

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCEGENERAL PURPOSES COMMITTEEEstimate of Expenditure 1964/65
and Forecast Estimates 1965/66 and 1966/67

The following estimates are submitted for approval:-

	<u>1963/64</u> <u>Estimated</u> <u>Out-turn</u> <u>£000</u>	<u>1964/65</u> <u>Estimate</u> <u>£000</u>	<u>1965/66</u> <u>Forecast</u> <u>£000</u>	<u>1966/67</u> <u>Forecast</u> <u>£000</u>	<u>Page</u>
<u>Rutherford Laboratory</u>					3
Capital	3,236	2,463	2,762	3,370	4-7
Non-capital	4,007	4,876	5,426	5,856	8
Total	<u>7,243</u>	<u>7,339</u>	<u>8,188</u>	<u>9,226</u>	
<u>Electron Laboratory</u>					9
Capital	529	1,980	1,451	910	10
Non-capital	100	412	587	752	11
Total	<u>629</u>	<u>2,392</u>	<u>2,038</u>	<u>1,662</u>	
<u>Atlas Computer Laboratory</u>					12
Capital	930	1,084	949	489	13-14
Non-capital	200	362	472	493	15
Total	<u>1,130</u>	<u>1,446</u>	<u>1,421</u>	<u>982</u>	
	<u>1963/4</u> <u>Grant</u> <u>£000</u>				
<u>Gross Total</u>					
Capital	4,422	4,695	5,527	4,769	
Non-capital	4,023	4,307	5,650	7,101	
Total	<u>8,445*</u>	<u>9,002</u>	<u>11,177</u>	<u>11,870</u>	
Less receipts	120	150	226	468	
<u>Net total</u>	<u>8,325*</u>	<u>8,852</u>	<u>10,951</u>	<u>11,402</u>	

*But an increase of
up to £600,000 was
authorised on 2.8.63

The estimates are on the basis of the level of prices at about July, 1963.

In previous estimates, and in the current five-year forecast, a "shadow-cut" has been applied to allow for unforeseen delays. It is now considered that a shadow cut is not applicable to the Rutherford Laboratory at its present stage of development, and that consideration of a cut of this kind, if any, at the Electron Laboratory should be deferred until the date of access to the Daresbury site is known.

A summary of previous forecasts for expenditure in 1964/65 given on page 2 shows in particular that the previous estimates of non-capital expenditure at the Rutherford Laboratory were much too low. The errors came to light as a result of the introduction of more powerful methods of control which Dr. Pickavance reported to the Committee at the last meeting. The details which are given on the following pages are rather fuller than in previous years, and are arranged in a new form based upon the way in which expenditure is controlled.

A "programme" for 1964/65 has been prepared as an accompaniment to the estimate, as is customary in the A.E.A., and is appended to this paper. It brings out the fact that these estimates are subject to two major uncertainties:-

(a) Although the estimate for 1964/65 has been kept to the minimum now seen to be needed, it substantially exceeds the amount which the Treasury have hitherto been ready to agree to in discussion of the 5-year forecast.

(b) The date on which access can be gained to the Daresbury site for the Electron Laboratory is still far from clear.

ESTIMATES OF N.I.R.N.S. EXPENDITURE 1964/65

COMPARISON WITH PREVIOUS FORECASTS £000

	<u>1964/5</u>		<u>1964/5</u>		<u>1964/5</u>
	<u>Forecast in</u>		<u>Current</u>		<u>This</u>
	<u>last year's</u>		<u>5-year forecast</u>		<u>Estimate</u>
	<u>Estimates</u>		<u>NI/63/4 (a)</u>		
	<u>NI/GP/62/28</u>		<u>(Not yet approved</u>		
			<u>by the Treasury)</u>		
<u>Rutherford Laboratory</u>					
Capital	2,412	) less	2,570	) less	2,463
Non-capital	3,766	) a	3,850	) a	4,876
Total	<u>6,178</u>	) shadow	<u>6,420</u>	) shadow	<u>7,339</u>
<u>Electron Laboratory</u>		) cut		) cut	
Capital	991	) of	1,860	) of	1,980
Non-capital	562	)	430	)	412
Total	<u>1,553</u>	) £500,000	<u>2,290</u>	) £500,000	<u>2,392</u>
<u>Atlas Computer Laboratory</u>					
Capital	1,031		1,130		1,084
Non-capital	487		330		362
Total	<u>1,518</u>		<u>1,460</u>		<u>1,446</u>
Gross total	8,749		9,670		11,177
Less receipts	230		270		226
Net total	<u>8,519</u>		<u>9,400</u>		<u>10,951</u>

- (a) The amended version of NI/63/4, circulated on 15.5.63, which takes account of the revised Electron Laboratory estimate approved by the G.P.C. on 13.5.63.

