The Need for Research on Automatic Speech Recognition in Air Traffic Management

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Project of AcListant®, AcListant®-Strips,
PJ.16-04-ASR-W1, MALORCA, HAAWAII

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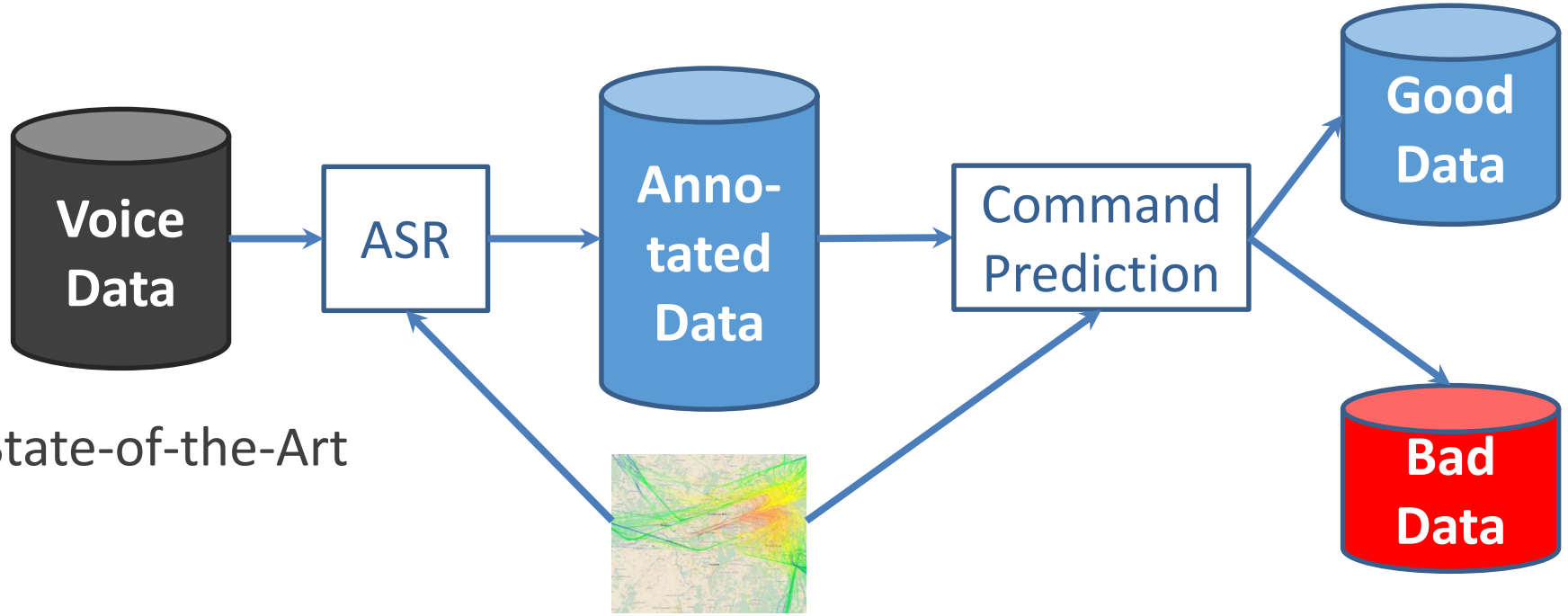
Contents

- Experiment with a smartphone
- Adaptation of Speech Recognition Systems by Machine Learning
- The HAAWAII project
- Speech Recognition is NOT Speech Understanding
- Conclusions

