**Athena User's Guide**

Athena S&RO Simulation, V3

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**Table of Contents**

1. Introduction 3

1.1 Overview of This Document 3

1.2 Other Documents 3

1.3 Changes for Athena 3 4

2. Athena Overview 6

3. Athena Objects 8

3.1 The Playbox 8

# Introduction

This document presents the models and software of the Athena 3.1 Stability & Recovery Operations (S&RO) Simulation from the user’s point of view. Users are advised to read this document before moving on to the other Athena documents.

The Athena simulation is a decision support tool designed to allow a skilled analyst to consider the intended and unintended consequences of various courses of action that might be taken during Stability & Recovery Operations. Athena contains models descended from the Joint Non-Kinetic Effects Model (JNEM), and includes many new models and other changes. In addition, where JNEM is a federated simulation, Athena is a stand-alone single-user application.

The intent of Athena’s models is first to capture and make explicit a wide variety of first order causal links, each of which makes sense on the face of it, and secondly to present the second and third order consequences of events while preserving the causal chain.

Everyone is familiar with the story of the ten blind men and the elephant. The goal of Athena is to model each of the elephant’s parts, and to link them together so that the man who has the elephant by the tail is sure to get thwacked by the elephant’s trunk (not to mention everything in between).

## Overview of This Document

This document covers four major topics.

* Sections 2 through 9 describe the Athena models and philosophy at a conceptual level; those interested in more detail can see the low-level model descriptions in the *Athena Analyst’s Guide*.
* Sections TBD through TBD describe the Athena application itself: the parts of the application, how to enter scenario data, how to run the simulation, and how to find the results.
* Sections TBD through TBD contain a cookbook of how to make use of Athena’s models and inputs for particular problems.
* Sections TBD through TBD contain reference information, including a complete glossary of terms. Detailed reference information can be found in the Athena application’s on-line help.

## Other Documents

In addition to this user’s guide, Athena is delivered with the following documents:

*Athena Analyst’s Guide*

This document contains a detailed, low-level description of the models used in Athena; it serves as the specification document for the implementation of the models in the Athena code. Consult it when you need to know more about the models than is contained in this user’s guide.

*Mars Analyst’s Guide*

Mars is an infrastructure layer that is shared with the Joint Non-kinetic Effects Model (JNEM). The *Mars Analyst’s Guide* can be thought of as an appendix to the *Athena Analyst’s Guide* that describes the models that happen to be implemented in the Mars code base, including the Generalized Regional Attitude Model (GRAM) and the Mars Affinity Model (MAM). The former tracks direct and indirect effects on civilian attitudes; the latter models belief systems and the resulting affinities between actors and groups.

*Athena Rules Document*

This document describes the events and situations (drivers) that affect civilian attitudes in more detail than does this user’s guide, and also details each of the Driver Assessment Model (DAM) rule sets that assess the attitude change caused by the drivers.

*Athena On-line Help*

The Athena application includes extensive on-line help; see the **Help** menu in the application’s main menu bar. The most detailed reference information for the Athena software is found in the on-line help.

When Athena is installed on Microsoft Windows, these documents are available from the Athena folder on the Start Menu. Alternatively, go to the Athena application directory and open “docs\index.html” in a web browser. Documentation can also be obtained directly from the Athena Project; contact William.H.Duquette@jpl.nasa.gov.

## Changes for Athena 3

In its conception, Athena was intended to be a single-user version of JNEM customized and extended to be a decision support tool for courses of action in the S&RO environment. JNEM depended on an external federation of simulations for much of its simulation input, e.g., combat, civilian casualties, presence and location of military forces, and so forth. Athena versions 1 and 2 relied on the analyst for much of this input as the simulation ran. In particular, the analyst was expected to run Athena forward in short one month to three month time steps; at each pause, the analyst was to role play each of the relevant actors in the region, make appropriate inputs and adjustments, and then advance time again. This placed a great burden on the analyst.

