

SOFTWARE RELEASE NOTICE

| | | |
|---|-------|----------------------------|
| 01. SRN Number: PA-SRN-120 | | |
| 02. Project Title: Thermal and Hydrologic Simulation of Large-Scale Problems in Nuclear Waste Isolation | | Project No. 20-5704-023 |
| 03. SRN Title: VTOUGH | | |
| 04. Originator/Requestor: Budhi Sagar | | Date: 01/22/96 |
| 05. Summary of Actions <ul style="list-style-type: none"> <input type="checkbox"/> Release of new software <input type="checkbox"/> Release of modified software: <ul style="list-style-type: none"> <input type="checkbox"/> Enhancements made <input type="checkbox"/> Corrections made <input type="checkbox"/> Change of access software <input checked="" type="checkbox"/> Software Retirement | | |
| 06. Persons Authorized Access | | |
| Name | RO/RW | A/C/D |
| N/A | | |
| 07. Element Manager Approval: <i>[Signature]</i> | | Date: 1/26/96 |
| 08. Remarks: Not considered important to regulatory reviews in revised FY96 OPS Plans. | | |

SOFTWARE SUMMARY FORM

| | | | | | |
|--|--|---|---|---|--|
| 01. Summary Date: 03/23/94 | | 02. Summary prepared by (Name and Phone) T.J. Ratchford 522-3083 | | 03. Summary Action: New | |
| 04. Software Date: 8/15/93 | | 05. Short Title: VTOUGH | | | |
| 06. Software Title: VTOUGH - Thermal and Hydrologic Simulation of Large-Scale Problems in Nuclear Waste Isolation. | | | | 07. Internal Software ID: NONE | |
| 08. Software Type: <input type="checkbox"/> Automated Data System <input checked="" type="checkbox"/> Computer Program <input type="checkbox"/> Subroutine/Module | | 09. Processing Mode: <input type="checkbox"/> Interactive <input type="checkbox"/> Batch <input checked="" type="checkbox"/> Combination | | 10. APPLICATION AREA A. General: <input checked="" type="checkbox"/> Scientific/Engineering <input type="checkbox"/> Auxiliary Analyses <input type="checkbox"/> Total System PA <input type="checkbox"/> Subsystem PA <input type="checkbox"/> Other b. Specific: | |
| 11. Submitting Organization and Address: CNWRA, SwRI, San Antonio, Texas | | | 12. Technical Contact(s) and Phone: R. Green, (210) 522-5305 | | |
| 13. Narrative: VTOUGH - VTOUGH is used to numerically simulate the thermal and hydrologic environment around nuclear waste packages in the unsaturated zone for the Yucca Mountain Project. | | | | | |
| 14. Computer Platform CRAY/XMP | | 15. Computer Operating System: UNIX | | 16. Programming Language(s): FORTRAN | |
| 17. Number of Source Program Statements: 14,642 lines of code | | 18. Computer Memory Requirements: UNKNOWN | | 19. Tape Drives: NONE | |
| 20. Disk/Drum Units: N/A | | 21. Graphics: UNKNOWN | | | |
| 22. Other Operational Requirements NONE | | | | | |
| 23. Software Availability: <input checked="" type="checkbox"/> Available <input type="checkbox"/> Limited <input type="checkbox"/> In-House ONLY | | | 24. Documentation Availability: <input checked="" type="checkbox"/> Available <input type="checkbox"/> Inadequate <input type="checkbox"/> In-House ONLY | | |
| 25. Submission Package Status: Acceptance Criteria: Met <input checked="" type="checkbox"/> Not Met <input type="checkbox"/> Software QA Assessment: Successful <input checked="" type="checkbox"/> Unsuccessful <input type="checkbox"/> Code Custodian: <u>T.J. Ratchford</u> Date: <u>3/23/94</u> | | | | | |

CNWRA INFORMATION PROCESSING STANDARD SOFTWARE SUMMARY

| | | | | | | | | |
|---|--|--|--|--|--|--|--|---|
| 01. Summary Date Yr. Mo. Day 9 2 0 1 1 0 | | | 02. Summary prepared by (Name and phone) Ronald Green 522-5305 | | | 03. Summary action New Replacement Deletion <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Previous Internal Software ID | | |
| 04. Software Date Yr. Mo. Day | | | 03. Software title VTOUGH - an Enhanced Version of the TOUGH Code for the thermal and hydrologic simulation of large-scale problems in Nuclear Waste Isolation. | | | | | |
| 06. Short title VTOUGH | | | | | | 07. Internal Software ID | | |
| 08. Software type <input type="checkbox"/> Automated Data System <input checked="" type="checkbox"/> Computer Program <input type="checkbox"/> Subroutine/Module | | | 09. Processing Mode <input type="checkbox"/> Interactive <input type="checkbox"/> Batch <input checked="" type="checkbox"/> Combination | | | 10. APPLICATION AREA General Specific <input type="checkbox"/> Computer Systems Support/Utility <input type="checkbox"/> Management/Business <input checked="" type="checkbox"/> Scientific/Engineering <input type="checkbox"/> Process Control <input type="checkbox"/> Bibliographic/Textual <input type="checkbox"/> Other | | |
| 11. Submitting organization and address LLNL Livermore, CA 94551 | | | | | | 12. Technical contact(s) and phone Terri Kirk Quinn 415-423-2385 | | |
| 13. Narrative The TOUGH Code was originally developed at LBL to simulate two phase flow through porous geologic media - LLNL vectorized the code and enhanced the code's performance in addition to making the code more robust and user friendly. | | | | | | | | |
| 14. Keywords Groundwater flow and transport Two-Phase flow | | | | | | | | |
| 15. Computer manufacturer and model SUN/IPC & CRAY | | | 16. Computer operating system * | | | 17. Programming language(s) Fortran | | 18. Number of source program statements |
| 19. Computer memory requirements | | | 20. Tape drives | | | 21. Disk/Drum units | | 22. Terminals |
| 23. Other operational requirements | | | | | | | | |
| 24. Software availability Available Limited In-house only <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> *Versions for SUN and CRAY are to be used. | | | | | | 25. Documentation availability Available Inadequate In-house only <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | |
| 26. FOR SUBMITTING ORGANIZATION USE | | | | | | | | |

total 132

| | | | | | | | | |
|------------|---|------|------|-------|-----|----|-------|--------------|
| -r--r----- | 1 | tjr1 | tjr1 | 4534 | Mar | 23 | 09:12 | Makefile |
| -r--r----- | 1 | tjr1 | tjr1 | 2110 | Mar | 23 | 09:12 | README |
| -r--r----- | 1 | tjr1 | tjr1 | 34943 | Mar | 23 | 09:12 | cycit.F |
| -r--r----- | 1 | tjr1 | tjr1 | 125 | Mar | 23 | 09:12 | dim.h |
| -r--r----- | 1 | tjr1 | tjr1 | 1142 | Mar | 23 | 09:12 | functions1.F |
| -r--r----- | 1 | tjr1 | tjr1 | 9894 | Mar | 23 | 09:12 | hdr.h |
| -r--r----- | 1 | tjr1 | tjr1 | 43360 | Mar | 23 | 09:12 | input.F |
| -r--r----- | 1 | tjr1 | tjr1 | 17427 | Mar | 23 | 09:12 | lineq.F |
| -r--r----- | 1 | tjr1 | tjr1 | 23622 | Mar | 23 | 09:12 | main.F |
| -r--r----- | 1 | tjr1 | tjr1 | 9068 | Mar | 23 | 09:12 | newballa.F |
| -r--r----- | 1 | tjr1 | tjr1 | 16089 | Mar | 23 | 09:12 | output.F |
| -r--r----- | 1 | tjr1 | tjr1 | 15521 | Mar | 23 | 09:12 | ppbal.F |
| -r--r----- | 1 | tjr1 | tjr1 | 34735 | Mar | 23 | 09:12 | pvt.F |
| -r--r----- | 1 | tjr1 | tjr1 | 33418 | Mar | 23 | 09:12 | report.tex |
| -r--r----- | 1 | tjr1 | tjr1 | 4749 | Mar | 23 | 09:12 | slots.F |
| -r--r----- | 1 | tjr1 | tjr1 | 2493 | Mar | 23 | 09:12 | sunsrc.F |
| -r--r----- | 1 | tjr1 | tjr1 | 15082 | Mar | 23 | 09:12 | test1i |
| -r--r----- | 1 | tjr1 | tjr1 | 59599 | Mar | 23 | 09:12 | test1o |
| -r--r----- | 1 | tjr1 | tjr1 | 67308 | Mar | 23 | 09:12 | timeh.F |
| -r--r----- | 1 | tjr1 | tjr1 | 29780 | Mar | 23 | 09:12 | veos.F |
| -r--r----- | 1 | tjr1 | tjr1 | 44516 | Mar | 23 | 09:12 | vmulti.F |
| -r--r----- | 1 | tjr1 | tjr1 | 23924 | Mar | 23 | 09:12 | vpvt.F |

gemstone.7 ~/vtough/WKDIR =>

3/23/94 4/R

134.20.1.1 11:11:49

March 21, 1994

MEMORANDUM

TO: R. Green

FROM: T.J. Ratchford



SUBJECT: Software Static and Dynamic Analysis Report

Attached you will find the Static and Dynamic Analysis Report run by INEL on VTOUGH. The report provides the weakness and strengths of the program and is provided to you for your review.

