pared in the design study would allow the 1/3 stage to be reached in 1988 with four of the experimental areas in action, if authorization to build is given in 1981. The cost estimate for the 1/3 stage is 1065 million Swiss francs and a further 210 million Swiss francs would be needed to complete Stage 1.

The peak energy could be pushed ,ittle beyond 90 GeV with further copper cavities but significant advance to the Stage 2 aim of 130 GeV requires the installation of superconducting cavities. Until the development programme for the production of such cavities is much further advanced it is not reasonable to state costs or timescales to reach Stage 2.

The LEP project as described in the 'Pink Book' carries the very strong support of the European high energy physics community. In June of this year it is intended to present the project formally to the delegates of the twelve Member States of CERN. It is hoped that authorization for construction will be obtained a year later, in June 1981, and will have passed through all the necessary governmental approvals by the end of that year. If this is achieved, LEP could begin to take shape at the beginning of 1982.

High Energy Physics in Europe

A thorough survey of the present and possible future activities and resources in high energy physics in the CERN Member States has been carried out by a Working Group of ECFA (European Committee for Future Accelerators) under the Chairmanship of John Mulvey. The aim ?s been to obtain a view of the pi esent European scene and to see whether it looks well adapted to the effective exploitation of possible future machines in Europe (particulary LEP) and the rest of the world. A report (ECFA/RC/79/47) has been presented to ECFA.

The high energy physics community in the twelve CERN Member States comprises about 2000 experimental and 1000 theoretical physicists centred in some 140 universities and research institutes. 88 per cent of the experimental physicists are spread around research centres in Europe while 12 per cent are employed at the two major accelerator Laboratories, CERN and DESY. Nearly a quarter of the physicists are research students of whom about 190 obtain their degrees each year. A half of this influx of young people moves to other work within three years of taking the degree.

A survey carried out a year ago revealed that between 50 and 60 per cent of the experimentalists utilized the 400 GeV proton synchrotron, the SPS, at CERN and that trend continues with the advent at the SPS of the proton-antiproton collider. The total number involved in the CERN research programme (not counting the synchro-cyclotron) was about 1350. About 320 physicists were using electron-positron machines with 230 of them on PETRA at DESY. Some 90 physicists based their main experimental activities at USA Laboratories (mainly Fermilab and SLAC) and 25 at Serpukhov (half of them on the Mirabelle bubble chamber). To balance this movement, some 70 American and 90 Soviet and Eastern European physicists came to CERN and another 20 American physicists to DESY. While mentioning bubble chambers, it is interesting to note that, since the previous survey in 1966, the number of experimenters using only the bubble chamber or emulsion techniques has fallen from 55 to 19 per cent.

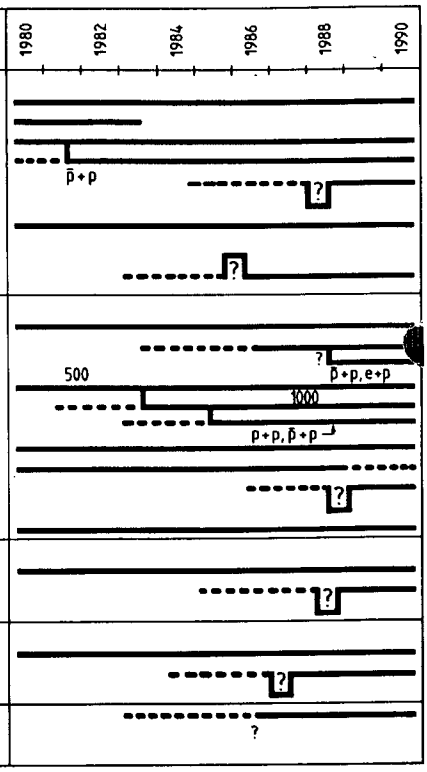
Direct financial support for the experimental programme (not including salaries, overheads and 'central' computing costs) is estimated at about 146 million Swiss francs in 1978. About half came from the two host Laboratories and some 13 MSF of the remaining University money was absorbed by travel and subsistence expenses. The manpower support (engineers, technicians, programmers) for the experimental programme involved some 2650 man-years in 1978, about one third being provided in the two host Laboratories.

The size of collaborations has grown with the complexity of the experiments and a collaboration of about 40 physicists is now typical with some collaborations reaching 70 or 80. The average size of a team coming from a single institute is 6.5.

In looking towards the future, a scenario has been drawn up in

The future pattern of high energy physics research in terms of the main machines which could be available in the coming decade. The question marks indicate possible start-up dates for projects yet to be approved. Dotted lines indicate periods devoted to preparation of experiments.

