Overview Forecast Analysis

Year, Quarter, M...
Multiple selections

ParentCompany
All

CustomerID
All

PartNumber
00102-0534-0001

Forecasted Parts Count

Volume	Sales
6	6

Forecasted Customer Count

Volume	Sales
1	1

Forecasted Total

Volume	Sales
0.00M	\$0.16M

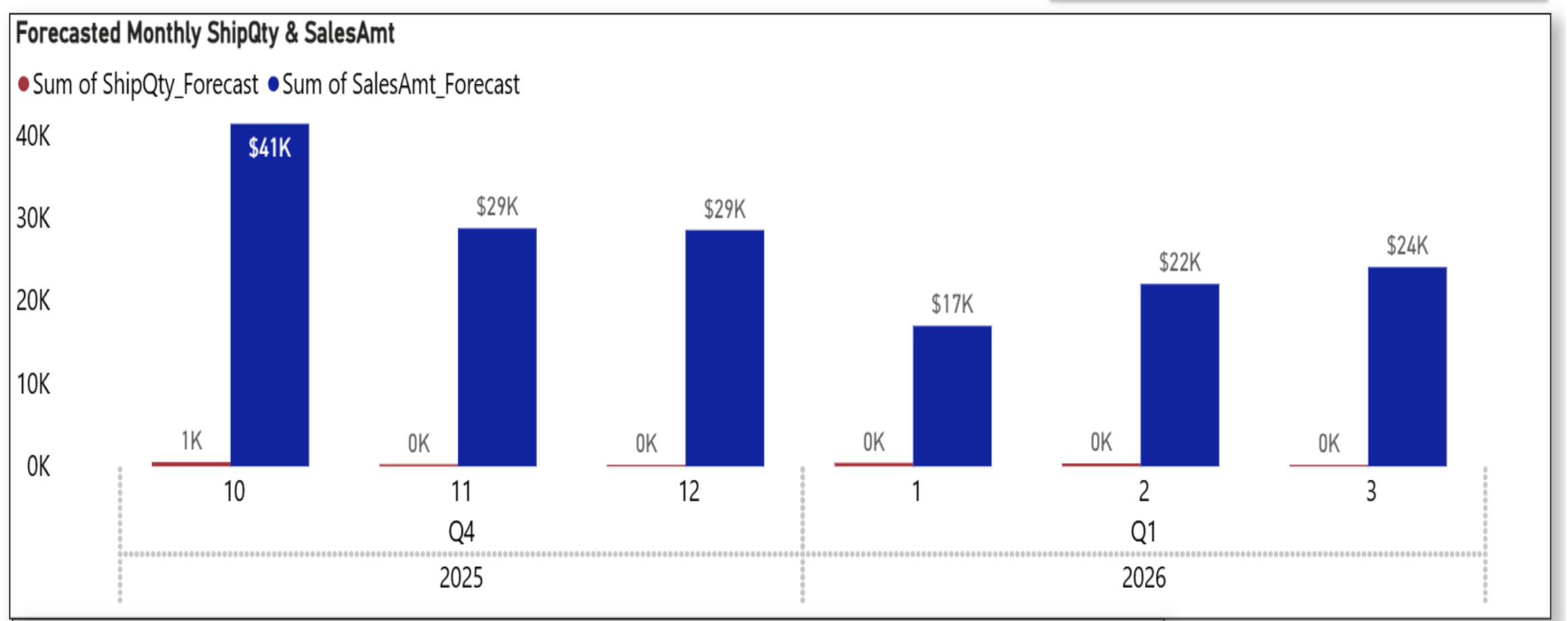
Sales by Confidence

100.00%

Volumes by Confidence

100.00%

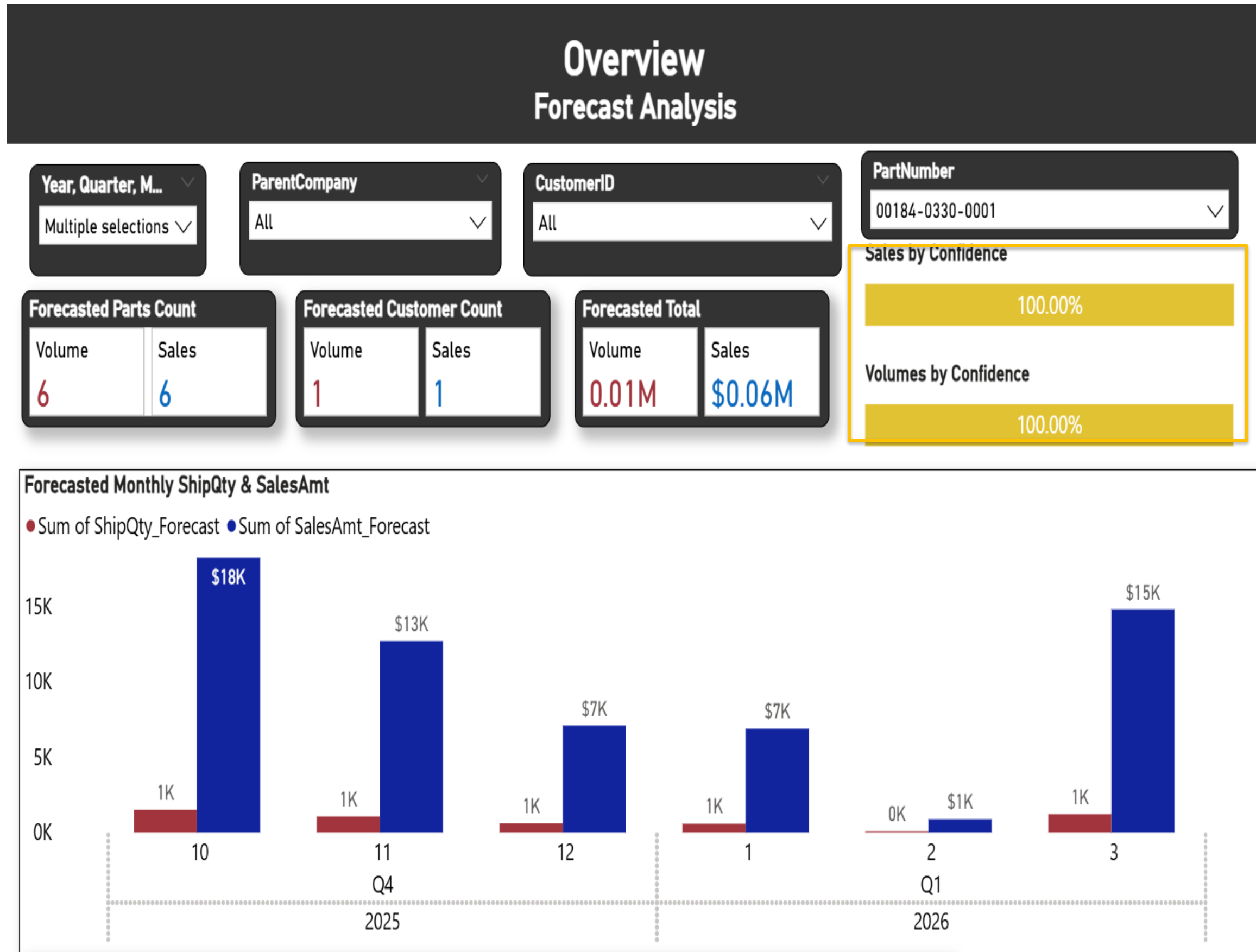
Median Confidence ensures trustworthy forecasts.



After peaking in 2024, this part appears to be moving through a normal demand cycle. Compared to prior Q1s, both volume and rate have returned to mid-range levels, indicating a softening but not a severe decline.

Stable mid-range performance suggests maintaining current levels with periodic quarterly review.

