Economics of Airline Automation

By Richard Eastman

Abstract…

Airlines created the first evolution of e-commerce as a function of automating airline-seat inventory and, subsequently, order entry, distribution, and settlement. The structure was so well conceived and holistic in nature that it withstood almost 30 years of computer technology evolution. Entire airlines and the departments and processes within, and around them … rose … and fell … some to rise again … and again – built on and around the basic automation functions and processes spawned by these original systems.

The system became the airline. "Silos" of management defined their business processes around capabilities of the systems – originally because of the computer's ability to process information faster than anything then known to business … and later, to evolve solutions so unique to airlines that only people having matured in the industry could effectively manage the established airline business processes. Processes became "inbred" to each airline … and to the industry. Processes became layered, one on top of another, as deregulation of the industry changed the core competitive processes, new business techniques and skills became available, and suppliers and providers integrated their own solutions with airline systems. These systems were the foundation of airline industry computer applications from their inception in the early 1960's until the early 1990's. Then, microcomputers began to extract data from GDS data environment[1] and Internet began its rapid penetration as a high-speed information access and processing gateway to the holistic airline environment. Data from GDS and airline host systems could be processed more easily and more productively "offline" due to the flexibility of local area networks and the Internet.

But the technology and information-processing evolution was (and is) not limited to the bit-and-bytes of Internet. It has expanded to include bi-directional wireless telephones and pagers, interactive television and new presentation media. This technology transformation has been driven by user demands for more, faster, and context-driven information needs. It has equally transformed the supplier-driven mass-information hierarchy to a demand-driven interactive-information hyperarchy[2].

[1] AQUA (Automated Quality User Assurance) was the first micro-computer-based software to extract data from the GDS (and subsequently, airline) systems for the purpose of automating functions previously performed by human agents. AQUA was created and developed by the author and his company, The Eastman Group, Inc., in a joint-effort with Associated Travel, Inc., now part of Navigant International, Inc.

[2] Hyperarchy - defined by Philip Evans and Thomas Wurster in the Harvard Business Review, September-October 1997, Page 75. Evans and Wurster suggest that digital communication enables everybody to communicate interactively with everybody. The term takes its name from the "hyperlinks" of the World Wide Web and the "hierarchy" of current commerce models. Not only is the WWW a hyperarchy ... but so too is a deconstructed hierarchical supply chain within an industry ... and also object-oriented programming in software or packet switching in telecommunications. "The hyperarchy challenges all hierarchies, whether of logic or of power, with the possibility (or the threat) of random access and information symmetry," say Evans and Wurster. Evans and Wurster subsequently released a book in 2000 on the hyperarchy: "Blown to Bits: How the Economics of Information Transforms Strategy"

The impact of the hyperarchy of information on the airline community has been multi-dimensional. It has wrought havoc in traditional distribution structures that have served the industry for the better part of 30 years … and is now forcing a compelling transformation. But the transformation is still in its infancy and has come face-to-face with inherent limitations of original airline legacy architecture, their airline business infrastructures and the related cultures that have evolved around those structures as airlines came to dominate world transportation.

Hierarchal structures of information processing and the internal business processes that early automation structures forced upon airlines have been unable to support the first-evolution of the hyperarchy-enhanced distribution of travel product. The core inventory-based architecture of legacy systems designed for access by a defined and limited number of human agents using keyboard command instructions was never designed to respond to high speed automated relational queries driven by hundreds of millions of users.

But more important than the core design issues, subsequent layers of functionally independent operational processes and the silo departments they spawned to serve a supply-driven and supply-controlled information and economic model … are simply unable to cope with demand-driven interactive information expectations of users; be those users potential buyers of product in travel distribution channels or production, marketing, selling, service providers, and/or governmental agency users involved in manufacturing airline-seats.

The problem is not limited to the airline community. Similar dilemmas are faced by virtually every segment of e-commerce. Internet-enabled distribution and information systems have far outpaced the ability of product manufacturers, packagers, and/or suppliers to produce product. Effectively, the hyperarchy has evolved into virtual-distribution without supporting virtual production. Correspondingly, sales and support of new distribution systems have waned temporarily. Still, new distribution solutions have demonstrated their potential and buyers have "seen the light". Buyer expectations and demands are driving suppliers to restructure their manufacturing and production processes.

While the airline industry has been a traditional leader in supply-driven development of information processing, its core paradigms restrict airline managements from understanding the core fundamental change that is taking place in airline product and distribution. With few exceptions, airlines continue to respond to evolving Information Age changes by force-fitting upgrades to their legacy hardware and operational architectures. These "upgraded" systems are failing in the onslaught of demand from a restructured informational paradigm.

Airlines must restructure their information systems. Since current airline organizational structures closely parallel automation tools on which they depend, airlines must necessarily also restructure their very core organizational and operational structures. This will virtually re-model the way airline seats are produced and distributed.

The airline-seat product will change from a hub-centric, supplier-driven market efficiency model to a radically different scenario: point-to-point demand-driven networked "activity-based" economies.

Airplanes will be "sized" to fit market and frequency point-to-point demands. There will be increasing real product differentiation, including an entirely new "business service" composed of small business-jet direct flights managed via automation tools to enable virtual biz-jet networked nodes. Mass-produced airline-seats "manufactured" by larger airplanes will transition further from their origins as a differentiated service product to that of a price sensitive commodity[3], often packaged as part of some other buyer-demanded solution. Airline-seat production will become increasingly integrated with distribution. Economics of airline automation will be transformed.

A Quick Overview
History provides the base for changing the way people relate to one another

Airlines created the first e-commerce -- before it was ever a word or concept. In the late 1950s and early 1960s, the airlines were confronted with a need to automate their inventory. Inventory for an airline is a seat that goes from Point A to Point B. In the early 60's, big airplanes would hold 100 to 130 passengers. They would fly from A to B, on average, five to eight times a day. An airline might own 50 to 100 airplanes. As an example, their inventory of "seats" was, effectively, for each airline, 100 seats X 5 flights-a-day X 50 airplanes X 365-days-a-year -- or something over 9 million "widgets" (seats) a year per airline. Obviously, it varied by airplane, number of flights per day and size of fleet. But at that time, it was necessary to keep track of all those seats with manual labor-intensive staffing.

The airlines attempted to go, collectively, to IBM for a computerized inventory management system. But after a few years of effort to try to devise a way to build a joint inventory system, American Airlines said "to heck with it", and funded development of a computer system to track its own seat inventory. That system became Sabre. United quickly followed suit with development of Apollo, and shortly thereafter, most airlines followed suit.

In evolving the system, IBM created a new operating system (called TPF) that was, at the time, based on a 6-bit computer word[4] -- for speed, and because the need for an 8-bit word (i.e., the ability to have upper and lower case characters) was not apparent. These systems were very hierarchal in process structure (for efficiency) ... but lacked data structure.

Soon after inventory systems began to be used (the early/mid 1960s), American, again, concluded that it would be cheaper for the airline to run data lines linking their host platforms with travel agency sites, and then teaching agents how to do data entry commands – then it was to have agents

[3] For an excellent discussion of the progression of economic value of products – commodity, good, service, experience and transformation – see "The Experience Economy" by Joseph Pine and James Gilmore, Harvard Business School, 1999.

[4] A computer "word" is generally defined as the number of bits (0's or 1's) that the core CPU (Central Processing Unit) can process every time there is a "pulse" of the electronic timing clock. For example, at each pulse of the clock above, '101010' bits are read and acted on. Combinations of bits represent different instructions or letters or numbers, etc., to the CPU. A 6-bit computer-word enables 36 different combinations of 0's and 1. Thus, the 6-bit word enabled the system to have a computer-word for each letter of the alphabet (26) and ten numeric characters (0 through 9). However, the system was (and is) limited to only one set of alphabetic letters – in this case, all capital letters. The soon-to-follow 8-bit word-computer allows 64 combinations of 0's and 1's, which enables computers to offer a complete upper and lower case alphabet (i.e., 52 characters).

call American-staffed data-entry clerks over the telephone to make reservations. Soon, all airlines were putting "dumb terminals[5]" at agency locations. Airlines then concluded that it was less expensive and faster to send high-speed messages between each other's host systems than the costs and speeds that were achieved by each airline installing its own data lines out to each of multiple travel agency sites. Thus, the CRSs (now called GDSs) evolved.

Using shared-ownership airline communication networks ARINC[6] and SITA[7], the airlines opted to network their inventory solutions as well. Remember, during this period, communication between computers was via analog[8] transmission - usually dedicated lines -at a very slow transmission rate. Central computers "polled"[9] each dumb terminal in the environment. Message traffic between mainframes was via structured EDIFACT[10] message formats.

In that time period, data lines between systems were linked with analog modem-driven data links with modem speeds that varied from 300 to 1200 baud[11], usually through dedicated lines. To put this in perspective, 300 baud equates to between 45 and 50 alpha-characters per second when using a 6-bit word. At 1200 baud, 200 alpha-characters. An early typical user screen contained 28 to 48 alpha-characters in each line and 22 to 32 lines ... or between 616 and 1536 character locations. Thus, to fill an entire agent screen at 1200 baud would take between 3 and 8 seconds.

Even using dedicated circuits, modem speeds rarely exceeded 4800 baud throughout the 1980's. Compare these numbers with today's digital systems that move 10's and hundreds and even thousands of megabits through connectivity networks. And even for those without access to digital

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[5] A "dumb terminal" is a video display unit that displays data sent to it from a central host mainframe or minicomputer CPU, and data entered on its corresponding keyboard is sent directly to the host CPU for processing. Before the evolution of microcomputers, all terminals were "dumb terminals".

[6] ARINC is a corporate name, originally derived from as an acronym meaning Aeronautical Radio Incorporated. Even today, Aeronautical Radio remains a continuing business entity within ARINC, the corporation. ARINC was created in 1929 when representatives of four major airlines met to establish ARINC as the single licensee to coordinate radio frequencies for the airlines.

[7] SITA is an acronym for Societe Internationale de Telecommunications Aeronautiques, although in contemporary times, SITA never spells its name out and prefers to use SITA for branding and logo. SITA was founded in 1949 by 11 (mostly European) airlines to bring together their existing communication facilities to gain the cost efficiencies of a shared infrastructure.

[8] Analog communications move sound in a wave-type format. Conventional telephone lines carry data in wave format. To convert a sound wave form sound to digital electronic form, a modem is used. Modem is a shortened term for "modulate, de-modulate". A modem takes electronic digits generated by a computer and converts them to sound so they can be transmitted by conventional phone systems … and at the receiver end, a second modem converts the sound wave back to electronic digits that a computer can read.

[9] In a "polled" environment, the CPU queries each terminal or process to "ask" for command instructions. In an "event-driven" environment, each terminal or process is triggered by the arrival of a message or comment (i.e., an event). A "polled" environment requires CPU time to be used to query for instructions whether there is a message waiting or not, which creates a distorted use of the available processing time.

[10] EDIFACT is the acronym for Electronic Data Information For Accounting and Commerce Transactions. EDIFACT is commonly a message standard that is overseen by entities within the United Nations and used in International commerce. EDI (Electronic Data Information) is the acronym more commonly used when message structures are coordinated by organizations within a given country's national boarders for the purposes of national standards.

[11] BAUD is a common measurement of transmission speed named after J. Baudot, the French inventor. The Baud rate is a measurement of the number of bits per second transmitted in or between computer systems.

networks, the common modem in use today across conventional analog phone lines is 56,000 baud (or about 7000 8-bit words a second).

Given the technology of the time, it becomes clear why 6-bit architectures, command-language instructions, and hierarchical process structures were necessary. They effectively minimized message traffic to optimize speed of these legacy systems and their networks. Keep these key technology origins in perspective as you read further in this essay.

As airlines mastered their inventory management challenge, they then addressed distribution solutions. Travel agency networks matured, and airlines then turned their focus inward on operations. Since seat inventory was and is the only product of an airline, airlines built operational and management systems on top of existing inventory systems. Inventory management systems are thus, the core of each process or management need that most airlines use today.

These management and process systems were not "pre-planned". They evolved in response to business needs of any particular business period. They also evolved, disjointedly, as a function of knowledge gained from other computer systems and computer-programming skills evolving outside the airline community – particularly in business, accounting, and statistical systems management. Further, these airline operations or business solutions were often unique to each airline's business model or practices.

As airlines evolved their needs, ARINC and SITA also expanded their analog 6-bit communication networks beyond inventory and distribution functions to serve (a) operations management, (b) airport operations and controls, (c) government reporting, (d) accounting and revenue management, (e) fleet management and maintenance, (f) catering and special services, (g) cargo, (h) yield and planning management, equipment utilization, etc., etc., etc. Throughout these developments, which took place over decades, operational control centers remained the hierarchal legacy 6-bit architectures. Because network communications were still tied to slow analog modem messaging, optimization of message networking and transfer mechanisms remained essential.

For each airline, the trick became how to extrapolate or integrate information into, and out-of, various sub-systems that each airline built as necessary to manage and run their ever expanding needs and support increasingly modern aircraft and airline services. Over a period 40 years, airlines have built their own largely unique management systems -- one layer at a time; but all tied to original inventory platforms. Like an onion, these the core remained as each subsequent solution layered atop its predecessor.

The entire airline industry evolved as an extension of their electronic networks – and the network's message structures – and the quasi-automated e-commerce processes that evolved in and around them. And, because airlines were first to link their computer systems in a commercial structure by many years, they were also leaders in what we now call e-commerce.

