SELF-MADE-ATC

TECHNICAL DEEP DIVE:
ADAPTING AUTOMATIC SPEECH UNDERSTANDING TO NEW AIRSPACES & APPLICATIONS

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SELF-MADE-ATC

DLR

Speech Recognition is NOT Speech Understanding

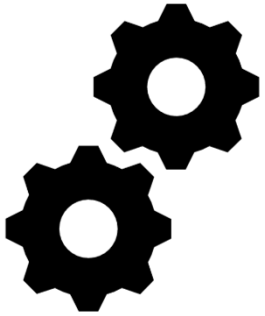
- air france two seven five descend flight level eight zero proceed direct olivo
- two seventy five go down level eighty to olivo

→AFR275 DESCEND 80 FL, DIRECT_TO OLIVO (Speech Understanding)

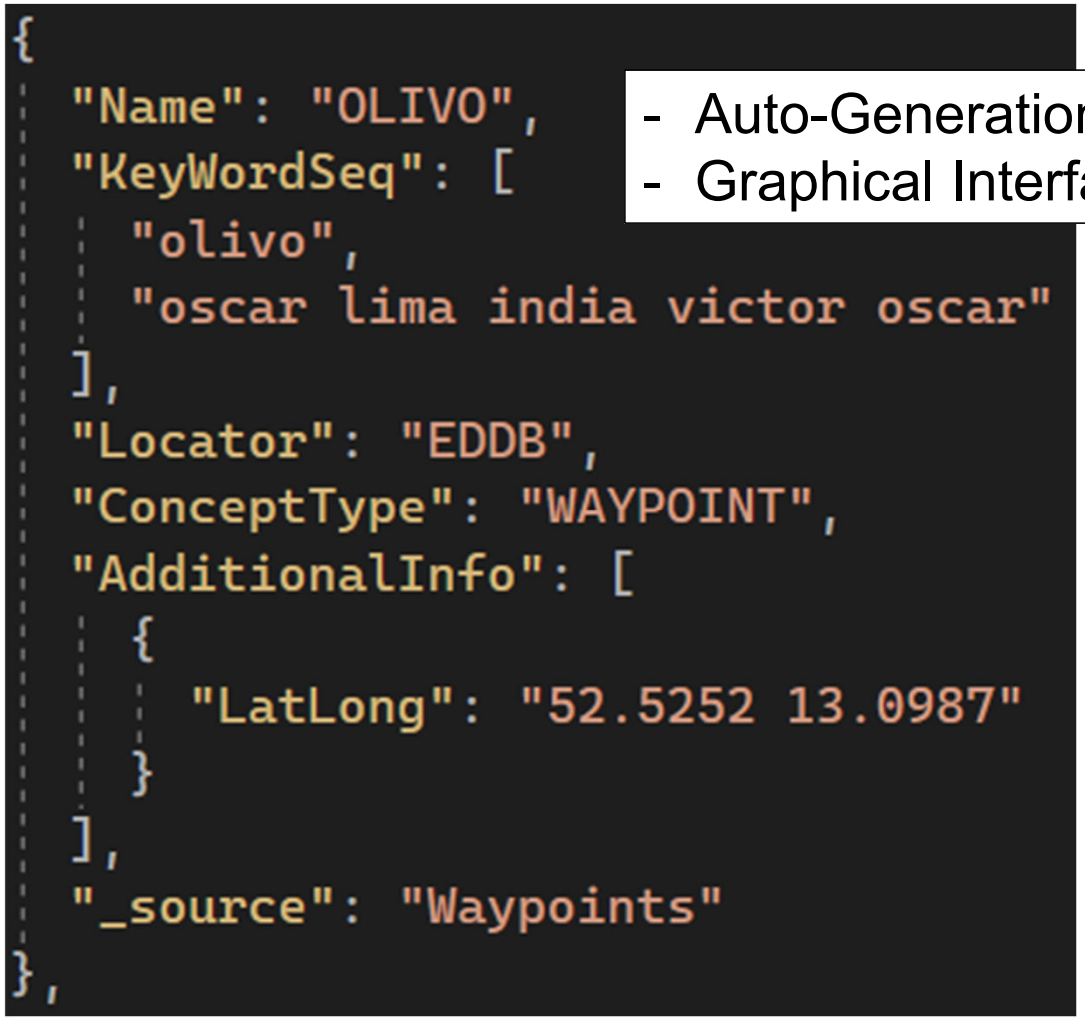
- Keyword sequence (*"proceed direct"*)
- Command type (<<*DIRECT_TO*>>)
- ATC concept (<<*OLIVO*>>)

