Strategic Reorientation in Times of Economic Crisis: Operationalizing Ambidexterity in Dual-Use Technology Organizations

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**Abstract**

The concept of ambidexterity and the mechanics of how explorative and exploitative activities are accomplished in dual-use technology organizations are studied in this paper. Ambidexterity has been addressed by numerous studies and in multiple contexts. There is, however, limited research on ambidexterity in dual-use technology organizations. This research studies the ambidextrous activities executed by dual-use organizations (Trimble, Raytheon, Texas Instruments and Rockwell Collins) under the economic crisis following the end of the cold war era. Because of uncertainties triggered by an economic crisis; firms develop strategic reorientation plans where numerous ambidextrous activities are executed. We uncovered acquisitions and divestitures of business units as the most frequently executed ambidextrous activities based on the organization’s strategic outcome. Some organizations rely mostly on exploration or exploitation alone, while others choose balanced approaches to ambidextrous activities; however, the execution of equal amounts of ambidextrous activities may not be feasible for defense and dual-use organizations.
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Introduction

The concept of ambidextrous organization was coined by Robert Duncan (1976) as a way of describing the “dual structures” many organizations put in place to manage activities that involve different time horizons and managerial capabilities. He argued that organizations needed to shift structures to initiate and, in turn, execute innovation. Tushman and O’Reilly (1996) proposed that organizations needed to explore and exploit simultaneously, to be ambidextrous. Their conclusion
was that “To remain successful over long periods, managers and organization must be ambidextrous – able to implement both incremental and revolutionary change”.

March (1991) identified that exploration activities include things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. Additionally, exploitation activities include such things as refinement, choice, production, efficiency, selection, implementation, execution. Tushman and O’Reilly (1996) further assert that what ambidexterity means for an organization is that they must have the ability to maintain the current successful status-quo of their products and at the same time be able to create innovative products and/or services that will help the organization to remain profitable over long periods of time.

Markides and Charitou (2004) further examine a specific aspect where organizations must address a dichotomy in their strategic planning and execution for the purposes of staying competitive in a fast-changing business environment. They address the dilemma of the potential growth that a successful implementation of a ‘radical’ business model would bring to the organization. The same radical business model carries indeed also the risk of destroying value for the organization. They suggest that such organizations need to establish a balanced approach to achieve value generation when executing ambidextrous activities, namely exploration and exploitation.

There are numerous academic papers available to enlighten organizations on how to formulate and execute ambidextrous strategies; as Lavie et al (2010) explains, by maintaining balance between their exploration and exploitation activities. Gibson and Birkinshaw (2004) suggest balancing the activities by maintaining a single organizational unit and implementing discipline, support and trust. Brown and Eisenhardt (1997) suggest the strategic temporal separation of exploration and exploitation over time. Additional scholars propose the separation by means of distinct organizations (Benner and Tushman, 2003; Markides and Charitou, 2004). Furthermore; other
research suggests achieving ambidexterity for ensuring firm’s survivability when faced with economic crises (Raisch et al., 2008, Jansen et al., 2006, Raisch et al., 2009 and Staw et al., 1981). Most of these publications address those organizations that support exclusively the civilian markets and industries; including, amongst others, the automobile industry, multinational manufacturing, high-tech, restaurant chains, computer industry, financial services, package foods, etc. While these studies are unquestionably significant, they are not representative of all organizations nor of all the industries. One noticeable gap in documented research is consequently found in the dual-use technology organizations that deliver products and services for both the commercial and defense markets and consequently are part of the understudied defense and dual-use industries.

During the 90’s, firms doing business with Department of Defense experienced drops in R&D funding (see Figure 1) as well as drops in public procurement, in the US and in other geographic areas. In the case of the US the funding drop was mainly attributed to the perceived disappearance of the cold war era enemy, the Soviet Union. The effects of the economic crisis prompted dual-use organizations to react by reallocating their assets to ensure survival and longevity; these reallocations could manifest themselves by exploring new strategic directions for the organization or by exploiting the current limited assets in more efficient manners to ensure survival.

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This paper addresses the following important question: \textit{what are the ambidextrous activities that dual-use technology organizations execute to adapt under an economic crisis environment?} The study covers the decade that followed the collapse of the Soviet Union (1990 to 2000), due to the
significance of the economic crisis that ensued when massive defense budget cuts created an unprecedented crisis for the defense and dual-use organizations of the time. This paper focuses on dual-use organizations because the existing literature is slim in research associated with this type of industry; in addition, the case study of dual-use organizations will emphasize the results given the fact that these organizations were the most affected by the economic crisis of that period. Our expectation is to inquire the possibility of achieving ambidexterity for ensuring firm’s survivability when faced with economic crises in a similar fashion as it has been addressed by several academics for commercial organizations (Raisch et al., 2008, Jansen et al., 2006, Raisch et al., 2009 and Staw et al., 1981). We intend to complement the current ambidexterity literature by providing a new perspective based on the dual-use organizations as an empirical case study.

The following section provides the background literature review which includes the dual-use technology concept and the ambidexterity theory. Then, the methodology is described followed by the findings, conclusion, contributions and limitations sections.

**Background Theory**

The concept of dual-use technology has been addressed under multiple frameworks; the most predominant papers, including Merchant and Pope (2009), address dual-use technology from the ethical and policymaking points of view. Thornton (2007) remarks that the concept of dual-use was broadly used during the decade of defense industry consolidation (1990 to 2000) to address the economic dislocation generated from the reduction in defense budget spending after the end of the cold war. The government created a program aimed at promoting the creation of commercial products based on military products or military research; this concept would amount to the creation of innovations with the purpose of ensuring longevity; in other words, executing exploratory activities (under the ambidexterity context).
Schmitt et al. (2010) suggest that ambidexterity is either triggered or accelerated given an economic crisis; they further argue, that resource availability is critical for the execution of ambidexterity. For the purposes of this research, we consider the 1990’s decade as a time when defense and dual-use organizations experienced economic crisis; consequently, their available resources were drastically diminished and necessitated strategic re-allocation. The definition of crisis taken from Schmitt et al. (2010) states that crisis is an uncertain situation that poses major threats to organizational survival (Pearson and Clair, 1998), whose causes and effects are unknown (Dutton, 1986), to which there may be little time to respond (Hermann, 1963) and which requires decisions or judgments that will result in a change for the better or the worse (Marcus and Goodman, 1991). This definition is applicable to our research as we consider the defense budget cuts as the trigger of an economic crisis that sent many defense and dual-use organizations into a battle for survival.

