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# Status of TIRA Upgrade Activities

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# Outline

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## 1. Introduction

## 2. Current status of TIRA upgrade projects

- Antenna drive and control system
- Replacement of Radome hull
- L-band power transmitter

## 3. Conclusions

# Introduction

- The TIRA radar system is in operation for nearly 40 years and several critical components and subsystems have to be urgently replaced due to
  - Mid/long-term supply with spare parts isn't guaranteed any longer:
    - Antenna drive and control system
    - Built-in high-power klystrons of the present L-band transmitter
  - End of Life is reached or is already exceeded for essential components:
    - High-power klystrons of the present L-band transmitter
    - Radome hull
- The growing importance of Space Situational Awareness (SSA) triggered requirements for enhanced capabilities and improved (operational) availability of TIRA
- In 2009 upgrading projects for antenna drive/control, radome and L-band transmitter were initiated

# Current Status

- Upgrade of antenna drive and control system
  - DC-drives replaced by more powerful state-of-the-art AC-drives
  - Antenna control system hardware and software upgraded
  - Final acceptance tests successfully finished in May 2011
  
- Replacement of radome hull
  - Contract negotiations still ongoing
  - On-site works currently scheduled to start end of 2013



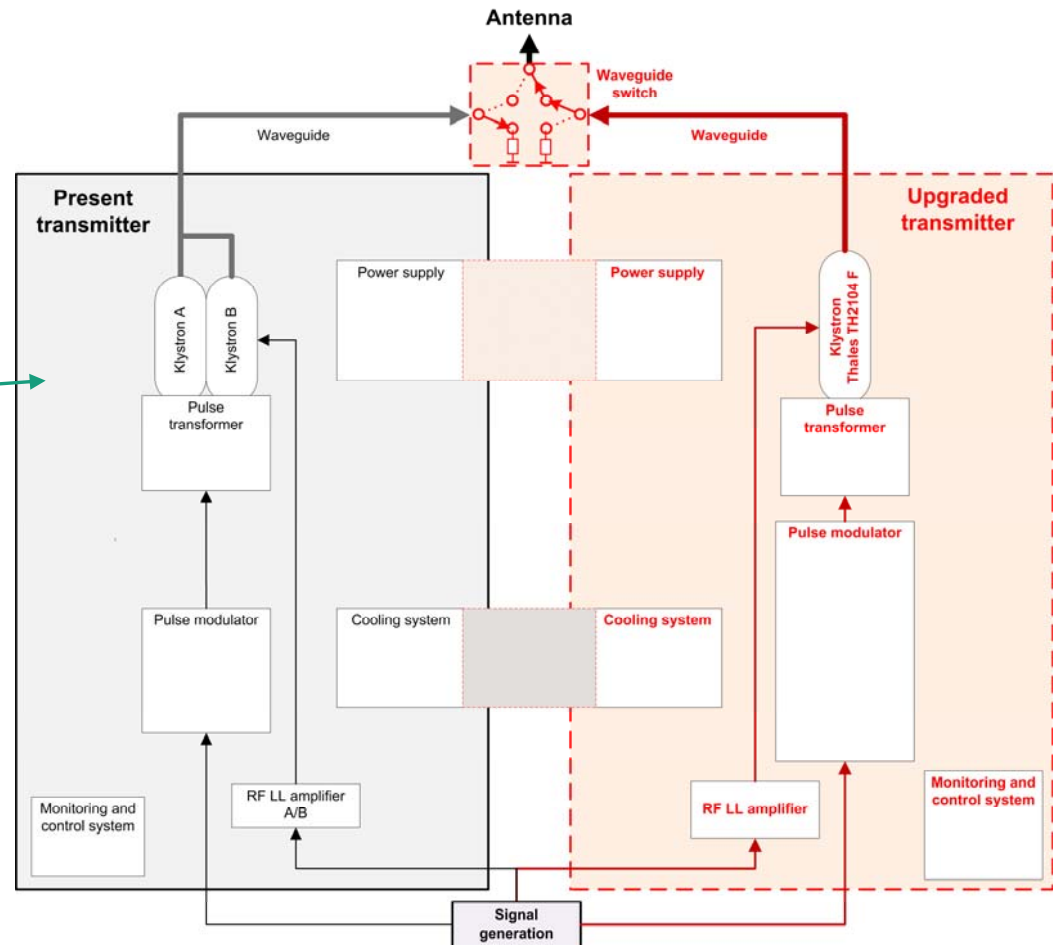
# Current Status

## Upgrade of L-band power transmitter

### ■ Already finished:

- Design of the **upgraded transmitter** and the new **waveguide switching system**
- Assembly in parallel to the present transmitter (the „old“ transmitter will be operated as backup system in future)
- Waveguide switching system enables the use of the old transmitter during the assembly and test phase

➡ *System down times could be minimized*



# Upgrade of L-band power transmitter

Some highlights from the assembly phase

**The 5 MW Pulse modulator is ready for action !**





# Upgrade of L-band power transmitter

Mounting of the transmitter's centrepiece: **The 5 MW high-power klystron**



# Upgrade of L-band power transmitter

Klystron integrated in the pulse transformer before/after mounting the lead shieldings





# Upgrade of L-band power transmitter

## ■ Work still to be done:

- „Beampark qualification“ for the upgraded L-band transmitter
  - Testing long-term stability via 24 h operation at max. RF pulse output power
  - Previous test attempts failed due to waveguide arcing
  - The reasons for the arcs still are under investigation but we hope to solve the problems within the next two months
- Finishing of the final acceptance tests
- Commissioning phase

# Conclusions

## Potential benefits regarding future Beampark campaigns

- The upgraded TIRA L-band transmitter will provide a max. RF pulse output power up to **2 MW**
  - *Approx. 2 dB more output power compared to the old transmitter results in an moderate improvement of TIRA detection sensitivity from 2 cm to **1.9 cm** (minimum detectable object size at 1000 km range)*
- Capability of switching between upgraded and old L-band transmitter
  - *Significant reduction of mid/long-term TIRA system down times due to maintenance and repair activities*
  - *Reduction of short-term outages during a BP campaign by temporary switch over to the backup system after a failure of the active transmitter*
- The upgraded transmitter no longer needs a longsome „training“ phase (to obtain max. output power) to be ready for a 24 h campaign but will be available **20 min** after power-on
  - *Enables a near-term realization of „ad hoc“ debris measurements, e. g. shortly after a fragmentation event*
- The upgraded antenna drive/control system could relieve the realization of the „Stare & Chase“ mode
  - *Improved estimation of debris orbital parameters*