miprom 21™

Advanced
Elevator
Logic & Power
Control

montgomery®
excellence at every level

Imagine...

...a company who could successfully merge cutting edge technology with the science of vertical transportation.

...a company who could then create an entirely new Elevator Logic & Power Control Universe built with technological sophistication while assuring maximum comfort and dependability.

...that this new universe was real...and available to serve you with but the touch of a button.

meCOS

C-COM

Logic
System

Motion
Control

Performance
Deviation
Identity
Program

Signal
Fixtures

Door
Control

Contract
Specific
Services

Targeting

Navigation
("Run")

Auto-
Tuning

Car
Systems
Supervisor

System
Performance
Criteria

Velocity
Profile
Program

Adaptive
Profile
Patterning

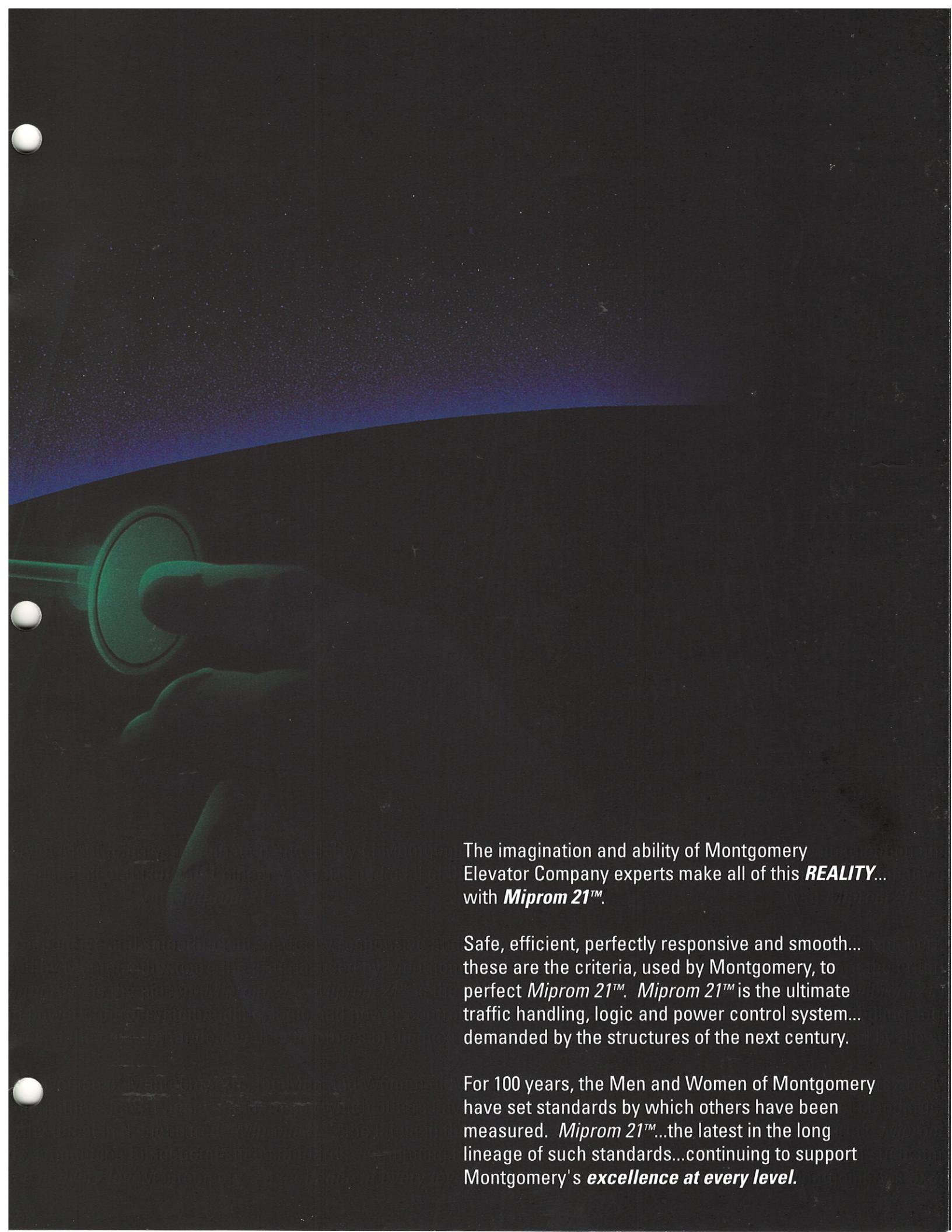Testing

System
Activity
Corre-
spondent

ULTRON® Drive

Execution

Logistical
Data
Stamping

Optimum
Performance
Restoration

Non-
Volatile
Historical
Record

Real
Time
Delay
Event
Recorder

The imagination and ability of Montgomery Elevator Company experts make all of this *REALITY*... with *Miprom 21*™.

Safe, efficient, perfectly responsive and smooth... these are the criteria, used by Montgomery, to perfect *Miprom 21*™. *Miprom 21*™ is the ultimate traffic handling, logic and power control system... demanded by the structures of the next century.

For 100 years, the Men and Women of Montgomery have set standards by which others have been measured. *Miprom 21*™...the latest in the long lineage of such standards...continuing to support Montgomery's *excellence at every level.*

Montgomery pioneered the application of micro-circuited logic control for the mass elevator market. For these past 20 years, we have invested heavily in Research and Development to constantly build on that pioneering effort.

The world of technology has expanded at a dizzying pace over that same period. Montgomery's exponential advancements in application of this technology, to elevator control, takes shape in *Miprom 21™*.
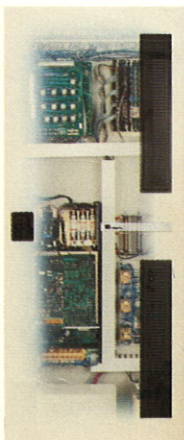
Miprom 21™ is more than mere computerization. *Miprom 21™* is the result of excellent thought on the part of technologically superior Montgomery *elevator experts.* This is the blinding speed of electronic communication merged with system and program designs created by people who are dedicated to elevator excellence. These are people who understand elevators...and more importantly...people who understand how elevators are expected to serve people.

