9 Project management and organisation

9.1 Introduction

In accordance with the draft X-Ray Free-Electron Laser (XFEL) legal texts (Convention and Articles of Association):

- the construction and operation of the European X-ray FEL Facility shall be entrusted to a limited liability company, the XFEL GmbH;
- the XFEL GmbH and Deutsches Elektronen Synchrotron (DESY) in Hamburg will collaborate on construction, commissioning and operation of the XFEL on the basis of a long-term agreement;
- the shareholders contribute to construction costs either in cash or in kind, where the in-kind contributions are defined and decided in accordance with rules laid down in Annex 5[8] to the XFEL Convention.

While implementing these objectives, it has to be ensured that:

- the XFEL GmbH is provided with the appropriate resources and tools to assume the responsibility for construction and operation;
- the collaboration between the XFEL GmbH and DESY is transparent, with clearly defined roles, no duplication of structures and no conflicts of interest;
- reasonable and adequate consideration is given to the international partners' interests to contribute to the project, with equal conditions and opportunities for DESY and other interested institutes.

The intended set-up of the future XFEL GmbH and the structure of the relationship of the XFEL GmbH with all contributing institutions during the construction period is set out in the following sections, with special consideration of the relationship between the XFEL GmbH and DESY. Section 9.2 deals with the structure of the XFEL GmbH itself, first the internal organisation foreseen for the steady state in about ten years, then the steps to attain this objective. Section 9.3 describes the project management structure and the general procedures concerning tasks, work packages and in-kind contributions, while Section 9.4 focuses on the special aspects of the corresponding collaboration agreement between the XFEL GmbH and DESY. This refers, on the one hand, to DESY's role as contributor to the XFEL project, and on the other, to DESY's role as host of the XFEL GmbH. Section 9.5 sets out the management tools to be applied, largely inspired by the well-proven practice of DESY.

[8] See the basic rules and procedures in Section 9.3.2.

9.2 Internal organisation of the XFEL GmbH

9.2.1 General aspects

Once the XFEL legal texts (Convention, Final Act and Articles of Association) are signed and the XFEL GmbH is registered, the responsibility for advancing the project, so far borne by DESY, will lie with the XFEL GmbH, the cash contributions will flow through its accounts, and it will have to oversee all in-kind contributions. The appointment of Managing Directors (forming the Management Board) is one of the preconditions for registering the company. One of the directors will assume the function of the project leader. In addition, a core team will be necessary from the start, even if many components are provided as contributions in-kind and many tasks, especially in the beginning, are handled by DESY through power of attorney. The coordination and management of the construction of the XFEL facility requires a technically competent team as part of the XFEL GmbH, to assist the XFEL Project Leader, with experience in the following fields: Accelerator Physics, Civil Engineering, Infrastructure (electrical, fluids, cryogenics, communication networks), Photon Beamlines and Instrumentation, Project Management and Administrative Procedures (Accounting, Purchasing, Contract Management).

The XFEL GmbH must also be ready to take over those work packages or tasks, which will not be assigned to collaborating institutes. In particular, the build-up of a Scientific Experiments Division must start as soon as possible and grow in a few years to a staff of about 200 people.

9.2.2 Primary tasks and internal structure of the XFEL GmbH

The XFEL GmbH with its organs (Council, Management Board), supported by various advisory committees (Science, Machine, Administration and Finance), will, in particular, be in charge of the:

- coordination and monitoring of the construction activities;
- scientific policy and strategy;
- build-up of five beamlines with ten experiment stations and associated infrastructure;
- operation of the beamlines and the implementation of the user programme;
- further development of the facility based on a vigorous research and development (R&D) programme;

and, related to the aforementioned tasks;

- management, supervision and controlling of all financial and other resources made available by the shareholders or through collaboration contracts.

The internal structure of the XFEL GmbH, aimed at in the long-term, is illustrated in Figure 9.2.1. It shows the organs of the company (Council and Management Board), the Advisory Committees (Machine, Science, Administration and Finance) and the distribution of the personnel among, essentially, three divisions (Technical, Experiments and

Administration) and some services directly assigned to the Director General (Safety, Communication and Internal Audit). This structure refers to the operation phase and has, for the time being, to be considered as a best guess, which needs further fine tuning during the years to come.

The relationship with the in-kind contributors and, in particular, with DESY during the construction period is further expanded in Section 9.3.

