

Overview

AutoSLAM (Scan, Label, Apply, Manifest) system integrates AFT (Amazon Fulfillment Technology) and uses a system of conveyors, scanners, and printers to validate the accuracy of the order before applying a shipment label. AutoSLAM is the last point of quality check and includes Auto Check Weight (ACW), dunnage audit, larger than recommended box, and hazmat label verification. A kickoff (KO) is a customer package that has failed at the SLAM machine and can occur for several reasons. A KO operator processes KOs through the Ship app, and the shipping label is manually attached regardless of the reason for the KO.

Problem Statement and Suggested Solution

The pack SLAM KO DPMO over the past three months (April-June 2020) has, on average, been 44% greater¹ than the threshold value of 18,000 DPMO per day at YYZ7. Based on the NACF average labor of \$0.80 per KO², the financial impact is \$276K in additional expenses in the same period. This document provides two recommendations for the reduction of SLAM KO attributable to barcode no read. After analyzing all inputs and selecting key contributors to the KO, a combination of standardizing the packing process across all shifts and installing two extra cameras at each SLAM line will lower the DPMO by 4,624 per day resulting in expected savings of \$218K per year at YYZ7.

Reasons for KO

A package can get kicked out for eleven different reasons. 70% of the KO's from April - June 2020 are due to the following four factors:

1. ACW Fail (Auto Check Weight) - 21%
2. Barcode no read (Spoo no read) - 21%
3. Bad Label Scan - 17%
4. No Label Zone - 11%

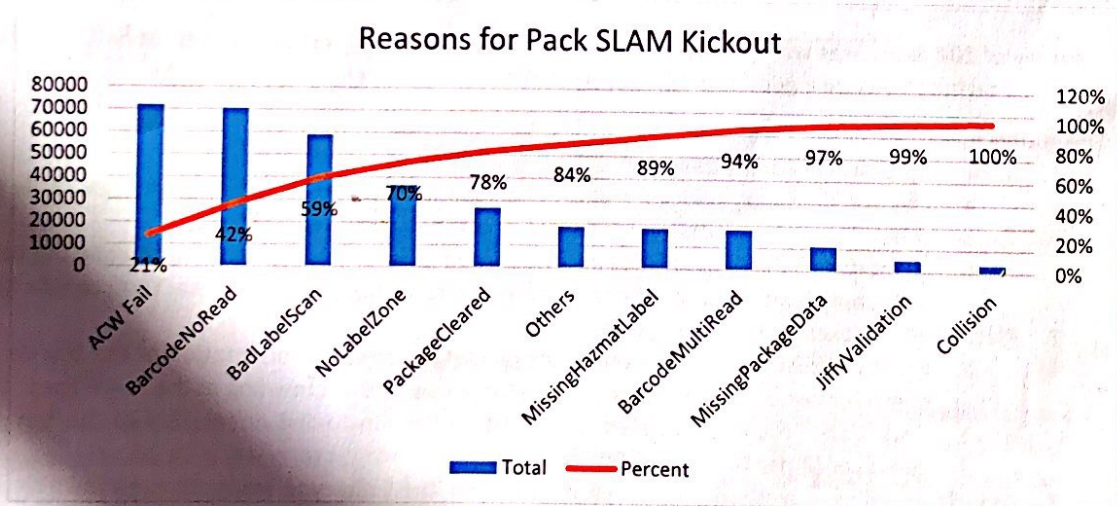


Figure 1: Pareto chart of KO by causes

¹ The average pack slam DPMO from Apr-Jun was 25,803 per day

² ACES finance validated cost per kickoff

ACW system is designed to reduce the number of packages shipped to the wrong customer by measuring and comparing the weight of an item against its expected weight. Packages that fall outside the tolerance are kicked out and checked for accuracy before a shipping label is attached. 42% of all ACW KO at YYZ7 are non-issues (Opened/Unopened). The root cause of the non-issue KOs is due to an inherent flaw in the ACW software logic and timeline for the fix is OP1 next year.³

For this paper, barcode no read has been identified as the KO with the most significant potential for improvement and highest return on investment.

Barcode no read

KO due to barcode no read occurs when a package goes through the SLAM and fails to pass because the camera is unable to read the spoo label and hence does not receive a shipping label. In this instance, the KO operator applies the shipping label manually.

