CERN-RRB-2002-025
31st March, 2002

Strategy and Scenarios for Deferrals in ATLAS

1. Introduction

ATLAS has presented its plans for the staged initial detector configuration at the RRB meeting of October 2001, and documented it in RRB-D 2001-118. At the same time the costs to completion were announced as documented in RRB-D 2001-121, composed of the construction completion costs and the overall pre-operation costs (M&O and C&I) planned over the period 2002 to 2005 for an initial detector installed at the end of 2005, ready for first collision in April 2006. The estimates in RRB-D 2001-121 are

Construction completion costs	52.0 MCHF
C&I all categories (A, B)	21.1 MCHF
M&O all categories (A, B, C)	24.9 MCHF

leading to the total of 98.0 MCHF. The construction completion costs of 52.0 MCHF divide into 40.5 MCHF for common items (common projects and infrastructure) and 11.5 MCHF of system specific items. The ATLAS Collaboration proposed that the former are to be shared by the full collaboration whereas the latter within the concerned system communities. A complete documentation has been worked out since the last RRB, and the details on the construction completion costs are given per line item in the tables of the attached Annex.

The ATLAS Collaboration acknowledges that in spite of tremendous and encouraging efforts made by the Funding Agencies to find fresh resources it is necessary to prepare a contingency planning in case some of these resources would be missing before the start-up of the experiment. In fact the CERN Management has required ATLAS to provide scenarios with in total 20 MCHF ('scenario A') and 40 MCHF ('scenario B') less resources available from the Collaboration. As part of this effort ATLAS has continued to scrutinize and reduce costs whenever possible in order to minimize the strain put onto the Funding Agencies supporting the experiment.

In this note 'deferrals' are referred to as a mechanism to redirect the funding to the completion costs of highest-priority and time-critical items from components that could eventually be added at a later stage. These actions, if necessary, would ensure timely construction of the most vital components, albeit inevitably at the cost of initially strongly reduced physics performance and all its consequences for the large physicist community of ATLAS.

2. Strategy of deferral scenarios

2.1. General approach

The contingency plan has been structured such that the contingency *scenario A* still corresponds as much as possible to the staged initial detector concept as discussed before, albeit with serious restrictions in the pre-operation and commissioning preparations, and some further system-internal staging and cuts. Naturally all reductions achieved in charges directly to the Collaboration will be part of the scenario A. In addition the entire small contingency that has been built up by the initial staging plan will be lost in this scenario.

Assuming somewhat optimistically that the additional deferrals necessary in this scenario would not have too strong an impact, one can consider that the physics case for this configuration has already been evaluated and discussed with the LHCC as also documented in ATLAS RRB-D 2001-118. One of the main conclusions of that study was for example that the discovery potential for a low-mass Higgs signal in several final states would be degraded by about 10%, with higher risks coming from the less robust pattern recognition and tracking performance. This degradation of signal significance means that 20% more luminosity would be needed to compensate this loss. Other physics channels will be affected stronger, for example by the degraded b-tagging performance of 30%.

For *scenario B* very strong deferrals for the scalable High Level Trigger (HLT) and DAQ components would have to be implemented, clearly jeopardizing to a large extent the B-physics and also cutting into the high-p_T physics discovery potential, the primary goal of the ATLAS experiment. In addition, further severe system-specific staging and cuts would have to be made that would affect initially the operational integrity of the detector. More severe cuts on M&O and C&I would put important parts of the entire integration and commissioning phase into question, meaning that LHC operation would have to start with a detector that has not been systematically tested beforehand, and thereby leading to an increased risk of major failures. The effects of major cuts in pre-operation funding have been documented in detail in the internal ATLAS resources coordination note ARN-18-01 (November 2001).

The two following sections contain a description of the two scenarios which are also summarized in Table 1.

2.2. Scenario A

The staged initial detector configuration as described in ATLAS RRB-D 2001-118 will ‘liberate’ 8.0 MCHF of resources, which can be redirected, to cover over-costs on common items, and more specifically on the magnet system:

Processors from Common Projects	4.0 MCHF	
Components of the 3rd pixel layer	3.0 MCHF	
High luminosity part of forward shielding	1.0 MCHF	
Total		8.0 MCHF

The staged initial detector will have further components missing, but their corresponding funding will not be available in time for the initial detector. As described in ATLAS RRB-D 2001-118, they include the outermost TRT end-cap wheels, part of the LAr ROD system, the Tile Calorimeter gap scintillators, the transition region (EES and EEL) MDTs, and half of the layers of the CSCs. These components are staged because they are either part of the low-priority US management contingency components (US scope increase most likely not possible before the availability of future upgrade funding), or based on the funding parts expected to be only available late in the funding profile, or finally because of a remaining overall CORE funding short-fall as reported at previous RRB meetings.

