Human factors systems analysis of the PSA 182 mid-air collision

Contents

Introduction

On September 25 1978, a passenger jet from Pacific Southwest Airline, Flight 182 (PSA 182), while on its approach to land at Lindbergh Field (LF), collided mid-air with a Cessna 172 from a local flight school. The Cessna disintegrated on impact, killing both the instructor and pupil. PSA 182 lost control and crashed into a residential area in San Diego, killing all 135 on board and an additional 7 people on the ground. (NTSB, 1979)

This report aims to study the PSA 182 accident from a systems perspective in order to better understand the web of causal factors and provide recommendations across system levels.

Systems Ergonomics

Rasmussen (1997) provides a general model of sociotechnical systems common in risk management. There are 6 levels, which are (ordered by distance from hazardous processes):

- Work
- Staff (carry out the work)
- Management (direct and oversee the staff)
- Company (internal policy that guides the management)
- Regulators, Associations (control company policy)
- Government (create laws)

Levels can be influenced from either direction, typically with those furthest from the hazards changing those closer to them, and feedback on system status flowing in the other direction (Rasmussen, 1997; Branford, 2011). Errors can occur at any level to increase the risk of accident, not just at the ‘sharp end’ (close to the hazardous process). Often latent errors from higher in the system create the conditions for those that directly initiate the accident (Reason, 1995). A key concept to note regarding accidents in complex systems comes from Dulac and Leveson (2004: 3):

> “Accidents are most likely in boundary areas or in overlapping areas of control. In both boundary and overlap areas, the potential for ambiguity and for conflicts among independently made decisions exists.”

Aviation Safety

Midair collisions (MACs), despite the small number of planes and large airspace, occurred surprisingly frequently: “In the past fifteen years prior to the PSA accident there were 470 mid-air collisions resulting in 928 deaths” (Parker, 1979). This number is perhaps less surprising considering that most occur during departure or arrival at airports (Shuch, 1989). Paradoxically, most MACs occur in clear meteorological conditions, during daylight hours. The cause becomes more apparent when it is noted that this when Air Traffic Controllers (ATCs) pass the responsibility to ‘see-and-avoid’ to the pilot (Danaher, 1980). This is not to minimise the importance of ATC - indeed the model by Machol (1980) suggests orders of magnitude fewer collisions compared to a system without ATC.

The active errors that result in aviation accidents are typically preceded by latent systemic weaknesses that create the conditions for these errors to occur, following Reason’s (1995) model (Li and Harris, 2006). There are a number of subsystems in aviation where latent errors can reside, from the regulatory bodies (the FAA in the USA (Preston, 2005)) to the design of the equipment used daily. Errors from each appear at least once in this accident.

Aviation has some similarities to other domains, most obviously other methods of transportation - maritime shipping, for example, is a regulated area **where** crew-operated vehicles move through a large space at a typically low density. Ships occupying the same area can vary in scale by many orders of magnitude. The activity is highly demanding, and accidents can have high financial and human cost (Pike *et al.*, 2013). Crew exist in a hierarchy with well defined roles. Analogous between domains, collisions occur as a similar proportion of all accidents in each: 2-5%

(Machol, 1980; Pike *et al.*, 2013). Human factors are commonly considered the main reason for collisions in both domains (Parker 1979, Pike *et al.*, 2013), Überlingen, for example, another MAC (Branford, 2011).

Aviation has some components that are particular to the domain. The significance of a 3rd dimension (up/down) is atypical of transportation elsewhere (barring perhaps submarines). ATC, while superficially similar to the maritime Vessel Traffic Service, differs in the key area of responsibility delegation. ATC maintains responsibility for monitoring state, ensuring separation and routing until explicitly passing this to pilots, whereas the responsibilities are shared at all times or fall on ship crew in the maritime context. (Praetorius *et al.*, 2012).

Due to the requirement of flight, an additional restriction exists for on-plane technology in the form of size and weight limits that are not so stringent elsewhere (Shuch, 1989). A further problem for aviation accidents in general, and MACs in particular, is the limited field of view (FOV) in most cockpits - less than 180° laterally and less than 90° vertically (Figure 1), explaining, for Machol (1980, 1995) the 30 times greater incidence of MACs that are rear-quadrant collisions.