Adapting Speech Understanding

- 1) Add/modify ATC concept (e.g., waypoint, runway)
- 2) Add new command type
- 3) Add new keyword sequence to existing command type

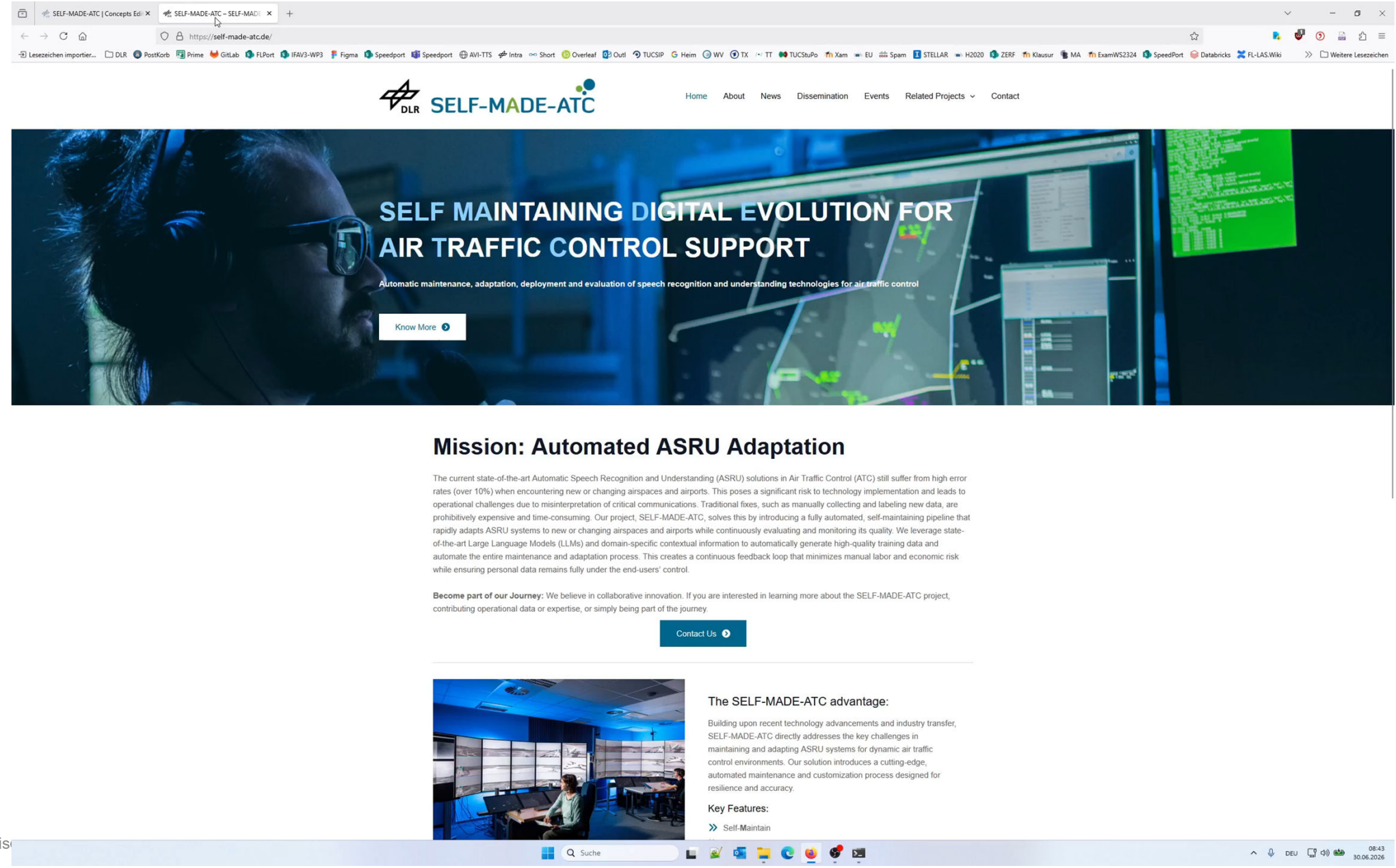


Traditional Way: Modify Configuration File manually…



```
{
  "Name": "OLIVO",
  "KeyWordSeq": [
    "olivo",
    "oscar lima india victor oscar"
  ],
  "Locator": "EDDB",
  "ConceptType": "WAYPOINT",
  "AdditionalInfo": [
    {
      "LatLong": "52.5252 13.0987"
    }
  ],
  "_source": "Waypoints"
},
```

- Auto-Generation?
- Graphical Interface?