By the time that 8-bit mini-computers and microcomputers came along, the airline infrastructure was well embedded in airline business process structures - virtually every facet. Because airlines

had built their own inter-airline distribution and financial settlement process (ATC[12] originally, ARC since deregulation) – they saw no need for their systems to integrate any evolving technologies that came along in subsequent years. Because the entire airline transaction was contained wholly within the airline community … inventory, distribution, sale via agents, and settlement via an airline-owned settlement process, and communications using airline-owned networks, airlines were simply able to remain contemporary by throwing more and more mainframe "horse power" at existing legacy architectures and solutions.

Airline infrastructures did not begin to break down until Internet came along.[13]. And, while the core distribution system is beginning to unravel, the core infrastructure that underlies all of the "manufacturing process" of the airline product (i.e., seat production from "Point A to B") remains dependent on these 6-bit hierarchal command-line-driven legacy systems and their architectures.

But time catches up to us all. Airlines have been slow to recognize how the systems have locked the industry into solutions designed or built before more contemporary, lower cost, computer architectures, networking, or software solutions were even available to be considered. Airlines are just now beginning to understand the need to "un-peel the onion" of operational and functional solutions built on the core airline inventory systems over many years. And it is necessary to do the "un-peeling" BEFORE it is possible to begin to rebuild the core inventory system. But those systems must be rebuilt if they are to serve new "demand-driven" needs of the information hyperarchy, of which Internet is but one facet.

Note that the Internet is but one aspect of the evolving digital information world. The hyperarchy is an information or human relationship structure. In the data sense, it is represented in the ability to interactively and bi-directionally transmit information. It includes the cell-phone connectivity, interactive voice response systems, wireless networks in their many forms, interactive television, and any other virtual and contextual information messaging tool. Contemporary "hype" has given Internet the role of the "example". But the Internet is only symbolic of differences between older hierarchal one-way mass-communication processes and the newer relational interactive model – whether technological or human business processes.

In the technology sense, airline systems are centrally hosted, managed, and controlled – while the Internet is distributed, unmanaged, and fluid. Where airline host systems "poll"[14] for messages" – Internet Protocol (IP) structures are "event driven". Where airline host operating systems require "command-line" instructions, -- IP structures can be integrated interactively.

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[12] ATC is the acronym for Airline Traffic Conference, a ticket settlement entity within the Airline Transport Association prior to deregulation in 1978. Following deregulations, ATC became ARC (Airline Reporting Corporation), a non-profit business owned by Air Canada, Alaska Airlines, Aloha Airlines, American Airlines, America West Airlines, Continental Airlines, Delta Airlines, Hawaiian Airlines, Northwest Airlines, Southwest Airlines, United Airlines, and US Airways

[13] For a short essay on that subject, go to the author's web site << www.eastmangroup.com >>, into "Eastman's Corner", "Articles" and download "*Managing the Unknown*". There is also a slide presentation in the "Presentations" section of "Eastman's Corner", "*Supply-driven to demand-driven Distribution*", that amplifies on the essay

[14] As noted in Footnote 9, a "polled" environment requires CPU time to be used to query for instructions whether there is a message waiting or not, which creates a distorted use of the available processing time.

But perhaps most important is the social or cultural aspect. People who hold management roles and make computer or solution buying decisions in the airline world are executives who have spent 20 or more years learning how to work with, and to evolve business processes using, centrally hosted solutions within existing architectures of their legacy airline systems, while the Internet and IP world is full of decentralized, outsourced and alternative business solutions derived from disparate and independent needs.

Even today, ARINC and SITA remain the primary network solution communications providers to airlines. And while both have evolved IP message networks to enable links with contemporary architectures, the cultural and business focus of legacy architectures survives largely because, in the end, both companies must serve needs of airlines who are their customers, and, thus, needs of the airline "mind-set". Only a very few airline managements have been able to step outside of that "cultural box" that has, for the past 40 years, contained everything about and within the airline industry.

Challenges are Opportunities With The Wrapping Still On
Communication is changing the way people relate to one another

Communication is changing the way people relate to one another, and thus, the airline industry is undergoing significant change, both in the way it distributes airline seats to buyers and in the way it manages production of those seats. The distribution aspect is more obvious; production issues are, today, less obvious because of the incestuous nature of the airline community. This section provides some insight as to why this is happening and is apt to continue to happen for at least 10 years.

As was noted in the previous section, the current airline distribution system was designed and created in the late 1950's and early '60's. It was the first e-commerce. At the time of its creation, there were no computers in business. Further, the federal government governed airline route structures and airline fares. Thus, these systems were developed for inventory allotment and financial control of pre-sold, virtual seat, products. Computer systems were very new and it was not possible to foresee other business needs that might arise. Systems were centralized and self-contained. As depicted to the right, airline seats were inventoried at each airline site (top), distributed through the GDS/CRSs[15] (left) to travel agents (bottom) who interfaced with buyers. Travel agents, in turn, settled payment on behalf of buyers through ARC (right), who distributed the money back to the airlines (top). Even passengers were outside of the airline's holistic distribution

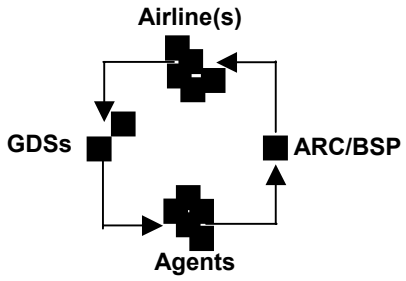

Figure 1

[15] GDS/CRS … the author prefers to use the term GDS (Global Distribution System) when referring to the airline solutions that distribute available inventory to potential buyers through agents; and CRS (Computer Reservation Systems) when referring to individual airline inventory host systems. In the United States and many other parts of the world where CRSs originally provided both inventory and distribution functions, the term CRS is used interchangeably. When used interchangeably, the meaning of CRS is dependent on which segment of the industry the speaker is referencing. This often causes great confusion when agents and airline managements communicate – since an airline CRS can do things that a distribution GDS cannot perform; and visa versa.

loop. A ticket, obtained from an authorized travel agent, was the same as cash. Actual inventory, risk, and settlement, was contained with the self-contained "holistic" loop … entirely by the airline(s).

As computer systems evolved in the late '60's and early 70's, computerized business solutions became independent, and self-contained. Business computer solutions were independent. While some computers could run multiple programs at the same time, individual processes remained separate from each other. A minicomputer might have an accounting system used by one group of people, a word-processing system used by another group, with inventory management and parts maintenance being equally independent solutions.

In the travel industry, these minicomputers might contain a tour vendor's inventory control, accounting, and word-processing – each software solution independent of the other although all running on the same hardware. While even the airlines used mainframes for inventory management, these same airlines evolved independent minicomputer systems to pre-process data entering the mainframe systems and extracting data for internal business processing. In the 1980's, microcomputers evolved, enabling individuals to shed their dependency on a single hardware platform and enabling local programming of spreadsheets or independent word processors for people with specific management tasks.

Both mini and microcomputer systems of this time period were designed to serve needs of existing offices, manufacturing and distributions management structures. These structures were usually "hierarchical" as depicted to the right. But hierarchical structures were more a business organizational structure -a way of managing people and processes, than an outgrowth of automation technologies of the times. In fact, technology solutions of the day were designed and built to serve business structures, whether running on mainframe, mini or microcomputers.

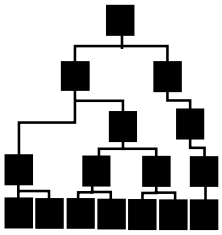

Figure 2

The airline holistic structure and the automation solutions that were built to serve that structure were really an adaptation of the hierarchal business model of the day, implemented to serve the long-reach of airline products. Both models reflect an essential element of effective mass-product and the mass-production that have provided the economic foundation of the Industrial Age … for the past 100-plus years.

That essential element is the power derived from being at the top of the hierarchy, be that hierarchy one of management, or one derived from being "supplier" of a product or solution. In this model, information flows from the top, down through tiers of the hierarchy. Information only flows "up" the hierarchy to the extent that the next higher level is willing to pass it further "up". In a hierarchy, the only real power at any level is the power to say "no" to those wishing to move information of ideas "up" the information channel. To endorse an upward flow of information it to put one's job or one's role in the channel … "at risk". Since most people are "risk-averse", their processes are structured to also be "risk-averse". Thus, information rarely flows up, or even across, levels within a hierarchy.

This model is true, whether it is a management hierarchy, a production processing hierarchy, or a supplier-of-product distribution hierarchy. Even in the holistic airline distribution model noted above, the "supplier" (in this case, the airlines) controlled the information that flowed down through the distribution channel to the buyer. Accordingly, as in the hierarchal model, there was and is no easy way to move significant or meaningful information "up" the distribution channel.

The key difference between the airline holistic model and the more conventional hierarchy is that the airlines also control the settlement process – while in the conventional business environment, settlement has a hierarchy of its own. This difference can be traced to the early adoption of e-commerce by airlines – where electronic settlement via ATC (later ARC) needed to be channeled to ensure advance payment for travel to be provided.

Still, a major problem with both models described above is that information is very restricted, controlled, and efficiently flows only one-way – from supplier to buyer; from management to staff.

A second significant problem evolved in the airline industry's holistic airline structure - and the hierarchal business distribution processes that evolved in subsequent years – in that airline systems were (and are to this day) designed to serve 6-bit word inventory transaction processing needs while contemporary hierarchical business applications were, at a minimum, 8-bit word multi-purpose architectures. Accordingly, airline systems have high emphasis on structures in process control and communications, but are very unstructured in content. Conversely, business systems that came along in later years were designed to serve multi-purpose needs. These newer systems were less structured in process control and were generally self-contained; but very structured in content and applications control. As the two significantly different computer structures evolved in parallel, costs to integrate these different architectures became increasingly prohibitive. Thus, airlines continued to resolve their needs for increased speed and capacity within their unique holistic solution with faster hardware; leaving other less-essential business processes to be undertaken independently with tools that did not integrate with a true production environment.

Faster hardware "worked" until the Internet began to gain public acceptance and usage. Evolution of the "hyperarchy"[16] of high-speed digital communication brought about major changes in all of society. In particular, it created two major changes in distribution of product and product-related information – leading to a third change in the way people "talk to one another". The latter change has impacted economic relationships in society, and will lead to a complete "retooling" of internal "manufacturing processes" of airline seats.

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[16] Hyperarchy – as noted in Footnote 2, is defined by Philip Evans and Thomas Wurster in the Harvard Business Review, September-October 1997, Page 75. Essentially, Evans and Wurster suggest that digital communication enables everybody to communicate interactively with everybody. The term takes its name from the "hyperlinks" of the World Wide Web. However, not only is the WWW a hyperarchy ... but so too is a deconstructed hierarchical supply chain within an industry ... and also object-oriented programming in software or packet switching in telecommunications. "The hyperarchy challenges all hierarchies, whether of logic or of power, with the possibility (or the threat) of random access and information symmetry" say Evans and Wurster. Evans and Wurster released their book "Blown to Bits: How the New Economics of Information Transforms Strategy", Harvard Business School Press, in January 2000.

To understand the "why and how" of the retooling process, one must grasp the impact of the hyperarchy of high speed digital communications on the whole of society, which brings us back to examples as depicted by two major changes in current airline distribution modes

First … is separation of the "product" (i.e., a ticket representing an airline seat) from the physical distribution channel (i.e., an agency or airline network that formerly distributed physical pieces of paper - tickets to each future traveler). The ability to distribute information at very high speed without being limited to physical distribution channels (holistic or hierarchical noted above), enables buyers to compare offerings from suppliers across channel lines, and to choose alternative products as appropriate to their needs. This hyperarchy also enables suppliers to accept instantaneous "feedback" from multiple interactive prospective buyers, and to modify product offerings interactively to meet buyer needs. Information is bi-directional – not one-way as in a hierarchal structure.

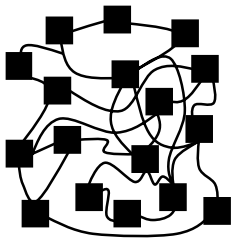

Figure 3

Since the hyperarchy of communication obviates a need for information to move through the same channels as physical goods, one can gain knowledge of a product without the information being directly linked to its delivery channels. In the airline industry, tickets have represented "physical goods" for over 50 years … with travel agencies passing that "physical good" to buyers for later exchange for a seat on an airline. In the early days, tickets needed to be with passengers to prove that travelers had paid for passage. Use of e-tickets separates the information about travel from the passenger. It provides that fares for travel have been paid, without risk of document conversion or physical loss. Proof of payment is contained within computer systems, wherever travelers go within the network. E-tickets effectively break the link between the "physical" representation of the product (i.e., the ticket) and the actual right to sit in a seat on a given airplane.

But separating the "physical good" from its relevant information is difficult to implement in the holistic structures of airline CRS and GDS architectures. While slightly less costly, separating physical goods from information is also expensive in the hierarchal structures of most computerized business solutions built prior to 1998. But the hyperarchy is forcing this evolution on all businesses, including air travel – and in all other aspects and segments of the travel industry.

Second … information in the hyperarchy can be, and is, distributed to users or buyers as appropriate to their respective buying or informational needs. It is no longer necessary to "centralize" buyer information, processes, or even inventory in a single site -- as was/is required by current airline CRSs and the Global Distribution Systems (GDSs).