Invention of MALORCA

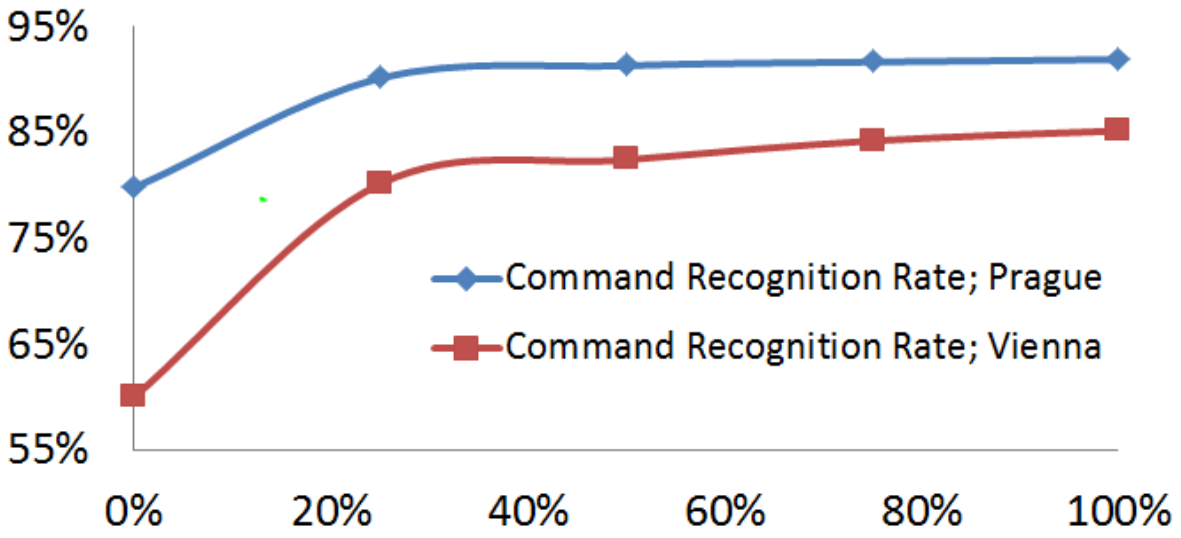


State-of-the-Art

Data selection: Select “good” or “bad” data

Learning Curve

Command Recognition Rate (not just word recognition rate) depending on amount of provided untranscribed training data



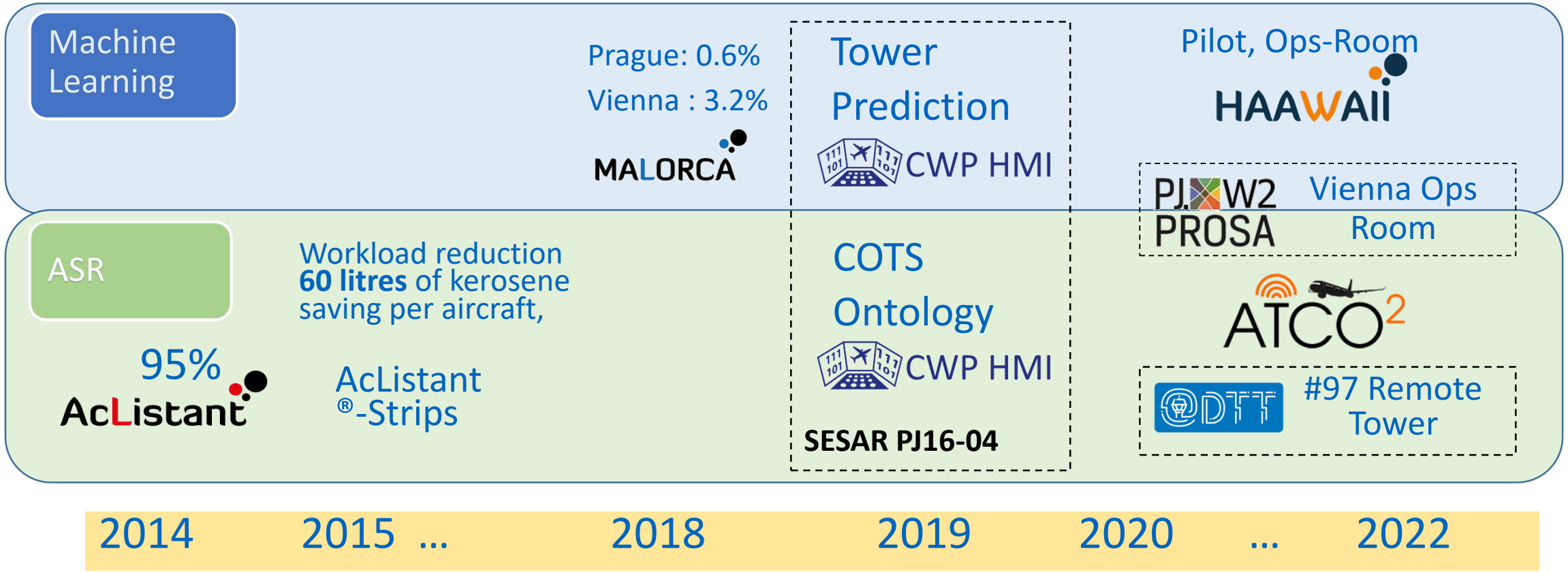
Vienna	Recognition Rate
0%	60.0%
25%	80.2%
50%	82.4%
75%	84.2%
100%	85.2%