Delivered to R. Green on 3/21/94

VTOUGH Fortran Program Static and Dynamic Analysis

March 10, 1994

Earl S. Marwil
John E. Tolli
Scientific Computing Unit
Idaho National Engineering Laboratory

1. Introduction

This analysis was performed on the Cray version of the software as provided by Southwest Research Institute (SwRI).

One sample problem was supplied along with the source code. The program was analyzed using the Craft (Cross Reference Analysis of Fortran) tool, FORWARN, the Fortran 77 analyzer, and PC-Metric. These tools provide static analysis, coverage analysis, and complexity analysis.

The sample problem was found to abort when VTOUGH is loaded with a core preset of indefinite. The program was loaded with a core preset of zero for the dynamic analysis runs.

2. References

- [1] N.H. Marshall and E.S. Marwil, Cross Reference Analysis of Fortran (CRAFT), EG&G-CATT-9198, EG&G Idaho, Inc., July 1991.
- [2] Fortran 77 Analyzer User's Manual, National Bureau of Standards, NBS GCR 81-359, 1981
- [3] FORWARN User's Guide, Quibus Enterprises, Inc., July 1991.
- [4] PC-Metric User's Guide, SET Laboratories, Inc., 1987.

3. Functions

The VTOUGH program contains 160 Fortran routines.

There are no alternate entry points.

There are 15 extraneous routines:

c2fortra, covis, finder, getdesc, getmnval, getmxval, initname,
itlkup2, match1, match2, nicensum, reqofil, thyme, viss, xinter.

4. Common Block Irregularities

There are 96 common blocks in the VTOUGH program.

There are several common blocks which are declared in only one program module:

| Block name | Module | Block name | Module |
|------------|---------|------------|--------|
| ----- | ----- | ----- | ----- |
| /bal/ | balcalc | /p7/ | main |
| /ldim/ | main | /seconc/ | main |
| /p6/ | main | /seconx/ | main |

Variable exceptions are noted as follows:

| Block name | Variable | Exception |
|------------|----------|-------------------|
| ----- | ----- | ----- |
| /ammis/ | ma | defined, unused |
| /ammis/ | iab | defined, unused |
| /ammis/ | iscale | defined, unused |
| /bala/ | tfm0 | undefined, unused |
| /bala/ | tvm0 | undefined, unused |
| /bala/ | tfe0 | undefined, unused |
| /bala/ | tve0 | undefined, unused |
| /bala/ | tse0 | undefined, unused |
| /cdt7/ | hc | undefined, unused |
| /dmn/ | inum | undefined, unused |
| /dmn/ | iprint | undefined, unused |
| /ldim/ | licn | defined, unused |
| /ldim/ | lirn | defined, unused |
| /p6/ | row | undefined, unused |
| /p7/ | col | undefined, unused |
| /seconc/ | npcmx | defined, unused |
| /seconc/ | parc | undefined, unused |
| /seconx/ | npvmx | defined, unused |
| /seconx/ | nvpmx | defined, unused |
| /seconx/ | parx | undefined, unused |
| /times/ | itpr | undefined, unused |

There are several instances of a common block not being used by a module in which it is declared:

| Block name | Modules not using |
|------------|--|
| ----- | ----- |
| /ammis/ | main |
| /bala/ | reafile, wrifi |
| /c1/ | indata, main |
| /c10/ | input, main |
| /c2/ | indata, main |
| /c3/ | input, main, out |
| /c4/ | input, main, out |
| /c5/ | input, main, out |
| /c6/ | input, main, out |
| /c7/ | input, main, out |
| /c8/ | indata, input, main, reafile |
| /c9/ | input, main |
| /cdt7/ | finder, findl |
| /comdebug/ | cycit |
| /comkc/ | acctim |
| /compo/ | main |
| /cputim/ | balcalc, balla, conver, lineq2, lineq3, out, veos, |

```

vmulti, wrifi
/cyc/      phascon, prsecpar
/dfm/      reafile
/dlt/      reafile
/dm/       reafile
/dmn/      reafile
/dop/      reafile
/e1/       main
/e2/       main
/e3/       main, out
/e4/       main, out
/e5/       indata, main, out, phascon, reafile
/e6/       indata, main, out, phascon, reafile
/g1/       input, main, qu
/g10/      conver, indata, input, main, out
/g11/      conver, indata, input, main, out
/g12/      conver, input, main
/g13/      conver, input, main, out
/g14/      conver, input, main
/g15/      conver, input, main, out
/g16/      conver, indata, input, main, reafile
/g17/      conver, indata, input, main, reafile
/g2/       main
/g3/       main
/g4/       conver, input, main
/g5/       conver, input, main
/g6/       conver, input, main, out
/g7/       conver, input, main
/g8/       conver, input, main
/g9/       conver, indata, main
/konit/    reafile
/l1/       main
/l2/       main
/l3/       main
/nep/      indata, input
/p1/       main
/p2/       indata, ineos, main
/p3/       indata, ineos, main, out, phascon
/p4/       indata, main, out
/p5/       indata, main, out, vmultifl
/p6/       main
/p7/       main
/porvel/   main
/pov6/     out
/secondx/  main, typeflux
/soli/     reafile
/solic/    balla, out, reafile, wrifi
/solid/    out
/step/     cycit
/subcom/    balcalc, balla, conver, lineq2, lineq3, out, veos,
           vmulti, wrifi
/svz/      eoscalc2, out, reafile
/th2com/    ckeset, cktrig, getcval, geteval, getgrd, wrmxtr
/th3com/    ckeset, cktrig, getcval, geteval, getgrd, wrmxtr

```


| | |
|----------|---|
| /th4com/ | getcval, geteval, getgrd, timehout |
| /th5com/ | cktrig,getcval, geteval, getgrd, wrmxtr |
| /times/ | qu |

5. Interface Irregularities

Exceptions are noted as follows:

| Module | Line# | Exception |
|---------|-------|--|
| ----- | ----- | ----- |
| lineq3 | 108 | argument #12 to ZSGBFA has the wrong type |
| lineq3 | 109 | argument #17 to ZSGBFA has the wrong type |
| lineq3 | 109 | argument #18 to ZSGBFA has the wrong type |
| outrpcl | 28 | VPCAP is called with too few arguments (5, not 6) |
| pvtab | 69 | character argument #1 to ERRSTP has the wrong length |
| pvtab | 78 | character argument #1 to ERRSTP has the wrong length |
| veosc | 41 | VSUPST is called with too few arguments (5, not 6) |

6. Local Variable Irregularities

There are several instances of a parameter not being used in a module in which it is declared:

| Parameter | Modules not using |
|-----------|---|
| ----- | ----- |
| ilong | getdesc |
| ishort | getdesc |
| lentab | supst, vcowat, vsat, vsupst |
| maxcv | main |
| maxev | main |
| maxloc | main |
| maxvar | main |
| mmmxx | main, reafile, resconv, vmultifl |
| mxdtim | main |
| mxstim | main |
| nballa | acctim, balcalc, conver, lineq2, lineq3, out, veos, vmulti, wrifi |
| nconvr | acctim, balcalc, balla, lineq2, lineq3, out, veos, vmulti, wrifi |
| neos | acctim, balcalc, balla, conver, lineq2, lineq3, out, vmulti, wrifi |
| nlineq | acctim, balcalc, balla, conver, out, veos, vmulti, wrifi |
| nmulti | acctim, balcalc, balla, conver, lineq2, lineq3, out, veos, wrifi |
| nnmx | main, reafile, resconv, vmultiac, vmultifl |
| nout0 | acctim, balcalc, balla, conver, lineq2, lineq3, veos, vmulti, wrifi |
| nout1 | acctim, balcalc, balla, conver, lineq2, lineq3, veos, vmulti, wrifi |

| | |
|--------|---|
| nwrifi | acctim, balcalc, balla, conver, lineq2, lineq3, out, veos, vmulti |
| tabpmn | vsat |
| tabtmx | pvtab |
| tcowat | supst, vsat, vsupst |
| tcrit | supst, vcowat, vsupst |

