Beyond the Clash: Managing High Tech Professionals

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For inclusion in Von Glinow and Mohrman (Eds.), Managing Complexity in High Technology Industries, Systems and People, Oxford University Press.

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Introduction

On January 28, 1986 millions watched as the Spaceship Challenger blew up only seconds after take off. Some say the incident was avoidable. Hours before the tragedy, Thiokol project engineers pleaded with authorities to delay the launch. They feared the inevitable, that the cold temperatures would cause the O-rings and joints to malfunction. Much to the nation's regret, the engineers were overruled by their management.

The President's Commission investigating the causes of the incident concluded that:

> "The Thiokol Management reversed its position and recommended the launch of 51 - L, at the urging of Marshall (an intermediary vendor) and contrary to the views of its engineers in order to accommodate a major customer" (Presidential Commission, 1986, pg. 82).

Individuals who work in high tech environments were not at all surprised by this incident. To some degree it happens every day. In the final analysis decisions are routinely made by managers concerned with profit and loss statements, not engineers concerned with product integrity. The trade-off between the firms need for financial profitability and product quality is at the core of most high tech firms today (Kleingartner and Anderson, 1987). In most cases the primary emphasis on financial soundness fortunately, does not result in lost lives. The tension between these two systems--one motivated by profit and the other motivated by expertise--make the management of high tech firms a crucial

balancing act. This chapter examines those critical tensions and offers recommendations for the management of the high tech firm.

Who Are These 'High Tech' Workers?

High tech professional workers are first and foremost knowledge workers--highly educated, autonomy-seeking and career--oriented (Drucker, 1988; Von Glinow, 1988). They engage in knowledge exchange as the currency of trade and pursue intellectual and technical challenges. Typically they strive for technical breakthroughs. Their allegiances are suspect, but generally they join a firm because of the challenge of the work, and the management practices (Raelin, 1985; Bailyn, 1985). They expect to be rewarded accordingly. They also demand autonomy, abide by a set of ethics, expect to live up to professional standards set by collegial, or occupational groups, and tend to have more sunk cost in their skills, abilities and education than they do in the employment contract with their organization. They prefer to identify with other high tech and professional workers who are engaged in similarly important, challenging tasks. In short, high tech professionals are a new breed of worker with strong ties to their technical specialty through their profession.

The difference between high tech professionals and their organizational counterparts is significant. For many years sociologists and organizational scientists have studied the differences between professional and non-professional employees (Hughes, 1967). It is generally concluded that the two groups--

professional workers and organizational workers tend to be significantly different from one another. Their motivations for working are different, their values tend to be different and their work-related behaviors reflect those differences. Over the years and through considerable empirical study, it is now fairly well established that professional and non-professional workers have vastly different "world views" about work (Von Glinow, 1988; Bailyn, 1987; and Benveniste, 1987). When we discuss high tech professionals, we refer to the professionalized segment of the workforce engaged in high technology industries, such as electronics computing equipment, chemicals, drugs, semiconductors and related services, electronic components, aircraft and parts, communications robotics and computer-based instruction (Belous, 1987). In general, a high technology industry is one which has a higher proportion of engineers and scientists than other industries, has a higher percentage of expenditures on R&D, has technology-oriented goods and services and a proportion of technology-oriented workers equal to 150% of the rate for all U.S. industries (Von Glinow, 1988). As such then, we refer to high tech workers as those professionals such as engineers and scientists engaged in knowledge exchange. Typically, they work within high tech industries; however, there are many industries other than those mentioned above which may employ high tech workers.

Recently, we investigated some of these differences in a large Fortune 100 electronics firm. Among the factors probed was pride in work and organizational satisfaction. The data from a relatively small sample of managers and engineers revealed that technical and professional employees were more likely to take pride in the quality of the technology than were their management counterparts who focused on the health of the business. When both groups were asked for sources of satisfaction, professional and technical workers mentioned challenging work, autonomy and variety in their work while their management counterparts were more likely to mention opportunities for promotion (Resnick, 1985). While the sample for this particular study was relatively small, these results have been consistently supported in studies of high tech employees in contrast to organizational employees (Miller, 1986; Von Glinow, 1988; Raelin, 1985).

The nature and cycle of their work differs as well. High tech employees frequently work within the realm of ideas, engaged in the innovation process. This creativity or innovation process is <u>at best</u> difficult to define, measure, evaluate or control (Von Glinow, 1988). Ideas are also difficult to schedule and when the time between conceptualization and product development is continually decreasing, this becomes particularly important for the highly competitive high tech firm. Scientists and technologists are never quite sure when the breakthrough will come, how long it will take to debug a program, or in the case of

the Challenger disaster, develop O-rings that do not freeze. In development work, creation often takes on a life of its own and breakthroughs rarely come at a controlled or predictable pace. Equally problematic here is knowing at what point in the innovation process to cease improving and refining the core ideas. One manager criticized the engineers over-attention to this idea-generating process by claiming "these kind of people don't know when to quit. They don't seem to know when good enough means good enough. This can destroy product scheduling." Thus, the organizational goals of prediction and control are difficult organizational criteria for the high tech employee to attend to while engaging in the innovation process. They are, however, the focal point for organizational employees.

