



CENTRE NATIONAL D'ÉTUDES SPATIALES

3rd IASS
Conference



Building a safer space together :

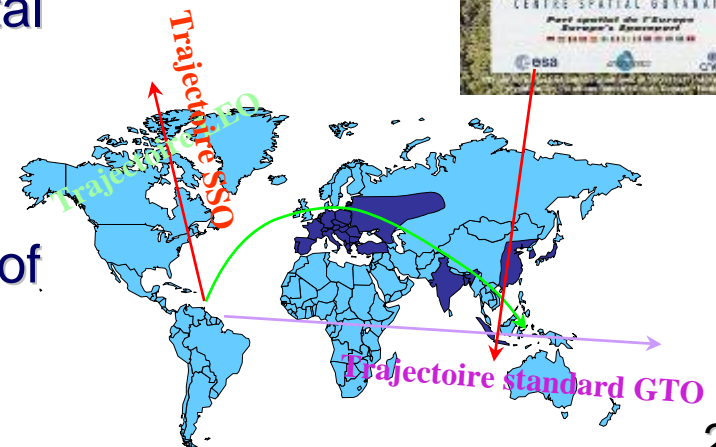
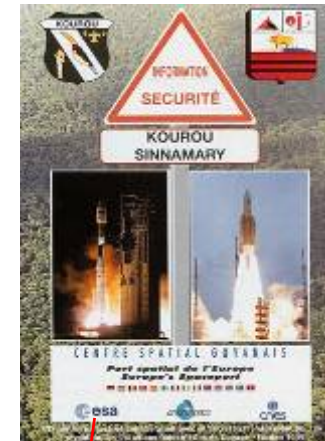
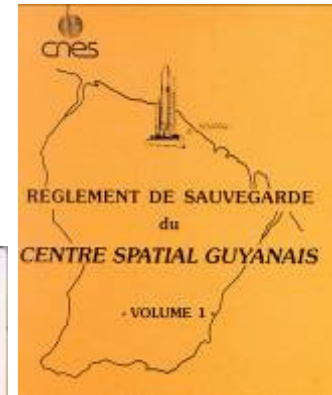
CNES and Space Safety

Michel EYMARD

Head of Launchers Directorate
CNES

Since more than 40 years, **CNES** is deeply involved in **Safety**

- **legal needs** : CNES rules for operations and flights, ensuring security towards States and Earth population
- **operational needs** : safety and mission success, deeply linked to the performance of a space system (launch service or orbital service), design driver for hardware reliability
- **space protection** (debris mitigation, end of life management)



Launchers

- Project aspects :

integration of safety aspects at the beginning of the design (definition of risky systems, danger analysis, RAMS analysis, specific tests for security, ...)

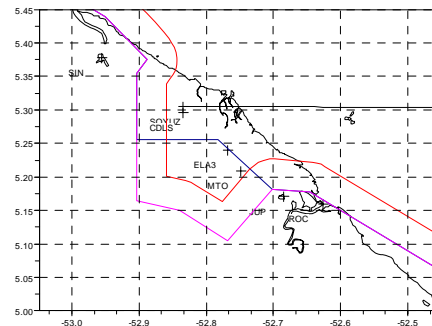
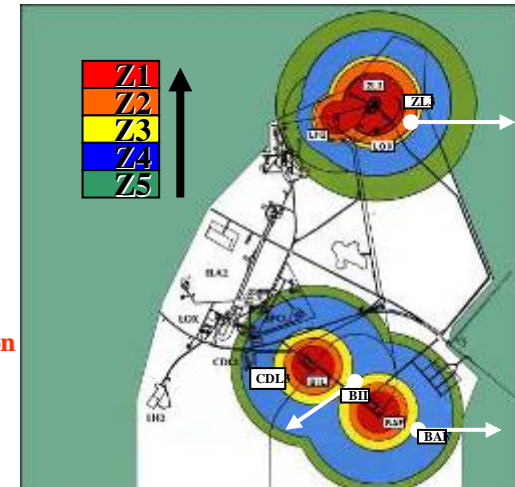
- Safety process :

formal «submissions » at each major step of a program, with respect to CNES Safety Policy (ground, near-field range, nominal stage fall back, far range, satellisation of upper composite, end-of-life measures : models, methods, tools and algorithms on ground or on board ...etc)

No casualties during space port exploitation ;
destruction of launchers if abnormal behaviour
(Ariane 4 V36, Ariane 5 L501 and 517)



Destruction units



Spacecraft

Objectives :

- Protection of Earth and celestial bodies: planetary protection
- Protection of satellites: space debris
- Protection of population: ground safety

Content of safety activities :

- Mission analysis
- Definition of requirements
- Development of software tools for trajectory prediction, debris footprint estimation and on-ground risk evaluation, in-orbit collisions predictions
- Operations: collisions (operational collision monitoring activity) and reentries (controlled or uncontrolled)



