

**Contributors guide
to**

BRLCAD



1. A CALL TO ARMS (AND CONTRIBUTORS).

"THE FUTURE EXISTS FIRST IN THE IMAGINATION, THEN IN THE WILL, THEN IN REALITY." - MIKE MUUSS

Welcome to BRL-CAD! Whether you are a developer, documenter, graphic artist, academic, or someone who just wants to be involved in a unique open source project, BRL-CAD has a place for you. Our contributors come from all over the world and use their diverse backgrounds and talents to help maintain and enhance one of the oldest computer-aided design (CAD) packages used in government and industry today.

WHAT IS BRL-CAD?

BRL-CAD (pronounced **BE-ARE-EL-CAD**) is a powerful, cross-platform, open source solid modeling system that includes interactive three-dimensional (3D) solid geometry editing, high-performance ray tracing support for rendering and geometric analysis, network-distributed framebuffer support, image and signal-processing tools, path tracing and photon mapping support for realistic image synthesis, a system performance analysis benchmark suite, an embedded scripting interface, and libraries for robust high-performance geometric representation and analysis.

For more than two decades, BRL-CAD has been the primary solid modeling CAD package used by the U.S. government to help model military systems. The package has also been used in a wide range of military, academic, and industrial applications, including the design and analysis of vehicles, mechanical parts, and architecture. Other uses have included radiation dose planning, medical visualization, terrain modeling, constructive solid geometry (CSG), modeling concepts, computer graphics education and system performance benchmark testing.

BRL-CAD supports a wide variety of geometric representations, including an extensive set of traditional implicit "primitive shapes" (such as boxes, ellipsoids, cones, and tori) as well as explicit primitives made from collections of uniform B-spline surfaces, non-uniform rational B-spline (NURBS) surfaces, n-manifold geometry (NMG), and purely faceted polygonal mesh geometry. All geometric objects may be combined using boolean settheoretic CSG operations such as union, intersection and difference.

Overall, BRL-CAD contains more than 400 tools, utilities, and applications and has been designed to operate on many common operating system environments, including BSD, Linux, Solaris, Mac OS X, and Windows. The package is distributed in binary and source code form as Free Open Source Software (FOSS), provided under Open Source Initiative (OSI) approved license terms.

BRL-CAD was originally conceived and written by the late Michael Muuss, the inventor of the popular PING network program. In 1979, the U.S. Army Ballistic Research Laboratory (BRL) (the agency responsible for creating ENIAC, the world's first general-purpose electronic computer in the 1940s) identified a need for tools that could assist with the computer simulations and analysis of combat vehicle systems and environments. When no existing CAD package was found to be adequate for this specialized purpose, Mike and fellow software developers began developing and assembling a unique suite of utilities capable of interactively displaying, editing, and interrogating geometric models. Those early efforts subsequently became the foundation on which BRL-CAD was built.

HISTORY AND VISION

Development of BRL-CAD as a unified software package began in 1983, and its first public release came in 1984. Then, in 2004, BRL-CAD was converted from a limited-distribution U.S. government-controlled code to an open source project, with portions licensed under the LGPL and BSD licenses.

Today, the package's source code repository is credited as being the world's oldest, continuously developed open source repository. As a project, pride is taken in preserving all history and contributions.

The ongoing vision for BRL-CAD development is to provide a robust, powerful, flexible, and comprehensive solid modeling system that includes:

- Faithful high-performance geometric representation.
- Efficient and intuitive geometry editing.
- Comprehensive conversion support for all solid geometry formats.
- Effective geometric analysis tools for 3D CAD.

KEY STRENGTHS

All CAD packages are not alike. Among the many strengths of the BRL-CAD package are the following:

- BRL-CAD is **open source!** Don't like something? You can make it better.
- You can leverage **decades of invested development**. BRL-CAD is the most feature-filled open source CAD system available, with hundreds of years time invested.
- **Your work will get used**. BRL-CAD is in production use and downloaded thousands of times every month by people all around the world.
- You have the ability to create extensively **detailed realistic models**.
- You can model objects on scales ranging from (potentially) the subatomic through the galactic, while essentially providing **all the details, all the time**.
- You can leverage **one of the fastest** raytracers in existence (for many types of geometry).
- You can convert to and from a wide range of **geometry file formats**.