We created the *Miprom 21™* "universe" to graphically illustrate how the thoughts and plans of our people have taken shape. They conceived and developed an Elevator Control System which interfaces with electrical, electro-mechanical and electronic components in a cohesive fashion, assuring dependability, safety, responsiveness and comfort.

Individual elements of the *Miprom 21™* "universe" identify single directional information flow as shown here:
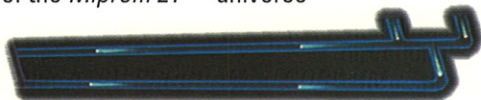
Bi-directional flow of information, and interactive capabilities of internal with external elements, are indicated as shown below:

The **Montgomery Elevator Computer Operating System** is the executive which administers access to system resources and global memory. *meCOS™* is the decision maker which constantly evaluates system requirement priorities in real time. All *Miprom 21™* top level tasks are provided full access to the data in global memory in accordance with the *meCOS™* determination of task need. *meCOS™* interactively controls task communication and switching to facilitate the assembly of data for processing and storage, and expedites distribution of that data for system use as required.

The **System Control Manager** oversees responsibilities of the *Miprom 21™* group system. Some of these functions have formerly been referred to in various ways including "group common control". *Miprom 21™* provides this **System Control** as an integrated, fully computerized program, interrelated and redundant throughout the control system. The **syCOM** operating plane has been graphically isolated to illustrate specific *System Control* tasks.

The **DISPATCH PROGRAM ALGORITHM** houses the required elevator operational characteristics which handle dispatching in response to demand. The program is based on the anticipated function and traffic patterns within the planned structure. **TPI** is reference to **TRAFFIC PATTERN INTENSITY**...the recognized directional flow and demand created by elevator passengers (i.e. those registering hall calls and those registering car calls).