Jansen, et al. (2006) further argue that under conditions of economic crisis, there is a need for the execution of exploitation and exploration at the same time. Raisch et al. (2009) maintain that in organizational crisis, ambidexterity is likely to be positively related to the survival of the organization. Sanchez (1995) and Harrigan (1985), argue for flexible organizational capabilities to better respond to environmental changes and sustain competitive advantages; this implies the execution of ambidextrous activities. Bowman and Hurry (1993) mention that organizations that exercise their flexible capabilities have the advantage of outperforming competitors under situations of environmental change; this implies the ability to perform both, exploration and exploitation.

Some scholars, including Levinthal and March (1993) and March (1991), have further argued that environmental scarcity and the need for proximate outcomes cause exploitation to drive out
exploration. Furthermore, Staw et al. (1981) suggest that organizations leverage existing competencies and capabilities only through exploitation in the presence of economic crisis; while Hedberg, et al. (1976) conversely argue that exploration is an appropriate response. Similarly, Virany et al. (1992), as well as Tushman and Rosenkopf (1996) have studied strategic reorientations and have positively associated them with organizational adaptation under environmental crises. Consequently; despite the vast research material available, there are still contradictory research results proposing the positive or negative relationship between ambidexterity in the presence of economic crises.

Lin (2011) argues that corporate-level strategy involves the continuous pursuit of new domains, in which organizational ability is explored and exploited to create value from using its competencies. She asserts that the exploration of new markets and the exploitation of the existing ones are unquestionably the major reason for acquisitions. Furthermore; mergers and acquisitions, consisting of related and unrelated acquisitions, have been considered as an effective corporate-level strategy in recent decades (Barkema and Schijven, 2008, Shave and Mezias, 2009).

As discussed by O’Reilly and Tushman (2013), the multiple case studies conducted over several decades have paved the way in capturing the complexities of ambidexterity and help ground the phenomenon. However; The case of the defense industry has not been explored or analyzed under the ambidexterity construct. Hence; this paper offers a perspective based on the experienced complexities and decisions made by dual-use and defense organizations under the economic crisis environment of the post-cold war era. Furthermore, this research aims at providing a better understanding on how organizations shift between exploration and exploitation in the presence of economic crisis and the process of adapting to new economic conditions.
**Methodology**

We employed a qualitative content analysis to investigate the selected organization’s data associated with their chronological histories for the period starting in 1990 to 2000. Over 1600 articles were reviewed to identify the important ‘strategic activities’ executed by each one of the organizations. Additionally, the chronological history of each of the selected organizations was reviewed and event timelines were identified for each one of the organizations. N-Vivo software was utilized to facilitate the content analysis and to code the findings.

We consider that the organizations that were part of the initial GPS receiver creation would be of utmost importance to our research for several reasons. First the genesis and development of the GPS receiver aligns with our selected analysis timeframe (1990 to 2000). Second, the organizations were fabricating products (including the GPS receiver) that were funded with government money. Finally, this product (the GPS receiver) provides an important contextual perspective associated with the overall defense and dual-use industries.

We implemented rigorous selection criteria to select the case study organizations. The criteria included the following: We considered and selected those firms that produced commercial, defense or dual-use products. Furthermore, we down selected those companies that were part of the original production of the GPS receiver. We then conducted a preliminary content data analysis and found a smaller and meaningful number of organizations. Finally, we nominated only those organizations which are still in business today, namely: Raytheon, Rockwell Collins, Trimble and Texas Instruments.

We then collected extensive archival data on the four selected organizations for the period of interest. The data originated from the organizations’ websites, newspapers, magazines, financial newspapers, the trade press and business press. Similar data sources have been built and utilized
by Humphreys and Latour, (2013) as they declare that data from newspapers tend to be stable indicators of events; newspapers form a metric for established cultural associations that is comparable over time. Data were collected in exhaustive searches on the LexisNexis database; additional authors utilizing the similar databases include Cichy and Salge (2017) and Lundahl (2018). The keyword searches employed included the name of the company paired up with the following words: merger, acquisition, divestiture, strategy and/or innovation.

Each one of the 1600 articles in our data was analyzed to identify empirical manifestations of ambidextrous activities. The focus was on identifying and categorizing recurrent instantiations associated with discussions on strategic plans, mergers and acquisitions, divestitures, innovation endeavors, joint venture initiatives, new product introductions, research and development plans, etc. Once the categorization based on empirical manifestations was completed, we coded the information into two main strategic activity categories: Exploratory or Exploitative. Based on March (1991), we consider Explorative activities those that aim at generating disruptive innovations, creating new markets or increasing the R&D capabilities. We also consider Exploitative activities those that include such things as refinement, choice, production, efficiency, selection, implementation, execution.

To organize and visualize the data, a table was developed; Table 1 represents the core concepts providing an overview of the empirical manifestations uncovered from each organization, the initial assigned categorization from a strategic point of view and finally the coding as it pertains to the exploratory or exploitative nature of the manifestation.

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Findings and Discussion

Texas Instruments: Divestitures, Acquisitions and Refocusing

Texas Instruments (TI) was one of the first organizations to manufacture and commercially introduce the first commercial transistor. After World War II, a time when many defense contractors had shifted their focus from military manufacturing to civilian markets, TI management believed that defense contracts would help them establish TI as a leading-edge electronics organization. They won contracts to produce such military equipment as airborne magnometers and complete radar systems. Late in 1953, when TI went public by merging with the almost-dormant Intercontinental Rubber Organization. In 1953 alone, TI acquired seven new organizations, establishing TI as a major electronics manufacturer.

The New York Times reported on 1989, Nov. 21 (Hayes, 1989) that TI announced that it was cutting 1,500 jobs across three of its different divisions. The job cuts did not include cuts related to programs or employment from the defense sector. Additionally, after bad earnings trend for the most part of the early 1990’s TI started to take bids for its defense division to focus the organization’s resources to develop and maintain the semiconductor market; the divestiture strategy started as soon as the government announced the defense budget cuts. In October or 1990 the Financial Post (Daily Edition, 1990, Oct. 18) reported that TI laid off 450 employees from its defense subsidiaries; TI reported this as being part of the plan to reduce costs. This was the indicator of a series of massive layoffs by the different defense contractors throughout the United States.

As documented by The Globe and Mail newspaper (Bloomberg Business News, 1996, May 30), the initial TI strategy was to not rely so heavily on defense contracts; instead, searched for a
diversified market where they could grow. This was the vision of the CEO at the time Jerry Junkins, who in 1991 helped TI quit some of its unprofitable business, wean itself from a heavy reliance on defense contracts and focus on specialty chips used in everything from cellular phones to personal computers.

