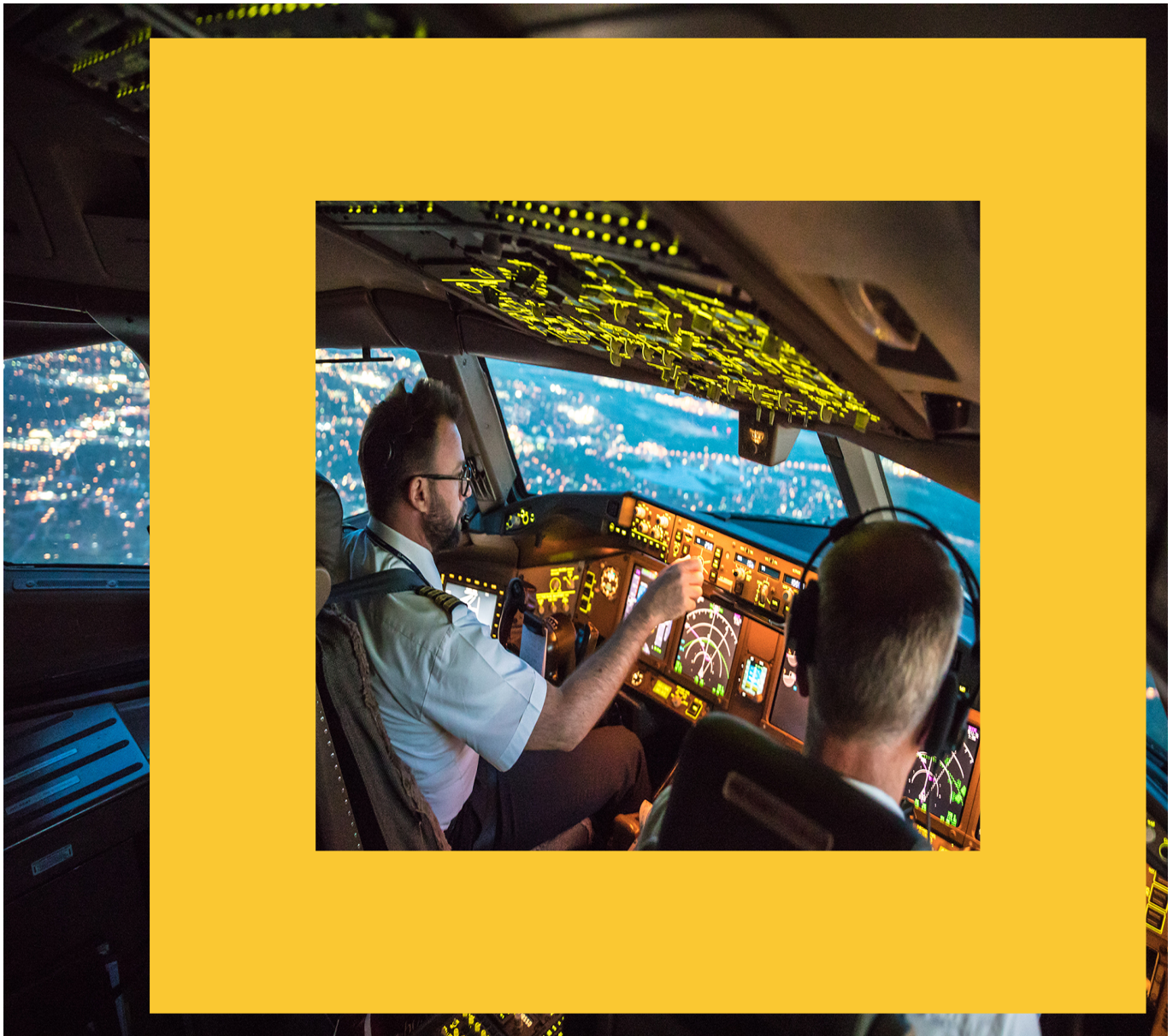




Aircraft Handling and Manual Flying Skills Report





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1. Executive Summary

Today's modern aircraft are operated using highly sophisticated automation. Automation is a useful tool for pilots and has, without doubt, improved safety, operational efficiency and precise flight path management. However, it was found that continuous use of automation does not strengthen pilots' knowledge and skills in manual flight operations and in fact could lead to degradation of the pilot's ability to quickly recover the aircraft from an undesired state.

Poor manual techniques are flagged by a number of accident analysis that cite inappropriate or erroneous control inputs by the flight crew in response to abnormal events. Although the overall Loss of Control In flight (LOC-I) accident rate has decreased, this accident category continues to outpace other factors as the leading cause of fatal accidents. A number of these accidents may have had a different outcome if the pilots have shown a higher level of monitoring and flying manual skills. Poor manual techniques may also lead to other events such as hard landing, unstable approaches, runway excursions and others. Amongst other techniques and enhancements for manual flight operations, keeping pilots engaged, maintaining and improving the knowledge and skills needed are essential for a safe flight operation.

An analysis of the accident data conducted by IATA identified an increase in manual handling errors. To better understand the issues and why many pilots are reluctant or unable to practice manual flight, a survey was conducted by IATA on Aircraft Handling and Manual Flying Skills to capture the pilots' subjective feedback about their airline automation policies, manual flying practices during everyday line operations and during operator training.

This survey, which included 42 questions, was circulated to over 8,000 people in the aviation industry with the objective to assess:

- if increased automation contributes to pilots' over-reliance and manual flying deficiencies or shortcomings
- how critical manual handling skills are for pilots' confidence and competence, and are needed to take control of the aircraft when automated systems fail to function as intended
- the effect that training techniques and automation policies and guidance have on the ability of pilots to obtain and maintain manual flying skills
- whether there is a need to adjust standards/guidance, so pilots have better opportunities to practice manual flying skills without compromising flight safety, efficient flight operations and/or passenger comfort
- the degree to which dependency on automation may be occurring globally and review the procedures currently employed to ensure pilots maintain the necessary skills.

Note: Pilot(s) and Flight crew are terms often used interchangeably in this document.

2. Survey Results in Brief

The overall results of the survey from 5,650 respondents:

- Good manual flying skills remain essential to achieve safe line operations
- Manual flying skills need to be trained and maintained, irrespective of the aircraft generation
- Manual flying skills can be lost if they are not practiced on a regular basis
- Pilots should have the possibility to revert to basic hand flying when situation permits
- Pilots should be trained to revert to manual flying when automation fails or during an emergency
- Pilots need to maintain manual flying skills to a high degree of proficiency and must develop confidence in their ability to do so

But:

- Many pilots are facing very limited manual flying opportunities, due to regulatory restrictions or airline policies.
- At some airlines, culture and policy discourage pilots from practicing manual flying, since deviations are being managed in a strict way. Consequently, pilots keep away from hand flying, to avoid any potential disciplinary measure.

- Some operators have established automation policies which specify the appropriate use of automation; these policies may also include provisions related to manual flying. Automation policies vary among operators. These range from always mandating the use of full automation, except for take-off and landing, to encouraging the disconnection of automation whenever possible, under certain conditions.
- Although some of the respondents have indicated that they have no clear policies with regards to the use of automation versus manual handling, many have indicated that their policies recommend the highest level of automation to maintain a high level of situation awareness.
- The use of automation above a certain flight level being mandatory means that regulations prevent pilots from acquiring practical manual flying experience at high altitude and high speed.
- The high altitude and speed cruising phase are trained infrequently in the simulator.
- Airline policies recommend the use of automation unless the pilot sees a situation that endangers the safe conduct of the flight.

3. Recommendations

Recommendations regarding pilot training; flight crew techniques, and ways to encourage and measure safety enhancements are listed in this section:

3.1. Operators

- As the manual flying competency is essential for flight Safety, Operators should:
 - Consider whether their automation policies allow sufficient manual operation during line operations.
 - Monitor, in a non-punitive way, using Flight Operational Quality Assurance (FOQA) data, pilots' manual flying performance.
 - Analyze FOQA data to identify and correct deficiencies.
 - Give guidelines to their pilots regarding the minimum level of automation that must be used (considering manufacturers' requirements and operational context).
 - Encourage regular practice of manual flying skills, when appropriate, in order to reinforce the pilots' confidence in their manual flying capabilities.
 - Develop an integrated approach to manual handling into both line operations and simulator training (to include more time allocated to manual flying in the simulator sessions).
 - Ensure that the training objectives include the pilot's ability to manually control the aircraft using the relationship between aeroplane attitude, speed and thrust while monitoring and assessing the aircraft's energy state, and its anticipated flight path;
 - Ensure that flight crew maintain their ability to manage the flight path through manual control of pitch, bank, yaw and/or thrust. This may be conducted with or without the use of a flight directors. but demands pilot competency, ability, knowledge, and skills in the cognitive and motor areas.
 - Consult for further information with the different regulatory publications on promoting manual flight operations when appropriate. Examples of such documentations are the Safety Alert for Operators ([SAFO 17007 issued on 5/4/17](#)), EASA Safety Information Bulletin ([SIB No.: 2013-05, Issued: 23 April 2013](#)), and Transport Canada Advisory Circular ([AC-600-06, Issued: 26 May 2015](#)).
- The operator's training policies should include statements about the importance of maintaining situation awareness and, in particular, mode and energy awareness.
- Automation versus manual flying guidance rules should be based on a mature TEM approach (taking into consideration the four major threats identified in the survey: adverse weather, poor visibility, fatigue and traffic).

3.2. Flight Crew

- To ensure that Manual Handling Skills are maintained, Pilots should:
 - Have a good understanding of the automation systems and use all pilots' competencies when encountering unusual situations.
 - Perform a Threat and Error assessment of the situation to ensure both crew members are fully aware of the risks involved when manually flying. This should include (but is not limited to):
 - Weather conditions
 - Crew experience
 - Knowledge and experience of the operating environment (airport, air traffic control etc)
 - Traffic conditions
 - Fatigue
 - What level of automation will still be engaged? i.e. does the pilot intend to use flight directors, autothrust, etc
 - Workload
 - Following this assessment, a full briefing should take place which ensures both pilots are aware of when and how the automation will be managed and this should include:
 - When will the automation be disengaged?
 - If there is an increase in workload, a reduction of situation awareness or any other situation that may impact the flight safety, how will the automation be re-engaged?

4. Conclusion

Generally speaking, in modern aviation, automation has contributed to the improvement of systems accuracy, reliability and greater operational efficiency. However, it must be noted, and this survey confirms this point, that a significant number of pilots have experienced a degradation of their manual handling skills, and a subsequent over-reliance and dependence on automation.

Operators must provide all their pilots, even the highly experienced ones, with opportunities, as appropriate, to hand-fly the aircraft. They must also monitor in a non-punitive way, using FOQA data, pilots' performance with the view of improving safety. This data should be continuously used to guide future pilot assessment and training.

This general sense of lack of confidence in the pilots' manual flying skills can be reversed by encouraging pilots to fly manually whenever the situation permits.

5. Supporting Data - Survey Results

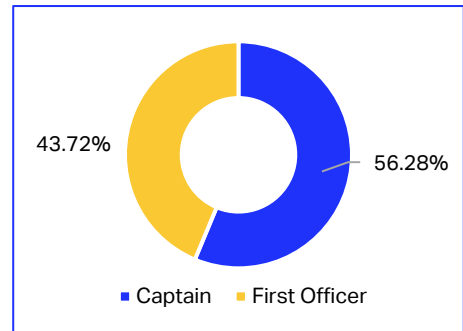
5.1. Demographic Information

Question 1: is a background question to identify the respondents' position. A total of 5,650 participants responded to this question; 56% are Captains.

56% OF THE RESPONDENTS ARE CAPTAINS

Question 1: Please specify your position.

	% of responses	# of Responses
Captain	56.28%	3,180
First Officer	43.72%	2,470



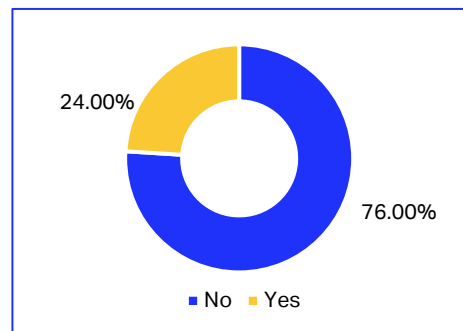
Answered 5,650 - Skipped 0

Question 2: The purpose of this question is to find out whether the respondents perform other duties. A total of 5,650 participants responded to this question. Most of the respondents indicated that they do not perform other duties.

76% OF THE RESPONDENTS DO NOT PERFORM OTHER DUTIES IN THEIR RESPECTIVE AIRLINES

Question 2: Do you have other duties?

	% of responses	# of Responses
No	76.00%	4,294
Yes	24.00%	1,356



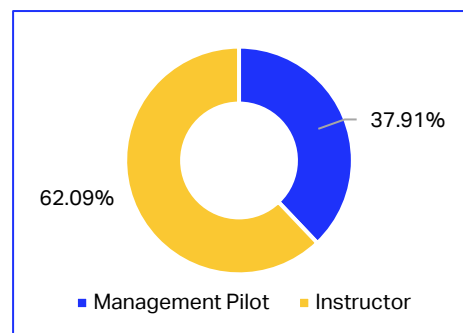
Answered 5,650 - Skipped 0

Question 3: We want to know, from the 1,356 affirmative responses to question number 2 above, the types of duties they perform. About 62% indicated that they are instructors and 38% indicated that they are management pilots. 359 out of the 1,356 did not specify the type of duty they perform.

MORE THAN 60% OF THE RESPONDENTS WHO PERFORM OTHER DUTIES ARE INSTRUCTORS

Question 3: What other duties do you carry out?

	% of responses	# of Responses
Management Pilot	37.91%	378
Instructor	62.09%	619



Answered 997 - Skipped 4,653

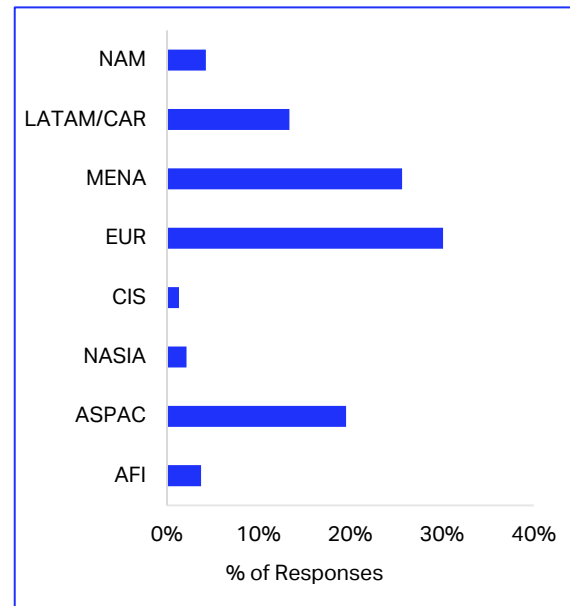
This question indicates that amongst the 1,356 of pilots that perform other duties, more than 60% are instructors.

Question 4: This question identified the region where the respondents are based. 5,289 responded to this question, the majority of the respondents are based in the Europe (EUR) region with 30%, followed by Middle East and North Africa (MENA) with 26% and Asia Pacific (ASPAC) with 20%.

30% OF THE RESPONDENTS ARE BASED IN EUROPE REGION

Question 4: In which region are you based?

Africa (AFI)	3.72%	197
Asia Pacific (ASPAC)	19.53%	1,033
North Asia (NASIA)	2.12%	112
Commonwealth of Independent State (CIS)	1.30%	69
Europe (EUR)	30.10%	1,592
Middle East and North Africa (MENA)	25.64%	1,356
Latin America and Caribbean (LATAM/CAR)	13.35%	706
North America (NAM)	4.24%	224



Answered 5,289 - Skipped 361

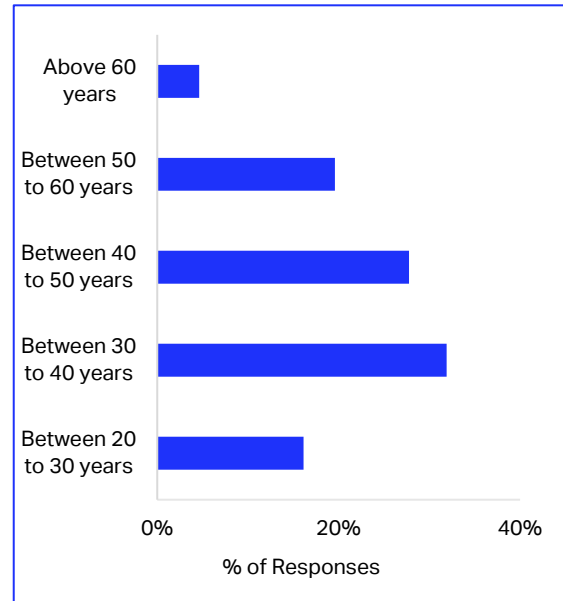
The geographical representation of the survey participants was not quite adequate, although there were no set targets, Africa (AFI), North Asia (NASIA) and Commonwealth of Independent States (CIS), Latin America and Caribbean (LATAM/CAR), North America (NAM) did not participate in the numbers expected.

