A SYSTEM FOR SUPPORTING CASH MANAGEMENT DECISIONS

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A user friendly, personal computer-based system designed to help solve cash management problems is discussed. The system is a "smart" system that enables the cash manager to use analytic techniques that otherwise would not be as accessible to anyone other than a technical analyst. The system formulates a cash management problem as a network problem, solves that network problem, ensures feasibility of the problem formulation, interprets the output of the solution and recommends alternative courses of action.

1. Introduction. Embedded in the general cash management problem is a subproblem that has received substantial attention. Many mathematical operations research (OR) models have been suggested to solve the problem of choosing from a portfolio of financial instruments to maximize terminal cash flow (e.g., Gregory 1976 and Srinivasan and Kim 1986a). Unfortunately, these models have received little use in practice (e.g., Petty and Bowlin 1976). There are at least two interlinking reasons for the lack of use of these models.

First, although these OR models can be used to develop optimal solutions to specified problems, they *may not solve the entire problem that the cash manager faces*. Instead, not only is cash management interested in maximizing cash flow, the cash manager also faces other political, organizational and environmental concerns. The cash manager may have a feeling that a particular investment would not have the stated return. The cash manager may have an opinion that certain events are going to occur and that those events may impact the parameters of an investment. The cash manager may think that the firm will face certain, as yet unspecified, cash outflows and thus, there is an extra need for liquidity. Thus, what appears to be a well-defined problem is filled with actions based on feel or opinion.

However, the model does provide structure to the problem. It also can be used to provide an estimate on the expected return that can be used to compare to the portfolio of instruments that the cash manager does choose. In addition, it can be used to provide the manager with feedback on various scenarios, to answer certain "What if..." type questions.

Second, unfortunately, the typical process of using mathematical models entails an iterative process between the OR expert and the cash manager: the cash manager goes to the OR expert, then the OR expert helps the user formulate, solve and interpret a solution. Few financial executives have the time to iterate through this process. Further, the solutions are generally situation specific and are not reusable. Thus, each situation must be solved anew. In addition, oftentimes the models with all their symbolic mathematical structure are difficult to understand and provide no additional intuitive understanding to the financial executive.

The difficulties associated with this traditional problem solving approach can be mitigated, in part, by developing a system that cash managers could use to support their decision making. Such a system would need to decouple the cash manager from the OR expert by building into a system the expertise of a human OR expert to formulate, input and analyze an OR solution to a problem. Such a system also would need to allow cash management decision making in a timely manner. In addition, if properly designed, the system would lessen input difficulties and structure the cash management problems so that each cash management problem occurrence did not require complete redevelopment of the problem formulation. Further, the approach would "make sense" to the financial executive. The conceptual model of a network is more congruent with the way financial executives view the world than less intuitive linear programming approaches. This paper describes a system called CASH MANAGER, designed to accomplish these objectives by assisting the cash manager's decision making in the selection of potential investments from among a portfolio of potential investments or financial instruments, so as to maximize cash flow at the end of a prespecified period of time.

This paper proceeds as follows. §2 reviews selected research in cash management models and systems, decision support systems in other finance applications and in generalized networks, the mathematical basis of the model discussed in this paper. §3 examines the network representation of financial instruments in CASH MANAGER and provides an example that is discussed in detail later in the paper. §4 provides an overview of the capabilities of CASH MANAGER. §5 demonstrates the use of the system with the example in §3. This includes selected menus and reports from CASH MANAGER for the example problem. Finally, §6 summarizes the paper.

2. Approaches to cash management and financial management decision making problems. A number of different approaches have been suggested for various aspects of the cash management problem and other financial management decision making problems. These include OR methodologies, such as linear programming and networks, and information system methodologies, such as expert systems and decision support systems. A recent comprehensive survey of cash management and decision support systems (DSS) is provided in Srinivasan and Kim (1986a) and so we do not present a detailed literature review of those applications.

Linear programming formulations of cash management systems. Linear programming has been used to model various situations where the manager faced choosing from a portfolio of alternatives, such as different investment opportunities. This type of cash management problem was first modeled as a linear program by Robichek et al. (1965). That linear programming model was later generalized by Mao (1968), Orgler (1969), Pogue and Bussard (1972) and O'Leary and O'Leary (1982) to allow for the possibility of unequal time periods, additional deterministic constraints, chance constraints and multiple criterion. Maier and Vander Weide (1978) developed a version of the linear programming model that was more "user oriented" than other versions. Their approach focused on making the system accessible to nontechnical users, by allowing easier input of the data and output reports that the financial executive could understand.

Network formulations of cash management systems. Network formulations of choice-based cash management problems also have been investigated. Srinivasan (1974) used the transshipment model, while Golden et al. (1979) modeled cash flow problems using generalized networks.

However, network problems have found application in broader formulations of cash management problems. Embedded generalized networks (generalized networks with additional constraints) have been used in conceptualizing a broad range of applications. Crum et al. (1983a) designed a model for cash management of multinational companies. Crum et al. (1983b) designed a model for meeting working capital needs using a generalized network approach. Both of these models were aimed at making a broad range of integrated decisions beyond those of formulations normally conceived of as cash management problems. For example, they built production and marketing expenditures into their models. Although, this paper views the decision problem as choosing from a portfolio of financial instruments to maximize cash flow, a broader-based approach, similar to that of Crum et al. (1983a), could be taken.

Further, generalized networks provide more than a conceptual framework for such problems. There are very efficient algorithms to solve generalized network and embedded generalized network problems (Brown and McBride 1984 and McBride 1985). Thus, formulating problems as generalized networks also provides an efficient implementation format for such applications.

Expert systems. Expert systems (ES) are computer programs designed to capture aspects of human expertise. References on expert systems include the "classic" treatment in Hayes-Roth et al. (1983) and more recent contributions such as Turban (1988). Because so few ES actually capture "true expertise" some researchers prefer to refer to systems that use aspects of expertise as knowledge-based systems. This paper uses the terms interchangeably.

There are a limited number of applications in financial management published to data. Rauch-Hindin (1985) discusses "K:Base" a system that employs a Bayesian statistics approach to recommend investments. She also discusses the potential development of a number of expert systems ranging from applications in insurance advice to acquisitions and mergers. Turban (1988) lists some other applications. Recently, the First Annual Conference on Expert Systems in Business (Feinstein et al. 1987) brought together the developers of a number of other financial applications. Breese (1987) discussed an expert system for decision analysis in securities trading, while Duchessi et al. (1987) discuss an expert system for commercial loan analysis. Other applications are summarized in Silverman (1987).

Decision support systems. Decision support systems (DSS) are computer-based systems designed to support decision making (e.g., Bennett 1983, Keen and Scott Morton 1978). Decision support systems typically make a portfolio of models and interfaces to those models, e.g., mathematical programming algorithms and graphics, available to the user to aid decision making. In some cases, DSS include expert systems in their portfolio of models. For example, Keen and Scott Morton (1978) describe the well-known expert system MYCIN (Buchanan and Shortliffe 1985), as a DSS. In addition, most expert systems are designed to support decision making rather than replace it.

