

Practical Solutions - Quantum Gains: Automating The Replenishment Of Your Products.

a Skychain White Paper
June 2006



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The industrial gases industry is clearly an innovator where a large percentage of supply transactions involve automated replenishment programs and multi-year sourcing agreements. Today, automated replenishment has been proven to be a practical business solution with substantial business benefits. Combined with improvements in the economics, advancements in technology, and availability of companies that specialize in this work, the leadership of Skychain believes automated replenishment will enter the mainstream of business across broad chemical and fuels markets over the next few years. Skychain will be one of the leading ambassadors of this new trend.

Chemical Industry Trends

The 1990's witnessed a number of competitive challenges confronting US chemical businesses. Innovation ranks among the key imperatives of the 21st century, according to the American Chemistry Council (ACC). More specifically, ACC reports that the revolution in information technology will significantly alter market and industry structures that have historically defined the nature of competition.



As a whole, the Chemical industry is not meeting its cost of capital. This is attributable to a number of factors.

- Raw materials, commonly derived from oil and natural gas are increasingly more expensive.
- Distribution costs are up because fuel costs are skyrocketing while regulations on hours and safety have driven carriers to capacity.
- Product lifecycles have shortened. New molecules and formulations are commoditized and imitated.
- Consolidation, both in the industry and customer base, has led to more complex and difficult to manage supply chains.
- Capacity is online from East Asia, dropping market pricing and churning customer bases.
- Customer management is becoming increasingly difficult with shorter lead times, consignment contracts, and emergency production runs for partial fills and rush orders.



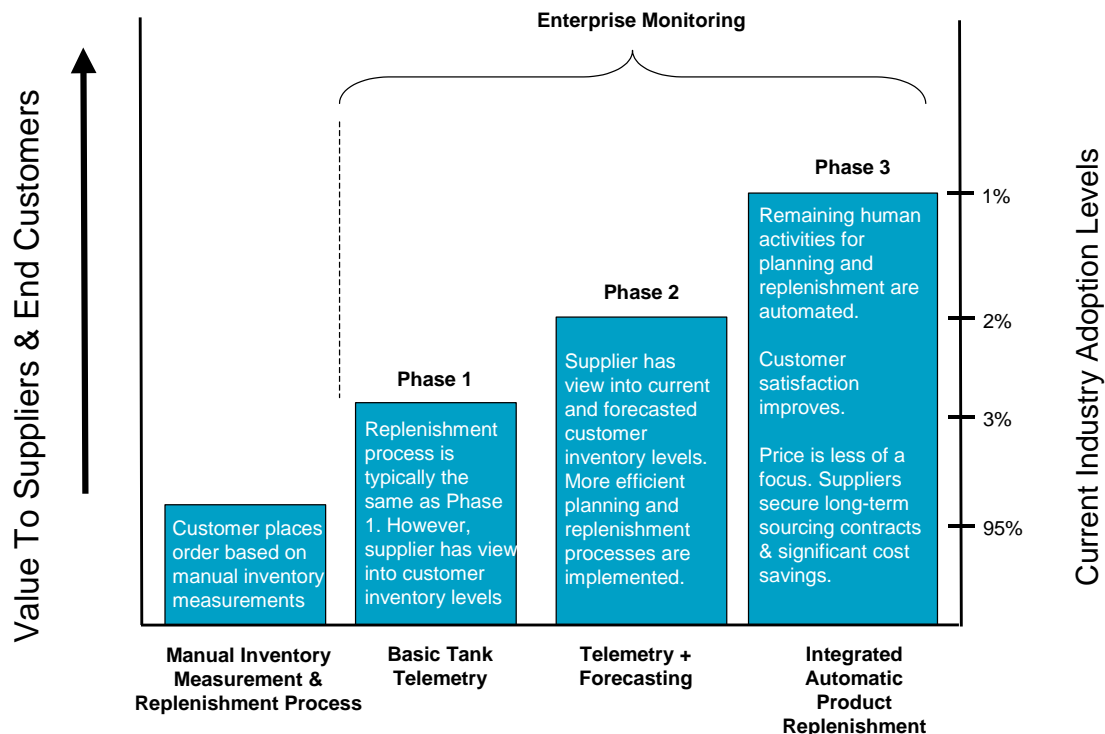
Yet within all this adversity, some chemical companies manage to grow and profit. Some embrace these trends and use them as drivers to innovate – not just with new molecules, but new processes, technologies, and management practices. Automating the replenishment of your chemical products is one such innovation that has proven to be a practical solution that can deliver quantum benefits for all parties involved.

Any new innovative program, especially involving software and IT spending, should be scrutinized for the expected ROI before making the investment. In the wake of significant ERP investments, appetites vary across the industry for solutions like automatic replenishment. Still, there are some process innovations that are so highly accretive that it makes practical business sense for many segments.

