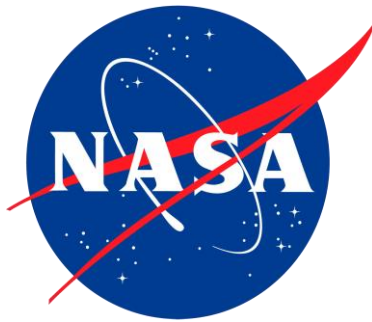


# **Installation Procedures for NASA's Calculation of Complex Chemical Equilibrium Compositions and Applications II Program (CEA)**



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## **1.0 Scope and Introduction**

1.1 This manual will define for the user the requisite steps required to install NASA's Chemical Equilibrium Compositions and Applications II Program (CEA).

1.2 The Chemical Equilibrium Compositions and Applications II Program (CEA) is a software that analyzes complex mixtures in order to determine the thermodynamic and transport properties of each, the results of which can be applied to several different problems. Additional built in applications include the calculation of combustion properties, as well as shock tube parameters and Chapman-Jouguet detonation parameters. The CEA program, designed and written by Bonnie J. McBride and Sanford Gordon in ANSI standard FORTRAN 77, was designed for use by the NASA John H. Glenn Research Center, and made available for public release.

## **2.0 Installation Software Requirements**

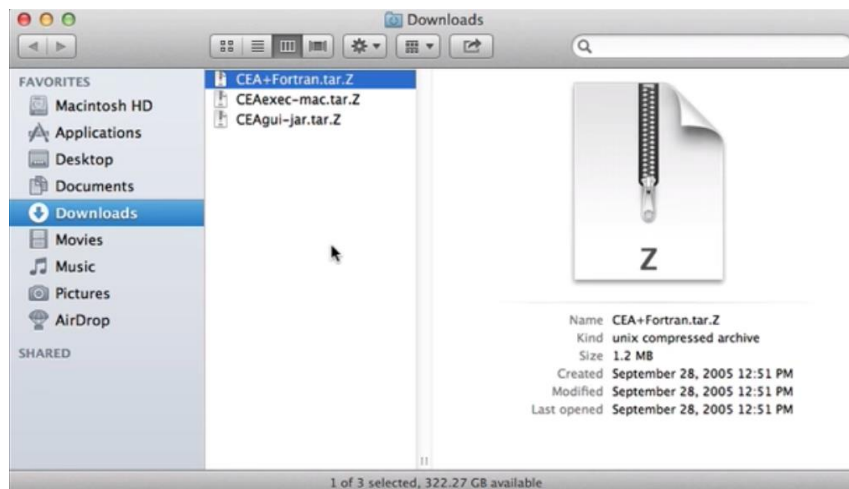
2.1 To begin installation on your MAC OS X, ensure your operating system is running OS X 10.8.5 or newer. Additionally, it is recommended that Apple Xcode 10.2.1 (10E1001) is downloaded prior to extracting the CEA files, in addition to the command line tools for Xcode.

2.2 To download these additional line tools, visit [developer.apple.com/downloads](https://developer.apple.com/downloads) and search the term "command line tools." Select version 10.2.1 to download and attach to existing Xcode application.

## **3.0 Installation**

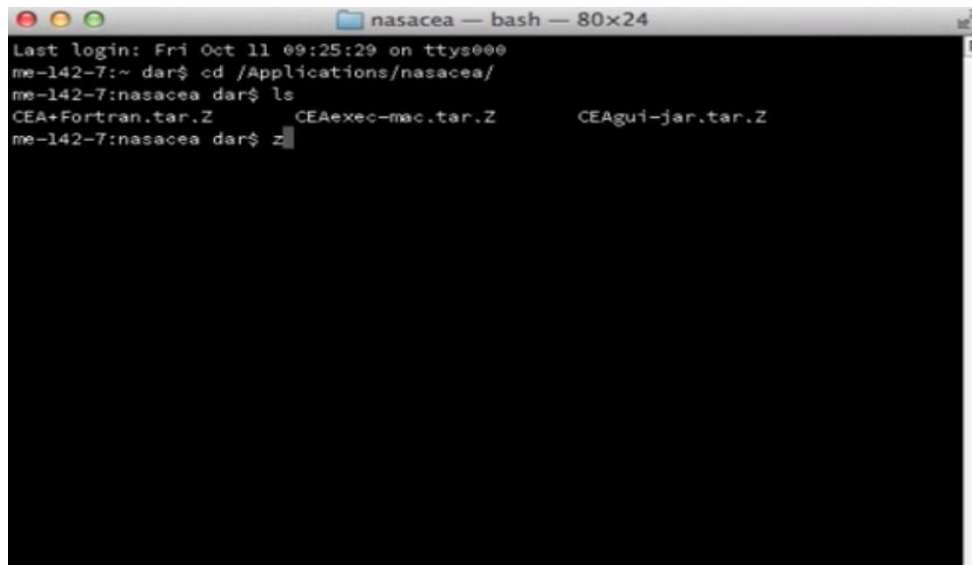
3.1 Download the CEA program through NASA's Glenn Research Center by visiting [GRC.NASA.GOV](http://GRC.NASA.GOV) and following the appropriate links on the sidebar for the CEA request form. Once approved, you can download CEA straight from your browser by accessing the download area through your NASA login credentials.