Thus, in the distribution process perspective, the hyperarchy takes control of information from supplier and/or physical distribution channel -- and enables buyers to assume desired power over what information is, or is not, appropriate to their needs. "Branding" becomes an information "navigation" tool for buyers, rather than a "push" marketing tool of suppliers.

The hyperarchy of information will, over time, change the role(s) of many intermediaries that perform a role in linking or controlling information with the actual "physical goods", traditional

GDSs and travel agencies being among them. Concurrently, buyers'-needs for accurate, timely, and relevant information in the hyperarchy will change the way airlines "manufacture" airline seats within their own systems and processes. Planning projections will necessarily be integrated with on-line revenue management and sold interactively to buyers, both individuals and bulk, in conjunction with controls enabled by revenue accounting departments.

These two fundamental change elements in the relationship of information to physical product(s) and/or intermediaries are forcing a new economic dimension in society – one never experienced by any businessman living today. That change is from a "supplier-driven" mass-production/marketing model -- to a "buyer-driven" event-produced individually marketed economic structure.

The last 100-plus years of modern commerce have been "supply-driven" – where the price of a product was primarily a factor of supply relative to demand. Oversupply drove prices down … under-supply drove prices up. Suppliers, through manufacturing levels, marketing investments, and distribution channels, largely controlled supply and thus, prices.

The original airline CRS systems were automated because of a need for airlines to manage and control the "supply-driven" inventory of seat distribution.

In an era of virtually unlimited access to information about alternative supplies, enhanced by each individual supplier's ability to respond to buyer needs in real-time, ,buyers can interactively select from among multiple alternatives – balancing "needs" and "desires" to fit current specifics of a purchase. In such an environment, commerce becomes "demand-driven" – not "supply-driven". In such an environment, old "manufacturing processes" of airline seats – pre-designing and publishing schedules of available inventory - must give way to "interactive" seat management and production.

Contemporary managers, airline or otherwise, have virtually no experience with a "demand-driven" economic model. For that matter, nobody does. Society is embarking on a voyage of attempting to reach an undefined destination – to manage a big "unknown". While the future is not known to any of us, management in the hyperarchy must be linked to an ability to manage information – to access widely disparate information sources and convert that information into knowledge specific to needs of users and buyers. "Transaction processing" will become transparent and people serving those roles will transition to roles in "knowledge-management" -- navigating a widely expanded information paradigm.

Many believe that the airline industry is perhaps the last of the major "pure" products spawned by the Industrial Age. An airline has large capital investment(s) in its "manufacturing plant" – the airplane itself. Airlines have large capital investments in infrastructure to manage and support each "manufacturing plant" (i.e., the support of each airplane). And in what some would call "classic industrial manufacturing" process – each aspect of each segment of the manufacturing process is segmented into its own "automated" set of management tools … and its own "hierarchically" staffed management team.

Communication is changing the way people relate to one another. And in that vein, the labor-dependent (i.e., including the multiple "silos" of staff organizations) structures that have been

institutionalized in airline automation processes built around the original CRS structures, cannot persist in attempting to solve communications needs of an evolving "demand-driven" society – either economically or culturally. In the challenges of overcoming the legacy structures and processes that abound in airline industry operations are opportunities to rebuild an entire industry and to rebuild effectively, the way that people travel and the way they communicate.

Change Perspective … It Might Just Feel Good

Information is changing the way people relate to one another

For airlines to rebuild themselves, management must change its perspective about information, what it is, how it is used, and most important – how people should interact with information to turn it into useful and economically viable knowledge. Information is changing the way people relate to one another and the way they relate to their jobs.

In every major airline throughout the world, virtually every Chief Executive Officer and every Operational Vice President have climbed to the top of the airlines' hierarchy through years of service in the airline industry; usually within the airline he/they currently oversee. These executives have "earned their stripes" within the holistic structure of the airline industry – where suppliers owned the distribution channel, sold their product (seats) via retail outlets that were agents of the supplier, and collected directly from agents of the airlines through jointly-owned airline settlement banks.

In the beginning, banding together collectively was necessary to launch air transportation. Airline transportation was, at the time, an "experience" and was relegated to those willing to take a risk, and necessarily, the wealthy. For airline entrepreneurs, costs that could be shared without impacting product differentiation helped ensure survival. Such was the case in the origins of the airline jointly owned ARINC.

As airlines evolved from being an "experience" to becoming a true transportation service, the government(s) stepped in to regulate routes, prices, and coordinate communications. Among other things, the jointly owned SITA had it origins in this period. As aircraft technologies evolved and airplanes became larger, the ability to provide accurate information about whether seats were available and/or had been sold began to stress human resources challenged with this task … and a need for computerized inventory seat management evolved.

As noted, airlines did attempt to create a jointly owned computer inventory reservation system. At the time, the government controlled airline routes and pricing. Thus, a jointly owned CRS was not perceived to offer either proprietary competitive information or other unique value-added benefit. But, delayed by lack of consensus among potential users, American opted to move ahead on its own; forcing other major carriers to follow[17].

[17] Interesting historical sidelight: when United decided to abandon its participation in JICRS (Joint Interline Computerized Reservation System), American mistakenly assumed that United intended to go on its own immediately, to win a disproportionate share of agency industry participation. American thought a war had begun and aggressively

Throughout its evolution, the airline industry was purely a product of the Industrial Age, implementing management knowledge gained over the previous 50 years and following the same "navigational principles."[18] Those principles guide airline decision making even today. The leading principle is that an airline should have a visionary Chief Executive Officer supported by a cohesive management team. That management team should, in turn, control the organization with a system of rules and regulations. A successful airline should have a common and unified culture, and an airline must focus on the "bottom line".

To deviate from those rules or from that culture with any sustained view or disagreement resulted in failure to move up through management levels banishment from that airline and the industry. Further, "bottom line" improvements of big manufacturers in the Industrial Age are derived from incremental improvements in doing better what you've done before. Deviant ideas in the production process are like deviant ideas in management quickly dropped because they are typically, in their early stages, costly.

Into this existing culture, airlines introduced computers. These systems were not introduced as management tools. They were not built to assimilate or manage information. There were not even built to communicate with others. These systems were designed in their purest state to enhance the productivity of processes already being done by humans and to provide incremental improvements to inventory management or business processes related to inventory. These solutions were inventory systems, pure and simple. The subsequent systems that evolved were designed around business processes that existed at the time, and effectively, "locked those processes" into the airline seat production model for the ensuing 40-plus years.

Most senior airline executives today have been in the airline industry for 15 to 20 years. Effectively, none of today's senior airline executive leaders have spent any meaningful management time working in a business environment that is not "holistic" in structure. In fact, the computerized "holistic" nature of the industry is one of the reasons for its incestuous nature. Without having evolved from within the industry, understanding "business rules and processes" of the highly computerized airline community was too daunting for most outside executives; and understanding dependencies of a hierarchical economic model was equally disorienting for long-time airline executives seeking to exit the industry.

As noted, the major economic and cultural differences between the supply-driven hierarchal economic model and the holistic model of the airlines is largely in that the airline system is (a) self-contained, (b) computerized, and (c) incorporates its own settlement process.

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mounted a campaign to preempt United, when in fact United was ill-equipped at that time to compete, so American actually realized a first-strike advantage that Sabre benefits from even today (I was there and helped launch that campaign nationwide). Source: Rolfe Shellenberger, Runzheimer, Personal memo to author September 4, 2001.

[18] For a discussion on the four navigational principles of established managements and their weaknesses in contemporary society, see "Managing the Unknowable, Strategic Boundaries between Order and Chaos in Organizations", Ralph D. Stacey, Jossey-Bass Publications.

For example, in the hierarchal model in Figure 4, at each subsequent level of distribution (top-to-bottom), a change of ownership takes place; and risk shifts from seller to buyer. Those links may or may not be computerized. And at each change of ownership/risk, a separate settlement process using a banking system independent of either buyer or seller prevails. Thus, four strawberries "manufactured" in a field could move through four different distribution channels in the hierarchical model from grower to wholesaler to repackager to retailer with ownership/risk being assumed at each transaction and with an independent settlement for each transaction.

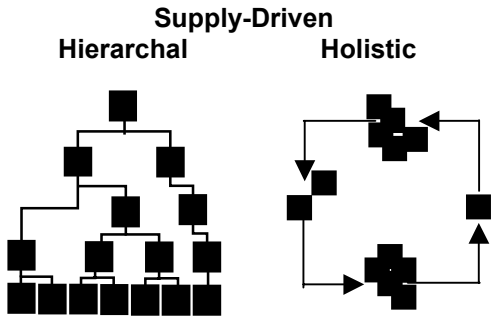

Figure 4

Conversely, as noted earlier, that is not true of traditional holistic airline product distribution. Seats sold in the same airplane or on the same airline or on different airlines channel through virtually identical GDS distribution outlets, which do not assume ownership/risk in the product[19]. So too, agents are agents of airlines and agents settle through an airline-owned settlement process. Even tickets sold using external banking services such as credit or debit cards, pass through airline bank settlement (ARC or the local BSP) on behalf of that carrier on which an agency "plated"[20] the ticket.

What is common to both hierarchical and holistic economic models is that they are "supplier-driven", are designed to mass-communicate information in only one direction – from supplier to buyer. They require high costs to support, and product availability or production (in the airline's case, seats) is largely an "educated guess" on the part of the supplier.

Concurrently, what seems to be evolving in the hyperarchy economic model depicted in Figure 5 is a total reversal. These economic models are "demand-driven" because they are bi-directional. Each "node" can "demand" a service from any other node, or through multiple nodes. Since a buyer funds the communication device and equipment (i.e., owns the computers and purchases access to his own telecommunication port) and there are hundreds of millions of buyers of technology platforms (as compared with hundreds of thousands that use airline systems) – the cost of bi-directional access is both operationally and technologically lower. And perhaps most important, the bi-

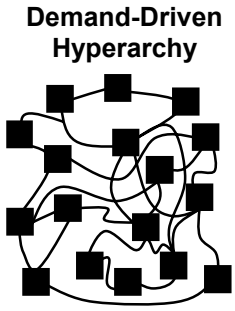

Figure 5

[19] Just as there are exceptions to the hierarchal model, there are exceptions to the airline holistic model as well. Some tour operators (particularly in Europe) and a few consolidators take inventory risk by purchasing some airline seats and holding them as inventory before they are actually sold to buyers. As with those suppliers in the hierarchal model that sell direct, over the past 20 years, such "risk-takers" have represented a very small percentage of airline seats sold.

[20] An agency is given a ticketing "plate" when it becomes accredited to issue tickets on behalf of an airline or airlines. Typically, an ARC or BSP accredited agency is authorized to issue a ticket on any carrier's "plate". Thus, an agency can select which carrier it wishes to issue the ticket against, so long as at least one segment on the coupon includes the "plated" carrier. If the agent does not specify, the automated ticketing system will default to the first major carrier on the ticket coupon. Money subsequently collected from the agency by ARC is allocated to the plated carriers account. Other airlines that provide travel services on that ticket coupon must submit ticket-lift data to ARC to have the money for the service provided transferred from the plated carriers account to the service provider's account.

directional nature of the information provides the seller with virtually immediate feedback about the buyer's needs or intentions.

Effectively, buyers are better informed. Buyers are more knowledgeable in the product selections they make. Buyers are better able to discern which product(s) meet their needs. Buyers are able to advise sellers in real-time as to what they need. Sellers structured to participate in the hyperarchy can adapt the product that they sell, interactively, to meet the needs or demands of buyers.

The "demand-driven" hyperarchy of information is changing the way people relate to one another … between seller and buyer – and between processes and management structures that produce airline seats. Airline managements necessarily need to change their perspective … from the holistic/hierarchical economic, information, and production models around which they currently devise their product – to new ways of responding interactively to needs of a "demand-driven" society. In so doing, they will lower their information technology costs, reduce significant labor functions linked to the old business processes, and restructure the way they produce airline seats. As they change their perspective … it just might feel good.

It (Technology) Can Sense Your Fear

Technology is changing the way people relate to one another

Technology is changing the way people relate to one another. All significant airline business processes and most departmental staffs have evolved from around structures and architectures of legacy computer systems. In the "early days", no other choice existed. Tasks were fundamental to core business needs of the airline and there was no other way to manage the volume of data.

Hardware technology evolved in lock-step with software solutions. But the closed-loop holistic structure of airline distribution, and the embedded 6-bit architecture of the inventory systems – precluded a cost-effective transition to newer or more contemporary automation solutions. Over time, information technology solutions of running an airline came to mimic the business-processes – or vice versa.

Using inventory management systems as the central core, airlines evolved business processes to serve (a) operations management, (b) airport operations and controls, (c) government reporting, (d) accounting and revenue management, (e) fleet management and maintenance, (f) catering and special services, (g) cargo, (h) yield and equipment planning, etc., etc., etc. Many of these functions are interlinked.

For purposes of this discussion piece, the author will use the example of four typical (and hypothetical) airline departments – Planning Management, Sales Management, Revenue Management, and Revenue Accounting. Every airline has a different name or a different meaning for each of these functions. Each airline has different ways of integrating these business functions. These are, however, functions or processes necessary to running any airline. And while I have picked only four generalized functions to discuss, the concept or premise outlined applies equally to any and all business processes with an airline.

In my example as depicted in Figure 6, each function has a hierarchy of its own, as is true of any airline currently running on airline legacy information platforms.

