RAOB Program History

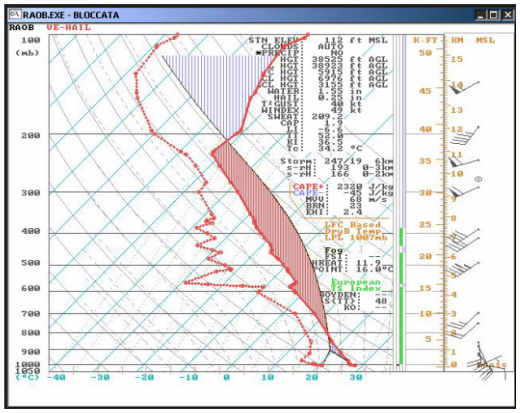
The RAOB Program was created by John D. Shewchuk. Both a meteorologist and programmer, John designed and developed RAOB into a world class sounding analysis tool. He currently continues RAOB development from his residence in The Villages, Florida.

The RAOB Program was born in 1987 as John's personal sounding analysis tool. It started out as a curious hobby. It first took shape on a RadioShack Tandy-1000 computer. The computer only had a black & green monitor, dual floppy disk drives, and 640 KB RAM. Eventually, a color monitor, a hard-drive, and more memory were added. The Tandy computer came with the standard MS-DOS operating system which also included Microsoft's GW-Basic programming language.

John quickly learned GW-Basic because it was very similar to Fortran-IV. Fifteen years earlier, John learned Fortran-IV as a second language as a student at Pennsylvania State University (PSU). He often spent many hours at the PSU computing center -- picking up computer punch cards which he occasionally dropped on the floor. He further expanded his programming skills while at the Naval Postgraduate School (NPGS), where his thesis focused on improvements to the Navy's Typhoon prediction module. His hard work was rewarded with a 3-year tour of duty to the Joint Typhoon Warning Center on Guam. There he earned the Air Force Forecaster of the Year Award while working on typhoon-related programming projects.

By using information found in AWS/TR-79/006 (Equations and Algorithms for Meteorological Applications in Air Weather Service) and after numerous hours of trial & error programming, a fully scalable and interactive SkewT diagram was attained. This was all before availability of a computer mouse.

By using information found in NOAA FMH (Federal Meteorological Handbook) manuals, RAOB's first data decoder was created. It only decoded standard WMO (TTAA, TTBB, etc) formatted sounding data, and only up to the 100 mb level. A few years later, after studying AWS/TR-200 (Notes on Analysis and Severe-Storm Forecasting Procedures of the Air Force Global Weather Central), RAOB's unique "classic" data display took shape.



The SkewT image at left is a sample of the RAOB 4.0 program. The 4.0 program was the last version created for the MS-DOS environment. It also had capability to create Hodographs and Cross-Sections, and even had a Soaring display screen. Ever since its release in 1998, it is still in use around the world, and John continues to provide free technical support to its users.

It should be noted that ever since RAOB's inception, John worked a full time day job, raised a growing family, walked the dog, played his accordion with local bands, gave accordion lessons to his children and others, composed his own

music, created computer games for his children, and occasionally found time to sit back and relax in the dentist chair. During these years, he also became a leading contributor to a popular magazine dedicated to Tandy and IBM-clone computer users: PCM (the Personal Computer Magazine). Many of his articles were featured on the PCM cover, including the very popular "Star Trek" game. His "Chekkers" game submission was also a hit, which became a Shareware success when it was recognized by "The International Checker Hall of Fame" as the best checkers computer program. His biggest PCM hit was his personal organizer program called "Event Minder", which won the PCM Magazine's Grand Prize in 1990. John later expanded this award winning program, called it the "Calendar" program, and released it to the public as Shareware. The "Calendar" program quickly found its way into the Department of Defense's (DoD) shareware library and for many years it was used by all military services.

Although still just a personal hobby, RAOB program development was slowing due to the Tandy computer's memory limitations. Even more limiting was the lack of reliable algorithms regarding the two critically important atmospheric hazards to aircraft: structural-icing and mountain-wave turbulence.