The 52.0 MCHF construction completion costs include a total of 16.3 MCHF for common infrastructure items, for the over-costs of the various detector support structures as well as for many experimental area infrastructure and services components. After careful common evaluations and scrutiny with the LHC Experimental Area group, a number of items have been identified and agreed upon which are included in the general CERN LHC machine over-cost, and which are therefore not to be counted against the costs of the Collaboration. This implies a reduction of 4.9 MCHF on the ATLAS construction completion costs.

Experimental area infrastructure items not to be counted against the experiment	4.9 MCHF

Further cuts as well as staging options at the level of 3.7 MCHF would have to be implemented on system-specific construction completion costs. Included are also some over-cost components for which an arrangement has been found within the communities, thereby removing them form the current list. In these cases ATLAS will recognize them as an increased scope of deliverables in the future. All these items correspond to entries in the detailed tables annexed to this document. The items are

ID reduced scope of the SR1 facility	0.5 MCHF	
ID TRT assembly of ‘C-wheels’, a staged item for the initial detector configuration	0.7 MCHF	
LAr end-cap components that were initially not covered (increased deliverables)	0.8 MCHF	
LAr Hall 180 integration facilities shared within the LAr community	1.2 MCHF	
Tile Calorimeter reduced scope in integration tooling and cooling system	0.3 MCHF	
Muon system reduced provision for hall space rental	0.2 MCHF	
Total		3.7 MCHF

Finally, the M&O and C&I planning for 2002 has been revised and various reductions have been implemented, as presented to the RRB scrutiny group and contained in the budget requests to be presented for the April 2002 RRB. The reductions are 0.7 MCHF for M&O and 0.3 MCHF for C&I.

Reduction of M&O and C&I activities in 2002	1.0 MCHF

As a summary, the deferral scenario A presented above and chosen as first stage contingency plan could be achieved with 17.6 MCHF less supplementary funding available from the Collaboration. This total includes a permanent reduction of costs to be borne by the Collaboration of 5.9 MCHF. In other words, this scenario could be realized if the Collaboration would be supported in total with 80.4 MCHF supplementary resources for the construction completion and the pre-operation costs.

Total construction completion and pre-operation costs in scenario A (including also M&O category C)	80.4 MCHF

Note that the pre-operation costs for this overall total include for the M&O the category C costs and that no rebates are applied yet. It is expected that this will correspond to at least some 4 MCHF.

2.3. Scenario B

In addition to what has already been reduced and deferred in scenario A, a very drastic deferral of scalable high-level trigger (HLT) and DAQ components would have to be implemented in order to liberate further funding for the construction completion costs of the common items. Two cases are being worked out which would defer 10 MCHF (case 1) and 15 MCHF (case 2), because rather distinct differences in the physics impact can be expected.

The priorities guiding these deferrals are unambiguous: ATLAS will try to preserve as much as possible its potential for high-p_T and discovery physics, with the search for the Higgs boson and for SUSY already during the first physics run. Only if there remains trigger, data acquisition and analysis capacity on top of these primary goals, will it be used for other physics channels including B-physics.

The HLT processors and network bandwidth can be scaled down at the price of reduced input rate capacity. The level-1 trigger output rate will need to be reduced accordingly, primarily by raising thresholds. The baseline HLT/DAQ system is designed to handle an input rate from level-1 of 75 kHz. The preliminary assessment of deferral scenarios suggests that a deferral of an additional 10 MCHF (case 1, corresponding to half of the HLT/DAQ investments) would result in a reduction of the HLT input rate capacity of more than a factor of two, to approximately 30-35 kHz. An even larger deferral (15 MCHF, case 2) would result in a capacity which would require an input rate reduction of more than a factor five, to approximately 10-15 kHz.

These bandwidth capacities should be compared to an expected level-1 rate of ~25 kHz for the ATLAS high-p_T trigger menu at initial luminosity of $2x10^{33}$ $cm^{-2}s^{-1}$. However, one should bear in mind that these expected rates have very large (factor ~2) uncertainties due to the uncertainties in the LHC cross-sections and the detector occupancies. There are also considerable uncertainties in the above estimates for the bandwidth capacities due to lack of accurate knowledge of processing requirements for the HLT physics selection.

It is understood that these TDAQ deferrals would not only curtail the B-physics capability but also jeopardize elements of the high-p_T physics programmme. For instance, the deferral of an additional 10 MCHF (case 1) would eliminate nearly all margins in the capacity with respect to the expected high-p_T rate at initial luminosity, therefore requiring an increase in thresholds or restrictions in selectivity if cross-sections are higher than estimated. Increased threshold would for instance affect the precision measurements of the W boson mass, which, together with the top quark measurement is used to constrain the Higgs mass (and even the search if not found directly) in the Standard Model. Deferral of an additional 15 MCHF (case 2) would cut deeply into ATLAS' high-p_T physics programme.

