Kolsky
Memo 3

April 18, 1958

Project 7000

FILE MEMO

SUBJECT: SIGMA Performance -- A List of Some "5 Percent Effects"

In discussing the results of various SIGMA Timing Simulator runs (Project 7000 File Memos dated February 6, 1958 and March 12, 1958) with interested parties, the conversations frequently come around to questions of the relative importance of small changes in the computer or the possibility of "trading-off" a decrease in one area for an increase in another.

This memo is written to record some of the examples of 5% effects which have come to light in these discussions and to suggest areas which will require careful watching.

There are three words of warning:

(1) The SIGMA system performance can be quite non-linear in its response to changes in component performance. So one must not assume that a 5% increase and a 5% decrease will necessarily balance out to 0% change in speed. Similarly two 5% changes may result in considerably more or less than a 10% change when taken together.

(2) The list which follows is built about so-called "realistic" speeds which result in a SIGMA performance of about 60 times 704 internal computing speed. In general the Sigma system becomes more sensitive to individual component changes when its overall performance is higher. For example, at a performance of 90 times 704, a change from IAU average rate 1.0 usec to 0.75 usec would cause a 14.% increase in overall speed instead of 5%. In other words, this list cannot be applied safely to different SIGMA configurations.

(3) Finally, remember 5% is not trivial -- it can be worth three 704's to the user.

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List of 5% Performance - Effects on a "Realistic*" SIGMA Configuration

Assuming a system which is about 60 times 704 Speed on the Mesh Calc:

2	0.6 us Instruction Memory	IAU rep. rate 1.0 usec average	
4	2.0 us Data Memory	AU Fl Add 1.0 us	
4	levels of Look-Ahead	Fl Mpy. 2.0 us	Average
	0.8 us Index Cores	Fl Div. 7.5 us	1.45 us
		Fl Load, Store 0.6 us	

	Increasing by 5% (60 → 63)	Decreasing by 5% (60 → 57)
1.	Raising IAU average rate from 1.0 us to 0.75 ms	1.0 us to 1.25 us
2.	Reducing the Fl Load 0.6 us to 0.3 us	0.6 us to 0.9 us
3.	Reducing the Floating Add 1.0 us to 0.7 us	1.0 us to 1.4 us
4.	Reducing the Floating Multiply 2.0 us to 1.4 us	2.0 us to 2.7 us
5.	Reducing the FL Divide 7.5 us to 5.7 us	7.5 us to 9.7 us
6.	Increasing the no. of Look-Ahead levels 4 to 7	4 to 3
7.	Increasing the no. of Main Mem. Boxes ---------	(4 to between 1 and 2)
8.	Increasing Index core cycle rate 0.8 us to 0.6 us	0.8 us to 0.95 us
9.	Changing Read out-time of Main Mem (only) 0.8 us to 0.4 us	0.8 us to 1.2 us
10.	Changing Read-out time Main & Instr. Mem** 0.8 us to 0.5 us	0.8 us to 1.1 us
11.	Putting in an extra core reg for data 1 to 2	----------

* A completely unofficial (and largely undesirable)estimate.

** Both Mems. Assumed to be 2.0 us for this case only.

DISTRIBUTION: Same as March 12 Memo.