Local variable exceptions are noted as follows:

| Module | Variable | Exception |
|----------|----------|-------------------|
| bindiff | nvpjmx | UNUSED |
| chrint | isign | Defined, Unused |
| covis | c | UNUSED |
| covis | f | UNUSED |
| covis | m | UNUSED |
| covis | ome | UNUSED |
| covis | trd | UNUSED |
| cowat | d | UNUSED |
| cowat | p | UNUSED |
| cowat | sl | UNUSED |
| cowat | t | UNUSED |
| cowat | u | UNUSED |
| cycit | dtmx | UNUSED |
| dtpmnt | nel | UNUSED |
| dulpnr | iopt | UNUSED |
| dulpnr | pc | UNUSED |
| dulpnr | sw | UNUSED |
| dulpnr | xkg | UNUSED |
| dulpnr | xkl | UNUSED |
| dxmout | nloc | Defined, Unused |
| dxmout | nloc2 | Defined, Unused |
| eos | xsoln | UNUSED |
| gas2p | zero | Defined, Unused |
| getscrfi | filnam | UNUSED |
| getscrfi | ifdout | UNUSED |
| ineos | nmp | Defined, Unused |
| ineos | xsoln | UNUSED |
| ineos | xx | Undefined, Unused |
| ineos | za | Defined, Unused |
| ineos | zero | Defined, Unused |
| limsol | iter | UNUSED |
| limsol | x | UNUSED |
| lineq3 | avar | UNUSED |
| lineq3 | ia | UNUSED |
| lineq3 | iofile1 | UNUSED |
| lineq3 | iofile2 | UNUSED |
| lineq3 | ja | UNUSED |
| lineq3 | wrbuffer | UNUSED |
| nequal | iend | Defined, Unused |
| oldvdulp | iopt | UNUSED |
| oldvdulp | nmp | UNUSED |
| oldvdulp | pc | UNUSED |
| oldvdulp | sw | UNUSED |

| | | |
|----------|--------|-----------------|
| oldvdulp | xkg | UNUSED |
| oldvdulp | xkl | UNUSED |
| pcap | dumy2 | Defined, Unused |
| pcap | hc | Defined, Unused |
| pcap | pmax0 | Defined, Unused |
| pcap | za | Defined, Unused |
| phascon | us | Defined, Unused |
| phascon | za | Defined, Unused |
| pp | ul | Defined, Unused |
| prnopn | ipctem | UNUSED |
| pvtint | pmin | UNUSED |
| qu | aden | Defined, Unused |
| qu | anum | Defined, Unused |
| relp | dmy | Defined, Unused |
| relp | dummy | UNUSED |
| sat | nmat | UNUSED |
| sat | pp | UNUSED |
| sat | psat | UNUSED |
| sat | sl | UNUSED |
| sat | t | UNUSED |
| scdulpor | iopt | UNUSED |
| scdulpor | nmat | UNUSED |
| scdulpor | pc | UNUSED |
| scdulpor | sw | UNUSED |
| scdulpor | xkg | UNUSED |
| scdulpor | xkl | UNUSED |
| tmstp | dtmx | UNUSED |
| tmstp | dxorig | UNUSED |
| veos2p | sl | Defined, Unused |
| veosg | hc | Defined, Unused |
| veosg | sg | Defined, Unused |
| veosg | zero | Defined, Unused |
| visco | d | UNUSED |
| visco | p | UNUSED |
| visco | t | UNUSED |
| visco | vismix | UNUSED |
| visco | xair | UNUSED |
| viss | d | UNUSED |
| viss | pt | UNUSED |
| viss | t | UNUSED |
| viss | vs | UNUSED |
| visw | p | UNUSED |
| visw | ps | UNUSED |
| visw | t | UNUSED |
| visw | vw | UNUSED |
| vpcap | dum1 | Defined, Unused |
| vpcap | dum2 | Defined, Unused |
| vpctem | hc | Defined, Unused |
| vpctem | za | Defined, Unused |
| vpvtint | pmin | UNUSED |
| vrelp | dum | Defined, Unused |
| vsat | u | Defined, Unused |
| vvisco | p | UNUSED |
| vvis | p | UNUSED |

| | | |
|--------|----------|--------------------|
| zsgbfa | abd | UNUSED |
| zsgbfa | alloc | UNUSED |
| zsgbfa | avar | UNUSED |
| zsgbfa | ia | UNUSED |
| zsgbfa | iend | UNUSED |
| zsgbfa | ifdout | USED but UNDEFINED |
| zsgbfa | ifront | UNUSED |
| zsgbfa | info | UNUSED |
| zsgbfa | iofile1 | UNUSED |
| zsgbfa | iofile2 | UNUSED |
| zsgbfa | ipvt | UNUSED |
| zsgbfa | iunit | UNUSED |
| zsgbfa | ja | UNUSED |
| zsgbfa | lda | UNUSED |
| zsgbfa | m1 | UNUSED |
| zsgbfa | mu | UNUSED |
| zsgbfa | n | UNUSED |
| zsgbfa | nelt | UNUSED |
| zsgbfa | wrbuffer | UNUSED |
| zsbsl | abd | UNUSED |
| zsbsl | ipvt | UNUSED |
| zsbsl | job | UNUSED |
| zsbsl | lda | UNUSED |
| zsbsl | m1 | UNUSED |
| zsbsl | mu | UNUSED |
| zsbsl | n | UNUSED |
| zsbsl | wrbuffer | UNUSED |
| zsbsl | x | UNUSED |

7. Fortran Extensions

Data statements precede specification statements in module "stidel".

A potential overlap in a character assignment statement occurs in module "c2fortran".

The following routines contain lowercase characters in their active Fortran:

main, acctim, adjpv, balcalc, balla, bdcoef, bindiff, blkbnf, blkdec, blkslv, c2fortran, chreal, chrnt, ckname, ckeset, cksname, cktrig, closef, compsat, conver, covis, cowat, cycit, dtadpv, dtprnt, dulpor, dulpor2, endrun, eos, eos, eoscalc2, eosx, errstp, exvalck, gas2p, getcval, getdesc, geteval, getfil, getgrd, getmnval, getmxval, getscrfil, halvdt, inadjpv, indata, indexvt, ineos, initimeh, initname, initpc, input, intchr, invmat, io, itlkup2, knudsen, ldmatt, ldsgbf, lensym, lenvt, lmsol, lineq2, lineq3, lnblnk, match1, match2, multi, mxsol, nequal, nicenum, nocall, nocall2, numcloc, numeloc, numvarx, oldvdulpor, out, outrpc, outrpcl, parslb, pcap, phascon, prelem, prmxsol, prout, prsepar, prsol, pvtab, pvtint, rdchar, rdtimeh, rdval, readdebug, reafil, redmx, relp, reqfil, reqofil, resconv, sat, scdulpor, setmat, stidel, supst, timea, timeout, timing, tmstp, typeflux, vcovis, vcowat, vdulpor, veos, veos2p, veosc, veosg, veosl, visco, viss, visw, vitlkup2, vmulti, vmultiac, vmultifl, vpcap, vpctem, vpvint,

vrelp, vsat, vsatl, vsupst, vvisco, vvisw, vxinter, wrifi, wrmxtr, wrtimeh, xinter, zsgbfa, zsgbsl.

The following routines contain entity names which are longer than 6 characters:

main, acctim, balcalc, balla, bindiff, c2fortran, chreal, chrint, ckname, ckeset, cksname, cktrig, compsat, cycit, dtadpvp, dtprnt, dulpor2, eoscalc2, errstp, exvalck, getcval, getdesc, geteval, getmval, getmxval, getscri, halvdt, inadpvp, indata, indexvt, initimeh, initname, input, intchr, io, itlkup2, knudsen, lineq3, mxsol, nicenum, nocall, nocall2, numcloc, numeloc, numvarx, oldvdulpor, out, outrpc, outrpcl, parslb, pcap, phascon, prelem, prmxsol, prsecpar, prsol, pvtab, rdchar, rdtimeh, rdval, readdebug, reafile, redmx, relp, reqifil, reqofil, resconv, scdulpor, supst, timea, timeout, timing, tmstp, typeflux, vcowat, vdulpor, veos, vitlkup2, vmulti, vmultiac, vmultifl, pcap, vpctem, vpvtint, vrelp, vsat, vsupst, vvisco, vvisw, vxinter, wrmxtr, wrtimeh, zsgbfa, zsgbsl.

Some variables in named common are initialized in modules which are not block data routines:

| Variable | Block name | Initialized in |
|----------|------------|----------------|
| ntpv | /adpvpcom/ | inadpvp |
| jndx | /adpvpcom/ | inadpvp |
| grdfil | /thlcom/ | initimeh |
| iev | /thlcom/ | initimeh |
| uev | /thlcom/ | initimeh |
| ucv | /thlcom/ | initimeh |
| dsolmx | /opts/ | input |
| ithdev | /fildes/ | io |

Some named common blocks are declared with mixed character and non-character items:

| Block name | Module(s) in which declared |
|------------|--|
| /thlcom/ | ckeset, cktrig, exvalck, getcval, geteval, getgrd, initimeh, rdtimeh, timeout, wrmxtr, wrtimeh |
| /th2com/ | ckeset, cktrig, exvalck, getcval, geteval, getgrd, initimeh, rdtimeh, timeout, wrmxtr, wrtimeh |
| /th3com/ | ckeset, cktrig, exvalck, getcval, geteval, getgrd, initimeh, rdtimeh, timeout, wrmxtr, wrtimeh |
| /th4com/ | ckeset, cktrig, exvalck, getcval, geteval, getgrd, initimeh, rdtimeh, timeout, wrmxtr, wrtimeh |
| /th5com/ | ckeset, cktrig, exvalck, getcval, geteval, getgrd, initimeh, rdtimeh, timeout, wrmxtr, wrtimeh |

The following modules have format statements containing fields which are not separated by a comma:

input, limsol, outrpcl, prsecpar, redmx.

8. Optimization

The following table summarizes the performance data gathered from execution of the sample problem. Only those routines exercised by the sample problem are shown (see "Coverage Analysis" for a list of routines not exercised by the sample problem, i.e., coverage = 0%). The table lists all program modules in descending order according to CPU time. To optimize code execution time, emphasis should be placed on those modules which appear highest in the listing.

In order to obtain meaningful statistics for performance evaluation, the program should execute for a reasonable amount of time. Note that the execution time for this sample problem is short (<< 10 sec) and that the resulting statistics may therefore not accurately reflect program performance for more typical (possibly longer) runs.