As stated by the New York Times (Fisher, 1993, Aug. 25), TI continued to reduce its workforce from its defense electronics unit; in the last quarter of 1993, TI reported that it would reduce the defense electronics unit workforce by 4,800 jobs by the end of 1997. At this time, the TI defense unit accounted for 27 percent of the organization’s revenue and it employed 13,500 people, down from 25,000 in 1988. The estimates on job cuts were provided by Tony Geishauser, who also said that the figures were rough estimates and did not reflect organization plans to eliminate jobs immediately. “Should the organization receive additional military contracts, he said, or succeed in converting more of its defense production to commercial work; the number of jobs at risk would be smaller.” The comments made by the TI spokesman were also the standard and prevalent type of responses of defense contractors regarding the ‘conversion of defense to commercial’ work. In other words, there was a push to spin off some of the products into the commercial market.

The New York Times in November 1996 (Myerson, 1996, Nov. 7) reported that TI planned to sell its defense electronics business and concentrate on making chips that would bring higher but more volatile profits. The TI sale of its defense unit would help the organization to “… concentrate on making computer chips, another business where size and financial strength matter because of the huge cost of research, development and plant construction”.

Gant (2002) reports that during 1996, the price of its memory chips dropped by nearly 80 percent. Then, in May, Mr. Junkins died suddenly of heart failure. Tom Engibous took over as president and CEO and stepped up the organization's acquisition and divestiture plan. The trigger that had
started with the defense budget cuts continued with additional economic environment problems that kicked TI into high gear to continue a massive restructuring and focus on activities aligned with the commercial markets (as opposed to the defense market)

The New York Times (Myerson, 1996, Nov. 7) reported that TI sold its Defense and Electronics division to Raytheon at the time where most of the defense organizations were being consolidated in only a few defense-contracting giants. TI’s defense division was profitable and had a tremendous backlog of defense orders; however, TI’s strategy was to divest the defense business and focus on their core competency “semiconductor products”. The Vancouver Sun (Bloomberg, 1997, Jul. 12) reported that “TI said it would use proceeds from the sale to strengthen its focus on digital signal processing products, which are used in electronic equipment such as cellular phones and computers,

The Financial Times (Bloomberg, 1996, Nov. 7) reported on the TI strategy where the digital processing chips were being used in everything from cellular phones to videocassette recorders. “This is a strategic decision on their part to focus on making the chip side more profitable,” said Eric Boyce, an analyst at First Dallas Securities.

In October 1997 as reported by the Financial Post (Bloomberg, 1997, Oct. 15); TI’s situation had turned around after selling the TI defense electronics unit. TI’s “… profit skyrocketed based on demand for specialized computer chips, underscoring the most dramatic turnarounds in the high-tech industry this decade”. TI changed their focus to Digital-signal processors, which make up the fastest growing segment of the semiconductor industry. The newspaper further reported that TI invented the signal processors in 1982 and now (1997) controls 45% of the US$5 billion-a-year-market for those chips.
In early 1998, TI announced the purchase of Spectron Microsystems, a unit of the Dialogic Corporation, for more than $20 Million in cash. Dialogic makes software operating systems for digital signals processors. This move, as reported by the New York Times, 1998 (Bloomberg News, 1998, Jan. 23) was a shift from memory chips and focuses on more profitable digital signal processors, chips that translate inputs such as sound and light into the ones and zeroes for digital signals in products like cellular phones, automobiles and camcorders. Also, In June 1998, TI was reported by the Financial Post (Bloomberg, 1998, Jun. 11) as dominating the market for chips used in mobile phones, having shed other units including its defense electronics so it could focus on specialty chips.

TI supplied products to the commercial and defense markets at the beginning of the 1990’s. In contrast with Raytheon, TI had a different vision of their future. TI’s future was in the commercial electronics market, more specifically in the digital signal processing applications and semiconductor markets. To this end, TI divested all the defense business units to focus the resources in the commercial markets. Data analysis results suggest that there were also attempts to convert and take advantage of the defense knowledge and translate it to commercially viable applications. TI and Raytheon had a similar goal of focusing their efforts into one market only, TI focused on the commercial market while Raytheon placed its bets in the defense market. The data suggests TI as being more aggressive in the innovation and product introductions while Raytheon’s data does not show much innovation impetus.

TI grew its commercial enterprise by acquiring small and large organizations aligned with their strategy of growing commercial products and building new core offerings (namely Digital Signal Processing and other electronic devices). Their acquisitions happened to support their innovative strategy of spinning off new products that had their origins in defense related research. Their
acquisitions spurred and accelerated the execution of an explorative strategy; most of the acquisitions aimed at strengthening the technological core knowledge to innovate and introduce new commercially viable products. While the acquisition of non-defense organizations could be categorized as an exploitative strategic reorientation, the reason for doing so can potentially be part of an explorative goal; namely, the innovation and creation of disruptive technology products.

Raytheon’s Strategies to Align and Grow the Defense Products

Raytheon’s website mentions that the company was created on July 7, 1922; the organization's founders were Vannevar Bush, Laurence Marshall, and Charles G. Smith. It was established as one of the earliest technology start-ups in Cambridge, Mass. Their revolutionary innovation was the S gas rectifier tube, a device that eliminated one of the cumbersome expensive batteries that previously powered home radios. The tube transformed the radio into an affordable "must-have" appliance that could be plugged into a wall socket, turning radio into a true mass medium that brought the world into America's living rooms.

Pederson (2001) states that Raytheon quickly moved to the forefront of innovation in the electronics industry. During World War II, Raytheon supplied 80 percent of the magnetron tubes used in U.S. and British radars and developed parts for the crucial proximity fuse in antiaircraft shells. After the war, Raytheon began offering civilian products, the microwave being among the most famous. In 1992, Picard (Then the CEO) announced a new five-year plan. Its goals included increasing foreign military sales from 20 percent to 40 percent of total defense revenues; doubling energy and environmental services' $1.7 billion in sales; doubling Beech's $1.1 billion in sales; and increasing appliance sales by 60 percent.
Raytheon's single most important product in the early 1990s; the Patriot missile, was considered pivotal to an increase in the organization's overseas sales. From the end of the Gulf War until late in 1994, Raytheon received nearly $2.5 billion in orders for the missiles from overseas customers (Pederson, 2001).

In 1993, the organization expanded its aircraft activities by adding the Hawker line of business jets by acquiring Corporate Jets Inc., the business jet product line of British Aerospace (now BAE Systems). This entity merged with Beech Aircraft Corporation, which Raytheon had acquired in 1989 to become the Raytheon Aircraft Organization.

Raytheon by 1994 was known for making appliances, aircraft and missile systems. The organization at that time was diversified enough to have both commercial and defense contracts. In 1994 Raytheon executed an extensive overhaul of the appliance segment, including downsizing and consolidation. Raytheon also acquired UniMac Organizations, which helped increase the division's sales and profits (Pederson, 2001).