Barbosa and Hirko (1980) suggested that there are a number of advantages to including OR algorithms in DSS. Unfortunately, the above algorithmic approaches still require OR expert intervention to allow the use of the OR tool. In addition, few of the above problem formulations were designed to function in a user friendly personal computer environment (e.g., O'Leary 1986b). Further, many of the above referenced analytic approaches have been designed to solve only isolated portions of the total cash management problem.

One of the best descriptions of a financial management DSS is the capital budgeting system discussed in Gordon and Pinches (1984). In addition, Olson and Sprague (1981) present a financial planning DSS.

Srinivasan and Kim (1986a) contend that research in cash management must move toward integrating many of the facets of cash management, rather than focusing only on relatively isolated problems. To aid this integration, Srinivasan and Kim (1986a) presented a DSS framework for investigating the cash management problems.

Intelligent mathematical programming-based decision support systems. Nevertheless, none of the above OR approaches allows cash managers to divorce themselves from the OR expert. Recently there has been a trend in the development of computer-based systems to build "intelligence" into the system. For example, this could mean building an "understanding" of formulating or interpreting OR problems into those cash management systems that employ OR techniques.

At least two other systems, both outside of cash management, have been designed or developed to be able to formulate and interpret specific OR-based problems, without assuming that the user has any OR knowledge. Binbasioglu and Jarke (1986) developed a Prolong-based model that formulated and solved production-based liner programming problems. The model incorporated substantial production management information into the model. The model is designed to solve a single problem that is "hard coded" into the system. O'Leary (1986a) designed a system for production scheduling that built knowledge associated with the generic application areas of production and scheduling into the system.

3. **Financial instruments as networks.** CASH MANAGER is a general system designed to choose an optimal portfolio from a set of possible elements. The current scope of the system is focused on short term financial instruments. However, the system scope can be expanded to correspond to the firm level as in Crum et al. (1983a). Further, CASH MANAGER is developed based on the assumption that the potential portfolio elements can be represented as networks. Accordingly, the purpose of this section is to demonstrate how to formulate short-term financial instruments as networks.

Short-term financial instruments. The most common financial instruments used for short-term financing include money market securities, certificates of deposit, banker's acceptances, commercial paper, money market funds, and daily repurchase agreements. In addition, coupon bearing and installment financing instruments also may be used in short-term financing. For example, installment financing agreements can be constructed to pay for equipment or merchandise.

These instruments can be organized conceptually as borrowing and investment instruments. Borrowing instruments would be commercial paper, banker's acceptances, coupon bearing and installment financing. Investing instruments would be money market securities, CDs, commercial paper, banker's acceptances, daily repos, and coupon bearing instruments.

Network representation of instruments. Some general modeling concepts can be used to model the above instruments. Let points in time be represented by nodes and investments be represented by arcs. Figure 1 depicts an investment.

Node i represents the start of the time period and node j represents the end of the time period. Arc (i, j) represents an investment with return r. If $X_{i,j}$ is invested at time i, then $(1 + r)^*X_{i,j}$ arrives at time j. Upper and lower bounds can be imposed upon the flow to limit the amount invested. $(1 + r)$ is called the multiplier for arc (i, j). The multiplier modifies the flow leaving node i to get the flow arriving at node j, generally as an increase in the flow (return on investment) or a decrease (interest on the investment). If the multiplier is greater than one then more arrives at node j (i.e., r is

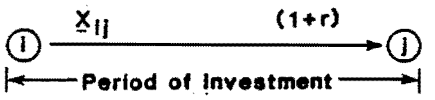

FIGURE 1

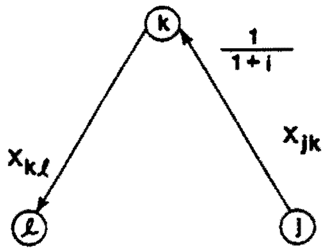

FIGURE 2

FIGURE 3

greater than zero). And if the multiplier is less than one then less arrives at node j. The bounds apply to $X_{i,j}$ and not to $(1 + r)^*X_{i,j}$.

A short-term loan is modeled in Figure 2. $X_{k,l}$ flows into node l as a loan. $X_{j,k}$ represents repayment at time j. Node k represents the lender at time j. The amount arriving a node k is $X_{j,k}^*[1/(1 + i)]$. The amount $X_{j,k}$ exceeds $X_{k,l}$ represents the interest paid on the loan. The transaction in Figure 2 can be modeled without node k, as illustrated in Figure 3.

Figures 1 and 2 can be used to model market securities, certificates of deposit, banker's acceptances, commercial paper, and daily repurchase agreements. The model in Figure 1 is used for investment and the model in Figure 2 is used for borrowing. The main difference between these instruments is the return computation.

Using the above modeling concepts, only financial instruments that start at one point in time and end at another can be modeled. Some financial instruments such as installment financing, coupon bearing instruments and other investments cannot be modeled using a single arc. These instruments require that we place additional constraints on arc flows. Figure 4 can be used to model an investment at time i with payments to the investor at times j and k. Let α_1 represent the percentage of the total paid to the investor at time j and α_2 be the percentage paid at time k. The additional constraint shown in Figure 4 must be added to ensure the proportional payments.

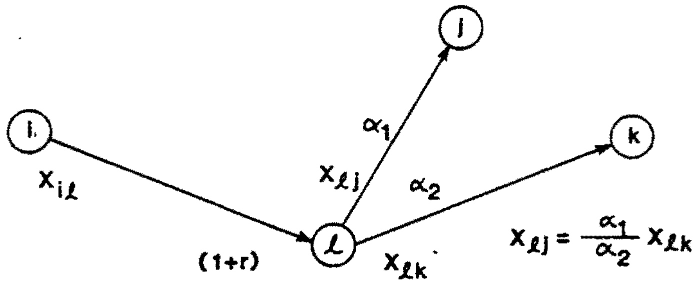

FIGURE 4

To illustrate these concepts, consider the following example. Air Co. has the following projected cash flows for the next two months.

Day	Cash Flow
1	($20,000)
16	$55,000
31	($10,000)

The positive value represents a cash inflow for Air and the negative values represent cash outflows that Air must make.

Air has a line of credit with a local bank at an interest rate of 9% per annum. Air has several investment opportunities. It can invest in CD's, money market accounts and commercial paper. There is also an additional investment (say, "Tricities Investment") available on day 1, with returns on days 31 and 61, with a 10% return on investment. If $31,482.61 is invested on day 1 then Air receives $8,000 on day 31 and $ 24,000 on day 61.

The investments can be summarized as follows.