While attending the local chapter of the American Meteorological Society (AMS) in 1992, a friendship quickly developed with Richard Cale. Richard was a retired Air Force weather officer, a retired Booz-Allen atmospheric scientist, and a self-employed Certified Consulting Meteorologist (CCM). He was world-renowned for

his extensive and successful work as a forensic meteorologist who specialized in aviation accidents. After just a few minutes of introduction and a brief exchange of meteorological interests, a growing mutual attraction soon became obvious - but for completely different reasons.

RAOB was lacking aircraft icing and mountain-wave algorithms. On the other hand, Richard's investigative specialty was aircraft icing and mountain-wave turbulence. But, he did all his work on a hand-held HP-41CX programmable calculator for which he spent many years developing numerous algorithms. These algorithms were a culmination of his many years as an experienced operational and research meteorologist. He had amazing talent for transforming thermodynamic concepts and manually-driven methods into functional program code. Although very slow and manually-intensive, Richard's algorithms repeatedly proved reliable as evidenced by his many successful case histories.

The ensuing symbiotic relationship was inevitable and a meeting was held the next day. Richard had the aircraft icing and mountain-wave algorithms, and RAOB had the power to quickly process sounding data in a variety of "what-if" scenarios in addition to producing alphanumeric and graphical reports suitable for legal presentation. Collaborative efforts started immediately.

On a nearly daily basis, the RAOB project grew through meetings at each other's homes, phone calls, fax transmissions, and a brand new form of modern day communications -- emails. The RAOB project was like a 2-person Manhattan project. It was exciting and intense.

Just as the RAOB project got into high gear, the Tandy computer was upgraded to a much faster IBM-clone PC with the Windows 3.1 operating system. The software development and data management environments significantly improved. Even though RAOB was still being developed within the MS-DOS environment, its GW-Basic memory limit had not yet been reached.

The RAOB project was now on a fast track. Richard provided detailed algorithms along with precise documentation, and John transformed them into computer code. They checked each other's work, and ensured results matched down to the last decimal point. Numerous case examples were run and the RAOB system was stress-tested wherever possible. Within a few months, Richard had a fully functional RAOB program running on his PC. The RAOB program was no longer a personal hobby. It was like having your first child set out into the world.

The year was now 1994. Through other AMS meetings and Richard's investigative work, word began spreading that the RAOB Program was producing detailed, accurate sounding analyses. In addition to an improved SkewT diagram, RAOB now also produced Hodographs, Cross-Sections, Icing Analyses, and a unique Turbulence & Mountain-Wave diagram. It also included a vast array of thermodynamic parameters with extensive user configuration options.

After 22 years in the Air Force weather service, John retired as a Lt Col and obtained his Certified Consulting Meteorologist (CCM) status. He then moved to his childhood home in Matamoras, PA where he attempted to start his own

private weather consulting business. It was a slow go, and so John found a local day job in order to keep the RAOB development computers running. And to make life a little more interesting, John also became a NWS Cooperative Weather Observer, where everyday at 7 AM he sent temperature and rain/snow precipitation measurements to WFO Binghamton, NY.

By 1995 requests to purchase copies of the RAOB Program started to arrive. And so began preparations to market and sell RAOB. Environmental Research Services (ERS) was established as a sole proprietor business and a RAOB website was now under construction. At the same time, a few RAOB programs were provided to individuals who showed great interest in RAOB and who offered to be Beta testers. Those that provided detailed feedback and constructive suggestions for improvement became the primary influence in RAOB's initial development path. This was the beginning of RAOB's success - it became - and still is - a customer driven product.

It was now 1997. Ten years after the program's inception, RAOB 3.0 (for DOS) was ready for sale. These DOS-based programs were initially distributed on 5.25" floppy disks and eventually on optional 3.5" disks. Program improvements continued through 1999 as several new features were added, including a special Soaring display, a rotating 3-D Hodogram, and expanded import/export functions. These efforts culminated with the RAOB 4.0 program, which became the last DOS-based version of RAOB.

RAOB had now attained an established worldwide customer base. Beta testers had come and gone, but a core group of dedicated testers remained. They came from the 4 corners of the earth. The international testers were critical to ensuring RAOB properly handled the idiosyncrasies of foreign operating systems. Other testers came from a wide range of backgrounds - from private users to industrial applications. The most dynamic interactions came from testers within the national weather services (both foreign and domestic). These testers not only helped with the quality control process, but they were a major influence in RAOB's development path. Several Beta testers have become life-long RAOB users and good friends.