The performance data show that a high percentage of the overall execution time (80.211%) is spent in the first 21 routines listed. This is due primarily to the following (applies to some or all of the 21 routines):

- 1) a low percentage of floating point operations which are performed in vector mode (%Vflops is small)
- 2) a high overhead factor for calls to the routines (IFact > 1)
- 3) a high level of memory conflicts (MC/MR > 1)
- 4) a high rate of instruction buffer fetches (IBFR > 1).

A detailed optimization analysis effort should focus on these 4 areas.

PERFORMANCE DATA FOR VTOUGH

| ROUTINE NAME | Time | %ExTime | %AccumT | %Vflops | IFact | MC/MR | IBFR |
|--------------|-------|---------|---------|-----------|-------|-------|-------|
| SUPSTX | 0.336 | 17.257 | 17.257 | 63.05059 | 1.51 | 1.089 | 0.368 |
| BLKDEC | 0.244 | 12.532 | 29.790 | 100.00000 | 0.00 | 1.364 | 0.452 |
| VMULTIFL | 0.196 | 10.047 | 39.836 | 96.07294 | 0.00 | 0.866 | 0.506 |
| VITLKUP2 | 0.108 | 5.527 | 45.364 | 96.76203 | 0.71 | 0.993 | 0.196 |
| BLKSLV | 0.083 | 4.242 | 49.605 | 89.52765 | 0.00 | 0.280 | 0.136 |
| VPVTINT | 0.079 | 4.035 | 53.641 | 97.00540 | 1.91 | 1.647 | 0.321 |
| VPCAP | 0.053 | 2.714 | 56.355 | 100.00000 | 2.54 | 1.152 | 1.337 |
| VVISCO | 0.049 | 2.523 | 58.877 | 91.55195 | 0.52 | 0.995 | 0.991 |
| INPUT | 0.044 | 2.242 | 61.119 | 66.42746 | 0.00 | 0.643 | 0.914 |
| VCOWAT | 0.040 | 2.053 | 63.172 | 90.34522 | 2.05 | 1.314 | 1.016 |
| INITIMEH | 0.038 | 1.976 | 65.148 | 0.00000 | 0.00 | 0.606 | 0.006 |
| CYCIT | 0.037 | 1.893 | 67.041 | 77.76602 | 0.00 | 0.927 | 1.054 |
| VEOS2P | 0.037 | 1.883 | 68.924 | 100.00000 | 0.01 | 0.807 | 1.144 |
| PVTAB | 0.036 | 1.829 | 70.753 | 3.02447 | 0.00 | 0.914 | 1.469 |
| VDULPOR | 0.030 | 1.552 | 72.305 | 37.81981 | 2.54 | 1.124 | 1.467 |
| VSAT | 0.029 | 1.502 | 73.806 | 94.95485 | 0.55 | 0.960 | 0.898 |
| VMULTIAC | 0.026 | 1.356 | 75.162 | 99.79036 | 0.02 | 0.928 | 0.382 |
| INITPC | 0.026 | 1.313 | 76.475 | 10.82364 | 0.00 | 0.689 | 0.800 |
| BINDIFF | 0.025 | 1.280 | 77.754 | 99.24324 | 0.88 | 0.759 | 0.451 |
| VPCTEM | 0.024 | 1.248 | 79.003 | 82.65725 | 5.52 | 1.625 | 0.819 |
| COWATX | 0.024 | 1.208 | 80.211 | 37.38594 | 0.18 | 1.087 | 0.636 |

| | | | | | | | |
|-----------|-------|-------|--------|-----------|------|-------|-------|
| VXINTER | 0.022 | 1.146 | 81.356 | 98.26679 | 5.72 | 1.879 | 0.522 |
| REAFIL | 0.020 | 1.026 | 82.383 | 78.54639 | 0.00 | 0.454 | 0.804 |
| VCOVIS | 0.019 | 0.975 | 83.357 | 98.15492 | 5.40 | 2.543 | 0.732 |
| VEOSG | 0.019 | 0.966 | 84.323 | 95.50914 | 0.02 | 1.123 | 1.109 |
| OUT | 0.019 | 0.953 | 85.276 | 69.37413 | 0.00 | 0.720 | 0.787 |
| VSUPST | 0.018 | 0.944 | 86.220 | 78.49007 | 0.56 | 0.970 | 0.836 |
| BDCOEF | 0.018 | 0.921 | 87.141 | 73.70518 | 0.02 | 1.240 | 0.524 |
| INDATA | 0.018 | 0.906 | 88.047 | 82.53212 | 0.00 | 0.661 | 0.694 |
| VVISW | 0.017 | 0.897 | 88.944 | 83.77089 | 1.47 | 1.140 | 0.697 |
| VEOSL | 0.017 | 0.872 | 89.816 | 100.00000 | 0.02 | 0.978 | 1.216 |
| LDMAT | 0.014 | 0.726 | 90.541 | 98.72678 | 0.02 | 0.520 | 0.063 |
| INVMAT | 0.014 | 0.725 | 91.266 | 16.66667 | 2.24 | 1.558 | 0.685 |
| PHASCON | 0.012 | 0.613 | 91.879 | 32.49166 | 0.03 | 0.864 | 1.421 |
| BALCALC | 0.010 | 0.504 | 92.383 | 56.43902 | 0.00 | 0.839 | 1.092 |
| LINEQ2 | 0.009 | 0.463 | 92.846 | 3.74065 | 0.04 | 0.762 | 0.515 |
| SETMAT | 0.009 | 0.463 | 93.309 | 0.00000 | 3.51 | 1.897 | 0.644 |
| GAS2P | 0.009 | 0.449 | 93.758 | 99.59163 | 0.73 | 1.029 | 0.795 |
| VRELP | 0.009 | 0.447 | 94.205 | 100.00000 | 0.74 | 1.491 | 1.198 |
| ACCTIM | 0.008 | 0.409 | 94.614 | 79.91568 | 2.02 | 2.441 | 1.087 |
| VVISS | 0.008 | 0.392 | 95.006 | 100.00000 | 3.35 | 2.026 | 0.910 |
| PRELEM | 0.007 | 0.377 | 95.383 | 50.75829 | 0.00 | 0.853 | 0.850 |
| PCAP | 0.007 | 0.372 | 95.754 | 0.00000 | 6.75 | 5.606 | 0.995 |
| TMSTP | 0.006 | 0.330 | 96.084 | 0.00000 | 0.05 | 1.387 | 0.148 |
| DTPRNT | 0.006 | 0.295 | 96.380 | 58.95339 | 0.00 | 0.717 | 0.806 |
| QU | 0.005 | 0.255 | 96.635 | 1.43472 | 0.09 | 1.728 | 1.337 |
| RESCONV | 0.005 | 0.254 | 96.890 | 83.74385 | 0.09 | 0.612 | 0.185 |
| VEOS | 0.005 | 0.240 | 97.130 | 100.00000 | 0.09 | 1.427 | 1.690 |
| VMULTI | 0.004 | 0.226 | 97.355 | 100.00000 | 0.10 | 1.216 | 1.622 |
| TYPEFLUX | 0.004 | 0.187 | 97.542 | 70.46335 | 0.00 | 0.796 | 1.132 |
| EOSCALC2 | 0.004 | 0.180 | 97.722 | 100.00000 | 0.11 | 0.995 | 1.243 |
| FINDL | 0.003 | 0.180 | 97.902 | 0.00000 | 0.51 | 2.683 | 0.401 |
| PP | 0.003 | 0.172 | 98.074 | 0.00000 | 2.99 | 2.913 | 1.298 |
| WRIFI | 0.003 | 0.170 | 98.244 | 58.89063 | 0.00 | 0.637 | 0.997 |
| VEOSC | 0.003 | 0.133 | 98.377 | 97.53695 | 0.17 | 0.824 | 0.796 |
| MAIN | 0.003 | 0.131 | 98.508 | 97.56346 | 0.00 | 0.722 | 0.370 |
| GETFIL | 0.003 | 0.130 | 98.638 | 97.08998 | 0.00 | 0.768 | 0.571 |
| SETSOL | 0.002 | 0.125 | 98.763 | 0.00000 | 0.16 | 1.068 | 0.267 |
| BALLA | 0.002 | 0.121 | 98.884 | 82.25354 | 0.00 | 0.797 | 0.429 |
| LIMSOL | 0.002 | 0.114 | 98.998 | 0.00000 | 0.14 | 1.447 | 0.347 |
| GETSCRFIL | 0.002 | 0.105 | 99.103 | 97.66764 | 0.00 | 0.594 | 0.667 |
| COMPSAT | 0.002 | 0.105 | 99.208 | 100.00000 | 0.20 | 0.844 | 0.974 |
| IO | 0.002 | 0.078 | 99.286 | 94.13453 | 0.00 | 1.021 | 0.726 |
| TIMEHOUT | 0.001 | 0.076 | 99.362 | 92.21440 | 0.01 | 0.860 | 1.156 |
| BLKBN | 0.001 | 0.073 | 99.435 | 100.00000 | 0.22 | 0.924 | 0.958 |
| SATX | 0.001 | 0.066 | 99.501 | 0.00000 | 0.23 | 1.966 | 0.573 |
| CPVEC | 0.001 | 0.063 | 99.564 | 0.00000 | 1.37 | 0.831 | 1.091 |
| QINTER | 0.001 | 0.058 | 99.622 | 0.00000 | 1.59 | 6.412 | 1.228 |
| SETDX | 0.001 | 0.055 | 99.677 | 100.00000 | 1.18 | 0.649 | 1.079 |
| INEOS | 0.001 | 0.055 | 99.732 | 88.36574 | 0.00 | 0.953 | 0.369 |
| CONVER | 0.001 | 0.048 | 99.780 | 0.00000 | 0.01 | 1.218 | 0.486 |
| PRSol | 0.001 | 0.041 | 99.821 | 0.00000 | 2.04 | 9.810 | 1.654 |
| PROUT | 0.001 | 0.036 | 99.856 | 5.08475 | 0.51 | 5.123 | 1.243 |
| TIMING | 0.000 | 0.026 | 99.882 | 70.85030 | 0.00 | 0.998 | 0.968 |
| HALVDT | 0.000 | 0.020 | 99.902 | 78.50474 | 0.00 | 0.847 | 0.836 |