Question 5: The objective of this question is to know the age distribution of the respondents, the breakdown of the 5,288 responses is as follows: the majority of the survey respondents fall between 30 to 40 years of age, with 32% of the total; followed by the respondents between the ages of 40 to 50 years of age with 28%. Whereas respondents above 60 years are under-represented.

32% OF THE RESPONDENTS FALL BETWEEN 30 TO 40 YEARS OF AGE

Question 5: Please specify your age.

Between 20 to 30 years	16.13%	853
Between 30 to 40 years	31.90%	1,687
Between 40 to 50 years	27.76%	1,468
Between 50 to 60 years	19.59%	1,036
Above 60 years	4.63%	245



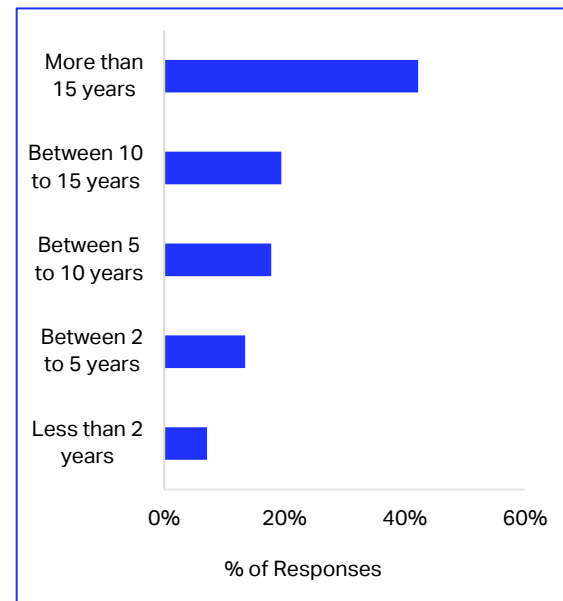
Answered 5,289 - Skipped 361

Question 6: The purpose of this question is to gain further insight into the respondents' experience in commercial aviation. 5,289 responded to this question, the majority has more than 15 years of experience.

42% OF THE RESPONDENTS HAVE MORE THAN 15 YEARS OF EXPERIENCE IN COMMERCIAL AVIATION

Question 6: What is your experience in commercial aviation?

Less than 2 years	7.11%	376
Between 2 to 5 years	13.44%	711
Between 5 to 10 years	17.77%	940
Between 10 to 15 years	19.47%	1,030
More than 15 years	42.20%	2,232



Answered 5,289 - Skipped 361

Looking at the regional distribution of the 2,232 respondents with more than 15 years of experience, it is to be noted that most of them live in the MENA Region, followed by those who live in EUR.

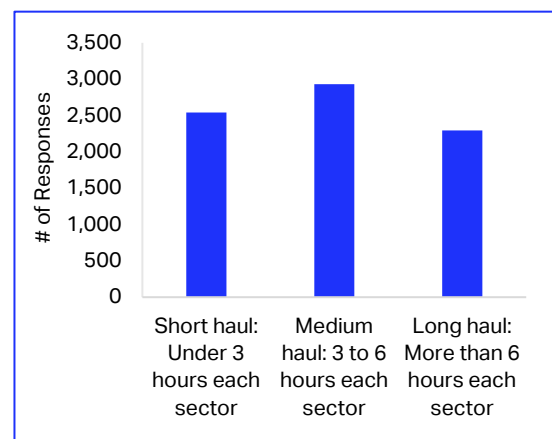
Africa (AFI)	3%	73
Asia Pacific (ASPAC)	20%	439
North Asia (NASIA)	2%	49
Commonwealth of Independent State (CIS)	1%	19
Europe (EUR)	27%	608
Middle East and North Africa (MENA)	30%	675
Latin America and Caribbean (LATAM/CAR)	11%	241
North America (NAM)	6%	128

Question 7: The purpose of this question is to get an idea of the sort of operation they perform; this question asked if the respondents are involved in short, medium or long-haul flights. 5,289 responded to this question. However, this question allows the participants to check more than one answer and hence the numbers are higher than the number of survey respondents. Percentages are not calculated in this question because the same participant was able to select more than one answer. The results show that the respondents' selection of the medium haul is slightly higher.

THE HIGHEST NUMBER OF RESPONDENTS INDICATED THAT THEY PERFORM MEDIUM-HAUL FLIGHTS

Question 7: What is your network? Select all that apply

Short haul: Under 3 hours each sector	2,542
Medium haul: 3 to 6 hours each sector	2,931
Long haul: More than 6 hours each sector	2,295



Answered 5,289 - Skipped 361

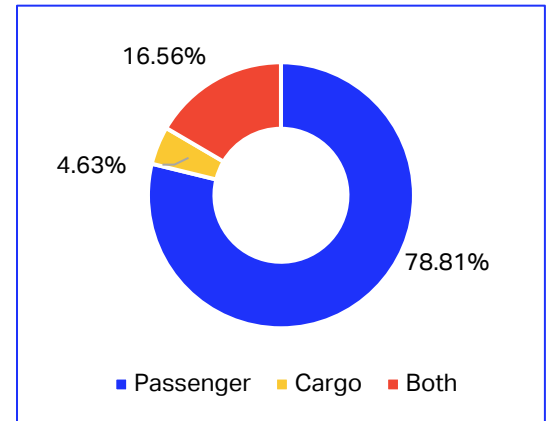
887 respondents indicated that they operate both medium haul and long hauls. 1,578 of the respondents indicated that they operate short, and medium hauls, and 682 respondents indicated that they operate short and long hauls.

Question 8: The aim of this question is to find out which of the service category is more predominant passenger, cargo, or both. 5,289 responded to this question.

79% OF THE RESPONDENTS INVOLVED IN PASSENGER COMMERCIAL OPERATIONS

Question 8: What is your type of operation?

Passenger	78.81%	4,168
Cargo	4.63%	245
Both: Passenger and Cargo	16.56%	876



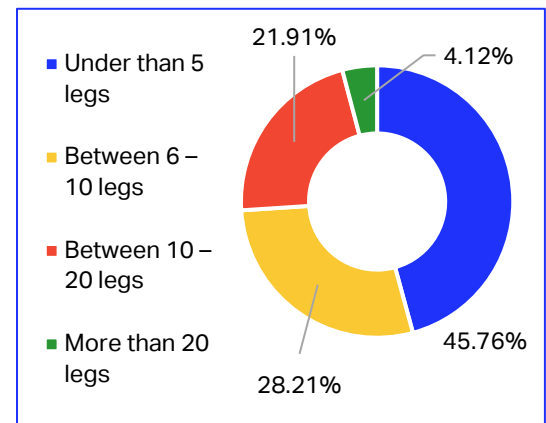
Answered 5,289 - Skipped 361

Question 9: To evaluate the influence of recent flying on pilots' manual flying performance, the number of sectors flown in a typical duty week are assessed. 5,289 participants responded to this question. The majority of the responses report that they fly less than 5 legs per duty week.

46% OF THE RESPONDENTS REPORTED THAT THEY FLY LESS THAN 5 LEGS IN A TYPICAL DUTY WEEK

Question 9: How many legs do you fly in a typical duty week?

Under than 5 legs	45.76%	2,420
Between 6 – 10 legs	28.21%	1,492
Between 10 – 20 legs	21.91%	1,159
More than 20 legs	4.12%	218



Answered 5,289 - Skipped 361

Question 10: The aim of this question is to assess whether the survey respondents are operating today on newer generation aircraft or older ones. This question allows the participants to check more than one answer and hence the numbers are higher than the number of survey respondents. 5,289 responded to this question. The majority of the survey participants indicate that they operate on the different types of generation 4 – jet aircraft.

MOST RESPONDENTS OPERATE MORE ON THE DIFFERENT TYPES OF GENERATION 4 JET AIRCRAFT

Question 10: Could you please indicate the type of aircraft you currently operate?

Generation 4 — Jet: 3,915

A318/A319/A320/A321 (including neo), A330, A340-200/300, A340-500/600, B777, A380, B787, A350, Bombardier C Series, Embraer E170/E175/E190/E195

Generation 3 — Jet: 1,191

A310/A300-600, B737-300/400/500, B737-600/700/800 (NG), B737 MAX, B757, B767, B747-400, B747-8, B717, BAE 146, MD11, MD80, MD90, F70, F100, Bombardier CRJ Series, Embraer ERJ 135/145

Generation 3 — Turboprop: 148

ATR 42-600, ATR 72-600, Bombardier Dash 8-400, BAE ATP, Embraer 120, Saab 2000

Generation 2 — Jet: 15

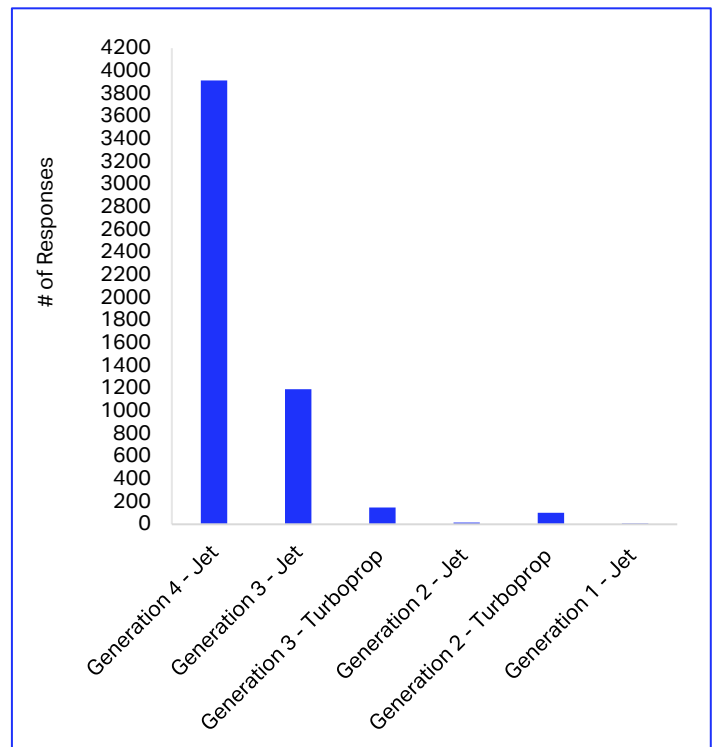
A300 (except A300-600), BAC111, B727, B737-100/200, B747-100/200/300, DC9, DC10, F28, L1011

Generation 2 — Turboprop: 102

ATR 42, ATR 72 (all series except -600), BAE J-41, Fokker F27/50, Bombardier Dash 7 and Dash 8-100/200/300 Series, Convair 580-600 Series, Shorts 330 and 360, Saab 340

Generation 1 — Jet: 7

DC8, B707



Answered 5,289 - Skipped 361

Question 11: The objective of this question is to assess the respondents' amount of flight experience on the operated aircraft type. 5,289 responded to this question. The types of aircraft operated the most by the survey participants and on which they have more than 3,000 hours are: A318 / A319 / A320 / A321 (including neo) fleet, followed by B737-600 / 700 / 800 (NG) and B777.

THE TYPES OF AIRCRAFT OPERATED THE MOST BY THE SURVEY PARTICIPANTS AND HAVE EXPERIENCE GREATER THAN 3000 HOURS ARE ON A318 / A319 / A320 / A321 (INCLUDING NEO) FLEET, FOLLOWED BY B737-600 / 700 / 800 (NG) AND B777

Question 11: What is your experience on the type you currently operate?

It is apparent that those who operate on the following aircraft types: A318 / A319 / A320 / A321 (including NEO) as well as B737-600 / 700 / 800 (NG), regardless of the number of legs they operate during a typical duty week, have more than 3000 flight hours. While the respondents' experience in other aircraft types varies.

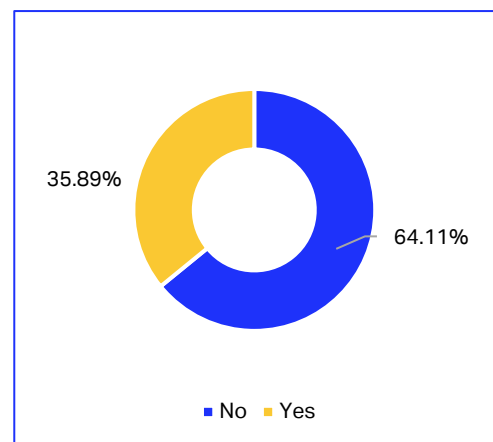
5.2. Airline Policy

Question 12: The goal here is to gain more insight into the respondents' airline policy. We want to know if their policy allows and supports manual flying **without any limitations**? Out of the 5,241 responses, about 36% of the respondents indicated that their airline policy allows and supports manual flying **without any limitations**.

ONLY 36% OF THE RESPONDENTS INDICATE THAT THEIR AIRLINE POLICY ALLOWS AND SUPPORTS MANUAL FLYING WITHOUT ANY LIMITATIONS

Question 12: Does your airline policy allow and support manual flying without any limitations?

No	64.11%	3,360
Yes, without any limitations	35.89%	1,881



Answered 5,241 - Skipped 409

How does this compare with the regional distribution of the respondents? Many of the EUR respondents' airline policy allows and supports manual flying without any limitations (901 Yes and 683 No). In MENA, the proportion is completely different (172 Yes against 1;174 No).

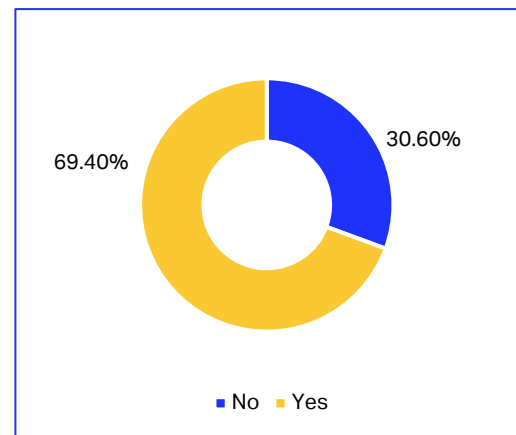
	Yes	No
Africa (AFI)	74	121
Asia Pacific (ASPAC)	296	724
North Asia (NASIA)	34	77
Commonwealth of Independent State (CIS)	17	50
Europe (EUR)	901	683
Middle East and North Africa (MENA)	172	1,174
Latin America and Caribbean (LATAM/CAR)	265	432
North America (NAM)	122	100

Question 13: Similar to Question 12, the aim of this question is to gain more insight into the respondents' airline policies and to find out if their policy allows and supports manual flying **within specific limitations**. 4,801 responded to this question. Sixty nine percent responded affirmatively that their airline policies allow and support manual flying **within specific limitations**.

69% OF THE RESPONDENTS INDICATED THAT THEIR AIRLINE POLICY ALLOWS AND SUPPORTS MANUAL FLYING WITHIN SPECIFIC LIMITATIONS

Question 13: Does your airline policy allow and support manual flying within specific limitations?

No	30.60%	1,469
Yes, within specific limitations	69.40%	3,332



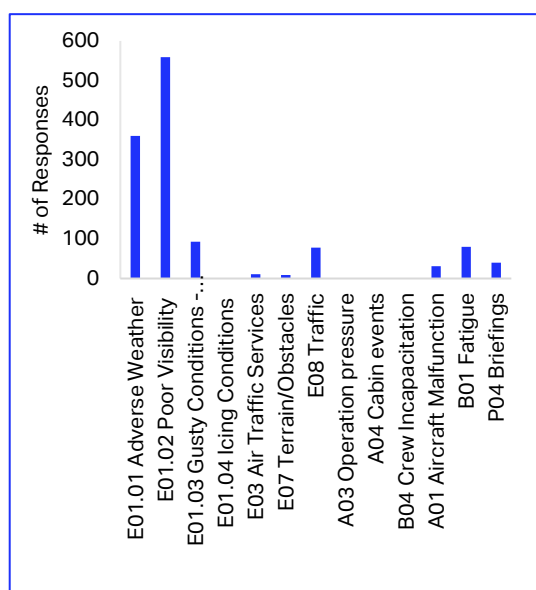
Answered 4,801 - Skipped 849

The 30.60% of "No" does not match with the 35.89% of "Yes" in the previous question, as most airlines have some kind of limitation(s) [at least manufacturers' limitations], even when they strongly support manual flying.

