mapped landmarks generated per image allow for automatic detection and elimination of bad matches. Atti-
titude and position can be generated from each image; this image-based atti-
titude measurement can be used by the onboard navigation filter to improve the attitude estimate, which will im-
prove the position estimates.

The algorithm uses normalized cor-
relation of grayscale images, producing
precise, sub-pixel images. The algo-

rithm has been broken into two sub-al-
gorithms: (1) FFT Map Matching (see figure), which matches a single large template by correlation in the fre-

quency domain, and (2) Mapped Land-
mark Refinement, which matches many small templates by correlation in the spatial domain. Each relies on feature

selection, the homography transform, and 3D image correlation. The algo-

rithm is implemented in C++ and is

rated at Technology Readiness Level

(TRL) 4.

This work was done by Andrew Johnson,
Adnan Ansar, and Larry Matthies of Caltech

for NASA's Jet Propulsion Laboratory. Fur-
ther information is contained in a TSP (see

page 1).

The software used in this innovation is
available for commercial licensing. Please

contact Karina Edmonds of the California
Institute of Technology at (626) 395-2322.
Refer to NPO-44463.

WMAP C&DH Software

Goddard Space Flight Center, Greenbelt, Maryland

The command-and-data-handling

(C&DH) software of the Wilkinson Mi-

crowave Anisotropy Probe (WMAP)

spacecraft functions as the sole inter-

face between (1) the spacecraft and its

instrument subsystem and (2) ground

operations equipment. This software in-

cludes a command-decoding-and distri-

bution system, a telemetry/data-hand-

ling system, and a data-storage-and-playback system. This software performs onboard processing of attitude sensor data and generates

commands for attitude-control actu-

ators in a closed-loop fashion. It also

processes stored commands and moni-

tors health and safety functions for the

spacecraft and its instrument subsys-

tems. The basic functionality of this soft-

care is the same of that of the older

C&DH software of the Rossi X-Ray Tim-

ing Explorer (RXTE) spacecraft, the

main difference being the addition of

the attitude-control functionality. Pre-

viously, the C&DH and attitude-control

computations were performed by differ-

ent processors because a single RXTE

processor did not have enough process-

ing power. The WMAP spacecraft in-

cludes a more-powerful processor capa-

ble of performing both computations.

This program was written by Alan Cud-

more, Tim Leath, Art Ferrer, Todd Miller,

Mark Walters, Bruce Savadkin, and Ji-Wei

Wu of Goddard Space Flight Center; Steve

Siegel of Duedalian Systems Corp.; and Emory

Stagner of Litton/PRC. Further information is

contained in a TSP (see page 1).

GSC-14964-1

Web-Based Environment for Maintaining Legacy Software

Lyndon B. Johnson Space Center, Houston, Texas

“Advanced Tool Integration Envi-

ronment” (“ATIE”) is the name of both a

software system and a Web-based envi-

ronment created by the system for main-

taining an archive of legacy software and

expertise involved in developing the legacy software. ATIE can also be used in

modifying legacy software and develop-

ing new software. The information that

can be encapsulated in ATIE includes

experts’ documentation, input and out-

put data of tests cases, source code, and

compilation scripts. All of this informa-

tion is available within a common envi-

ronment and retained in a database for

case of access and recovery by use of

powerful search engines. ATIE also ac-

 commodates the embedment of sup-

porting software that users require for

their work, and even enables access to

supporting commercial-off-the-shelf

(COTS) software within the flow of the

experts’ work.

The flow of work can be captured by

saving the sequence of computer pro-

grams that the expert uses. A user gains

access to ATIE via a Web browser. A

modern Web-based graphical user inter-

face promotes efficiency in the retrieval,

execution, and modification of legacy

code. Thus, ATIE saves time and money

in the support of new and pre-existing

programs.

This program was written by Michael

Tigges of Johnson Space Center; Nelson

Thompson, Mark Orr, and Richard Fox of

Dynacs, Inc.; and Rich Rohan of Lockheed

Martin Corp. Further information is con-

tained in a TSP (see page 1).

MSC-23810-1

Information Metacatalog for a Grid

Ames Research Center, Moffett Field, California

SWIM is a Software Information

Metacatalog that gathers detailed in-

formation about the software compo-

nents and packages installed on a grid

resource. Information is currently

gathered for Executable and Linking

Format (ELF) executables and shared

libraries, Java classes, shell scripts, and

Perl and Python modules. SWIM is

built on top of the POUR framework,

which is described in the preceding ar-

ticle. SWIM consists of a set of Perl

modules for extracting software infor-

mation from a system, an XML schema

defining the format of data that can

be added by users, and a POUR XML

configuration file that describes how

these elements are used to generate pe-