Planning Management takes historic data collected from the government, GDS tapes, and the airline's own CRS data – and builds planning and projection forecasts against which that airline plans fleet utilization, estimates passenger loads (and revenue), and establishes booking criteria in airline CRSs. There are many different terms, job descriptions, and cross-functional departments within an airline that can be charged with the planning function. For purposes of this essay, I have elected to call it Planning Management.

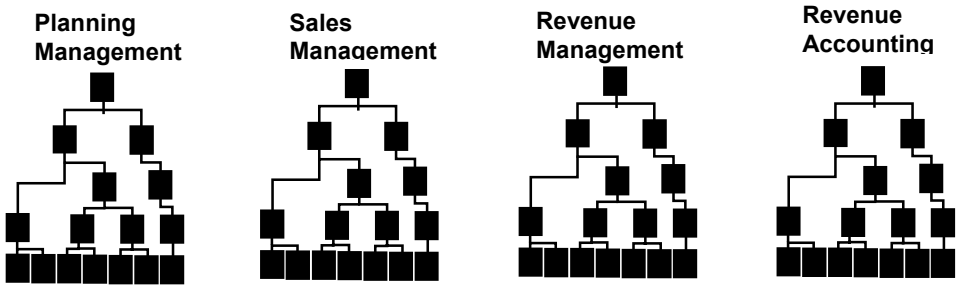

Figure 6

Sales Management is responsible for fulfilling the plan developed by Planning Management. In conjunction with Marketing, Sales make calls on agencies and corporations to ensure that all possible passenger traffic is directed to their airline's seats. They make "deals" with corporations, provide overrides, authorize consolidators to sell "distressed inventory", ensure tour operator relationships and pricing, and, using whatever economic and price incentives they can, attempt to reach goals implicitly set by Planning. Interestingly, Sales and/or Marketing are terms that seem to be used consistently for the same purpose within the airline community.

Revenue Management is typically overseen by the "computer geeks" that manage the actual booked seats in the inventory of an airline's host CRS. Revenue Management, like Planning Management above, is defined differently within different airline entities. Management Consultant Rolfe Shellenberger[21] prefers to separate Yield Management and Revenue Management. For purposes of this essay, Revenue Management describes the total function which audits flight bookings to determine which have weak yields for the airline and/or which flights are overbooked. Revenue Management validates that an agent or airline has actually issued passengers booked tickets. They verify that the class of service booked is that which the passenger is entitled and for which the agency agreed to pay. Revenue Management strives to sustain the operational balance between what Planning projected, Sales promised, and what the airlines can or will carry.

[21] Rolfe Shellenberger, Runzheimer Inc., Consultants; notes to author Sept. 9, 2001. Mr. Shellenberger spent many years with American Airlines. In Shellenberger's airline world, "Yield management are the computer programmers who do demand analysis by flight, by day of week, by climate, by when Yom Kippur or Christmas occurs, etc., to establish a forecast of revenue combining all kinds of travelers and markets. Revenue management is after-the-fact chasing down why things didn't go as planned." Mr. Shellenberger's comment is included to help the reader understand that airlines define these functions and processes differently, but that no matter what they are called, the functions are necessary to support or work with the existing traditional airline information systems.

Revenue Accounting is the staff of "dweebs" that count the money after the airplane seat has traveled from "Point A" to "Point B" (or wherever). Revenue Accounting is a term often found in airlines, although the function may be applied differently, depending on how a given airline's finance department is managed. Revenue Accounting in this essay refers to the financial function which ensures that money collected by an agency matches class of service delivered to a passenger, and that the airline has collected all money due for each passenger who occupied a seat in one of its airlines. Revenue Accounting reconciles monies it collects from ARC or the BSP, issues debit and credit memos to agencies, other airlines, internal departments, etc., and ultimately, provides financial information reported to management, government agencies, investors, and others.

As depicted in Figure 6, these are separate departments with separate staffs. Because everything that each function or "department" does involve airline seat inventories – all their business processes and control systems must interface in one way or another within the airline host system. They are necessarily dependent on the holistic structure of the CRS architecture.

Concurrently, the staff undertaking these functions are necessarily dependent on the cultural rules and regulations that make up the way the airline operates. Those rules and regulations are, necessarily, linked to what the humans can see, do, or build in the CRS systems; or to processes that provide exceptions to what can be done in those systems.

Accordingly, both in technology systems and business processes, these (and most other) departments are "linked at the head" – or centralized – through control mechanisms that are, themselves, defined by the architecture of the original CRS inventory systems. Graphically related, these functions or departments might be depicted in Figure 7.

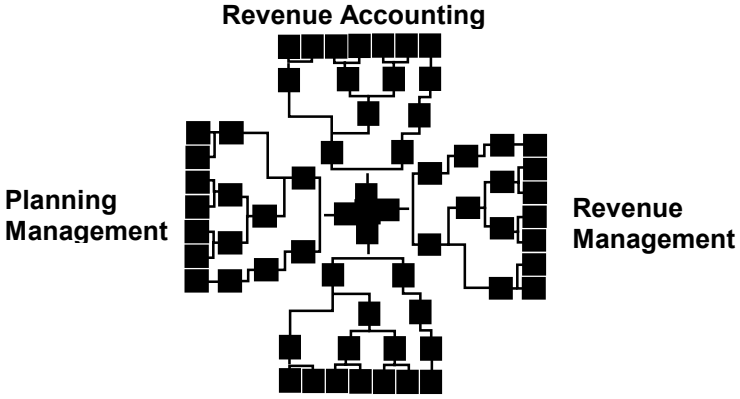

Figure 7

Notice how each departmental function remains intact … both from the perspective of management line and control … and from the perspective of the technology business processes that each department is accountable for and/or must oversee.

The system is closed, not just to the outside – but also between business units, except through the central-hub. While they have closely overlapping functions, each linked and dependent on the other; automation solutions to each business' needs were developed independent of the other and typically, at different times, in the evolutionary state of the airline. Thus, tools used by Planning Management have no direct interface with tools used by any of the other three departments. Sales Management tools, like Frequent Flier programs and the few Customer Relationship Management (CRM) processes, have no accesses to Planning Management except through the old legacy CRS tools.

Revenue Management solutions have only recently become integrated into the airline CRS and GDS environments. But as with Planning and Sales, tools are not integrated with the other department processes. And finally, Revenue Accounting gets its data from the CRS after the passenger has traveled. Because it is not integrated with any of the other three functions, it cannot validate that Planning projections are as forecast, that Sales is selling what they were allocated to sell, or that revenue depicted in the forward bookings contained in the CRSs are consistent with cash and financial projections.

Accordingly, each department is working in an information-constrained environment. It has too little information. Further, each department must use humans to effect transactions and management decisions because there is no way to pass the information efficiently or cost effectively from one departmental process to another. When data does get passed through processes other than the airline's own CRS, it is typically via human-intervention – via tape or some other file transfer protocol.

Compare the structures depicted above with the model representing the hyperarchy of information noted earlier and depicted again in Figure 8. Picture each node in the hyperarchy as one of the different processes or business functions that make up the independent processes of the centrally constructed departmental structures above. Note the potential economies of scale derived from business processes that are networked and distributed. Note the potential openness or access to information from any individual or business process in the network, depending on need. Conceptually, the diagram to the right could represent an integrated Planning, Sales, Revenue Management, and Accounting group of interactive functions.

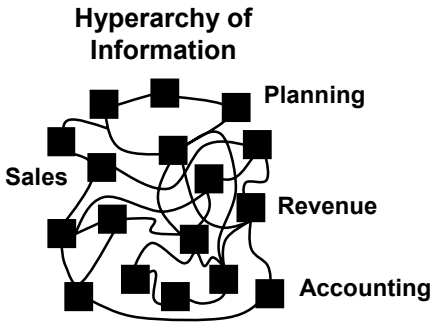

Figure 8

One of the problems of the current hyperarchy of information is that there is too much information available … and too few people who know how to convert the information to knowledge that provides economic benefit to the business entity – be it an airline or some other business solution. But too much real information is an advantage, because it can be culled as needed and turned into knowledge. Too little information, or information stacked in silos, is a risk, because it represents potential lost knowledge.

Finally, in the hyperarchy diagram, note the potential to automate information links and make transaction processing transparent; to eliminate the need for human involvement in dealing with data other than in managing exceptions (good and bad), knowledge, strategies, and planning.

But airline managements are reluctant to relax their hold on existing reality, a reality that has been a part of their core business culture since before their senior managers ever joined their respective airlines. These are generally managers using images of their own experiences and their own roles, unable to recognize the reality of a transition from the hierarchal structures that have prevailed in airline management and processes, to new forms of corporate and product relationships derived from a different structure and innovative ways of managing information in a hyperarchy.

No one can ponder new ways to manage information or to restructure business processes while continuing to think of old ways. Networks and enabling the "look and feel" of a hyperarchy often mask the influence 0f legacy thinking which, in turn, constrains actual opportunities. The fear of unknown, of risking a career, by breaking from existing culture or processes, remains the greatest inhibitor to airlines' responding to new buyer expectations. It is as if technology can sense management's fear.

Face Your Fears … They Are Never As Bad As They Seem

Functions are changing the way people relate to one another

Dealing with the fears of the unknown is something fairly new to every-day life. It has not previously been a part of daily experience because the rate-of-change in business and life experience has been manageable. But it becomes a necessary risk as the hyperarchy speeds the actual rate-of-change. The risk in dealing with these fears is now equal or less than the risk is failing to do so. Airline managements need to face these fears … for those fears are not as bad as they seem.

It is mostly fear of the unknown that inhibits airline managers from innovating new solutions. It's like the old axiom of the mid-80's, "Nobody ever gets fired for selecting IBM" … where, in today's world, "IBM" might more likely be "Microsoft". The point of the message is that managers' … people … seek least risky options when confronted with decisions that involve significant change, major investment with risk of failure, or some other unknown.

Thus, airline careers and job security are tightly linked to four corporate traits -- culture, habits, existing processes, and particularly within the airline community, government rules and regulations. Airline management decisions reflect, accordingly, the significant influence of these four traits ... overriding issues of cost, change, needed new business processes, and even responding to customer needs.

Each of these traits takes years to build and acquire … and in turn, become so infused in the fabric of the airline that each subsequent year builds the barrier higher with respect to extraneous concepts or ideas. They become paradigms around which lives are lived. Throughout the history of man, the rate of change has been sufficiently slow to permit incremental adaptation to new ideas, concepts, and paradigms. While change has always been a part of the human experience, it was never fast enough to become a "threat" … particularly to senior level managers in big companies and within the airline industry.

An interesting aspect of these corporate paradigms is the impact of government rules and regulations. Government laws, rules, and regulations in a Democracy are, by necessity, reactive. They are almost always created "after-the-abuse" … to curb an abuse. Once established, they force compliance, and like other business processes, become established genera. But rules and regulations derived of law become paradigms of their own; and frequently long outlive the abuse for which they were originally created, including airlines.

People born before 1970 did not experience the electronic world in their youth. They did not experience "Preparation for Electronic Digital Commerce in Business" at University. They did research in libraries, not on the Internet. Society simply did not anticipate that these now senior airline managers would need to know how to integrate "smart" technologies into their daily business decision-making processes, let alone, their lives. Nor did politicians and federal administrators anticipate how rapidly their rules and laws would be overtaken by the hyperarchy of information.

Thus, the airlines find themselves with senior level executives approving strategic technology buying decisions based on paradigms that are extensions of a non-digital Industrial Age; with little insight to the burgeoning hyperarchy of information that is the paradigm of the spending generations. Concurrently, airline management systems and processes are designed to serve government rules and regulations that are equally inappropriate to the evolving digital information paradigm.

The threat of technology and the hyperarchy of information are very real to airline managers and government regulators … so real that they generally fail to allow themselves to "see them". It's an easier and a safer career path to work within the boundaries of the airline's culture, habits, processes, and rules to evolve incremental improvements on what has always been done – rather than risk dealing with an unknown. And while senior managers blissfully think that their subordinate managements are dealing with such issues, the very same subordinate management teams are blinded by the same four traits … literally "enforced" by the very management that is relying on them for solutions.

Fortunately, or unfortunately (depending on your perspective), the airline technology infrastructure has come to a "breaking point". As noted in earlier sections, the architecture and fundamental design can no longer deal with the expectations and demands for data that is originating from newer evolving technologies supporting the hyperarchy of information.

But the issue is not the new technologies; rather, it is what people do with the new technologies that must be addressed.

Technology is but a tool of humans. Technology is certainly the result of human demands for automating repetitive human tasks … for finding better ways to do thing … for processing information in new and innovative ways. But those are all human needs … driven by human desires and expectations.

In most segments of society, these needs are being met … from the simplist communication needs to the very complex management of space travel … from determining the genes of mankind to booking airline seats on the Internet. But the "institutionalized" processes of the airline community remain oblivious to these changes, a function of its command-and-control supplier focus. But buyers are forcing this to change, and with it, will force airlines to restructure of the fundamental core way that airline seats are manufactured.

The off-setting elements to culture, habits, existing processes, and government rules are lower costs, a need to change, new solutions to old processes, and responding to the demands of buyer needs.

By comparing each strategic aspect of costs, change, solutions, and buyer needs with the barriers of culture, habit, existing processes and rules – managements can remove the "technology fear" by identifying the people and corporate needs within the decision-making process.

Having said that, it remains a difficult process … because it means breaking established corporate cultures and habits, changing established processes around which departments, jobs, and traditions are built. It means, in some cases, challenging government rules and regulations … or finding new ways to meet them. These are costly tasks, and often have disproportionate learning curves. But as noted already, the current system is unable to meet the new needs of buyers. Those that cannot change will find it increasingly hard to compete.