How does this compare with the regional distribution of the respondents? All respondents in all regions indicated that their policy allows manual flying but within limitations.

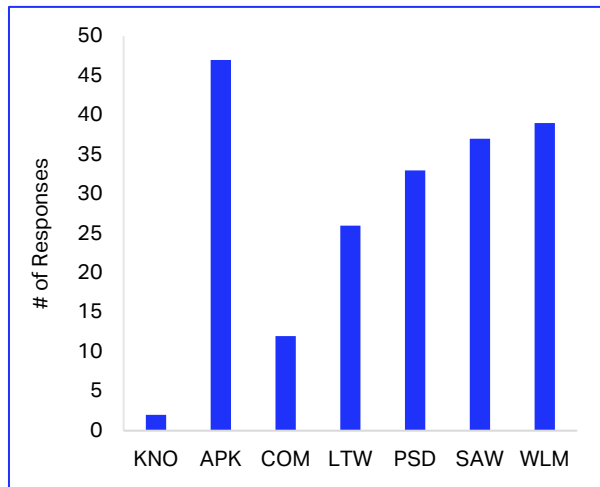
	Yes	No
Africa (AFI)	122	51
Asia Pacific (ASPAC)	727	215
North Asia (NASIA)	75	22
Commonwealth of Independent State (CIS)	51	9
Europe (EUR)	897	549
Middle East and North Africa (MENA)	865	372
Latin America and Caribbean (LATAM/CAR)	453	186
North America (NAM)	142	65

This question asked the participants to provide information on the manual handling policy with the specific limitations. 2,275 provided free text. Using the IATA Accident Classification Taxonomy (see Appendix), we can cluster the free-text answers about limitations as follows:



Threat Category	Responses
E01.01 Adverse Weather	360
E01.02 Poor Visibility	559
E01.03 Gusty Conditions - Windshear - Wake Turbulence	93
E01.04 Icing Conditions	1
E03 Air Traffic Services	11
E07 Terrain/Obstacles	9
E08 Traffic	78
A03 Operation pressure	0
A04 Cabin events	0
B04 Crew Incapacitation	1
A01 Aircraft Malfunction	31
B01 Fatigue	80
P04 Briefings	40

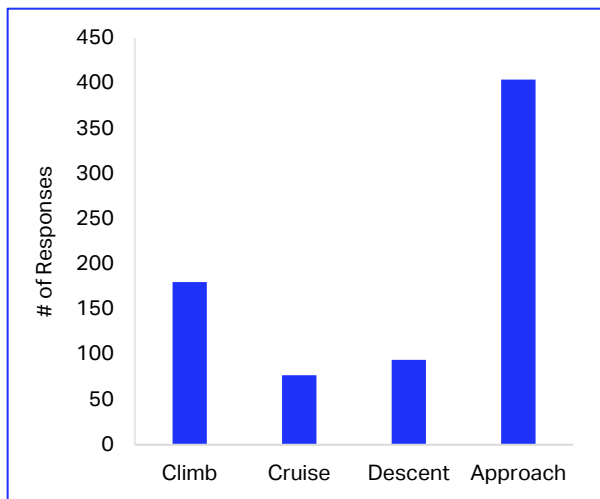
Out of 2,275 responses, the above threat categories were mentioned 1,263 times.



Competencies (not including FPA/FPM)

KNO	2
APK	47
COM	12
LTW	26
PSD	33
SAW	37
WLM	39

8.6% of respondents mentioned a competency in their response.



Phases of Flight

CLIMB	180
CRUISE	77
DESCENT	94
APPROACH	404

33.2% of respondents mentioned a tagged phrase related to a phase of flight in their response.

Some respondents reported that the use of Flight Directors (FD) is always mandatory, while others reported that flight crew can decide about the use of desired levels of automation. Furthermore, from the voluntary comments received, it was apparent that there are certain restrictions to disconnect the autopilot (AP), Auto-Thrust/Throttle (A/T[HR]) and the FDs; these restrictions are related to visibility, flight level, airspace procedures, and type of approach:

Additionally, general context encourages greater use of automation, as autopilot use is mandatory in areas such as Reduced Vertical Separation Minima (RVSM) airspace. Performance-based Navigation (PBN) and/or Automatic Dependent Surveillance Broadcast (ADS-B) are also designed to allow the use of automation. Furthermore, congested airspace and operating to an unfamiliar airport call for solutions that can be addressed by using automation. Also, due to the implementation of the complexity of the Area Navigation (RNAV), Standard Arrivals (STAR) and Standard Instrument Departures (SID) which have replaced many conventional procedures at airports globally, the dense traffic situation in terminal areas, and strict noise abatement procedures, many of the respondents indicated that they are not in favor of hand flying, at least from a workload management perspective.

The other aspect quoted by respondents about manual flying practice is the fear of adverse attention from management, even if manuals give the impression to encourage manual operation.

Quotes extracted from the survey:

- *Auto thrust and FD shall remain engaged at all time unless SOP or a failure dictate otherwise.*
- *From ground to 10000 feet, during high workload, keep auto thrust and FDs on.*
- *It allows but does not support. Stable approach criteria are used as limitations which is clearly acceptable however, above answer dominates operations.*
- *FDM is used to punish pilots. No one takes risks flying manually. Autopilot is used ALWAYS from 200 ft on departure to 500 ft on arrival and there are so many pilots without previous experience in manual flying.*
- *Manual flying below FL 100 is allowed. Higher levels only due to equipment failure/temporarily.*
- *Airspace with strict limitations of heading, altitude and speed.*
- *VMC landings with type of approach restrictions. Example: autopilot Off/autothrust ON during non-precision app without vertical guidance.*
- *Crew fatigue, type of approach, restricted visibility (2000 meters), low ceiling (400 ft.), limited to final approach, no raw data approach.*
- *Manual flying is discouraged. Prohibited above 10000, no AP + FD off at one time. Raw data approaches prohibited; visual approaches prohibited unless no other option. No other approach allowed if ILS is serviceable and available.*
- *No manual flying above 10,000'. A/THR OFF not allowed. Raw data approaches not allowed. I don't think the company supports manual flying.*
- *Manual flying is only allowed below 10000', only Autopilot OFF (Auto thrust must be ON), no "raw data" when manual flying. Airline does not support manual flying. Instructors do not "recommend" it.*
- *Flight director should be used unless it's providing incorrect guidance. Raw data ILS only permitted in VMC conditions*
- *Manual Flight is allowed below 10 000 FT, nevertheless punitive culture doesn't promote the manual flight.*
- *Any safety incident or flight data event involving manual flying, where automated flying was an option, will be dealt with punitively. The manuals give the impression of encouraging manual operation, but the safety culture discourages it. Some pilots are afraid to hand fly because it increases the risk of adverse attention from management.*

Question 14: The survey respondents were asked to provide a description of their airline's policy limitations (i.e., when do you engage and disengage auto pilot, autothrust, etc.?). 3,406 respondents provided comments. It is to be noted that differences were found concerning autopilot use.

Question 14: Could you provide a description of your airline's policy limitations (i.e., when do you engage and disengage auto pilot, autothrust, etc.)?

The main points highlighted from the comments to this question are that they:

- Disengage autopilot when the runway is insight and that they are fully configured for landing.
- Can hand fly only below FL100.
- Only allowed when congested traffic is not an issue and at captain's discretion.
- Engage autopilot shortly after takeoff and should be disengaged as late as possible on approach. The maximum/appropriate use of automation is always recommended.

Furthermore, some respondents reported that they:

- Do not have limitations with regards to manual handling, the only limitations they have are the stable approach criteria and operation in RVSM airspace.
- A/THR and FDs must always remain engaged unless they are unserviceable or specifically disengaged by SOP or checklist action.
- Fly Raw Data approaches at least once per month
- Auto thrust is usually recommended. Autopilot engagement is recommended for all noise sensitive airports and for all automatic landings.
- Raw data on takeoff, approaches and landing are allowed except in some airports where the use of A/THR is recommended.

Quotes extracted from the survey:

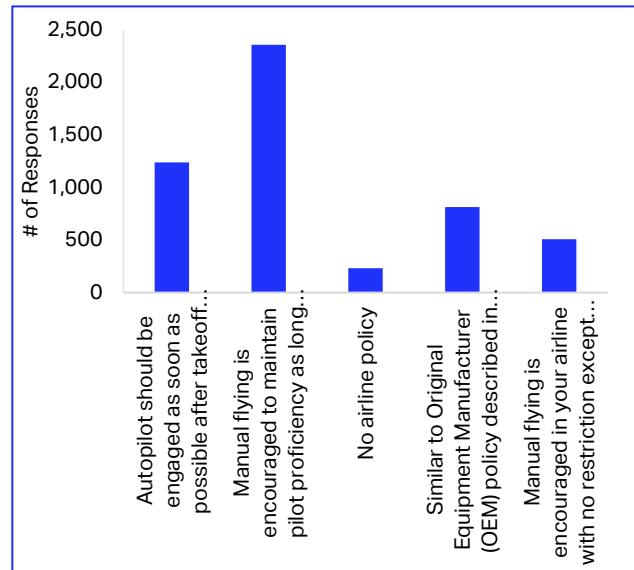
- *The only limit is that 'normally the autopilot is engaged above FL 100'. The AT is trained to be left engaged on departures but there is no SOP. Arrivals you'd always disconnect both.*
- *The A/P should be engaged for all IFR operations unless clear of cloud and in sight of the surface.*
- *Pilots discretion but normally autopilot Should be engaged by 10000ft in climb out and not before 1000ft. In descent there are no limitations except being outside RVSM airspace*
- *No specific limitations but passenger safety and comfort must not be compromised.*
- *Autopilot and auto throttle should be engaged and disengaged at the same time. Minimum engage height for autopilot is 400' height, disengage 158' height.*
- *1000ft after takeoff and no actually SOP regarding landing. Mostly when ac is stable and configured for landing from personal experience*
- *Autothrust almost never disengaged, auto pilot generally disengaged when established on final or on base leg, except for visual approaches where autopilot is disengaged on downwind with FD OFF*
- *Below RVSM airspace and categories approaches AP ON*
- *When congested traffic is not an issue and always at captain's discretion*
- *For takeoff, autopilot must be engaged before transition level. For landing, no limitation for usage of autopilot. Autothrust must always be used in all phases of flight.*

Question 15: Please select the items corresponding to your airline's policy with regards to automation and manual flying (including autothrust and/ or flight-directors off). The distribution of the 4,044 responses is as follows. This question allowed the participants to check more than one answer, hence the numbers are higher than the number of survey respondents. Percentages were not calculated for this question because the same participant was able to select more than one answer.

232 RESPONDENTS INDICATED THAT THEIR COMPANY DO NOT HAVE A POLICY

Question 15: Please select the items corresponding to your airline's policy with regards to automation and manual flying (including autothrust and/ or flight-directors off).

Autopilot should be engaged as soon as possible after takeoff and should be disengaged as late as possible (e.g., at the minima) on approach	1,238
Manual flying is encouraged to maintain pilot proficiency as long as weather conditions, ATC environment, and pilot workload can assure a safe operation (individual risk analysis to be performed by the flight crew)	2,358
No airline policy	232
Similar to Original Equipment Manufacturer (OEM) policy described in the Flight Crew Operating Manual /Flight Crew Training Manual (FCOM/FCTM)	813
Manual flying is encouraged in your airline with no restriction except regulatory ones (e.g.: RVSM rules, ...)	507



Answered 4,044 - Skipped 1,606

How does this compare with the regional distribution of the respondents?

The policy with respect to "Autopilot should be engaged as soon as possible after takeoff and should be disengaged as late as possible" can be seen more with the respondents based in MENA region. One thing to draw the attention to that if pilots are obliged to always engage the autopilot as soon as after takeoff and just before landing; their manual flying opportunities can be diminished as their actual manual flying practice time can be limited to just few minutes, especially in long-haul flights.

The policy related to "Manual flying is encouraged to maintain pilot proficiency as long as weather conditions, ATC environment, and pilot workload can assure a safe operation" can be seen more with the rest of the respondents. Pilot skills can be acquired and maintained over the course of a pilot's career; as with any skills developed, they need to be practiced in order to be maintained at the appropriate level of expertise.

Furthermore, several respondents mentioned that they do not have airlines policies with regards to manual handling. If the airline SOPs and policies do not support or encourage manual flying, pilots may have difficulty maintaining the skills needed to control the aircraft in an abnormal situation. Exacerbating the problem is that some operators require the use of automation as much as possible to increase efficiency and to enhance the safety of flight operations.

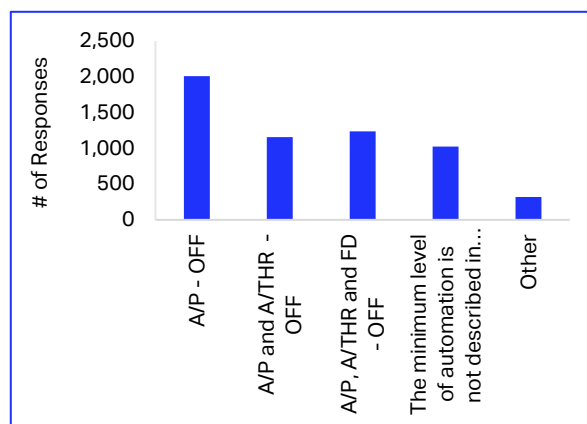
	Autopilot should be engaged as soon as possible after takeoff and should be disengaged as late as possible	Manual flying is encouraged to maintain pilot proficiency as long as situation permits	No airline policy	Similar to OEM policy described in FCOM/FCTM	Manual flying is encouraged in your airline with no restriction except regulatory ones (e.g.: RVSM rules)
Africa (AFI)	38	77	5	43	10
Asia Pacific (ASPAC)	191	485	39	203	72
North Asia (NASIA)	25	44	10	18	2
Commonwealth of Independent State (CIS)	13	27	4	9	5
Europe (EUR)	158	894	86	234	281
Middle East and North Africa (MENA)	638	417	40	126	24
Latin America and Caribbean (LATAM/CAR)	157	291	33	151	76
North America (NAM)	20	127	16	30	38

Question 16: The Standard Operating Procedures (SOPs) of an airline provides the framework for a smooth interaction between pilots and the automated systems of the aircraft. It is essential to assess the level of automation the respondents' airline policy allows during line operations. 4,044 responded to this question. This question allowed the participants to check more than one answer and hence the numbers are higher than the number of survey respondents. Percentages were not calculated for this question because the same participant was able to select more than one answer.

1,026 RESPONDED INDICATED THAT THE MINIMUM LEVEL OF AUTOMATION IS NOT DESCRIBED IN YOUR COMPANY POLICY

Question 16: What level of automation does your airline's policy allow during line operations:

Autopilot (A/P) - OFF	2,011
A/P and autothrottle (autothrust – A/THR) - OFF	1,158
A/P and A/THR and Flight-director - OFF	1,237
The minimum level of automation is not described in your company policy	1,026
Other	320



Answered 4,044 - Skipped 1,606

How does this compare with the regional distribution of the respondents? The majority indicated that their SOP allows pilots to switch the autopilot off in their daily operations.

