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AN ASSESSMENT FOR INTERMETRICS

By

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Introduction

Introduction

Intermetrics, Inc., commissioned INPUT to provide a limited analysis of the posture of its InterTools products in the embedded computer software development tool marketplace.

A

Purpose

INPUT's purpose was to abstract whatever general guidance could be gleaned to assist Intermetrics in making decisions about the future conduct of its InterTool business.

B

Scope

INPUT briefly reviewed selected items of published literature on the embedded processor business, the **CASE market in general**, and in particular the embedded processor development tool portion of the latter.

INPUT then interviewed ten Intermetrics InterTool users and ten competitive users selected randomly from lists supplied by Intermetrics.

INPUT reviewed Dun and Bradstreet reports and other available demographic data on seven InterTool competitors designated by Intermetrics. INPUT also conducted telephone interviews that were as lengthy as the respondents were willing to tolerate.

Executive Overview

Executive Overview

A

The Industry

- CASE in total is a $575-595 million market at present, growing at around 18% per year or better.
- Estimates of the embedded processor development tool portion vary because of:
  - Definition problems
  - Overlaps
  - Extreme fragmentation
- Range is from $40 million to upwards of $250 million; INPUT's present best estimate is $100 million.
- Growth should keep pace with the software industry as a whole and with CASE at 15-18% per year.
- Market is incredibly fragmented and diversified into:
  - Front-end
  - Back-end
  - Software components
  - Differing platforms
  - Differing chips
  - Differing applications
  - Differing objectives
  - Idiosyncratic developers
- No "ride that wave and be a winner" opportunities are visible.

B

Vendor Profiles

Intermetrics

- Optimizing C compilers, macro cross-assemblers, high-level debuggers, and a range of utilities.

- Variety of hosts: DEC, Apollo, Sun, HP, and PC
- Fairly solid product set; some feel is well-supported.
- A few users and competitors feel Intermetrics is not keeping up or not able to exploit technical merits.
- Revenues and other business details well known to the reader.
- Suffice it to say, Intermetrics is an important factor in this relatively small market. Could be more important.
- No other player brings Intermetrics' technical resources, custom involvement, and corporate strength.

Green Hills Software

- Broadest range of optimizing compilers: Fortran, C, Pascal.
- Native and cross on Unix V, Berkeley, and PC DOS.
- Code generation for 32-bit Intel, Motorola, Intergraph, National, Weitek, and AMD.
- Generic support and documentation weak, not suitable for real-time, back-end work.
- Does custom simulator/debuggers for new products.
- Mainly OEM. Resells to systems manufacturers. 10,000 compilers in use.
- Dominates 32-bit compiler market. Growing rapidly.
- Sales around $2.5 million.
- 10 employees.

Lattice, Inc.

- Mainly generic C native compilers
- Limited cross-compiling, no optimization.
- Excellent support to claimed 50,000 users.

- Seen as currently losing out to Microsoft in target PC markets.
- Now offering C language training and publications.
- Obviously not a factor in real-time or back-end markets.
- Systems for embedded processors running around $250 thousand per year out of total revenues of $6 million.
- Subsidiary of SAS.
- 55 employees.

Microtec Research

- Assemblers and C and Pascal compilers on many platforms.
- New simulator/debugger eliminates in-circuit emulator.
- Complete suite of tools.
- Very focused on embedded market.
- Claim heavy support of users in a "strategic relationship" mold.
- Work with emulator companies as well.
- Distributes through Northwest Instruments and also resells Green Hills software.
- Seems to be well regarded.
- Sales around $3.5 million per annum.
- 50 employees.

Northwest Instrument Systems (now MicroCASE)

- Mainly a manufacturer of test and measurement equipment.
- Distributes software made by others, especially Microtec.
- New unnamed strategic partnership in the works.
- Tries to start at front-end with design tools and integrate into user's existing tool suite.

- Accepts output from wide variety of compilers.
- Seems to be a "solution seller."
- Revenues under $10 million, software portion unknown.
- 120 employees.

OASYS

- Leading developer/integrator/distributor for software engineering tools.
- Does custom work for OEMs and manufacturers.
- Worldwide "single-source" supplier.
- Compilers, assemblers, operating systems, debuggers, editors, simulators, utilities, AI, etc.
- Simulator to eliminate in-circuit emulators scheduled this year.
- Reputation is good, but not much end-user support.
- Accused of selling a hodge-podge of incompatible products.
- OEM and/or strategic partnerships with IBM, Sun.
- Focusing on object-oriented programming products, Microsoft C cross-compilers, and Motorola 68000 world.
- Sales around $6 million.
- 30 employees.
- Division of XEL.

Ready Systems

- Design tools, development tools, and software components (including cross-chip O/S called VRTX).
- Claims to integrate these three components uniquely.
- 50% of business in software components, not tools.
- Tightly targeted to embedded market since 1981.

- Strong marketing, distribution.
- Believes in relationships with other vendors.
- Sales running at $6 million, net at $1 million.
- Strong balance sheet.
- 61 employees, 7 sales offices.

Whitesmiths, Inc.

- Compilers and operating systems.
- Variety of platforms.
- Once strong in C and cross-compilers; lost position.
- Seen to be "coming back."
- Main strength is outside U.S.
- Network of developers/distributors overseas.
- Sales flat at $2.5 million.
- Emerging from recent losses.
- Good balance sheet.
- 34 employees.

C

Survey Findings

- Variety of hosts in use.
- Intermetrics users are less PC-oriented (20% vs. 80%)
- Variety of targets; no differences for Intermetrics.
- C predominates, although 2 Intermetrics users reported 100% assembler use.
- Most frequently mentioned competitor was Microtec Research.
- User views of Intermetrics varied: no overwhelming consensus among small sample.

Intermetrics Users:

1. Problems, bugs, poor response.
2. Good—portability is key.
3. Liked Tektronix better, but needed AT&T 3B2600 support.
4. Falling behind, but like user interfaces.

5. Very good. Price a factor.

6. Compatibility with Sun.

7. It's the one I know.

8. Don't know.

9. Price.

10. Pros and cons, but support is good.

- Emulators and monitoring equipment quite prevalent.
- Users would like a less-expensive alternative.
- Many use commercial O/S: VRTX from Ready is quite popular.
- Trade journals and WOM are most prevalent source of product information (60-80%).
- EE-Times read by 70%.
- Only 30% attend trade shows.
- Host and target compatibility is key decision factor.
- Price: 5 Intermetrics users mentioned it; only one non-Intermetrics user.
- Language standards, ease of use, documentation, error messages, and performance are also factors.
- A number of detailed, favorable comments were elicited about Intertools.
- Complaints centered around slowness and poor documentation.
- Also mentioned bugs, missing features.

Desired Improvements:

- Intermetrics; essentially correct the aforementioned deficiencies.
- Non-Intermetrics similar, but three mentioned need for source-level debugging.

Future Needs:

- No clear pattern. Mentions:
  - Faster compiling
  - CASE
  - Engineering workstations
  - Simulators

Use of CASE

- Half don't plan on CASE.

- Two Intermetrics users already have it, three looking. Cadre, Yourdon, Index mentioned.

- Non-Intermetrics users like MacIntosh, Sun, and Ready's Card Tools.

Target Chips

- Much stability with 68000 family.

- One or two straying to National and TI.

- Five non-Intermetrics users mentioned "market drive" and possible move with technology.

Satisfaction with Supplier Sufficiency

- Intermetrics: half and half
  - don't support specific controllers
  - SDS can do it better
  - Microtec in a better position
  - file management and version control a void
  - no tools for 386 and DSPs.

- Half the Intermetrics users use more than one supplier.

- Seven non-Intermetrics users said yes, but five mentioned multiple suppliers as the hedge.

- Average size of Intermetrics development groups was 18, non-Intermetrics was 51.

- Both groups were reported to be 65% EEs and 34% computer science grads.

- Standalone systems were in the minority, especially among Intermetrics users.
- Most of the reported shared systems were via LAN.

D

Conclusions and Recommendations

- Market is collection of niches; idiosyncratic.
- No clear mainstream.
- No dominant player(s).
- Not particularly attractive-looking on a "steady as you go" basis.

Alternatives

- Pick a solid subset, concentrate and develop/sell/support a la Intermetrics, Green Hills.
- Concentrate on development. OEM and resell a la Microtec.
- Distribute and support other software a la OASYS and Northwest.
- Do everything: only example is OASYS.

Recommended for Consideration

1. Focus resources on development, and delegate distribution. Sheds overhead but gives up margin and market control.
2. Round out with others' products. Become a supermarket. Could be a better critical mass, but plays to Intermetrics' weaknesses.
3. Merger, acquisition, or spin-off. The right partner could make a crucial difference, but it's "iffy."

Picture of the Industry

Picture of the Industry

A

Direction of Software Tools Market for Embedded Processors

The variety of microprocessor chips available for embedded systems can be grouped into two classes—the Low-End (4-, 8-, 16-bit), event-oriented chips and the High-End (16-, 32-bit) chips. Intel says unit sales of the former will grow from 500 million in 1986 to 1.1 billion in 1991; and from one-half million units of the latter, more complex chips in 1986 to 36 million in 1991 (see Exhibit III-1).

EXHIBIT III-1

EMBEDDED MICROPROCESSOR MARKET

($ Millions)

	1986		1991	
	Units	$	Units	$
Event-Oriented (microcontrollers)	500	1,850	1,100	2,300
High-End (16–32-Bit Processors)	.5	18	36	780
Total		1,868		3,080

Source: Intel Corp.

Over 30% of all 16-bit 80286 and 32-bit 80386 high-end microprocessor design wins to date are in embedded control applications. With high-end chips in the ascendency overall, these facts bode well for the embedded processor tool market.

According to L. F. Rothschild & Co., Inc., designers of embedded systems represent 11% of the overall base of software designers in the U.S.

In addition, the annual design tool budgets for embedded systems designers are larger than those for other types of programmers and developers, averaging $12,200 per person—and are expected to increase by 28% over the next two years to $15,600.

Furthermore, embedded systems are growing more and more complex, with median program lengths having almost doubled since 1985. And with only 24% of embedded-software developers satisfied with the development and maintenance tools they now use and 59% actively seeking new tools, the opportunities for vendors of software development tools for embedded processors are substantial.