According to The Independent (Grimond, 1995, Apr. 4) E-Systems operated in an unusual niche – complex electronic gear, much of it was used in intelligence related work, for which financing is shrinking more slowly than for other types of defense work. Raytheon targeted this type of work because the financial support for these types of ‘niche’ products were not being targeted for drastic cuts as other military products. Raytheon was banking in future earning based on these niche products by E-Systems.

As reported by The Independent (Grimond, 1995, Apr. 4): Raytheon's chairman and chief executive, Dennis Picard, said: "The combination opens new defense and commercial markets worldwide, brings our annualized electronics sales to $6bn and our current electronics backlog to
$8bn." After the merger, Raytheon’s experience in international and commercial business would complement E-Systems capabilities to grow the business in the international marketplace. The acquisition was strategically supporting the exploitation of E-Systems capabilities, a portfolio of their current products that can be marketed in international markets; increasing efficiencies and capabilities to maintain and gain market share in the niche market (as represented by E-Systems).

In 1995 Raytheon, exited from the publishing field with sale of D.C. Heath to Houghton Mifflin Co (Pederson, 2001).

In 1996, Raytheon acquired two Chrysler Technologies business units, namely the Chrysler Technologies Airborne Systems and Electrospace Systems Inc. The Airborne Systems designs and installs aircraft modifications for defense and commercial clients. In addition to designing and building head-of-state airplanes, it also modifies and updates older military aircraft. With this acquisition Raytheon shows its commitment to be a major player in the shrinking U.S. defense industry, even as it shifts toward civilian business, which at the time (1996) accounted for 60% of Raytheon’s revenue. With this acquisition, the E-Systems division of Raytheon had little to no overlap in capabilities; hence, increasing the expertise and capabilities to continue supporting the shrinking demands of the military client. The Los Angeles Times in April 1996 (The Associated Press, 1996, Apr. 9). reported what Lowell Lawson, the E-Systems chairman and CEO said about the acquisitions: “It solidifies our standing as a top-tier defense organization”.

In 1997, Raytheon merged with Hughes Electronics’ Defense Business. As reported by Raytheon’s corporate communications, the combination of Hughes and Raytheon defense business will create a unique technology organization and a world leader in defense electronics. Together, the organizations will have the critical mass needed to compete effectively in all their global markets.
Raytheon would be posed to offer an even broader range of products and services to each of its customers.

Also, in 1997, Raytheon acquired TI’s defense business unit to strengthen Raytheon’s leadership in defense electronics while enhancing its position for continued growth in a consolidating industry. This business unit brings significant positions in several important government programs where Raytheon was not a significant participant. The combined operations would be highly complementary and would open new defense markets worldwide.

The expectation was to grow and complement capabilities to further penetrate additional markets that Raytheon did not initially have; furthermore, the expectation was to grow globally in the defense market. These latest acquisitions propelled Raytheon into the top three among defense contractors and into the top position in defense electronics (Pederson, 2001).

Following the completion of the Hughes transaction, Raytheon consolidated its defense businesses--Raytheon Electronic Systems, Raytheon E-Systems, and the TI and Hughes units--into a new operation called Raytheon Systems Organization. In connection with this restructuring and a smaller restructuring of Raytheon Engineers & Constructors, Raytheon took a $495 million restructuring charge in 1997 for a plan that by 1999 eliminated more than 14,000 jobs from the workforce and closed about 28 facilities in the United States (Pederson, 2001).

In December 1997, the organization also created a new subsidiary called Raytheon Systems Limited, which was based in the United Kingdom and was formed to develop products for export from that country (Pederson, 2001). Hence, getting further in the exploitation of the current products by means of globalization and international commercial and military sales.

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By this time, it was evident that Raytheon had made a striking shift in strategy, placing a greater emphasis on its defense businesses, alongside the commercial electronics applications that developed out of the defense operations. The divestment of additional noncore operations was further evidence of this trend, with the divestments also helping to hold down the organization's mounting debt load, which exceeded $10 billion by the end of 1997 thanks to the defense acquisitions\(^2\).

In 1997, Raytheon sold its home appliance, heating, air conditioning, and commercial cooking operations to Goodman Holding Co. That same year, the organization sold its Switchcraft and Semiconductor divisions.

Divestments continued in 1998, including the sale of the organization's commercial laundry business for $334 million. Operations now consisted of the defense units, Raytheon Commercial Electronics, Raytheon Aircraft Organization, and Raytheon Engineers & Constructors.

As part of the ongoing strategy to focus on core defense business, in 1998 Raytheon Co. acquired Allied Signals Communications Unit. This unit develops secure communications technology systems for combat identification, military radar and civilian air traffic management.

In 1998, Raytheon divested its commercial aviation training business to GE Capital. This Raytheon Systems Ltd. Flight Training based in London’s Gatwick Airport provides commercial aircraft pilot training services and leases flight simulator time. This divestiture was not aligned with supporting and growing the defense market.

Following the aggressive strategy to grow the defense business Raytheon in 2000 sold Engineers & Constructors business unit to Morrison Knudsen Corporation.

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\(^2\) Retrieved October 18, 2018, from Raytheon’s website: [www.raytheon.com](http://www.raytheon.com)
From the above historical account of mergers, acquisitions and divestitures, Raytheon’s strategy was to “grow or perish”. By acquiring additional capabilities, Raytheon was able to grow the product portfolio to the government and was able to achieve critical mass to effectively compete with the newly emerged Defense Industry Titans (Lockheed Martin Corp., Boeing Corp., Northrop Grumman Corp., BAE, etc.). This approach was also complemented with the growth of some of the commercial business units; however, as the strategy was to grow the defense sector, Raytheon decided to divest most of the commercial units.

Raytheon’s strategic activities provided some unexpected outcomes. Raytheon opted to grow into a defense industry titan to compete with other titans instead of divesting the defense business units and re-focus on other markets. Raytheon initially did not focus on technology innovating and searching new markets; Raytheon took markets from other defense organizations to strategically eliminate competitors. Additionally, Raytheon acquired an advantageous critical mass with a much larger portfolio of defense products. By acquiring the other defense organizations, Raytheon posed itself as a massive conglomerate with a robust portfolio of offerings to the military with fewer competitors. Most of the offerings were complementary to the original products that Raytheon had in their catalogue of defense products. Raytheon had initially focused on both markets, the commercial and the defense markets. However, as the decade ended, it became obvious that Raytheon would favor the defense market over the commercial one and continued divesting the commercial business units.