It is clearly understood that the level of these deferrals would be adjusted to the strictly required minimum, always with a view of restoring this damaging action as fast as new resources would become available.

Deferrals of scalable HLT/DAQ components, range for the two cases given	10–15 MCHF

In the scenario B also further system-specific deferrals or cuts would have to be imposed and implemented in the planning. The target figure is a total of 3 MCHF. The detailed items are still being worked out, and will include off detector electronics and power supply components. The strategy would be to use these resources inside the systems to cover part of the system-specific construction completion costs as included in the annexed tables.

Further deferrals of system-specific construction completion costs	3 MCHF

Furthermore, the contingency planning for the partial availability of M&O and C&I resources would have to be applied also for the years beyond 2002. The target figure imposed would be a cut at the level of 6 MCHF, which would correspond to a cut of the order of 15% from the initially budgeted pre-operation costs 2003 to 2005. The effects would clearly be delays and a reduction in testing activities, part of it in coherence with the anticipated, resources-driven, reduction of test beam availability at CERN in the coming years.

Reduction on pre-operation costs also for the years 2003–2005	6 MCHF

In summary for scenario B, reductions of 6 MCHF and deferrals of 13–18 MCHF, depending on the TDAQ deferral case, would result in a plan in case, on top of scenario A, a further 19–24 MCHF less supplementary costs would be available. In practice this level would be adapted to the strictly required minimum in order to limit the clearly identified damage to the physics.

This scenario would have to be implemented if the additional resources from the Collaboration for the total supplementary costs would remain limited initially to the range of 57.4 to 61.4 MCHF.

Total construction completion and pre-operation costs in scenario B (including also M&O category C)	57.4–61.4 MCHF

Note that also in this case the pre-operation costs for this overall total include for the M&O the category C costs and that no rebates are applied yet. It is expected that this will correspond to at least some 4 MCHF.

3. Conclusions

The ATLAS Collaboration has evaluated possible planning scenarios in case the required amount of supplementary funding for the staged initial detector, as presented at the October 2001 RRB, would only partially be available during the construction and pre-operation period. This planning is evolving with time as better understanding of the funding situation, the LHC schedule, and the detector construction and commissioning becomes known.

Two scenarios have been presented which could handle, albeit at a high risk and strong cuts into physics, the eventuality of missing resources from the Collaboration at the level of some 20 MCHF and 40 MCHF as requested for planning purposes by the CERN Management. They are summarized in Table 1, also indicating the redirection of resources, with the understanding that these deferrals would be restored as soon as fresh resource would again become available. It has to be stressed that this is absolutely necessary to reach the full physics goals of ATLAS even for the first phase of LHC at initial luminosities. In particular, the scenario in which a funding shortfall of 40 MCHF would have to be absorbed would leave the detector in a stage where the physics potential would be severely jeopardized.

Deferrals and Reductions			
	Resources redirected towards (or reductions or included elsewhere, see text), all in MCHF		
Items	**Construction completion costs** Common items	system-specific	**M&O and C&I**
Scenario A			
Processors CP	**4.0**		
3rd Pixel layer parts	**3.0**		
JF shielding parts	**1.0**		
Experimental area budget	**4.9**		
Various system-specific		**3.7**	
M&O and C&I 2002			**1.0**
Total A	***12.9***	***3.7***	***1.0***
Scenario B			
HLT/DAQ components	**10.0–15.0**		
Various system-specific		**3.0**	
M&O and C&I 2003-2005			**6.0**
Total B (including A)	***22.9–27.9***	***6.7***	***7.0***