Instrument	Maturity	Annual Yield	Yield for Period Invested (365 days)
Borrowing			
Line of Credit (LC)	15	9%	$i_1 = 0.0036975$
Investment			
Certificate of Deposit (CD)	45	8%	$r_1 = 0.009859$
Paper (P)	30	8.5%	$r_2 = 0.006984$
Market Account (MA)	15	7.5%	$r_3 = 0.003081$
Tricities Investment (TCI)	30, 60	10%	$r_4 = 0.016434$

Air desires to maximize their cash on hand at the beginning of day 61. The network for the complete problem is shown in Figure 5. The problem is solved in §5 to illustrate the use of CASH MANAGER.

4. CASH MANAGER overview. CASH MANAGER is a prototype expert system that includes the expertise of an OR expert. Since it is a prototype it has not yet been implemented in an organization. However, the system uses an approach similar to that employed in an international silver company, who faces an environment where short-term financing is critical.

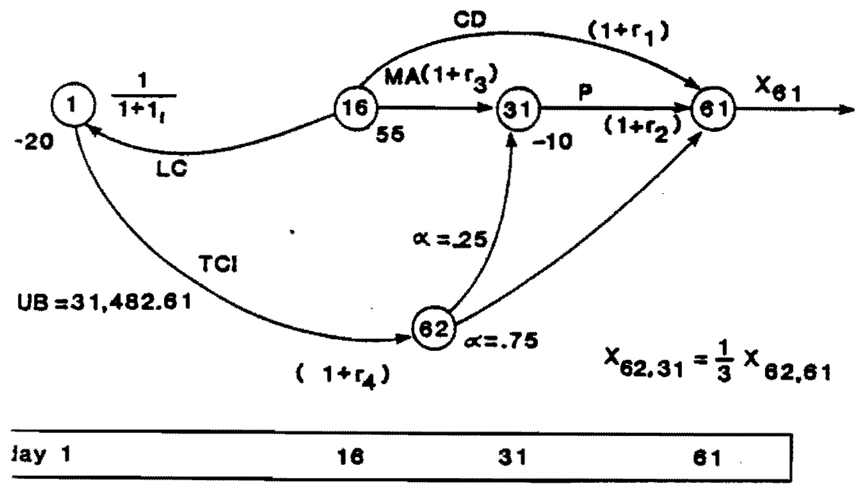

FIGURE 5

CASH MANAGER is designed to serve cash management as a tool to help support (not replace) their decision making, i.e., a decision support tool. It can be embedded with a portfolio of other decision support tools to form a more complete decision support system. In any case, it is a tool that can help the decision maker by facilitating "What if..." questioning of the environment.

CASH MANAGER was developed for use on an IBM AT PC, using Microsoft's Windows, in a mouse-based environment. It is a user friendly system that allows a cash manager without substantial OR expertise to develop a network model of a cashflow resource choice problem and solve it using an OR tool, embedded generalized networks. CASH MANAGER uses a set of menus to elicit information about a portfolio of investment opportunities from the user. The user chooses the set of instruments to be compared and supplies the parameters that explicitly define particular instruments (e.g., days the instrument is to be used). The system then formulates that portfolio of financial instruments into an embedded network problem for CASH MANAGER. The system formulates the problem using the network templates, and solves and interprets a network that relates those instruments.

New financial instruments. The financial world changes rapidly. Frequently, new financial instruments are developed (e.g., Peat Marwick 1987). Accordingly, there is no presumption that all characteristics of financial instruments can be developed, a priori. Thus, it is necessary to have the system accept information about new financial instruments. This is a feature of CASH MANAGER. The user can add financial instrument information to the system by defining custom instruments, which can be used as any other instrument.

Infeasibility checks. The formulation of a cash flow network can sometimes inadvertently lead to some infeasible situations, based on the parameters or portfolios specified by the user. For example, inadvertently the user may try to establish a network that has possible investment opportunities, yet has no funds flowing into the system. Alternatively, the required investment amount may be more than that supplied by the available set of financial instruments that the user has specified. As a result, the system is designed to perform two sets of feasibility checks. The first set examines the feasibility of the network before the solution, during the formulation process. The second set occurs during the solution process. In each case, the error messages are presented to the user in a manner that is easily understood.

Analysis of output. Since, as noted by Geoffrion (1977, p. 81), "the purpose of mathematical programming is insight, not numbers," one of the main concerns of CASH MANAGER is output analysis. CASH MANAGER provides its user with the optimal set of investment instruments, the timing of the investments and the investment amounts. In addition, the solution is presented in a manner that summarizes the results on a day-by-day basis, for each of those days for which a decision must be made. Throughout, the results are presented in a manner that a cash manager can understand.

CASH MANAGER also does a sensitivity analysis of the network to provide further analysis of the output. Linear programming sensitivity analysis is done on the portfolio cash inflows and outflows which are supplies and demands at nodes.

The perspective of CASH MANAGER. The mathematical programming approaches to cash management force the user to view the problem as a set of variables and coefficients on those variables (e.g., Maier and Vander Weide 1978). This is likely to be contrary to the manner in which the cash managers think about cash management problems. However, CASH MANAGER's network approach is more congruent with the way that cash managers view the world.

CASH MANAGER views the cash problem as a portfolio of financial instruments that have a specified lifetime. It views the selection process as simply choosing from that portfolio to meet the financial needs of the firm.

CASH MANAGER allows financial managers to continue to employ many of the same heuristics that they have used in the past. For example, human cash managers may try to invest in only certain high grade instruments. However, if there are an insufficient number of such instruments then they will need to invest in other available instruments. CASH MANAGER rapidly identifies situations of this type.

As another example, there may be a great deal of uncertainty in the arrival dates of cash inflows or required departure dates of cash outflows: there may be a number of alternatives. As a result, cash managers often must find new investment portfolios, because the flows have changed. CASH MANAGER allows the user to rapidly identify those alternatives using a "what if" approach to the analysis of alternatives.

5. **Using CASH MANAGER.** CASH MANAGER makes use of menus to guide the user. Initially, as seen in Figure 6, the user faces four major categories in the menu bar: File, Edit, Build and Solve.

Under *File* (Figure 7), the manager has the option to start a *New* cash management problem, *Open* an existing file of a portfolio of instruments, *Append* an additional set of instruments to the working set, *Save As* a different file and leave the starting file (if not starting from scratch) unchanged.

The problem from the previous section, Air Co., will be solved to illustrate the use of CASH MANAGER.

