98-1-8-1

Conceptual Framework for Consume 3.0 ← 2.1 Plus JFSP changes

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Document Purpose

This document is intended to serve as a bridge between the requirement meetings of December 4 & 5, 2001 and the final design of Consume 3.0. This document also consolidates and synthesizes features to be retained from Consume 2.1 and new features identified for Consume 3.0 during the requirements meeting. The objective of this documents is to review and confirm these features before proceeding with a more detailed design.

Document Sections

- Conceptual Data Model
- Functional Model
- Consume/FCC Interface
- Other Consume 3.0

Consume 3.0 Conceptual Data Model

The purpose of the conceptual data model is to display important groups of information (entities) and their relationships. The data model is primarily a business view of Consume 3.0 data requirements and is independent of any implementation mechanism. From the conceptual model a design for a specific implementation technology will be built.

This data model encompasses the following new features agreed to for Consume 3.0:

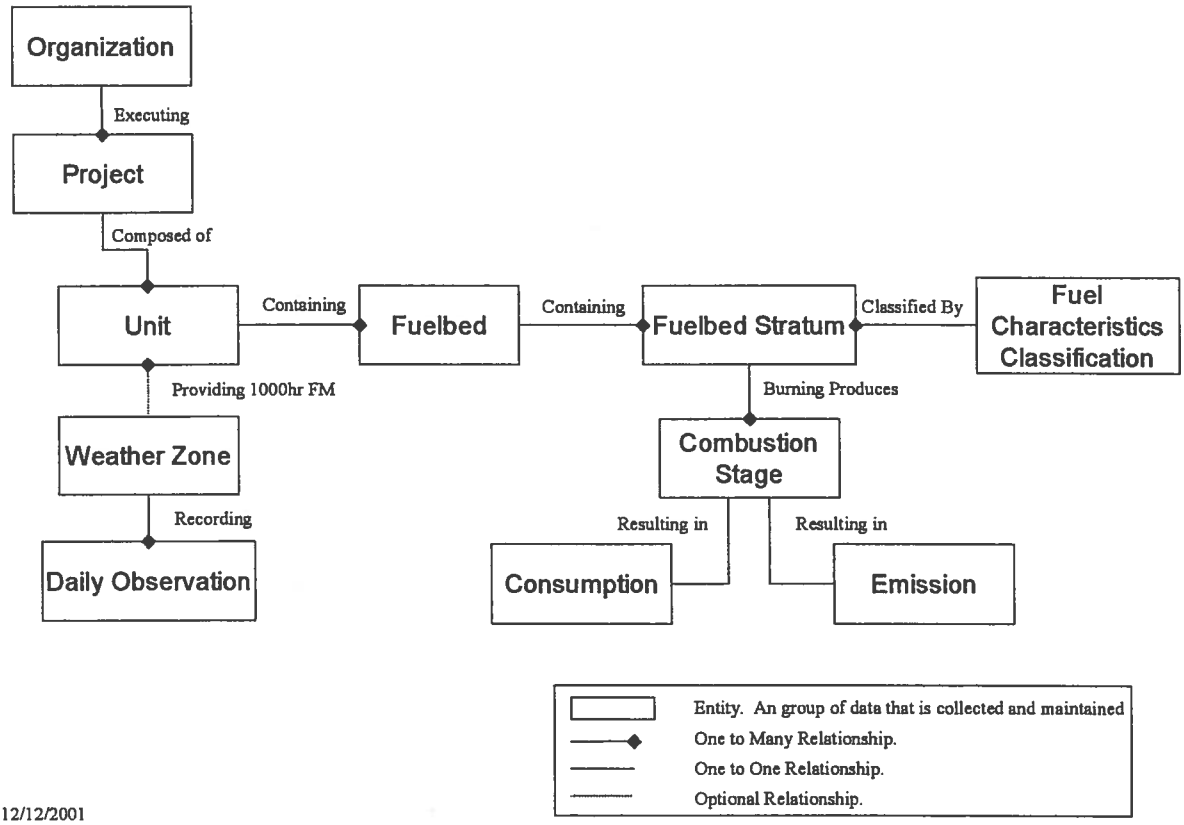
- Ability to have multiple units within one project.
- Ability to have multiple fuelbed type within a unit.
- Ability to have one or more fuelbed strata within a fuelbed.
- Ability to for each fuelbed stratum to store emissions and consumption by combustion stage.

This affords the maximum granularity at the fuelbed stratum while allowing report grouping at the fuelbed, unit, project, and organization levels. This data can then be collected for a group of organizations and a regional or area report can be compiled.