Table 1

Version 3.0

Last update = 25/03/02

ANNEX Table 1 - SUPPLEMENTARY COSTS ITEM LIST

Nature of Cost	Item Description	History and Justification	Funding Agency involved	To be provided as	Contract Info	Commit. Date	MCHF Cost Overrun	Payment Profile <=2002	2003	2004	2005	>=2006	Contact Person
		IK stands for 'in-kind'											
1.1. Barrel Toroid Magnet	1.1.1. Engineering	Recognition of LASA engineering work (0.8) + US installation coordinator (0.4). IK contribution agreed by the April 2001 RRB for INFN.	INFN/LASA, US	cash	TMOU add.3	RRB Apr-01 Oct-99	**1.2**	0.9	0.1	0.1	0.1		G. Volpini
	1.1.2. Warm structure	***Core cost = 2.6, current cost 4.1 .*** Cost increase due to an increase in the market price of AL and an increase of the volume. Several parts for shimming have also been added. The procurement of the AL forget pieces will be done with a CF contract to be placed with Samara (Russia). All mechanical work will be done in JINR as an IK contribution.	RF, JINR, CERN, CF	partially IK		May-02	**1.5**	0.1	0.7	0.7			H. ten Kate
	1.1.3. Coil casing	***Core cost = 10.5, current cost = 12.5 .*** Net cost increase in AL and welding qualification + 2 years inflation.This contract is indexed. Sharing of extra costs is under negotiation between D and CH as part of an additional IK contribution. Contract running with Alstom Suisse.	D, CH	IK	CERN-F278 CD1000628 CD1180767 CD1000664 CD1000679	Jun-01	**2.0**	1.5	0.5				H. ten Kate
	1.1.4. Integration 1&2	***Core cost = 5.0, current cost = 5.6 .*** Integration 1 contract higher after competitive tendering (+1.1), partially compensated by a cost effective cryostating by JINR. Contracts running with JINR(RF) for integration 2. BDT contract under cancellation, work will be done at CERN with a mixed solution (firm, ATLAS manpower).	CF	CF	CERN-F372 CERN-K758	Jun-01	**0.6**	0.2	0.3	0.1			H. ten Kate

Nature of Cost	Item Description	History and Justification	Funding Agency involved	To be provided as	Contract Info	Commit. Date	MCHF Cost Overrun	Payment Profile <=2002	2003	2004	2005	>=2006	Contact Person
	1.1.5. Vacuum vessels	***Core cost = 5.3, current cost = 5.8 .*** Transportation option in contract taken (+0.38), extra material necessary for supports reinforcements (+0.12). Contract running with Felguera (S).	S, SP	IK	CERN-F298	Feb-01	**0.5**	0.3	0.2				L. Miralles
	1.1.6. Tie rods	***Core cost = 0.5, current cost = 1.1 .*** Low temperature safety proof loading in the cold of all 64 tie rods required (+0.18), contract signed with Kurchatov(Russia). Extra material for heads and axis (+0.42). Main procurement as IK contribution (IHEP, Luch).	RF, CERN, CF	IK, CF	CA1101601 CERN-K570	Oct-00	**0.6**	0.4	0.2				H. ten Kate
	1.1.7. Cryoring	***Core cost = 1.1, estimation = 1.6 .*** Very complex in nature and requirements. Tendering phase.	possible IK + CF	IK	MS phase	Sep-02	**0.5**		0.2	0.3			H. ten Kate
	1.1.8. Installation	***Core cost = 1.4, estimation = 2.4.*** Additional manpower needed wrt original planning, additional complexity on tooling. We have adopted a solution where ATLAS will do all the project organization, subcontracting part of it if necessary.	CF, IK Spain ?	CF, IK	MS phase	Oct-02	**1.0**			1.0			H. ten Kate
1.2. End Cap T. Magnet	1.2.1. Engineering & inspection	***Core cost = 7.8, estimation = 15.3 total for items below.*** Exchange rate effect (contract with RAL in Pounds at a rate of 1.83 vs average of 2.5).	possible UK IK? CF	CF	CERN-K414	Jun-97 Jan-02	**1.7** **1.2**	1.7 0.4	0.3	0.3	0.2		H. ten Kate
	1.2.2. Additional central engineering	Additional RAL manpower needed wrt original planning for design and follow up. Also redesign of common vacuum system to avoid hardware extra cost. Option in the initial CERN-RAL contract. 0.8 spent.	possible UK IK? CF	CF, IK?	CERN-K414	Dec-96	**2.1**	0.8	0.7	0.6			H. ten Kate

