



Software Release Note

NEOPOP

Near Earth Object Population
Observation Program

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ESA's Near Earth Object Population Observation Program (NEOPOP) was developed by the Institute of Space Systems at the Technische Universität of Braunschweig under ESA contract. This report was compiled at the Institute of Space Systems with contributions from the study team.

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History of Changes:

Date	Version	Author	Change Description
16.04.2019	1.0	Horstmann	Final Version
24.04.2019	1.3a	Horstmann	Excluding gnuplot from the list of tools, Adding JAVA requirement
29.04.2019	1.3	Horstmann	Adding statement for a clean workspace environment when updating NEOPOP
07.05.2019	1.4	Horstmann	Adding gnuplot to section 4 and section 5; revising "clean workspace environment" statement in section 6
15.10.2019	1.5	Horstmann	Changing required Java version to 1.8
29.06.2021	1.6	Principe	Adding new features and bug fixes of version 1.4 in the section 7 Removed 64-bit in both Processor and OS Architecture Requirements as too generic. Only x86-64 to represent the requirement
01.04.2022	1.7	Principe	Adding new features and bug fixes of version 1.5 of the software in the section 7
05.07.2022	2.0	De Riz	Adding bug fixes of version 2.0 of the software in Section 7

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1 Introduction

This document is about the **Near-Earth Object Population Observation Program (NEOPOP) 2.0** release. It is meant as a basic overview of the release; for detailed descriptions please refer to chapter 3.

2 Software Overview

NEOPOP allows users to create and analyze Near-Earth Object (NEO) populations and to simulate and analyze observations of such populations.

Populations may be created randomly or based on two NEO models that have been validated scientifically. Various population properties can be plotted in 2D and 3D as well as in scatter and solar system overview plot form.

Population observations may be simulated by defining ground- or space-based locations as well as optical and radar sensors. The results of observations can be plotted in the same way as it is the case for population analyses (sky plots are available additionally, though).

NEOPOP consists of the Command-Line Tool (CLT) and the Graphical User Interface (GUI).

The CLT is the main tool, is written in Fortran and yields the main functionalities described above. Users provide configuration and input files to tell the tool what to do when executed. As a result, the tool creates text files which – depending on the settings in the input files – contain generated populations, observation results, summaries, instructions for gnuplot or measurements.

The GUI is based on Eclipse Rich Client Platform (Eclipse RCP) and thus written mainly in Java. It serves as a front-end for the tool. Because of this, users can change the tool's configuration and input files, run it and view the tool's output files through the GUI in a graphical and user-intuitive way.

3 Documentation

As stated before, this document is meant as a basic release overview. There are two documents giving you more information about certain topics in the context of NEOPOP. The Software User Manual [02] explains how to install, configure and use NEOPOP in detail. It also contains a tutorial. The theory behind NEOPOP's algorithms, models etc. is described in the Final Report [01].

[01]	J. Gelhaus, G. Hahn and S. Müller, " <i>The Near Earth Object Population Observation Program</i> ", Final Report, ESA/ESTEC Contract No: 4000106274, 2015
[02]	J. Gelhaus and S. Müller, " <i>The Near Earth Object Population Observation Program</i> ", Software User Manual, ESA/ESTEC Contract No: 4000106274, 2015

4 System Requirements Specification

In order to ensure that NEOPOP runs correctly on your system, your operating system must meet the following requirements:

Processor Architecture	x86 or x86-64
Processor	AMD or Intel @ 2,8 GHz
RAM	Min. 2 GiB
Disk Space	Min. 2 GiB
Operating System	Either: <ul style="list-style-type: none"> • Windows 10 • Linux with GNU C Library (glibc) 2.x where $x \geq 26$. This applies, for example, to <ul style="list-style-type: none"> ○ openSUSE 15.0+ ○ Ubuntu 17.10+ ○ Debian 9+
Operating System Architecture	x86-64
Java Runtime Environment	Java Standard Edition Runtime Environment 1.8 which is also known as Java 8 (has to be available in PATH)
gnuplot	v4.6+ <ul style="list-style-type: none"> • On Windows: must be installed separately • On Linux: must be installed separately
PDF Viewer	like Adobe Reader or Okular, optional
Text Editor	like Notepad++ or gedit, optional

Note that, however, in all cases, later versions of Windows or Linux should work.

PDF Viewer and text editor are not required to start the GUI and run the tool. Without them you can't open PDF and text files through the GUI though – including the Software User Manual. You can define the programs of your choice at any time after installation via the settings button in the toolbar of the GUI. On Linux systems, popular choices for PDF readers include “acroread”, “okular” or “evince”; popular graphical text editors are “kate” or “gedit”. When setting them in the GUI, they have to be prefixed with their full path (usually “/usr/bin/” on Linux and “C:\Program Files\” on Windows).

5 List of Tools and Libraries

In the following a table is provided stating all tools and libraries that NEOPOP uses:

Tool/Library	Version	Purpose	Licensing	Distribution site
SPICE Toolkit for Fortran	N0064 June 11, 2010	Part of NEOPOP used for calculation purposes, error handling and more	Free of licensing	http://naif.jpl.nasa.gov/naif

Cairo library	1.0.2	Part of Linux versions of GUI. It's a graphics toolkit used by Eclipse launcher.	Mozilla Public License Version 1.1 ("MPL")	http://www.cairographics.org/
pixman library	0.1.6	Used in Cairo Library	Specific licenses; see NEOPOP license agreement for details	http://www.cairographics.org/snapshots
gnuplot tool	4.6+	Used by GUI to create plot picture files	Gnuplot Copyright	http://www.gnuplot.info/
GNU C Library (glibc, only on Linux)	2.5	Major system library	GNU Lesser General Public License	https://www.gnu.org/software/libc/

6 Installation

Download the ZIP file for Linux (64-bit Linux, 64-bit Java 1.8) and unzip it into an installation folder of your choice. This will create a new folder "NEOPOP_v2.0" in that folder. In there, you'll find "start.sh", a bash script that you can execute in order to start NEOPOP GUI.

Download the ZIP file for Windows (64-bit Windows, 64-bit Java 1.8) and unzip it into an installation folder of your choice. This will create a new folder "NEOPOP_v2.0" in that folder. In there, you'll find "start.bat", a batch file that you can execute in order to start NEOPOP GUI.

When updating from a previous NEOPOP version, please ensure a clean workspace environment. In particular, please make sure to not reuse the workspace folder of a previous NEOPOP version, as they are not compatible and will cause NEOPOP to fail. An empty workspace folder has to be used in order to run NEOPOP.

7 New Features and Bug Fixes

Version 1.4

- Fixing issue with message error when incompatible java 32 with windows 64 bits
- Fixing bug with detection of objects even though the sun was above the horizon
- Adding estimation of remaining computational time in Population Generation Module while running the software
- Increasing maximum dimension in pixels of the square optical detector in "Observation Simulator"

Version 1.5

- Adding estimation of computational time in the ObsSim module
- Adding error message in case of running out of memory
- Fixing bug in cases where the crossing time is smaller than the "Exposure time" or frame of the given telescope
- Adding missing labels to some buttons of the GUI
- Set default program for pdf viewer and text editor, which are kept between sessions
- Fixing inconsistency between limits suggested by the GUI and actual limits

Version 2.0

- Fixing issue with OSD input file
- Output orbits file format aligned with Orffit / AstOD format

8 Known Limitations

- For some problems and possible solutions, please consult section chapter 10 in Software User Manual