The big change in Athena 3 is the addition of actors and their strategies. By defining the relevant actors and their strategies, the analyst can set up a complete scenario, and then let the modeled actors respond to the changing conditions. It is still possible for the analyst to pause frequently and make course-corrections if desired, but this is no longer an essential feature.

More specifically, in Athena 3 we have:

* Added actors and their strategies (goals, tactics, and attached conditions)
* Added the notion of *belief systems*; comparison of belief systems is the basis for the model of inter-group and group/actor relationships.
* Added a model of actor support, influence, and control of neighborhoods.
* Added a model of Essential Non-Infrastructure Services, which uses a new paradigm for driving attitude change.
* Revised the user interface:
  + Separated Scenario Mode from Simulation Mode. The data presented is now appropriate to the task being done. In particular, data populated only during simulation is now longer visible during scenario preparation.
  + Added the Detail Browser, a web-browser-like window for browsing the scenario and the simulation results.

# Athena Model Overview

Athena is a collection of many models that involve the relations and interactions between a number of kinds of simulation object. This section gives a brief overview of the most important kinds of simulation object, and of the six major modeling areas. The various kinds of simulation object are documented in detail in Section 9; the modeling areas and the models they contain are described more fully in Sections 3 through 8, and are documented in detail in the *Athena Analyst’s Guide*, *Mars Analyst’s Guide*, and *Athena Rules* documents.

## The Simulation and its Objects

At its highest level, Athena models the actions taken by significant decision makers, called *actors*, within a region of interest, called the *playbox*. The playbox is divided into sub-regions, called *neighborhoods*. Each neighborhood is inhabited by some number of civilians, who are divided into *civilian groups*, and who form both the consumers and the labor force in the *local economy*.

The actors attempt to control, aid, or otherwise influence the civilians in the neighborhoods by means of their actions, which are called *tactics*. Executing tactics requires *assets*, of which there are two kinds: money and personnel. Each actor has an income, and may also own bodies of personnel, e.g., army troops, police forces, humanitarian relief organizations, and so forth. These are called *force groups* or *organization groups*, depending on the nature of the group. By attaching *conditions* to tactics, an actor can determine when and under what circumstances tactics are used. The collection of an actor’s tactics and conditions is called the actor’s *strategy*.

The civilian groups have *attitudes*: satisfaction or dissatisfaction with respect to particular, and a willingness or unwillingness to cooperate (i.e., share information with) members of force groups. These attitudes vary over time in response to the events and situations that occur in the simulation, including those triggered by the actors’ actions.

In addition, civilian groups can *support* actors to a greater or lesser degree. Support is based upon shared or compatible beliefs, but is also affected by actors’ actions and by conditions in the civilians’ neighborhoods. Members of force and organization groups also support the actor to whom the group belongs. Actors may use the support they receive, or lend it to other actors. An actor with sufficient support in a neighborhood is said to have *influence* in the neighborhood; and an actor with sufficient influence may *control* the neighborhood.

Thus, we have the following feedback loop:



The actors’ actions determine the situation on the ground, which in turn affects civilian attitudes. This in turn affects civilian support for the actors, which can cause a change in which actor controls each neighborhood. That political situation then drives the actors’ actions. There are, of course, smaller feedback loops within this one; for example, an actor can increase his support in a neighborhood by moving a significant military force into that neighborhood. The force supports him, possibly enough so that he gains control, bypassing (at least temporarily) civilian attitudes altogether. Similarly, there is a feedback loop from the situation on the ground back to the actors’ actions—even politicians look at more than just the latest polls. But at a high level, this is the dynamic that drives Athena execution.

The primary outputs at the end of an Athena run are these:

* The actor in control of each neighborhood
* The stability and security of each neighborhood
* The civilian groups’ attitudes about the state of the playbox
* The resources decisions required by each actor to bring about this end state.