The tool market for embedded processors is incredibly fragmented and diverse. On May 8, 1988, the *New York Times* said of the CASE market, "The potentially vast market looks like a tangled collection of niches." The writer could have been staring directly at the embedded processor development tool segment, where nothing is standard; where targets and platforms vary widely; where objectives, and hence tool requirements, change from application to application; and where the developer's individual style determines in large measure what, and what mix of, hardware and software tools he or she will use.

Adding to the confusion are at least three conflicting lines of microprocessor architectural development proceeding in parallel: the present low-end, special-purpose microcontrollers, the new high-performance RISC-based processors, and the newer general-purpose (and mostly compatible/partly optimized) 16- and 32-bit CISC processors.

One application requires the absolute minimum use of memory, another absolute control over execution timing, another the utmost in algorithmic flexibility, and so on. One application may be tightly constrained by end cost, another by throughput, and another by the timing of the development cycle versus the marketplace window of opportunity.

In such an environment, it is impossible to point to a trend or a standard and say, "Ride that wave, and you'll come in a winner." A more likely answer might be to ride almost every wave and be prepared to jump quickly from one to the next as conditions dictate.

B

Market Size

As shown in Exhibit III-2, recent INPUT synthesis of the overall 1986 CASE marketplace, including compilers but excluding project management tools, yielded an estimated total of $575-595 million per annum.

INPUT believes that no more than 20% of that total can be ascribed to the embedded processor software development segment, thus indicating a ceiling of about $115-119 million.

EXHIBIT III-2

SYNTHESIS OF 1986 ESTIMATES
($ Millions)

	Product Category	CASE Outlook	IDC	INPUT
1.	Analysis, Design, and Prototyping Tools	82	78	60-80
2.	Project Mgmt, Config. Mgmt, Repository/Dictionary, and DBMS tools	80	—	
	• Project Mgmt. Portion			(40)
	• Net			40
3.	Code Generators and 4GLs	170		
	• Code Generators		114	75
	• 4GLs		327	
4.	Editors, Compilers, Debuggers, and Testing Tools	450		400
		Total		575-595

Coming at the market from another direction using data gathered by Rothschild and The Technology Research Group yields another estimate, as follows: In 1986 the total U.S. programmer/analyst population is estimated at 700,000 people as shown in Exhibit III-3. The group estimates that 11% or 77,000 of these developers are devoted to embedded processors as shown in Exhibit III-4.

Rothschild says the average design tool budget per embedded processor system designer is $12,200, including hardware, software, and pro-rata share of large computers. If this be the case, the total comes out to $924 million, of which perhaps 80% applies to hardware, leaving a software budget of $185 million. This number would have to be increased by at

EXHIBIT III-3

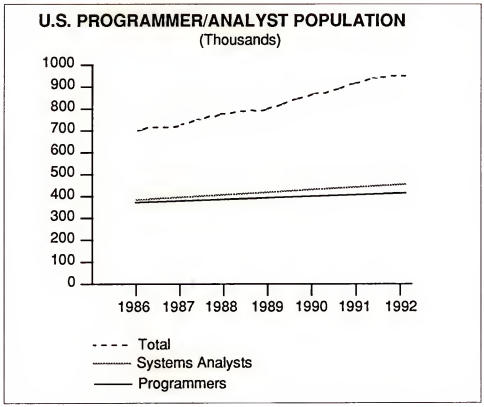
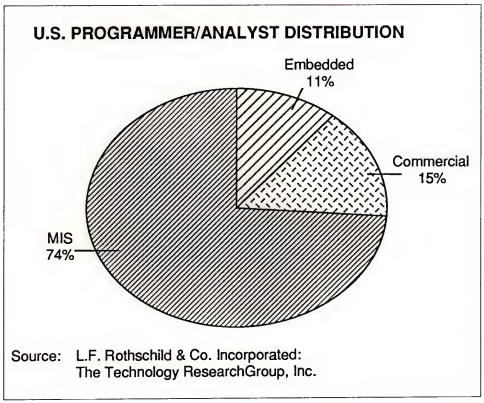


EXHIBIT III-4



least 40% to account for work outside the U.S., yielding a projection of $259, which INPUT feels is extravagantly high.

Projections of 1986 unbundled embedded processor development software sales supplied to INPUT by Intermetrics range from $40 million to $126 million.

Because the market is so fragmented, definitions so fuzzy, and overlaps with general-purpose development tools difficult to detect, INPUT feels moderately comfortable with a middle-range figure of $100 million, recognizing it as the best guess based on the information available. If so, this estimate would imply a worldwide Intermetrics marketshare of $2.0 million out of $100 million, or 2%, which appears low. A figure of $2.0 million, even against the lowest market estimate of $40 million, still yields only a 5% share.

C

Growth

Even less is certain about the growth of the embedded processor development tool market. Rothschild says embedded software designers expect their tool budgets to increase over the next two years by 28%. We have no way of estimating whether this growth projection is accurate and, even if so, what portion of the 14% AAGR applies to hardware as opposed to software.

Given the sustained worldwide growth of 15-18% in Systems Software, in total, backed by lively growth in the embedded microprocessor market itself (see again Exhibit III-1), the 14% figure is probably low for software. A sensible estimate is perhaps 15-18% over the next 3-5 years.

Vendor Profiles

Vendor Profiles

A

Intermetrics, Inc.

1. Definition of Business

Intermetrics is a high-technology software and professional services company that designs, develops, and markets computer software services and products for the U.S. Department of Defense, NASA, and commercial customers.

Intermetrics specializes in systems engineering, software development, and software engineering tools for real-time applications, as well as in the software technology surrounding embedded microprocessors, which are making their way into a growing number of industrial and consumer products—from cars and telephones to microwave ovens and guided missiles.

Standard products are InterTools: compilers, assemblers, debuggers, and librarian configuration management systems.

2. Product and Service Line

Intermetrics designs, develops, and markets computer software products and services, which include software engineering tools totalling 35% of total revenues in fiscal 1987.

Better known as "InterTools," the microprocessor development products include optimizing C compilers, macro cross assemblers, high-level debuggers, and the utilities (included with every compiler and assembler)—the librarian, linker, ROM processor, formatter, and locator.

InterTools are supported by host systems from manufacturers, including DEC, Apollo, Sun Microsystems, HP, IBM PC, and compatibles.

Customer Services include:

- Software support by the technical services staff, including toll-free telephone consultation and software releases with performance improvements.
- Training sessions offered throughout the year either at the Cambridge office or at customer offices.

3. Market Position

Better known for providing products and services to the U.S. government and big industrial concerns than for supplying the commercial market and individual end users.

Software development tools for embedded processors are widely used. Some Intermetrics users as well as non-Intermetrics users who are aware of the company remarked that, even though Intermetrics' products were popular two to three years ago, the company has fallen behind in updates, improvements, and support.

4. As Viewed by Other Vendors

Ready Systems:
Sees Intermetrics as a wonderful company, but one that has never really been effective selling products. Intermetrics is seen as primarily a technology house with a great reputation doing consulting and custom programming.

Intermetrics has never been successful in selling packaged products, although Intermetrics does have a number of them—and some of them are quite good. Having a good product doesn't mean you support it properly or update it properly or listen to your customers or do "common sense" business.

Microtec Research:
Intermetrics is the one Microtec sees most in competitive situations because of Intermetrics' high-level source code debugging capabilities.

Lattice:
Doesn't hear much about Intermetrics in the commercial sector.

B

Green Hills Software, Inc.
425 East Colorado Street, Suite 710
Glendale, CA 91205

Telephone: (818) 246-5555 Telex: 910-588-3274 FAX (818) 246-7037

Company Type: Private

When Founded: February 1982; Incorporated in California, May, 1982
No. Employees: 8 - 10 (US)

1. Definition of Business

GHS is a manufacturer and distributor of a full set of globally optimizing compilers for the high-level languages C, Fortran, and Pascal for the major 32-bit microprocessors.

Brief History:

Green Hills Software (GHS) was formed with the goal of becoming the industry standard compiler vendor for 32-bit microprocessors. GHS was the first company to apply the optimizing compiler technology developed for mainframe computers to the business of making compilers for microprocessors.

Recognizing the diversity, but basic similarity of most microprocessors and programming languages, HGS adopted a modular compiler design. This design has allowed GHS to build the broadest line of compatible optimizing compilers available today.

2. Management

Dan O'Dowd, President (CEO)
Carl Rosenberg, Treasurer, Finance, R&D

3. Financial Posture

Sales figures for 1987 are estimated to be between $1 and $2.5 million.

Terms: Net 30 days

Territory: International in scope.

4. Product and Service Line

Compilers

GHS makes advanced plug-compatible, fully validated optimizing compilers for Fortran 77, C, and Pascal. These full-featured compilers run in native or cross-mode on Unix System V, Berkeley Unix, and 386/PC-DOS.

GHS claims its globally optimizing compilers perform optimizations that are not available in other microprocessor compilers. Such optimizations can decrease the size of a program by up to 30% while increasing its speed by up to four times.

Other Tools

GHS also has code generators for the Intel 386, the Motorola 68000/10/20/30, the Intergraph Clipper, the National 32000 family, the Weitek XL RISC family, and the AMD 29000.

GHS Fortran is ANSI Fortran 77, and includes three DoD extensions (necessary for bidding on government contracts), plus almost all of the DEC VAX/VMS Fortran extensions, more than 100 of them.

GHS C is ANSI C, and also Unix C, with the Berkeley extensions. It also contains many extensions from C++, including in-line procedures, and is powerful enough to recompile the entire Unix kernel and all of the Unix utilities.

GHS Pascal is ANSI Pascal, plus the Berkeley Unix extensions, and also conforms to the ISO level 0 standard.

For those who are designing a new computer system, GHS offers fixed-price, turnkey delivery of all three compilers as a package on that new system in less than a year, fully validated.

GHS can also supply a Unix-compatible assembler, linker, and librarian, thus offering a complete software development tool chain.

And for those without working hardware, GHS will create a software instruction set simulator/debugger and use it to develop the compiler tool chain.