To start, we proceed to the *Build* menu and pull it down with the mouse (Figure 8) and select the *Simple Loan* option to build the Line of Credit Borrowing Instrument. As each piece of data is entered in Figure 9 we just hit the tab key to move to the next data entry field. The limit on the amount of the loan is entered in units of $ 1,000. Any data field can be selected simply by moving the cursor to that field and clicking the mouse. The interest rate entered is the percentage interest rate paid for the duration of

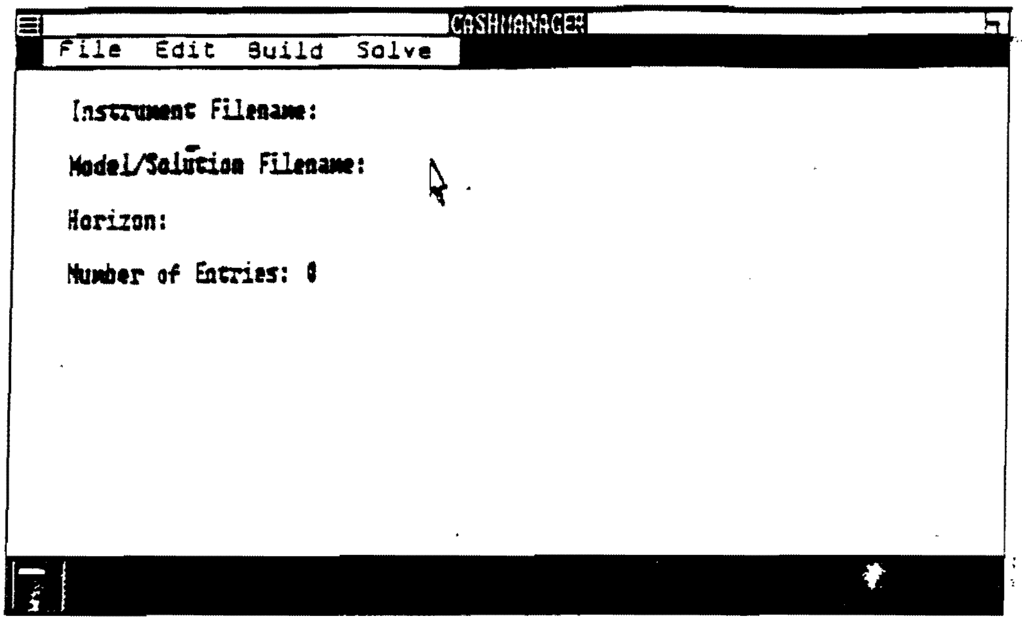

FIGURE 6. Main Menu Bar.

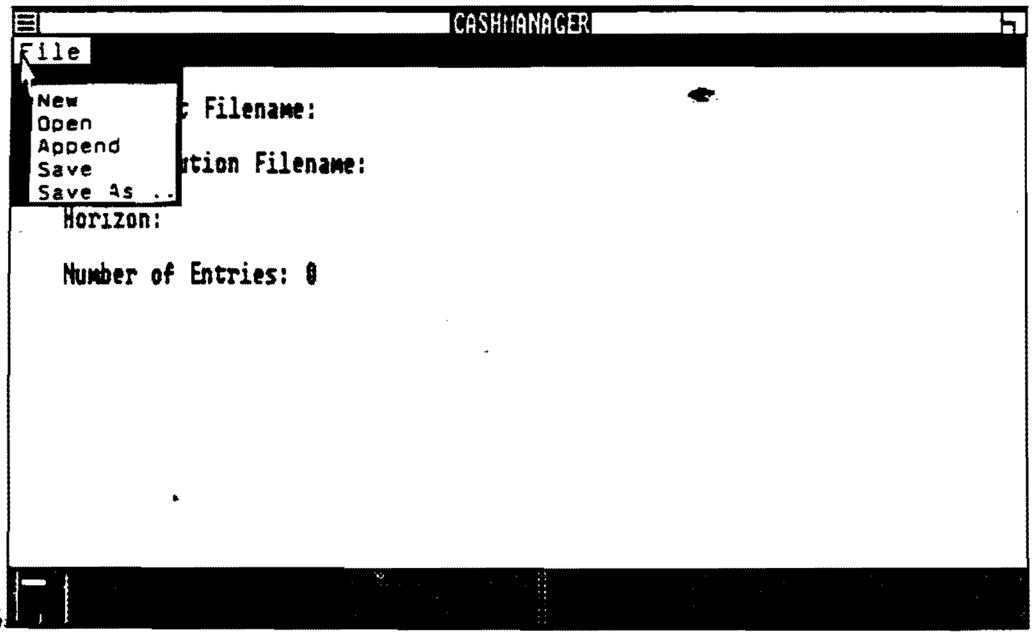

FIGURE 7. File Menu.

the loan. When all the data have been entered, the mouse is moved to the *OK* button and is clicked to save the instrument. The creation of the instrument can be cancelled by clicking the *CANCEL* button.

To build the Paper investment, the *General Investment* option in the *Build* menu is selected. If, instead, the investment is sold at a discount then the *Discount Investment* option is selected.

The template for the *General Instrument* is shown in Figure 10. The commercial Paper instrument is built by entering the data as shown in Figure 10. The rate of return is the percentage yield of the investment for the duration of the investment. The market account and the certificate of deposit instruments are built in a manner similar to the Commercial Paper instrument.

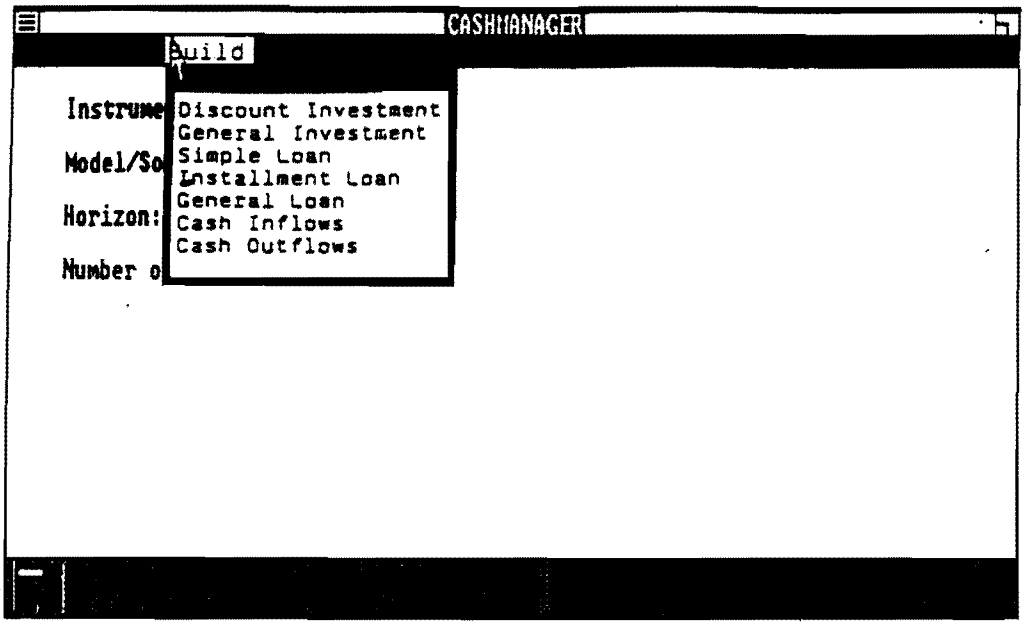

FIGURE 8. Build Menu.

