

# AI vs. Human: Air Traffic Control Communication

This study evaluates the performance of generative AI systems compared to human air traffic controllers. Your responses will help us analyze the effectiveness and reliability of AI in safety-critical environments.

The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

### Scenario 3

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other:

## Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?



## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

                                                                                

How accurate is the response from ChatGPT?

                                                                                

How effective is the response from ChatGPT?

                                                                                

How clear is the response from Gemini?

                                                                                

How accurate is the response from Gemini?

                                                                                

How effective is the response from Gemini?

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- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

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- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

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Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT?	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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How many years of experience do you have in aviation? \*

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Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

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Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

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2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

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ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

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Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

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Response from ChatGPT:

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ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

                                                                                

How accurate is the response from ChatGPT?

                                                                                

How effective is the response from ChatGPT?

                                                                                

How clear is the response from Gemini?

                                                                                

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

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# AI vs. Human: Air Traffic Control Communication

This study evaluates the performance of generative AI systems compared to human air traffic controllers. Your responses will help us analyze the effectiveness and reliability of AI in safety-critical environments.

The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna 172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna 172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other:

## Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

                      

How accurate is the response from ChatGPT?

                      

How effective is the response from ChatGPT?

                      

How clear is the response from Gemini?

                      

How accurate is the response from Gemini?

                      

How effective is the response from Gemini?

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# AI vs. Human: Air Traffic Control Communication

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Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

### Scenario 3

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

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Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

                                                                                

How accurate is the response from ChatGPT?

                                                                                

How effective is the response from ChatGPT?

                                                                                

How clear is the response from Gemini?

                                                                                

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Google Forms

# AI vs. Human: Air Traffic Control Communication

This study evaluates the performance of generative AI systems compared to human air traffic controllers. Your responses will help us analyze the effectiveness and reliability of AI in safety-critical environments.

The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

                        

How accurate is the response from ChatGPT?

                        

How effective is the response from ChatGPT?

                        

How clear is the response from Gemini?

                        

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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# AI vs. Human: Air Traffic Control Communication

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The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other:

## Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

                                                                                

How accurate is the response from ChatGPT?

                                                                                

How effective is the response from ChatGPT?

                                                                                

How clear is the response from Gemini?

                                                                                

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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# AI vs. Human: Air Traffic Control Communication

This study evaluates the performance of generative AI systems compared to human air traffic controllers. Your responses will help us analyze the effectiveness and reliability of AI in safety-critical environments.

The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

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# AI vs. Human: Air Traffic Control Communication

This study evaluates the performance of generative AI systems compared to human air traffic controllers. Your responses will help us analyze the effectiveness and reliability of AI in safety-critical environments.

The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

                                                                                

How accurate is the response from ChatGPT?

                                                                                

How effective is the response from ChatGPT?

                                                                                

How clear is the response from Gemini?

                                                                                

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

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# AI vs. Human: Air Traffic Control Communication

This study evaluates the performance of generative AI systems compared to human air traffic controllers. Your responses will help us analyze the effectiveness and reliability of AI in safety-critical environments.

The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

                                                                                

How accurate is the response from ChatGPT?

                                                                                

How effective is the response from ChatGPT?

                                                                                

How clear is the response from Gemini?

                                                                                

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

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# AI vs. Human: Air Traffic Control Communication

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The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?



## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

                                                                              

How accurate is the response from ChatGPT?

                                                                              

How effective is the response from ChatGPT?

                                                                              

How clear is the response from Gemini?

                                                                              

How accurate is the response from Gemini?

                                                                              

How effective is the response from Gemini?

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- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

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Google Forms

# AI vs. Human: Air Traffic Control Communication

This study evaluates the performance of generative AI systems compared to human air traffic controllers. Your responses will help us analyze the effectiveness and reliability of AI in safety-critical environments.

The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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## Google Forms

# AI vs. Human: Air Traffic Control Communication

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The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

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# AI vs. Human: Air Traffic Control Communication

This study evaluates the performance of generative AI systems compared to human air traffic controllers. Your responses will help us analyze the effectiveness and reliability of AI in safety-critical environments.

The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	----------------------------------	-----------------------	-----------------------

How accurate is the response from ChatGPT?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	----------------------------------	-----------------------

How effective is the response from ChatGPT?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	----------------------------------	-----------------------

How clear is the response from Gemini?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	----------------------------------

How accurate is the response from Gemini?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	----------------------------------

How effective is the response from Gemini?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
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# AI vs. Human: Air Traffic Control Communication

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The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

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Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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# AI vs. Human: Air Traffic Control Communication

This study evaluates the performance of generative AI systems compared to human air traffic controllers. Your responses will help us analyze the effectiveness and reliability of AI in safety-critical environments.