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SELF MAINTAINING DIGITAL EVOLUTION FOR AIR TRAFFIC CONTROL SUPPORT
Automatic maintenance, adaptation, deployment and evaluation of speech recognition and understanding technologies for air traffic control
Know More
Mission: Automated ASRU Adaptation
The current state-of-the-art Automatic Speech Recognition and Understanding (ASRU) solutions in Air Traffic Control (ATC) still suffer from high error rates (over 10%) when encountering new or changing airspaces and airports. This poses a significant risk to technology implementation and leads to operational challenges due to misinterpretation of critical communications. Traditional fixes, such as manually collecting and labeling new data, are prohibitively expensive and time-consuming. Our project, SELF-MADE-ATC, solves this by introducing a fully automated, self-maintaining pipeline that rapidly adapts ASRU systems to new or changing airspaces and airports while continuously evaluating and monitoring its quality. We leverage state-of-the-art Large Language Models (LLMs) and domain-specific contextual information to automatically generate high-quality training data and automate the entire maintenance and adaptation process. This creates a continuous feedback loop that minimizes manual labor and economic risk while ensuring personal data remains fully under the end-users' control.
Become part of our Journey: We believe in collaborative innovation. If you are interested in learning more about the SELF-MADE-ATC project, contributing operational data or expertise, or simply being part of the journey.
Contact Us
The SELF-MADE-ATC advantage:
Building upon recent technology advancements and industry transfer, SELF-MADE-ATC directly addresses the key challenges in maintaining and adapting ASRU systems for dynamic air traffic control environments. Our solution introduces a cutting-edge, automated maintenance and customization process designed for resilience and accuracy.
Key Features:
Self-Maintain
Suche
DEU
08:43
30.06.2026

ATCO air serbia five three echo turn left left heading zero seven zero vectoring for shortcut

ASL53E	HEADING	070	LEFT	

2026-08-05__12-47-50-60 END

PILOT own navigation to kolul euro wings eight four tango danke

EWG84T	NAVIGATION_OWN			
EWG84T	POSITION	KOLUL	none	

2026-08-05__07-20-08-92_P END

ATCO swiss five six four roger than when passing five thousand feet turn left direct omido

SWR564	AFFIRM	[than when]		
SWR564	DIRECT_TO	OMIDO	LEFT	WHEN ALTITUDE 5000 ft

2026-08-05__07-13-26-85 END

ATCO delta uniform x-ray cleared to donau estingen via tango delta zero zero two flight level eight zero ifr starts now