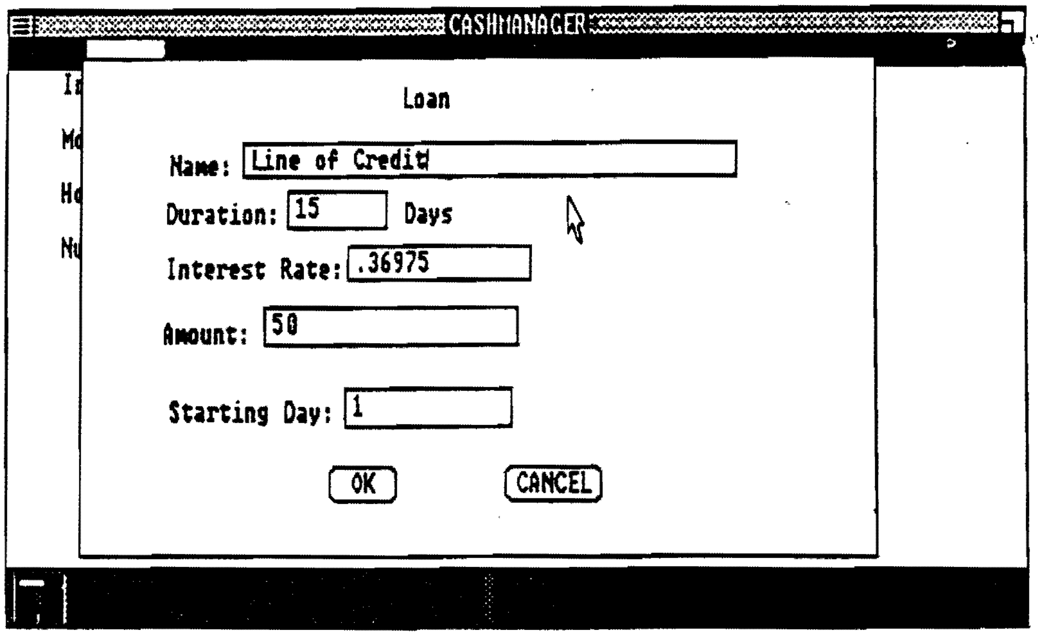

FIGURE 9. Simple Loan Template.

The more general capability of this *General Instrument* template is illustrated with the "Tricities Investment" (Figure 11). Payments are received on days 31 and 61 from the investment in the proportions of 25% and 75%, respectively. This is accomplished by listing the payment days and corresponding percentages as shown. The number of entries in the Inflow days and the Percent/Day field below it must agree. The same applies for the Outflow days and its Percent/Day field. If the percentages do not add to 100% or the number of entries are not the same, then when the OK button is clicked, the system will remind the user of the problem(s). The manager will be returned to the template for correction of the error.

The cash flows on days 1, 16 and 31 are entered by using the *Cash Inflows/Cash Outflows* options in the *Build* menu. The *Cash Outflows* option is selected to enter the

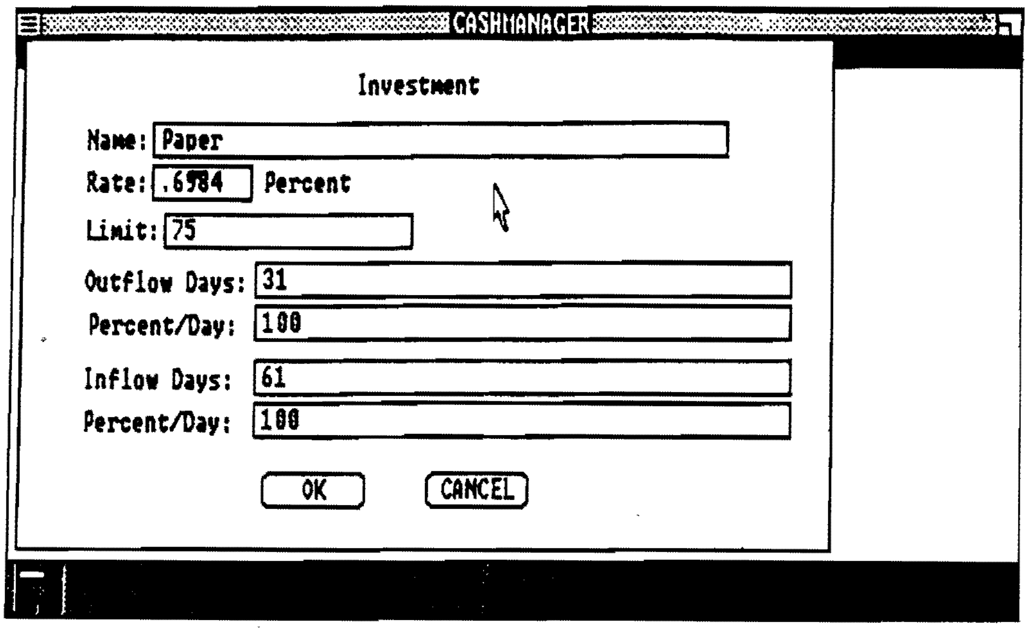

FIGURE 10. General Loan Template.

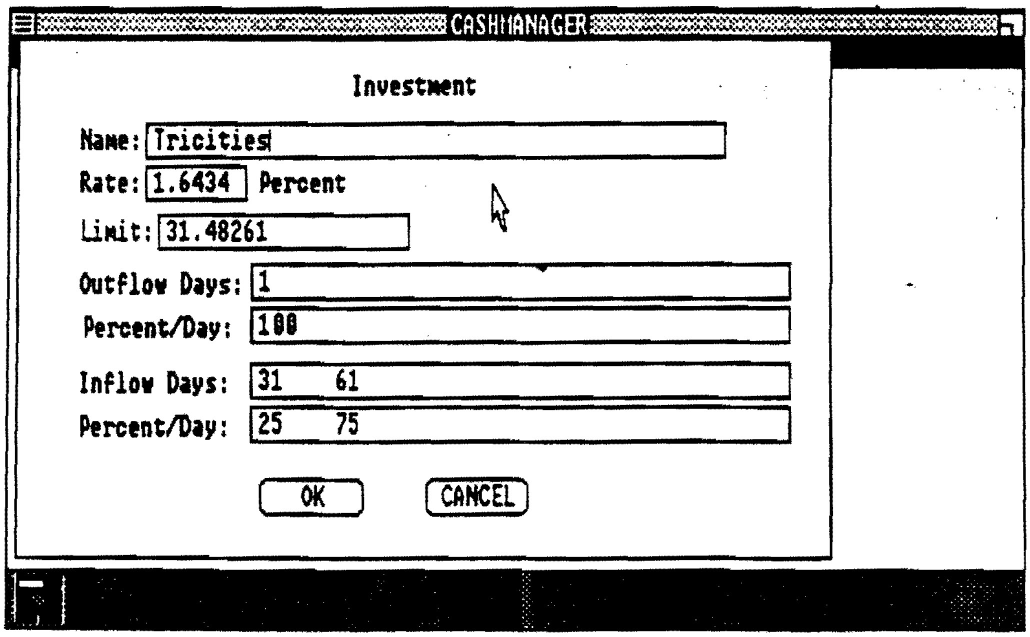

FIGURE 11. Tricities Investment.

