Costing for 2000 Machines

1. Hardware Specification

The hardware specification is listed in the Bill Of Materials (BOM). This shows the design time to be allocated to the Hardware Architect (HA) for each component, alongside the unit price when purchased in multiples of 1000. The table shows the components selected for the machine.

Component	Design Staff	Design Cost	Model	Spec	Unit Price £ (qty thousand)	Quantity per board	Component Design Cost (person weeks)
CPU2			68k8	5Mhz, 8/32, 1MB Max Ram	5.5	1	-
ULA1	HA	£5,000.00	G1	glue IOP-CPU	5	1	4
ULA2	HA	£5,000.00	G2	glue RAM-CPU	5	1	4
ULA3	HA	£5,000.00	G3	glue DISP-CPU	5	1	4
ULA4	HA	£5,000.00	G4	glue SYSTEM	5	1	4
ROM3	HA	£5,000.00	32K	32 KB ROM chip	4	2	4
RAM2			128Kb	8/16 bit, 100ns	2.5	4	-
IOP-J2			SC150	2ch Joy/mse/keybd connector	15	1	
IOP-S1			16550 UART	1 ch serial port	5	1	-
BOARD-SLDR	HA	£10,000.00	A83	CPU, IOP, G1-4, XXKb RAM SERPORT, INTSND	15	1	8
Storage1			disk	3.5" floppy	7.5	1	
CASE1	HA	£12,500.00	DESKTOP	int keyboard, 3 ext ports (+ exp)	25	1	10
KEYB1			int	int keyboard for case	5	1	
Pro Expansion			ProEx	CPU-Glue-SCSI - 4xRAM	15	1	
INTSND1			i8042	mono snd, 2 8-bit ports	1.5	1	-

2. Software Specification

The software specification is listed in the Bill Of Materials (BOM). This shows the design time to be allocated to the Software Architect (SA) for each component. The items in the table below form the minimum software applicable to the core system. There is no coding cost associated with these items.

Component	Design Staff	Design Cost	Component2	Producer	Design Cost (person weeks)
S1	SA	£3,000.00	Boot ldr & HWcfg	In House	2
S2	SA	£12,000.00	Sys: Kernel	In House/ HB/OS	8
S3			SYS: Libraries	In House/ HB/OS	
S4			SYS: Drivers	In House/ HB/OS	
S9	SA	£12,000.00	BAS: Kernel	In House/ HB OS	8
S10			BAS: core lib&I/O	In House/ HB OS	
S11	SA	£3,000.00	BAS: fs libs	In House/ HB OS	2
S38	SA	£6,000.00	CPM+BIOS	3rd party	4
S39			Libs & CLI	3rd party	
S40	SA	£6,000.00	68kBASIC	3rd party	4

3. **Licenses**

   A BSD copy license is required at £500 per version of the design. In addition, each machine is bundled with EZ-SUITE. A licence is required at a cost of £25 per machine in the production phase.

4. **Design Cost**

   The specification outlined above indicates a design cost of:

   - Hardware – 38 weeks (190 days)
   - Software – 28 weeks (140 days)

   The company has one HA (£250 per day) and one SA (£300 per day). The time in the design phase can be reduced, using agency staff (HA - £400 per day; SA - £450 per day). Some of this time may be offset against the Project Manger's (PM) time, as this could reduce the overall timeline.

5. **Production Cost**

   The production cost can be considered in 4 elements:

   i. Hardware components - £132.50 per machine
   ii. Case production - £8.75 per machine*
   iii. Board production - £7.00 per machine*
   iv. 2 Software disks - £1.00 per machine

   *The case and board production can be conducted simultaneously as the company has two in-house Hardware Engineers (HE) costing £175 per day. The cost per machine is based on a maximum build capacity of 20 cases and 25 boards per day. While the production cost can be reduced slightly through agency staff offset against the PM time, there can be issues with quality control and it has been decided not to use agency staff in this phase.

6. **Testing Cost**

   Hardware and software testing is conducted by the HE and SE respectively at cost of £175 and £195 respectively when using internal staff.

7. **Project Management Cost**

   The PM has a daily cost of £275 per day and will be employed daily throughout the project. While an additional PM can be employed from the agency, there is no financial benefit to do so.

8. Overall Costing

The team has examined a variety of models for both specification and delivery of the project. The table below shows the overall costs.

Phase	Role	Units	Fixed Cost	Wks	Days	Agency Staff (Wks)	Agency Staff (Days)	Agency Cost	Internal Staff (Wks)	Internal Staff (Days)	Internal Cost	Total Cost
Hardware Design	HA	1		38	190	9	45	£18,000.00	29.0	145	£36,250.00	£54,250.00
Software Design	SA	1		28	140	0	0	£0.00	28.0	140	£42,000.00	£42,000.00
BSD copy license		1	£500.00									£500.00
Case Build	HE1	1000		0.01	0.05	0	0	£0.00	0.0	0.05	£8.75	£8,750.00
Case Build	HE2	1000		0.01	0.05	0	0	£0.00	0.0	0.05	£8.75	£8,750.00
Board Production	HE1	1000		0.008	0.04		0	£0.00	0.0	0.04	£7.00	£7,000.00
Board Production	HE2	1000		0.008	0.04	0	0	£0.00	0.0	0.04	£7.00	£7,000.00
Hardware Components		2000	£132.50									£265,000.00
EZ-Suite License		2000	£25.00									£50,000.00
Disk		2000	£1.00									£2,000.00
Testing - HW	HE1	1		1.0	5	0	0	£0.00	1.0	5	£875.00	£875.00
Testing - SW	SE1	1		1.0	5	0	0	£0.00	1.0	5	£975.00	£975.00
Project Management	PM	1		38.0	190	0	0	£0.00	38.0	190	£52,250.00	£52,250.00

This model uses agency staff as part of the development phase speed up the hardware development and reduce the overall timeline, optimising cost.

The cost of delivering the project is £499,350.00 leaving a contingency of £650. This places a project at a financial risk as shown in the risk register below using the OSWAP (OWASP Risk Rating Methodology | OWASP Foundation):

Financial Risk Register

Risk	Likelihood (L)		Impact (I)		Overall Risk OSWAP Methodology
	0-9	Rating	0 - 9	Rating	
Software Errors	3	Low	6	Medium	Low
Hardware Errors (internal staff)	4	Medium	8	High	High
Hardware Errors (agency staff)	8	High	8	High	Critical
Project overrun	2	Low	8	High	Medium
Labour cost – increased agency due to staff absence or illness	6	Medium	9	High	High
Increase in component cost	3	Low	9	High	Medium
Import cost due to variation in exchange rate	1		4		4

Summary

The costing for the machine has involved changing the specification in order to meet the budget constraint while still delivering the core non-negotiables. The changes made have impacted the form factor of the machine and a lack of UNIX licence at this stage, however, these could be included in future production with a revised price for the point of sale. While the project is in budget, the very small contingency means that any issues picked up within either the sprint tests, or final testing would place the project at risk of being over budget. Similarly, the project would be at risk for any fluctuations in either component or labour costs. Finally, the project would be at risk regarding international exchange rates, specifically the GBP to US dollar, for components, such as the floppy disks, purchased outside of the UK.