Upon observing the packing process, SLAM and KO stations combined with conversations with JLL personnel, line straighteners and KO operators, two reasons emerged:

1. The practices followed by associates at the pack station is unstandardized across all shifts leading to KOs
2. The cameras do not pick up spoo labels specifically on jiffys and polybags with abnormally shaped items

This observation led to a two-prong approach to problem-solving:

1. Associate behavior-based approach
2. Equipment based approach

Associate behavior-based approach

A survey of 200 associates was conducted over seven days. The study included the front half, back half, days, and nights to ensure a good representation of all four shifts. (Refer to Appendix A)

The study led to the following insights:

1. Inconsistency in the application of spoo label across shifts:
 - a. **Day shift:** 28% of associates apply the spoo label on the top side of the box while the other 72% apply it either on the sides or combination of top and sides
 - b. **Night shift:** 72% of associates apply the spoo label on the top of the box while the other 28% apply it either on the sides or combination of top and sides (Refer to Appendix B)
2. Placement of boxes on the conveyors:
 - a. **Front Half:** 44% of associates do not pay attention to the orientation of the box on the conveyor nor understand it is a source of jams and overcrowding at the SLAM lines
 - b. **Back Half:** 35% of associates do not pay attention to the orientation of the box on the conveyor (Refer to Appendix C)
3. Associates piling boxes on top of each other on the conveyor leads to overcrowding and eventually KO

³ As per ACES AutoSLAM SME

Hypothesis: Standardizing the packing process across all four shifts will lower the KO DPMO.

Hypothesis Testing: To test the hypothesis, three minor changes to the packing process were tested.

1. The associates to be required to apply the spoo label always on the top of the box because the camera on the top is the master camera and has the highest probability of picking up the spoo label. Standardizing the spoo label application on all four shifts will take the decision making away from the associate and reduce the process variability
2. The associates to be required to place the box lengthwise as opposed to breadthwise on the conveyor belt to minimize jams
3. The associates are to leave a small gap on the conveyor between boxes to avoid overcrowding

A pilot was run from Thursday, July 16th to Monday, July 20th. The experiment was conducted across eight shifts in both the front half and back half of the week. Line three was identified as an ideal candidate due to the high volume that passes through the SLAM and its likelihood to be a good indicator of future results. The conditions on the shifts (The experiment) were identical to the conditions on the same shifts the previous week (The control). The same associates were not placed on the line, and stations were assigned arbitrarily. PDCA (Plan-Do-Check-Act) was used as an effective approach to establish objectives and processes, identify gaps, and adjust against the baseline.

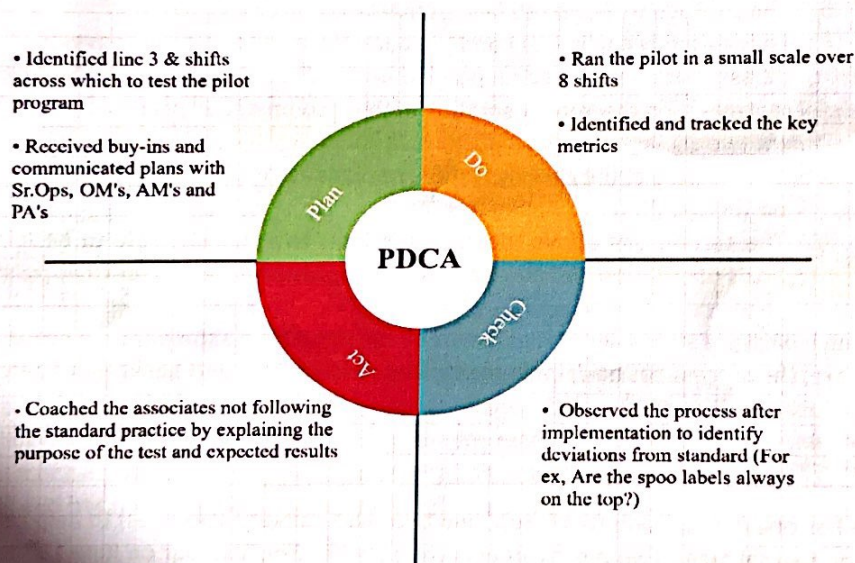


Figure 2: PDCA Cycle

Results: 6 out of 8 shifts showed a lower DPMO than the same shift the prior week, resulting in a 21% reduction in the KO's (Refer to Appendix D for a detailed analysis). This reduction equates to a savings of \$6,283 per year from line 3 and \$37,510 per year across all seven SLAM lines (Takes into account the expected volume per month in each line).