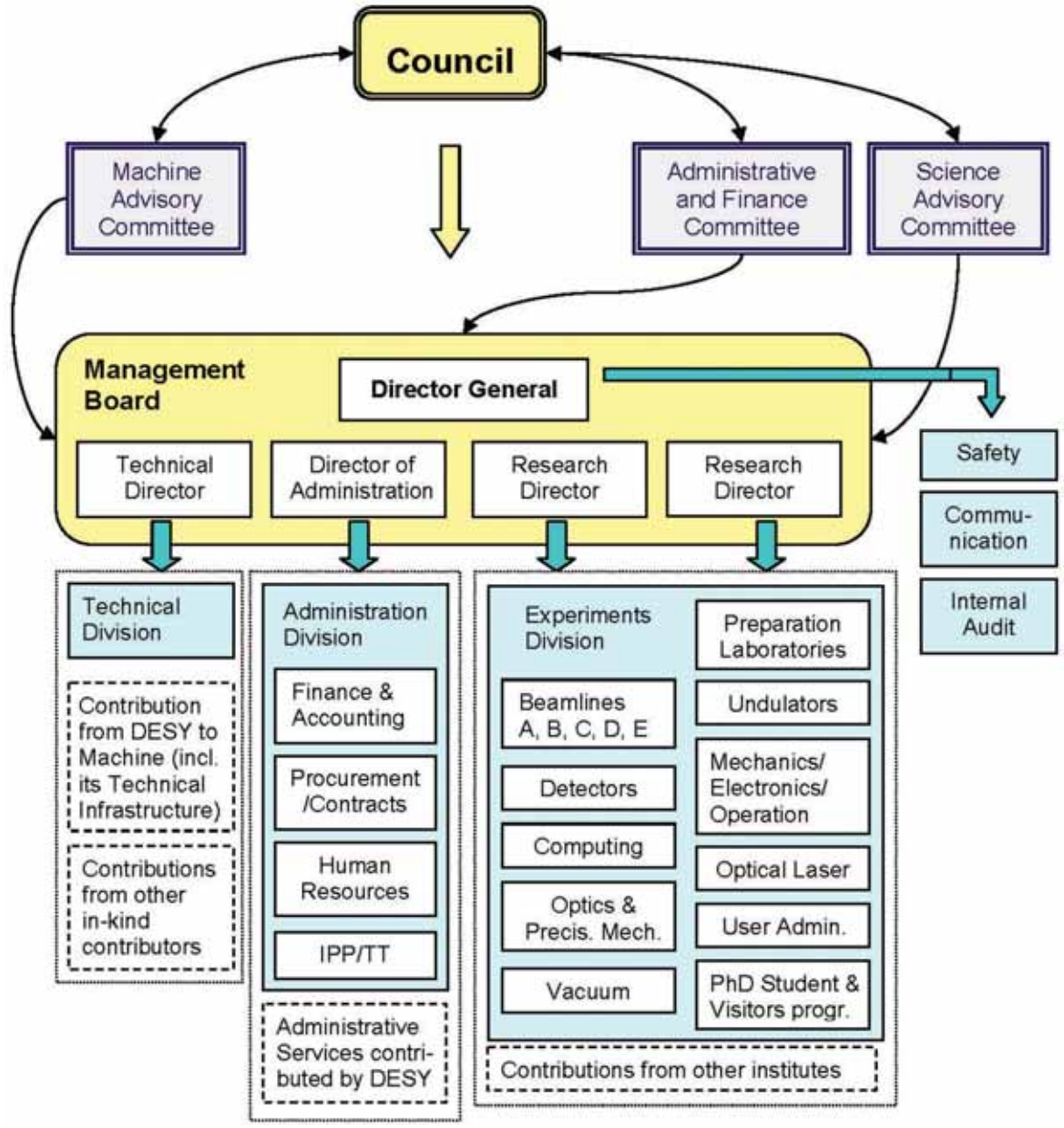

Figure 9.2.1 *Organisation chart of the XFEL GmbH for the operation phase.*

Certain tasks will be “contracted out” to DESY, on the basis of a long-term collaboration agreement. This will, in particular, apply for the accelerators and for the technical infrastructure. Although the extent is not fully specified, it seems very likely that for these two areas the staffing on the side of the XFEL GmbH can be restricted to people:

- working on very specific XFEL-related tasks; or
- coordinating and liaising with personnel from DESY and other in-kind contributors.

For the time being we assume that about 10% of the 251 full-time equivalents (FTEs) foreseen in the costing of the operation under accelerators/infrastructure will be represented by XFEL GmbH personnel. In Figure 9.2.1 they appear under Technical Division and Safety Group. This item is further developed in Section 9.2.3.

On the other hand, the photon beamlines and the ten experiment set-ups are expected to be constructed and operated essentially by XFEL personnel, albeit in close contact with interested user groups. The Experiments Division will, therefore, make up the main part of the XFEL GmbH’s staff with a complement of 203, out of which 115 (5 × 23) staff directly assigned to the five beamlines (ten stations), 51 to the various beamline support groups, four for user administration, 20 posts for thesis students and 10 posts to accommodate scientific visitors collaborating temporarily on specific projects. A tentative distribution by specific areas is given in Table 9.2.1.

The **Administration** will be in charge of all financial matters, all procurements not carried out in the framework of in-kind contributions, follow-up of contracts and all personnel matters such as recruitment, salaries, and staff development. While these core activities need to be under the close control of the XFEL Management, for other, more peripheral, administrative tasks (such as works doctor, guest services and site security), sharing of resources with DESY appears appropriate. The staff complement required for the Administration is estimated at about 34 persons.

Management of the XFEL GmbH will be under the responsibility of the **Board of Managing Directors** chaired by a Director General. Given the variety of disciplines concerned and the complexity of instrumentation, two Research Directors are foreseen for the operation phase. The five directors, one assistant and several secretaries together with Public Relations and Internal Audit make up a complement of 15 persons.

The aforementioned tentative staff distribution is based on our present overview of the project. However, the XFEL GmbH must retain a wide degree of flexibility in its organisation. The proposal outlined above may well be revised in the light of future experience and following the exact definition of the role of DESY in the long-term operation and development of the XFEL Facility.

