5-1-2011

Modern airline pilots quandary : standard operating procedures -- to comply or not to comply

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MODERN AIRLINE PILOTS QUANDARY:
STANDARD OPERATING PROCEDURES – TO COMPLY OR NOT TO COMPLY

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A Thesis

Submitted to the Graduate Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Master of Science

Grand Forks, North Dakota
May
2011

This thesis, submitted by Carrie N. Giles in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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This thesis meets the standards for appearance, conforms to the style and format requirements of the Graduate School of the University of North Dakota, and is hereby approved.

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Department: Aviation

Degree: Master of Science

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ABSTRACT

Modern airline pilots are tasked every flight with the safe and efficient operation of highly automated airliners in today's complicated global and economic environments. Airlines have developed standard operating procedures (SOP) for normal, abnormal, and emergency operations. These procedures serve as a script for crews to follow. These procedures are designed by airlines to ensure that aircraft are operated in the (1) most safe, (2) most efficient, and (3) most on-time manner. For the most part pilots will comply with SOP, but when they (1) don't agree with SOP, (2) don't understand SOP or the risks associated with not complying with SOP, or (3) don't feel adequately trained to know what SOP is, it is difficult to motivate them to comply. Airlines have the means to measure compliance through Flight Operations Quality Assurance (FOQA) and Line Operations Safety Audit (LOSA). The purpose of this research is to determine if increased understanding, knowledge and awareness of the risk of non compliance with SOP increase airline pilots' compliance with

SOP. This research explores data from line checks at a major US airline that was gathered in pursuit of understanding what drives SOP compliance. Baseline data was gathered and analyzed to determine the top 12 non compliant items. The airline provided training during the Human Factors module in each pilots recurrent training on Pilot Intentional Non Compliance (PINC). The training including developing pilots' understanding that while most Aviation Safety Action Program (ASAP) reports grant pilots immunity from legal action, if a violation is labeled PINC, ASAP protections do not apply. Further line checks were conducted after the pilots received the PINC training. The top 12 non compliant items from the pre-PINC training group were compared to the same 12 items in the post-PINC training group. Significant improvement in SOP compliance was found in six of the 12 items tested. The results established that training pilots on the risk of PINC did significantly increase SOP compliance.

CHAPTER I

INTRODUCTION

"Why? Because I said so." For the general population, these words provide very little motivation to comply with a request. However, in the black and white world of aviation, pilots are trained to follow the rules simply because they are the rules and the rules were made to be followed, and because the FAA and company policies and procedures "said so."

Checklists are completed step by step on every flight. Procedures for normal, abnormal and emergency operations are carefully developed and pilots are trained to followed them precisely. In fact, creative solutions are simply not allowed unless every other option has failed, a situation that has rarely been encountered in modern airline flying.

In normal day-to-day line operations, SOP allow pilots who have never worked together before or perhaps even met each other before to safely operate complex flights. According to Dismukes, Berman and

Loukopoulos (2007), "These written scripts establish the correct way to perform procedures and provide standardization across pilots. Standardization is crucial" (p. 2). Crews of two to four pilots are often brought together for the first time an hour before departure time and are expected to work together to provide the most safe, comfortable and profitable flight possible. Each pilot has a role and a script, and ideally, if SOP is followed, there should be very few surprises in normal, abnormal or emergency operations.

The knowledge of pilots' compulsion to comply with rules and regulations leaves airlines struggling to understand why Line Operations Safety Audits (LOSA) and Flight Operations Quality Assurance (FOQA) show that pilots are not dutifully complying with all Standard Operating Procedures (SOP). Several recent incidents and accidents point directly to deviation from SOP as a primary cause.

In the fatal crash in Buffalo, NY of Continental Connection Flight 3701, a Bombardier Q400 that was operated by Colgan Air, the NSTB found that:

> Contributing factors included his [pilot's] failure to monitor other warning signals of the plane's slowing speed, and violation of 'sterile

> cockpit' rules against casual conversation at low altitudes. The board also said Colgan had failed to spell out adequate procedures for crews to monitor air speed when icing is a risk (Trumbell, 2010, p. 90).

In the fatal crash of a Northwest Airlink ferry flight of a Bombardier CRJ-200 operated by Pinnacle Airlines:

> The NTSB determined that the 'unprofessional behavior, deviation from standard operating procedures and poor airmanship' of Pinnacle Flight 3701's two-man crew led to the crash of the regional jet (Fiorino, 2007, p. 25).

The wingtip damage of an American Airlines MD-82 on Flight 1402 was a nonfatal event in Charlotte, NC, where:

> A big question facing investigators is whether American's basic operational rules and procedures were followed. If complications crop up once an aircraft descends below 1,000 feet on an instrument approach, pilots generally are trained to break off the descent, gain altitude and circle back for another landing (Paztor, 2009, p. A6).

And, the investigation into the nonfatal crash of Continental Airlines Flight 1404, a 737-500 in Denver, CO, that departed the runway midfield during takeoff found that:

> The captain's use of the nosewheel steering tiller was contrary to company procedures and neither of these late control inputs was an effective method for turning the airplane at high speed. The NTSB concludes that the captain's use of tiller and full right control wheel in the 3 seconds before the excursion likely resulted from acute stress stemming from a sudden, unexpected threat, perceived lack of control, and extreme time pressure (National Transportation Safety Board, 2010, p. 44).

These accidents and incidents clearly illustrate the importance of compliance with SOP.

It is the airline's responsibility to ensure SOP are safe and their pilots understand and able to comply with current SOP. Clearly, the pilot's choice to deviate from or disregard SOP creates risk for the airline, passengers and crewmembers. According to Federal Aviation Regulations (FAR) and Airline Operation Specifications (Ops Specs), it is the pilot's obligation to comply (FAR/AIM 2011). This paper intends to explore the reasons for noncompliance and the effects of specific initiatives designed by airlines to improve pilots' compliance with SOP.

Literature Review

Standard Operating Procedures (SOP) are written, published and tested procedures that are expected to be universally and consistently applied within an organization. Further definition explains that SOP should identify and describe the standard tasks and duties of a flight crew for each flight phase, including what to do and when to do it. Also, SOP should be simple, clear, concise and prescriptive (Aviation Glossary, 2010).

From the early days of ab initio training, modern airline pilots are trained in the use of checklists and other procedures defined as SOP. From the moment a crew is brought together in the flight planning room until the cockpit door is locked and post-flight procedures are completed, a very specific series of steps are taken to dictate interactions between crew members. Furthermore, abnormal and emergency procedures are defined with specific protocol to ensure the best possible outcome of an unexpected circumstance.

FAR 121.533 is directly quoted in airline operating manuals and states “the Captain shall operate in accordance with FARs, Ops Specs [SIC] and airline procedures and policies except under circumstances provided for in FAR 121.557 [Captain’s emergency authority]” (FAR/AIM 2011). Furthermore, operating manuals assign the Captain with the duty of ensuring the timely completion and accurate adherence to checklist procedures (Flight Operations Manual, 2011). When the Ops Specs provide SOP that are simple, clear, concise and prescriptive it is easy for a Captain to understand how to comply. However, sometimes SOP are not easy to understand and apply, and that makes compliance difficult (Dismukes et al., 2007).

Airlines have long relied on protocol in the form of Standard Operating Procedures to coordinate and execute safe flights, and many other high-risk industries have followed the example set by airlines when developing their own SOP. For example, the medical field defers to airlines’ extensive experience and success with SOP and often uses airline SOP as a pattern for their own. According to Pape (2003), “The key to preventing medication errors lies within adopting protocols from other safety focused industries. The airline industry, for example, has methods in place that improve pilot's focus and provide a milieu of safety when human life is at stake" (p. 91).

The overriding rules for airline operations are made by the Federal Aviation Administration (FAA), but SOP is carefully developed by each airline to take the airline beyond safety to improve efficiencies and reduce surprises in the cockpit. Sukenik (1998) found that, "Adhering to SOP leads to a maximum utility and, thus, to greater flight safety than deviating from it, even if an alternative procedure is equivalent as far as safety is concerned or seems to lead to greater utility" (p. 405). The airlines want their pilots to follow SOP because it has been proven to increase safety and save money. Furthermore, FAR 121.533 states that pilots are obligated by their certificates to follow the FARs, put safety first, and to follow their respective operation specifications, also known as SOP (FAR/AIM, 2011).

Beyond the regulations, studies show that SOP should be adhered to in a pilot's pursuit of individual safety. Baker (2007) analyzed the effects of SOP compliance and found that, "Within an airline, management, operations, maintenance, training, equipment, and pilots must all be aligned. Accidents occur when breakdowns arise in the interactions of these components" (p. 186). Simply put, strict adherence to SOP helps each individual involved with the operation of a flight know what to expect. Baker's research showed clearly that, while SOP are not perfect, compliance with SOP make airlines safer, and noncompliance can lead to aircraft incidents and accidents. Furthermore, in analysis of 19 U.S. Airline accidents in the period of 1990-2000, Dismukes, et al. (2007) found inadequate execution of highly practiced normal procedures under challenging conditions and deviation from explicit guidance or SOP as two of six common themes underlying the NTSB's label "pilot error" as an accident cause or contributing factor. The authors felt noncompliance due to a lack of understanding or execution of SOP or blatant disregard for SOP are key problems that airlines must acknowledge and address in any attempts to increase SOP compliance.

Advanced Qualification Programs

In 1994 United Airlines Training Center developed the first Advanced Qualification Program (AQP) for the Boeing 737-300. United began operating the Boeing 777 in 1995 and all training on that aircraft has been accomplished under AQP (Federal Aviation Administration, 1991). This alternate method of training allows for more cost-effective training with the goal of increasing operator proficiency (Taylor & Emanuel, 2000). Today in 2011 nearly all major U.S. airlines, along with growing number of U.S. regional airlines, participate in this voluntary program.

The purpose of AQP is to encourage the use of innovative technologies, training and evaluation features to improve training performance. These programs are systematically developed, continuously maintained, and empirically validated proficiency-based training systems (Federal Aviation Administration, 1991).

During a pilot's career, they will experience initial (new-hire), transition (new airplane type), upgrade (new seat) and recurrent training. Recurrent training consists of simulator training to proficiency, along with 14 "part 121-mandated-training requirements...Crew Resource Management (CRM) and human factors" (Hughes, 1995, p. 27). Pilots are trained on the proper execution of SOP for all phases of flight in normal, abnormal and emergency operations. Evaluations are designed to ensure that understanding of SOP is demonstrated before the pilot is qualified for line operations. Once qualified on an aircraft, a pilot experiences training at least once a year under AQP. Additional training requirements are met through computer-based exams.

Once every 24 months each Captain is required to experience a line check. The term "line operations" refers normal flights during regularly scheduled trips, so a line check is an observation of a pilot during line operations (Klinect, Helmreich, Murray, & Merritt, 2003). During these line checks a check airman observes the Captain in line operations and assesses SOP compliance. These line checks are jeopardy events, meaning the pilot must pass or be removed from line flying for training to resolve deficient areas. Some of the Microscope Line Checks (MLC) referred to later in this study were done during routine line checks required by AQP.

As mentioned above, AQP requires airline pilots to be trained in crew resource management (CRM). CRM is defined as a set of principles that pilots and others are taught to use to make effective use of all available resources – human, equipment and information. Interaction and coordination among team members are emphasized (Dismukes, 2007). In the event SOP are not being followed or are in question, CRM training helps to increase each pilot's ability to communicate the discrepancy, regardless of position in the cockpit. First Officers are responsible to speak up if any other crew member, including the Captain, is not in compliance with SOP.

Helmreich (2001) discusses the specific skills that CRM training provides to countermeasures against risks and errors. The author explains how these skills equip pilots to be more alert and vocal about threats and impending errors, including the ability to better detect errors and manage their resolution.

Pilot Personalities

According to Bartram (1995), there are many commonalities in personality type between the airline pilot applicant and the pilots operating aircraft being flown by airlines today. Those who become airline pilots have similar personalities, and little difference exists in the traits of those trained in the military versus purely civilian trained pilots. However, it is important to understand that pilots' interests and methods of approaching crew coordination vary as personalities range across the general population (Chidester, 1991).

