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Applications of Gaming Techniques to Coastal Zone Problems

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APPLICATIONS OF GAMING TECHNIQUES TO COASTAL ZONE PROBLEMS

BY

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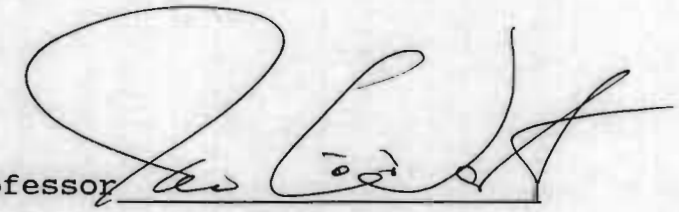
Major Professor 

APPLICATIONS OF GAMING TECHNIQUES

TO COASTAL ZONE PROBLEMS

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ABSTRACT

The boundary between sea and land is an area which presents enormous management challenges. It is an area of fragile ecology, dense and growing population, multiple competing demands for resource use, a multitude of regulatory agencies, and far from complete scientific understanding. Given these difficulties, planning for coastal zone management frequently suffers from incomplete data, lack of consensus among users, and lack of support from government authorities.

This paper proposes gaming as a tool for assisting in the information gathering, education, consensus building, and communications elements of planning. This is achieved by developing a planning game which is designed to consider coastal zone management issues arising from climate change. The game is designed specifically to be used for educational purposes from the perspective of state planners, but could be modified for educational or analytical play at the local, regional, or national level.

I. INTRODUCTION

The challenges and problems of Coastal Area Management are abundant. The coastal area is one characterized by high population density, multiple and conflicting use demands, fragile ecology, overlapping management responsibilities, and lack of adequate scientific and demographic research data. Added to these inherent difficulties, coastal area managers are frequently hampered by poor financial and political support from all levels of government. Yet their task is crucially important: providing for optimum use of precious coastal resources in a manner which prevents abuse, provides equitably for all users, and preserves the area for the enjoyment and use of our posterity. There is seldom a consensus as to how to do these things.

Gaming[1], a technique which involves a form of role playing to address planning problems, has proven useful in dealing with similar problems in many disciplines, including diplomatic, business, public administration, and military. The POLEX series at MIT during the 1960s involving thirty to forty government officials, scholars, and other experts[2], and the current SIMULEX series for students at the Fletcher School of Law and Diplomacy are examples of diplomatic games. Business games have been heavily used for instruction as indicated by the use of gaming in

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[1]GAME: Any type of model or simulation, not involving actual components of the system it seeks to emulate, in which the flow of events is affected by and, in turn, affects decisions made during the course of those events by "players" representing one or both opposing sides. Fundamentally, gaming is a process of human interaction, and is best used to investigate processes, not to calculate outcomes.

[2]Bloomfield, Lincoln P. "Reflections on Gaming," Orbis: A Journal of World Affairs. Vol 27, No 4, (Winter 1984): 785.

45% of U.S. business schools, primarily for Master's Degree and undergraduate students, in 1971[3]. The Financial Allocation and Marketing Executive Game (FAME) was an early business game developed for IBM[4]. An interesting variant of the business game is the Booz, Allen and Hamilton drug production simulation used to assist counterdrug operation planning. Public administration games include the Community Land Use Game (CLUG) developed at the Cornell, and METRO used at the University of Michigan[5]. Another interesting public administration game, designed for entertainment but placing players in the position of making zoning and budget decisions, is the "SIM CITY" game marketed by Nintendo corporation. Many military games are played by a multitude of organizations. Perhaps the largest and best known is the annual GLOBAL wargame played is the Naval War College in Newport. This game involves over 1000 participants from many military organizations and civilian agencies, including the Federal Emergency Management Agency (FEMA), Department of Transportation (DOT), and Department of State (DOS). In addition, all the military war colleges conduct games for their own students and organizations from their service, the Joint Chiefs of Staff maintain a gaming organization, and unified commanders have gaming facilities at their headquarters. The Naval War College hosts over 40 games each year for a variety of

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[3]Ibid., 219.

[4]Shubik, Martin. The Uses and Methods of Gaming. 1975. Elsevier. New York. p. 142.

[5]Shubik, Martin. Games for Society, Business, and War, 1975. Elsevier. New York. p. 303.

players including students, government laboratories, bi-lateral games with foreign navies, and numerous Washington commands. Gaming has thus proven itself a useful method for achieving organizational goals for a remarkable array of users.

Shubik identifies the uses of gaming as teaching, training, operations, research, therapy, and entertainment, and enumerates those disciplines which frequently use games. These include management science, operations research, education, political science, sociology, and economics[6]. Thus, gaming has potential to aid in addressing the coastal area management predicament from several perspectives. Properly applied gaming can help a manager to comprehend issues, educate and inform, establish or improve communications between various interest groups, and indicate helpful approaches to problem solving.

As an example of how gaming can be applied to coastal area management, this paper will develop a planning game to consider the impact of global climate change on the Rhode Island coastal zone. This application was chosen as one which is particularly intractable for the coastal area manager, but amenable to gaming. This approach is not intended to solve specific problems, but to illuminate the issue, stimulate creative thought, educate participants and observers, and establish communication structures which will be needed for real world planning.

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[6]Ibid., p. 3.

II. GAMING PRIMER

BACKGROUND "Gaming" is a technique for stimulating human decision making and interaction which has been applied to a wide variety of planning situations. Gaming entails the use of a scenario, role play, simulation[7], or model to provide a background in which players will act[8]. The "art" of gaming traces its roots back 5000 years to the Chinese military strategist Sun Tzu who used special game boards and colored stones to develop military strategy[9]. Gaming gained popularity for military planning in the 19th century with the German "kriegspiel", an application of simulation to military planning. This early game was used to explore tactical options on the battlefields of Europe, constructing detailed replicas of the terrain and using model armies for maneuver. Since then, gaming has developed a variety of forms and uses. These include national strategic decision making, diplomatic situation planning, business planning, emergency planning, and a variety of educational games.

As noted above, Shubik has identified a number of purposes for gaming, including teaching, operations, and training. Among specific applications from within each purpose, those of benefit to Coastal Area Management are: as a motivational aid to learning, reinforcement for other methods of training, a device for teaching facts, a

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[7]SIMULATION: A simulation involves the representation of a system or an organism that purports to have a relevant behavioral similarity to the original system. The simulation is usually simpler than the system being simulated and is more amenable to analysis and manipulation.

[8]Shubik, The Uses and Methods of Gaming. p. 6.

[9]Siddons, Philip Kemble, "The Rand Strategy Assessment System: A New Perspective on Decision Support Systems," unpublished Master's thesis, September 1988, Naval Postgraduate School, Monterey, California. p. 3.

device for studying dynamic cases, a device for teaching interpersonal relations, a means of exploration and generation of hypotheses, extra-organizational communications, exploration and testing, planning, group opinion formation, brainstorming, advocacy, and teaching bureaucratic organizational behavior.[10] A well designed and appropriately used game will contain many of these elements. Gaming has been successfully used for these purposes by businesses and universities as well as by the government. At least two large scale games designed for educational use at college, graduate school and the adult educational levels have been designed to consider different aspects of the city land use and urban development. These games illustrate problems of urban development and promote understanding of the interlinkages between the many parties and institutions which play important roles in urban areas[11].

GAME TYPES Games may be classified by a number of criteria. A summary of game classifications is listed in Table 1. These various classifications may be mixed

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[10] Shubik, The Uses and Methods of GAMING. p. 28.

[11]Shubik, Games for Society, Business and War. p. 303.

in any way. That is, a game may be educational, single sided[12], manual[13], with flexible rules and closed[14] information flow.

Table I: Game Categories

Sides	Format	Rules	Purpose	Information
Single	Computer	Rigid	Teaching/ Training	Open
Two	Manual	Flexible	Analytical	Closed
Multiple	Seminar (Freeform)	Mixed	Operations	
			Experimental	

Consideration of gaming frequently conjures up visions of complex board games with incomprehensible rules, strict procedures, dice, and tables, or else massive computer facilities with consoles manned by specialists providing detailed information churned out using complex models and detailed calculations. In these games, the player is almost isolated by the gaming system from fellow players or

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[12]SINGLE SIDED: Games in which players are opposed by "control" rather than by another team. Generally the opposition forces are manipulated to induce players to achieve game objectives rather than enhance their own position.