$20,000 cash outflow on day 1 (Figure 12). The other cash flows are entered in a similar manner.

At any time, previously built instruments can be edited by clicking the *Edit* menu option in the menu bar. Figure 13 demonstrates the result of selecting this option after building all of the Air Co. instruments, along with the cash flows. In this window any instrument can be selected by clicking the row. The Tricities instrument is selected to illustrate this procedure (Figure 13). By selecting one of the buttons at the bottom of the window, the manager can:

1. *MODIFY* the selected instrument or cash flow by bringing up the appropriate template with all of the data fields showing their current values, which can then be changed;

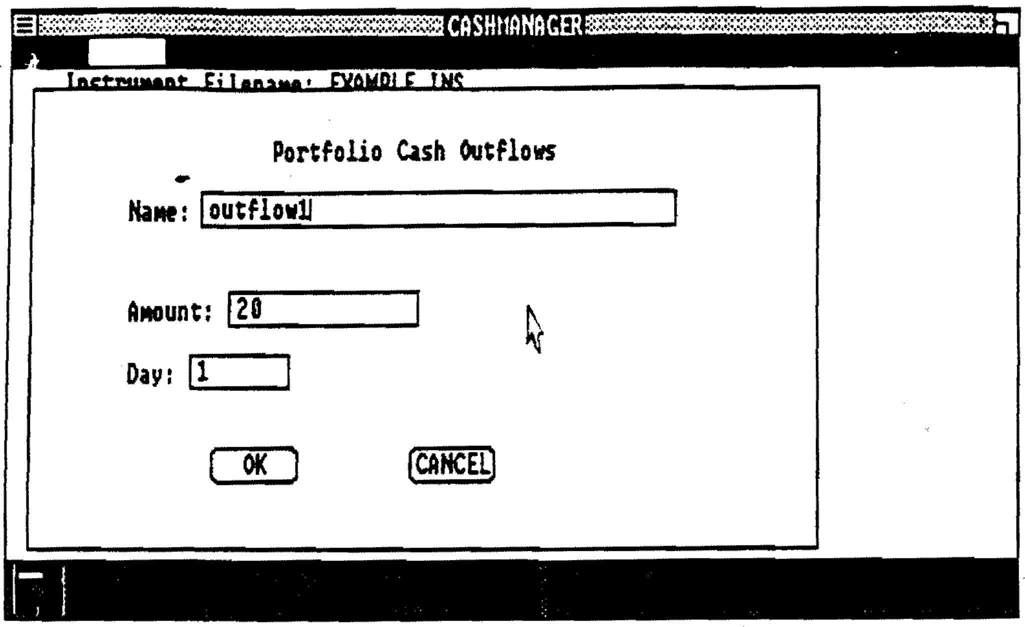

FIGURE 12. Cash Outflow Template.

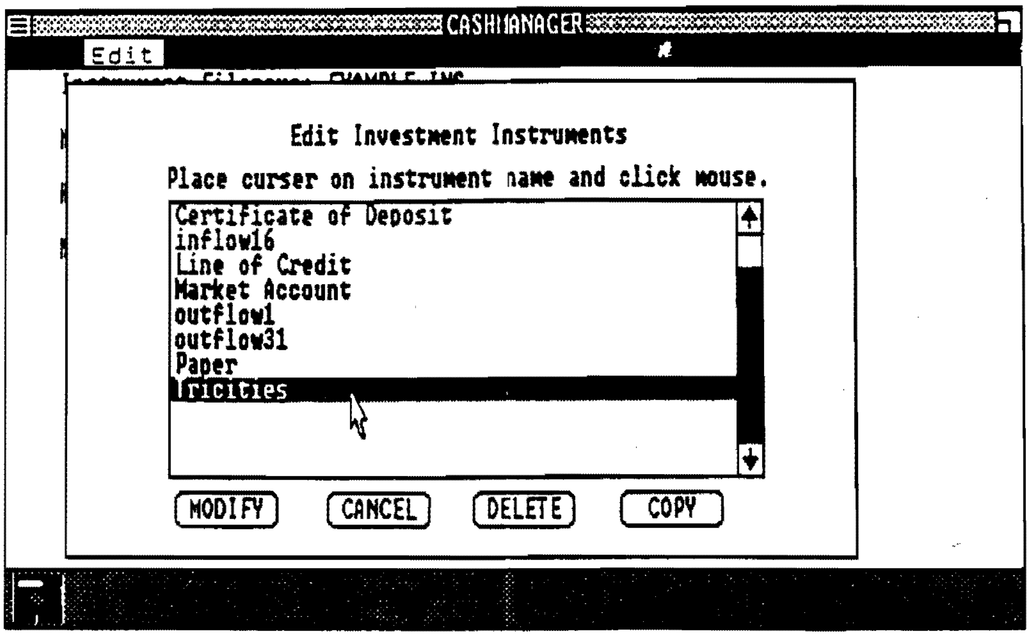

FIGURE 13. Edit Window.

2. *CANCEL* or exit out of the edit mode;
3. *DELETE* the selected instrument from the current working set;
4. *COPY* the selected instrument to create a new one having the same template. In this option the name of the instrument is left blank but all other data fields have the data of the selected instrument.

Next, the *Create and Solve Model* option is selected as shown in Figure 14. At this point, CASH MANAGER creates the cash flow model and checks for obvious infeasibilities (discussed below). If no infeasibilities are encountered, as is our case, the solution will be projected onto the screen and written to a file name delineated by the manager. Figure 15 shows the screen after the model is solved. That screen can be scrolled using the mouse. Figure 16 shows a listing of the solution file written to the