5. Marketing Approach

Industry Focus

Currently, GHS supplies compilers for resale to more than 60 system manufacturers that have sold over 10,000 GHS compilers to date.

In the long run, GHS expects to be recognized as the major independent compiler vendor, of sufficient quality and scope that manufacturers will no longer build their own compilers, but will instead incorporate the GHS product line.

Future Directions

GHS's future lies in three separate dimensions: more languages, more architectures, and more customers.

Given that GHS already has code generators for the most popular 32-bit microprocessors, adding an additional language would only broaden the market for GHS products.

The adoption of the modular compiler design has allowed GHS to build the broadest line of compatible optimizing compilers available today. Because of their modular design, adding a new language can be accomplished just by adding a new Front End and a new runtime library.

6. Market Position

GHS is currently the largest third-party Unix-compatible compiler vendor, with the best global and local optimizations (based on benchmark testing), the most language features for Fortran and C, the largest number of different supported architectures, and the most portable technology.

At present, GHS dominates the compiler market for the current generation of 32-bit microprocessors, and continues to grow rapidly, better than 60% per year compounded for six years. Furthermore, GHS already supports the widest range of architectures with its compilers—seven delivered code generators, three more under development.

GHS customers have developed another three (for the Z80, the 8086/186/286, and the Ridge workstation).

Given market demand, GHS could add as many as four to six new architectures per year.

7. As Viewed by Other Vendors

Microtec Research :

Although GHS has excellent compiler products that are very well optimized, these products are, however, off-the-shelf and lacking in the particular features you'd want in an embedded systems compiler (e.g., source-code-debugging, position-independent code, critical for the real-time multitasking operating systems, which allows users to truly and easily put their code in ROM).

OASYS:

GHS is an OEM company that does compilers under contract to the manufacturer. GHS typically does not do any documentation, nor any support—just straight OEM deals. In fact, OASYS is GHS's agent for end-user sales and any sales that involve customization.

Ready Systems:

Sees GHS as a generic front-end compiler company, and is hesitant to call GHS an embedded systems company. Many embedded systems developers will only use GHS for the front-end and will use someone else's technology for the back end.

Northwest Instrument Systems (MicroCASE):

GHS OEMs their products to othervendors like OASYS and Microtec Research. In fact, Microtec Research has bought source code from

GHS and has modified it and is reselling it as a Microtec Research product. Overall, Green Hills Software is not big at the end-user level.

C

Lattice, Inc.

2500 South Highland Ave., Suite 300
Lombard, IL 60148

Telephone: (312) 916-1600 Telex: 910-291-2190

Company Type: Private (Subsidiary of SAS Institute, Cary, NC)
When Founded: 1980; became subsidiary 1986

No. Employees: 45 - 55 (US)

1. Definition of Business

Lattice offers an array of professional software development tools for a wide range of operating systems and computers to give programmers familiar tools for use on micros up to mainframes.

A developer of utility and financial software and compilers; the sale of software tools for embedded processors is not Lattice's main focus, according to their VP of Sales and Marketing.

2. Management

Dave Schmitt - President, CEO (R&D, Personnel)
Steve A. Hersee - Vice President, Marketing
Wayne Nartker - Director, Corporate Sales
Frances Lynch - Director, Language Products

3. Financial Posture

Rating:	1A1
Started:	1986
Sales:	$6 million (proj)
Worth:	$601,473
Employs:	45 - 55
History:	Clear
Condition:	Strong

Terms: Cash 10% down, balance net 30-day terms.
Has 20,000 accounts, United States and International.

Revenue:	1988 (est.)	$6.0
	1987	$4.9

	Interim 6 months Mar. 31, 1988	*Fiscal Aug. 31, 1987*
Sales	3,185,822	4,954,542
Net Income	312,319	236,012

In April, 1988, Lattice reported selling about thirty 68000 compiler systems for embedded systems (including an assembler, linker) at $500 each.

Revenue from the sale of embedded system compilers (68000 and Z80) was about $270,000 for 1987, expected to decline to $250,000 for 1988.

	1987	*1988 (Est.)*
68000	180,000	$200,000
Z80	$90,000	$50,000
	$270,000	$250,000

4. Product and Service Line

Microprocessor Development Tools

Lattice offers a limited set of software development tools, categorized as follows:

MS-DOS and PC-DOS Products
- Compilers
- RPG S/W
- C Function Libraries
- C Utility Programs
- Productivity S/W

AMIGA Products
- C Compilers
- C Function Libraries
- C Utility Programs
- Productivity S/W
- MS-DOS Hosted Cross-Compilers

ATARI Products
- C Cross-Compilers
- 68000 Embedded Systems

Almost all compilers sold by Lattice are native, though Lattice does sell some cross-compilers for programmers who use the PC as host and 'ship' it to the Amiga.

Lattice's involvement with the 68000 compiler is really an offshoot of the Amiga—a market Lattice is not really aiming at.

Customer Services and Support

Lattice claims to offer its over 50,000 users services that competitors cannot match, including:

- A Technical Support Hotline for telephone support to all registered users of Lattice products.
- The Lattice Bulletin Board Service (LBBS), a free multiuser bulletin board system for owners of Lattice products.
- Support for the BIX (BYTE Information Exchange) Network for 24-hour assistance.
- The Lattice Update Service to ensure timely update information.

Education and Training

As of second quarter 1988, Lattice now offers C programming seminars, providing the equivalent of a college-level C programming course in four days of intense lecture and hands-on training (4 days, $895).

Lattice also offers two OS/2 Seminars:

- "OS/2 for Managers," designed for those who will be introducing OS/2 into their businesses as well as for those who must manage OS/2 product development (1 day, $395).
- "OS/2 Programming," which offers an in-depth description of the OS/2 environment (3 days, $895).

5. Marketing Approach

Lattice generates its sales through a mix of publishers, national and international distributors, dealers, OEMs, and direct corporate sales.

The acquisition of Lattice by SAS Institute would seem to place Lattice in a more favorable position, giving it more flexibility to take advantage of other market opportunities, not to mention a greater market presence.

Under the terms of the acquisition, Lattice will operate as an independent subsidiary with David Schmitt, President; Steve Herse, VP of Marketing; and Francis Lynch, VP of R&D—all continuing in their previous assignments at Lattice. In addition, Lattice's development, technical support, marketing, and management staffs will remain intact.

Overall responsibility for the management of Lattice's C compiler development has been consolidated at SAS Institute's Cary, NC headquarters, under the direction of Oliver Bradley of SAS. (Bradley is the Manager of Language Systems Development at SAS Institute, its representative on

the ANSI C standards committee, and a principal developer of SAS Institute's mainframe implementation of Lattice C.)

To this end, SAS has combined its compiler development staff with that of Lattice's, and had doubled its investment in compiler development to $1 million for 1988, "continuing to devote whatever resources are necessary to get the job done."

With SAS devoting substantial investment to the C compiler, Lattice now has the opportunity to expand its efforts in other directions, such as devoting more resources to other products like the RPG II compiler, as well as branching further into other areas such as software publishing—which has become a major source of revenue for Lattice.

The company says its products are used by more than 50,000 software developers and business users worldwide, and the company is continuously pursuing OEM markets as well as expanding its current distribution network.

6. Market Position

Lattice is not a big player in the software tools for the embedded processor market. Less than 5% of the company's total revenue is derived from this segment.

In addition, it appears that Lattice has been moving away from the PC marketplace, unable to compete with Microsoft's development tools.

7. As Viewed by Other Vendors

Microtec Research:

Sees Microsoft as effectively crowding Lattice out of the PC marketplace. According to Microtec Research, Lattice was a host PC company for a while, then went to IBM mainframes and was subsequently bought by SAS because SAS wanted control of the compilers for its business systems on the larger IBM mainframes. Now it's promoting cross-compilers.

OASYS:

Sees Lattice as a competitor to some extent in the cross-compiler market ever since it dropped out of the DOS market. Lattice has not been able to compete with Microsoft in the O/S2 and DOS worlds, and that's been hurting it in the other markets.

Regarding Lattice's takeover by SAS Institute, one would think Lattice would be in a better position. In effect, what's happened is that Lattice's R&D has virtually stopped. SAS probably wants to maintain its own version of the compiler, which it needs for its other products.

Ready Systems:
Sees Lattice as being similar to Green Hills Software (regarding affiliating with other vendors).

Northwest Instrument Systems:
Sees Lattice as being big in the PC environment. The company claims it now has a cross-compiler that can run on a VAX.

D

Microtec Research, Inc.

3930 Freedom Ct.
Santa Clara, CA 95054

Telephone: (408) 733-2919 Telex: 499-0808

Company Type: Private

When Founded: 1975

No. Employees: 50; 45 in U.S.

1. Definition of Business

Developer of language systems software. The software is used by industries (including electronics, aerospace, consumer electronics, and automotive electronics) and includes C-systems, Pascal, and assembler languages. The software runs on most mainframe, mini- and microcomputers. Some products are manufactured to military specifications.

2. Management

Jerry Kirk, President (CEO, Manufacturing, R&D)
Dan Jaskolski, Executive Vice President (Sales, Finance, Purchasing, Personnel)

3. Financial Posture

Rating:	3A1
Started:	1975
Sales:	$5,500,000 (Proj)
Worth:	$2,046,632
Employs:	50
History:	Clear
Condition:	Strong

Terms: Net 30 days.

Has 2,000 accounts; sells to electronics industry.

	Fiscal Mar. 31, 1985	*Fiscal Mar. 31, 1986*	*Fiscal Mar. 31, 1987*
Sales	$2,148,290	$2,659,843	$3,439,150
Net Income	105,629	(158,726)	420,800

4. Product and Service Line

Microprocessor Development Tools

Microtec Research offers a full array of software development tools, grouping its products accordingly:

Compilers	- C Compilers - Pascal Compilers	Symbolic Debuggers
Assemblers	- Relocatable Macro - Retargetable Microcode	Linking Loaders
High-Level Language Debuggers		Librarians
Communication Utilities		Terminal Emulators

Microtec Research has been experimenting with a new version of its debugger (which is actually a simulator) that will talk to monitors that customers can build into their embedded systems. This version will allow users to talk directly to it without the need of an in-circuit emulator.

