

Preliminary Draft Budget for CMS Maintenance & Operations in the Year 2007

INTRODUCTION

This document summarizes the preliminary funding requirements for the payments that the CMS Collaboration plans to make in the year 2007 in order to maintain and operate the already constructed detectors and Collaboration-wide facilities (M&O Cat. A).

In addition we present also estimates for the subdetectors maintenance and operations expenses (M&O Cat. B).

Both M&O Cat. A and Cat. B costs have been last scrutinized by the RRB Scrutiny Group for M&O before the October 2005 RRB. The Annexes presented here are based on the latest available figures or the scrutinized costs if more recent figures are not yet available.

The Cat. A costs are invoiced by CERN on behalf of the CMS Collaboration.

The Cat. B costs will be invoiced only upon request of each sub-detector and only for a small fraction of the total presented here.

The sharing of the costs is preliminary and given for information only. The exact sharing will be available after the PhD list is updated in September 2006.

The figures shown as "Payments expected in the year 2007" in the Summary Table (**Annex 2**) have not yet been reviewed by the RRB Scrutiny Group. Furthermore, various sharing percentages are based on the 2005 PhD count, which will change in the M&O Draft 2007 Budget submitted to the October 2006 RRB.

Following the established procedure for the Preliminary Draft Budget for Construction, this document is meant to give timely information to the CMS Resources Review Board (RRB) and to provide input for further discussions with the CMS Funding Agencies to prepare the M&O Draft 2007 Budget, which will be submitted for approval to the RRB in October 2005 after scrutiny by the Scrutiny Group.

Timely and early payments for this budget are necessary due to the operational nature of the costs presented here.

M&O CATEGORY A

With respect to the forecast for the year 2007 in the M&O Draft Budget for the year 2006 (cf. CERN-RRB-2005-108), the present budget request has changed in a few areas:

- A.1.07, Cooling fluids, now contains the cost of the filling and renewal of the coolant for the so-called Tracker cooling plant, which is the common cooling plant for Tracker (both Pixel and Silicon Strip Tracker) and ECAL Preshower.
- A.7.01, Cooling and Ventilation, has been updated following the latest estimates for the running costs of the general cooling and ventilation. In addition the estimated maintenance cost of the Tracker cooling plant has been included.
- A.7.03, Power Distribution, has been updated following the latest estimates for the running costs of the general power distribution. In addition the estimated maintenance cost of the distribution and control system for racks and low voltage has been included.
- A.7.12, Outreach, has been updated on the basis of a new draft plan for Outreach. This is still under discussion inside the Collaboration and will be reviewed in detail with the RRB Scrutiny Group

The total estimated cost for M&O-A in 2007 is 10'902 kCHF, to be compared with the estimate presented to this board in October 2005 of 10'362 kCHF.

The estimated manpower cost for A.9, Core Computing, in the year 2007 totals some 1'580 kCHF. For this particular category and as for the current year, the CMS Collaboration strongly prefers to receive contributions directly from the Institutes/Funding Agencies rather than hiring personnel through CERN.

Annex I.A gives the projected costs for M&O-A until 2010.

This updated budget request will be discussed with the RRB Scrutiny Group.

M&O CATEGORY B

With respect to the forecast for the year 2007 in the M&O Draft Budget for the year 2006 (cf. CERN-RRB-2005-108), the present budget request has changed in the Tracker, ECAL and HCAL areas.

The Tracker has increased its request for 2007 by some 500 kCHF to cover additional manpower and spares due to losses during production.

ECAL is overall cost neutral, but the balance between different categories has changed.

HCAL has reviewed the yearly profile with an overall increase in the order of 10% for the period 2006-2010.

The updated budget request will be discussed with the RRB Scrutiny Group.

M&O CATEGORY B SHARING

Material Resources

The CMS Collaboration will continue to share its M&O Cat. B costs for the year 2007 by responsibility for all subsystems.

Technical manpower

The technical manpower required at CERN from the Institutes (item B.2.01 in Annex B.1) will be shared by responsibility for all subsystems.

SUMMARY

The numbers given in this document are summarized in **Annex 2**. It should be noted that funds paid in 2007, which will not have been committed during 2007, will be reported to the April 2008 RRB and will be carried forward.