The work of the manager involves considerable predictability and tends to be well controlled. Business planning cycles are reasonably predictable. They are conducted the same time each year; dividends are distributed and taxes are paid the same time every year as well. Innovations, however, seem to come at unpredictable and uncontrollable intervals and applying pressure only delays them. In essence, we believe that not only are there fundamental differences between high tech workers and their organizational counterparts, but these differences transcend the culture of the firm as well.

The Bureaucratic and Professional Culture Clash

Siehl, Ledford, Silverman and Foy (1987) liken culture to a magnet which holds a company together through shared patterns of

meaning. But magnets with similar poles can repel one another. It is our contention that if improperly managed, the culture of the high-tech employee strongly resists the organizational culture of predicability and control, which we have labeled the "bureaucratic culture." The culture of the high tech employee is the culture of innovation. This culture lacks organizational boundaries. Whereas the bureaucratic culture appears dominated by profit maximizing constraints, the culture of high tech is inspired by the constant search for new ideas and applications quite apart from financial criteria. The time span is necessarily long and forward-looking. At the core of the high tech culture is autonomy. High tech employees generally prefer not to be strategically or operationally involved with their bureaucratic counterparts (Bailyn, 1985).

The bureaucratic culture is a culture dominated by control systems emphasizing company loyalty, short-term profitability, hierarchical authority and control. It measures growth in terms of production output, volume and size. In view of these polar cultures it is not surprising that there are inherent tensions that arise within the high tech firm.

A key dilemma in managing high technology and professional employees is to skillfully manage the interface between the creative and innovative roles played by high tech workers and the roles played by managers in attempting to control the output and energies of these human resources (Von Glinow, 1988).

The clash of these cultures is perhaps no different than the myriad of other culture clashes which take place in American firms. What is more alarming about this clash is that it takes place at the core of the high tech business. It cannot be unobtrusively cast aside to fester or be relegated to a staff function. This issue is fundamental to the business, and affects day-to-day operations of the firm. Because this is integral to the firm's overall health, the following section examines the core clashes in greater detail.

The Expert Clash

Expertise, or prolonged specialized training in a technical specialty is a requisite characteristic of high tech professionals. However, the expertise that characterizes these high tech workers leads to overspecialization, communication problems and unnecessary turf battles (Raelin, 1985). In discussing product delivery delays one engineer offered a typical comment elucidating the expert clash. "There were far fewer communication problems and misunderstandings with the engineers from the Japanese part of the company than with the managers in headquarters."

The communication barriers become particularly frustrating for the technical employee when they are compounded by issues of power and decision authority. This was the case of the Thiokol Engineer describing his futile attempt to delay the Challenger:

> "So we spoke out and tried to explain once again the effects of low temperature. Arnie actually got up from his position which was down the table and put a quarter pad down in front

of the table, in front of the management folks, and tried to sketch out once again what his concern was with the joint, and when he realized he wasn't getting through he just stopped" (Presidential Commission, 1986, p. 92).

The education and training of technical professionals reinforces their position, but they ultimately do not have the power to make the decision. In some high tech firms, R&D managers perceive their future, salary and power in the organization to be lower than that of their marketing manager counterparts. Marketing managers, particularly in industries such as consumer products, where marketing is perceived as a high status function, seem keenly aware of these status differences (Gupta et al., 1986). On the other hand, some industries such as aerospace frequently limit hierarchical advancement into line management for those who lack the appropriate scientific and technical background. Status differences abound in such industries, with the high tech employees receiving the lion's share of the perks.

Of course, to some extent the expert clash may be somewhat industry-specific. Industries not employing a large number of both technical professional and organizational employees would likely suffer less from this clash, than would industries such as electronics, aerospace and defense, where a large number of both types are critical to the business.

Technical professionals have been known to exacerbate this clash by failing to discuss or communicate with their hierarchical superiors. To maintain their mystique and culture, or because their language tends to be filled with technical or scientific

jargon unknown to most outside the specialty, they frequently establish barriers between their technical specialty and lay people. When the lay person happens to be their hierarchical superior, coordination can be a nightmare (Raelin, 1985).

The Autonomy Clash

Stemming from high tech professionals' belief in their expertise is their desire for autonomy or control over selecting projects on which they work (strategic autonomy), and how the work is to be performed (operational autonomy). To some extent, granting these employees control over the day-to-day operational autonomy of how the work is done is just good management practice. High tech employees, because of their expertise, are particularly sensitive to control in this arena.

From an organizational perspective greater tension arises over the former type of autonomy--the strategic autonomy or what work is done (Bailyn, 1985).

This autonomy clash also reinforces the expert clash. Since technical professionals have a tremendous investment in their expertise, understanding a few areas very thoroughly, they tend to resist outsider interventions into those specialized areas of expertise.

Yet all business including high tech. requires balancing the demands of multiple stakeholders against the pull of technological advancement. The best business decisions may not always be the best technical decisions, yet ideally they reflect technical inputs.

Funding feuds frequently erupt around these balancing acts. Technologists, trying to convince management they are on the brink of discovery and worthy of funding, frequently underestimate the time required to turn technical innovation into usable customer-oriented product. Thus, another aspect of the autonomy clash, in addition to the quality of the decision, involves the amount of time it takes. Meeting customer requirements may directly conflict with engineering requirements.

Technological advancement frequently conflicts with the market for a given product. Rather than finding a niche and filling it, high tech professionals prefer to find cutting edges and advance them.

