


Cognitive aspects of curved approaches



ヨルグ エントジンガー (工学博士)
Jorg ENTZINGER (Ph.D.)
東京大学大学院工学系研究科 助教
国際工学教育推進機構
バイリンガルキャンパス推進センター

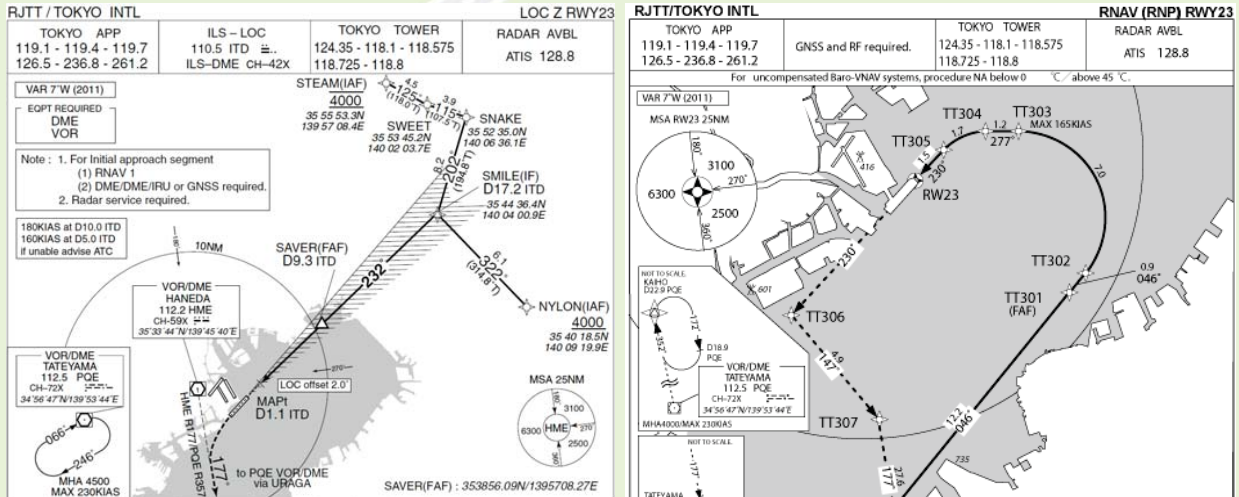
東京大学 I I I E E j-entzinger@t-adm.t.u-tokyo.ac.jp

What is the goal?

- Understand differences in mental models and cognitive processes between curved and straight approaches
- Support the pilot (through training or interfaces) in his supervision of automation and in decision making

Why curved approaches?