ANNEXES

Preliminary Budget Requirements for M&O in 2007

Annex 1: PhD Scientists per Funding Agency

Annex 2: M&O Cat. A and B Costs by Funding Agency

Annex A.1: M&O Cat. A Budget Request 2007

Annex A.2: M&O Cat. A by Funding Agency

Annex B.1: M&O Cat. B Budget Request 2007

Annex B.2: M&O Cat. B Budget Sharing 2007 by Funding Agency and Subsystem

Annex B.3: M&O Cat. B Estimated Costs Incurred in 2007 by Funding Agency and Subsystem

Annex I.A: Foreseen Cat. A Costs 2007-2010

Annex I.B: Foreseen Cat. A Costs 2007-2010

ANNEX 1

PhD Scientists per Funding Agency Based on the Annually Revised Annex 13 of the M&O MoU

The List of Names is Available at
<http://cmsdoc.cern.ch/docofficial.shtml>
(Count closed on September 27, 2005)

Institute FA	PhD #	PhD %
Austria	11	1.1%
Belgium	28	2.7%
Brazil	4	0.4%
Bulgaria	5	0.5%
CERN	62	6.0%
China	14	1.3%
Croatia	6	0.6%
Cyprus	2	0.2%
Estonia	2	0.2%
Finland	12	1.2%
France-CEA	16	1.5%
France-IN2P3	36	3.5%
Germany	44	4.2%
Greece	19	1.8%
Hungary	6	0.6%
India	22	2.1%
Iran	3	0.3%
Ireland	1	0.1%
Italy	162	15.6%
Korea	15	1.4%
Mexico	5	0.5%
New Zealand	3	0.3%
Pakistan	3	0.3%
Poland	8	0.8%
Portugal	4	0.4%
RDMS-DMS	34	3.3%
RDMS-Russia	54	5.2%
Serbia	3	0.3%
Spain	30	2.9%
Switzerland-ETHZ	16	1.5%
Switzerland-PSI	11	1.1%
Switzerland-UNIV	5	0.5%
Taipei	11	1.1%
Turkey	15	1.4%
United Kingdom	41	3.9%
USA-DOE	258	24.8%
USA-NSF	69	6.6%
Grand Total	1040	100.0%

ANNEX 2

M&O Cat. A and B Costs by Funding Agency Payments expected in the Year 2007 (kCHF)

Funding Agency	Category A	Category B	Total Category A+B	Total Invoiced
Austria	98.4	88.6	187.0	98.4
Belgium	250.4	227.0	477.4	250.4
Brazil	41.9		41.9	41.9
Bulgaria	44.7		44.7	44.7
CERN	554.5	511.2	1,065.8	554.5
China	146.8	34.5	181.3	146.8
Croatia	62.9	48.2	111.1	62.9
Cyprus	21.0	16.1	37.0	21.0
Estonia	21.0		21.0	21.0
Finland	107.3	100.9	208.2	107.3
France-CEA	143.1	128.6	271.7	143.1
France-IN2P3	322.0	333.9	655.9	322.0
Germany	393.5	378.9	772.4	393.5
Greece	169.9	74.8	244.7	169.9
Hungary	53.7		53.7	53.7
India	226.9	28.7	255.5	226.9
Iran	31.4		31.4	31.4
Ireland	10.5	8.0	18.5	10.5
Italy	1,449.0	1,414.7	2,863.7	1,449.0
Korea	157.2	52.1	209.3	157.2
Mexico	52.4		52.4	52.4
New Zealand	31.4		31.4	31.4
Pakistan	31.4	123.6	155.1	31.4
Poland	71.6	131.2	202.7	71.6
Portugal	35.8	43.0	78.8	35.8
RDMS-DMS	356.4	32.2	388.6	356.4
RDMS-Russia	511.9	156.4	668.3	511.9
Serbia	31.4	12.0	43.4	31.4
Spain	268.3	148.7	417.0	268.3
Switzerland-ETHZ	143.1	80.4	223.5	143.1
Switzerland-PSI	98.4	268.4	366.8	98.4
Switzerland-UNIV	44.7	174.5	219.2	44.7
Taipei	115.3	88.4	203.7	115.3
Turkey	157.2		157.2	157.2
United Kingdom	366.7	304.3	671.0	366.7
USA-DOE	2,678.2	1,785.7	4,464.0	2,678.2
USA-NSF	716.3	517.2	1,233.5	716.3
Grand Total	10,017	7,312	17,329	10,017