| | | | | | | | |
|-----------|-------|-------|---------|-----------|------|--------|-------|
| VSAT1 | 0.000 | 0.018 | 99.921 | 100.00000 | 0.10 | 1.140 | 1.273 |
| PRSECPAR | 0.000 | 0.017 | 99.938 | 0.00000 | 1.22 | 10.436 | 0.663 |
| PRNOPN | 0.000 | 0.016 | 99.954 | 100.00000 | 0.00 | 0.491 | 0.900 |
| TIMEA | 0.000 | 0.014 | 99.968 | 80.00001 | 0.12 | 2.337 | 1.116 |
| PRMXSOL | 0.000 | 0.009 | 99.977 | 72.91669 | 0.00 | 0.384 | 0.980 |
| CLOSEF | 0.000 | 0.009 | 99.986 | 0.00000 | 0.00 | 1.022 | 1.060 |
| MXSOL | 0.000 | 0.004 | 99.990 | 100.00000 | 0.00 | 0.705 | 1.048 |
| REDMX | 0.000 | 0.002 | 99.993 | 0.00000 | 0.12 | 28.269 | 1.651 |
| ENDRUN | 0.000 | 0.002 | 99.995 | 48.38713 | 0.00 | 0.806 | 1.188 |
| LENSYM | 0.000 | 0.002 | 99.997 | 0.00000 | 0.01 | 0.540 | 0.483 |
| READDEBUG | 0.000 | 0.002 | 99.999 | 100.00000 | 0.00 | 0.616 | 0.956 |
| WRMXTR | 0.000 | 0.001 | 100.000 | 0.00000 | 0.00 | 1.517 | 0.220 |
| WRTIMEH | 0.000 | 0.000 | 100.000 | 0.00000 | 0.00 | 16.600 | 1.603 |
| BDATAM | 0.000 | 0.000 | 100.000 | 0.00000 | 0.01 | 1.000 | 0.639 |

Totals (All Traced Routines)

| | | | | | | | |
|--|-------|---------|---------|----------|-------|-------|-------|
| | 1.946 | 100.000 | 100.000 | 82.74505 | 18.21 | 1.005 | 0.608 |
|--|-------|---------|---------|----------|-------|-------|-------|

Key:

%AccumT = accumulated percentage of total CPU time
 %ExTime = percentage of total CPU time
 %Vflops = percentage of floating point operations due to vector floating point operations
 IBFR = Instruction Buffer Fetch Rate (megafetches/sec)
 IFact = Inline Factor (total calls to routine / average time spent in routine for each call)
 MC = number of memory conflicts
 MR = number of memory references
 Time = total CPU time (sec)

9. Coverage Analysis

A coverage analysis shows that the sample problem yielded a 48% segment coverage of VTOUGH. Sample problems provided with simulation programs typically achieve only 35% to 50% coverage. A statement of software quality cannot be made for routines that have low coverage, i.e., large portions of the code are untested.

Note that 70 routines have 0% coverage. These routines are not tested with the supplied sample problem.

Four routines achieve 1%-19% coverage, 4 routines achieve 20%-39% coverage, 9 routines achieve 40%-59% coverage, 25 routines achieve 60%-79% coverage, 21 routines achieve 80%-99% coverage, and 27 routines achieve 100% coverage.

Please note that module names have been truncated to 6 characters in the following table.

| Module Name | Number of Segments in module | Number of Segments Executed | Percent Segment Coverage |
|-------------|------------------------------|-----------------------------|--------------------------|
| MAIN | 7 | 5 | 71.4 |
| ACCTIM | 8 | 7 | 87.5 |
| ADJPV | 14 | 0 | 0.0 |
| BALCAL | 14 | 14 | 100.0 |

| | | | |
|--------|----|----|-------|
| BALLA | 6 | 5 | 83.3 |
| BDATAM | 1 | 1 | 100.0 |
| BDCOE | 8 | 8 | 100.0 |
| BINDIF | 18 | 16 | 88.9 |
| BLKBND | 1 | 1 | 100.0 |
| BLKDEC | 51 | 50 | 98.0 |
| BLKSLV | 27 | 26 | 96.3 |
| C2FORT | 3 | 0 | 0.0 |
| CHREAL | 31 | 0 | 0.0 |
| CHRINT | 18 | 0 | 0.0 |
| CKDNAM | 20 | 0 | 0.0 |
| CKESET | 58 | 0 | 0.0 |
| CKSNAM | 34 | 0 | 0.0 |
| CKTRIG | 39 | 0 | 0.0 |
| CLOSEF | 1 | 1 | 100.0 |
| COMPSA | 12 | 12 | 100.0 |
| CONVER | 22 | 17 | 77.3 |
| COVIS | 1 | 0 | 0.0 |
| COWAT | 1 | 0 | 0.0 |
| COWATX | 6 | 4 | 66.7 |
| CPVEC | 3 | 3 | 100.0 |
| CYCIT | 70 | 48 | 68.6 |
| DTADJP | 13 | 0 | 0.0 |
| DTPRNT | 7 | 5 | 71.4 |
| DULPOR | 1 | 0 | 0.0 |
| DULPOR | 32 | 0 | 0.0 |
| DXMOUT | 16 | 0 | 0.0 |
| ENDRUN | 1 | 1 | 100.0 |
| EOS | 1 | 0 | 0.0 |
| EOSC | 1 | 0 | 0.0 |
| EOSCAL | 16 | 13 | 81.2 |
| EOSX | 1 | 0 | 0.0 |
| ERRSTP | 7 | 0 | 0.0 |
| EXVALC | 49 | 0 | 0.0 |
| FINDER | 14 | 0 | 0.0 |
| FINDL | 14 | 10 | 71.4 |
| GAS2P | 3 | 3 | 100.0 |
| GETCVA | 12 | 0 | 0.0 |
| GETDES | 6 | 0 | 0.0 |
| GETEVA | 4 | 0 | 0.0 |
| GETFIL | 4 | 2 | 50.0 |
| GETGRD | 1 | 0 | 0.0 |
| GETMNV | 8 | 0 | 0.0 |
| GETMXV | 8 | 0 | 0.0 |
| GETSCR | 1 | 1 | 100.0 |
| HALVDT | 3 | 3 | 100.0 |
| HINTER | 1 | 0 | 0.0 |
| ICONV | 13 | 13 | 100.0 |
| INADJP | 15 | 0 | 0.0 |
| INDATA | 39 | 28 | 71.8 |
| INDEXV | 1 | 0 | 0.0 |
| INEOS | 23 | 15 | 65.2 |
| INITIM | 13 | 12 | 92.3 |
| INITNA | 8 | 0 | 0.0 |

| | | | |
|--------|-----|-----|-------|
| INITPC | 10 | 9 | 90.0 |
| INPUT | 169 | 116 | 68.6 |
| INTCHR | 15 | 0 | 0.0 |
| INVMAT | 12 | 7 | 58.3 |
| IO | 6 | 4 | 66.7 |
| ITLKUP | 14 | 0 | 0.0 |
| KNUDSE | 15 | 0 | 0.0 |
| LDMAT | 10 | 9 | 90.0 |
| LDSGBF | 9 | 0 | 0.0 |
| LENSYM | 7 | 7 | 100.0 |
| LENT | 3 | 0 | 0.0 |
| LIMSOL | 16 | 8 | 50.0 |
| LINEQ2 | 11 | 11 | 100.0 |
| LINEQ3 | 21 | 0 | 0.0 |
| LNBLNK | 6 | 0 | 0.0 |
| MATCH1 | 6 | 0 | 0.0 |
| MATCH2 | 6 | 0 | 0.0 |
| MULTI | 1 | 0 | 0.0 |
| MXSOL | 5 | 4 | 80.0 |
| NEQUAL | 11 | 0 | 0.0 |
| NICENU | 14 | 0 | 0.0 |
| NOCALL | 1 | 0 | 0.0 |
| NOCALL | 1 | 0 | 0.0 |
| NUMCLO | 31 | 0 | 0.0 |
| NUMELO | 27 | 0 | 0.0 |
| NUMVAR | 10 | 0 | 0.0 |
| OLDVDU | 1 | 0 | 0.0 |
| OUT | 98 | 57 | 58.2 |
| OUTRPC | 3 | 0 | 0.0 |
| OUTRPC | 5 | 0 | 0.0 |
| PARSLB | 7 | 0 | 0.0 |
| PCAP | 118 | 6 | 5.1 |
| PHASCO | 82 | 47 | 57.3 |
| PP | 10 | 3 | 30.0 |
| PRELEM | 3 | 2 | 66.7 |
| PRMXSO | 1 | 1 | 100.0 |
| PRNOPN | 13 | 9 | 69.2 |
| PROUT | 11 | 10 | 90.9 |
| PRSECP | 15 | 2 | 13.3 |
| PRSOL | 4 | 2 | 50.0 |
| PVTAB | 17 | 14 | 82.4 |
| PVTINT | 11 | 0 | 0.0 |
| QINTER | 1 | 1 | 100.0 |
| QU | 100 | 23 | 23.0 |
| RDCHAR | 11 | 0 | 0.0 |
| RDTIME | 118 | 0 | 0.0 |
| RDVAL | 7 | 0 | 0.0 |
| READDE | 16 | 4 | 25.0 |
| REAFIL | 129 | 85 | 65.9 |
| REDMX | 3 | 2 | 66.7 |
| RELP | 62 | 0 | 0.0 |
| REQIFI | 4 | 0 | 0.0 |
| REQOFI | 6 | 0 | 0.0 |
| RESCON | 14 | 14 | 100.0 |