Data Model – Entity Relationship Diagram

The model below displays the principal entities and their relationships for Consume 3.0

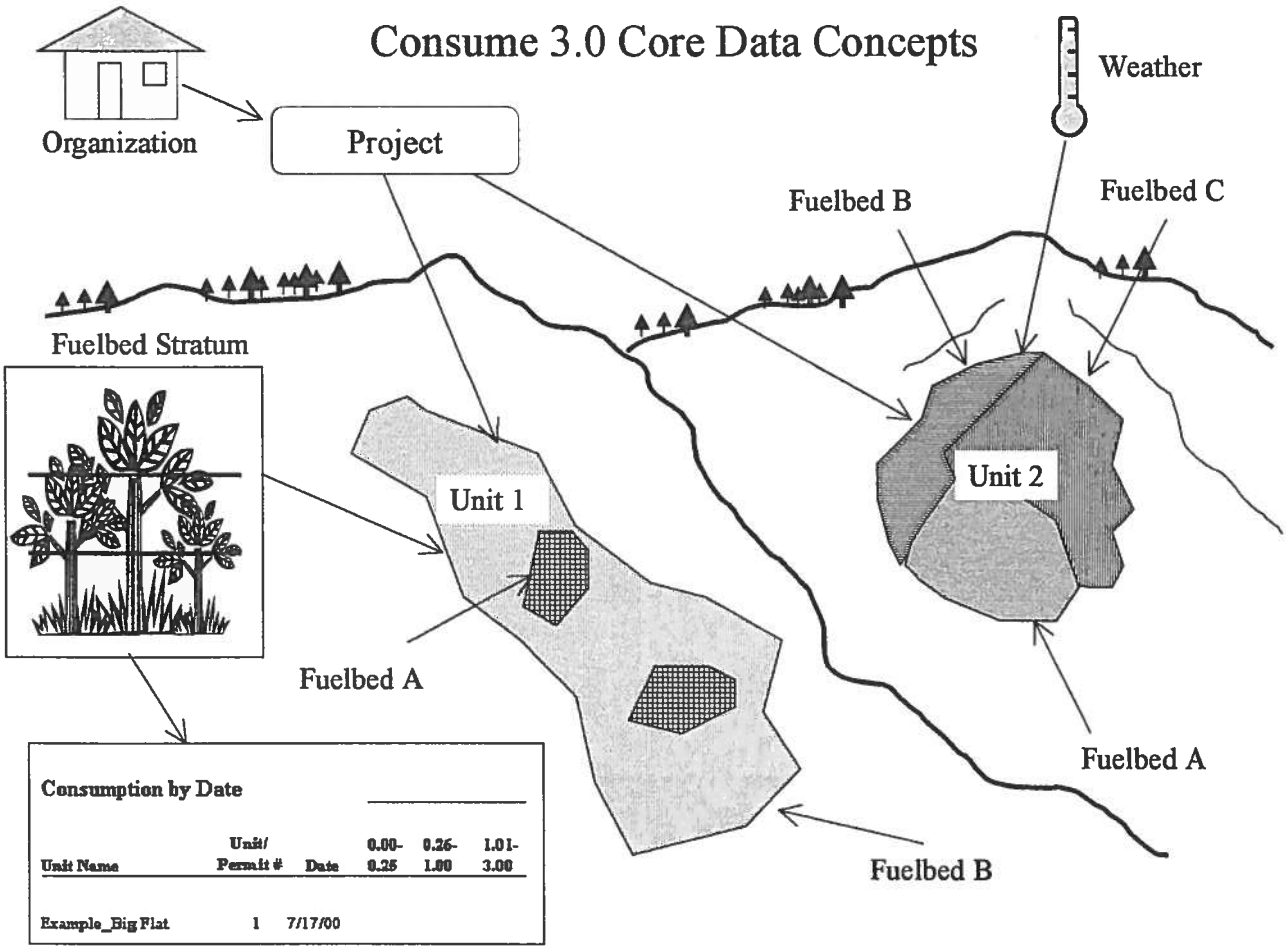
Consume 3.0 Conceptual Data Model



M.Calvin 12/12/2001

Diagrammatic View – Data Model

The diagram below presents a "real world" view of the Entity Relationship Diagram



Entity Definitions

Project. A Project consists of one or more Units that are organized and managed as a single endeavor. Projects may be planned such as a prescribed burn or it may be an unplanned event such as an wildfire. Projects are managed by an organization.

Unit. A Unit encompasses the area to be treated by fire or the area involved in a wildfire. A Unit consists of one or more Fuelbeds. Units are assigned to a single Project. Units can be planned and accomplished independently of other Units within the same Project. Units can be spatially contiguous or spatially separated.

Fuelbed. A Fuelbed is an area of similar fuel characteristics within a Unit. There may be one of more Fuelbeds within a Unit the sum of which must total 100%. A Fuelbed can be can contain either piles, natural fuels, human-altered fuels. The structure of a Fuelbed is further described in a Fuelbed Stratum.

Fuelbed Stratum. A Fuelbed Stratum describes a horizontal layer of a Fuelbed that represent a more or less independent combustion environment. Fuelbed Strata may consist of canopy, shrub, low vegetation, woody fuel, moss, lichen, litter, and ground fuels elements. A Fuelbed contains one or more Fuelbed Strata.