Raytheon’s defense business acquisitions fall under a mostly exploitative category since they were aiming at gaining market share by absorbing the competition. Raytheon also exploited the newly acquired organizations by eliminating redundancies and optimizing their efficiencies (gaining synergies).
Based on the analyzed data, Raytheon’s response to the economic crisis appears to heavily lean towards an exploitative strategy. Many of the identified activities fell under the exploitation category. The fact that there were not as many exploratory activities confirms that this organization was aiming at growing and securing a stable position in the defense industry. Raytheon slowly shifted from being a dual-use organization to becoming a predominantly defense company supporting defense contracts from the US government.

**Trimble’s Disruptive Innovations to the Commercial Market**

Charlie Trimble along with two others from Hewlett-Packard founded Trimble in 1978 above the old Los Altos theatre in Silicon Valley, California. From its origin, Trimble was envisioned as an organization that would pursue and exploit the commercial benefits that a Navigation satellite system like the GPS would provide. Trimble focused on developing innovative positioning and navigation products. Initially, the fledgling organization based its products on the LORAN technology, a ground-based navigation, location and timing system in U.S. coastal waters, and focused its products on the marine navigation market. The same year Trimble was founded, the first GPS satellite called the NavStar, was launched.

Recognizing the unique and vast potential of the new GPS technology to change the way we model our world, Charlie Trimble and the other founders' goal was to fully develop the immature GPS technology that Trimble had purchased from Hewlett-Packard. By focusing its resources on harnessing and expanding the power of GPS through innovative products, Trimble spearheaded the rapid development of commercial and consumer applications, as well as military use of the new technology.
Taking GPS from its exclusively military applications and applying it to traditional markets such as surveying and navigation would revitalize and redefine these markets, both highly dependent on the satellite positioning technology. Marrying GPS with other technologies, such as wireless communications, would spawn new and emerging markets that make use of position-centric information. These assertions place Mr. Trimble as one of the successful CEOs with a vision to exploit new technologies; above all the innovation and exploitation of military spin-offs was one of the main drivers to push forward the organization.

The Hobart Mercury (1991, Feb. 6) reported, "The Government was spending $US10 billion to put a set of satellites in place," Mr. Trimble said. "It represented a utility of information. The signals are free". The organization's first products were GPS units for yachts. Starting in 1984, when only five satellites were in orbit, the organization branched into surveying equipment, which as recently as 1983 accounted for half its sales.

The automotive market was also targeted by Trimble since they had already developed technology for GPS units to be electronically linked to a compact-disk player that was the repository for road maps. Exact locations, destination distances and route information were transferred for display on small screens to help drivers navigate to their destinations. By 1983 Trimble had already licensed this technology to the Japanese manufacturer Pioneer, which installed these units in high-priced Toyota models in Japan.

In 1984, Trimble introduced the world's first commercial scientific-research and geodetic-survey products based on GPS for oil-drilling teams on offshore platforms (Trimble’s Website).

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3 Retrieved October 18, 2018, from Trimble’s Website: (http://www.trimble.com/Corporate/About_History.aspx)
Starting in 1986, Trimble received the first of its more than 1,000 issued patents for advances in GPS and other technology, making GPS viable and extremely useful in dynamic situations and commercial markets.

In 1989, Trimble acquired the Navigation Systems Division of TAU Corporation and began developing differential GPS (DGPS) technology to provide increased accuracy for the fleet management market.

The New York Times reported (Pollack, 1991, Feb. 6) that the defense department approached Trimble Navigation Ltd. along with Magellan Systems Corp. to help supply the needed GPS receivers to virtually all the soldiers on the ground. The two organizations combined provided close to ten thousand handheld units to the defense department. Also, as reported by the Hobart Mercury (1991, Feb. 6): “The US military has scrambled to make the devices as widely available as possible, and in recent months a fast-growing high-tech organization, Trimble Navigation Ltd, has shipped thousands of them the Middle East”. The use of satellite position in the war has given an unexpected boost to the industry that builds receivers for commercial uses.

Trimble flatly refused to be acquired by a larger organization, insisting that he had an opportunity to turn Trimble Navigation into a Fortune 500 organization. Instead, he focused on forging strategic alliances with larger organizations. By 1992, Trimble Navigation had entered into ventures with Silicon Graphics, Pioneer Electronics, Westinghouse, and others, relying on partnerships to steer its way out of the financial doldrums (Pederson, 2001).

The Denver Post (Stets, 1996, May 26) quoted; “The technology is becoming ubiquitous. It is just beginning to affect the way people live and work”, said Charles R. Trimble, chief executive officer.

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4 Retrieved October 18, 2018, from Trimble’s Website: (http://www.trimble.com/Corporate/About_History.aspx)
and president of Trimble Navigation Ltd. Mr. Trimble was also the chairman of the United States GPS Industry Council, a manufacturers association that acts as an information source and pro-GPS lobby to the government on policy questions.

In March 29, 1996 by Vice President Al Gore and Secretary of Transportation Federico F. Pena announced that the government would continue to make the GPS signals and data available to anywhere, anywhere in the world, at no charge. After this announcement, The Denver Post (Stets, 1996, May 26) further reported in May 1996, that Mr. Trimble said assurance that data will continue to be available will help the commercial applications grow from a $1 Billion-a-year business now to a $9 billion industry by the turn of the century. This announcement by the government prompted private organizations to invest more resources to develop new implementations that would take advantage of the ‘free’ GPS satellite signals and data. Eventually the GPS application technology would improve, and the prices would drop.

Trimble was from its origins an organization aiming to supply the commercial markets with GPS receivers and applications; hence, their initial strategy was to disrupt the navigation industry. Namely, Trimble focused its resources on securing the free utilization of the GPS signals to exploit them and create disruptive technologies; they did so by heavily engaging in lobbying. Trimble pursued not only the acquisition of smaller organizations to enhance and complement their core capabilities but also engaged in lobbying strategies to influence government and military decisions. Its participation in the US GPS Industry council to ‘advise’ the military helped Trimble to influence the policies that enabled the opening of the GPS satellite signals for commercial use. Once the signals were secured for civilian utilization, Trimble engaged in developing and maturing disruptive technologies to serve different commercial markets. Trimble pursued the development of applications in multiple areas including the precision agriculture, surveying, automotive

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navigation, avionic navigation and space navigation. Trimble also aimed at marrying the GPS technology to other available technologies; hence disrupting not only the navigation market but also other markets. Trimble’s strategy was richer in innovative activities; hence, their strategic approach was predominantly explorative in nature, more so than the other organizations that supplied the GPS hand held devices as a dual-use technology.

Trimble was from its origin a commercial organization and fiercely continued to create strategies to maintain its position as one of the original innovative organizations that introduced GPS applications to the world.