Still, the process is not insurmountable. As an example, it is worth considering three start-up carriers that evolved in the recent past … Morris Airlines, WestJet, and JetBlue. Each airline was in a significantly different market. Each airline offered a significantly different product. Yet each has been successful.

Morris, based in Salt Lake City, launched in 1984, grew to become a threat to Southwest Airlines, and was acquired by Southwest in 1993. WestJet of Calgary, Canada, launched in February of 1996, went public in 1999 … and reported 18 consecutive quarters of profitability in August, 2001[22], a period where most major carriers were reporting minimal earnings or losses. JetBlue launched out of New York (JFK) in February, 2000, has grown successfully and profitably to a fleet of 14 Airbus 340s during the same period that major carriers encountered major downturns. Three different airlines with three different management teams in three different markets operating different aircraft; all measurably successful.

The only common-thread that runs through all three airlines is a common co-founder, David Neeleman … and the information system architecture that Mr. Neeleman initially evolved at Morris Airlines, acquired in the Southwest acquisition of Morris, and begin selling as the OpenSkies[23] airline hosting platform. While the OpenSkies platform cannot be considered a networked or distributed solution, OpenSkies does contain in a single operating environment, the key relational data structures that enables a virtual self-contained infrastructure of data necessary to respond to new informational demands required of an airline in contemporary society.

Using the OpenSkies information, Mr. Neeleman has evolved small and resourceful tactical management teams that cross and blend all typical mega-airline "departmental" functions. While not wanting to take any credit from Mr. Neeleman, it must be noted that WestJet has continued to operate with significant profits since the departure of Mr. Neeleman to launch JetBlue.

Concurrently, among the other users of OpenSkies are AirTran Airways and Ryanair. Each has also been a superlative performer while major airlines were encountering economic difficulties. In contrast, other start-ups using more traditional legacy systems have not achieved the same kind of

[22] WestJet Airlines Press Release, August 1, 2001
[23] OpenSkies has been subsequently sold, initially to Hewlett-Packard™ who, in turn, sold the solution to Navitaire™, a subsidiary of Accenture (formerly Anderson Consulting).

success during the same "stress" periods. Examples include Midway Airlines and National Airlines. Both airlines were structured to serve needs of the legacy airline CRS architectures and information reporting structures, with Vice Presidents to head each departmental function.

Is information management the only cause for success … or failure … in the airline business? Certainly not! And there are certainly other factors that can point to the success of these carriers. But business successes or failures are reflected in an accumulation of trends. And it is increasingly clear that those airlines that are restructuring their internal information management solutions are rebuilding their business processes to serve the needs of digitally interactive buyers. Their managements are able to use that information in ways different than carriers using the older legacy solutions. Thus, those with better information management tools seem to be surging to the forefront of the airline community.

It is unlikely that the trend will reverse. The hyperarchy of information is bringing about a change in the way airlines manage both internal and external information. But even more relevant is the impact that ready access to information is having on change, itself. Interactive access to information enables faster decisions and, accordingly, greater demand for more complex business process solutions. Effectively, the rate of change is compounding – by some futurist projections, doubling every 18 months.

In the book "Windows on the Future" [24], the power of doubling is cited … taking one cent and doubling it every day for a month. At day 10, the penny has compounded to a value of $5.12. At day 20, the penny has become $20,971.52. At day 31, the penny's compounded value is $10,737,418.24. The author's point is that at first, the change is only minimal … and slightly deceiving. People (i.e., airline managers in this example) are lulled into thinking that nothing much is happening. Unfortunately, by the time one becomes aware of the rate of change … it is too late. The authors conceptualize that, in the scheme of technology evolution, society has just passed day 20. They suggest, "What lies ahead is almost beyond our ability to comprehend. There is no end to the month in technological development. There is no Day 31. The growth … will continue into our foreseeable future."

It therefore becomes increasingly imperative that airline managements face the fears that come with challenging established airline hierarchy of cultures, habits, existing ways of managing information and processes and, where necessary, existing government rules – with strategic initiatives that evolve a hyperarchy of structures supporting open and distributed information. Change is necessary to evolve lower costs. Change is necessary to evolve interactive new solutions that can respond to the demands of evolving buyer needs. The functions of process must change that to effectively enable managements to meet the new buyer demands in the way people relate to one another.

"Doink"…

People are changing the way people relate to one another

[24] For an interesting discussion on the impact of the rate of change, see "Windows on the Future" by Ted McCain, Ian Jukes, 2001, Corwin Press, Pages 33 through 50 (Chapters 4 and 5).

Technology is but a tool -to paraphrase - "of the people, by the people, and for the people". Technology is changing the way people relate to one another. Technology is changing the ways information is distributed, to whom, when, where, why, and how. The paradigm of information about our areas of interest and the way we work has changed. Mass media that once told us to buy this product or call that 800 number, now invite us to visit a web to interact with the sellers contextual options.

The "light" has been turned on for the buyer/consumer. In 1995, less than 10% of the U.S. population had access to Internet or e-mail. Today, that number is approaching 75%[25]. Every major business in the World has become dependent on Internet for communication.

Consider a business letter to a key buyer just 40 years ago. That letter that took a day to draft, a day to have a stenographer type, correct, and retype, three days to travel in the U.S. mail to a destination in the U.S. – with the respondent taking another day to draft and write a response, another day for stenographic typing and posting, and three more days to reach the originator. Total time for a full-cycle correspondence was about 10 days. The fax came along and turned what was once a 10-day turn-a-round cycle into five. Desktop computers turned five-days into one or two. And e-mail has turned one or two days into hours.

But most manufacturers and most established producers, including all major airlines, are still building their "products" and producing their "goods," using equipment and processes conceived and designed 40 years ago! Because they controlled the information path about their product, the only changes they needed to make in their "manufacturing" or production "processes" focused on building more, faster. "Feedback" was simply how many buyers "voted" with their spending.

Only with a need to respond to requests and demands from buyers for more and accurate information and delivery of product, have manufacturers begun to experience what I call the "Doink" factor – the inability of existing manufacturing and production solutions to provide product in response to expectations and demands of new-found retail or buyer knowledge skills!

"Doink" does not mean anything other than what it says. It's akin to getting "hit on the head" for doing something that in hind-sight, is pretty stupid … something that one should have seen as a result of recognizing or participating in some other experience. Who among readers of this essay has not used e-mail, not used the Internet, not used cell telephones, not dealt with interactive voice; not used an e-ticket for travel, not watched a grocery clerk scan our food charges into their integrated inventory system, etc.?

With each of us interactively involved in a changing information paradigm, why has the airline community in particular failed to recognize that their existing e-commerce supply-driven infrastructure would be no match for this new demand-driven information culture with evolving

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[25] Source: http://www.Nua.com, How Many Online? Nua represents it self as "the authoritative online source for information on Internet demographics and trends." Nua offers an estimate of the global Internet user population, based on extensive examination of surveys and reports from around the world. Nua data for U.S. Internet usage sourced from Nielson//NetRatings.

technology solutions? "Doink"! … in fact, the industry appears to have waited too long. Airlines that have best endured the current economic stress period are those that have built early versions of integrated relational information tools. These tools seemed to permit them to modify their business processes to better respond to buyer and operational needs, adroitly adapting product and offerings quickly to shifting demands. "Doink"! …these airlines became demand-driven; were not supply-driven by traditional paradigms of airline seat-manufacturing and distribution.

So, what really is happening -particularly in airlines?

In the legacy model of information processing, people were transaction processors and intermediaries. Hardware systems were self-contained. Data were inserted into "black boxes" and software inside those "boxes" manipulated data and spewed out pre-formatted reports or elements of data relevant to human needs.

Computers processed data to enable humans to make transactions based on rules that built into the software. Rules were fixed by suppliers (i.e., manufacturers or producers). Data that could be manipulated was fixed. Reports (or displays) were fixed. All decisions were made by human intervention. Computers were not "smart enough" to make decisions.

But computer systems "grew up". Technology improved the ability for programmers to process more "rules" faster, to evolve "fuzzy logic" to expand the rule-base and also manipulate data, to display pictures and motion and graphics at faster and faster speeds using smaller and smaller user interface tools. But only after these tools became widespread in other businesses and with consumers, were airlines forced to include them.

Still, the airline paradigm precluded management from understanding fundamental changes-taking place in the way society used information. Accordingly, airline information "guru's" simply put "front-end" pre-processors in front of their core architectural systems that had handsomely served airline inventory needs for some 30 years. Airline management simply did not recognize that technology had outdated a need for humans to provide transaction-processing skills – and now enabled people and staff to convert information into incremental knowledge improvements.

As in the message example above, what used to require an agent intermediary to enter command key-strokes into an airline-linked dumb terminal - or a revenue manager intermediary to monitor bookings on a given flight – were replaced with "expanded rules" derived from computer software logic. As with the letter, what once took days and days, now takes minutes. What took minutes now takes seconds, if it is needed at all. Humans are effectively being transformed from transaction-processing intermediaries – to interactive knowledge providers or brokers.

Knowledge depends on information. The hyperarchy of digital nodes and networks makes information almost virtual, certainly virtual by past standards. Without dissemination of information, there is no knowledge. But equally, too much information causes confusion. Too much information requires skills to assimilate and discern, to rank or value, to "package" with other elements of information. Application of these skills represents knowledge. Increasingly, how to assimilate and apply information is what enables value-added knowledge that is unique to humans.

Users of the hierarchal airline systems come from a paradigm that confuses transaction processing with knowledge. In airline systems, people are challenged with spending large amounts of time searching through large amounts of "normal" data for isolated abuses. When abuses are found, these people then apply "rules" to prevent further abuse. Their "knowledge" is tied to their ability to do the search process – not to how to resolve problems interactively based on the current status of an event. In today's information environment, the "search" and "rules application" can all be automated – freeing staff to focus on interactive real-time responses that enhance revenue or planning to buyer and/or flight specific needs.

Coordinated application of knowledge skills is the current value of contemporary business in a hyperarchy of information. Optimization of coordinated knowledge is built on tools that pre-manage information against rules and processes in a real-time structure from data obtained from the originating source. In the airline systems, that "source" is often defined as their inventory systems – while in the hyperarchy of information, the "source" becomes the interaction between the buyer and the available inventory.

The original inventory-focused designs and fundamental processes from which the core airline "manufacturing" and "processes" structures have been built have become an albatross to the airline's abilities to deal with the demand-driven needs of high-speed relational information processing. Airline systems do not provide integrated information to enable a transition to human knowledge skills in the seat-production process.

The airline paradigm of business process and the culture that surrounds these processes are further inhibitors. Managements that espouse innovation and customer service "at all costs" can only accept changes that fit within the airline industries technologies technology paradigm.

In mid-2001, the author participated in an analysis of a major airline industry hosting-environment. The 12-person study team was comprised of leading hardware systems architects, airline and travel industry specialists, contemporary software designers, and financial planners involved in funding contemporary technology platforms. As part of the analysis, the study-group posed the hypothetical question to the existing management team – "What would you do if something totally wiped out your current host platform? How long would it take to build or rebuild a system that could support the existing business? How much would it cost?"

The participating counterpart senior management team of this airline company said … (a) it would not be possible to wipe out our host platform, but if it really did happen, (b) it would take multiple hundreds of staff working 16-hour days, two and a half years to rebuild the system (c) based on reconstructing software code retrieved from back-up tapes stored off-site with (d) costs approaching $800 million dollars. Effectively, this management team said, "it can't happen to us", and if it did, they would rebuild the same platform to serve the same needs as in the past.

This elicited the obvious question, "In the face of current technology enhancements, why would you rebuild the same platform"? Separately, and later, in consensus, each member of the management team stressed the fact that it was not possible to build a "transaction processing system" that could

manage the tremendous volume of demand from travel agents without duplicating the hardware, software, and business process solutions that exist in the business today.

The fact that there are many financial industry transaction-processing platforms processing 100X the volume of the managers' current system serving equal fiduciary customer demand-driven needs through user friendly comparative information responses with significantly faster response times – was totally lost on them. The possibility that such a system could be built or reconstructed using distributed and networked architectures in a three to four month time frame on hardware costing $1/10^{th}$ that of their present (and proposed) system – was beyond comprehension.

This management team was and is a very intelligent group of airline industry people spanning technology, financial, marketing, and planning skills. But it is a management team locked in its airline paradigm and culture, unexposed to, and unaware of, the transition in technology and applied technology skills that are redefining human behavior and cultural buying patterns and knowledge skills of their customers. Their paradigm precludes an ability to recognize that their own system users, current and projected – those that produce airline seats – are and would still be implementing processes and procedures no longer relevant to products buyers seek.

In August of 2001, , Sabre introduced what appears to the first true strategic initiative to begin migrating from its airline legacy-bound systems to a new, networked travel technology platform. The newly announced architecture represents a significant change from legacy structures of the industry's past.

As with e-tickets in 1995, this Sabre introduction is likely to impact the way airline information will be processed in the future. While Sabre's focus is to serve distribution needs of buyers, it will necessarily transition its new platform to serve its airline-hosting clients – which will enable airline managements using that platform to restructure the way they "manufacturer" their product.

The open demand-driven needs of an evolving Information society (hyperarchy) will, accordingly, respond to those airlines that offer a user-friendlier, user-integrated solution. Airlines that remain dependent on the supply-driven command-and-control legacy architectures will not be able to compete.