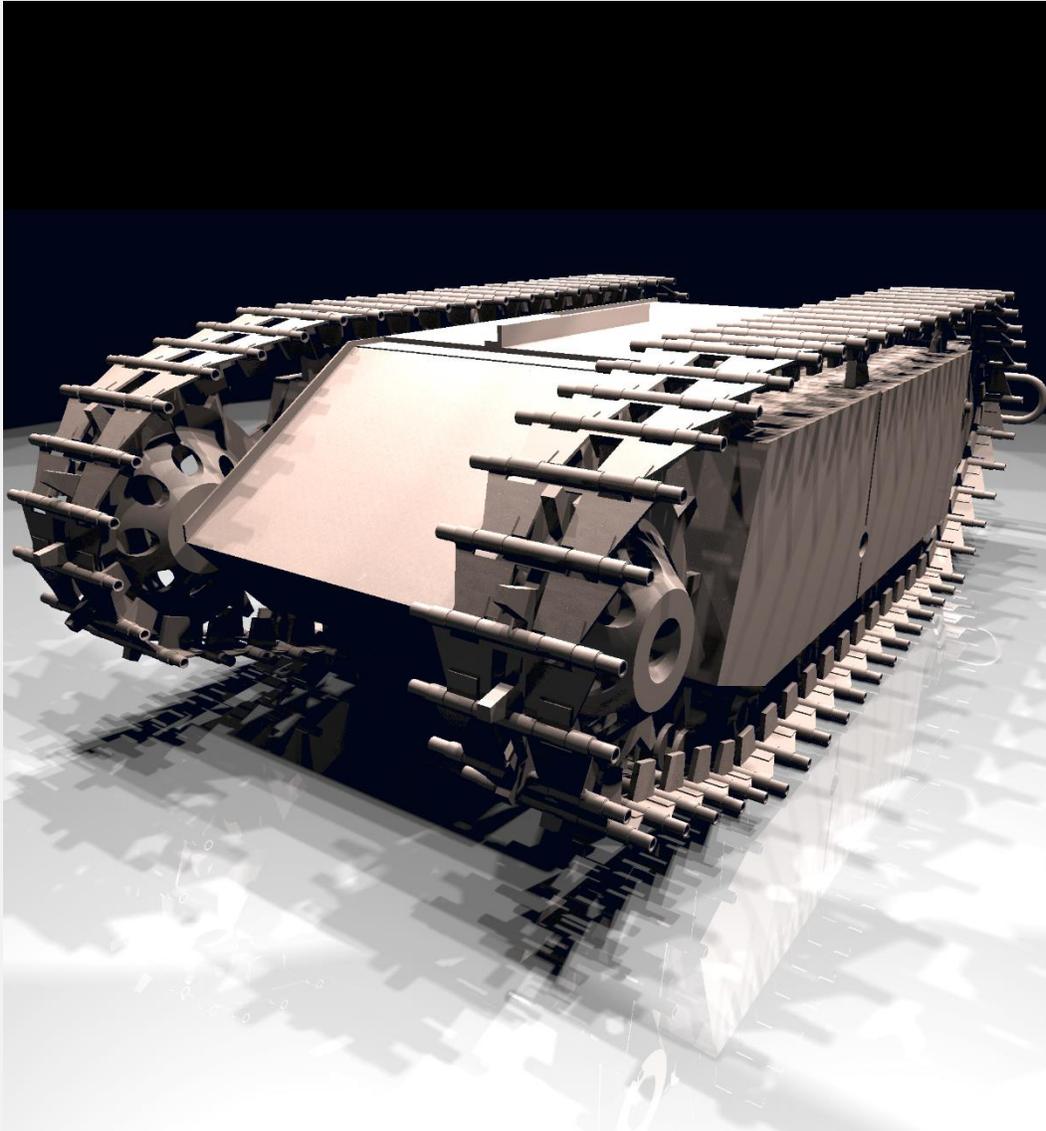
BRL-CAD has a powerful, **customizable scripting interface** with many advanced editing and processing.

2. FEATURE OVERVIEW

BRL-CAD has thousands of distinct features that have been developed over a number of decades. One strength of a solid modeling system with integrated high-performance rendering is the ability to showcase some of those features graphically.

