



Maintaining an Edge at ADI (B): The Story of Blackfin

Mr. Fishman listened carefully as Mr. Croteau and Mr. McGuire finished their update. The pair led the commercialization effort for the Blackfin processor. Both exuded confidence and optimism.

Blackfin had fallen short of expectations. However, in Mr. Croteau and Mr. McGuire's view, that was primarily because they had underestimated the length of time it would take for ADI's customers to design Blackfin into their own products. ADI had not experienced such a long adoption cycle, because the company had never launched such a complex product. Customers had to figure out how to deploy it.

By the middle of 2006, however, all leading indicators, especially *design wins* (when a customer selected Blackfin over a rival to use in a product under development), promised a sharp upturn in Blackfin's sales. In addition, while early adopters of Blackfin had been aggressive up-and-comers looking for an edge in the market, much larger and better known companies were showing confidence in the processor. Mr. Croteau elaborated:

You need to sell to innovators first to prove the value proposition. Now, we've done that. We have a track record with over 1,000 customers. We can show bigger, more risk-averse customers how Blackfin has been used. We have the credibility to turn the corner.

Also attending the meeting was CFO Joe McDonough, who frequently challenged his colleagues on their continued commitment to the DSP business despite its lagging performance. Mr. McDonough posed a few difficult-to-answer questions. How much more capital? How much more time before we see a return? Where would ADI be today if we had invested all of the capital we threw at DSP in more advanced analog technology?

Mr. Fishman took in the exchange. It was never easy to strike the right balance between immediate imperatives and short-term performance on the one hand, and innovation and long-term success on the other. Was the company making the right moves with Blackfin?

This case was written by Professor Chris Trimble of the Tuck School of Business at Dartmouth. The case was based on research sponsored by the William F. Ahtmeier Center for Global Leadership. It was written for class discussion and not to illustrate effective or ineffective management practices.

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Organizing to Commercialize Blackfin

Following the meeting, Mr. Croteau and Mr. McGuire proceeded to another meeting with one of the DSP engineers who had worked on a specialized version of Blackfin that had been designed for a cellular handset. The engineer described how some simplifications to the design would make it broadly applicable in their horizontal markets.

As Mr. Croteau and Mr. McGuire listened to the possibilities, they realized that yet another degree of complexity had arisen in bringing innovations to market. Here was a vertical initiative that generated new insight in how to win in horizontal markets.

There were six core activities within the DSP group. Which, Mr. Croteau and Mr. McGuire wondered, was the best way to coordinate these processes?

1. *Designing components.* Managed by horizontal business units but organized by technical competence and geographically located in ADI's technical design centers.
2. *Designing systems.* Managed by vertical business units.
3. *Generating demand for components.* Managed by the centralized sales group.
4. *Generating demand for systems and solutions.* Managed by vertical business units in partnership with the centralized sales group.
5. *Fulfilling demand.* Managed by the business unit managers in partnership with ADI's centralized manufacturing group and network of manufacturing partners.
6. *Building brand.* Managed, starting in 2003, by a new marketing head who had quickly taken the marketing function from limited technical marketing to more perceptual programs.

The Evolution of the DSP Business

ADI launched its first DSP product in the mid-1980s. That first design was still used in 2005 in straightforward applications, including some factory automation equipment and various medical devices. Since that early launch, ADI grew a steady DSP business in its horizontal markets. Once a customer selected ADI's DSP for inclusion in its products, sales could persist for 20 years or more, as long as the customer's application was in production.

In the early 1990s, ADI designed its second DSP core, dubbed the SHARC processor. SHARC also generated steady sales in horizontal markets and particularly gained popularity in high-fidelity audio. The SHARC included a *floating-point* calculation engine, which was costlier but more accurate and less software intensive than the competing *fixed-point* design. At the time of development, it appeared to ADI that the DSP market would favor floating-point designs, but by the end of the 1990s, cost had prevailed as the dominant consideration, especially in high-volume applications. The vast majority of DSP

applications called for fixed-point designs, except for a few high-end audio and imaging applications.