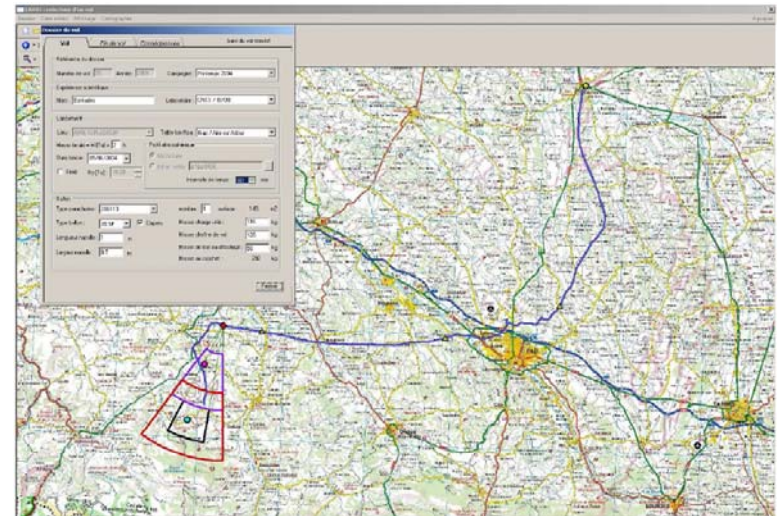


Balloons

Important CNES activity on scientific missions launched with balloons

CNES in charge of ground safety

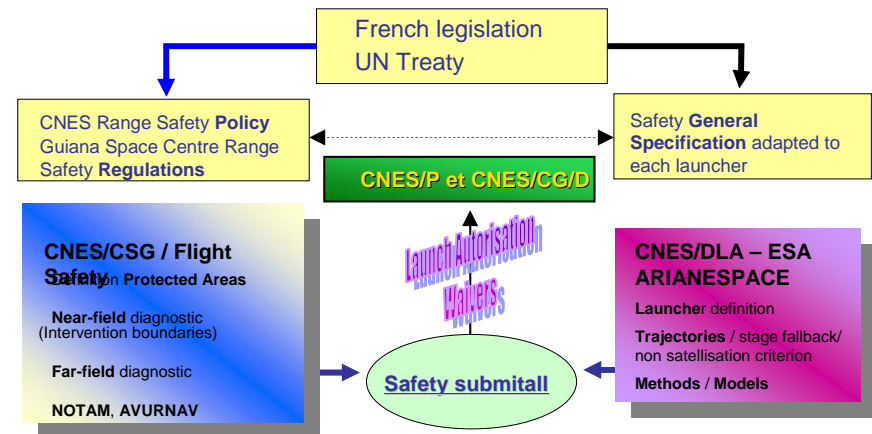
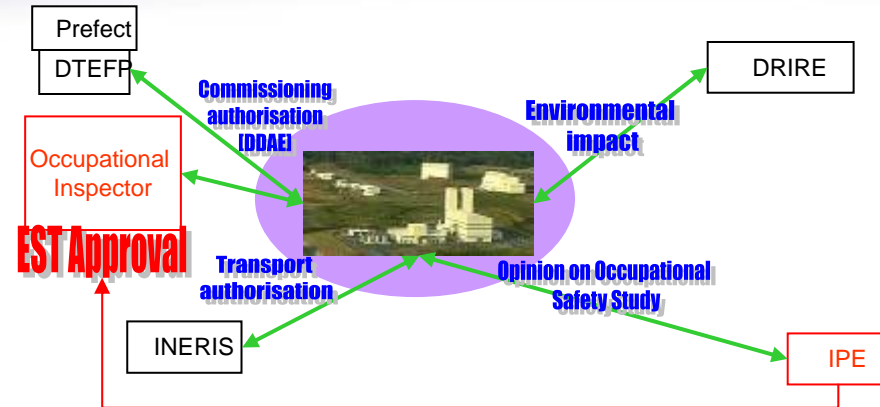
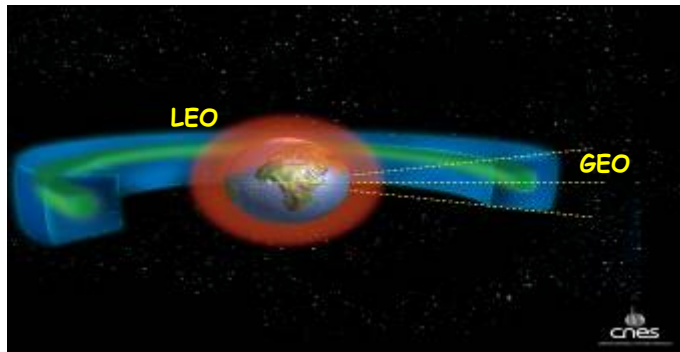
- Before launch: mission accepted estimated risk acceptable
- Last simulation with updated meteo just before launch
- During the flight the wind profile is updated: risk computed before end of flight decision





Today : Application of french laws + CNES Safety Policy for ground and flight safety + Code of Conduct for in orbit safety

- To limit operational debris
- To protect Low Earth Orbits (LEO): 25-year rule
- To protect the Geostationary Orbit (GEO): graveyard orbit
- To passivate space systems at end of life



Tomorrow : New regulation



French « law for space operations »

Enhancement of CNES technical control for French Research Minister

What are the **new challenges** for systems in Europe?

- Mars Exploration problematic (RHU ?)
- new methods thanks to new computer capabilities
- new launch systems (airplanes, reusable launchers, ...)
- human flights, ...
- reinforcement of the natural link between Safety and Environment protection



IAASS initiatives are preparing the future:

- link between design engineers, safety engineers and scientists
- international cooperation framework for space safety