Forecast Analysis: Collins Aerospace- Medium Confidence Parts

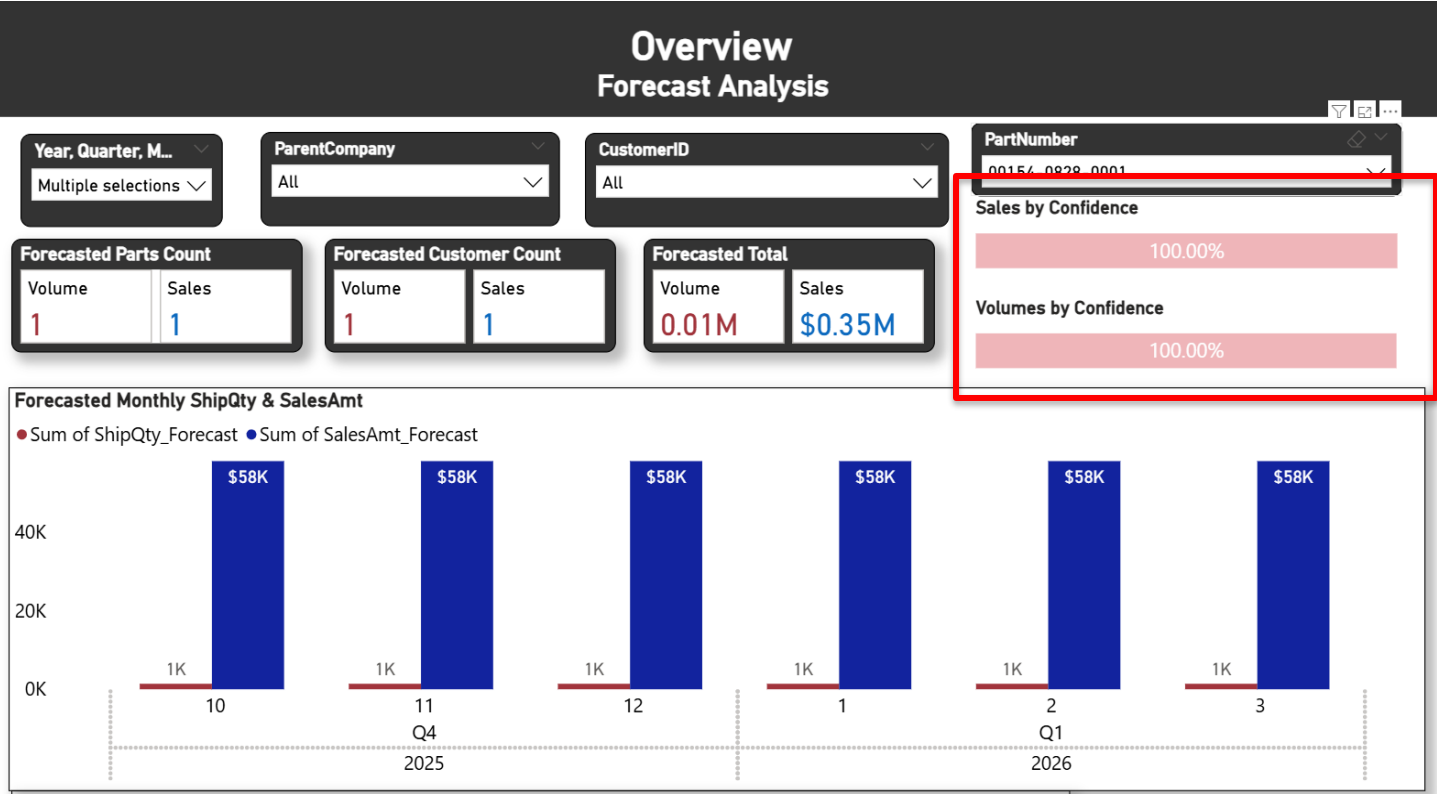
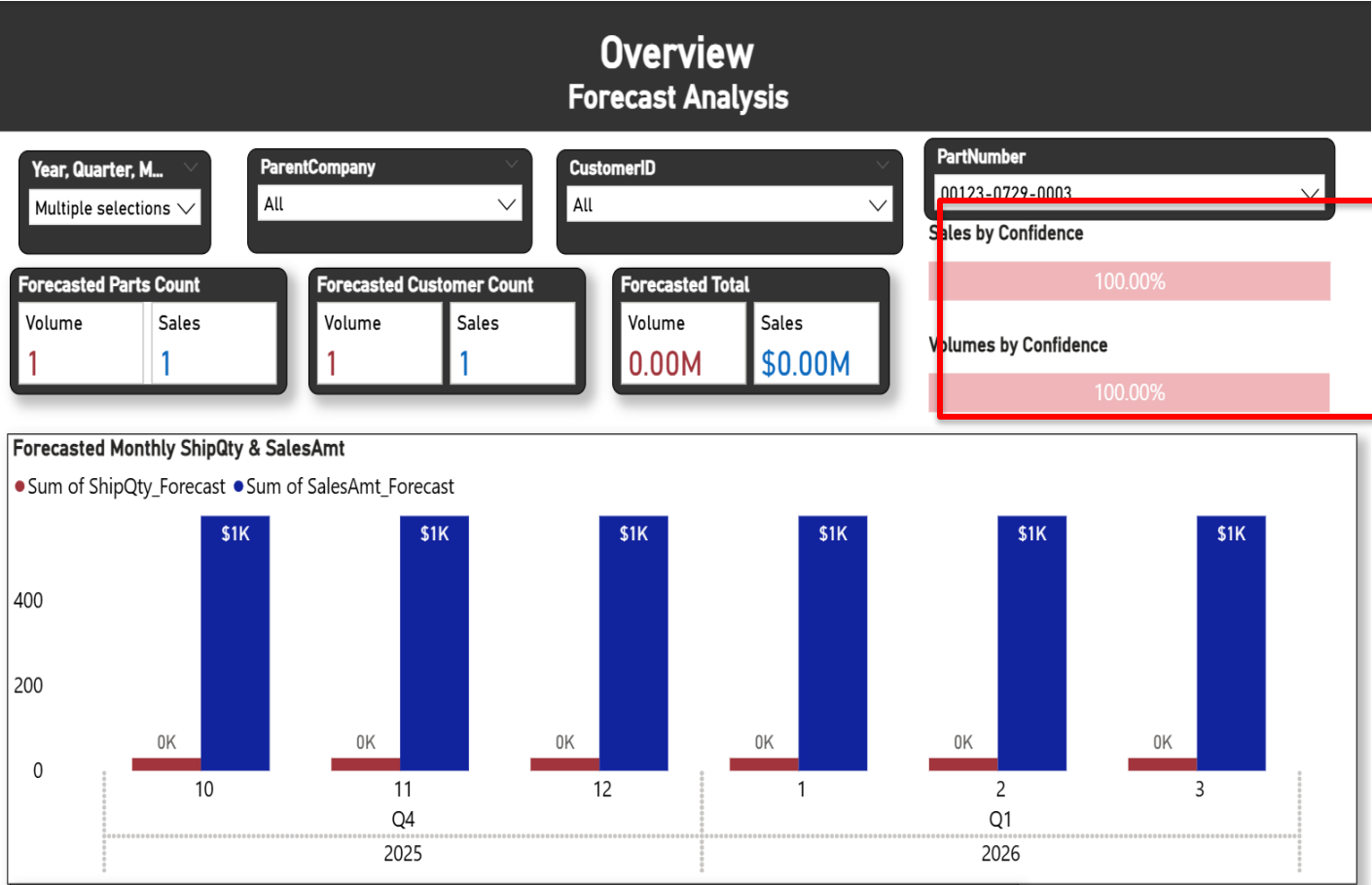


Median Confidence ensures trustworthy forecasts.

The product shows pronounced intra-quarter fluctuations, with Q1 demand historically dipping. While a decline is forecasted for 2026 Q1, the longer-term trend continues upward. This part warrants closer observation alongside Goodrich Bangali's demand signals.

Seasonal dips are normal—track Goodrich Bangalore closely as their demand drives this part.

Forecast Analysis: Collins Aerospace- Low Confidence Parts



Lower Confidence requires more data feeding

These parts exhibit low forecast confidence due to a small sample size. As more data becomes available, the underlying trend will become clearer and model accuracy will improve.



Low confidence reflects limited history—continue feeding data to improve model accuracy.

Forecast Analysis: Recommendations for Parts with Downward Trends

- **Establish Quarterly Forecast Reviews**

Set up quarterly forecast review process using line charts to visualize trends and detect forecast changes. When possible, refresh customer forecast making a blended forecast available.

- **Anticipate Demand Shifts**

Start by reviewing forecasts for top parts and capturing the current forecast trend. Anticipate demand shifts and adjust production proactively.

- **Address Flagged Sales Gaps**

Next set the Growth Target in the What If dashboard for top parts. Flag sales gaps (red) and apply upsell or bundling strategies to offset losses. Engage key accounts early to assess demand changes, confirm discontinued parts, and explore alternative parts.

Focus on regular forecast reviews, anticipating demand shifts, and early engagement with key accounts.

Forecast Power BI Dashboard

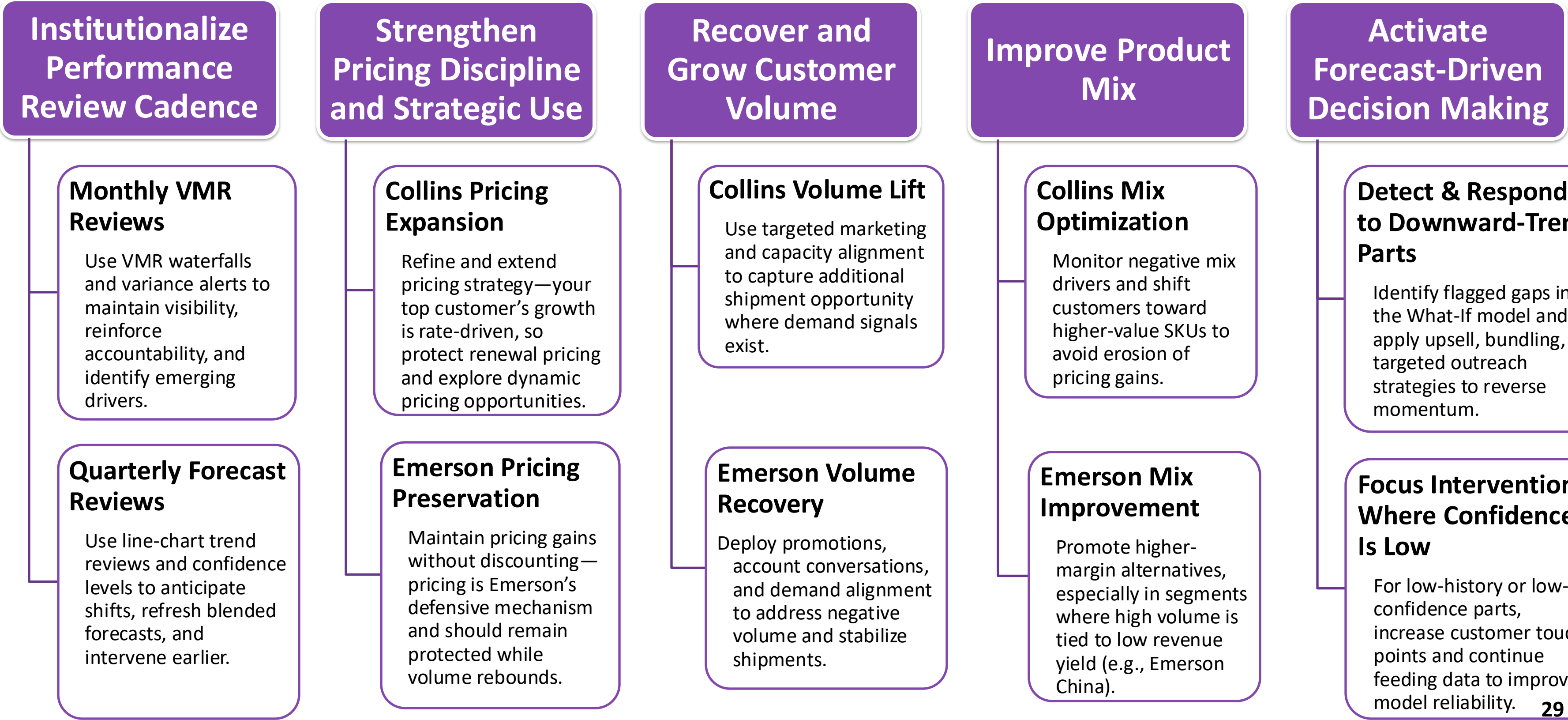
- Overall Dashboard Flow (**Executive** → **Analytical** → **Operational**)

Tab	Title	Purpose	Key Audience
Overview	Executive snapshot	Big-picture performance — combined SalesAmt & ShipQty with confidence context	Leadership
Volume Forecasts	Operational detail	Deep dive on ShipQty (volumes, confidence, regions)	Operations / Planning
Sales Forecasts	Revenue detail	Deep dive on SalesAmt (revenue trends, customers, categories)	Sales / Finance
What-If	Scenario Growth vs Forecast	Revenue& Volume target/playground	Leadership/Sales /Finance

1. [Research](#)
2. [VMR](#)
3. [Forecast](#)
4. [What-If](#)



Executive Summary – Call to Action



8

Q&A and Discussion



1 RESEARCH

Historical Sales Data Review

1. Data Fields and Meaning

- ☐ **Customer Location:** For understanding the customer mix, is the **Bill-To State** more useful than the **Ship-To State**?
- ☐ **Part Information:**
 - What does "P/N" in the **PART-DESCRIPTION** column stand for (e.g., "P/N 78-8065-6044-3 BRACKET CLAMP")? Does this indicate a part number?
 - Is there a lookup table available to associate **PART-NUMBER** with its actual part name?

Both Bill & Ship – To State are useful.

