

# X-Ray Inspection of Satellites

This project option focusses on designing a complete space mission built around the idea of inspecting a satellite using X-ray technology. The task is to consider the mission as a whole: the spacecraft itself with all its subsystems, the choice of a suitable European launch vehicle, and the ground segment needed to operate the mission and bring data back to Earth.

What makes this project interesting is the use of X-rays as an inspection tool. While most satellite observations today rely on optical or radar systems, X-rays could reveal features that are hidden from those methods. For example, they might help to identify structural damage inside a satellite, provide clues about the health of systems that have stopped responding, or offer more detailed assessments of debris objects in orbit. In other words, X-ray inspection could add a completely new dimension to how we monitor and maintain spacecraft.

There are also wider implications. Being able to look “inside” satellites could strengthen space situational awareness and help operators avoid risks in crowded orbital environments. It could also play a role in verifying the status of satellites for regulatory or security purposes, or in preparing strategies to remove large pieces of debris. These possibilities make X-ray inspection more than just a technical curiosity — it is a capability with the potential to shape how space is managed in the future.

As part of your design, you should also define the mission target or targets that your spacecraft will inspect. This choice is not trivial and will have significant impact on the rest of your design. A cooperative target, such as a satellite operated by a friendly agency or organization, may allow for easier mission planning and provide clearer data return. On the other hand, selecting a non-cooperative target — for instance, a defunct or unresponsive satellite — poses greater technical challenges but also highlights the unique value of X-ray inspection. You might also consider multiple targets, which would require trade-offs between orbital mechanics, fuel use, and mission duration. In any case, your target selection should be motivated by a clear rationale that ties into both the technical feasibility of your spacecraft and the broader relevance of the mission.

In addition to inspection, you may also choose to extend your mission concept to include repair or servicing of the target satellite. This would mean not only diagnosing damage or anomalies with X-ray imaging but also proposing ways to intervene physically — for example by replacing components, restoring functionality, or stabilizing a failing spacecraft. While this raises the level of complexity significantly, it also introduces new design challenges that are highly relevant to the future of space operations, where on-orbit servicing and repair are expected to play an increasingly important role.