PROGRAM MANAGEMENT OF A COMPLEX SIMULATION PROGRAM LESSONS LEARNED FROM STOW

Rae W. Dehncke
STOW Program Manager
Defense Advanced Research Projects Agency
3701 North Fairfax Drive
Arlington, VA 22203-1714
(703) 284-8892
rdehncke@darpa.mil

Donna J. Brooks
AB Technologies, Inc.
1600 North Beauregard Street
Suite 300
Alexandria, VA 22311
(703) 575-1087
dbrooks@abtechnologies.com

Abstract

The Synthetic Theater of War (STOW) is an Advanced Concepts Technology Demonstration (ACTD) being conducted in conjunction with USACOM and the United Kingdom. In November 1997, STOW 97 successfully demonstrated, in the largest ever entity based training simulation, that it is possible to support training from the platform level to the Joint Task Force with the same simulation. The program management of this complex, international program is both interesting and challenging. The STOW Management team has learned many lessons that would be of interest to the simulation community. The organization and management of such a complex program requires careful planning and a willingness to make organizational changes as the program evolves from phase to phase. The selection of key players, assignment of responsibilities and relationships among the members of the program is critical to the ultimate success of the program. The information flow within a complex program must be carefully planned and adjusted as the program changes direction. Decision making with regard to schedules, milestone development, testing and integration was a major responsibility for the entire program's leadership. The contracting effort to resource the 250 contractors in this program must be flexible and evolutionary to support program requirements and organization. Developing program management reporting requirements, conducting baseline reviews, determining required deliverables and the overall management of equipment was a significant task. As JSIMS and its Service component programs grapple with the issues of program management of their equally large and challenging programs, the lessons learned during STOW will assist them and other members of the simulation community to manage their programs more efficiently and effectively.

Keywords
Advanced Concepts Technology Demonstration, Advanced Distributed Simulation, Program Management, Synthetic Theater of War, USACOM, United Kingdom

Col. (Ret) Rae W. Dehncke has been a member of the STOW Management Team since January 1996 and the DARPA Program Manager since March 1998. After 30 years of service with the US Army he joined the Institute for Defense Analyses as the STOW Program Team Leader. Col. Dehncke has a Master's Degree from the University of Arizona, is an alumnus of the Army War College, and was a Senior Military Fellow at Harvard's Kennedy School of Government.

Donna J. Brooks has been the STOW Business Manager since May 1995. She is also the Advanced Distributed Simulation Team leader at AB Technologies, Inc. She has been involved in government acquisition and contract management for 17 years. Ms. Brooks is a graduate of Avertt College and the University of Virginia program for Procurement and Contracts Management.

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PURPOSE

The purpose of this paper is to report on some of the lessons learned while managing the Synthetic Theater of War (STOW) program. Experts have written much on the subject of program management and we do not advocate a particular approach. Rather, our goal is to share some of our experiences, good and bad, and offer for consideration either an approach that we think worked or an approach we would take if we had the chance to do it again.

We are writing this paper from the perspective of the government management team and thus we have a particular bias that might be quite different from that of the contractor. We hope however that many of the lessons learned will be useful to anyone, regardless of their position, who is involved in program management at any level.

STOW OVERVIEW

The Synthetic Theater of War, a large multi-year simulation development program, was conceived in DARPA as a technology research and development program designed to advance the state of technology associated with advanced distributed simulation. Upon STOW's designation as an Advanced Concepts Technology Demonstration (ACTD), USACOM became the operational sponsor and the United Kingdom became a full partner in the endeavor. The objectives thrust of the program were adjusted several times in response to ACOM's desire for a training prototype and the appearance on the horizon of JSIMS, the logical target for transition of the STOW technologies. Various management oversight groups helped to reorient the effort to develop, demonstrate, and transition the platform level simulation technology, tools and applications to the next generation of training simulations. Subsequently it became apparent that there were a number of additional potential uses for the STOW prototype and again the objectives of the program were adjusted to meet the demands of multiple customer's .The ACTD had a five-year life and was budgeted at over $175 million dollars. There were some 50 contractor teams involved and more than 20 agents were operational during the program. As the program developed four discrete phases were identified. These stages were Research and Development; System Integration and Testing; Demonstration; and, Prototype Improvement and Transition. As we write this paper we are in the last year of the program and thus have had considerable experience with the issues outlined below.