**Rockwell International Dual-Use Gamble**

Collins Radio Organization, founded by Arthur Collins in Cedar Rapids in 1933, Iowa, initially designed and produced short wave radio equipment. The organization steadily grew and captured the world's attention when Collins supplied the equipment to establish a communications link with the South Pole expedition of Rear Admiral Richard Byrd in 1933\(^5\). When the organization (Collins Radio Organization) experienced financial difficulties in 1973, Rockwell International, a diversified high-technology organization, acquired Collins Radio Organization.

Rockwell Collins website states that during the early 1990’s, the 68-year old organization moved to steadily build up commercial product lines. In the late 1990s, the organization spun off its semiconductor products as Conexant Systems Inc. (CNXT), which is publicly traded and based in Newport Beach, California. Rockwell International also spun off its automotive division as a publicly traded organization, Meritor Automotive, based in Troy, Michigan, which then merged with Arvin Industries to form Arvin Meritor.

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Furthermore, The Wall Street Journal (Cole, & Lipin, 1996, Mar. 20) reported that “Throughout the early 1990’s, Mr. Donald Beall (the chairman and CEO at that time) was adamant that Rockwell International stick with its aerospace and defense lines. The newspaper further reported that in January 1995, the strategy to build up commercial product lines culminated with the $1.59 billion acquisition of Reliance Electric Co. With that purchase, manufacturing automation became the organization’s largest business, accounting for 28% of Rockwell’s $12.98 billion in fiscal 1995 sales and nearly a third of operating earnings “. However, as reported in an interview posted by the New York Times (Deutsch, 1997, Jun. 2), in late 1995 Mr. Donald Beall decided to “Sell everything tangential to commercial electronics. “We decided, finally, that this was our core competency”, he said”.

Rockwell International divested its defense and aerospace units in 1996 to be viewed by investors more as an electronics organization and not as a cyclical defense organization. The sale of the defense and aerospace units would allow Rockwell International to grow in other core business that are not tied to federal procurement dollars. The defense and aerospace units being divested excluded the Rockwell Collins avionics units; which at the time, had been growing given the resurgence of commercial aircraft orders and had been one of the main suppliers of military GPS receivers to the Defense Department in the US.

USA Today (Montague, 1996, Jun. 26) reported that the organization adapted its Global Positioning System applications (originally designed to track missiles and spacecraft for the Pentagon) to provide on-board guidance systems for motorists. The system was made available for 20 major U.S. cities by the end of 1996. The adaptation of the GPS receiver technology to commercial applications was part of the defense spin-off strategies that were laid out in support of a concentration in commercial products. However; the organization never stopped supplying GPS
receivers to the military, but in smaller quantities. Nevertheless; the supplied products did not parallel to the original defense industry dependency that Rockwell had prior to the divestiture of the main defense units.

The Atlanta Journal and Constitutions (News Services, 1996, Aug. 2) reported that Rockwell moved aggressively in new directions to cope with the shrinking weapons business. Rockwell became a slimmer organization with a diversified portfolio in automation, automotive, semiconductor, avionics and communication businesses. By 1997 and following the defense unit divestitures, Rockwell emerged primarily as a commercial electronics organization, with its automation, semiconductor systems, avionics and communications business accounting for 71 percent of sales. Sales from heavy and light vehicle component systems account for the other 29 percent.

The Rockwell International organization further strengthened the focus on aviation electronics in May 1998 when it exited the Precision Agriculture and Integrated Local Government business and sold the Railroad Electronics business to Westinghouse Air Brake Organization (as reported by the New York Times on August 19, 1998).

The New York Times (Deutsch, 1997, Jun. 2) further reported that Rockwell entered the world where a day late and a dollar short is not a cliché; it is a recipe for bankruptcy. “Real speed and urgency are just not things you become proficient in overnight”, warned Iain Morris, a vice president at Motorola Inc. This reflects the complete transformation that needed to take place, this is part of the exploration activities executed by Rockwell Collins to adapt and survive the changing economic environments.
On June 29, 2001, as reported on the company’s website, what remained of Rockwell International was split into two organizations, Rockwell Automation and Rockwell Collins (both publicly traded organizations). The Globe and Mail Canada reported (Ordonez, & Pasztor, 2000, Dec. 11); “The businesses are in different industries and different markets and the dynamics in these markets are considerably different” Mr. Don Davis said (Chairman and CEO of Rockwell International). Today, Rockwell Collins, Inc. designs, produces, markets and supports electronic communications, avionics and in-flight entertainment systems for commercial, military and government customers worldwide. Rockwell Collins still provides services to the defense department in the form or GPS receivers utilized by multiple arms of the Department of Defense.

The case of Rockwell International shares similarities to the Raytheon’s case; however, Rockwell did not aim at only growing in the defense markets, they aimed to have a larger growth in the commercial markets. Rockwell divested its defense and aerospace business units to the exception of the business units that produced GPS applications and navigation systems. Rockwell grew by acquiring commercial organizations with the aim of creating a conglomerate with a diversified portfolio to reduce risk. Rockwell acquired automation, semiconductor and electronics organizations. Rockwell was one of the first providers of GPS devices to the military; they had the advantage of being first to market. Rockwell continued to grow specialized defense units in the navigation systems. Additionally, it continued to spin off proprietary technology for civilian utilization for automotive navigation and civilian airplanes. By keeping some niche markets in the defense industry and growing as a conglomerate, Rockwell had the advantage of producing dual-use products by leveraging technologies and distribution channels.

6 Retrieved October 18, 2018 from Rockwell Collins’ Website: https://www.rockwellcollins.com/Our_Company/History
Conclusions

Accomplishing Ambidexterity

With the end of the post-cold war threats, the U.S. government’s response was to reduce expenditures in the defense sector. Consequently, the organizations that depended heavily on military contracts found themselves in a position of having to react to an economic crisis. The analyzed data suggests that the organizations commenced a re-evaluation of their priorities and the budget reductions forced them to realign and reinvent themselves to survive the drastic reductions on defense budget expenditure. These organizations geared up and stepped up the execution of ambidextrous activities. Our findings showed that some organizations opted to invest heavily on explorative activities including disruptive innovation activities, spin-off technological applications, opening new markets and searching for new costumers. This was the case of TI, Rockwell Collins and Trimble; all organizations pursued the commercial side of business and opted for leaning towards exploration. On the other hand, Raytheon opted for implementing exploitative activities. Raytheon leaned heavily on a growth strategy by acquiring defense organizations to eliminate competition and to grow and compete with a much larger and complementary portfolio of defense products. In all cases, the status quo of the organizations in the decade studied was altered.