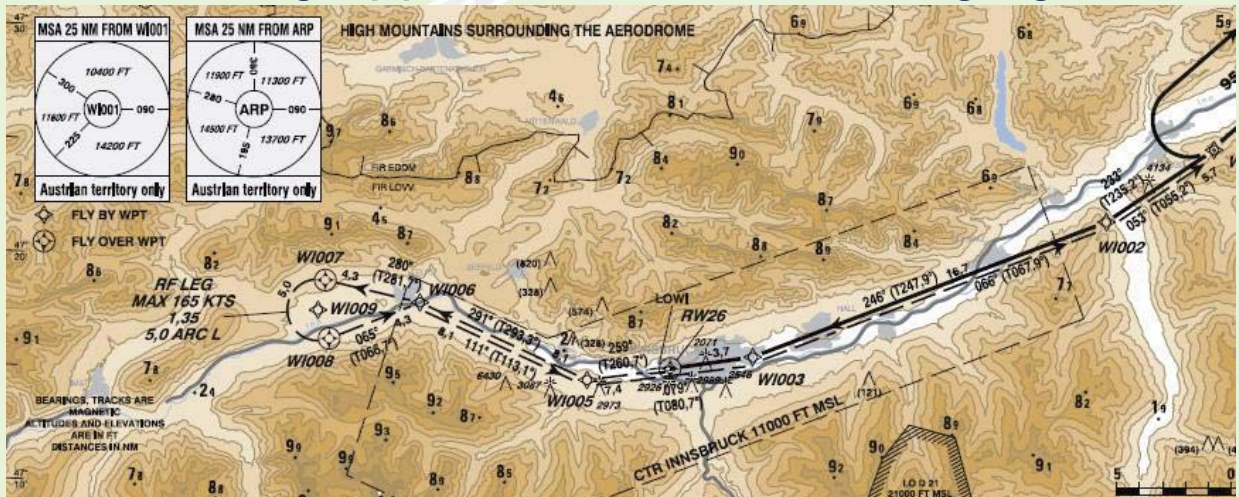
- Limit noise impact on the ground



Tokyo Haneda airport ILS approach (left) versus RNP-AR curved approach (right) 3

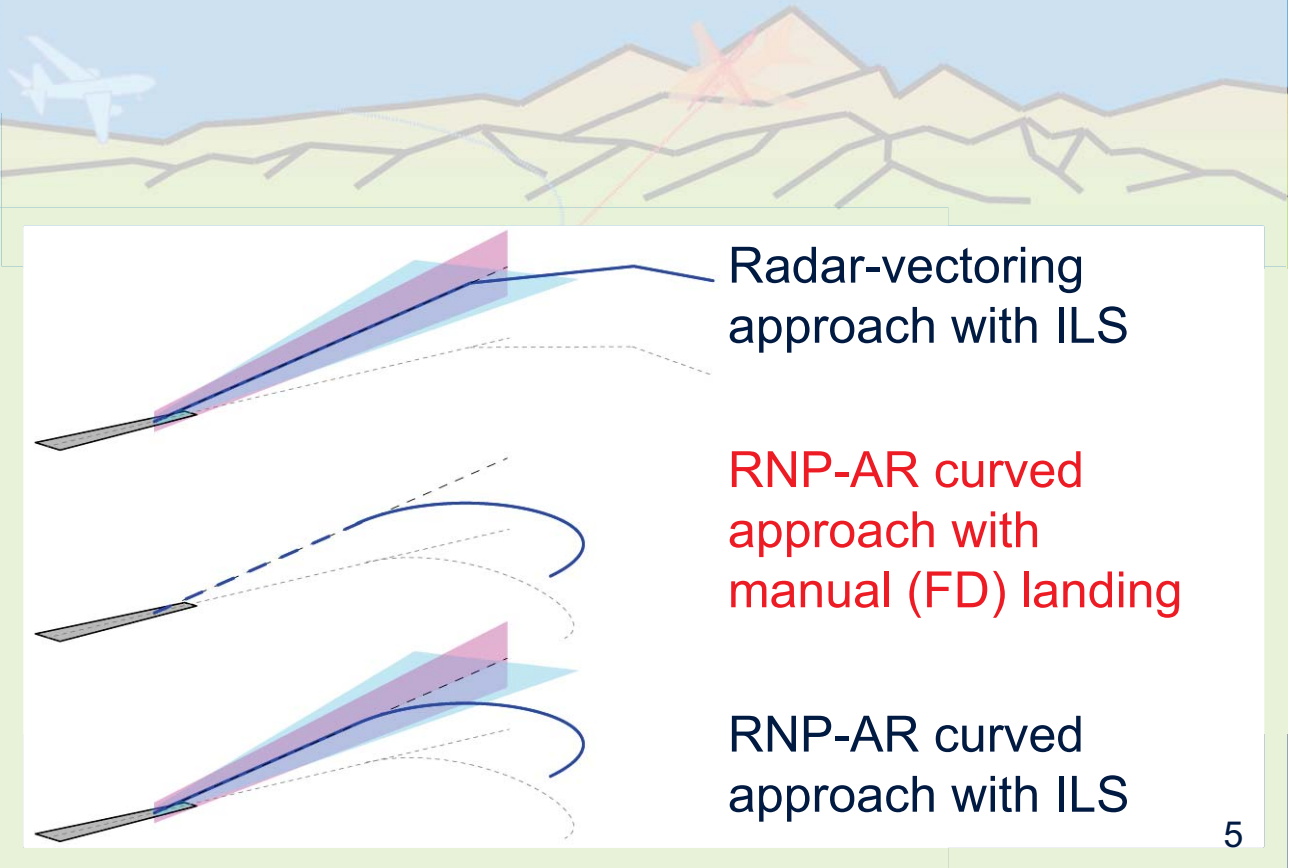
Why curved approaches?