Sabre outlined a 4-year development program, providing the first airline industry time-line reference point. This Sabre time-line is referenced toward distribution capabilities. Still, airlines, whether hosted in the Sabre environment or not, will necessarily be forced to respond with similar architectures to meet new customer demand expectations, new operational information requirements structures, and to lower operational and distribution costs.

In responding to this Sabre initiative, interactive integration of processes will evolve to replace processes currently separated in legacy system architecture architecture-induced business practices, and an industry culture built around legacy architectures.

Which leads to the question … what is the buyer of an airline seat purchasing?

Legacy inventory systems were built to serve the fact that a traveler was buying a seat from "Point A" to "Point B". While it might be necessary to route through points "C, M, X and/or Z" to get to "Point B," a buyer of an airline seat is basically buying "A to B". Airline systems support this convention … LAX JFK (Los Angeles International Airport to John F. Kennedy Airport in New York), a direct flight between the two cities – or BFL BTV (Bakersfield, California to Burlington, Vermont), that might route through ORD (Chicago), MSP (Minneapolis), or EWK (Newark).

In the "airline world", terms like LAX and ORD are recognized. But in reality, who the heck really knows what LAX, JFK, BFL, BTV, ORD, MSP, OR EWK represent? And why does one need to know it? Why are those particularly three-letter combination used to identify airports in cities throughout the United States and around the world? The answer, of course, is that they are constructs of the original airline legacy architectures that were unable to manage big names or fuzzy logic constructs when these systems were developed. And as such, these computer codes became embedded in almost all airline industry business processes, naming conventions, and even "lingo" of frequent business travelers not associated with the airline industry except for the purpose of traveling. They are an anachronism of the airline paradigm and its culture.

In this system, as it is used today, a traveler may go to a travel agent and request travel between Los Angeles and New York. The fact that she does that through a human travel agent, a human airline agent, or an Internet site or gateway operated by a travel agent, or an airline, does not change the fact that it is still an "agent" that can access the holistic distribution system in one way or another. And what does the traveler ask for? A seat between two airports!

Is that what the traveler is really buying? The author would suggest that it is not. The traveler *is* seeking to get between two points, A and B; but those two points are NOT airports. If it is a business traveler, those two points may really be between a traveler's home and the place where she intends to do business! And very likely, the travel need includes time at the business destination and a return journey home.

This business traveler is, in fact, packaging her needs. In addition to the airline seat that goes between the two airports, she must also arrange travel from her home to the airport, parking for her car if she does not take a shuttle, taxi, business limousine, or get dropped at the airport by a friend. At the destination, she must arrange travel to the hotel or business site and accommodations for however long she will be staying. And her return requires the same logistics issues.

Most of those "packaged" elements of what the traveler is really purchasing can be obtained via the current holistic distribution system if the buyer is willing or able to spend an excessive amount of time and probably pay a premium price for branded products offered via the holistic systems. But costs of participating in the current airline distribution system precludes access by any vendor other than the very largest that can afford to amortize costs of electronic connectivity across millions of booking transactions. Accordingly, more than 85% of possible alternative vendors offering packages that might fit the traveler's needs are not available in the current airline distribution system.

Also important in this dimension is the fact that a buyer must construct each element of the "package" manually, whether that is done by a buyer herself, her administrative assistant, travel agent, or some combination. The core legacy architectures disallow interactive building of a "packaged" product responding to specific buyer's needs. The supply-driven design construct of the system never anticipated that buyers would want or expect integrated packaging of multiple commodity travel products. Interactive needs of buyers cannot be serviced by systems that still require human intervention in planning, revenue, operations, and other "seat-production" transactions.

Still, the anachronism of the system can be overcome through "front-ending" high-demand needs until new architectures can be implemented. An even more relevant dilemma is how to educate airline management thinking to recognize that airline seats have become a commodity item included in a buyer's "packaged" travel-need. As railroad owners of the 1940's and '50's could not see airline seats as a threat to their dominance in transportation services, airline managers of today do not recognize or even understand the "packaged product" demand evolving from the hyperarchy of information. The paradigms are in conflict with a "seat-manufacturing" process.

Implicit in the evolving buyer demand-driven structure of packaged-knowledge e-commerce is that airlines must change what they offer. As one comes to recognize that the airline product must change to meet buyer expectations, then so too, airlines must change the way that product is created, packaged, and distributed.

Hey, We're Different…

Structures are changing the way people relate to one another

So, the airline industry is different. Hopefully, in the preceding discussions, it has become clear that a significant difference exists between automation platforms, business processes, and cultural foundations that make up airline holistic systems; furthermore, that differences exist between airline legacy systems and those dominating e-commerce. Structures that comprise these different paradigms are changing and changing the way people relate to one another.

It becomes appropriate then, to address key structural changes that confront airlines. In the author's perception, structural issues pertain to changing core airline product, external evolving cultural and business processes that demand internal operational restructuring, and structural processes by which new products must be generated and integrated into the distribution mode.

I am not a futurist. A futurist is an individual who projects some single future state or status. Rather, I am a "futures planner". A "futures planner" tries to anticipate all possible futures, to avoid being surprised. Airlines too must plan for "all possible" futures linked to the information hyperarchy. Planning for these futures involves identifying trends and multiple possible consequences of those trends and predicting most probable outcome of those trends[26].

[26] Chris Christensen, Christensen Associations, Inc., printed reference material to Christensen presentation, "Futures Research, a Briefing for the Association for Strategic Planning" to the Association for Strategic Planning, July 10, 2001.

Chris Christensen[27] points out that this also includes consideration of the "antithetical" future …the possibility that unseen factors will take the future down a different path or revert it to structures that currently exist. Still, as Christensen points out, all multiple futures, those most probable and the antithetical, share at their core a need to do the same business processes 85% of the time. Adapting to a specific future is minimized to only about 15% of total planning possibilities.

If one looks at evolution in airline seat-production, some obvious trends can be identified. Most obvious is the trend that buyers are demanding more point-to-point direct flight connectivity. This is in lieu of hub-centric services that have dominated the industry for the past 30 years, and represents a classic and significant paradigm shift in the product airlines will offer.

Airlines have traditionally been able to offer lower cost services to smaller service markets by moving traffic from multiple points through hubs – where passengers could self-distribute themselves to destination airports. But buyer needs induced by the information hyperarchy are impacting both the infrastructure that supports physical facilities of airline hubs as well as enabling passengers to support alternative point-to-point carrier services.

On the issue of a gathering momentum for point-to-point services, rather than try to explain this issue in the literal physical movement of airplanes, consider instead, the legacy airline inventory mainframe architectures – as compared with Local Area Networks or the Internet.

In a CRS environment, every message initiated by a user must transit through a central CRS CPU in order to be relayed to the requested process or to another user (i.e., the addressee). In a Local Area Network (LAN), each message initiated finds its own direct route to the addressee. Internet is essentially an expansion of a LAN -- where each message picks its own network links to optimize its speed to the end destination (addressee). But neither a LAN nor Internet is dependent on a single centralized-hub (i.e. CPU) to process successfully each message.

In the paragraph above, the issue was nothing more than moving digits (ones and zeros) from points "A" to "B". Those digits are little different from "bottoms in seats", in that both are providing networks of transportation to enable some "other" process or event to happen when the "bit" or "bottom" reaches its destination.

Accordingly, hub-centric airlines tend to be like a centralized CPU. To get from "A to C,M, X, or Z", one MUST go through "hub B". To the extent that "A" may sometimes be point-to-point "C" and/or point-to-point "Z", the need for "hub B" is minimized or eliminated. But "hub B" is still required for "M" or "X" ... at least, until a point-to-point link is built from "A"; or perhaps, even "Z". Point-to-point carriers may serve multiple nodes in the network and even pass-through one node to another in the case of Internet; but traffic is uniquely point-to-point and not dependent on a given central point.

As presented above, the commodity is transport of a passenger in a seat from point "A" to a desired destination, be it point-to-point or through a hub. But travelers are demanding more point-

[27] IBID.

to-point services and in some cases, seem willing to pay fractionally higher costs for such services rather than suffer "hub-induced" delay-costs. At some point a balance may erupt.

But perceived economies of scale in hub-centric services are being lost to increasing infrastructure-costs (slot and frequency demands, FAA capacity constraints, gate relative to equipment size restrictions, ground access by passengers, scarcity rents, etc.) =. which simply compound any customer perceived economic-cost benefit derived from lower fares (to the extent that the hub-networked airlines are willing/able to ameliorate "A-through-B to C, M, X or Z" fares) that compete with non-hub point-to-point services.

Being point-to-point does not mean not being networked (Southwest is a good airline example). It means that each node in the network is self-sufficient and can stand economically on its own. A recent innovation of the demand for point-to-point service is reflected in the evolving business-jet (biz-jet) markets. Small business jets operating with full loads on direct point-to-point flights can effectively compete with per-seat-mile cost of a typical first-class conventional airline product. This is particularly true when a conventional product must “hub” while the biz-jet can fly direct.

Two major constraints hinder the biz-jet market. The first is cost of “empty return flights”. Second is finding a way to distribute available seats to potential buyers. The recent introduction of Skyjet, an inventory-hosting platform serving multiple biz-jet product providers, portends a possible resolution of the second problem. Concurrently, the same platform becomes a “pooling” center for potential buyers of seats on “empty return flights”. Essentially, by networking the information interactively between buyer and multiple seat producers, the value-added benefit of product differentiation becomes easily marketable. In that environment, the biz-jet information management system enables a networked biz-jet physical product – and a potentially new high-profit product for airlines that move into that market segment.

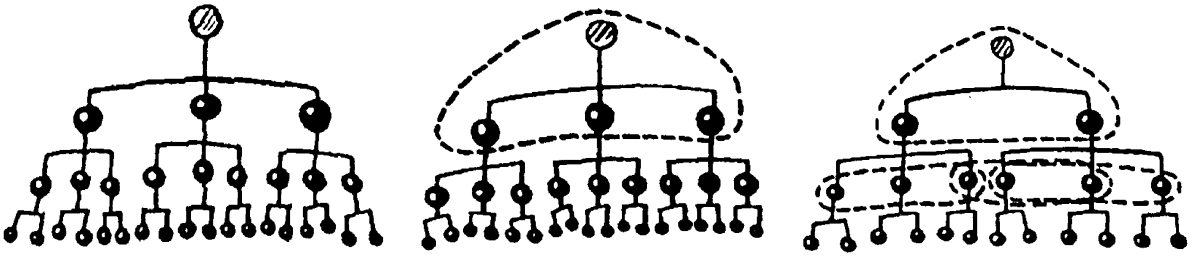
Demand for a commodity product of a seat moving from point "A" to a desired destination ... AND ... inability of hub-dependent carriers to cost-effectively and rapidly transform their product (seats) to networked point-to-point services places many airlines at risk. But these airlines keep themselves in this “risk state” because of (a) capital and infrastructure investments in existing product models, e.g., hub-centric scheduling; (b) labor agreements that preclude disassembling old structures, even to rebuild an equivalent new alternative solution; (c) existing business processes that do not allow for , or even permit recognition of alternative route, revenue, operational, maintenance, or even marketing models, and most important, (d) airline culture and airline managements have become so self-righteous and incestuous that even minor deviations from any hub-centric airline's core past are simply excluded from the "collective mind" of each airlines management/culture value sets.

Those airline managements that can overcome (d) can usually find ways to deal with (a), (b), and (c). But they remain an exception, not the norm.

An interesting dimension of this period of time is that most people recognize that society is in a state of change, change brought about by new information technologies. People all recognize a need for change for the “other guy”. Confronted with change, particularly change that impacts on job

security, all sorts of factors within the existing paradigm reinforce a status quo. Examples include such phenomena as previous successes are seen as promising future success, so new route structures must fit the mold of historical structures; if the Managing Director "says so", then it must have come from management.

But these largely "humanized" inhibitors are, in airlines, supported and propagated by information structures that surround the industry. In his book Imagin-i-zation[28], Gareth Morgan addresses new mindsets for seeing, organizing and managing. In Chapter 7, Morgan depicts three classic stereotype organizational structures …



Model 1: The Rigid Bureaucracy

Model 2: The Bureaucracy With a Senior "Management Team"

Model 3: The Bureaucracy With Project Teams and Task Forces

Figure 9

If the reader has worked in the airline business for more than three weeks, you've experienced one or more of these structures.

As Morgan points out, Model 1 is a classic bureaucracy. But not only is it a classic bureaucracy, it is also a replica of original airline inventory systems. The top of the channel represents the "seat" … and each level below represents some functional status of that seat … depending on availability, booked status, and/or flown status. Accordingly, airline organizational management structures took on similar structures to accommodate information availability at the time and the way that information could be integrated back into the company's processes.

Model 2 is more commonly found in most airlines today, a bureaucracy with a senior "management team". Some airlines have created information structures that attempt this model, building special service requirements on the original platforms to facilitate tighter control of cross-functional information management needs. But other than the hierarchal airline structures, there is very limited "flow-through" of information – and concurrently, very little distortion of business processes within the airline or staffing structures that support the information flow.

[28] Imigin-i-zation, Gareth Morgan, Barrett Koehler, Inc., copyright 1997

Model 3 is talked about in some airlines … implemented in a very few. When the command-and-control structure dominated the distribution aspects of seat distribution for the ten year period beginning in the mid-1980's, the owner airline's relationships with the GDSs closely simulated the Model 3 type structure … with the GDSs being quasi-independent but closely-linked sub-sets of the airlines. But as Internet evolved, control-and-command value of GDSs eroded and, combined with their high cost structures and increasingly independent strategic needs, airlines began to shed their GDS linkages in both a business and economic sense.