PartManagement is the lookup table for a part name

Historical Sales Data Review - continued

1. Data Fields and Meaning – continued

☐ Should the "Warehouse Handling Fee" be included in the analysis of overall revenue?

5	CUST-NBR	CUST-NAME	INVOICE-DT	INVOICE-#	SALES-ORI	PART-NUM	PART-DESCRIPTION	SHIP-QTY	SALES-AMT
116	GLOBALTE	GLOBAL TEK (XI'AN) CO. LTD	1/16/2025	195559			WAREHOUSE HANDLING FEE FOR		3330.18
117	GLOBALTE	GLOBAL TEK (XI'AN) CO. LTD	1/22/2025	195648			WAREHOUSE HANDLING FEE FOR		3330.72
118									-----
119	Customer Total								6660.9

Removed "Warehouse Handling Fee"

Suggestion: Consider add a separate table, graphs and forecasting separately, because it has no Volume/ShipQty to report

Historical Sales Data Review - continued

2. Data Inconsistencies and Gaps

- ❑ **File Completeness** - 1994 data is not in the csv and Power BI. Can this be confirmed?
- ❑ **Returns/Adjustments:** The **SalesByCustomer 2025** file shows negative **Sales-Amt** for Space Exploration Tech without a corresponding adjustment in **SHIP-QTY**. Does a negative sales amount represent a return or an offset for a billing error?

5	CUST-NBR	CUST-NAM	INVOICE-DT	INVOICE-#	SALES-ORI	PART-NUM	PART-DESC	SHIP-QTY	SALES-AMT
447	SPACEX	SPACE EXPLORATION TECHNC	1/6/2025	195400	13489	A15483	01744108-001	571	816.53
448	spacex	SPACE EXPLORATION TECHNC	1/22/2025	1776	R2483		P/N 01800837-001		-1462.5
449	spacex	SPACE EXPLORATION TECHNC	1/22/2025	1777	R2483		P/N 01800837-001		-270
450	spacex	SPACE EXPLORATION TECHNC	1/22/2025	195641	R2483	A15492	01800837-001	750	1462.5
451	spacex	SPACE EXPLORATION TECHNC	1/22/2025	195655	R2483		P/N 01800837-001;METAL ISOLATION		270
452	spacex	SPACE EXPLORATION TECHNC	1/28/2025	1778	R2483		01800837-001		-3444.21
453	spacex	SPACE EXPLORATION TECHNC	1/28/2025	195701	R2483	A15492	01800837-001	1491	3444.21
454									-----
455	Customer Total								816.53

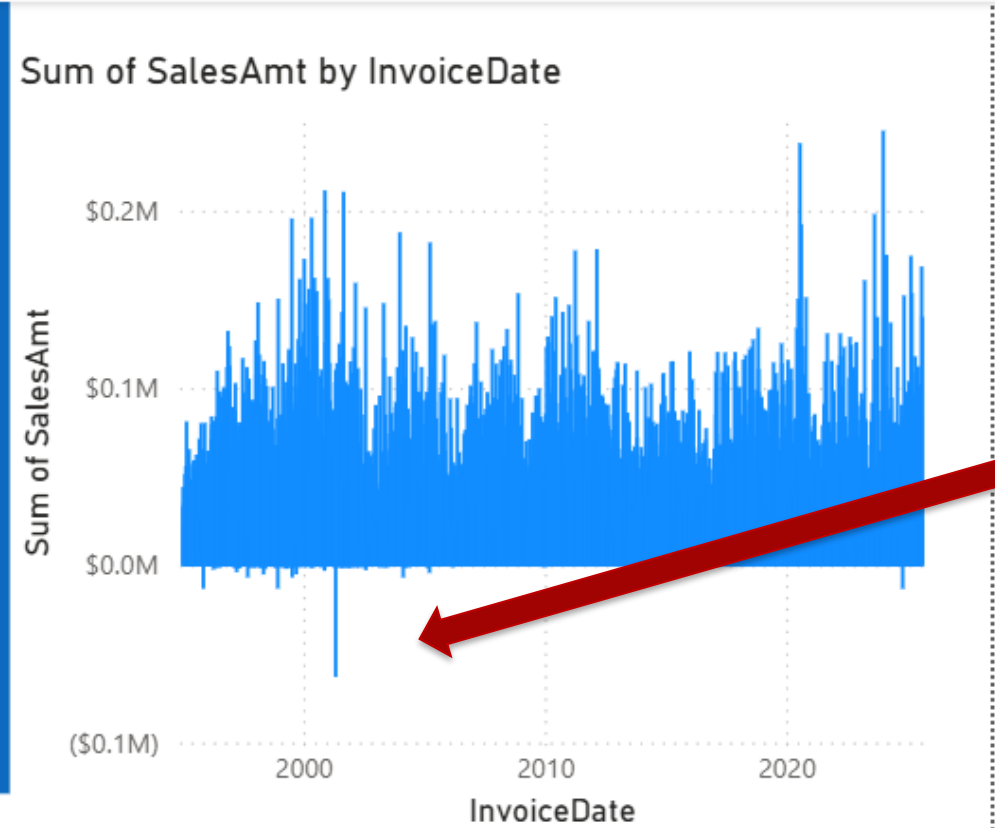
Team Note: PowerBI has duplicate names cleaned up, but State will need a similar clean-up

Note: There are several of these but understanding one will help me understand the others.

Removed records with a blank Ship-Qty. Similar to the Warehouse Handling Fees, consider a separate table and consider when to include/exclude them in the dashboard.

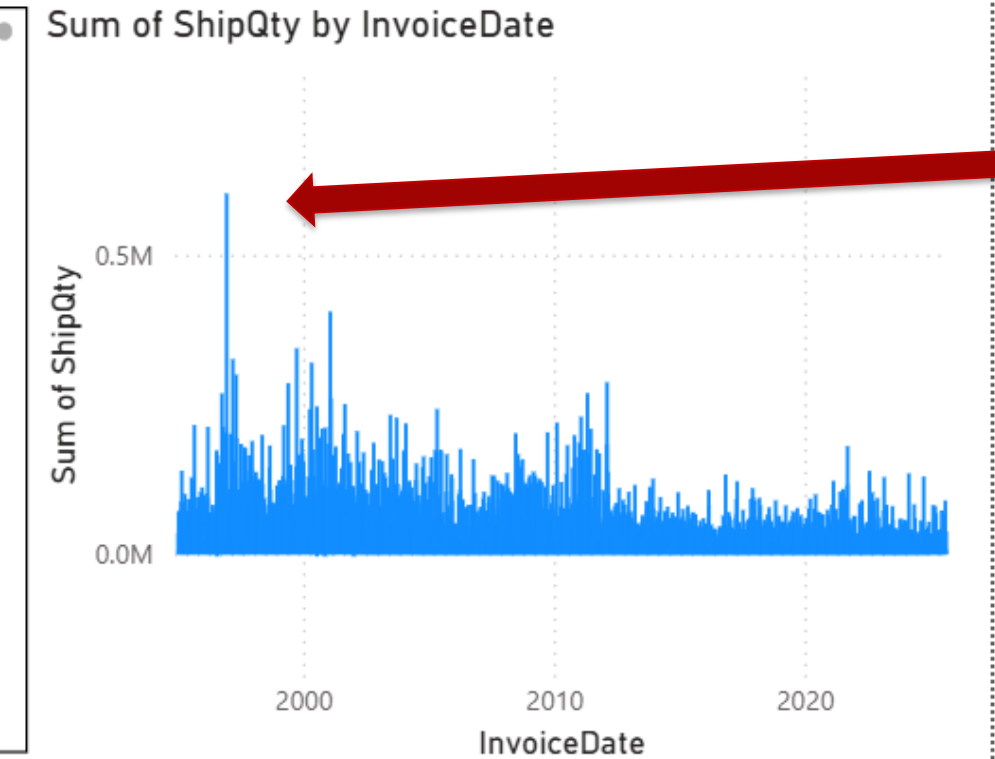


Historical Sales Data: Data Insights - Outliners



P/N records are negative outliers

CustomerName	InvoiceDate	CustomerPartNumber	ShipQty	SalesAmt
DENTSPLY PROFESSIONAL EAST	5/3/2001	P/N 90238 TIP & 80815 TIP BLANK		(\$62,795)
SURGICAL SOLUTIONS A GLOBAL	5/3/2001	P/N 213130-037 CLIP COMPONENT		(\$37)
3M COMPANY	5/3/2001	P/N 78-8065-8457-5 VARIFOCAL		(\$188)



Large order for \$0.02/part - not an outlier,
But last order Feb 2001

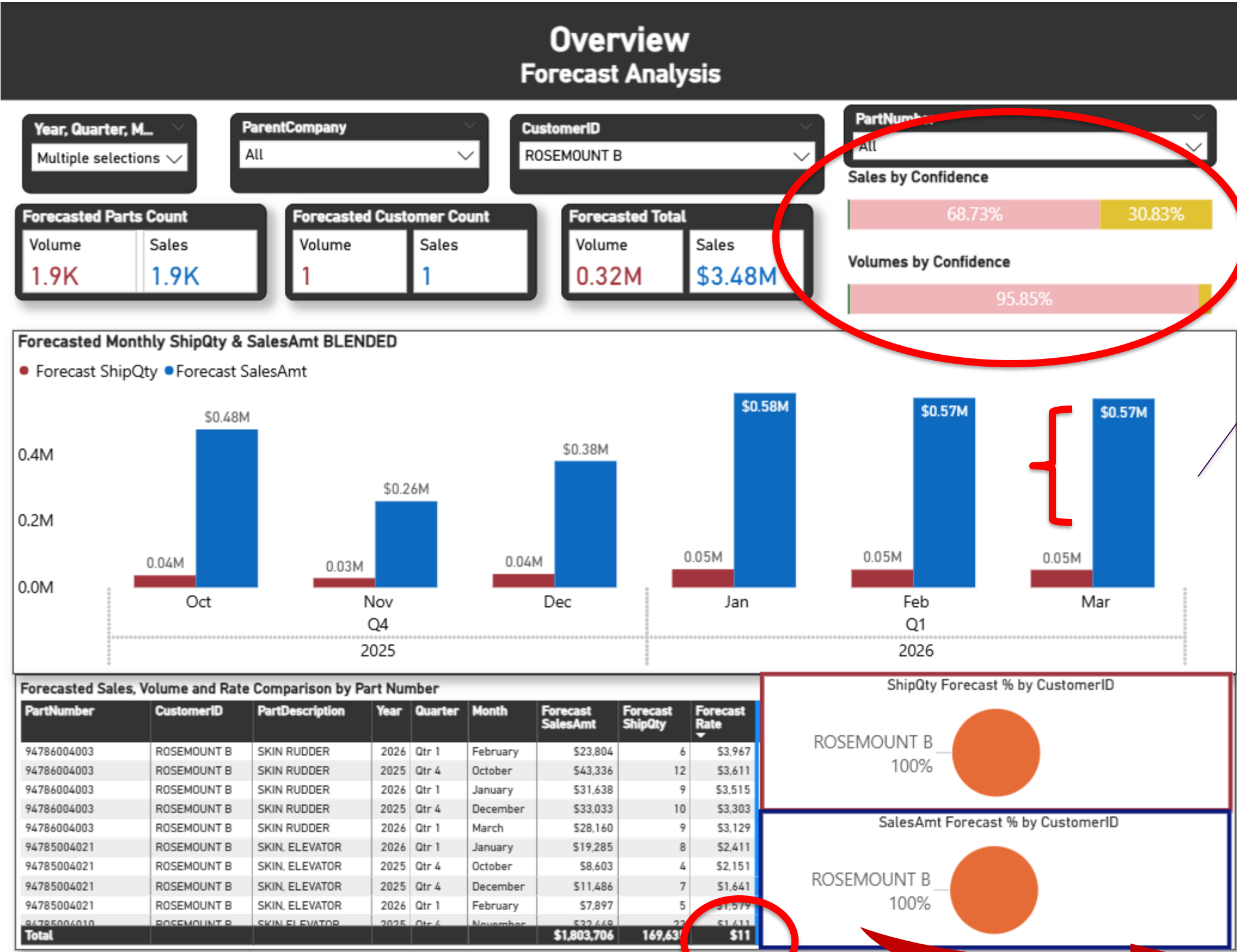
CustomerName	InvoiceDate
AULT INCORPORATED	1/10/2001
AULT INCORPORATED	2/9/2001
AULT INCORPORATED	1/26/2001
AULT INCORPORATED	3/31/1999
AULT INCORPORATED	12/13/1996
AULT INCORPORATED	11/22/1996
AULT INCORPORATED	11/6/1996