	A/P - OFF	A/P and A/THR - OFF	A/P, A/THR and FD - OFF	The minimum level of automation is not described in your company policy	Other
Africa (AFI)	45	33	23	46	15
Asia Pacific (ASPAC)	428	189	137	207	62
North Asia (NASIA)	40	24	13	17	9
Commonwealth of Independent State (CIS)	18	14	8	13	6
Europe (EUR)	450	501	658	368	49
Middle East and North Africa (MENA)	725	99	87	186	138
Latin America and Caribbean (LATAM/CAR)	218	203	229	130	30
North America (NAM)	88	96	82	61	12

The analysis of the comments, related to their airline policy, of the 320 respondents who selected "other", indicates that:

- The use of maximum automation is encouraged
- Some respondents reduce the level of automation or revert to manual flight operation when the automation does not produce the expected results
- Automation policies vary among operators, ranging from mandating the use of full automation at all times, except take-off and landing, to encouraging the disconnection of automation whenever possible, under certain conditions
- Some indicated that they fly raw data
- Some of the respondents' airlines encourage to keep A/THR- ON during normal operations, OFF only when required by abnormal/emergency procedures
- The automation can be disengaged as regulated and described by FCTM/FCOM (when unable to maintain a steady approach speed)
- If flying manually (with or without FD), manual thrust should be used
- Advised to keep the automation engaged unless it is limited by aircraft capabilities
- The problem is with the training methods, and not with the airline's policies

Quotes extracted from the survey:

- *As Airbus golden rules, "Use the appropriate level of automation at all times".*
- *We must remain in the higher level of automation, unless an emergency is encountered or landing is imminent.*
- *All approaches in conditions below CAT I weather minimums shall be planned as auto-coupled approaches to terminate with an automatic landing or an auto-coupled go-around.*
- *Practice Raw data allows All Automations and FD OFF.*
- *FDs are not to be selected off at any stage except after being visual after a non-precision approach. During all other stages of the flight, the FDs remain ON.*
- *Autothrust is on from takeoff till below 1500' AGL on approach. Autopilot comes on below FL 100 during climb and stays on until below 1500' AGL on approach. FD's to remain on throughout the whole flight unless performing a non-precision approach. (To be put off only once visual with the runway.)*
- *With restrictions on NPA App, FINAL APP not authorized with FD off.*
- *Allows crews to select A/P and Flight-director OFF while leaving the A/THR ON, especially in low experience pilots.*
- *Flight directors required at all times. Raw data flying not authorized regardless of weather conditions.*
- *There is no official policy but A/thr off approaches are unofficially frowned upon.*
- *The Company policy is to use A/P, ATHR, LNAV, VNAV.*
- *Autopilot off any time although its use is encouraged at all times. Flight director off only in VMC, on raw data ILS or visual approach.*

Question 17: Can you provide additional key elements of your airline's policy with regards to the different levels of automation (auto thrust / auto throttle included) in line operations? 1,971 responded to this question.

Question 17: Can you provide additional key elements of your airline's policy with regards to the different levels of automation (auto thrust / auto throttle included) in line operations?

The main points highlighted from the comments to this question were:

- As indicated above, automation policies vary from one operator to another:
 - When disengaging the AP, A/THR must also be disengaged, but arm mode is permitted on most occasions
 - A/THR is mandatory
- When converting to manual flying, pilots must conduct a proper briefing and review the tasks of the Pilot Flying (PF) and Pilot Monitoring (PM) duties.
- Respondents always prefer to keep automation engaged to maintain a higher Situation Awareness (SA).
- Some of the respondents indicated that their airline policy encourages the use of automation but does not specify the level of automation to be used e.g. autopilot, autothrottle, FD, LNAV/VNAV can all be used together at the same time or separate.
- There are no specific airline policies, the use of any level of automation is at pilot's discretion; their recent experience to manual flight; i.e. it depends upon the pilot's attitude to risk.

Highly sophisticated automation can prove to be highly complex from a pilot's perspective, especially if many tasks must be performed within a limited timeframe, as in abnormal situations or high workload situations. It is essential that pilots have a good understanding of the automation system and make the appropriate decisions when encountering unusual situations, such as when automation fails or in an abnormal or emergency situation.

Quotes extracted from the survey:

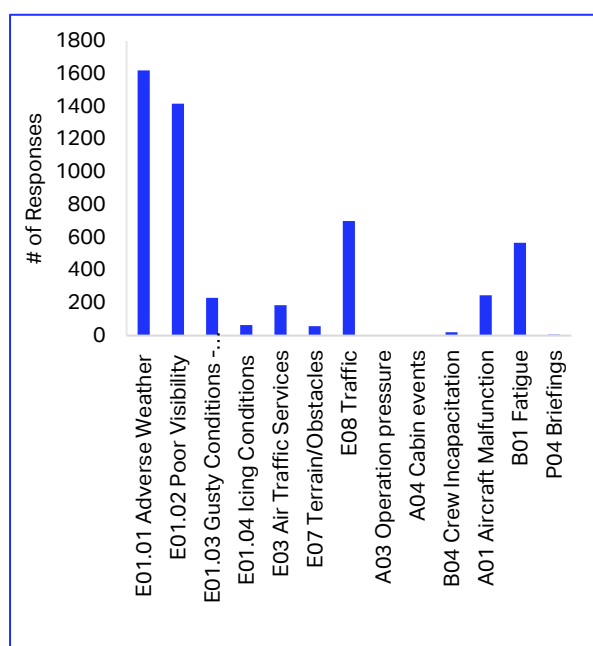
- *When disengaging the autopilot, auto throttle must also be disengaged.*
- *The highest available level should be used where appropriate but can be disengaged in agreeable circumstances for currency if briefed.*
- *Except regulatory exemptions are allowed all automation systems off.*
- *As high a level of automation should normally be used, stepping down the automation level when required to perform more simple or dynamic tasks.*
- *Generally, if you disconnect autopilot you should also disconnect Autothrottle, but arm mode is permitted on most occasions.*
- *21 out of 88 responses in AFI region indicated that the highest level of automation should base for all operations to maintain safety except when in fair weather condition are good, visual approaches and*
- *Speed off mode allowed to be used on approach*
- *The minimum level of automation is generally down to the MEL combined with flight crew's discretion dependent on the route being flown.*
- *manual takeoff without FD and AT -manual landing with AP and FD OFF, AT armed during ILS app and off during RNAV approach -circling and raw data approach without use of automation possible*
- *You may use all the automation you have, but they request us to practice manual flight (A/P, A/THR and FD OFF) as long the Weather, environment, traffic and cockpit workload and ATC permits. You have to be aware of any risk involved and exercise your situation awareness.*

5.3. Manual Flying

Question 18: The survey respondents were asked to provide their opinion to the following question: "Can you describe in which situation you, as a pilot, would refrain from flying manually". 4,365 provided free text responses.

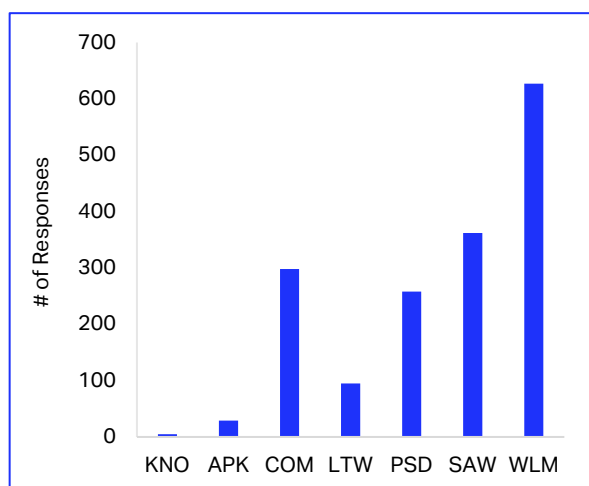
Question 18: Can you describe in which situation you, as a pilot, would refrain from flying manually?

It was indicated that the situations in which pilots refrain from flying manually were mainly in :
(based on the IATA Accident Classification Taxonomy)



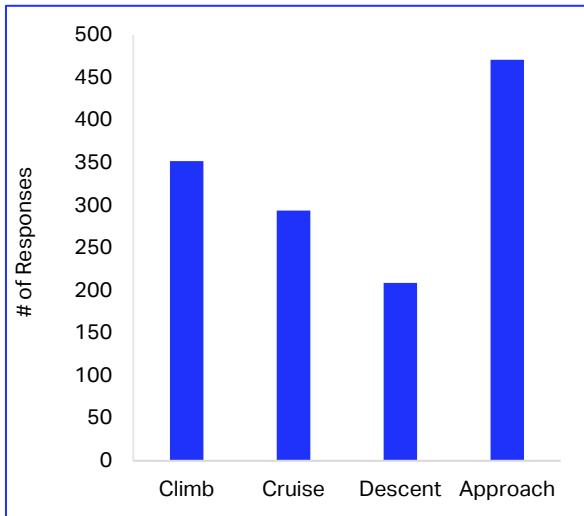
Threat Category	Responses
E01.01 Adverse Weather	1620
E01.02 Poor Visibility	1417
E01.03 Gusty Conditions - Windshear - Wake Turbulence	231
E01.04 Icing Conditions	64
E03 Air Traffic Services	186
E07 Terrain/Obstacles	58
E08 Traffic	700
A03 Operation pressure	0
A04 Cabin events	3
B04 Crew Incapacitation	20
A01 Aircraft Malfunction	246
B01 Fatigue	567
P04 Briefings	6

Out of 4,264 responses, the above threat categories were mentioned 5,118 times.



Competencies (not including FPA/FPM)	Responses
KNO	5
APK	29
COM	298
LTW	95
PSD	258
SAW	362
WLM	627

38.4% of respondents mentioned a tagged phrase related to a phase of flight in their response.

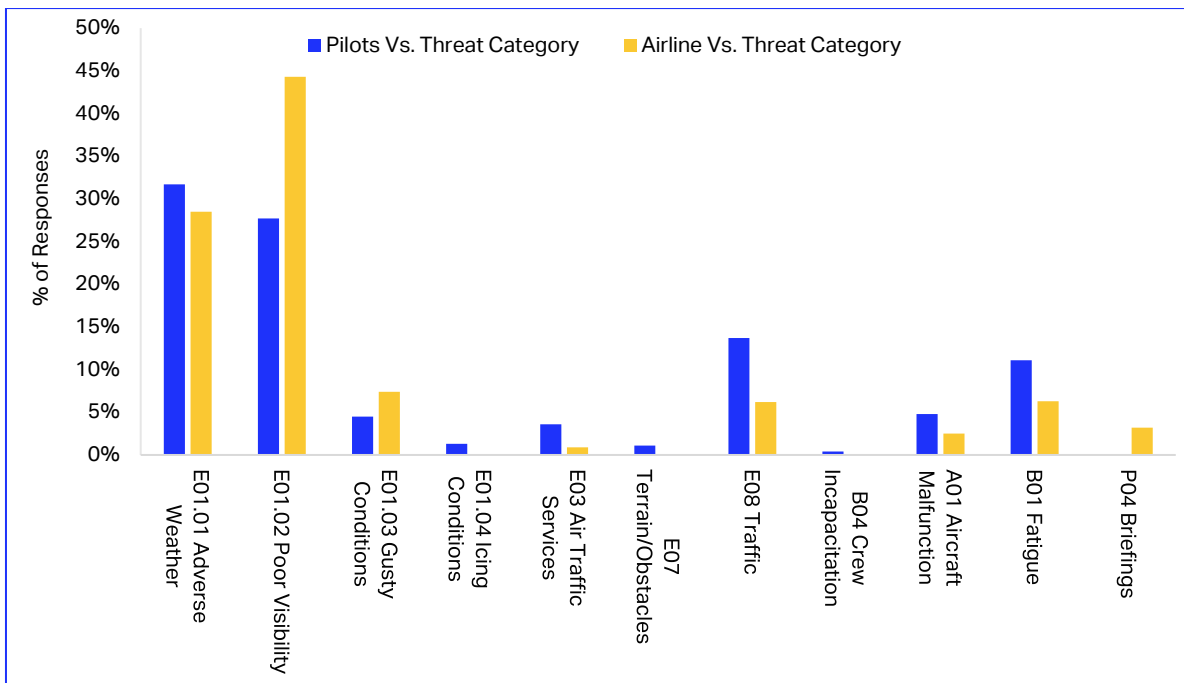


Phases of Flight

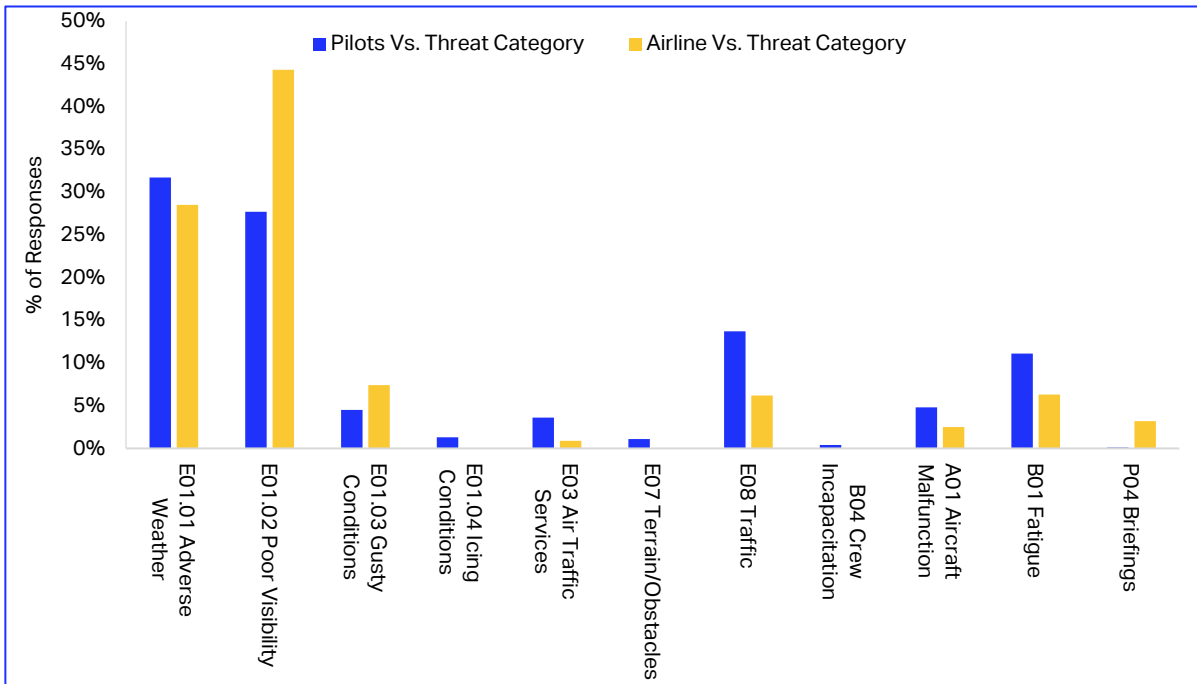
CLIMB	352
CRUISE	294
DESCENT	209
APPROACH	471

30.4% of respondents mentioned a tagged phrase related to a phase of flight in their response.

If we compare the airlines' policies limitations and the pilots' self-restrictions, weather related threats (adverse weather and poor visibility) are predominantly quoted in both cases.

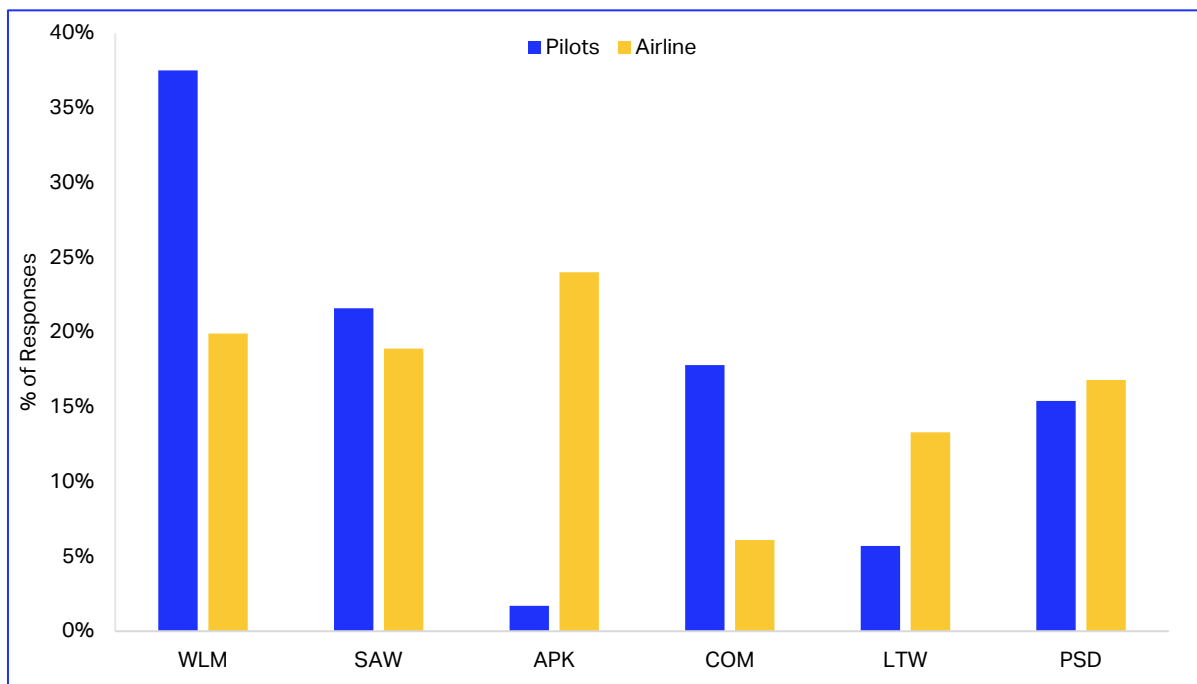


On the other hand, pilots' self-restrictions lay special emphasis on Fatigue and Traffic (busy airspace) compared to the airlines policies.