Line number	Average shipment/month	No. of defects/month with old process	No. of defects/month with new process	Cost savings/Month	Cost savings/year
1	176,143	897	711	\$ 148	\$ 1,779
2	443,957	2,260	1,793	\$ 374	\$ 4,484
3 (Line used for pilot)	622,160	3,167	2,513	\$ 524	\$ 6,283
4	686,182	3,493	2,771	\$ 577	\$ 6,930
5	508,816	2,590	2,055	\$ 428	\$ 5,139
6	582,257	2,964	2,352	\$ 490	\$ 5,880
7	694,679	3,537	2,806	\$ 585	\$ 7,016
Total				\$ 3,126	\$ 37,510

Figure 3: Cost savings by SLAM line by standardizing pack process

The standardized process also helps save the line straighteners time by looking for the spoo on one side as opposed to three. This process has a positive impact on indirect productivity and is likely to lower the KO marginally⁴.

Recommendation:

- 76% of pack associates⁵ did not know the impact of their work on the downstream SLAM process. My recommendation is to include as a part of the pack training process, a tour of the SLAM area, followed by constant coaching from PA's and AM's at the daily pack stand up reinforcing the below-recommended practice (Refer to Appendix E):
 - Spoo label always on the top side of the box
 - The package to be placed facing lengthwise on the conveyor
 - Leaving a tiny gap in front and the back of a package on the conveyor
- 82% of all associates⁶ surveyed responded with a "Yes" to the question of signage being helpful to strengthen the implementation of the recommended practice. My suggestion is to implement two signage boards:
 - The first one at the packing station; reminds associates to place the spoo label always on the top (Refer to Appendix F)
 - The second one above the conveyor belt; tells the associate to be mindful of the box's orientation and leave a small gap between boxes (Refer to Appendix G)

The pilot program indicates a strong correlation between the DPMO and a standardized process at packing stations. Therefore, the process has been implemented on all four shifts, and a change management email was sent out on Tuesday, August 4th.

Equipment based-approach

Each SLAM line has one master camera (On top) and two slave cameras (On sides) to help read the spoo, box code and the hazmat label. Two more cameras were installed on line four on June 18th to reduce the number of KO attributable to barcode no read. 79% of all the KO's in four weeks before installing the cameras were a combination of jiffys and polybags (Refer to Appendix H). The KO's were due to the non-flat (abnormal shaped) products inside the packages. The two extra cameras were expected to help reduce the barcode no read by reading the abnormally-shaped packages.

⁴ Based on the feedback from line straighteners from all shifts

⁵ From the study of 200 associates

⁶ From the study of 200 associates

Hypothesis: Installing two additional cameras at the SLAM will reduce KO due to barcode no read

Hypothesis testing: The two extra cameras on line four successfully lowered the DPMO by 65% resulting in expected savings of \$33K/year (ROI of three months – see table 5). The KO rate for jiffys and polybags dropped by 77% (Refer to Appendix I)

2 additional cameras installed on June 18th on line 4			
	Total shipments	Total Kickouts	DPMO
4 weeks prior to installation	740,611	5,755	7,771
4 weeks since installation	657,410	1,782	2,711
		% Reduction	65%

Figure 4: Comparison of KO before and after installation of two extra cameras

Recommendation:

Assuming line four is a good representation of all seven lines and taking into account the volume on each line based on historical data, installing two extra cameras will save YYZ an estimated \$180k/year in the long run. The return on investment is approximately three months. My recommendation is to install the two extra cameras across all seven lines.

Line number	Average shipment/month	No. of defects/month without extra cameras	No. of defects/month with extra cameras	Cost savings \$/Month	Cost savings/year	ROI (Months)
1	176,143	1,369	478	\$ 713	\$ 8,556	10
2	443,957	3,450	1,204	\$ 1,797	\$ 21,566	4
3	622,160	4,835	1,687	\$ 2,519	\$ 30,222	3
4 (2 additional cameras installed)	686,182	5,332	1,860	\$ 2,778	\$ 33,332	3
5	508,816	3,954	1,379	\$ 2,060	\$ 24,716	3
6	582,257	4,525	1,578	\$ 2,357	\$ 28,284	3
7	694,679	5,398	1,883	\$ 2,812	\$ 33,745	2
			Total	\$ 15,035	\$ 180,421	3

Figure 5: Cost savings and ROI by SLAM line from installing 2 extra cameras

The above recommendation can be scaled network wide provided bar code no read is a significant contributor to KOs and the FC processes jiffys and polybags. After looking at YVR2, YUL2, YYZ1⁷, YYC1⁸, YYZ4 and YVR4 from April 1st, 2020 to June 30th 2020, my recommendation is to consider YYZ4 and YVR4 for installation of cameras because 23% and 20% of all shipments respectively are jiffys and polybags (YYZ7 is 21%) and has the potential for additional \$302K per year in savings.