CustomerPartNumber	ShipQty	SalesAmt
200-4133-002	10,000	\$740
200-4133-002	208,200	\$7,079
200-4133-002	40,820	\$1,388
200-4133-002	199,523	\$6,784
200-4133-002	416,775	\$9,169
200-4133-002	24,400	\$537
200-4133-002	60,000	\$1,320

2- VMR (Volume, Mix, Rate)

3 - FORECAST

Rosemount B – Forecast Strength: Limited Medium Confidence



Rosemount B forecasts have low Confidence, but 30% has medium Confidence - \$1.07M

Why a large difference?

Rosemount C Average Rate Forecast is much lower.

Forecast Rate
\$2.29
\$2.42
\$2.46
\$2.51
\$2.42
\$2.35
\$4.59
\$4.38
\$3.27

Therefore, Rosemount B displays a bigger difference between Volume and Sales than Rosemont C.

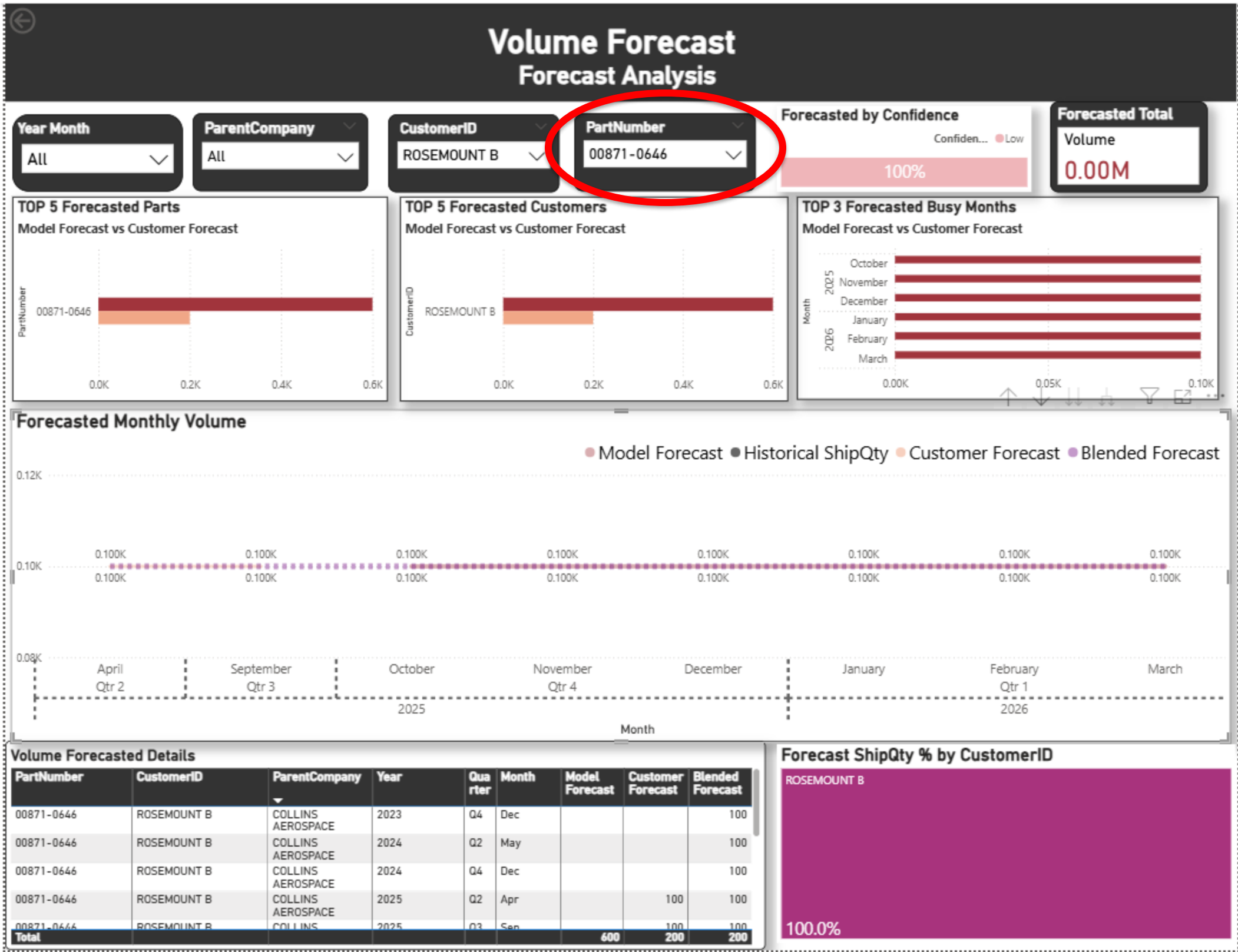
Collin – Rosemount B is driven by higher-value parts than Emerson Rosemount C

Low Confidence = Unreliable Forecasts

Plate Mount – 000871-0646 only ordered 3 times --> Forecast lacks reliability

InvoiceDate	PartNumber	ShipQty	SalesAmt
12/2/2024 12:00:00 AM	000871-0646	100	\$125
5/20/2024 12:00:00 AM	000871-0646	100	\$125
12/5/2023 12:00:00 AM	000871-0646	100	\$125

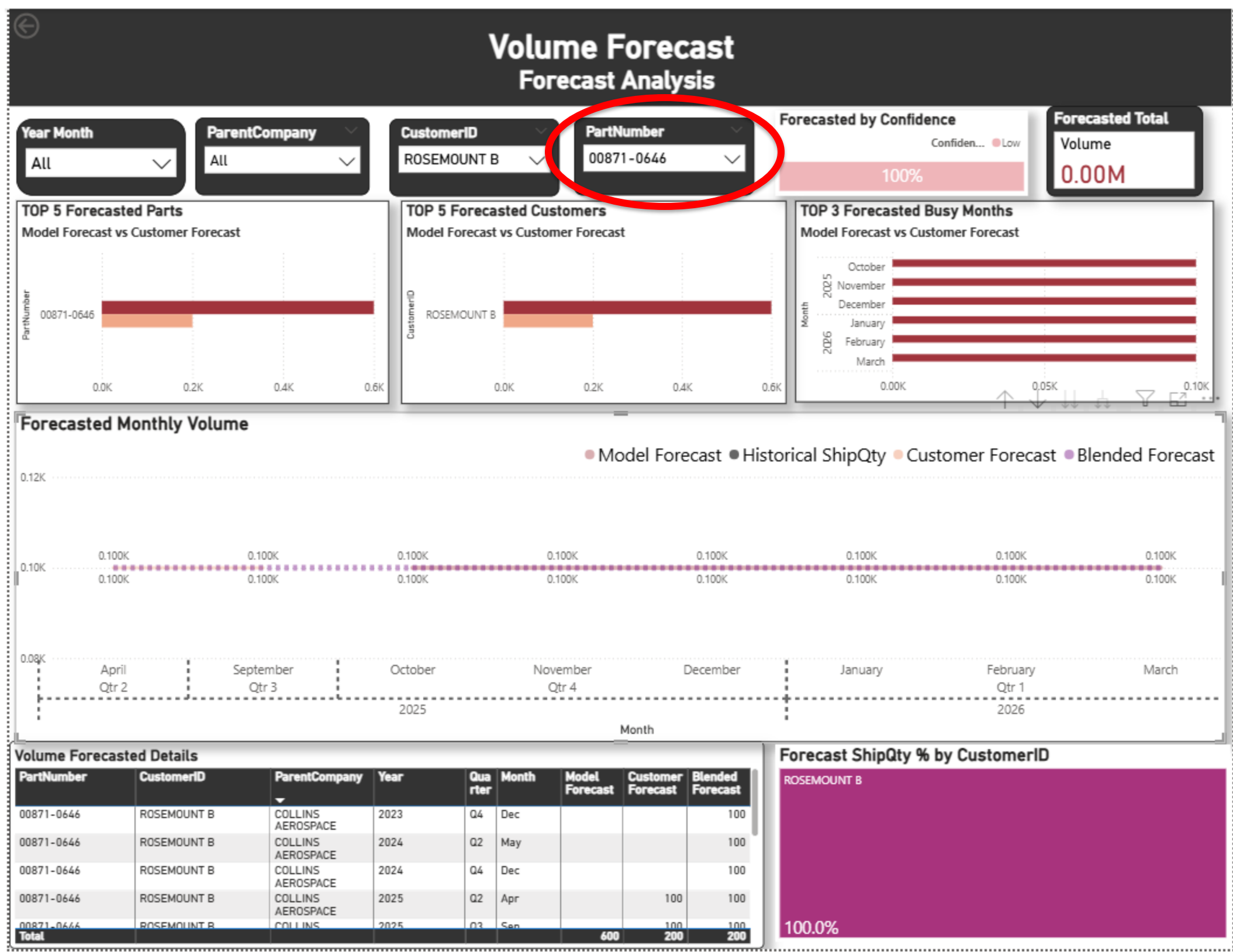
Last order Dec 2024 --> May indicate bi-annual or annual demand. This may even be a discontinued part



Low-confidence forecast improve with added history; discontinued parts, bi-annually or annually ordered remain low confidence.

