American Airlines

Charting a New Approach: What Goes Well and Why at American Airlines

A white paper outlining the second phase of AA's Learning and Improvement Team (LIT)

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Abbreviations

AA	American Airlines
APA	Allied Pilots Association; AA's pilot union
AQP	Advanced Qualification Program
ASAP	Aviation Safety Action Program
ATC	Air Traffic Control
CA	Captain
DCT	Data Collection Tool
EBT	Evidence Based Training
ERC	Event Review Committee
FAA	Federal Aviation Administration
FMS	Flight Management System
FO	First Officer
FOQA	Flight Operational Quality Assurance
FRAM	Functional Resonance Analysis Method
HF	Human Factors
ICR	Intercoder Reliability
LOSA	Line Operations Safety Audit
ODAWG	Operations Data Analysis Working Group
OSB	Operations Standards Board
PF	Pilot Flying
PM	Pilot Monitoring
SOP	Standard Operating Procedure(s)
SMS	Safety Management System
TEM	Threat and Error Management

Contents

Executive Summary

American Airlines' (AA) Learning and Improvement Team (LIT) has continued to develop and validate the concepts and process of capturing resilient behavior-based data in modern aviation. The initial effort for AA from 2018 to 2020 concerned proving the value of the concepts in LIT and demonstrating value to the current Safety Management System (SMS). It was determined that LIT data could and should become another unique data feed into the well-established AA SMS process. The program was funded and approved by senior leadership on that premise, and the historical account is depicted in the first paper explaining the initial steps of the journey.

LIT data contributes to training scenarios in realistic simulation syllabus development while providing fresh material to Human Factors (HF) training courses and Captain's Leadership and Mentoring modules currently mandated by the Federal Aviation Administration (FAA). One of the ultimate goals of the program is to help foster a more extensive and robust learning culture among pilots themselves. Addressing this goal requires understanding the foundational mechanism which underly the many ways pilots create resilience in their everyday work, and sharing the results from this learning to the front-line workers (line pilots).

The language developed by LIT at AA required refinement and validation before it could be leveraged in conducting analysis worthy of producing organizational change recommendations. First, each datapoint was reviewed and validated to assure that the recorded data accurately standardized and codified the resilient behaviors (proficiencies). Minor iterative changes to the coding process were identified and then processed by the team, resulting in a final dataset with rigorously scrutinized and validated language which can be confidently presented to external organizations. This data was used internally to provide initial analysis and learning about the resilient behaviors observed in AA flightdecks and to identify novel findings not previously recorded in safety assurance processes. The team identified that this new approach might be one of the first objective measures of flightdeck culture at a major airline. This discovery generated significant interest and discussion within the leadership team at AA and has proven to be one of the most critical findings to date in the journey.

This innovative discovery needed to be verified and confirmed by other means and the LIT group shifted part of their focus and energy into additional Shop Talk guided discussions and short surveys to capture similar data from line pilots. This qualitative data is more difficult to process but developed comparable findings to the flight observation data. The LIT group also used LOSA Evidence Based Training (EBT) competency data to independently validate the cultural findings of pilot flying (PF) versus pilot monitoring (PM) proficiencies as they pertain to crew position.

AA's LIT journey is progressing and has paved a now-proven path towards measurement of resilient behavior in the modern airline safety assurance data process. It has proven valuable and critical to identifying the culture of flightdeck relationships and understanding everyday work during line operations. AA is realizing the benefits of LIT efforts in creating training scenarios and source material that will shape the learning and leadership of future aviators.

Prologue

Introduction

In June 2020, AA published a paper outlining their Safety-II journey, entitled *Trailblazers into Safety-II: American Airlines' Learning and Improvement Team*. Since that time, the team has gathered and analyzed 100 flightdeck observations conducted over 10 months. The team has utilized the lower-tempo of flight operations experienced during the height of the COVID-19 pandemic to refine the LIT language and coding system as well as to lay the groundwork for a more widely recognized construct to view Safety-II within commercial aviation. During this tumultuous time, the team has shared the journey of the LIT program in multiple virtual presentations outside of AA. Incredibly, while many organizations and departments suffered staff and budget cuts, corporate leadership supported the LIT team in training two additional observers in mid-2020 and a plan to hire four more observers in late 2021. This growth will allow the program to increase data collection. The quantitative data collected from the LIT rides has also been complemented with tailored Shop Talk pilot interview sessions to add another dimension to understanding everyday work within AA flightdecks.

As the team has become more established within AA's Safety Department and gained recognition from external groups, it has met this success with a critical eye towards evaluating its own value within the established Safety Management System. Several initiatives have been identified to merge the data and analysis from LIT with other data streams. While narrative exemplars from LIT rides serve as powerful reminders of the more proactive and positive side of aviation safety, earning the respect of a pilot cadre deeply rooted in a Safety-I mindset (guided by the proven success of models such as Threat and Error Management) remains the greatest challenge ahead.

This paper will describe the work of the AA LIT team over the past year, accomplishing three mutually reinforcing goals:

1. To document the actions taken and decisions made when validating the initial flightdeck observations as related to the LIT language and coding.

2. To share the analysis and early observations from the dataset.

3. To offer insights into the value of a Safety-II effort in any organization and some of the developmental and growth challenges LIT encountered.

Figure 1. LIT Model: LPAC

Data Validation

Calibration

In December 2019, after conducting 100 LIT observations, the team took a pause in collecting data to evaluate their methods and data. In preparation for analyzing the data, it was deemed necessary to review and validate the coding and language used for each observation. Periodic inter-coder reliability exercises were conducted with the observer team to benchmark the coding standardization. This was accomplished by reviewing two de-identified observation reports. The four observers read the narrative block and coded the phase of flight, potential, proficiency, and pressure. This effort was repeated in January 2020 to ensure the observers were using the same frame of reference entering the data validation phase.

The level of calibration was surprisingly high given the short acclimation period of the new observers and their recently acquired knowledge of the LIT language. The table below shows the agreement in coding across these four areas. The two experienced observers who had been on the team from the onset agreed on nearly every coding exercise, which highlights the value of experience and comfort level with the coding structure. Discrepancies in coding were further explored which led to adjustments to the observer coding guide (explained in a later section).

	4/4 agree	3/4 agree	2/4 agree
Phase of Flight	52%	100%	100%
Potential	48%	87%	100%
Proficiency	27%	42%	100%
Pressure	30%	57%	100%

Table 1. Calibration results amongst 4 observers whose range of experience was 2 months, 3 months, 3 years, and 3.5 years.

Cleaning

The data cleaning effort to review the 100 observations was conducted in February of 2020. Initially, the plan was to have the LIT team accomplish the data cleaning alone, but after further consideration, it was decided to allow two LOSA observers (who also served as cleaners for LOSA data) to help clean the LIT data. Their outside perspective, along with their ability to explain the deliberate process of reviewing each line of information and discussing the consistency of coding, gave the team a higher confidence level internally in regards to the observation data. This served to further standardize how the team was coding, specifically with respect to proficiencies.

Over a period of three days, the team of LIT and LOSA data cleaners reviewed 1556 lines of data. Each data point represented an individual proficiency observed on the flightdeck at some point over the most recent six months. During the exercise, it was clear that the earliest data collected from the beginning of 2019 was too inconsistent and that the coding language was too immature in its development to deliver comparable value to more recent data. As a result, 110 lines of data were excluded from the larger dataset after the cleaning team determined that those specific observations were not indicative of the described operational proficiencies being studied here, but were evidence of compliance with expected procedures found within AA SOPs.

Summary of Data Cleaning Process Outcomes

Based on the group's analysis and with the goal to add more context to the observation data, the following changes were adopted:

- Standardized coding across all lines of data;
- Added a narrative prefix for linked potentials to signify that a linkage was coded. This notation preserves context for the analyst if the proficiency is extracted for analysis by itself;
- Coded a First Actor (CA PF, CA PM, FO PF, FO PM, or Both) attribute to indicate who initiated the sequence of resilient performance. The team later removed the “Both” code since it diluted who was responsible, and, in most cases, the first actor could be identified;
- Aligned PF/PM roles in the LIT data with how ground duties are recognized within other parts of the SMS: the CA is assigned as PF during all ground operations (preflight, pushback, taxi out, taxi in, and park), while the FO is assigned PM duties during those phases. However, the team recognized that, however infrequently, the FO does sometimes assume the PF role during the ground phase, and that special attention should be given to observation of resilient performance on the ground in this role configuration;
- Decided to reclassify turbulence events from “environmental” pressure to “weather” pressure since environmental pressures focused more on traffic and terrain conflicts;
- Extracted multiple, separate proficiency data points from many longer narratives, leading to an additional 15% in total data volume. This resulted in approximately 500 additional lines of data.

Insights and Follow-Up Work from Data Cleaning

One of the interesting insights from the collaboration with the LOSA cleaners was that the fundamental differences became quite evident between the process of data collection as well as the data collected with the Threat and Error Management, Safety-I approach and the proficiency and resilient performance, Safety-II approach of LIT. Upon gaining an understanding of the LIT coding process, one LOSA observer remarked that LOSA and LIT observations can’t be done simultaneously by the same observer since it would involve such different ways of thinking about the same work observed. The two senior LIT observers concurred, having transferred to LIT from the ranks of the LOSA observers. As was elaborated upon in the first LIT paper, these two observers found it took about six months to change their “lens” to truly capture resilient performance during flightdeck observations. Future observers for LIT were drawn from outside the LOSA observer ranks.

The process of reviewing the data resulted in several decisions that required some additional effort on the dataset itself:

- Re-work the Potential ID numbering (the unique ID code that follows a sequential and chronological order within a single observation) since many were deleted or added during validation, which created breaks;
- Update Parent/Child linkage numbering based on insertion of new lines of data;
- Description formats to standardize content and linkage chains;

- Check and validate all linkages to protect against disconnects in the parent-child relationship and connected potentials;
- Correct errors in coding found during cleaning, such as PF/PM discrepancies from the narrative blocks, along with pressure and proficiency labels and first actor codes;
- Review all Coordinate proficiencies, which comprised 50% of all proficiencies observed, to look for more granularity in coding.
- Complete an official codebook, assigning numerical proficiency codes to the actual proficiency descriptions for clearer analysis and to create a better framework for a more robust collection tool in the future.

This work was completed from March through July 2020.

Coding Refinement

Proficiencies

After the initial analysis of the proficiencies during the cleaning effort, it became apparent that the Coordinate potential dominated the dataset: of the four potentials, Coordinate was recorded nearly 50% of the time. The most prevalent Coordinate proficiencies were:

- Briefs or gives new info/update to other member or adds info to build SA (24%)
- Ask other crew member for input or assistance (12%)

This overwhelming presence of Coordinate was not entirely worrisome as it was congruent with the team's understanding and past research that safe and successful flight operations require a great deal of coordination to routinely achieve successful outcomes. The team theorized that refinement of the two proficiencies in question would allow for more nuanced, and thus more valuable, coding by considering when pilots brief each other and/or ask for assistance from internal vs. external resources. The group also realized that some aspects of briefing could be considered within the Plan potential when it involved returning to revise the original plan based on new information.

The team traveled to DFW on March 13th, 2020 to collaborate for further data cleaning and coding efforts, including further discussion regarding separating the proficiencies within Coordinate. Upon reviewing the dataset multiple times and thoroughly considering the intended value, goals, and pragmatics of re-coding the data, it was decided to further delineate and simplify several proficiencies. Below are some examples and the rationale:

- The proficiencies "Used Jeppesen charts or other information to monitor route and follow along" and "Monitor Automation" were combined into "Monitor Aircraft Status". The new term encompasses more than just monitoring automation, as it includes aircraft systems, electronic charts, and FMS entries. Furthermore, the fact that "Used Jeppesen charts…"

was noted in only 10 out of 2,010 lines of data assured the team that this proficiency could be captured within the new "Monitor Aircraft Status" proficiency.

- The proficiency, "Briefs or gives new info, update to build SA" was separated into two proficiencies. "Update change in plan" was added within the Plan potential to capture when the information briefed was amended from the original and would result in some replanning. Under the Coordinate potential, "Affirm new information supports plan" was created to signify the plan had not changed from that originally briefed or discussed. Given that "Briefs or gives new info, update to build SA" was already the most prevalent proficiency, separating it into two sections in terms of the relationship to the previously briefed information would allow more granular analysis when combined with which pilot and role initiated the resilient performance (CA/FO/PF/PM).

Next, the proficiency language was abbreviated to simplify coding. Initially, several of the proficiency titles were excessively verbose, and the team decided to truncate the terminology for efficiency of use. For example, "Change automation level/mode/programming for changing condition" became "Change automation." One final adjustment was modifying "Monitor automation, PM or PF deliberately references FMA or other aircraft system" to "Monitor Aircraft Status" to address the absence of a proficiency that captured various elements of monitoring the aircraft in its entirety.

In September of 2020, LIT met at the Charlotte, NC Training Center in-person for the first time since the beginning of the COVID-19 outbreak in March 2020. The goal of the meeting was to ensure the LIT language and coding were functionally complete to allow it to be shared with external organizations, as interest, both domestically and internationally, in the team's efforts was growing. As external interest grew, the team also desired to present its language and coding to those interested in exploring the opportunity to start their own Safety-II journey. To this end, a new proficiency labeling system was designed for more detailed data filtering and analysis. These changes were implemented to further structure the language for a coding scheme better aligned for a future, formal collection tool.