The 5-year forecast as submitted to the Minister for Science (NI/GP/63/10) is consistent with the above, but does not give the figures in this form.

Rutherford High Energy LaboratorySummary of Estimates 1964/65, 1965/66 and 1966/67 - £000

	<u>1963/64</u>	<u>1964/65</u>	<u>1965/66</u>	<u>1966/67</u>
<u>Capital</u>				
Schemes in Progress (August, 1963)				
- Plant	2,647	1,142	114	
- Buildings	569	237		
	<u>3,216</u>	<u>1,379</u>	<u>114</u>	
Schemes not yet started (August, 1963)				
- Plant	20	765	1,940	3,030
- Buildings	20	319	708	340
	<u>40</u>	<u>1,084</u>	<u>2,648</u>	<u>3,370</u>
Total Capital				
- Plant	2,647	1,907	2,054	3,030
- Buildings	589	556	708	340
	<u>3,236</u>	<u>2,463</u>	<u>2,762</u>	<u>3,370</u>
<u>Non-Capital</u>				
Standing Charges				
Group Budgets				
	2,065	2,411	2,581	2,731
	1,942	2,465	2,845	3,125
	<u>4,007</u>	<u>4,876</u>	<u>5,426</u>	<u>5,856</u>
Capital	3,236	2,463	2,762	3,370
Non-Capital	4,007	4,876	5,426	5,856
R.H.E.L. Total	<u>7,243</u>	<u>7,339</u>	<u>8,188</u>	<u>9,226</u>

Rutherford High Energy Laboratory
Capital Estimates 1964/65, 1965/66 and 1966/67 - £000

<u>Plant - Schemes in Progress</u>		<u>Total</u>	<u>1963/64</u>	<u>1964/65</u>	<u>1965/66</u>	<u>1966/67</u>	<u>Later</u>	<u>Remarks</u>
<u>£100,000 and over</u>		<u>Cost</u>					<u>Years</u>	
<u>NRO</u>								
1-7	<u>Nimrod</u>	7,580						
21	- 7 G.E.V. P.S.	418	541	200				
22	- Heavy Liquid Bubble Chamber	471	105	150	24			
-	- Helium Bubble Chamber	375	117	250	90			
30	- Hydrogen Bubble Chamber	1,000	540	200				
30	- Beam Handling Plant - Ph. I	400	113	287				
30	- Beam Handling Plant - Ph. II	125	101	24				
30	- Parasitic Area Extension - Shielding	355	202	15				
38	<u>General</u> - Orion Computer	-	2,094	1,126	114			
	<u>Under £100,000</u>							
41-6	<u>Nimrod</u>	-	39	-				
24	- Spares	80	40	11				
26	- Track Analysis Equipment	90	85	3				
34	<u>P.I.A.</u> - H.E.P. Apparatus - Cabling	89	74	2				
	- Analysing Magnets							
	<u>General</u> - Schemes under £25,000 and minor items for Group Budgets	-	315					
		-	553	16				
		-						
		-	2,647	1,142	114			

RUTHERFORD HIGH ENERGY LABORATORY
Capital Estimates 1964/65, 1965/66 and 1966/67 - £000

