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# An alternative language for astronomical computation

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**F**or many years, magazines like *Sky & Telescope* and *Astronomy* have included BASIC listings with astronomical computation articles. Many people, myself included, have gained insights into astronomical phenomena through such programs because of their ability to simulate, predict, and aid visualisation.

An April 1996 *Sky & Telescope* article cited various reasons why BASIC is still the right choice for such articles, including the ubiquity of BASIC interpreters and the simplicity of the language. They quote John M. A. Danby who they suggest: ...probably made the best case for BASIC in his book *Fundamentals of Celestial Mechanics* (2nd edition, Willmann-Bell, 1988):

*"My choice of BASIC as the language for program listing will also be controversial. I am looking for maximum understanding: any programmer can follow BASIC, even if he or she will not admit to using it."*

The author of the article, Stuart Goldman, goes on to say that while not all machines come with BASIC interpreters these days (eg. Macintosh), you can download free implementations, and that while line-numbered BASIC is not the norm in recent dialects (eg. Visual BASIC), this is the lowest common denominator, and is easy to understand.

I want to suggest that there is a suitable alternative to BASIC for the purpose cited above. Now, I have a soft spot for BASIC and between 1991 and 1996 I developed a freeware Amiga BASIC compiler (see <http://www.adelaide.net.au/~dbenn/>). But to quote Alan Kay, Apple Fellow and inventor of the SmallTalk programming language: "Languages should not hinder progress by outliving their usefulness". I do not wish here to embark upon a critique of BASIC or any other language. Rather, my primary concern is with the ease of dissemination of astronomical program code.

Every computer user who has either Netscape Navigator/Communicator or Internet Explorer also has access to the language I'm thinking of, and no, I don't mean Java. I'm referring to **ECMAScript**. You are more likely to have heard of JavaScript (Netscape) or JScript (Internet Explorer).

ECMAScript is the result of a standard (ECMA-262) based upon a common subset of JavaScript and JScript. ECMAScript programs are embedded within special tags in the HTML code of a web page and are interpreted by the browser. Just as you don't need to be online to edit and view HTML files, ECMAScript programs can be created and run while offline. Internet Explorer 4.0 and Netscape 4.5 are fully ECMA-262 compliant (Flanagan 1998), but many scripts are compatible with earlier versions of these web browsers.

ECMAScript programs have access to all the components of such a page, eg. form fields. It adds some dynamic capabilities to HTML, permitting for example, checking of form

field entries before submission, generation of a form component with the appropriate number of days for the current month, generating a different advertisement image upon each access to a page. ECMAScript is however a general purpose language. It is executed on the client side (your computer) unlike CGI programs which must talk to the remote server, which means no network delays. HTML and ECMAScript make it possible to perform arbitrary computations and to easily create a graphical user interface as a front-end to a program.

At the May 1999 General ASSA meeting, Kym Thalassoudis mentioned the popularity of member Ronald W. Mallen's Easter Dating web page. I have converted a BASIC program—written by Greg Mallen—found on that page (<http://www.assa.org.au/edm.html#Computer>) to ECMAScript. Indeed, this could be added as an extra section to Ronald's page. I also recently converted a BASIC Terrestrial Crater Impact Dimension program from *Sky & Telescope's* web site (<http://www.skypub.com/resources/software/basic/basic.html>) to ECMAScript.

Rather than waste Bulletin space with program listings, I suggest pointing your web browser to <http://www.adelaide.net.au/~dbenn/docs/projects.html> and seeing these and other scripts in action for yourself. Netscape and Internet Explorer allow you to view the source of any web page, including embedded JavaScript, via their View menus.

What are the problems associated with using ECMAScript? It has no graphics capability, although with later versions of the browsers it is possible to communicate with a Java applet which can display graphics. There is no file access (except in JScript version 5.0), motivated by the risk of web-based code damaging local files. However, many astronomical programs found on the *Sky & Telescope* site do not require either files or graphics. There is no equivalent of BASIC's PRINT USING command, but JavaScript's Perl-like regular expressions could help here. BASIC has existed for 30 years in some form, while ECMAScript has only been around for a few years.

In its favour, there are at least standards-conforming implementations in place. Even though a BASIC ANSI standard has been available for many years, it has rarely been adhered to by BASIC implementors.

My feeling is that the programs presented by *Sky & Telescope* and other magazines may be more useful on the web than as BASIC listings for which an interpreter or compiler may or may not be readily available. Perhaps ECMAScript versions could be offered in addition to these. An ECMAScript program is just a mouse click or three away, can be used immediately, and comes with the source code, all in one neat package. The only requirement is that the user has Netscape or Internet Explorer, both freely available. Alternatively, a free ECMAScript interpreter can be

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obtained from the Net. This is written in Java so will run on any platform with a Java interpreter. See Lugin in the list of references below.

Other alternatives to ECMAScript exist. VBScript is a BASIC scripting language which runs only under Internet Explorer. ActiveX, like Microsoft's VBScript is not a cross platform solution. Scripting languages such as Perl and Python are available for all major platforms (Windows, Macintosh, Unix, etc), but must be downloaded from the Net.

Java is more than suitable as a general purpose programming language, is freely available for the major platforms and produces ordinary applications or applets that can run within a web page. However, the learning curve is far steeper than for ECMAScript, download times for web pages with embedded Java applets can be long, integration with web page components (eg. forms) is minimal, one must endure the edit-compile-run cycle which is slower than a scripting language's edit-run cycle, and it is overkill for some applications. For anything non-trivial however, Java is a great choice. Recall however that the goal is to cater for as many systems as possible. Everyone has a browser, and most people have either Netscape or Internet Explorer, so access to ECMAScript. If not, they're freely available from the Net or various CD ROMs.

For programming paradigm buffs: unlike Java, ECMAScript is not object-oriented, but object-based. So while objects are the focus, there is no facility for inheritance, although this is unnecessary for numerical computation programs.

If anyone is interested in learning ECMAScript or has ideas for its application, I'd be happy to assist. I'd also be happy to write more articles on this and related topics.

### **References and Further Reading**

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