ANNEX A.1

M & O Cat. A

Budget Request for the Year 2007 (kCHF)

Maintenance & Operations (kCHF)				Year	
Group	Description	Ref.	Details	2007	
Maintenance & Operations	Detector related costs	A.1.01	Magnet	40	
		A.1.02	Magnet controls	142	
		A.1.03	Magnet power supply	60	
		A.1.04	Gas systems	210	
		A.1.05	Gas consumption	200	
		A.1.06	Cooling systems	180	
		A.1.07	Cooling fluids(above -50°C)	200	
		A.1.08	External cryogenics	465	
		A.1.09	Cryogenic fluids (below -50°C)	40	
		A.1.10	Moving/hydraulic systems	100	
		A.1.11	Detector safety systems	65	
		A.1.12	Shutdown activities	410	
		A.1.13	General Technical support	610	
		A.1.14	UPS maintenance	80	
		A.1.16	Beam pipe & vacuum	240	
		A.1.17	Counting & control rooms	200	
		Detector related costs Total			
	Secretariat	A.2.01	Secretarial assistance	180	
		A.2.02	Economat	15	
		A.2.04	Printing and publication	50	
	Secretariat Total				245
	Communications	A.3.01	GSM phones; on-call service	20	
		A.3.02	Automatic call-back	0	
	Communications Total				20
	On-line computing	A.4.01	System management	667	
		A.4.02	Data storage, (temporary on disk)	75	
		A.4.03	Detector controls	90	
		A.4.04	Computers/processors/LANs	858	
		A.4.05	Software licenses	120	
	On-line computing Total				1,810
	Test beams, calibration facilities	A.5.01	General operation	80	
		A.5.02	Common electronics	45	
		A.5.03	Electronics pool rentals	20	
A.5.04		Gas systems	10		
A.5.05		Gas consumption	10		
Test beams, calibration facilities Total				165	
Laboratory operations	A.6.01	Assembly areas, clean rooms	30		
	A.6.02	Workshops	250		
Laboratory operations Total				280	
General services	A.7.01	Cooling & ventilation	470		
	A.7.03	Power distribution system	60		
	A.7.04	Heavy transport	610		
	A.7.05	Cranes	70		
	A.7.06	Cars	40		
	A.7.08	Survey	130		
	A.7.09	Storage space	70		
	A.7.10	Common desktop infrastructure	60		
	A.7.11	Academic Subsistence	130		
	A.7.12	Outreach	220		
	General services Total				1,860
	Core Computing Infrastructure & Services	A.9.01	Central computing environment	623	
A.9.02		Software process service	260		
A.9.03		User support	327		
A.9.04		Central production operations	370		
A.9.05		Hardware	100		
Core Computing Infrastructure & Services Total				1,680	
Maintenance & Operations Total				9,302	
Power	Electricity	A.8.01	Power Consumption	1,600	
	Electricity Total			1,600	
Power Total				1,600	
Grand Total				10,902	

ANNEX A.2

M & O Cat. A by Funding Agency

All Figures in kCHF

Funding Agency	Category A without Power Bill	Power Billed	Category A
Austria	98.4		98.4
Belgium	250.4		250.4
Brazil	35.8	6.2	41.9
Bulgaria	44.7		44.7
CERN	554.5		554.5
China	125.2	21.5	146.8
Croatia	53.7	9.2	62.9
Cyprus	17.9	3.1	21.0
Estonia	17.9	3.1	21.0
Finland	107.3		107.3
France-CEA	143.1		143.1
France-IN2P3	322.0		322.0
Germany	393.5		393.5
Greece	169.9		169.9
Hungary	53.7		53.7
India	196.8	30.1	226.9
Iran	26.8	4.6	31.4
Ireland	8.9	1.5	10.5
Italy	1449.0		1449.0
Korea	134.2	23.1	157.2
Mexico	44.7	7.7	52.4
New Zealand	26.8	4.6	31.4
Pakistan	26.8	4.6	31.4
Poland	71.6		71.6
Portugal	35.8		35.8
RDMS-DMS	304.1	52.3	356.4
RDMS-Russia	483.0	28.9	511.9
Serbia	26.8	4.6	31.4
Spain	268.3		268.3
Switzerland-ETHZ	143.1		143.1
Switzerland-PSI	98.4		98.4
Switzerland-UNIV	44.7		44.7
Taipei	98.4	16.9	115.3
Turkey	134.2	23.1	157.2
United Kingdom	366.7		366.7
USA-DOE	2307.6	370.6	2678.2
USA-NSF	617.2	99.1	716.3
Grand Total	9,302	715	10,017