Nature of Cost	Item Description	History and Justification	Funding Agency involved	To be provided as	Contract Info	Commit. Date	MCHF Cost Overrun	Payment Profile					Contact Person
								<=2002	2003	2004	2005	>=2006	
	1.2.3. Cryogenics engineering	Additional RAL engineering requested for common proximity cryogenics system (from design to installation and commissioning). Partially redesign effort to avoid 5 MCHF overcost. 0.6 spent.	possible UK IK? CF	CF, IK?	CERN-K414	Oct-00	**1.7**	0.6	0.5	0.5	0.1		H. ten Kate
	1.2.4. Cold mass	To reduce risk and increase safety redundant cooling system cold mass added to the initial specifications (+0.6). Additional manufacturing cost for extra conductor cleaning (+0.2) and small parts (+0.2). Main contract with HMA running via Nikhef. 0.3 spent.	CF	CF	TMoU, Add2 CERN-K686	Nov-99 Dec-00	**1.0**	0.3	0.2	0.2	0.2	0.1	H. ten Kate
	1.2.5. Assembly, integration and controls	Additional construction budget for cold mass integration (+1.0), super insulation (+0.2), tower section (+0.15), instrumentation (+0.1), test station (+0.2) and various small parts (+0.35).	CF	CF		Dec-02	**2.0**		0.7	0.7	0.6		H. ten Kate
	1.2.6. Cryogenics / External system	***Core cost = 10.5, estimate = 11.5 .*** Overcost on main commercial contract for refrigerator (0.4) and additional pipework (0.6).	CF, IK ?	CF, IK?	CERN-F410	Jun-01	**1.0**		0.1	0.4	0.5		F. Haug
	1.2.7. Cryogenics / Proximity & Installation	***Core cost = 3.5, estimate = 4.5 .*** Overcosts on the manpower needed for installation (+0.2), PCS controls (+0.6), varia (+0.2).	CF	CF	tendering phase	Oct-02	**1.0**		0.1	0.4	0.5		F. Haug
1.3. LAr Cryostat & Cryogenics	1.3.1. Various items	Design and cost update, see C+C document ref. DF-09/02/01.	IN2P3, MPI? IK, CF	CF, IK?		Dec-01 Mar-03	**1.0**		0.5	0.5			P. Pailler
	1.3.2. Integration	Add. manpower needed wrt original planning for end-cap design and follow-up (0.65). Additional cost on slow controls software (0.65). IN2P3 IK contribution under discussion.	IN2P3	IK		Oct-02	**1.3**	0.7	0.6				D. Fournier

Nature of Cost	Item Description	History and Justification	Funding Agency involved	To be provided as	Contract Info	Commit. Date	MCHF Cost Overrun	Payment Profile					Contact Person
								<=2002	2003	2004	2005	>=2006	
1.4. TC Infrastructure	1.4.1. Shielding elements	**Core cost = 5.2, estimation 7.4 .** The overcost is mostly in the JF shielding for which a too low estimation was done in '95. This element has been recently re-engineered and optimized in term of weight (1100 tons) and cost. This project can be factorized in several sub projects, for which IK contributions are possible.	possible IK + CF	CF, IK?	MS phase	May-03	**1.2**			0.6	0.6		V. Hedberg
	1.4.2. Shielding elements	Redefinition and reduction of the Russian deliverables agreed by the '5+5' CERN - Russia meeting.		cash		May-03	**1.0**			0.5	0.5		M. Nordberg
	1.4.3. Traction systems	***Core cost = 0.5, estimation = 2.1 .*** This system in '95 was based on a different technology. Today the plan is to use air-pads with an hydraulic power plant behind (+1.3) for all movements (calorimeters, toroids, shieldings, trucks,..). New in this list is the traction system of the big wheel system (+0.3).	possible IK + CF	CF	MS phase	Jul-02 Oct-02	**1.6**		0.5	0.7	0.4		M. Hatch
	1.4.4. Access structures	***Core cost = 0.4, estimation = 1.5 .*** Regroups overcosts mostly due to new items in this list (access lifts to the inside of the detector, removable scaffoldings for access to the ID and calorimeters, added complexity to the gangways inside the muon system,..).	possible IK + CF	CF	MS phase	Feb-03	**1.1**			0.6	0.5		M. Hatch
	1.4.5. Support structures	***Core cost = 0.1, estimation = 1.5 .*** Regroups initially unforeseen support structures like : big wheels support brackets and access bridges (0.6), truck support structure inside the trenches (0.3), shielding supports (0.2), interfaces between calorimeters (0.3).	CF	CF	MS phase	Oct-02	**1.4**	0.3	0.6	0.5			M. Hatch

Nature of Cost	Item Description	History and Justification	Funding Agency involved	To be provided as	Contract Info	Commit. Date	MCHF Cost Overrun	Payment Profile <=2002	2003	2004	2005	>=2006	Contact Person
	1.4.6. Muon wheel supports	HO metallic structure, unfunded part inside the muon system (0.7) and part of CERN metallic structures contract. Additional costs on big wheel support structure underfunded by the muon system. The big wheel went through a big change in the complexity of the design and in the mechanical requirements in 2000-2001 (0.8). For this critical item the tendering is foreseen in 2002.	possible IK + CF	CF	MS phase	Jan-02 Jun-02	**1.5**		0.5	0.5	0.5		F. Butin / F. Bertinelli
	1.4.7. Electrical distribution	Power distribution and lighting in all buildings, assumed as a CERN responsibility (0.8). Additional contribution to UPS from CF (0.2).	CERN budget area, CF	CERN, CF		May-03	**1.0**		0.8		0.2		K. Potter / Ph. Fartouat
	1.4.8. Vacuum chamber	R&D and prototype work assumed to be CERN responsibility (1.4). Cost increase in the Be beam pipe (+0.6) in CF.	CERN budget area, CF	CERN, CF	MS phase	May-02	**2.0**	1.4	0.6				R. Veness
	1.4.9. Cooling & ventilation	Options in main contract 405, including upgrade to 180 KW, SCX1 and SDX1 buildings CV, all this assumed as CERN responsibility.	CERN budget area, CF	CF	CERN-F405	Apr-01 Apr-02	**2.0**		1.0	1.0			K. Potter
	1.4.10. Flexible support carriers	Flexible supports for services and cables for the moving detectors as the endcaps calorimeters and toroids, material (0.75) and installation (0.65). D IK contribution for the material accepted by October RRB.	possible IK + CF	CF, IK?		Mar-02	**1.4**		0.65	0.75			M. Hatch
	1.4.11. Varia - racks, cable trays,..	***Core cost = 1.8, estimated = 2.5.*** Additional racks in US,USA,UX,SCX,SD and cables trays and junction boxes.	CF	CF	MS phase	Aug-02	**0.7**		0.4	0.3			J. Inigo-Golfin