[13]MANUAL GAME: That type of system game in which force composition and positions are plotted manually on charts or other representations, and interactions and outcomes are assessed using some form of off-line modeling. Most board games are manual games.

[14]CLOSED: A closed game limits the information available to players. Players are isolated from one another and only allowed to communicate by a method that replicates the real world.

opponents. While computer games[15] or rigid form manual games are perhaps the most familiar forms of gaming, free form[16] manual games, sometimes referred to as seminar games, are better suited to deal with issues which require synthesis of ideas, organizations and personalities.

Rigid games have limited utility for the complex planning scenario required for coastal area management. Freeform, or seminar format games, however, have proven extremely useful in addressing complex issues which are not readily modeled. As noted by Brewer, a fundamental purpose of free form gaming is to encourage creative, innovative thinking about problems that defy treatment with more conventional analytic approaches and methods[17]. Free form games may be used for exploring any problem areas in which there is a confrontation or conflict among actors, confrontations in which there is some existing knowledge of the nature and methods of the actors, and confrontations in which the competitive interactions can occur simultaneously in several venues.[18] As opposed to the rigid rules and highly

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[15]COMPUTER GAME: That type of game in which some or all elements of play including geographical and financial, and move results are simulated by micro-computer or mainframe computer models. Computer games may have some or all data displayed for players, or may simply provide assessment or other data to support game play.

[16]FREE-FORM GAME: A scenario-based game in which opposing teams of participants are confronted with a generally realistic situation or problem and work out responses both to the situation and to moves made by their opponents. A Free-Form game is a type of seminar game.

[17]Brewer, Garry D. "Child of Neglect: Crisis Gaming for Politics and War." Orbis: a Journal of World Affairs. Vol. 27 No. 4 Winter 1984. pp. 803-812.

[18] Jones, William M. On Free-Form Gaming. August 1985. Rand Report N-2322-RC. The Rand Corporation. Santa Monica, Ca. p. 2.

structured approach used in early games, modern free form games are characterized by open discussion periods, group planning, dynamic interactions, and great flexibility. This permits application of the gaming process to almost any situation where people must interact with one another in planning or decision making situations. Interactions of people with nature, or existing economic or social situations, may also be gamed. The proposed game is a multiple sided, closed, educational seminar game with flexible rules.

GAME CAPABILITIES AND LIMITATIONS Before applying gaming to the coastal zone, or any other situation, it is important to consider what gaming can and can't do. Improperly applied, gaming can be disappointing at best, and dangerous at worst. An adage says "Games don't prove anything". What properly designed games can do is: stimulate players to think problems through; produce personal interactions which create information flow and synergistic development of ideas; raise issues and questions which must be examined at greater length; suggest possible courses of action; suggest shortfalls of information which must be addressed by further research; open lines of communication between individuals or agencies which will be of value during normal work; and increase understanding among participants from different organizations or backgrounds. Gaming has been accurately described as a communication form.[19] Indeed, the ability of a game to create interest and stir the imagination make it peerless as a stimulating means of communicating.

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[19]Duke, Richard D. 1974. GAMING: THE FUTURE'S LANGUAGE. Sage Publications. New York. p. 75.

As can be readily imagined, games may well raise more questions than they answer. This, however, is part of the product and benefit. The participants are stimulated to question, think, and communicate. The danger of gaming lies in its ability to build consensus, create an illusion of reality, and convince participants of the validity of results. Game products and outcomes are not rigorous in the scientific sense. Most games are superficial in their level of detail and analysis. The data upon which decisions and plans are made tend to be limited. The time devoted to planning is very short. Properly designed games are fast paced, leaving the players frustrated at not being able to examine all facts or explore all options. The pace is forced because gaming intentionally uses a different dynamic than staff planning, relying on intuitive approaches and the stimulus of urgent deadlines to force communication and rapid reaction. Game products are generally quite different than products of detailed planning efforts based on ample data with extended time for reflection. The game and its products can't replace scientific studies, modeling, and detailed planning.

Another weakness emerges when the game format involves adjudication of outcomes. This assessment[20] process is also frequently based on intuition, unvalidated, or simplistic models rather than detailed analysis. Even the most detailed assessments and models often fail to accurately replicate reality. Rather, the results are representative of outcomes which could reasonably be expected based on player plans, and are presented to stimulate further thought and planning rather than to give the

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[20]ASSESSMENT: Evaluation of player moves by the control team for the purpose of facilitating game play, providing players with feedback, and meeting game objectives.

"true answer". Players must be warned to recognize that the value of their product lies not in the findings or plans themselves, but in the process used to determine the plans, including identifying sources and types of information needed, people or organizations contacted, questions raised, decision making dynamic, and the thought processes used.

As noted by Jones, "The free-form game is not a device for the confident prediction (sic) of the outcomes of possible future events"[21]. Weiner states that games cannot substitute for research or experiments, and cannot forecast the future[22]. Within these constraints, however, games can be an extremely helpful organizing and educational vehicle.

The most valuable product of a free form game is not the outcome. Solutions posed by the players have not been developed or tested rigorously, and thus have little value on their own without significantly more research. Rather, the processes of defining issues, postulating solutions and alternatives, gathering information, and negotiating with players who have differing agendas are the primary benefits of gaming.

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[21]Jones, p. 9.

[22]Weiner, M.G. "Gaming". In Systems Analysis and Policy Planning. E.S. Quade and W.I. Boucher ed. pp. 265-278. 1968. The RAND Corporation.

GAME MECHANICS[23] A game is made up of many elements which together comprise the game mechanics, or structure, content, and rules by which the game is played. The foundational elements are the sponsor and the game objectives. These determine the other elements listed in Table 2. Each of these elements will be briefly discussed in turn.

Table II Game Elements

Sponsor
Objectives
Purpose
Organization
Support requirements
Schedule
Scenario
Participants
Tasks
Rules
Data Collection
Analysis

The *sponsor* is the organization or group of organizations for whom the game is designed and played. The sponsor's representative is the key individual who must make final decisions regarding all elements of game design. Although the game may be designed and played by individuals from other organizations, the sponsor, through his representative is the "customer" who must be satisfied by and approve all central elements of game design. The sponsor's representative generally participates in the game as a member of the

[23]GAME MECHANICS: Procedures which implement player decisions and inform players of their effects. The procedures define what players can and cannot do, sequence game events to allow for accurate re-creation of cause and effect, and manage the flow of information to and from players and control.

control team, representing higher levels of authority and monitoring game play to ensure objectives are being met.

Game *purpose and objectives* are the most important elements of game design, and must be thoughtfully developed early in the game design process. They suggest the most appropriate format and all other elements of game mechanics, who the participants should be and how the game is to be recorded and analyzed. Properly conceived objectives will be clearly stated, limited, measurable, and achievable. While long running game series may have standing objectives, each time the game is played the sponsor should reconsider the specific objectives and modify the game as appropriate. Each step of game design and play should be considered specifically in light of the objectives. In the post-game review, success of the game in accomplishing objectives should be evaluated.

Game *format* must be chosen to support the objectives. For example, a game proposed to analyze oil spill response plans for an agency tasked with oil spill containment might be very different than a game designed to educate students about oil spill response. The first game would require rigid rules and a detailed assessment process, with a significant effort devoted to data collection and analysis. The latter would benefit from flexible rules, a greater access to information, and a more intuitive assessment process. Within each category of game listed in Table One, there is considerable diversity of design. Again, game objectives will dictate how to tailor each format.

Table III Player Cell Organization

Position	Responsibility
Chairman	Guide discussion. Keep schedule. Keep control informed.
Facilitator	Provide infrastructure support.
Players	Role play. Perform tasks assigned.
Analysts	Keep game record.