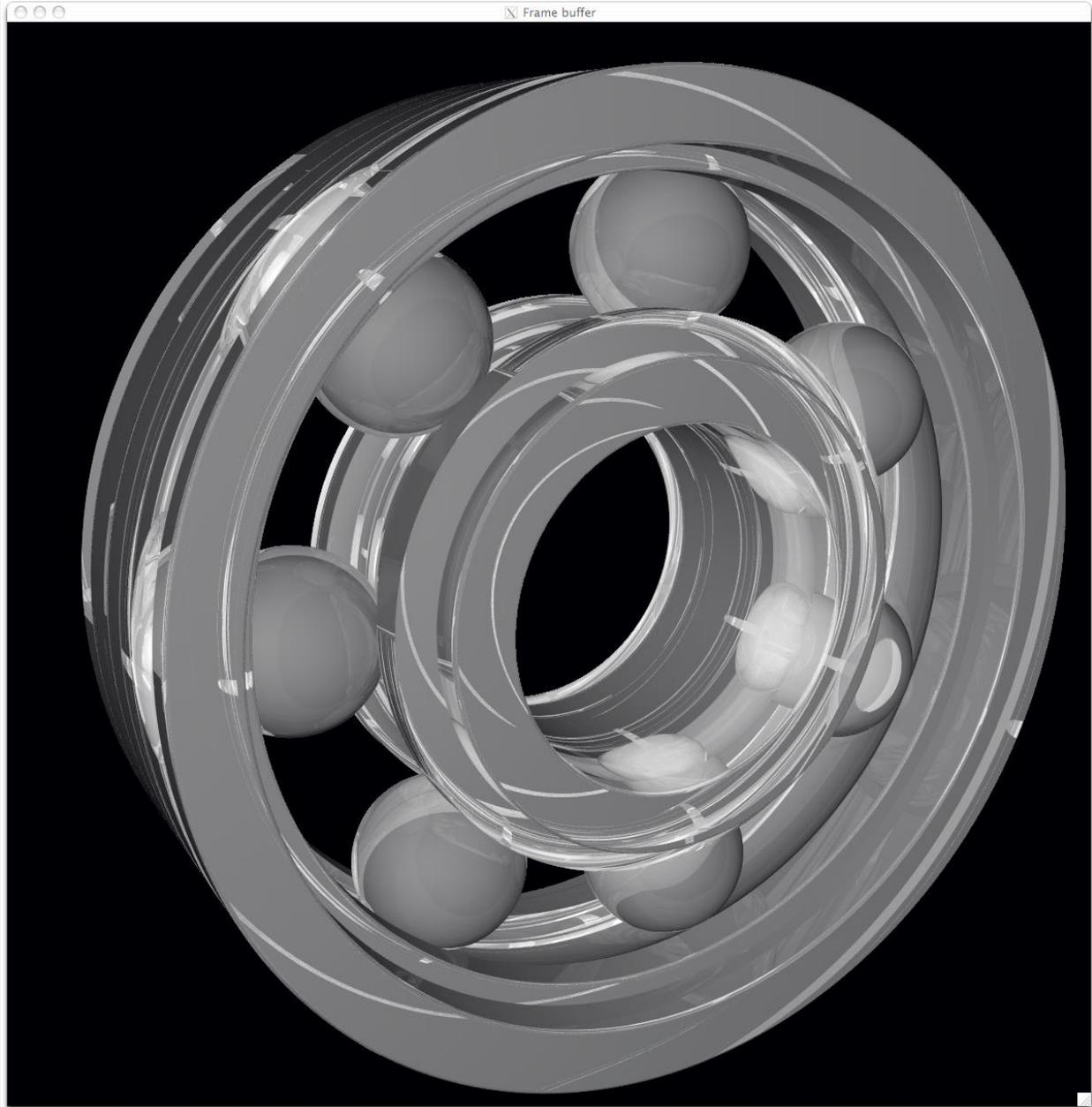
Let's take a quick look at just some of the high-level features provided by BRL-CAD.

