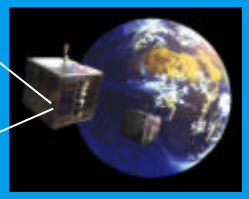

A Pilot Space Weather Service Employing SHAFT

Simon Clucas, David Rodgers and Keith Ryden,
Space Weather Workshop, ESTEC
3-5 November 2003

QinetiQ

Contents

1. Project Rationale
2. Background
3. Web Application screenshots
4. Other Issues

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Section 1

Project Rationale

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Section 1 – Project Rationale

Awareness of the problem

- Increasing awareness of the role of space weather on the performance of technological systems in space and on Earth and of its effects on human health
- Of the four main hazards to satellites (Single Event Effects, Surface charging, Total dose and Internal Dielectric Charging (IDC)), IDC is a significant hazard facing satellite engineers and operators in our experience
- Need for a co-ordinated European System which, along with all hazards, deals with IDC

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Section 1 - Project Rationale

Initial User requirements

- We have found that the main requirements for users are:
  - Diagnostics
  - Short-term forecasting
  - Effective information delivery
- Physical modelling is not at a stage where it can provide useful real-time forecasts, but accurate short-term forecasts can provided using numerical techniques
- We are collaborating with two users; the Paradigm and NewSkies NV. They have agreed to use produce user requirement and use the subsequent service

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Section 2

Background

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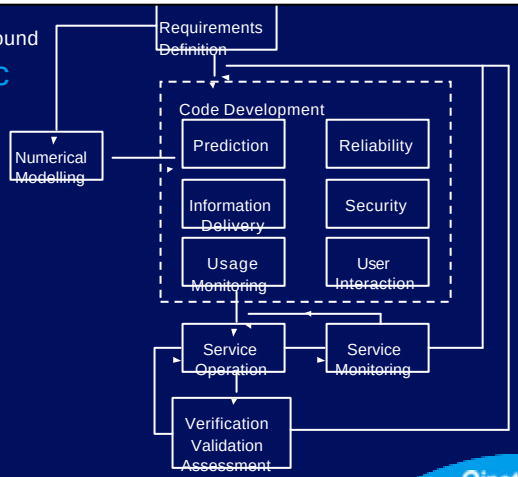
Section 2 Background

Study Logic



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Section 2 - Background

GEOSHAFT

(GEO Spacecraft Hazard and Anomaly Forecasting Tool)

- GEOSHAFT is a Java-based modular service designed to provide real-time space radiation threat information
- GEOSHAFT acts as an expert system, so as well as collecting data it performs processing and applies user-defined rules to determine hazardous conditions.
- GEOSHAFT modules include DICTAT, FORECAST, ANOMALY, and ALERT. But more can be added.
- GEOSHAFT can deliver different alerts and forecasts to different users via e-mails, faxes, SMS or a client viewer

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Section 2 - Background

DICTAT

- DICTAT is a module to determine the IDC hazard assessment, due to outer belt variability
- DICTAT calculates the electric field and charging current within a shielded dielectric. All aspects of the model can be controlled by the user via the web application, or they can opt to run with defaults.
- DICTAT interfaces with a materials database to allow many materials to be used in the calculations.

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Section 2 - Background

FORECAST

- The forecast module uses time-series analysis codes and radial basis function neural network algorithms to produce non-linear forecasting models.
- Many models can be compared and the best model used
- Models can constantly re-train on new data
- Once the service has been operating for a while, these models should get better

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Section 2 - Background

ALERT

- GEOSHAFT uses user defined thresholds attached to any of the service outputs, such as electron fluence or electric field, to alert the user.
- Alerts can be either FAX, email, SMS or via a client viewer.
- Alerts can be triggered for various reasons, i.e. going above a threshold, being above a threshold for more than a certain period of time etc.

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Section 2 - Background

ANOMALY

- The ANOMALY module will allow users to enter anomaly information which will then be referenced to corresponding environment conditions and internal charging levels.
- A profile can be built up and used to supply anomaly probabilities to users based on current and future radiation environments.
- All anomaly information will be stored encrypted for confidentiality.

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Section 2 - Background

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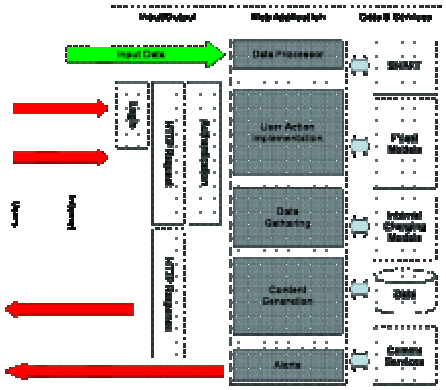
Overview of the Service



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Section 3

The Web Application

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- Typical numerical output from GEOSHAFT
- All aspects of the users display can be customised

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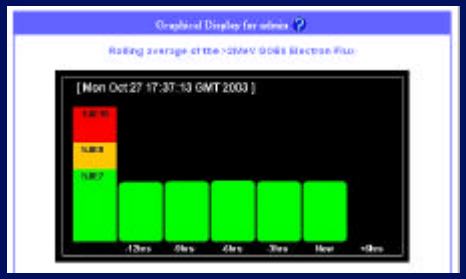

- Typical graphical output from GEOSHAFT
- Many different graphical representations can be selected to suit the user

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Section 4

Other issues

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Public/Customised Access

- Content managed web site (portal) consisting:
  - General public area
    Most information will be available along with interesting resour ces and links
  - Registered user area (username, password, email only)
    Same information but with user customised content and information alerting, i.e. users can decide what information they want to see and what information they want to be alerted about
  - Administration and monitoring area
    Area to allow administration of the site along with feature to allow the monitoring of SHAFT and server performance

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Integration and Interaction with SWENET

- Currently the service is configured as a stand alone site
- However, all presentation of content is controlled using style sheets etc, so can easily be configured to fit in with other frameworks

Evaluation

- Evaluation of data and benefits will be publicly available on the study web site

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Section 4 - Other issues

Status of Project

- Two users have been consulted regarding user requirements, and a protocol has been established to allow smooth interaction.
- A prototype is available to the users to determine any additional user requirements once they have had chance to sue the service.
- Moving onto the numerical modelling and code development

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