Organization. A government or private entity responsible for managing Projects.

Combustion Stage. A unique burn environment composed specific types of Fuelbed stratum. These stages are crown fire, surface fire, and smoldering.

Weather Zone. A weather station that is representative of a Unit's area and is used to estimate 1000 hour fuel moisture. The relationship to Unit is optional as the 1000 hour fuel moisture can be entered directly without data from a Weather Zone.

Daily Observation. A record of daily weather conditions for a Weather Zone.

Consumption. The amount of fuels by weight consumed within a specific Combustion Stage for a Fuelbed Stratum by timelag category.

Emissions. Pollutants produced within a specific Combustion Stage for a Fuelbed Stratum such as carbon monoxide and particulate matter that are released to the atmosphere from the combustion of biomass.

Fuel Characteristic Classification. A Fuelbed derived from a unique combination of ecological descriptors with assigned physical and derived fuel bed variables required for the operation of various fires, ecosystem, and global change models.

Functional Model

The functional model describes what functions Consume 3.0 will perform in order to meet its stated goal. This model is meant to reflect the high level process within the scope of Consume 3.0.

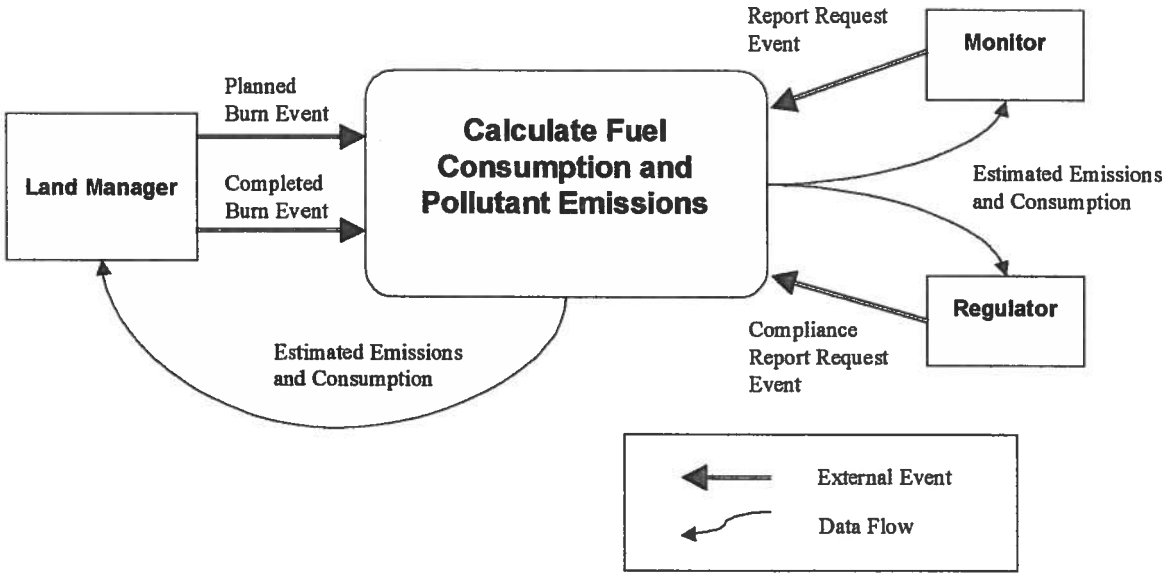
The primary goal of Consume 3.0 is:

To provide accurate estimates of fuel consumption and emissions in order to support the land manager's use of prescribed fire to maintain and restore ecosystems, reduce fuel loadings, expose mineral soil, improve wildlife habitat, and reduce the hazard of wildfire.

Functional Model – Context Diagram

The context diagram displays the highest level of interaction between the Consume 3.0 business process and the external interfaces.

Consume 3.0 Function Model - Context



The principle events triggering the use of Consume 3.0 are:

Planned Burn Event. An event where the Land Manager is contemplating or planning the use prescribed fire to treat a area of vegetation and he/she needs to evaluate conditions required to achieve the desired fuel consumption or emissions.

