2/19/88

INFLATION REPORT

NSAC Subcommittee on Inflation

Peter Parker, Chair
Sam Austin
Gerald Garvey
Stanley Kowalski
Robert Stokstad
William Weitkamp

The increase in the cost of research has been studied in a survey of 20 nuclear science groups and laboratories. The items surveyed make up the great majority of the total operating costs. From 1981 to 1987 the average increase in these unit costs is $\approx$ 7.6% per year excluding overhead charges and $\approx$8.5% per year including overhead charges. This compares to an average increase of 3.7% per year in the Consumer Price Index (CPI-W) over the same period. Integrated over this period, surveyed research costs increased by $\approx$ 63% compared to an increase of 24.4% in the CPI-W. These unit cost increases do not include the cost of the increased sophistication of experiments, and they therefore represent only a lower limit.

5 February 1988

In the analysis of funding scenarios (historical, as well as future projections) and in the generation and justification of local laboratory/group budgets, there is always the question of what deflator to use in converting between "current dollars" and "constant dollars". Over the years the Bureau of Labor Statistics' CPI-W has become the accepted deflator that is generally used in such conversions and intercomparisons, but it is not at all clear that this index is applicable to any specific situation. The issues arising from the applicability or non-applicability of the CPI-W can be severe, particularly in its cumulative effect over many years. It is a perennial source of tension between federal agencies which struggle to keep their contracts and grants abreast of the CPI-W and principal investigators who find that in spite of such increases they are falling farther and farther behind in purchasing power. This is not a new problem, but it has unfortunately remained largely anecdotal and undocumented for research in nuclear physics.

Therefore, given the need to quantify this problem so that it could then be addressed with more than just hand-waving, at its Spring 1987 meeting NSAC created a Subcommittee on Inflation "to examine the real inflationary costs of doing nuclear research over a period of several years (5 or more) if the data are available". [The full text of the charge to the Subcommittee is attached as Appendix A.]

In order to establish the data base needed to carry out this analysis, the Subcommittee surveyed 24 nuclear physics groups (listed in Appendix B) using the attached questionnaire (Appendix C). The 24 groups were chosen to represent a cross section of DOE and NSF research activities in nuclear physics and therefore included national laboratories, universities, large and small facilities, and user groups. In order to make the results of this survey as meaningful and credible as possible, the budget categories covered in the questionnaire were chosen (1) so that they were particularly well-defined with clear, unambiguous prescriptions for their calculation and (2) so that they included a large fraction of the operating costs for the grants and contracts.

20 of the 24 groups responded to the survey. These 20 groups combined represent ≈ 75% of the total DOE + NSF operating budget for nuclear physics during this time frame. For each group, for each budget category their unit costs for each year (1981-1987) were normalized to 1.000 for 1981. Then for each budget category for each year an unweighted (equally weighted) average was formed of all the available, normalized responses. The resulting averages are plotted in Figure 1 and listed in Table 1 together with their r.m.s. uncertainties. Since the number of cases in each of the different types of groups (national labs, universities, users) are small it is not warranted to present separate averages for each subset; there were no systematic trends in the differences between these subsets, and the differences were generally small and well within the r.m.s. uncertainties.

Over this 6 year period (1981-1987), the results for these budget categories (which account for more than 70% of operating costs of the surveyed grants and contracts) show very dramatic increases (50%↔77%) compared to the CPI-W (24.4%). In terms of dollars and cents, typical examples of what these increases represent are seen in the data reported by some of the respondents; at one national laboratory average unit costs for support staff salaries rose from $31,000/year in 1981 to $48,000/year in 1987 (compared to a CPI-W increase to only $38,600/year) while at one university the machine shop rate rose from $20.80/hr in 1981 to $32.20/hr in 1987 (compared to a CPI-W increase to only $25.90/hr) and at another university graduate student tuition charges rose from $3100/student in 1981 to $5410/student in 1987 (compared to a CPI-W increase to only $3860/student).