DELUX	DIRECT_TO	TD002	none	
DELUX	ALTITUDE	80 FL		
DELUX	CLEARED IFR	none		

2026-05-21__08-38-32-19 END

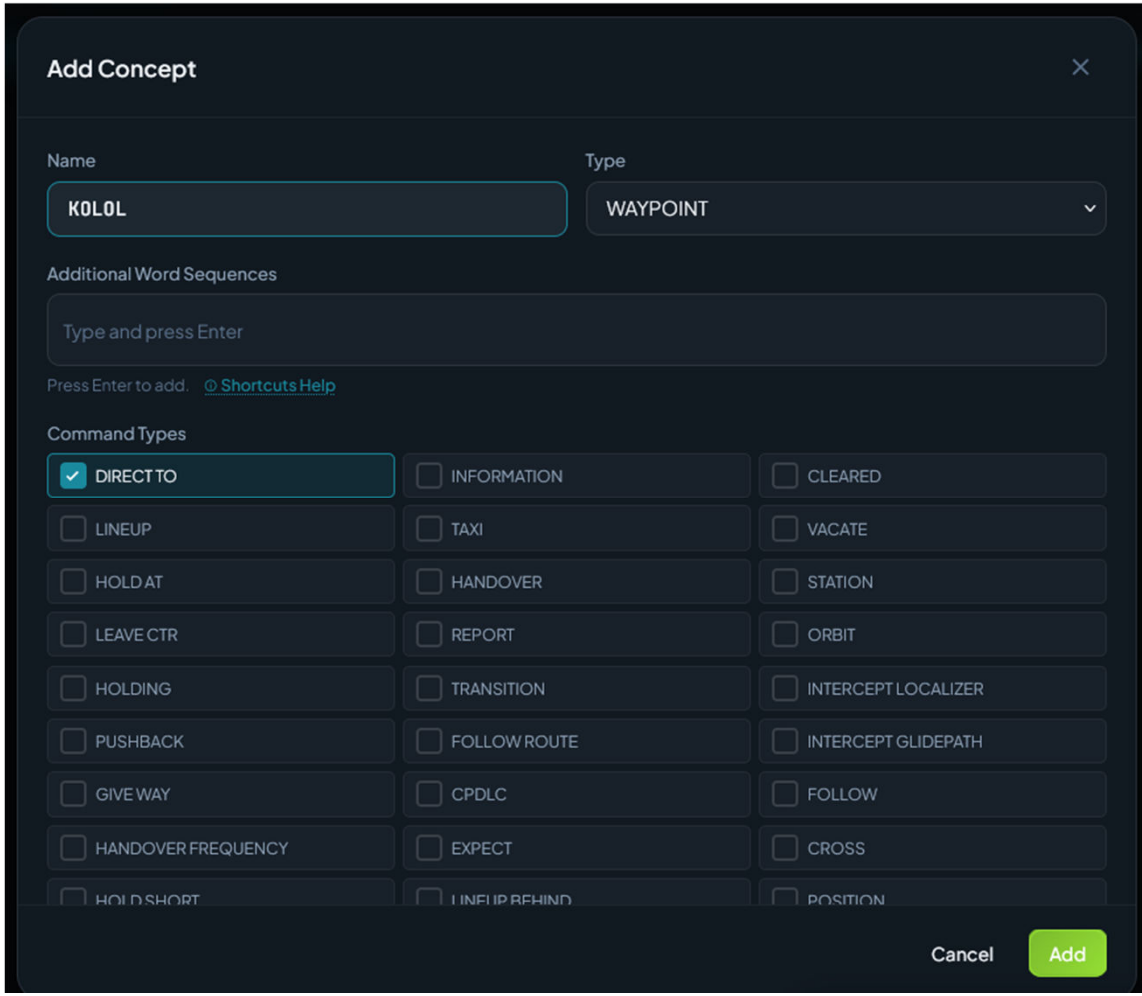
ATCO swiss one papa mike twu braval hello cleared to zulu hotel four one four thereafter toosnam for the ils approach runway one four descend to flight level one hundred

SWR1PM	GREETING			
SWR1PM	DIRECT_TO	ZH414	none	
SWR1PM	EXPECT ILS	RW_14		

Jump to Start

Adding a new Waypoint

- 1) Add/modify ATC concept (e.g., waypoint, runway)
- 2) Add new command type
- 3) Add new keyword sequence to existing command type



PILOT own navigation to kolul euro wings eight four tango danke

EWG84T	NAVIGATION_OWN			
EWG84T	POSITION	KOLUL	none	

2026-08-05__07-20-08-92_P END

ATCO swiss five six four roger than when passing five thousand feet turn left direct omido

SWR564	AFFIRM	[than when]		
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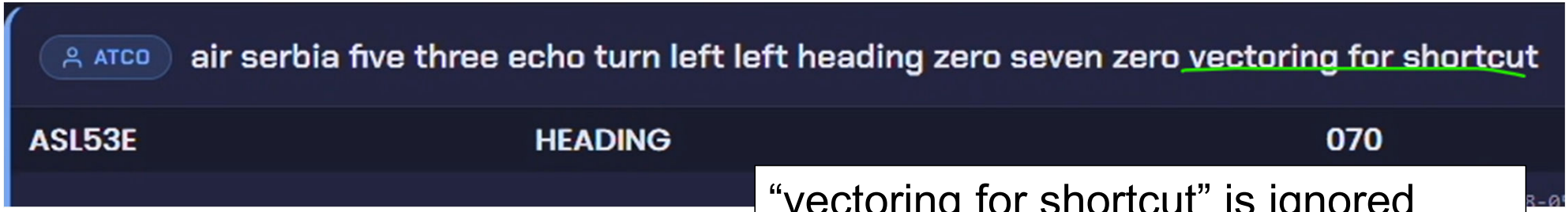
ATCO swiss one papa mike twu braval hello cleared to zulu hotel four one four thereafter toosnam for the ils approach runway one four descend to flight level one hundred

SWR1PM	GREETING		
SWR1PM	DIRECT_TO	ZH414	none
SWR1PM	EXPECT ILS	RW_14	
SWR1PM	DESCEND	100 FL	

2026-05-21__06-05-29-91 END

ATCO ryan air eight five juliett tower hello cleared to iraklyon air vaburg one whiskey d… Jump to Start …lanned route and squawk one thousand