Regarding to EBT competencies, airlines put 25% of their focus on APK and KNO combined, whereas pilots only 2% - which is a huge difference.

If pilots and airlines match on SAW, there is a discrepancy regarding to WLM & LTW (pilots put about twice the emphasis).



Furthermore, pilots' over-reliance on automation can be encouraged by either the automation policies or SOPs directing pilots to generally use automation and to refrain from manual flying wherever possible.

Quotes extracted from the survey:

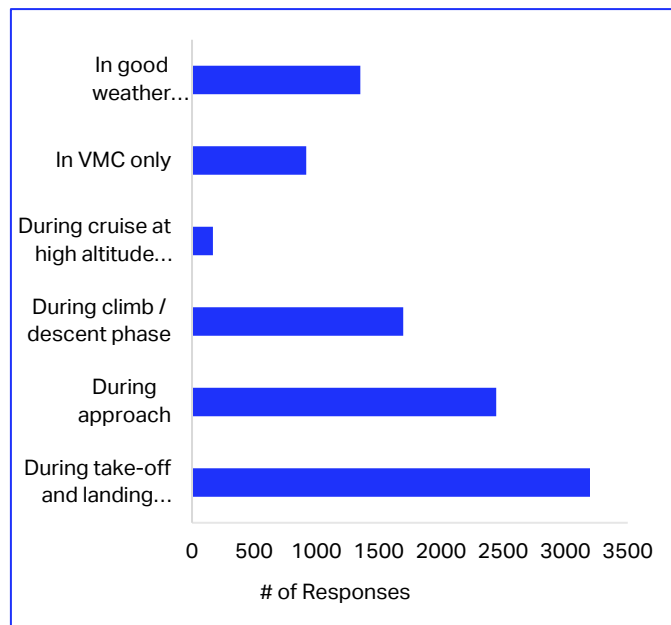
- *When flying in RVSM airspace; when within the TMA and vectored for the approach - all the time except when landing under CAT 1 conditions;*
- *Departure and Arrivals at busy airports; Bad weather; Abnormal or Emergency situations; Marginal visibility; Suspected wind shear during approach;*
- *On cruise within RVSM airspace; Severe ATC traffic;*
- *During high speed regime; Very high cross wind; Busy airspace; Late night or early morning flights;*
- *A busy terminal environment with an inexperienced FO, or if either operating pilot is feeling tired or fatigued;*
- *Emergency/Urgency; Inclement weather; High workload airspace; Fatigue; Stressed out;*
- *Low visibility; High workload environment e.g. busy airport complying multiple instructions;*
- *When I am tired (e.g. last sector of the day); when there is any other demanding situation (e.g. adverse weather) that requires my full mental capacity;*
- *Always as per company policy and culture;*
- *fatigue; Long duty hours;*
- *low visibility and inclement weather conditions; marginal weather conditions including any risk of wind shear, contaminated runways; Turbulent conditions;*
- *challenging approaches where automation can reduce the workload (A/T during challenging visual APCH); Cat 2 and 3;*
- *Depending on the captain; in cruise flight, high workload;*
- *Local noise and aggressive regulations, low level sharp turns SID;*
- *IMC, fatigued, unfamiliar environment;*
- *During pilot incapacitation and lean workload periods;*
- *Flying an instrument approach in full IFR conditions;*
- *High traffic environment with high chance of go around in congested airspace or with bad weather on final approach.*

Question 19: Since more pilots flying today have little experience, or have never experienced an industry where hand flying was, or is, the norm, unlike pilots in the past or older ones, we thought it would be essential to assess the level of their manual flying experience in line operations. This question allows the survey participants to check more than one answer and hence the numbers are higher than the number of survey respondents. 3,778 responded to this question. Percentages were not calculated for this question because the same participant was able to select more than one answer. This question also offered the respondents an opportunity to give comments at the end of the question. 240 provided comments.

THE MAJORITY SELECTED THAT THEIR EXPERIENCE IN MANUAL FLYING IS DURING TAKE-OFF AND LANDING

Question 19: What kind of recent experience of manual flying do you have in line operations?

During take-off and landing only	3,197
During approach	2,444
During climb / descent phase	1,696
During cruise at high altitude (if applicable)	168
In VMC only	917
In good weather conditions only	1,352
In daytime only	433



Answered 3,778 - Skipped 1,872

From the comments, it is indicated, by several respondents, that they used to practice manual flying more in the past than nowadays. Few have indicated that they have not hand flown for at least a year now. Although, other indicated that they usually practice hand flying whenever the conditions permit, others indicated that they hand fly all the time irrespective of time or condition. The main reasons for this being the pilot's personal satisfaction in performing manual flying tasks, the requirement to perform manual flying exercises during simulator sessions and the need to be able to manually fly the aircraft.

The Cruise phase at high altitude is rarely quoted related to manual flying (168 respondents).

Quotes extracted from the survey:

- During SIDS I may fly manually until FL 100. I seldom disconnect in descent until on final unless visually manoeuvring.
- Cruise without autothrust, AP on
- Usually AP OFF from T/O until 10,000 AGL and raw data from 10,000 AGL to Landing
- Day and night in VMC and clear conditions
- I have experience on manual flying in every context, excluding LVO.
- Always manually for T/O and LDG. Occasionally for longer during clb and dec but generally only below 10,000' and for the purpose of personal proficiency. Only during favorable weather conditions. Simulator
- No recent experience at all. The company rules do not allow you to fly the aircraft manually. At least Auto Thrust has to be on, even with the AP off.
- Within the airline limitations, the opportunity to manually fly is exercised as frequently as possible in order to maintain basic skill.

- *I try to fly one raw data ILS approach every few months for practice. Usually manually fly approach if able in actual conditions based on level of fatigue and weather. I.e. first leg is 800 OVC I'll hand fly. After 6 legs late at night down to mins, I'll let the AP fly it to mins.*
- *During gusty/windy approaches, always manual flight incl manual thrust, esp monsoon*
- *Never on departure, due to the busy airspace. On approach usually, I disengage the A/P at 1,000 ft.*
- *We used to fly manually from takeoff to around FL180 and then again from 10,000ft MSL to the runway in all but IMC to an instrument approach. That has changed and now we fly manually in good weather but utilize the autopilot more in IMC and in high task load phases of flight.*
- *In all honesty, I admit that I do generally avoid hand flying in IMC, except occasionally I do hand fly an ILS approach with weather comfortably above Cat I minimums. However, I do fly, on average, between 4 and 8 Cat III ILS approaches (manually with HUD) per year.*
- *I hand fly every leg to 15,000' and every decent and landing from 5,000' to touchdown.*
- *I try to encourage the F/O to hand fly as much as possible, if the weather is above Cat 1 and the crosswind is not limiting. I also normally try to hand fly below 5000' both in climb out and descent, local procedures notwithstanding.*
- *As a training captain, I encourage to switch off A/P within company limitations and fly manually on some occasions below 10,000 ft on takeoff/climb and descend/approach phase. On some certain occasions I encourage to keep the A/P on, e.g. busy terminal environment, marginal weather conditions, or after ling duty.*
- *As an "Old School" pilot I had plenty of manual flying experience at the beginning of my career, including freedom to hand fly wide-bodies at my previous airline (VARIG), but the last 12 years as expat pilot following the Middle Eastern British/Australian/Asian mentality, these opportunities have been drastically reduced. 99% of my colleagues, and also management see manual flight as a safety risk EVEN at the same time admitting that the lack of it also creates a potential safety risk*

European-based respondents are the ones who have more experience in manual handling on the approach than any other flight phase. North American respondents have reported the same experience on takeoff/ landing and during climb and descent. The rest of the respondents' manual handling experience is only during takeoff and landing. All respondents have less experience in manual handling during cruise at high altitude.

	During take-off and landing only	During approach	During climb / descent phase	During cruise at high altitude (if applicable)	In VMC Only	In good weather conditions only	In daytime only
Africa (AFI)	101	73	45	8	37	37	8
Asia Pacific (ASPAC)	627	475	346	34	201	295	75
North Asia (NASIA)	66	52	32	3	27	30	15
Commonwealth of Independent State (CIS)	35	19	14	1	6	16	11
Europe (EUR)	877	943	715	74	260	383	128
Middle East and North Africa (MENA)	938	406	198	8	170	292	66
Latin America and Caribbean (LATAM/CAR)	413	321	206	16	171	243	105
North America (NAM)	140	155	140	24	45	56	25

Question 20: The purpose of this question is to find out when flight crew typically engage the autopilot on departure. 3,677 provided comments.

Question 20: When do you typically engage the autopilot on departure?

The main points highlighted from the comments to this question were that flight levels varied between one operator to another. The minimum altitude for autopilot engagement was generally the acceleration height or around 400 AGL or 500 AGL, though as mentioned this can vary between operators. A good number of the survey respondents flew until the first level off or until climbing and accelerating through 10,000 feet. To be more specific, respondents mentioned that they engage autopilot somewhere between 5,000 and 10,000 feet, or earlier and during complex SIDs. The respondents also reported that there are certain factors that can play a role in their decision making to engage/disengage automation; such factors are congested traffic, weather conditions, workload, captain's decision, pilot incapacitation, FO experience, etc.

Question 21: The objective of this question is to know when pilots typically disengage the autopilot on approach. 3,681 responded to this question.

Question 21: When do you typically disengage the autopilot on approach?

The respondents varied in their responses, however the majority stated that they disconnect autopilot in reference to an altitude (generally 1,000 feet before touchdown if the condition at the time permits), i.e. good weather, normal traffic, being stable, visual conditions, etc. Also, it was stated that they disconnect the autopilot when they intersect with the localizer/glideslope and in accordance to the minimum altitudes, which are given in the aircraft operating limitations.

Question 22: As it is important to practice flying without the autopilot / auto throttle / flight director to maintain proficiency in basic flying skills, we asked the survey participants to answer in percentage, how many approaches they fly with limited automation?

Question 22: Among the sectors that you fly, how many approaches (in %) do you fly with limited automation?

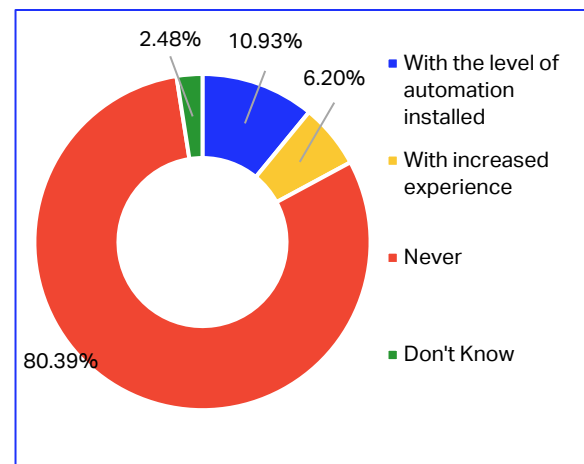
Autopilot (A/P) Off	Of the 3,276 responses, 614 participants said 0% while 526 said 100% and 263 said 10%
A/P and auto throttle (auto thrust – A/THR) Off	Of the 3,155 responses, 1,375 participants said 0% while 236 said 5% and 237 said 10%
A/P and A/THR and Flight director Off	Of the 3,113 responses, 1,650 participants said 0% while 283 said 5% said 271 said 10%

Question 23: Nowadays, it is to be believed that commercial airline pilot handling skills have declined because of the use of automation. As seen throughout this survey, pilots flying with commercial airlines only fly manually for the first and last few minutes of each flight. The intent of this question was to find out the respondents' opinion on manual flying practice, if it is becoming less important. 3,778 responded to this question. Percentages were not calculated for this question because the same participant was able to select more than one answer. The majority selected that they never really believed that manual flying practice is becoming less important. This question also offered the respondents an opportunity to provide their opinion at the end of the question. 216 provided comments. Many of the respondents believe the contrary, that manual flying practice is important.

THE MAJORITY SELECTED THAT THEY BELIEVE MANUAL FLYING PRACTICE IS IMPORTANT

Question 23: Do you believe that manual flying practice becomes less important?

With the level of automation installed	423
With increased experience	240
Never	3,111
Don't Know	96



Answered 3,778 - Skipped 1,872

From the comments received, most respondents believe that manual flying practice is important and that it should not be replaced by simulator specific training.

While most respondents recognize the importance of maintaining manual flying skills, they believe that an integrated approach covering initial, recurrent simulator training as well as manual flying during line operation is needed. Enough time in simulator training should be allocated to foster the development and maintain these skills, specifically in the recognition of failed or contradictory instrumentation. They also believe that operators should have a company policy regarding manual flying. Manual flying practice shall be considered every time the conditions allows it, with of course strict monitoring skills.

Quotes extracted from the survey:

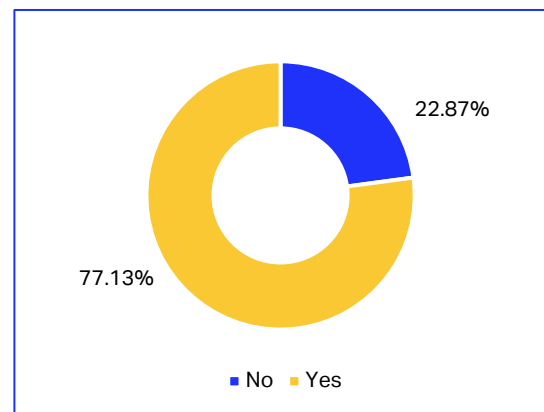
- *Proficiency in manual flying will always be important in the event that flying with automation becomes unavailable due to mechanical failure, emergency situation, or airport with limited approach capability.*
- *It is a very important skill that must be kept up.*
- *Obviously, automation failure but also, it's the most enjoyable part of the job!*
- *Companies encourage manual approaches but monitoring criteria by company seems to discourage in case these limits are exceeded.*
- *Very important, and it's the part of the job that I enjoy the most.*
- *Manual flying skills are always important and if not frequently practiced do become rusty.*
- *Pilots must keep their manual flying skills high for when automation fails. Regular practice is essential.*
- *Manual flying proficiency is fading especially among pilots whose sole experience is with 4 gen a/c, no wonder why LOC-I has become number 1 category killer in commercial aviation.*
- *Modern commercial operations rely on automation and technology being used within their design, such as GLS or RNAV approaches so manual flight becomes less important in normal operations.*
- *I firmly believe that manual handling and instrument scan should be practiced more often. We should be able to hand fly without any automation if the situation allows it.*
- *I personally believe manual flying should be encouraged. Nowadays pilots rely too much on automation and loose basic manual flying skills.*

Question 24: The intent of this question was to determine if the automated cockpit environment has any effect on flight crew coordination? 3,778 responded to this question. The majority reported that the use of automation has an impact on flight crew coordination. This question also offered the respondents an opportunity to provide their comments at the end of the question. 2,208 provided comments.

77% BELIEVE THAT THE USE OF AUTOMATION HAS AN IMPACT ON FLIGHT CREW COORDINATION

Question 24: Does the use of automation have any impact on flight crew coordination?