	<u>Total Cost</u>	<u>1963/4</u>	<u>1964/5</u>	<u>1965/6</u>	<u>1966/7</u>	<u>Later years</u>	<u>Remarks</u>
<u>Plant - Schemes not yet started</u>							
<u>£100,000 and over</u>							
<u>Nimrod</u>							
- H.E.P. Apparatus	750		10	150	150	440	Continuing
- Machine Improvements	-			10	250	250	
- Beam Handling Plant - Ph.III	1,000				50	950	
<u>P.L.A.</u>						5,000	
- Machine Extension	5,000						
<u>General</u>							
- Large Electrostatic Generator*	2,500		40	700	1,350	410	
- Future Major Accelerator*	16,000					16,000	
	-		50	860	1,800	-	
<u>Under £100,000</u>							
<u>Nimrod</u>							
- H.E.P. Apparatus	-		50	100	200	300	Continuing
- Track Analysis Equipment	-		100	200	200	200	Continuing
- Special Beam Equipment & Magnets	-		50	200	250	300	Continuing
<u>P.L.A.</u>							
- Tank I Improvement	70		50	-	-	-	
- Major Modification	-		-	20	20	20	
<u>General</u>							
- Helium Liquefier	120		30	70	20	40	Continuing
- Reactor Loops etc.	-		-	40	40		
- Schemes under £25,000 and minor items for group budgets	-		435	450	500	500	Continuing
	-		715	1,080	1,230	-	
	-		765	1,940	3,030	-	

*Site Unknown

Rutherford High Energy Laboratory

Capital Estimates 1964/65, 1965/66 and 1966/67 - £000

Buildings - Schemes in Progress

£100,000 and over

	<u>Total Cost</u>	<u>1963/64</u>	<u>1964/65</u>	<u>1965/66</u>	<u>1966/67</u>	<u>Later Years</u>	<u>Remarks</u>
<u>Nimrod</u>							
- Phase I Buildings	3,160	80	20				
- Extension to Control Building R.2	223	85	62				
- Heavy Liquid Bubble Chamber Annexe	41	4	-				
- Extension to Parasitic Area	61	35	8				
<u>P.L.A.</u>							
- Nuclear-Chemistry Laboratories & Offices	273	17	-				
<u>General</u>							
- Orion Computer Building	47	10	2				
- Heavy Laboratory & Office Block - R.25	221	27	7				
- Restaurant	106	25	10				
- Houses at Didcot	120	2	-				
- Houses at Abingdon	108	93	10				
- Phase II Buildings	412	18	-				
	-	396	119				
<u>Under £100,000</u>							
<u>Nimrod</u>							
- Experimental Area Extension	78	19	20				Incl. HeBC Compressor Room
<u>General</u>							
- Extension to Electronics W/S - R.18	48	25	12				
- Lecture Theatre	47	15	21				
- Substation 13	31	12	2				
- Substation 14	44	20	21				
- Site Power Distribution	74	30	32				
- Roads & Car Parks	53	10	8				
- Schemes under £25,000	-	42	2				
	-	173	118				
	-	569	237				

Rutherford High Energy LaboratoryCapital Estimates 1964/65, 1965/66 and 1966/67 - £000Buildings - Schemes not yet started

	<u>Total Cost</u>	<u>1963/64</u>	<u>1964/65</u>	<u>1965/66</u>	<u>1966/67</u>	<u>Later Years</u>	<u>Remarks</u>
<u>£100,000 and over</u>							
<u>Nimrod</u> - Aux. Building for H.E. Physics	100		5	50	40	5	
- 2nd Main Experimental Area	290				50	240	
- Physics and Office Block	250				10	240	
- Power Supplies & Special Services	150				10	140	
<u>P.L.A.</u> - Machine Extension	1,000					1,000	
<u>General</u> - Electronics Bldg. & Office Block	150		50	90	10		
- Bldgs. for Electrostatic Generator*	500		10	300	150	40	
- Bldgs. for Future Major Accelerator*	5,000					5,000	
	-	-	65	440	270	-	
<u>Under £100,000</u>							
<u>Nimrod</u> - Hydrogen Target & Remote Test Bldg.	50		5	45			
<u>P.L.A.</u> - Building Modifications	-		30	-			
<u>General</u> - Heavy Plant Store	61		30	31			
- Cooling Towers Extension	40		15	25			
- Safety Store & First Aid Post	30		1	29			
- Services Workshop	30		1	29			
- Chilton Houses	80		52	18			
- Site Services Development	-	10	20	20	20	20	1963/64 - land purchase
- Schemes under £25,000	-	10	100	71	50		
	-	-	254	268	70	-	
	-	20	319	708	340	-	

* Site Unknown

Rutherford High Energy LaboratoryNon-Capital Estimates 1964/65, 1965/66 and 1966/67 - £000