Nature of Cost	Item Description	History and Justification	Funding Agency involved	To be provided as	Contract Info	Commit. Date	MCHF Cost Overrun	Payment Profile <=2002	2003	2004	2005	>=2006	Contact Person
	1.4.12. Safety detectors	Additional safety items (fire detection/extinguishing in detector area (1.3) assumed to be CERN responsibilities. 0.7 imposed to the experiments. Additional items like racks smoke detection in CF.	CERN budget area, CF	CERN, CF	MS phase	Aug-02	**1.4**		1.3	0.1			K. Potter / G. Benincasa
1.5. Systems	1.5.1. ID tooling, test stations, assembly	TRT: cooling, powersupplies, cables in SR1 (0.4), assembly tools(+0.25) SCT: readout, cooling, powersupplies, cables in SR1 (0.86) PIXEL: readout, cooling, powersupplies, cables in SR1 (0.3), B-layer tooling (0.15), insertion tooling (0.15), tools to install barrels and disks in global supports (0.1), operation of assembly site (0.12).	ID system	IK possible+ Syst. CF		Oct-02	**2.5**	0.27	1.35	0.9			S. Stapnes
	1.5.2. LAr integration parts, cryostat transports	Test stations for commissioning, integration work in bulding 180 and in ATLAS (0.6).	LAr system	Syst. CF		Apr-02 Apr-03	**0.6**	0.25	0.15	0.16	0.04		H. Oberlack
	1.5.3. TileCal tooling, cooling, trigger cables	Additional items not in core in '95: assembly tooling, including overcost on saddles (+0.45), cooling plant (0.50), power supplies (+0.25). For most of these items the overcost is due to an increase in the specification requirements and updates in the design. Non magnetic steel for the saddles, radiation tolerance for the power supplies.	Tile system	IK possible+ Syst. CF	MS phase	Apr-02 Jan-03	**1.2**	0.5	0.7				R. Leitner
	1.5.4. Muon CSM modules, small wheels support	Electronics modules CSM for MDT chambers (1.5). Small wheels integration work (0.3).	Muon system	IK possible+ Syst. CF		Oct-02 Oct-03	**1.8**	0.15	1.15	0.5			G. Mikenberg

Nature of Cost	Item Description	History and Justification	Funding Agency involved	To be provided as	Contract Info	Commit. Date	MCHF Cost Overrun	Payment Profile					Contact Person
								<=2002	2003	2004	2005	>=2006	
	1.5.5. ID installation tooling	Installation tooling (trolleys (0.04), rails on cryostat (0.04), thermal pads and gas monitoring (0.07), lifting frame and installation tooling, scaffolding (0.11), PIXEL installation tube temporary support an dthermal plug (0.04).	ID system	IK possible+ Syst. CF		Apr-03	**0.3**	0.2	0.1				S. Stapnes
	1.5.6. LAr EM End-Cap components	Funding for various components not covered.	LAr system	IK possible+ Syst. CF		Jun-00	**0.8**	0.6	0.2				D. Fournier
	1.5.7. LAr Electronics	Funding for various components not covered, mainly LV power supplies and FE crates components.	LAr system	IK possible+ Syst. CF		Dec-02	**1.0**		0.7	0.3			H. Oberlack
1.6. Systems infrastructure	1.6.1. ID SR-building for (pre-)assembly, integration	Construction of a large clean area for ID assembly in SR1. CV (1.0), CE (0.6).	ID inst.	internal loan	tendering phase	Apr-02	**1.6**	1.6					S. Stapnes
	1.6.2. LAr integration clean room area in B180	Construction of large clean room area in bldg 180 for barrel and endcap LAr assembly. Arranged as a payment advancement within the community. Work in execution.	LAr inst.	internal loan		Jan-01	**1.2**	1.2					H. Oberlack
	1.6.3. Muons integration laboratories	Renting of space outside CERN for passive storage ~2000m2 plus labs equipment for integration/repairs work.	Muon system	Syst. CF	MS phase	Oct-02	**0.5**	0.14	0.21	0.12			G. Mikenberg
1.7. Common Projects	1.7.1. Missing contributions to Common Fund	Funding missing after 2 new institutes, one partial withdrawal.	CF	CF		RRB Apr-01	**2.3**	0.5	0.6	0.6	0.6		M. Nordberg
TOTAL overcosts							**52.0**	**15.0**	**17.4**	**13.9**	**5.5**	**0.1**	