ANNEX B.1

M & O Cat. B

Budget Request for the Year 2007 (kCHF or FTE)

Year	2007
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Description	Amount (kCHF/FTE)		Detector					Grand Total	
	Ref.	Details	Tracker	ECAL	HCAL	Muon	Trigger		Core Computing
Material Resources (kCHF)	B.1.01	Mechanics	10	55		23			88
	B.1.02	Gas-system	0	4	1	42			48
	B.1.04	Cooling system	0	66	1	21			89
	B.1.05	FE electronics	0	182		340			522
	B.1.06	Standard electronics, PS (LV, HV)	548	164	10	282			1,003
	B.1.07	Standard electronics, Crates	0	79	10	99			188
	B.1.08	Standard electronics, RO Modules	748	193	10	491	490		1,932
	B.1.09	Controls, (DCS, DSS)	74	215		170			459
	B.1.10	Sub-Detector Spares	741	40	3	99			883
	B.1.11	Areas	100	65	28	124			317
	B.1.12	Communications	15	22	125	37			198
	B.1.13	Store Items	40	70	158	58			326
	B.1.14	Hired Manpower @CERN	400	351	330	179			1,260
	Material Resources (kCHF) Total			2,676	1,506	676	1,965	490	
Human Resources (FTE)	B.2.01	Technical Manpower @CERN	6	10	9	12	8		45
	B.2.02	Core Computing Manpower @CMS						75	75
Human Resources (FTE) Total			6	10	9	12	8	75	121

ANNEX B.2

M&O Cat. B Cost Sharing by Funding Agency and Subsystem

Funding Agency	Tracker	ECAL	HCAL	Muon	Trigger
Austria	1.4%				10.6%
Belgium	8.5%				
Brazil					
Bulgaria					
CERN	10.7%	10.2%		3.2%	1.7%
China				1.8%	
Croatia		3.2%			
Cyprus		1.1%			
Estonia					
Finland	3.8%				
France-CEA		8.5%			
France-IN2P3	6.5%	10.7%			
Germany	9.2%			6.7%	
Greece		3.0%			6.1%
Hungary					
India		1.7%	0.6%		
Iran					
Ireland		0.5%			
Italy	22.4%	14.8%		30.0%	0.9%
Korea				1.8%	3.5%
Mexico					
New Zealand					
Pakistan				6.3%	
Poland					26.8%
Portugal		2.1%			2.2%
RDMS-DMS					
RDMS-Russia		8.2%			
Serbia		0.8%			
Spain				7.6%	
Switzerland-ETHZ		5.3%			
Switzerland-PSI	9.1%	1.6%			
Switzerland-UNIV	6.5%				
Taipei		5.9%			
Turkey					
United Kingdom	4.9%	10.4%			3.5%
USA-DOE	17.1%	8.6%	71.7%	30.7%	32.2%
USA-NSF		3.4%	27.8%	12.0%	12.6%
Grand Total	100.0%	100.0%	100.0%	100.0%	100.0%

All subsystems sharing by responsibility

ANNEX B.3

M&O Cat. B Costs by Funding Agency and Subsystem

Estimated Costs Incurred in 2007 (kCHF)