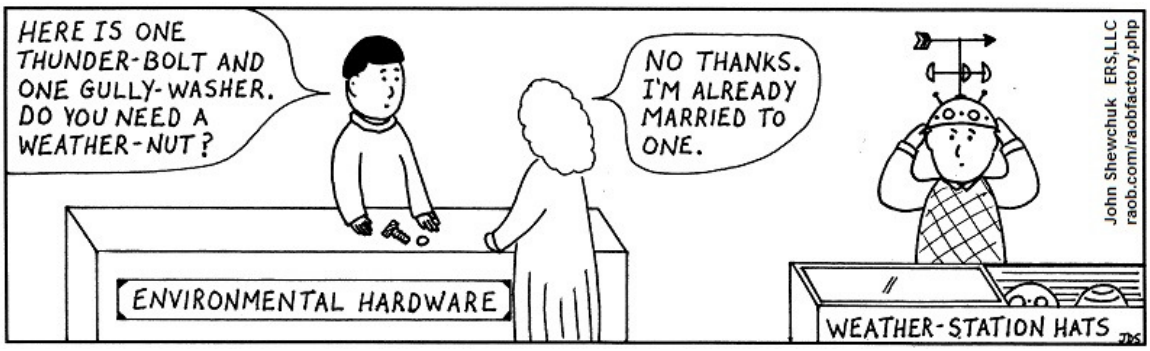
Not only did the RAOB customer base continually grow each year, but so did the demand for a Windows-based program. RAOB customers wanted to use a mouse-driven interface, and so began a massive coding project to transform many thousands of lines of code from GW-Basic to Visual Basic 6 (VB6).

But first, John remarries, climbs Mount Washington, and then gets back to work. The transformation project was exhausting. The internal mathematical transformations were relatively quick and easy, but the many graphical, mouse-driven interfaces were demanding and time consuming. During the conversion, some improvements and new functionalities were added. The entire conversion project lasted 2 years.

It was now 2002. The world survived the Y2K computer meltdown predictions, while Firefox and Linkedin first appeared on the Internet. Also appearing was the brand new RAOB 5.0 program, which was the first Windows-based version. The next few years experienced very fast growth, both from new RAOB customers and those wanting to upgrade from DOS to the new Windows version. At the same time, customer requests for new functions and features exploded.

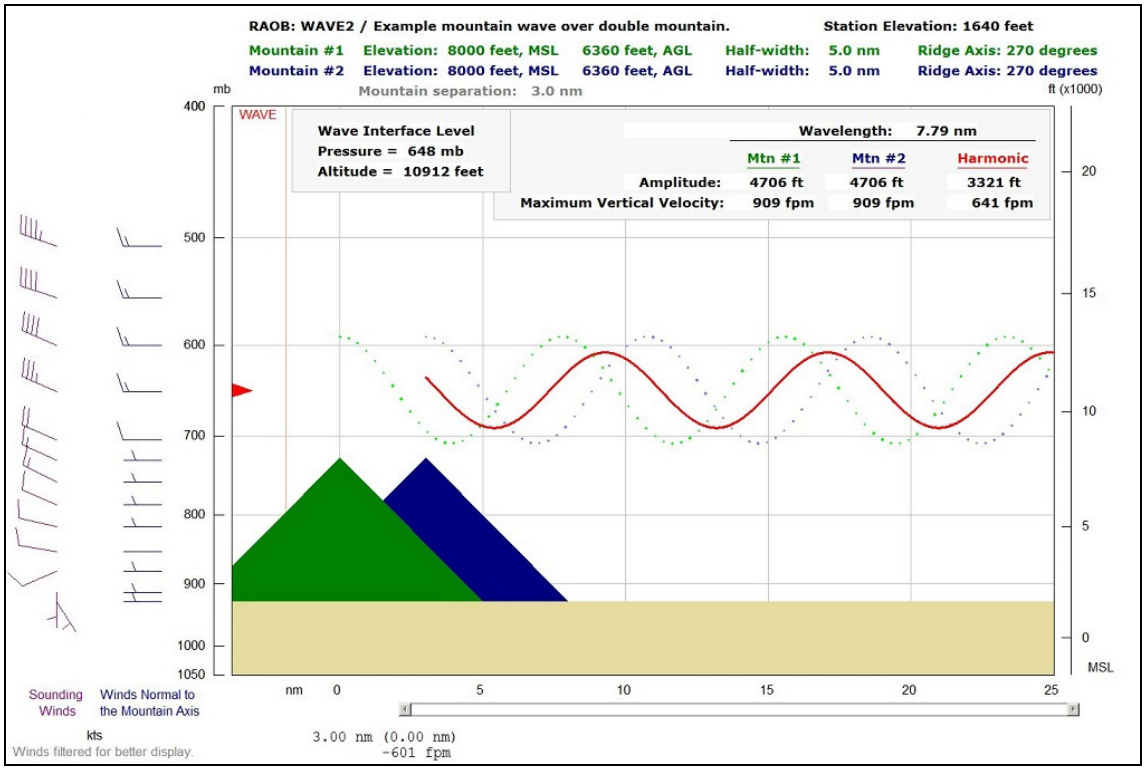
In order to keep up with customer demand for new functions and features, John released a new RAOB version each year, starting with 5.1, then 5.2, etc. As of this writing, RAOB 6.9 is being prepared for release in late 2018. Not only did RAOB grow each year, but it also evolved to accommodate the ever changing requirements associated with each of Microsoft's new operating systems.