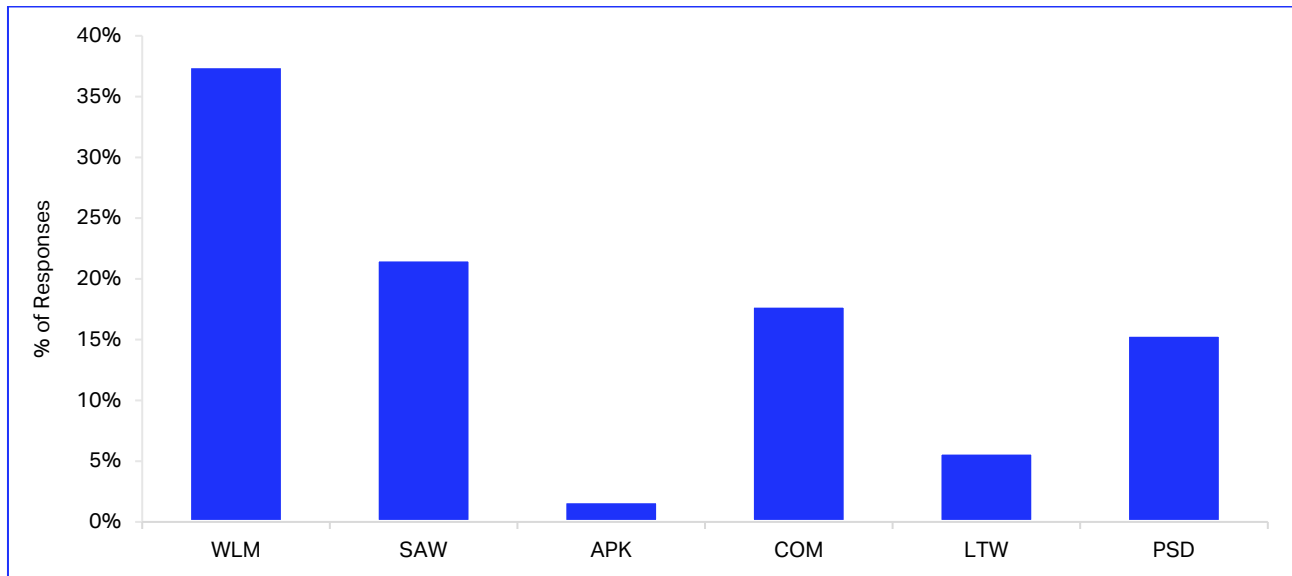
No	22.87%	864
Yes	77.13%	2,914



Answered 3,778 - Skipped 1,872

One should note that one-third of the respondents skipped the question.

Pilots quote WLM (375%) as a key competency to succeed in this area. Other competencies as SAW and COM are cited less frequently.



Some of the main comments from the respondents with regards to automation are as follows:

- Automation provides better monitoring, cross checking, communication and coordination but reduces the level of manual flying skills, and hence reduces the confidence to fly the aircraft without automation.
- Automation changes the allocation of tasks within the cockpit. Flying with automation (AP/FD/ATHR) increases the capacity of monitoring for the PM.
- Some respondents believe that the use of automation increases situation awareness, especially in high demanding situations. While other respondents believe that automation can reduce crew situation awareness because of the feeling that the aircraft can do everything by itself.
- Automation can increase workload especially during emergency and non-normal situations.
- The advanced automated systems generate new challenges, such as complacency and overconfidence.
- Automation enhances safety and increases situation awareness when workload is high, operating in congested airspace, in bad weather, operating to new airports and with new flight crew, etc.
- Automation decreases manual flying skills, in particular, in Generation 4 aircraft, which are more likely operated with the highest degree of automation.

Some of the main comments from the respondents with regards to manual flying are as follows:

- Manual flying can lead to a lack of crew coordination. It can also increase workload and the level of stress in the cockpit.
- Manual flying helps maintain proficiency in situations that exclude the operability of the autoflight systems.
- Manual skills can deteriorate without regular practice.

Some of the recommendations provided by the respondents are:

- Both crew members should have a good knowledge of the aircraft automation.
- Pilots should not be discouraged to hand fly the aircraft; they should be encouraged to hand fly in sectors where the workload expected is compatible with the pilots' personal limitations.
- Increasing confidence in hand flying is obtained through training and practice.
- Proper training, robust SOPs, efficient CRM will mitigate the impact when transitioning to manual handling.

Quotes extracted from the survey:

- Pilots are losing the ability to better coordinate the tasks during manual operations. The PM gets overloaded by the PF' demands. The pilots are forgetting to study the manual flight SOP, call outs, etc.
- Automation, if used wisely, can help the flight crew focus more on ATC, weather avoidance, etc.
- As you rely more and more on automation, workload is reduced thus coordination may relax.
- AP on is better coordination. Manual flying takes mental energy.
- The lack of automation is a great training tool for new first officers as it forces them to be assertive in the cockpit as the PF's hand are full flying the plane. If errors have been made, they are able to understand better the reasons as to why they happened. It helps improve their confidence.
- Good training and understanding of auto systems will result in good coordination.
- Due to our company policy, the amount of practice that, especially inexperienced pilots get, is so minimal that it leads to a reduction in safety margins, i.e., when the automation fails or during crosswind landings.
- Flight deck automation has provided significant benefits, such as economic efficiency, increased precision and safety, and enhanced functionality within the crew interface. These enhancements, however, may have been accrued at a price, such as complexity added to crew/automation interaction that has been implicated in a number of aircraft incidents and accidents.

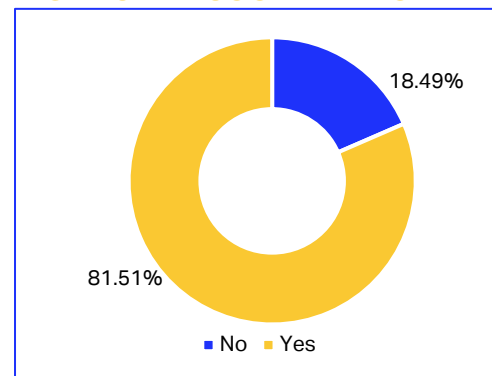
It is important to note that if pilots do not fully understand the aircraft's automated system, are unsure about its behaviour and/or have poor monitoring of the level of automation, this can lead to loss of mode awareness and reduced situation awareness.

Question 25: The intent of this question was to understand if hand flying has an impact on flight crew coordination. 3,731 responded to this question. This question also offered the respondents an opportunity to provide their comments at the end of the question. 2,346 respondents provided comments.

82% REPORTED THAT HAND FLYING HAS AN IMPACT ON FLIGHT CREW COORDINATION

Question 25: Does flying manually have any impact on flight crew coordination?

No	18.49 %	690
Yes	81.51 %	3,041



Answered 3,731 - Skipped 1,919

Some of the main comments from the respondents with regards to manual flying are as follows:

- Hand flying increases workload, especially for the PM with consequences on monitoring effectiveness.
- Hand flying reduces mental capacity and hence the ability to interact and communicate effectively.
- Hand flying may decrease situation awareness in complex situations and lower safety margins.
- Delegation of tasks may be overlooked especially in high workload environments or in challenging situations. Communication between the flight crew may break down because of their focus on the aircraft parameters - that's where proper briefing comes in and pilots' good judgement to assess the proper level of automation that should be used.

- Flying manually sharpens senses for aircraft reactions, energy management and increases self confidence in own capabilities in non-normal situations.
- Flight Crew are accustomed to automation, so when automation is not used, they can easily become confused.
- SOPs are usually tailored for Auto flights, the lack of encouragement and proficiency in manual handling can cause confusion.
- Less automation usually means a slightly higher workload for both crew members, thus less capacity for checklists, briefings, etc.

Furthermore, as seen throughout the survey, one of the advantages of automation is the reduction of workload. But in non-normal situations, pilots can become task saturated.

Some of the recommendations provided by the respondents are:

- All flight crew must be well coordinated and should be in the loop.
- A good level of flight crew coordination during manual flying can be achieved through proper training and briefing.
- Operators' standard operating procedures related to manual flying should be well established, and flight crew should be well prepared and briefed.
- Increases pilot's confidence and handling, will improve flight safety when converting to manual flying.

Quotes extracted from the survey:

- *The PF has less capacity, and so will likely reach task saturation sooner than PNF. Practice hand flying increases spare capacity.*
- *Increases workload for both pilots. Largely because I don't believe we do it enough.*
- *Increases workload especially for PM, reduces effectiveness of monitoring.*
- *High workload reduces the ability to communicate.*
- *Takes away concentration from monitoring other aspects of the flight, such as flight path or ATC communication.*
- *While flying manually more attention is diverted to aircraft handling, therefore less spare capacity to monitor different aspects of the operation.*
- *Crew are used to flying with auto pilot on, when they have to fly manual, there is a momentary confusion on the PM's side, in the manipulation of switches and knobs, as now the PF is flying manually.*
- *Flying your airplane frequently and recurrently helps growing your basic flying skills and thus your self-confidence and means less stress. Eventually it sets free extra situation awareness capacity which might help in dealing with more challenging situations.*

Question 26: This question asked respondents to rank the factors that may lead to degradation of manual flying competency, with the most important being 1. The most important factors leading to degradation of manual flying competency were associated with issues related to airline policies that direct the pilots to use automated systems over manual flying, fatigue, and lack of practice. 3,425 responded to this question.

Question 26: Please rank the factors that may lead to degradation of manual flying competency, with the most important being 1.

	1	2	3	4	5	6	7	8
Airline policies that direct the pilots to use automated systems over manual flying	5.25%	14.67%	11.08%	8.77%	7.49%	7.49%	8.05%	7.18%
	1,129	470	355	281	240	240	258	230
OEM operational policy in regard to automation	2.80%	14.03%	10.22%	9.59%	12.14%	13.72%	15.85%	21.64%
	89	446	325	305	386	436	504	688
Fatigue	17.07%	11.09%	15.64%	12.89%	12.14%	11.12%	9.42%	10.63%
	551	358	505	416	392	359	304	343
Inadequate training	8.55%	15.03%	14.72%	19.49%	13.51%	12.26%	8.80%	7.64%
	274	482	472	625	433	393	282	245
Overreliance on automation	11.47%	14.60%	15.34%	14.88%	17.02%	12.55%	8.99%	5.15%
	370	471	495	480	549	405	290	166
Crew Resource Management e.g. Captain reluctant to downgrade the level of automation when the first officer would like to practice	2.16%	5.68%	9.13%	12.10%	17.28%	22.25%	16.85%	14.56%
	70	184	296	392	560	721	546	472
Lack of understanding of automation modes and/or workload management during manual handling	0.38%	6.68%	10.37%	11.10%	13.11%	13.94%	24.21%	18.21%
	78	219	340	364	430	457	794	597
Lack of practice	22.60%	19.45%	14.77%	11.77%	7.89%	5.34%	5.69%	12.49%
	762	656	498	397	266	180	192	421

Question 27: We wanted to know how often the respondents have encountered an unstable approach as a result of manual flying in the past 5 years, and how often did that result in a missed approach; and if this was managed using automation or manually flown. 3,190 responded to this question. The responses varied and were not specific or clear in regard to the number of missed approaches and/or go-arounds.

Question 27: How often have you encountered an unstable approach as a result of manual flying in the past 5 years, and how often did that result in a missed approach; and was this managed using automation or manually flown.

The main points highlighted are:

- A very good number of respondents confirmed that they had never encountered unstable approaches due to manual handling in the last 5 years.
- Those who encountered unstable approaches reported that they were not due to manual handling but to other factors, such as inexperienced flight crew, aircraft management, configuration, poor planning, late ATC clearance and/or unclear ATC instructions, adverse weather conditions, turbulence, change of aircraft fleet

and airline policies that either provide for strict maintenance of stabilization criteria, thus giving very little room to set the pilot up for an unstable approach or do not encourage manual handling.

- Spatial disorientation, fatigue, poor judgement and lack of practice of manual handling also were factors contributing to their unstable approaches that ended up in missed approaches.
- Several respondents reported that their unstable approaches / missed approaches were mainly due to automation. It is to be believed that it is not the automation itself but the failure to monitor automation (FMC, ILS, A/THR, etc.) or the lack of adequate understanding of the automation.

Respondents do not make any direct link between manual flying and unstable approaches. The main contributing factors to unstable approaches remain: unexperienced pilots, poor aircraft management, failure to appropriately monitor automation, late ATC clearances, etc.

Quotes extracted from the survey:

- *Zero unstable approaches due to manual flying / 0 G/A (1 G/A due to wake turbulence of preceding aircraft during AP/ATHR/FD OFF approach -> not a manual flying problem).*
- *You are more likely to have an unstable approach using automation because sometimes automation doesn't work well.*
- *Encountered unstable approaches for other reasons.*
- *Usually the manual part comes as an intervention to not being able to correctly use automation and managing it in a timely manner.*
- *All my missed approaches were due to bad weather/poor ATC/poor descend planning. I never had to perform a missed approach due to a manual unstable approach.*
- *Manual flying is not a common practice in the airline.*
- *Three unstable approaches using automation resulted in go around. No unstable approach as a result of manual flying because it is never practiced in line operations.*
- *Flying manually is the best way to achieve a target. Automation is quite slow in some situations.*
- *As a matter of fact, I've seen more automatic than manual unstable approaches, because the use of autopilot does not replace good planning skills (you can reach final app. with too much speed and/or altitude and still have A/P and A/T on...).*
- *As a result of manual flying...none. As a result of over reliance on automation twice and both did not result in a missed approach. They were resolved due to manual flying.*
- *Not that often but on the other side, manual flying helped us avoid a go around due to a very bad vectors to approach.*
- *Very often the lack of practice of hand flying ends up in a missed approach.*
- *It is not very often, but the last time I had an unstable approach was flown using automation.*

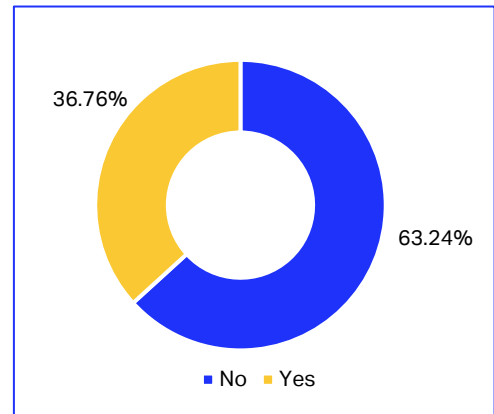
Question 28: The aim of this question was to understand if pilots are reluctant to disengage the autopilot and hand fly the aircraft. Of the 3,452 responses, 37% of the respondents confirmed they hesitate to disengage the autopilot and take over manual control. Furthermore, in order to understand why pilots are reluctant to intervene with automated systems and disengage the autopilot, we offered the respondents an opportunity to provide their comments at the end of the question. 1,382 provided comments.

63% REPORTED THAT THEY ARE NOT RELUCTANT TO DISENGAGE THE AUTOPILOT

Question 28: Have you ever been reluctant to disengage the autopilot?

No	63.24%	2,183
Yes	36.76%	1,269

Nearly 40% of the respondents skipped the question about preference to keep automation engaged.



Answered 3,452 - Skipped 2,198

Their hesitations to disengage auto pilot are highlighted below:

- When flight crew is fatigued, after long night flight, in low visibility, busy environment, high workload, operating on new fleet, complex approaches, challenging environmental conditions and/or late ATC clearance
- Due to flight crew performance, experience and/or judgment at that time
- Pilots have more confidence in the automation than they do in manual handling skills
- Flight crew are discouraged to fly manually due to their company policy;
- When flight crew are operating in IMC and in the presence of the environmental factors that might increase operational complexity;
- Due to the company blame policy and the punitive culture in their company;
- Due to FOQA Parameters, exceedance is not allowed.

Based on the voluntary comments from the respondents, the survey highlighted that some pilots were reluctant to intervene due to strict company policy and culture, long night sector flight and fatigue, as well as poor weather, strong wind and low visibility. In addition to the above, some concerns were about the increasing workload. Finally, poor training and lack of manual flight experience were also emphasized.

Quotes extracted from the survey:

- *Uncomfortable flying manually due to lack of training or fatigue.*
- *Because of fatigue, bad wx, bad ATC, not encouraged by company, fellow crewmembers uncomfortable with it.*
- *Challenging environmental conditions, reluctant captain, fatigue.*
- *Fatigue and the stress of being called into the office and of being issued a warning letter.*
- *Where busy airspace/airport /fatigue.*
- *CRM factors were an issue.*
- *I am confident in my manual flying skills however the permission for more manual flying is essential.*
- *Due to lack of self-confidence. The list shown with an order of reasons that prevents manual flying e.g.: lack of practice caused by airline policy that prevents this; CRM factors that cause a Capt not to allow an FO to fly manually.*
- *In some situations, I will be reluctant - but may increase my vigilance of autopilot behaviour. For example, on an ILS approach in VMC, the critical areas are not protected. Surface movements may cause interference with LOC or GS signals. If TWR cautioned us, I would be reluctant to commence manual handling. If oscillations were observed, I would guard controls but leave autopilot engaged, unless it became "necessary" to disengage. Manually flying increases my workload, and I am likely already tired, or starting a long duty.*
- *Have made conscious effort to maintain manual flying skills and maintain scan rate. Aim to hand fly an approach from 10000' conditions permitting, on the line, once a week on average. It is a skill to look through*

the automation and it must be practiced. I have looked through flight directors' numerous times when I can see it was not appropriate for the conditions.