Organization refers to the way players and other participants are grouped into planning teams or syndicates, the way those teams are organized internally, and the way in which they interact. The organization and rules dictate how the game actually functions. Players may be organized to oppose each other, that is plan how to work against one another, in two sided games, but more typically are arranged into task oriented teams presented with planning different aspects of the same issue, or approaching the problem from different perspectives. Each team should contain a minimum of four, but ideally no more than 12 players to encourage group action while involving all.[24] Organization also includes the "control team"[25], which is responsible for the smooth functioning of the game and playing those roles not

[24] Heidt, John. 1992. Former Director, Wargaming Department, U.S. Naval War College. Interview with author dated 24 Nov 92.

[25]CONTROL TEAM: Group of individuals responsible for managing the game, controlling information flow, injecting stimuli, adjudicating interactions, providing administrative support, and all other elements which go into making a game run. The control team includes the sponsor's representative, game director, umpires, support personnel, and expert witnesses such as intelligence or meteorological specialists.

accounted for elsewhere. Typically the sponsor's representative is a member of the control team. Syndicates of participants other than players may also be part of the organization. For example, the game organization may include panels of experts who are invited to provide a resource for player planning, or some organizations may send individuals to represent their real world interests on supporting panels. These participants are not "players" in the sense of role playing and tasking. They will represent their own specialized fields of expertise to give the game substance. Internal cell organization includes specific roles players are assigned, control team representation, support personnel, and chairmanship. The chairman may be a player or a member of the control team assigned to facilitate discussion and meet game assignments. If a control team member, the chairman must be careful to draw out players into their roles and allow them to determine the course of their own planning and make their own decisions rather than imposing his own judgment on them. Typical internal cell organization for a freeform game is contained in Table Three.

Support requirements include those mundane items needed for players to execute assigned tasks. They include adequate space for the number of player teams, appropriate materials for group planning such as conference tables, charts and reference material, butcher block paper, scratch paper, pens, pencils, charts, background information, computers, message forms, etc. All required material must be provided in adequate quantities, and means provided to respond to requests for additional support material as players determine additional needs. While mundane, support requirements must be carefully considered to minimize player frustration and

encourage the proper type of response to assigned tasks. For example, if briefings are to be prepared, viewgraph transparencies and computers with graphics software are helpful. If "conferences" are to be planned between player teams, appropriate conference facilities must be provided. Meeting some of these requirements may require long lead time, so planning must be done well in advance. Even for simple games, room layout should be carefully considered, because it has a subtle but significant impact on how players organize themselves and approach their tasks. Player reorganization of the physical layout should be invited, however, as this encourages creativity and an aura of game ownership. Often players will have insights into unanticipated resources which are important to successful game play, and every effort should be made to provide them if possible.

The game *schedule* is another key element of design. It is really the blueprint for game play, and is a vital piece of information players invariably study carefully. The schedule must allow sufficient time to orient players by means of background briefings regarding the game situation, their tasks, scenario[26], and applicable real world information. The schedule for actual game play must be carefully crafted to focus on the most important issues and push players at the proper pace. Too slow a schedule permits players to lose interest, become bored, or seek to plan too much

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[26]SCENARIO: The setting in which game takes place. The scenario provides background information establishing the global political situation, forces, and events leading up to game start which are causing tension or creating a problem. A scenario should include all essential, but no superfluous, information about the game's setting. Components of a scenario include background information, objectives, resources, and planned modifications.

detail. Too fast a pace leaves players frustrated and unsatisfied with their efforts. Players should feel considerable pressure and be forced to do more than they feel they can comfortably achieve. In addition to carefully formulating the schedule in light of game objectives and assigned player tasks, the control team must observe how play actually transpires and be prepared to inject additional tasks, provide additional information, or add additional schedule items to speed up game play.

A *scenario* is needed to provide the starting point for a game. It establishes the "playing field" on which planning is accomplished, providing players with sufficient background to understand their tasks. The scenario should also stimulate interest by linking the game situation to the present real world situation. A scenario must not provide so much detail that obvious solutions are suggested, nor should it answer all questions. Uncertainty is a key element which effects decision making, and planners must invariably face the task of planning with information scarcity. A scenario, to be useful, must be plausible, but may be entirely fictitious. That is, it should describe a situation which conceivably could occur, but may be one which does not now exist, and may not be predicted. Players must be properly introduced the scenario, not just so they can understand what it contains, but so they can also appreciate the role it plays. Even a well constructed scenario may have shortcomings which encourage players to "fight the scenario", arguing against its plausibility or credibility rather than accepting it as a given starting point for the game. The scenario is closely linked to sponsor objectives because is sets the stage for player decision making, forcing them to consider issues most important to the sponsor. All

elements of game organization must be considered in the scenario so players and control team members can understand their roles. No scenario can be all encompassing. Some creativity will be required of all game participants to place themselves productively in the game world created by the scenario. The scenario may be divided into sections with different players receiving different information depending on their role. Thus players are forced to search for additional details from other participants. This lack of information, while frustrating to players, often reflects reality, and also provides the control group with latitude to alter the situation if needed as the game progresses.

As introduced in the discussion of cell organization, *participants* fall into the categories of control team, players, experts[27], analysts, and observers. The control team is responsible for game planning, organization, and functioning. The key control team members are the game director[28] and the sponsor's representative. The game director is accountable to the sponsor for all aspects of game organization. The director must ensure all pregame requirements are met. During the game, the director, working with the control team, ensures play is progressing satisfactorily

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[27]EXPERT WITNESSES: Specialists tasked with providing information and expertise not resident in player cells. Expert witnesses will be available to all players, not just one team, and do not participate as players, but provide "expert testimony" to players in specific topics of interest. Expert witnesses may be tasked with producing reports or analysis related to the game.

[28]DIRECTOR: Individual tasked by the gaming agency with overseeing development and execution of the game. He has broad responsibility for all administrative details as well as ensuring game mechanics are functioning appropriately. He acts as liaison officer between the gaming center and sponsor. With the sponsor's representative, he reviews, modifies if necessary, and approves all assessments and briefs.

toward meeting objectives, and appropriate actions are taken to stimulate players as necessary. Other control team members report game progress and problem areas to him. Choice of players depends on the sponsor's purposes for the game. They may be members of the sponsor's organization, be chosen to bring particular expertise to the game, or be chosen from any group of people the sponsor wishes to educate or involve. Various experts may be employed for benefit of players or the control team. Expert witnesses are invited to represent their own specialized fields. They may be technical authorities brought in to provide scientific or engineering type data, or specialists in any other discipline which can impact the subject being explored in the game. Analysts assist the sponsor and control team by providing a running record and critique of game play. Observers may be invited to provide an "outside view" of the game for the sponsor or to expand the educational reach of the game.

Tasks are assigned to the player cells as catalysts for player interaction. Tasks may be self evident and need not be specified, but in free-form games they perform the function of providing focus for the group's efforts. The tasks may involve producing written or verbal plans of various sorts, "move sheets"[29] containing intentions, messages, or preparing briefings and background papers. The tasks themselves are more important as means for forcing player creativity and interaction

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[29]MOVE SHEET: Formatted form prepared by players to provide the control team with specific plans and intentions for the next move. Move sheets supplement player briefings with greater detail, prerequisites for planned operations, optional moves to deal with contingencies, etc. Level of detail is dependent on the level of the game, but move sheets will often be the only document available to control to determine proper execution of player plans.

than as finished products with their own value. As players are required to respond to tasks, they must seek information and support from sources outside their own cell. If properly designed, the tasks will force replication of real world processes which will illuminate real world issues, and encourage establishment of valuable communication links.