THE CHALLENGES

The challenges facing the managers of any program are many. Issues facing the managers of a large program based on emerging technology, with multiple customers and a requirement for a simulation prototype are greatly increased. Unfortunately most new program managers are not aware of what decision-making situations will confront them, or when they will be required to make a key decision. Each program is different, but we believe each program has a number of similarities that can be enumerated and discussed. For the sake of this paper we have decided to concentrate on the following major issues: Management Structure; Communication; Decision Making; and, Business Management. Why these? Because we think we have learned, lessons in these areas that might be helpful to someone managing another program. Our approach will be to briefly discuss an issue and then provide a specific recommendation for consideration.

MANAGEMENT STRUCTURE

For the sake of this discussion assume The Program begins on Day One with the appointment of the Program Manager (PM). The tendency is to think this PM will remain with the program until its completion, but STOW has had five PMs over its life cycle and we suspect it is the rule rather than the exception that PMs will change. The new official brings new ideas and a chance to reorient the program for better or worse. From the start therefore, we suggest that the program manager document his decisions so that down the road the new leadership will have some understanding as to how and why the program got to the point it did. How to do this? Memorandums of Record, Program Management Reviews, and documented Adjustments to the Baseline all help. Recommendation - Appoint a member of the government team as the "Program Scribe" with the major duty of recording programmatic decisions.

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Once on board the PM creates a management structure. The PM thinks in terms of the government team, SETA support and contractor counterparts. These team members are not interchangeable and each brings to the table a unique perspective and measures of success. All too often we see a blurring of roles and responsibilities accompanied by a lack of direction which results in a great deal of wasted time and effort. This is not meant to imply that the government and contractor teams cannot work together harmoniously and for the good of the program but that does not just happen without hard work, mutual respect and trust developed overtime. A large program will have a complex management structure and unfortunately we have noticed that they tend to evolve over time rather than result as an outcome of a carefully thought out strategy for success. Recommendation - Determine management structure based on the needs of the program and not on some existing model that may or may not be applicable to your needs. Expect and plan to reorganize several times during the life of the program.

Listed below are the important management teams utilized in STOW along with a few thoughts about their operations.

Government Only Leadership Team

Composed of the government officials and their immediate direct support personnel. Does not include the developers, integrators or other contractors. Responsible for the overall management of the program. The PM must be careful to limit the topics discussed by this group so that it is not trying to make decisions with incomplete information. It is also a good idea to keep this group low in profile so that the other members of the team do not feel disenfranchised.

Senior Management Team

The most important part of the management structure is composed of personnel selected by the PM who provide the day to day leadership of the program and are involved in most decisions relative to managing the program. We caution to keep this team small but include the key management and technical personnel, regardless of affiliation, so that the group has the information and expertise to make program wide decisions. This group will tend to increase in size as everyone wants to be involved but a large group is a sure sign that it will become ineffective. Keep the meeting schedule at a regular time, length or meetings and have an agenda. Review the membership at each phase of the program and adjust as necessary.

Oversight Committee

Selected according to applicable regulations or agreements, this group provides high level guidance to the PM and adjudicates as necessary those problems that can not be resolved at a lower level. Members of the Oversight Group frequently speak for the program at external meetings. In a complex program the oversight group is important because it tends to be the mechanism by which the various customers are kept informed of the direction for the program. Expect membership to change and plan for the continuing reeducation of the members. Do not encourage the members to make management decisions-they are there to provide broad direction to the PM and those programs in which the Oversight Group is involved in day to day or even month to month decision making are doomed to a state of inaction, reaction and repetition.

Technical Leads/WBS Leads

Appointed by the government or contractor program managers, these individuals have responsibility and authority for specific aspects of the program. Extremely important members of the mid management team, these are the experts who will to a great extent determine the success or failure of the program. They must have authority and responsibility to lead their groups to accomplish specific tasks within the framework or architecture approved by the PM or senior management team.

Integration Team

Responsible for the integration and testing of the software. Create it early and support its membership with the best people. Clearly define its charter and be sure it includes the right mix of talent. Team must have a strong and respected leader.