5. Marketing Approach

Industry Focus

Microtec Research sees its niche as the embedded processor world. The company has a complete suite of tools that is placed around compilers, making those compilers useable for embedded systems.

Have seen a shift where most sales are now driven by the software development tools, as opposed to hardware development tools. This change is because the software portion of the embedded designs takes so much longer than the hardware, and people often start on software projects six months before they know what hardware they're going to use.

Sell a significant amount of software for PCs as well as for DEC VAXs.

Advertising

Although many vendors offer software development tools and compilers, many of these off-the-shelf tools lack the very features one would need in an embedded systems environment—such as source code debugging,

position-independent code, etc. Other concerns include how one goes about handling initialized data variables, how one moves from a ROM to a RAM environment, etc.

To this end Microtec Research is promoting itself as providing those very tools—the automatic mechanisms that allow users to effectively handle issues such as those touched upon above when working with embedded processors. Microtec includes whatever is required to make its products adaptable for the embedded processor marketplace.

In addition, the company sees this market as one that requires much support for the end users. Many hardware end users have moved into software, and have to deal with compilers that interact with hardware. This move often brings up a specific set of problems that require support—and Microtec Research is ready to offer that support. Microtec also sees vendor alliances as very critical for any company that wants to survive in the business of software for the embedded processor world.

According to Microtec's president, Jerry Kirk, "We've tackled this market over the last several years from an entirely different approach than that of an OASYS—or, say, Intermetrics. We try to add value to our products that will create a strategic relationship and really give compelling reasons to want to buy or sell our software tools and products. So we try to interface well with the in-circuit emulator companies (we see Applied Microsystems as having been the dominant standalone in-circuit emulator company for the last few years; Zax, on the other hand, has been pretty flat) as well as with the real-time operating system companies. And now we're trying to interface well with some Ada companies."

We're trying to build strong customer relationships, a strong customer base—and that's accomplished by providing excellent service and support."

Distribution

Domestic (70%) and International (30%)

As of mid-May 1988, Microtec will have a new Director of Marketing and Sales. Microtec is currently in the process of deciding exactly what it's going to be doing, in terms of how and to whom advertising will be directed. Microtec is planning to step up advertising for Spring 1988; the company admittedly had slowed its advertising this past year.

Microtec distributes primarily through Northwest Instrument Systems (now MicroCASE).

Microtec sees the various components of the software development tool chains as becoming more and more integrated.

6. View of Others

Microtec sees its main competitors as Intermetrics, Boston Systems Office (BSO), and AVOCET (which is very PC oriented).

7. As Viewed by Other Vendors

Ready Systems:
Very good company, stable. In fact we actually sell Microtec Research's products.

Northwest Instrument Systems:
We see Microtec Research as both supplier and reseller. The company utilizes other vendors as channels for distribution, as well as resells the Motorola 68000 software from Green Hills Software.

E

MicroCASE
(formerly Northwest Instrument Systems, Inc.)

19545 Northwest Von Newmann Drive, Suite 200
Beaverton, OR 97005

Telephone: (503) 690-1300 Telex: 469558 FAX: (503) 690-1320

Company Type: Private

When Founded: 1981

No. Employees: 100–120

1. Definition of Business

Although NWIS (now MicroCASE) is a manufacturer of electronics test and measurement equipment, it does not manufacture or sell its own software development tools (assemblers, compilers, debuggers), but rather acts as a distributor for other vendors' products.

The company's overall products line is sold to multiple market segments.

NWIS, having broadened its product line offering beyond just instruments to include software development tools for embedded processors, felt that its current name was too limiting. Hence the new name—MicroCASE.

2. Management

Lawrence T. Sutter, President/CEO
Michael O. Maerz, Executive Vice President
James Cavoretto, Vice President, Engineering

James E. Fisher, Vice President, Marketing and Sales
Ernest Williams, Vice President, Manufacturing, Purchasing
Ed Whitehurst III, CFO

3. Financial Posture

Rating: Not rated
Started: 1981
Sales: $15,000,000 (projected for 1986)
Employs: 100–120 (80 US)
History: Incomplete

Revenue: 1988 $7 - 12M (Est.)
1987 $5 - 10M

4. Product and Service Line

In addition to being a distributor of an array of software development tools from other vendors, NWIS also offers its Software Analysis Workstation (SAW).

SAW is a system designed to integrate all of the software analysis tools needed to program embedded systems into a single workstation, including: global trace, local trace, accurate performance measurements, and verification tools.

SAW supports 8-, 16-, and 32-bit microprocessors from a variety of manufacturers and designed to run on a variety of host systems, from PCs to minis to mainframes, and for a variety of languages, including C, Pascal, Fortran, Modula-2, PL/M, and assembler.

Other products include:

Microtek Emulation Products

- MICE Series in-circuit emulators
- MICE Universal Symbolic Debuggers

Microtec Research's full line of software development tools, including: compilers, assemblers, high-level language debuggers, symbolic debuggers, terminal emulators, linking loaders, and the standard utilities.

5. Marketing Approach

Not being a manufacturer or seller of its own software development tools, the company is a distributor for other vendors' products.

NWIS has the explicit distribution rights for Microtek emulators, and for Microtec Research's software development tools.

Branches: Saratoga, CA (Atron Division (20 employees)).

Remaining sales personnel operating out of seven sales offices scattered throughout the United States and the free world.

Subsidiaries:

- Northwest Instruments Systems Europe Inc., Beaverton, OR. Oregon corporation chartered 1984. 100% privately owned. Marketing support offices in West Germany and United Kingdom.

General view of the industry:

NWIS sees the whole development cycle as starting with CASE tools, with a lot more people doing front-end analysis and spending much more time before they actually start implementation.

This change necessitates that workers clearly understand the requirements for the product they're trying to develop—and use the front-end design tools to make sure that the design has internal integrity before they start to implement.

Hence the linking of design tools is becoming more and more important.

Furthermore, until industry standards are firmly established, more and more companies and vendors are forming strategic alliances, like NWIS and Cadre, to make sure their products can work well together.

NWIS recognizes that its customers and other users have made huge investments in the variety of tools that have been available, so therefore users are not looking for a solution that says, "START OVER!"

Instead, users of software development tools for embedded processors are looking for a solution that involves the integration of their existing environment into the vendor's "solution." In other words, if an end-user has already made an investment in a set of tools that provides at least part of the solution, NWIS addresses how it can integrate that working part of the solution into another vendor's environment.

Hence, what NWIS sees as being in demand is the ability to utilize a variety of symbol loaders that will accept the symbolic output from a variety of different compilers.

This ability to get the files generated from different compilers into one's existing system is very important.

NWIS does not see optimization as being germaine in many real-time environments, because optimization alters the machine code.

Therefore many compiler vendors are trying to develop a means of updating the symbol file to reflect the changes that are made during the compilation process.

NWIS has just entered into a strategic partnership (company not mentioned) to integrate various tools with its own equipment and to let NWIS resell these tools as a VAR.

When asked who they perceive as their biggest competitors, NWIS cited Hewlet-Packard and Applied Microsystems.

6. Market Position

For a long time, NWIS was identified as a manufacturer of electronics test and measurement equipment. However, Northwest Instrument Systems, Inc. announced that as of May 2, 1988 it was changing its name to MicroCASE to better reflect the overall product line as well as the strategic focus on embedded microprocessor software development.

7. As Viewed by Other Vendors

OASYS:
Sees NWIS's current business as being in in-circuit emulators and supported by OASYS. OASYS' products support NWIS' object module formats for the in-circuit emulation. So, the more boxes NWIS sells, the better it is for OASYS—its products require our products.

Ready Systems:
Can't comment on them—don't know that much about them.

F

OASYS

230 2nd Avenue
Waltham, MA 02154

Telephone: (617) 890-7889

Company Type: Private—Division of XEL

When Founded: 982

No. Employees: U.S = 30

1. Definition of Business

OASYS, a division of XEL, Inc. claims to be the leading software developer/integrator/distributor for professional software engineers.

OASYS often does major custom work for OEMs and hardware manufacturers, enhancing or modifying a particular compiler to work in a particular piece of hardware running a particular operating system.

In one sense, OASYS can be characterized as a "one-stop-shopping" service, supplying programmers and software developers with a plethora of integrated software and hardware development tools from other vendors and suppliers, in addition to offering its own development tools.

OASYS refers to itself as being "your 'Single Source' supplier."

2. Management

Joel Schact, President (CEO, Purchasing, Manufacturing, R&D)
Paul Ray, Vice President Sales
Greg Kee, Director, Marketing
Robert Arace, Director, Finance and Administration

3. Financial Posture

Started: 1982
Sales: $6,000,000 (Est.)
Employs: 30
History: Clear

Domestic terms are net 30 days.

Revenue:	1988	$7 - 10 million (Proj.)
	1987	$5.5 - 6 (Est.)

According to Robert P. Arace, VP Finance, sales for the fiscal year ended September 30, 1986 showed a 100% increase over fiscal year 1985.

Profits were up 52% over the same time period.

Domestic sales (80%), International (20%).

4. Products and Service Line

OASYS is both a distributor of software developed by others (60%) and a developer and distributor of its own software (40%).

Software Development Tools:

- Compilers (C, Pascal, Fortran, Ada, Prolog, Modula-2)
- OASYS/Microsoft Cross C Development System (Microsoft C, MASM, and LINK)

- Cross Compilers to 68000/10 and 68020+68881, 8086/88/186/286/386, 32016/32, and Fairchild CLIPPER microprocessors
- Cross-Assemblers to the most popular 8-, 16-, and 32-bit Microprocessors
- Assemblers, Linkers, Locators, Librarians (Cross and Native)
- Symbolic Source-Level Debuggers
- Simulators
- Interpreters (e.g., C and APL)
- Translators (e.g., Designer C++, OASYS' new object-oriented C++)
- Performance Profilers, Quality Assurance Tools
- Communication Utilities
- Syntax-Directed Editors (for C, Ada, and Pascal)
- Real-Time Kernel (Executive) Operating Systems
- Artificial Intelligence Tools
- General-Purpose Tools

Hardware Coprocessors

- PC and VAX Attached Processor Boards with supermini performance

5. Marketing and Approach

As the PC market has standardized on DOS, OASYS has taken advantage of this opportunity by picking up the Microsoft C cross-compiler as an exclusive on all non-DOS hosts. As the OASYS Vice President of Marketing stated, "We've been noticing a tremendous demand for that particular environment" (non-DOS hosts).