Rules establish the procedures which govern player interactions and by which player actions are evaluated. Rules regarding communication are particularly important. For example, communication from one player cell to another must be regulated to enable recording of important discussions and force replication of real life linkages. Thus, players may be required to send all communications by means of written messages which are reviewed and transmitted by the control team, and meetings must be scheduled through the control team rather than directly from player to player. This prevents the game from collapsing in confusion, enables sponsors to record play progress for future analysis, and replicates the real world where communications are difficult and must often be by means of memos or must be scheduled days or weeks in advance. A second area of rules concerns how the control team evaluates, or assesses, player actions. This is a complex field which is beyond the scope of this paper. Assessment techniques may be classified as "Top Down"[30] or "Bottom Up"[31]. In general, assessments must be plausible and oriented

[30]TOP DOWN: A method for assessing aggregate move results by adjudicating outcomes to promote sponsor's game objectives. End results are based on control team and sponsor judgment of outcome reasonability, plausibility, and utility. In general, models are not used. Results are briefed at a moderate level of detail. The goal is to provide a plausible outcome most suitable for game purposes, with a summary of

toward achieving game objectives. Unless extremely rigorous analysis supported by well validated models is possible, assessment results must be considered illustrative or educational, rather than "proof" that a particular course of action would have a specific outcome. For the coastal zone planning application, it is unlikely that such models are available, so assessments must be based on evaluator judgment with appropriate caveats to participants.

Data collection and analysis are elements of gaming which can yield significant benefits for sponsors, but may not be necessary at all to achieve game objectives. For educational games, the primary benefits are derived by the participants' direct actions and observations during the game, and detailed game records may be superfluous. Even so, requiring players to keep records and produce documents helps enhance the game atmosphere and focus their activities. These records may be valuable to sponsors who are interested in analyzing the players' responses and background knowledge, and to the gaming agency which can use them as feedback for game improvements. Analytical games may require a detailed analysis plan which records all details concerning player decisions, procedures, and

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movements and events created to enhance credibility of the assessment result. This method is most commonly used during seminar games, but may be used in system games. The primary advantages of this method include quicker turn around of information to the players and more flexibility in crafting outcomes to support the sponsor's game objectives.

[31]BOTTOM UP: Method for assessing move results based on detailed analysis of all factors and forces involved. Computer models are normally used to assist in determining outcomes. This method has the greatest "fidelity", but is time consuming and frequently provides results which are contrary to game objectives and must later be modified to enhance game play. This method is used in seminar and system games.

actions, their outcomes, and responses by other teams. Such analysis can yield valuable insights into issues generated and approaches to resolving those issues. Frequently, shortfalls in real world data or planning are highlighted, suggesting follow up actions for the sponsor. The processes used by players to address game problems may suggest approaches which would be appropriate for the real world. The analysis plan should be developed in coordination with the sponsor and game objectives. The plan should specify the type of data to be collected, procedures and means for collecting the data, plans for post game data reduction, and facilitate the organization of the final reports.

III APPLICATION TO COASTAL ZONE PLANNING

Effective strategic planning in the coastal zone is crucial for at least three fundamental reasons. First, the coastal zone is home to an enormous and growing population. Worldwide, sixty-five percent of cities with populations above 2.5 million inhabitants are located along coasts, some at or below present sea level[32]. Seventy percent of the world's population will live within 60 kilometers of the coast by the year 2000 according to some estimates[33]. Second, the coastal zone is intimately linked with ocean productivity. As much as 85-90% of the total world

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[32]Pernetta, John C. and Elder, Danny L. "Climate, Sea Level Rise and the Coastal Zone: Management and Planning for Global Changes." Ocean and Coastal Management. No. 18. (1992). p. 114.

[33]Ibid. p. 114.

finfish catch comes from within the EEZs, most within 9 kilometers of the shore[34]. Third, the coastal zone is host to many thriving industries which are dependent for their existence on the ocean. These include recreation and tourism, energy, transportation, waste disposal and dumping, and residential development. Frequently, these activities compete for limited space and resources. All these are applicable, in greater or lesser degree, to Rhode Island.

Pernetta and Elder have identified the following physical problems which impact the coastal zone: Spatial limitations which result in user conflict; coastal erosion, exacerbated by coastal construction; coastal pollution; increasing frequency of eutrophication, anoxic conditions, fish kills, and harmful algal blooms; coastal ecosystem loss and degradation; fisheries resource depletion and loss; inundation and flooding. They add the following management problems: adequate coastal zone databases and information systems; data management capability; management infrastructures for integrated coastal zone planning and management[35]. These physical and management problems are additive. In addition, the root causes of the physical problems do not necessarily originate from within the coastal zone itself, so regulatory schemes which have no authority beyond the coastal zone lack necessary power, resources, and organizational linkages to adequately address them. These physical and management problems and the conflicts they cause correspond strikingly to the phenomena which may be addressed by gaming. The capability of free form

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[34]Ibid. p. 115.

[35]Ibid. p. 117.

games to deal with complex situations of conflict and confrontation as noted above, in addition to the general gaming benefits of communication, education, and interaction, suggest them as ideal management tools.

A further potential application of gaming to Coastal Area Management is in building public support. There is a lack of general public awareness about coastal related problems in contrast to other environmental concerns.[36] This lack of public support limits the ability of Congress to fund Coastal Zone initiatives and enact supporting legislation. Use of games to educate and assist planning is another means of involving concerned constituencies. For example, in the game proposed in this paper, there is a cell representing environmental groups. By recruiting appropriate participants, these groups can be exposed to specific coastal area concerns from a Coastal Area Management perspective. Playing Coastal Area Management games also offers opportunities to publicize the issues of concern in advance and the results afterwards. Post game publications could include scholarly analysis of the game results or more public affairs oriented press releases.

While gaming is applicable to many aspects of coastal area management, this paper develops a game in which players are required to plan responses to the potential problems caused by global climate change from the perspective of Rhode Island coastal area planners. This scenario was chosen because it highlights the difficulties of coastal area planners and the robust potential of gaming as a planning and

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[36]Kitsos, Thomas R. 1985. Coastal Management Politics. Journal of the American Planning Association. 51,3: 275-287. p. 285.

educational tool. There is not yet a scientific consensus regarding causes and extent of climate change and adequate scientific data, and models to make such judgments are woefully lacking.[37] As applied to the coastal area, the difficulty gets worse. First, coastal areas, even without the additional threat of climate change, are already stressed by development and increasing population. Second, existing studies reveal the diversity of impacts likely to occur in different coastal locations is so great as to make the case study approach appear futile.[38] Further, while most research and debate has concentrated on direct effects of sea level rise, other components of global change may be as important as sea-level rise.[39]

Precisely because gaming is not scientifically rigorous, the game scenario may postulate several of these components, and encourage players to examine others, not on the basis that they have been proven to be imminent, but because they are potentially threatening and pose interesting issues for investigation. Climate changes are felt over a long time scale, and planning also must look well into the future. Again, gaming may assist this planning process by placing players in the future and having them face the full range of climate change potentialities. The process of projecting themselves into the future causes players to examine current realities and plans in a new light.

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[37]Landsberg, Helmut E. 1989. "Where Do We Stand with the CO_2 Greenhouse Effect Problem?" In Global Climate Change. S. Fred Singer ed. Paragon House. New York. p. 87

[38] Pernetta and Elder. p. 124.

[39] Ibid. p. 123.

The potential issues of climate change are intractable for many of the same reasons that Coastal Area Management is intractable. These very difficulties are those which free form gaming addresses. The many conflicting organizations and constituencies can be represented in game play, encouraging players to recognize who these groups are, what their role is, and to gain an appreciation for their perspective. The very process of game play then helps to inform and build consensus among those who will be forming the concerned public in the future. Lack of scientific data can be overcome by hypothesizing future conditions, but also can be highlighted to suggest priorities and stimulate support for research.

Thus, a properly conceived and designed game may contribute significantly to the Coastal Area Management process. While no game can substitute for orderly staff planning, research, or the normal means of communicating and consensus building, judicious gaming applications may enhance these other processes.

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IV. GAME DESIGN

GENERAL: Following is the design for a Coastal Area Management planning game. The design is for a two day free form game with four player cells, an expert witness cell, and a control group. Total number of participants may range from 30 to 50. The scenario is set in the year 2000, and players are tasked with planning responses to a situation of severe climate change from the perspective of various Rhode Island constituencies. This game is intended to conceptually demonstrate how gaming may be applied to Coastal Area Management issues.