The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other:

## Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

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# AI vs. Human: Air Traffic Control Communication

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The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

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# AI vs. Human: Air Traffic Control Communication

This study evaluates the performance of generative AI systems compared to human air traffic controllers. Your responses will help us analyze the effectiveness and reliability of AI in safety-critical environments.

The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

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Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

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- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

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# AI vs. Human: Air Traffic Control Communication

This study evaluates the performance of generative AI systems compared to human air traffic controllers. Your responses will help us analyze the effectiveness and reliability of AI in safety-critical environments.

The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

### Scenario 3

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

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# AI vs. Human: Air Traffic Control Communication

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The objective of this survey is to evaluate the performance of generative AI systems, such as ChatGPT and Gemini, in air traffic control (ATC) communications compared to human controllers. By analyzing participant responses, this study aims to assess the accuracy, clarity, and effectiveness of AI-generated ATC instructions and explore whether AI can reliably assist or replace human operators in safety-critical scenarios.

Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?



## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

	1 (not good)	2	3 (neutral)	4	5 (excellent)
How clear is the response from ChatGPT	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from ChatGPT?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How clear is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
How accurate is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
How effective is the response from Gemini?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

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Do you consent to participate in this study and allow us to use your anonymized responses for research purposes? \*

- Yes
- No

What is your role in aviation? \*

- Pilot
- ATC professional

How many years of experience do you have in aviation? \*

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

Scenario 1- 4

For each scenario from 1- 4 , please carefully read the provided responses. Follow the prompts to identify AI-generated responses, and share your feedback in the other tab.

## Scenario 1

\*

Response 1:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Tower: Cherokee 8121K, Runway 26, cleared for takeoff.

Pilot: Cleared for takeoff Runway 26, Cherokee 8121K.

Response 2:

When ready to taxi:

Pilot: Lancaster Ground, Cherokee 8121K, west ramp, VFR, 4,500 to Frederick with Sierra.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

When ready for takeoff:

Pilot: Lancaster Tower, Cherokee 8121K, Runway 26, ready for takeoff.

Ground: Cherokee 8121K, Lancaster Ground, taxi to Runway 26 via Taxiway Alpha, the runway is clear.

Pilot: Taxi to Runway 26, Cherokee 8121K.

Response 1

Response 2

Not Sure

Other: .....

## Scenario 2

\*

### Response 1:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional-jet347,Tallinn Tower, roger MAYDAY

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway 22L,after landing stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big-prop 1233,Kastrup Tower, roger MAYDAY, runway 22L cleared to land, wind 260 degrees 10kt,emergency services alerted

### Response 2:

Pilot: MAYDAY MAYDAY MAYDAY Tallinn Tower Regional jet 347

Embraer 195 engine failure, continuing SID, passing TN 850

2000 ft, climbing to altitude 4000 ft, endurance 2 ½ hrs, 112 POB

ATCO: (MAYDAY) Regional Jet 347, Tallinn Tower, roger MAYDAY. Maintain 4,000 ft. Turn left heading 310 to ensure safe routing. Advise intentions.

Pilot: MAYDAY MAYDAY MAYDAY,KastrupTower,Big-prop1233,ATR72,right-hand engine fire, continuing approach runway22L,afterlanding stopping on the runway,5 miles final, altitude 1600ft descending,64POB

ATCO: (MAYDAY) Big Prop 1233, Kastrup Tower, roger MAYDAY. Runway 22L cleared to land. Winds 260 degrees at 10 knots. Emergency services alerted and standing by. Report when on short final.

Response 1

Response 2

Not sure

Other: .....

**Scenario 3**

\*

CTR Crossing -Request for crossing an active control zone

Response 1:

Pilot: De Kooy Tower, PH-ABC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: PH-ABC, De Kooy Tower. Cross Zuluvia to November at 2000ft. Maintain 2000ft.

Squawk 1200. Report established..

Response 2:

Pilot: De Kooy Tower, P-BC

ATCO: PH-ABC, De Kooy Tower, go ahead

Pilot: TB-9, overhead Schagen, altitude 1500ft, VFR Lelystad to Texel, request to cross control zone from Zuluvia

overhead the field to November, altitude 2000ft, PH-ABC

ATCO: P-BC, roger, crossing approved, along the coast to November, altitude 1500ft

QNH1020, report entering control zone

Response 1

Response 2

Not Sure

Other: .....

## Scenario 4

\*

Response 1:

### Go Around

ATCO: Regional-jet347, GO AROUND! I SAY AGAIN GOAROUND! ACKNOWLEDGE!