	<u>1963/64</u>	<u>1964/65</u>	<u>1965/66</u>	<u>1966/67</u>
<u>Standing Charges - note 1</u>				
Salaries and Wages	1,264	1,380	1,480	1,540
Travel and Subsistence Expenses	77	90	100	100
Houses, Hostel & Restaurant Exes.	31	43	45	45
Electricity, Rates, Telephones etc.	292	493	576	676
U.K.A.E.A. Charges				
Overheads etc.	155	170	170	170
Site Services	100	130	130	130
General Services	215	185	180	180
	2,134	2,491	2,681	2,841
<u>Less</u> Costs attributable to the Atlas Laboratory	69	80	100	110
	2,065	2,411	2,581	2,731
<u>Group Budgets - note 2</u>				
Applied Physics	820	850	950	1,050
P.L.A. and H.E. Physics	677	850	950	1,050
University E.M.R. and Experimental Agreements	160	300	350	400
Reactors	110	200	300	300
Engineering	100	130	145	160
Administration	75	135	150	165
	1,942	2,465	2,845	3,125
Standing Charges	2,065	2,411	2,581	2,731
Group Budgets	1,942	2,465	2,845	3,125
	4,007	4,876	5,426	5,856
<u>Staff in post at 31st March</u>				
	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>
Professional	343	367	425	465
Ancillary	338	368	435	455
Industrial	230	260	270	290
	911	995	1,130	1,210

Note 1: These are charges over which little or no day to day control is possible.

Note 2: These charges are under the control of group leaders.

ELECTRON LABORATORYSummary of Estimates 1964/65, 1965/66 and 1966/67 - £000

	<u>1963/64</u>	<u>1964/65</u>	<u>1965/66</u>	<u>1966/67</u>
<u>Capital</u>				
Schemes in Progress - Plant	259	1,020	451	410
(August, 1963) - Buildings	250	900	850	120
	509	1,920	1,301	530
Schemes not yet started - Plant	-	10	40	280
(August, 1963) - Buildings	20	50	110	100
	20	60	150	380
Total Capital - Plant	259	1,030	491	690
- Buildings	270	950	960	220
	529	1,980	1,451	910
<u>Non-Capital</u>	100	412	587	752
Capital	529	1,980	1,451	910
Non-Capital	100	412	587	752
<u>E.L. Total:</u>	629	2,392	2,038	1,662

ELECTRON LABORATORY

Capital Estimates 1964/65, 1965/66 and 1966/67 - £000

	<u>Total Cost</u>	<u>1963/64</u>	<u>1964/65</u>	<u>1965/66</u>	<u>1966/67</u>
<u>PLANT</u>					
<u>Schemes in Progress</u>					
NINA Project	1,760	229	920	331	280
Minor Plant	-	30	100	120	130
	-	<u>259</u>	<u>1,020</u>	<u>451</u>	<u>410</u>
<u>Not Yet Started</u>					
External Electron Beam	310	-	-	10	140
Physics Apparatus	-	-	10	30	140
	-	-	<u>10</u>	<u>40</u>	<u>280</u>
	-	-	-	-	-
<u>BUILDINGS</u>					
<u>Schemes in Progress</u>					
NINA Project	2,120	250	900	850	120
<u>Not yet Started</u>					
Canteen	30	-	20	10	-
Hostel and Flats	150	-	-	50	50
Minor Works	-	20	30	50	50
	-	<u>20</u>	<u>50</u>	<u>110</u>	<u>100</u>

ELECTRON LABORATORY

Non-Capital Estimates 1964/65, 1965/66 and 1966/67 - £000

	<u>1963/64</u>	<u>1964/65</u>	<u>1965/66</u>	<u>1966/67</u>
Salaries, Wages etc.	50	162	237	302
Administrative Expenses	10	20	40	50
Stores, Materials and Services	25	190	270	350
E.M.R.	15	40	40	50
Total:	<u>100</u>	<u>412</u>	<u>587</u>	<u>752</u>
Staff in Post at 31st March	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>
Professional	3	40	55	70
Ancillary	2	30	55	75
Industrial	-	20	30	45
Total:	<u>5</u>	<u>90</u>	<u>140</u>	<u>190</u>