What is the typical path to automatic replenishment?

Automatic replenishment is the final phase of a typical evolutionary path of automating the supply of chemical products. Many chemical suppliers follow a process involving manual measurements of customer inventories and personnel intensive procedures for ordering, shipping, and planning. As corporations try to gain scale and efficiencies, awareness increases that some form of enhanced visibility and enterprise monitoring is required to remain competitive.

Customer Value Proposition



Embarking on an enterprise system is typically a three-phased approach. Phase 1, noted in the above illustration, occurs when suppliers implement automated tank level monitoring technology on their customer tanks and have a view into inventory levels through the Internet or in some cases an ERP system. Phase 1 is accomplished through an internal initiative or outsourcing to a vendor

specialized in tank level monitoring. While the replenishment process may not be changed much in Phase 1, the supplier has gained visibility and is in a better position by having access to customer inventory levels at any time. Unfortunately, just this added visibility is not sufficient to manage the replenishment inventory of a customer. Companies who attempt this quickly experience a scaling problem with customer service, where a tremendous amount of manual intervention and calculations must be performed every day.

In order to take the next step towards efficiency and turn the data into insight and action, suppliers enter Phase 2, where the knowledge of forecasted inventory levels at customer locations based on highly accurate and sophisticated forecasting modules is incorporated into the solution. These modules predict future needs based on actual usage patterns and proven mathematical algorithms. Armed with this knowledge, the supplier can now start to more proactively and efficiently manage the replenishment process for its customers. At this point the supplier is well positioned to take its current offering and gain maximum benefits.

Through integration with existing ERP systems, a company enters Phase 3 and the bridge between the supplier and buyer is forged providing automation of the remaining human activities for planning and replenishment. At this final phase, the full hard and soft benefits of an automatic replenishment solution are realized.



Case Study: Air Products and Chemicals, Inc.

In 1993 one of Air Products and Chemicals, Inc.'s (NYSE: APD) business units faced a difficult challenge. The company had 70 different regional distribution and logistics hubs spread throughout North America, each operating independently, warehousing products, taking customer orders, distributing products and supporting customers. As a result, the business had a number of inefficiencies.

After analyzing its strategic options, Air Products arrived at the decision to centralize and automate many of the support functions of the business, including customer orders,

deliveries, and production, appropriately referred to internally as an Automated Chemical Replenishment (ACR) management system.

Air Products executed a two-part plan to deploy the ACR solution involving: 1) the tools required to automate the supply chain; and 2) changing managerial processes to utilize the automation. Devices were installed on customer tanks that measured the volume of product contained in the vessel. Taking the necessary readings and detecting problematic volume changes, these devices would communicate over a POTS (plain old telephone service) line to the back office. Back-office applications would convert raw data into actionable information for the supply and logistics planners.



Parallel to the technology efforts, a number of business processes were altered to achieve maximum returns on the technology investment. A call center, which included all route planning activities, was created as a central function, fully reliant on the output of the ACR system. The call center, and not the sales force or the customer, had the ability to demand when the product would be delivered. The sales force shifted its responsibilities to understanding the business needs and usage patterns of the liquid gas, feeding that data into the central systems.

With deployment, Air Products recognized operational benefits, while customer service benefits escalated. Equipped with this leading supply chain innovation, Air Products is able to achieve an average of 99.95% of fills without a stock-out on its 330,000 annual deliveries, 8% reduction in total miles to serve the customer base, and a reduction of customer service representatives. Meanwhile, the Company is able to track and quantify the improved pricing and reduced customer-churn. Since industrial gas has a relatively low carrying cost and high turnover, inventory efficiencies were also realized.

Today, automated replenishment of products is a standard industry operating practice in the industrial gases industry, and a requirement for remaining competitive.

Where automatic replenishment makes sense

There are several characteristics of a supplier and buyer situation where automatic replenishment of chemicals makes the most economic sense. These are:

- ***Bulk supply:*** Easily measured using today's technology. The economics for the hardware are not conducive to tanks less than 500 gallons. With the

coming of RFID tags and scanner infrastructure, packaged chemical goods are on the horizon for venter managed replenishment.

- Consignment contracts: Supplier inventory is stored at the customer site resulting in tremendous opportunity for both balance sheet and operational excellence. This is particularly important in high value specialty chemicals.
- High volatility: Tough to serve, volatile customers are more prone to stock-outs and emergency shipment, often requiring a higher safety stock.
- High distribution costs: When truck miles are an important part of either your or your customer's cost stack, there are vast opportunities for scheduling efficiencies – combining partial bulk loads into milk runs and reducing frequency of full bulk rolls.