SOLID GEOMETRY

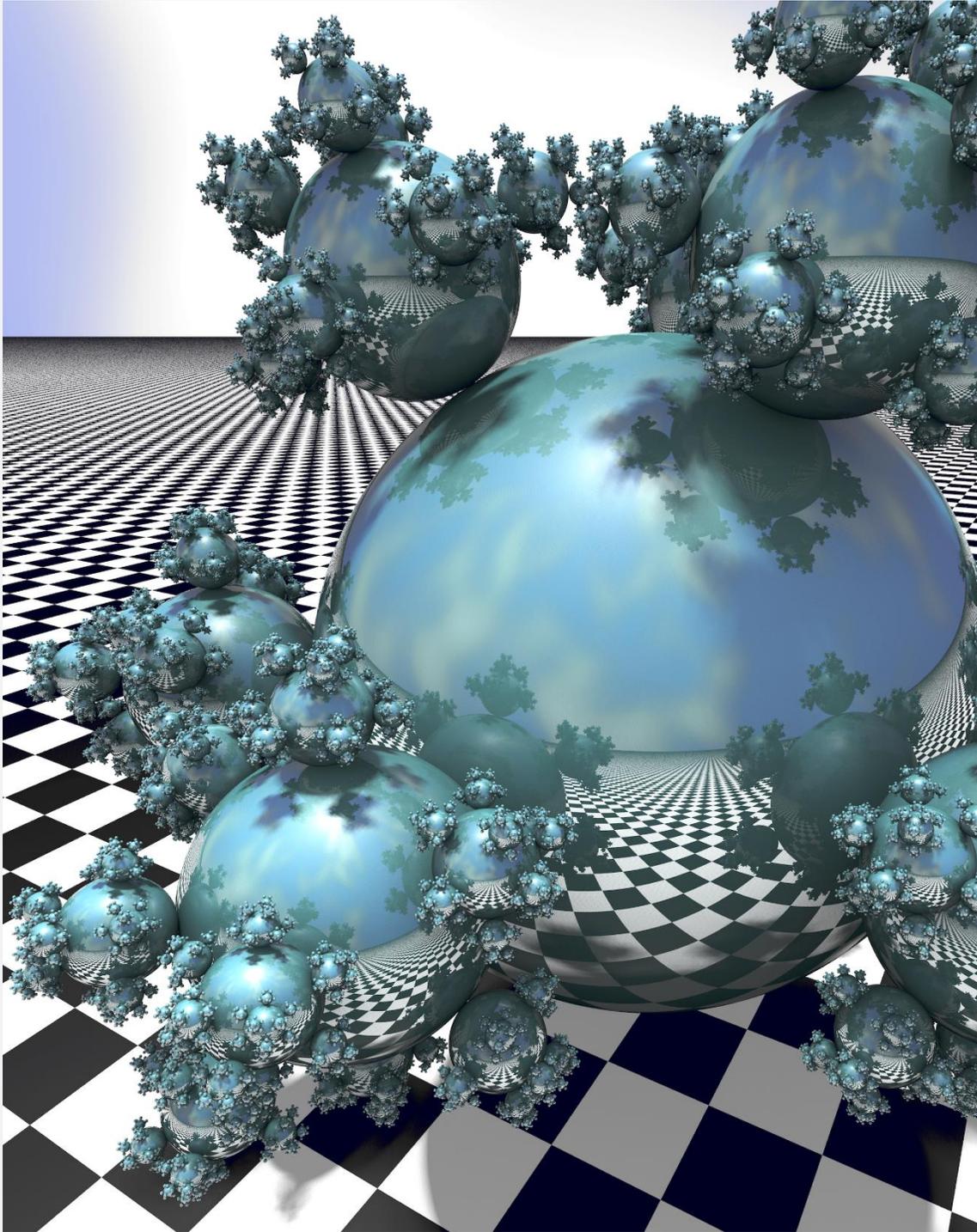


BRL-CAD focuses on solid modeling CAD. Solid modeling is distinguished from other forms of geometric modeling by an emphasis on being physically accurate, fully describing 3D space. Shown is a 3D model of a Goliath tracked mine, a German-engineered remote controlled vehicle used during World War II. This model was created by students new to BRL-CAD in the span of about 2 weeks, starting from actual measurements in a museum.