PURPOSE: Educational game for students and faculty of the University of Rhode Island Marine Affairs curriculum to enhance understanding of Rhode Island Coastal Area Management planning procedures and issues.

OBJECTIVES:

1. Introduce students to Coastal Area Management planning processes and problems.
2. Provide students with insights into competing Coastal Area Management goals and participants.
3. Stimulate consideration of the potential problems and solutions for the Rhode Island Coastal Zone caused by global climate change.
4. Explore existing and potential organizational linkages which are important for Coastal Area Management.

SCENARIO

CAVEAT: **It must be emphasized that this scenario is entirely fictitious. It is not predictive, nor is it based on any scientific analysis. Rather, it is a hypothetical but plausible "worst case" construct posed to stimulate player thought and interaction.**

Timeframe: December 2000

U.S. National Political Situation

Although environmental groups had hoped for better, the federal government has been preoccupied with the budget deficit since the overwhelming Clinton victory in 1992. Facing continuing long term economic stagnation, high unemployment, an increasing debt burden, increased health care costs, and the demands of a turbulent world, the federal government was forced to adopt strict austerity measures. Although considerable rhetoric was devoted to environmental concerns, little funding was made available for increased planning or enforcement at the federal level, and many state governments became increasingly hostile to environmental efforts in an effort to improve their appeal to business and manufacturing interests. Coastal zone planners,

although given moral support from the White House and Vice President's office, were not given the fiscal or staff help needed to do anything more than hold their own. Similarly, ambitious plans to increase automobile fuel efficiency, reduce chlorofluorocarbons, eliminate acid rain sources, find alternative energy sources, and preserve forests and wetlands went unfunded in the face of the all consuming deficit and swelling health care costs. While the annual deficit was somewhat reduced, reductions in services, disappointment by many interest groups, and continued economic malaise led angry voters to replace the Clinton-Gore Presidency with the ultra-conservative, pro-development Helms-Limbaugh ticket in 1996. The Congress, however, continued to be dominated by an increasingly populist centered democratic party majority.

Immediately, renewed conflict with Congress resumed, reminiscent of the later Reagan years. While coastal zone programs were protected by Congress, approved funding was only reluctantly spent by the administration, staff positions went unfilled, and morale plummeted. Although the Helms administration staunchly opposed increased government spending for social programs of any sort, the Clinton legacy included increased entitlement programs and a national health insurance program which was consuming a large and increasing share of the shrinking budget. Adding to the budget squeeze at the state level was a new series of state ballot initiatives prohibiting new taxes passed in many states during the Republican landslide of 1996. Thus encouraged, the administration openly favored development interests at the expense of environmental programs, research and enforcement funds were cut, and

the U.S. lost its position as the world environmental protection leader. Most of the federal and state bureaucracies had developed a fairly well established environmental sensitivity during the Clinton years, but due to staffing and funding shortfalls were unable to keep up with the turbulent pace of change. As a result, when climate change suddenly went from academic theory to global reality, the administration was not prepared ideologically, organizationally, or fiscally to respond. Ironically, the economy did finally rebound, but economists and a growing coalition of business and conservation groups joined to warn that the boom was based on unsustainable practices which would ultimately cause disaster.

By 2000, the nation realized it had made a mistake in electing a doctrinaire pro development administration, and a new tide of politicians was swept into office. These included "Teddy Roosevelt" conservationist Republicans, environmentally minded Democrats, and, for the first time in U.S. politics, radical "Greens" from California and Rhode Island. The White House was returned to the Democrats for the third party change in three elections. Although the leadership flip-flops were causing organizational chaos in staffing the bureaucracies, the Bradley administration took office with clear goals and a strong consensus supporting firm action to deal with the environmental crisis. The stage was finally set for an integrated program to take the steps necessary to implement long term environmentally responsible programs, but in the context of a looming crisis.

WORLD POLITICAL SITUATION

Overview: Although the Clinton-Gore administration attempted to make environmental protection the centerpiece of their foreign policy, the "New World Order" increasingly was characterized by chaos, conflict, and catastrophe. This approach, similar to the Carter human rights based policies of the 70s, only served to alienate many friendly nations while apparently unleashing unrestrained savagery. The decade of the 90s saw escalating ethnic violence in the former Soviet Republics featuring atrocities of a scale unprecedented in the post World War II era. Included were scorched earth campaigns and large scale use of chemical and biological weapons causing localized environmental catastrophes and measurable global impact. The deep recession of the 90s affected even the robust economies of Japan and Germany, so funds for aid to developing nations became severely limited. The global economic malaise also contributed to decreasing funding worldwide for environmental concerns. Research projects were halted or underfunded, and ambitious projects begun in the wake of Brazil 92 languished.

Russia, itself, stabilized somewhat after the overthrow of the Yeltsin regime in 1995. The new conservative regime retained the free market reforms, but pursued a policy of ruthlessly exploiting Russia's natural resources, inviting foreign companies to assist in development of oil fields in Arctic waters and remote regions of Siberia. Unencumbered by environmental protection laws, and accelerated by foreign capital and technical help, Russian resources contributed to a rapid increase in energy

consumption by the "Asian Tigers" and several Latin American countries. In addition, Russia became home to many "dirty" industries being moved from Japan, Taiwan, and even Germany. The increased foreign currency earnings helped Russia to move into the world economy, but the price in environmental damage was beyond calculation. While pursuing nationalistic economic and oppressive racial policies, Russia has not yet begun to rearm on a massive scale, and is abiding by nuclear disarmament agreements.

Added to the man made disasters were a continuing series of famines and other natural disasters in Africa, Bangladesh, and the oil poor Arab nations. With the wealthy democracies absorbed by their own economic problems, ethnic conflict flourished throughout these regions. Although Saddam Hussein's overthrow in 1994 reduced the threat to the Gulf states, the weakened Iraqi state was unable to counter Kurdish separatists or the spread of Iranian inspired Shiite Moslem incursions in the coastal regions. The situation in Iraq appeared similar to that in 1992 Yugoslavia, with the exception that the violence frequently resulted in burning oil wells instead of burning villages.

Similar conflicts erupted in South Africa and elsewhere. Resulting famine and migration absorbed much of the attention and financial resources of the developed world. No longer did foreign aid go to prop up friendly regimes or aid responsible economic development. Now it could not keep up with the press of immediate concerns. The much smaller and underfunded military forces of the U.S. and other western powers could not provide peace keeping or disaster relief forces in the

numbers needed to maintain stability. Voluntary contributions to disaster relief efforts fell dramatically as people became inured to reports of mass starvation. Trapped by their own budgetary woes, developed nations were unable to allocate funds to alleviate suffering. New waves of migration began sweeping much of the world by the mid 90s. Many European nations implemented draconian measures to restrict immigration, but desperate refugees found ways to circumvent normal regulations. Several nations began arming their borders in an attempt to prevent illegal immigration. Germany's immigration laws, amended to exclude virtually any new arrivals, provided a model for both European and South American nations. In short, the bright hopes of the early 90s were as yet unfulfilled.

RHODE ISLAND STATE POLITICAL SITUATION

After three terms of Democratic government, Governor Cianci was elected in the Helms-Limbaugh landslide of 1996. Vowing to "put Rhode Island on the map again", Governor Cianci gutted DEM and CRMC, putting political cronies in some positions, and leaving others unfilled. Projects long deferred as being environmentally damaging were pushed forward, and an increasing number of violations of existing regulations were reported in the press, but seldom acted upon. Proving that corruption is an equal opportunity phenomenon, the reform minded new legislators elected in 1992 were increasingly targeted in federal corruption probes and investigative press exposes. In short, it was business as usual in Rhode Island. The

"Newportization" of the state's coastal zone increased. Condominiums, exclusive residential developments, and hotels threatened coastal wetlands and beaches. Local zoning boards were under intense pressure to grant exceptions, and public rights and access were constantly threatened.

