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CONFIDENTIAL

PRIME MINISTER

INMOS

An unexpected difficulty has arisen in relation to INMOS. In general, the company has made the sort of progress hoped for when the decision was made to continue supporting it. From sales of £14m in 1982, it has now reached an annual rate of turnover of £60m, and achieved breakeven for the first time in October, in line with the last year's forecast. Although there remain risks (INMOS' production difficulties have prevented it meeting its potential and have increased the cost of its sales, so that its loss for the year substantially exceeds that forecast a year ago), the company seems to have turned the corner; even with substantial contingency provisions, it forecasts a profit next year of £7.5m. Annex A gives detailed figures.

2 As a result of this performance, private sector interest in INMOS has picked up sharply. Western Electric would like to take majority control but have not said yet what price they would pay or what they would do with the business. A Dutch company would provide $30m for ten per cent of the company on condition that an assembly plant were built in Holland. Another US company would subscribe for 17 per cent of the company provided two other investors came in on similar terms. Arnold Weinstock told me on Monday of his

interest: whereas previously he had been uninterested, he is now prepared to make an offer for it, I expect on the basis of a starting offer of a nominal cash payment with an agreement to pay royalties against future sales or a share of future profits.

3 These various offers expose a range of problems. We do not want to sell INMOS at a price which reflects its past rather than its future, and renders us liable to a charge of having disposed of an asset too cheaply. Of greater concern, I should not want to see INMOS taken over by a company which then simply broke it up, and sold out the assets, especially if the industrial capability and control were to be transferred to foreign hands. I see advantage in keeping INMOS in British hands, not least because INMOS is now of increasing strategic importance. The restrictions on the export of US technology have tightened since last year, and to sell out to a company such as Western Electric - who in any case manufacture integrated circuits for their own consumption already - could lose us an assured supply of products, important to a growing range of equipment manufacturers and service companies. To avoid this risk, some time is needed to ensure INMOS is transferred to new owners who will finance the substantial developments still needed (£50-75m next year) and not just break it up, possibly with control going outside the UK.

4 In the time needed for this, INMOS must be kept going. Although the company now expects to be paying its way on trading account, there is a substantial capital equipping programme early next year, for which the company will require further finance. The BTG have not asked for additional funding, but have proposed raising bridging finance to cover the period while they pursue negotiations with potential investors, through the sale and leaseback of the INMOS Colorado Springs facility. This would raise $13m without recourse back to the BTG/NEB. Although it is attractive on that score, it seems to me - and I believe also to Treasury Ministers who have discussed the matter with Sir Malcolm Wilcox, the UK Chairman - a poor tactic to pursue when trying to bring in a new investor; and to be on terms which are not particularly attractive. The alternative to this would be to agree a temporary increase of £15m in INMOS' borrowing ceiling, currently standing at just under £30m, to allow BTG time to pursue their negotiations with all the parties now showing interest.

5 I recognize that this choice is a difficult one, and should welcome views on which course you think we should pursue. I am sending copies of this minute to Members of E(A).

NT

9 December 1983

Department of Trade and Industry

Annex A

INMOS - 1983 PROGRESS

	1982			1983									Forecast 1984						
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4
les £m	1.6	1.9	1.7	1.5	1.7	2.1	1.8	1.9	2.4	2.4	2.9	4.2	5.1	5.3	5.9	17.2	20.0	25.4	35.1
BIT £m	(1.1)	(0.5)	(1.0)	(1.4)	(1.4)	(1.0)	(2.1)	(1.6)	(2.0)	(1.7)	(1.2)	(0.9)	-	0.3	1.2	1.4*	2.0*	3.9*	5.8*
nploy-ent																			
UK	269	275	275	280	286	311	351	397	433	455	519	549	584	625	645	708	841	995	1011
US	660	663	669	679	680	679	680	724	731	738	763	804	844	845	856	942	1047	1140	1197
ufer tarts OOs																			
UK	1.9	2.2	2.2	0.6	1.6	2.4	2.9	2.6	3.2	3.6	4.0	3.6	5.4	7.4	5.8	30.7	36.1	41.6	52.6
US	9.7	9.0	6.9	8.4	7.3	8.2	8.8	11.2	11.1	11.9	13.1	11.3	14.1	13.5	11.5	38.5	40.0	45.3	48.9
nits to inished ods s	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.5	0.7	0.7	1.0	1.2	1.4	4.7	5.9	7.5	10.8

* £13.1m profit projection for 1983 has been reduced by provisions for contingencies to £7.5m.

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Bristol BS1 2NP
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(0272) 2[redacted]51
Telex 444723

cc: W.B. Willott
I.M. Barron
R. Selwood

Kenneth Baker, Esq., MP,
Minister of State for Industry
and Information Technology,
Department of Trade and Industry,
1 Victoria Street,
London. SW1H OET

31 October 1983

Dear Minister,

The Introduction of the Transputer

I felt you would like to know that we are tomorrow making a formal announcement of our plans to introduce the transputer which will be the first major VLSI product to be designed and destined to be manufactured wholly within the United Kingdom.