Morgan makes the point, "To be effective, organizations need to structure themselves through models that are appropriate for dealing with the external challenges being faced"[29], and discusses three other evolving organizational structures. "To achieve the flexible, innovative, committed organization that is needed to deal with the turbulence and change found in the modern environment, organizations have to get beyond Model 3. This is where Models 4, 5, and 6 come, especially Models 5 and 6."[30]

While Morgan discusses organizational needs of responding to a modern business world, he addresses only the human relationships. But big companies, including airlines, are made up of more than just the human relationships – and in the airline environment particularly, organizational structures are defined by the information systems that enable people to manage with knowledge. To enable these organizational structures, there must be effective informational links.

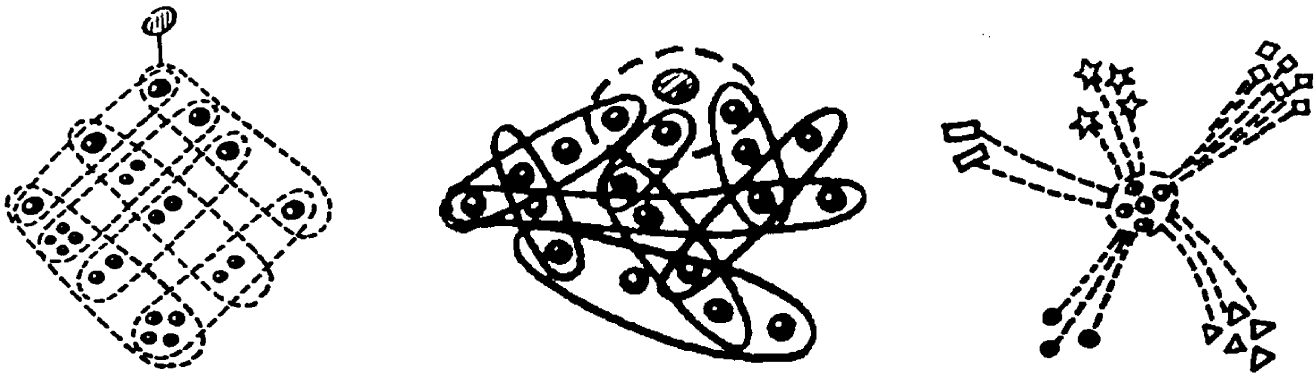
As the reader looks at the organizational structures depicted in Figure 10 below, they closely parallel – actually seem to precede – the evolution of the digital networks. The early structures of ARAPNET functioned in a way much like the matrix depicted in Model 4. Today's Internet structure closely approximates Morgan's Model 5. Interactive voice, television, and other tools are likely to reflect the loosely-coupled networks defined in Model 6. Further, corporate structures that evolve a Model 5 digital information network and then seek to access other information structures or networks, are likely to also interact as loosely-coupled networks.

In contemporary large businesses, including airlines, it is probably not possible managerially or economically to implement networked organizational structures using face-to-face communication or organization charts. Information about work roles or product(s) is no longer tied to the hierarchal channels that link manufacturing and distribution processes. The hyperarchy allows the information to pass interactively through management nodes to provide buyers or users with intelligent real-time information.

Existing airline inventory management and distribution solutions are no longer valid to meet the needs of the information hyperarchy; the organizational and business structures that surround these processes can no longer respond fast enough to serve the hyperarchy. Airlines must modify both the information platforms and the business structures and processes to participate in a contemporary business world.

[29] IBID, page 163; pictures from page 161
[30] IBID, page 164

As noted, early development of the government's ARAPNET, the precursor to what is now called Internet, was structured more along the lines of the matrix organization Morgan defines in Model 4. Morgan refers to the matrix form as a "hybrid bureaucracy" that gives roughly equal priority to functional departments. The early government needs for ARAPNET also provided roughly equal functional priority to the early participants in the network.



Model 4: The Matrix Organization

Model 5: The Project Organization

Model 6: The Loosely-Coupled Organic Network

Figure 10

More contemporary Internet design closely simulates Model 5. Concurrently, in Morgan's Imagin-i-zation, he suggests that more contemporary organization structures will need to more closely resemble Model's 5 and 6[31]. If data is already flowing in these networks, then management structure *and business processes* must soon emulate Model's 5 and 6. Outside of the airline community, it is easier for the technologists to optimize the efficient flow of "bits and bytes" to match management and process structure. Often, for managements, adapting business processes to information flows is easier than forcing information into existing hierarchal business process pipelines.

Until the buyer's need for information leveraged its way through automated Internet agent portals, the airline industry's existing melded organizational/automation structure was more than adequate. But buyer demands for new, different, and timely on-demand information is proving too much of a challenge for the existing systems.

Lets consider first-hand, the impact of the Internet on the hierarchical structure of the airline distribution model.

There are somewhere between 1000 and 1500

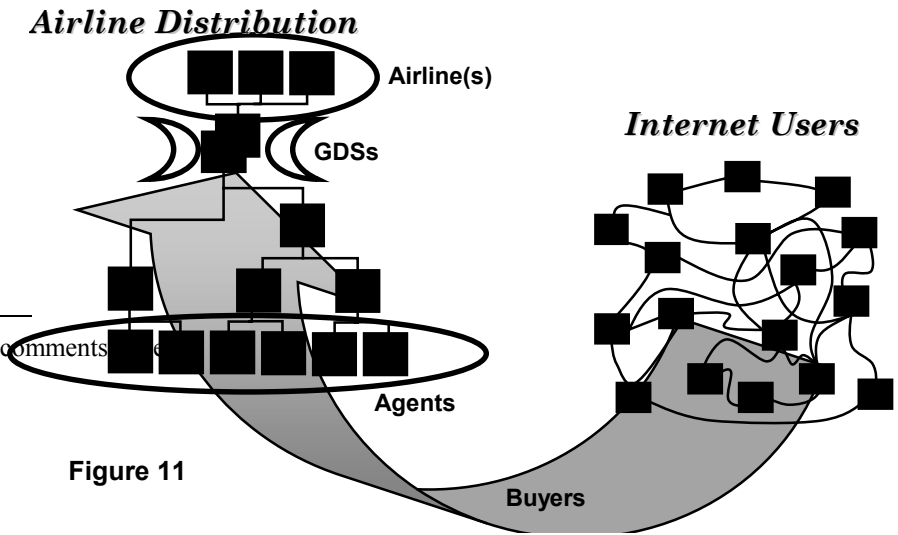


Figure 11

[31] IBID, pictures from page 161, comments

airlines offering scheduled services, as depicted in the circle at the Airline Distribution hierarchy in Figure 11. Distribution for those airlines are, at the present time, through the four primary GDSs – depicted below the airlines between the)-(symbols. In the hierarchy that follows, airline seats are distributed directly or through various second-tier packagers (tour operators, consolidators, etc.) to agencies (circled at the bottom of the hierarchal diagram). There are somewhere between 200,000 and 250,000 travel agencies (or an estimated 850,000 or so agent terminals) in the world, all linked through the hierarchal structure through the 4 GDSs.

Consider that prior to the evolution of Internet, essentially all information pertaining to travel channeled through one of the 250,000-plus agencies, which accessed inventory through one of the four GDSs to reach the airline inventory systems. The first half of the arrow at the bottom of the Airline Distribution hierarchy represents how travelers accessed airline inventory via agents. Individuals needing to travel simply went to their local travel agency as depicted in the big circle at the bottom of the hierarchal graph.

But in the mid 1990's, buyers begin networking via the hyperarchy – sharing information and buying needs, initially obtained by through word-of-mouth from travel agents. But the explosion of Internet led to automated solutions. By the year 2002, there are an estimated 168,000,000-plus Internet users in the United States, 425,000,000-plus users throughout the world[32]. If only 10% of the Internet users seek airline or travel information, that represents 42,500,000 users are now attempting to access airline information systems. And each of those requests are coming through automated travel agent gateways served by one of four GDSs – as depicted by the extended arrow.

Compound this demand with the fact that agents are trained to pre-screen traveler requests and ask systems only for data relevant to a traveler's itinerary. Internet users, on the other hand, do not have the typical agent's knowledge of the system or the data contained in it. Further, the user-friendly "front-end" software solutions do little to control or manage Internet queries because they (a) they are unable to interact intelligently with the customer and (b) legacy structures of architecture based on supply demand strict adherence to commands necessary to obtain information from stored data.

Instead of serving 850,000 or so knowledgeable travel agents using skilled command language entries that the architecture was evolved to serve, the legacy distribution systems are attempting to provide disparate information to 37 million untrained users seeking access to information previously provided or screened by agents. The number of Internet users seeking airline information is expected to grow 70% a year[33] for the next five years.

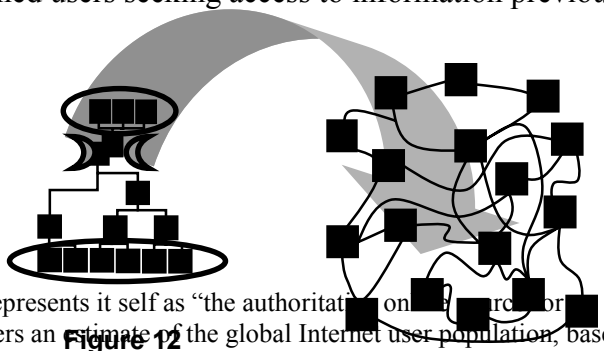


Figure 12

[32] Source: http://www.Nua.com, How Many Online? Nua represents it self as "the authoritative online source for information on Internet demographics and trends." Nua offers an estimate of the global Internet user population, based on extensive examination of surveys and reports from around the world. Nua data for U.S. Internet usage sourced from Nielson//NetRatings.

[33] Sabre Holding Company announcement of its new technology platform, captured from its announcement web broadcast at http://webevents.broadcast.com/compaq/sabre01.

There can be little doubt that the two disparate distribution systems must meld into one. But the hierarchical supply-driven command-and-control structure of airline's distribution structure precludes effective integration of widely distributed demand-driven buyer needs. Thus, the transition must reverse the information arrow's flow. The airline distribution solutions must integrate into the hyperarchy of information as depicted in Figure 12.

Conceptually, the premise is fairly easy to follow at this point. However, the "meld" represents more than just an integration of the old technology structure into the new. For the old hierarchical system to integrate effectively into the new-networked model, the core business organization structures that support technological integration must also change.

Having presented the concept in the distribution dimension, it is imperative to take this "product offering" model and transform it back into the "supplier's" processing or "manufacturing" (of the seat) mode.

If one looks closely at Figure 13, it is possible to see the old hierarchal structures (smaller black squares) within the networked model. Of course, this is only a graphical representation. But even in the graphical representation, it is easy to recognize the integration of the disparate nodes of information or expectations between supplier product availability and needs of buyers.

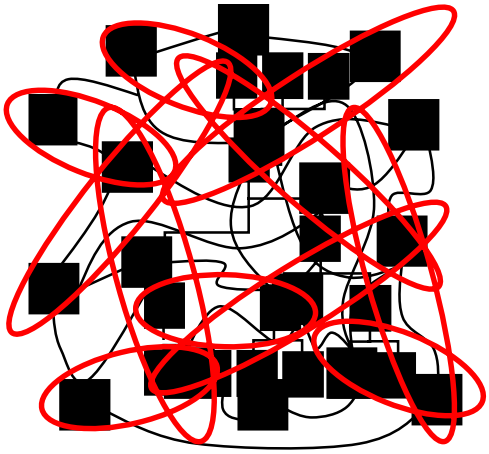


Figure 13

If the product delivery or distribution system has reconstructed itself into a structure of informational-related network nodes, how can the hierarchal culture of the airline business processing units remain outside the network?

As you view the integrated diagram, keep in perspective that the nodes may be transactional data nodes necessary to affect a product display or reconcile a credit approval – or they could just as likely be human-interface nodes … i.e., a bulk seat purchaser or a tour operator. Note that is some instances, the circles of relevant data cross both hierarchal and hyperarchy nodal links.

Lets go back and consider the Planning, Sales, Revenue, and Accounting hierarchies depicted in Figure 14. A Planning projection moves up through the hierarchy to the connect-point and is then distributed as target information back down through the respective alternative hierarchies. A Revenue problem moves up through the hierarchy to the connect point and back down the Sales hierarchy to be fixed by person calling an agency outlet or somebody. When humans make the decisions and humans audit

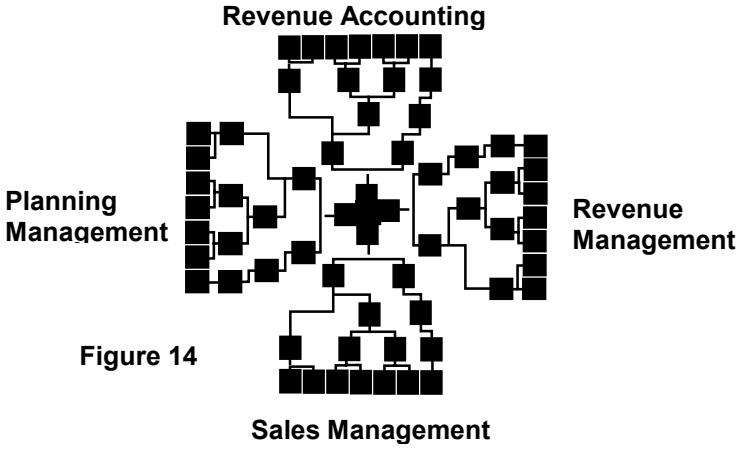


Figure 14

the compliance and deviation – this diagram makes sense.