Keeping market and technological goals aligned is one of the more difficult problems in managing high tech firms and industries, such as banking, which routinely have a large high-tech component. Gibson (1987), for example, relays the tale of a debacled Citibank automation project. The initial intent of the project was to automate every aspect of bank work. Instead of giving the bank a huge competitive edge, it produced big bills and internal anguish. According to one insider, "The problem was that the computer power available then was inappropriate to the task, but those working on it said, "Just give us another budget review." They went from overrun to overrun. Eventually the bank brought in another technical team that reengineered and scaled down the project" (Gibson, 1987, pg. 23).

Like strategic autonomy over goals, timing and the perception of time is a continual tension between technical professionals and managers. Technologists, motivated by innovation often become furious when projects are cancelled for reasons relating more to short-term profitability than long-term technical success.

In highly competitive, shifting markets, strategic decisions often cancel well-run projects, as in the case of GM's Fiero automobile. The business demands shifting goals but threatens the professional's autonomy over what they do and how they do it (Raelin, 1985; Bailyn, 1985; Von Glinow, 1988).

The Standards Clash

Most technical professionals believe only colleagues with similar specialties are capable of evaluating their work. Because the work is frequently exploratory and abstract, they reason, one must understand the process of the work in order to evaluate it. Results may or may not be a measure of performance. In many professions one can do flawless technical work and not obtain short-term profitability. When that happens, as is frequently the case early in the research process when there are no tangible outcomes to assess, this poses a problem. Assessments by colleagues particularly early in a project are more likely to focus on how the work was done and how much it contributes to the growth of the field than on the project's financial performance. To technical professionals, how well the activity is done is frequently more important than its achieved results. Absent

interim measures, results are the sine qua non for high tech managers who need a common denominator to evaluate across professional groups. Herein lies one of the greatest strains between managers and technical professionals: the use of bureaucratic versus professional standards (Raelin, 1985), which we refer to as the standards clash.

As we have mentioned, technical professionals working on the creation of new knowledge generally believe ownership of these ideas resides in the public domain. This is why they prefer collegial maintenance of standards. When standards are promulgated, maintained, and upheld by a professional group of experts, the standards are less apt to be arbitrarily altered to meet organizational results.

When overt conflict over standards occurs, or when technical professionals become frustrated with seemingly insoluble problems, they often share those conceptual frustrations with colleagues outside the business. The frustration often leads to problem solving and the problem solving frequently leads to new discoveries. Because discovery occasionally occurs at a "watering hole" after work (Rogers and Larsen, 1984) another dilemma emerges: To whom does this new knowledge, created by a group effort, independent of the employing organization, belong? If such a problem-solving group stumbles upon a new innovation, which firm is the rightful owner? Some high tech firms, including those that comprise the many R&D consortia around the country today such

as MCA in Austin, Texas, believe that "discovery" is part of the public domain. Once those ideas shift to product development and new products begin to emerge, ownership shifts to the firm.

Professionals like to publish their findings in professional journals where they can receive recognition from their peers. Organizations on the other hand are reluctant to prematurely release information for proprietary reasons and fear of loosing their competitive edge. Thus, the dissemination of professional knowledge tends to be a strong point of contention. Technical professionals believe their careers are best served by maintaining professional contacts, and thus they want to publish their research results to insure their name remains "top of the mind." A clash occurs when the firm wants to keep the information confidential, or is under time pressure to meet changing markets. Under those conditions, the firm prefers that the professional spend time strictly on business issues, not on enhancing their career marketability.

Role models and feedback are critical for a professional's growth. Because these employees are more likely to identify with their professions than their company, their role models are likely to be external to the employing firm. As a measurement of their development, professionals look to the standards set by their external role models and, are likely to be motivated by feedback from those valued sources.

As we have noted tension occurs when professional standards are in conflict with organizational goals. The management of this tension is a challenge for the professional as well as the firm.

Of course, not all high tech professionals are like this; there are those who are solely interested in achieving rank and status within their own organizations. These people, referred to as "Locals" (Gouldner, 1957) are more likely to accept the standards established by the firm, and thus are less prone to the standards clash.

The Ethics Clash

Ethics was at the core of the Challenger tragedy. Not only did Thiokol management reverse their decision to launch, but levels of management above Thiokol withheld information from key decision makers. As unfortunate as this case was, it isn't an isolated incident. Ethics clashes like this routinely appear and range from the highly publicized aircraft brake scandal of B. F. Goodrich, the Chernobyl crisis, and Three Mile Island to more minor product delays or product malfunctions which disappear from the public attention rather quickly. Typically the technical professional sounds an alarm, which gets muffled by the middle so as not to upset the top.

The Thiokol management did not intentionally act unethically, most of us rarely do. Ethics frequently becomes the area of ambivalence where unethical behaviors inadvertently become rewarded and reinforced through regular organizational practices.

Because they see themselves as members of a larger community, professionals are more likely to make judgements based on the well-being of that professional community than on the well-being of the business.

Tension around ethical issues can take several forms. The professional's code of ethics may conflict sharply with an organization's seemingly deceptive product marketing. The firm's desire for secrecy around new products may conflict with the professional's commitment to disseminate information, or a firm's overt disregard for ethical considerations in the use of research may conflict with the professional code.