| | | | |
|--------|------|------|-------|
| SAT | 1 | 0 | 0.0 |
| SATX | 6 | 4 | 66.7 |
| SCDULP | 1 | 0 | 0.0 |
| SETDX | 3 | 3 | 100.0 |
| SETMAT | 5 | 5 | 100.0 |
| SETSOL | 8 | 8 | 100.0 |
| SIGMA | 4 | 0 | 0.0 |
| STIDEL | 6 | 0 | 0.0 |
| SUPST | 8 | 0 | 0.0 |
| SUPSTX | 29 | 29 | 100.0 |
| THYME | 4 | 0 | 0.0 |
| TIMEA | 18 | 7 | 38.9 |
| TIMEHO | 27 | 5 | 18.5 |
| TIMING | 8 | 8 | 100.0 |
| TMSTP | 28 | 27 | 96.4 |
| TYPEFL | 37 | 37 | 100.0 |
| VCOVIS | 3 | 3 | 100.0 |
| VCOWAT | 25 | 19 | 76.0 |
| VDULPO | 22 | 13 | 59.1 |
| VEOS | 12 | 8 | 66.7 |
| VEOS2P | 56 | 51 | 91.1 |
| VEOSC | 8 | 7 | 87.5 |
| VEOSG | 36 | 33 | 91.7 |
| VEOSL | 34 | 30 | 88.2 |
| VISCO | 1 | 0 | 0.0 |
| VISS | 1 | 0 | 0.0 |
| VISW | 1 | 0 | 0.0 |
| VITLKU | 20 | 19 | 95.0 |
| VMULTI | 8 | 6 | 75.0 |
| VMULTI | 55 | 50 | 90.9 |
| VMULTI | 173 | 144 | 83.2 |
| VPCAP | 25 | 18 | 72.0 |
| VPCTEM | 15 | 13 | 86.7 |
| VPVTIN | 14 | 11 | 78.6 |
| VRELP | 17 | 12 | 70.6 |
| VSAT | 29 | 20 | 69.0 |
| VSAT1 | 1 | 1 | 100.0 |
| VSUPST | 33 | 23 | 69.7 |
| VVISCO | 11 | 8 | 72.7 |
| VVISS | 7 | 6 | 85.7 |
| VVISW | 7 | 4 | 57.1 |
| VXINTE | 3 | 3 | 100.0 |
| WRIFI | 5 | 5 | 100.0 |
| WRMXTR | 9 | 5 | 55.6 |
| WRTIME | 51 | 2 | 3.9 |
| XINTER | 1 | 0 | 0.0 |
| ZSGBFA | 1 | 0 | 0.0 |
| ZSGBSL | 1 | 0 | 0.0 |
| Totals | 2995 | 1428 | 47.7 |

0.20 0.40 0.60 0.80 1.00

| | -----+----- -----+----- -----+----- -----+----- -----+----- |
|--------|---|
| MAIN | ***** |
| ACCTIM | ***** |
| ADJPV | |
| BALCAL | ***** |
| BALLA | ***** |
| BDATAM | ***** |
| BDCOEF | ***** |
| BINDIF | ***** |
| BLKBND | ***** |
| BLKDEC | ***** |
| BLKSLV | ***** |
| C2FORT | |
| CHREAL | |
| CHRINT | |
| CKDNAM | |
| CKESET | |
| CKSNAM | |
| CKTRIG | |
| CLOSEF | ***** |
| COMPSA | ***** |
| CONVER | ***** |
| COVIS | |
| COWAT | |
| COWATX | ***** |
| CPVEC | ***** |
| CYCIT | ***** |
| DTADJP | |
| DTPRNT | ***** |
| DULPOR | |
| DULPOR | |
| DXMOUT | |
| ENDRUN | ***** |
| EOS | |
| EOSC | |
| EOSCAL | ***** |
| EOSX | |
| ERRSTP | |
| EXVALC | |
| FINDER | |
| FINDL | ***** |
| GAS2P | ***** |
| GETCVA | |
| GETDES | |
| GETEVA | |
| GETFIL | ***** |
| GETGRD | |
| GETMNV | |
| GETMXV | |
| GETSCR | ***** |
| HALVDT | ***** |
| HINTER | |
| ICONV | ***** |
| INADJP | |

| | | | | |
|--------|-------|--|--|--|
| INDATA | ***** | | | |
| INDEXV | | | | |
| INEOS | ***** | | | |
| INITIM | ***** | | | |
| INITNA | | | | |
| INITPC | ***** | | | |
| INPUT | ***** | | | |
| INTCHR | | | | |
| INVMAT | ***** | | | |
| IO | ***** | | | |
| ITLKUP | | | | |
| KNUDSE | | | | |
| LDMAT | ***** | | | |
| LDSGBF | | | | |
| LENSYM | ***** | | | |
| LENT | | | | |
| LIMSOL | ***** | | | |
| LINEQ2 | ***** | | | |
| LINEQ3 | | | | |
| LNBLNK | | | | |
| MATCH1 | | | | |
| MATCH2 | | | | |
| MULTI | | | | |
| MXSOL | ***** | | | |
| NEQUAL | | | | |
| NICENU | | | | |
| NOCALL | | | | |
| NOCALL | | | | |
| NUMCLO | | | | |
| NUMELO | | | | |
| NUMVAR | | | | |
| OLDVDU | | | | |
| OUT | ***** | | | |
| OUTRPC | | | | |
| OUTRPC | | | | |
| PARSLB | | | | |
| PCAP | *** | | | |
| PHASCO | ***** | | | |
| PP | ***** | | | |
| PRELEM | ***** | | | |
| PRMXSO | ***** | | | |
| PRNOPN | ***** | | | |
| PROUT | ***** | | | |
| PRSECP | ***** | | | |
| PRSOL | ***** | | | |
| PVTAB | ***** | | | |
| PVTINT | | | | |
| QINTER | ***** | | | |
| QU | ***** | | | |
| RDCHAR | | | | |
| RDTIME | | | | |
| RDVAL | | | | |
| READDE | ***** | | | |
| REAFIL | ***** | | | |

| | | | | | |
|--------|-------|--|--|--|--|
| REDMX | ***** | | | | |
| RELP | | | | | |
| REQIFI | | | | | |
| REQOFI | | | | | |
| RESCON | ***** | | | | |
| SAT | | | | | |
| SATX | ***** | | | | |
| SCDULP | | | | | |
| SETDX | ***** | | | | |
| SETMAT | ***** | | | | |
| SETSOL | ***** | | | | |
| SIGMA | | | | | |
| STIDEL | | | | | |
| SUPST | | | | | |
| SUPSTX | ***** | | | | |
| THYME | | | | | |
| TIMEA | ***** | | | | |
| TIMEHO | ***** | | | | |
| TIMING | ***** | | | | |
| TMSTP | ***** | | | | |
| TYPEFL | ***** | | | | |
| VCOVIS | ***** | | | | |
| VCOWAT | ***** | | | | |
| VDULPO | ***** | | | | |
| VEOS | ***** | | | | |
| VEOS2P | ***** | | | | |
| VEOSC | ***** | | | | |
| VEOSG | ***** | | | | |
| VEOSL | ***** | | | | |
| VISCO | | | | | |
| VISS | | | | | |
| VISW | | | | | |
| VITLKU | ***** | | | | |
| VMULTI | ***** | | | | |
| VMULTI | ***** | | | | |
| VMULTI | ***** | | | | |
| VPCAP | ***** | | | | |
| VPCTEM | ***** | | | | |
| VPVTIN | ***** | | | | |
| VRELP | ***** | | | | |
| VSAT | ***** | | | | |
| VSAT1 | ***** | | | | |
| VSUPST | ***** | | | | |
| VVISCO | ***** | | | | |
| VVISS | ***** | | | | |
| VVISW | ***** | | | | |
| VXINTE | ***** | | | | |
| WRIFI | ***** | | | | |
| WRMXTR | ***** | | | | |
| WRTIME | ** | | | | |
| XINTER | | | | | |
| ZSGBFA | | | | | |
| ZSGBSL | | | | | |