RAYTRACING

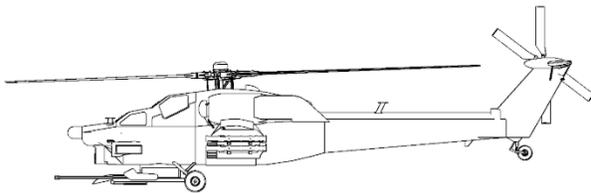
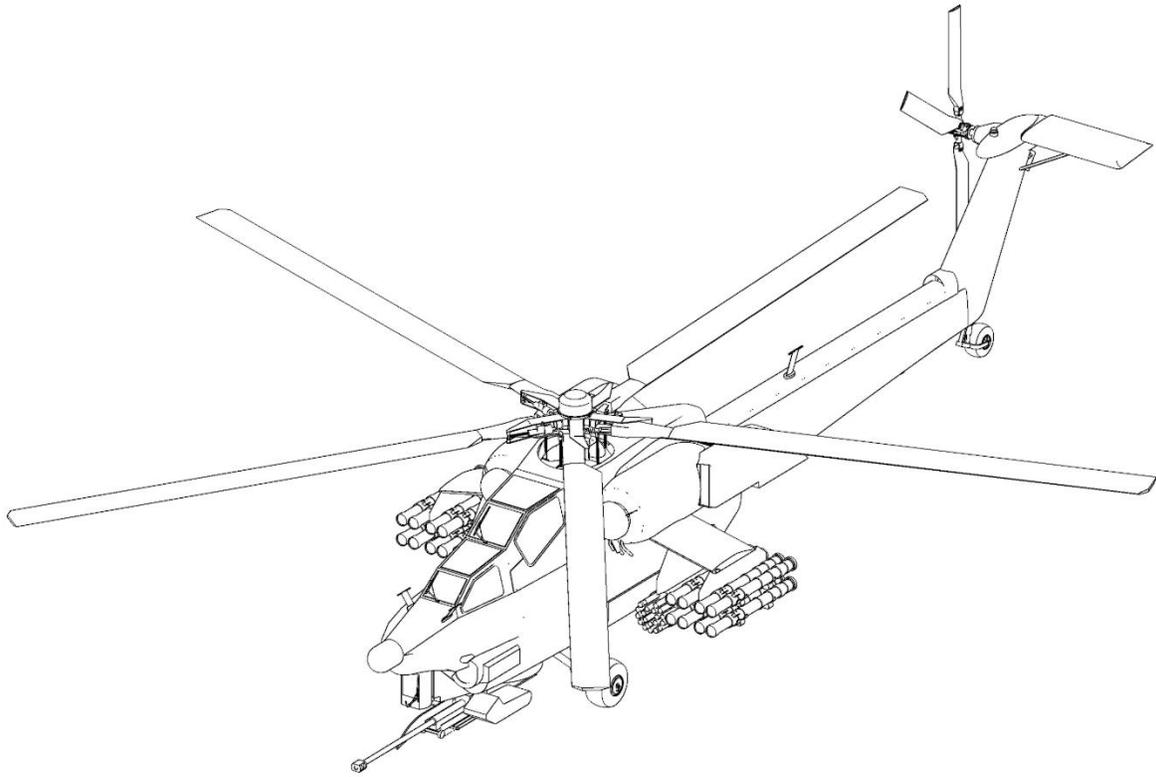


Raytracing is central to BRL-CAD as a means for performing geometric analysis (e.g., calculating weights and moments of inertia) and for rendering images for visualization purposes. The image shown is a BRL-CAD 2D framebuffer screenshot displaying the rendering of a ball bearing. The bearing is modeled with a material appearance resembling acrylic glass, and this raytracing result shows reflection, refraction, shadowing, and some caustic effects.



BRL-CAD provides a comprehensive procedural geometry interface as a means for creating models algorithmically instead of manually. This screenshot shows a classic "Sphere Flake" model with five levels of recursion, specular reflections, multiple light sources, environment mapping, checkered texture synthesis, ambient occlusion, and soft shadows.

HIDDEN LINE RENDERING



This raytrace image is a multiple-view hidden line rendering of an Mi28 Havoc Russian attack helicopter using BRL-CAD's `rtedge` utility. The model is entirely composed of implicit primitives combined together with CSG boolean operations.

DOCTEMPLATE:NEW MGED COMMAND

The following DocBook XML template illustrates the general structure that is used when defining a man page for MGED commands, along with examples of how elements such as paragraphs, lists, and examples are included.

```
<!-- body begins here -->
<refsynopsisdiv xml:id="synopsis">
  <cmdsynopsis sepchar=" ">
    <command/>
    <arg choice="opt" rep="norepeat"/>
  </cmdsynopsis>
</refsynopsisdiv>
```
