# READBACK

## Turning Aviation Radio Communications into Clear, Actionable Cockpit Information

Investor Overview

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**A locally operated, safety-oriented aviation communications platform**

# The Opportunity

Aviation radio communication is fast, compressed, and workload-intensive. Pilots must interpret callsigns, altitudes, headings, frequencies, routes, clearances, and runway instructions while simultaneously managing the aircraft, navigation, weather, and traffic.

Poor reception, unfamiliar phraseology, stepped-on transmissions, accents, congestion, and momentary distraction can cause a pilot to miss or misunderstand an important instruction. Readback is being developed to provide a clearer, structured record of the communications intended for that pilot's aircraft.

| ~1.5 sec | 75 | >300 | 25/25 |
|---|---|---|---|
| Representative end-of-transmission to final-text latency | Controlled audio recordings in the current corpus | Automated engineering tests | Controlled IFR text scenarios passing |

## The Product

Readback connects to aircraft radio or audio-panel output, processes speech locally, identifies communications directed to the configured aircraft, and converts relevant instructions into structured cockpit information.

- Automatically detects complete radio transmissions.
- Transcribes locally without requiring an internet connection.
- Filters unrelated traffic before operational parsing.
- Extracts aviation fields such as altitude, heading, frequency, squawk, route, and clearance limits.
- Separates actual assignments from expectations, requests, predictions, and advisories.
- Maintains an auditable history of what the system heard and how it interpreted it.

# How Readback Works

| | |
|---|---|
| 1 | **RADIO AUDIO**<br>Aircraft radio or audio-panel signal |
| 2 | **SEGMENTATION**<br>Detects the beginning and end of each transmission |
| 3 | **LOCAL ASR**<br>Faster-Whisper produces a local transcript |
| 4 | **OWNSHIP GATE**<br>Determines whether the transmission addresses the configured aircraft |
| 5 | **AVIATION PARSER**<br>Normalizes phraseology and extracts structured fields |
| 6 | **AIRCRAFT STATE**<br>Applies only independently authorized evidence, exactly once |
| 7 | **PILOT DISPLAY**<br>Presents relevant instructions and recent communications |

## Current local configuration

- Faster-Whisper base.en, CPU/int8, beam size 1.
- No cloud transcription, hotwords, forced vocabulary, or LLM authority.
- Transmission-aware capture replaces the original fixed eight-second window.
- The deterministic parser and state engine remain the operational authority.

# Why Readback Is Different

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| **Ownship-focused** | The system first determines whether ATC is addressing the configured aircraft. Other-aircraft and ambiguous transmissions are blocked from ordinary clearance parsing. |
| **Aviation-specific** | Readback interprets aviation numbers, callsigns, routes, clearances, restrictions, frequencies, squawk codes, and amendments using bounded deterministic rules. |
| **State-aware** | Assigned, expected, predicted, requested, pending, and refused information remain distinct. An expectation cannot silently become an instruction. |
| **Auditable** | Evidence, applicability, parser version, confidence, source, and resulting state events can be retained for testing and review. |

# Development Accomplished

Readback began as a prototype that recorded fixed eight-second audio windows. The present architecture is a governed, testable communications platform with safety boundaries and repeatable evidence.

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|---|---|
| **Audio latency** | Identified the eight-second capture window as the primary delay; reduced representative end-of-transmission latency to approximately 1.4-1.5 seconds. |
| **Segmentation** | Preserved an 11.34-second dense transmission, rejected silence and brief noise, and supported capture during inference. |
| **Ownship protection** | Implemented a five-outcome, fail-closed callsign applicability gate with session-aware abbreviation handling. |
| **IFR parsing** | Implemented deterministic parsing for CRAFT, as-filed, routes, SIDs, altitudes, headings, frequencies, squawk, climb-via, amendments, and corrections. |
| **Certification corpus** | Created 25 controlled IFR scenarios, 75 ordered turns, 75 audio recordings, machine-readable ground truth, hashes, and repeatable validation. |
| **Model evaluation** | Compared base.en with small.en configurations and retained base.en because the larger model degraded callsign and applicability safety while increasing latency. |

## Controlled audio improvement

| Field | Initial | Improved |
|---|---|---|
| Altitude and time | 0% | **85%** |
| Heading | 0% | **100%** |
| Frequency | 60% | **86.7%** |
| Squawk | 13.3% | **93.3%** |
| Assigned vs. expected | 12.5% | **85%** |

Controlled synthetic speech results are engineering evidence, not authentic ATC-audio or certification performance.