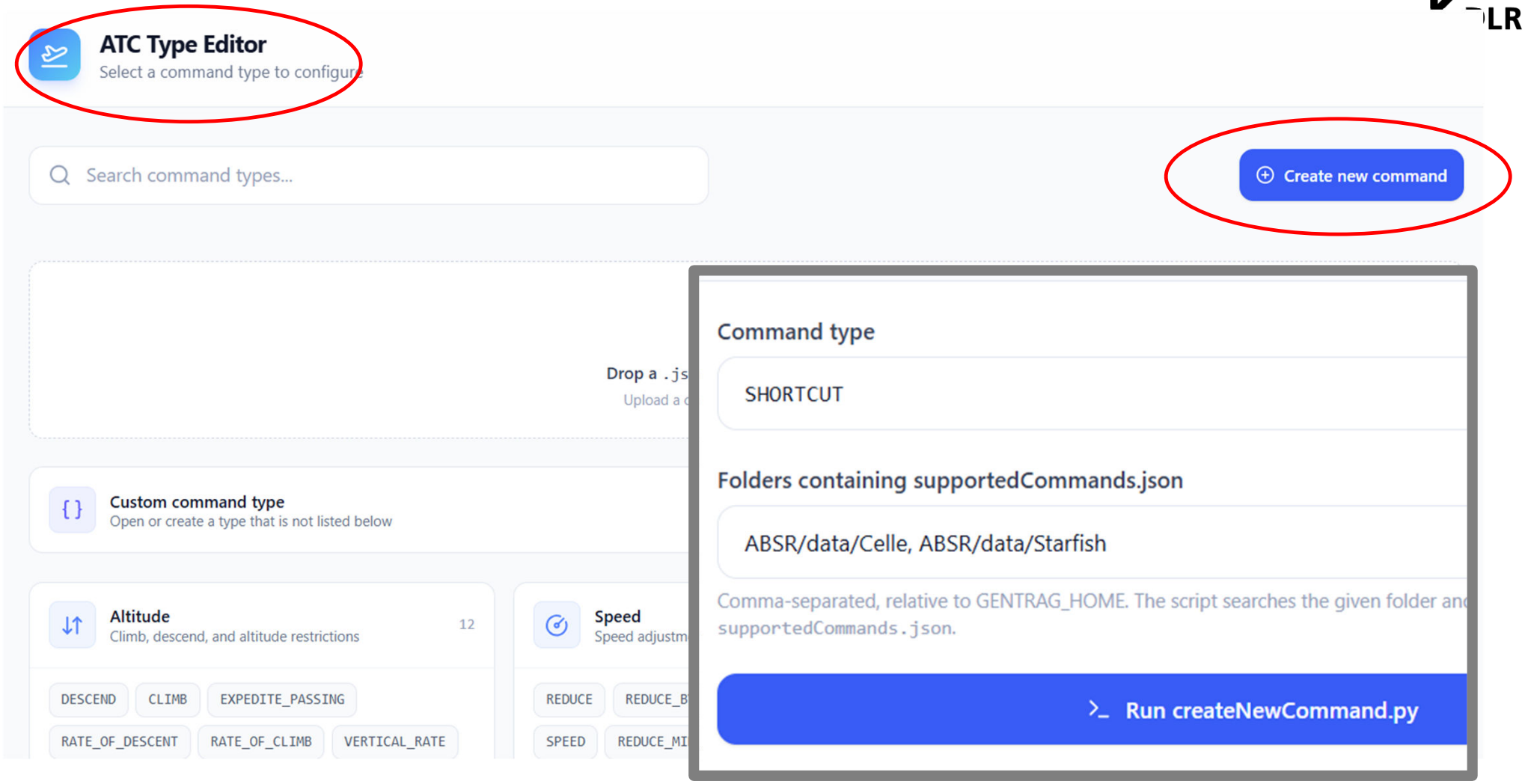
Implementing a new Command Type



"vectoring for shortcut" is ignored
Let's assume, we want a new command type "SHORTCUT".