The increase in the salary costs/person for scientific and support staff individuals at a rate which is approximately double the CPI-W inflation rate can be understood in terms of the compounding of cost-of-living increases with a number of other factors, such as the increasingly stiffer competition for qualified individuals to fill technical postitions and the increasing sophistication and seniority of these scientific and support staffs. This is not an equilibrium population; demographic studies (e.g., Beverly Porter, American Institute of Physics Education and Employment Statistics Division) show that during this period the average age of physicists at National Laboratories has been increasing at the rate of ≈ 0.4 years/year and for university physicists this rate is ≈ 0.8 years/year! (In an equilibrium population this figure would be 0 years/year.) This situation is further exacerbated in the groups in our data base by the fact that since unit costs are increasing faster than their budgets there must necessarily be fewer units and as a practical matter this generally means fewer younger, less expensive people. At a seniority/experience escalation rate for salaries of 5% per year (doubling the real salary in $\approx$ 15 years) the aging of the university scientific staff by 0.8 years/year corresponds to $(1.04)^6=1.27$ over the period of our survey which compounds with the 1.244 CPI-W inflation to an increase in the unit salary cost of 58%.

In addition to the increased costs documented in Table I/Figure 1, there is a further compounding of this problem due to the escalation of the various institutional Overhead rates levied against all of these costs, except tuition. With no change in the overhead rate, overhead costs would still rise at the same rates as the other costs to which overhead is charged; increases in the overhead rate represent a form of double jeopardy by the application of the higher overhead rate to the already higher unit costs. Averaged over the respondents, these increased overhead rates amount to $(1.008)^6=1.051$, compounding the typical 55% unit cost increases in Table 1/Figure 1 to 63%, compared to the CPI-W increase of only 24.4%.

We did not include electric power costs in this analysis because it was not possible to make meaningful comparisons between the wide variety of ways in which these costs are charged (nearly half of which changed significantly during this 6 year period). For the respondents, electric power costs generally amounted to only a few per cent of their total operating costs. It is interesting to note anecdotally that in that case where electric power costs were most significant ($\approx$15% of the LAMPF operating budget) there was a 58% escalation the cost/kwh between 1981 and 1987.

It should also be noted very specifically, that this survey does not address the issue of "sophistication inflation", the question of how to meaningfully compare the cost of making gamma-ray spectroscopy measurements using a single 3"x3" NaI(Tl) crystal vs an array of Ge detectors with BGO Compton-suppression, or the cost of Si(SB) detectors vs large wire chamber arrays, or the cost of carrying out increasingly sophisticated theoretical calculations on increasingly sophisticated computers, etc. The fact that we have not addressed this problem does not mean that it does not exist. It most certainly does exist and needs to be dealt with separately on its own terms. The Subcommittee finds that there is very clear and credible evidence of a real inflation problem in the well-defined categories included in the questionnaire, and in order to avoid any confusion which might detract from these very obvious and important conclusions, we decided not to include the less quantifiable, and more difficult issue of sophistication inflation.

The charge to this Subcommittee was to examine and document the real inflation rate associated with doing nuclear physics research. Our results are clear and unambiguous, showing an average real inflation rate (including increases in institutional overhead rates) of 8.5% per year [$(1.085)^6$=1.63] which is more than double the corresponding CPI-W inflation rate of 3.7% per year [$(1.037)^6$=1.244]. Finding a solution to this problem will not be so simple, but it must certainly start by creating (1) an awareness by the appropriate parts of the Legislative and Executive branches of the federal government of the severity of this problem and (2) a recognition by these same groups of the need to address this problem in order to preserve and protect the essential role of basic research in this country.

Table I
Average Relative Unit Costs

	1981	1982	1983	1984	1985	1986	1987
Support Staff	1.00	1.11	1.19	1.28	1.37	1.42	1.52±.13
Starting Postdocs	1.00	1.08	1.13	1.27	1.32	1.42	1.50±.17
Scientific Staff	1.00	1.11	1.24	1.35	1.45	1.54	1.63±.25
Student Tuition	1.00	1.15	1.30	1.42	1.50	1.66	1.77±.21
Student Stipends	1.00	1.10	1.18	1.27	1.35	1.46	1.62±.25
Central Machine Shop	1.00	1.14	1.24	1.34	1.42	1.53	1.60±.14
CPI-W	1.00	1.072	1.109	1.145	1.186	1.212	1.244

These unit cost increases do not include the effects of increasing overhead rates which by 1987 had compounded these increases by an additional average factor of 1.051 [e.g., 1.55 x 1.051 = 1.63] for each of these categories except tuition.