To this end, OASYS has started working on an embedded system for the Microsoft cross tools (OASYS expects it to be out in Summer 1988). The system will support most of the common in-circuit emulators.

OASYS has also been working on an embedded debugging solution that will not require the use of an in-circuit emulator. The solution is targeted for late summer, 1988, since what typically happens is that when a new processor is released, the in-circuit emulators are a year off, and a lot of people start coding for them—the 386s are just beginning to appear now.

Rather than just being a "supermarket" of loosely connected software tools, compilers, and debuggers, OASYS is now offering an "integrated solution" to its larger customers. Such customers are typically OEMs, large companies doing a bid, or ones that need to put an entire system in place, or government agencies. OASYS will arrange a meeting with such prospective clients, obtain all necessary specifications, and return with a proposal.

OASYS does not, though, offer such customized solutions to the typical, individual end users.

Over the past year, OASYS has established relationships and alliances with hardware vendors, including Sun and IBM (IMAP program). These companies are basically selling OASYS' solutions.

In addition, OASYS is engaged in joint-development work with hardware vendors. OASYS wouldn't say which companies.

OASYS is also on the Motorola 88000 consortium.

Industry Focus

OASYS claims to have recently changed its focus, concentrating on three lines of business:

1. Object-oriented programming products: C++
2. Microsoft C cross-development systems
3. The Motorola 68000 world (including all the simulators, debugging tools, and compilers for that market).

For the past two years, OASYS has been an exclusive distributor of Designer C++, which at this point, according to OASYS, has a larger installed base than the AT&T version.

What's happening in the industry, according to OASYS, is that object-oriented programming is working its way into the standard environment. Most of the hardware companies—Sun and Apollo, for example—have an investment in the success of a particular operating system and are getting behind object-oriented programming, which is becoming part of the environment.

OASYS is also "tying" all this together with library support for specific operating systems (object-oriented library support) and with C++ sensitive editors and debuggers.

OASYS is also starting to support the RISC market, which, according to OASYS, is going to be a major portion of the chip market.

Distribution

In addition to regular advertising in the trade journals, OASYS utilizes its in-house telemarketing group. For potentially large sales, OASYS will conduct visits to the customer's site.

OASYS also does direct-mail campaigns, with target mailings of 30 to 40 thousand to a specific population every couple of months.

OASYS has a two-person West Coast sales office whose primary purpose is to interface with OEMs on the West Coast.

6. Market Position

Recognized worldwide for its wide selection of development tools, technical expertise, and excellent support and training capabilities, OASYS' goal is to provide professional programmers with the most efficient means of acquiring the best, most reliable, and most compatible set of software development tools.

Furthermore, OASYS regularly enhances, ports, integrates, and maintains its products.

OASYS claims not to have any direct competition—though it does have competitors in some market segments.

In the embedded market, OASYS sees Microtec Research as the major competitor for OASYS' debugger for the 68000 market. In terms of the Microsoft cross-development market, OASYS doesn't see any other company as a threat.

7. As Viewed by Other Vendors

Microtec Research:

Sees OASYS as selling a slew of C compilers that are not compatible with one another. This is a market that requires a lot of support for end users—support that OASYS does not offer, at least not for the small end-user. OASYS will customize a solution or tool set for large contracts.

Merely having the product at a cheap price doesn't build a customer base—that requires excellent service and support.

Ready Systems:

Sees OASYS as being similar to Microtec Research (SIC) in that both put out compilers based on other people's technology for the embedded systems markets.

Northwest Instrument Systems:
Regarding OASYS, we see it as selling any kind of compiler it can get its hands on. The major drawback to this approach is that OASYS doesn't foster compatibility between its lines of products.

G

Ready Systems

449 Sherman Avenue
P.O. Box 61029
Palo Alto, CA 94306

Telephone: (415) 326-2950 Telex: 711510608 FAX: (415) 326-1427

Company Type: Private

When Founded: 1981

No. Employees: 61 (45 US)

1. Definition of Business

Ready Systems provides software development products for the real-time systems market. Products include cross-compilers, real-time multitasking debuggers, a VRTX operating system, and a Real-Time C cross-development environment for embedded systems.

Ready Systems distinguishes itself from most other CASE tool manufacturers in that it doesn't go after just the real-time market, but also after the embedded systems market—aiming to have its tools 'understand' the same target system that the developers use.

2. Management

Aryeh Finegold, President
James F. Reday, Senior Vice President
Thomas K. Hamilton, Vice President, Finance & Administration
Peter W. Palm, Vice President, Marketing

3. Financial Posture

Rating:	3A2
Started:	1981
Sales:	$8,000,000 (proj)
Worth:	$1,522,936
Employs:	61 (45 US)
History:	Clear
Condition:	Good

Terms: Net 30 days for all accounts.

Domestic sales (80%), International (20%).

From April 1, 1986 to September 30, 1986 sales were $3,185,500; net income was $512,384.

Ready Systems breaks out its revenue as follows:

Design Tools	33%
Software Components (VRTX, Ada)	50%
Development Tools (compilers, debuggers)	17%

4. Product and Service Line

Microprocessor Development Tools

Ready Systems views its VRTX operating system as a tool—as Ready Systems sees it, if you think of CASE as anything that helps someone write software, then there's no question that software components, of which VRTX is a strong example, are part of that.

VRTX is an example of a reusable software component that was designed to be chip-independent.

5. Marketing Approach

General Overview:

Ready Systems notes that "the thing about the whole software tools industry is that there is so much technology going on that not any one company can really do it all. So you really do have to strike some kind of alliance(s) with other companies. Having a meaningful, almost symbiotic relationship with 4 to 5 other vendors can really make sense."

Although Ready Systems sees the software tools marketplace as giving birth to industry standards, it doesn't forsee any quantum leaps in technology overnight.

Instead, Ready Systems sees the changes as an evolutionary process, with the eventual shake-out probably taking a while to happen—"these shake-outs are usually proportional to how fast the markets grow. And while this market is growing very fast, it's also very fragmented. And when it's very fragmented, it basically means that it has a lot greater capacity to keep small companies alive."

Industry Focus

Since 1981, Ready Systems has been defining and selling into the real-time embedded systems market.

Ready Systems recognizes that in the software world, as opposed to the hardware world, there are very nonhomogeneous people, and the company believes that no single vendor is going to come along with the "one-and-only complete integrated solution."

And because programmers, developers, and end users are always going to be using different types of tools from different vendors, Ready Systems' strategy is to have an application- or function-specific focus—because you can't address everyone's needs all the time. That philosophy was the basis for the VRTX, designed as chip-independent technology.

To this end, Ready Systems designs its development tools to link to its VRTX operating system as well as to the "whole embedded systems area."

Advertising

In the past, Ready Systems was known for its outlandish campaigns, such as offering a Volkswagen Beetle to anyone who could find a 'bug' in their software—"Find a Bug, Get a Bug" was the slogan.

Ready Systems admits that it could have done a better job at "spreading the gospel when we got into the CASE tools marketplace," and that the company suffered in the past by having the image of 'just' being an operating system company identified with VRTX.

Recognizing its predicament, Ready Systems is changing its advertising strategy from product-specific and/or applications-oriented to a corporate awareness approach—a change, Ready Systems claims, from tactical to strategic ads, telling the marketplace what the company is 'really' about.

Furthermore, a flurry of new ads is expected in June, 1988, to let the world know that Ready Systems stands not only for VRTX, but also "software development in embedded and real-time systems." Instead of advertising products for specific things, Ready Systems will be pushing its corporate image and overall capabilities.

Ready Systems advertising tends to be targeted in trade journals, namely EE Times and EDN, and sometimes in magazines devoted to CASE.

Distribution

Ready Systems is international in scope. Its Worldwide Sales Headquarters is based in Dallas, TX. Within the United States (including Canada) there are five regions and seven sales offices.

European locations include the European Sales Headquarters in France, and offices in Israel, Germany, and the United Kingdom.

6. Market Position

Ready Systems sees itself as the market leader in real-time operating systems. The company's aim is to make it as easy as possible for the customer to develop an embedded processor.

As Ready Systems sees it, most vendors specialize in one of the three following areas:

DESIGN TOOLS - the front-end portion (flow charting, data analysis, tasking analysis, performance modeling)

COMPONENTS - the end-products

DEVELOPMENT TOOLS - the back-end portion (compilers, debuggers, tools to help write the code and maintain it)

The key to the product line is the ability, or attempt, to integrate all of those technologies.

Regarding competition, Ready Systems acknowledges strong competition in each of the three aforementioned areas, but holds the optimistic belief that, at the moment, there really isn't anyone out there doing it as well in terms of integration.

So, although Ready Systems doesn't expect to see any real 'shake-out' soon, "by sticking to the area we know best—that being the embedded systems area—and really trying to increase productivity there ...by having that focus, we'll eventually be head and shoulders above our competition. And when that 'shake-out' does come, we'll be in pretty good shape."

7. As Viewed by Other Vendors

OASYS:

That's one I never heard of—oh, VRTX, now I recall. Though VRTX does compete with us indirectly, I don't recall ever losing a sale to it.

It doesn't seem to be out there that strong, and we don't directly compete against it very often.

Northwest Instrument Systems:
Ready Systems seems to be moving beyond real-time operating systems and getting more into the front-end design tools and performance analysis.

H

Whitesmiths, Ltd.

59 Power Road
Westford, MA 01886

Telephone: 627-692-7800

Company Type: Private

When Founded: 1978

No. Employees: 34 (US)

1. Definition of Business

Supplier, distributor of an extensive set of integrated program development tools, most of which are prepackaged for the popular development hosts, from the smallest PC-based development systems to the IBM mainframes, as well as distributor of an IDRIS UNIX-compatible operating system.

In addition, many companies resell Whitesmiths products as part of their own product lines.

Today, Whitesmiths is a major innovator in systems software technology—contributing to the emerging ANSI and ISO standards for C.

Sales marketplace: United States primarily, with approximately 33% of its volume exported worldwide.