It is now 2010 and John retired from his 2nd day job ... and the RAOB Factory is now a 24/7 operation. He also took the time to document a recent trip to the hardware store.



After several computer upgrades, thousands of additional lines of program code, and hundreds of new program functions - RAOB 6.0 finally arrived. Major program advances included the Soundingram module which creates X-Y graphs of supplemental sounding data (like Theta, Shear, and Ozone), unique data displays (like the Layer-Analyzer and the Severe-Weather & Winter-Weather screens), and new data decoders which can process non-conventional soundings (like radiometer and wind-profiler data). Just like the automobile industry, the RAOB Factory continued its annual release of new RAOB programs. And just like the auto industry, trade-in discounts were offered for program upgrades. But unlike the auto industry, technical support was totally free and nearly 24/7 on a worldwide basis.

Over the years many individuals and organizations began using RAOB on a routine basis, including high schools and universities worldwide. Even "high tech" industries use RAOB. These include many of our nation's leading research centers for laser technologies, weapons testing, fire-weather & air-quality operations, and even NASA support. Forensic meteorologists especially like



RAOB for its powerful aircraft icing and mountain-wave turbulence capabilities. Only RAOB gives users the option to manually tweak thermodynamic parameters to find "best fit" matches for aircraft icing and mountain-wave turbulence conditions. RAOB is the only stand-alone sounding program that can produce consistently reliable mountain-wave turbulence analyses. For these and other reasons, the NTSB and other similar foreign agencies use RAOB for all aircraft incident investigations.

Like Henry Ford's production line, the RAOB Factory continues to produce new RAOB versions each year. Each new version expands RAOB's capabilities in response to customer requests. These annual expansions often include dozens of major and minor program enhancements. The below list highlights some of the main enhancements for the RAOB 6 series programs:

RAOB 6.0 - Added 9 new data decoders, including radiometer profiler data.

RAOB 6.1 - Added the new Sodar/Lidar/Radar wind-profiler decoder module.

RAOB 6.2 - Added the new Fire-Weather & Air-Quality display screen, a new Scanner display screen, and 8 new data decoders.

RAOB 6.3 - Added the new Advanced Export module, the new Advanced Merge module, and 9 new data decoders.

RAOB 6.4 - RAOB merge and cross-section (time-height) functions can now process up to 3,000 soundings. Added 6 new data decoders.

RAOB 6.5 - Added the new Binary Data Encoders module, the RICAPS cloud & precipitation analysis system, and 8 new data decoders.

RAOB 6.6 - Added the new Hazards display system with email alert capabilities, data analyses up to 0.1 mb, and 7 new data decoders.

RAOB 6.7 - Added the new Doppler decoder with PPI/RHI display system and 11 new data decoders, including aerosol profiles.

RAOB 6.8 - Expanded PBL functions with new display screen options, data analyses up to .001 mb, and 10 new data decoders.

John moved the RAOB Factory to Florida in 2016 in preparation for the next ice age. But that's just the cover story. The real story is that snow shoveling was interfering with quality program development time.

During the Florida transition, the business name changed to Eosonde Research Services, because the old name was already in use by another Florida entiry. However, the same, familiar "ERS" abbreviation remained.