New structure planning often projects (within the planning) anticipated *TPI's* which are not realized to the degree that was originally forecasted. Less sophisticated elevator dispatch systems are difficult (or impossible) to amend where actual building conditions are not coincidental with design planning.

The *DISPATCH PROGRAM ALGORITHM* is a computer driven, high-speed, repetitively calculated decision matrix, designed for *Miprom 21™*. It is system reactive to actual events regardless of pre-programming. Occasions will exist where this system reactive capability is most helpful (e.g. in the event of an isolated traffic surge occurrence). The *DISPATCH PROGRAM ALGORITHM* is integrated into the *SYSTEM CONTROL MANAGER* through interactive scheduling by *meCOS™* and can identify *TPI* trends and modes in an ongoing evaluation. Thus, a practical determination of potential need for program revision may be made. For permanent settings, direct computer program modification (when called for) can be accommodated with the interactive capabilities of the Montgomery *Service Tool* (explained later).

Effective elevator motion control requires accurate recognition of all hall call registration and prompt response to that stimulus. *syCOM* is the collection point of individual hall demand input in the form of electronic pulse messages from all Hall Stations to the **DISPATCH PROGRAM ALGORITHM.** This is true interface of human requirement with the *Miprom 21™* "universe".

Data assembly, and the results of data interpretation, run from **STATISTICS ACCUMULATION and ANALYSIS** through the *ADAPTIVE RESPONSE PROGRAM* to the *DISPATCH ALGORITHM.*

STATISTICS ACCUMULATION and ANALYSIS is the collection point of all event information in the form of electronic pulse messages from all individual Car Control Managers. It is because of this immediate and extensive availability of performance and operational data that *Miprom 21™* is the best informed elevator control available.

People make decisions based on information and external stimulus. "Metacognative" thought is the human condition which permits the re-evaluation of why the first thought occurred. *Miprom 21™* incorporates the **METACOGNATIVE CONTROL MATRIX** as a computerized intelligence loop to accomplish similar functions. Some would say that this approach is "artificial intelligence". In fact, it is an advanced computer concept which permits re-evaluation of initial responses to afford the system the opportunity to make more well informed decisions as the thought process is repeated. This learning is evident in the *DISPATCH PROGRAM ALGORITHM.* Final *Hall Call Assignment* is determined by comparing real time system performance with the lessons learned from statistical analysis.
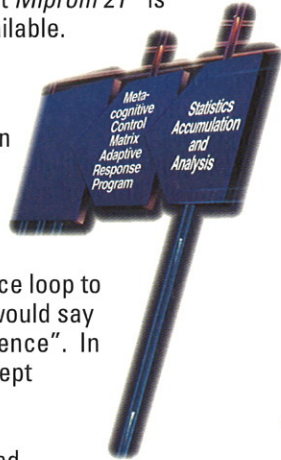
A primary result of the *Miprom 21™* thought process is the **HALL CALL ASSIGNMENT DECISION.** The ultimate standard for making this decision is the determination as to which elevator can provide the *quickest response* **time.** This is one of the many areas where *Miprom 21™* shows true advancement in technology. This *ASSIGNMENT DECISION* is based on a projection of response time regardless of distance travelled. Because *Miprom 21™* is immediately in touch with the total dynamics of elevator group operation, accurate projections of car response time are constantly evaluated to assure the most rapid response achievable, making the *ASSIGNMENT DECISION* the most responsive to satisfy passenger demand.

Until the final *Targeting* commitment is made, the *DISPATCH ALGORITHM* constantly re-thinks within the framework of real time system performance. System performance covers a broad spectrum of quality parameters including the current Average System Response Time of the entire elevator group. It is for that reason that *Miprom 21™* will deliver a car in response to your need which is, in the final analysis, the best choice for building and personal service.

The final *ASSIGNMENT DECISION* is recorded. A record of that decision is available (both in real time and in the historical record) through the optional application of *T.E.D.®* The electronic impulse that carries the *ASSIGNMENT DECISION* is accepted by the appropriate Car Control Manager *(C-COM)* and is implemented in accordance with *Miprom 21™* programming instructions.