		Specific fields of activity (tentatively)									
		Experiments	**Detectors**	**Computing**	**Optics/ diagnostics/ beam transport**	**Optical laser systems**	**Preparation labs**	**Vacuum**	**Mechanics/ electronics/ operation**	**Undulators**	**Total**
Per each of the five **beamlines** (with **two** stations each)		**9**	**2**	**2**	**3**	**1**	**2**	**1**	**3**		**23**
out of which	scientists	5	1	1	1		1				9
	engineers	2	1	1	1	1		1	1		8
	technicians	2			1		1		2		6
BL support groups		**5**	**2**	**6**	**8**	**3**		**6**	**8**	**13**	**51**
out of which	scientists	5	2	1	2	2				3	15
	engineers			5	3	1		2	4	4	19
	technicians				3			4	4	6	17
BL operation total		**50**	**12**	**16**	**23**	**8**	**10**	**11**	**23**	**13**	**166**
out of which	scientists	30	7	6	7	2	5			3	60
	engineers	10	5	10	8	6		7	9	4	59
	technicians	10			8		5	4	14	6	47
									User Administration		**4**
									PhD student programme		**20**
									Visitors programme		**10**
									Secretariat		**3**
									Experiments Division Total		**203**

Table 9.2.1 *Planned staff complement of the Experiments Division.*

9.2.3 Operation of the accelerator complex

During its period of usage, i.e. after the commissioning phase, the XFEL will run in continuous around-the-clock operation for long periods in order to obtain stable conditions and to make the best benefit from the large investment made. The objectives of:

- high availability and reliability of the accelerator complex;
- adjusting the beam parameters to the specific requirements of the users;
- keeping the beam parameters extremely stable during the experimental sessions; and
- achieving this with an efficient use of the available resources;

put strong demands on the organisation of operation. Those people who are involved in this task must:

- have the adequate know-how of the technical systems and the functionality of the accelerator in order to be able to react appropriately in case of problems;
- communicate effectively about the performance of the technical systems, limitations and problems, needs for developing new tools, etc; and
- be highly motivated to achieve the optimum performance of the accelerator complex.

There are various technical systems mandatory for reliable operation, which have to be fixed as quickly as possible in the event of failures. For some systems such as cryogenics or power supplies, experts must either belong to each shift crew or be available on very short notice. For other systems such as vacuum systems, on-call duty might be sufficient.

The DESY Machine Group, which is likely to be strongly involved in the construction and commissioning of the accelerator complex, is, due to its intimate knowledge of all systems, also best suited to assume the operation tasks. Joining forces with the operation of the other accelerators at DESY (DORIS III, PETRA III, and especially FLASH) brings additional benefits. By bundling the service for the systems of all accelerators, it will become feasible to ensure shift service for systems which otherwise could only be covered by on-call duty.

For the time being, it is, therefore, proposed that, in the framework of the long-term cooperation agreement between the XFEL GmbH and DESY, the operation of the accelerator complex and the associated technical infrastructure be entrusted to DESY. Nevertheless, the XFEL GmbH should not remain totally bare of any involvement in operation, let alone to enable the full understanding of all problems which might arise and of any further development work proposed. The small machine-oriented technical team of the XFEL GmbH will essentially pursue R&D projects, but also participate in the XFEL operation alongside their colleagues of DESY.

9.2.4 Build-up of the XFEL staff complement

As indicated at the end of Section 9.2.2, the staff requirements detailed hereafter should be treated as a tentative proposal. They are shown, as a function of time, in Tables 9.2.2 to 9.2.6 with a breakdown by grade and type of work. The numbers represent the positions to be filled **at the end** of each corresponding year (and as such, should not be confused with the FTEs needed **during** the year). At the end of year 2016, a total complement of 281 people is planned. Of these, 135 will be of category K1 (scientists, senior engineers and administrators) and 126 of category K2 (technicians, junior engineers[9] and administrators and secretaries), and 20 will be thesis students. It is expected that there will be more thesis students working at the XFEL Facility, but funded from other sources (e.g. EU grants or national grants in the framework of collaboration contracts).

Although in the long term, the XFEL activity will possibly grow beyond the current target specifications and might well be expanded to a second fan of beamlines, the present estimates are based on the assumption that beyond 2015, the x-ray source and the ten experimental stations are run in a steady-state mode. This explains the flattening out of the staff evolution in the later years (apart from the visitors and students programme added from 2016 on). Obviously, this will have to be revised if the second fan of beamlines is to be implemented.

Figure 9.2.2 illustrates the planned evolution of the personnel of the XFEL GmbH, as summarised in Table 9.2.6. Specific posts for PhD students appear here only once the facility is in full operation. This does not exclude that beforehand, posts of the planned general staff complement are opened for thesis students working on tasks related to construction and commissioning.

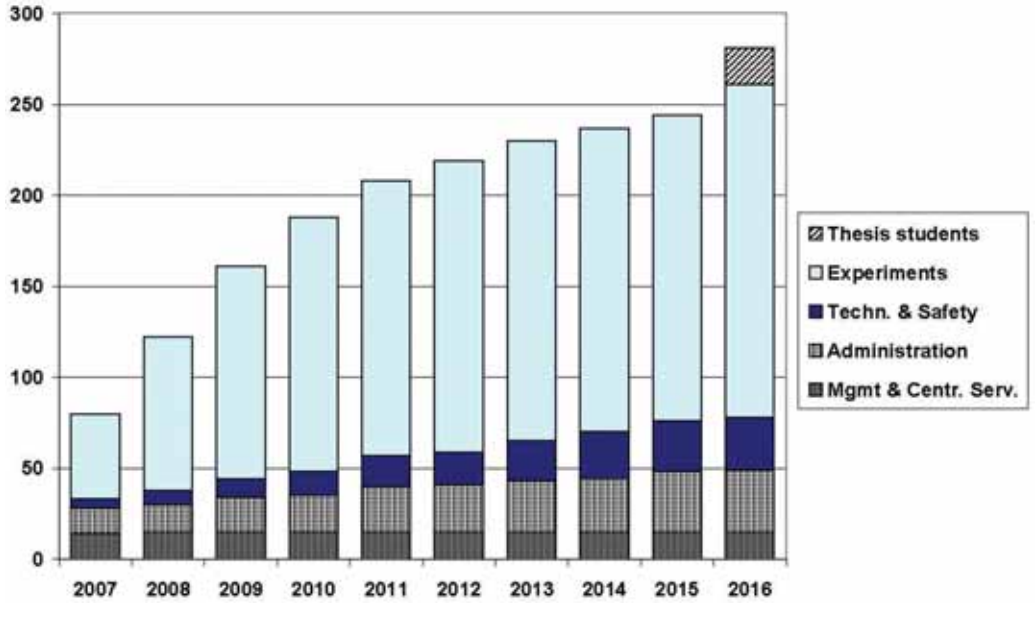

Figure 9.2.2 *Evolution of personnel of XFEL GmbH.*

[9] About half of the engineer positions were assigned to K1 and half to K2.