Research shows that the pilot population is commonly wired for success because they must be driven to make it into their highly competitive business, and that commonality groups them together. As a group, pilots score significantly more intelligent, emotionally stable, and mature in comparison to the general population norms (Wakcher, 2003). For risk assessment, pilots are trained (often times through experience) to make good decisions in all circumstances, and risk-management is a skill that improves with experience (Hunter, 2002). Also, as their experience increases, pilots are less likely to be involved in a violation of any Federal Aviation Regulations (Rebok, Qiang, Baker, McCarthy & Li, 2005).

Learning Theory

Airline pilots today are trained in a variety of learning environments, including classroom, simulator, computer based modules and line operations. Once initial training is completed, recurrent training is accomplished in all of these environments to refresh already developed skills and ensure understanding of changes to SOP.

Since the purpose of this research is to evaluate experienced pilots' compliance with SOP, it is important to understand how pilots learn following initial training. Pilots are always building on experience, whether it is with a new airplane, a new procedure, or a new role. While each new learning experience presents challenges of different degrees, professional pilots are expected to perform well in all aspects of training as it is part of their job. Each new training experience begins with transfer of learning from a pilot's previous experience, and in order for the training to be effective the pilot must overcome, agree with the new procedure and become proficient at executing it. In line operations, pilots are expected to adopt and comply with company prescribed SOP. This requires pilots to overcome any bias, including any personal dislike or disagreement with SOP (Dismukes et al., 2007).

All procedural changes require the creation or alteration of SOP and the training for pilots to understand what is now expected of them. Clearly, the airlines are very experienced and very good at making SOP for all areas of operation, and as new procedures are implemented, a checklist normally accompanies them (Sukenik, 1998).

For example, the beginnings of the FAA's NextGen implementation have included the development for Required Navigation Performance Area Navigation (RNAV-RNP) approach procedures. Each airline seeking FAA approval to fly RNAV-RNP approaches has developed their SOP for how the approaches will be loaded into the Flight Management Computer (FMC), briefed by the pilot flying (PF), flown by the PF, and what steps will be taken by the pilot monitoring (PM). All pilots are trained on the specific procedures in initial, transition, upgrade and recurrent training before they are qualified to fly RNAV-RNP approached in line operations. In most cases pilots are given a checklist or some other sort of tool to guide them through the steps to fly an RNAV-RNP approach in the company specified manner.

The concern arises when the FAA sets the minimums for training requirements, and the standards are influenced by cost cutting initiatives. Dismukes et al. (2007) found "inadequate knowledge or experience provided by training and/or guidance" (p. 298) was a factor in a third of the 19 accidents studied. A critical component of these accidents involved pilots who found themselves in "challenging situations for which they had received training, but the experience they received from that training was of inadequate fidelity to the actual situation, inadequately detailed, or incomplete" (p. 298). In these accidents the authors discovered the pilots completed the training, but the airlines' efforts to ensure that pilots understood SOP to the point they would be comfortable executing new procedures simply fell short. The authors go on to explain that if airlines were more aware of the limitations of their training, they could make modifications and train pilots to make well thought out decisions that utilize SOP based on their solid understanding of how to apply the new SOP to real-life situations.

Aeronautical Decision Making

It was long believed pilot's decision-making was based on analysis performed by considering a range of solutions, evaluating each option to determine how each would affect the flight, then choosing the best option. This decision tree is known as the Rational Choice method (Klein, 2000). Klein explains further that pilots simply don't have the time to consider all options in situations where an instant decision must be made. Because of the time pressure to make a decision, pilots often look for the first workable option. The best rules can be rendered useless when conditions or circumstances never considered become a pilot's present reality.

Research shows that when faced with a decision, experienced pilots will normally make a choice based on the circumstances they understand, and unless there is a good reason to change course, they will press on. This is not a stubborn act, but instead it demonstrates a pilot's keen ability to assess a situation and decide how to respond. This skill, also known as situational awareness (SA) is the ability to identify one's position in relation to other aircraft in a flight environment. A pilot with good SA will "comprehend the various forces that are acting on the airplane and will be able to anticipate how these forces will shape the future course of the airplane" (Klein, 2000, p. 173). Pilots are not likely to consider many options and choose the best, as Rational Choice would imply. Instead pilots use experience to make a decision, and only if there is time for additional consideration and the wisdom of their current choice becomes questionable will they seek out other solutions (Klein, 2000).

Airline training departments are tasked with training pilots with a broad range of experience. Therefore, if experience is a required component of good decision-making, the natural and accurate conclusion is that the most common reason for poor decisions is a lack of experience (Klein, 2000). Understanding how pilots learn and make decisions is key to developing training on SOP. SOP is developed not necessarily to bring pilots to the best choice, based on the pilot's experience, but to the prescribed choice. An example is the Quick Reference Handbook (QRH), which is part of the Aircraft Flight Manual (AFM) approved by the FAA, and is used to guide pilots through abnormal and emergency procedures.

For example, abnormal findings often have prescribed procedures in the QRH. It contains checklists and decision trees that assist a pilot in understanding what each specific system failure means and what decisions need to be made. Under SOP, pilots are expected to respond to an abnormal findings by accomplishing immediate action items associated with their condition (if any) and then referring to the QRH. Pilots are expected to accomplish the QRH - exactly as written - unless there is some reason why the Captain determines it would be safer to act otherwise. Any decision to act outside the protocol defined by SOP falls under the realm of Captain's emergency authority (Aircraft Operating Manual, 2010).

The problem occurs when a pilot possesses prior experience is better understood than the current SOP. This experiential knowledge may be the basis of the pilot's first choice and the choice they continue with unless it becomes unsafe to proceed. If pilots are less familiar with SOP than they are with a procedure they have tested and know to be safe, they are unlikely to trust SOP when faced with decision making in abnormal or emergency situations (Dismukes et al., 2007). This is why it is so critical for airlines to train their pilots in all SOP, ensuring that they understand and trust the SOP and they understand that any deviation from SOP outside of an emergency situation is a violation of their certificate (Dismukes et al., 2007).

Line Operations Safety Audit

Besides the AQP required line checks, airlines employ a safety tool known as Line Operations Safety Audit (LOSA). These cockpit observations are similar to line checks as they are gathered during normal flight operations, but their purpose is different:

> In the most general of terms, LOSA is similar to getting your cholesterol checked during a routine examination. The test, usually performed as a preventive measure, provides evidence of risk on having a heart attack or other serious health event. The results themselves do not provide a solution but can prompt a person to make healthier lifestyle choices. A person might also choose to do nothing and carry on as normal. Either way, the person learned something and is responsible for change. LOSA is the same. It provides a diagnostic snapshot of safety performance. It uses cockpit observations collected in normal operations to provide a profile of safety strengths and weaknesses. Similarly, the onus is on the airline to respond to the data and make change if necessary, in order to prevent an incident or accident. (Klinect et al., 2003)

Like AQP, these line checks are voluntary.

Flight Operational Quality Assurance

Flight Operational Quality Assurance, or FOQA, is another voluntary safety program approved by the FAA for commercial airline use allowing commercial airlines and pilots to share de-identified information with the FAA. The FAA can use this information to monitor national trends in aircraft operations and prescriptively apply resources to address operational risk issues (Longridge, 2003). Like ASAP, this information is de-identified and voluntarily disclosed to the FAA by the airlines in cooperation with the union. This information is electronically generated through a Flight Data Acquisition Unit, or FDAU, that works along with the Flight Data Recorder (FDR) to record specific flight parameters. This information is collected and downloaded through the Aircraft Communications Addressing and Reporting System (ACARS) that sends the desired parameters as digital information to the Gatekeeper. The Gatekeeper is typically a union official who is the only person with the ability to link the collected data to the specific flight and therefore individual crewmembers (Holtom, 2006).

The information gathered for the FOQA program is analyzed for three main purposes: exceedence analysis, statistical analysis, and validated trend information (Federal Aviation Administration, 2004). Exceedence data would include any flight parameter outside of the normal operating envelope for normal operations, for instance a roll angle of greater than 45 degrees. Normal operations would not require more than 30 degrees of bank, and while 45 degrees of roll is not necessarily a dangerous flight attitude, it is outside the normal flight parameters. The gatekeeper can use this FOQA data to determine the exact time, altitude and phase of flight to understand if this was a momentary exceedence or if this was a trend. If there is a reported bank of 60 degrees or more, the gatekeeper might choose to conduct a more detailed investigation of the event (FAA, 2004).

Statistical data can be used to identify trends at a given airline that might be useful for improving operations and refining procedures. For example, an airline might notice through FOQA data that ATC requests to maintain higher airspeeds on arrival are resulting in a high occurrence of unstabilized approaches leading to go-arounds. This information might influence an adjustment to current procedures resulting in better managed approaches, thereby increasing the number of stabilized approaches leading to successful landings.

Validated trend information is used to ensure all required maintenance action is completed if there is an unreported exceedence. For example, if an aircraft limitation is exceeded a maintenance inspection is required. If the exceedence is not entered into the aircraft logbook for any reason, FOQA exceedence data will trigger an inspection. The gatekeeper can link the data to the flight and follow up with the flight crew to understand the circumstances of the event (FAA, 2004).

ASAP

The first ASAP program was started at American Airlines (AA) in 1994. It was an agreement between the airline, the union, and the Federal Aviation Administration (FAA). The program was modeled after NASA's Aviation Safety Reporting Program (ASRP), a program that allowed pilots to disclose safety violations without risk of punishment. The NASA program was good, but the airlines were only able to access a limited amount of data and unable to gain the specific information necessary to improve the safety of their operations. The ASAP program was developed for an 18-month trial period with this goal in mind:

> The objectives of the American Airlines Aviation Safety Action Program are to prevent accidents and incidents. The means by which we accomplish these objectives are by identifying flight safety concerns and achieving corrective action. Consequently, ASAP analyzes risks, increases education and awareness, validates program effectiveness, measures system performance and ensures accountability. As a result, a successful ASAP should help to increase employee compliance with the FARs. The scope of events that are considered under ASAP includes any observation that highlights a potential flight safety concern. The actions taken in this program reflect the desire of all parties to solve problems through corrective action and education. ASAP combines essential self- reporting elements of previous self-reporting programs and provides solutions to the identified hazards in order to prevent incidents and accidents (Federal Aviation Administration, 2009, p. 20)

The program was recognized early in its existence as very forward thinking. This statement from then CEO Don Carty was made in the presence of President Clinton, FAA Administrator Jane Garvey and union officials as they met when American Airlines' ASAP Program was honored At White House in 2000:

> The ASAP program is a model of what can be done when business, labor and an enlightened government agency work together positively. Without question, the outstanding leadership of Jane Garvey at the FAA has allowed this and other safety initiatives to thrive. (American Airlines Press Release, 2000, p. 1)

After the 18-month trial the program was made permanent at AA. Since then ASAP programs have been adopted at most U.S. Airlines. Programs have also been implemented for mechanics, flight attendants and dispatchers. The program encourages workers to “voluntarily report any incident that might raise a safety concern or any circumstances where safety might have been compromised” (American Airlines Press Release, 2000, p. 1). From these reports the airlines are able to gather information that otherwise may have not been reported if the risk of punishment existed.

There are certain events that are reported that are not covered under ASAP’s umbrella of protection. "In instances involving possible criminal activity, substance abuse, controlled substances, alcohol, or intentional falsification the terms of confidentiality contained in this MOU do not apply" (Federal Aviation Administration, 2009, p. 14). In the event an excluded event is reported the Event Review Team (ERT) must turn over that information to the FAA and law enforcement, as appropriate (Federal Aviation Administration, 2009). While most reports grant employees immunity from legal action, there are certain cases where ASAP protections do not apply:

> It's not supposed to be a 'get-out-of-jail-free' card for outrageous, unsafe, unprofessional behavior. Instead, it is supposed to allow good people to report on mistakes they've made without being punished -- mistakes that otherwise would go unreported and uncorrected. (Maxon, 2008, p. 1)

PINC and PUNC

James Huntzinger, the former Vice President of Safety, Security & Compliance at Korean Air has been credited with coining the terms Procedural Intentional Noncompliance (PINC) and Procedural

Unintentional Noncompliance (PUNC) (Agur, 2007). Quite simply, these acronyms are used to label behavior as pilots' unintentional or intentional deviation from company prescribed SOP.