The **Car Control Manager** is that aspect of the *Miprom 21™* system devoted to each individual elevator within a common group. Separate operating planes exist to perform the proprietary functions associated with an individual elevator. The **C-COM** operating plane illustrates specific operational capabilities independently associated with each car even though such capabilities are directly interrelated with all other *C-COM* operating planes.

C-COM contains three individual top level functions. The **LOGIC SYSTEM** dictates how the elevator directly "interacts" with the expressed needs of the riding public. *LOGIC* is the destination of the electronic pulse message from *syCOM* indicating the *HALL CALL ASSIGNMENT. LOGIC* accepts *syCOM* assignments along with other input made available by *meCOS™* to proceed in accordance with its *Miprom 21™* programming procedure. *LOGIC* oversees many diverse functions.

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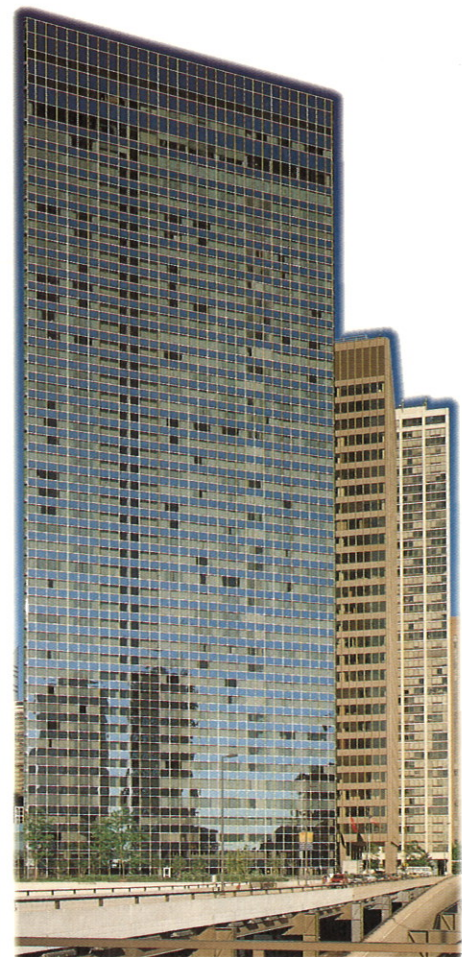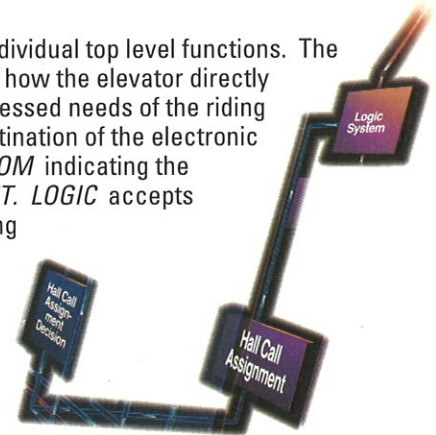
SIGNAL FIXTURES receive direction from *LOGIC*. They are advised to illuminate, change indication, provide audible signaling, etc., because *LOGIC* understands actual elevator condition.

DOOR CONTROL opens and closes doors, re-opens them as well as keeps them in the open or closed position. Traffic monitoring is integral to *DOOR CONTROL* which possesses administrative responsibility not only for the mechanical functions but for the electronic timing functions which are dynamic based upon *TPI*, preset performance parameters and instantaneous traffic conditions germane to each single elevator.

DOOR CONTROL operates with microcircuited door operation equipment built by Montgomery and electronic door sensor equipment *(the EDGE™)*. To assure that all door functions are safe, rapid and smooth, door sensor information and actual door condition are integral parts of data re-directed to *syCOM* for overall system performance scrutiny.