	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016	
ExperimentsDdivision	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**
Experiments	10	5	20	7	30	10	33	12	34	13	34	14	35	15	35	15	35	15	35	15
Detectors, computing	8	2	15	5	18	7	20	8	20	8	20	8	20	8	20	8	20	8	20	8
Optics/diagnostics/beam transport	3	2	5	5	8	8	10	11	10	12	11	12	11	12	11	12	11	12	11	12
Laser systems/Preparation labs/vacuum	2	2	3	4	4	6	7	8	8	13	11	14	11	15	12	15	12	15	13	16
Mechanics/electronics/operation	2	3	4	5	4	8	5	11	5	13	5	16	5	16	5	16	5	16	5	18
Undulators	5	2	6	4	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6
Secretariat		1		1		1		2		2		2		2		3		3		3
User administration													1	1	1	1	1	2	1	3
Visitor programme																			10	
Subtotal	30	17	53	31	71	46	82	58	84	67	88	72	90	75	91	76	91	77	102	81
	47		84		117		140		151		160		165		167		168		183	
Thesis Students (½ K1)																			20	
Total																			203	

Table 9.2.2 *Evolution of Experiments Division Personnel (excluding thesis students), in number of posts to be filled at the end of the corresponding year.*

	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016	
Technical Division & Safety Group	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**
Total	4	1	6	2	7	3	8	5	9	8	9	9	11	11	12	14	13	15	13	16
	5		8		10		13		17		18		22		26		28		29	

Table 9.2.3 *Evolution of Technical Division and Safety Group personnel, in number of posts to be filled at the end of the corresponding year.*

Administration Division	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016	
	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2
Finance (budget, accounts)	1	3	1	3	2	3	2	3	3	4	3	4	3	4	3	4	3	4	3	4
Procurement, contracts, stores	1	3	1	3	1	4	1	5	2	6	2	6	2	7	2	7	2	8	2	8
Personnel (recruitment, pay, etc.)	1	3	1	3	2	3	2	3	3	3	3	4	3	4	3	4	4	4	4	4
General (reception, travel, library, etc.)		2		3		4		4		4		4	1	4	1	5	2	6	2	7
Total	3	11	3	12	5	14	5	15	8	17	8	18	9	19	9	20	11	22	11	23
	14		15		19		20		25		26		28		29		33		34	

Table 9.2.4 *Evolution of Administration Division personnel, in number of posts to be filled at the end of the corresponding year.*

Management Board	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016	
	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2	K1	K2
Directors and assistants/secretariat	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5
PR, Communications, Web	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1
Internal Audit			1		1		1		1		1		1		1		1		1	
Total	8	6	9	6	9	6	9	6	9	6	9	6	9	6	9	6	9	6	9	6
	14		15		15		15		15		15		15		15		15		15	

Table 9.2.5 *Evolution of Management Board and associated personnel, in number of posts to be filled at the end of the corresponding year.*

	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016	
XFEL GmbH	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**	**K1**	**K2**
Experiments	30	17	53	31	71	46	82	58	84	67	88	72	90	75	91	76	91	77	102	81
Technical Division and Safety Group	4	1	6	2	7	3	8	5	9	8	9	9	11	11	12	14	13	15	13	16
Administration	3	11	3	12	5	14	5	15	8	17	8	18	9	19	9	20	11	22	11	23
Management and associated services	8	6	9	6	9	6	9	6	9	6	9	6	9	6	9	6	9	6	9	6
Subtotal	45	35	71	51	92	69	104	84	110	98	114	105	119	111	121	116	124	120	135	126
Students (½ K1)																			20	
Total	80		122		161		188		208		219		230		237		244		281	

Table 9.2.6 *Summary of evolution of XFEL GmbH Personnel, in number of posts to be filled at the end of the corresponding year.*

9.2.5 Status of personnel and recruitment policy

The XFEL GmbH's personnel management and salaries policy depend on the legal framework. As a private company under German law, the XFEL GmbH will be subject to German legislation, including the current labour legislation. Salary scales and working times similar to those paid in the public sector (and thus, not too different from those at DESY and at other German research centres) are anticipated. Nevertheless, some positive features available to employees of public service-like organisations such as DESY (employment security, additional pension scheme, etc.) will have to be compensated for by some extra payment in order to render the XFEL GmbH competitive in the labour market, especially for scientists and engineers.

As far as possible the aim of the recruitment policy will be to produce a balanced staff structure with respect to nationality. Where reasonable, the posts will be advertised in all the member countries. As with other comparable international organisations, people hired from abroad will receive settling-in, adaptation and expatriation allowances, and their removal expenses will be refunded. The allowances for transfer to the Hamburg area and the expatriation allowance will be set to attract good candidates from all Contracting Party countries.