To aid LIT observers in coding and to ensure inter-rater reliability, LIT developed a master codebook (Appendix A). During the early development period, a codebook did not exist, and observers were forced to select proficiencies with minimal guidance. This meant data collection was not as accurate as possible, and in some cases the same observables from different flights were coded as two different proficiencies. With this risk in mind, deliberate decisions were made during the iterative development of the codebook as to which observable examples belonged to which proficiencies.

The codebook is broken down by potentials, the associated proficiencies, and pressures. Each proficiency has examples listed to assist observers in coding observations. While not all-encompassing, the examples serve as a solid foundation for observers to code their observed flightdeck behavior. This has significantly improved the ease of data collection, standardization, and allows for a more refined data analysis.

The new observers that joined the team in January 2021 were formally trained using the new codebook. The improved results were immediately apparent as only approximately 15% of the collected proficiencies needed to be corrected in the cleaning process – a significant improvement over the first observations collected during early LIT development. Additionally, the LIT observers commented on how the codebook aided their capture of resilient performance during flight observations, suggesting an improvement in data collection and coding accuracy.

Pressures

The data cleaning effort also afforded the opportunity to further clarify the definitions of various pressures for coding. The team decided to move turbulence from the Environment category to the Weather category. This aligned with the categories used in LOSA observations and also made more intuitive sense since other environmental pressures centered around terrain and traffic conflicts. The Ramp pressure was also amended to include examples of language barriers with push crews and included the clear area when taxiing into the gate.

During this effort, the team reviewed the occurrence of pressures over the first 100 observations. The findings of this review afforded another watershed insight: regardless of the safety mindset used to effectively mitigate those pressures (in LIT language) or threats (in LOSA language), and regardless of the lens (Safety-II or Safety-I) observers applied to collect their data, observations showed that flight crews interact with the same external forces at the same prevalence rates. Specifically, the two most prevalently recorded LIT pressures, ATC and Weather, were the same as the two most prevalent threats observed by the LOSA team across a much longer timeframe of 5+ years and 3,000+ observations.

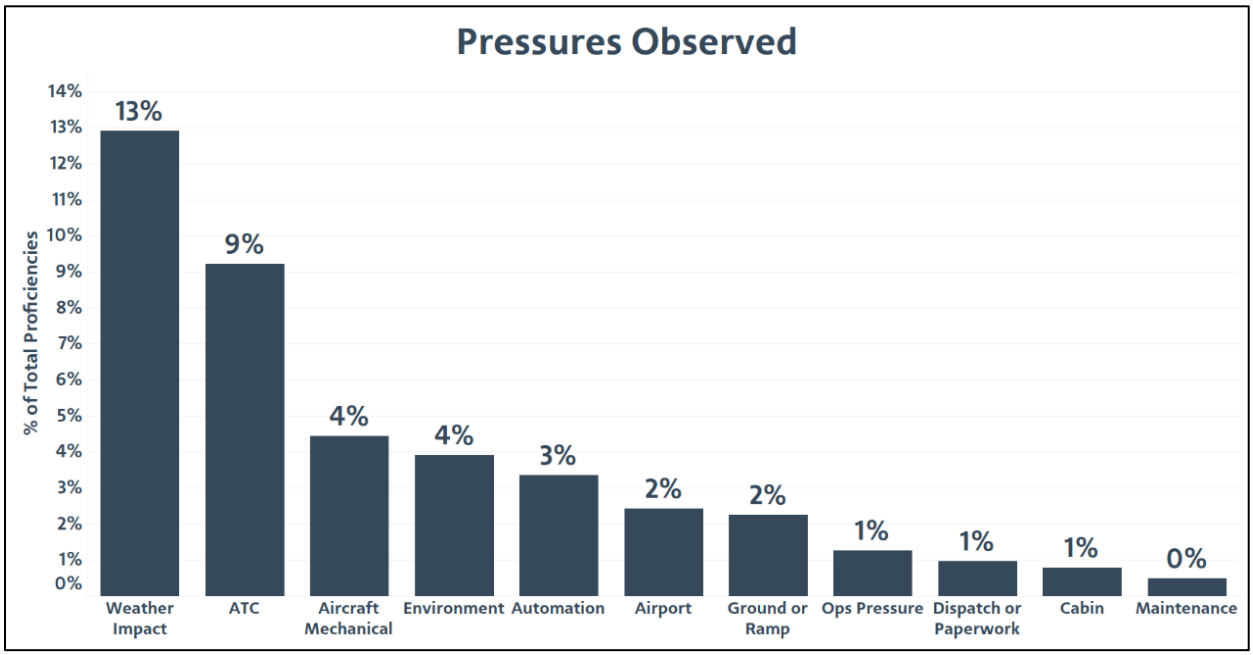


Figure 2. Pressures observed during LIT Rides. 58% of proficiencies had no related pressure.

The proficiency review effort also revealed that in 42% of observation data points, a pressure was associated with an observed proficiency. Further exploration and discussion into this phenomenon led to the conclusion that the majority of the time, a proficiency was observed without a stimulus, meaning that an external force was not necessarily evident when a pilot initiated resilient performance. Examples are especially notable among the Plan and Learn potentials: crews that think ahead, discussing information and lessons learned, do not necessarily respond to an observable pressure related to that proficiency.

Linkages

During the September 2020 meeting, the team thoroughly examined linked proficiencies within the dataset. Four individual members of the LIT leadership team analyzed how the linkages varied when considering which potential initiated the linkage chain. It was clear that linked proficiencies continue to bring value and context to the dataset – rich in complexity and displaying the non-linear relationships of everyday work. However, patterns among the data with this linkage attribute require further study and more data collection before the team can draw inferences.

The book *Friendly Fire* by Scott A. Snook was recommended to the team and used as a primer to discuss the options for defining the linkage relationships. LIT started to better understand that some linkages are more complicated and essential than others. LIT also gained the insight and collaboration of NASA's Human Contributions to Safety (HC2S) team, part of NASA's System-Wide Safety Project. HC2S has been on a parallel path with AA in researching resilient behavior across multiple groups, including recent analysis of their own interviews with AA pilots pertaining to the complexities of airport arrivals. Their input helped to refine LIT's discussion related to the observed linkages and was also instrumental in developing a training survey for AA pilots (discussed later in this paper).

Related to this effort, the two newest LIT observers researched the Functional Resonance Analysis Method (FRAM) model as a way to better grasp the complexity of everyday line operations. This was a very detailed and time-consuming effort but showed an opportunity to understand other complex system wide issues such as clean ramp operations and the process of an aircraft pushback. This tool showed value in mapping out future endeavors LIT could undertake.

Observation Data

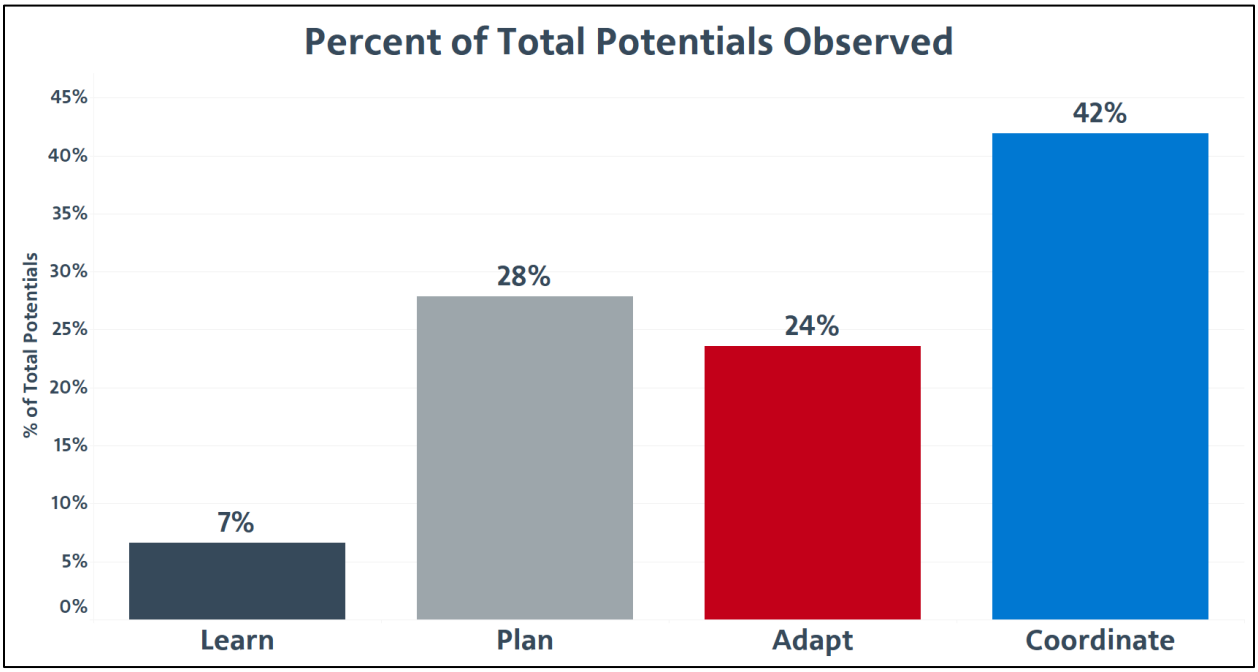


Figure 3. Percent of total observed potentials (N=2052).

This chart depicts the percentage of all potentials observed and recorded. Observers do not strive to meet quotas, goals, or objectives to achieve a certain percentage in each potential. The distribution of the observed potentials was not unexpected given that Learn can frequently be difficult to observe on the flightdeck, while Coordinate is often much easier to observe. The lower prevalence of learn proficiencies being observed does not mean learning is not taking place. This also aligns with our team's interest in exploring how to enhance a learning culture within the pilot cadre and see where other opportunities for learning may be present. Since coordination centers around verbal communication between pilots, this facilitates observers more easily recognizing these proficiencies during a flightdeck observation.

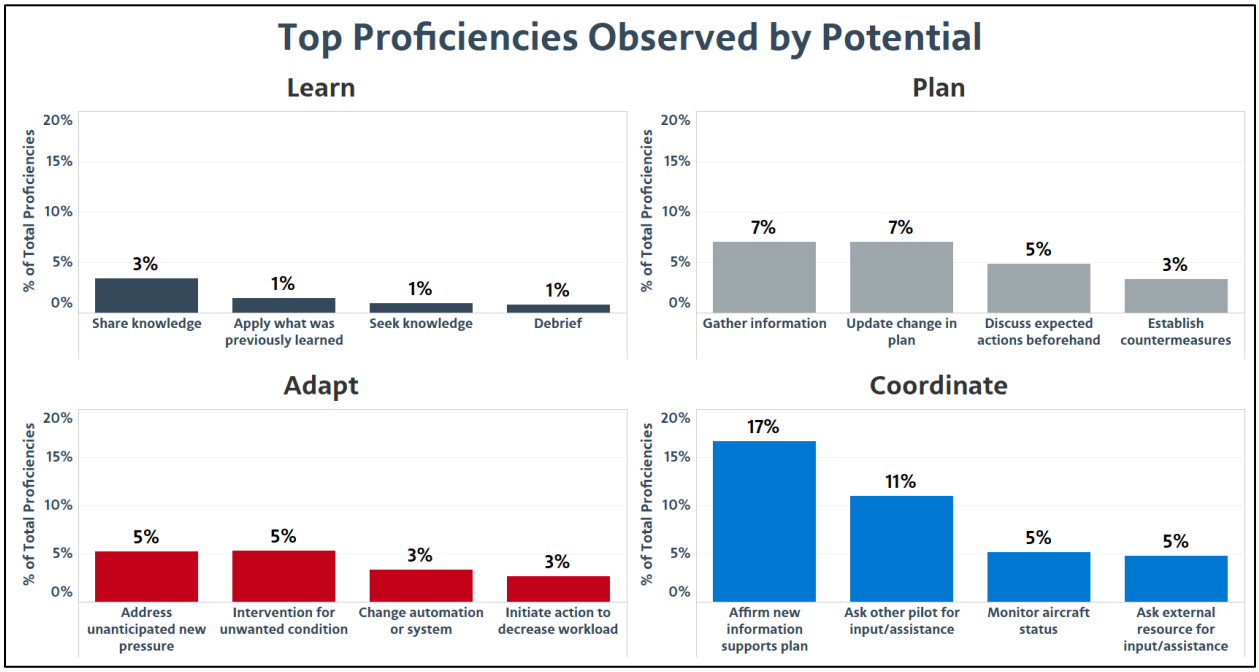


Figure 4. Top proficiencies (x/2052) observed within each potential.

This chart depicts the top four proficiencies observed within each potential. The most observed is clearly the 'Affirms new information supports plan' proficiency under the Coordinate potential and was subsequently broken into further proficiencies. Notwithstanding the fact that the observed Learn proficiencies represent only 7% of total observed proficiencies (143/2052), it should be noted that 'Share knowledge' is observed as often as, for example, 'Change automation' under Adapt, or 'Establish countermeasures' under Plan.