3.2 Once the download has completed, open the download folder on your MAC and ensure that all three CEA files have properly downloaded.



3.3 Open the terminal window on the MAC by pressing Command - spacebar to launch Spotlight and typing "**Terminal**" in the search bar and double-clicking the search result.

3.4 Once inside the terminal window, begin by typing the location of the CEA files that you downloaded. The three .ZIP files that contain the program will appear, and you can begin the process to unzip them.



3.5 Using TAR and ZCAT, you can begin to unpack the CEA files. Once all files have been unpacked from the .ZIP folder, double check to ensure you have the requisite files once more before compiling the code from all three files, using the command line software downloaded earlier from Xcode.

```

nasacea — bash — 115x27
COLLECT_GCC_OPTIONS='-mmacosx-version-min=10.8.5' '-v' '-shared-libgcc' '-mtune=generic'
/usr/local/libexec/gcc/x86_64-apple-darwin10/4.6.0/f951 cea2.f -ffixed-form -fPIC -quiet -dumpbase cea2.f -mmacosx
-version-min=10.8.5 -mtune=generic -auxbase cea2 -version -fintrinsic-modules-path /usr/local/lib/gcc/x86_64-apple-
darwin10/4.6.0/finclude -o /var/folders/wr/k1er8d8n3zL5_vhn02dj7ng0000gn/T//ccaltjX4.s
GNU Fortran (GCC) version 4.6.0 20100703 (experimental) (x86_64-apple-darwin10)
  compiled by GNU C version 4.6.0 20100703 (experimental), GMP version 4.3.1, MPFR version 2.4.1, MPC version
  0.8.1
GCC heuristics: --param gcc-min-expand=30 --param gcc-min-heapsize=4096
GNU Fortran (GCC) version 4.6.0 20100703 (experimental) (x86_64-apple-darwin10)
  compiled by GNU C version 4.6.0 20100703 (experimental), GMP version 4.3.1, MPFR version 2.4.1, MPC version
  0.8.1
GCC heuristics: --param gcc-min-expand=30 --param gcc-min-heapsize=4096
COLLECT_GCC_OPTIONS='-mmacosx-version-min=10.8.5' '-v' '-shared-libgcc' '-mtune=generic'
as -arch x86_64 -force_cpusubtype_ALL -o /var/folders/wr/k1er8d8n3zL5_vhn02dj7ng0000gn/T//cc3xYNI2.o /var/folders
/wr/k1er8d8n3zL5_vhn02dj7ng0000gn/T//ccaltjX4.s
COMPILER_PATH=/usr/local/libexec/gcc/x86_64-apple-darwin10/4.6.0/:/usr/local/libexec/gcc/x86_64-apple-darwin10/4.6.
0:/usr/local/libexec/gcc/x86_64-apple-darwin10:/usr/local/lib/gcc/x86_64-apple-darwin10/4.6.0:/usr/local/lib/gcc
/x86_64-apple-darwin10/
LIBRARY_PATH=/usr/local/lib/gcc/x86_64-apple-darwin10/4.6.0:/usr/local/lib/gcc/x86_64-apple-darwin10/4.6.0/./../.
./usr/lib/
COLLECT_GCC_OPTIONS='-mmacosx-version-min=10.8.5' '-v' '-shared-libgcc' '-mtune=generic'
/usr/local/libexec/gcc/x86_64-apple-darwin10/4.6.0/collect2 -dynamic -arch x86_64 -mmacosx_version_min 10.8.5 -weak
_reference_mismatches non-weak -o a.out -lort1.10.5.0 -L/usr/local/lib/gcc/x86_64-apple-darwin10/4.6.0 -L/usr/local
/lib/gcc/x86_64-apple-darwin10/4.6.0/./../. /var/folders/wr/k1er8d8n3zL5_vhn02dj7ng0000gn/T//cc3xYNI2.o -lgfortr
an -lgcc_s.10.5 -lgcc_ext.10.5 -lgcc -no_compact_unwind -lSystem
COLLECT_GCC_OPTIONS='-mmacosx-version-min=10.8.5' '-v' '-shared-libgcc' '-mtune=generic'
me-142-7:nasacea dar$

```

3.6 Once all three files have been unpacked and compiled using the command line software, you can finally run the CEA program by typing `./runcea.sh/usr/bin/java`, which will finish updating the code and thus launch the newly installed CEA software in a new window, as shown below.