During construction of the facility, the XFEL GmbH will only recruit people who will continue to be needed for its operation, improvements and developments. The engineers and technicians who have worked on the construction of the machine and the instruments will have an intimate understanding of it. They are the best people to operate the source and the experimental equipment efficiently. Additional "peak" effort possibly required during construction will, therefore, be "bought in" by subcontracting and will be quoted under Capital Costs.

Personnel directly involved in the operation of the facility such as engineers, technicians, other support staff and at least one scientist per beamline could be offered permanent contracts.

Directors and most junior scientists will have fixed-term contracts, normally for five years. Nevertheless, contracts for staff engaged in the early design and construction phase of the project might be extended for a certain period. They should have the opportunity of following up commissioning and the early stages of operation. Research posts (normally three years) will be available for thesis students.

Specific in-house provisions will be set up for:

- shift work, staggered working hours and on-call duty (in the context of the permanent operation of the installations);
- personnel from outside firms and temporary workers;
- visitors and consultants.

9.3 General project structure and procedures for the construction period

9.3.1 Principles

The whole XFEL construction project has been structured according to work packages or tasks, combined into groups as follows:

Group 1: Linac	01 RF system 04 SC cavities 07 Frequency tuner 11 Cold magnets	02 Low level RF 05 Power coupler 08 Cold vacuum	03 Accelerator modules 06 HOM coupler 09 Strings
Group 2: Accelerator Subsystems	12 Warm magnets 16 Lattice 19 Warm vacuum	14 Injector 17 Standard Beam Diagnostics 20 Beam Dump	15 Bunch compressor 18 Specific Beam Diagnostics
Group 3: Photon Beamlines	21 Undulators 24 Photon diagnostic 27 FEL concepts	22 Hard photons 25 Experiment areas	23 Medium photons 26 Detector developmt
Group 4: Control and Operation	28 Control systems 36 General safety	29 Operability 38 Personnel interlock	35 Radiation safety 39 EM interference
Group 5: Infrastructure	10 Module test facility 33 Tunnel installation	13 Cryogenic 34 Utilities	32 Survey
Group 6: Site and Buildings	31 Site and civil construction	37 Plan approval procedure	

Preparatory work has been carried out on this scheme for about three years, pushed forward almost exclusively by DESY's XFEL Project Group. For the construction, commissioning and operation, a broader participation is expected. The procedures for the distribution of these tasks have to ensure that for tasks which are not performed by the XFEL GmbH itself, individual institutes have the opportunity to contribute to the project according to their capacities and with their contributions being visible as such.

From the funding point of view, there are basically two different options for institutes from the Contracting Party countries to get involved in the construction and operation of the XFEL Facility:

- a contract with the XFEL GmbH on the supply of equipment and/or services, paid from the XFEL's budget; and
- the contribution in kind, for which some basic rules and procedures are laid down in Annex 5 to the XFEL Convention.

All other supplies, not provided by institutes from the Contracting Party countries, will be procured by the XFEL from industrial or commercial suppliers.

9.3.2 Collaboration agreements between contributing institutes and the XFEL GmbH

In both cases mentioned under Section 9.3.1, institutes which are interested in contributing to the realisation of the European XFEL project conclude a collaboration agreement with the XFEL GmbH. The agreement specifies the obligations and responsibilities of both partners and sets out whether or not the collaboration constitutes an in-kind contribution.

The assignment of in-kind contributions requires the approval by the XFEL Council, given that the in-flow and scheduling of cash contributions is affected. For other collaboration agreements there will be certain levels set out in the financial and/or purchasing rules, above which the Administrative and Finance Committee or even the Council might intervene.

In line with the basic rules for in-kind contributions (see below), the agreement for each task describes the cost, the schedule, the deliverables, the milestones, the acceptance procedures, etc., for the whole duration, i.e. until the final delivery. It will also contain a work plan to be updated on a yearly basis. This means that, at the time of signature, as an integral part of each contract, there will be a work plan for the whole period of the task, which is particularly detailed for the first year, agreed and signed by the XFEL Director General and the equivalent person (Director General) of the other institute(s). The work plan stipulates, among other things, the manpower assigned to the XFEL project, as well as the other resources (e.g. use of special labs, clean rooms and assembly halls). Once a year, this work plan has to be updated for the remaining period, and these updates, also signed by the Director Generals, also become integral parts of the contract.

The management of each institute, which concludes a collaboration agreement with the XFEL GmbH, appoints a person responsible for handling all tasks for the XFEL project within the institute.

Basic rules and procedures for in-kind contributions

(proposed as Annex 5 to the XFEL Convention)

1 In-kind contribution might cover:

- a technical component as well as personnel needed for its installation and integration on site; or
- personnel made available for specific tasks during the construction phase.

2 Special attention has to be paid to the allocation of responsibility, the calculation of the monetary/financial value of the contribution, the problem of under- and over-spending, and the resolution of disputes.

Continued

3 The in-kind contribution agreement for each task will contain *inter alia*:

- a technical description and specifications;
- time schedules and milestones;
- deliverables;
- quality control issues;
- performance testing, acceptance and commissioning;
- technical and financial control systems;
- appointment of responsible technical personnel;
- intellectual property right issues.

4 An In-kind Review Committee is set up, composed of one representative per Contracting Party and the Project Team, to propose to the XFEL management the allocation of in-kind tasks to specific partner institutes for decision by Council.

5 The Review Committee seeks to take the best profit of available expertise at DESY and throughout Europe and identifies to this end the possible/potential work packages for in-kind contributions as a function of the available expertise and independent of the location.

6 The Review Committee, when evaluating possible allocations of in-kind contributions, will take into account the willingness of the partner institute to make available personnel and experts for the installation and integration of the delivered system as well as for its operation. The conclusion of long-term maintenance contracts may be envisaged.