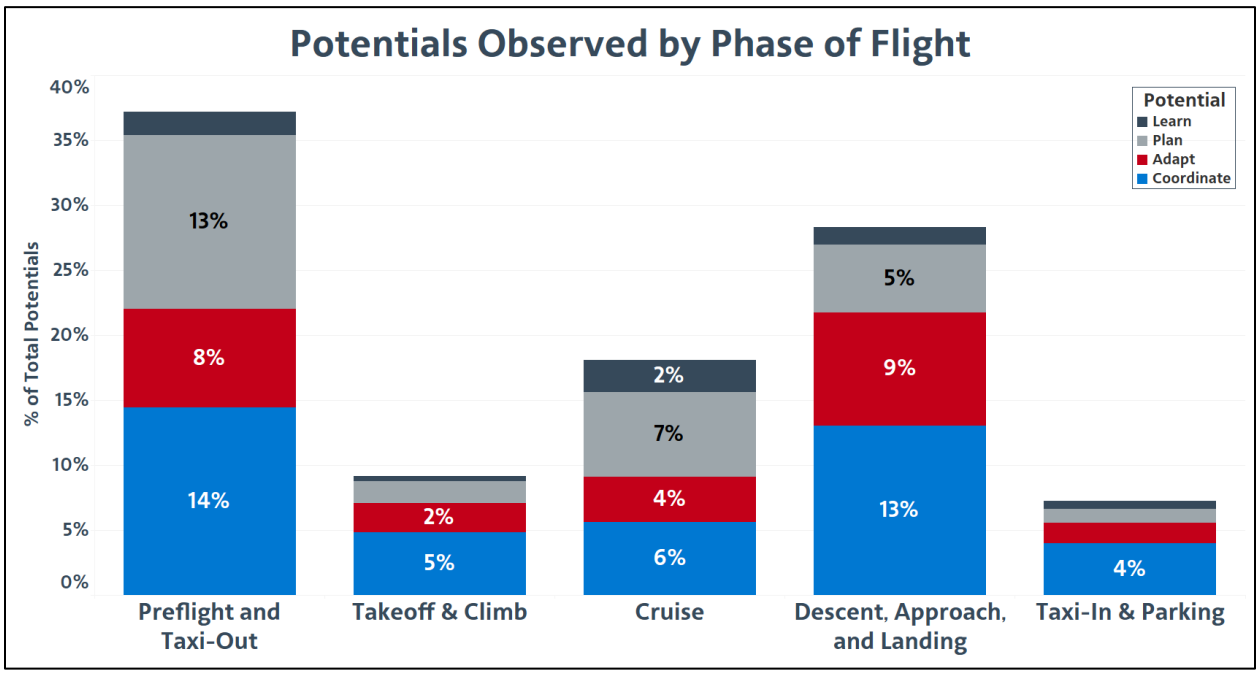


Figure 5. Potentials observed by phase of flight (N=2052).

This chart depicts the percentage of total potentials observed during each of five major phases of flight, depicted chronologically from left to right. It is evident from the increased percentage of potentials captured in the phases of flight during which pilots typically leverage more adaptation and initiate responses to external stimuli, that is, Preflight / Taxi-Out and Descent / Approach / Landing. Given that the flightdeck crews have more time to formulate a plan during Preflight and Cruise, the increase in the Plan potential during those phases of flight is logical. An excellent example of the relationship between Adapt and Coordinate is evident during Preflight / Taxi-Out and Descent / Approach / Landing: where Adapt increases, a similar increase in Coordinate is also evident. As crews deal with emergent pressures in these busy phases of flight by adapting, they naturally follow this up with coordinating; asking the other pilot for assistance or confirming the new information supports their original plan.

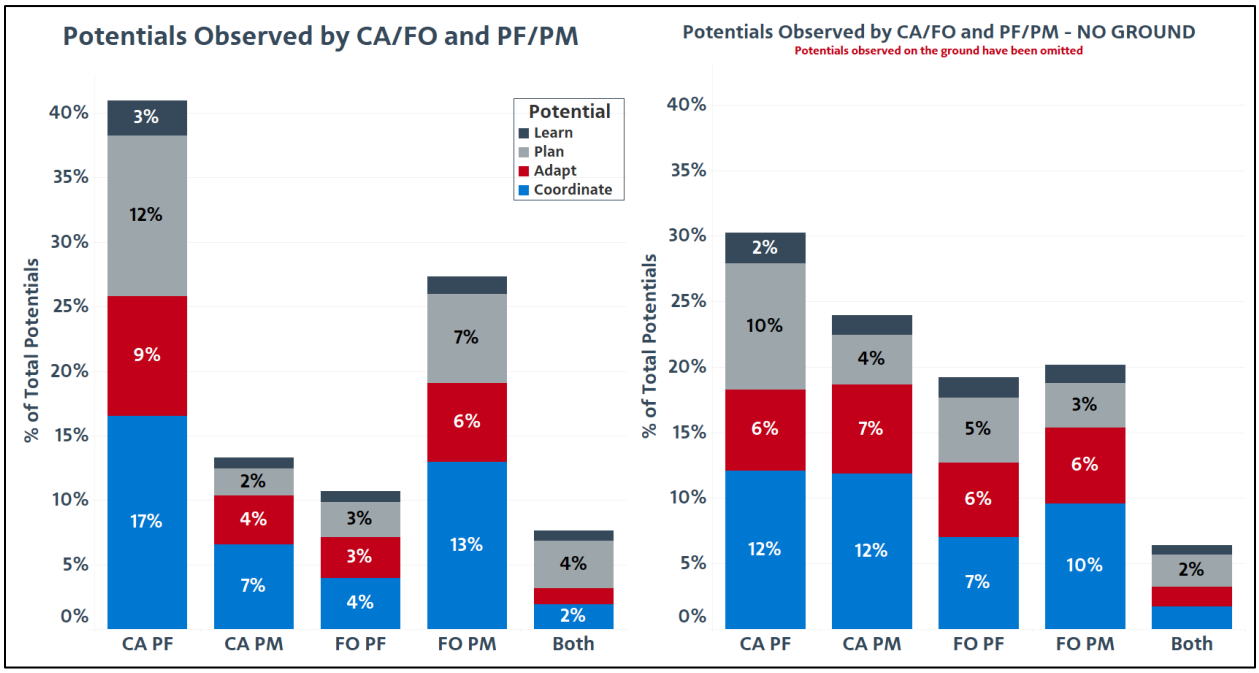


Figure 6. Potentials observed by CA/FO and PF/PM. The left chart includes all potentials observed (N=2052), while the right chart includes only those observed during takeoff and before landing (N=1140).

The chart on the left depicts the observed potentials by overall percentage of all potentials recorded and further grouped by the first actor. The first actor is the seat and crew position combination that first demonstrated the potential to the observer in application on the flightdeck. A first actor is recorded for each observed potential and proficiency. The analyzed dataset showed exactly 50% of observations where the CA was PF and 50% with the FO as PF. The captain is the most frequent first actor for all proficiencies inflight, with a stronger tendency towards PF duties than PM duties. It is interesting that the FO demonstrated fewer proficiencies as both PF and PM and did not show a meaningful difference inflight between the two crew positions. The surprising relationship was that the crew composition of CA as PM and FO as PF showed the lowest percentage of proficiencies observed for any crew combination.

The chart on the right includes in-flight potentials only; all ground phases of flight are omitted. This is because the captain assumes the PF role during all ground operations, which aligns with the greater SMS coding at AA. Naturally, this paradigm facilitates significantly more proficiencies as first actor to the CA as PF during ground operations, and in the full dataset, over 44% of all proficiencies are recorded on the ground. The chart on the right was generated to remove the ground bias by only analyzing first actors only while airborne. In the airborne-only dataset, the FO PM combination initiates a potential nearly as frequently as the CA PM combination. The role distribution was much more significantly pronounced in the full dataset.

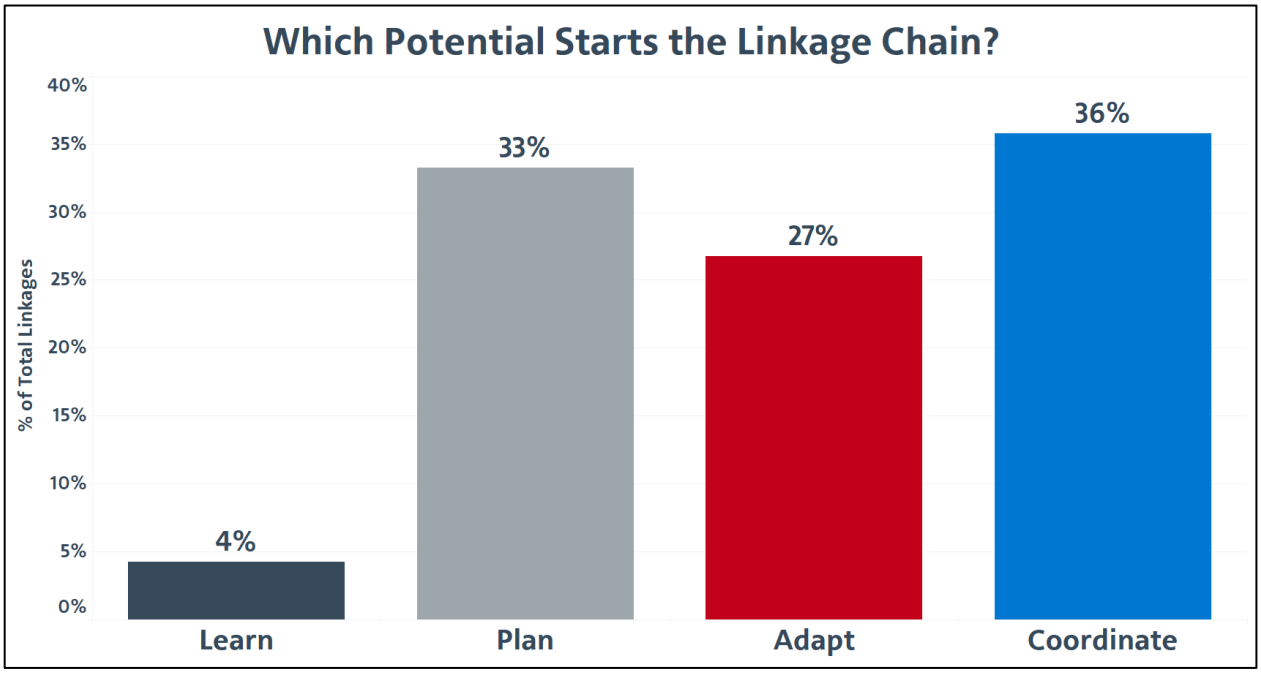


Figure 7. Potential percentages that start linkage chain (N=355).

This chart depicts the potential that begins the chain of linked potentials by percentage of all linked potentials recorded. Almost 17% of all potentials are linked to additional potentials in a chain of related resilient behavior. The Learn potential is linked at an even more reduced rate as compared to its overall potential capture rate in Figure 3. The Plan potential shows increased prevalence in linkages versus overall potential observations. These relationships will need to be further explored as data collection expands but it is believed to show a need to strengthen the learning culture within the organization as well as how important planning is to facilitating resilient performance in the early phases of flight operations.

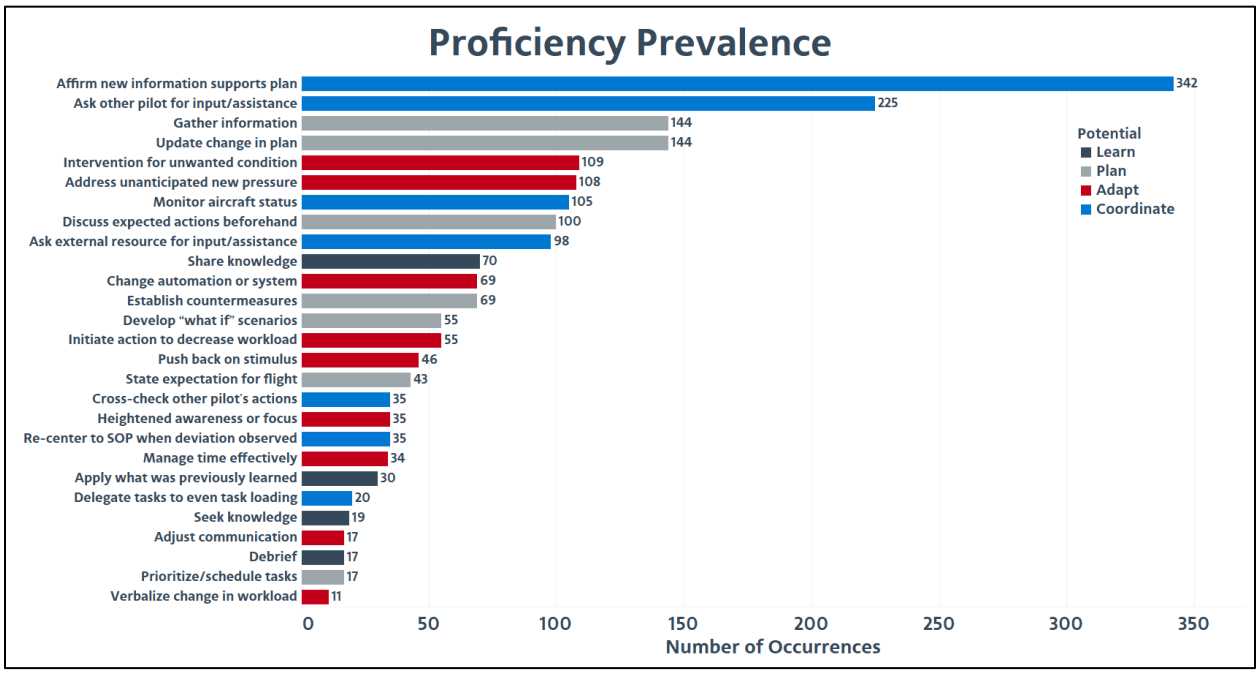


Figure 8. Proficiency prevalence (N=2052).