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: PH-ABC, Lelystad Tower, roger your relayed MAYDAY from PH-DEF"

Response 2 :

### Go Around

ATCO: Regional Jet 347, go around, I say again, go around. Climb to 3,000 feet, fly runway heading

Pilot: GOING AROUND, Regional-jet 347

### Relayed emergency message

Pilot: MAYDAY MAYDAY MAYDAY, Lelystad Tower, PH-ABC, have intercepted MAYDAY from PH-DEF, I say again PH-DEF, Cessna172, engine failure,

forced landing 5 miles south of Harderwijk, altitude 1200ft descending, heading 125, 3POB"

ATCO: Harderwijk Tower, this is Lelystad Tower. Mayday Relay. PH-DEF, Cessna 172, reports engine failure.

Forced landing 5 miles south of Harderwijk. Altitude 1200 feet, descending. Heading 125 degrees. Three persons on board.

Response 1

Response 2

Not Sure

Other: .....

### Scenario 5-7

For the same scenarios, responses from two AI systems - ChatGPT and Gemini is provided. Please rate each response on clarity, accuracy, and effectiveness using the provided scale.

## Scenario 5

\*

The flight crew declared an emergency, transmitting “Mayday Mayday Mayday” followed by “Bird strike, bird strike, go-around and the aircraft initiated a go-around maneuver, requesting permission to land from the opposite direction on Runway 19.

Response from ChatGPT:

Pilot: MAYDAY, MAYDAY, MAYDAY. [Station Name], [Flight Number]. Bird strike, bird strike, go-around.

ATCO: [Flight Number], roger MAYDAY. Confirm intentions.

Pilot: Requesting permission to land on Runway 19 from the opposite direction. [Flight Number].

ATCO: [Flight Number], roger. Stand by for clearance.

ATCO: [Flight Number], cleared to approach Runway 19. Winds 190 degrees at 8 knots.

Emergency services will be on standby. Report established on final.

Pilot: Cleared for approach Runway 19. Will report when established on final. [Flight Number].

Response from Gemini:

Pilot: Mayday Mayday Mayday! [Flight Number], bird strike, bird strike, go-around!

ATC: [Flight Number], [Station Name], say again, nature of emergency?

Pilot: Bird strike, severe engine damage, requesting immediate go-around!

ATC: [Flight Number], [Station Name], go-around approved. Squawk 7700. Maintain visual separation from other traffic. Vectors for Runway 19 approach will follow.

Pilot: [Flight Number], go-around initiated, requesting immediate vectors for Runway 19 approach.

ATC: [Flight Number], [Station Name], vectors for Runway 19 approach. Turn left heading 270 degrees. Maintain 1500 feet. Expect further vectors.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

How accurate is the response from ChatGPT?

How effective is the response from ChatGPT?

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

## Scenario 6

\*

Flight 295 has caught fire in the cargo and wants to descend immediately.

Response from Gemini:

ATCO: Do you wish to, do you request a full emergency?"

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700. Vectors for immediate descent to FL140 will follow. Stand by.

Pilot: Flight 295, turn left heading 270 degrees. Maintain 15,000 feet. Expect vectors for immediate descent to FL140.

Response from ChatGPT:

ATCO: Do you wish to, do you request a full emergency?

Pilot: Yes, Mauritius Approach, we request a full emergency. We have a fire in the cargo hold and are descending immediately.

ATCO: Flight 295, Mauritius Approach, Roger. Full emergency declared. Squawk 7700.

Descend to FL140 immediately. Vectors for approach will follow.

Pilot: Flight 295, squawking 7700. Descending to FL140. Request vectors for approach.

1 (not good)      2      3 (neutral)      4      5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

How effective is  
the response  
from Gemini?

## Scenario 7:

\*

Below is the description for transmitting:

Pilot: Seattle Approach, Cherokee 8121K, 20 [miles] southwest of Seattle VOR at 7,500, en route Arlington, request transmit Class Bravo airspace.

Response from ChatGPT:

Cherokee 8121K, Seattle Approach, squawk 4502 and ident. Remain outside Class Bravo airspace while clearance is being coordinated.

Response from Gemini :

Cherokee 8121K, Seattle Approach, radar contact. Squawk 1200.

Cleared through Class Bravo direct Arlington. Maintain 7,500.

Monitor 124.3 for further instructions.

1 (not good)                    2                    3 (neutral)                    4                    5 (excellent)

How clear is the response from ChatGPT

    

How accurate is the response from ChatGPT?

    

How effective is the response from ChatGPT?

    

How clear is the response from Gemini?

    

How accurate is the response from Gemini?

    

How effective is the response from Gemini?

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