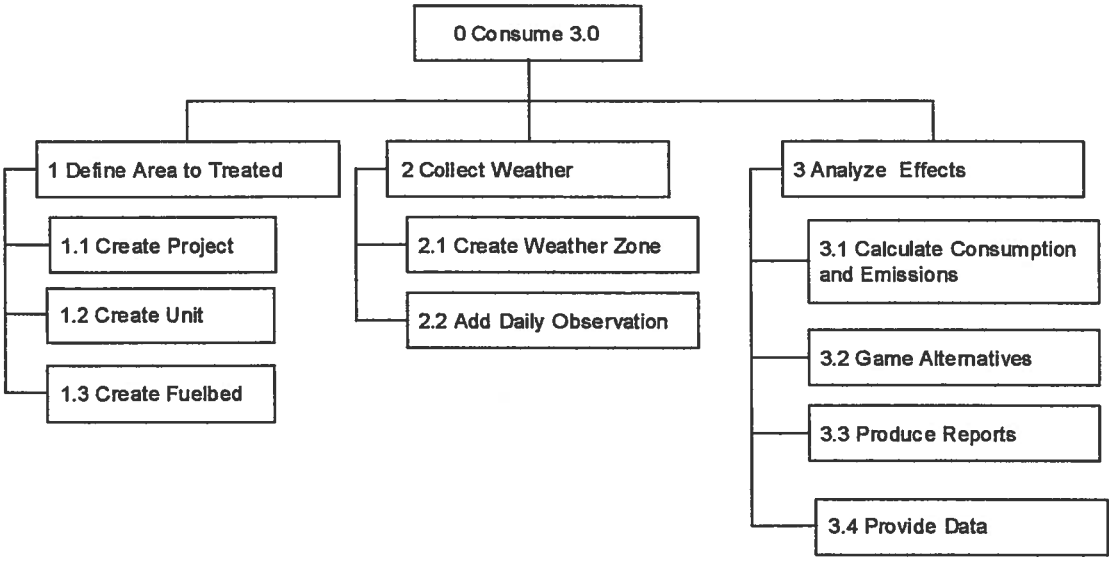
Completed Burn Event. An event where Land Manager has executed a prescribed fire and they need to estimate the actual fuel consumption and emissions.

Compliance Report Event. An event where a Regulator such as an air quality board requires information concerning emissions for a prescribed or wildland fire.

Report Request Event. An event where a Monitor such as Forest Service regional office requiring a report summarizing emissions for group of national forests.

Consume 3.0 Function Model

The following diagram depicts the basic functional elements of Consume 3.0. It represents a business view of what is done and not how it is done. It does not imply a sequence or implementing technology.



Function descriptions for the above diagram:

1. Define Area to Be Treated. A function to describe the area of vegetation to be treated by prescribed fire or involved in a wildfire.

1.1 Create Project. A process to identify the project (wildfire or prescribed fire) in terms of the responsible organization and other identifying information.

1.2 Create Unit. A process to associate discrete areas of prescribed fire or wildland fire with a project.

1.3 Create Fuelbed. A process to associate a distinct area of fuelbed characteristics within a unit.

2 Collect Weather. A function to collect weather to help predict the 1000 fuel moisture required for some Consume calculations.

2.1 Create Weather Zone. A process to identify a representative weather station for one or more prescribed fires or wildland fire units.

2.2 Add Daily Observation. A process to insert daily weather observations for a weather zone.

3 Analyse Effects. A function to compute consumption and emissions for a unit within a project and to produce reports and other outputs.

3.1 Calculate Consumption and Emissions. A process to compute the amount of fuel consumed and pollutants produce for a unit within a project.

3.2 Game Alternatives. A process to allow the systematic examination of a range of environmental conditions, fuelbed conditions or treatment alternatives for a unit within a project.