Funding Agency	Tracker	ECAL	HCAL	Muon	Trigger	Total
Austria	36.7				52.0	88.6
Belgium	227.0					227.0
Brazil						
Bulgaria						
CERN	286.6	153.4		62.8	8.5	511.2
China				34.5		34.5
Croatia		48.2				48.2
Cyprus		16.1				16.1
Estonia						
Finland	100.9					100.9
France-CEA		128.6				128.6
France-IN2P3	173.1	160.8				333.9
Germany	246.5			132.4		378.9
Greece		45.0			29.8	74.8
Hungary						
India		25.3	3.8			29.0
Iran						
Ireland		8.0				8.0
Italy	598.4	223.0		589.1	4.3	1,414.7
Korea				35.0	17.0	52.1
Mexico						
New Zealand						
Pakistan				123.6		123.6
Poland					131.2	131.2
Portugal		32.2			10.9	43.0
RDMS-DMS						
RDMS-Russia		123.6				123.6
Serbia		12.0				12.0
Spain				148.7		148.7
Switzerland-ETHZ		80.4				80.4
Switzerland-PSI	244.3	24.1				268.4
Switzerland-UNIV	174.5					174.5
Taipei		88.4				88.4
Turkey						
United Kingdom	130.7	156.6			17.0	304.3
USA-DOE	457.6	129.4	484.2	603.4	157.8	1,832.3
USA-NSF		50.5	187.8	235.5	61.6	535.3
Grand Total	2,676	1,506	676	1,965	490	7,312

ANNEX I.A

M & O Cat. A Costs 2006-2010

(All Figures in kCHF)

Group	Description	Ref.	Details	Type (1)	Year					Grand Total	
					2006	2007	2008	2009	2010		
Maintenance & Operations	Detector related costs	A.1.01	Magnet	C	50	40	40	30	30	190	
		A.1.02	Magnet controls	O	70	110	110	110	110	510	
		A.1.03	Magnet power supply	O	10	30	30	20	20	110	
				C	10	30	20	20	20	100	
		A.1.04	Gas systems	O	80	160	160	160	160	720	
				C	30	50	50	50	50	230	
		A.1.05	Gas consumption	C	150	200	300	300	300	1,250	
		A.1.06	Cooling systems	O	120	150	190	190	190	840	
		A.1.07	Cooling fluids(above -50°C)	O	50	30	30	30	30	170	
				C	15	200	200	200	145	760	
		A.1.08	External cryogenics	O	180	345	345	345	345	1,560	
				C	250	120	30	30	30	460	
		A.1.09	Cryogenic fluids (below -50°C)	C	24	40	40	40	40	184	
		A.1.10	Moving /hydraulic systems	O	50	50	50	50	50	250	
				C	20	50	30	30	30	160	
		A.1.11	Detector safety systems	O	25	25	25	25	25	125	
				C	20	40	40	40	40	180	
	A.1.12	Shutdown activities	O	110	390	390	390	390	1,670		
			C	20	20	20	20	20	100		
	A.1.13	General Technical support	O	550	550	550	550	550	2,750		
			C	50	60	60	60	50	280		
	A.1.14	UPS maintenance	C	50	80	80	80	80	370		
	A.1.15	Electronics pool rentals	C								
	A.1.16	Beam pipe & vacuum	O	40	120	120	120	120	520		
			C	40	120	120	120	120	520		
	A.1.17	Counting & control rooms	O	120	120	120	120	120	600		
			C	40	80	120	120	100	460		
	Detector related costs Total					2,206	3,242	3,302	3,282	3,197	15,229
	Secretariat	A.2.01	Secretarial assistance	O	180	180	225	225	225	1,035	
		A.2.02	Economat	C	15	15	15	15	15	75	
		A.2.04	Printing and publication	C	50	50	100	100	100	400	
	Secretariat Total					245	245	340	340	340	1,510
Communications	A.3.01	GSM phones; on-call service	C	20	20	20	20	20	100		
	A.3.02	Automatic call-back	C	0	0	0	0	0	0		
Communications Total					20	20	20	20	20	100	
On-line computing	A.4.01	System management	O	347	667	987	987	987	3,975		
	A.4.02	Data storage, (temporary on disk)	C	25	75	150	250	250	750		
	A.4.03	Detector controls	C	70	90	110	130	130	530		
	A.4.04	Computers/processors/LANs	C	386	858	1,670	2,637	2,770	8,321		
	A.4.05	Software licenses	C	60	120	180	240	240	840		
On-line computing Total					888	1,810	3,097	4,244	4,377	14,416	
Test beams, calibration facilities	A.5.01	General operation	O	80	60	40	40	30	250		
			C	20	20	20	20	10	90		
	A.5.02	Common electronics	C	45	45	15	15	15	135		
	A.5.03	Electronics pool rentals	C	30	20	20	20	20	110		
	A.5.04	Gas systems	C	10	10	10	10	10	50		
	A.5.05	Gas consumption	C	10	10	10	10	10	50		
A.5.06	External cryogenics	C									
Test beams, calibration facilities Total					195	165	115	115	95	685	
Laboratory operations	A.6.01	Assembly areas, clean rooms	C	40	30	20	20	20	130		
	A.6.02	Workshops	O	220	220	220	220	220	1,100		
			C	30	30	30	30	30	150		
A.6.03	Laboratory instruments	C									
Laboratory operations Total					290	280	270	270	270	1,380	