Atlas Computer Laboratory
Summary of Estimates 1964/65, 1965/66 & 1966/67 - 2000

	1963/64	1964/65	1965/66	1966/67
<u>Capital</u>				
Schemes in Progress - Plant	750	758	649	199
(August, 1963) - Buildings	175	74		
	<u>925</u>	<u>832</u>	<u>649</u>	<u>199</u>
Schemes not yet started - Plant	5	250	250	250
(August, 1963) - Buildings	-	2	50	40
	<u>5</u>	<u>252</u>	<u>300</u>	<u>290</u>
Total Capital - Plant	755	1,008	899	449
- Buildings	175	76	50	40
	<u>930</u>	<u>1,084</u>	<u>949</u>	<u>489</u>
<u>Non-Capital</u>				
Standing Charges	119	225	321	336
Group Budgets	81	137	151	157
	<u>200</u>	<u>362</u>	<u>472</u>	<u>493</u>
<u>Capital</u>	930	1,084	949	489
<u>Non-Capital</u>	200	362	472	493
<u>A.C.L. Total</u>	<u>1,130</u>	<u>1,446</u>	<u>1,421</u>	<u>982</u>

Atlas Computer Laboratory

Capital Estimates 1964/65, 1965/66 and 1966/67 - £000

	Total Cost	1963/64	1964/65	1965/66	1966/67	Later Years	Remarks
<u>Buildings - Schemes in Progress</u>							
£100,000 and over							
Computer Building	293	175	74	-	-	-	
- Schemes not yet started							
Under £100,000							
Building Extensions	-	-	1	40	30	-	
Minor Works	-	-	1	10	10	10	
	-	-	2	50	40	-	
	-	175	76	50	40	-	

Atlas Computer Laboratory

Capital Estimates 1964/65, 1965/66 and 1966/67 - £000

	<u>Total Cost</u>	<u>1963/64</u>	<u>1964/65</u>	<u>1965/66</u>	<u>1966/67</u>	<u>Later Years</u>	<u>Remarks</u>
<u>Plant - Schemes in Progress</u>							
£100,000 and over							
Atlas Computer	3,121	750*	758*	649*	199*		
<u>Plant - Schemes not yet started</u>							
£100,000 and over							
Disc Store	200		200				
Printers	100			100			
Visual Display Unit	100			100			
Core Store	150				150		
Fixed Store	200					200	
Computer Extension	5,000					5,000	
	-	-	200	200	150		
<u>Under £100,000</u>							
Drum Store	50						
Minor Plant	-	5	50	50	50	50	
	-						
	-	5	50	50	100	-	
	-	5	250	250	250	-	

*Including development payments

ATLAS COMPUTER LABORATORYNon-Capital Estimates 1964-65, 1965-66 and 1966-67 - £000

	<u>1963-64</u>	<u>1964-65</u>	<u>1965-66</u>	<u>1966-67</u>
<u>Standing Charges - note 1</u>				
Salaries and Wages	46	62	77	82
Travel and Subsistence	2	6	7	8
Electricity, Rates, Cleaning, etc.	2	27	37	36
Computer Maintenance Contract	-	50	100	100
R.H.E.L. Overheads	69	80	100	110
	119	225	321	336
<u>Group Budgets - note 2</u>				
Operations	22	44	66	72
Programming	2	5	10	10
Mathematics	1	3	5	5
Administration	10	15	20	20
E.M.R.	6	30	50	50
A.E.A. Computer Support	40	40	-	-
	81	137	151	157
Standing Charges	119	225	321	336
Group Budgets	81	137	151	157
	200	362	472	493
<u>Staff in post at 31st March</u>				
	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>
Professional	13	19	23	26
Ancillary	23	27	29	31
Industrial	3	3	3	3
	39	49	55	60

Note 1. These are charges over which little or no day to day control is possible.

Note 2. These charges are under the control of group leaders.

THE N.I.R.N.S. PROGRAMME FOR 1964/65

INTRODUCTION

In December, 1962 when the 1963/64-1967/68 5-year forecast was finally revised (NI/GP/62/29) it was still thought that the approved programme of nuclear and high energy physics at the Rutherford and Electron Laboratories could be accommodated within the "2% pattern" laid down by the Treasury, although it was clear that additional schemes would be submitted for consideration.