⁷ YVR2, YUL2 and YYZ1 rejected because of low KO rate due to bar code no read

⁸ YYC1 has the two extra cameras installed

Reduction of DPMO at AutoSLAM

Pathways Operations Internship, Badri Narayanan

Site	Total no. of shipment	% of jiffys and polybags	No. of defects/month without extra cameras	No. of defects/ month with extra cameras	Cost savings/year
YYZ7	12,819,387	21%	28,863	10,069	\$ 180,421
YYZ4	20,370,278	18%	38,828	13,590	\$ 242,285
YVR4	6,891,689	20%	9,765	3,418	\$ 60,931
Total potential savings					\$ 483,637

Figure 6: Potential for cost savings at YYZ4 and YVR4

Next steps: Addressing KO's due to no label zone

Laser profilers are mounted above the conveyor at the front end of the AutoSLAM Scale and are seen as red dots. These profilers ensure there is enough space on the package for the shipping label to be applied. A shipping label is 4" x 6", and when both profilers do not detect a 6.18" zone, the machine does not request a shipping label and instead kicks the package out. This functionality exists to prevent packages from receiving shipping labels that would be overhanging the package.

Over the past three months (April-June 2020), No label zone has contributed to 11% of all KO's. SIOC's are responsible for 28% of all the no label zone KOs, and 54% are a combination of jiffys and small box sizes A1 and A3 (Refer to appendix J). The reason for SIOC KOs are because of the top surface under the 6.18" threshold and will need to be put through the cubiscan to update the shipping method (possibly shipped in boxes or polybags).

The jiffys and small boxes get KO despite having enough area to accommodate a shipping label due to improper alignment on the conveyor. Standard practice dictates there should be no gap between the package and the alignment rail (Refer to Appendix K). Assigning line straighteners to the SLAM lines will help lower the KO. Currently, the number of line straighteners vary across different shifts from one per line (Most effective but highest cost) to one for three-four lines (Least effective but also lowest cost). The opportunity for improvement is to understand the different variables that have an impact on the effectiveness of the line straighteners' vs cost ramifications (For e.g., number of pack associates on the line, expected volume in the shift). The solution could be a hybrid of one per line on busy lines to one for two lines on others. The future state would evaluate all the variables and optimize the number of line straighteners to maximize efficiency and minimize cost.

Appendix A: Breakdown of 200 engaged associates

Survey	Front Half	Back Half	Total
Day	50	52	102
Night	58	40	98
Total	108	92	200

Appendix B: Spoo label application over four shifts

Spoo label	Day Shift	% of Total	Night Shift	% of Total	Total
Top	29	28%	71	72%	100
Sides	11	11%	1	1%	12
Top/Side	62	61%	26	27%	88
Total	102	100%	98	100%	200

Appendix C: Orientation of boxes on the conveyor

Orientation	Front Half	% of Total	Back Half	% of Total
Facing forwards	60	56%	57	62%
Facing sideways	4	4%	2	2%
Both	44	41%	33	36%
Total	108	100%	92	100%

Appendix D: Results of the pilot

Pilot	Shift Type	Shift	DPMO - Control	DPMO - Experimental	Difference (+/-)
1	Back half	Days	4,967	4,521	9%
2	Back half	Nights	5,703	2,793	51%
3	Back half	Days	5,658	3,628	36%
4	Back half	Nights	3,805	4,590	-21%
5	Back half	Days	4,130	2,829	31%
6	Back half	Nights	6,353	5,433	14%
7	Front Half	Days	7,778	4,801	38%
8	Front Half	Nights	3,779	4,085	-8%
		Average	5,091	4,039	21%

HELLO PACK TEAM!!

Safety Tip Don't forget to do ministriches

Quality Tip: Place Spoo labels on TOP of the packages.