3.3 Produce Reports. A process to generate textual and graphical reports for projects and units.

3.4 Provide Data. A process to make data available to programs external to the Consume 3.0 application.

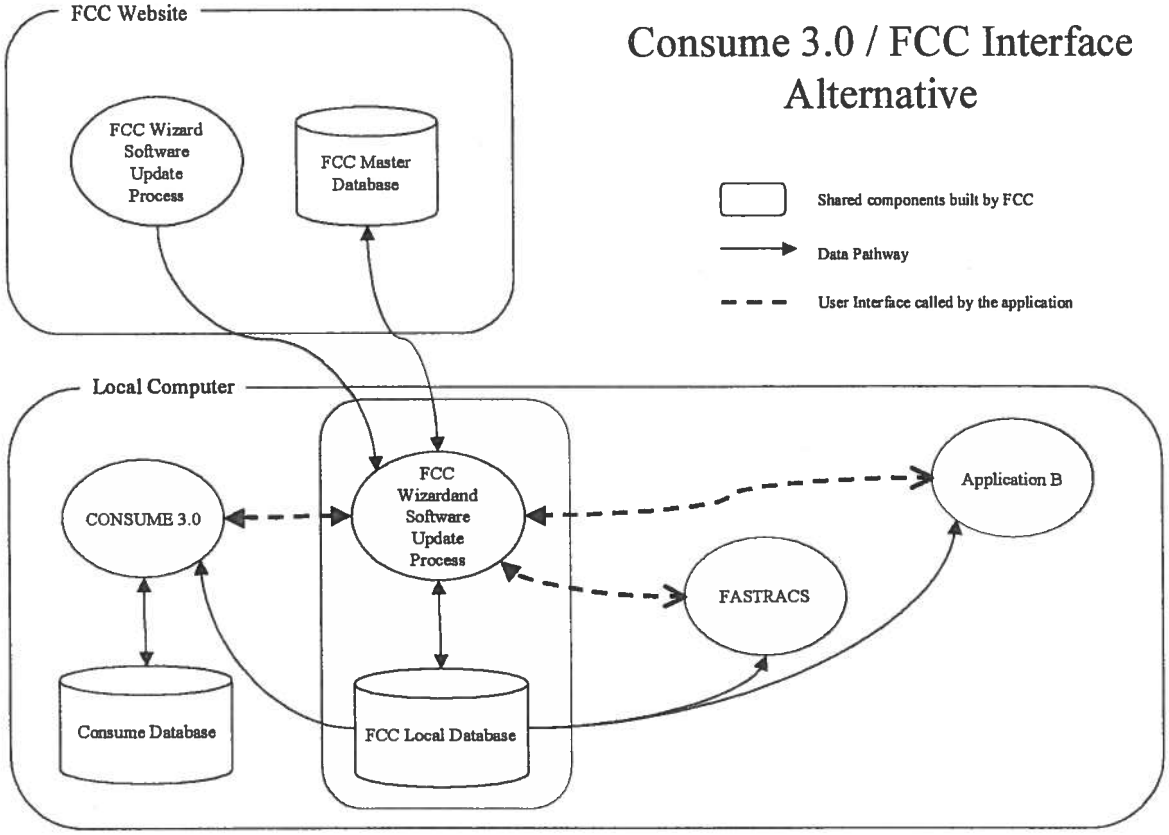
Consume 3.0 / FCC Interface

After looking at various alternatives for the Consume 3.0 to FCC system interface I developed a slightly different one than the one we discussed in Portland.

In the FCC design document they recommend a thin client solution. This means that all the user interfaces, programs, and data are located on a central web site. The user would access the FCC system via an internet browser. There are many advantages to this approach, however, it has one important shortcoming. If a user does not have internet connection capabilities such as in the field, they can not access the FCC system. This does not seem practical for Consume.

The approach I came up with provides a means to store FCC in a local database and provides a locally running FCC wizard that can either tap into the web-based database or the local database. The local PC based wizard would be eliminate the need for every application to build its own FCC interface and would provide a consistent interface. The alternative's key features are:

1) The FCC master database will be web based with exploration, browsing, updating, and exporting (text files) tools, all web based, for standalone use.
2) The FCC project will build a PC based wizard client and database to hold local FCCs for tightly coupled applications like Consume. The functions of this wizard will be:
   a) Select a local FCC through a wizard-like interface or analogous standard fuel model.
   b) Select and download a web-based FCC through a wizard-like interface or analogous standard fuel model.
   c) Select and download multiple web-based FCCs through a wizard-like interface.
   d) FCC data would be stored in a single (separate from Consume) local database, accessible by multiple local applications.
   e) Synchronize local FCCs with changes in the web FCC database.
   f) Automatically detect and update PC component software from the FCC website.