- "Very easy" for ATM system supplier…
- We have many pages of documentation describing each step (if up-to-date)
- Just changes to nine C++ files are necessary (including unit tests)
- Compile and Link and "then" the new command type is supported

Creating a new Command Type (Tool Supported)

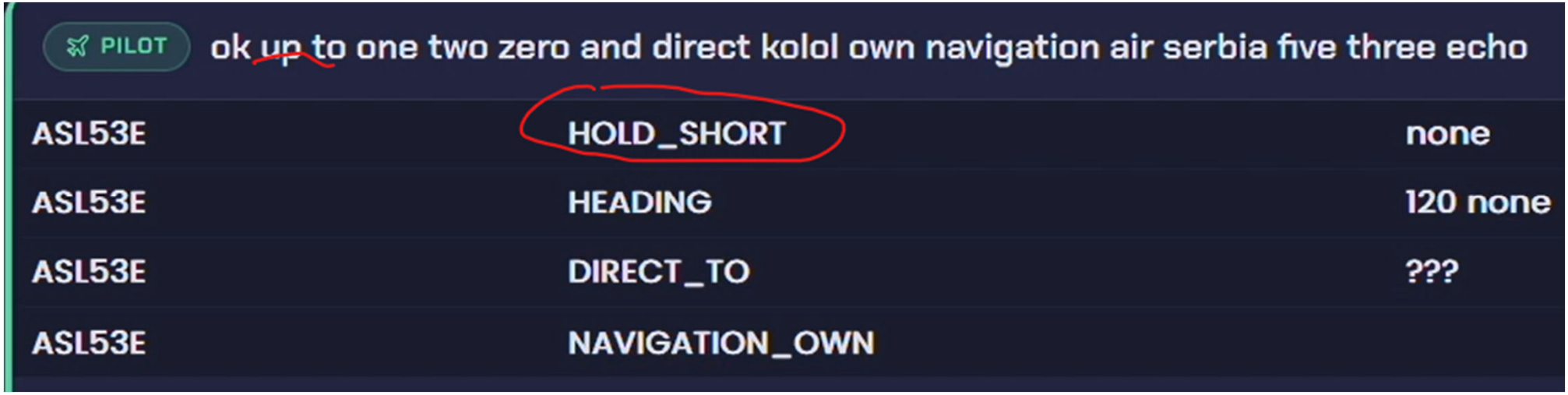


Adding a new Command Type

- 1) Add/modify ATC concept (e.g., waypoint, runway) 
- 2) Add new command type 
- 3) Add new keyword sequence to existing command type

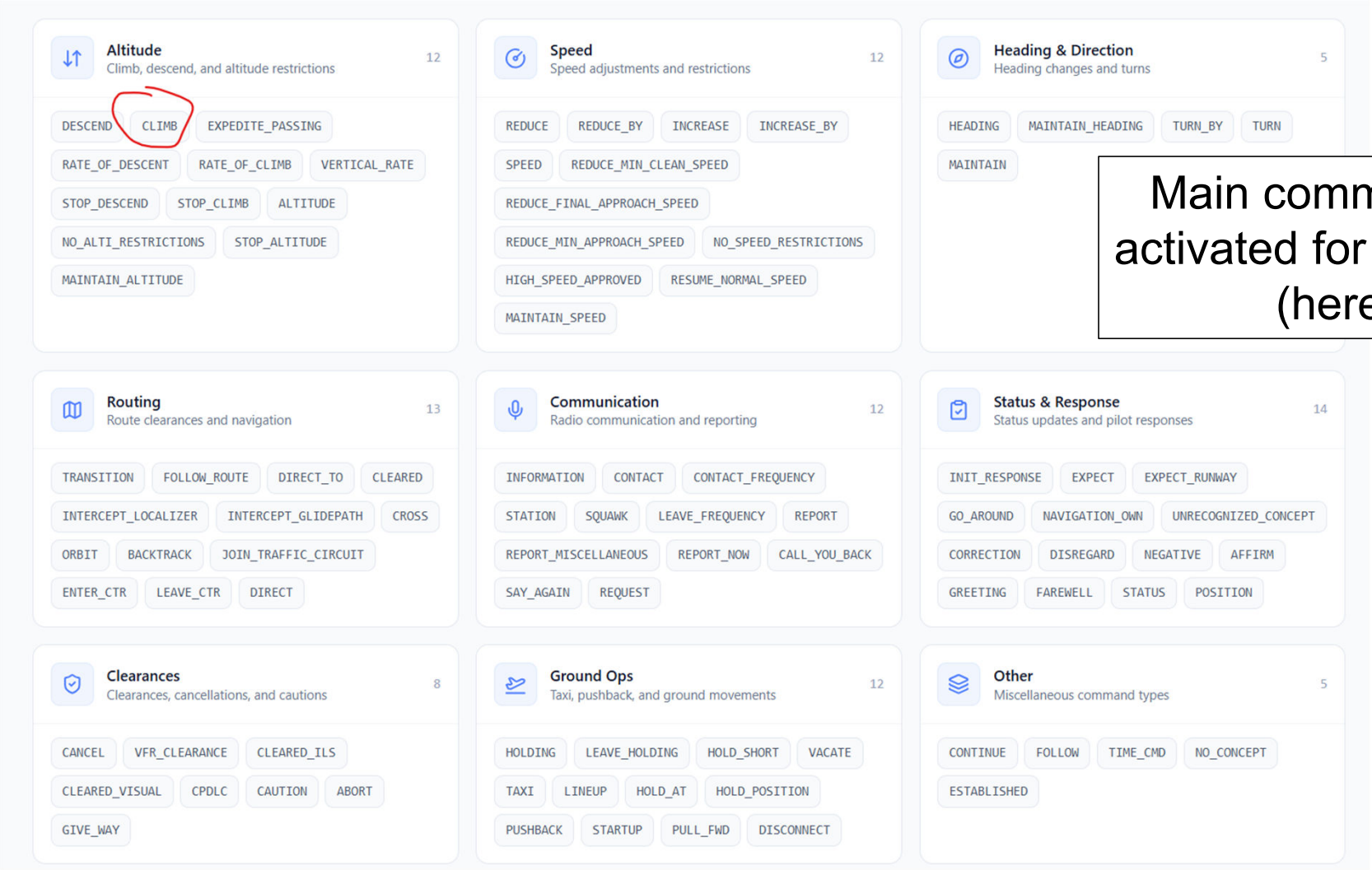
Add new keyword sequence to existing command type