This chart depicts the prevalence in raw count of each of the 27 unique proficiencies ranked in order from most prevalent to least prevalent. The two most prevalent proficiencies are both found within the Coordinate potential. The most prevalent Learn proficiency ('Share Knowledge') is fairly far down on the ranked order list from top to bottom, with many of the Learn proficiencies in the bottom quartile of the ranked list. All flights do not provide the same opportunity for proficiency demonstration if it is a very simple and straightforward flight, yet the overall small number of observed occurrences for some proficiencies was surprising such as "Verbalize change in workload" at only 11 out of 2,000+ times when this is a central part of AA's threat and error management model in terms of getting crews back into a safe operating environment.

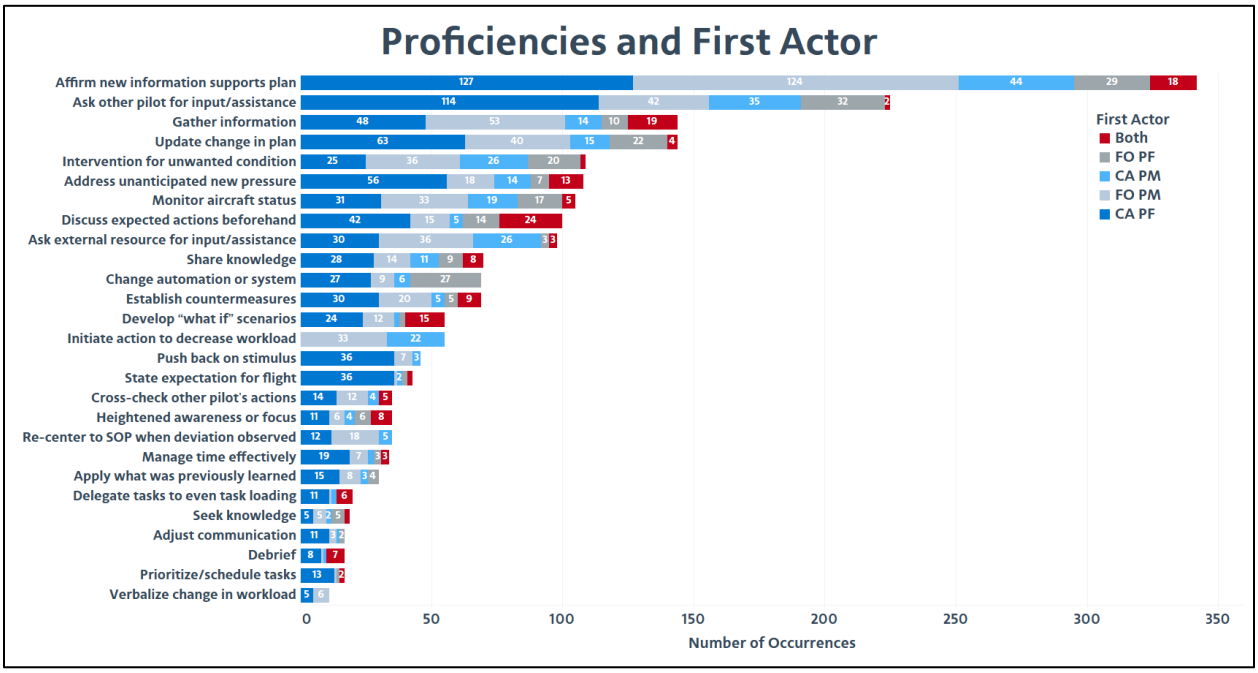


Figure 9. Proficiency prevalence and first actor (N=2052).

This chart elaborates on Figures 6 and 8 with the first actor delineated by color as an overlay to each individual proficiency prevalence. The first actor is defined by crew position and role: pilot flying, pilot monitoring, captain, and first officer. The crew composition of CA/PF and FO/PM are placed together for simpler grouping and then the other crew composition of FO/PF and CA/PM as the secondary complement. It is clearly evident that the crew composition of FO/PF and CA/PM does not generate the same number of observed proficiencies as the crew roles with the CA as PF.

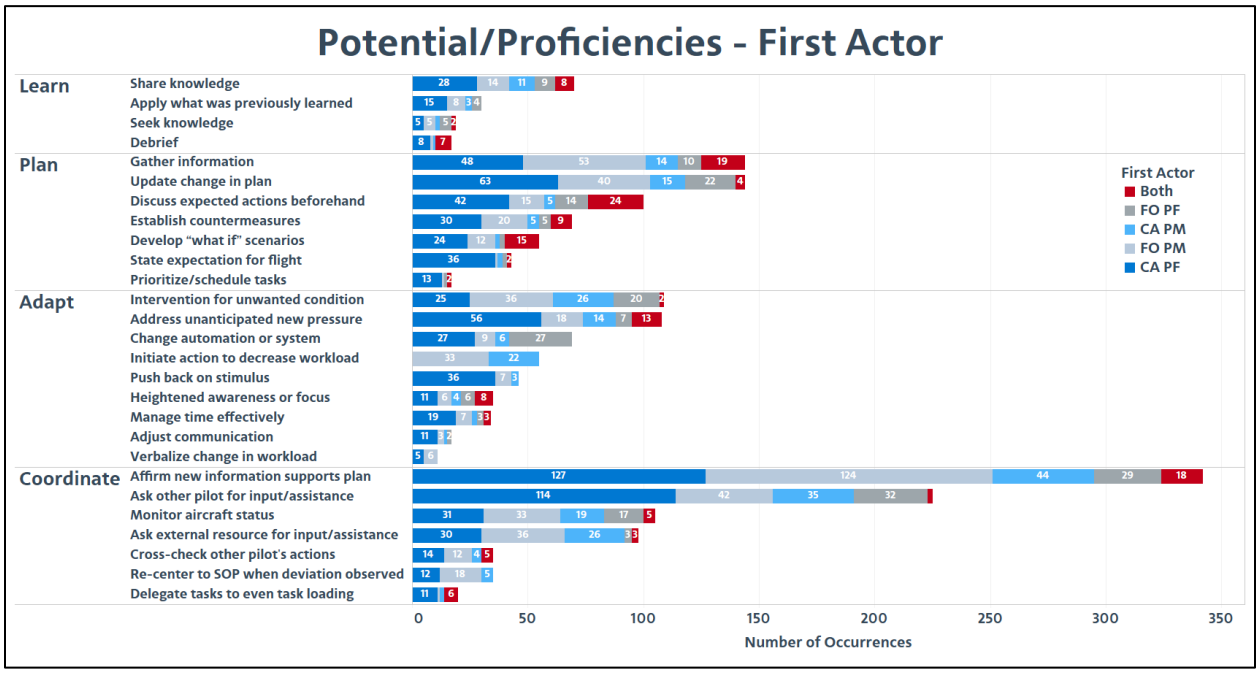


Figure 10. Potential / Proficiency and first actor (N=2052).

This chart depicts the same breakout of first actor and crew position as in Figure 9 except here it is grouped by Potentials. The Coordinate proficiency of 'Ask other pilot for input/assistance' shows a surprisingly low observed count among FOs in the PF role. This interesting breakout of one of the more frequent proficiencies is still being investigated and validated by other means to determine the applicability to a training program or future culture and mentoring opportunities.

Evidence Based Training Competencies

In 2019, AA's LOSA observers began capturing Evidence Based Training (EBT) competencies and performance indicators during flightdeck observations. EBT is an initiative supported by ICAO aimed at improving pilot performance and decision making through the use of core competencies to improve safety. While there are no plans to adopt EBT in flight operations at AA (AA currently trains under the Advanced Qualification Program (AQP)), AA decided to analyze its EBT data as another avenue to understand and validate the initial findings in LIT data. The LIT team divided LOSA-collected EBT data for the Communication, Leadership, and Teamwork competencies into four role categories: CA/FO and PF/PM based on which role combination was credited with the competency. This data was compared to LIT proficiency data in the same four categories.

In the initial data analysis, LIT recognized a change in the resilient performance of the crew depending on whether the FO was PF or PM based on the prevalence of proficiencies observed when the FO was PF or PM. The team hoped analysis of the EBT data could shed light on why this phenomenon was occurring. Unfortunately, a strong inferential explanation could not be reached since the EBT data set was too small and not mature. However, this EBT analysis exercise also revealed crew performance changes depending upon both seat position and flying role, which lent credibility to the LIT data in the same categories. It is hoped that further maturation of both LIT and EBT datasets through increased collection rates and increased observer calibration will offer future opportunities for more robust data analysis.

Qualitative Data

Shop Talk

In addition to LIT's observational data stream, LIT also facilitates Shop Talks, which are one-on-one, semi-structured, interview-discussions between a LIT observer (facilitator) and a line pilot selected at random, usually while the pilot is attending recurrent training. Shop Talks are de-identified and the only demographics collected are fleet type and seat (captain or first officer). Shop Talks create time and space for more in-depth conversation than is often possible during line flights and usually last between 30-60 minutes. LIT facilitators attended an internal training course to develop the skills and methods for conducting Shop Talks. This training was also designed to ensure the facilitators were calibrated and standardized in their methods.

The premise of Shop Talks is to ask pilots how they approach everyday work; in the Safety-II vocabulary, Shop Talks explore how "work as done" relates to "work as imagined" or "work as prescribed." Topics discussed include, but are not limited to: captain leadership and command, go-arounds, and problem solving based on line (non-training) experiences of the interviewed pilots. These experiences can involve both normal and non-normal line operations.

The first Shop Talk sessions were recorded in June 2019. At the time, AA had existing safety programs (ASAP, FOQA, and LOSA) to document and gather data on unsuccessful or undesired outcomes. In certain cases, crew interviews were conducted as part of a FOQA or ASAP event review, but these mostly collected data about undesired situations or incidents. The Event Review Committee (ERC) gathered information from the pilots in order to build context into why the event occurred. Select FOQA and ASAP events and ERC interview excerpts are published in AA's internal publication *Safety Preflight* which is available to all pilots. However, there was no data stream for unique events that did not end with an event or incident that would be the typical trigger for further investigation. The initial content collected during Shop Talk sessions was immediately fulfilling of this gap. LIT is hopeful that this data collected will allow knowledge and experiences to transfer from individual pilots to the pilot group as a whole. Excerpts from Shop Talks have been published in *Safety Preflight* allowing line pilots to learn about events they may not have learned about from ASAP or FOQA. An example is included in Appendix B.

In addition to helping to confirm the insights generated in the observation, Shop Talks also produced new, thought-provoking data in and of itself. Having dedicated, protected discussion time (as opposed to a line flight observation that has very limited and/or unpredictable time for discussion) with participants allowed for more in-depth discussion on events where the outcome was successful as opposed to unsuccessful or undesired outcomes. LIT facilitators are encouraged to ask follow-up questions designed to get the participant pilot to verbalize their thought process – what did they do and why? How did the event happen and what was the outcome? What did the pilot learn from the event/outcome? The approach is intended to mimic two pilots congenially trading flying stories.

During the analysis of the first six months of Shop Talks, LIT realized that more structure was needed in the Shop Talk discussions: each facilitator had asked questions on the same subject in slightly different ways, resulting in a lack of consistency in responses. The decision was made to create a standard template to ensure the exact same questions were asked of each participant. This standard template was used for the next round of Shop Talks beginning in January 2021 (Appendix C). (No Shop Talks were conducted during 2020 as a result of reorganizations, reallocations, and safety concerns in the COVID-19 pandemic response.)

Despite the use of the template, LIT took great care to ensure the loose structure of the question style encouraged, rather than restricting the responses of the participating pilots. Analysis of Shop Talk responses has proven to be challenging due to the flexible format and the variability of follow up questions, making each Shop Talk session slightly varied. However, it was decided the data collected would be more valuable than the risk of data analysis complexity. Pilot testing of questions was leveraged as a reliable way to improve internal question validity and balance some of the follow-up question variability.

Although the standardized template ensured the same initial questions were asked by each facilitator, the templates themselves could be tailored with respect to certain areas of concern or interest in AA flight operations. For example, beginning with the January 2021 template, LIT asked each fleet's check airmen what questions they would like incorporated during Shop Talks. LIT will

present both the raw data and an analysis by fleet to the check airmen, providing a data stream previously unavailable to them.

LIT intends to rotate templates each quarter. Some questions will always be asked, including, for example, *"Can you tell me about an event or a situation you had which required significant adaptation or when you could not follow standard procedures exactly?"* This question in particular is at the very heart of resilient performance. Other questions on the template will be rotated to allow AA to focus on current areas of concern within the flight safety department and the organization at large. For example, the January 2021 template included a series of questions related to the COVID pandemic and how it had changed pilots' approach to work.