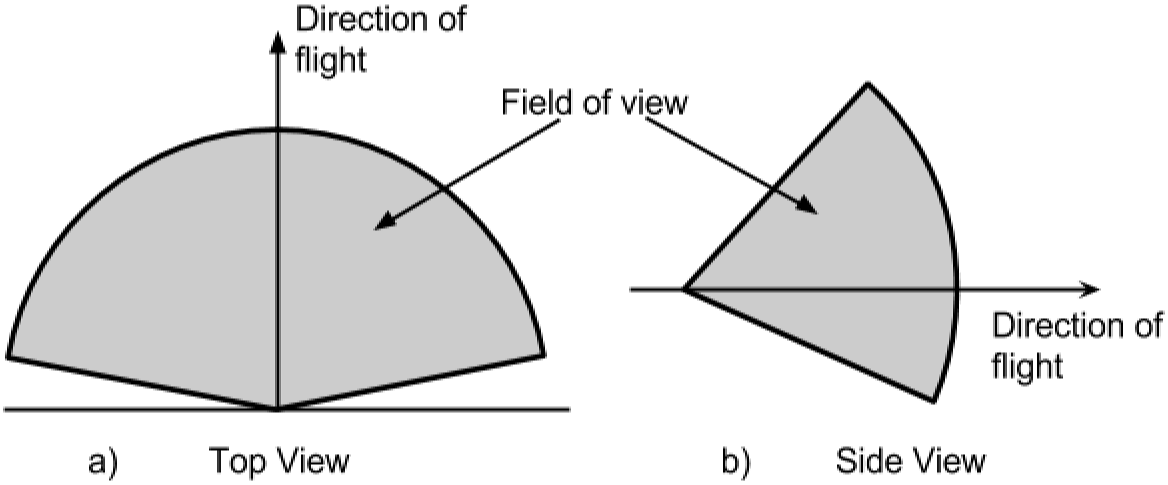

Figure 1: Estimated field of view from a typical cockpit as seen from the top and the side (based on Machol, 1980)

Accident Analysis

Accident Context

- The weather was clear and sunny, with 10 mile visibility.
- A **Cessna 172** was being used to train a (certified) pilot in Instrument Flight Rules around **Lindbergh Field (LF)**. They performed 2 instruments approaches before climbing and heading Northeast.
- **Pacific Southwest Airlines 182 (PSA)**, a regular passenger jet from Sacramento was approaching to land at LF. The timeline starts with PSA on the frequency of **San Diego Approach Control Facility (SDA)** (located 8 miles North of LF) before switching to LF's frequency.
- The relevant radar and controls were located at SDA, with the data then transmitted to LF without altitude readings. SDA had an additional feature in their radar system that calculated cylinders around each plane's projected path, and sounded a 'conflict alert' if this intersected with another plane's cylinder. (NTSB, 1979)

The system involved in the PSA 182 accident can be partitioned into 4 subsystems: the 2 planes, and the 2 ATC centres (see Table 1) along with the additional component of Montgomery field. Errors were made in all 4 subsystems without which the accident may never have occurred.

The paths of both planes and the key locations in the accident are shown in Figure 2, followed by an abridged timeline of the event in Table 2.

Table 1: Actors involved in PSA 182 crash

Planes		Air traffic control	
PSA 182	**Cessna 172 N7711G**	**Lindbergh Tower**	**San Diego Approach Control**
Captain McFeron	Instructor Kazy	Coordinator Majoros	Supervisor Farwell
First Officer Fox	Trainee Boswell	Controller Saville	Controller Lehman
Flight engineer Wahne			
(Off duty dead-heading captain)			