The 2000 gubernatorial campaign was a bitterly fought three way race. The Democratic party, fractured between a reform minded group and traditional powers, was unable to unite behind their candidate. On the Republican side was the powerful Cianci machine, still a formidable vote getter despite allegations of bribery and corruption. Pollsters gave Claudine Schneider, running on the Green ticket, little chance of election. However, reflecting the rapidly changing mood of the country, she was swept into office with a clear majority, and a slate of state legislators which included some "Greens", and a unique assembly of sober minded legislators which promised for the first time to address the problems of global change with serious, long term solutions.

GLOBAL CLIMATE DEVELOPMENTS

Global climate change continued to be debated through the early 90s while greenhouse gas production continued unabated. During the deep recession of the Bush-Clinton era, many developing nations abandoned what little environmental concern they had begun to show. With the U.S. and other developed nations focused on their own economic woes, and the continuing worldwide epidemic of ethnic unrest,

there was little support worldwide for environmentally responsible resource exploitation. Undocumented reports of renewed environmental disasters in Russia, including Arctic ocean oil spills began to circulate. Brazilian rain forest destruction accelerated, more and more "dirty" industries moved to unregulated third world locations, wetlands and other vital habitat areas were lost, and the push to replace harmful compounds receded. By mid decade, the few voices raised in protest began to cite statistical evidence to support their concerns. Ocean and air pollution levels were beginning to show significant increases, previously favorable trends in some areas such as the Mediterranean were reversed, and the ozone hole was expanding alarmingly.

That a global environmental crisis was looming began to become clear by early 1998. The rise in atmospheric CO_2 levels had clearly accelerated. The triggering event seemed to be the massive spring 1997 oil well blowout in the Arctic Ocean north of Siberia. With inadequate technology or planning in place to respond to such an event, the oil slick covered a vast portion of the ocean, reducing the albedo with a corresponding rapid retreat of the ice cap. While the total effect could not be measured, the brief Arctic ocean growing season was lost, along with countless marine mammals and sea birds. The next dramatic sign was a devastating 1997 El Nino event which resulted in unusual world wide weather patterns including drought in Africa, several major storms worldwide, and failed Peruvian fisheries. Scientists monitoring global weather patterns began to note even more ominous indicators, however. The most puzzling and menacing was a sudden shift in the Atlantic oceanic

currents. Unusual incursions of warmer waters far into the North Atlantic were accompanied by the worst hurricane season on record. No fewer than three major hurricanes slammed the U.S. during the 1998 season, one in the Gulf of Mexico and two on the south Atlantic coast. That winter, North Atlantic storms had a devastating effect on New England beaches.

The apparent shift global weather patterns caused the UN to call an emergency meeting on Global Climate Change in the spring of 1999. Despite the arguments of the U.S. delegation that the current phenomena were transient and not proof of any true long term change, a clear consensus agreed that fundamental changes in the earth's weather were at hand. While estimates of change varied, those of many scientists converged toward the upper limits of previous temperature rise of up to 5°C by the end of the next century was expected, with sea level rise of up to one meter. By 1999 the sea level rise had reached 5 cm above the levels of 10 years before.

The unpredicted shifts in ocean circulation patterns, however, increased the element of risk, particularly for northern hemispheric regions. The changing patterns indicated an increased probability of major storms, coastal flooding, increased erosion rates for exposed shorelines, increased motion of barrier beaches and islands, and accompanying sea level rise. With this backdrop, both the scientific community and government planners were galvanized to greater research efforts to deal with the situation, but the previous years of neglect left a shortage of basic data and proper analysis of existing data. Planners were left in a crisis atmosphere demanding action without hard answers from the scientific community.

During 1999, the weather crisis deepened. Unusual rainfall patterns, typhoons and hurricanes, and the warmest year on record contributed to tens of thousands of deaths worldwide both from drought induced starvation and from coastal flooding. Worldwide fish catches were down 10%, and polar ice cap shrinkage had become measurable. The annual rate of sea level rise increased from .5 cm in 1990 to .75 cm in 1999.

With these highly visible signs, worldwide public reaction was almost hysterical. The press corps reported each typhoon, tornado, flood, and hardship, editorializing with 20/20 hindsight that these events were the obvious consequence of poor planning, and pressuring governments for instant solutions.

LOCAL SITUATION

So far, Rhode Island has escaped the worst ravages of the crisis. No hurricanes have yet hit Narragansett Bay, but coastal erosion rates in many areas have increased by 15%-20% over those of the 80s, salt water intrusion has been noted in several community wells, and the Scituate reservoir has been unable to provide for the needs of all users during summer months, causing a statewide water crisis. The Georges Banks fishing grounds and recreational fisheries have both yielded smaller takes each year, despite shifts by many fishermen to formerly under utilized species. It is not clear what, if any, of this can be related to the loss of wetlands. Apparently due to the sections of Narragansett Bay which are still off limits to shell fishing, the quahog industry has so far escaped unscathed. Despite Rhode Island's relatively

favorable coastal situation, press and special interest groups are demanding action, some for "protecting" the coastal areas by means of seawalls, groins, or other protective structures, others for rapid action to clear the coastal zone of most human habitation in an effort to preserve coastal features and prevent loss of life. It is in this atmosphere of uncertainty, fear, and chaos that the new administration took office.

PLAYER ORGANIZATION AND TASKING

"Governor Elect" Schneider has asked for Governor Cianci's help in the transition process. As part of her effort to enter office with plans and draft legislation ready to present to the state assembly, she has asked various state offices to prepare plans and briefings on pivotal issues, including climate change. The CRMC staff has been asked to prepare a long range estimate and plan for responding to potential climate change impacts on the coastal zone. They are specifically tasked with commenting on the following issues:

- Increased frequency of flooding.
- Increased inland extent of flooding.
- Rearrangement of coastal sediments and soils.
- Increased soil salinity in areas previously unaffected.
- Accelerated beach and dune erosion.
- Upward and landward retreat of the freshwater-brackish water boundary.
- Changes to bank and wetland vegetation.
- Changes in marine and terrestrial primary production.[40]

Other interested government and non-government organizations are also preparing position statements and lobbying efforts in an effort to influence the new administration.

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[40] Pernetta and Elder p. 138.

Players will be divided into four teams with specific tasking as indicated below:

CRMC PLANNING TEAM: This will be the largest and central team. Team size would ideally be approximately 10-15 players, allowing for discussion and division into committees to work on assigned tasks. Players are appropriately drawn from the Marine Affairs program. Primary tasks will be the following:

- Develop outline 10 year Special Area Management Plan to deal with all issues of climate change from the perspective of Coastal Area Management, specifically addressing the Governor Elect's concerns. This plan should include goals, research priorities, milestones, federal assistance required, proposed legislation, support needed from various other agencies, and funding requirements.
- Prepare for and conduct a press conference on the issue of climate change relating to the Rhode Island coastal zone, including your plans to deal with it.
- Conduct at least one "public hearing" on your plans. Invite appropriate parties, brief them on your progress, and solicit comments and criticisms. Include this feedback in your final product.
- Prepare a final briefing on your plan for delivery to the "Governor elect". In this briefing discuss major concerns, goals, central elements of your plan, difficulties experienced in developing and expected in implementing the plan, expected sources of opposition, funding requirements, and timetable.

DEVELOPER/COMMERCIAL INTEREST CELL: This will be a somewhat smaller team tasked with determining and defending interests and concerns of commercial and private property owners in the Rhode Island coastal zone. Players would appropriately be drawn from Civil Engineering, Business, Architecture, or Public Administration curricula. Player tasking will include:

- Develop priority list of goals, interests, and means for defending them.
- Attempt to influence CRMC 10 year plan in a way which protects your interests. Attempt to influence Local Community Cell to include your concerns in their own plans and lobbying efforts.
- Attend "public hearing" to voice your concerns.
- Prepare final briefing for the "Governor Elect" in which you list and defend goals and attempt to persuade her to support your priorities.