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Demonstration Team

Responsible for the training and demonstrations and all that is associated with those tasks. They require special training and should have a few highly talented technical people working with the operations. Recommendation **-** Clearly delineates the organizational structure and lay out in writing roles and responsibilities. Hold an offsite meeting occasionally to discuss if the organizational structure is supporting or hindering mission accomplishment. Make changes in organization and membership as necessary to support program goals, even though individual feelings may be hurt.

COMMUNICATION

Communication both within the program and to the outside world is critical to the success of any program. A program with multiple customers and international partners has additional unique challenges. There are many means of communicating and we have reviewed those used within the STOW program and offer the following for your consideration.

Multiple Customers

The challenge of satisfying multiple customers in not to be taken lightly. Within STOW we were often faced with conflicting demands from our principal customers, DARPA and ACOM as well as with demands or requests from all of the military services, from the JSIMS community and even from our UK partners. The Program managers have had to juggle priorities, resources and personal energies in an attempt to satisfy the demands placed upon him. Do not expect that your Oversight Group will understand what is best for the overall program as each member comes with a bias towards the group that they represent. Over time it is the PM that must make the decisions and take the heat to balance the needs of the multiple customers with the goals of the program and the resources available to accomplish the mission. Recommendation - Limit oversight meetings to the extent possible and allow the Program Manager to work within the broad guidelines outlined by his superiors. Limit attendance at meetings to reduce the number of visitors who are always ready to offer opinions and advice, often without foundation, as to how the program ought to be run. Recommendation - Communicate often, via various means and keep your customers informed about where the program is heading and how you are trying to accommodate them within the boundaries within which you are operating. Do not allow confrontation at public meetings and keep the discussions on a professional not personal level. Provide “public” information communications, via a Web-site or professional meetings to the interested greater community on a regular basis to satisfy those with a real or perceived need to know.

International Partners

International Partnerships bring both a potential for great collaboration and a whole series of concerns to a program and its managers. Normally international participation is directed by senior DOD officials and governed by a Memorandum or Agreement, which outlines the roles and responsibilities of each side. That agreement, however, is only the beginning and the day to day modus operandi must be developed. Even when both partners speak “English”, communications must be carefully thought out to avoid misunderstandings and international repercussions. This is the subject for an entire paper someday but suffice it to say that an international partner drastically increases the manager’s scope of responsibility. Recommendation - Limit the number of international partners in any developmental effort. Clearly define roles and responsibilities. Pay attention to protocol and remember that even if the international partner is very junior in terms of contributions they are equal in terms of international relations. Finally, enjoy the opportunity to work with, learn from and interact on a personal basis with your international partners.

Program wide meetings

Useful and required on a carefully planned schedule. Program wide meetings are expensive in terms of TDY costs and lost productive time. Not everyone needs to attend every meeting but you will find there are a group of professional meeting goers who want to do just that. We found that internal program wide meetings should not mix internal work and briefings to external attendees. Much time is wasted by both when this occurs and there is a great likelihood that neither

group will leave the meeting satisfied. At a program wide meeting you can explain program objectives, conduct working sessions and of course do a lot of useful team building. Recommendation - If you are going to have a program wide meeting determine who should attend, what the objectives of the meeting are, who will control the agenda and what meetings/working session should be conducted in conjunction with the larger meeting to take advantage of those present. If outside attendees are present we recommend you limit their attendance to the first day and the overview sessions only.

Email

Email is a very effective way to communicate within the program. However, we have learned that not everyone needs to get every message and there are those who will spend their entire day reading and responding to emails that do not even pertain to their responsibilities. Email groups should be created and messages sent to those who have a need to know or a responsibility for action. Certainly there are messages that should go to the entire team so that everyone is aware of key decisions or events. First those should be the exception not the rule. Remember too, that anything you write and send is likely to have a wider distribution than you may have intended and this can be the cause of great unrest within a program. As a rule, Email is not the place to make policy, but if decisions are made via email then the Scribe has the responsibility to record and share those decisions with appropriate personnel.
Recommendation - Review your email flow occasionally and have the management team discuss who is getting what information and whether it is in accordance with you plan.