Brief History:

Incorporated in Delaware, July, 1978, Whitesmiths was the first company to respond to the need for high-quality cross-development tools by delivering the first commercial C cross-compiler in 1979.

2. Management

Dr. P. J. Plauger, President
John T. W. Baggott, Vice President, Finance
Telford B. Sartell, Vice President, Development

3. Financial Posture

Rating: BA2
Started: 1978
Sales: $2,600,000 (proj)
Worth: $448,149
Employs: 34 (US)
History: Clear
Condition: Good

Terms: Net 30 days.
Has 600 regular accounts

	Interim Consolidated June 30, 1987	*Fiscal Consolidated Dec. 31, 1986*	*Fiscal Consolidated Dec. 31, 1985*
Sales	1,255,673	2,489,028	2,434,414
Net Income	80,741	(50,244)	(69,216)

4. Product and Service Line

Whitesmiths operates as a designer and seller of computer software; the company provides mainframe, mini, and microcomputer compilers and operating systems.

The following is an outline of Whitesmiths' product line:

Software Tools:
- XA8 Cross-Assemblers
- C Cross-Compilers
- C Native Compilers
- Pascal Compilers

MICISM Simulators—MICSIM microprocessor simulator is a software tool for testing, debugging, and monitoring the performance of embedded programs on a convenient host development system. No add-in boards, download/upload links, or hardware emulators are required.

IDRIS Operating System—UNIX-compatible development system, packaged for several Motorola 68000 configurations and the Atari/ST line of computers.

Whitesmiths publishes a newsletter for its customers and prospects. The newsletter often includes surveys to get marketing input on products and services.

5. Marketing Approach

Distribution

Sells to scientific, engineering, manufacturing, and software developers.

A network known as Whitesmiths International Associates sells and supports Whitesmiths products. These international companies have access to source code, and are authorized to license subdistributors and OEMs. All these companies develop software in their own right, and produce their own software tools that compliment Whitesmiths' product line.

Many Whitesmiths International products are sold and supported by Whitesmiths in the U.S. and Canada.

Licensing and Distribution Agreements

Licensing Source Code—The source code of any Whitesmiths products can be licensed by signing a standard Source Agreement and paying a one-time fee. This grants the purchaser the right to keep a machine-readable copy of the source code for a Whitesmiths product on a designated computer. The source can be used to satisfy contractual backup requirements. A separate Distribution Agreement must be signed to move executable Whitesmiths products to other computers.

6. Market Position

Although Whitesmiths claims to have a worldwide customer base numbering in the tens of thousands, it appears that it has fallen behind other compiler companies domestically.

7. As Viewed by Other Vendors

Microtec Research:

> According to Microtec Research's president, his company sees Whitesmiths as undergoing a resurgence. Whitesmiths almost dropped out of sight for a couple of years. Whitesmiths was one of the early companies in cross-software and C compilers, and had become a dominant force in the industry for a long time. Microtec doesn't encounter Whitesmiths much at all in this country. Microtec sees Whitesmiths as the principal competition in Japan and Asia. Whitesmiths is very strong in Asia.

OASYS:
We support some of Whitesmiths' outputs for embedded work—Whitesmiths compilers are out there. On the compiler side, Green Hills Software always wins—it's a better compiler in terms of the benchmarks.

Ready Systems:
Sees Whitesmiths as just another compiler company.

Northwest Instrument Systems:
Whitesmiths seems to have a very low profile.

Survey Findings

Survey Findings

The results of a 19-question survey on the use of software development tools for embedded processors by 10 Intermetrics users and 10 Non-Intermetrics users are presented below.

A

Applications

The following list describes the applications and/or devices or products into which the embedded processors will reside:

Intermetrics Users:

1 - Packet-switching equipment; in-circuit boards
2 - Device for printing graphics onto credit cards
3 - AT&T brand telecommunication equipment (terminals, controllers)
4 - Printers (laser and on-line)
5 - Two-way portable radio; mobile cellular telephones
6 - Analytical instruments for industrial applications
7 - Communications process equipment
8 - Portable-remote terminals (trucks, vans)
9 - Base stations for mobile telephones
10 - Hospital monitoring equipment (vital signs)

Non-Intermetrics Users:

11 - Slot machines
12 - VME board to be used in in-circuit emulators
13 - Analytical testing equipment
14 - Class-5 telephony switches
15 - Electronic measuring instrumentation (medical)
16 - Hospital equipment (Contin. Passive Movement devices)
17 - Electronic switches for telecommunication equipment
18 - PC-based peripherals
19 - Data-communication equipment (modems)
20 - Laser cutting device for testing/correcting PC boards

B

Host System(s)

The types of host systems used varied as widely as the applications; over 35% of all respondents used more than one type of host for development and programming of embedded processors.

A major difference between Intermetrics users and Non-Intermetrics users was their reported use of PCs and engineering workstations:

	Intermetrics	Non-Intermetrics
PCs	20%	80%
W/S	50%	10%

C

Use of Standalone and/or General-Purpose Computers

Ninety percent of the Intermetrics users classified their host systems as General-Purpose Computers (GPC); the remaining 10% as Standalone systems.

For the Non-Intermetrics users 70% reported using GPC, 10% reported using Standalone (PC AT), and the remaining 20% reported using both GPC and Standalone.

D

Development Trends (General-Purpose Computers, Engineering Workstations, PCs)

The only significant difference between the Intermetrics users and Non-Intermetrics users lies in the planned use of PCs for development. The Intermetrics users reported the following development trends:

- 40% using/will be using PCs
- 40% using/will be using Engineering Workstations
- 20% staying with General-Purpose Computers

Of all the Intermetrics users, 20% were utilizing a mixed environment combining PCs, workstations, and general-purpose computers.

The Non-Intermetrics users reported the following:

- 70% using/will be using PCs
- 20% using/will be using Engineering Workstations
- 10% using a mixed environment

Once again, the Non-Intermetrics users appear somewhat more heavily PC oriented. Overall, these findings support the recommendations of The Technology Research Group, in that tools used to automate the design of embedded software will need to run on PCs, superminis, mainframes, microprocessor development systems, and workstations, if vendors wish to offer a complete product line.

E

Target Microprocessor Chips

The type of target microprocessor chips used ranged from the simple 8-bit to the complex 32-bit chips. A frequency breakdown of the chips mentioned is as follows:

For Intermetrics users:

- Motorola 68000 family 7 times
- Zilog Z80 (NSC800) 3 times
- Intel 8186/88 family 2 times
- Motorola 6801 1 time
- Intel 8096/8097/8510/8048 1 time
- Intel 8051 1 time

For Non-Intermetrics users:

- Motorola 68000 family 7 times
- Zilog Z80 (NSC800) 5 times
- National 32000 family 2 times
- Intel 8051/8085 1 time
- Zilog Z188 1 time

F

Languages Used for Development

The C programming language was without a doubt the most widely used language. Eighty percent of the Intermetrics users and 90% of the Non-Intermetrics users were programming in C.

Two Intermetrics users reported using Assembler 100% of the time, and two others reported using Assembler 50% of the time (C was used the remaining 50%).

Of all users, 25% planned on using C almost exclusively.

This population differs somewhat from that explored by The Technology Research Group, which found that developers of embedded software use a mix of C (32%), assembly (33%), FORTRAN (20%), and Ada (11%).

One Non-Intermetrics user, a manufacturer of electronic switches for telecommunications equipment, reported using an entire array of languages, including C, Ada, Fortran, Pascal, and Assembler.

G

Types of Software Tools Used

The variety of software tools being used was too varied for even the users themselves to recall in detail.

Respondents' reported tool usage was:

For Intermetrics (I/M) users:

1 - I/M, Applied Microsystems emulator, IBM's ISPF (librarian)
2 - I/M, Borland, Mark Williams, other off-the-shelf tools for PCs.
3 - I/M, Unisoft (Z80) assembler, Microsoft C
4 - I/M, Microtec Research
5 - I/M, Apollo utilities
6 - I/M, Green Hills S/W (through OASYS)
7 - I/M
8 - I/M
9 - I/M
10 - I/M

For Non-Intermetrics users:

11 - DEC, Tektronix
12 - Microtec Research tools
13 - Whitesmiths, Microtec Research, I/M (never used)*
14 - Whitesmiths, Northwest Instr. Sys. (MicroCASE)
15 - Ready Systems (Card Tools, VRTX), Microsoft C
16 - AVOCET, Microsoft
17 - Microsoft, DEC, Ready Systems (VRTX)
18 - Microtec Research, Intel Borland, Zice, Paragon Systems
19 - MANX (Aztec), Green Hills S/W, Lattice, Borland
20 - Whitesmiths, Unisoft, Software Development Systems

* One medical analytical testing equipment company (Haemonetics Corp.) purchased Intermetrics tools but decided not to use them, claiming the tools were "too complicated to work with"—referring to the linkers.

H

How Intermetrics' Products Stack Up

Interestingly, 30% of the Intermetrics users couldn't comment on how they saw Intermetrics as "stacking-up" in the industry, reportedly because they "didn't know" or "couldn't say."

The following responses were given, listed by their corresponding interview number:

1 - "Having a lot of problems with Intermetrics products—lots of bugs. They are very slow and unresponsive in addressing customers' problems. Their assembler cannot detect illegal instructions nor produce error messages. Assembler not very good at syntax checking. When we told Intermetrics what the problem was and where the bugs were, they either didn't have the resources or the time to do it. It was over two months before they responded to us—so we gave up on them."

2 - "The real advantage of the Intermetrics stuff was that (since we're not locked into a vendor) they do a very good job at being Version 7 C compatible, so things written in C that run on a 64180 work

virtually without any changes on an 8086 or 68000—which is the whole point of cross-development."

3 - "They seem to be pretty good, though we liked the Tektronix tools better, but Tektronix didn't support the AT&T 3B2600."

4 - "I get the general impression that they may be falling behind to companies like Microtec Research. While Intermetrics came out with their source-level debugger first, Microtec's seems to be a little bit better. The user interfaces are a little better with Microtec—as they do windowing."

5 - "Intermetrics...very good. It (Intermetrics assembler) was based on the Motorola and does what it's supposed to do. I probably selected Intermetrics because of its price."