Shop Talk collection goals for 2021 are set at 6-8 Shop Talks per month, resulting in about 50 over the course of the year. Balanced interviews across both narrow and widebody fleets will allow for adequate sampling to detect different issues and/or concerns. LIT hopes that Shop Talk data will be just as valuable to AA as the LIT flight observation data has been, to-date. Shop Talk provides an extremely unique and important opportunity for senior leadership and AA flight operations to learn first-hand the challenges facing line pilots.

Analysis

Shop Talk questions were designed using the Critical Incident Technique (Flanagan, 1954) and the Critical Decision Method (Klein et al., 1989). As mentioned above, scripting was not formalized to facilitate interviewer leeway within the conversation with the pilot(s). Two LIT observers conducted Shop Talks with eight pilots between June and December 2019: 4 captains and 4 first officers, whose tenure ranged between 6 and 33 years at AA. The captains had served between 3 and 17 years in that role. While such a small sample size would usually limit generalizability of the findings, LIT and flight training leadership were more confident in the responses since they were corroborated with other data streams.

In conjunction with AA's training department, LIT leadership decided to explore four avenues of inquiry relating to captains: captain's leadership training, characteristics of leaders, advice for new captains, and challenges faced by captains. Iterative analysis using content, thematic, and focused coding yielded concepts that were visually represented using CmapTools software. The concept map as well as holistic coding detected several "through-line" truths that emerged from these respondents, and a comprehensive narrative (below) was created along with the concept map (Appendix D).

Training: Captains learn in the classroom and on the flightdeck. In the classroom, captains believe they would learn best in one 8-hour, highly interactive and engaging, low-tech, all-encompassing leadership class with a small class size that they attend immediately upon upgrading. The training content should be practical and useful (e.g., who to call, what forms to complete, updates to the flight operations manual), as well as decision-making strategies (e.g., making tradeoffs, technology use) and people skills (e.g., crucial conversations, interacting with others as a leader).

Rather than motivational speeches from leadership figures, pilots want to hear what is expected of them with regard to both organizational culture and technical operations. In both the (single session) captain upgrade course and the (recurrent) annual human factors training, pilots prefer highly practical (rather than theoretical), flightdeck focused, scenario-based discussions of real events both mundane and extraordinary, accident/event reports, and experiences of other pilots in the class, especially those new to AA. On the flightdeck, CAs can help first officers (FOs) learn how to be captains by delegating tasks, including them in decisions, giving positive feedback and encouragement, and treating them as captains-in-training rather than as subordinates. FOs can demonstrate a learning attitude by asking CAs for advice in how they handle various situations and exploring task-specific execution strategies.

Leaders: Good leaders often stand out for their skill, interpersonal demeanor, and ability to coordinate and synchronize with others. Pilots appreciate leaders who remain up-to-date on protocols and take them seriously, who “walk the walk”, lead by example, and are self-aware of their skill. Good leaders communicate confidently yet tactfully, have a sense of humility, initiate congenial small talk, and create a focused yet relaxed atmosphere. Asking for and listening to input from the FO, articulating expectations, explicitly asking the FO to “call me out”, and other examples of open communication demonstrate a good leader’s willingness to be a team player. By contrast, pilots can quickly identify arrogance in a captain, especially when the captain acts boastfully and proceeds to perform error-laden behaviors, fails to perform as expected under pressure, or employs outdated, disused, or discredited behaviors.

Challenges: CAs find themselves responsible for being aware of, as well as integrating into their work, a great many fast-paced changes in organizational as well as aviation knowledge and information. Sometimes, this new information seems to arrive without context. Current CAs feel pressure to make the right decisions, beyond reproach, constantly and consistently. Nevertheless, they would advise new CAs to leverage teamwork to create success, and that new CAs need not internalize the weight of all decisions made.

Advice: Respondents would advise new CAs to be methodical in stressful situations and to remember their responsibility as a leader to manage the tempo of work. As a word of caution, experienced CAs want new CAs to equate complacency with risk.* New CAs should internalize how important their job is and strive for excellence over and above what the rules and regulations stipulate.

*LIT recognized the nuanced discrepancy between the complacency/risk equivalence captured in the Shop Talks and what AA safety culture espouses about complacency and risk. The data revealed a rich example of “work as done” and “work as imagined”, and the findings were pushed up the chain of command with urgency.

LIT realized that much of the variation among question phrasings could be described in terms of whether the respondent was asked to answer from a mindset of their own reality, that is, from lived experience (ontology), or from a mindset of functional knowledge and narrative recall (epistemology). Ambiguity about which mindset to leverage or “double-barreled” phrasings that

asked for both mindsets may have led to confusion among facilitators and pilot respondents. The January 2021 template revised the question set with attention to the desired kind of response and has pilot-tested new questions as a reliable way to improve internal question validity and balance response variability.

Training Surveys

In October 2020, the team met to review the data focused on looking at PF/PM relationship and resilient performance. As the team grappled with the significance of resilient performance displayed by the CA and FO in terms of their roles as PF/PM, it was decided to gather focused data via a survey method. The team constructed a series of three focused questions to investigate the PF/PM relationship and how crews learn. LIT sought the counsel again of NASA's HC2S team to better understand survey mechanics and how to efficiently phrase the questions. The plan was to deliver the survey at the beginning of pilots' recurrent ground training classes. The observers disseminated the survey to pilots with an emphasis that it was voluntary. Approval and support from the Allied Pilots Association was obtained beforehand which helped to highlight the collaborative safety approach of the effort and enhance participation.

A total of 102 surveys were collected. The survey was designed to solicit quick responses by the respondents, and their answers were bucketed into organic categories for analysis. Respondents represented both widebody and narrowbody fleets (59% A32F, 23% B737, 11% B777, 3% B787, 4% not reported) as well as comparable role diversity (42% CA, 51% FO, 1% SIM-P, 6% not reported). A breakdown of the questions and responses yielded the below results. Also included are a few excerpts from the responses to each question.

Table 2. Training Survey Responses.

Question	Top 3 Responses	Excerpts
1. When during a sequence do you talk about what you have learned or ask the other pilot to share their flying experiences?	1. Cruise: 50% 2. Preflight: 29% 3. Layover: 11%	"One of the best things that can happen on the flightdeck is two pilots sharing their 'war stories' during the flight. These stories usually start off by saying: 'The last time I was in here…' or, 'Let me tell you what happened to me last week…' or, 'Ugh, this airport is a nightmare…' I would say 95% of our pilot group wants to share their experiences with the other person they are flying with. Sometimes starting with a specific event, at the beginning of the trip, is a great ice-breaker to spur greater conversation later on during the trip." "The time at the gate before pushback and when everything is done in preparation for departure (just waiting on final boarding, etc.), there can be a fair amount of time to talk about what happened on your last trip, or what you learned when you just got back from R9/18, etc. Many times, it is a way of having something to talk about with the other pilot if you've never flown with them before. It is a good way to break the ice."
2. In your opinion, when do you think would be the best time to accomplish this learning discussion during a sequence?	1. Cruise: 41% 2. Preflight: 29% 3. Layover: 19%	"Cruise offers the most time. If I had to pick one time, that would be the best period during the flight. I have always thought it would be useful if the crew committed to one another to finding time to talk about procedures, systems, policies, hangar flying, etc. during a flight. I have thought that committing to that idea on the ground at the gate during the departure briefing might a good time to first discuss the idea, and then at cruise, actually have the discussion on some agreed upon topic." "I think finding out the other pilot's experience and recency is key early in the sequence, hopefully before the first flight together. It opens up the flow of information early. I know going forward, hearing what the other pilot's experience is will let me know where I will look to learn from them or assist them." "Pre-trip brief: 'Hey, I'm _____. I just want you to know this is OUR cockpit and I'm fully open to suggestions, criticism, or new stuff if you've been to training lately.'"

Question	Top 3 Responses	Excerpts
3. Do you think the crew performs better when you are pilot flying or pilot monitoring? Why?	1. PM: 38% 2. Both: 34% 3. PF: 14% The top reasons given for PM were: • Greater Situational Awareness 51% • Better at Monitoring 13% • More Experience 13% The top reasons given for Both were: • Equal PF/PM Skills 29% • Depends on Other Pilot's Strengths 26% The top reasons given for PF were: • Control 21% • Greater Situational Awareness 21% • Setting the Tone 14% • Personal Preference 14% • Less Experience 14%	"The crew performs better when I'm PM because my mind is not focused primarily on flying the aircraft but rather on monitoring the other pilot AND getting a big picture of the situation hence greater situational awareness. Also, as CA, I find it easier to A.S.I. (ask, suggest, insist) to determine what the PF's plan is. As an FO, I would just watch the CA assuming he knew what he was doing until there came a point where I thought I needed to speak up. I think PM/PF performance is also affected by seat and the ability of either role (CA, FO, PM, PF) to communicate so that they both share the same mental model." "PM. Because, generally, I think the best situation is when the FO is flying and the Captain is monitoring. This allows the Captain to be less task saturated and have greater situational awareness." "In my opinion, the PM should be working harder than the PF. The PM should be handling every duty outside of the primary control of the aircraft. If the PF can delegate more tasks to the PM, that leaves more room for the PF to monitor primary flight controls." "It was ingrained into my training early in aviation life that the pilot flying shouldn't do anything that surprises the other pilot in a multi-crew environment. To me, this comes out in the form of announcing before making changes, asking for verifications, stating my intentions before accomplishing a task, and giving benchmarks for the other pilot to measure against. For example: 'I plan to be fully configured and stabilized by 1500AGL. If I'm not, I'm messing up so please feel free to call me out on it.' A broader example may be simply communicating threats and more importantly the planned mitigation prior to encountering the threat so that it can be discussed ahead of time. This has often allowed the other pilot to capture errors in my plans before the event even occurs. I do feel I state my plans much more than most pilots I fly with. Far too often I've found myself wondering how the other pilot plans to navigate a threat."

To summarize the results, AA crews answered overwhelmingly in favor of learning during cruise and preflight, with the possibility for these conversations to carry over during the layover. These phases during a sequence offer crews the most free-time with fewer interruptions and a captive audience to have candid discussions on experiences and lessons learned throughout their professional careers which creates a golden opportunity for resilience to be taught at a peer-to-peer level.

Most crews who completed the survey preferred the role of PM due to their ability to see a bigger picture, thus, gaining greater situational awareness and being able to reduce the workload of the PF. Many of the respondents also noted that their communication is better as PM, keeping the crew on the same page, building resiliency, and having more opportunity to trap threats and mitigate errors. It is interesting to note that captains surveyed were over 5 times more likely to favor a role as PM, versus FOs who were only 1.7 times as likely to favor a role as PM. This "desired" crew pairing differs substantially from our observed flightdeck resilient behavior captured by our proficiencies, which shows that CAs as PF and FOs as PM exhibit the most resilient behavior during actual line flying.

Development and Future of LIT

Program Justification and Budgeting

In May 2020, with AA responding to the financial impacts of COVID-19 and the safety department engaged in some strategic planning, LIT leadership was asked to provide their goals and budget for 2021 and beyond. The team gathered input and outlined the following objectives:

<u>LIT will perform work over the next 1.5 years with the following goals:</u>

1. Provide a data stream to CA Leadership, Mentoring, HF courses, and SMS as desired.
2. Streamline a training program and hire 3 additional LIT members to augment data collection.
3. Publish and present a White Paper on the first two years of LIT journey at AA.
4. Analyze the current 100 observation dataset and begin writing White Paper II, emphasizing lessons learned from the data analysis – promote Learning in flight operations.
5. Begin development and testing of a Resiliency Metric for Safety Index inclusion at AA.
6. Begin discussions with other working groups at AA to promote learning from what goes right.

<u>Work will be performed equitably across these four areas within flight safety:</u>

1. Shop Talk (crew interviews) and survey data capture and analysis – 25%
2. Flightdeck observation data capture and analysis – 25%
3. ASAP, FOQA, AI, Machine Learning, and other available data mining and analysis – 25%
4. Overall conclusions and recommendations drafting from the above analysis – 25%

Production plan for 2021:

1. 100 additional flightdeck observations to validate the current dataset and LIT training process
2. 50 additional Shop Talk interviews with crews to develop the dataset and coding
3. 2 sets of 100 surveys gathered at pilot recurrent training
4. Quarterly analysis and mining of ASAP, FOQA, AI, Machine Learning, and other sources for trends and ideas
5. An annual report capturing lessons learned (results) and process improvements

Responsibilities for 3 Distinct Member Groups within LIT:

1. Steering – oversight and all external communications including FSF, Safety-II, other airlines/unions, and AA departments
2. Leadership – planning, scheduling, strategic goals and production, data compilation
3. Analysis – data collection on flightdeck observations and interviews, analysis breakouts, author articles

Resources required for this scope of effort:

1. Steering Committee – 3 pilots at an average of 3 days per month of effort for each
2. Leadership Team – 3 pilots at an average of 5 days per month of effort for each
3. Analysis Team – 3 pilots at an average of 4 days per month of effort for each (plus a full-time analyst = 40+ hours/week split between LOSA and LIT)
4. TOTAL – 36 days of monthly work = 176 hours per month
5. TOTAL (minus Steering) – 27 days of monthly work = 132 hours per month

LIT Observer Training

When LIT was established, the first three LIT observers transferred directly from the AA LOSA program. This meant they were already trained for capturing data in the flightdeck, albeit for a different methodology (errors-what went wrong, versus proficiencies-what went right). Training previous LOSA observers allowed LIT to quickly begin collecting Safety-II oriented data. However, it proved difficult for all three observers to pivot from error-based observation to resilience-based observation. These three observers indicated that it took about six months to fully make the transition in mindset. This revelation determined how LIT would expand the program in the future.

