15 Operational Analysis

The primary task in the design of a large facility such as HiPER is the necessity to precisely define the needs and objectives required for the investment. This must include the performance of the facility in order to reach the required science goals, but also the available budget for the construction and the operational phase (without forgetting decommissioning), the operational organisation, the machine survey and maintenance and the available manpower.

The final system will be a trade off of all above parameters, analysed using a detailed performance-cost model. This need to be built with independent parameters defining the life cycle of the facility. In addition a complete risk analysis is necessary to reach a realistic picture: scientific, technical, industrial, manpower (skills), organization and political, etc.

Many of the fundamentals of this approach are common to all large facilities, and indeed in the case of HiPER, much overlap can be expected with the detailed analysis performed for other large laser facilities.

The life cycle profile describes the following parameters for each type of activity to be performed:

- the occurrence
- the period when it occurs
- the duration
- the associated system configuration
- the goal of the system for this activity

From the above description, one can extrapolate:

- the parameters to manage the availability and maintainability
- the parameters to manage the operation cost

The life cycle profile is derived from:

- the users needs
- the operational constraints

The operational analysis of a large laser facility requires the following parameters to be defined:

- the diagnostics configurations (type, number and position)
- the target types (cryogenic, radioactive, etc)
- the laser parameters: number/campaign, the ratio of successful shots required, the laser performance (energy, intensity, symmetry, smoothing, number of beams …)
- degraded modes

Practically for a facility like HiPER, specific characteristics should be taken into account. These could include:

- The goal : to achieve inertial fusion with fast ignition and a laser driver (this includes cryogenic targets and laser specifications)
- The operating consequences : radioactivity in experimental areas which lead to radioprotection and safety procedures which may forbid access
- The physics goal requires specific energy and power levels from the laser system. This induces a design trade off to determine the intensity per beam (for both compression and ignition beams). The optics damage phenomena which is proportional to intensity, will lead to optics maintenance criteria impacting on operational cost and availability of the machine.

- Number of calibration shots needed
- The shot cycle duration
- The number of shifts/day
- The activities which cannot be done simultaneously

Once the life cycle profile is determined with some assumptions for the operational parameters, one can define the system availability, from which is allocated the equipment availabilities. This impacts the equipment design and the integrated logistic support (ILS) from which equipment reliability and maintenance tasks can be described.

The following iterative model can be set up.

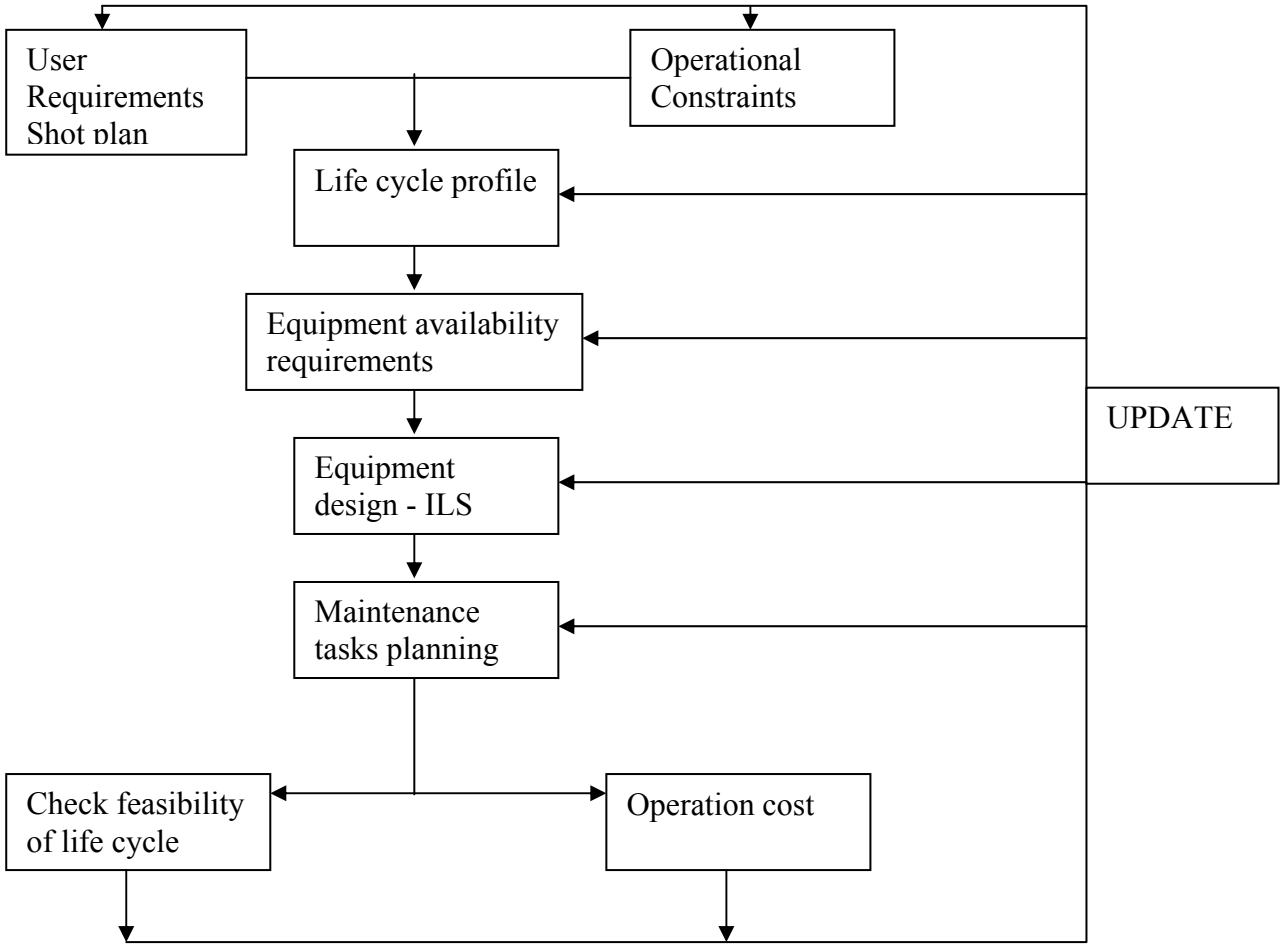

Figure 15.1 Operational analysis model

During the preparatory phase it will be necessary to develop and adapt the model to optimise the technical design, the performance, operation and management of the HiPER facility. It will possible to derive the method from existing facilities and in particular drawing from the experience within CEA.