6 - "Can't really say—don't know that much about the other products that are out there. We had to select a vendor whose software development tools worked on Sun Microsystems."

7 - "I can't say how they stack up, as Intermetrics is the only one I've ever used, and when I changed jobs, as I was familiar with Intermetrics, I decided to stay with them. It takes a fairly long time (productivity-wise) to learn how to use a new tool set."

8 - "Don't really know."

9 - "We've been using Whitesmiths and then Intermetrics (both slow and both had bugs). The fee for Intermetrics wasn't too bad."

10 - "Better in some aspects and poorer in other aspects. Their software support is very good for us."

I

Use of Specialized Monitoring Equipment

There was no significant difference in the use of specialized monitoring equipment between the Intermetrics users (70% using) and the Non-Intermetrics users (80% using). However, even though the use of in-circuit emulators as monitoring devices was popular (Intermetrics users - 40%; Non-Intermetrics users - 50%), many emulator users expressed their desire to find less-expensive alternatives to emulators as monitoring devices.

Applied Microsystems' emulators were the most popular, accounting for over half of the emulators used, with Zax accounting for 20%. The three other emulator brands mentioned were from Atron, Advanced Microsystems, and Zice.

Other monitoring devices included HP's Data Scopes, Northwest Instrument Systems' (MicroCASE) Soft Analyst, HP's IFR for hardware monitoring, Motorola's HDS3000, and Arium's logic analyzer.

J

Use of Commercial Operating Systems

Similarly, 60% of the Intermetrics users and 50% of the Non-Intermetrics users reported using commercially available operating systems.

Of all operating systems used, the most popular was VRTX from Ready Systems, which accounted for 45%, followed by Software Components Group's PCOS with 18%. Other systems mentioned were JMI's C-Executive; Industrial Programming, Inc.'s MTOS; Whitesmiths' IDRIS; and another UNIX clone.

Of those respondents not using such systems, only one Intermetrics user and one Non-Intermetrics user reported having written their own operating systems.

Other Vendors and Products Considered

The mix, or chain, of tools making up the class of tools that are used for programming-embedded processors can be grouped into three areas:

1 - Design Tools
2 - Software Components
3 - Development Tools

The preference for particular brands of tools in each class, again, is just as varied as the applications, and somewhat dependent on the host system(s) used, let alone user preference. When respondents were asked if they considered any other vendor's products before selecting the software tools they're currently working with, the following responses were given:

Tools considered by Intermetrics users:

1 - Green Hills Software (assemblers, compilers—through OASYS), Microtec Research products
2 - Boston Systems Office (BSO), Whitesmiths compilers, Archimedes compilers
3 - Any that would support the AT&T 3B26000
4 - Intermetrics, Microtec Research tools
5 - Just Intermetrics
6 - Those tools that support the Sun 3 workstation
7 - Only Intermetrics
8 - Tektronix, BSO, Microtec Research
9 - BSO, Apollo's utilities
10 - Not many considered, only those that supported Apollo

Tools considered by Non-Intermetrics users:

11 - BSO, Whitesmiths, Applied Microsystems
12 - Considered Intermetrics (but that was 2 years ago)
13 - Lattice C for PC, Mark Williams, Intermetrics C compiler
14 - It depends on what you're looking for—we shop around
15 - We're driven by market demand (Lattice, Whitesmiths)
16 - Can't think of any
17 - Lattice, Whitesmiths, Microtec Research
18 - Borland Turbo C, Paragon, Zice Z80 emulator
19 - None in particular
20 - Intermetrics cross compiler XDB

K

Knowledge of Other Vendors' Offerings

Most frequently mentioned as the source for knowing about other vendors' offerings was ads in trade journals (80% for both Intermetrics and Non-Intermetrics users), and word-of-mouth from colleagues and associates (60% for Intermetrics users; 80% for Non-Intermetrics users).

However, word-of-mouth referrals and recommendations weighed much more heavily in the final decision process than the promises and claims made by the vendors in their ads.

Of the plethora of trade journals and magazines mentioned, the one cited the most was EE-Times, which is read by 70% of both Intermetrics and Non-Intermetrics users.

Interestingly, even though two of the Non-Intermetrics users mentioned that they asked the vendors of the host systems and emulator manufacturers which software tool products they should use, none of the Intermetrics users mentioned asking their hardware vendors.

Four of the Intermetrics users (compared to two of the Non-Intermetrics users) mentioned attending trade shows as a means of knowing about vendors' products. Those using trade shows totaled six, or 30% of the survey population.

L

How Kept Abreast of Latest Developments

The responses as to how the interviewees kept abreast of the latest developments in development tools for embedded processors were almost identical to those for the previous question.

The only difference was one mention each of users' groups, *Dr. Dobb's Journal*, and the Gold Books for sources of information.

M

Key Features and/or Aspects Considered

The common denominator for all respondents in terms of key features and aspects considered was compatibility with the host system and, of course, support for the target microprocessor chip itself.

Interestingly, price seemed to be a major consideration for the Intermetrics users; 50% of them made mention of it. This is in contrast to the Non-Intermetrics users, of whom only one respondent mentioned price as a major factor.

Similarly, three of the Intermetrics users considered vendor support for the products important, compared to only one of the Non-Intermetrics users.

Only Intermetrics user number four considered ROM ability (size optimization) an important feature, compared to 50% of the Non-Intermetrics users.

Other key features and aspects that were mentioned for the Intermetrics users were: adherence to industry standard (Unix, C), ease of use, documentation, flexibility and compatibility of the software tools, good error messages from the cross-development tools, and performance (optimization, speed).

The key features mentioned by the Non-Intermetrics users were not that different from those mentioned by the Intermetrics users; the answers of both groups included industry standards, ease of use, good documentation, efficient code generation, compatibility with other tools, as well as compatibility with in-circuit emulators.

The previously cited Rothschild study conducted by The Technology Research Group, Inc., found the relative importance of decision factors to be as shown in Exhibit IV-1.

N

Like Best About Tools in Use

The features liked best about the tools in use were as varied as the targeted applications.

For the Intermetrics users:

1 - "Easier to debug in assembler"
2 - "They're up to date on Version 7 for C; code is reliable; they're tools you can trust"
3 - "Their assemblers are better than most; and the tools have very good capabilities, referring to linking"
4 - "Relatively bug-free, and their user interfaces are better than those of Microtec Research's"
5 - "They support all the features of the Motorola 6801"
6 - "Their tools integrate well with Zax, Sun, and Unix"

EXHIBIT IV-1

ATTRIBUTES WHICH ARE MOST IMPORTANT TO THE NEW TOOL PURCHASE DECISION

	Percent of Respondents
Compatibility with H/W already owned	80
Compatibility with S/W tools already in use	61
Quality of post-sales support	54
Consistent user interface for all tools	45
Low overall tool cost	42
Consistent database for all tools	42
Availability of S/W independent of H/W	40

Base: 1,523 respondents
Source: L.F. Rothschild & Co., Inc;
The Technology Research Group, Inc.

7 - "The flexibility of their tools; full-featured compiler"
8 - "You can single-step through a program and control the emulator, remotely, via the terminals connected to the host"
9 - "(compared to Whitesmiths), Good response, good service, and the price is reasonable"
10 - "They support Apollo (workstations), allow for transparent access to the Applied Microsystems' emulator; the output is in ASCII, not object files; it's an 'integrated' tool set"

For the Non-Intermetrics users:

11 - (re: Tektronix) "A well-optimized compiler"
12 - (re: Microtec Research) "Their products work fine"
13 - (re: Microsoft) "Their screen compiler has the screen manipulation needed for graphics. Their C for the PC interfaces nicely to Pascal, FORTRAN, and assembler"
14 - (re: Whitesmiths) "Seems okay"
15 - (re: Ready Systems) "Their VRTX is well suited for industry standards— DoD approved"

16 - (re: Microsoft) "Their libraries are useful; good documentation"
17 - (re: Microtec Research) "Like its speed and efficiency"
18 - "We use too many vendors' products to say what we like best"
19 - (re: Borland's Turbo C) "Good diagnostics and speed" (re: MANX) "Outstanding Documentation"
20 - "We use too many products—can't comment"

O

Like Least About Tools in Use

Although the dislikes expressed by Intermetrics users were also varied, they did tend to focus on three areas:

1 - Much too slow (compiling and downloading)
2 - Not very optimizing
3 - Poor documentation

The following are the responses given by the Intermetrics users to this question:

1 - "Assembler can't detect illegal instructions—no error messages"
2 - "Much too slow at times"
3 - "Poor documentation; assemblers not standard—they are processor dependent"
4 - "Can't initialize union; too slow, no windowing capabilities"
5 - "Don't have higher-level constructs"
6 - "Too many bugs; not as efficient as Green Hills S/W"
7 - "It does not delete the temporary (partially completed) output file—makes it very hard to manage files"
8 - "Download time too slow, documentation is poor; very hard to install Intermetrics software. When you get a tape from them it's very hard to load into a VMS/Unix environment—takes about a week to 10 days to get things smoothed out—this should only take about a half a day"
9 - "Inefficient compiling; not very optimizing; multiuser problems when running under Apollo's Domain"
10 - "Compilers are too slow—assembling too slow; documentation is poor"

P

Features and Improvements Desired

The most common features and improvements desired by the Intermetrics users were faster compiling time and better documentation. Below are the responses of the Intermetrics users:

1 - "A cross-reference for the listings"
2 - "The ability to substitute a macro expression operation for an I/O operation; a software simulator added to their H/W debugger interface"
3 - "Not having Intermetrics change the assembler directives from target to target"

4 - "Windowing; more like Microsoft's C debugger; a cross-debugger"
5 - Higher level constructs; a more efficient compiler"
6 - "Better documentation; better ease of use; more profiling and performance measurement features"
7 - The ability to delete temporary output text files that are created when you interrupt or stop an assembly or compiling process"
8 - "Better documentation"
9 - "None at this time"
10 - "Make it (compiler) fifty times faster—it's too slow"

The features and improvements the Non-Intermetrics users wanted to see were as follows:

11 - "Source-level debugging, as opposed to debugging in assembler"
12 - (re: Microtec Research) "Seems to be doing just fine"
13 - (re: Microsoft) "Faster compilers and assemblers"
14 - (re: Whitesmiths) "Source-line debugging"
15 - (re: Ready Systems) "The ability to generate management reporting and cost information. This is necessary for government contracts. The ability to generate documentation; generation of test-cases and test parameters"
16 - (re: AVOCET) "Better error messages"
17 - (re: Microtec Research) "Make it more user friendly"
18 - "Something that can tell you what location in the code you're in, instead of giving a source-line that could be anywhere"
19 - "Library maintenance to provide better control over revisions"
20 - "A really good source-level debugger"

Interestingly, one-third of the Non-Intermetrics users were looking for a good source-level debugger—the very tool that Intermetrics does provide!