LOCAL COMMUNITY CELL: A team which will represent the interests and requirements of the coastal communities of Rhode Island. This team will represent a specific community, such as Wakefield, which includes the full spectrum of interests and challenges faced by communities in the coastal zone. Players could be drawn from the Public Administration curriculum as well as Marine Affairs, Business, or Political Science. Player tasking includes:

- Develop prioritized list of goals and concerns from the community perspective. Propose local or state regulations and plans to deal with these concerns for which you need state or national assistance.
- Attempt to influence CRMC 10 year plan to support your priorities.
- Prepare final briefing for the "Governor Elect" which includes your own goals and priorities and a critique of CRMC regarding content of the 10 year plan and of their receptivity to your input.

ENVIRONMENTAL ADVOCACY CELL: Players in this cell will participate as representatives of various environmental groups. They will develop their own priority goals and concerns and attempt to influence development of the CRMC plan in a way which in their judgment best protects the environment without specific regard for property owners or other influence groups. They may attempt to influence other cells, such as the local community cell. Their tasking includes:

- Develop list of five top priority concerns for environmental protection in the coastal zone in the face of the climate change postulated. Develop supporting prioritized list of five specific environmental goals.
- Attend public interest hearings to represent your concerns.
- Issue a press release during a "press conference" you organize, schedule, and host prior to the public interest hearings to publicize your concerns and attempt to enlist public support.

- Prepare a final briefing for the "Governor Elect" which provides your priority concerns and goals, evaluates how well the CRMC plan meets them, and attempts to influence the governor elect in your favor.

Players for the game cells as designed can be taken from a variety of sources. Ideal players are graduate or undergraduate students in the URI programs of Marine Affairs, Political Science, Public Administration, Business Administration, Civil Engineering, Biology and other natural sciences. In order to stimulate discussion and interaction, students strengths and skills should be mixed in each cell, and the role playing perspective enhanced by requiring students to advocate unnatural positions. For example, ecology students might be forced to play in the Developer's Interests cell, and business students in the Environmental Advocacy cell. Alternatively, the players could be taken from government or citizens groups. For this free-form game, it is important for players to be knowledgeable in their own field, since they will be the source of much of the information required to successfully play the game.

Player cells will include two or more representatives of "control". One will function as the cell moderator. The moderator's responsibility is to guide discussion and organization to ensure the schedule is maintained and player tasking is completed. The moderator should attempt to avoid influencing decisions, but ensure the cell functions smoothly. In addition, a "facilitator" will be assigned to assist in administrative requirements such as carrying messages to other cells. The facilitator may also participate as a player.

In addition to player cells, two additional groups are required, a "Control Group" and "Expert Witness Cell". These two cells must provide all the information and influences normally received from the "outside world". They function as resources available to the players, but also be proactive to ensure game play flows smoothly and players are guided appropriately into their roles and tasks. Specific responsibilities are discussed below.

CONTROL CELL: This team is not a player team, but consists of the sponsor and a group of "trusted agents" who systematically observe player cells and report progress to the sponsor and other control team members. Through use of announcements, provision of additional information, added player tasking, or arranging meetings between cells, the control team must stimulate and control play to meet game objectives. Additionally, the control team plays "higher authority", including the "Governor Elect", state legislature, federal government, and any other groups not covered elsewhere. These positions should enable the control team to respond to player requests for assistance or information. Control team members will move into and out of these other roles as required. The control team should keep a record of interactions with players, and be able to discuss player actions and products, but will not be tasked with specific briefings or reports. Control representatives will participate in the final panel discussion.

The ideal control team membership would include individuals with experience in simulations and also those with expertise in the roles being represented. Faculty

members of the Graduate Program in Marine Affairs would be well suited, but also members of the Political Science Department, Public Administration faculty, or even representatives from state or national government would give the team depth, balance, and credibility for the players. Control experience is resident at the U.S. Naval War College in Newport, RI where there is precedent for support of gaming at civilian academic institutions.

EXPERT WITNESS CELL: This is a team of experts brought in to support game play. The expert witness cell should include representatives of the scientific, academic, and possibly business communities as well as the press corps. Scientific disciplines might include oceanography, geology, biology, fisheries management, ecology, etc, particularly those specializing in the coastal zone. Other disciplines represented might include geographers, coastal zone law experts, resource economists, and public administration specialists. The primary responsibility of the expert witness cell is to respond to student requests for information, but in the absence of such requests, members should prepare brief presentations to give to the players in an effort to inform them prior to finalizing their plans. The press representative should be called in by player cells to be briefed, and should be given press releases for circulation, but this individual may also ask for interviews with players, publish and circulate them during game play to replicate the role of the press during actual decision making. If facilities are available, videotape or live TV interviews should be

conducted and broadcast. The press representative may also interview expert witness cell members and circulate these to players.

These roles may be played by faculty members or graduate students from the University of Rhode Island, or by invited specialists. All the disciplines required, including journalism, are represented on the URI faculty, but inviting outside authorities would broaden player exposure, expand the educational span of the game, and could serve to enhance professional interaction.

FINAL GAME PRODUCTS

Each player cell will be responsible for providing two final products: a paper which outlines and a final briefing for the "governor elect" consisting of hand written briefing transparencies. The paper should be in outline format and provide specific responses to essential tasks as assigned by the Governor Elect and listed in player cell instructions. The briefing slides should cover essentially the same material as in the paper, but without supporting details. In addition, each cell facilitator should retain copies of all press releases, "faxes", and other communications generated by the cell.

The expert witness cell should maintain a log of all player information requests and prepare a short closing briefing to be given during the concluding round-table discussions.

GAME RULES

As a free-form game, rules will be flexible, designed to enhance player interaction while permitting the Control Team to monitor play progress and intervene as necessary. Player organization and communication are represented graphically in Figure 1.

PLAYER COMMUNICATION: Communication between player cells will be limited and controlled. Communication may be by one of three means:

1. Urgent verbal messages conveyed by assigned facilitators. These messages should be repeated to the control team;

2. "Faxes". These are hand written messages drafted by players and hand delivered to appropriate recipients, with a copy to control. Players should retain a copy of all "faxes" for reference.

3. Formal arranged meetings. All meetings should be scheduled through the control team, so proper representation and planning may be introduced. Meetings may include representatives of more than one team, and press or "public" interest may be generated, with or without player approval.

CELL PROCEDURES: Internal cell organization and procedures will be the prerogative of players in consultation with the moderator.

EXPERT WITNESS PROCEDURES: Expert witnesses may be consulted by players at any time by any means. Requests for assistance may be made by means of written or verbal queries. Expert witnesses should maintain a record of requests and responses for analysis.

MATERIAL SUPPORT

Since this game is designed using a free form format, material support required is fairly basic. Ideally, each cell would have its own conference room of a size suitable for the number of participants assigned. Each conference room should be equipped as indicated in Table IV. If separate rooms are not available for each team, larger rooms with room dividers will be satisfactory. The key is to enable each team to plan in relative privacy, and restrict informal means of communication. If available, computers allow rapid drafting of plans using word processing for easy revision and printing, but handwritten drafts are acceptable. Care must be taken when actually setting up rooms to do so in a way which encourages player interaction and productivity. Extra space, tables, and chairs allow for players to group into subcommittees or reorganize themselves as they best see fit.

Table IV ROOM EQUIPMENT

Room Supplies
Table and chairs
Notepaper/pencils/pens
Slide transparency/pens
Overhead projector and screen
Butcher block pad/easel
"Fax" blanks
Coastal area charts
Computer with printer; Word processing and Graphics software (if feasible)
Reference material
Roster of players
Charts of schedule and tasks

In addition to the individual player cells, a larger conference or lecture room suitable for plenary sessions is needed. This room will be the location for opening

and closing briefings, may be used for press conferences, ad hoc meetings, and may also be a suitable location for the expert witness cell. The plenary room should have an overhead projector with screen, lectern, and, if necessary, a sound system. At least one room, or a secluded hallway, may be set aside for scheduled inter-cell meetings and allow privacy for lobbying efforts. The control team will also need a room with a supply of materials similar to those in each player cell.

Each player should be provided with a packet of game materials including a copy of the scenario, game organization, participants, rules, tasks, and schedule.