During the October 2020 LIT meeting at the Charlotte, NC Training Center, the team began training two new observers who were screened and selected during the COVID-19 pause in data collection from April until December 2020. Both candidates were widebody first officers with no previous experience performing flightdeck observations. At the conclusion of the initial training program, LIT leadership sought to expand the team again to hire a captain, as the previous captain on the team had taken an opportunity to become a check airman. This would fulfill the team's balanced representation across narrowbody and widebody fleets, as well as among CA and FO roles. Leveraging this particular skill and experience mix, LIT leadership foresaw enhanced credibility when collecting data and briefing results internally and externally.

Initially, LIT did not have a purpose-built training program for observing, so each new LIT observer was mentored by an experienced observer. Several calibrations were conducted with new observers during this first phase to ensure data collection was as standardized and accurate as possible. Based on this experience and the time needed to calibrate the observers, LIT leadership understood the need to establish a more formal training program. Despite the resulting high-quality performance of the original observers, it became evident how much more efficient a purpose-built program could be.

With this in mind, LIT observer training was planned at the AA Flight Academy in Fort Worth, TX in January 2021 for the new observers. Due to continuing COVID-19 restrictions and elevated cases locally, it was decided to conduct training remotely via web conferencing. The training was conducted over three days to teach observer protocols, data capture techniques, scheduling, and a thorough review of coding and standardization exercises. The virtual training turned out to be overwhelmingly successful and very productive, enhanced via questions and conversations among the new team members. LIT was poised to begin conducting flightdeck observations after an 11 month pause due to the pandemic.

Having a dedicated training program immediately proved its value. The first few LIT rides conducted by the new observers demonstrated they had a firm grasp of the flight observation mechanics and coding within the LIT data collection tool. After one month of observing line flights, all five active observers performed calibration exercises and the results were clear: all five observers were much more in agreement with coding compared to the early observers who received only informal training. As a result of the success of the formal training, all new LIT observers will be required to attend the formal training course before capturing data.

LIT Outreach and Presentations

During the pause in data collection due to COVID-19, the team made use of the downtime to share its message and initial findings with a variety of organizations through various formats:

- Several articles written for AA's internal safety magazine, *Safety Preflight*, addressing the Coordinate Potential and Shop Talk analysis.
- April 2020: Blog entry for the Resilient Engineering Association discussing initial AA Safety-II journey lessons learned and roadblocks. American Airlines & Safety-II - Resilience Engineering Association (resilience-engineering-association.org)
- June 2020: LIT White Paper I posted on Skybrary: https://www.skybrary.aero/bookshelf/books/5964.pdf
- September 2020: Flight Safety Foundation (FSF) Learning from All Operations (LFAO). Initial conference from FSF investigating the interest of industry to have a coordinated Safety-II effort in the future. Results were overwhelmingly in favor of pursuing the collaboration.

- October 2020: Safety-II in Practice. Virtual conference hosted by Erik Hollnagel. Presented initial LIT results and analysis from recent data reviews at AA.
- October 2020: Children's Hospital Association S-II: Launch into New Altitudes of Safety. Team virtually presented a general review of LIT's history and journey to date on Safety-II implementation at AA.
- October 2020: FSF 73rd Annual International Air Safety Summit (IASS) Team presented LIT data collection efforts and limited review of data analysis.
- December 2020: FSF LFAO and Working Group. As a key stakeholder, offered that future LFAO papers could capture LIT's story and new information to benefit the group.
- December 2020: Team participated in a one-hour podcast with David Provan from Forge Works safety consulting group concerning the LIT journey, and answering numerous live questions from the audience. Over 300 attendees and over 400 views worldwide (50% non-aviation entities).
- February 2021: British Airline Pilots Association (BALPA) Safety Conference. Team presented operational aspects of implementing Safety-II and the regulators view of the process to worldwide audience virtually
- April 2021: Article published for Hindsight magazine discussing COVID-19 impacts to pilots.
- June 2021: Presentations and cross-industry discussion panel at the 9th Symposium on Resilience Engineering.

The Path Forward

Internal Awareness of LIT

During AA's Operations Data Analysis Working Group (ODAWG) February 2020 meeting, LIT data was used to educate the check airmen on three areas that the training department wanted to gain a better understanding of: turbulence related events, tailwinds for takeoff, and go arounds (Appendix G). The team compiled previously observed proficiencies related to these areas to present at the meeting, and the check airmen genuinely saw the value in this unique "what went well" data methodology versus the traditional "what went wrong." After the meeting, several check airmen expressed further interest in Safety-II concepts, including improving learning within the operation.

In April 2020, ahead of the monthly Operations Standards Board (OSB) meeting, LIT leadership sent out several examples from LIT observation narratives for check airmen to review. During OSB, the check airmen were broken down into two teams by fleet type and were asked to brief what they learned from these examples. Several check airmen mentioned that they already teach their pilots from examples, and that they envisioned these LIT examples being extremely valuable. LIT now maintains a steady stream of examples to check airmen for use in front-line learning.

During the same time, the team also created a proof-of-concept presentation for the Training Department to incorporate LIT principles into the Human Factors (HF) class. Training leadership wanted to merge their existing, Safety-I focused slide deck and scenarios with the Safety-II viewpoint brought by LIT proficiencies and examples from observations. Although LIT itself does not seek to define best practices, Training leadership sought to leverage LIT's unique, measurable, and quantifiable insights into how successful crews operate, to support best practices espoused by the Training Department. Leadership examples from the Shop Talk sessions were also integrated into the HF class.

During the beginning of the pandemic, the LOSA program was asked to review LOSA observation data to understand COVID-19 impacts to operations. LIT examined these findings and compared them to LIT proficiencies, generating a new series of Shop Talk discussions specifically focused on the impact of COVID-19 on pilots (Appendix H).

Value of LIT

One of the recurring ideas the team explored throughout the pandemic pause was the practical implementation of the data. The team spent a lot of time brainstorming new and varied opportunities to demonstrate to AA leadership and the pilot group how LIT data could enhance AA's safety culture. The team was also encouraged when safety department leadership asserted their intention to incorporate LIT into other meetings, offices, and agencies. LIT was successfully communicating externally, but internally, awareness among line pilots was still low. The team decided to focus future efforts to educate other departments within training and safety.

One of the challenges at this point in the program's history is realizing that LIT faces two, at-times conflicting organizational pressures: transition from an academic/proof of concept phase to a more pragmatic approach to achieve deliverables, and to maintain a close alignment with foundational concepts and rigorous research. Acknowledging the program's ongoing maturation, LIT's big question is now, "How has this data allowed AA to make changes that enhance safety?" or "What changes did AA make to enhance safety, using LIT's new data stream?"

The team has collected the following thoughts to stimulate that discussion. Other organizations may find themselves faced with similar issues:

- Data users are primarily SMS and training (check airmen, Human Factors, and Captain Leadership courses). Pilots are more concerned with adopting best practices through higher quality instruction than they are with receiving the data or analysis directly. Increased data collection will provide more insight for SMS to review. Once mature and if the data supports, this will also allow LIT data to be used for procedural changes.
- Create talking points for check airmen within the Human Factors class that show the positive side of performance, contrasting with examples that focus on pilot error. Combining perspectives that show positive aspects of crew performance along with following SOPs and learning from others' mistakes increases the opportunity for success.

- The organization is the customer. We provide the raw materials. Pilots don't really see a policy change and say, "Wow! LIT changed that." They don't think that way. Training and SMS is the real consumer.
- Ultimately, the line pilot should be the focus as the sharp end of the work, but it is difficult to deliver it to them. Further discussion about whether LIT needs recognition from line pilots leads to the question if the SMS is the customer.
- Establishing LIT as a fourth leg of the safety stool within SMS (in addition to LOSA, ASAP and FOQA).
- Increasing awareness of LIT with other departments in the organization.
- Cultural challenges in other work groups may prove difficult to implement Safety-II concepts (trust, stick vs. carrot approach).
- Data analysis is another challenge in determining if it is feasible to come up with a resiliency score to brief the safety department on a routine basis.
- Debriefing concept within the Learn Potential – to be embraced, we need to present data to show pilots and Training why they need it, including where to insert it within the flight sequence.

Conclusion

AA's Flight Safety and LIT members have continued developing a pathway for success in the implementation and learning from resiliency in the modern airline flightdeck environment. The journey can be likened to shooting an approach in IMC to a brand-new runway, with the cargo being a new and undeveloped data stream into SMS. With the foundational work and struggles surmounted, the team has confidence that the LIT language and coding scheme is relevant, reliable, and appropriate given the strengths and constraints of the system. LIT's processes to capture the data have been jointly designed and refined with input from leading academic supporters, top-level scientists from NASA, and leaders in other industries. External relationships have been critical to stay the course and ensure that the runway is straight and durable for use going forward. Rigor and reflection are applied to ensure that the processes evolve bimodally with protected creativity as well as control and oversight measures. The ability of outside experts to contribute important ideas at critical design moments has been one of the greatest successes of the journey, facilitating significantly higher quality program development.

Reflecting on the past year, LIT's primary focus was in reviewing and validating the proficiencies and coding captured during the first in-flight observations. This process, though time intensive, has established a stable and corroborated, and rigorous foundation for the program going forward. This review highlighted necessary changes while providing confidence in the coding and language, and the validated language was released to the industry in late 2020. New data collection methodology was also developed during this validation step to better facilitate data analysis. Deeper analysis on subjective data feeds like Shop Talk facilitated discussions and short surveys also shed light on learning opportunities.

These data streams combined to form a better understanding of learning at AA. The knowledge captured is being used to develop more vigorous and comprehensive leadership and mentoring training for American Airlines pilots. This enhanced training is in direct support of the ultimate goal of LIT, which remains to encourage and stimulate a better learning culture in AA's flightdecks, across the entire spectrum of operations. Various venues in which to leverage LIT insights are currently being planned and tested to maximize the effectiveness and applicability for all pilots. LIT considers the conceptual and demonstrative phases of its development to be complete at this point. Continued efforts will be to monitor, trend, and update important learning conclusions from flightdeck operations as data capture expands.

Through the Learning and Improvement Team's efforts, AA and APA members have successfully provided a new and capable process for the aviation industry to capture data related to resilient behavior. AA's journey has been highly educational and enlightening across many different domains. The relationships and collaboration that have emerged with LIT's commitment to open and transparent developmental efforts have been the most rewarding aspect for the entire team. AA is committed to providing an accurate account of, and accessibility to, the methods and tools to interested parties as this fruitful application of system thinking is further explored and enhanced.

Appendix A. LIT Observer Codebook

American Airlines

Learning and Improvement Team – Master Codebook

LEARN: What will I do or change next time. Share past experiences.

Learn serves as the base for crew resilience. Each crew member has individual experiences from the past to aid in decision making. Additionally, experiences learned either directly from each flight or second-hand experiences from other crewmembers can be applied to future flights.

1010-Apply what was previously learned

- Pilot accomplished a task based on prior or learned knowledge. The pilot may verbalize it to the other crewmember after the action occurred (*observer may have to query the pilot as to why they accomplished said task).*

1020-Debrief

- Used some sort of debrief to discuss what went well or could have been handled differently
- Debrief unexpected outcome for future knowledge

1030-Seek knowledge

- Pilot demonstrates a positive interest in learning or improving
- A less experienced or familiar pilot asks for guidance from more experienced pilot – *"What runway do you think we will get?"*

1040-Share knowledge

- A more experienced or familiar pilot shares experience with less experienced pilot - *"Last time I was in here…, here is an easier way to control the speed in VNAV, etc."*

1099-Other – Learn

PLAN: Think ahead. Enhance future SA. Threat forward-talk.

Plan should be considered as items accomplished ahead of time. While this can be considered long-range planning, it is not always the case. Plan is both noun and verb. For example, pilots plan a departure at the gate to gain a shared mental model of that plan. Once pilots have that plan, they can detect changes or pressures to the plan more quickly.