While our research was not originally intended to focus on mergers and acquisitions achieved during the period analyzed; we came across ‘mergers, acquisitions and divestitures’ as the most recurrent ambidextrous strategies executed by the defense industry organizations. However, the mergers and acquisitions observed were aimed at both exploration and exploitation. Some organizations acquired or merged with similar businesses to grow bigger in the industry; we identify this as exploitation activity. Additionally, some organizations acquire non-similar
businesses to change direction away from the defense industry; we identify this as exploratory activity.

Even though the concept that ambidexterity as an equally balanced ability has merit; we question whether organizations that are successful at simultaneously managing exploration and exploitation are always able to achieve these two activities in equal proportions; we have determined that under economic crisis the equal amounts of ambidexterity may not support the success of the organizations. While some researchers such as Lubatkin et al., (2006) and Simsek (2009) suggest that ambidexterity is the ability to pursue both exploration and exploitation with ‘equal dexterity’; our results suggest that under economic crisis the equal amounts of ambidexterity may not support the organization’s strategic plans.

The research observations align with the previously documented findings from Tushman and O’Reilly (1996) stating that organizations must be ambidextrous in order to survive. We were able to observe that an approach where unequal levels of exploration or exploitation can be implemented to achieve the expected strategic outcome or organizational reorientation. Regardless of the defense or commercial business nature, our research found that the strategies that organizations execute are essentially similar at their core. For instance, the analyzed organizations engage in divestitures, mergers and acquisitions, and product/business model innovations. However, the way they implement strategies to achieve the anticipated outcome differ from either commercial, defense or dual-use organization.

Our research found evidence to suggest that the number of mergers, acquisitions and divestitures that happened in the defense industry during the studied decade indicates an increase of both explorative and exploitative activities depending on the reason for the acquisition and divestiture. Additionally, the research found evidence that indicates a tendency to increasing the spin-off of
products and the creation of new markets; these findings lead to the conclusion that explorative activities also increased within the analyzed organizations.

The amounts of how much exploration or exploitation needs to be executed cannot be accurately determined; our research only points to the conclusion that both activities need to be exercised to ensure survival when faced with economic crisis. Regardless of the degree of exploration or exploitation executed by each organization; our research concludes that the predetermined expected strategic outcome is the key to trigger exploration or exploitation activities.

Depending on the outcome prospect, organizations divest or acquire other organizations. The realignment of priorities coupled with the efficient reallocation of scarce resources in an organization lead some organizations to divest or acquire. Most, if not all these strategic events are triggered by the economic crisis caused by the reduction in defense spending. While some organizations cut their losses by divesting the defense business units, other organizations increase their debt by acquiring those business units to grow. The profits gained from divesting defense business units can potentially be utilized to execute the strategic realignment envisioned. For the organizations that acquired the defense units, what is left is a larger organization with a larger debt and a challenging task of gaining efficiencies and finding complementary product offerings.

Contributions

Our research advances the understanding on the way firms can benefit from an unbalanced approach when executing ambidextrous activities under economic crisis when studying the defense and dual-use industries. We advance the understanding of several theories in at least three ways.

First, we provide complementary findings from a new empirical setting that has been understudied within the ambidexterity construct; namely the defense and dual-use industries; these findings
reinforce the previously documented findings from Tushman and O’Reilly (1996) when they stated that organizations must be ambidextrous to survive. Indeed, the studied organizations executed ambidextrous activities to ensure survival during the defense budget reduction crisis.

Second, we advance the current body of research on the ambidexterity theory by questioning the traditional view concerning the merits of an equally balanced approach to contextual ambidexterity; we provide a view that allows for strategic reorientation via an unbalanced ambidextrous approach either by executing mostly exploration or mostly exploitation depending on the expected strategic outcome. Some contextual ambidexterity proponents (Gibson & Birkinshaw; 2004 and McCarthy & Gordon; 2011) suggest a balanced approach to ambidexterity, however; their findings and recommendations do not explicitly call for equal amounts of exploration and exploitation. Consequently; based on our results we propose that the emphasis should be placed on the organization’s ‘expected strategic outcome’, hence, the amounts of exploration or exploitation will be dictated by the expected strategic outcome.

Finally, we provide complementary evidence from an empirical setting that can strengthen Lin’s (2011) claims when she asserts that the exploration of new markets and the exploitation of the existing ones are unquestionably the major reason for acquisitions. Our research findings lead us to concur with Lin (2011) as she suggested that the exploration of new markets and the exploitation of the existing ones are unquestionably the major reason for acquisitions.

Limitations and Future Research

The findings in this study are based on an in-depth study of four firms. Obviously, this study could not establish generalizable findings to all firms producing dual-use technology products, or whether they generalize to consumer products or services. However, the findings presented above
have a strong intuitive and conceptual appeal and are amenable to potential quantitative verification. Future research could measure firms’ quantitative ambidexterity and determine if the amounts of ambidextrous activities align with the intended strategic reorientation.

Additionally, our findings are based on ex post activities executed under economic crisis; further research may focus on attempting to discover potential triggers for strategic reorientations that may cause ambidextrous activities by organizations based on more recent environmental crises.

References


Ordonez, J. & Pasztor, A. (2000, Dec. 11) Rockwell to spin off Collins Avionics Unit; Surprise announcement continues parent; company’s pruning of its business lines. The Globe and Mail Canada.


<table>
<thead>
<tr>
<th>Empirical Phenomena Manifestation</th>
<th>Concept Categories</th>
<th>Ambidex. Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TEXAS INSTRUMENTS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None reported in analyzed period.</td>
<td>Acquisitions (Similar)</td>
<td>Exploitation</td>
</tr>
<tr>
<td>Cutting 1500 jobs. Laid off 450 employees. Reduce its work force. Job cuts.</td>
<td>Consolidation</td>
<td>Exploitation</td>
</tr>
<tr>
<td>Quit unprofitable businesses. Wean itself from reliance on defense contracts</td>
<td>Divestitures</td>
<td>Exploitation</td>
</tr>
<tr>
<td>Expecting additional military contracts. Diversify Market.</td>
<td>Market Share Increase</td>
<td>Exploitation</td>
</tr>
<tr>
<td>Company Names/Description</td>
<td>Description</td>
<td>Strategic Innovation</td>
</tr>
<tr>
<td>---------------------------</td>
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</tr>
<tr>
<td>Toccata Technologies, Burr-Brown Corporation, Alantro Communications, Dot Wireless. (20 Instances)</td>
<td>Converting more defense production to commercial work. Concentrate on making chips. Focus on core competency semiconductor products. Strengthen its focus on digital signal processing products. Concentrate on making computer chips. Use defense operation as an incubator for new products. Step up the organization’s acquisition and divestiture plan.</td>
<td>Strategic Innovation</td>
</tr>
</tbody>
</table>

**RAYTEON CORPORATION**

<table>
<thead>
<tr>
<th>Year</th>
<th>Acquisitions (Similar)</th>
<th>Exploitation</th>
</tr>
</thead>
</table>

Increasing the expertise and capabilities to continue supporting the shrinking demands of the military client. Solidify their standing as a top-tier defense organization. Build critical mass needed to compete effectively in all their global markets. Strengthen Raytheon’s leadership in defense electronics.