Every elevator system will contain some operational characteristics which are specific only to the given application because of location, type/use of structure, code conditions, etc. These **CONTRACT SPECIFIC SERVICES** are important operational characteristics overseen by *LOGIC* which directs their function and response. These *services* are extensive and may be usual items such as Independent Service, Building/Elevator internal security, Fire/Emergency Control, etc. These *services* may also be of a special nature. Here, *Miprom 21™* technology and flexibility show Montgomery's ability and willingness to be responsive to customer requests for special operational functions.

syCOM instructions to *C-COM* are directed through *LOGIC* to *TARGETING*. This task integrates the Hall Call Assignment, the local traffic demand (i.e. car calls), and the floor designation assignment with the precise location of the elevator...and translates the *syCOM* assignment into descriptive instructions for further routing within the *C-COM* network.

The bi-directional communication links shown below the four sub-systems of *LOGIC* explain the interrelationship between each function and the Montgomery *Service Tool*.

Single directional communication from all sub-systems permits data transmission direct to *syCOM* for input into *STATISTICS ACCUMULATION* and *ANALYSIS*.

MOTION CONTROL is the top level *C-COM* system which directs the elevator to respond to initial instructions received from *TARGETING*. "Motion" pertains to vertical travel of the elevator, rotating equipment operation, power conversion and control.
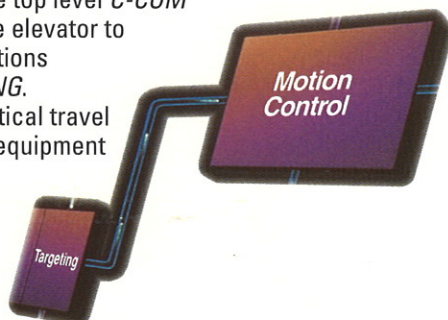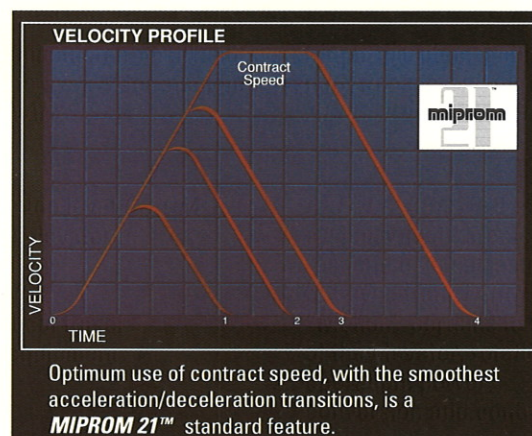
NAVIGATION is the constantly monitored *Motion Control* program used to provide smooth and efficient elevator performance by establishing and following the most expedient control "path". The *VELOCITY PROFILE* ("path") guides the elevator through each performance stage. *VELOCITY PROFILE* is the "performance route" most suitable to assure a quality ride to the car destination.

The *Miprom 21™* **VELOCITY PROFILE** program is an established pattern of acceleration, through the performance plateau of full speed travel, to deceleration...all with smooth transitions from each characteristic to the next. This Montgomery program is based upon performance parameters established at the time of initial system engineering. The profile program uses instantaneous position and velocity loop feedback to adjust the profile for optimum performance within the established guidelines. This program may also be amended through the interactive communication capability of the Montgomery *Service Tool,* by Montgomery personnel.

VELOCITY CONTROL is a closed loop system using an optical quadrature encoder. Velocity feedback is encoded digitally to eliminate variations in data that might be caused (in an analog system) by wear on brushes, heat degradation, etc. Surrounding this *velocity loop*, *Miprom 21™* MOTION CONTROL also provides a *position loop* implementing data accumulated from a second quadrature (position) encoder. Actual elevator location (position) is determined, constantly monitored and updated within the *meCOS™* database. This repetitive re-confirmation of floor locations, through interface of data from the aforementioned velocity and position loops, creates a continuum of reliable floor location data critical to optimum system performance.