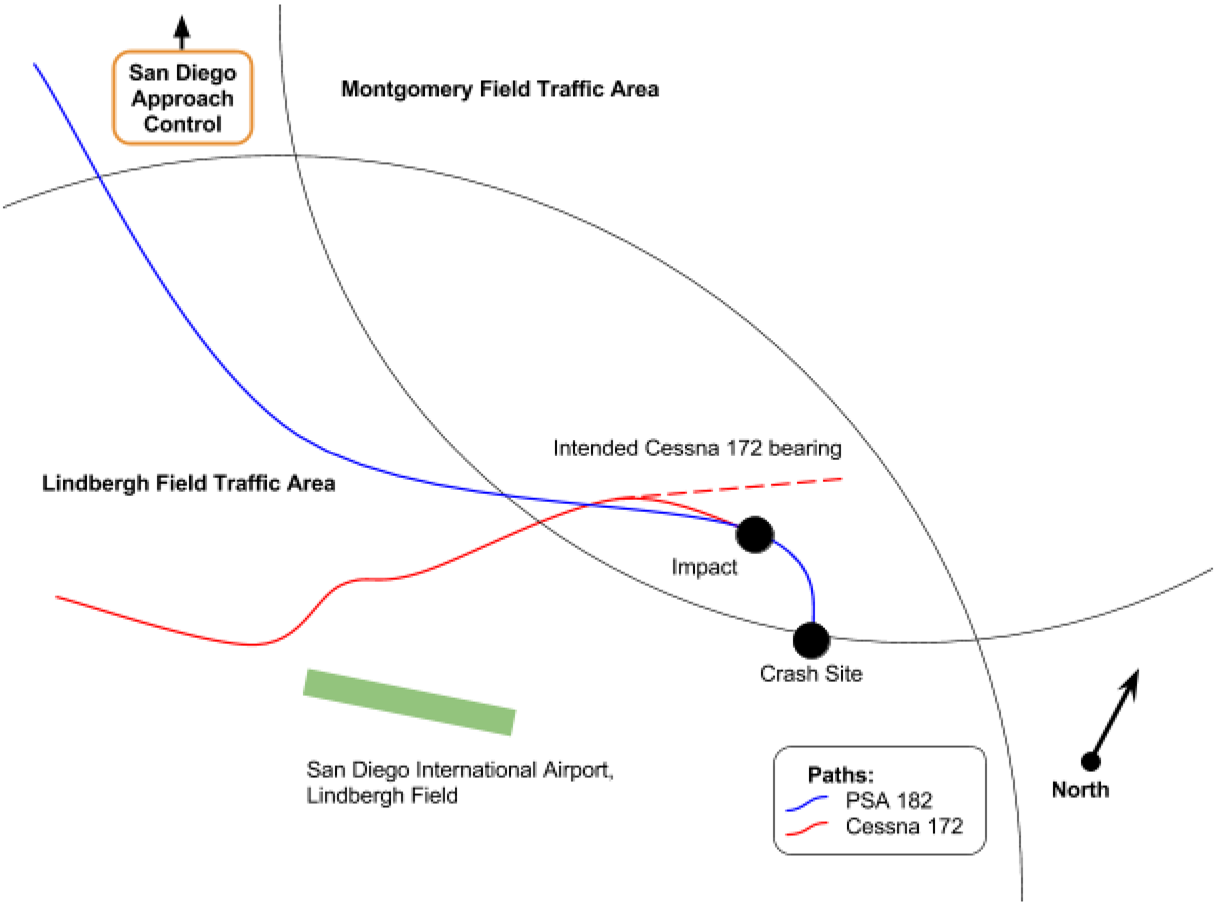

Figure 2: Flight paths and key locations in the accident. Adapted from NTSB (1979)

Table 2: Simplified timeline of collision (see Appendix A for more complete version)

Time	San Diego Approach, then Lindbergh ATC	Cessna 172	PSA 182
	[San Diego Approach:]		*((Crew discuss anecdote))*
0857:06	PSA 182 cleared for visual approach landing		Acknowledged visual approach landing
0859:30	PSA 182 warned of traffic at 1 mile and 3 miles		At least one of these acknowledged
0859:57	Cessna told to and maintain VFR at altitude 3500 or below, heading 070		
0900:15	Repeats 3-mile traffic warning to PSA 182		“Traffic in sight”
0900:23	“Maintain visual separation, contact Lindbergh tower”		Acknowledged ((crew now have responsibility for seeing/avoiding the Cessna, or reporting if they lose sight))
0900:31	Warns Cessna of PSA jet, which “has you in sight”	“Roger”	
	[Lindbergh tower:]		((Switches frequency from SDA to LF))
0900:38	Warns PSA 182 of Cessna at 1 mile ((no heading given))	In front of and below PSA 182	
0900:42			Crew can no longer see Cessna
0900:50	(Hears “he’s passing off to our right”)	Turns to 090 heading	“I think he’s pass(ed) off to our right” On 090 heading
0900:52 - 0901:20			Crew discuss Cessna’s position
0901:21			“Oh yeah, before we turned downwind, I saw him about one o’clock, probably behind us now”
0901:28	CONFLICT ALERT AT SAN DIEGO APPROACH (not relayed to Lindbergh Field or Cessna)		
0901:39			*“I was looking at that inbound there”*
0901:47	CESSNA AND PSA 182 IMPACT		
0902:05	PSA 182 IMPACTS GROUND		

Accident System Modelling

Accimap (Figure 3)

Accimaps, introduced by Rasmussen (1997) display the interrelationships between the factors that caused an accident, organised primarily into the different levels of a system. Factors and events are represented as boxes, and the arrows between them show the relationship 'B' would have been unlikely to happen without 'A' where A→B. "linkage of failure within and between levels... ensures that failures are considered in the context of the factors influencing them" (Salmon, Cornelissen and Trotter, 2012: 1167). A key benefit of the Accimap method is that it makes very clear that multiple errors had to occur to cause the accident. This counters the often erroneous common belief in a single 'root cause' for accidents. Another feature is the flexibility of the method (Waterson *et al.*, 2016); here, levels have been introduced wherever notable errors occurred. This was strongly influenced by Rasmussen's (1997) system levels, but more explicitly differentiates between intra- and inter-organisational factors, wherein an organisation can be considered as a separate subsystem. If a factor was primarily related to the actions of one subsystem, the outline was coloured to represent that.

Human Factors Accident Classification System (HFACS) and HFACS-S (Figure 4)

HFACS provides a complementary view to Accimaps. Initially created for aviation, it provides a taxonomy of errors linked to preconditions created at successively higher levels (Shappel and Wiegmann, 2000). Its defined structure has been demonstrated to lead to acceptable inter-rater reliability by Li and Harris (2006). Harris and Li (2011) provide an extension that is appropriate in this scenario by incorporating some elements of the STAMP model (Dulac and Leveson, 2004) (hence 'HFACS-S'). Each subsystem undergoes a separate HFACS analysis, which are then linked such that 'Unsafe Acts' from any subsystem can lead to any other level in other subsystems. Colours are used as before.