7 The Review Committee will define very early in the process the necessary interface specifications and common standards, in order to extend the field of potential in-kind contributions to any task which has a clear interface with another task, element or component.

Central coordination for each of the elements is essential and will have to be located where the relevant expertise is available.

9.3.3 Project management structure and oversight

The Managing Directors of the XFEL GmbH, together with the persons responsible in the various institutes involved, form the **XFEL Executive Board**. The Executive Board is the main coordination and communication body for the execution of the XFEL project. It monitors the execution of individual work packages or tasks and discusses matters involving several of them. The Executive Board meets regularly (probably once per month, also in the form of video conferences). It is chaired by the XFEL Project Leader, i.e. the Director General of the XFEL GmbH or a person designated by them to fulfil this role.

On request of the XFEL Project Leader experts from the institutes involved may be appointed as members of the Executive Committee.

Personnel employed by the participating institutes and assigned to the XFEL project according to the corresponding contract and approved work plan, remain under the regulations of their employer, in particular as far as their supervision is concerned, whether working in their home laboratory or at the DESY site, unless explicit detachment to the XFEL GmbH is foreseen as part of the contract or a separate agreement.

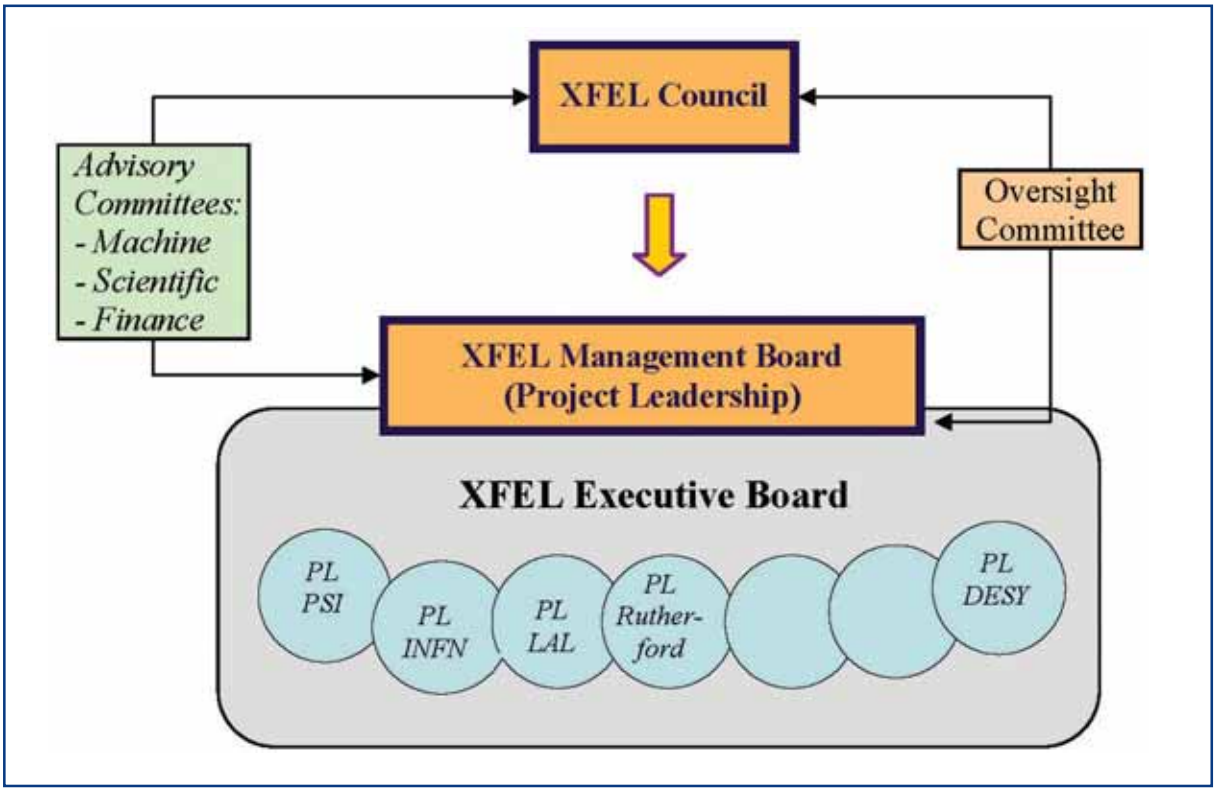

Figure 9.3.1 *Relationship between XFEL GmbH and collaborating institutes during the construction period.*

During the construction period, an **Overseeing Committee** nominated by, and reporting to, the XFEL Council regularly monitors the overall management of the project and the partners' adherence to the agreements. The committee is composed of independent experts on management of scientific projects. The Overseeing Committee will be in a position to identify problems in the implementation of the foreseen work plans, to examine any proposed remedial action and, if needed, suggest alternative action by the managements of the institutes, by the XFEL management and, if necessary, by the XFEL Council.

9.3.4 Later operation of the equipment contributed in kind

For all components and systems produced for the XFEL project it is essential that the corresponding know-how is available for the operation of the facility. It would be desirable that institutes, which have taken the responsibility for the construction of a component or

system, are also responsible for it during operation (see item 6 of the “Basic Rules and procedures for in-kind contributions”, reproduced in Section 9.3.2). Therefore, the XFEL GmbH has to clarify the responsibility for all in-kind systems during operation when an agreement is signed.

9.4 Special relationship between the XFEL GmbH and DESY

9.4.1 DESY as contributor to the construction, commissioning and operation of the XFEL Facility

9.4.1.1 Volume of DESY involvement

The DESY involvement is significantly different from that of other partners, since tasks entrusted to DESY are likely to correspond to a very large fraction of the total project costs during the early years of the construction period.