The Air Safety Foundation reported that a review of accidents involving professionally flown aircraft shows that four out of five events included PINC or PUNC by pilots. Additionally, "PINCs and PUNCs are reduced dramatically when an effective safety culture exists." (Agur, 2007, p. 13). One might conclude that the way to reduce PINCs and PUNCs is to increase the effectiveness of the safety culture at an airline. Simple as that sounds, U.S. major airlines are already incredibly safe and have effective safety cultures in place (Snyder, 2007). Moreover, "on a typical American airline, your chances of dying on a flight are somewhere around one in 13 million." (Maxa, 2009, p. 1)

It has already been established that airline safety records are commendable and current regulations motivate operators to avoid situations where they could be violated by the FAA. The question as to why PINC and PUNC are surfacing as causes of aircraft incidents, accidents and as a contributing factor on ASAP reports remains. Huntzinger (2006) summarized the following:

> What's interesting is that PINC events typically involve crews who have been flying most of their adult lives — veteran aviators who train on simulators once or twice a year; attend initial and then recurrent training classes that cover procedures, FARs, limitations and other best practices; practice CRM; ride with check airmen; and so on. In short, they clearly know the rules and regulations, yet they intentionally violate them. (p. 42)

Huntzinger describes the three elements of a PINC event as: (1) a reward for the violator; (2) knowledge of the associated risk; (3) consideration of how ones peers will react. If a pilot is able to determine that, for example, the reward of an on-time arrival (getting to the layover hotel sooner) is worth the risk of an unstabilized approach (that by SOP should result in a go-around) and in their opinion they determine that continuing the approach and landing would be considered safe enough by their peers, even if it violates SOP, and even though they know better, their safe enough landing has all the elements required for PINC. "They [PINC] are often the result of well-meaning pilots trying to do their job but willfully taking risks to achieve what should be a secondary goal, 'completing the mission.'" (Agur, 2007, p. 36)

PUNC can be considered a SOP violation that is less deliberate in nature, but it is the result of a lack of information or understanding that results in a pilot unknowingly violating SOP. The pilot is responsible to comply with company SOP, and the airline is responsible to train the pilots who operate their aircraft. An effective airline safety culture strives to inform pilots of ever evolving SOP, but this is not an easy task. Anthony (2009) summarizes: "Aviation is inherently a dynamic and ever-changing industry that is constantly producing hazards even as it strives to reduce them" (p. 42). The task of finishing the work of SOP development so that pilots can be perfectly informed of SOP is never complete, and PUNC is often the result of a lack of training by the company and thereby pilot's efficiency in understanding of SOP.

Safety Culture

According to Reason (1998), "Safety cultures evolve gradually in response to local conditions, past event, the character of the leadership and the mood of the workforce" (p. 293). Research has already established that it is in a professional pilot's nature to comply with the rules, and that they do not want to be charged with PINC or PUNC (Rebok, 2008). They are already naturally resistant to risky behavior, yet these pilots are not perfectly compliant with SOP. If an ideal safety culture is needed to drive airlines to a sustainable condition of SOP compliance "regardless of the leadership's personality or current commercial concerns" (Reason, 1998, p. 294), what can already safe airlines do to positively affect their safety cultures and increase compliance?

When looking to the root cause of forces that drive 'rule followers' to become 'rule breakers', research shows that if there is a lack of understanding of what unacceptable behavior is, unacceptable behavior will happen (e.g., PUNC). If there is a lack of understanding of the consequences of unacceptable behavior, known unacceptable behavior will happen (e.g., PINC) (Huntzinger, 2006). Education (training) to the point of applicability to line operations is the key. The idea that the noncompliant behavior is only a negative when detected is false because (1), much of it is detected through FOQA and (2), noncompliance with SOP can lead to incidents and accidents, outcomes pilots and management are fundamentally against. In describing a just culture, Reason (1998) states that, "All members of an organization should understand where the line must be drawn between unacceptable behaviour [SIC], deserving of disciplinary action, and the remainder, where punishment is neither appropriate nor helpful in furthering the cause of safety" (p. 303). An informed culture is a safe culture, and when both management and pilots are motivated to avoid risks and stay out of the newspapers, it seems that information is key.

Following the crash in Buffalo, NY, of Continental Connection Flight 3407, a flight operated by Colgan Air, in February of 2009, the cockpit voice recorder (CVR) was reported to have "distracted banter" during the period of sterile cockpit required by FAR 121.542 during all non-cruise operations below 10,000 feet MSL (Trumbell, 2009). These and other incidents and accidents have led to increased concern for airlines and pilots and are grounds for scrutiny by the FAA of pilot-professionalism in U.S. airline cockpits. In an article written for USA Today, FAA Administrator Randy Babbitt (2010) comments on the access the FAA has to flight information:

> The FAA has more information from airlines, pilots and aircraft recorders than we have ever had before. These tools enable our

safety inspectors to better analyze data, spot safety trends, and prioritize risks before accidents happen. (p. 10A)

Both airline management and pilot unions have little interest in voluntarily giving the FAA access to data that could put them in jeopardy, and, while airline safety programs have been developed with protections from disciplinary action, all parties involved are skeptical (Logan, 2008). Pilot unions have raised concerns about AQP and LOSA, which rely on concepts like "train to proficiency" and the integrity of the process, which requires management and pilots to trust each other. Any lack of trust reduces the authenticity of the results. Simply put: "If an airline fails to earn its pilots' trust, then LOSA will be nothing more than an elaborate line check, and the airline will have wasted an opportunity to gain a unique perspective of actual practices on the line." (Klinect et al., 2003, p. 5)

CVR data is only analyzed when there is reason to collect it following an accident or incident, and pilots' unions do not favor allowing more access for the FAA or even airline officials (Wald, 2005), but there is plenty of other data available for scrutiny.

Programs like ASAP, FOQA, LOSA audits and the FAA's involvement with airline training allow for regulators to understand much of what is happening in U.S. airline cockpits. In an article describing airlines efforts to prevent errors, Logan (2008) made this conclusion: "Airline safety programs have evolved from reactive to proactive programs in an attempt to improve an already excellent safety record. Zero accidents are the goal that the industry strives for" (p. s181). These tools are used by the FAA and airlines to discover trends and areas where a lack of SOP compliance is indicated.

Research Questions

The purpose of this research is to determine if increased understanding, knowledge and awareness of the risk of noncompliance with SOP will increase airline pilots' compliance with SOP. It has already been established that pilots are commonly a very capable group. As their experience grows, their adversity to high-risk may cause them to avoid situations where they might find trouble. Often times their intelligence drives them to make the wisest, most prudent choice as they strive for safety. A natural extension to understanding pilot personalities might be to assume that they are likely to enjoy the establishment of SOP and are excited to follow it to the letter. Quite the contrary, pilots are not content with the way labor has been treated in "the airline industry's...most volatile period in the past 20 years" (Goodman, 2008, p. 14). This frustration could serve as a distraction resulting in attention to SOP being diverted (Dismukes et al., 2007).

Since September 11, 2001, uncertainty has ruled airline aviation, and when it comes to pushing for compliance, pilots have a tendency to push back. A quandary is defined as a state of doubt or uncertainty, especially with regard to the choice of alternatives (Quinion, 2008). In the case of PINC, the pilots' know SOP but choose another procedure, where in the case of PUNC the SOP may not be clear or properly understood. In every case pilots' are tasked to comply, even if they are unsure what a specific SOP compliance requires or don't like the SOP, the more difficult charge to the pilot in command. Perhaps this is why pilots find themselves in a quandary regarding SOP compliance – they are conflicted.

SOPs are developed by airline management and experienced line pilots in the safety and comfort of an office. Safety, trainability and what is best for the company are all factors in how SOPs are determined. Along with personal experience and past practice, they consult the manufacturer's airplane flight crew operating manual and other sources to determine what SOP is best. "A single pilot sitting in an airplane going 450 knots does not have that luxury, so I believe that adherence to SOPs is primary to flight safety. No procedure developed on the fly can compare." (R. Cunningham, personal communication, February 23, 2011). New initiatives result in new procedures and it is difficult sometimes for pilots to keep track of which procedure is the current procedure, especially when the reason for the change to SOP is not explained or understood. Pilots may feel that the SOP prescribed for a given scenario is unsafe, complicated, or simply unnecessary. Pilots are opposed to change, especially when the procedure being replaced was, in their opinion, was at least as safe, if not more safe than the new SOP (Dismukes et al., 2007).

Also, because of Captain's authority, pilots mistakenly believe that their certificate entitles them to disregard SOP if they have determined that their way is "more safe." This is true in the application of 'recommended practices', the term applied to specific techniques trained by the airline. When it comes to recommendations, pilots can adopt the recommended technique or develop their own (Aircraft

Operating Manual, 2010). For SOP, except for in an emergency situation where an emergency has been declared, failure to comply with SOP is a violation of the certificate they hold which requires them to operate according to company policies and procedures (FAR/AIM 2011). Therefore, pilots may believe that the company prescribed way to operate a jet and the absolute safest way to fly are often not equal.

In a specific airline's AQP, recurrent training time is often limited because the goal is to meet the minimum requirements and keep costs low. According to Rigner and Dekker (2000), today's airlines are sometimes faced with limited training time available, and their chosen training approach may not allow instructors to elaborate where need is shown because of prescribed tasks that must be accomplished. In other words, there is a lot to cover in a limited amount of time, which often results in training deficiencies that may or may not show up in Line Oriented Flight Training (LOFT) or line checks. Updates to current procedures are distributed to pilots by bulletins, and amended SOP are sometimes trained by textual description alone. Pilots are expected to maintain a firm understanding on the execution of current SOP, often times without receiving any training on that SOP. Therefore, the amount of information and training provided with changes to SOP is may not be adequate.

Several authors state that the lack of understanding of the implications of disregarding SOP is a factor in a pilot's decision to violate SOP. Before FOQA programs, airlines were largely unaware of the specific configurations their aircraft were operated by a particular pilot on a given day. With FOQA and ASAP, they can link the pilot to flight performance data through all phases of flight. Another factor is the protection of the ASAP program, which protects pilots as long as the violation was unintentional and not in violation of SOP. Pilots may not have adequate understanding of the consequences of intentional non compliance. PINC holds pilots responsible to follow procedures, and except for emergency situations, they are expected to follow SOP or face the consequences. The consequences include being violated by the FAA because the immunity of the ASAP programs will not extend to intentionally risky behavior. The truth is "they" (the company and FAA) know what pilots are doing on every flight and the responsibility to comply with SOP is not only present on a line check. Therefore, pilots may not be adequately aware of the risk associated with their decision to disregard

SOP. This is a new change, and once pilots are trained and understand the risk associated with noncompliance with SOP, compliance may increase.

The research questions posed by this study are

1. Do Microscope Line Check findings differ following instruction on PINC and PUNC as compared to pre-instruction findings?
2. Do the top 12 "non-standard" items on the Microscope Line Check improve in rank amongst top 12 items following instruction on PINC and PUNC?
3. Do Microscope Line Check findings differ following a corporate strategy to improve SOP compliance is put into place?

CHAPTER II

METHODOLOGY

The purpose of this research is to determine if increased training of the risk of noncompliance with SOP will increase airline pilots' compliance with SOP. To establish a need for further study, LOSA checks were accomplished at a major U.S. airline during January of 2010. As a result of the LOSA checks, it was determined that more emphasis and education were needed concerning SOP compliance.

Microscope Line Checks (MLC) were conducted on 308 flights in January and February of 2010. Check airmen were assigned to observe on randomly selected routes to collect the data and complete the checks. These MLC were classified as line checks, not LOSA, and therefore if a pilot were to fail the MLC they would be disqualified and sent for training in accordance with AQP.