All Amounts in kCHF					Year					Grand Total	
Group	Description	Ref.	Details	Type (1)	2006	2007	2008	2009	2010		
	General services	A.7.01	Cooling & ventilation	O	120	175	195	235	235	960	
				C	120	295	315	355	355	1,440	
		A.7.03	Power distribution system	C	50	60	60	60	60	290	
		A.7.04	Heavy transport	O	490	550	400	280	280	2,000	
				C	60	60	60	60	60	300	
		A.7.05	Cranes	C	70	70	50	50	50	290	
		A.7.06	Cars	C	40	40	30	30	30	170	
		A.7.08	Survey	O	120	120	120	60	60	480	
				C	10	10	5	5	5	35	
		A.7.09	Storage space	C	100	70	50	50	50	320	
		A.7.10	Common desktop infrastructure	C	60	60	50	45	40	255	
		A.7.11	Academic Subsistence	O	130	130	60	50	40	410	
	A.7.12	Outreach	O		50	50	50	50	200		
			C	60	170	170	170	170	740		
	General services Total					1,430	1,860	1,615	1,500	1,485	7,890
	Core Computing Infrastructure & Services	A.9.01	Central computing environment	O	519	623	675	675	675	3,167	
		A.9.02	Software process service	O	217	260	282	282	282	1,323	
		A.9.03	User support	O	273	327	355	355	355	1,665	
		A.9.04	Central production operations	O	308	370	400	400	400	1,878	
		A.9.05	Hardware	C	100	100	100	100	100	500	
Core Computing Infrastructure & Services Total					1,417	1,680	1,812	1,812	1,812	8,533	
Maintenance & Operations Total					6,691	9,302	10,571	11,583	11,596	49,743	
Power	Electricity				700	1,600	1,800	1,800	1,800	7,700	
	Power Total				700	1,600	1,800	1,800	1,800	7,700	
Grand Total					7,391	10,902	12,371	13,383	13,396	57,443	

(1) O=Operation, manpower intensive
C=Consumables

ANNEX I.B

M& O Cat. B Costs 2006-2010 for all CMS Subdetectors

(Material Resources in kCHF, Human Resources in FTE)

Amount (kCHF/FTE)			Year					Grand Total
Description	Detector	Subsystem	2006	2007	2008	2009	2010	
Material Resources	Tracker	Pixel	192	670	698	714	714	2,988
		SST	1,085	2,006	1,455	1,455	1,455	7,456
	Tracker Total		1,277	2,676	2,153	2,169	2,169	10,444
	ECAL		1,390	1,506	1,506	1,506	1,506	7,412
	HCAL		855	676	653	598	1,161	3,942
	Muon	Barrel Alignment	35	29	24	24	24	136
		Drift Tubes	604	639	607	607	607	3,064
		EMU	878	881	881	881	881	4,402
		Forward RPC	192	157	157	157	157	820
		LinkAlignment	60	31	16	16	16	139
		RPC Barrel	278	228	228	228	228	1,190
Muon Total		2,047	1,965	1,913	1,913	1,913	9,751	
Trigger		490	490	490	490	490	2,450	
Material Resources Total			6,058	7,312	6,714	6,675	7,239	33,999
Human Resources	Tracker	Pixel			2	2	2	6
		SST	4	6	6	6	6	28
	Tracker Total		4	6	8	8	8	34
	ECAL		8	10	10	10	10	48
	HCAL		9	9	9	9	9	46
	Muon	Barrel Alignment	2	2	1	1	1	7
		EMU	5	5	5	5	5	25
		Forward RPC	2	2	2	2	2	10
		LinkAlignment	1	1	1	1	1	5
	RPC Barrel	2	2	2	2	2	10	
Muon Total		12	12	11	11	11	57	
Trigger		8	8	8	8	8	40	
Core Computing		70	75	81	81	81	388	
Human Resources Total			111	121	127	127	127	613