The integration of cognitive functions will enable mechatronic systems to be superiorly embedded into their environment and to follow their system objectives independently. The intention is to develop intelligent adaptive systems, which are more flexible, robust and user-optimized. Numerous challenges, however, become apparent on the way to such advanced mechatronic systems. For instance, there is a lack of a systematic coupling of those disciplines, which are relevant for the exploration of cognitive functions with the general engineering approach in product development. To overcome these challenges, the integration of cognitive functions has to be supported already during the early stages of the development with some kind of methodology. Important requirements occur in terms of the intensified interdisciplinarity of the development and the increasing system complexity. Therefore, a design framework for the integration of cognitive functions in advanced mechatronic systems is developed, which integrates both existing and newly developed methods in a well-structured procedure. It is based on an engineering terminology for cognitive aspects. The design framework itself is divided into four main components: a well-structured procedure model, a technique for the system description, reusable solution knowledge in form of solution patterns and a conception of a tool support, which is prototypically implemented. The design framework is validated by the conceptual design of a sub system of the project Neue Bahntechnik Paderborn/RailCab,