Low Confidence = Unreliable Forecasts

Element Sheath – 00154-0808-001
infrequent orders with increasing
volume --> Forecast lacks reliability;
that could stay...

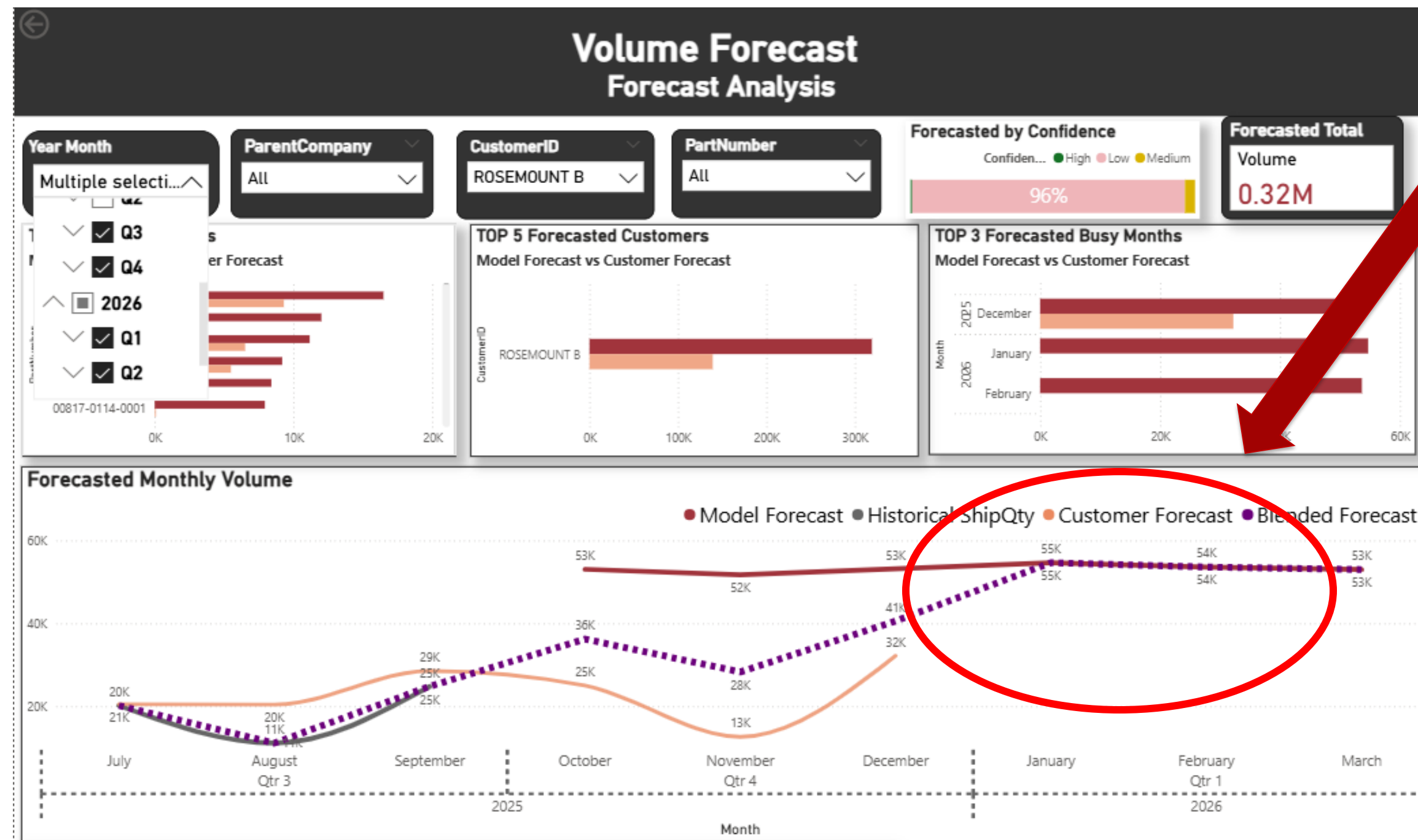


InvoiceDate	PartNumber	ShipQty	SalesAmt
8/14/2025 12:00:00 AM	00154-0808-0001	150	\$15,687
5/22/2025 12:00:00 AM	00154-0808-0001	125	\$12,728
5/7/2025 12:00:00 AM	00154-0808-0001	125	\$12,728
4/10/2025 12:00:00 AM	00154-0808-0001	50	\$5,091

Possible Quarterly Shift --> Stronger
future forecast .

Unstable order patterns keep forecasts weak

Collin – Rosemount B – Volume Forecast Dashboard



Why isn't there a Customer forecast for January 2026 & February 2026?

- Collin File ended December 2025

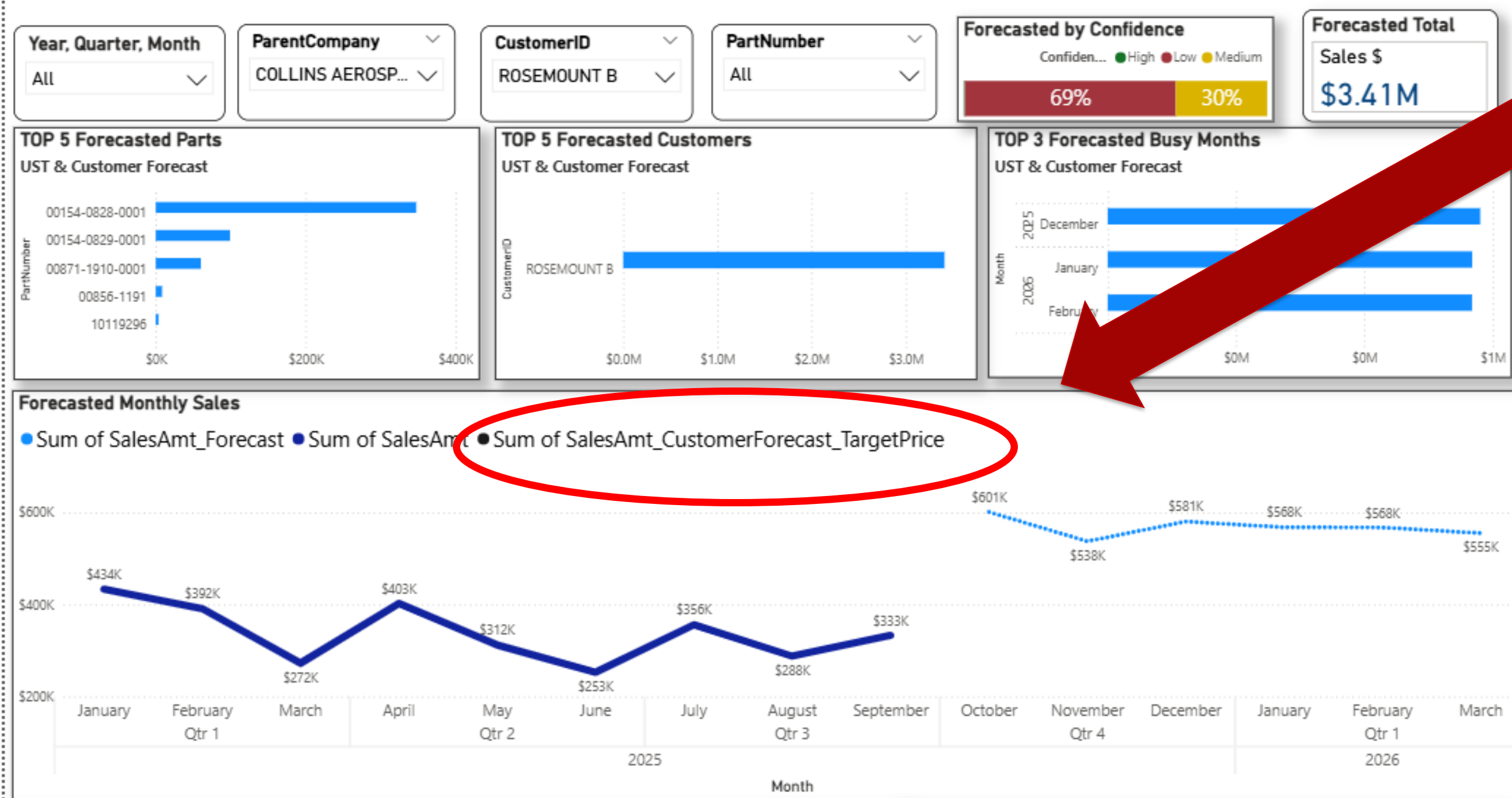
What are the forecast date ranges used by the project?

- Collin files March - December 2025
- Emerson file Aug 2025 – Dec 2026
- UST Forecast Oct 2025 – March 2026

Customer forecast files have different date ranges.

What if we change the filter to 2025 Q1?

Collin – Rosemount B – Sale Forecast Dashboard



Why is Rosemount B missing Customer Sale Forecast?

- Missing Target Prices

SalesAmt_CustomerForecast_TargetPrice is a calculated value

- Collin files only include ShipQty (no Sales)
- Customer_ShipQty X Target Price = Customer Forecast Sales