ADAPTIVE PROFILE PATTERNING is an extension of the *Miprom 21™* metacognitive capability. After *NAVIGATION* has evaluated actual conditions, the pre-programmed velocity profile may be amended for most responsive service based upon elevator load, line voltage fluctuation, special customer requests, etc. The appropriate profile becomes a series of electronic velocity commands to **ULTRON®** Drive.
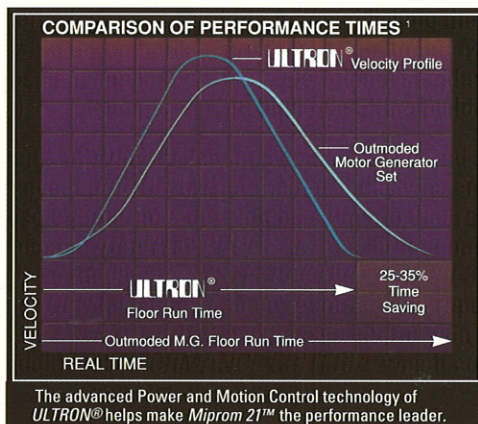
VELOCITY PROFILE

Contract Speed

VELOCITY

TIME

Optimum use of contract speed, with the smoothest acceleration/deceleration transitions, is a **MIPROM 21™** standard feature.

1-Single Floor Run   2-Two Floor Run   3-Three Floor Run   4-Multi-Floor (Express) Run

ULTRON® Drive is a Montgomery exclusive. ULTRON® is the solid state, computer driven, power conversion system generating necessary direct current from available building A.C. power. ULTRON® Drive also incorporates the elevator rotating equipment driven by the ULTRON® provided D.C. power.

After final installation has been accomplished, AUTO-TUNING is implemented to assist in final Miprom 21™ adjustment. This Montgomery exclusive is a computer process (patents pending) which assures uniformity of system performance quality through objective, interrelated computer decisions. AUTO-TUNING evaluates the actual manufactured and installed condition of the D.C. powered rotating equipment to establish optimum performance parameters. The results, stored digitally, assure quality interface between ULTRON® Drive and the inherent characteristics of the rotating equipment as installed. Thus, variations in the system caused by heat, wear, change in inductance, etc. can be monitored to assure optimum interface between equipment and the system as adjusted.

AUTO-TUNING is interactive with the Montgomery Service Tool to facilitate initial system installation and start-up while continuing to provide direct access for system program modification.

COMPARISON OF PERFORMANCE TIMES [1]

ULTRON® Velocity Profile

Outmoded Motor Generator Set

ULTRON® Floor Run Time

25-35% Time Saving

VELOCITY

Outmoded M.G. Floor Run Time

REAL TIME

The advanced Power and Motion Control technology of ULTRON® helps make Miprom 21™ the performance leader.

1-Single Floor Run

MOTION CONTROL relies on the **CAR SYSTEMS SUPERVISOR** to monitor its interactive and subordinated activities. Bi-directional communication exists between the CAR SYSTEMS SUPERVISOR and NAVIGATION. This interactive capability monitors the success of NAVIGATION in concert with pre-determined performance criteria to assure that safe and quality parameters are constantly achieved.

Motion Control

Navigation ("Run") | Auto-Tuning | Car Systems Supervisor

This SUPERVISOR is also responsible for safety string monitoring. Condition of critical items such as elevator governors, safeties, door locks, hatch switches and speed sensors are all continuously monitored by the CAR SYSTEMS SUPERVISOR.

The essence of safe, responsive and smooth elevator motion control. To assure that Montgomery elevator passengers are provided with such service, internal diagnostics systems exist within all operating planes. These diagnostic programs are depicted as elements within the Miprom 21™ "universe". Where a diagnostic element is found in both the syCOM and the C-COM planes, only one explanation is provided as the general function is identical...only the sphere of influence is different.

SYSTEM PERFORMANCE DIAGNOSTICS is the computer program method by which actual elevator operation quality is consistently evaluated. Through direct interaction with the Montgomery Service Tool, this program provides data on event occurrence and identity.

System Performance Diagnostics

The **PERFORMANCE DEVIATION IDENTITY PROGRAM** isolates and identifies aberrations within the system. Within this program rests the Montgomery benchmark standards of excellence against which real time operation is measured. Where a system fault is perceived, this portion of the program records the event. In all cases, the criteria for establishing the benchmarks for comparison are tailor made to the Miprom 21™ specific application (e.g. operational standards for hospitals as compared with high rise office buildings, etc.).