# Safety-Oriented Architecture

### Fail closed

Uncertain, ambiguous, conflicting, clipped, or merged evidence cannot update authoritative state.

### Verify the intended aircraft

A transmission must pass ownship applicability before ordinary clearance parsing and again at the state boundary.

### Never invent a clearance

Context may prioritize an interpretation but cannot create missing words, digits, callsigns, or assignments.

### Separate expectation from authority

Expected, predicted, requested, and informational values cannot silently become assigned instructions.

### Exactly once

Duplicate events do not apply the same instruction repeatedly.

### Preserve evidence

Source transcript, normalization, applicability, evidence, confidence, and parser version remain available for audit.

**Artificial intelligence supplies transcription evidence. Deterministic safety rules remain the authority.**

# Platform and Intellectual-Property Potential

Readback's potential value extends beyond transcription. Its developing technical base combines specialized aviation components that are more difficult to reproduce than a general speech-to-text interface.

- Aviation-specific transmission segmentation
- Ownship callsign applicability and abbreviation lifecycle
- Phase-aware vocabulary architecture
- Evidence-preserving normalization and route interpretation
- Deterministic clearance parsing
- Assigned-versus-expected state semantics
- Auditable event processing and regression methodology
- Versioned aviation communication certification fixtures

A formal patentability and freedom-to-operate review has not yet been completed.

# Potential Customers and Applications

| Initial users | Longer-term applications |
|---|---|
| General aviation pilots | Integrated cockpit displays |
| Instrument students | Electronic flight bag companion tools |
| Flight schools and instructors | After-flight communication review |
| Pilots operating in congested or unfamiliar airspace | Training and proficiency scoring |
| Pilots who benefit from communication accessibility tools | Simulator debriefing |
| | OEM and avionics partnerships |

## Potential revenue models

- Hardware plus software package
- Software licensing for supported computing hardware
- Annual software, airport-data, and vocabulary updates
- Premium training and debriefing tools
- Flight-school and simulator subscriptions
- OEM licensing and integration partnerships

The final commercial model will depend on hardware design, regulatory classification, product-liability strategy, and customer validation.

# Product Roadmap

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|---|---|
| 1 | **Complete the core engine**<br>Finish callsign hardening, improve IFR audio performance, and expand the certified regression corpus. |
| 2 | **Expand operational vocabulary**<br>Ground/taxi, tower, departure, enroute, approach, VFR, weather, emergency, and CTAF. |
| 3 | **Validate authentic audio**<br>Integrate aircraft audio, conduct human-reviewed callsign testing, and measure weak-signal and noisy-airport performance. |
| 4 | **Build the cockpit experience**<br>Develop the pilot display, acknowledgement controls, phase context, and simulator/cockpit evaluations. |
| 5 | **Prepare for commercialization**<br>Finalize hardware, regulatory strategy, human factors, cybersecurity, manufacturing, support, and partnerships. |

# Investment Rationale

Readback offers the opportunity to help define a new category of general aviation safety and accessibility technology. The project already has a functioning local prototype, governed safety architecture, structured parser and state engine, repeatable certification-development corpus, controlled audio benchmarks, documented engineering provenance, and an independent experimental research program.

## Investment would accelerate

- Authentic cockpit-audio and multi-airport validation
- Human-factors and cockpit-interface development
- Hardware refinement and integration
- Corpus expansion and engineering support
- Regulatory, product-liability, and intellectual-property review
- Pilot, flight-school, and simulator trials
- Commercialization and partnership development

## Current limitations

Readback is an active development prototype. It has not been validated across a representative population of controllers, pilots, radios, and airports; submitted for FAA approval; certified as avionics; or approved as a navigation or operational authority.

Current controlled audio was generated using macOS text-to-speech. Recorded PilotEdge material has supported provisional research, but portions still require human verification. These evidence classes are deliberately kept separate from verified real-world performance.

**Help pilots recognize, retain, and correctly interpret the radio instructions intended for their aircraft.**

Readback is not intended to replace ATC, approved avionics, or pilot judgment. It is being designed to give pilots a clearer, safer, and more useful representation of what was said.