ADI needed a new fixed-point DSP core, but ADI's horizontal DSP customer base had not become large enough to justify the high costs of developing a new DSP. A costly investment in a new DSP could be justified only if ADI could build a strong market presence in vertical applications as well.

In verticals, however, the going had been much tougher. For example, in the mid-1990s, ADI nurtured a relationship with a major European manufacturer of wireless telecommunications devices and had developed and sold a custom DSP with integrated analog functionality. The relationship foundered, however, when the customer became nervous because ADI had only a small DSP manufacturing capability and barely kept up with shipments. The customer chose to work instead with ADI's larger rival, Texas Instruments, and the two companies set up a joint manufacturing facility in Europe. In ADI's view, TI's DSP core was less sophisticated. The customer, however, did a lot of engineering in house, right down to custom chip design, and enhanced TI's design to meet its specific needs. Though TI's role was primarily to manage manufacturing operations, TI's DSP business grew much faster than ADI's because it secured the biggest customers in the largest DSP application: wireless telecommunications.

Subsequently, ADI invested roughly \$30 million in taking the SHARC to the next level for use in base stations for third-generation cell phone networks. The new DSP core, dubbed Tiger SHARC, was not only more powerful, it combined multiple functions on a single chip. The same European customer was intrigued and allocated a full-time development team to work on new products based on Tiger SHARC. The product was technologically a winner, but the customer had to back away from the investment, as did ADI's second largest customer, due to pressures in its own business. ADI cancelled the project.

Beyond these two experiences, ADI learned much from disappointment in its first decade in the DSP business. Mr. Fishman recalled,

The horizontal DSP business developed slowly but without complication. By comparison, it took us a decade to understand the vertical DSP business. Instincts that had served us well for over 30 years took us in the wrong direction. For example, we acted as though product performance was more important than time-to-market. If I could do it all over again, I would hire a few outside experts to help us, even if doing so was more expensive.

Finding a Way to Develop a Breakthrough DSP

Late in 1998, Mr. Fishman wondered for the first time if ADI would be able to sustain its presence in DSPs. ADI's existing products, including the SHARC line, were not going to be sophisticated enough to meet the demands of the next generation of electronics. If ADI wanted to stay in the game, it needed to make a mammoth investment in designing a new DSP core from scratch. The capital investment required was astronomical, and in 1998,

the semiconductor industry was on the downside of a sharp business cycle. There was little capital to be found, and even if funds could be raised, did it make sense to escalate ADI's investment in a product line that had not earned money? Nonetheless, ADI was a company that did not take well to giving up, and not financing the development of a new DSP core was akin to giving up.

At the time, Mr. Fishman was in the midst of some interesting conversations with Intel. ADI had served Intel as a customer for many years, providing signal-processing chips for PCs. Intel assembled circuit boards that included both its own microprocessors and peripheral chips from ADI and others for shipment to PC manufacturers.

The sequence of conversations with Intel representatives was intriguing. Intel had concluded that it needed to diversify beyond microprocessors. The company had always respected ADI. Several business proposals were exchanged. At one point, Mr. Fishman perceived that Intel was interested in acquiring ADI.

As the conversations evolved, Intel showed great interest in DSPs. Sensing a solution to his DSP bind, Mr. Fishman directed the conversation towards a jointly financed R&D effort to produce a cutting-edge DSP. An agreement soon followed. ADI had found a way to finance the project and to accrue even greater credibility in the market through association with the giant of semiconductors.

Both companies stood to learn from the other. The new processor, which ADI eventually branded Blackfin, would combine signal-processing functionality with microcontroller functionality. Microcontrollers were dramatically simpler versions of microprocessors, used for specific and narrow data-processing tasks, such as thermostats, automotive engine controls, clock controls, button controls, and even the controls in home coffeemakers. Microcontrollers were neither mathematically complex nor real-time intensive, but they had never been combined with signal processing before. The science and engineering underlying the two products are distinct. Neither ADI's nor Intel's experts understood much of the other's world. Brian McAloon described the potential of the combination:

We are working with customers on home sound-system products that link wirelessly to your computer, download your music, display your music library on a video screen, and generate high-fidelity sound. It used to be that to design such a system, you would need microcontrollers from Motorola, network processors from Intel, and sound and video processors from ADI. Now, you can do it all with a single Blackfin. This enables ADI's customer to decrease size, power, and cost—the three critical design factors in any portable system.