Version 3.0
Last update = 25/3/2002

ANNEX Table 2 - SUPPLEMENTARY COSTS STRATEGY

Nature of Cost	Item Description	Funding Agency involved	Commitment date start	MCHF CERN pit infrastruct.	MCHF Discussion ongoing	MCHF Before Apr 2002 RRB	MCHF Remaining afterwards	Strategy to be pursued or recognized as suplementary funds
		IK stands for 'in-kind'						*IK stands for 'in-kind'*
1.1. Barrel Toroid Magnet	1.1.1. Engineering	INFN/LASA, US	RRB Apr-01 Oct-99				**1.2**	Covered currently by INFN IK and US CF, negotiate/reduce phase D engineering contracts to compensate.
	1.1.2. Warm structure	RF, JINR, CERN, CF	May-02				**1.5**	CF income needed to cover, use either fresh money or shift from elsewhere, maybe partially as JINR IK on overcosts.
	1.1.3. Coil casing	D, CH	Jun-01		**2.0**			Covered by commitments from D for their part. Written agreement with CH still needed, release current TDAQ CF processr staging (to be done).
	1.1.4. Integration 1&2	CF	Jun-01			**0.6**		CF income needed to cover, use either fresh money or shift from elsewhere.
	1.1.5. Vacuum vessels	S, SP	Feb-01		**0.5**			Spain agrees extending their IK, Transport part agreement need to be written.
	1.1.6. Tie rods	RF, CERN, CF	Oct-00			**0.6**		CF income needed to cover the tests, use either fresh money or shift from elsewhere.
	1.1.7. Cryoring	possible IK + CF	Sep-02				**0.5**	Try to negotiate with CEA as recognized IK contribution with over costs, decide when known, possible swap with phase D engineering contract.
	1.1.8. Installation	CF, IK Spain ?	Oct-02				**1.0**	Need to work out concept within ATLAS now, with cost constraints.
1.2. End Cap T. Magnet	1.2.1 Engineering & Inspection	possible UK IK?	Jun-97			**1.7**	**1.2**	UK exchange rate loss, try to get recognized compensation from UK.
	1.2.2. Additional central engineering	possible UK IK? CF	Dec-96			**0.8**	**1.3**	CF income needed to cover, use either fresh money or shift from elsewhere, try to get UK IK help, negotiate future part.
	1.2.3. Cryogenics engineering	possible UK IK? CF	Oct-00			**1.7**		CF income needed to cover, use either fresh money or shift from elsewhere, try to get UK IK help.
	1.2.4. Cold mass	CF	Nov-99 Dec-00			**1.0**		CF income or shift needed otherwise.
	1.2.5. Assembly, integration and controls	CF	Dec-02				**2.0**	Depends on current contract negotiations, CF income needed or shift needed otherwise (1.0 MCHF can be decided later).