After the high frequency MLC in January through February of 2010, the airline elected to continue using the same survey on all scheduled line checks required by AQP. Additional data was collected through March 2011 and is also used in this research. All data were recorded anonymously and tested against specific changes to airline training and policies to determine effect on pilot's SOP compliance. Finally, the Institutional Review Board at the University of North Dakota reviewed and approved the project including the survey questions, proposed sample, and research methods.

The Survey

The checks utilized a standardized survey of 60 different SOP items. The survey items were broken down by phase of flight. Each phase of flight included any checklists to be completed, actions to be taken and any other specific SOP actions required. There was also a section for general SOP items, for example "Appearance" or "Point and Shoot used for all altitude changes" [See appendix A for specific descriptions of each survey item.] Each item was scored either as "Standard," "Nonstandard," "Not Applicable" or "Not Observed." The check airmen performing the

MLC were asked to record comments on each of the "Nonstandard" items to establish the reason for the discrepancy.

To understand the specifics of each occurrence of noncompliance, the researcher recorded and analyzed the comments from each of the flights conducted in January and February of 2010. While this qualitative data was not used to determine any trends of noncompliance, it was used to determine which specific initiatives and procedural changes should be tested for potential effect on SOP compliance.

Corporate Strategy to Improve SOP Compliance

Along with the MLC that began in January, 2010, the company determined that the LOSA of January 2010 indicated a need to change its SOP training and better explain what was expected of pilots. To kickoff the campaign, a poster of a pilot with the banner, "SOP: It's the only choice" was placed in the entrance to the operations area of each of the airline's crew bases [see appendix C]. Specific training on PINC was added to the Human Factors training module that was presented to pilots during initial, transition, upgrade and recurrent training. By August 31, 2010, all participants had completed this training. On September 1, 2010, specific training designed to address and stimulate discussion of Captain's decision making was added to the Human Factors training module.

Participants

Participants are current and qualified flight crews at a major U.S. airline. MLC checks were randomly conducted on flights in both domestic and international flight operations during January, February and March. Additional MLC data was gathered during the next 12 months during AQP required line checks. With few exceptions, all flight crew members (Captains and First Officers) hold a type rating on the aircraft flown. The check airmen who conducted the MLC are also type rated, current and qualified captains on the equipment checked.

Protection of Human Subjects

Participants remained anonymous except for the generalized demographic data queried at the beginning of the survey. The study author notified and received written permission from the management of the respective airline to utilize data collected from the survey. The Institutional Review Board at the University of North Dakota reviewed and approved the project including the survey questions, proposed sample, and research methods.

Potential Biases

The one area of concern for bias is the potential for false-positives on items found to be "Standard" SOP performance. The MLC is a testing event, and therefore it is impossible to know if the pilots exhibited "standard" behavior because they always follow SOP, or if they are complying with SOP because they are being watched and face de-qualification if they fail to comply with SOP. It is unrealistic to expect that pilots will demonstrate the same behaviors they would if the check airman were truly an unknown presence. Therefore, any analysis will be limited to application to SOP compliance with a check airman in the cockpit, as it is impossible to know if the same compliance will carry over to line operations (Helmreich, 2003).

Additionally, some of the participants who were checked during the random MLC used to establish the baseline for SOP compliance may have attended Human Factors training prior to their MLC. Statistically, only 14% of line pilots experienced this training during this period. Because the MLC were conducted as the company initiative was launched, no data without this bias existed. The Human Factors training on PINC would have biased them towards SOP compliance, so using those numbers as a baseline is more conservative than to have purely unbiased numbers.

Data Analysis

The data will be analyzed to determine if the effect of specific initiatives on SOP compliance is significant. The baseline data will be analyzed to determine the top 12 areas of noncompliance. That data will be ranked and compared with the data collected during the months after the PINC training was presented to all pilots to determine what effect, if any, the PINC training had on SOP compliance rates. The data groups were compared using chi-square to determine any significant change in compliance levels between the pre-PINC training and post-PINC training time periods.

CHAPTER III

RESULTS

The data set was divided into two groups, pre-PINC training for the data collected in January and February of 2010, and post-PINC training for the data collected after September 1, 2010. The data from the pre-PINC training flights were ranked based on the number of 'non-standard' events in each of the 60 areas tested. The top 12 areas of noncompliance from the pre-PINC training group were analyzed in this study.

The first group of data, labeled pre-PINC training, was from the period before all subjects experienced the Human Factors module containing PINC training. These data were gathered from 306 randomly selected flights. Of the 60 areas tested in the survey, the top 12 areas of non compliance from the January and February 2010 MLC (pre-PINC training) were ranked below in Table 1.

The second group of data, labeled post-PINC training, was collected during flights that were flown after each line pilot at the airline had received PINC training during the last 9-months. These data were gathered from 289 flights during which AQP required line checks were being accomplished. Of the 60 areas tested in the survey, the top 12 areas of noncompliance from the September 2010 through March 2011 MLC (post-PINC training) were ranked in Table 1 (numbers in parenthesis indicate survey question number):

Table 1. Top 12 non standard items ranking.

Non-standard Item	Pre-PINC Training Rank (n = 306)	Post-PINC Training Rank (n = 289)
Climb speed policy compliance (29)	1	1
Standardized descent speed compliance (44)	2	6
Appearance (63)	3	12
"Point and Shoot" for all altitude changes (65)	4	7
Before Takeoff checklist (26)	5	3
Before Taxi/Taxi checklist (18)	6	8
Takeoff briefing accomplished (13)	7	10
(G)FMS route/legs verification check (12)	8 (tie)	4
After-Landing - Taxi checklist (57)	8 (tie)	11

Table 1. Top 12 non standard items ranking cont.

Non-standard Item	Pre-PINC Training Rank (n = 306)	Post-PINC Training Rank (n = 289)
Parking checklist (61)	10	9
Before Starting Engines checklist (16)	11	2
Cruise Checklist (31)	12	5

Note: The post-PINC training rankings do not represent the top-12 of all 60 non-standard areas in the post-PINC training group, but a re-ranking of the top-12 from the pre-PINC training group. The same 60 areas were tested for SOP compliance on all flights.

Statistical Analysis

The data groups were compared using chi-square to determine any significant change in compliance levels between the pre-PINC training and post-PINC training time periods.

Table 2. Non-standard results.

Non-standard Item	Pre-PINC Training Observed/ expected	Post-PINC Training Observed/ Expected	*Sig.*
Climb speed policy (29)	48/38.8	27/36.2	0.023
Standardized descent speed (44)	28/20.4	12/19.6	0.012
Appearance (63)	22/11.2	0/10.8	0.000
"Point and Shoot" (65)	21/15.7	10/15.3	0.051
Before Takeoff checklist (26)	20/19.0	17/18.0	0.741
Before Taxi/Taxi checklist (18)	18/12.9	7/12.1	0.036
Takeoff briefing (13)	16/10.8	5/10.2	0.022
(G)FMS route/legs check (12)	15/15.3	15/14.7	0.901
After-Landing - Taxi checklist (57)	15/9.3	3/8.7	0.006
Parking checklist (61)	14/10.3	6/9.7	0.088
Before Starting Engines checklist (16)	13/15.9	18/15.1	0.277
Cruise Checklist (31)	12/12.9	13/12.1	0.717

Data Summary

Of the top 12 noncompliant areas analyzed for relationship, six of the 12 showed increased compliance with the specific area of SOP. The greatest difference between the pre-PINC training and post-PINC training groups was in non-standard appearance. Non-standard "Point and Shoot" used for all altitude changes, was not statistically significant, but with p = .051, this item approached finding a significant difference between pre-PINC and post-PINC groups.

CHAPTER IV

DISCUSSION

The data show that in six of 12 specific areas studied, pilots who have been exposed to training on PINC will perform SOP in a manner that the company will grade "standard" on line checks. In all areas (n=12) except three, there was an overall improvement in SOP compliance. In two the three cases where the SOP compliance did not improve, the item tested was a checklist with multiple items, and therefore multiple places where the non-standard behavior could have been displayed. Further research into the qualitative section of the MLC form would be useful to determine the cause of the "non-standard" grading.

Checklist items accounted for two of the six areas with significant improvement. In both the Before Taxi/Taxi Checklist and the After Landing -Taxi Checklist, pilots who experienced training on PINC were found to perform better than pilots who had not received PINC training:

Table 3. Before Taxi/Taxi Checklist

PINC Status		Pre-PINC Training	Post-PINC Training	Total
Non-Standard	Observed/Expected	18/12.9	7/12.1	25
Standard	Observed/Expected	286/291.1	280/274.9	566

$\chi 2$ (1, N = 591) = 4.418, $p < .05$.

Table 4. After Landing - Taxi Checklist

PINC Status		Pre-PINC Training	Post-PINC Training	Total
Non-Standard	Observed/Expected	15/3	3/8.7	18
Standard	Observed/Expected	288/293.7	280/274.3	568

$\chi 2$ (1, N = 586) = 7.439, $p < .05$.

The researcher finds this noteworthy because in the Before Taxi/Taxi Checklist and After Landing – Taxi Checklist there are 11 (approximately – depending on fleet type) items on the checklist, and therefore 11 places to find oneself graded "non-standard" by a check airmen. The specific checklist items with noted improvement each consist of over 10 individual checks which could each result in noncompliance. Additionally, the Before Taxi/Taxi checklist was introduced in 2009 in order to achieve fleet standardization. Before that time, fleets only had Taxi checklists. The improvement in compliance could be attributed to pilots becoming more familiar with the new procedures as they visited the simulator and received training by the check airmen on the new change, something that occurred during the same training cycle they received their PINC human factors training.

Non-standard descent speed compliance was number two in the pre-PINC training "non-standard" rankings, and showed improvement to number six in the post-PINC training rankings.

Table 5. Non-standard Standardized Descent Speed Compliance

PINC Status		Pre-PINC Training	Post-PINC Training	Total
Non-Standard	Observed/Expected	28/20.4	12/19.6	40
Standard	Observed/Expected	266/273.6	271/263.4	537

$\chi 2$ (1, N = 577) = 6.239, $p < .05$.

The reason for this is twofold: first, "minimum descent speed – checked" is an item on the first section of the Cruise Checklist. It is a simple entry (cruise mach/aircraft specific descent speed) called for at a quiet part of the flight (level off), and the checklist cannot be called "complete" until it is entered. Second, PINC training specifically addressed checklist completion. It is interesting to note that the number 12 "non-standard" item in the pre-PINC training rankings was the Cruise Checklist, which showed no improvement in SOP compliance in post-PINC training group, and it actually had one more occurrence of noncompliance in a smaller number of total flights in the post-PINC training group.

Table 6. Non-standard Cruise Checklist

PINC Status		Pre-PINC Training	Post-PINC Training	Total
Non-Standard	Observed/Expected	12/12.9	13/12.1	25
Standard	Observed/Expected	289/288.1	270/270.9	559

$\chi2$ (1, N = 584) = 0.131, $p > .05$.

In terms of ranking, the Cruise Checklist had the second worst 'decline' in ranking between the pre-PINC training ranking and the post-PINC training ranking, rising from 12th worst area of non-compliance to 5th. "Minimum Descent Speed – Checked" is on the Cruise Checklist. Further research into the comments on "non-standard" grades on non-standard Cruise Checklist, is required to understand the reason for the "non-standard" marks.

Non-standard climb speed policy compliance showed significant improvement from the pre-PINC training group to the post-PINC training group, yet it still remained the number one area of noncompliance in the post-PINC training group.

Table 7. Non-standard Climb Speed Policy Compliance

PINC Status		Pre-PINC Training	Post-PINC Training	Total
Non-Standard	Observed/Expected	48/38.8	27/36.2	75
Standard	Observed/Expected	255/264.2	256/246.8	511

$\chi 2(1, N = 586) = 5.205, p < .05$.

