# Sentinel-2 Mass Memory and Formatting Unit and Future File Based Operations

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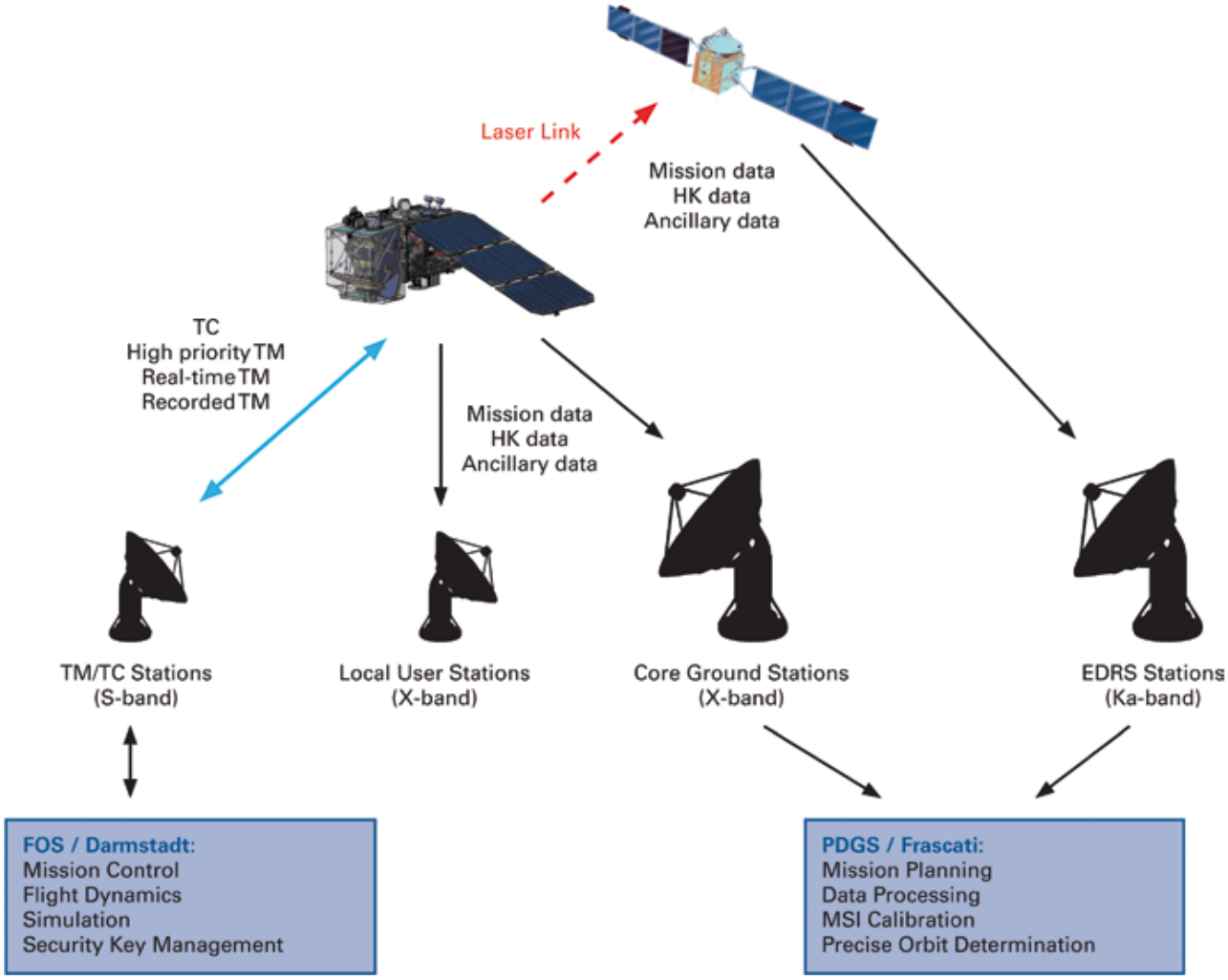
# Sentinel-2 Communication Links [1]



# Sentinel-2 Communication Links [2]

- **S-Band link**
  a. Dual rate TM (1Mbps nominal mode, 64kbs for safe mode)
  b. Single rate TC (64kbs)
  c. Transponder interfaces directly to On-Board Computer (OBC). OBC Mass Memory is source of S-Band data
- **X-Band link**
  a. Payload Image data, Satellite HK data and Satellite Ancillary Data (platform data used to process image data) transmitted via X-Band mission link
  b. Frames formatted according to CCSDS AOS standard
  c. 2*RF channels @ 280Mbps each channel
  d. System level FER requirement =>10E-7
  e. High margins ensure much better link performance than requirement
- **Optical link**
  a. Encapsulates CCSDS AOS frames within another frame layer => Treated as a bit-stream
  b. Proposed approach specific to Sentinel-1a and 2a, demonstration of operation rather than final configuration for future EO missions
  c. Data stream occupies one 600Mbps channel, OCP capable of 3*600Mbps. Optical link performance is TBD.