In fact, out of the work packages of the whole XFEL construction project (see Section 9.3.1), DESY is expected to play a major role in Groups 1 (Linac), 2 (Accelerator Sub-systems) and 5 (Infrastructure), and possibly, at least partially, in Work Package Groups 3 (Undulators, Photon beamlines), 4 (Control and Operation) and 6 (Site and Buildings).

All work package groups, apart perhaps from Group 3, will, already in the early stages of the project, get strongly involved in commitments, expenditure and recruitment. Therefore, mechanisms must be set up so that the XFEL GmbH can retain the responsibility and therefore, full control of its activities and budget. Consequently, in the special case of DESY, the general model for all in-kind contribution contracts will have to be supplemented by special provisions in order to assure the aforementioned responsibility and transparency. This will mean very close communication (much more intense than possible during the monthly meetings of the Executive Board) on all aspects of management, schedule and funding. These provisions will ensure the participation of the XFEL Managing Directors all decisions concerning major purchases, in the recruitment of personnel, etc.

9.4.1.2 Power of attorney

For some special aspects of the project, for instance obtaining the building permit (“*Planfeststellungsverfahren*”), DESY acted even before the XFEL GmbH was founded. In these cases and in others that are likely to emerge in the course of time, such as the:

- preparation of technical documents and engineering drawings for project implementation;
- preparing/obtaining permits including permit management; and
- other administrative services;

a “power of attorney” might be granted by the XFEL GmbH to DESY, for the necessary procedures, negotiations, and legal actions. The contract should specify the power of attorney granted to DESY and its limitations, for example, from the financial point of view.

Where DESY is granted power of attorney by the XFEL GmbH, the extent of the liability of DESY will have to be clearly defined. It could be stipulated that DESY should be liable only for wilful intent or gross negligence, except where this would be inconsistent with statute law. Moreover, a limitation of liability and the conclusion of a third party liability insurance contract by DESY should be considered.

9.4.1.3 Long-term involvement

DESY is strongly interested in providing its longstanding experience in the operation of accelerators, especially the vacuum ultraviolet (VUV)-FEL FLASH, to ensure optimal operation and upgrades of the XFEL. DESY is willing to stay responsible for all components and systems it supplies and guarantees a long-term commitment to provide the necessary know-how and services (including for upgrades of the facility), for the lifetime of the project . As mentioned in Section 9.2.3, it is planned to meet this interest by entrusting the operation of the accelerator complex to DESY.

9.4.2 DESY as host for the XFEL GmbH

The XFEL-DESY relationship has two basically different aspects: Besides contributing to the construction and operation of the XFEL, DESY plays the role of the host for the XFEL GmbH, and provides not only buildings but also site and infrastructural services, at least as long as the XFEL GmbH does not have its own campus in Schenefeld. The services mentioned here include, for example, services to ensure supplies and disposals, access to the canteen, security and safety, use of DESY's IT and communications infrastructure, use of the scientific infrastructure (e.g. library), etc.

For reasons of principle and practical convenience, these services on the one hand and the implementation of work packages on the other, are to be regulated by two different contracts:

- From a principle point of view, it is hardly possible, as far as site services are concerned, to respect the principle that DESY should be given the same chances and treatment as any other laboratory. Some measure of competition may be possible with local private companies providing similar services, but not with institutes located in different countries.
- From a practical point of view, two separate contracts are helpful to ensure complete cost transparency, and also for tax reasons.

The contract for site services has to reflect a usual tenant-landlord relationship or a customer service provider relationship and to specify a fair and transparent accounting procedure. The contract with the European Molecular Biology Laboratory (EMBL), an international organisation which has operated an outstation on the DESY site for many years, will be taken as model.

Given the size of the XFEL-related activities and their impact on the site management, the directorates of DESY and of the XFEL GmbH will meet regularly, to exchange information and to solve all possible interferences and conflicts between the various activities. Obviously, once the Schenefeld site becomes operational, the amount and type of the services provided by DESY will change.

9.5 Project management

The project management for the XFEL construction phase will follow well established and proven best practice techniques as described in standard handbooks for project management, for example **[9-1]** and Annexes 15 and 16 of the administrative and financial issue (AFI) FCI report **[9-2]**. An overview is given in Section 9.5.1. The detailed implementation of these best practises is to be defined by the XFEL Project Leader (see Section 9.5.2). The project management will be supported by tools for scheduling, resource planning and progress tracking, as set out in Section 9.5.3.

9.5.1 Overview

Following, by and large, the “Guide for planning and control procedures for large scale DESY Projects”, the XFEL Management Board will set up and keep updated a project plan comprising, in particular the:

- project structure plan;
- project schedule;
- project costing plan (financial planning with chronological profile);
- resource planning.

The **project structure plan** contains all activities pertaining to the construction and commissioning of the XFEL Facility. Related tasks form **work packages**; related work packages form **work package groups**. Work Package Leaders are responsible for the implementation of their work packages.

The planned completion time of the elements of the project structure plan and the relationship between these elements result in the **project schedule**. It is represented as a network plan (PERT chart) and as a bar diagram (Gantt chart) where the interrelations between various work steps are visible, and the critical path of the project schedule is established. The project schedule contains applicable milestones. The project schedule will be updated at reasonable intervals and indicates the degree of completion of the elements of the project structure plan.

The **project costing plan** specifies planned expenses and funding as a function of time for the overall project and for the individual elements of the project structure plan. A summary is set out in Chapter 10 of this report. During implementation of the project, budgeted costs and actual expenditure as well as corresponding funding are continuously tracked and trend analyses generated, if required.