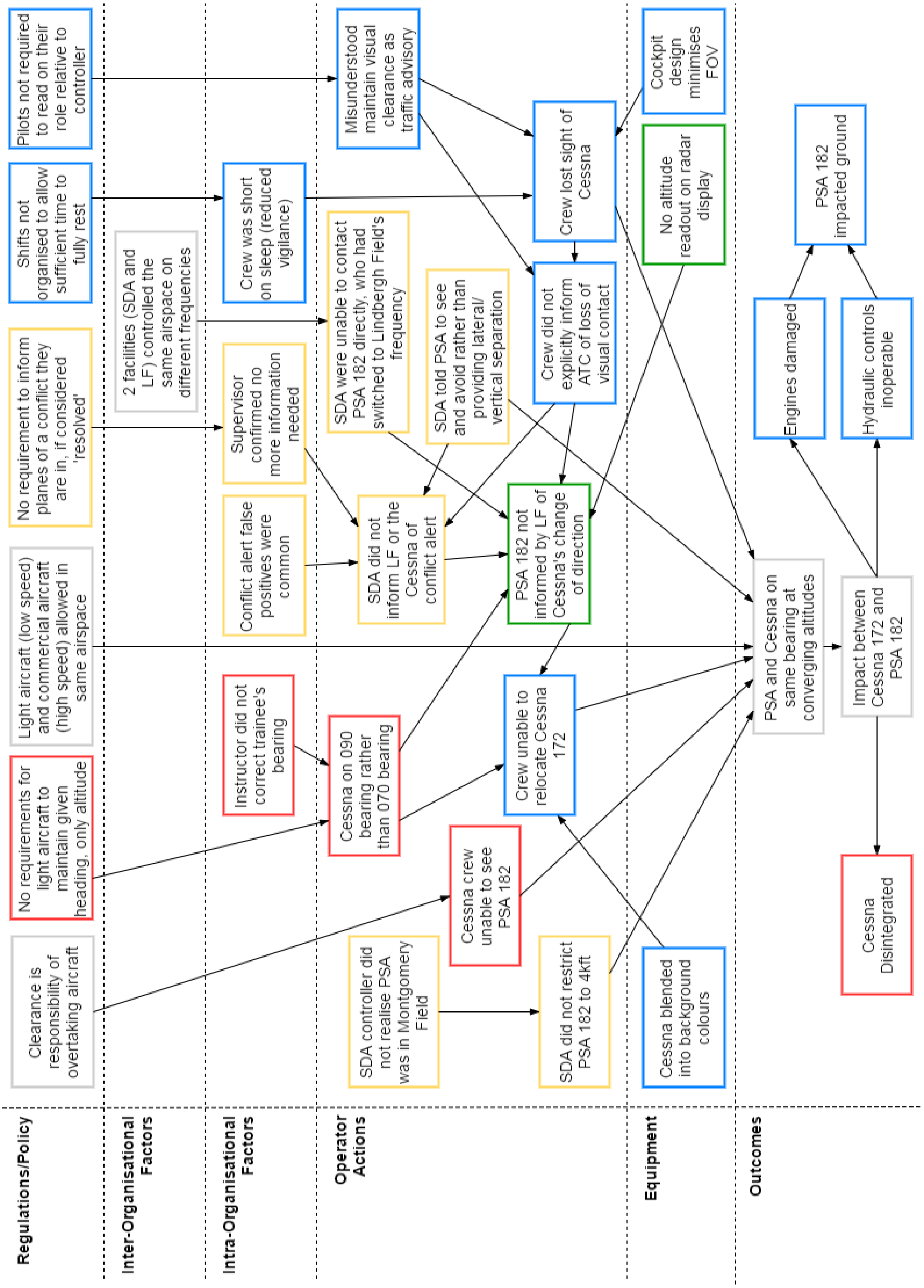

Figure 3: Accimap model of PSA 182 accident (larger version attached)