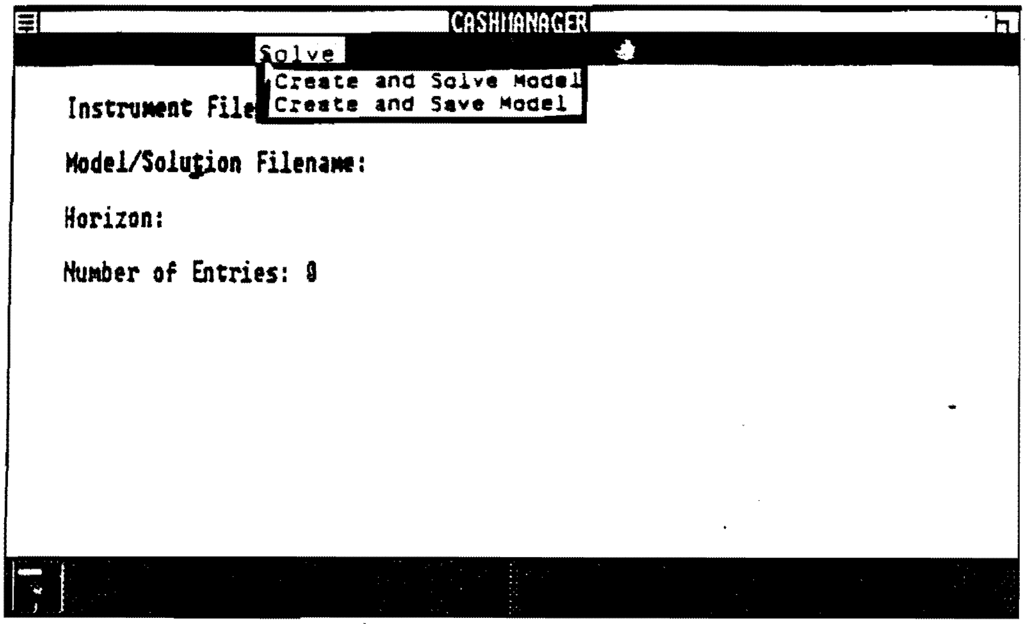

FIGURE 14. Solve Window.

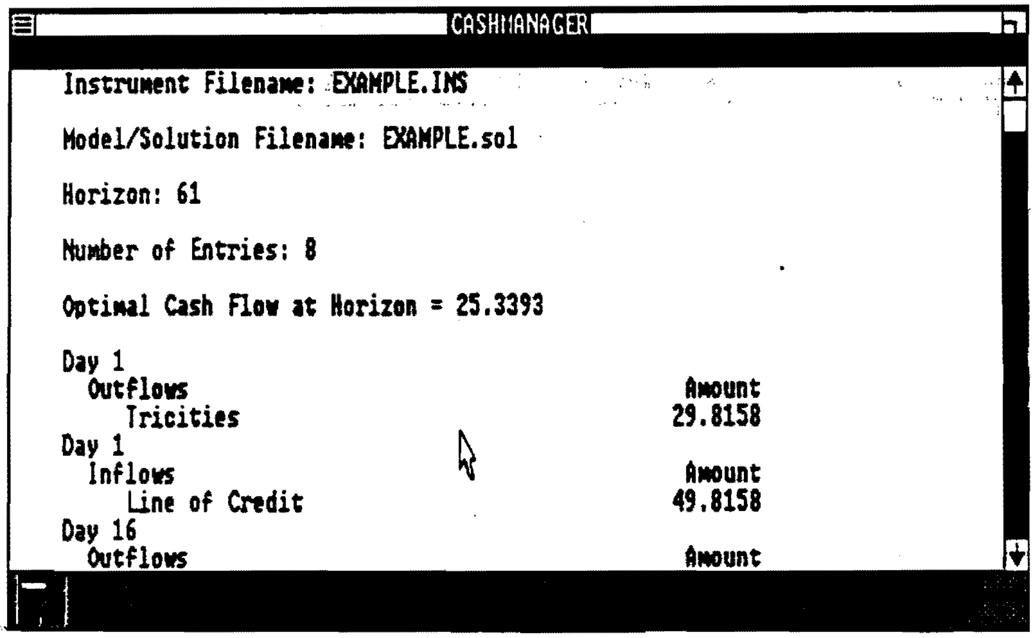

FIGURE 15. Solution Screen.