Professional ethics generally define the do's and don'ts of the profession. Since they are written across organizational boundaries professionals view themselves as having responsibilities beyond the boundaries of any one organization. Problems arise when the ethics of the profession clash with the interest of the firm (Benveniste, 1987).

Given our current technology, decisions made in the context of a single organization can have tremendous repercussions for the general public. Problems of pollution, and chemical and nuclear dumps typify this concern. Professionals' training alerts them to the danger of these acts before the lay person notices them. Frequently, business people trained to focus solely on their goals and their short-term results fail to observe the implications until its too late. One manager in our sample noticed that

"obstacles are those frightening things you see when you take your eyes off the goal." While sometimes motivational a company culture built on that philosophy can suffer from tunnel vision. When that gap in perspective becomes regularized, ethics clashes will frequently arise.

Sometimes the tension is covered-up as in the case of the Challenger. With almost machismo-like fever, middle management "bet the store" that they could outrun the technologists' concerns. Other times, the tension is illustrated by the professional's open dissent and challenge to managerial authority. This tension, like the others must effectively be managed if one is to effectively manage the high tech professional.

The Clash Over Commitment to Calling/Love of Work

At the core of many employee involvement movements in the U.S., today is the notion of ownership. If workers feel they "own" the project, their motivation increases (Lawler, 1986). Without any effort on the part of management to build employee ownership, technical professionals already experience ownership. The very nature of the socialization process instills a sense of commitment, of love of work that very frequently has little to do with the rewards attached. Benveniste (1987) calls this quasi-religious fever commitment to one's calling.

Commitment to calling is the very thing that caused the Thiokol engineers to get down on the floor with a quad pad and repeatedly try to infiltrate the barriers to communication. It's

a type of magic that, once engendered, is exceptionally powerful as a motivational tool. Professionals' training instills in them a sense of commitment to calling and love of work that cannot be duplicated by the organization. Nevertheless, the organization can influence the extent to which professionals may participate in projects where their commitment will be evident. While it is very difficult for the firm to create this commitment, it is somewhat easier to erode. The erosion begins when communication barriers are impenetrable, budgets are cut below a level that allows a competent job, and when turnaround is too short for existing tasks. Much of the mismanagement of these professionals comes from the organizationally--enforced erosion of their sense of commitment (Von Glinow, 1988).

The External Identification Clash

The knowledge base for scientific and technical professionals changes rapidly. Professional groups emerge to help professionals keep in touch with the advancements in new knowledge (Hall, 1985). In order to keep current in their technical specialty, professionals tend to seek out other professionals through professional alliances. These external referents serve as reinforcement and encourage professionals to push for their own standards within bureaucratic structures. The professional associations exert tremendous social and political influence through the dissemination of knowledge, updating members on current trends, affording contact with other professionals,

accrediting and establishing standards of ethics, conduct and behavior. Thus, the professional who identifies with the profession over the employing organization can receive considerable support from his or her peers. This support, professionals claim, is rarely offered by the firm particularly if there are few specialists in the technical specialty.

In summary Table 1 highlights some of these common clashes between the high tech professional and the firm.

Insert Table 1 about here

Attaining Cultural Compatibility

Professionals, fueled by their expertise and demands for autonomy, chafe at overly-rigid bureaucratic structures. Organizations, designed for prediction and control typically tighten the supervision of professionals when that occurs. The task of leadership is to harmonize the two, which is an extremely difficult task. For this to happen, both the professional and bureaucratic culture must learn to tolerate and accommodate aspects of the other. The result of this fusion is a third type of culture, a new kind of organization where professional integrity is maintained, and organizational goals are valued.

Drucker (1988) likens this new organization type to a hospital or symphony. Like them, he hypothesizes, these new organizations will be "composed largely of specialists who direct the discipline their own performance" (p. 45). Organizational

goals will be based on this performances and reflect professional inputs far more significantly than today's organizations do.

Drucker (1988) refers to this as ר information-based organization where the management side of most high tech firms will be cut from one-third to one-half its current members. He notes that this structure bears little resemblance to our current organizational forms, noting that organizations of the future will have little choice but to become information-based. This is due partly to demographic factors that have shifted employment away from manual and clerical workers to knowledge workers who, as we have noted, resist the "command and control" model borrowed from the military over a century ago (Drucker, 1988).

We believe that ultimately organizations that employ high tech professionals will evolve structurally and philosophically to this position. Currently, most high tech firms are undergoing transitions that reflect the demographic changes and cultural clashes that we have highlighted.

Organizational change is often neatly defined as a three step process. One defines the future state, assesses the current state and manages the transition (Beckhard, 1969). Drucker (1988) and others involved in high tech management have defined the future state. We believe that this chapter is a first attempt at addressing transitional issues in a positive way. We believe managers can begin to systematically deal with the clashes we have highlighted, by incorporating the following suggestions into their

day-to-day interactions with high tech professionals. These suggestions have had success across a wide array of high tech organizations employing numerous high tech professionals. We offer them here as harmonizing methods for easing culture clash.