The signing of the ADI-Intel joint development agreement was significant for the semiconductor industry. It signaled that market lines between signal processing and microprocessing could blur. That, in turn, meant that scale was becoming ever more tied to competitiveness.

Working with Intel

Intel and ADI decided to house the venture in neutral territory, in Austin, Texas. Both companies dispatched small management delegations to lead the effort. The team proceeded to hire numerous former employees of Motorola and Advanced Micro Devices who were available in Austin, bringing perspectives from two more semiconductor companies into the mix.

The partners named a five-person steering committee, consisting of three managers from Intel and two from ADI, mixing both marketing and engineering perspectives. The committee reported to both Mr. McAloon and a representative from Intel.

Some observers within ADI were concerned that such a massive product development effort was proceeding without a clearly identified target application or target market. Mr. Croteau recalled,

There was a risk it would all turn out to be an academic exercise. It was the closest thing to pure innovation you could be involved in.

On the other hand, there was no clear alternative path to developing the next generation DSP.

Both companies had “stage-gate” product-development processes, with design milestones scheduled to be completed by certain dates. To set expectations for budget and time to complete each stage, the partnership followed Intel’s “planning day” practice, in which a group of engineers collectively debated appropriate expectations. Based on their experience (e.g., “Let’s see—generally it takes X engineers X weeks to do a design like this.”), they decided on the goals. The critical characteristic that defined the process was that the discussion *preceded* assignment of individual accountabilities.

The project proceeded smoothly. The team completed a “reference design” for a new DSP that incorporated both signal-processing and microcontroller functionality within 60 days of the original 18-month schedule.

In accordance with the original agreement, both companies were free to do as they pleased with the design. Though some ADI employees feared Intel would get more out of the partnership because of its more established market position, the two companies rarely ran into each other in the marketplace through 2005. Intel remained microprocessor focused, and ADI remained signal-processing focused. Mr. Fishman speculated that Intel faced a struggle similar to the one ADI faced: figuring out how to organize to bring multiple interrelated technologies to the market as an integrated solution for a specific application. “They are microprocessor people. They are deeply immersed in putting Pentiums in PCs,” observed Mr. Fishman

Though the two companies did not end up competing directly in the marketplace, the decision to work with Intel rather than build the processor independently rankled many ADI engineers. Their pride was wounded. Some believed ADI already had sufficient

microcontroller expertise. Others seemed frustrated that so few ADI employees were directly involved with the effort. Nonetheless, from Mr. Fishman's perspective,

The partnership turned out terrifically. They funded half of the project, and we learned a lot about how to manage a complex chip design effort on time and on budget.

ADI named the processor Blackfin. Intel used a different name. Next, ADI would make Blackfin truly its own.

Blackfin: The Next Generation

In 2001, right around the time the Intel partnership finished, Mr. McAloon took responsibility for the DSP division and quickly proceeded to launch Blackfin. Mr. Roche reflected on the experience:

Blackfin was a superb launch. It created a lot of awareness and interest in the product—one of our best efforts in two decades.

Mr. McAloon hoped that Blackfin would become a quick success in horizontal markets and justify all the R&D that the company had poured into the project. It did not. ADI created some initial brand recognition for Blackfin and got the product in the market, but early sales were not promising. Nor was early feedback. Mr. Roche continued,

However, we did not understand the customer ecosystem at a deep enough level. When a customer uses a DSP, they need well-developed tools plus applications software and a suite of peripherals tailored to the target applications segments.

Mr. McAloon also understood from customers that the hardware's performance fell short of "breakthrough." After consideration, Mr. McAloon and his colleagues embarked on an ambitious endeavor: to rebuild Blackfin and make it even better.