The transputer - now well into the development stage - is a programmable component containing a microprocessor together with memory and communications capability. It will have direct application in military telecommunication and commercial products and is expected to be highly competitive against any comparable American or Japanese device of which we have knowledge. Perhaps more important is the fact that a series of transputers has the unique quality of being capable of interconnection in such a way as to build more powerful concurrent systems, which opens the door to fifth generation applications.

The 32 bit version of the transputer will contain 250,000 transistors on a chip of 45 sq. mm and will be able to process over ten million instructions every second. To put this performance into context, an American manufacturer recently announced a 32 bit microprocessor which is capable of handling 1.2 million instructions per second.

We expect that we shall be producing the transputer in volume in 1985 and the reason for announcing it now is that it will give manufacturers ample time to incorporate it within the design of new products. To judge from the interest shown already, we believe that it will make a significant contribution to the UK electronics industry.

.../cont...2.

From the office of
the Chairman

Broad Street House
55 Old Broad Street
London EC2M 1RX
01-920 0141

I hope it will not be thought immodest if the company takes the view that this is an event of which the UK can be proud, as we believe it represents an important step in the enhancement of semiconductor design.

I am taking the liberty of sending a copy of this letter to the Secretary of State for Trade and Industry, believing that you would wish this and that such a move will be of convenience to all concerned.

Yours sincerely,

Malcolm Wilcox.

k

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press release

File

M/Fons
To see

(Please return to the Private Office)
Returned with thanks.
RJ
7/11/83

INMOS announces the transputer, a British superchip

From the office of
the Chairman

Broad Street House
55 Old Broad Street
London EC2M 1RX
01-920 0141

The transputer packs the power of a hundred home computers onto a single chip of silicon a quarter of an inch square.

It uses 250,000 transistors to form a processor as powerful as many mainframe computers, a large memory area and a sophisticated communication system to allow it to communicate with other chips and transputers.

The transputer offers a more powerful alternative to existing and planned microprocessors. Its simplicity of programming, and ease of connecting to other chips will make it attractive to system builders. Its extra processing power will make life easier for the users of devices such as word processors.

But what really sets the transputer apart from conventional microprocessors is its ability to be easily connected to other transputers to build very powerful computer systems, the so-called fifth generation systems. This concept of a programmable component, which can be used as an intelligent building brick, is basic to the design of the transputer and is what will be the key to the long term success of INMOS

The transputer was designed in the UK headquarters of INMOS and is and is a significant advance on products available in Japan or the US. It will be available in 1984, but users can already begin to develop applications through the occam programming system.

1 November 1983

For further information
please contact

Dick Selwood in Bristol

inmos

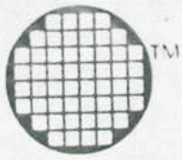
Notes to editors

1) The complexity of the circuitry can be compared to a street map of the Greater London area, which also shows gas mains, sewage systems, electricity and telephone networks. All this printed onto a quarter inch square of silicon.

2) To create such a complex device required developing an integrated set of computer based design tools. This system is widely regarded as the most advanced in the world

3) The Bristol design team which started with 20 people in 1978, now employs over 50 graduate engineers and computer scientists. This team, tiny by world standards, has already racked up an impressive list of success, with an advanced memory chip, the computer based design system, and occam, a programming language for the design and implementation of complex computer sytems.

4) The transputer is a family of products. Details of the first member of the family., a 32bit version called IMS T424 are attached. Also under development for early introduction are a 16 bit transputer a disc processor and a graphics processor. All transputer products are compatible and programs written for one transputer will run on any other transputer, current or future.



T424 Transputer

Processor memory and communications on single chip

32 bit system
10 MIPs throughput

Processor
Reduced instruction set for efficiency
High performance arithmetic

Memory
4 Kbytes on-chip
80 Mbytes/sec data rate

Memory interface
32 bit multiplexed interface for mixed memory systems
Direct address extends to 4 Gbyte
25 Mbytes/sec data rate

Peripheral interface
8 bit multiplexed interface
4 Mbytes/sec to industry standard devices

INMOS links
4 INMOS standard transputer to transputer links
1.5 Mbytes/sec data rate

Technology
250,000 devices
2 micron CMOS

Programming
Programmable in standard high level languages
Direct execution of occam for efficiency and concurrency

Refer to Hall

Suggested responses to q and A

What is a transputer

A transputer is a programmable component.

It is high performance device which has a microprocessor memory and a communication system integrated onto one silicon chip.