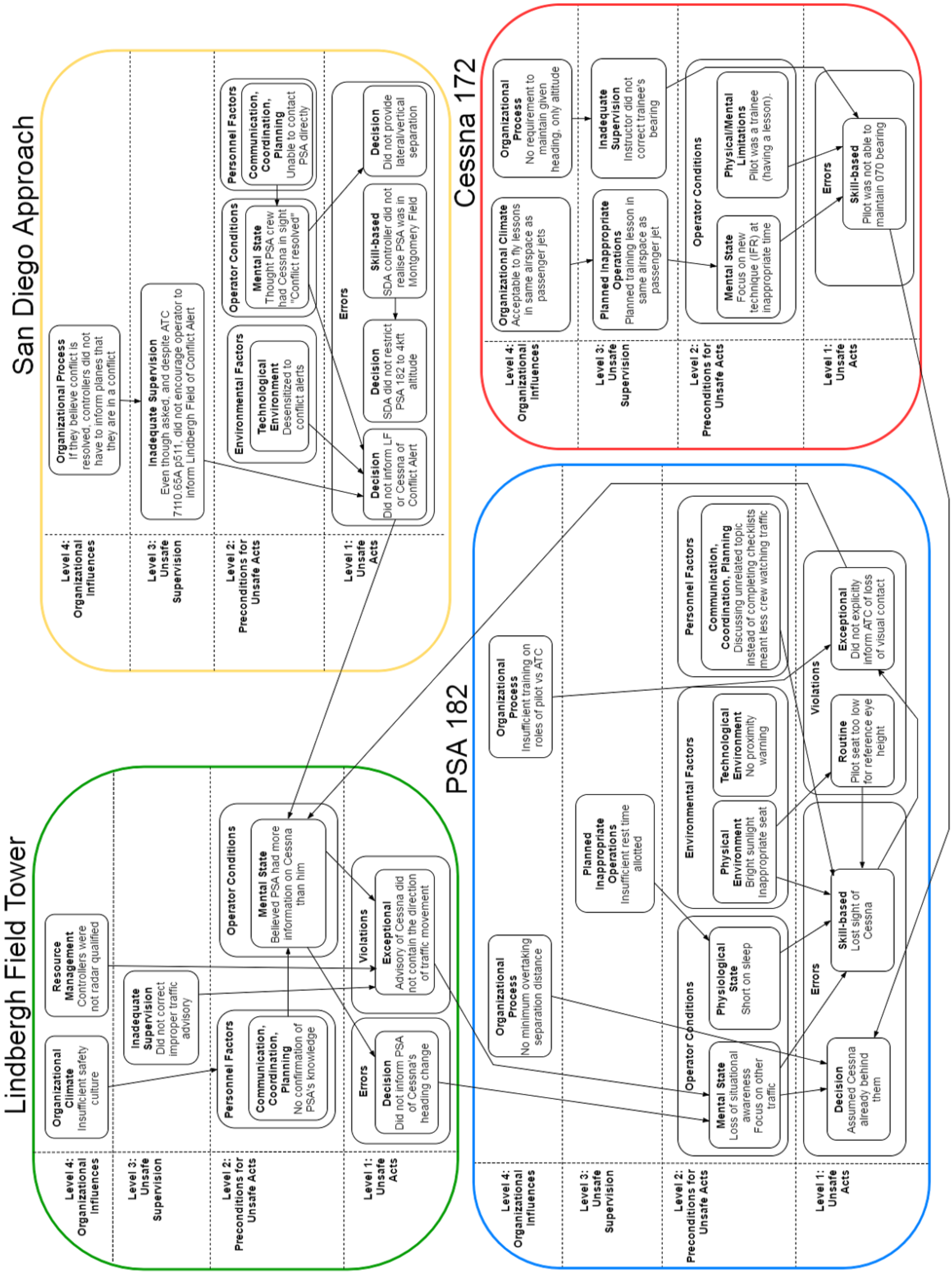

Figure 4: HFACS-S model of accident (larger version attached)

Overview of Human Factors Issues

The scope of this report does not allow for a complete analysis of all human factors issues involved in the accident, so a few issues are briefly addressed in Table 3.

Table 3: High level overview of major human factors issues and resources for better understanding and addressing these

System Level	Situation-specific errors	Human factors	Resources
Equipment	Cockpit design prevents eyes being at reference point while still able to operate controls and see entire instrument panel	Anthropometrics not/poorly applied	Pheasant and Haslegrave, 2006
	Radar system only automatically visually separates close-proximity planes in a specific mode; no feedback on which mode system is in	Poor feedback, mode errors; incorrect mental models	Norman, 2002
Operator	PSA lost track of Cessna; projected it having passing them in a straight line	Situational awareness (SA), levels 1 and 3	Endsley, 1999
	Key words misheard/ misinterpreted (“passed” → “passing”)	Speech intelligibility; vocabulary/word choice; signal-noise	Sanders and McCormick, 1993:197-221
	Imprecise messages given by multiple parties	Communications, mental model mismatch; no redundancy	Cushing, 1995; Isaac *et al.*, 2002; Wiener, 1980
	Cessna not following given heading	Mishearing; no repeat of instruction (‘hearback’)	Monan (1988)
Management	Crew discussing unrelated anecdote at key flight time during approach	Poor safety culture; crew resource management (CRM)	Ek *et al.*, 2007; Flin *et al.*, 2002; Helmreich *et al.*, 1999
	Insufficient time allotted for sleep between flights	Sleep deprivation impairs decision-making, communication, changing plans	Price and Holley (1982); Harrison and Horne (2000)
Policies/ Regulations	Roles/responsibilities of ATC and pilots not clear to all	Impaired system schemas, insufficient/ inappropriate training	Gorman and Rentsch, 2009

Key Causal and Contributory Factors

In the dissenting opinion from McAdams (NTSB, 1979), later adopted by the NTSB in 1982 (Preston, 2005), he ascribes the 2 major probable causes of the accident to 1) PSA losing visual contact and not reporting it, and 2) ATC procedures authorizing visual separation when lateral/vertical radar separation could have been provided (Appendix B) (NTSB, 1979: 43).