Top Performers for:

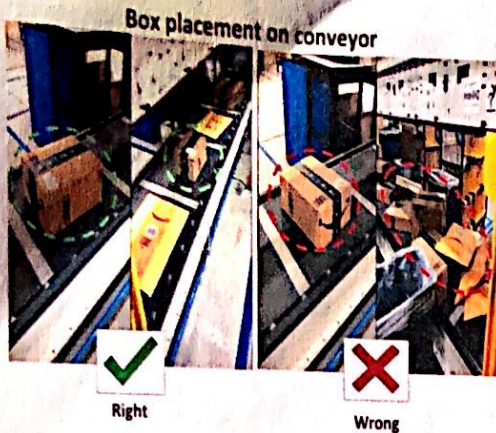
Mutis

Singles

Smartpac



161 **Appendix G: Signage for placement of box on the conveyor and location on pack station**



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163 **Appendix H: KO based on barcode before installing extra cameras**

Packaging Type	Count	Cumulative % of Total
BM3	1098	19%
-	1029	37%
BM4	893	52%
BB1	780	66%
BBJ	379	73%
BM5	371	79%
BY0	281	84%
BY1	254	88%
B47	119	90%
B45	78	92%
B4E	72	93%
BNA	63	94%
BO1	59	95%
BNB	53	96%
B4D	49	97%
B41	34	98%
B42	30	98%
BO2	29	99%
B4F	22	99%
B4G	22	99%
B48	18	100%
BNH	16	100%
BNJ	6	100%
Grand Total	5,755	

Jiffys and polybags

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165 Appendix I: Reduction in the number of KO for Jiffys and Polybags

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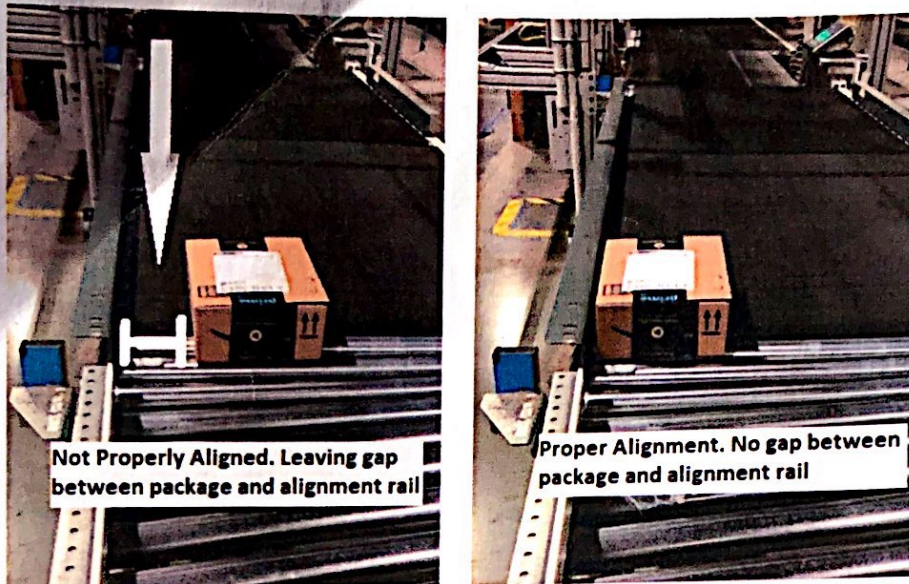
	Before Camera	After Camera	Difference(+/-)
BM3	1,098	223	80%
BM4	893	226	75%
BM5	371	102	73%
BBI	780	136	83%
BBJ	379	71	81%
-	1,029	274	73%
Total	4,550	1,032	77%

168 Appendix J: KOs due to No label zone

Packaging Type	Total	Cumulative % of Total
SIOC	10,163	28%
BM3	8,102	50%
BM4	5,210	64%
BY0	2,670	71%
BY1	2,246	77%
BM5	1,962	82%
B47	1,344	86%
BBI	1,190	89%
B45	699	91%
BNA	681	93%
BBJ	526	94%
BO1	410	95%
B4E	371	96%
B41	356	97%
B90	304	98%
BNB	271	99%
B42	115	99%
BO2	91	100%
B4D	57	100%
B48	54	100%
B4F	33	100%
B4G	24	100%
CUSTOM_PAC	11	100%
BNJ	4	100%
Grand Total	36,894	100%

Jiffys and small boxes

170 **Appendix K: Alignment of jiffys and boxes on conveyors**



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