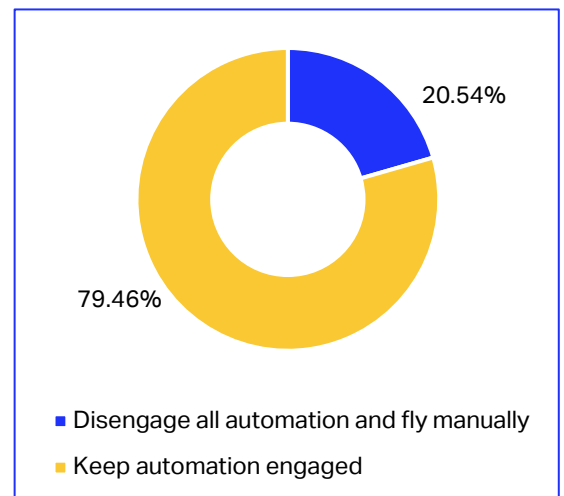
- *The airline company's strong support for automation and dislike of manual flying creates captains who fear manual flying.*
- *I feel comfortable flying manually on (long) final or during departure. I must admit that flying a complete approach by hand from say 10,000ft with stepdown would feel somewhat challenging because of a lack of practice.*
- *When you feel the aircraft is not doing what you expect it to do then disengage and fly manually while PM reprograms the FMS.*
- *I was thinking that the Captain would criticize my manual flying skills.*
- *I simply do not disengage the A/P since it is not allowed, and any exceedance would be greatly punished.*
- *In strong, gusty winds in addition to moderate turbulence in the terminal area whilst on approach. The temptation is to let the automation handle it for as long as possible. But there is also the danger of disconnecting too late and not having enough time to get to grips with the manual handling of the aircraft in the above-mentioned conditions.*
- *FOQA deviations are a NO GO in our policy.*

Question 29: The purpose of this question was to know if pilots disengage or keep all automations engaged in an event of loss of situation awareness. 3,452 responded to this question (and 2198 skipped the question). Most of the survey respondents reported that they keep automation engaged in such situation.

79% REPORTED THAT THEY KEEP AUTOMATION ENGAGED IN AN EVENT OF LOSS OF SITUATION AWARENESS

Question 29: With autopilot engaged, in the case that situation awareness is lost, and until situation is recovered; do you prefer to:

Disengage all automation (AP, FD, ATHR) and fly manually	20.54%	709
Keep automation engaged	79.46%	2,743



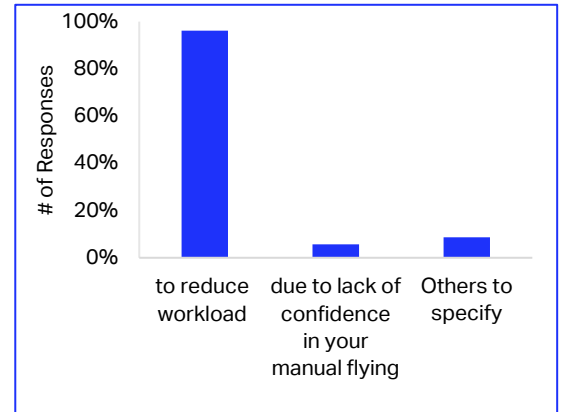
Answered 3,452 - Skipped 2,198

Question 30: We wanted to know the reason why they prefer to keep the automation engaged. 2,718 responded to this question (but 2,932 skipped the question). The majority reported that they keep the automation engaged to reduce workload.

96% OF THE RESPONDENTS REPORTED THAT THEY KEEP AUTOPILOT ENGAGED TO REDUCE WORKLOAD

Question 30: If you prefer keeping automation engaged, is it:

to reduce workload	96.14%	2,613
due to lack of confidence in your manual flying	5.70%	155
Others to specify	8.65%	235



Answered 2,718 - Skipped 2,932

The main point from the comments received under the category "Others" with regards to why they keep the automation engaged is "company policy and consequences":

Other reasons are:

- To be able to scan, evaluate the situation, and monitor more
- To achieve a better situation awareness
- Fatigue

Quotes extracted from the survey:

- *There are different cases where I would disconnect everything such as in unreliable speed indication, however on the other hand, there are situations where I would keep the automation engaged, such as encountering severe turbulence. The manuals are quite clear on this kind of topic.*
- *If the plane is flying normally but the pilots have lost SA disengaging the autopilot will lead to two pilots with degraded SA trying to fly a plane manually without understanding what is going on, possibly making matters worse. If the automation is the source of confusion, then resorting to manual flight may be the best option. It depends on the situation, but initially I would say do nothing until you have figured out what's going on.*
- *If situation awareness is lost, it is most important to regain the overview. If the situation awareness has been lost in regard to the state of the automation, I would switch the whole automation off.*
- *I would rather downgrade automation a level, instead of going completely raw data. If situation calls for it, I would not hesitate to disconnect and maintain wings level, pitch and power adequate for the flight phase until I can regain SA.*
- *There is a reason for pilots to lose situation awareness. In that case leave automation ON during the time needed to regain control of the situation.*
- *Spare more capacity to analyse the situation and regain situation awareness.*

5.4. Training Policy

Question 31: We called for comments on the best way to improve manual handling skills, e.g., using the aircraft with FD only. 2,493 provided comments.

Question 31: What do you think is the best way to improve manual handling skills? For example, using the aircraft with FD only.

The main comments highlighted the following:

- The respondents expressed the need that airlines develop and implement a non-punitive environment.
- Respondents expressed the need to urge airlines to embed the opportunity for pilots to practice, when appropriate, manual flying in their respective policies.
- Pilots are aware of the need for manual aircraft control training and clearly expressed this need when responding to the survey.
- More manual handling practice dedicated in simulator training and in line operations.
- Operators should ensure that their pilots have the manual handling skills and confidence to take control of the aircraft if automation does not perform as expected.
- Respondents have also expressed their interest to go back to basics, practice on raw data flying with FD off.

Quotes extracted from the survey:

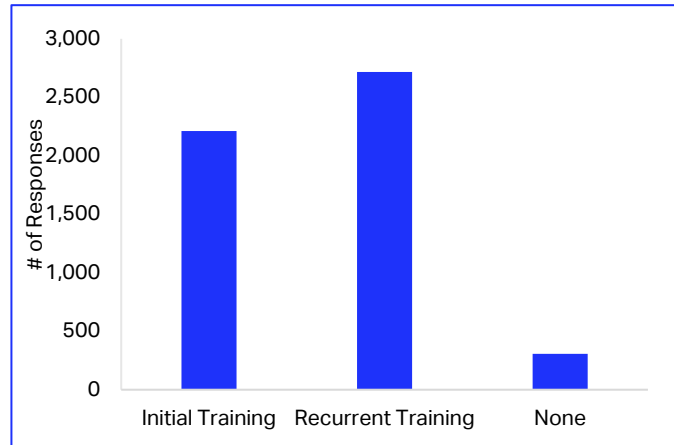
- *Less punitive on criteria and reporting of exceedance from flight safety department may give the pilots more confidence to disengage.*
- *More simulator sessions with touch and go and fly with FD off at least during climb until 10000 feet.*
- *Encouraging manual flying in every phase, including cruise.*
- *Disengage A/P (and auto throttle if applicable) on approach when in sight of surface and hand fly. Delay engaging A/P on departure.*
- *More practice and training.*
- *The best way is purely raw data flying but there is a "time and place". FULLY BRIEFED PRIOR TO EXECUTION with associated threats to be mitigated.*
- *A sensible policy that encourages manual flying in appropriate circumstances.*
- *Using the FD only is a good idea to increase confidence.*
- *Autopilot and auto throttle disengaged then when confident that things are well flight director off. I believe it results in a smoother transition to manual flight.*
- *Focus more on training rather than checking during sims. Encourage manual flying in VMC.*
- *Company to encourage more manual flying practice.*
- *Flying manually where possible on the line. More training during simulator sessions - practicing manoeuvres such as go-arounds without the use of F/D, etc.*
- *Practice in simulators, practice during line training and non-punitive environment if mistakes happen.*
- *FDA doesn't help. Knowing you have a computer "breathing on your neck" doesn't exactly encourage you to perform a manual approach unless conditions are clearly favourable. Flying the A/C with F/D only would help, but it has to be company policy.*
- *I think FDM is a big, and probably the main, reason why a lot of pilots don't fly manually anymore. They would rather not have that email or phone call from the safety department. "Better to stay out of trouble and under the radar". So many things are monitored and will be flagged if limits are broken, hence it's easier to just let the AFDS fly us to the FAF.*
- *Manual flying in both the departure and approach phases in order to maintain smooth, consistent handling of the aircraft while also maintaining complete situational awareness.*

Question 32: The purpose of this question was to see if and when pilots receive manual flying training? The percentages were not calculated for this question because the same participant was able to select more than one answer. They all indicated that their initial and recurrent training allow flight crew to practice manual flying. 307 respondents however specified that their training does not include manual flying competency.

307 RESPONDENTS SPECIFIED THAT THEIR TRAINING DOES NOT INCLUDE MANUAL FLYING COMPETENCY

Question 32: In which training session(s) does your airline specifically train manual flying competency?

Initial Training	2,211
Recurrent Training	2,716
None	307



Answered 3,432 - Skipped 2,218

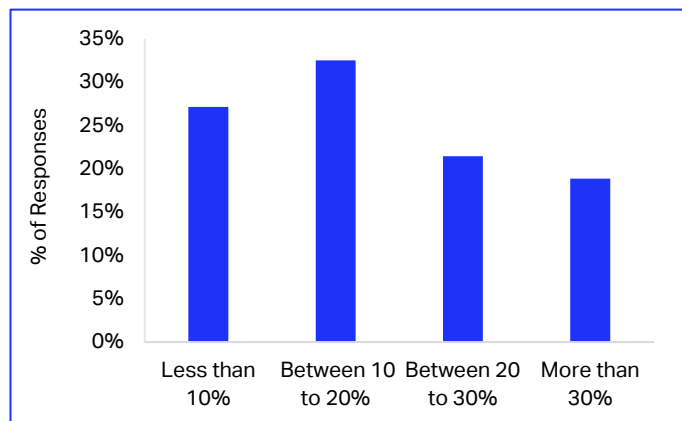
The respondents indicated that it is more in the recurrent training sessions than in initial training that they train the FPM competency. It should also be noted that 307 respondents indicated that the FPM competency is not trained at all in simulator sessions.

Question 33: This question asked the respondents to specify the percentage of time that is dedicated to manual flying in recurrent training. 3,031 respondents to this question. Also, this question gave the respondents the possibility to provide the amount of time dedicated to manual flying competency training if not specified in the table below. 1,255 provided comments.

33% REPORTED THAT THE ALLOCATED TIME IS BETWEEN 10 TO 20% OF THEIR TRAINING

Question 33: Please specify the percentage of time that is dedicated to manual flying in recurrent training.

Less than 10%	27.15%	823
Between 10 to 20%	32.53%	986
Between 20 to 30%	21.45%	650
More than 30%	18.87%	572



Answered 3,031 - Skipped 2,619

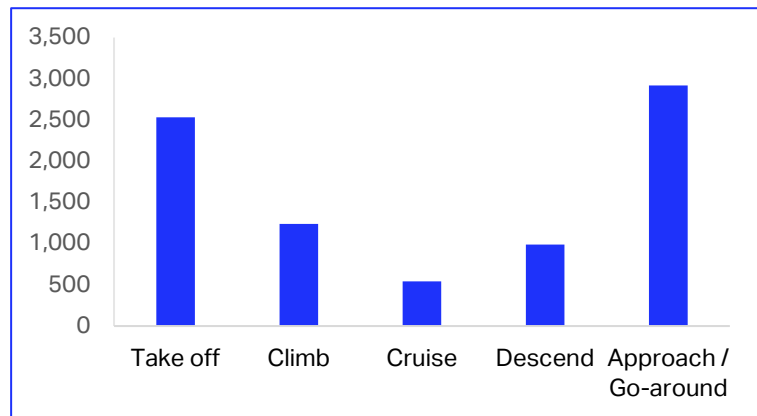
The majority indicated that the amount of time allocated to such training was less than an hour per training session; to be more specific, the respondents indicated that the time allocated is about 30 minutes.

Question 34: We wanted to know in which flight phase pilots receive manual flying training. 3,058 responded to this question. The percentages were not calculated for this question because the same participant was able to select more than one answer. There is a significant low figure regarding the cruising phase: the paradox is that CRZ phase is the less trained in simulator and the less trained in operations (due to legacy restrictions).

MANUAL FLYING TRAINING IS NOTABLY STRONGER IN APPROACH / GO-AROUND, LANDING, AND TAKEOFF

Question 34: When performing manual flying training, which flight phases are trained?

Take off	2,532
Climb	1,240
Cruise	542
Descend	988
Approach / Go-around	2,918
Landing	2,872



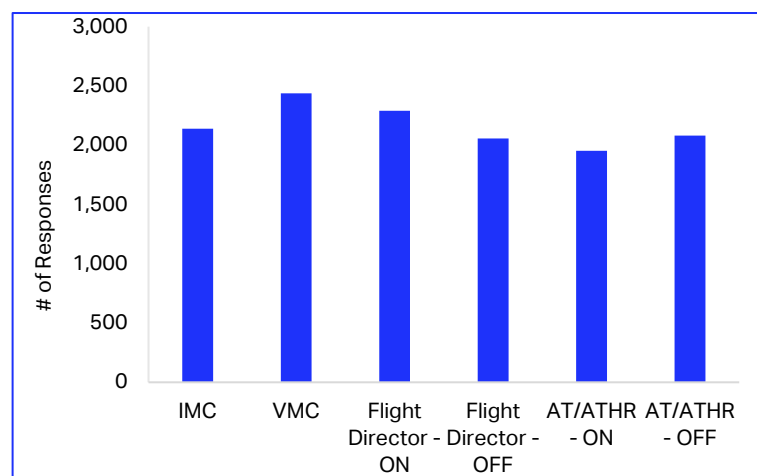
Answered 3,058 - Skipped 2,598

Question 35: We wanted to know in which operational conditions pilots receive manual flying training. 3,058 responded to this question. The percentages were not calculated for this question because the same participant was able to select more than one answer. Manual flying training is performed relatively in the same way in all operational conditions.

PILOTS RECEIVE TRAINING IN ALL OPERATIONAL CONDITIONS

Question 35: When performing manual flying training, in which operational conditions are you trained?

IMC	2,139
VMC	2,438
Flight Director - ON	2,290
Flight Director - OFF	2,057
Auto throttle auto thrust (AT/ATHR) - ON	1,953
Auto throttle auto thrust (AT/ATHR) - OFF	2,081



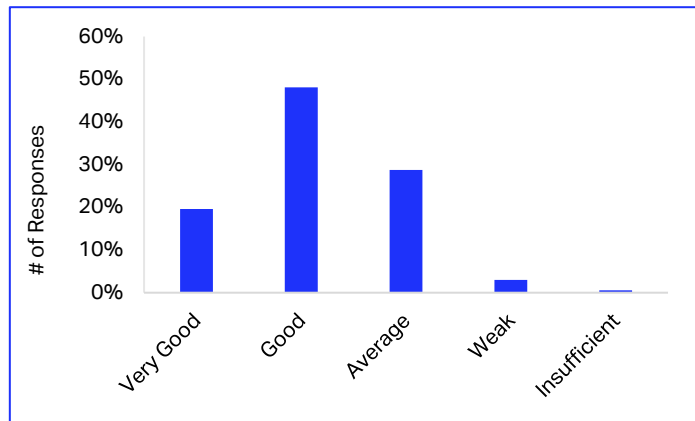
Answered 3,058 - Skipped 2,592

Question 36: We wanted to know how the respondents would rate their manual flying competency. The majority rated their manual flying competency as good.

48% OF THE 3,358 RESPONSES RATES THEIR MANUAL FLYING COMPETENCY AS GOOD

Question 36: How would you rate your manual flying competency?