- Modify semantic extraction



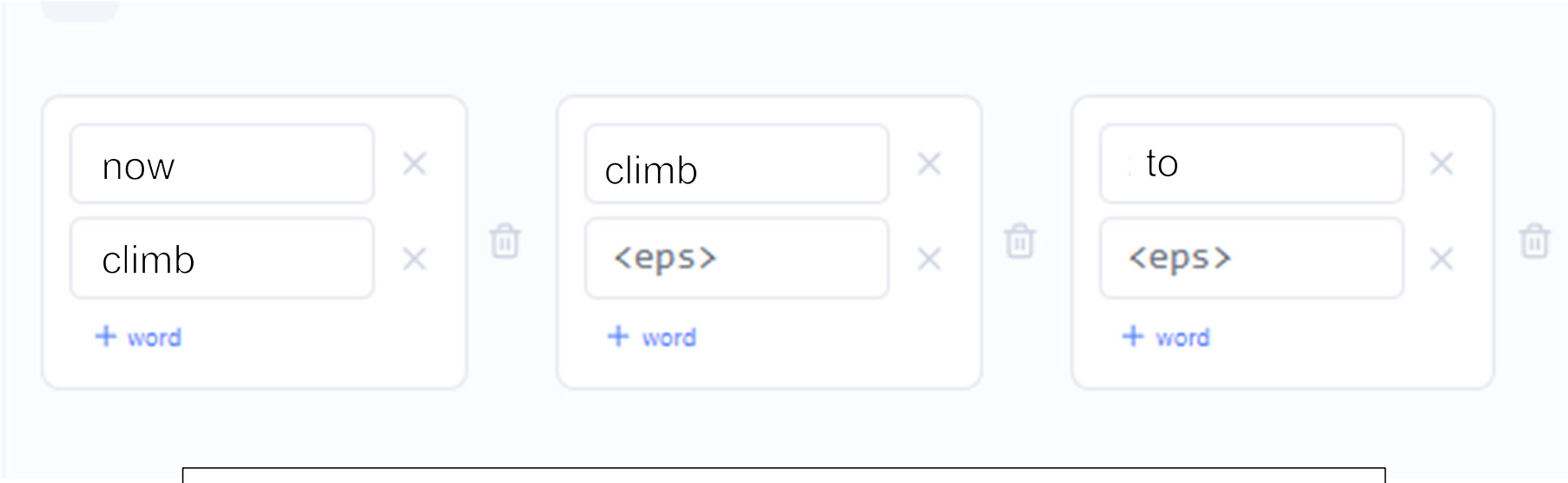
- CLIMB 120 none (instead of HOLD_SHORT none and HEADING 120 none)

Command Types in the Ontology



Main command types, activated for this airspace (here 94).

Adding Phraseology via Concept Editor



In our case we add “up to” also for CLIMB command

Functionalities: Tool-Supported Manual Adding Works

- 1) Add/modify ATC concept (e.g., waypoint, runway)
- 2) Add new command type
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Can this be done (semi-)automatically?