WER: 5.1%

Prague	Recognition Rate
0%	79.8%
25%	90.2%
50%	91.3%
75%	91.7%
100%	91.9%

WER: 2.3%

Speech Recognition and Machine Learning Roadmap



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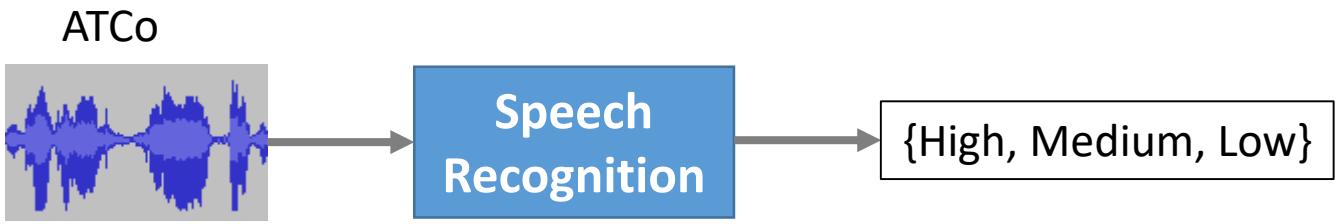
ASR Applications of HAAWAII

HAAWAII

Highly Automated Air Traffic Controller Workstation with Artificial Intelligence Integration