Set a Vision

It is common for most firms to have a mission statement. What is less common is the fact that few high tech firms involve their technical staff in creating that mission, or vision. Since these employees are central to the firm and comprise the organizational knowledge bank for generating ideas and products, these employees should not be merely an afterthought. Particularly when so many high tech firms today concentrate a tremendous amount of energy into attracting, compensating, and retaining these workers, their inputs should be sought prior to generating the mission or vision of the firm. The firm should ideally include the high tech professional in the creation and operationalization of the vision. An effort should be made to include the professional's opinions. These workers generally come to the table with a demonstrated capacity for commitment to their technical speciality and a work ethic that is strong. Company leaders need to build upon that commitment by considering them not as adjunct prima donnas, but as critical stakeholders. This is a difficult task particularly since professional and organizational goals are frequently "at an angle" to one another, but one that successful firms, such as Apple, Hewlett Packard and Intel manage

to accomplish. Establishing a vision that all stakeholders share is a fundamental step in creating a loyal work force.

Implementing a vision sounds easy enough to accomplish, yet in reality, is extremely difficult. Setting a vision is reasonably easy. Communicating the vision and causing others to believe it is more complex. It takes vigilance, attention to detail, and use of every possible aspect of the organization (Lawler, 1986). One company president went to great expense to develop a video message to share part of his vision and the state of the business with his 8,000 employees. One year later he lamented, when during a staff meeting, no one sitting round the table had seen or remembered the video. Alternatively, another CEO used the same format to communicate massive restructuring and culture change and that video has become part of the folklore of that firm.

Although, communicating a vision which treats the high tech employee as a stakeholder is an important element for mobilizing change, the real key to managing the transition lies in concrete actions. We turn next to a discussion of those.

Show Them the Big Picture. Many of the tensions which arise between high tech professionals and their management stem from differences in their perspective and ability to understand the demands of the other's position. Concerted efforts to show both groups the big picture and the role they play in it is helpful.

This suggests rotating high tech employees periodically through some of the other functional areas.

For example, an engineer in one high tech firm was sent to Europe to install, and work with the marketing department as they presented a new product at a trade show. The engineer was amazed by both the intelligence and depth of the marketing people and the customers, and upon his return suggested that more engineers be allowed to experience the same type of activity.

Bemis Company, involved in packaging, often has its engineers accompany salespeople to listen to customer needs. We not only advocate technical specialists spending time in a functional role but we also advocate the reverse. The latter is done less frequently; however, the few cases of which we were aware reported favorable results. Thus, marketing, manufacturing, and staff personnel would also be well served by spending time in product development turf.

An important result of showing employees the big picture is that they usually begin to feel that they play a part in it. But, inspiring employees to feel part of the business doesn't do any good if they don't have the skills to gainfully participate. Many corporations, Xerox and General Electric among them, are training all employees in basic fiscal management. When everyone understands the financial impact of such things as too much inventory, etc. they are capable of making financially sound

decisions, and as a result, more likely to participate in the business.

When the technical professional's interests go toward expanding their repertoire of skills, they should be encouraged to both rotate through other functions or seek advanced training either through in-house educational programs or through university-based programs. Job rotation affords an excellent opportunity to experience another function's job-related problems. When marketing employees are pulled from the ranks of the technical community in which they have rotated, many of the differences between the two have reportedly dissolved (Gupta et al., 1986).

This type of rotation has been shown to be extremely successful and is the hallmark of most Japanese sogo sosha, or large trading firms such as Mitsui and Mitsubishi, including their American subsidiaries. It does, however require some willingness on the part of the technical employee as well as careful manpower planning to assure skill distribution, and equitable reward distribution.

A natural way to both improve products and expand the horizon of both technical professionals and others is to use cross functional teams to develop products. We now discuss those teams as well as other structural solutions to the problem of culture clash.

Create Interdisciplinary Teams

Developing a product is more like playing rugby, than participating in a relay race. In today's competitive market, speed and flexibility is as important as high quality, low cost and differentiation. The traditional sequential "relay race" approach to product development--exemplified by the National Aeronautics and Space Administration's Phased Program Planning (PPP) system--may conflict with the goals of maximum speed and flexibility. Instead, a holistic or "rugby" approach--where a team tries to go the distance as a unit, passing the ball back and forth--may better serve today's competitive requirements, (Takeuchi and Nonaka, 1986).

Many companies now use product development teams comprised of members from engineering, manufacturing, sales, marketing, and service. When structured correctly these interdisciplinary teams have been highly successful in reducing the time it takes to get a product to market. Referred to as quasi-structure by Schoonhoven and Jelinek in their chapter, these teams exist in concert with the traditional formal organizational structure, as well as the more "informal" networks of the organization. These intermediate-level structures have a considerable success record in high tech firms that must constantly innovate to remain competitive. Xerox for example, has been able to halve both the number of people and time it takes to develop a product (Hought, 1987). Sun Company, in its upstream activities always involve experts and technicians in interdisciplinary project teams.

Working together on a common goal is also one of the most effective means of reducing cultural tension (Sharif, 1951). Nevertheless, when the teams are not established and managed appropriately, cultural differences polarize the team rather than serving as a means of pulling the organization together. The cultural differences sited earlier in this chapter, can cause problems in communication which are not ameliorated by simply putting a group of technical and marketing people together and instructing them to "be creative." These teams need to be given skills in order to work with each other. Cultural differences need to be made explicit so that problems stemming from them can be addressed and subsequently resolved. To some extent, quality circles (QC) serve the same purpose. Although QC has had a checkered history in firms where the culture has not supported the activities, firms which have blended competing cultures together successfully, such as HP and Honeywell, claim their interdisciplinary QC teams work satisfactorily.