1) a) Why was PSA unable to “maintain visual separation”? b) Why did they not report the loss of visual to ATC? These shall be addressed in reverse order:

(b) The crew were not necessarily formally aware of the exact apportioning of responsibilities between pilot and ATC in different contexts. There was no requirement for them to undergo specific training on this, nor to read the Airman’s Information Manual (unlike the FAA Handbook) which described the interrelationship of roles. As a result, it is very possible that PSA did not understand the full significance of the ‘maintain-visual-separation’ clearance (Appendix B). This could explain the lack of explicit mention of the loss of visual contact (NTSB, 1979). An alternative explanation could involve the desire not to lose respect, particularly if the company was harsh on small perceived ‘failures’ (Ek *et al.*, 2007).

This may to some extent also answer (a) - the crew may not have been sufficiently attending to the surrounding airspace. Indeed the report states that crews “exercise a lower degree of vigilance in areas where they receive radar assistance than in non-radar areas” (NTSB, 1979: 34). Situational awareness (SA) findings can be applied here. SA in an aviation context can be considered the “internalized mental model of the current state of the flight environment” (Endsley, 1999:257). It involves 3 levels of increasing abstraction:

Level 1 - Perception of elements in the environment
Level 2 - Interpretation of current system status
Level 3 - Projection of future system status

(Endsley, 1999)

The crew initially losing sight of the Cessna could be classified as level 1 SA error, the most common SA error found as a causal factor in aviation accidents

(Endsley, 1999). A number of factors affect situational awareness, including sleep loss. Price and Holley (1982) estimate, based on interviews with crews from the same airline, that given the arrival times of the plane the nights before and the locations of their hotels, the available sleep times would have been 5 hours 37 minutes the night before the accident, and 5 hours 2 nights before that (with a layover day/night in between). Before PSA took off on the day of the accident, the cockpit voice recorder caught the captain remarking to a stewardess, “I'm draggin'! It was a short night.” (Price and Holley, 1982: 299), corroborating this theory. Their paper further elaborates on the detrimental effects of similar levels of sleep deprivation on situational awareness and ability to respond to changes in plan. An additional challenge in perceiving the Cessna below them came from its colouring - white with a mustard stripe. This would have providing little contrast against the background city, Given the similar heading of the aircrafts, the movement would also have not have stood out (NTSB, 1979).

For the designated FOV, pilots were instructed to align their seat with a reference eye height, however many company pilots could not operate the rudders or see the entire instrument panel from there, so they moved their seat aft (backwards) and down (NTSB, 1979). This poor application of anthropometrics in the physical design of the cockpit lessened the already restricted FOV below the direction of travel (Figure 1b), meaning the only way the pilot could have seen the Cessna, once it reached a certain angle below the jet, would have been by standing up and leaning forwards (an action much more likely if their mental model had not projected the Cessna flying straight along its path, thus already behind them).

Leaving the second causal factor temporarily, it is worth noting here the ‘failure’ of the controller at SDA (with the approval of his supervisor) to make any other party aware of the conflict alert (Appendix B). Because PSA had switched frequency to LF, SDA could not contact them directly, but they would have been able to inform LF to relay on or the Cessna directly. As there were “many conflict alerts where there either was "no actual conflict" or no aircraft close enough to require further action” (NTSB, 1979: 19), controllers may have become used to not responding to these alerts. Despite over a minute passing between the PSA’s statement “Traffic in sight” and the conflict alert, the controllers at SDA testified to considering them to be seeing-and-avoiding without further issue (as they attended to other nearby aircraft). LF were similarly confident. The implication here, corroborated by NTSB (1979) is that having given the aforementioned clearance to planes, ATCs relax their vigilance toward them, despite the high traffic. This creates a situation with both flightcrew and ATC at lowered vigilance - the pilot still expects radar info if needed, and the controller expects the pilot to see and avoid without help.

As for causal factor (2), the provision of lateral/vertical separation is another factor without which a collision seems unlikely. With the facilities at hand to provide such instruction, it seems unwise of procedures not to more forcefully discourage clearing planes for visual separation. This would allow for visual checks as an additional barrier against hazards. McAdams considered this the “last redundancy of the system removed” NTSB (1979: 39), the importance of which is contextualised by the ending statement from the majority decision of the accident report:

> “The principle of redundancy has been recognized as one of the foundations of flight safety, and redundancy between the pilot and controller can only be achieved when both parties exercise their individual responsibilities fully regardless of who has assumed or been assigned the procedural or regulatory burden.” NTSB (1979:35)

The factors put together in this section predict a high-traffic system around an airport with minimised redundancies and reduced vigilance of both parties, with the flight crew’s job of visual location made more difficult by both decisions made above them and the equipment they use. Given time, an accident became almost inevitable.