The airline introduced the climb speed policy in 2009 in the interest of minimizing fuel burn and standardizing fleets. Unlike non-standard descent speed, “climb speed” is not an item on any checklist. It is supposed to be entered into the flight management computer during the preflight, and it is covered under the umbrella of the “CDU – Checked” response on the Before Starting Engines Checklist. Before the policy was introduced, pilots used a variety of recommended practices to program their climb speeds (i.e., flight plan climb speed, transitioning to cruise mach number), but there was no existing SOP for the entry of a climb speed. The new climb speed policy was distributed by pink bulletin as an amendment to the Aircraft Operating Manual, and at first a reminder was printed out in the appended messages portion of every flight plan. This “reminder” was removed at some point after the pre-PINC training group MLCs took place. The Standard Climb Speeds are currently located in the aircraft operating manual in the Climb – Cruise – Descent section, something not normally accessed during normal preflight procedures.

Non-standard takeoff briefing accomplished was unique as it was the only item in the top-12 non-standard ranking with an expanded definition of which SOP items check airmen should be looking for. The description lists "Taxi Route, Hot Spots, SID, FM II special procedures, engine out, terrain considerations (MEA, MSA, Grid MORA), Transition Altitude, takeoff." There results showed that pilots who had received PINC training were more compliant with SOP than the pre-PINC training pilots, $p = .022$.

Table 8. Non-standard Takeoff Briefing

PINC Status		Pre-PINC Training	Post-PINC Training	Total
Non-Standard	Observed/Expected	16/10.8	5/10.2	21
Standard	Observed/Expected	287/292.2	279/273.8	566

$\chi 2$ (1, N = 587) = 5.266, $p < .05$.

This validates the researchers belief that PINC training will increase SOP compliance, but in the pursuit of understanding the SOP for a takeoff briefing the researcher found no place in the Aircraft Operating Manuals or in the Flight Operations Manual where all these requirements are listed as SOP.

In fact, this it all that is included about takeoff briefings in the Aircraft Operating Manual [items in bold in original document for emphasis]:

> The takeoff briefing consists of (as a minimum):
>
> - Designate the pilot-flying
> - Rejected takeoff considerations
> - Any other contingencies (if applicable).
>
> The briefing is completed at the gate, to the extent possible, to allow both pilots to focus on taxi operations after gate departure. Last minute clearance changes from ATC (taxi or departure) will be verbalized by the F/O and verified by the Captain. Checklist items covering the departure procedure need not be briefed unless some contingency or exception exists. When required, the Captain will conduct whatever briefing is appropriate to the situation (e.g., poor weather, inexperienced crew member, etc.). The Captain, at his / her discretion, may delegate the briefing to the F/O (Pilot-Flying), with the understanding the Captain will take the aircraft in the event of an RTO in compliance with current policy."

Followed by this:

> "The takeoff briefing will be conducted by the Captain (or at the Captain's discretion, the Pilot-Flying) at the gate and include, as a minimum:
>
> - Designate the pilot-flying
> - Rejected takeoff considerations.
>
> Contingencies, if appropriate:
>
> - Departure procedure (required only if not covered previously by checklist completion or if revised by ATC)
> - Airport specific engine failure profile
> - Takeoff alternate
> - Takeoff weather considerations
> - Runway surface conditions
> - Terrain considerations
> - Any other variables associated with the taxi and takeoff. (Aircraft Operating Manual, 2010)

Of those listed on the MLC form, standard instrument departure (SID), engine out, terrain and takeoff are the only ones that the researcher could find in the governing books of the airlines SOP. It would be expected that a pilot could decide that in order to effectively brief terrain considerations, the minimum safe altitude (MSA) should be briefed, or that it is wise to brief the planned taxi route, but that would be considered recommended technique, not SOP.

The term "Hot Spots" is not found in any of the manuals, nor is there any requirement to brief the taxi route. International Civil Aviation Organization (ICAO) defines a hot spot as a location on an airport movement area that has historically been at high risk for collisions or runway incursions (Federal Aviation Administration, 2011). These areas are highlighted on airport charts to increase awareness for pilots and drivers. The qualitative comments from the pre-PINC training group explain why the "non-standard" mark was given included, "Captain did not brief 'hot spots' along planned taxi routing" and "No taxi route brief." It seems there might be some confusion in the training department as to what the official SOP is for the takeoff briefing. This exemplifies the need for simple, clear, concise and prescriptive SOP so that everyone, pilots and airline training departments, understands what is expected. (Aviation Glossary, 2010)

The largest improvement in SOP compliance was found in non-standard appearance.

Table 9. Non-standard Appearance

PINC Status		Pre-PINC Training	Post-PINC Training	Total
Non-Standard	Observed/Expected	22/11.2	0/10.8	22
Standard	Observed/Expected	272/282.2	285/274.2	557

$\chi 2$ (1, N = 579) = 22.169, $p < .05$.

This standardized residual far exceeded 1.96 (z = 3.2) and the actual p < .001. While it is possible to draw the conclusion that PINC training had an incredible effect on pilots appearance, it is interesting to also note that the flight department at this particular airline distributed a letter to all pilots signed by a majority of the chief pilots indicating that the culture of uniform compliance is changing. Another possible contributing factor was a change in leadership that was accompanied by a less-restrictive hat and tie policy "rumor". That rumor became official in a recent revision to the carriers flight operations manual. Analysis of the pre-PINC training data comments to understand how many of them were hat and tie related might reveal fewer non-standard appearance scores if the current policy were applied to pre-PINC training data. Regardless, the airline can be satisfied to know that they met the seemingly unachievable goal of perfect compliance with SOP in this one area in the post-PINC training line checks.

Although not significant, non-standard "Point and Shoot" used for all altitude changes did recognize improvements between the pre- and post-PINC training groups. The difference between post-PINC training pilots approached significant improvement over the pre-PINC training group, $p = .051$.

Table 10. Non-standard "Point and Shoot" used for All Altitude Changes

PINC Status		Pre-PINC Training	Post-PINC Training	Total
Non-Standard	Observed/Expected	21/15.7	10/15.3	31
Standard	Observed/Expected	270/275.3	273/267.7	543

$\chi2$ (1, N = 574) = 3.809, $p > .05$.

While the airline had a coincidental policy of limiting SOP changes during the period of the data collection, this particular item did have a change effective April 8, 2010. This change modified the "Point and Shoot" that required the PM to change the altitude, point at the window, state the altitude and wait for the PF to verbally acknowledge and point, or "shoot" at the altitude window. The new policy got rid of the need for the PF to "shoot" the window and now required only a verbal acknowledgement of the newly assigned altitude. In the pre-PINC training group there were 21 non-standard marks from 291 flights, and only 10 non-standard marks out of the 283 post-PINC training flights. While the findings were not significant, it is possible that the simplification of procedures could have had an impact on the top-12 rankings, moving from 4th least compliant item in the pre-PINC training to 7th in the post-PINC training group.

Of the remaining items to be discussed, three of them are checklists that showed no significant difference between the pre-PINC training and post-PINC training data. In fact, the non-standard marks on the Before Starting Engines, Before Takeoff and Parking Checklists all had worse rankings on the post-PINC training top-12 than on the pre-PINC training top-12.

Table 11. Non-standard Before Starting Engine Checklist

PINC Status		Pre-PINC Training	Post-PINC Training	Total
Non-Standard	Observed/Expected	13/15.9	18/15.1	31
Standard	Observed/Expected	291/288.1	269/271.9	560

$\chi 2$ (1, N = 591) = 1.183, $p > .05$.

The Before Starting Engines Checklist compliance item was ranked 11th worst pre-PINC training to 2nd worst post-PINC training, the greatest increase in rank of all items. The researcher believes that due to the large number of items on a checklist, it is easy to find something non-standard which would deem the entire checklist non-standard. On one fleet, the Parking Checklist's non-standard comments involved six different checklist items, three of which were only marked non-standard on a single flight.

Table 12. Non-standard Parking Checklist

PINC Status		Pre-PINC Training	Post-PINC Training	Total
Non-Standard	Observed/Expected	14/10.3	6/9.7	20
Standard	Observed/Expected	287/290.7	280/276.3	567

$\chi 2$ (1, N = 587) = 2.905, $p > .05$.

It is important to study further the source of these non-standard marks and determine which areas can be focused on to improve pilot's understanding of SOP on normal checklists.

The final item for discussion is item 12, non-standard (G)FMS route/ legs verification check. Regarding item 12, the SOP for this is not new.

Table 13. Non-standard (G)FMS Route/Legs Verification Check

PINC Status		Pre-PINC Training	Post-PINC Training	Total
Non-Standard	Observed/Expected	15/15.3	15/14.7	30
Standard	Observed/Expected	286/285.7	273/273.3	559

$\chi 2$ (1, N = 589) = 0.015, $p > .05$.

This item's ranking moved from 8th least compliant area to 4th least compliant, the third worst decline in rank. The researcher found the SOP for this item to be fairly consistent in all fleets, with variations in the types of (G)FMS the only reason for between-fleet differences. The interesting finding about this data was that of the 30 flights found non-standard, 25 of them (83.33%) were flown on domestic routes.

A possible explanation for this finding is that international routes are complex and often flown over areas without reliable ground based navigational aids or radar coverage, the flight plan is checked against the (G)FMS for accuracy many times. Domestic flights are almost always in radar coverage, routes are familiar, and while the chance for violation is just as prevalent as it is on international routes, the fear of a gross navigational error fine simply doesn't exist. This theory could be researched further to understand if there is a significant difference in (G)FMS route/legs check compliance between domestic and international flights and, if so, explore the check airmen's comments to further understand potential solutions to increase domestic pilots awareness of how to comply and the risk of noncompliance.

Recommendations

Due to the significant findings of improvement in the post-PINC training group in six of the 12 areas tested, this researcher feels that PINC training should continue to be a part of human factors training. Additionally, the airline should continue to look for new ways to increase pilot's understanding of the consequences of choosing to disregard SOP. As of September 1, 2010, Captain's decision making training was added to the PINC training. However, in order to increase the safety culture the airline should provide assertiveness training to the First Officers. This training should involve both Captains and First Officers with the goal of establishing roles and expectations. First Officers must respect the role of the Captain while helping the Captain comply with SOP, and alerting the Captain to any deviation from SOP is part of that. This training has the potential to bring the CRM aspect of SOP full circle and this step is vitally necessary in pursuit of a more SOP compliant operation and improvement in the overall safety culture of the airline.

To simplify SOP compliance, a Quick Reference Card specific to each fleet should be developed. In the case of Climb Speed compliance, the card would serve to make complicated Climb Speed tables easily available for pilots to crosscheck every flight. This card could be used as a tool to help pilots comply with all items required on the Takeoff briefing. This tool should also include similar lists for Crew Change briefings for 3- or 4-pilot crews and for the Approach briefing called for on the Descent Checklist. Aircraft limitations as well as other recommendations from line pilots could be added as well.

Research into the causes of non-standard procedure compliance in the MLC comments section could reveal additional items to include on the Quick Reference Card. The card should be administered not as a recommended tool, but as SOP for all crewmembers to reference the card, at least in the case of multiple item briefings.

Because six of the top-12 areas of noncompliance were checklist related, there are two recommendations to help improve in checklist SOP. First, there were a number of "no 'checklist complete' call out" and "incorrect response to a couple of items" qualitative remarks on all the checklists that made the top-12. Checklist discipline is something that some pilots make a daily practice of, while others make sure they brush-up on it for whenever they need to go to training. If the pilots are encouraged in training to make line operations checklist discipline just as stringent as it is in training, the culture could shift quickly to be more SOP compliant. First Officers should feel compelled to correct their Captains if they say, "Set" when they should say, "Checked," for example, and Captains should correct First Officers on incorrect responses to challenge and response items when they are the pilot monitoring (PM). The responsibility for good checklist discipline falls on both Captains and First Officers, and the one holding the card and reading the checklist has all the answers in their hand.

The Cruise Checklist was one of the least affected items between the pre-PINC training and post-PINC training groups, and its ranking went from 12th-worst to 5th-worst between groups. This checklist covers the portion of the flight from "top-of-climb" through "Just Prior to Top-of-Descent," which might be 30-minutes on a domestic leg, but can easily exceed 12 hours on international flights. This means that the checklist is in progress and awaiting completion for the majority of many flights. The researcher recommends consideration of establishing two or three separate checklists for the cruise portion of flight as this may make it more reasonable to expect pilots to remember to comply with all SOP even on the longest of flights. Other modifications recommended are to add

"Climb Speed – set" to the Before Starting Engines Checklist and "Seat Belt Sign - ON" to the Just Prior to Top-of-Descent portion of the Cruise Checklist.