By May, 1963 when the 1964/65-1968/69 5-year forecast was submitted to the Minister for Science (NI/63/4), it was seen that the approved programme would require expenditure substantially exceeding the "2% pattern".

In June, 1963 a detailed review showed that the expenditure at the Rutherford Laboratory, particularly the non-capital expenditure, had been seriously under-estimated. It became necessary to seek additional funds for 1963/64, and it was seen that the normal operation of the Rutherford Laboratory as it now exists would consume more funds in later years than had been allowed for this purpose in the 5-year forecast. The Minister's Office and the Treasury were at once informed and on 2nd August additional funds for the Rutherford Laboratory were authorised, and approval to proceed with the Electron Laboratory was reaffirmed, after it had been made quite clear that the Rutherford Laboratory and the Electron Laboratory could not proceed properly within the 2% pattern. Nevertheless, no explicit approval of departure from the 2% pattern was given, no new pattern was approved, and discussion of the 5-year forecast was deferred.

BASIS OF THE PROGRAMME

In the circumstances described above, the Institute's programme for 1964/65 has been drawn up on a financial basis which is not already approved by the Treasury. An additional major source of uncertainty is that the date on which access to the Daresbury site can be gained is not yet known.

Although subject to these uncertainties, the assumptions upon which the programme has been drawn up and the estimate has been made, are quite clear:-

- (a) That at the Rutherford Laboratory, Nimrod and the P.L.A. will be well exploited and there will be a reasonable programme of capital development.
- (b) That access to the Daresbury site will be gained in September, 1963, and that the Laboratory and accelerator are to be built as fast as possible, and completed in four years.

RUTHERFORD LABORATORY

Construction of Nimrod has been completed and only small terminal payments (£200,000) will fall in 1964/65. The allocation of effort after the completion of change from construction to use of Nimrod is very hard to foresee. Strenuous efforts will be made to keep down the complement but a net increase of 84 is forecast. The main blocks of work at the Laboratory will be:-

(a) Development, commissioning and operation of Nimrod and equipment for use with Nimrod

This work will take up between one-third and half of the effort of the Laboratory as roughly judged by considering manpower and non-capital expenditure. Capital expenditure will include £400,000 on the construction of bubble chambers, £500,000 on beam handling equipment and £100,000 on small items under £25,000.

(b) High Energy Physics Research

As time goes on it will be increasingly difficult to differentiate between this item and the previous one, because both will be directed towards the same objective. The effort directly devoted to high energy physics will be rapidly increased from about one-sixth towards about one-third of the Laboratory total; not all of it can be found by diversion from other activities.

(c) The Proton Linear Accelerator

The P.L.A. will continue to be used 24 hours a day, 7 days a week for a very vigorous research programme. The P.L.A. accounts for about one-sixth of the Laboratory's effort. Improvements to Tank I, already designed, will be carried out at a cost of £50,000.

(d) Other Accelerator Developments

Work on the variable energy cyclotron for A.E.R.E. will continue. Work on the electrostatic generator for Oxford university is expected to be finished during the year, freeing some effort for re-deployment.

(e) Buildings

An Electronics and Office building, deferred from 1963/64 owing to the financial situation will be started with expenditure of £50,000 falling in the year. Capital expenditure on building schemes under £100,000 is estimated at £250,000.

(f) Future Major Schemes

A start is planned on the proposed £3m to £4½m scheme for a large electrostatic generator, on a site to be chosen. This item has been included under the heading of the Rutherford Laboratory for convenience only. Expenditure of £50,000 during the year is possible.

ATLAS LABORATORY

Final payments on the main building and progress payments on the computer will make the total capital expenditure about £1m. The computer should be installed at the Laboratory during the year and may be in operation by the end of it.

ELECTRON LABORATORY

The programme of the Electron Laboratory is to construct a 4 GeV strong focussing electron synchrotron and the laboratory to house it. A site has been chosen and the detailed planning of the buildings is finished. The basic design of the synchrotron is completed and the major components are being put out to manufacture.

AMENITIES

Owing to the financial situation the housing scheme at Chilton has been deferred. Terminal payments on the Abingdon housing scheme will amount to about £10,000. Completion of the small lecture theatre will cost £20,000