Performance Deviation Identity Program

Where such an event is discovered and logged, the IDENTITY PROGRAM determines if this was an isolated event or if it is part of a developing scenario that requires resolution. The IDENTITY PROGRAM has directional communication (laterally) with the SYSTEM ACTIVITY CORRESPONDENT so that such deviations can be recorded and reported. The IDENTITY PROGRAM also passes information to SYSTEM PERFORMANCE CRITERIA which conducts additional investigation.

The diagnostic program goes beyond a mere recognition of a given event. It also computes up to four of the most probable causes for the event existence. It identifies and communicates these "excuses" within the framework of the event report. The program tags the "excuse" which is the most probable cause. . . that cause which should be evaluated first.

Performance Deviation Identity Program

SYSTEM PERFORMANCE CRITERIA accepts the communicated "fault" report and compares it with pre-designed performance standards to determine the intensity of the perceived difficulty. The results of this evaluation are then communicated to the next program level.

The interrelated functions of *LOGIC* and *MOTION,* overseen by *C-COM,* are numerous and complex. *C-COM* incorporates an expansive program for **TESTING** which is implemented whenever deviations of any description are reported. Implementation of electrical, electro-mechanical and computer testing are designed to resolve any conflict in data. *TESTING* recognizes the need for evaluation, establishes a plan of interrogation, determines additional monitoring which should be implemented immediately (including constant cross reference verification of data from the velocity and position loops) so that a firm identification can be established with regard to any need for corrective action. The determination of an internal action plan is then communicated to the **EXECUTION** program where the test(s) will be performed. It is with that program that *C-COM* may proceed with the re-establishment of *OPTIMUM PERFORMANCE.*

OPTIMUM PERFORMANCE RESTORATION is the program locale where the identified and explained "fault" is compared with system internal resolution capability. To the extent of system capability, instructions are forwarded to the *DISPATCH PROGRAM ALGORITHM* to implement the restoration pattern.

The "note taker" which records events recognized at the higher levels of operation is the **SYSTEM ACTIVITY CORRESPONDENT**. It adds critical record information necessary for further evaluation. The *CORRESPONDENT* adds time and date stamping to the record of the event while also recording the elevator system position within the region of control at the exact time of the event. In *C-COM, LOGISTICAL DATA STAMPING* adds data on the exact car position. Having recorded all appropriate notes for any given event, the *CORRESPONDENT* proceeds with reporting this data to two different information files.

The **REAL TIME EVENT REPORTER** provides direct access to the system permitting moment by moment (i.e. real time) operation review. This is not a memory function but is the communication of an actual event at the exact moment of occurrence.

The **NON-VOLATILE HISTORICAL RECORD** is the computer memory compendium which stores the 63 most recent events as identified through the single directional flow of information as illustrated. This is an ongoing and totally complete historical record permitting the addition of a new event with the elimination of the oldest event from the memory. Each of the 63 events is exploded to identify up to the four most probable reasons for creation of the reported fault/event. This *"asterisk notation"* is displayed by the *Service Tool* as explained later.

T.E.D.®, the Total Elevator Diagnostic System, is an available option with *Miprom 21™.*