Region and Laboratory	MACHINE	PARTICLE(S)	ENERGY (GeV)	POSSIBLE DEVELOPMENTS
EUROPE				
CERN	P.S.	p	26	LEAR: High intensity, low energy $\bar{p}$.
	I.S.R.	p+p	31+31	$\bar{p}$+p
	S.P.S.	p	450	
	S.P.S.	$\bar{p}$+p	270+270	
	L.E.P.	? e^+e^-	65+65 (1st phase)	e^+e^- 130+130; e+p ~100+270
DESY	PETRA	e^+e^-	19+19	
	(also	e^+e^-	5+5 DORIS)	
	DESY II	? e+p, e^+e^-		
USA				
B.N.L.	A.G.S.	p	33	
	ISABELLE	p+p	400+400	$\bar{p}$+p, e+p?
F.N.A.L.		p	500	
	Doubler / Saver	p	1000	p+p 250+1000, $\bar{p}$+p 1000+1000?
SLAC	SLAC	e	22	SLED, 40 GeV
	PEP	e^+e^-	18+18	
	PEP II	? ?	?	
CORNELL	CESR	e^+e^-	8+8	
USSR				
SERPUKHOV		p	76	
	UNK	? p	3000	p+p, $\bar{p}$+p, ?
JAPAN				
K.E.K.		p	12	
	TRISTAN	? p+p	200+200	e+p, e^+e^-, $\bar{p}$+p?
CHINA		p	50	



which obviously the large electron-positron storage ring LEP figures as first priority for Europe. The Working Group stressed that LEP should not be delayed. Operation is assumed to start in 1988 so as not to leave CERN too long with the SPS and the proton-antiproton collider as its front line machines since these are likely to be overtaken by machines in the USA by the mid-1980s. Too long a shift of balance to the USA would make it difficult for Europe to recover its present status. It is hoped that a new machine at DESY will do much to fill the gap from the mid-80s. (We hope to have more on the DESY plans in a forthcoming issue.)

The Working Group comments that the future scenario takes a significant step towards a situation where new facilities in the different regions of the world are complementary rather than duplicated, bringing economies while still allowing the

In the context of the sharing of facilities world-wide, the most positive recommendation we have yet seen came from the Fermilab Physics Advisory Committee last year concerning policy towards non-USA groups. Other similar statements are likely to appear in the final report from the ECFA Working Group and from the International Committee for Future Accelerators, ICFA. The Fermilab Committee said:
'The predominant considerations in accepting or rejecting any experimental proposal should continue to be the physics merit, the technical feasibility, the capability of the group and the resources required. The Laboratory should welcome outside money or equipment, but such opportunities should not have excessive weight in determining the choice among proposals. The national or institutional affiliations of proponents should not per se influence the acceptance or rejection of proposals. We expect that foreign groups would naturally want to team up with local experimenters, and the Laboratory should encourage this. However, we do not feel that it is in the interests of the Laboratory or of the field of particle physics to establish quotas or restrict the international character of the field. We hope that other major laboratories around the world would have similar policies'.

Numbers of people involved in high energy physics research in Europe

CERN Member State	Experimental Physicists			Total	Theoretical Physicists			Total
	Tenured	Fixed Term	Student		Tenured	Fixed Term	Student	
Austria	18	3	2	23	15	9	6	30
Belgium	26	12	10	48	28	18	19	65
Denmark	13	6	4	23	7	12	–	19
France	313	26	59	398	123	18	18	159
Germany	98	110	112	320	66	64	53	183
Greece	5	12	6	23	6	7	4	17
Italy	228	31	61	320	116	17	23	156
Netherlands	27	9	21	57	18	5	18	41
Norway	14	9	10	33	10	6	7	23
Sweden	4	26	21	51	4	11	12	27
Switzerland	20	21	23	64	10	12	10	32
United Kingdom	163	94	111	368	65	34	71	170
Total	929	359	440	1728	468	213	241	922
Based at DESY	38	33	–	71	6	6	–	12
Based at CERN	64	94	–	158	11	31	–	42
Total	1031	486	440	1957	485	250	241	976

research to advance on a broad front. This implies, however, that experimental physicists from any region should be allowed to have access to these facilities and be given the support necessary to use them.

The Working Group assumes some 200 European physicists will be drawn to use the Energy Doubler at Fermilab and the ISABELLE storage rings at Brookhaven and later in the decade some 80 being drawn to use UNK in the USSR. A return flow of physicists from the USA and USSR is anticipated for LEP and the new DESY machine.

If facilities in Europe develop as it is assumed, the number of users of fixed target facilities at the SPS would be likely to fall from 1000 to 500 while the users of colliding beam machines increase from 550 to 1000 mainly through the use of LEP and the new machine at DESY.

The initial LEP experimental programme is assumed to comprise six experiments at an average cost of 30 MSF involving some 450 physicists from the CERN Member States (later rising to 600). If the present pattern and levels of financial support are sustained and the experiments are carried out by large collaborations 50 to 100 (physicists), the necessary finance would be assured. It implies, however, that the host Laboratories must continue to have provision in their budgets to meet half the capital costs of the experiments. For CERN this would involve about 90 MSF over the three or four years prior to LEP start-up. The necessary technical support could also be found if present levels are sustained.

The Working Group was wary of the centralization of effort and resources implied by the size and complexity of the experiments and stressed the importance of providing resources to enable contributions to be made by physicists working in their home Laboratories. This would also strengthen the contribution made by high energy physicists to local academic life, improve the training of graduate students and lead to broader contact with a wider local community including local industries.

The 'concluding remarks' of the report the Working Group state 'Europe today possesses a broad range of front rank facilities for high energy physics research and the proposals under discussion would provide great opportunities for the future'.