Very Good	19.62%	659
Good	48.09%	1,615
Average	28.74%	965
Weak	3.01%	101
Insufficient	0.54%	18



Answered 3,358 - Skipped 2,292

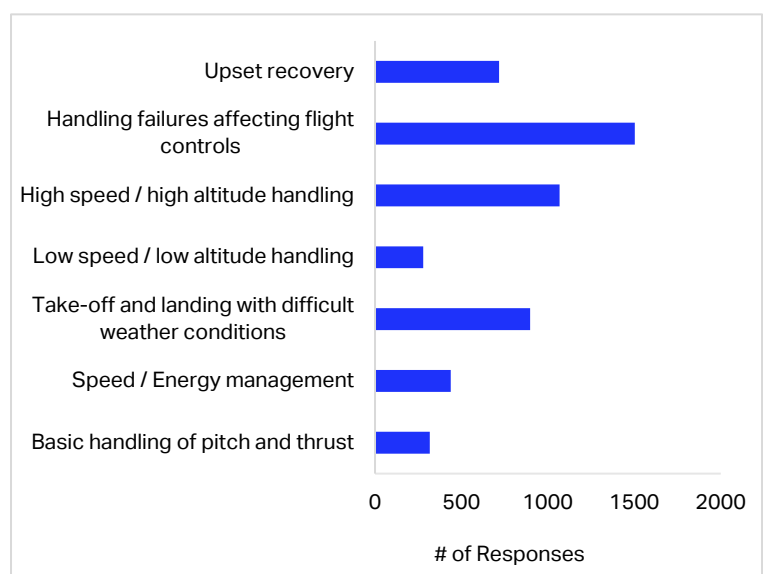
Pilots have a higher perception of their manual flying skills compared to objective data issued from EBT airlines grading data. As pilots strongly believe that their skills are adequate/good to face day to day situations on an aircraft, the airlines (through instructors' observations) note that during simulator sessions the pilots' manual flying skills could be improved (for example in non-normal situations).

Question 37: The aim of this question was to determine in which area of manual flying they feel less competent. 3,358 responded to this question. The percentages were not calculated for this question because the same participant was able to select more than one answer. Most of the respondents felt less competent in the areas associated with handling failures affecting flight controls as well as high speed / high altitude handling.

THE RESPONDENTS FELT LESS COMPETENT MANAGING OR HAND FLYING THE AIRCRAFT WHEN DEALING OR HANDLING FAILURES AFFECTING FLIGHT CONTROLS

Question 37: In which part/s of manual flying do you feel less competent?

Basic handling of pitch and thrust	317
Speed / Energy management	438
Take-off and landing with difficult weather conditions	897
Low speed / low altitude handling	279
High speed / high altitude handling	1,068
Handling failures affecting flight controls	1,503
Upset recovery	718



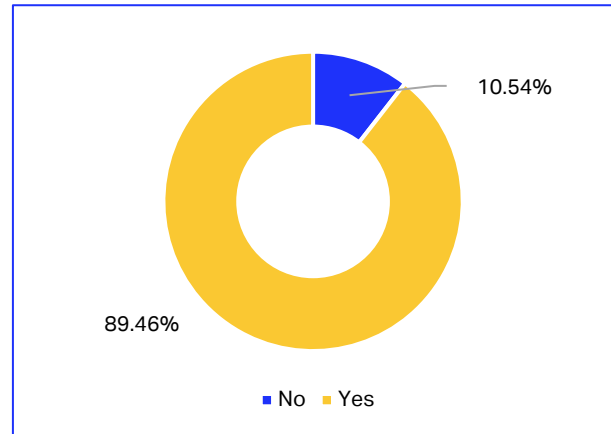
Answered 3,358 - Skipped 2,292

Question 38: The purpose of this question was to gain more insight into the respondents opinion in regards to their airline using flight simulation training devices (FSTD), including Full Flight Simulator (FFS), in their recurrent sessions to train and enhance manual flying skills. 3,358 responded to this question. The majority responded yes to this question, meaning that they would like their airline to use FSTD, including FFS, in their recurrent sessions to train and enhance manual flying skills.

89% OF THE RESPONDENTS REPORTED AFFIRMATIVE

Question 38: Does your airline use flight simulation training devices (FSTD), including Full Flight Simulator (FFS), in recurrent sessions to train and enhance manual flying skills?

No	10.54%	354
Yes	89.46%	3,004



Answered 3,358 - Skipped 2,292

Moreover, we asked those respondents who answered no, to provide an explanation to support their answer: 291 provided comments. The main comments were related to:

- Training is not dedicated to manual handling (based on a voluntary process in some cases)
- Training is offered only in respect to upset recovery, non-normal situations, emergencies, malfunctions
- There are too many items to be covered, so manual flying takes a back seat and is not the primary focus
- Manual handling practice sessions involve limited raw data flying
- The time allocated for such training is not enough

Quotes extracted from the survey:

- *Too many items to be covered so manual flying takes a back seat.*
- *Insufficient time, as most recurrent sessions are predominated by regulatory and mandatory items.*
- *To a limited degree during recurrent training sessions, all of which are done in FFS. Also, our pilots are permitted to book FSS when they are available. I do this 2-3 times a year to practice manual flight, no A/P, auto throttle, or F/D. It is voluntary, some pilots do it, others not at all.*
- *Yes, we do manual approaches IMC, VMC and other manual training, such as Stall, upset recovery, steep bank and so on.*
- *We practice visual traffics on all FFS sessions. The focus in FFS is on following procedures and emergencies.*
- *In general, the time spent with manual flying in the simulator consists of regulatory maneuvers like one engine out takeoff and approach, TCAS and GPWS maneuvers and upset recovery, it's exclusively mandatory time. There are occasional exceptions with some other specific TRI/TRE.*
- *Once checked to line I see the simulator 4 days a year. 2 days per session. All those sessions deal with failures, etc., nothing about a normal Ops. Circuits or cruising, etc.*

Question 39: This question aimed at getting a subjective assessment from the respondents as to whether they believe that training in FSTD, including FFS or manual flying in line operation, can improve manual flying competency or compensate for the lack of manual flying during line operations. 3,358 responded to this question.

MANY OF THE RESPONDENTS DISAGREED

Question 39: To what extent do you agree or disagree with the following?

	Training in FSTD (including FFS) is sufficient to enhance manual flying competency	Training in FSTD (including FFS) can compensate for the lack of manual flying during line operations	Manual flying in line operations is sufficient in order to maintain or to enhance manual flying competency
Strongly Disagree	457	502	217
Disagree	1,267	1,130	1,038
Neutral	632	596	721
Agree	836	969	1,115
Strongly Agree	195	192	303

To better understand the reason(s) behind their response, we provided the respondents space to comment. 1,167 provided comments to support their response. The main points highlighted were that:

- The experience in a simulator is not the same as in an aircraft. A balance of regular line flying, and simulator flying is required to maintain and enhance the needed skills.
- Confidence to downgrade the level of automation during line operations is gained in the simulator.
- Manual flying should be practiced in FSTD and FFS as well as line operations because simulator training does not give the same effect as in real line operation. A combination of both is required.
- More time should be allocated to manual flying whether in a simulator or in real life.
- Manual flying in the simulator such as steep turns, approach to stall recovery and go arounds should be part of a warmup session at the beginning.
- Due to the punitive culture in some of the companies, flight crews are forced to use automation.

Quotes extracted from the survey:

- *Nothing quite replicates the real aircraft. However, I find that the opportunity to practice in the SIM is good for confidence.*
- *Simulator feeling doesn't match the real experience. As there is almost no chance to practice in normal operations there is very little chance to enhance. Practice should be mandatory.*
- *Manual flying in line ops is limited to a small number of manoeuvres where in a sim you can replicate unusual or more demanding situations.*
- *Although the feedback in most simulators is not as good as in the aircraft, time can be allowed in the simulator to train the correct techniques which can then be applied to the line.*
- *A combination of both FFS and line flying is the best way to maintain manual flying skills. Certain things cannot be practiced in line flying, but line flying is what we do the most, hence it is where we are most likely to maintain our skill.*
- *The simulator is a very good tool for allowing pilots to face situations they are unlikely to have during line operations and practice their skills in a safe, controlled environment. However, the simulated environment is not a replacement for the real one and confidence grown from manual flight during line operations will help ensure the pilot feels capable of handling the aircraft when there is no 'pause' button.*

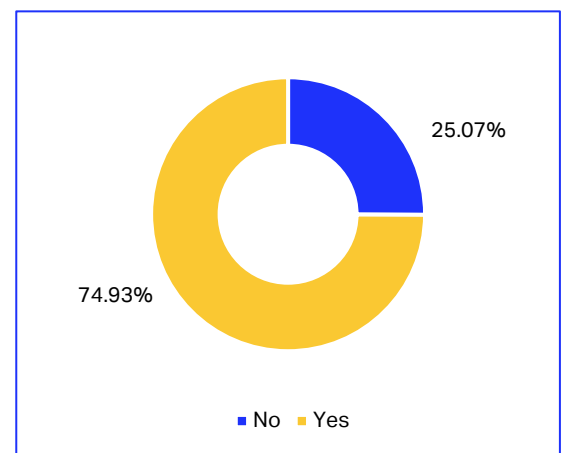
- *Hand flying 1 approach every 6 months is not sufficient to maintain hand flying skills. An approach should be manually flown on the line at least once a week to maintain proficiency.*
- *Hand flying is a skill that must be practiced. You can learn the basics, and experience situations you couldn't safely practice in a sim, but this must be backed up by regular hand flying in real world conditions.*
- *I would like to be encouraged to hand fly more, but I feel my current airline is too quick to penalize crews for making errors. As such it is easier - and safer for my job prospects - to stick with the automatics unless forced not to.*
- *Flying manually during line operations will give the practice that is needed for normal flight. However extra practice of abnormal/upset situations is required in the simulator.*
- *The simulator feels unrealistic since the traffic cannot be simulated and also you always have in the back of your head that a mistake won't be punished unlike actual flying.*
- *If Company policy allowed the PF to manually fly approaches without autopilot or autothrust and occasionally without Flight Director during low threat daytime operations, this would be sufficient to compensate for the current lack of competency and confidence in manual flying. The barrier to this though is the Company's attitude to penalizing Flight Deck crew for minor FDR and QAR exceedances. Many sackings have occurred during these past 15 years, so the pilot force complies with the Automation policy.*

Question 40: We wanted to know the opinion of the respondents on whether training should put more emphasis on the expected transition from automatic flight to manual flying and vice versa? 3,358 responded to this question. The majority believe that training should put more emphasis on the expected transition from automatic flight to manual flying and vice versa.

75% OF THE SURVEY RESPONDENTS RESPONDED AFFIRMATIVE

Question 40: Do you believe that training should put more emphasis on the expected transition from automatic flight to manual flying and vice versa?

No	25.07%	842
Yes	74.93%	2,516



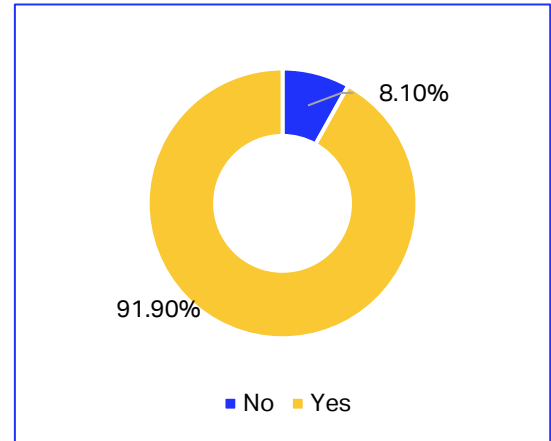
Answered 3,358 - Skipped 2,292

Question 41: As with question 40, we wanted to know the opinion of the respondents on whether training should put more emphasis on the unexpected transition from automatic flight to manual flying and vice versa? 3,358 responded to this question. A large majority of respondents (91,90%) believe that training should put more emphasis on the unexpected transition from automatic flight to manual flying and vice versa.

92% OF RESPONDENTS RESPONDED AFFIRMATIVE

Question 41: Do you believe that training should put more emphasis on the unexpected transition from automatic flight to manual flying and vice versa?

No	8.10%	272
Yes	91.90%	3,086



Answered 3,358 - Skipped 2,292

Question 42: We have provided the respondents a free text box for any additional information they would like to add. 909 provided comments.

Question 42: Please use this space below for any additional information you would like to add:

In brief, respondents believe that:

- A company culture which encourages manual flying is a drive for pilots to feel comfortable when switching automation off.
- Airline operators should implement an easier non-punitive reporting culture.
- Operators should ensure that their pilots maintain their manual handling skills, with opportunities to train in FSTD, especially for the long-haul pilots.
- Operators should offer their pilots enough training, correct concept and techniques for more manual flying practice.
- Pilots must have a good understanding of the aircraft automation systems and make the appropriate decisions when encountering unusual situations, such as when automation fails or there is an emergency.
- High speed/high altitude should be trained to avoid overreaction to temporary environmentally induced speed excursions.

Quotes extracted from the survey:

- *Companies should encourage manual flight from 10.000 till touchdown.*
- *During long haul operation there's seldom a chance to be PF, less to practice manual flying.*
- *We all make mistakes in manual flight. A company approach of easier reporting culture should be in place to ensure more people fly themselves.*
- *The industry, for the sake of safety, should realize that pilots must keep their manual handling skills to a very good level and encourage this.*
- *Correct concept and technique for more manual flying practice is important.*
- *Please read all of my comments contained within this survey. I believe I have included many reasons that cause degraded manual flying skills. Once lost, they are very hard to get back when you are a part of a professional airline. It is hard to admit that you no longer have the level of proficiency required when you are a professional pilot. It is hard also for an operator to admit this. This should change.*

- *I think manual flight has eroded over the years and too much reliance on automation is now the case. Manual flight should be encouraged more to retain skills.*
- *Training such as flying go-arounds manually without the use of the F/D's etc. More startle factor to be built into manual flying training in the simulator.*
- *Company culture is the strongest drive for a pilot workforce to feel comfortable to take the automation off during line operations.*
- *The pilots' profession involves flying the plane without any automation. Pilots should be competent at flying the plane at all times. Automation doesn't replace hand flying skills.*
- *I have seen Pilots arguing that passenger comfort is paramount, and one should not fly manually for this reason. That's because they are not used to do it. And Pilots shouldn't even try to understand what the autopilot is doing when it is not doing what it's supposed to. IMMEDIATELY A/P AUTOTHRUST OFF. And VERY comfortable about doing it, any phase of flight, any weather.*
- *Our first commitment is to safety but in the real life our first commitment is to passenger comfort, therefore the airline does not allow us to practice manual flying in the majority of the flights. But in order to keep a safe operation if an automation failure is encounter, we need to practice more manual flying ASAP.*
- *High speed high altitude manual flight transition should be trained and emphasized. Flight beyond the normal envelope into the extended envelope specially in the high-speed regimen should be better trained to avoid overreaction to temporary environmentally induced speed excursions.*
- *Sometimes there's lack of practice due to automation and some people think that manual flying is a wrong way to fly, and do not feel support from their companies and from manuals. The first golden rule says use the correct automation at all times.*
- *Automation is wonderful to reduce workload. However, if one does never hand fly, loss of training and lack of confidence may be dangerous if hand flying becomes really necessary. Hand flying, if done regularly increases confidence, and improves monitoring skills while flying with automation.*
- *Long haul pilots do very few flights as PF and are generally tired and therefore prefer to use automation as long as possible. They must have opportunities to train on FFS.*
- *Technology is here to make pilots' life easier but emphasis on understanding the technology plus simple flying should be encouraged at all time.*

Appendix A – Methodology for extraction of data from free-text questions – IATA Accident Classification Taxonomy

The IATA Accident Classification Taxonomy was used for a direct mapping to be possible between the free-text answer data analysis and the pre-existing accident/incident analysis for future detailed cross-referencing.

Threats that were considered irrelevant to manual flying were then removed either because they were directly linked to a ground phase of flight (e.g. A06 Dispatch/Paperwork) or possibly not a reason for manual flying to be refrained from (E04 Birds/foreign objects).

Common free text terms used were then manually searched for in the documentation and tagged to each main threat by an aviation expert. This method was applied until it was felt that the majority of clear terms were identified. Ambiguous terms were not included.

From a competency perspective, FPA and FPM were removed as this survey is directly related to their use or non-use and therefore it was inappropriate to include them. Terms were tagged to competencies based on Observable Behaviours descriptions.

The tagged terms were then searched for and a total count was taken to calculate the total number of terms seen for each threat and competency. Where appropriate, some terms were added to both a threat and competency.