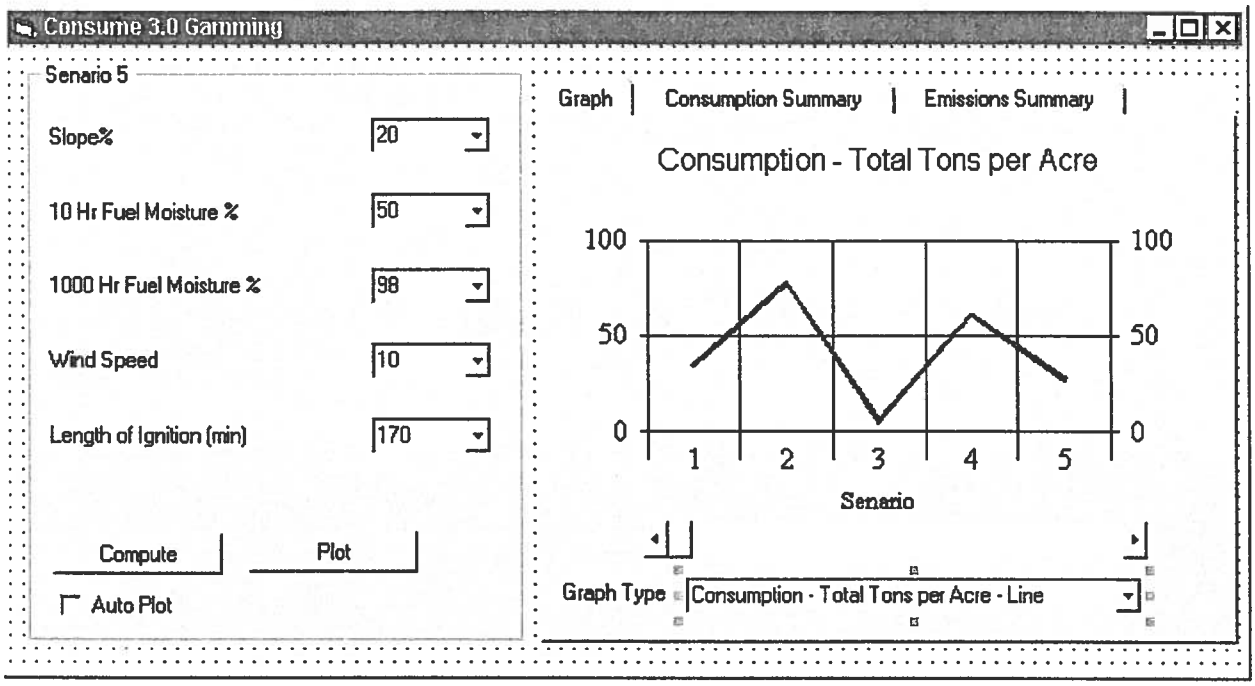

Consume 3.0 / FCC Interface Alternative
FCC Website
FCC Wizard Software Update Process
FCC Master Database
Shared components built by FCC
Data Pathway
User Interface called by the application
Local Computer
CONSUME 3.0
FCC Wizardand Software Update Process
Application B
FASTRACS
Consume Database
FCC Local Database

Other 3.0 Features

The following additional or enhanced features were identified for inclusion in Consume 3.0 at the requirement meetings of December 4 & 5, 2001.

Improved Gaming Support

Provide the user with the means to test various combinations of input parameters and see the immediate result of those parameters. The sample screen below depicts the principal concepts of a split gaming screen. Various input scenarios could be calculated and optionally plotted for comparison.



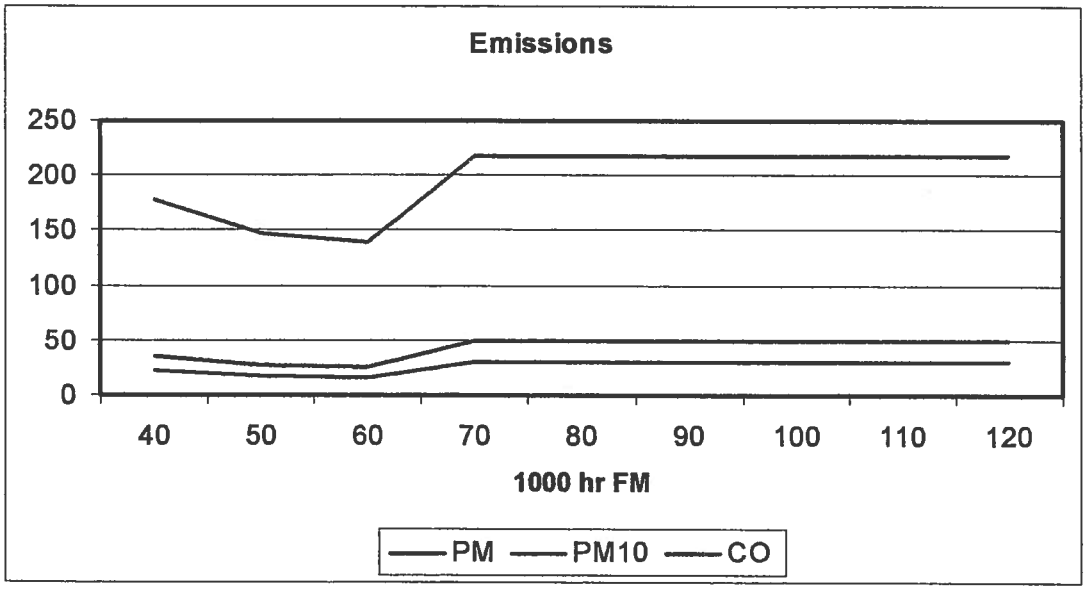
In addition, an improved reporting facility will allow the user to game a specific sequence of input parameters such as currently available in Consume 2.1, but would add graphing capabilities as a visualization aid.

Emissions by 1000 Hour Fuel Moisture

Report Date: 12/22/01

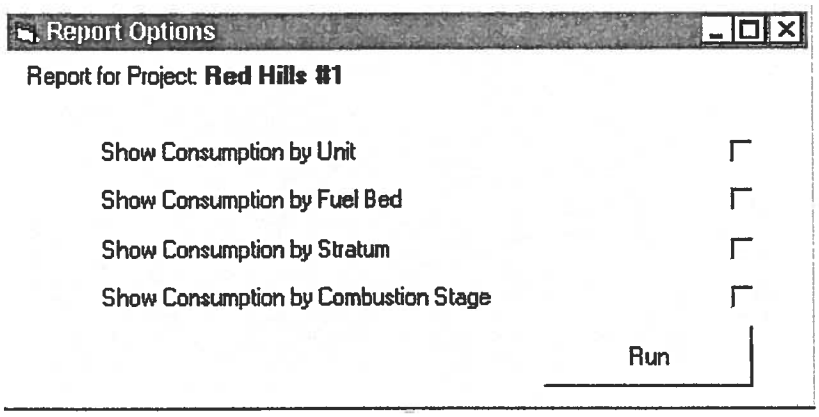
Unit: Example_Gold Ridge 2 **Unit/Permit #:** 1 **Date of Burn:** 7/17/00