2010-Develop "what if" scenarios

- Emergency return plan (right or left downwind, overweight landing, expanded 10-7 discussion)
- Plan for contingencies
- Possible runway change
- Holding or minimum fuel considerations
- Approach/landing (plan unexpected go-around, expanded 10-7 discussion)
- Potential diversion plan and options

2020-Discuss expected actions beforehand (expanded above required briefing items)

- Planned taxi route if complex
- Specific SID/STAR considerations
- Takeoff performance exceptions (APU on, bleeds off, improved, tailwind)
- Approach/landing exceptions (tailwind, offset LOC, steeper than normal path)
- Terrain or MSA considerations
- NOTAMS affecting flight
- MEL implications

2030-Establish countermeasures

- To known pressures
- Reminders (highlighted taxi route, gate position, cleared to land time hack, checklist placement as a reminder for crossfeed or missing logbook, etc.)
- Secondary flight plan entries
- Fix page entries

2040-Gather information

- Current ride conditions, convective weather information, etc. (will ride remain as expected or are there changes?)
- Use EFB resources (Comply365, JeppPro, WSI, phone-patch to dispatch)
- Hand-written notes (TOLD cards, notes on PDC or flight plan, etc.)
- ACARS requests or communication with dispatch
- Contact company via VHF for operational information
- Use of weather radar

2050-Prioritize/schedule tasks

- Items to be accomplished at a later point, not in-the-moment
- Brief when items or tasks will be accomplished

2060-State expectation for flight

- CA states expectations of FO
- FO states expectations of CA
- PF states expectations of PM
- PM states expectations of PF
- Conducts a thorough flight attendant briefing

2070-Update change in plan

- Pilot briefs or updates other pilot with info that amends/changes the plan (runway change, approach change, NOTAMS, weight and balance or performance changes.)
- PF briefs or updates PM with info on how they are amending/changing the plan or aircraft state – *"I'm going to fly slightly high on glideslope for wake turbulence from the preceding aircraft" etc.*
- Pilot briefs change in ATIS or runway outside of normal briefing times (weather changes for better or worse, unplanned runway changes)
- Amended clearance or call for release program
- Crew briefs group outside of flightdeck on new/amended plan

2099-Other – Plan

ADAPT: Act given the current condition. Semper Gumby – always flexible.

Adapt is in-the-moment. This is crew recognition that the plan is changing, and a response or intervention is needed. Crew behavior to affect task loading is included in this potential.

3010-Address unanticipated new pressure

- Address conflicting ground traffic
- TCAS events
- Wake turbulence
- Unexpected gate hold
- Aircraft malfunction

3020-Adjust communication

- Delay engaging other pilot(s) if their workload does not permit
- Use of interphone/com if having communication difficulty
- Language barrier

3030-Change automation or system

- Autopilot level/mode
- FMS entries/programming
- Aircraft system
- Aircraft configuration
- Aircraft speed (for turbulence, downwind entry or appropriate speed relative to arrival airport)

3040-Heightened awareness or focus

- Before non-standard or complex task
- Lengthy revised ATC clearance
- Runway change during or after pushback
- Landing runway change from assigned or planned associated with time compression
- Slam dunk approach
- Application of complex MEL
- Takeoff or approach/landings in challenging or difficult conditions (weather, environment, or airport)
- Crossing runway during taxi or approaching hold short line

3050-Initiate action to decrease workload

- PM offers to clean up flight plan during approach with AP on
- PM changes FMS entries for late runway changes, setup up landing minimums
- Load new arrival if PF task saturated

3060-Intervention for unwanted condition

- Incorrect autopilot setting or mode
- Incorrect/missing/omitted FMS entries
- Missed or late ATC radio calls
- Selected lower altitude for buffet considerations
- Airspeed, heading or altitude deviation (G/S, LOC)
- Incorrect aircraft configuration
- Wrong surface operation
- Correcting the aircraft position for vertical or lateral deviation

3070-Manage time effectively

- Delay task until more appropriate time
- Time permitting, move up task to ease possible subsequent task loading

3080-Push back on stimulus (or create more time. Put up your hand ✋)

- Slow down aircraft speed (taxi or airspeed if inflight)
- Tell external stimulus “standby”
- Tell ATC “unable”

3090-Verbalize change in workload

- Use of color-coding language (in the yellow)
- Heads down/up
- Alert other pilot of change in task loading

3099-Other – Adapt

COORDINATE: Get the team on the same page, stay engaged.

Coordinate may not only involve the pilots, but also groups outside of the flight deck (cabin, dispatch, ATC). It is an interactive potential that keeps the pilots sharing the same mental model.

4010-Affirm new information supports plan

- Briefs taxi instructions or turn
- Crew briefs group outside of flightdeck on current plan
- Briefs ATC clearance if same as planned or filed
- Brief upcoming restriction (required restriction will be satisfied climb or descent)
- Brief or verbalize expected change in FMS, FCU, MCP programming

4020-Ask external resource for input/assistance

- Dispatch
- Flight Attendants
- Maintenance
- ATC (clearance verification, relief of restriction, deviation recommendations for weather, turbulence when aircraft in active turbulence, ask for new altitude for better ride conditions)

4030-Ask other pilot for input/assistance

- Ask other pilot if ready for next task (brief, takeoff, "in the green" etc.)
- Ask for input in decision making
- Ask for help to alleviate workload

4040-Cross-check other pilot's actions

- Takeoff performance entries
- Landing performance calculation or entries
- AP/MCP/FCU settings
- FMS entries

4050-Delegate tasks to even task loading

- Crew division of tasks during late runway change
- Crew division of tasks during diversion
- Crew division of tasks during medical emergency
- Crew division of tasks during non-normal procedure

4060-Monitor aircraft status

- Pilot monitors FMS entries
- Pilot monitors FMA
- Pilot monitors/references aircraft system
- Pilot physically points to aircraft system
- Used Jeppesen charts or other information to monitor route and follow along
- Awareness of aircraft vertical track, lateral track, or current airspeed

4070-Re-center to SOP when deviation observed

- Correct missed callouts
- Prompt for checklist, if missed
- Correct improper aircraft configuration change commands
- PM set missed approach altitude on autopilot if PF missed

4099-Other – Coordinate

PRESSURES

9010-Aircraft Mechanical

- MEL
- Fuel imbalance
- System fault

9020-Airport

- NOTAMS
- Closely spaced runways
- Challenging design features
- Special airport qual

9030-ATC

- Landing runway change from assigned or planned associated with time compression
- Runway change during pushback or taxi out
- Challenging clearance change
- Wrong call-sign
- Frequency congestion or hard to understand
- Slam dunk approach
- ATC applied time pressure
- Controller further restricts SID/STAR from charted
- Language barrier

9040-Automation

- Vertical deviation
- Lateral deviation
- Airspeed deviation
- Undesired mode or mode change

9050-Cabin

- Flight Attendants
- Passenger related issue

9060-Dispatch or Paperwork

- EFB
- Takeoff Performance
- Release errors

9070-Environment

- Conflicting air or ground traffic (aircraft or vehicular)
- Terrain
- Birds
- TCAS TA or RA

9080-Ramp or Ground Servicing

- Clear zone not clear
- Communication difficulties or language barrier
- Ground crew pushback error
- Confined, or tow-in gate

9090-Maintenance

- Mechanic interfering with flight crew duties
- Missing aircraft logbook

9100-Ops Pressure

- Gate agent or customer service
- Operational changes (change in PTOW/ATOW, etc.)
- Late arrival aircraft
- MOT

9110-Weather Impact

- Gusty winds or tailwind
- Convective
- Turbulence
- Snow/ice

Appendix B. AA *Safety Preflight* Article

Back in the Saddle:

Adjustments to the new reality of work at American Airlines

(March 2021)

First Officer Bogomir Glavan, LIT Observer

Pilots at AA are returning to flying after being out of the flightdeck for extended periods of time. Crews now face additional COVID-19 protocols and policies that have changed the way they approach everyday work.

AA's Learning and Improvement Team (LIT) resumed our Shop Talk pilot discissions at the end of 2020. If you recall, these are pilot to pilot conversations led by trained pilot LIT observers. They last 30-40 minutes reviewing recent experiences and everyday work on the line. Our focus areas for the start of 2021 concern recency with multiple pilots coming off of leaves of absences and the operational impacts of COVID-19. This article will share some examples from these pilot discussions and highlight how we are adjusting and adapting to the new reality of work during the pandemic.

Key Points:

- **Pilots coming off of a lengthy leave of use a variety of personal techniques to regain their comfort and have been proactively communicating any lack of recency to fellow crew members.**

- **Crews are spending more time engaging with flight attendants and other front-line workers regarding the additional COVID-19 protocols in place.**

- **Mask compliance, enforcing that policy, and communicating while wearing masks are additional and new crew challenges.**

6,600 of our 15,000 AA pilots have taken some sort of multi-month leave during the pandemic. Flight hours flown are roughly 50% from where they were before the pandemic. Pilots have taken advantage of multiple resources created by APA and AA to prepare for returning to work. Most have an established process where they review mandatory callouts, procedures, and "chair fly" more complex procedures like go-arounds or single-engine emergencies. In response to this concern, the LIT members asked the following questions to pilots:

How often do you fly? Were you on a leave of absence? How did you prepare for returning to work? Did your personal techniques make you feel ready?

Three examples pilots shared of personal strategies for refreshing their knowledge base:

"When I do have a break of over a week I review flows, single-engine profiles and other maneuvers. I created a sheet with limits, emergencies and profiles that I reference and review. Also talk through procedures on the way to the gym."

"I watch the flow guides in the online training section, then I review the flows with a cockpit mockup until they are natural again. I review systems and the maneuvers guide, with emphasis on emergency procedures. I felt prepared but my FMS work was pretty poor."

"Big ticket items like engine failure procedures and call-outs, fight or flight responses I look at a few days out. Now that I am going to some unfamiliar airports because my previous fleet did not operate in these areas, I sometimes will look ahead to study the airport and company pages."

Pilots were then asked a follow up question if they encountered anything unexpected on their first trip back. Pilots reported overall that nothing significant happened upon their return. Most seemed self-aware with their level of proficiency and made more deliberate efforts to communicate that to the other pilot.

One pilot remarked that as they became more task saturated, they reverted to callouts from a previous aircraft they were qualified on for 10+ years beforehand.

"I actually had a goof up and found myself making some callouts from the 777. My FO asked, 'what was that?' and I realized I had defaulted to primacy. I said, 'max power', and not 'TOGA'. My brain just went back to what it is most comfortable with."

Other pilots commented they felt a bit rusty with some of the more complex hand flying skills such as with go-arounds, but quickly regained their confidence and scan patterns within the first few trips back.

The LIT group realized this return-to-work issue was a significant concern within the safety department and wanted to explore how pilots approached work differently when they had been away from the flightdeck for an extended period of time. Thus, part of the discussions took time to ask:

How do you discuss your recency of experience with other crew members before departure?

Most pilots agreed this was an area of concern, but they also stated that it is openly discussed within the first few minutes of crew introductions at the gate or on the flightdeck. Their answers showed a surprisingly candid tone:

"We all know that is an area of concern and not being around aviation for a while makes us rusty. We then become more alert. We see some info ahead of time like the landings and hours on aircraft with mobile CCI that can alert us to this issue."

"Yes, especially with the CAs I see who come back from their time away - it comes up naturally during the crew intro in preflight within the first 5 minutes. They state how long they have been out, and we discuss what they prefer to do. I like to recommend I take the first leg as PF and let them get the big picture back."

"I tell my FOs about my recency and concerns for proficiency. I tell them outright to speak up, it won't hurt my feelings. I find if I compliment them and keep things open it helps them feel more empowered to speak up later in the flight."

AA recently retired four aircraft types, leading many pilots to change equipment qualifications and operating aircraft with minimal experience. Two pilots below shared their mitigation strategies for addressing this with their crews.

New B777 FO: *"I brought up that I was new with the entire crew. There is always a lot of discussion as there are many of us that are low time and not flying regularly."*

A330 FO transitioned to A320 CA: *"I have spent the last few years flying international widebody, so the pace of domestic narrow body is challenging. I tell them if I forget something call me out on it."*

As with all aspects of our world today, pilots explained it is hard to find any part of everyday work not impacted by the pandemic. The LIT group explored this theme by inquiring:

How have you changed your approach to your work during the COVID pandemic?

Pilots described adapting, namely dealing with mask protocols and restricted communication, as well as needing more time for additional procedures and announcements. Their responses ranged from addressing mask usage to cleaning and physiological needs:

"I use cues from our introduction as to how the FAs and FO feel about the protocols and adjust my communication method based on that. For example, with mask usage in the flightdeck, I see what the FO wants to do. I have had some FOs say 'I am going to wear my mask the whole time, I hope you don't mind.' As the CA I just say 'okay, I will do the same' to put them at ease and know that will take one more stressful thing off their plate."

"I wear a mask 24/7 when I am at work, including on the flightdeck. I can tell you that wearing a mask around other crew members has become a huge issue. I tell everyone I fly with to be respectful and wear the mask whenever the door is open, not only because it's the right thing to do, but because there is a huge amount of write-ups for crews not complying with the mask protocols."

"I try and create a little extra space between myself, customers, and fellow employees because I know some are concerned and I want to set a good example, because I know a lot of people are watching us. I also have to adjust how I project my voice with the mask on to ensure I am heard. On that note, I also have to read people with more focus on eye movements and facial expressions since the mask covers up quite a bit to infer from."

“As a pilot I want the passengers and flight attendants to know that their health and safety is of primary concern to me. I want them to know I will back them up with any mask non-compliance issues.”

“I guess I am more aware of the FAs and all their changes and disruptions back there. I know our mask usage is a concern of theirs, so I try and remind the FO when we take a lav break to have our masks up. I usually do that at cruise right before we call them up.”

“I spend more time with the briefs and getting to understand what the concerns are of the crew. I get there extra early now, at least an hour, so I can get set up. I need extra time now for the PAs and various items we need to cover for COVID protocols.”