SCHEDULE

As noted in the discussion of gaming above, the schedule must be taut in order to replicate real world tension, force rapid and deep player involvement, and stimulate intensive interaction. A two day schedule for the game is as follows:

Day One

0800-0900	Check in. Review game materials.
0900-1200	Indoctrination briefings.
0900-0915	Administrative remarks.
0915-1015	Keynote address: Climate Change-Prospects and Challenges for the Coastal Zone.
1015-1030	Break
1030-1115	Game scenario situation.
1115-1200	Game mechanics: Organization, participants, role playing, tasks, communications, schedule.
1200-1300	Lunch
1300-1500	First planning period. Meet in game cells. Assign internal cell organization. Make task assignments. CRMC cell plan public

hearings. Other player cells determine priority issues, positions and initial input to CRMC during public hearing.

1500-1600 — Public hearings. CRMC cell organize and conduct hearings attended by representatives from all player cells and control. Attempt to discern major issues and perspective of all cells. Some members of each team may continue planning effort during hearings.

1600-1700 — Second planning session. CRMC cell summarize issues and player cell positions. Begin to formulate 10 year plan. Other cells summarize issues and positions. Refine positions and attempt to establish alliances to influence CRMC. Consult expert witnesses to supply needed data and expertise.

1630-1645 — Environmental Advocacy Cell Press Conference. Environmental Advocacy Cell comment on CRMC planning effort and attempt to enlist public support for draft positions.

1700 — Break for evening.

Day Two

0800-0815 — Administrative announcements. Provide updated climate situation and stimulus to players as needed. "Governor elect" make brief exhortation.

0815-0930 — Third planning session. All player cells continue development of 10 year plans and positions. Legislative "fact finding visit" of control team members to each player cell. CRMC team plan press conference. Other cells draft and issue press releases and conduct lobbying efforts. Attempt to obtain draft of CRMC 10 year plan.

0930-1000 — CRMC Press Conference. Present outline of draft 10 year plan.

1000-1200 — Final planning session. Prepare presentations for "governor elect". Finalize papers presenting 10 year plan (CRMC cell) or priority goals and concerns (Development Interests and Environmental Groups cells).

1200-1300 — Lunch.

1300-1430	All player cells brief Governor Elect.
1430-1445	Break.
1445-1600	Closing panel discussion (Cell leaders, Governor Elect, expert witnesses). Provide assessment and informal critique of player plans.

During planning sessions, the control team may use the following events to stimulate discussion or interaction: Legislative "fact finding visit"; control scheduled meetings between player cells; visits by lobbyists; providing "news" reports such as natural disasters, law suits, additional scientific discoveries, economic or political events. The use of these "injects" is dependent on the progress of the game. If players are proactive in scheduling and conduction "lobbying" efforts, it may not be necessary to schedule any additional meetings, but if players are reclusive and remain within their own cells, the control group must take the initiative to schedule additional meetings. Similarly, the control team must remain informed about development of player plans, and if glaring shortcomings are noted, provide stimulus through news reports or the expert witness cell to focus players on the important issues. As an example, if CRMC players project budget needs to increase unrealistically, the control team may issue a news report or "staff memo" which signals an economic downturn with reduced funding availability.

STUDENT PREPARATION: This game may be easily modified to play as a classroom exercise. The major difference is that students must play the roles of

expert witnesses and some students will be needed to undertake control functions. As designed, the game is dependent on faculty members or other invited experts to provide the technical resources needed for meaningful play. To effectively replace these authorities, students must be given research homework of a level approaching that of a class paper.

Each student must be assigned his role at least a month in advance of the game, and be required to gain significant knowledge of the field prior to game start. Players assigned to play government agencies should visit these agencies, outline their organization and mission, review any current work applicable to the game, and be able to represent their role and position during the game. They should be tasked with finding and bringing appropriate existing plans and other documentation to the game. Similarly, students assigned to play NGO's should visit, interview, and study these organizations to learn their procedures and positions. Those assigned to play scientific and technical experts should review current literature in their "field", interview appropriate faculty members, and bring applicable documentation to the game.

Actual game play would then take the place of one week of classes. The first class period would consist of team planning, the second would be for meetings and press conferences. The third would consist of the final briefings and panel discussion. Some time outside the classroom would be required for teams to finalize responses to tasking, but adequate time for meetings and other formal game events would be available during class periods.

V. PLAYING THE GAME

FEASIBILITY: Gaming is a complex, sometimes cumbersome, and frequently expensive undertaking. While this game has been designed as a demonstration of a hypothetical academic activity, it could reasonably be played, with appropriate modifications, in a variety of settings and for different purposes. Rhode Island is ideally situated to host a coastal zone planning game, possessing in relatively close proximity the University of Rhode Island with a prominent Marine Affairs faculty, active state Coastal Zone Management Council, and the Naval War College with superb facilities for free form gaming and skilled game control managers. These assets make actually playing the game quite feasible for far lower cost than a game of this sort would normally require. Marine Affairs students could conduct research to support game play as part of course requirements. The Naval War College has previously provided support for gaming efforts by other New England academic institutions, and can provide game control expertise to a game played on the URI campus, or could provide a gaming facility with ample conference rooms, game support materials, and unique resources such as closed circuit television broadcast facilities. Rhode Island also has a complete complement of the various constituencies which have an interest in Coastal Zone matters. Thus they are available to assist in planning and game play, and can benefit from insights generated during the game.

PURPOSES: There are many potential applications for a game such as this, many appropriate to sponsorship by an academic institution. Among these are using the game as centerpiece for a coastal zone management symposium held for other

academic institutions; using the game as a centerpiece for a multi-disciplinary coastal zone management symposium; and using the game as part of an alumni weekend to showcase current faculty and student research and issues, using alumni as players. Using a "game" as the centerpiece activity fostering group dynamics can stir the imagination and serve to attract more participation than more conventional means such as lectures or group discussions. The participatory aspects encourage a greater sense of involvement and "ownership" in the exercise. Individuals who otherwise might be inclined not to attend such events might well be encouraged to take part. By means of alumni participation, current faculty achievements and research can reach a sympathetic audience in a compelling and interesting format, and Marine Affairs alumni working in related fields are afforded the opportunity to interact with students in a setting which encourages beneficial interchanges. Additionally, current issues may be exposed to a broader audience in a way which involves them in solution development.

Future Development: A natural development of this game would be to introduce more rigid rules for evaluating player plans and extend play for more moves. To do this, models should be developed for evaluating player plans in light of the given environmental, fiscal, and political situation. As players conclude plans for each move, the models would be used to evaluate and provide feedback on outcomes. The control team would then brief results to the players and they would be required to adjust plans as appropriate for their next move. Conceptually, time steps of roughly

five years for each move would be needed to provide sufficient time for policy decisions to be implemented and have some noticeable effect.

Evaluation models could include computer based algorithms which would specifically address investment and tax patterns to determine effects on coastal zone infrastructure. Other computer based models could evaluate the effects of engineering approaches to coastal stabilization, or the impact of coastal zone programs on populations and usage intensity. Development of such models is time consuming, may yield unsatisfactory results, and may produce undesirable side effects. Computer generated models may seduce players into undue confidence in the outcome of their work. They may also cause players to "work for the model" rather than the model working for the players. Alternatively, non-computer models for evaluating player moves may be devised, which can be applied by experts assigned to the control group. While not as emotionally satisfying as computer models, conceptual models provide a structure for evaluating player moves without the pitfalls of computer models. The output may well be as authentic as the computer assisted results, with greater game utility and less danger of perceptual problems.

VI. CONCLUSIONS

Gaming, particularly free form gaming, offers significant potential for Coastal Area Management education and planning. Gaming can encourage thinking, awareness of the many participants and issues involved, and education of participants and observers. It can also establish valuable linkages among individuals or groups

with differing viewpoints, goals, and capabilities. Gaming has an unsurpassed potential for illuminating the complex social and interdisciplinary scientific issues with which Coastal Area Management abounds. Gaming has application for students and planners, and can be tailored for a variety of purposes including education and improving information and communications flow. While gaming can be expensive and complex, The University of Rhode Island is uniquely able to successfully stage Coastal Area Management games, and could do so in a variety of formats with great potential benefit.