Now consider the same sets of guidelines and rules – but applied using new networked node technologies as depicted in the hyperarchy at the top. Decisions formerly made by managers in the hierarchy, are made from comparative computer logic derived of disparate data obtained by a "specialist" node and distributed to those on a "need to know" basis. Thus, knowledge and compliance become automated for each unique application of the rules data-set as applied to a particular current situation in real-time.

Those rules can be based on the relationships (or lack thereof) of (a) any given segment of flight, (b) any given passenger Planning, (c) the customer or agency group importance to the total of the airline's market performance, or (d) the airlines current or future cash needs, etc. – and/or any combination there-of. Note in Figure 15, how the needs of Planning, Sales, Revenue, and Accounting are integrated in the network, not tied to the hierarchal "head" of the star as depicted in Figure 14. The need for the human organization and departmental oversight structures that served historical needs of airlines and airline-automation hierarchy are removed.

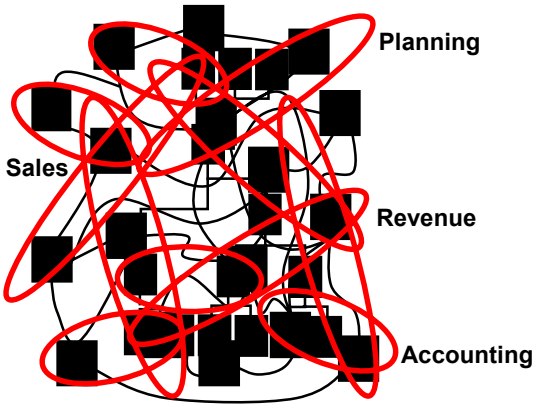


Figure 15

Knowledge teams that create rules applied by computer systems necessarily replace these legacy organization structures that were designed to manage transaction data. Knowledge teams oversee nodes of automated informational solutions rather than enable transactions. The relationships between what were once self-functioning organizational fiefdoms dissipate – because rules become relational and cross-functional.

Ultimately, the structure of the new automation architecture induces changes in the organization structure of airlines – to optimize efficiency of new systems. Economics of automation become integrated into economics of airlines. Roles of people change from processing transactions to optimizing use of information.

In the hyperarchy of information, the automated transaction necessary to drive a business relationship is no longer tied to human intervention. A buyer need not be ARC approved if a bank debit card transfers money directly to the airline's account. If the integrated data structure can verify availability relative to money offered by buyer in a real-time interaction, a need for interactive human revenue oversight management goes away. To the extent that financial settlement is automated through existing banking systems, the need for an ARC reconciliation department erodes. If special meals or wheelchair requirements are integrated in the traveler profile, and links to catering or to airport special services are integrated, the need for human intervention disappears.

The issue of automation is not solely in the domain of tracking production seats sold to customers. It extends to production, operational, and functional costs of airlines. Most airplane cost control systems are tied, in one form or another to conventional cost accounting measures. Typical

measures are tied to ASM's (Available Seat Miles), RSM (Revenue Seat Miles), etc. Legacy structures of airline information systems disallowed determination of activity-based accounting.

Peter Drucker, in his book "Management Challenges for the 21st Century"[34], points out a fundamental difference between cost accounting and activity accounting. "Traditional cost accounting, first developed by General Motors seventy years ago, postulates that total manufacturing cost is the sum of costs of individual operations. Yet, the cost that matters for competitiveness and profitability is the cost of the total process, and that is what the new *activity-based costing* records and makes manageable.

The basic premise of activity-based costing focuses on the fact that business is an integrated process that starts when supplies, materials and parts arrive at the plant's loading dock and continues even after the finished product reaches the end-user. Service is still a cost of the product, and so is installation, even if the customer pays. Traditional cost accounting measures what it costs to *do* something…. Activity-based costing also records costs of *not doing*…. *Costs of not doing*, which traditional cost accounting cannot, and does not record, often equal and sometimes even exceed costs of doing. Activity-based costing therefore gives not only much better cost control; increasingly, it gives *result control."*

An airplane is the "manufacturing plant" for an airline, "manufacturing" seats between point A and point B. Most airlines have extracted cost accounting solutions from the legacy architectures. But data are still derived from legacy-architecture data sources and, like most airline business processes, airline "cost accounting" has become a part of the common legacy airline paradigm. Once initiated, the holistic nature of the integrated seat-distribution, operations-control and settlement solution – with its incorporated cost accounting processes – became increasingly impregnable. Thus today, airlines and virtually all airline-oriented services, find themselves locked into increasingly outmoded cost accounting measurement criteria.

With few exceptions, airline yield management systems are "predictive" with forecasts against historic booking models. Few airlines actually manage "booking activity," converting these cost accounting forecasts into real-time interactive *activity-based costing* (i.e., working unticketed bookings to maximize revenue-paying travelers, voiding bookings as appropriate, and re-forecasting both bookings and revenue in advance of departures).

Another example lies in the "infamous" BIDT or MIDT[35] data. Most airlines take these cost accounting billing and marketing reports via tapes at the end of each month and take another month to analyze the data … in lieu of interactively capturing and managing the information as it evolves in the GDSs to gain "*result control".* The examples are never-ending.

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[34] "Management Challenges for the 21st Century", Peter F. Drucker, Harper Business, 1999, Page 111

[35] BIDT is the Billing Information Data Tape used by GDSs for billing justifications. MIDT is the Marketing Information Data Tape provided for a fee by GDSs to airlines by which the airlines assess their specific market sales to various GDS outlets. The value of MIDT information to airlines, in particular, is eroding rapidly as alternative Internet and direct booking solutions are adapted.

The single biggest block to incorporating *activity-based costing* in current airline operations is the inability of airline middle managers to understand and identify differences between *cost accounting* (measuring what you "do") and *activity-based costing* (measuring *both* what you "do", and what you "do not" do). These middle managers await "direction" from senior management, few of which themselves, have the management experience or vision to understand the strategic impact of interactive information management.

Yet the problem involves virtually every aspect of the "manufacture" of an airline seat – from flight operations to crew scheduling to catering to airport control. It is the inability of airline managements to interactively integrate real-time *activity-based costing* at operational levels that will change as airlines move from legacy information structures to networked information hyperarchy.

Conclusion

The hyperarchy of information is changing the way people relate to one another. Information begets more information, and the rate of available new information is doubling roughly every 18 months. While some of this information explosion reflects back on itself in the form of doubling the technological base every 18 months, the same compounded growth of information is spreading equally across all segments of society: in biology, medicine, law, behavioral sciences, construction, and transportation. Still, it is important to recognize that people induce and drive the collective whole of all the need for information and the need for technology growth – to meet the perceived or real needs and desires of other humans.

Thus, humans drive technology enhancements.

In a world of generally free capitalism, profit is the criterion for success. Profit is derived when revenue for sale of a good or service is greater than total cost of production. Since what a buyer is willing to pay for any given product determines the price that a supplier can capture, costs must be managed in such a way as to be less than the price that the product is sold for. Whether that service or product is provided internally within a company as part of the production of some derivative product – or the actual end-product – a need to control costs is essential to optimized profit upon sale to any buyer.

Thus, buyers drive suppliers.

When people were involved in the production process of "manufacturing" a product ,be it driving rivets in an assembly line or auditing "revenue buckets" in an airline inventory system, hierarchical command-and-control systems were essential to ensure quality product at lowest possible cost. But with the evolution of information technology, operational, production, quality control, and financial control transactions can become transparent and integrated. Since costs cannot be totally defined until a buyer has taken delivery of a product, it is equally necessary to integrate production processing with the distribution structure to effect interactive total activity management.

Thus, operations information management must become interactive with product distribution.

As the Information Age matures, buyers have increasing access to information … the same information that is available to packagers and/or to suppliers. The legacy structures are content providers. Evolving automation extracts content and makes it available as information. Too much information spawns confusion, and thus, an expanding need of knowledge workers to make sense of a new expanded information base. Information derived from diverse content sources and applied to context becomes knowledge. Applied knowledge becomes buyer acceptance and/or supplier profit.

Thus, real-time information in context is more important than simple content.

This phenomenon is taking place throughout the world, at different rates and in culturally adapted paradigms. It is happening in all commercial lines of business, at different rates and in concert with needs of buyers. The airline industry led the world with its computerized inventory solutions for managing and distributing "seats" in a classical Industrial Age content-managed supplier-driven solution. But the airline industry became so wrapped up in its hierarchical command-and-control production and distribution systems that it failed to understand accurately a new evolving hyperarchy of the Information Age.

Technology designed to meet the needs of buyers is deconstructing the Industrial Age supplier-driven economic models and enabling a new demand-driven buyer-focused relationship with suppliers. This new contextual and relational environment incorporates hardware, software, networking and other technology solutions that, in volumes produced to serve millions of different segments of society, drive the cost base of adapting new solutions to the airline industry, down by factors of 100 or more.

Airlines that do not soon begin to move from legacy architectures that currently inhibit and bind their ability to respond to buyers needs and effect accurate economic controls over their manufacturing and operational processes will soon be overtaken by those airlines that respond and adapt to demand-driven needs of buyers in a new information hyperarchy.

Sidebar -- Impact of September 11, 2001

This essay on the Economics of Airline Automation was submitted to the Editor prior to the tragedy of September 11, 2001. It is almost trite to say that September 11 "changed the contemporary world"; for it impacted the world … if not for its direct poignancy, then as a defining point with respect to the timing of the recession of 2001.

Before September 11, business in general was contracting slowly following almost a decade of growth … with the airline community becoming increasingly impacted with each progressive month. Still, even the future contraction was largely forecast as an extension of the past.

In the travel industry in general and the airline community in particular, resistance to change was embodied in each person's every action. New ideas and concepts for dealing with the rapid airline

contraction needed "proof" … difficult to prove in a contracting environment. The industry was having a particularly difficult time dealing with aspects of the "value-add" evolving around the new information based society.

September 11.

"The shutdown of the transportation system was pervasive, with the FAA's immediate order to close all U.S. airports. Flights already in the air, both domestic and international, were … rerouted to Canada …" as TWCrossroads noted in a sidebar that day.

The impending fear of the economic slow-down slammed home. In one day, with the shutdown of the transportation system, the recession arrived! The inability to resurrect the transportation system smoothly and efficiently proved far worse for the economy than the terrorist act (which, in no way, minimizes the terrorist acts of September 11).

When it became necessary to shut down the transportation system, the action effectively terminated a primary and essential tool of contemporary commerce. As a people, we were forced to change … not just how we dealt with the reality of the threat of terrorism … but how we dealt with managing the change needs that came with our altered culture(s).

"Change" impacts people differently. Behavioral studies have shown that once a person accepts that he/she, personally, will be impacted by mandated "change"… that individual's mental mind-set becomes open to many other facets for change including changes other than the primary focus of the mandated change-action. Said differently, once change of one type is mandated on a person, the mind opens up to possible changes of many types … to accepting new ideas that previously were defined by existing paradigms.

Before September 11, the airline's legacy inventory systems were already overloaded in trying to support the needs of the new "demand-driven" hyperarchy of information. But purveyors of the new hyperarchy information solutions were confronted with people trained in 40-years of doing business the "airline way". Those management could not "hear or see" the new solutions.

In the aftermath of September 11, cultural and airline process barriers that have inhibited the adoption of new information tools and the technologies of the hyperarchy in the past … have come under close scrutiny.

There was, and is, a continuing short-term period of "make-do" … to get the industry up-and-running again. But as with many things pre and post September 11, and the economic bottom that it defined, the inadequacies of the airline inventory solutions as an information platform, became glaring. The inability of the airline systems to easily and transparently integrate their core inventory data and platforms in response to the immediately demanded needs and expectations of contemporary security analysis platforms … federal security and investigation systems, private enterprise biometrics solutions, etc. … created an awareness in senior airline managements that had not surfaced in recent pre-September 11 times.

But the issue was not really "security". The security issues were simply the catalyst. It allowed senior airline managements to "see" a world of information processing that had gone unrecognized within the industry's holistic paradigm. It created an awareness that transcended security … into operations management and revenue integration and even human resources management.

Astute senior airline managers came to understand that real financial recovery and a return to a growth economy … for both the industry and America … became dependent on how rapidly airlines are able transform their core "supply-driven" hierarchal and human-dependent transaction process systems into interactive "demand-driven" relational distributed information solutions.

It is too early to tell how the industry will react to this new awareness as this essay goes to press. But it seems quite clear that as the airlines and government resolve the initial need to enhanced security solutions … the new digital tools of the evolving information hyperarchy will get closer scrutiny from airline managements … and the rate of change as outlined in the pre-September 11 essay will becomes significantly faster – potentially, the transition to the new information dimension could be halved.

The old structure remains. Airline inventory systems cannot be transformed into information tools overnight. But the awareness by key management of the need will transform the rate of acceptance. And as a function of necessarily surviving the economic low-point, airlines will force many of the changes. Airlines that do not recognize and respond to this need become the failure candidates of the economic crisis of September 11, 2001.

And from those that make the transition, it is probable that these carriers will evolve the totally new airline business model outlined in the essay – different not just in distribution (or security) … but different in the very core concepts of how to use information to run an airline and how to run an airline with new types of information!

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