To tackle the challenge, ADI called upon the leadership of one of the company's most talented engineers, Jim Wilson. Mr. Wilson had been a signal-processing engineer his entire career, starting with defense systems. At a critical turning point in his career, Mr. Wilson almost chose to shift to management, but he decided his heart was in semiconductor design and later was designated an ADI Fellow. He had years of experience in DSP design and most recently had been running a "mixed-signal" group, one of the rare groups within ADI that combined analog and digital designers. Bringing together these two disparate skill sets was challenging and rewarding, but Mr. Wilson could not resist the opportunity to make Blackfin better, faster, and cheaper.

In fact, Mr. McAloon challenged Mr. Wilson to double the speed while halving the power and cost. Mr. Croteau and Mr. McGuire began their day-to-day general management of the Blackfin franchise, reporting to Mr. McAloon. Mr. Croteau and Mr. McGuire were viewed as a strong tandem. Mr. Croteau was one of the best strategy and marketing

thinkers in the company, one who understood customer needs, and Mr. McGuire was equally strong in engineering and product development.

Mr. Wilson proceeded to put together a hardware design team of nearly 10 people, all of whom had worked with him for more than a decade. They all understood semiconductor design to the last detail—transistors, logic, gates. The complexity of the project seemed staggering, despite the fact that it was a redesign of the existing Blackfin.

There were many surprises. And, because ADI was working in unfamiliar territory, matching the right person on the team to particular aspects of the design problem was not always obvious. Although the team did feel accountable to its deadlines, Mr. Wilson insisted on stopping after each mistake to acknowledge the error, recognize its causes, and learn.

The team completed the hardware design in two years, in the spring of 2003. From a technical standpoint, the product was a home run. It had met all of its design goals, and it was simultaneously the best digital signal processor on the market and the best microcontroller on the market.

Throughout the hardware design process, Mr. McGuire and Mr. Croteau prepared for the relaunch of Blackfin. They quickly set out to expand their software capabilities under the leadership of Josh Kablotsky, another ADI Fellow, who had been developing DSP software at ADI since the early 1990s.

Mr. Kablotsky looked to India to expand his team, hiring a dozen programmers. Through daily conference calls and sharing modules of software code, he ensured everyone was on the same page. The software development team analyzed a number of potential Blackfin applications, including telecommunications and video. Through a discussion with Microsoft, Mr. Kablotsky discovered that the latest video applications in PCs were absorbing far too much microprocessor power, so there was an opportunity to shift part of the load to a programmable DSP like Blackfin. Gradually, as the wide range of commercial applications became clear, Mr. Kablotsky ramped up his team to 80 developers.

Mr. Kablotsky and Mr. Wilson interacted frequently. Mr. Wilson viewed Mr. Kablotsky as his window to the customer. Mr. Kablotsky reflected on his early experiences talking with customers:

I learned why it is important to start designing software at the same time you start developing hardware. We had several conversations with customers that were not productive. They'd say, "What can it do?" We'd say, "It *can* do *anything*." And they'd say, "Show me." And we'd have to say, "Well, give me some time to develop the software." We did not anticipate how close we needed to be to a complete system just to have a productive conversation with many customers.

Blackfin: Launch II

For a second time, the response to Blackfin was less than ADI had hoped. Mr. Croteau elaborated on the lessons learned:

We went in fairly naively. We had an innovative and unique product and, thus, nothing to benchmark our rollout against. Not only that, because our SHARC franchise was so old, we literally had to shock the industry into thinking differently about us.

Mr. Fishman recognized early that lack of attention to branding may have been part of the problem. The company launched a significant campaign to raise awareness of Blackfin within the engineering community. By 2005, awareness of Blackfin was very high. Mr. Croteau reflected that branding was imperative and yet it was something to which ADI traditionally gave little thought.