It is thus a high performance microprocessor, which is competitive with products to be announced by other companies, and which also has the unique ability that it is easily connected to other transputers to form more powerful systems.. (Fifth generation systems)

(Alternative way of putting it for a less technically sophisticated audience)
A Transputer is a microchip computer which packs the power of around 100 homecomputers onto a single chip of silicon.
This new British component will outperform anything that the Japanese or Americans have in production or under design.
Its immediate use is making systems easier to use (user friendly) and can be used anywhere where a conventional micro can be used.

When will it be available

Engineering samples during H2. 1984

Have you got prototypes

We have seen prototypes of all the constituents of the transputer. This has proved the design system, the process and the ideas behind the transputer concept.

How much will it cost

It is not our policy to predict pricing.
Since it has a very small chip size,(44 sqmm) particularly in comparison with other 32 bit processors we are confident it will be will competitively priced.

Where will it be made

As with all our products, the initial manufacture will be in the Colorado Springs facility.
Volume manufacture will as with all our products be at the most appropriate site.

Why have you taken so long to develop it
(alt How long has it taken to develop it)

It hasn't taken that long, particularly in comparison with some other projects. We have been concerned to get the basic architecture correct since the first products are setting the standards for the future.

We have been working on the transputer from the start of the activities at Bristol in 1979. During that time the same design centre has developed occam the INMOS CAD system and memory products

How many people have been working on the project

The design team was formed in 1979 with 20 people. It now has around 50.
The design team has also been responsible for the CAD layout and simulation work and of course all the occam work.

How much has it cost so far

The initial plans of the company budgeted around £5M for the design of the transputer. We are still within that budget.

Why did you make a memory chip

It is a memory particularly suited to microcomputer applications and also provides us with valuable experience of memory design.

Will you second source the transputer and if so to whom

We have seen considerable interest in second sourcing the transputer products but are not able to say anything yet.

What interest do you have so far

We have spoken to people, here in Europe and the US . They have all been very excited by the concepts.
We are not able to tell you in detail who we have spoken to, but one thing we can say is that we have been able to speak at an early date to significant UK companies.

Do you have any customers signed up

We don't have any committed customers yet. Our problem has been, however, not one of signing up customers, but keeping them at arms length, until we were able to give them full information which we are now able to do. Hence this announcement.

Who is the competition and why do you think you will succeed against them

The immediate competition must be Intel and Motorola. We are confident that the transputer

has significant advantages over anything coming from the US.
In the longer term we see the major competition as coming from Japan.

The advantages of ease of programming ease of communication, and ease of engineering, coupled with processing power should give us the ability to compete effectively.

How long will you be able to retain a significant lead

We don't currently know of anyone working in the same way as ourself. By being in first and by extending and exploiting the ideas,we will extend the extend the concept into silicon systems.

Where is it going to be used

The concept of a programmable component means that it will be widely applicable.
It is going to provide the user with significant advantages in any application where they would wish to use a 32 bit micro
We don't want to limit the sort of areas that the designer would consider, but the high performance means that it will be very effective in information processing and signal processing applications.

Is this going to be yet another British invention that is going to be exploited commercially by other countries

INMOS is doing its to best to ensure Britain will benefit from supplying the transputer
It is up to the UK Electronics industry to make sure it exploites this new British design in its products, and by being a British Company we have given them at least equal chance withthe rest of the world to see the transputer

If the transputer concept is so great why hasn't someone else done it before

Some one has to be first!
Britain has a good tradition of innovative cxomputer design.

Why can you program it only in occam

The Transputer has been designed to be extremely efficient in executing high level languages. We will be offering a selection including C Pascal and Fortran.
But for the most efficient development of software, and of course to

exploit concurrency and the compopnent nature of the transputer, there will be significant advantages in using occam.

Will you offer ADA

Yes, when there ios a compiler that has gained the confidence of the computing community.

Will you offer the instruction set

occam is seen as the lowest level we will offer, and provides efficiency at least comparable with many assemblers,

Which operating systems will you support

For many applications, particularly in real time, the transputer instruction set and occam make an operating system unnessecary.

For those people who rquire an operating system, it is possible to implement one (using occam!)

What is your attitude to third party software

Positive
We will be supplying source licences and encouraging its development.

Support products and when will they be available

We will be providing full support, and it is already possible, through the occm programming sytem to begin developing software for the transputer
The basic simplicity of this approach eases the users problems, and of course ease our support and training task

<u>peripheral chips</u>
Ther will be a full range of peripheral controllers in the transputer family.
At an early date there will be a disc processor and a graphics processor.

<u>development systems</u>
The occam programming system is the basis of the transputer development system. While full support for the transputer ill be available next year it is already possible to begin work on developing transputer applications.

<u>In circuit emulators</u>
Much of the work done by an ICE is unnessecary with the transputer since there is a high level of integration on chip.

What is the US involvement

The Colorado Springs Technology Center is the INMOS centre for process technology, and has developed the process which we need to make the transputer. They will also provide the initial manufacturing.

The transputer itself is totally designed in the UK