One of the most common areas of noncompliance on the After Landing – Taxi Checklist was not an actual line item on the checklist, but an arrival procedure. First Officers are required to make an arrival PA immediately after gate arrival. There were many cases of First Officers making the announcement approaching the gate, which does not comply with SOP. Additionally, the Captains immediate action item upon gate arrival is to set the parking brake and turn off the seat belt sign.

According to SOP, these actions must be performed immediately upon gate arrival, which leaves the First Officer announcing, "Ladies and gentlemen, please remain seated until the Captain has turned off the seat belt sign. Flight Attendants prepare for arrival and cross check," two to three-seconds after the Captain has turned off the sign. If the First Officer makes the PA early or the Captain delays the immediate action of turning off the sign, they are not complying with SOP. The first portion of the PA is to prevent passengers from unbuckling and getting hurt in the last few precious feet of their flight, and the second portion is to let flight attendants know that the brake is parked, aircraft is at the gate, and it is safe to disarm their doors.

The SOP should be modified so that the "Ladies and gentlemen, please remain seated until the Captain has turned off the seat belt sign," portion of the PA is announced once the parking area has been cleared and the aircraft will immediately proceed to the gate. Once the parking brake is set at the gate, the First Officer can announce, "Flight Attendants prepare for arrival and cross check." This modification allows for the reminder to remain seated with seat belts fastened to precede the seatbelt sign being turned off, the flight attendants to disarm the doors only after aircraft arrival, and would bring SOP in line with the intention to keep passengers and flight attendants safe.

One of the biggest challenges for many U.S. major airlines is that they essentially operate two different airlines, one domestic and one international. They have short-haul and long-haul flights and a variety of fleets enlisted to accomplish the goal of safely moving people. In the goal of standardization, these differences cannot be ignored. Non-standard (G)FMS route/legs verification check, brought to light a difference between compliance rates domestic and international flights.

If it is the airlines plan to standardize fleets in this operating area, it is important that this procedure is highlighted and the reason behind checking the paper flight plan with the electronic flight plan is brought to light. Pilots are frustrated when they are asked to do something because it is SOP, especially when it seems to be excessively redundant for routes they routinely fly. There are many reasons why this route/legs check is important, and the application of this procedure to domestic flights makes sense because there is a potential for mistakes if the procedure is not conducted properly. The skies are getting more populated, and ATC separation requirements are shrinking. Educating pilots on the "how?" and "why?" of a procedure that they may have deemed unnecessary could shift their thinking.

The final recommendation of the researcher is in all development of training and new SOPs, differences between fleets and pilot's aversion to change must be acknowledged and addressed to effectively increase SOP compliance.

Future Research

The question as to whether increased understanding, knowledge and awareness of individual airline SOP and the risk of noncompliance with SOP increase airline pilot's compliance with SOP has been only partially explored by the research project, and further research is required to more fully answer the question. It was the original intention of the researcher to measure the effect of specific training on the 757/767 fleet's SOP compliance rates, but due to time constraints there was not enough data to complete that specific portion of the research. That training will be distributed to the pilots on the 757/767 and the data should be available for analysis in July 2011. That training is specifically focused on the top-10 areas of noncompliance on the 757/767 fleet and the information to be distributed can be found in appendix C.

Because the data was collected on multiple fleets in both domestic and international operations on long-haul and short-haul flights, further investigation comparing data in these groups could lead to better understanding of specific areas where SOP compliance rates may differ. This research could serve to better explain the conditions under which greater rates of noncompliance exist in certain operations, thereby allowing training to be designed to directly address the problem area. This would help to avoid blanket solutions that, applied company wide, are often rejected by the groups not exhibiting the noncompliant behavior. This data is already available for further analysis, and this prescriptive application of new SOP to problem areas has the potential to be well received by pilots who understand why SOP is being changed and how to use the new SOP. Additionally, the airline should consider a study of their current checklist procedures to determine if there is any room for improvement or change.

It is also recommended that the airline to use future data to understand the effect of non-training events on SOP compliance. The PINC training that pilots received that was tested for this research project was an example of an external motivator for compliance. If pilots don't comply with SOP, they risk being violated. This external motivator, while shown by this study to be effective, is defined as a negative motivator. The U.S. Navy publishes this about the use of negative motivation on subordinates:

> Fear activates such negative incentives as threat of punishment or restriction of personal needs. Negative motivation, however, often

> destroys morale; and effectiveness will decline as morale declines. Long-term or frequent use of negative motivation is self-defeating. (U.S. Navy, 2010, p. 4-17)

Future research into the effects of positive external motivators like improved working conditions due to settled union labor disputes, positive corporate financial reports, and the announcement of growth with new airplanes, route, or hiring of new pilots should be conducted. This research could reveal if improved morale and the possible effect of a less distracted cockpit environment could lead to an increase in SOP compliance. Additional research could answer if the removal of financial pressures on pilots increase SOP compliance. Data gathered during times of expansion could compare new Captains to Captains who have been in the left seat for five years or more to determine who is more SOP compliant. These and many other questions could be analyzed to better understand what motivates pilots to comply with SOP.

Conclusion

Due human error, it is not possible for airlines to ever achieve 100% compliance with SOP, no matter how much training, clarification and understanding pilots have of existing SOP. Pilots will make mistakes, but the determination to pursue perfect SOP compliance should be a part of a pilot's commitment to professionalism just as primum nil nocere, "first, do no harm," is a fundamental part of physician's ethics training in medical school. It is an attitude of excellence, a foundation that serves to underlie the best, most safe operation every time they are charged with the command of an aircraft full of trusting passengers.

The amount of man-machine interaction required in the operation of highly automated aircraft flown by airlines today is negligible when compared to the virtually non-automated 707 or even the 727. This has reduced the need for pilots to 'do' and increased the need for pilots to 'monitor'. Bhana (2010) states, "The paradigm shift is significant, as it requires a different pilot skill set to be added to the traditional 'stick and rudder' skills." (p. 14). Couple this threat of complacency with FOQA and the threat of PINC and PUNC, and it is vividly apparent that today's airline pilots are operating in a different world in 2011 than they were even 5 years ago, and it is drastically different from the environment 15 to 35 years ago when most of today's U.S. major airline pilots learned to fly. Acknowledgement of that change requires understanding of the implications that accompany FOQA, PINC, PUNC and automation, bringing to light the fundamental need for SOP compliance.

Aristotle once said, "Excellence is an art won by training and habituation. We do not act rightly because we have virtue or excellence, but we rather have those because we have acted rightly. We are what we repeatedly do. Excellence, then, is not an act but a habit (n.d.)" John Hale, the Vice President of Flight at American Airlines has been credited with coining the phrase 'aggressively safe.' In his introduction to the Flight Operations Manual he states, "We just do not have the luxury of being anything but excellent every single time we climb into the cockpit" (Hale, 2011). Aggressively safe is an attitude he asks his pilots to adopt every time they fly, a proactive approach to flying in pursuit of preparation for the unknown threats that absolutely exist. He believes that, like in defensive driving, we must pursue safety throughout all phases of flight because the threat of complacency is real. SOP compliance is the foundation to aggressively safe operations.

If airlines can provide pilots with SOP that are simple, clear, concise and prescriptive and provide pilots with the training to understand the reason for SOP and how to successfully apply it and tools to make compliance easy, they will have done their part. This research established that training on the “because I said so” that is the risk of PINC did increase SOP compliance. While SOP compliance is the goal, if pilots receive training, clarification and achieve understanding of the ‘why?’ and ‘how?’ of SOP, they will be far more motivated to do the right thing. “Because I said so,” works, but “because it is the right thing to do,” changes the motivation from fear to one where the satisfaction of complying with SOP because they understand and can justify it as the right thing to do positively motivates pilots and engages them as professionals to be an important contributor to the airline’s safety culture.

APPENDICES

APPENDIX A

Microscope Line Checks Non-standard Item Legend

6)Non-standard Pilot license and Medical Certificate checked
7)Non-standard Fuel planning coordination with dispatch
8)Non-standard Preflight and Walk Around inspections complete
9)Non-standard F/A briefing accomplished: Turbulence, security, enroute delays, cabin/galley E6 logbook write-ups, Gen Decs/ Customs forms. If routed over 66N over Greenland did Captain request F/A review of 66N Supplemental O2 unit?
10)Non-standard Cold Weather Operations - Deice/Anti-Ice procedures compliance
11)Non-standard check (G)FMS against flight plan and clearance
12)Non-standard (G)FMS route/legs verification check
13)Non-standard Takeoff briefing accomplished: Taxi Route, Hot Spots, SID, FM II special procedures, engine out, terrain considerations (MEA,MSA,Grid MORA), Transition Altitude, takeoff
14)Non-standard Captain manages workload during re-flight phase to assure logbook review and flight plan crosscheck concerning MEL/ CDL items thorough and complete
15)Non-standard ETOPS 1 or 2 sign-off check
16)Non-standard Before Starting Engines checklist
17)Non standard Starting Engines Procedure compliance
18)Non standard Before Taxi/Taxi checklist
19)Non-standard Proper clearing of the area before taxi
20)Non-standard no head down procedures performed while in the ramp area during taxi
21)Non-standard Airport Diagram in use by all pilots
22)Non-standard Captain's attention primarily focused on taxi
23)Non-standard Captain and F/O review of takeoff data
24)Non-standard Single Engine Taxi procedures
25)Non-standard communications using standard/ICAO phraseology
26)Non-standard Before Takeoff checklist

27)Non-standard Terrain/Obstacle awareness on departure
28)Non-standard crew comply with airspeed/altitude restrictions and navigation parameters on SID
29)Non-standard climb speed policy compliance
30)Non-standard After Takeoff - Climb checklist
31)Non-standard Cruise Checklist
32)Non-standard Oceanic Clearance procedure compliance
33)Non-standard Crew properly maintained AIREP form
34)Non-standard Circle and Tick procedure compliance
35)Non-standard Required ATC position reports and plotting compliance
36)Non-standard ATC communications compliance (including FIR crossing requirements)
37)Non-standard briefing on crew change, who is PIC, alternates, weather, etc.
38)Non-standard communication compliance: HF SELCAL check, company position reports, etc.
39)Non-standard SLOP in North Atlantic/North Pacific
40)Non-standard MTCP procedures
41)Non-standard Fuel Saving procedures
42)Non-standard Cold Fuel procedures
43)Non-standard Descent Checklist
44)Non-standard Standardized descent speed compliance
45)Non-standard approach briefing accomplished (timing, content, accuracy, terrain considerations - MEA, MSA, Grid MORA - transition altitude)
46)Non-standard STAR navigation, speed and altitude compliance in terminal area
47)Non-standard Before Landing checklist
48)Non-standard Contaminated Runway Operations and Landing Performance Check
51)Non-standard Landing Configuration - gear and flaps by 1000' AFL
52)Non-standard Stabilized approach by 1000' IMC, 500' VMC
53)Non-standard On visual approach, used all available nav-aids
54)Non-standard Touchdown point (centerline, touchdown zone)
55)Non-standard Crew Executed a go-around
56)Non-standard Communications using standard/ICAO phraseology
57)Non-standard After-Landing - Taxi checklist

58) Non-standard Airport Diagram out and referenced by all pilots
59) Non-standard Single Engine Taxi procedures
60) Non standard crew ensures equipment clearance is adequate during gate arrival
61) Non-standard Parking checklist
62) Non-standard APU procedures with External Power connected
63) Non-standard Appearance
64) Non-standard Sterile cockpit procedures compliance
65) Non-standard "Point and Shoot" used for all altitude changes
66) Non-standard Read back of all clearances per Flight Manual Part 1
67) Non-standard Cockpit door security
68) Non-standard communication with F/As when approaching/ entering turbulence procedures

APPENDIX B
Survey

Microscope Observation Form

Boardmail to:
Captain Bart Roberts
MD 843 GSWFA

Flight Information
Enter the following information concerning the flight:

1. Fleet Type
❑ B777 ❑ B767 ❑ B757 ❑ B737 ❑ MD80

2. Flight Date | Flight No.

3. Check Airman (Name and Employee #)

4. Captain's Crew Base
❑ DFW ❑ LAX ❑ LGA ❑ MIA ❑ ORD ❑ SFO ❑ DCA ❑ STL ❑ BOS

5. Departure Station | Destination Station | Diversion Station

Pre-Departure

6. Pilot License (English Proficient) and Medical Certificate checked
❑ Standard ❑ Non-Standard ❑ Not Applicable ❑ Not Observed

7. Fuel planning coordination with dispatch
❑ Standard ❑ Non-Standard ❑ Not Applicable ❑ Not Observed
Captain ADD fuel? Quantity and reason why?