Objective ATCo Workload Estimation

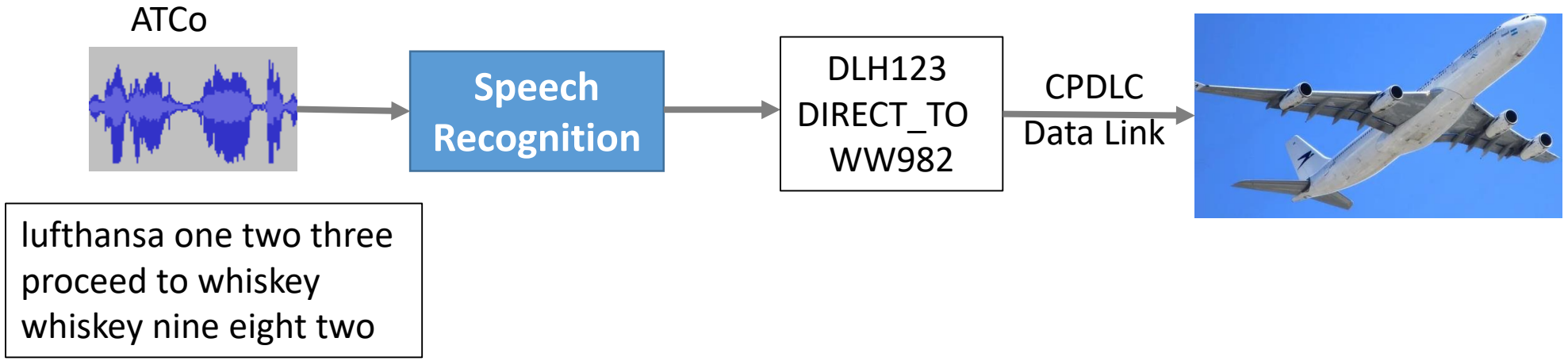


8min

ASR Applications of HAAWAII Integration of ASR and CPDLC

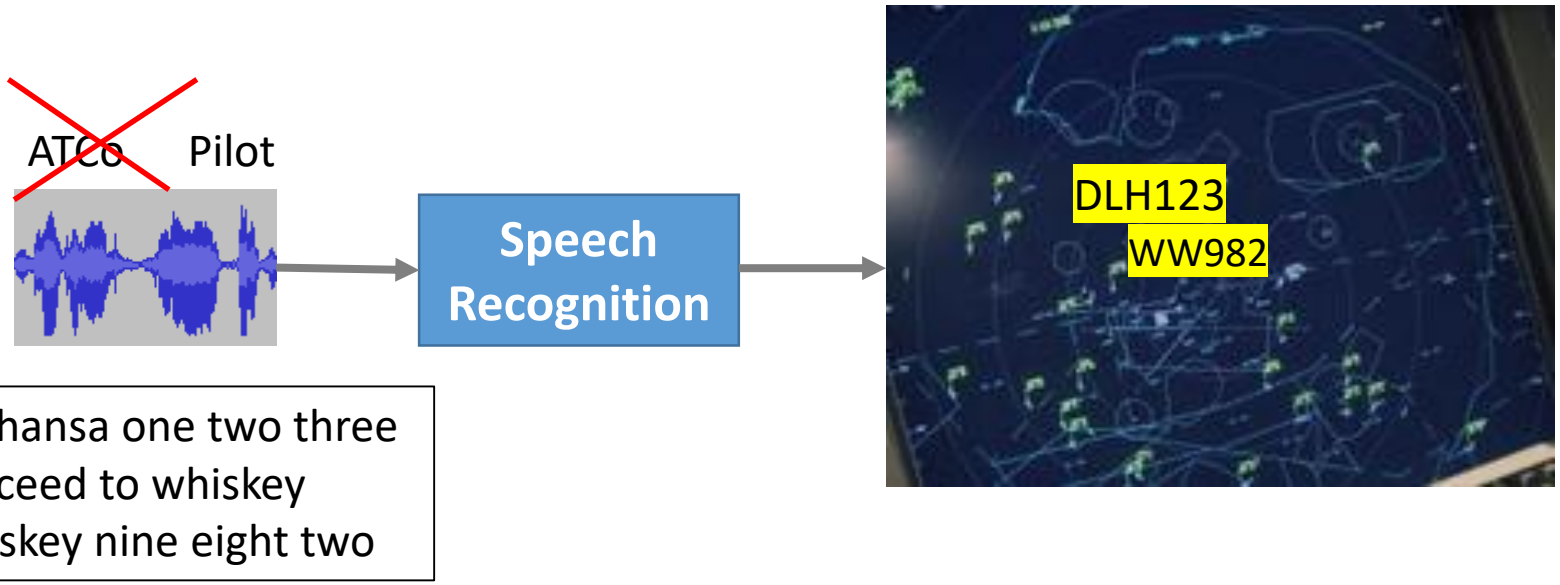
HAAWAII

Highly Automated Air Traffic Controller Workstation with Artificial Intelligence Integration