There is always a back-log of requests to add new features to the RAOB program, which John calls his "to-do" list. This is not to be confused with his "honey-do" list, which John affectionately calls other names. There has been much speculation as to which list will be completed first.

So ... as the battle of "lists" rages on, many ask about the process used to prioritize RAOB development. There are 3 decision levels:

1. All US military requests become priority one. Since John is a retired Air Force meteorologist, national defense support always comes first. First-responder requests (such as fire-weather functions) also become high-priority projects.

2. Requests for new data decoders are the next priority, because it all starts with being able to read the sounding data before any analyses can begin. RAOB currently has over 100 different data decoders and new ones are added each year. The power of RAOB is its ability to interrogate the content of a data file before determining which decoder is used. This makes the sounding data's filename irrelevant and gives users great flexibility with naming sounding data files. This makes RAOB a very user-friendly and data-friendly program.

3. The last priority level contains all other program requests. This includes new functions, features, displays, etc. These requests are further prioritized according to how many customers make the same request and a determination of how useful it would be to existing or new RAOB customers. Some new features can take weeks to program, while others only take a few hours to code, test, and upload for immediate customer use.

One year after moving to Florida, John experienced his first hurricane - Irma. Here, John took wind speed readings as the storm approached. Unfortunately, his anemometer was not water proof, so he had to stay indoors as it passed by. Then just a weakening Category I hurricane, remnants of Irma's eye-wall passed directly over the RAOB Factory, which remained fully operational during the entire event.

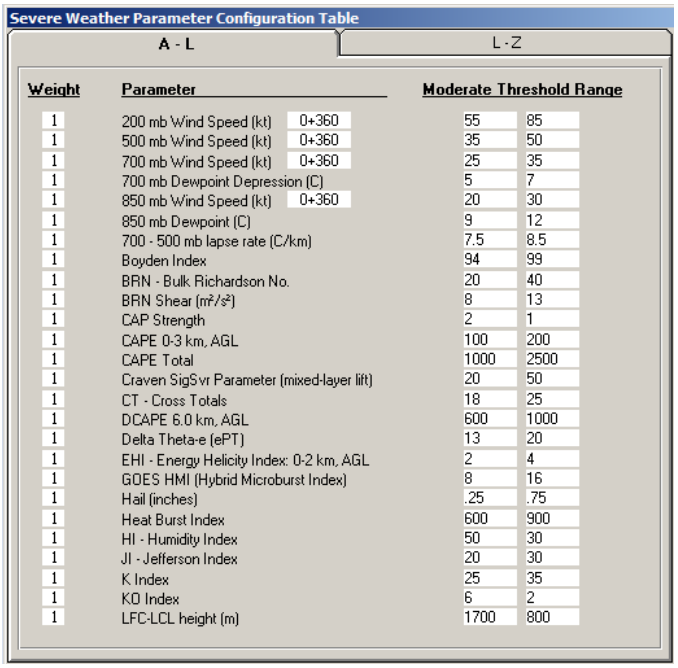
With thousands of worldwide RAOB customers, John is still able to provide nearly 24/7 technical support with no annual maintenance or subscription fees. Not only does the RAOB program contain extensive Help file information, but most program displays also provide "help buttons" that run tutorial videos.

People often ask, "Why should I pay for a RAOB Program when there are so many free sounding programs available?" In addition to RAOB's unmatched, free technical support, there are 9 other reasons, which John call's RAOB's Ten Commandments:

1. Provide free and responsive technical support.

2. Provide program display options. Some sounding programs only provide one or just a few screen display options. RAOB offers users 26 different display screen options to graphically view sounding data. (There are even more ways to present text data.) Additionally, all display screens are user-configurable and scalable. In order to accommodate customers who wanted to duplicate graphic displays of other sounding programs, RAOB now has a "Custom Display" screen which allows the user to create any combination of RAOB display screens. The "Custom Display" feature is highlighted at the end of the RAOB's first music video: "RAOB Unleashed."

3. Provide data configuration options. RAOB provides more than 70 different thermodynamic data configuration options for items such as parcel lifting, mixing-layer, inversions, cloud detection, icing, turbulence, etc. Additionally, RAOB provides users with more than 2,000 display screen configuration options, which provide users thousands of program & data configuration combinations. Since RAOB provides so many options, users often want to use and compare output variations, so RAOB allows users to create up to 8 different "virtual" RAOB programs, each employing independently different program configuration options. This works for either 8 different RAOB users, or 8 different RAOB environments, such as tropical weather, winter weather, etc.