# Sentinel-2 MMFU Architecture [1]

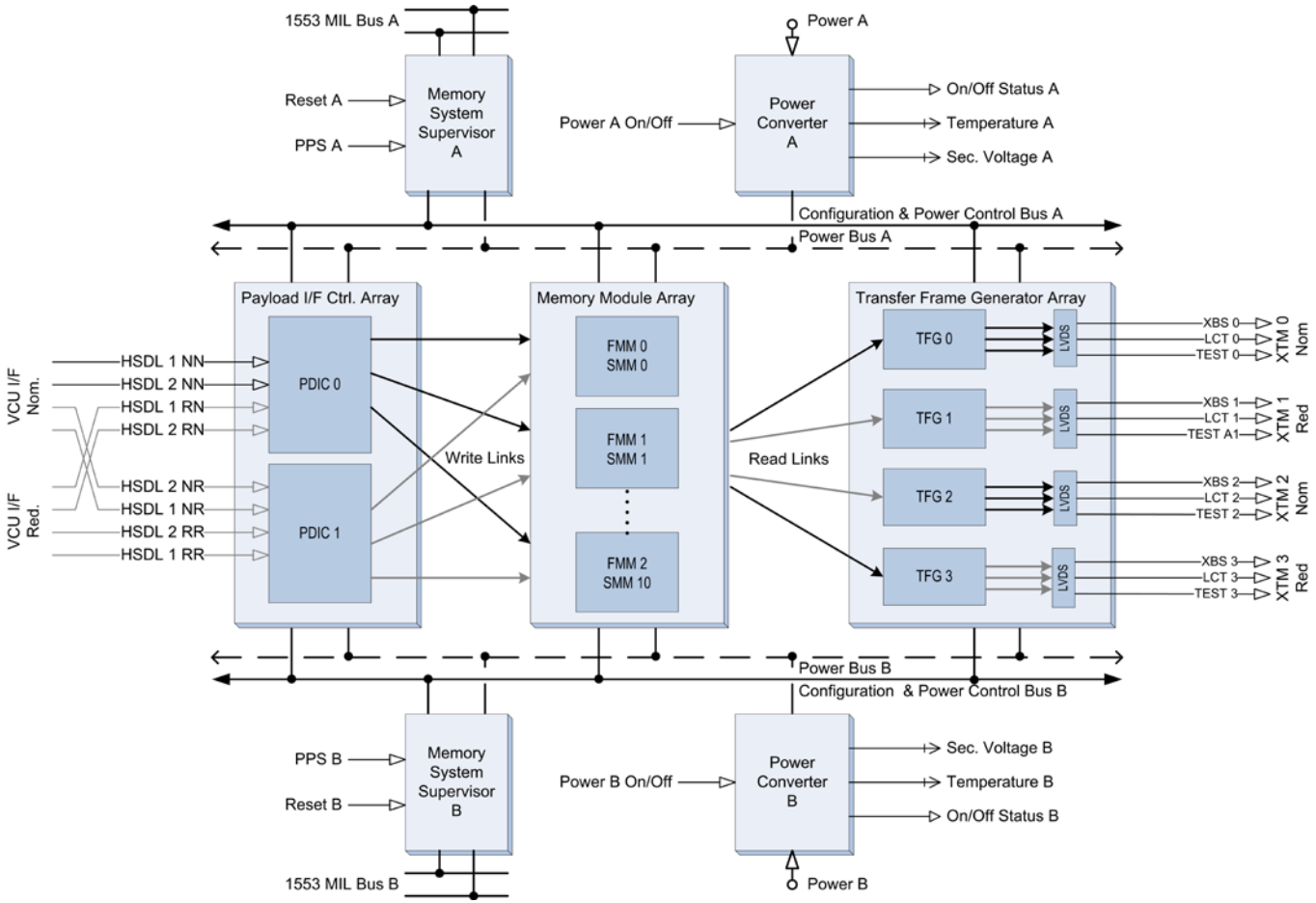



Image provided by Astrium-D

# Sentinel-2 MMFU Architecture [2]

- MMFU is based on NAND-Flash technology => Capacity of 6Tbits BoL
- NAND-Flash technology selected in order to minimise mass, power and volume of the unit. Approx 50% saving compared to SDR SDRAM
- Memory organised into packet stores (satellite HK, satellite ancillary data and payload image data) => Classical ESA EO architecture
- Packets store sizes can be re-configured by telecommand. Data can be accessed with or without delete operation => Allows re-transmission of missing data on successive X-band passes.
- X-band and Optical interfaces are Tx only. Re-transmission requests must be sent via S-band links => S-band stations are not necessarily colocated with X-band stations so real time re-transmission requests are not currently possible

# Future Outlook

- Mission data availability & timeliness directly determine criticality of data transfer performance, e.g. GMES Sentinels are operational missions and therefore have demanding mission/data availability requirements
- Currently, all Sentinel-2 mission requirements can be met using only X-band and S-Band links. Optical payload is embarked as a demonstrator.
- Data volumes and link rates (particularly for radar missions) will only increase as mission capabilities increase.
- Future Earth Observation missions may/will utilize Ka-Band and/or Optical terminals => Link characteristics are quite different when compared to X-Band. Need for re-transmission of lost packets may become “nominal”
- File-based operations could allow more efficient management of all comms links (X-Band/Ka-Band, S-Band, Optical) => Automation of repetitive mission operations, improved process for handling data on-ground
- Using Sentinel-2 MMFU as an example, move to file-based operations would require limited satellite HW modifications. Ground architecture/concept would possibly require greater modification

# Summary of Issues to be Addressed

- Decision to implement file based operations must take into account space segment, mission control and mission data processing needs, i.e. SYSTEM LEVEL => Therefore all parties must be involved in the definition of concept, formats etc.
- Close coordination between space and ground experts to ensure concept, data structures, file formats meet the needs of the mission. Particularly availability and timeliness of data in the case of operational missions such as GMES must be maintained or even improved
- Performance characterisation of EO satellite ⇔EDRS link is critical as this is likely to become nominal mission link (together with X or Ka-Band)
- Future operations concept should attempt to minimise impacts on existing architecture (if possible?) => Evolution rather than Revolution
- Changes/Impacts to existing ground architecture should be critically assessed. Any implementation of file-based system should also take account of mission data processing => space segment to final data product.
- Other Issues?