Dealing with stress is a core part of the pilot’s skill set and thus we are well equipped to defuse many of these newer complex interactions. The last question explored responses to the added complexity and interruptions.

How have the various restrictions and quarantine protocols affected your habit patterns at work?

“I make the PA to the passengers personal, so they know their compliance is of utmost importance and I need them to be safe for the FAs and crew to be able to operate best. I also add into the PA a quick summary of the technical info of the air recirculation and the filtering, so they have some peace of mind. ‘Breathe easy because we are going to have a great flight today!’”

“I just take my time and create an environment where my crew feels like they are not pushed.”

As you can see, these are topics many of us have had on our minds lately and we are trying as a safety department to get a sense of their impacts. With thousands of pilots returning after an extended absence, our discussions have revealed that crews successfully mitigate the risk from a lack of recent flying experience by taking extra time to study and prepare before their first trip back. They also are forthcoming with other pilots about their time away to increase their peers’ awareness and ability to be more effective monitors. The information and personal examples we gather from these Shop Talk sessions provide a unique and critical insight into the working conditions and challenges our pilots face. This qualitative data has been an invaluable complement to our flightdeck observations in understanding the complexity of this COVID-19 operating environment. We look forward to having the time to sit down with you in the future and gain your valuable perspective!

Appendix C. Shop Talk Template

Learning and Improvement Team Shop Talk Q1.2021

(Plan on 35-60 minutes, depending on participant responses)

Demographics

- Seat
- Equipment
- Base
- Time in aircraft
- Years at AAL
- Years in current seat

Section 1: Current events and recency.

1. How often do you fly?

    a. Did you take a VSTLOA or VELOA?

(If answer from 1.a was NO, proceed to question 2)

   i. How did you prepare for return to work?

   ii. How prepared did you feel for your return to work?

   iii. During your first trip back, what was surprising or unexpected?

2. How do you approach work differently when your lack of recency is a factor?

    a. How do you discuss your recency of experience with other crew members before departure?

3. How have you had to change your approach to your work during the COVID pandemic?

    a. How have the various restrictions and quarantine protocols affected your habit patterns at work?

    b. How have you responded to that?

Section 2: Leadership, resilient performance, and learning.

1. Can you tell me about a recent event that required significant adaptation on the part of your crew? *This does not need to be a watershed moment or significant emergency. It could be a situation that fell outside of SOP or where there was not a clear-cut response, checklist, etc.*

    If they can't think of one, try: Can you tell me about something that happened on your last flight (or last couple) that required some adaptation on your part?

2. Do you feel the crew performs better when you are acting as PF or PM?

    a. Why?

3. During a sequence, when do you talk about what you have learned from past experiences or ask the other pilot what they have learned?

4. In your opinion, when do you think would be the best time to accomplish this learned experiences discussion?

For the next series of questions, if the participant is a captain, ask the captain questions. If the participant is a first officer, ask the first officer questions.

5. **Captain:**
    a. How can American Airlines better prepare new captains?

    b. How can American Airlines guide and mentor first officers to become future captains?

6. **First officer:**
    a. What do captains do to allow you to perform at your best?

    b. How do you know, upon first meeting the captain on a trip, whether he or she will listen to you and value your input?

    c. How well-prepared do you feel to upgrade to captain?

    d. What can the training department do to better prepare you?

The following is for widebody participants. If participant is a narrow body pilot proceed to Section 3.

7. **Captain**:

    a. In your experience with augmented operations, how can the training department better prepare first officers to make decisions when the captain is not present on the flightdeck?

8. **First Officer**:

    a. In your experience with augmented operations, how can the training department better prepare first officers in decision making when the captain is not present on the flightdeck?

Section 3: Check airmen focus areas.

1. Recently, a lot of experienced pilots retired or retired early. Have you seen a significant change in the experience levels on your fleet?

    a. What has changed, and in what way(s)?

    b. Do you talk about this with the other pilot(s) you are working with? How about your pilot friends?

2. To what degree do you find the pilots you fly with are standardized?

    a. Which areas or phases of flight do you think crews are most synchronized?

b. Which areas or phases of flight you see a large variation from SOP?

3. In addition to the large turnover among line pilots, there has also been a large turnover in check airmen. What suggestions do you have to maintain standardization on your fleet during and after this transition?

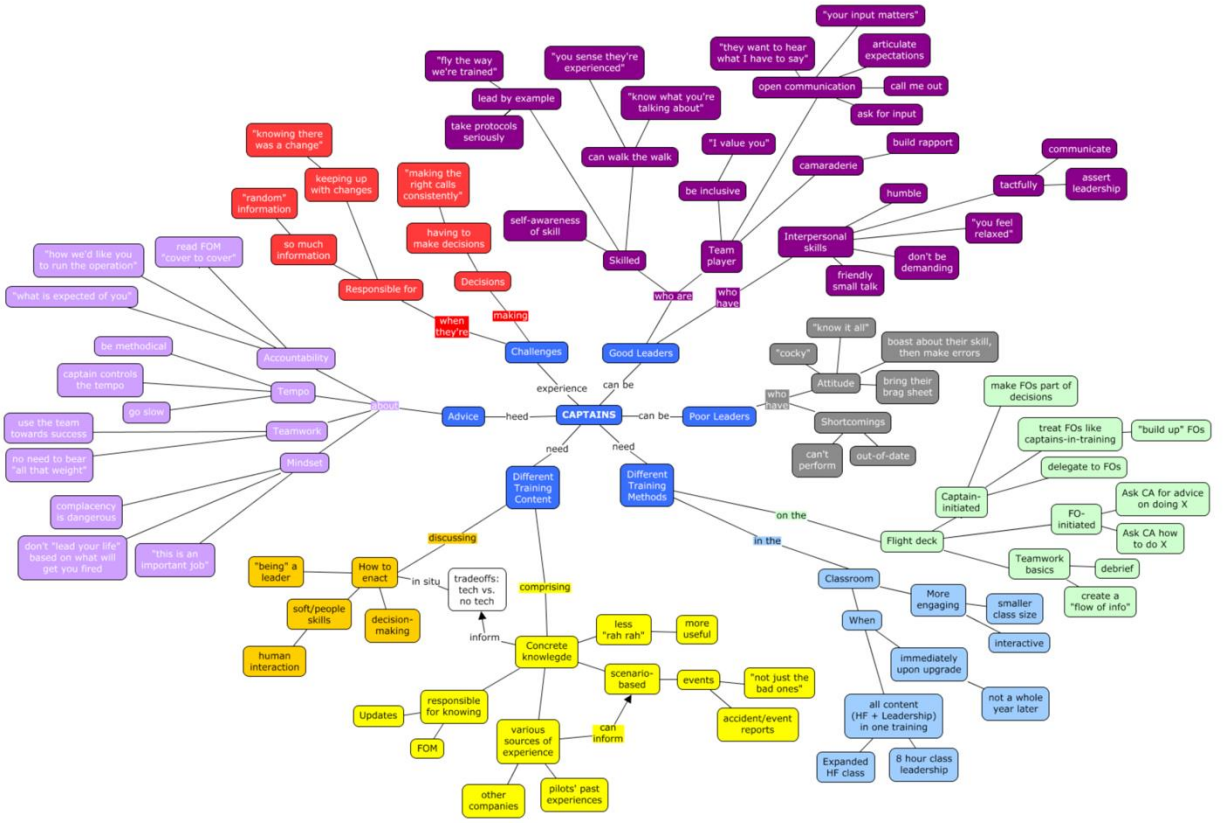
4. Were there any areas of operation you felt that training did not adequately prepare you for?

a. How did you address this?

b. Can you give me a couple of examples specific to your fleet where you see a disconnect between training and real-world operations?

c. How do you think these could be addressed?

Appendix D. Shop Talk Response Diagram



Appendix E. Training Surveys

Learning and Improvement Team

Fleet (Circle One)**: A32F / B737 / B777 / B787**

Seat (Circle One)**: CA / FO**

----------Section 1: LEARNING----------

1. **When during a sequence do you talk about what you have learned or ask the other pilot to share their flying experiences?**

2. **In your opinion, when do you think would be the best time to accomplish this learning discussion during a sequence?**

----------Section 2: PERFORMANCE----------

3. **Do you think the crew performs better when you are pilot flying or pilot monitoring? Why?**

Appendix F. Summary Slides for New Observer Training

Agenda

Day 1

- Our role as LIT Observers
- Flight Selection
- A12 Listing
- NS Listing
- Gate agent letter and at the gate
- Crew introduction
- Conducting the observation
- End of the flight and farewell
- FAR 117 submission
- Narratives
- Collection tool coding exercises

Day 2

- Collection tool coding exercises
- Linkage discussion

Day 3

- Shop Talk
- Closing comments and departure

APA 1

Goals of LIT Rides

Basic Tenets

- Voluntary
- Non-Jeopardy
- De-Identified
- Confidential
- Trained Observers

Goal:

Natural Performance

Basic Processes (AC):

- Joint Company & Pilot Union effort
- Logistical planning and procedures
- Observer training
- Marketing to pilots
- Capture data / Calibrate observers
- Validate data
- Analysis
  - Out-brief results
  - Flight Dept. and Union leadership
  - Training Dept. and Fleet Managers
  - Line pilots
  - SMS team
  - FAA CMO / Peer airlines (optional)
- Accountable Action Items

APA 2

Appendix G. ODAWG Brief Examples for CKA

Turbulence Example from LIT Ride

- Dispatch sent an update about moderate turbulence that was expected during descent. The CA (PF) read the message and then discussed the contents with the FO (PM). Additionally, the CA entered the area in the FIX page of the MCDU.

  Plan: Establish countermeasures

- CA then called the cabin crew and asked them to clean up service items and be seated for the descent into DFW.

  Plan: Update change in plan

3

Go Around Example from LIT Ride

- During approach, after intercepting the glideslope at 3,000', the FO (PF) verbally reviewed the go around procedures and discussed the intent to perform a soft go around if needed.

  Plan: Develop "what if" scenarios

- The FO (PF) reviewed the procedural steps but mixed up the flap clean up and gear up steps. The CA (PM) clarified and corrected the intended sequence of clean up, if required.

  Coordinate: Re-center to SOP when deviation observed

  No go around was required or performed.

4

Appendix H. COVID-19 Analysis

Overview – Phase of Flight Approach

1. Home life, family, trip preparation, AA Crew Scheduling, Union/Company relations, contract issues:
2. Transportation to work (air/auto/other), parking, TSA, airport terminal environment:
3. Predeparture Details – Flightdeck Crew, flightdeck prep, iPad/EFB, Dispatch, Maintenance/AML, Fueling, ATC, Airport Ops, Gate Agents, Ramp Agents, Flight Attendants, Passenger issues
4. PHASE OF FLIGHT
   a) Preflight up to pushback
   b) Pushback through takeoff
   c) Climb
   d) Cruise
   e) Descent
   f) Approach & Landing"
   g) Landing through gate arrival and postflight
5. Destination gate, terminal, transportation to/from hotel, lobby, room, food options, hotel surroundings, exercise options, overall layover/hotel experience
6. Overall trip debrief, return home, family, medical, miscellaneous, remarks, anything else:

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Glossary

Adapt	Effectively react to normal triggers, alarms, threats and anomalies. Recognize disturbances/pressures to the plan as they arise. Evaluate, respond, and intervene to minimize impact of the disturbance or redirect to positive outcome.
Coordinate	Proactively build the team and establish a shared mental model. Utilize all available resources, both internal and external. The response to the altered plan with other team members. Ensure the crew has shared a mental model for getting the plan back on track or normalized as quickly as possible. Continue until the plan has stabilized.
Error	Any practice that deviates from a written policy or procedure, or deviates from the crew's intention. (AA Flight Operations Manual, 2019)
Learn	Knowing what has happened (Hollnagel, 2015); Active process of improving future performance. When I was last here X happened, and this time will do Y. Reflect on the outcome of the disturbance/pressure for future planning. Review materials/ flight documents/ previous lessons learned before making the next plan
Plan	Create, discuss, initiate and monitor in action for disturbances. Proactively act to keep it on track.
Potential	Positive, recurring capability to adjust performance by responding to changes disturbances and opportunities under actual operating conditions in a flexible and timely manner
Pressure	Influences or pressures originating outside of the flightdeck that impact the crew’s task loading and prioritization
Proficiency	Specific function whose presence serves as a proxy measure to resilient capability (potential)
Resilience Engineering	Engineering what a system needs for its continued existence and growth, hence addresses both safety and core business processes (productivity, quality, and effectiveness). (Hollnagel, 2015); Resilience Engineering as a field, seeks to 1) discover operational principles which allow complex systems to adapt to the often-unforeseen conditions of changing worlds; 2) design, develop and operate systems according to those principles.

Resilient performance	The ability to sustain required operations under both expected and unexpected conditions by adjusting its functioning prior to, during, or following events such as changes, disturbances, and opportunities (Hollnagel, 2015)
Safety-I	Protection and prevention against harmful events (Hollnagel, 2015)
Safety-II	Enhancing the system's ability to function in a way that produces acceptable outcomes (Hollnagel, 2015)
Threat	An event, external to a pilot or flight crew, which increases operational complexity and occurs outside the influence of the flight crew. (AA Flight Operations Manual, 2019)

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