This type of interdisciplinary team tampers with the normal power structure of the organization. Team members need to have new skills in group decision processes. These teams, by their nature, also lead to flatter organizations since the teams provide their own management. Flatter organizations in turn increase the probability that technical problems are heard by key decision makers. At NASA, at the time of the Challenger disaster, the organizational structure had become so complex that the people with technical expertise became isolated from important technical

decisions. People that designed the product were no longer involved in decision making.

To address the problem of group decision making, both TRW and Xerox Corporation heavily involve their organizational development specialists in product development, so that the latter can transfer the skills necessary for team performance. The use of these teams has reduced the number of organizational levels at Xerox thus reducing the middle level's muffling of technical messages.

One frustrated ex-technical professional-turned-entrepreneur suggested that development teams be allowed to pick their own team members. However, not all development teams have the big picture in mind when selecting team members. The selection of team members and the development of employees capable of working in this arrangement becomes a key role for management in the high tech firm. To guarantee interdisciplinary team success, management must insure that the environment is ripe for teamwork. This does not mean that management should squelch conflict. On the contrary, too little conflict has been cited as the primary reason for many organizational failures, including Penn Central. Some prior training in conflict resolution and problem solving may enhance team activities.

Tolerate Confrontation

One important key to managing corporations with high tech employees is to learn to tolerate confrontation. In the bureaucratic organization confrontation is tantamount to

insubordination. In technical professional cultures, confrontation and disagreement is frequently the way the sciences or professions advance themselves. Similar to the problem of working in interdisciplinary groups, management needs to support the statement that "disagreement is health" and as such, encourage that confrontation skills be taught. Since disagreements are inevitable, learning to confront without hostility is critical to achieving a creative synergistic work force.

Tolerance for diversity has been labelled a cognitive style--one where some individuals may be more psychologically-suited to greater levels of diversity than others. This then argues for some type of cognitive style or skill assessment to ensure that interdisciplinary teams are comprised of individuals who have the greatest likelihood to tolerate and grow from diversity.

Share the Wealth

Many high tech firms fail to share the wealth with all relevant stakeholders. The concept of wealth-sharing involves providing greater return to high tech workers from a profitable season. This might take the form of stock options, profit sharing, gain sharing and/or other means of sharing wealth (Schuster, 1985). When profitability stems from direct contributions by interdisciplinary teams, all team members should benefit, not just senior management.

Generally, wealth-sharing plans include both a short- and a long-term incentive plan. The short-term plan emphasizes a period

of twelve months or less, while the long-term plan typically is based on performance over a period of time in excess of twelve months. This is particularly relevant to the high tech professional, because many innovations take far longer than twelve months to reach fruition. Nevertheless, the product life cycle for new high tech products is being reduced daily. In fact, the average period for electronics and computers may be less than one year (Riggs, 1983).

Most high tech firms use stock options as the principal form of long-term incentive (Schuster, 1985) and use a pool of incentive dollars distributed on the basis of some measure of performance as short-term incentives (Von Glinow, 1988; Gomez-Mejia and Balkin, 1985).

We are not altogether comfortable with these methods, for reasons which we discuss in the next section. What is relevant for managers involved in managing high tech workers, is that compensation and wealth-sharing schemes should ideally be designed to communicate and reward performance that is consistent with the firm's performance objectives (Von Glinow, 1988). If the link between wealth-sharing and performance is missing, predictable woes occur for most high tech firms caught in the drive for increased productivity to bolster their competitive edge. A key question for managers is, just what is meant by the term "wealth?"

Reward Appropriately. When the term wealth-sharing is mentioned, we typically think of money and other financial

components. However, review studies in a variety of high tech industries have consistently shown, that traditional rewards, including money, promotions, status symbols, and the like are consistently less important in controlling the performance of professional and high tech workers (Von Glinow, 1988). When we suggest that wealth-sharing is important, we mean that rewards should be seen as appropriately distributed. That is, rewards should be seen as important to those who receive them.

In general, financial rewards lack leverage in incenting high tech workers to perform (Von Glinow, 1988; Griggs and Manring, 1986; Miller, 1986). They tend to be weak as far as motivating professionals to perform and still weaker as retention devices. Money is cited as less important than almost all other categories or rewards for high tech professionals. When we remember that professionals value the work they do because they are committed to their "calling," it is easier to see that they are motivated not because of financial incentive, but because of the nature of the work itself.

Table 2 illustrates the rewards that are most valued by high tech and professional workers. The key is that the most important rewards have to do with the professional rewards and the nature of

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Insert Table 2 about here

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the work itself, and <u>not</u> financial rewards. There are of course some rewards that may be valued by different age categories. For

example, people in their 20's seem to respond to job content rewards (or the nature of the work itself), and a few financial rewards; those in their 30's respond to professional rewards; the professionals in their 40's respond to professional, career, and job content rewards; people in their 50's want greater social, financial and career rewards; and finally, people in their 60's seem to value financial and some social status rewards (Von Glinow, 1988).

In all, it seems exceedingly important to us that managers be aware of the different rewards and their appropriateness for different age categories. This awareness should be followed by systematizing those meaningful rewards into a reward system aimed at different types of individuals. In other words, some tailoring to the high tech professional is strongly advocated.