Integrated Product Teams (IPT)

One of the hot management techniques currently in vogue. Our experience has shown that these teams can be very effective or a tremendous waste of time and talent. There are programs that have so many IPTs that they conflict with each other, require a great deal of resources to support, seldom produce any products of value and attract the professional meeting goers who add nothing but personal opinion and confusion to the effort. We have also found that some contractors, who bid to produce a product and claimed an ability to do so, like IPTs because it takes the heat off them and transfers it to a group that is often willing to revise requirements or offer more expensive solutions to the requirements. The most effective IPTs we have seen are lead by the contractor with the responsibility for a task and they are not allowed to meet until the contractor has a product for discussion by the group. This generally means that the IPT lead will take a lot of heat from the group but that's why we pay them the big bucks. There should also be a government representative in each IPT and together with the contractor lead they should be members of, and report to, a higher level management team to insure the efforts of their IPT are properly focused and integrated. Recommendation - Regularly review the composition, agendas and goals of the IPTs. Limit then to those who can truly contribute to the effort and require the IPT contractor leads to produce a strawman for discussion rather than a blank piece of paper at the start of the meetings. Demand a 'brief out' and a list of action items after each meeting.

Teleconferenceing/Phonecons

Very efficient and cost effective means of conducting business in a large program. Beyond the obvious cost savings over TDY, they save travel time and allow multiple participants from each site. Again, an agenda and a careful review of the participants increase effectiveness. Recommendation **- Use** the phonecon with a carefully prepared agenda and list of participants. Several short telcons are more effective than large, multi-agenda sessions.

DECISION MAKING

Within the life of any program there will be program change and decision making issues surfacing virtually every day. The Program Manager must expect this situation and insure that he has procedures in place to make decisions at the appropriate levels. A well-defined organizational structure and clearly delineate roles and responsibilities will help. There are also decisions that should be reserved for the PM alone since he bears the legal and fiduciary responsibility for the program. This type of decision needs to be defined early and reiterated

often so well meaning subordinates do not cause a programmatic crisis with an inappropriate action. We found that we were most successful when responsibility and authority were delegated to the appropriate levels with a good flow of information up and down the management structure keeping the right people informed and consulted. Weekly senior management meetings were used to help focus issues, assign responsibilities to gather information and to make decisions. Decisions should be recorded and promulgated as necessary through out the team. Recommendation - Set aside a period of time to discuss how decisions will be made early in the program's life and establish the mechanisms by which issues are brought to the appropriate decision making groups.

Personnel Turbulence

You must assume that the management structure and personnel matrix will change over the life of the program. People come and go on there own initiative and your contractors will pull people from existing programs to start new ones. New phases require a relook at the organization and the key players. The loss of a key person-such as the Technical Director or the lead integrating contractor may be a chance to realign roles and responsibilities. But it is also a time of concern about lost momentum and ability to make decisions. The important lesson learned is that change is inevitable and that the PM and his management team must look ahead at least 6 months to insure that change is managed to the extent possible so that it comes at the appropriate e time in the life cycle of the program. Recommendation - Develop a long range-planning event that allows management to plan based on projected personnel turbulence and major milestones and refocuses the program at the most advantageous times.

REQUIREMENTS DETERMINATION

One would think all programs begin with a set of requirements from which to begin and that is a true but it is certainly an incomplete statement. Determining the requirements for the program is a most challenging endeavor. Even more difficult perhaps is defining those requirements in terms that can be understood by your customers, integrator and developers. It is a long way from the "vision of senior management" to the geek writing the code. There are various documents that are useful and we tried to write most of them. STOW found the Technical Requirements Document (TRD) the best way to establish the links between customer's needs and technical requirements for the developers. Whether operating from an ORD, a TRD or a listing of desired capabilities, the thing to remember is that the list will never be complete and/or fully accurate. There will be tremendous pressure to work outside the written requirement as your customers desire new capabilities or as the contractors realize they can not deliver as promised. It is incumbent upon the program and business managers to hold the developers to a baseline document in order to control the program costs. Programs that allow developers to free wheel are asking for cost overruns and requirements creep. While it is not always or even likely that a fully developed TRD will exist it is certainly possible and absolutely necessary to get to a 90% solution. This document will give you the baseline necessary to control the developers and satisfy the engineers to an extent that they have a path from start to finish. Recommendation- Changes to the TRD should be boarded and then approved. The Program Manager is making on decision, should delete nothing without a conscious action. Do not allow "marketing" during baseline discussions. Some developers will tend to do that which is easy or desired from their perspectives and slip on the hard or critical efforts. Thus the TRD and the program development schedule should be carefully aligned early and adjust often to support only those changes approved by the management team.