4. Provide a "Severe Weather Parameter Table." This table allows users to tailor parameter thresholds in order to produce the best severe weather analyses. It was the first major customer request and it continues to expand in response to customer needs. This table currently allows users to configure 50 different parameters. Similar tables have since been created for significant weather hazards such as Fog, Fire-weather, Dust storms, and Air-pollution.

5. Provide program modularity. RAOB initially offered users 3 module options in addition to the RAOB Basic program. Users could then choose which modules they needed, thereby avoiding costs for unnecessary program functions. This 3-module option gave users 8 different possible program configurations, and if they only obtained some modules during initial purchase, they could always add other modules later. As of this writing, RAOB now offers users 22 module options, thereby giving hundreds of program module combinations.

6. Provide weather alert functions. While RAOB provides color-coded parameter listings to better visually notify users of significant data, RAOB also provides a sophisticated alert system, which produces audio-visual alerting. Users can configure alert thresholds for dozens of severe-weather indicators. RAOB even has options to Email or Text alert messages to multiple addressees.

7. Provide program automation. RAOB can be configured to automatically download data from the Internet and produce sounding diagrams and cross-section & time-height diagrams, in addition to printing, faxing, exporting, encoding, and emailing a vast array of output data. This automation can be accomplished either by using RAOB's built-in timer functions or external batch (script) commands.

8. Provide export and encode functions. Not only does RAOB provide more data decoders than any other sounding program, but RAOB can also encode data into other formats. RAOB has become the "Rosetta Stone" for sounding data. It can decode data from the world's most popular data sources and then encode that data into 7 different data formats: RAOB's intrinsic CSV format, WMO Coded, BUFKIT, GSD/FSL, BUFR, netCDF, and several STANAG (NATO) formats. Additionally, RAOB can export hundreds of sounding data parameters (including layer data and mean data) in either text or spreadsheet formats.

9. Provide data editors. Not only does RAOB have over 100 data decoders, but RAOB also allows users to edit the source data - in multiple ways. Users can edit data files in their original text format, or by using RAOB's raw data editor which conveniently separates temperature and wind data. Users can even graphically edit sounding data directly on the plotted sounding diagram by using click-&-drag mouse operations.

10. Provide Back-to-Basics capabilities. This is the most widely ignored function by other sounding programs. It is also the most important if the lights go out. RAOB is the only program that can fully operate in a tactical environment. Not only can users manually enter data to build complete soundings, but RAOB also provides single-station forecast functions allowing users to produce reliable short-term forecasts without the aid of any external information - e.g. without the Internet. This gives RAOB the ability to process any sounding data in any part of the world. RAOB's only limitations are the user's meteorological knowledge and the computer's power source.

John keeps many doors open to maximize customer communications options. While the RAOB website and monthly Newsletters have continued for many years, other doors have since opened as a result of social media. Now, the "RAOBprogram" can be found on Facebook, YouTube, and Twitter.

As the development cycle for this year's RAOB 6.9 version continues, the RAOB factory's software engineering (and dish washing) staff is already collecting information for next year's program. Among the many program questions John receives each year, there are 3 which occasionally reappear:

#1. Will there be a MAC or Unix version? John has not yet found a satisfactory way to do either. All options include combinations of high expense and tremendous workloads. Maybe a future owner will take on this challenge.

#2. Will RAOB become "open source" software? John sees more danger than benefit with open sourcing. He says, "RAOB development is like cooking, where too many cooks can spoil the broth." He's tried both ... and both ended poorly. The program went into an infinite loop and the broth became sour soup.

#3. How does RAOB compare to other standards? John will tell you RAOB is the standard. Not in the absolute sense, but in its ability to give users the ultimate in data processing and display options. There are options for lifting, vapor pressure, liquid water, turbulence, icing, clouds, wind-shear, and many more. Additionally, calculation accuracy always takes precedence over processing speed. CAPE is calculated at 1 mb intervals. RAOB even adjusts the gravity constant for elevation and latitude. John has added every option requested by customers - and much more. Need an option - ask John.