Nature of Cost	Item Description	Funding Agency involved	Commitment date start	MCHF CERN pit infrastruct.	MCHF Discussion ongoing	MCHF Before Apr 2002 RRB	MCHF Remaining afterwards	Strategy to be pursued or recognized as suplementary funds
	1.2.6. Cryogenics / External system	CF, IK ?	Jun-01			**1.0**		CF income needed to cover, use either fresh money or shift from elsewhere.
	1.2.7. Cryogenics / Proximity & Installation	CF	Oct-02				**1.0**	Revise for cost savings (manpower contributions?)
1.3. LAr Cryostat & Cryogenics	1.3.1. Various items	IN2P3, MPI? IK, CF	Dec-01 Mar-03		**1.0**			CF income needed or shifts for first part, revise part two for cost savings. Try to get recognized IK from IN2P3 and MPI.
	1.3.2. Integration	IN2P3	Oct-02		**1.3**			Covered currently by IN2P3 IK, to be recognized as supplementary costs under discussion.
1.4. TC Infrastructure	1.4.1. Shielding elements	possible IK + CF	May-03				**1.2**	Work on future IK contributions from existing or new collaborators, make some parts stageable.
	1.4.2. Shielding elements		May-03				**1.0**	Work on future IK contributions from existing or new collaborators.
	1.4.3. Traction systems	possible IK + CF	Jul-02 Oct-02				**1.6**	CF income needed to cover, use either fresh money or shift from elsewhere. We try to negotiate IK with Germany for air-pads.
	1.4.4. Access structures	possible IK + CF	Feb-03				**1.1**	Work on future IK contributions from existing or new collaborators.
	1.4.5. Support structures	CF	Oct-02				**1.4**	Work on future IK contributions from existing or new collaborators. Possible saving under investigation (0.3).
	1.4.6. Muon wheel supports	possible IK + CF	Jan-02 Jun-02			**0.7**	**0.8**	Big wheel part critical, CF income needed to cover, or shift needed otherwise.
	1.4.7. Electrical distribution	CERN budget area, CF	May-03	**0.8**			**0.2**	0.8 on CERN infrastructure budget agreed.
	1.4.8. Vacuum chamber	CERN budget area, CF	May-02	**1.4**			**0.6**	ATLAS specific beam pipe order increase, needs CF income or shift from elsewhere, rest CERN infrastructure agreed.
	1.4.9. Cooling & ventilation	CERN budget area, CF	Apr-01 Apr-02	**2.0**				CERN infrastructure budget agreed.
	1.4.10. Flexible support carriers	possible IK + CF	Mar-02		**0.7**		**0.7**	Material (0.75 MCHF) covered currently by German IK, recognize as supplementary costs to MPI? Rest CF, installation manpower IK possible.
	1.4.11. Varia - racks, cable trays,..	CF	Aug-02				**0.7**	CF income needed to cover, use either fresh money or shift from elsewhere.
	1.4.12. Safety detectors	CERN budget area, CF	Aug-02	**0.7**			**0.7**	Part on CERN infrastructure budget over costs (was imposed to be trimmed to 0.7 MCHF in latest iteration), rest CF income.

Nature of Cost	Item Description	Funding Agency involved	Commitment date start	MCHF CERN pit infrastruct.	MCHF Discussion ongoing	MCHF Before Apr 2002 RRB	MCHF Remaining afterwards	Strategy to be pursued or recognized as suplementary funds
1.5. Systems	1.5.1. ID tooling, test stations, assembly	ID system	Oct-02				**2.5**	Shifts inside ID by 'consuming' stageing, possibly DSM TRT electronics, SCT alignment off-detector electronics, and have Institutes commit supplementary costs.
	1.5.2. LAr integration parts, cryostat transports	LAr system	Apr-02 Apr-03			**0.2**	**0.4**	IK from Institutes (reuse of equipment) for the urgent part, new resources needed for the installation transports.
	1.5.3. TileCal tooling, cooling, trigger cables	Tile system	Apr-02 Jan-03				**1.2**	Collect from Institutes for urgent part, supplementary cost contribution from Spain (to be discussed), stretch pre-assembly.
	1.5.4. Muon CSM modules, small wheels support	Muon system	Oct-02 Oct-03				**1.8**	Small wheel supports in 2002, CSM in 2003. Possible shifts against CSC off-detector electronics, and supplementary contributions likely.
	1.5.5. ID installation tooling	ID system	Apr-03				**0.3**	Shifts inside ID by 'consuming' staging, SCT alignment off-detector electronics, and have Institutes commit supplementary costs.
	1.5.6. LAr EM End-Cap components	LAr system	Jun-00		**0.8**			Cost were shared between IN2P3 and Spain, to be recognized later (sharing to be decided).
	1.5.7. LAr Electronics	LAr system	Dec-02				**1.0**	Seek cost savings and staging in ROD system, ps contracts with staging options.
1.6. Systems infrastructure	1.6.1. ID SR-building for (pre-)assembly, integration	ID inst.	Apr-02			**0.6**	**1.0**	Initially intended to be paid by advance inside ID community except for 0.5 MCHF agreed by TC, now shifts inside the system (TRT C wheels, SCT alignment off-detector electronics). Possible saving on HVAC (0.5).
	1.6.2. LAr integration clean room area in B180	LAr inst.	Jan-01		**1.2**			Arranged and agreed inside LAr as advance payment (category B).
	1.6.3. Muons integration laboratories	Muon system	Oct-02				**0.5**	Try to further squeeze storage space, and cover integration as part of deliverables (now in M&O).
1.7. Common Projects	1.7.1. Missing contributions to Common Fund	CF	RRB Apr-01				**2.3**	Work further on new contributions. If not covered needs to be shifted to the something late in the CF.
TOTAL overcosts				**4.9**	**7.5**	**8.9**	**30.7**	