1000 Hour FM (%)	Pollutant Emissions (tons)						
	PM	PM10	PM25	CO	CO2	CH4	NMHC
40	35.05	22.25	20.46	177.71	4,412.36	11.10	9.14
50	27.84	17.93	16.62	147.75	3,427.17	9.27	7.54
60	26.00	16.82	15.63	140.04	3,175.82	8.79	7.13
70	49.09	29.93	26.90	217.19	6,552.67	13.40	11.42
80	49.09	29.93	26.90	217.19	6,552.67	13.40	11.42
90	49.09	29.93	26.90	217.19	6,552.67	13.40	11.42
100	49.09	29.93	26.90	217.19	6,552.67	13.40	11.42
110	49.09	29.93	26.90	217.19	6,552.67	13.40	11.42
120	49.09	29.93	26.90	217.19	6,552.67	13.40	11.42



Improved Reports

In addition to the above gaming enhancements all non-gaming reports will display user inputs along with the output values. Reports will be capable of displaying a user selectable level of detail including output summaries by Project, Unit, or Fuelbed. Unit and Fuelbed level reports shall be capable of displaying outputs by combustion stage and by Fuelbed Strata (see below example). Also, the ability to add and print user notes will be implemented.



Metric/English Units

A user will be able to enter and display data in either metric or English units of measure. A default option for new projects can be set in the Preferences screen. In addition, units of measures can be changed dynamically for existing projects.

Improved User Aids

In addition to the online help system other mechanisms shall be used to assist the user. This will include "tool tips" for every control, clearly worded labelling and on screen instructions, and the use of mini wizard or helper tools where appropriate.

Preferences and Localization

Consume 3.0 will provide a preferences screen that will allow the user to define defaults for certain inputs such as organization name, organization id, units of measure, etc. In addition, a mechanism to alter Consume 3.0 inputs based on a geographic region should be investigated. All of these features are designed to make the use of Consume as easy as possible.

GIS Support

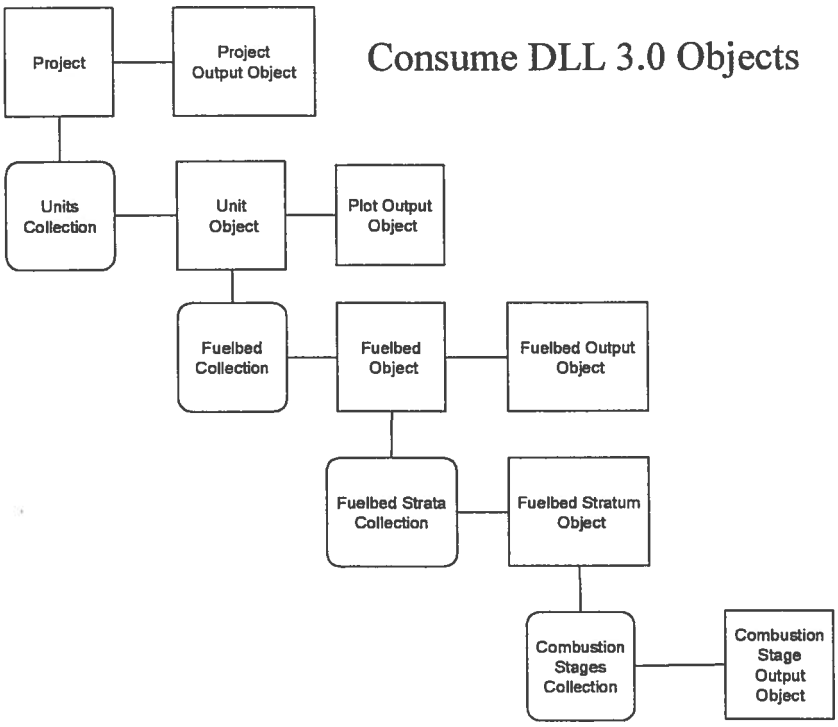
Consume 3.0 will not provide direct support for GIS, instead it will provide mechanisms that will allow GIS applications to access the Consume database or the Consume computational library (Consume.dll). In order to facilitate this GIS support Consume 3.0 will provide:

1. Testing of the Consume.dll for GIS support as part of the Consume 3.0 development.
2. Documentation for use of the Consume.dll that is targeted at GIS users.
3. Organization, Project, and Unit identifiers that can be used as GIS layer tags.