8. Preflight and Walk Around Inspections completed
❑ Standard ❑ Non-Standard ❑ Not Applicable ❑ Not Observed

9. F/A briefing accomplished: Turbulence, security, enroute delays, cabin/galley E6 logbook write-ups, Gen Decs/Customs forms. If routed north of 66N over Greenland did Captain request F/A review of 66N Supplemental O2 unit?
❑ Standard ❑ Non-Standard ❑ Not Applicable ❑ Not Observed

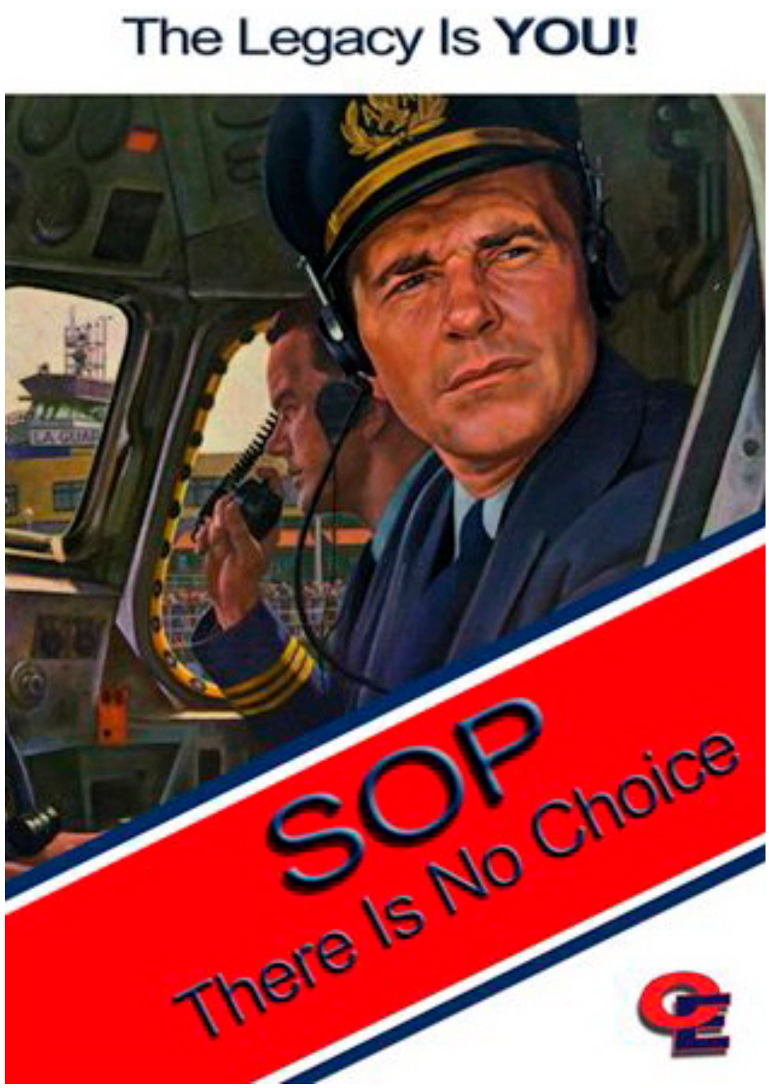
10. Cold Weather Operations – Deice/Anti-Ice Procedures compliance
❑ Standard ❑ Non-Standard ❑ Not Applicable ❑ Not Observed

11. Check (G)FMS against flight plan and clearance
❑ Standard ❑ Non-Standard ❑ Not Applicable ❑ Not Observed

12. (G)FMS Route/Legs Verification Check
❑ Standard ❑ Non-Standard ❑ Not Applicable ❑ Not Observed

APPENDIX C

Corporate Strategy Poster



APPENDIX D

Briefing Bulletin for Future Research

Greeting 767 Crews! My name is Carrie Giles and I am completing my Masters in Aviation at the University of North Dakota, and that is the reason for this bulletin. I am in hot pursuit of better ways to educate and train pilots in the realm of Standard Operating Procedures, better known as SOP. In light of the current environment it is easy to understand that SOP compliance might not be the most prominent thing on your radar, so I appreciate you taking the time to read this.

Compliance with SOP is something that Captains are tasked with each time they sign the flight plan, and First officers are responsible to speak up whenever SOP are not being followed. When it comes to flight, day in and day out, your certificates and operating manuals require that you follow SOP to the letter. This might sound easy, but SOP seem to change all the time, and one must pay close attention to stay up-to-date on current SOP. So, professional pilot, do you know 757/767 SOP?

In February and March of 2010 Microscope Line Checks (MLC) were accomplished to determine the level of SOP compliance on all fleets. Crews were marked either 'Standard' or 'Non-Standard' in 60 different areas. The data gathered from those checks was analyzed to determine the top 10 deficient areas for the 757/767 fleet. Examples of non-standard marks from those MLC will be given for the top 10 areas in order to highlight the discrepancies and explain what AA SOP are. Chances are you are on top of most of these, but in case you missed a change or simply forgot something since your last training, this information is provided to help you. My hope is that this information will help to increase your understanding of SOP so that you and your crew are 100% compliant the next time a check-airmen shows up on your jet-bridge.

NOTE: Non-standard operating procedures were noted in a variety of areas indicated in bold. These are the highlights – for more please refer to 767 training page on AA Pilots.

#1 - Non-standard Climb Speed Policy Compliance - 45 occurrences

Examples from MLC comments:

"Didn't program CLB speeds in FMS."
"The initial climb speed/Alt. was not entered on CDU climb page. V-NAV used after takeoff." "Climbed with full power vs. CLM 2, then CLM 1. Used ECON SPD (330/.82) to CLM with (instead of 300/.80)."

"Standard speed climb profile not entered into FMC until discovered by Captain climbing through FL180."
"Debriefed CA & FO on selecting flaps to 5 degrees on a 15 degree flap T.O. prior to the standard 3000' AGL flap retraction altitude for standard ICAO noise abatement procedure in Europe."
"Out of 10K used ECON CLB. speed of 345 kts. to climb. Flying VNAV SPD in CLB to CRZ ALT, FL 330. Full CLB speed reselected out of 16,000' (climb rate was down at 1500'/min due to extremely high IAS of 345 kts.)" "Captain used approx. 280 KIAS during climb. Asked what normal 757 climb speed was - he said about 280-290 KIAS. I said normal = 300 KIAS, Turbulent air penetration = 290 KIAS."

- On Pre-flight checklist:
  - CLIMB SPEEDS...EDIT: **Enter climb speed on the FMC CLB page SEL SPD at 2L.**
- On After Takeoff - Climb Checklist:
  - THRUST RATING PANEL......................... **Upon reaching 250 knots, select: 757– CLB 2**, 767 – CLB
    - On the 757, when the rate of climb falls below approximately 1000 feet per minute, select "CLB 1" or "CLB", as appropriate.

Recommendation: Enter Climb Speeds during FMC loading right after takeoff data (write the numbers on Normal Procedures checklist - the bottom of the first panel is a good spot).

Aircraft	Weight	Speed
757, 767-200 and 767-300	up to 300,000 lbs	300 kts / M .80
767-300	above 300 to 350,000 lbs	310 kts / M .80
767-300	above 350 to 408,000 lbs	320 kts / M .80

Non-Pegasus - See Systems 65.7: Climb (CLB) Page: This page will display a non-restricted 250 knot climb to 10,000 feet, unless intervening speed or altitudes had been previously entered.

Pegasus - VNAV Page - See Systems 66.14: The VNAV Key displays CLB, CRZ and DES pages. Pressing VNAV on the ground, during takeoff, or climb shows the CLB page. The only difference on the CLB page is the title. Speed displays the type of climb, e.g., V2 + 20, 250

#2 - Non-standard After Landing – Taxi Checklist - 27 occurrences

Examples from MLC comments:

"CA turning autobrake sw. to off on taxi-in - debriefed."
"Reached down and manually turned off autobrake selector while on landing rollout."
"Crew threw a couple of switches on the parking checklist, while taxiing."
"F/O did not notice that Capt. had not turned strobe lights off after landing and announced checklist complete."
"Flaps not left at 20 degrees after approach in icing conditions."
"APU non-std. start"
"FO reaches over and turns off the auto brakes switch while the aircraft

is still on the centerline of the runway. Capt. had already overridden the autobrakes well before this."
"FO starts after landing (directed by CA) as we came up to hold short 24L (land 24R). FO head down till we stopped at RWY."
"Remember - the flight is not over until the parking checklist is complete and the cockpit door is locked on the way out

- With the exception of the Autopilots (which are normal runway items) **no other item on this checklist should be accomplished until clear of runway.**
- Autobrake selector should not be turned off until the Parking Checklist flow as accomplished by the Captain. **Do not reach down while on the runway or taxiing to turn off the switch.**
- **Both pilots will monitor the appropriate tower frequency when number one in position to cross an active runway**. Anytime the aircraft is cleared to hold short of or cross an active runway, the Captain and FO will **verbally confirm the clearance with each other.**
- Icing Conditions - Flap Policy FLAPS... RETRACT to 20. Advise station by radio, if possible, or upon reaching gate position, of the need for a check of the flap area. Deicing personnel or flight crew must check the inboard flap wells for snow, ice, or slush accumulation. Prior to next departure, any snow, slush, or ice accumulation will be removed by deicing before retracting the flaps.
- **Engine Cooldown Period** For the 757, allow 1 minute after landing before shutting down the engine to permit the hot section to thermally stabilize. For the 767, allow at least 3 minutes after landing before shutting the engine down for cooldown. Use a thrust setting no higher than that normally used for taxi.
- APU should normally be started **2 minutes prior to gate arrival** to allow engines to be shut down upon gate arrival, and to provide pneumatic pressure for proper closing of the engine bleed valves.
- When all items have been accomplished, the First Officer will advise – "**After landing checklist complete.**"

#3 - NON-STANDARD STANDARDIZED DESCENT SPEED COMPLIANCE - 22 OCCURENCES

Examples from MLC comments:
"Did not enter STD descent SPDS"
"Did not use STD descent speeds - debriefed."
"Descended at 265 kts, did not notice mach to IAS changeover - did slow to 250 KIAS @ 10K - that's where they noticed."
"Programed and flew 320 kt. descend. Was not trying to make up time (no discussion of this). FLT was ARR MCO for shutdown for the night."
"No ATC speeds given - Capt. flew other than standard speed."

- **On Cruise Checklist: MINIMUM DESCENT SPEED...CHECK**
  - Verify minimum descent speed (**cruise mach / 290 knots in domestic airspace**) is entered in FMC.
- **Standardized Descent Speed Policy:**
  - At domestic stations use cruise mach, then 290 knots as a planned descent speed.

- ○ Use this speed rather than Cost Index generated descent speeds. If another speed is desired, coordinate with ATC.
- ○Outside domestic airspace, consider an optimum (CI generated) descent speed into those destinations where experience and judgment indicate no ATC conflict. Enter this speed into the FMC before descent.

#4 - Non-standard Starting Engines Checklist - 18 occurrences

Examples from MLC comments:

"CA & FO mistakenly believe CTR FUEL PUMPS could remain OFF until after takeoff if center tank quantity is less than 5000 LBS, turn on at cruise. Debriefed, to follow CL, turn pumps on before engine start, to ensure pumps operate after engine start and before take-off."
"Did not have proper response to a couple of checklist items."
"Checklist - pressurization - auto - set - landing altitude was not correctly set. FO caught it during cruise."
"Hydraulic pumps were turned on 'left to right' instead of 'right to left'."
"All 3 IRUs not checked on BSC."
"Captain airspeed bugs incorrectly set. Set Ref 20, not V2 + 20."
"FO/FB - inserted 4 digit APU hour meter reading in ACARS, Pegasus FMS, instead of 3 digits + A/D. Both for Dept. and Arrival."