Because Blackfin was cutting-edge technology, Mr. Croteau expected it would be most attractive to developers in cutting-edge, just-emerging industries. Of course, these were the hardest markets to identify. They also typically consisted of smaller customers who were willing to gamble to become bigger.

Bhaskar Banerjee took on the challenge of locating and developing emerging applications, from iPods to multimedia IP phones to video-enabled handsets. He discovered a wide range of possible applications and a wide range of customer behaviors—from those who were ready to do all of the programming and systems design work to those who wanted to buy a complete system, and from those who immediately grasped the possibilities to those who needed to be educated.

As Mr. Banerjee learned customer needs, he passed the most promising leads to the sales team to develop further. It became apparent to Mr. Banerjee that it took about two years to get from his early conversations with customers to sales conversations that felt routine.

Mr. Croteau spent a great deal of time on the road speaking with potential customers as well, helping to achieve a critical mass of Blackfin users in key market segments. The community of product designers was small. If Blackfin could benefit from sufficient word of mouth, sales would grow on their own. Because of the number of possible applications for Blackfin, Mr. Croteau wished to spend even more time on the road, but doing so was not practical while running the business.

Blackfin in 2006

By 2006, Blackfin was accumulating design wins, including fingerprint-activated door locks, automotive warning devices that indicated another vehicle was in the driver's blind spot, and new portable digital music players. There had also been some near-misses on very high potential customers that could almost single-handedly turn the business to profitability.

Some customers were proliferating Blackfin designs without ADI's knowledge. Furthermore, the sales force began hearing more and more positive feedback, occasionally comments like, "If you're not designing with Blackfin, you're using the wrong part." Mr. Croteau also felt that ADI had proven to the market that a single chip could be a best-in-class DSP and a best-in-class microcontroller, thus reducing the number of chips in end products and lowering costs.

Still, the DSP business was not yet proven. Product awareness was high, but product preference was lagging behind. Mr. Croteau anticipated that preference would shift from the competition to Blackfin as more users tried Blackfin.

In addition, revenues were still too low. Mr. Croteau and Mr. McGuire explained the low revenues by the longtime delays characteristic of this particular market. For example, customers couldn't simply drop Blackfin into their existing products; they had to make the decision to completely redesign their products around the new chip. This was costly, so the case for Blackfin had to be unambiguous.

Even when ADI convinced a customer to switch, revenues were hardly immediate. Only when the customer completed its product development process, launched the new product, and built it to scale did ADI receive a significant ongoing revenue stream.

Finally, the products that incorporated Blackfin designs were often networked, or interdependent with other software and hardware advancements outside of ADI's direct control. For example, to stimulate the development of operating systems compatible with Blackfin, ADI partnered with Microsoft. By 2006, Mr. Croteau had named several segment strategy managers, who reported directly to him. Each strategy manager was responsible for an equipment category and extended ADI's knowledge beyond the direct needs of its customers to the needs of its customers' customers and their networks of partners.

Mr. Croteau often pondered whether additional hiring or spending more in business development, sales, and marketing could accelerate Blackfin's run to success. He had been frustrated at times by barriers to hiring but concluded that the biggest constraint to sales was out of his control; it was these delays.

Objectively, the DSP business remained unproven. It was still losing tens of millions of dollars per year. Over the long term, if Blackfin made its way into enough horizontal applications, it could earn a return. In the short term, however, its fortunes depended on breaking into vertical applications. The biggest was cellular handsets.

Questions:

1. How should the DSP group be organized?
2. Evaluate ADI's experience in developing and launching Blackfin. What, if anything, should it have done differently?
3. Imagine you were in Mr. McGuire's and Mr. Croteau's shoes in 2001. You need to sketch out a plan for the relaunch of Blackfin. You need to estimate capital and staffing requirements for the launch across all functions, and you need to estimate when and how quickly to scale up spending and staffing in each function. How would you go about coming up with a plan? How accurate do you think it could be?
4. How did ADI go about allocating resources to support the launch of Blackfin? Who was involved?
5. How would you assess the profitability of Blackfin?
6. How should ADI decide whether to keep investing in DSPs? What would you do?