Extensive overhaul of the appliance segment. Downsizing and consolidation. Restructuring activities. By 1999 eliminated more than 14,000 jobs from the workforce and closed about 28 facilities in the United States. Combine the organizations to continue competing against much larger organizations that have been merging after the defense budget was shrinking.


<table>
<thead>
<tr>
<th>Increase foreign military sales. Increase appliance Sales. Expand its aircraft activities. Open new defense and commercial markets worldwide. Penetrate additional markets that Raytheon did not initially have. Grow globally in the defense market. Offer an even broader range of products and services (portfolio diversification). Double energy and environmental services. Double Beech's $1.1 billion in sales. Created a new subsidiary called Raytheon Systems Limited in the UK to develop products for export from that country.</th>
<th>Market Share Increase</th>
<th>Exploitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>None reported in analyzed period.</td>
<td>Acquisitions (Non-Similar)</td>
<td>Exploration</td>
</tr>
<tr>
<td>Pursue new technology opportunities in defense as well as in the commercial business.</td>
<td>Strategic Innovation</td>
<td>Exploration</td>
</tr>
</tbody>
</table>

**TRIMBLE INC.**

<table>
<thead>
<tr>
<th><strong>1999</strong> Manufacturing assets to Solectron. (1 Instance)</th>
<th>Divestitures</th>
<th>Exploitation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2000</strong> Acquisition of Spectra Precision Businesses from Thermo Electron Co. (1 Instance)</td>
<td>Acquisitions (Similar)</td>
<td>Exploitation</td>
</tr>
<tr>
<td>Invest more resources to develop new implementations that would take advantage of the ‘free’ GPS satellite signals and data. Product line became solely dedicated to GPS.</td>
<td>Consolidation</td>
<td>Exploitation</td>
</tr>
<tr>
<td>Focused its products on the marine navigation market. Licensed this technology to the Japanese manufacturer Pioneer. Supply the needed GPS receivers to virtually all the soldiers on the ground. Trimble Navigation Ltd, has shipped thousands of them the Middle East. Spawn new and emerging markets that make use of position-centric information. Branched into surveying equipment. The</td>
<td>Market Share Increase</td>
<td>Exploitation</td>
</tr>
</tbody>
</table>
The automotive market was also targeted. Provide products based on GPS for oil-drilling teams on offshore platforms.

<table>
<thead>
<tr>
<th>None reported in analyzed period.</th>
<th>Acquisitions (Non-Similar)</th>
<th>Exploration</th>
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</thead>
</table>

Forging strategic alliances with larger organizations. Entered into ventures with Silicon Graphics, Pioneer Electronics, Westinghouse.

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<tr>
<th>Strategic Partnership</th>
<th>Exploration</th>
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</table>

Pursue and exploit the commercial benefits that a Navigation satellite system. Develop innovative positioning and navigation products. Develop the immature GPS technology that purchased from Hewlett-Packard. Development of commercial and consumer applications, as well as military use of the new technology. Applying GPS technology to traditional markets such as surveying and navigation. First products were GPS units for yachts. Received the first of its more than 1,000 issued patents for advances in GPS and other navigation technology. Innovation activities by integrating GPS technology with communications technology

<table>
<thead>
<tr>
<th>Strategic Innovation</th>
<th>Exploration</th>
</tr>
</thead>
</table>

### ROCKWELL INTERNATIONAL

None reported in analyzed period.

<table>
<thead>
<tr>
<th>Acquisitions (Similar)</th>
<th>Exploitation</th>
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</thead>
</table>

Rockwell became a slimmer organization with a diversified portfolio in automation, automotive, semiconductor, avionics and communication businesses. Rockwell International was split into two organizations

<table>
<thead>
<tr>
<th>Consolidation</th>
<th>Exploitation</th>
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Spun off its semiconductor products. Rockwell International also spun off its automotive division. Sell everything tangential to commercial electronics. Divested its defense and aerospace. Exited the Precision Agriculture and Integrated Local Government business. Sold the Railroad Electronics business

<table>
<thead>
<tr>
<th>Divestitures</th>
<th>Exploitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>Event</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>1991</td>
<td>Network Transmission Systems Division to Alcatel.</td>
</tr>
<tr>
<td>1996</td>
<td>Goss Printing Press Division to ??, Aerospace and Defense Units to Boeing, Graphic Systems to Sotnlington Partners Inc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Acquisitions</th>
<th>Exploitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>Ikegai-Goss Co (Joint Venture).</td>
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<td></td>
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<tr>
<td>1992</td>
<td>Rubery Owen Holdings Ltd (Joint Venture).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>Automotive Parts (Skoda Mlada Boeslav in Czechoslovakia), Chip-Making Plant from Western Digital Corp., Data Control Division (From Sundstrand Corp.), Sprecher &amp; Schuh AG (Electronic Control Devices).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>Aerospace Technologies of Australia Ltd., Silicon Wafer Factory from Microelectronics Unit of the United Tech Corp.</td>
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<td></td>
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<tr>
<td>1996</td>
<td>Acq. Autarky Auto Products (Window regulators in India), Brooktree Corp. (computer chip maker).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>Comstream Corp Hi-Media Semiconductor unit (Video and Data Chips), Acq. Hughes Electronics Unit.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>EJA Electronics (machine safety products), Intertrade Ltd. (16 Instances)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Form an alliance with B.F. Goodrich Co. of Charlotte NC**
- **Acquisitions (Non-Similar)**

- **Emerged primarily as a commercial electronics organization. Rockwell moved aggressively in new directions to cope with the shrinking weapons business. Rockwell International’s initial intent was to stick with its aerospace and defense lines.**
- **Strategic Reorientation**

- **Steadily build up commercial product lines. Grow in other core business that are not tied to federal procurement dollars. Adapted its Global Positioning System applications (originally designed to track missiles and spacecraft for the Pentagon) to provide on-board guidance systems for motorists. Execute defense spin-off strategies**
- **Strategic Innovation**

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**Table 1 Conceptual Framework**

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Figure 1 The Evolution of Defense R&D Budget in Major Countries and Economic Areas