Consume 3.0 DLL Component

The Consume 3.0 computational library (Consume.dll) shall contain all computational elements for the calculation of fuel consumption and emissions. Consume.dll is a shared component used by other applications such as FASTRACS. This product was introduced with Consume 2.1 and will need to undergo many changes for version 3. Among the many changes are:

1. Removal of FCC wizard and pile wizard. These wizards will be provided by the new FCC system.
2. Removal of all direct connections to the MS Access database. This will provide greater flexible for users of the Consume.dll.
3. Inclusion of new consumption and emission algorithms.
4. Treatment of Consume.dll as a distinct and key product.
5. Improved developer documentation and support.
6. Implementation of a new object model that will include the use of collections to create a robust relational structure. The following diagram illustrates the Consume 3.0 object model.



Data Migration Utility 2.1 to 3.0

If possible Consume 3.0 will provide a mechanism to convert data from the present Consume 2.1 format. The feasibility of this feature will be assessed toward the later stages of Consume 3.0 construction.

Consume 3.0 Tutorial

An online tutorial will be provided in lieu of formal classroom training for Consume 3.0. The tutorial will supply case studies along with accompanying text and graphics.

Improved Help System

The Consume 3.0 help system will be implemented using Windows HTML help or Winhelp. This will allow the user to browse by contents or index and perform keyword searches. In addition, each Consume 3.0 screen will have context sensitive help that will take the user into the section of the help system specific to that screen.

Improved Web-based Support

A Consume 3.0 and Consume DLL website will be established that includes:

- A summary of capabilities and uses of each product.
- Notification of available downloadable updates and support files.
- A list of reported problems and fixes.
- Contact information and process for reporting problems and getting additional help.

Features and ideas deferred to Consume 4.0

- Inclusion of Brazilian data
- Palm computer version
- Capability to have Consume suggest fuel moisture to achieve desired results.
- Apply factor to outputs based on percent burnt
- Crown stratum outputs.

Other Issues

1. Output of EPA required components.
2. Standardization of data elements with Behave Plus, etc.
3. Regional haze outputs.
4. EPM linkage

Conceptual Framework for Consume 3.0

Questions and other Notes

26 December 2001

The purpose of this document is to raise questions related to the design of Consume 3.0. As you review please also note any omissions or new ideas. I have arranged my notes by the sections of the Conceptual Framework document.

Consume 3.0 Conceptual Data Model

1) Note: I have used labels like Unit, Fuelbed, etc. Because they are generic and they seem to be the best fit. They are also used in most of the FCC documentation. From a system design point of view it will be easier to use simple (ie: Project) vs. compound labels (ie: Project/Incident).
2) Note: Wildfires are synonymous with project and not Unit.
3) Question: Should weather be associated with a project or unit? I choose unit since you could have units of the same project that are in different weather zones.
4) Question: Will piles be incorporated in the FCCs? This is what the data model reflects. If not then I will need to add another entity and modify the model.
5) Question: How will output be stored at the Combustion Stage and Fuelbed Stratum level? In the paper Roger gave me from March 2001 there is overlap between the two (figure 2). For example if x amount of PM 10 is produced from the woody fuel stratum how is the total amount divided into surface and smoldering stage from a this specific stratum? The model I drew has the relationship of one or more combustion stages for each fuelbed stratum. This means the combustion stage is where emissions and consumption data is stored.
6) Question: Is the relationship Fuelbed Stratum to FCC correct?
7) Question: Will wildfires be accommodated in 3.0 and how will it effect the data model?

Functional Model

1) Question: Will weather be used and handled the same as in Consume 2.1?
2) Question: Function 1.3: How will fuelbed characteristics (fuel loadings) input parameters be handled? This is a complicated issue so I will attempt to explain it better by posing more detailed questions:

> A) Will the current 2.1 list of fuel loading parameters be used for the new algorithms? What about piles?
> B) If outputs are to be produced for each fuelbed stratum won't the user need to specify loadings by stratum either by using an FCC or manual input?
> C) If the user does not use the FCCs to populate each stratum's loadings then the user will need to enter data for each stratum. Right now in 2.1, loadings are only

entered for the aggregate of all strata. We will need separate input screens for each stratum type. Is this what you want?
D) How do piles figure into this? Will we need separate screens if a user enters the data manually?
C) Will the FCC system handle piles or will we need to retain something like the current 2.1?

Consume 3.0/FCC Interface

1) Is it possible to influence the development of the FCC system to fit the new interface model if it is what you want?
2) What is the status of the prototype?
3) There is decision needed on this or another alternative as it greatly effects what is to be built by the Consume 3.0 project team and thus the design of 3.0 This alternative puts more work into the FCC camp but reduces work to Consume and other applications that will use the FCC system in the future

Other Features

Gaming

1) What gaming options do you want (inputs – left side and outputs – right side)?
2) What are the specific inputs and outputs (text and graphs) are needed for each option?

Reports

1) What standard reports are to be included in 3.0?
2) Should graphs be a separate report type or part of the standard report?
3) What types of graphs are needed? What should be plotted?
4) Should we include the ability to build custom reports and graphs?