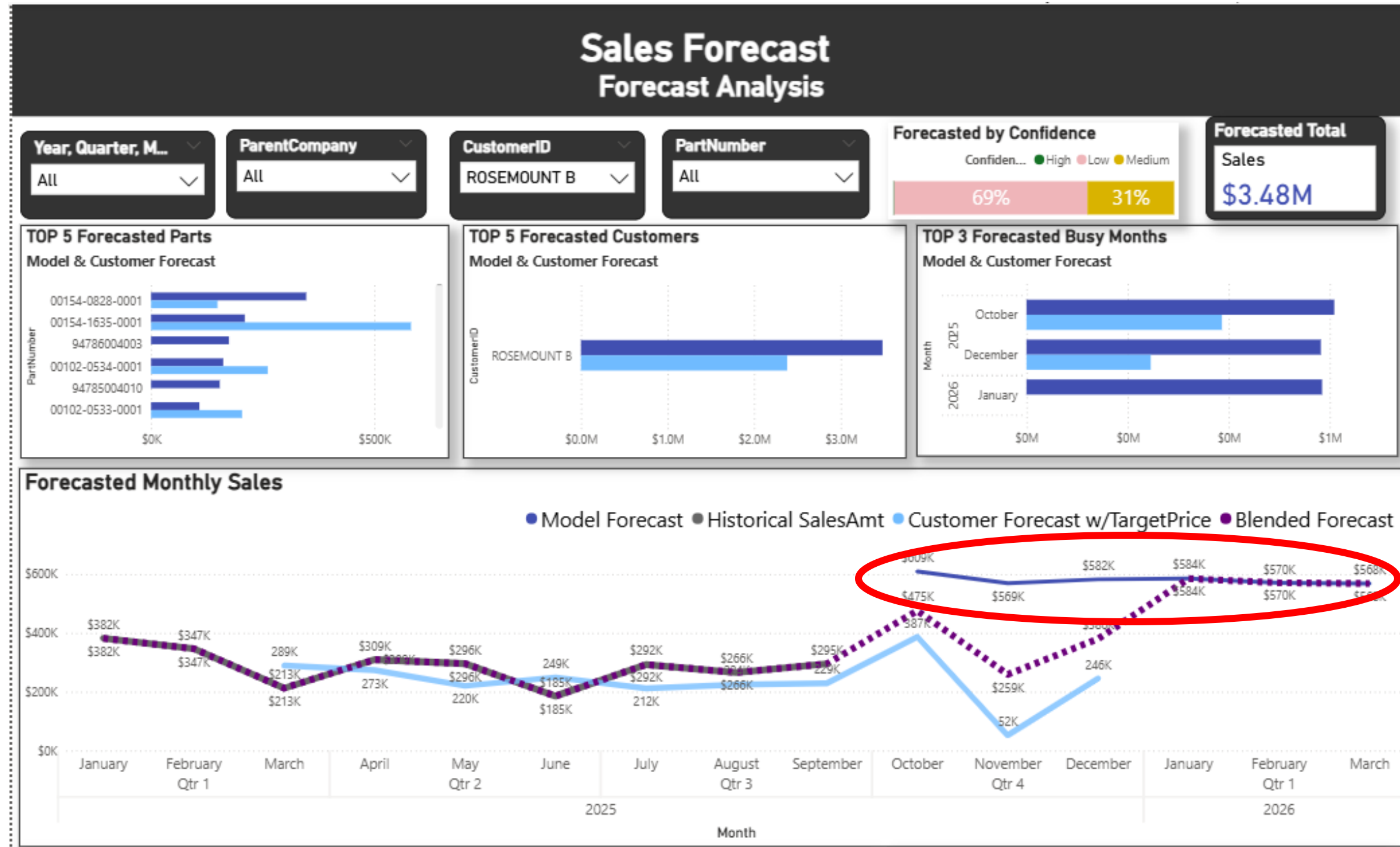
Where does the Target Price come from?

-  TargetUnitPrice.xlsx

Collin – Rosemount B latest unit prices are missing, so a sales forecast can't be made.

What if we add the prices?

Collin – Rosemount B – Sale Forecast Dashboard

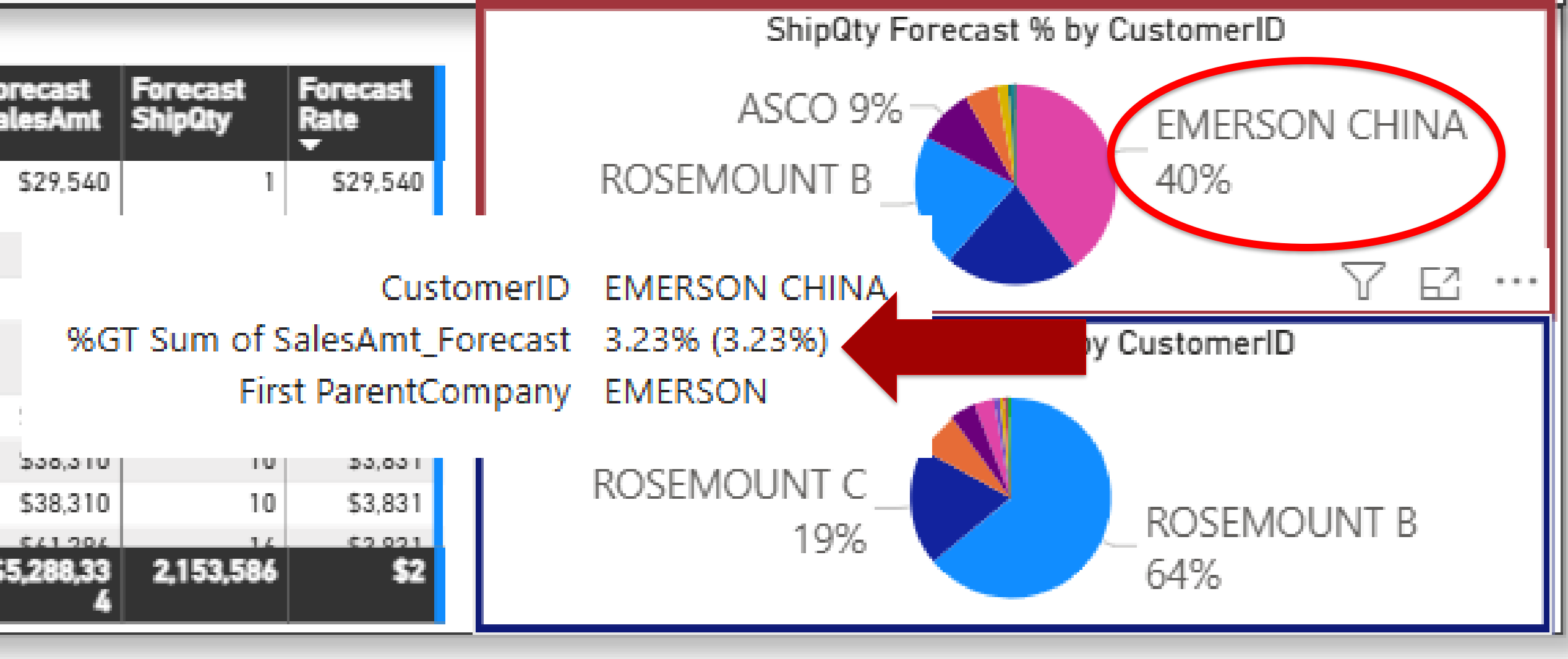


Prices added - Rosemount B has a Customer Sale Forecast?

- Higher than the Customer forecast
- 31% Medium Confidence
- 69% Low Confidence

Collin – Rosemount B now has sales forecast that is mostly low in confidence.

Accelerating Revenue in Strategic Accounts



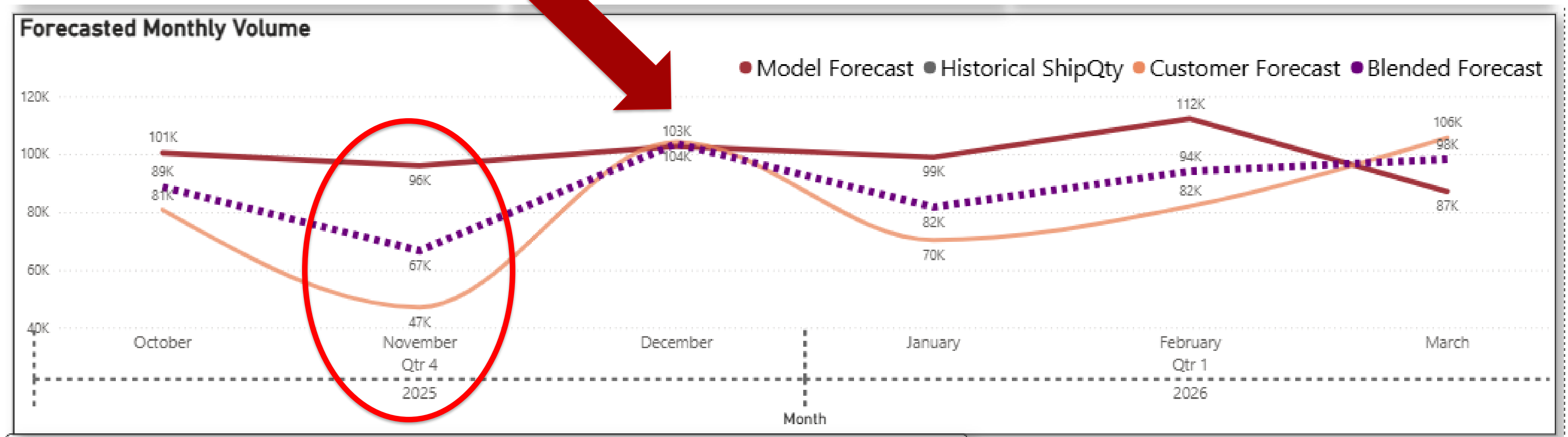
Strategic Account
Emerson China

Reason
High ShipQty /Low SalesAmt



40% Volume, but only 3.23% Sales stand out as a Strategic Account.

Tracking Forecast Accuracy: November Results, December Expectations



Strategic Account: Emerson China

Results to gather: November volume

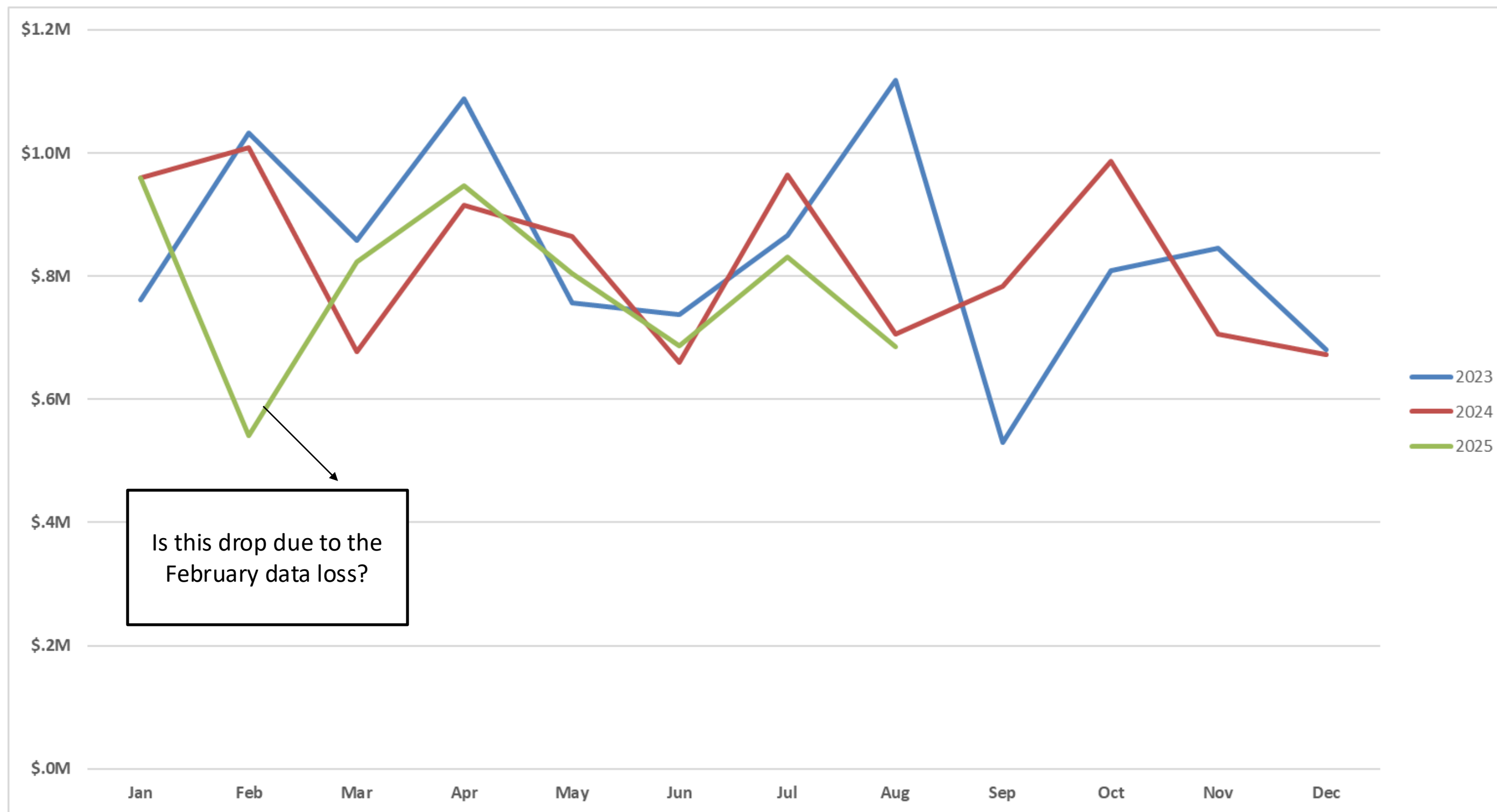
Both Forecasting: December with higher volume

Opportunity to compare actual and gain for Q1 forecast.