Case Study: Company Confidential

A bulk chemical manufacturer had a customer with highly variable usage rates at 8 delivery sites, and requirements for rail deliveries and consignment inventory storage.

Because of these challenging supply requirements, the company was sending 70 emergency tanker trucks per year, resulting in high distribution and often overtime costs.

An automatic replenishment solution was put in place and the 70 emergency shipments were reduced to zero the following year. Additionally, the company was able to achieve a 60% reduction in inventory on site. Now, every replenishment delivery typically occurs within 10-15% of safety stock.

“We finally have something to work together on, rather than just negotiating price increases.” -Account Manager

***“This is a scope change in the way we serve customers.”
-Supply Chain manager***

Why automatic replenishment make sense

The benefits for an automatic replenishment system come in four forms:

1. Operational
2. Balance Sheet
3. Revenues
4. Intangibles

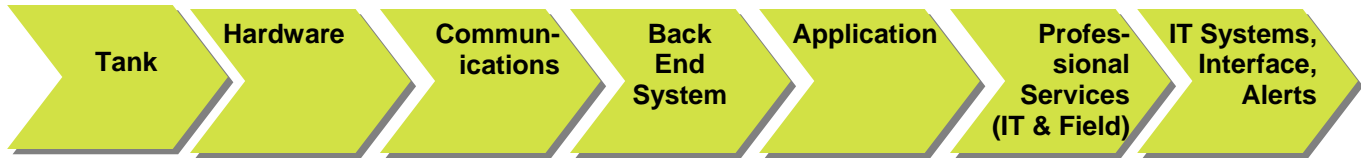
A successful program makes a supplier more competitive while also increasing the success of the customer, resulting in long term supply relationships and wins for both parties. The full list of benefits, along with the values observed in experiences from implementers is included in Table 1.

Table 1: Benefits of Automatic Replenishment

Operational Benefits	Typical Value Expected	Supplier or Buyer Benefit
Eliminate emergency shipments	From current level to zero	Both
Eliminate emergency production	From current level to zero	Supplier
Reduced customer service organization	10-75%	Supplier
Reduced purchasing /sale resources	10-75%	Both
Balance Sheet Benefits	Typical Value Expected	Supplier or Buyer Benefit
Reduce average finished goods inventory	30-60%	Buyer (unless consignment)
Reduce average raw materials inventory	10-60%	Supplier (unless consignment)
Future tanks capital	5-15% reduction in tank PPE over 10 years	Tank Owner
Revenues	Typical Value Expected	Supplier or Buyer Benefit
Saleable service to the customer	\$0-50/mth; exchange for shorter payment	Supplier
Increased customer retention	.5-1% average less annual churn	Supplier
Increased or sustained pricing in core products	.5-1% average in annual pricing	Supplier
More sole source deals	Value of the contract	Supplier
Intangibles	Typical Value Expected	Supplier or Buyer Benefit
Better utilization of sales force hours	No time spent managing customers' tanks	Supplier
Integrated link with customer	Many benefits	Both
Visibility into competitive fills	Sales enforced into sole sourced contract	Supplier

Components To An Automatic Replenishment Program

Remote tank monitoring has been possible for decades. In order to monitor a tank, one needs the following:



Despite having all the capabilities available, until recently, the economics have limited applications to niche markets and critical applications. Several things have changed to make the full solution more practical as shown in Table 2.

Table 2 – Solution Components

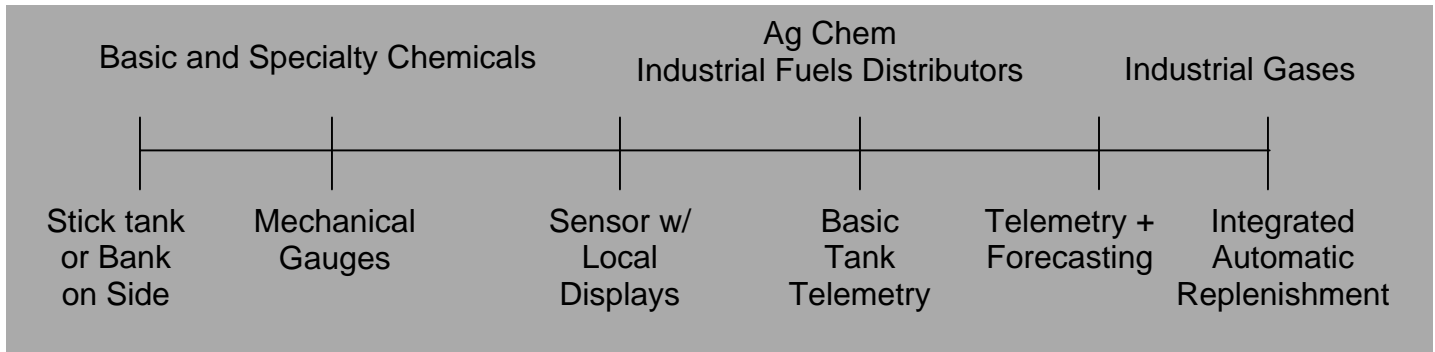
<i>Hardware</i>	<i>Communications</i>	<i>Back End Systems</i>	<i>Applications</i>	<i>Professional Services</i>
<ul style="list-style-type: none"> Costs of sensors and transceivers have reduced Computing power has advanced significantly. 	<ul style="list-style-type: none"> Wireless cellular coverage is widespread, reliable and secure Remote IP networks widespread 	<ul style="list-style-type: none"> System and server costs have reduced, Extra capacity exists 	<ul style="list-style-type: none"> VMI generic off the shelf software is available (although customization is required) A few targeted, high utility, 3rd party hosted systems available. (no customization required) Most ERP systems are in place for integrations and value add bolt-ons 	<ul style="list-style-type: none"> IT costs have reduced through outsourcing Dedicated and distributed service organizations with experience exist.