Systems Engineering

This is a specific sub category of decision making worthy of lengthy discussion in a longer paper. In many programs, "Change" is the Providence of the Systems Engineer for better or worse. System engineering is important to the program but it is the products that count and not the 'Process'. There is a tendency to delay decision making and execution while we waited for the engineers to come up with the plan. The fact of the matter is that you will never have enough information in the format you need it. You must push on with less than perfect information or the program will languish, morale will fall and time will be wasted. Accept a less than perfect and complete solution early and move on. Continue the systems

engineering effort and look for insights that can help with program and sub system change. Recommendation - Push the engineers and make them outline a process, a requirements document, and test plans that form the baseline for the program but do not allow the process to be more important than the products. If you are not comfortable with the lead engineer consider replacement. Just as there are different leadership styles for a PM there are different styles for systems engineers and the two individuals must be compatible and complimentary.

TECHNOLOGY EVOLUTION AND INSERTION

The STOW program began as a technology program and in fact technology continued to develop through out the life of the program. This presented a unique challenge for the leadership as we were constantly faced with questions of upgrading software, integrating new hardware and even integrating new federates as the customers demanded new capability or the developers came forward with new technology, tools or applications.
Recommendation - Allow the integration of the latest improvements up to a point that is determined well in advance and then hold the line at the good idea cut off point. There must come a time when the decision is made that the risk associated with inclusion of the, new outweighs the benefits of the tested!

DEVELOPMENT VS TESTING/INTEGRATION

There is a natural friction between the developers and the testers/integrators. The former want to develop and develop forever, always looking for the perfect product and the testers/integrators want to do their thing from day one. You need a schedule for deliverables from the developers that gives them time to make an improvements or create a new version and test it on their own before program wide testing. We also learned that most real development seems to occur in the weeks immediately before a deliverable is due. Finally, we learned know schedule changes are very disruptive and make everyone unhappy. Therefore we adopted a rule that about every six months we would have a deliverable and a new cycle of testing. As we moved closer to the event we worked carefully to have deliverables managed in such a manner as to allow the more important and or larger programs to dictate the schedule to some extent. Recommendation - Determine early the schedule for development and integration and try very hard to adhere to it. Insure that your schedule is event oriented so that you integrate at a logical time in the program life rather than on a calendar date, but do not allow developers to go for more than six months without a deliverable.

Schedule

One of the most important decision making tools is the schedule. In an R&D environment, it is often difficult to project the entire picture, and the schedule can become cumbersome, but it is critically important and must be usable to all.
Recommendation - Develop a schedule, which depicts major contract milestones. Each subsidiary group should also have its own schedule. The Master schedule should be an integrated product, and updated monthly. Particular attention should be focused on the major milestones. When events occur that potentially impacts a milestone, get the senior management team involved. Use the schedule on as a management tool. Display it at all meetings and force discussions regarding schedule impacts. The schedule should be maintained by the contractor and reviewed by the management team.

BUSINESS MANAGEMENT

The challenges of business management of a program of this magnitude cannot be understated. The Business manager must be involved in all aspects of the program to enable continual assessment of financial and contractual impacts. In the beginning the Business Manager works very closely with the Program manager to determine funding allocations. For the first 3 years of STOW, we had several PMs each with their own operating budgets. Determining focus and priory was extremely difficult. As we got closer to the actual exercise we adapted a new approach. We basically combined into one program, determined tasks, prioritized as a team and combined the individual sub-program's budgets as one bucket of money. The new organization was comprised of a mix of personnel. It was the single most effective thing we did toward reaching our goal managing the program. Recommendation - A business management perspective was advising the contractor of your expectations from schedule,

reporting and cost management requirements. Plan for change and have a defined process to document the reaction and the results. Understand their processes, be patient, be consistent, be firm and most important be fair.