- Limit noise impact on the ground
- Enabling approaches with challenging terrain

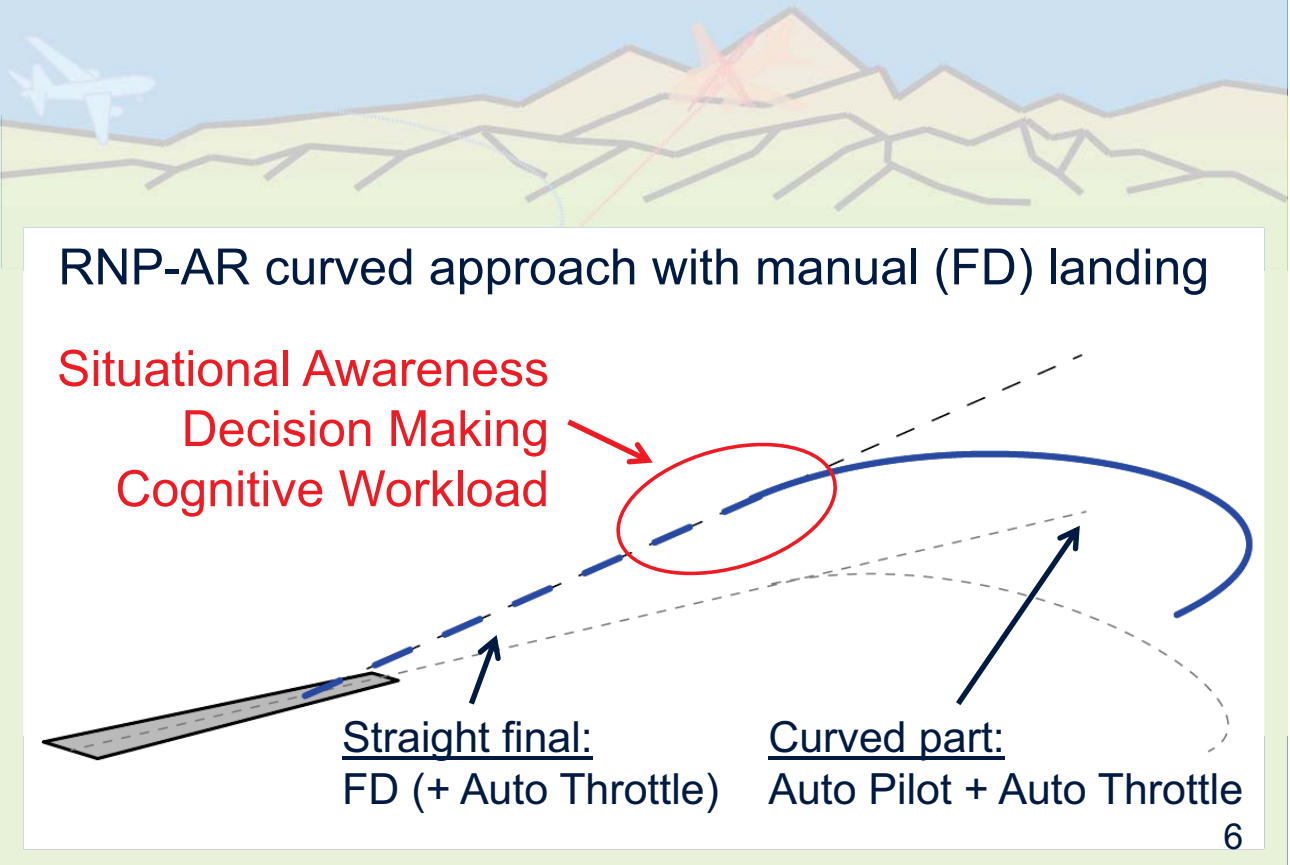


RNP-AR approach and RNP-AR go-around at Innsbruck airport (Austria) 4

What are we looking at?