But with all advances come intrinsic obstacles and complications. Lower costs sensors and transceivers mean there are many players in the market for a variety of costs, quality and applicability. Cellular communications are widely available, but there are complex challenges for companies that lack the necessary intellectual property and expertise. Back end servers are readily available, but still require expert personnel to run a telemetry system and 24/7 call center. And as mentioned above, using off the shelf hardware needs to be customized for individual operations and specificities.

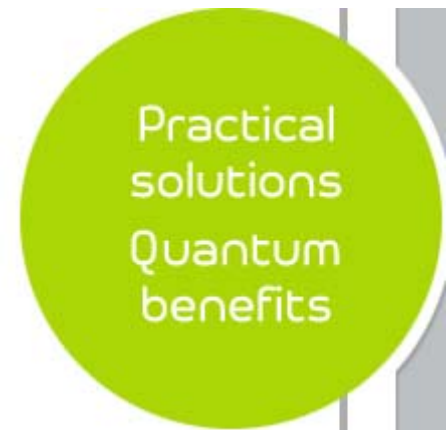
Expected Trends

Given these advances, different industries are in differing states of sophistication in serving customers as illustrated in Figure 2.

Figure 2 - Example Industries



As stated earlier, the industrial gases industry is clearly an innovator in optimizing the supply chain. Today, automated replenishment has been proven to be a practical business solution with substantial business benefits. Combined with improvements in the economics, advancements in technology, and availability of companies that specialize in this work, the leadership of Skychain believes automated replenishment will enter the mainstream of business across broad chemical and fuels markets over the next few years. Skychain will be one of the leading ambassadors of this new trend.



About Skychain

Skychain is a joint venture between Air Products and Chemicals, Inc. (NYSE: APD) and nPhase formed to address the growing needs to optimize the supply chain in chemical, fuels and related industries. Built from the rich history of supply chain innovation at Air Products and the leading edge wireless monitoring solutions of nPhase, Skychain delivers tailored supply chain solutions that are practical, proven and deliver an attractive return on investment. For more information, visit www.skychainsolutions.com.

About Air Products

Air Products (NYSE:APD) serves customers in technology, energy, healthcare and industrial markets worldwide with a unique portfolio of products, services and solutions, providing atmospheric gases, process and specialty gases, performance materials and chemical intermediates. Founded in 1940, Air Products has built leading positions in key growth markets such as semiconductor materials, refinery hydrogen, home healthcare services, natural gas liquefaction, and advanced coatings and adhesives. The company is recognized for its innovative culture, operational excellence and commitment to safety and the environment and is listed in the Dow Jones Sustainability and FTSE4Good Indices. The company has annual revenues of \$8.1 billion, operations in over 30 countries, and over 20,000 employees around the globe. For more information, visit www.airproducts.com.

About nPhase

nPhase is a recognized leader in providing comprehensive Smart Service solutions to product-based businesses. Smart Services are about electronically networking a company's products operating in end-use markets to enable enhanced knowledge about product performance and delivery of value-added "Smart" services. It is an exciting new industry predicted to exceed \$100 billion by 2010. nPhase clients include Gardner Denver (NYSE: [GDI](#)), Air Products (NYSE: [APD](#)), ABB Robotics (NYSE: [ABB](#)), AMETEK (NYSE: [AME](#)) and others. Partners include Cingular Wireless, Sprint, Siemens Mobile, Wavecomm, MultiTech, Opto 22 and Beckett LogiSync. In 2004, nPhase was a winner of the prestigious Chicago Sun Times Innovation Award. For more info, go to www.nphase.com or www.m2mblog.com.