In the event of a deviation in the project schedule or the project costing plan from the base plan, the required resources must, if necessary, be re-coordinated with the participating divisions (XFEL and/or DESY) and, if appropriate, with the in-kind contributors.

Labour requirements are also determined from the project structure plan. The work packages in the project structure plan include investments, **labour and technical**

resources. The assignment of XFEL groups to work packages is set out in an internal project assignment document; the assignment of DESY groups or of groups from other institutes are regulated in the corresponding agreements on in-kind contributions.

Quality standards for the final facility and its major components are established in this report. Following completion of an interim product, a work package or other work steps, the result is compared with the quality standards and documented. If a quality standard is not attained or work is completed late, the consequences to the project will be analysed and documented. This documentation is an integral part of the project plan.

The Executive Board will develop a plan that specifies the authorisation for undertaking **changes to the project**, including how changes will be documented and communicated within the project. Fundamental changes to the project plan, in particular to the project structure plan, schedule and costing, must be confirmed in writing by the XFEL Management Board, after approval of the XFEL Council, if appropriate. This authorisation plan is an integral part of the project plan.

Internal project **communication**, as well as reporting to external bodies and committees, is supported by the programming system for project management. Every project member should have access to the information in their field of activity, in particular with regard to the project schedule, cost base plan and resource planning. A specific communication scheme governs who may view larger areas of the project and access standardised reports and who will be informed of changes in the project and in what manner. Communication within the project includes the management of project documents. For each element of the project structure plan the related documents (e.g. planning documentation, production documentation and protocols for quality controls) must be easily retrievable.

The risk analysis consists of the identification of risks, their quantification with respect to the likelihood of the incidence of events and their consequences for the project. Risk analyses should be updated and documented at appropriate intervals. These documents become part of the project plan.

The Overseeing Committee assesses the progress of a project at least twice a year. The progress report contains at least the following updated information, as generated by the programming system for project management:

- a network plan with critical path;
- a schedule in the form of a bar diagram with milestones;
- a milestone analysis;
- an earned value analysis;
- a resource plan showing the utilisation of planned resources;
- an updated risk analysis.

Assessment dates should, where possible, be coordinated with the other reports to be produced.

9.5.2 Roles and responsibilities within the XFEL project

According to the general structure of the XFEL project in terms of Work Package Groups and work packages, as described in Section 9.3, the main roles and responsibilities for the project team are as follows:

The **XFEL Project Leader** coordinates, instructs, leads and motivates the project team, releases the overall project plan and approves the work plan of the work packages within the context of the overall project plan, ensures the overall technical and scientific progress of the project according to the released project plan and develops solutions in case of problems. The project leader assigns financial and personnel resources to the individual work packages; tracks the project schedule by establishing and monitoring project relevant milestones; and reports to the Overseeing Committee (see Section 9.3.3).

The **Work Package Leader** fulfils the same responsibilities as the project leader for the tasks within their work package. They establish the work package plan with scheduling and resource planning for the tasks in their work package. This plan is approved by the project leader and then released for the overall project plan. The Work Package Leader is responsible for the execution of the tasks according to the approved plan. The progress of their work package is recorded appropriately in the project plan by updating it with actual values. The Work Package Leader reports regularly to the project leader on the status of their work package.

The XFEL Project Leader and the project team are supported by a **Project Management Office**. The Project Management Office establishes planning and reporting guidelines for the XFEL project and provides the necessary tools (see Section 9.5.3). It ensures that the individual work package plans follow those guidelines formally and can, therefore, be (upon approval by the Project Leader) incorporated to create a consistent overall project plan. The Project Management Office coordinates the status reporting within the project and composes an overall project status for the XFEL Project Leader; keeps track of the financial status of the project and provides this information for the project team; supports the Work Package Leaders in planning and other management and administrative tasks where necessary; and is assigned directly to the XFEL Project Leader.

9.5.3 Project management tools

The approach of project planning currently carried out by the XFEL project group at DESY, which will also be adopted for the XFEL construction project, is a system of bottom-up project plans created by the Work Package Leaders linked together by cross-work package milestones in an overall project plan. The individual work package plans are maintained by the Work Package Leader but (in case of changes) released for the overall project schedule by the XFEL Project Leader. The project plan contains the scheduling, and personnel, financial and equipment resource allocation. Maintenance of the plan includes updates in case of necessary changes (to be handled by the change management) and for actual values for personnel, finances and equipment usage. Since the XFEL project is a European effort with work packages being managed by partners not located at the XFEL site, the central project management software should be easily

available for all partners. Since it will also be the central tool for progress tracking, there should be opportunities to import actual financial data from various Enterprise Resource Planning (ERP) software packages used in the XFEL partners' administration. At DESY, this is the SAP system.

Microsoft Project Enterprise **[9-3]** with the Microsoft Project Web-access is the most widely used project management software and fulfils most, if not all, of the requirements, and will, therefore, be the central planning and tracking tool for the XFEL Project Team. Financial data will be imported automatically for cost controlling whenever possible. The Web-access will be used for online project progress tracking information for the project management and the entire project team.

Tracking and controlling of the project will be performed using project management best practise techniques such as milestone trend analysis and earned value-analysis.

References

[9-1] *A Guide to the Project Management Body of Knowledge*, Project Management Institute, Newtown Square, PA 19073-3299 USA.

[9-2] Final Report of the Sub Group of Full Cost Issues (FCI) in respect of the European Free-Electron Laser Facility XFEL.

[9-3] Microsoft Project Enterprise, Microsoft Cooperation, http://office.microsoft.com/en-us/FX011204851033.aspx