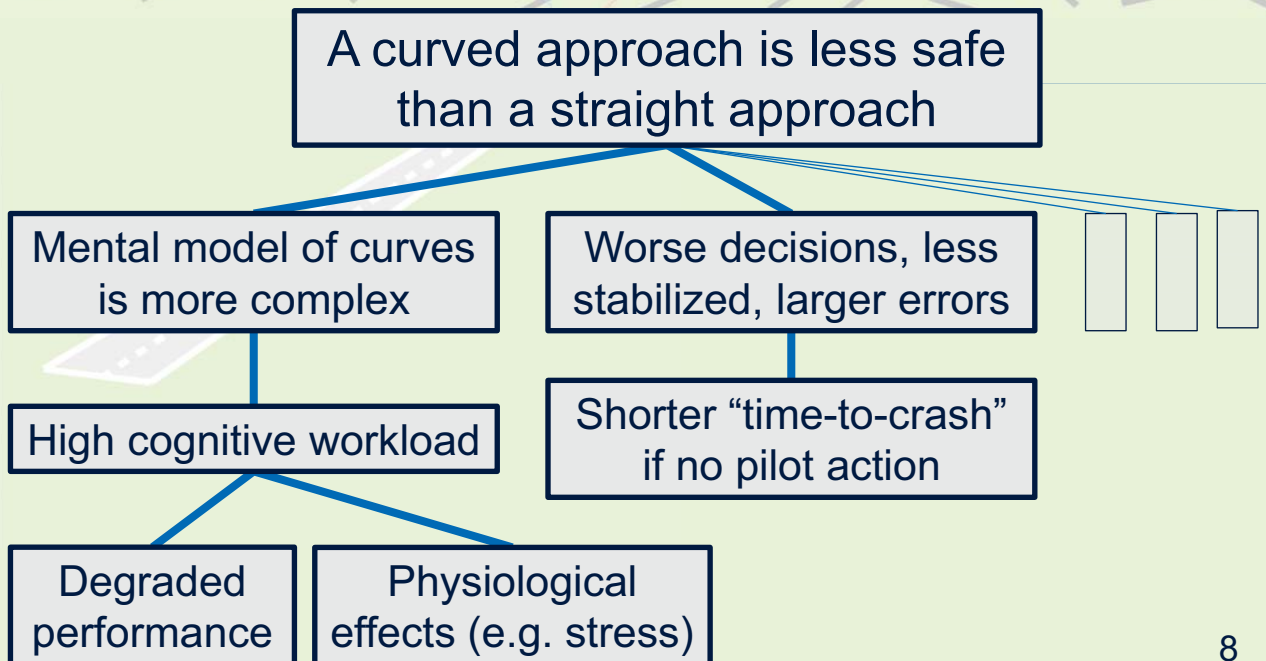
What are we looking at?



What is the problem?

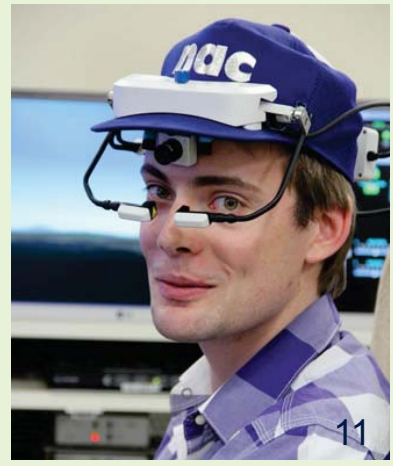
- Verification of navigation database during flight is practically impossible
- Workload reduction under normal conditions, but likely to increase with abnormalities
- Supervision of automation is more difficult
- Less time to confirm alignment with runway
 - Decision height may be in a curve
 - Go-around may be initiated in a curve
 - Location of runway in visual field uncertain

What is the problem?



How to measure cognitive workload?

- Subjective measures (e.g. Task Load Index)
- Pupil size



How to measure cognitive workload?

- Subjective measures (e.g. Task Load Index)
- Pupil size
- Heart-rate-variability



12

Intermediate conclusions

- Research: mostly hardware or trajectory
- Pilot training: systems and procedures
- Missing: *human factors*
- Irregular cases are not yet considered (challenging weather, one engine out, etc.)
- Late changes of plan due to mixed-mode airport operations occur
- Small differences between procedures, certifications, and systems confuse crew

13

Where do we go from here?

- What are the most demanding cases?
- What support/training is needed?

Challenges:

- Current simulator has no RNP-AR capability
- Still few pilots with RNP-AR experience (especially in Japan)

14