T.E.D.® is the destination for the system performance data and historical information accumulated from throughout the *Miprom 21™* "universe". *T.E.D.®* provides a library of color screen graphics depicting isolated or overall system performance while also identifying momentary system events. Statistical charts confirm time frame performance. The graphics display is a helpful tool in an overall building lobby security system. When located within the elevator equipment room, *T.E.D.®* is a communicative tool for building management and Montgomery Preventive Maintenance personnel. A high speed printer, working in conjunction with *T.E.D.®*, is available to produce reviewable hard copy performance graphics and statistics.
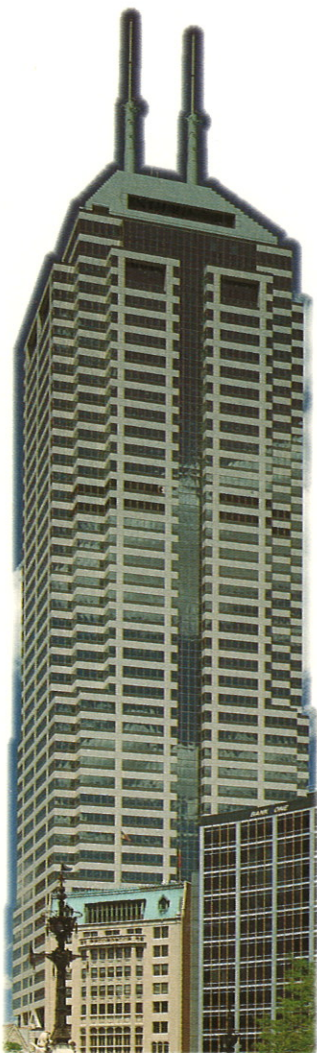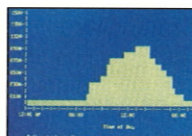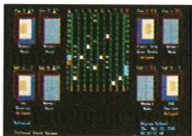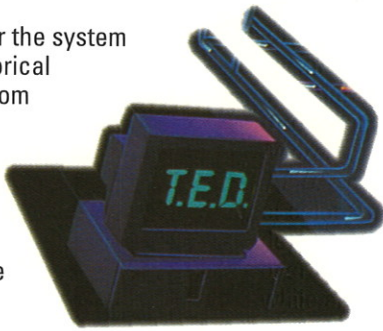
Throughout the explanation of the *Miprom 21™* "universe", a great deal of reference has been made to direct access to operational tasks by the Montgomery **Service Tool**. This proprietary Montgomery designed electronic communication tool is used by highly trained Field Adjusting personnel and Preventive Maintenance experts...permitting them to "see inside" *Miprom 21™*. Through a series of coded messages appearing on the *Service Tool* L.E.D. display, *Miprom 21™* advises condition and provides historical record from throughout the vastness of its network.

The *Service Tool* offers two operational levels permitting the operator to proceed through a system check in an automatic mode...or...through an interactive mode permitting specific inquiry. The *Service Tool* is used during final installation adjustment to fine tune the system in accordance with real time condition and established quality operational parameters. Also important is the ability to lock out various floors (during construction) in accordance with contractor needs.

After installation and final adjustment, the *Service Tool* is an invaluable device used during the regular Montgomery Preventive Maintenance visit to assure continued operation in accordance with the customer's desires. The *Service Tool* is also used to perform permanent modification to system design when the need is recognized and/or when the customer communicates a desire for modification.
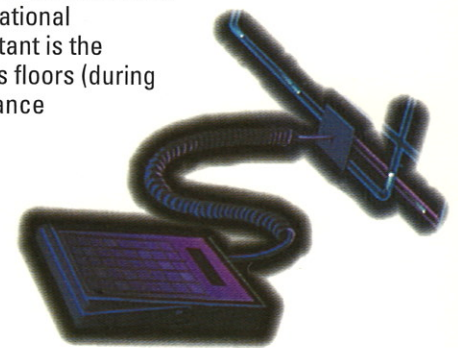
The cutting edge technology and service excellence of *Miprom 21™* is offered with pride by the Men and Women of Montgomery. *Miprom 21™* is the right choice for all Traction Elevator applications...geared and gearless...because your building tenants deserve the best!

miprom 21™ The sophistication of the *Miprom 21™* technology family is also made available to our valued elevator modernization customers.

TMS 21™ *TMS 21™* offers the complete Logic Control features of *Miprom 21™* for use as an overlay product for existing elevator systems which retain original power control equipment.

miprom DTM 21™ A complete *Miprom 21™* elevator modernization package, including *ULTRON®* Drive, has been specifically designed for modernization application. *Miprom 21 DTM™* provides this entire technology package for the most sophisticated upgrade available for your existing elevator system.

For more information on the entire Miprom 21™ technology family offered by Montgomery Elevator Company, we invite you to speak with a Montgomery Sales Professional.

montgomery®

excellence at every level