- CDU...SET and CHECKED means that PERF page/ T/O page agree w/TPS, CDU data agree with clearance and that Pre-departure clearance route has been properly entered.
- APU Hourmeter - PEGASUS aircraft **- I**NDEX 1/2 – MESSAGES – STATUS – APU HOURS – **Enter last 3-digits of the APU hourmeter followed by A for arrival or D for departure**. Sent automatically.
- FUEL PUMPS…ON: **If center tank contains fuel: Turn switches on, regardless of quantity.** Verify both Center Tank Fuel Pump Low PRESS lights are illuminated and CTR L FUEL PUMP and CTR R FUEL PUMP EICAS messages are displayed.
- HYDRAULIC PUMPS...ON / AUTO: **Pressurize Right System first** to prevent fluid transfer.
  - ○757 - Electric Pump Switches (R, C, & L) – ON - Center No. 2 PRESS light will be illuminated until an engine is started. Engine Pump Switches – Check ON
  - ○767 - Demand Pump Selectors (R, C, & L) – AUTO Primary Pump Switches – ON - Center No. 2 PRESS Light will be illuminated
- Do not release brakes until doors are closed and the groundman and **do not release brakes until doors are closed and the groundman and Ramp/Ground Control have cleared the aircraft to push.**
- When all items have been accomplished, the **First Officer will advise the Captain – "Before Starting Engines checklist complete."**

#5 - Non-standard Before Takeoff Checklist - 17 occurrences

Examples from MLC comments:

"Captain did not brief 'hot spots' along planned taxi routing."
"Captain displayed complacency with respect to CRM and D & R - briefings were minimal, less than what we would consider normal for a crew that is paired together regularly. LAS eng. out was touched on

but not briefed, taxi out and taxi in routes not briefed. Captain wascompletely debriefed with respect to these requirements."
"No taxi route brief."
"I did not hear the crew discuss the E/O NOTAM procedure for the departure RWY."
"Capt. Pre. Dept. brief could have included more about obstacle & wx. avoidance."
"Capt. did not brief expected taxi out route, FO had to go heads down to check (pull out of book) the DFW standard taxi routes."
"The TPS had 4R as the top RWY of the 5. The actual takeoff RWY was RWY09. The FMC loads 4R which the crew properly changed to RWY09. Then the closeout came which "reset" the FMC takeoff page to RWY 4R. TPS had 64C setting while RWY 09 requires 59C. Neither pilot caught the fact that they had too little power for takeoff on the shorter RWY 09. The check airmen had to stop the crew from taking off and have them correct the takeoff power to the proper setting in the FMC. The check airman busted the crew's domestic quals."

- Non-standard response to checklist items was noted in reference to entire checklist
- MAP DISPLAY... CHECKED, RUNWAY ___‡ **BOTH CAPTAIN AND FO MUST RESPOND "Checked, Runway ___"**
  - Set HSI/ND to 10 NM range in MAP mode if conducting RNAV SID.
  - Verify correct runway is displayed for takeoff. **If re-selection of runway is necessary, SID and transition must then be re-selected if conducting RNAV SID.**
  - Verify accuracy of aircraft symbol position relative to runway is acceptable. Accuracy is acceptable when approaching number one position prior to takeoff, the apex of the airplane symbol (triangle) appears it will fall between the two lines that depict the runway symbol
  - **If FMC accuracy cannot be verified, select Terrain System Override (TERR OVRD) until FMC position is updated and do not conduct an RNAV SID.**
- **T. O. PA.......................COMPLETED**
  - The Captain will make the takeoff PA no less than two minutes prior to takeoff, "Flight Attendants prepare for takeoff"
  - When takeoff is imminent, chime the cabin by rapidly cycling the NO SMOKING Switch once.
- Wing Illumination, Runway Turnoff Light and Taxi Light when taking position on the runway for takeoff
- Just prior to initiating takeoff roll **LIGHTS ...ON – All other lights on.** Landing lights and white anti-collision lights may be left off if reduced visibility causes scatterback.

#6 - Non-standard Before Taxi/Taxi Checklist - 16 occurrences

Examples from MLC comments:

"Set T/O flaps late."
"Debriefed F/O on missing EICAS 'recall' on taxi checklist."
"FO announced 'Before Taxi Checklist Completed' before aircraft movement in ramp area." "Due to Captain not calling for Before Taxi Checklist, F.O. moved the flaps while aircraft was in motion in ramp."

"Crew conducted flight control check while in ramp area."

- FLAPS...SET for TAKEOFF: After pushback, **select flaps for T/O prior to releasing parking brake** for taxi. Flaps need not be indicating the T/O position for taxi. Do not delay taxi for transitioning flaps.
- Accomplish Before Taxi items from memory by using a flow pattern **prior to brake release** for taxi.
- **No "Before Taxi Checklist Complete" call is required**.
- FLIGHT CONTROLS...CHECKED - Check flight controls **when clear of ramp area**.
- EICAS…RECALL - **Press RECALL Switch** on the CAUTION CANCEL / RECALL Panel. Check that no system failures are displayed. Press CANCEL Switch (if required).
- Verify accomplishment of Before Taxi and Taxi items by reference to the Taxi checklist when clear of the ramp area. Saying "Taxi Checklist Complete" confirms the completion of both checklists.

#7 - Non-standard Parking Checklist - 16 occurrences

Examples from MLC comments:

"Arrival P.A. too early"
"F/O did arrival PA prior to aircraft coming to a complete stop at the gate."
"IRS's turned off by Captain immediately upon gate arrival, before the checklist calls for them to be shut down and before the groundspeed and drift rate could be checked."
"757 HYD pump (R to L) parking checklist."
"HYD panel 'off', 'set; is proper response."
"FOs parking scan and items out of order."
"No 'Checklist Complete' called."

- Arrival PA made by the FO immediately **after gate arrival – aircraft stopped at the gate. CAPTAINS: PLEASE WAIT TO TURN OFF THE SEATBELT SIGN UNTIL YOUR FO HAS COMPLETED THIS PA!!**
- HYDRAULIC SYSTEM...SET: **Depressurize right system last** to prevent fluid transfer between systems.
- IRUs...CHECKED / OFF: Accomplish an End of Flight Accuracy Check after flights exceeding 60 minutes block to block time.
    - Captain will check residual ground speed. If any residual ground speed exceeds 15 knots: Make an E6 entry.
    - First Officer will check radial position error tolerance **thirty seconds after last engine is shut down.**
        - **If the error rate for any IRU is:**
            - Greater than 3.0 nm / hr for flights with block-to-block time less than eight hours
            - Greater than 2.0 nm / hr for flights with block-to-block time eight hours or more or flights To/From Hawaii
    - If an E6 entry is required because of excessive radial position or ground speed error for any unit, E6 entry should include block-to-block flight time, radial position error, and ground speed error for all three systems. Use FMR CODE 3444. **Do**

not turn the IRU Switches OFF. The IRUs should be left on for Maintenance.

- When all items have been accomplished, **the First Officer will advise the Captain – "Parking checklist complete.**"

#8 - Non-standard Takeoff Briefing: Taxi Route, Hot Spots, SID, FM II special procedures, engine out, terrain considerations (MEA,MSA,Grid MORA), Transition Altitude - 15 occurrences

Examples from MLC comments:

> ***"Captain did not brief 'hot spots' along planned taxi routing."***
> ***"Did not do."***
> ***"Captain displayed complacency with respect to CRM and D & R - briefings were minimal, less than what we would consider normal for a crew that is paired together regularly. LAS eng. out was touched on but not briefed, taxi out and taxi in routes not briefed. Captain was completely debriefed with respect to these requirements."***
> ***"No taxi route brief."***
> ***"I did not hear the crew discuss the E/O NOTAM procedure for the departure RWY."***
> ***"Capt. Pre. Dept. brief could have included more about obstacle & wx. avoidance."***
> ***"Capt. did not brief expected taxi out route, FO had to go heads down to check (pull out of book) the DFW standard taxi routes."***

- The takeoff briefing will be conducted by the Captain (or at the Captain's discretion, the Pilot-Flying) **at the gate** and include, as a minimum:
  - Designate the pilot-flying
  - Rejected takeoff considerations
  - **And if appropriate:**
    - Departure procedure (required only if not covered previously by checklist completion or if revised by ATC) including Transition Altitude
    - **Airport specific engine failure profile** – 10-9 page, NOTAM
    - Takeoff alternate
    - Takeoff **weather** conditions
    - Runway surface conditions
    - **Terrain** considerations (MEA, MSA, Grid MORA)
    - Any other variables associated with the taxi (**Route, Standard Taxi Routes & Hot Spots**) and takeoff

#9 - Non-standard Cruise Checklist - 14 occurrences

Examples from MLC comments:

> ***"No 'Checklist Complete' called."***
> ***"Captain was PM and did not have checklist out. While most of the items on the cruise and descent checklist were accomplished, some were not. I strongly emphasized the use of checklists. Some Captains out there think they are just for F/Os."***

"Capt. was PM and did not use checklist during these checks, nor did he call them 'complete'. Emphasized strongly in debrief."
"Did not complete cruise checklist in timely manner - slow to log RVSM - debriefed."
"Transponder alt reporting not correct OM."

- **AIRPLANE PERFORMANCE...CHECKED:** After transitioning to cruise flight, **verify (check) aircraft is performing as expected** (e.g., airspeed, thrust, etc.).
- **ALTIMETERS (RVSM Airspace only)...CHECK / RECORD**
  - When level in RVSM airspace, **record the Captain, FO, and Standby Altimeter readings**.
  - In RVSM airspace, **transponder altitude reporting source should be selected to the altimeter closest to the assigned altitude.** This will ensure that ATC receives the same information that the aircraft is using for an altitude source.
- The **PM will use the checklist to verify that all items have been accomplished**. Any item that cannot be verified as having been accomplished will require a challenge and response.
- When all items have been accomplished**, the Pilot-Monitoring will advise – "Cruise checklist complete."**

#10 - NON-STANDARD FMS ROUTE/LEGS VERIFICATION CHECK - 12 OCCURRENCES:

Examples from MLC comments:

"Did not check glass against paper SID during legs check."
"Read waypoints from CDU not from HSI."
"Did not do."
"Captain did not perform FMC route/leg verification properly. Debriefed. Although FO knew the correct procedure, he did not feel the need to speak up (more) forcibly."
"The crew read the fixes from the paper FP to the FMC while the other pilot checked them in proper sequence and stepped through them. No route check ever done."
"Legs check was accomplished page at a time rather than stepping through fix at a time."

- **CDU...SET and CHECKED:** Check the Pre-Departure Clearance (PDC) route vs. the Flight Plan.

  <u>**Route Verification Check:**</u> After ACARS route up-link, or manual route loading, waypoint names will be displayed and verified by both pilots. One pilot will **read waypoint names from the Navigation Display (HSI/ND)** while the other pilot checks them against the flight plan or current ATC clearance.

  <u>**Legs Verification Check:**</u> plan and / or ATC clearance is entered and that all points are connected by a solid magenta line. A crosscheck of each flight plan leg, as displayed on the HSI, must be made against each leg of the computer flight plan so any deviation or unusual heading change is readily apparent**. One pilot will read the HSI display, while the other pilot checks it against the SID, flight plan or ATC clearance.** This also ensures that no leg or waypoint has been omitted.

- HSI Mode Selector...PLAN
- HSI Range Selector...AS DESIRED
- LEGS Key.. PRESS
- **Using the MAP CTR STEP prompt [5R], step through and read each waypoint from the center of the HSI screen to the other pilot who verifies the waypoint from the left hand margin of the flight plan.**

○**NOTE: When conducting an RNAV SID, the check must be made using the Jeppesen paper copy of the SID, including any SID transitions.**

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