4- What-If

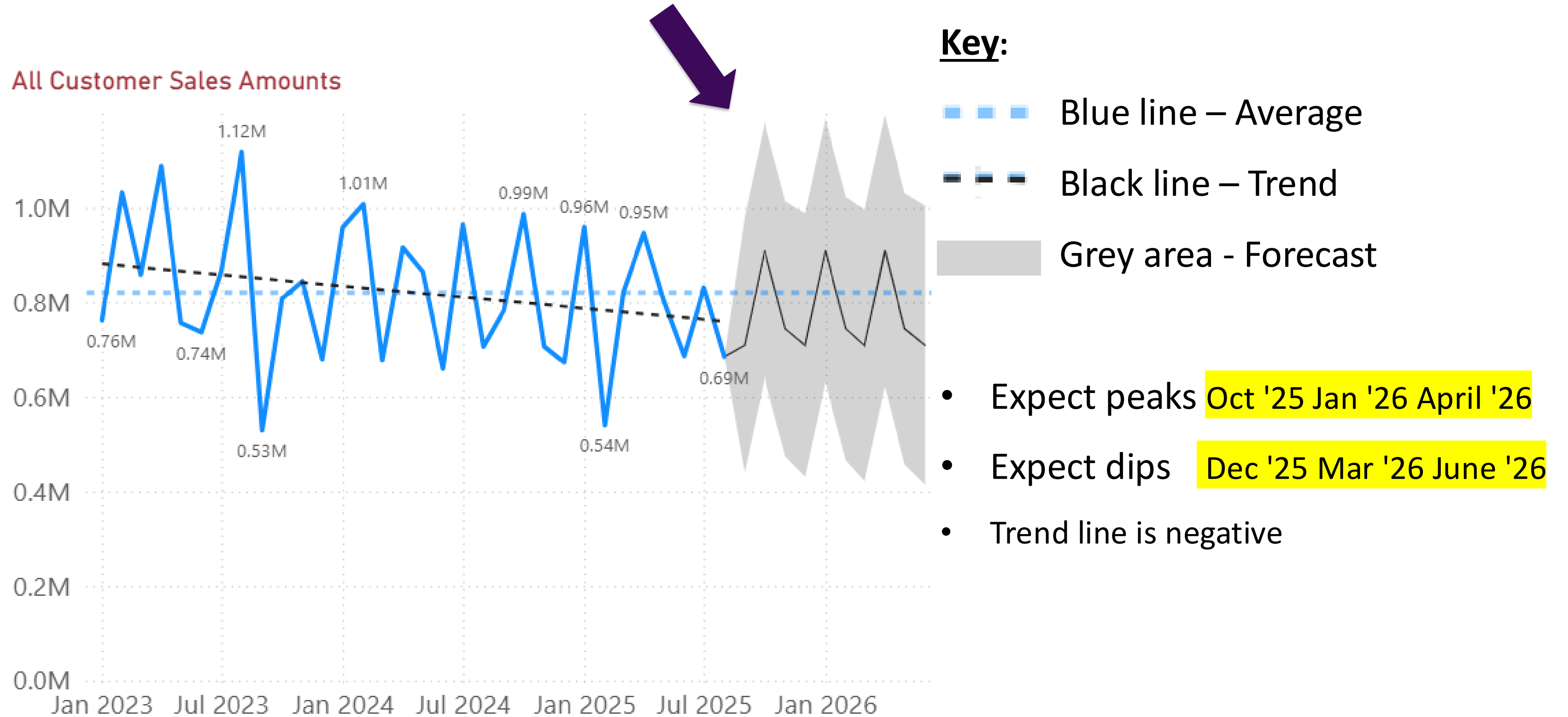
4 LEAVE BEHIND

Monthly Sales Trends by Year from 2023-2025



- The green line represents 2025 but only includes data from January to August.
- A noticeable drop in February 2025 may be due to a data loss incident the company experienced. (February data starts from February 17th).
- Sales in other months of 2025 appear consistent with previous years, suggesting strong performance despite the missing data.

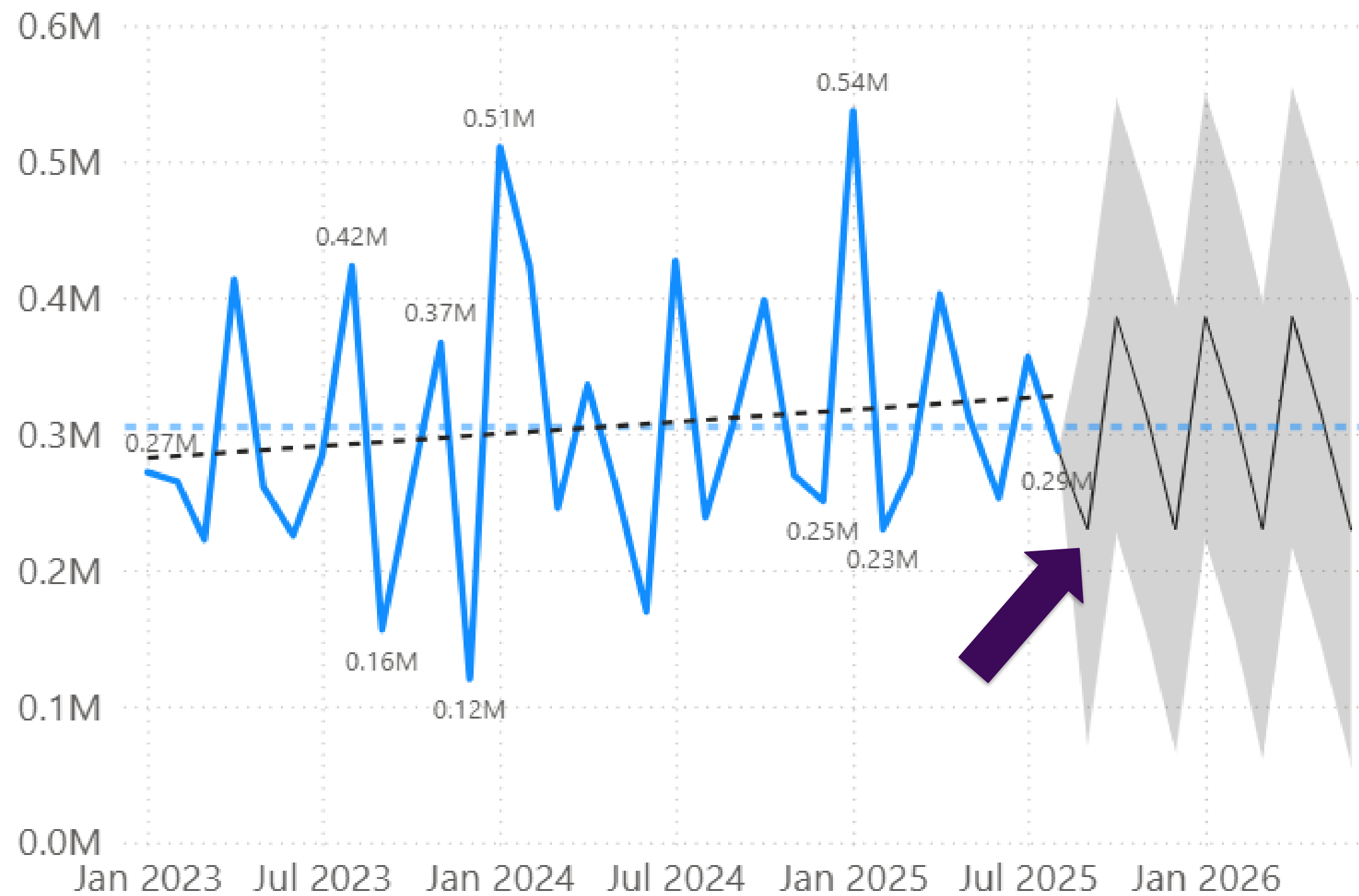
Out of the Box – Power BI Forecasting



Missing inflation, anticipated cost changes, and other key forecasting factors

Out of the Box – Power BI Forecasting

Collins Aerospace Sales Amounts



Key:

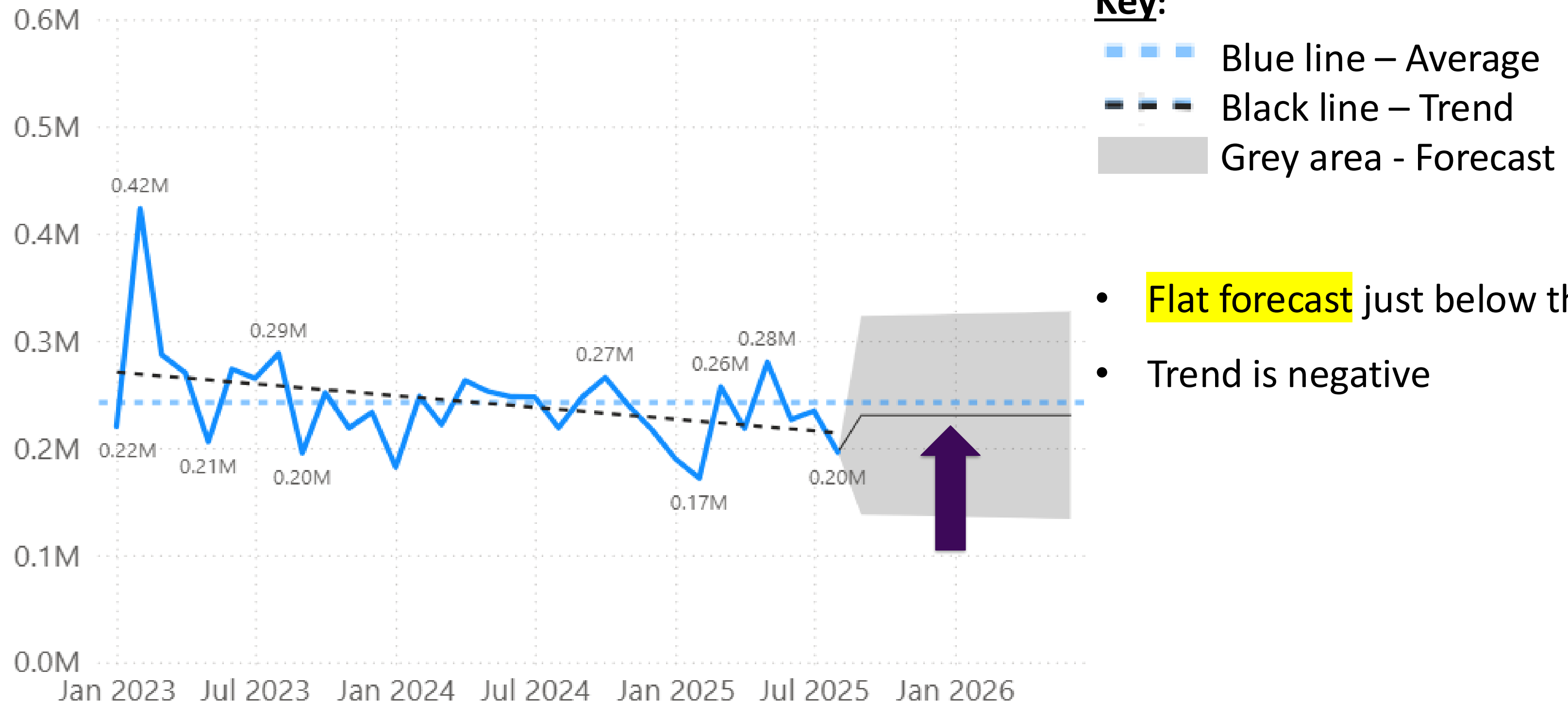
- Blue line – Average
- Black line – Trend
- Grey area - Forecast

- Expect peaks Oct '25 Jan '26 April '26
- Expect dips Sept '25 Dec '25 Mar '26 Jun '26
- Trend is positive

Collin Aerospace is trending positive sales growth – forecasting a dip for this month

Out of the Box – Power BI Forecasting

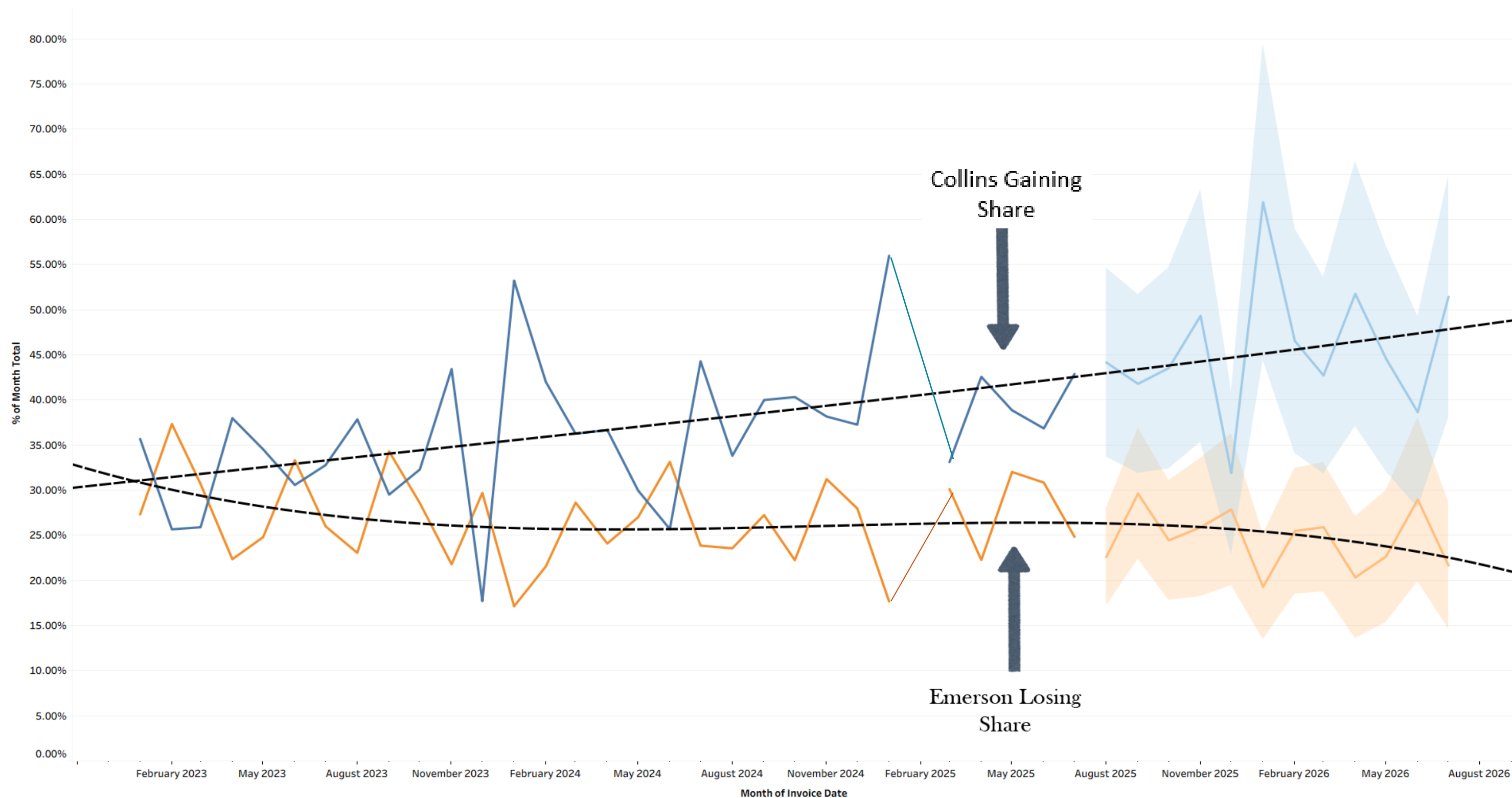
Emerson Sales Amounts



- Flat forecast just below the average
- Trend is negative

Emerson forecasting .23M Sept '25 – June '26

Exploring Tableau Forecasting and Its Broader Applications



Findings:

- Collins shows a steady upward trend in share.
- Emerson shows a gradual decline in share.
- Market shifts Collins.
- Collins and Emerson matter most, as together they represent the largest portion of total sales (see appendix).

Percent-of-total calculations were created in Tableau, grouped by month, and trend lines were added to highlight directional changes. This exploratory analysis helps us identify which customer groups are gaining or losing relative share, supporting the design of a forecasting model that captures market shifts. The appendix table confirms that Collins and Emerson together account for the majority of monthly sales, underscoring their importance in forecasting.

Morgan- Data Intergration & Cleaning &Data Quality

Report- appendix

Goal 1: unify multiple sales exports into one clean dataset for Power BI Sales table comparison

Multiple Inputs: CSVs by customer_time period (2000–2002, etc.)

Automated Processing:

1. Remove invalid rows
(nulls>5, repeated header, "customer total")
2. Extract metadata and attach as columns
(Run Date, Begin Date, End Date)
3. Standardize column types
(IDs->text, amounts->float, dates->string/datetime)
4. Processed files concatenated into one master file
(all_sales_union.csv)
5. Data Quality Report
(missing %, duplicates, unique key checks)

```
=== Column-level report ===
```

	dtype	missing_count	missing_pct	unique_count	missing_flag
CUST-NBR	object	0	0.00	577	✓ OK
CUST-NAME	object	0	0.00	461	✓ OK
INVOICE-DT	object	0	0.00	6185	✓ OK
INVOICE-#	object	1	0.00	177766	✓ OK
SALES-ORDER	object	1978	1.11	63910	✓ OK
PART-NUMBER	object	3165	1.78	4912	✓ OK
PART-DESCRIPTION	object	11	0.01	6572	✓ OK
SHIP-QTY	float64	3165	1.78	7091	✓ OK
SALES-AMT	float64	0	0.00	36975	✓ OK
BEGINNING DATE	object	0	0.00	12	✓ OK
ENDING DATE	object	0	0.00	12	✓ OK
RUN DATE	object	0	0.00	4	✓ OK
source_file	object	0	0.00	12	✓ OK

```
=== Global stats ===
rows: 177773
columns: 13
duplicate_rows: 0
duplicate_keys: 7
unique_keys: 177766
key_columns: ['CUST-NBR', 'INVOICE-#']
```


Morgan- Data Intergration & Cleaning &Data Quality

Report-appendix

Goal 2: Customer & Part Table Extraction

Inputs: Customer Contracts – Part Cost Info

Customer Dimension (KLESK_cust_extract_from_parts_cost_info.csv)

1. Extracted: CUST-NBR, CUST-NAME, REVENUE CODE
2. Applied drop_duplicates() to keep one row per customer–revenue mapping
3. Added a duplicate check to flag cases where a single CUST-NBR is linked to multiple REVENUE CODEs

Part Dimension (KLESK_cust_extract_from_parts_cost_info.csv)

1. Extracted: PART-NUMBER, PART-DESCRIPTION, PRODUCT CODE, PRIMARY WORK CENTER
2. Applied drop_duplicates() to ensure each part is stored once
3. Added a duplicate check to flag cases where a single PART-NBR is linked to multiple PRODUCT CODEs

=== Column-level report ===

	dtype	missing_count	missing_pct	unique_count	missing_flag
CUST-NBR	object	0	0.00	98	✓ OK
CUST-NAME	object	0	0.00	79	✓ OK
REVENUE CODE	object	92	79.31	7	✗ Critical

=== Global stats ===

```
rows: 116
columns: 3
duplicate_rows: 0
duplicate_keys: 18
unique_keys: 98
key_columns: ['CUST-NBR']
```

=== Column-level report ===

	dtype	missing_count	missing_pct	unique_count	missing_flag
PART-NUMBER	object	75	10.12	662	⚠ Warning
PART-DESCRIPTION	object	0	0.00	741	✓ OK
PRODUCT CODE	object	732	98.79	7	✗ Critical
PRIMARY WORK CENTER	object	733	98.92	6	✗ Critical

=== Global stats ===

```
rows: 741
columns: 4
duplicate_rows: 0
duplicate_keys: 79
unique_keys: 662
key_columns: ['PART-NUMBER']
```