Thus, Athena can be used both to analyze an existing political situation and to assess the results of various courses of action designed to change it, from the point of view of any or all of the actors involved.

## The Six Modeling Areas

Athena’s models fall loosely into six broad areas; the borders between these areas are often fuzzy, and some of the Athena models straddle them. The six areas are as follows:

**The *Ground* Area**

Literally, where things are on the ground, the things they are doing, and what is happening to them as a result. (Section 3.)

**The *Demographics* Area**

This area concerns where civilians live and how many of them there are, along with the computation of such population statistics as the number of consumers in the local economy. (Section 4.)

**The *Attitudes* Area**

This area deals with the attitudes of the people in the playbox, especially their satisfaction and cooperation levels, but also their belief systems and the relationships between the various groups in the playbox. (Section 5.)

**The *Politics* Area**

This area deals with actors and their strategies (goals, tactics, and attached conditions) along with the determination of support, influence, and neighborhood control. (Section 6.)

**The *Economics* Area**

This area deals with the local economy, relating changes in population and production to the consumer price index (CPI) and the unemployment rate. (Section 7.)

**The *Information* Area**

This area deals with information flow in the playbox, and especially the effect of information flow and information campaigns on attitudes and politics. (Section 8.)

The models in each of these areas are inter-related: every area depends on inputs and outputs from the other areas, as shown in the following figure. It is necessary to track all of them to get a complete view of the simulation.



Each of these areas and the models contained within it are described in the referenced sections; for full details on the models, see the *Athena Analyst’s Guide*, *Mars Analyst’s Guide*, and *Athena Rules* documents.

There is a chicken and egg problem here: to understand the models, it is necessary to understand the objects (neighborhoods, groups, etc.) they use; but it is difficult to discuss the objects without describing the models that use them. Because the models are described in detail elsewhere, but the objects are described in detail in the reference sections of this document, we will take the chicken firmly by the horns and discuss the models first. The reader may find it useful to skim Section 9 before proceeding.

# Ground

The Ground Area is quite literally concerned with what is happening on the ground: where people are, and what they are doing, and the results of their actions. It includes:

* The breakdown of the playbox into neighborhoods
* The relationships among the neighborhoods
* Where civilian, force, and organization personnel are located
* The activities that they are performing, including combat activities
* The Athena Attrition Model (AAM)
* Neighborhood security levels

Events and situations occurring in the Ground Model affect attitudes in the Attitudes Model.

# Demographics

The *Demographics* *Model* is closely tied to the Ground Model, as it is concerned with how many civilians there are and where they live. It is also responsible for determining the size of the labor force, the number of consumers in the local economy, and similar population statistics. In addition, it determines the effects of unemployment on each civilian group, which in turn drives attitude change in the Attitudes Model.

# Attitudes

The *Attitudes Model* deals with the attitudes of the people in the playbox, and particularly:

* The belief systems of each of the actors and civilian groups
* The vertical relationships between groups and actors
* The horizontal relationships between groups
* The satisfaction of the civilian groups with respect to various concerns
* The cooperation (i.e., willingness to share information) of the civilian groups with respect to the force groups.
* Assessment of the effects of events and situations in the other models on the attitudes.

Note that the term *attitudes* properly applies to satisfaction and cooperation levels, which are managed by the Athena Regional Attitudes Model (ARAM). However, the relationships (which derive from the belief systems, among other things) are also attitudes in a wider sense.

# Politics

The *Politics Model* deals with actors and their strategies (goals, tactics, and attached conditions) along with the determination of support, influence, and neighborhood control. As described above in Section 2, the interplay of actor’s strategies being executed over time is the engine that makes Athena run.

# Economics

TBD

# Information

# Athena Objects

An Athena scenario consists of a collection of related objects created by the analyst, upon which the Athena models operate. This section describes the objects and their data attributes in some detail; we suggest that the reader skim this section on first reading, and then go on to the model areas, returning to this section for details as needed.

## The Playbox