Q

Purchasing Power

All respondents surveyed, except for one Intermetrics user whose boss had such power and had just quit, reported they had the leeway to purchase software tools for embedded processors. The only constraint was budget. As one user put it, "I can't run out and buy a Cray-1."

Intermetrics user number 8 was more realistic in his comment: "(When deciding to purchase a new tool or tool-set)... It's a trade-off between getting something that's really better and getting 'another' tool that is just marginally improved. You have to consider the learning curve and the time it takes to make that tool fully productive from a profitability standpoint."

R

Future Needs and Requirements

The responses to "What do you anticipate your future needs and requirements to be regarding development tools for embedded processors?" were not unlike the responses to the features and improvements they'd like to see. Below is a summarized listing of the responses:

For Intermetrics users:

1 - "We see more development being done on engineering workstations"
2 - "Software simulators for when we're not running under Unix"
3 - "Better, more efficient C compilers; more work being done on PCs"
4 - "We don't anticipate anything radical"
5 - "Like to see more-efficient C compilers"
6 - "We're going to integrate the work of teams, going to CASE tools"
7 - "We're going to need the ability to manage the development of different versions of a product through better file management"
8 - "Faster emulators, and additional workstations for debugging"
9 - "Can't say what our future need will be. We just fill a small market niche"
10 - "It depends on the target chips we have to use"

For Non-Intermetrics users:

11 - "Moving to a MicroVAX host. More-efficient compilers"
12 - "Moving to a Sun as host with Zax in-circuit emulator"
13 - "Nothing earth-shattering"
14 - "Can't say as we use so many different processors"
15 - "We're driven by what the market and OEMs dictate"
16 - "Better error messages; interactive debuggers; schematic drawing packages"
17 - "Better ROM-ability"
18 - "Development tools for MPUs"
19 - "Nothing for the next few years"
20 - "We're deciding whether to go more with Unix or networked PCs"

S

Use of CASE Systems

Half of both the Intermetrics and Non-Intermetrics users did not plan on using a CASE system in the future—the reasons being that their work was not complex enough to warrant it and/or CASE was too expensive.

Of the remaining Intermetrics users, two are already using a CASE system, Cadre's Teamwork, while three others were looking at various CASE systems, mentioning Cadre, Yourdon, and Index.

Of the half of the Non-Intermetrics users who were planning on using a CASE system, respondent number 17 believed the Macintosh to be the best because it was "very user friendly"—thus cutting down on the time it takes to learn how to use it. Other vendors being considered for CASE systems were Sun and Ready Systems' Card Tools.

T

Other Anticipated Changes in Target Chips

All but one of the Intermetrics users who were using the 68000 family (70% reported developing for the 68000) said they would be staying within the 68000 family. That other respondent said her/his company would be moving to the National 32000 family.

Other anticipated changes in the target chips were indicated by the following responses:

For Intermetrics users:

1 - "Move from 68000 to 68030"
2 - "Moving to whatever chips will be put into Smart Cards"
3 - "Staying with 68000, more development in C, and a lessening of our reliance on emulators for debugging"
4 - "Moving to the National 32000 family"
5 - "None in the foreseeable future"
6 - "No—we're okay for now"
7 - "We're looking at nonvolatile memory chips"
8 - "No—we'll stay with the 68000"
9 - "Maybe moving (from 68000) to 68020/30"
10 - "Moving to DSP for TI"

As for the Non-Intermetrics users:

11 - "No—staying with the 68000"
12 - "Not at this time—our chips (68010s) have enough 'horsepower' for now"
13 - "Not for our product line (medical analytical testing equipment)"
14 - "Can't say—we're driven by what the market demands"
15 - "We're market driven"
16 - "We're ok with our 8-bit chips"
17 - "We see ourselves moving to 32-bit chips. We go with the flow of technology"
18 - "Very unlikely"
19 - "I see us moving to more sophisticated chips in the future"
20 - "Possibility of going to DSPs"

U

Current Supplier(s)' Sufficiency in Meeting Requirements

Among the Intermetrics users, five felt that Intermetrics was sufficient in meeting their needs, but three added the qualifier "for now!"

In the responses of users who felt that Intermetrics was not sufficient in meeting their future needs, the following reasons were given:

2 - "They don't support nongeneral microprocessor controllers, such as the 8051, which Archimedes does"
3 - "I see Software Development Systems, Inc. as being better able to meet our needs"
4 - "We see Microtec Research in a better position in meeting our needs.

They have a better ability to pick up newer processors and support faster than Intermetrics"
7 - "I don't see Intermetrics as being able to help us as it relates to managing files and revisions of software products"
10 - "They (Intermetrics) don't have tools for the 80386 and DSPs. So, if we wanted to start development on these tomorrow, they couldn't help us"

When asked about current supplier sufficiency, one half of the non-Intermetrics users reported using more than one supplier.

The Non-Intermetrics users' comments on current supplier sufficiency were:

11 - (re: Tektronix) "Yes"
12 - (re: Microtec Research:) "Yes, sufficient, and maybe Intermetrics when we move from PCs to the Sun Workstation"
13 - (re: Microsoft) "Yes"
14 - "We don't have 'a' current supplier. When we need something, we shop around"
15 - "Question not applicable—we have too many different suppliers"
16 - (re: AVOCET) "They're meeting our needs"
17 - (re: Microtec Research) "Yes"
18 - "We have multiple suppliers. If one of them can't meet our need, we go to another"
19 - "Yes, as we have multiple vendors"
20 - "Yes—we have a mixture of vendors"

V Application Development Staff for Embedded Processors

- Size

The average size of the development group using the Intermetrics tools was 18, ranging in size from 4 (respondent number 7) to 50 people (respondent number 2).

As for the Non-Intermetrics users, the size of the development groups ranged from one person (respondent number 16) to 300 (respondent number 15); the average was 51 people per group.

- Make-Up (EEs, Computer Scientists, Other)

Approximately 65% of these developers are reported as having degrees in electrical engineering, 34% had backgrounds in computer science, and 1% held managerial and support positions.

There were no significant differences between the Intermetrics and non-Intermetrics users.

- Standalone, LAN, Shared Systems

Only one Intermetrics user, number 5, reported using a standalone system—the Apollo workstation, but it was networked via Domain.

Most of the reported 'shared systems' were in the form of a network.

Eighty percent of Intermetrics users reported having, or being in the process of installing, some sort of network or expansion of their existing network.

Only 20% reported having PCs hooked together in an LAN.

As for the Non-Intermetrics users, 30% reported using a LAN for the PCs.

Although 70% of the non-Intermetrics users reported having standalone systems, only 40% reported using PCs solely as standalone and not in an LAN or some sort of network.

VI

Conclusions and Recommendations

Conclusions and Recommendations

A

The Marketplace

Intermetrics' InterTools compete in a relatively small, extremely fragmented, and diverse market.

The underlying technologies are diverse and changing.

The customer is often demanding, unforgiving, and single-mindedly focused on his niche, which may be dramatically different from that of someone working on another application and/or another microprocessor.

There are few actual standards and no "mainstream" de-facto standards or groundswells in the business as of this writing.

Of the present players in the business, none is very big, and each seems to be taking a somewhat different tack.

The present alternatives of choice appear to be:

1. Pick a subset of the wide range of tools and then develop, sell, and support that array.
   Example: Intermetrics, Green Hills.

2. OEM selected proprietary tools to equipment manufacturers and/or distribute them through resellers. Example: Microtec.

3. Distribute (and support) software made by others. Example: OASYS, Northwest Instrument Systems (MicroCASE).

4. Do a little bit of everything. Example: OASYS.

B

Clear Signals

INPUT doesn't see a simple solution. Intermetrics' present path is not unreasonable, in principle. Intermetrics' product line is, for the most part, solid and useful and the technology good. INPUT does not, however, see

evidence that Intermetrics is particularly adept at marketing, customer support, or quick responses to user demands.

Nor is it clear that the attainable volume of sales would necessarily support the kind of development, product management, marketing, and customer support organization necessary to achieve optimum steady-state operation in this market, small and fragmented as it is.

C Alternatives

Three plausible scenarios for Intermetrics to consider are:

1. Become exclusively a developer, turning distribution over to OEMs and/or a "supermarket" seller like OASYS. The potential advantage would be to shed marketing overhead and concentrate limited resources on developing best-of-breed products in subsegments of the marketplace.

   The downside, of course, is almost total abandoning of control, a big sacrifice in margin, and at least the possibility that partners or distributors might not exploit the true potential of what Intermetrics can develop.

2. Become a supermarket. Invest more heavily in marketing, sales, and customer support and aggressively round out the product array with alliances and reseller arrangements with other developers.

   This approach keeps internal development focused, while at the same time satisfying a much wider range of user needs. The approach has the potential of creating better visibility, a greater critical mass, and more-efficient utilization of resources in all departments.

   Although one cannot say so with certainty without developing a full business case, this approach may have the potential of creating a sizeable, profitable business. One problem, however, is that it plays to attributes that have not proven to be Intermetrics' particular strengths on the InterTools side of the house.

3. A third alternative is to join forces with one or more other companies in the business via acquisition, merger, or spin-off. The right partner might bring a combination of product, distribution, and critical mass; or conversely, the InterTool portion of Intermetrics might fill significant gaps for someone else in the industry.

   The pros and cons of this course are ultimately tied to the specifics of the potential partner and the deal that could be struck, so generalities are meaningless. INPUT would be happy to assist Intermetrics in further examining this approach and, if appropriate, screening and approaching potential partners.