CONTRACTS

In most instances, the PM begins with the contract already in place. For large R&D efforts DoD typically uses Cost Plus contracts. The contractor is performing research & development and it is not in the interest of the government to add risk to this situation. So, pay them for their efforts in total. The fee is another issue, however, a fixed fee limits the PM's influence. An Incentive fee, on the other hand, insures that the contractor realized that there would be periodic evaluations of their management of the R&D effort. If they are sloppy in time management, Government Furnished Equipment (GFE) management, CDRL deliverables, there will be a penalty assessed. However, careful management attention to these areas can net a substantial payoff. It is an important motivational tool. Be certain that the form of cost reporting matches with the scope and objectives of your contract. Variances loose meaning easily in a CPFF environment. Know your contractor's processes. Be aware of the accounting periods and practices. Work closely with the contractors contracting department so that you are certain of good communications. Check voucher regularly, and pay attention to detail. If you question a practice, or a number, or a change, ask for an explanation. Keep copious notes and documents action items. Recommendation - If you are in the position to influence the contract type, do so by requesting options?

CDRL MANAGEMENT

CDRLs in an R&D Program should focus primarily on processes and lessons learned. In STOW, SEID we had CDRLs, clearly too many. Develop a schedule and a POC with the contractor. Don't be hard over on delivery of non-essential CDRLs. Insist on timely delivery of R&D status reports and CSSR. Accomplish monthly comparison analysis and review discrepancies with the contractor; then report results to the PM. Don't bother the PM with small stuff – alert them to only those items requiring their attention.

Share the CDRLs with the community. Determine in advance who should review them, prioritize them, and decide which ones should be placed on the WEB for public and/or private viewing. Recommendation - Remember CDRLs cost time, and time cost money. Limit the CDRLs to essential program documentation.

MANAGEMENT REPORTING

In STOW, we conducted quarterly management reviews, and found the timing to be effective. These reviews were done for all efforts regardless of size. Involve the PM and the contractor PM. Conduct dry runs with the contractor to be sure that formatting, level of detail, current status, and issues are all understood in advance.

Before reviews, insist the following; A consistent format for management reporting proved helped. We developed a high level format for reporting which included 1) an obliterate statement of work, 2) accomplishments/ deliverables, 3) schedule, personnel matrix, and 4) problem areas. In addition, basic financial graphs were included. This management tool enables us at a quicker glance to do a comparison analysis as well as provide the PM with program specifics in an easy to understand basic approach. Recommendation **-** As a Business manager, you do not want any suprises. Know who is working the effort their percentage of time. Keep constant surveillance on the burn rate, recognizing changes and understand the reasons.

BASELINE REVIEWS

At the initial start of the contract, carefully review the Work Breakdown Structure (WBS) and understand it. Review it with the PM, and if necessary request appropriate changes. Understand how the WBS fits into the cost structure and reporting process.

Periodic baseline reviews are important. During STOW, we conducted these reviews only during and after a rebaseline had occurred. This process worked as long as the Business manager participates in the majority of meetings, so that constant analysis of program focus and change is accounted for and recognized in the contractor's monthly reporting. Recommendations - Review the baseline at each quarterly review. Officially annotate changes that affect the cost structure,

and note closed WBS elements. These types of changes are prevalent in an R&D environment as one concept is dropped and another added, or total cost to complete determine the necessity to abandon the project.

Government Furnished Equipment (GFE)

Property management must be closely structured at the beginning. Establish procedures to authorize purchase of GFE under the contract, insist on a property procedure and a specific contractor POC. Plan for maintenance and upgrade costs, and depending on the program, plan for shipping and storage. Recommendation - Review the procedures carefully, and include the review of all GFE within the quarterly review agenda. Expect loss and damage.

Evaluation

Program evaluation is a requirement and must be carefully planned and executed. A program can be successful from several perspectives but if the written evaluation does not satisfy the needs of the customers and present the information in a useful manner the program will suffer greatly. It is not necessarily easy to find qualified evaluators, especially in a new technology program. It was necessary for us to have three teams of evaluators in order to satisfy the various requirements that existed for evaluation. Recommendation **-** Plan evaluation and begin early in the life of the program. Insure evaluators are qualified and that all those agree upon evaluation objectives with a valid requirement for the report.

CONCLUSION

Managing a large program is an important responsibility and a great personal challenge. Teamwork, planning, attention to detail and an understanding of your environment are keys to success. The lessons learned on the STOW program will hopefully assess things in making goals. We wish you luck.