Outlook: Semi-Automatic Adding (ATC concepts, command types, keyword sequences)

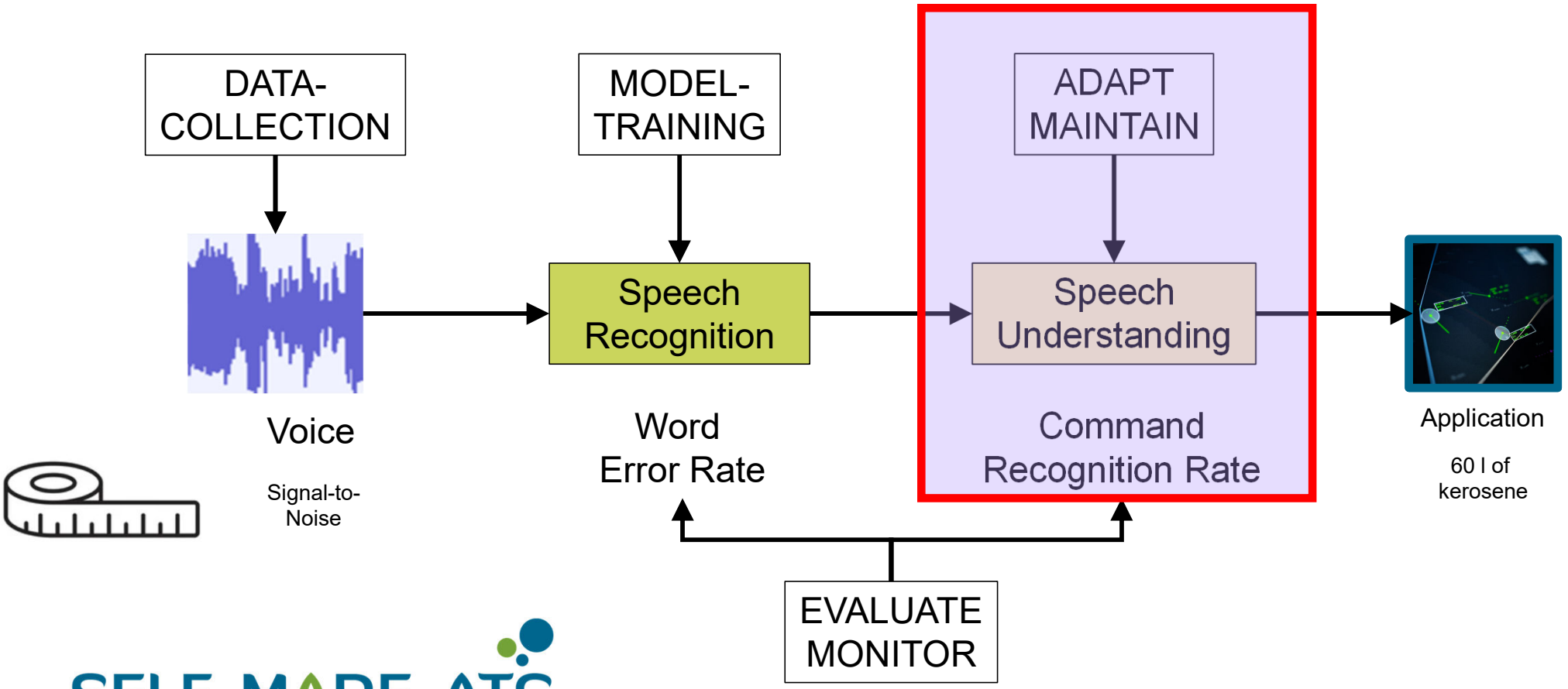
- Utilize a model for automatic identification of required additions (analyzing gold transcription + annotation; considering error reports):

Recognized phrase	Map to	Occ.	Note
`drehen sie auf den endanflug` (ATCO)	`DIRECT FINAL`	11	Currently `NO_CONCEPT`
`drehe auf endanflug` (pilot)	`DIRECT FINAL`	11	Currently `NO_CONCEPT`

- → User, do you want to add "drehen sie auf den endanflug" as a keyword sequence for "DIRECT FINAL"?
  YES NO

- In case of "YES", it will be added to a JSON configuration file for type "DIRECT"

Building Blocks for Adapting ASRU



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Summary of Adapting Speech Understanding

- Manual error-prone config file input → Automatic generation of files
- Code changes → Convenient graphical interface for modifications
- Modifications possible without technical expertise (for end-users)







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END

Quelle: Software-Entwickler Web-Entwickler - Kostenloses Foto auf Pixabay

Impressum

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