Recommendations

Parker (1979) criticized the NTSB majority report for focusing on the ‘pilot factor’ and minimising other areas that could more feasibly be improved. Recommendations to engender safety at a range of different system levels are presented as changes or areas of inquiry for equipment and policy/management, such that improvements filter from both directions into the system.

Equipment

Onboard traffic detection of some type may be helpful:

- Soon after the PSA 182 accident, in 1981, the Traffic Alert and Collision Avoidance System (TCAS) was adopted by the FAA. This technology was primarily used by large aircraft, and required both aircraft to have the transponder (Preston, 2005), thus it would not have positively influenced the PSA 182 case. Indeed, its implementation may have had a detraining effect for such a situation.
- Acknowledging of the large amount of information pilots have to deal with at any particular time, it is not advisable to further overload them. As much of the flight task is visual, an alternative modality display, may be more appropriate (see Latorella, 1998; Sarter, 2006 for further discussion). Shuch (1989) presents another possible solution that would function regardless of whether the other aircraft contained a transponder. It would provide positional, proximity and speed-of-convergence information through stereo tone location, amplitude, and pitch respectively. This does not seem to have been actively pursued, perhaps due to contemporary technical difficulties, however Ericson (2007) provides much-needed related data.

Cockpits should be designed with pilot anthropometrics in mind, using both existing data and user trials to validate them (Pheasant and Haslegrave, 2006).

An area for further investigation may lie in technology for minimising casualties after collisions.

Given the low contrast of the Cessna against the city and the importance of visual search, aircraft colouring/patterning that improves the range of conditions in which they are visible is worth considering. This may be implemented as a requirement at policy level.

Methods to provide a better FOV (larger windows, mirrors, cameras...) should also be explored.

Policy/Management

The confusion over language suggests that more guidelines here would be helpful (see Table 3 for specific areas and references).

Conflict alerts should not be considered resolved before informing aircrafts of their proximity to other traffic.

Where capabilities exist, vertical/lateral separation should be required as the default procedure.

Policy should require pilots and ATCs to fully understand their relative roles. This could take the form of regular training/testing, and at minimum require reading that explains this.

Emergency frequencies should exist so ATCs can contact aircrafts not ‘on their frequency’, minimising the hurdles required to reach flightcrews.

Safety culture and CRM training would help provide crew with an understanding of the importance of, and methods for achieving, a safer working practice (Flin *et al.*, 2002). Ek *et al.* (2007) suggests 9 key aspects to safety culture:

1. Learning culture
2. Reporting culture
3. Just culture
4. Flexibility
5. Communication
6. Safety-related behaviours
7. Attitudes towards safety
8. Working situation
9. Risk perception

Conclusions

Aviation has a number of properties that dictate the type of accidents that are common: operation as a crew, reliance on ATC, limited FOV, movement in 3 dimensions, and a limit on technology size/weight due to the requirement of flight.

Errors at all levels of both Accimap and HFACS-S models contributed to the eventual accident. Key factors and recommendations included:

Equipment that minimised the Cessna’s visibility from PSA and that provided insufficient information to the ATCs.
Recommendations: on-board traffic detection, improved FOV, conspicuous plane colouring/patterning.

Operators, both flightcrew and ATCs, had relaxed vigilance, as each expected the other to minimise traffic hazards, removing system redundancies.

Supervisors did not correct controllers’ insufficient actions.
Recommendations: safety culture and CRM training.

Policy allowed for ‘maintain-visual-separation’ clearance even when capabilities exist to provide vertical/lateral separation and for conflict alert to be considered resolved when last contact with the crew was over a minute before.
Recommendations: make the default option more cautious.

PSA 182 provides a valuable case study from which to learn lessons regarding aviation safety in particular and system safety in general. Considering the proliferation of complex systems, the importance of these lessons is perhaps even greater today than in 1979.