Conclusion

In conclusion, this paper has identified key clashes which separate technical professionals from their organizational counterparts and suggested ways of ameliorating those clashes. Successfully managing the transition from today's high tech firm, riddled with culture clash, to tomorrow's high tech firm harmonized with diversity requires attention to multiple factors. The firm must be willing to set a vision, which includes all its stakeholders, and communicate that vision so all involved understand the firm's goals. To facilitate this vision, we recommend managers encourage rotation of technical professionals

with other functional areas of the high tech firm, such that each side comes to better understand the requirements of the other's position. This entails showing everybody the "big picture."

Similarly, we encourage the formation of interdisciplinary teams, comprised of not only technical professionals, but marketing, manufacturing and other personnel involved in getting the product from idea stage to market. Since this de facto means a certain element of conflict and confrontation, we suggest that such conflict not be "avoided at all costs," but rather, be encouraged, with appropriate conflict-resolution and confrontation-handling skills as part of the training program of the interdisciplinary teams.

Finally, we recommend that the wealth be shared more with all members of the team, not strictly the key contributors. Key contributors programs have generally failed to incent professionals to perform since by definition a key contributor program singles out individuals, not teams. We believe that rewards may be more appropriately administered if attention is paid to which rewards are most salient for technical professionals. We cite new research which weights the relative salience of a variety of rewards, across different age categories, for technical professionals.

Perhaps one of the most important recommendations for the successful management of high tech firms, is to be aware of the

perception held by the international community of the current management of U.S. high tech industry today.

Since the 1960s, the world opinion of the competence with which U.S. high tech firms are managed has declined dramatically (Sexton, 1988; Madique and Hayes, 1984). The U.S. has failed at keeping pace with many other countries, most notably Japan and many of the NICs, in terms of patents, invention rates, and important new innovations, and this has been attributed to poor management (Riggs, 1983). All of our recommendations become highly pertinent when world opinion of U.S. high tech management is so low.

We believe these recommendations will have particular salience for managers and leaders concerned with managing the transition from today's firm, to tomorrow's. The transition will undoubtedly be a difficult one for most managers, and firms modeled after the military model, or that of old-line manufacturing firms. Given that such out-dated emphases have predominated management thinking, it is time that high tech management in particular be alert and receptive to change. To some extent, a change of world view may be necessary to attain competitive advantage.

We began this chapter with an excerpt from the president's commission analyzing the causes of the Challenger disaster. Since the event, many organizational researchers and case writers (Maier, 1988; Marx, Stubbart, Traub, and Cavanaugh, 1987;

Schwartz, 1987) have studied the events which lead to the disaster. Some have hypothesized that the disaster was inevitable given NASA's post moon landing environment. They believe post-Apollo NASA lacked vision and direction, was racked with an over-politicized environment, funding deficits, and a culture so infiltrated with "can do" that they couldn't hear "we can't." The problems which lead to the Challenger disaster were equally as systemic.

NASA and its contractors are not unlike many firms which employ high tech professionals. Perhaps they are more mature than some and, precisely because of that, we believe the Challenger incident has a lesson to offer. In this chapter we have made systemic recommendations because we believe the problems stemming from the clash between technical professionals and their organizations are widespread and involve multiple aspects.

The reason we advocate such massive change, is that many of the previously-mentioned clashes arise from the fact that most high tech professional workers are considered difficult to manage. Attributions such as prima donna, and space-cadet abound. It is our contention that these high tech professional workers are not eccentricities that the firm must endure in order to produce new product and process innovations. They are not adjuncts, nor peripherals, to be "put up with" in one manager's words. Rather, these people are essential to the production process. They are the raison d'etre for the high tech firm, and managing to

accommodate them is central to the mission of the firm. Without a change of organizational philosophy such that differences are tolerated and respected, we predict that firms of the 1990s will fail in their attempt to attract, motivate and retain these valued workers. When that occurs, these firms will cease to remain competitive.

Thus, in conclusion we believe that managing the transition is necessary to achieving organizational growth. But for high tech firms to competitively enter the nineties, committed managers and diverse high tech professionals must respect each other's diversity, and change out-dated structures and practices to reflect the new high tech firms of our future.

REFERENCES

Bailyn, Lotte. "Autonomy in the Industrial R&D Lab" Human Resource Management, 1985, Vol. 24, No. 2, pp. 129-146.

Beckhard, Richard. Organizational Development: Strategies and Models, Reading, Mass.: Addison-Wesley, 1969.

Belous, Richard. "High Technology Labor Markets: Projections and Policy Implications." Human Resource Management in High Technology Firms, edited by A. Kleingartner & C. Anderson, pp. 24-25, Lexington Books, 1987.

Benveniste, Guy. Professionalizing the Organization. San Francisco: Jossey-Bass, 1987.

Drucker, Peter F., "The Coming of the New Organization," Harvard Business Review, January-February, 1988, pp. 45-53.

Gibson, Richard, "Managing the Techies: Closing the Lab Coat-Pinstripe Gap," Wall Street Journal Special Report, June 12, 1987, pp. 23

Gibson, Richard, "Managing the Techies," Wall Street Journal, Special Report, June 12, 1987.

Gomez-Mejia, Luis and Balkin, David. "Managing a High Tech Venture." Organizational Dynamics, February, 1987.