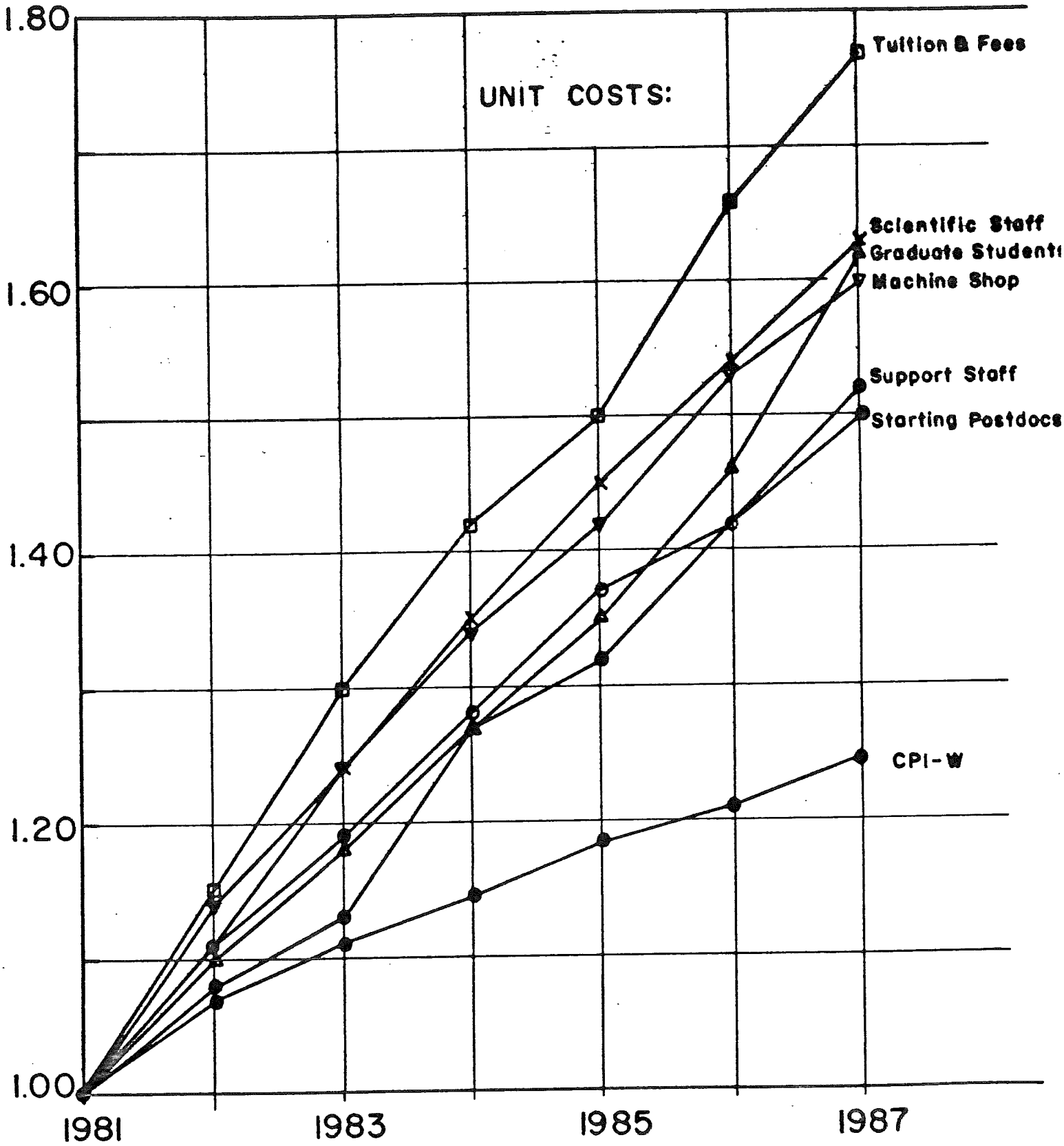

Figure 1: Increases in unit costs for nuclear physics research for the period 1981-1987. These increases do not include the effects of increasing overhead rates which by 1987 had compounded these increases by an additional average factor of 1.051 [e.g., 1.55x1.051=1.63] for each of these categories except tuition.

UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON 98195

Department of Physics, FM-15

May 19, 1987

TO: SUBCOMMITTEE ON INFLATION

Peter Parker, Yale, chairperson
Sam Austin, Michigan State
Gerald Garvey, LANL
Stanley Kowalski, MIT
Robert Stokstad, Lawrence Berkeley Laboratory
William Weitkamp, Univ. of Washington

Thank you for your willingness to serve as a subcommittee of NSAC to consider the problems caused by true inflationary costs rather than those mandated by the Office of Management and Budget (OMB).