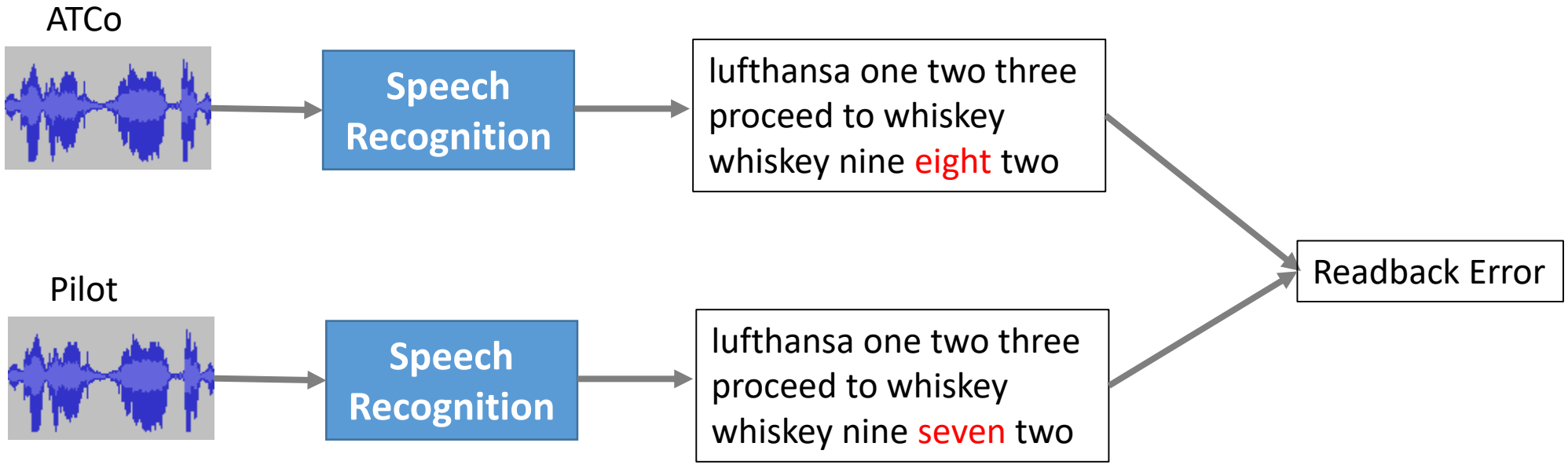
CPDLC: Controller –Pilot Data Link Communication

ASR Applications of HAAWAII
Callsign Highlighting & Prefilling Radar Labels



ATCo Callsign Highlighting is “easy”.
The challenge and benefits is for pilot’s voice.

ASR Applications of HAAWAII Readback Error Detection (simple)



ASR Applications of HAAWAII Readback Error Detection

Speed Recognition is NOT Speech Understanding
Alan Turing 1952

ATCo

good morning speed bird two zero zero zero alfa
reduce one eight zero knots until DME four miles
contact tower
on frequency one one eight decimal seven zero zero

Pilot

one eighty to DME four
tower one eighteen seven
speed bird two thousand alfa

Readback Error?

- Word sequences are different
- Not each command needs a readback
- Sequence of command can be different
- “nineteen” and “one one nine” are the same
- “thousand” and “zero zero zero” are the same

ASR Applications of HAAWAII Readback Error Detection

good morning speed bird two zero zero zero alfa
reduce one eight zero knots until DME four miles
contact tower
on frequency one one eight decimal seven zero zero

BAW2000A REDUCE 180 kt UNTIL 4 NM DME
BAW2000A CONTACT TOWER
BAW2000A CONTACT_FREQUENCY 118.700

one eighty to DME four
tower one eighteen seven
speed bird two thousand alfa

BAW2000A PILOT SPEED 180 none UNTIL 4 none DME
BAW2000A PILOT CONTACT TOWER
BAW2000A PILOT CONTACT_FREQUENCY 118.700

Conclusions

We need Research on Automatic Speech Recognition in Air Traffic Management

- **COTS engines (smartphone, google etc.) are good, but not for ATM**
- **Speech Recognition does not include Speech Understanding**
- **Europe has an ontology**

- **Readback-Error detection is a challenge for research AND for subject matter experts**
- **Iterative approach is necessary AND possible**

The full presentation is available on request, see email below

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