Griggs, Walter H. and Susan Manring. "Increasing the Effectiveness of Technical Professionals" Management Review, May, 1986.

Gupta, Ashok Raj and David Wilemon, "R&D and Marketing Managers in High-Tech Companies: Are They Different?," IEEE Transactions on Engineering Management, Vol. EM33, No. 1, February 1986.

Hought, Thomas M. "Working Better and Faster with Fewer People," Wall Street Journal, 15 May 1987.

Lawler, Edward E. High-Involvement Management. San Francisco: Jossey-Bass, 1986.

Lawler, Edward E. Pay and Organizational Effectiveness: A Psychological View. New York: McGraw Hill, 1971.

Madique, Modesto A. and Robert H. Hayes. "The Art of High Technology Management," Sloan Management Review, Winter, 1984.

Maier, Mark. The Final Hours of Flight 51-L: Using the Space Shuttle Tragedy to Teach About Ethics and Organizational (Mis)Communication. A bibliography of references compiled for 2nd Annual Regional Organizational Behavior Teaching Conference. Philadelphia; March 12, 1988.

Marx, Robert, Charles Stubbart, Virginia Traub, and Michael Cavanaugh. "The NASA Space Shuttle Disaster: A Case Study." Journal of Management Case Studies, 1987, 3, pp. 300-318.

Miller, Donald B. Managing Professionals in Research and Development. San Francisco: Jossey-Bass, 1986.

President's commission Report on the Challenger, etc. Report to the President By the Presidential Commission on the Space Shuttle Challenger Accident, Washington, DC 1986.

Raelin, Joseph. "The Basis for the Professional's Resistance to Managerial Control." Human Resource Management, 1985, Vol. 24, pp. 147-176.

Raelin, Joseph, C. K. Sholl. and D. Leonard. "Why Professionals Turn Sour and What to Do." Personnel, October 1985, 62 (10), p. 28-41.

Resnick, Susan M., Pride in Xerox: A Study of Employee Attitudes and Morale, Technical Report. Xerox Corporation El Segundo, 1985.

Riggs, Henry E. Managing High-Technology Companies. Belmont, California: Lifetime Learning Publications, 1983.

Rogers, Everett and J. K. Larsen Silicon Valley Fever: Growth of Hith Technology Culture, NY: Basic Books, 1984.

Rogers, Everett M. and Thomas W. Valente. "Technology Transfer in High Technology Industries," Paper presented at the Second Annual IBEAR Research Conference, University of Southern California, April, 1988.

Schuster, Jay. "Compensation Plan Design," Compensation Plans, May, 1985.

Schwartz, Howard. "On the Psychodynamics of Organizational Disaster: The Case of the Space Shuttle Challenger." The Columbia Journal of World Business. Volume XXII, Number 1, Spring 1987.

Sexton, Donald L. "Propensity for Change: A Prerequisite for Growth in High Technology Firms," paper presented at the Managing the High Technology Firm, Boulder, Colorado, January, 1988.

Sharif, 1951. Experimental study of intergroup relations. In J. Rohrer and M. Sherif (Eds.), Social Psychology at the Crossroads. New York: Harper and Row, 1951. pp. 388-426.

Siehl, Caren, Gerald Ledford, Richard Silverman and Peter Foy, "Managing Cultural Differences in Mergers and Acquisitions: The Role of the Human Resource Function," Mergers and Acquisitions.

Takeuchi, Hirotaka and Ikujiro Nonaka, "The New Product Development Game." Harvard Business Review, January-February, 1986, Volume 64, Number 1, pp. 137-147.

Von Glinow, Mary Ann. The New Professionals: Managing Today's High Tech Employees. Cambridge, Mass: Ballinger Publishing Company, 1988.

Table 1

Culture Clashes Between Professionals and Organizations

Clash Categories	Bureaucracy		Professional
Expert Clash:	Hierarchical/ organizational control	vs.	Expert Evaluation and Control
Standards Clash:	Rules of the company	vs.	Professional standards
Ethics Clash:	Organizational secrecy	vs.	Dissemination of information
Commitment Clash:	Organizational loyalty	vs.	Commitment to the field or profession
Autonomy Clash:	Organizational decision making	vs.	Professional demands for strategic and operational autonomy

Table 2

Rewards Most Valued by High Technology and Professional Workers

Professional Rewards

1. Opportunity to work with top-flight professionals
2. Freedom to make the most of your own work decisions
3. Intellectually-stimulating work environment
4. Not working on repeating yesterday, but working on tomorrow
5. Having an impact on national legislation

Job Content Rewards

1. A productive atmosphere
2. Flexible work hours
3. Long-term project stability
4. Opportunities to address significant human needs
5. Diversity of business that creates continuing new opportunities
6. Patriotic projects
7. Projects of an altruistic nature

Career Rewards

1. Working for a leading-edge company
2. Diverse opportunities for personal growth and advancement
3. Opportunity to participate in the company's successes
4. Career opportunities to stay ahead of the crowd
5. The chance to get in on the ground floor of important projects
6. Opportunities for self-expression
7. Being able to play a role in the company's future

Social Status or Prestige Rewards

1. Beautiful location
2. Open-door management
3. Extensive recreational facilities

Financial

1. Twice yearly salary reviews
2. Compensation for unused leave
3. Cash bonuses

Source: Von Glinow, 1988.