At the last meeting of the Nuclear Science Advisory Committee it was agreed to form this subcommitte because the increases proposed for the ongoing program have been set at the federal government's "inflationary rate" rather than the true one, and this appears to be causing considerable problems for nuclear physics laboratories and theoretical groups.

The subcommittee is requested to examine the real inflationary costs of doing nuclear research over a period of several years (5 or more, if the data is available). We discussed a number of categories that it may be useful for you to examine in more detail:

1) Salaries for
   a) physicists
   b) technical personnel
   c) other support personnel
   d) students

2) Sophistication inflation. Experiments are getting more sophisticated and complex.

3) Power, supplies (e.g. liquid N_2, O-rings and similar small "equipment" items)

4) Computing

5) Indirect costs and fringe benefit costs; other management costs

6) Travel

You may think of other categories. Indeed, I leave it to you to decide the best way of organizing the data that you will obtain. Also, it may be useful to make comparisons with inflationary costs in industry.

I hope that you will be able to complete your task in time for the fall meeting of the parent committee. This meeting usually occurs in October.

Sincerely yours,

Ernest

Ernest M. Henley
Chairman, NSAC

cc: D. Hendrie
H. Willard
NSAC members

In the summer and fall of 1987, we surveyed the 24 nuclear physics groups listed below, using the attached questionnaire. Responses were received from 20 of the groups.

20 University Groups:

Caltech (Boehm)
Caltech (Kellogg)
Carnegie Mellon
Colorado
Duke
FSU
Illinois
Indiana
Michigan
Minnesota (Dehnhard)
MIT-Bates
MSU
Princeton
Rochester
Rutgers
Stony Brook
Texas (Riley)
UCLA (Igo)
Univ. of Washington
Yale

4 National Laboratories

ANL
BNL
LAMPF
LBL

YALE UNIVERSITY
A. W. WRIGHT NUCLEAR STRUCTURE LABORATORY
P.O. Box 6666, 272 Whitney Avenue, New Haven, Connecticut 06511

July 21, 1987

Dear :

Ernie Henley has recently appointed us (Sam Austin, Gerry Garvey, Stan Kowalski, Peter Parker, Bob Stokstad, Bill Weitkamp) as an NSAC subcommittee on inflation with the responsibility of examining the real inflation rate associated with doinig nuclear research, as compared to the CPI inflation rate which the federal government wants to use as the benchmark for determining annual increases in grants and contracts. We hope that we can make a strong enough case for more realistic inflation allowances that the funding agencies will no longer be able to ignore this problem but will have to respond in a more positive way.

In order to help us document this problem, we are asking about 20 groups (facilities and user groups) to supply us with the following information for each fiscal year for the period FY81 through FY87: (if your budget or contract year is based on a 12-month period that is different from the federal fiscal year (Oct. 1 to Sept. 30), please feel free to use whatever is most convenient and corresponds reasonably closely to the respective fiscal year.)

(a) Overhead rate (please indicate the categories of expenditures on which overhead is charged.)
(b) Machine shop rate ($/hour)
(c) Electric power rate ($/kwh)
(d) Graduate student tuition and fees ($/student)

For the following categories, do not include overhead charges in these figures, but please indicate whether or not overhead is charged on them.

(e) Graduate student stipend+fringe ($/person)
(f) Support Staff salaries+fringe ($/person) (calculate this as your total support-staff salary+fringe budget divided by the number of "support-person-years.")
(g) Scientific Staff (individuals with a Ph.D degree or its equivalent) salaries+fringe ($/person) (calculate this as your total scientific-staff salary+fringe budget divided by the number of "scientific-person-years.")
(h) Starting salary+fringe for a new post-doc

For your present budget year (or last year, whichever is more convenient), please also indicate approximately what percentage of your total annual budget is represented by each of b, c, d, e, f, and g.

If your data are to be incorporated into our analysis and report, I will need to receive them by August 7.

If you have any questions or suggestions, please do not hesitate to call me. Thank you for your help.

Best regards,

Peter Parker
NSAC Inflation Subcommittee
203-432-3090
GANDALF at YALENSL.Bitnet

PDP/lac