disk. A sensitivity analysis (SA) also is provided with the solution. The SA shows the change in the optimal cash flow at the horizon for a unit change in the cash inflow/outflow. For example, if only an outflow of $19,000 is required on day 1 then the optimal cash flow at the horizon would increase by $1,018.20. This rate of change stays the same, as long as the cash outflow on day 1 does not exceed $30,199.80 or drops all the way to 0.0.

```
Optimal Cash Flow at Horizon = 25.3393

Day 1
  Outflows                                      Amount
     Tricities                                  29.8158
Day 1
  Inflows                                       Amount
     Line of Credit                             49.8158
Day 16
  Outflows                                      Amount
     Market Account                             5.0000
     Line of Credit                             50.0000
Day 31
  Outflows                                      Amount
     Paper                                      2.5919
Day 31
  Inflows                                       Amount
     Tricities                                  7.5764
     Market Account                             5.0154
Day 61
  Inflows                                       Amount
     Tricities                                  22.7293
     Paper                                      2.6100

Inflow/Outflow Sensitivity Analysis

Rate of change  Day   Lower Limit        Given    Upper Limit

     1.0182      1      -30.1998      -20.0000         0.0000
     1.0101     16       52.4161       55.0000   9999999.9999
     1.0070     31      -12.5919      -10.0000         0.0000
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FIGURE 16. Solution File Listing.

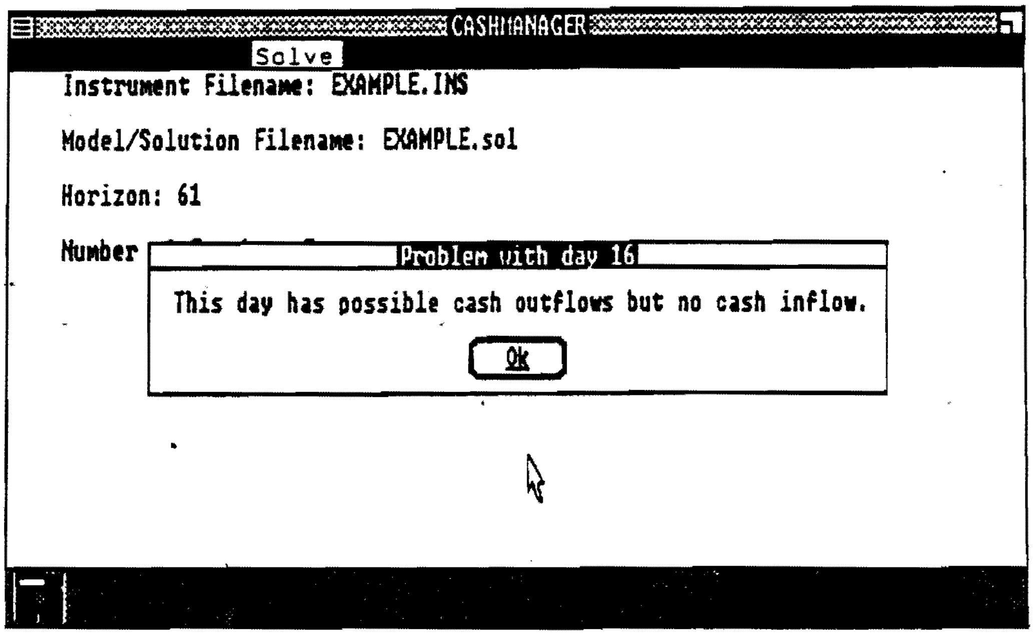

FIGURE 17. Feasibility Check Message Box.

Creating a network with additional constraints for a set of instruments can sometimes lead to infeasibilities. As a result, the system is designed to perform two sets of feasibility checks. The first set examines the feasibility of the network before the solution, during the formulation process. Currently, there are seven of these feasibility checks. They include checks such as "Does an arc have a zero upper capacity?" If such an arc upper bound exists then no flow could go over that arc, thus, there is clearly an error.

The second set occurs during the solution process. In each case, the error messages are presented to the user in an easily understood manner. If there was no cash inflow on day 16, then, during the formulation process, the Message Box in Figure 17 would

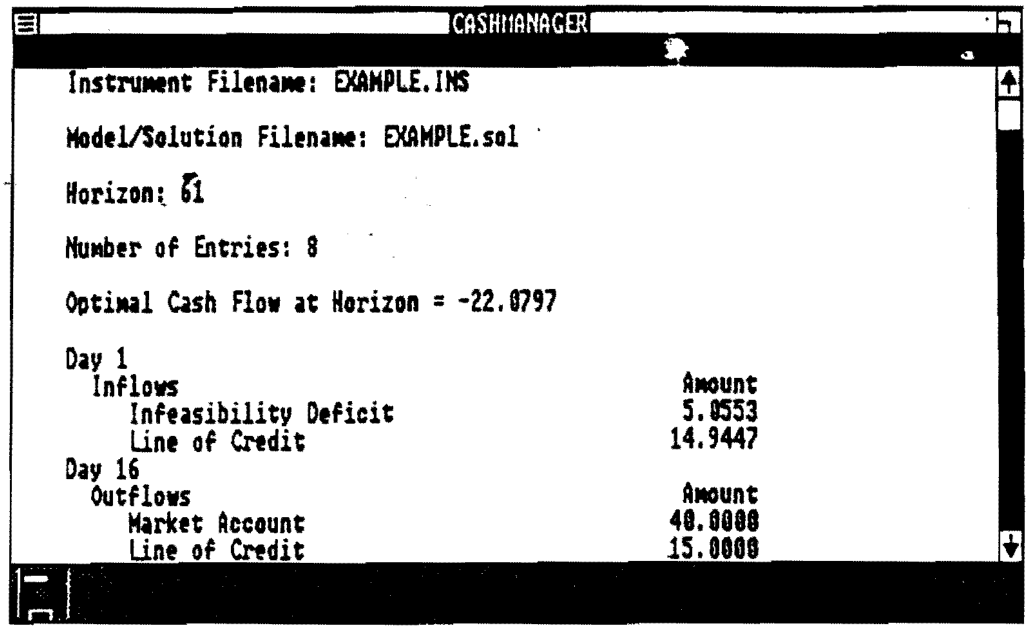

FIGURE 18. Infeasibility Deficit Screen.

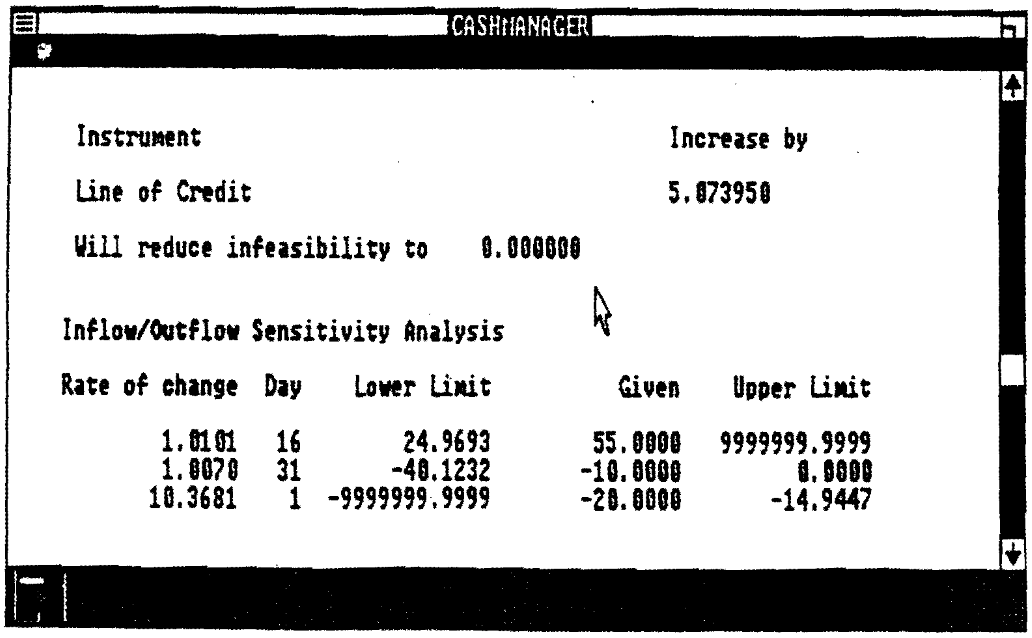

FIGURE 19. CASH MANAGER Recommendation for Infeasibility Reduction.

appear on the screen. It would stay on the screen until the user clicks the *OK* button. The solution step is not taken if any Message Box indicating a problem appears. When a Message Box appears there is a sure infeasibility or an oversight on the part of the system user.

CASH MANAGER also provides infeasibility analysis relating to the amounts of the portfolio items. Suppose the model was solved with the maximum payback on the Line of Credit had been set at $15,000. The screen shown in Figure 18 would appear indicating an Infeasibility Deficit on day 1. This would tell the manager that there is not sufficient borrowing capacity to meet the cash outflow of $20,000 on day 1. Scrolling down the solution file we will find the screen shown in Figure 19. This tells the user that the infeasibility can be reduced to 0.0 by increasing the capacity of the Line of Credit to $5,073.95.

Conclusion. CASH MANAGER is a user friendly, knowledge-based system designed to support the decision making of the corporate cash manager in a PC environment. The system solicits minimal amounts of information from the user and employs that information in the context of an embedded network, to help the user choose between alternative financial instruments.

The system employs operations research expertise and cash management knowledge. Network modeling expertise is used to take information about a portfolio of financial instruments and develop a network that represents that portfolio. Feasibility analysis is employed to ensure that the user inputs the parameters in an appropriate manner and to guide the user to the addition of other instruments to the portfolio. Sensitivity analysis is used to help the user understand the implications of the output. CASH MANAGER is not limited to a small set of financial instruments. Instead, the system is designed to acquire information about new financial instruments as the need arises.

CASH MANAGER does not have the same implementation limitations of other OR-based tools for cash management. Since the user can use the system at their own discretion, in the privacy of their own PC there should be no time constraint invoked by the use of the model and there should not be a constraint of only using the system when the OR analyst is available. So now the cash manager is decoupled from the OR analyst. Further, since the system contains the generic instruments and the means to assemble a portfolio, unlike other analytic methods, each occurrence does not require a new system. In addition, the mouse environment makes the system easy to use and the network approach makes it easy to understand.

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