Word Count: 2993/3000

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Appendix A: Crash timeline, with partial transcript

Key: Normal text - Event description/communication over radio
Italics - Discussion internal to crew
“Speech” - Direct quote
(word) - Questionable text
[Actor:] - Change in actor
Number- - Crew member: 1-Captain, 2-1st officer, 3-2nd Officer, 4-Off-duty PSA Captain

Time	San Diego Approach, then Lindbergh ATC	Cessna 172	PSA 182
	[San Diego Approach:]		*((Crew discuss anecdote))*
0857:06	PSA 182 cleared for visual approach landing		Acknowledged visual approach landing
0859:30	PSA 182 warned of traffic at 1 mile		2- “We’re looking”
0859:39	PSA 182 warned of more traffic at 3 miles		
0859:50			2- “Okay we’ve got that other 12”
0859:57	Cessna told to maintain VFR at altitude 3500 or below, heading 070		
0900:15	Repeats 3-mile traffic warning to PSA 182		
0900:21			*2- “Got ‘em”*
0900:22			1- “Traffic in sight”
0900:23	“Maintain visual separation, contact Lindbergh tower”		“Okay”
0900:31	Warns Cessna of PSA jet, which “has you in sight”	“Roger”	
	[Lindbergh tower:]		
0900:38	Warns PSA 182 of Cessna at 1 mile	Aft and below PSA 182	
0900:42			*1- “Is that the one (we’re)*

0900:43			*looking at"* *2- "Yeah, but I don't see him now"*
0900:44			1- "Okay, we had it there a minute ago"
0900:47	"182, roger"		
0900:50	((ATC hears "he's passing off to our right"))	Turns to 090 heading	1- "I think he's pass(ed) off to our right"
0900:51	"Yeah"		
0900:52 0900:53			*1- "He was right over here a minute ago"* *2- "Yeah"*
0900:53 0901:08	((Landing details)) PSA 182 cleared to land		((Landing details))
0901:11 0901:13 0901:14 0901:20 0901:21			*2- "Are we clear of that Cessna?"* *3- "Suppose to be"* *1- "I guess"* *4- 'I hope'* *1- 'Oh yeah, before we turned downwind, I saw him about one o'clock, probably behind us now'*
0901:28	CONFLICT ALERT AT SAN DIEGO APPROACH		
0901:38 0901:39			*2- 'There's one underneath'* *2- 'I was looking at that inbound there'*
0901:47	CESSNA AND PSA 182 IMPACT		
0901:51 0901:52 0901:53			*1- 'What have we got here?'* *2- 'It's bad'* *1- 'Huh?'* *2- 'We're hit man, we are hit'*
0901:55			1- "Tower we're going down, this is PSA"
0901:57	"Okay, we'll call the equipment for you"		
0902:05	PSA 182 IMPACTS GROUND		

Timeline of key actors, with quotes included where relevant to the collision. For full transcript, see NTSB(1979: 52-65).

Appendix B: Regulations and Guidance Text

All excerpted from NTSB (1979)

Conflict alerts

Contained in Paragraph 723a of the ATC Handbook which states:
"When a conflict alert is displayed, take appropriate action to resolve the confliction. Initiate coordination with the controller involved to determine the best resolution if the alert involves an aircraft:
(1) In another controllers airspace
(2) Under position/track control of another controller
(3) In handoff status
Coordination is not necessary, if immediate control action is required to maintain separation or both aircraft will be under your control in adequate time to insure separation.”

Paragraph 33b [of the ATC Handbook] states:
"Aircraft conflict advisory--Immediately issue an advisory to an aircraft under your control if you are aware of an aircraft that is not under your control at an altitude which, in your judgment, places both aircraft in unsafe proximity to each other. With the advisory, offer the pilot an alternate course of action when feasible."

Traffic advisories

The controller is required to issue traffic advisories as an additional service. Paragraph 511 states that the controller should issue this information to an aircraft on his frequency when, in his judgment, 'their proximity may diminish to less than the applicable separation minima. Provide this service as follows:

"a. To radar identified aircraft: Traffic, twelve o'clock, one zero miles, southbound DC-8, one seven thousand,"

Visual Separation (ATCs)

Paragraph 490 states that "aircraft may be separated by visual means when other approved separation is assured before and after the application of visual separation.*" Paragraph 490a permits the application of visual separation within the terminal area provided. .
"(1) You are in communication with at least one of the
aircraft involved, and,
(2) You see the aircraft and maintain visual separation
between them or,
(3) A pilot sees another aircraft and you instruct him to maintain visual separation from it. If the aircraft are on converging courses, inform the other aircraft that visual separation is being applied."

Visual separation (Pilots)

[The AIM] states on page 54:
“2. A pilot's acceptance of traffic information and instructions to follow another aircraft or provide visual separation from it is considered by the controller as acknowledgement that the pilot sees the other aircraft and will maneuver his aircraft . as necessary to avoid it...
3. When pilots have been told to follow another aircraft or to provide visual separation from it, they should promptly notify the controller if they do not sight the other aircraft involved, if weather conditions are such that they cannot maintain visual contact with the other aircraft to avoid it, or if for any reason they cannot accept the responsibility to provide their own separation under these circumstances.” (NTSB, 1979: 20)

The flight engineer’s role in looking for traffic

Set forth in the company's Basic Flight Operations Manual, page 6.10, paragraph 12: "Assist the pilots in maintaining a traffic watch. Particular attention should be given to delaying paperwork and radio contacts until such time as en route traffic is at a minimum. Routine paperwork and radio contacts should be planned to be accomplished at altitudes above 10,000 ft."