| | | | | | |
|-------------------------|--|--|---|--|--|
| coverage = 0. | ADJPV CKESET DTADJP EOSC GETCVA GETMXV INTCHR LINEQ3 NEQUAL NUMELO PARSLB RELP SIGMA VISS | C2FORT CKSNAM DULPOR EOSX GETDES HINTER ITLKUP LNBLNK NICENU NUMVAR PVTINT REQIFI STIDEL VISW | CHREAL CKTRIG DULPOR ERRSTP GETEVA INADJP KNUDSE MATCH1 NOCALL OLDVDU RDCHAR REQOFI SUPST XINTER | CHRINT COVIS DXMOUT EXVALC GETGRD INDEXV LDGBF MATCH2 NOCALL OUTRPC RDTIME SAT THYME ZSGBFA | CKDNAM COWAT EOS FINDER GETMNV INITNA LENTV MULTI NUMCLO OUTRPC RDVAL SCDULP VISCO ZSGBSL |
| 0.01 <= coverage < 0.20 | PCAP | PRSECP | TIMEHO | WRTIME | |
| 0.20 <= coverage < 0.40 | PP | QU | READDE | TIMEA | |
| 0.40 <= coverage < 0.60 | GETFIL PRSOL | INVMAT VDULPO | LIMSOL VVISW | OUT WRMXTR | PHASCO |
| 0.60 <= coverage < 0.80 | MAIN FINDL MXSOL SATX VPVTIN | CONVER INDATA PRELEM VCOWAT VRELP | COWATX INEOS PRNOPN VEOS VSAT | CYCIT INPUT REAFIL VMULTI VSUPST | DTPRNT IO REDMX VPCAP VVISCO |
| 0.80 <= coverage < 0.85 | BALLA | EOSCAL | PVTAB | VMULTI | |
| 0.85 <= coverage < 0.90 | ACCTIM VVISS | BINDIF | VEOSC | VEOSL | VPCTEM |
| 0.90 <= coverage < 0.95 | INITIM VEOSG | INITPC VMULTI | LDMAT | PROUT | VEOS2P |
| 0.95 <= coverage < 1.00 | BLKDEC | BLKSLV | TMSTP | VITLKU | |
| coverage = 1.00 | BALCAL COMPSA HALVDT QINTER SUPSTX VXINTE | BDATAM CPVEC ICONV RESCON TIMING WRIFI | BDCOEF ENDRUN LENSYM SETDX TYPEFL | BLKBND GAS2P LINEQ2 SETMAT VCOVIS | CLOSEF GETSCR PRMXSO SETSOL VSAT1 |

Program coverage for this run =0.48

10. Complexity Analysis

Some key metrics are the number of executable statements (sloc), the number of non-blank comments (ncomt), McCabe's extended cyclomatic complexity (vg2), the number of branching statements (cgoto, ugoto, bIF, and lIF), and Halstead's predicted number of errors in (re)writing the code (bhat). Measures are normalized per 100 executable statements for ease of comparison and are listed in the table below.

The branching measures for this code indicate few unconditional GO TO statements and logical IFs for most program modules. There are, however, some notable exceptions (e.g. errstp, TIMEA). This code appears to be fairly well structured.

Some routines have a good ratio of non-blank comments to source code. However, most have low to moderate ratios.

M McCabe's extended cyclomatic complexity (vg2), normalized per 100 lines of source code, indicates high values. Generally, the routines with the highest complexity are those most likely to have defects. As a guideline, normalized measures of 15 or greater should be considered complex. A software maintenance program should focus on those routines with the highest measures.

Please note that module names have been truncated to 7 characters in the following table.

Complexity Report by Subprogram for VTOUGH

| Name | loc | sloc | cmnt | ncomt | ncomt /sloc | vg2 /sloc | cgoto | cgoto /sloc | ugoto | ugoto /sloc | bIF | bif /sloc | lIF | lif /sloc | Bhat |
|----------|-----|------|------|-------|-------------|-----------|-------|-------------|-------|-------------|-----|-----------|-----|-----------|------|
| MAIN | 405 | 42 | 341 | 241 | 573.8 | 11.9 | 0 | 0.0 | 0 | 0.0 | 1 | 2.4 | 2 | 4.8 | 0 |
| acctim | 37 | 17 | 11 | 9 | 52.9 | 23.5 | 0 | 0.0 | 0 | 0.0 | 3 | 17.6 | 0 | 0.0 | 0 |
| adjpgv | 56 | 29 | 35 | 33 | 113.8 | 17.2 | 0 | 0.0 | 0 | 0.0 | 2 | 6.9 | 0 | 0.0 | 0 |
| balcalc | 153 | 78 | 49 | 28 | 35.9 | 10.3 | 0 | 0.0 | 1 | 1.3 | 0 | 0.0 | 3 | 3.8 | 1 |
| BALLA | 92 | 40 | 28 | 8 | 20.0 | 7.5 | 0 | 0.0 | 1 | 2.5 | 0 | 0.0 | 1 | 2.5 | 1 |
| BDATAM | 10 | 5 | 6 | 3 | 60.0 | 20.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| bdcoef | 53 | 25 | 15 | 4 | 16.0 | 20.0 | 0 | 0.0 | 0 | 0.0 | 1 | 4.0 | 0 | 0.0 | 0 |
| bindiff | 64 | 31 | 49 | 35 | 112.9 | 29.0 | 0 | 0.0 | 0 | 0.0 | 5 | 16.1 | 0 | 0.0 | 1 |
| blkbnd | 23 | 4 | 37 | 31 | 775.0 | 25.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| blkdec | 86 | 50 | 48 | 38 | 76.0 | 58.0 | 0 | 0.0 | 1 | 2.0 | 1 | 2.0 | 1 | 2.0 | 1 |
| blkslv | 50 | 30 | 37 | 28 | 93.3 | 43.3 | 0 | 0.0 | 0 | 0.0 | 1 | 3.3 | 1 | 3.3 | 1 |
| c2fortr | 8 | 6 | 10 | 9 | 150.0 | 33.3 | 0 | 0.0 | 0 | 0.0 | 1 | 16.7 | 0 | 0.0 | 0 |
| chreal | 68 | 50 | 18 | 16 | 32.0 | 40.0 | 0 | 0.0 | 1 | 2.0 | 6 | 12.0 | 1 | 2.0 | 0 |
| chrint | 49 | 31 | 33 | 28 | 90.3 | 32.3 | 0 | 0.0 | 1 | 3.2 | 4 | 12.9 | 0 | 0.0 | 0 |
| ckdname | 49 | 29 | 21 | 17 | 58.6 | 51.7 | 0 | 0.0 | 0 | 0.0 | 5 | 17.2 | 0 | 0.0 | 1 |
| ckeset | 167 | 90 | 50 | 42 | 46.7 | 32.2 | 0 | 0.0 | 4 | 4.4 | 15 | 16.7 | 0 | 0.0 | 1 |
| cksname | 60 | 46 | 23 | 19 | 41.3 | 34.8 | 0 | 0.0 | 0 | 0.0 | 9 | 19.6 | 0 | 0.0 | 1 |
| cktrig | 117 | 54 | 28 | 23 | 42.6 | 42.6 | 0 | 0.0 | 0 | 0.0 | 12 | 22.2 | 0 | 0.0 | 1 |
| closef | 10 | 5 | 6 | 5 | 100.0 | 20.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| compsat | 33 | 21 | 9 | 3 | 14.3 | 28.6 | 0 | 0.0 | 0 | 0.0 | 2 | 9.5 | 0 | 0.0 | 0 |
| CONVER | 109 | 42 | 35 | 22 | 52.4 | 31.0 | 0 | 0.0 | 3 | 7.1 | 1 | 2.4 | 6 | 14.3 | 0 |
| covis | 7 | 4 | 2 | 1 | 25.0 | 25.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| cowat | 5 | 3 | 2 | 1 | 33.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| COWATX | 59 | 33 | 13 | 10 | 30.3 | 9.1 | 0 | 0.0 | 1 | 3.0 | 0 | 0.0 | 1 | 3.0 | 0 |
| CPVEC | 7 | 4 | 23 | 21 | 525.0 | 50.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| cycit | 305 | 151 | 100 | 88 | 58.3 | 31.8 | 0 | 0.0 | 8 | 5.3 | 15 | 9.9 | 14 | 9.3 | 2 |
| dtadjpgv | 43 | 24 | 21 | 20 | 83.3 | 25.0 | 0 | 0.0 | 0 | 0.0 | 4 | 16.7 | 0 | 0.0 | 0 |
| dtprnt | 29 | 11 | 5 | 1 | 9.1 | 54.5 | 0 | 0.0 | 0 | 0.0 | 2 | 18.2 | 1 | 9.1 | 0 |
| dulpor | 5 | 3 | 5 | 4 | 133.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| dulpor2 | 123 | 75 | 37 | 21 | 28.0 | 17.3 | 0 | 0.0 | 0 | 0.0 | 7 | 9.3 | 2 | 2.7 | 1 |
| DXMOUT | 53 | 34 | 16 | 10 | 29.4 | 26.5 | 0 | 0.0 | 1 | 2.9 | 2 | 5.9 | 1 | 2.9 | 1 |
| endrun | 18 | 7 | 30 | 28 | 400.0 | 14.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| eos | 6 | 3 | 2 | 1 | 33.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| eosc | 5 | 3 | 3 | 2 | 66.7 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| eoscalc | 54 | 25 | 18 | 9 | 36.0 | 36.0 | 0 | 0.0 | 0 | 0.0 | 1 | 4.0 | 3 | 12.0 | 0 |
| eosx | 5 | 3 | 11 | 9 | 300.0 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |

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|----------|-----|-----|-----|-----|-------|------|---|-----|----|------|----|------|----|------|---|
| errstp | 17 | 10 | 16 | 9 | 90.0 | 40.0 | 0 | 0.0 | 1 | 10.0 | 0 | 0.0 | 2 | 20.0 | 0 |
| exvalck | 169 | 79 | 30 | 25 | 31.6 | 34.2 | 0 | 0.0 | 0 | 0.0 | 20 | 25.3 | 0 | 0.0 | 1 |
| FINDER | 27 | 16 | 9 | 2 | 12.5 | 37.5 | 0 | 0.0 | 2 | 12.5 | 0 | 0.0 | 2 | 12.5 | 0 |
| FINDL | 27 | 16 | 12 | 5 | 31.3 | 37.5 | 0 | 0.0 | 2 | 12.5 | 0 | 0.0 | 2 | 12.5 | 0 |
| gas2p | 34 | 17 | 22 | 15 | 88.2 | 11.8 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| getcval | 77 | 15 | 36 | 28 | 186.7 | 40.0 | 0 | 0.0 | 0 | 0.0 | 1 | 6.7 | 0 | 0.0 | 0 |
| getdesc | 43 | 8 | 17 | 13 | 162.5 | 37.5 | 0 | 0.0 | 0 | 0.0 | 1 | 12.5 | 0 | 0.0 | 0 |
| geteval | 68 | 7 | 26 | 21 | 300.0 | 28.6 | 0 | 0.0 | 0 | 0.0 | 1 | 14.3 | 0 | 0.0 | 0 |
| getfil | 22 | 13 | 16 | 12 | 92.3 | 15.4 | 0 | 0.0 | 0 | 0.0 | 1 | 7.7 | 0 | 0.0 | 0 |
| getgrd | 60 | 3 | 34 | 26 | 866.7 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| getmnva | 22 | 12 | 18 | 14 | 116.7 | 33.3 | 0 | 0.0 | 0 | 0.0 | 2 | 16.7 | 0 | 0.0 | 0 |
| getmxva | 22 | 12 | 8 | 7 | 58.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 2 | 16.7 | 0 | 0.0 | 0 |
| getscrif | 6 | 3 | 7 | 6 | 200.0 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| halvdt | 15 | 6 | 5 | 2 | 33.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 16.7 | 0 |
| HINTER | 15 | 3 | 9 | 4 | 133.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| ICONV | 37 | 30 | 9 | 7 | 23.3 | 23.3 | 0 | 0.0 | 3 | 10.0 | 1 | 3.3 | 3 | 10.0 | 0 |
| inadjpv | 65 | 26 | 22 | 21 | 80.8 | 26.9 | 0 | 0.0 | 0 | 0.0 | 3 | 11.5 | 0 | 0.0 | 0 |
| INDATA | 242 | 93 | 37 | 12 | 12.9 | 16.1 | 0 | 0.0 | 11 | 11.8 | 0 | 0.0 | 9 | 9.7 | 1 |
| indexvt | 5 | 3 | 1 | 1 | 33.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| ineos | 109 | 52 | 40 | 23 | 44.2 | 19.2 | 0 | 0.0 | 4 | 7.7 | 3 | 5.8 | 5 | 9.6 | 0 |
| initime | 118 | 49 | 26 | 21 | 42.9 | 16.3 | 0 | 0.0 | 0 | 0.0 | 1 | 2.0 | 0 | 0.0 | 1 |
| initnam | 30 | 26 | 6 | 5 | 19.2 | 15.4 | 0 | 0.0 | 1 | 3.8 | 2 | 7.7 | 0 | 0.0 | 0 |
| initpc | 134 | 83 | 54 | 39 | 47.0 | 6.0 | 0 | 0.0 | 1 | 1.2 | 0 | 0.0 | 2 | 2.4 | 1 |
| INPUT | 624 | 295 | 246 | 140 | 47.5 | 22.4 | 1 | 0.3 | 41 | 13.9 | 10 | 3.4 | 33 | 11.2 | 5 |
| intchr | 51 | 32 | 15 | 14 | 43.8 | 21.9 | 0 | 0.0 | 0 | 0.0 | 3 | 9.4 | 0 | 0.0 | 1 |
| invmat | 37 | 28 | 9 | 6 | 21.4 | 21.4 | 0 | 0.0 | 0 | 0.0 | 1 | 3.6 | 0 | 0.0 | 1 |
| io | 74 | 40 | 39 | 27 | 67.5 | 7.5 | 0 | 0.0 | 1 | 2.5 | 2 | 5.0 | 0 | 0.0 | 0 |
| itlkup2 | 32 | 28 | 3 | 2 | 7.1 | 21.4 | 0 | 0.0 | 3 | 10.7 | 4 | 14.3 | 0 | 0.0 | 0 |
| knudsen | 41 | 20 | 15 | 11 | 55.0 | 45.0 | 0 | 0.0 | 0 | 0.0 | 2 | 10.0 | 0 | 0.0 | 1 |
| ldmat | 60 | 38 | 20 | 17 | 44.7 | 13.2 | 0 | 0.0 | 0 | 0.0 | 2 | 5.3 | 0 | 0.0 | 0 |
| ldsgbf | 40 | 18 | 16 | 11 | 61.1 | 27.8 | 0 | 0.0 | 0 | 0.0 | 2 | 11.1 | 0 | 0.0 | 0 |
| lensym | 16 | 14 | 14 | 12 | 85.7 | 42.9 | 0 | 0.0 | 1 | 7.1 | 0 | 0.0 | 2 | 14.3 | 0 |
| lenvt | 11 | 7 | 6 | 6 | 85.7 | 28.6 | 0 | 0.0 | 0 | 0.0 | 1 | 14.3 | 0 | 0.0 | 0 |
| LIMSOL | 70 | 32 | 36 | 35 | 109.4 | 31.3 | 0 | 0.0 | 0 | 0.0 | 5 | 15.6 | 0 | 0.0 | 0 |
| lineq2 | 49 | 16 | 55 | 46 | 287.5 | 43.8 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 6.3 | 0 |
| lineq3 | 91 | 39 | 46 | 28 | 71.8 | 25.6 | 0 | 0.0 | 2 | 5.1 | 1 | 2.6 | 4 | 10.3 | 1 |
| lnblnk | 16 | 11 | 19 | 16 | 145.5 | 27.3 | 0 | 0.0 | 1 | 9.1 | 2 | 18.2 | 0 | 0.0 | 0 |
| match1 | 14 | 8 | 20 | 16 | 200.0 | 37.5 | 0 | 0.0 | 0 | 0.0 | 1 | 12.5 | 0 | 0.0 | 0 |
| match2 | 15 | 8 | 4 | 3 | 37.5 | 50.0 | 0 | 0.0 | 0 | 0.0 | 1 | 12.5 | 0 | 0.0 | 0 |
| multi | 5 | 3 | 8 | 7 | 233.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| mxsol | 11 | 7 | 11 | 9 | 128.6 | 42.9 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 14.3 | 0 |
| nequal | 31 | 23 | 22 | 18 | 78.3 | 21.7 | 0 | 0.0 | 1 | 4.3 | 3 | 13.0 | 0 | 0.0 | 0 |

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|---------|-----|-----|-----|----|-------|------|---|-----|----|------|----|------|----|------|---|
| nicenum | 41 | 34 | 7 | 6 | 17.6 | 20.6 | 0 | 0.0 | 1 | 2.9 | 5 | 14.7 | 0 | 0.0 | 0 |
| nocall | 10 | 3 | 3 | 2 | 66.7 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| nocall2 | 10 | 3 | 21 | 16 | 533.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| numcloc | 81 | 62 | 25 | 21 | 33.9 | 33.9 | 0 | 0.0 | 0 | 0.0 | 7 | 11.3 | 0 | 0.0 | 1 |
| numeloc | 62 | 46 | 25 | 21 | 45.7 | 30.4 | 0 | 0.0 | 0 | 0.0 | 6 | 13.0 | 0 | 0.0 | 1 |
| numvarx | 20 | 14 | 4 | 3 | 21.4 | 35.7 | 0 | 0.0 | 0 | 0.0 | 1 | 7.1 | 0 | 0.0 | 0 |
| oldvdul | 5 | 3 | 19 | 17 | 566.7 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| OUT | 346 | 158 | 112 | 49 | 31.0 | 31.0 | 0 | 0.0 | 13 | 8.2 | 4 | 2.5 | 30 | 19.0 | 2 |
| outrpc | 9 | 6 | 5 | 4 | 66.7 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| outrpcl | 33 | 16 | 12 | 5 | 31.3 | 18.8 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| parslb | 26 | 18 | 7 | 6 | 33.3 | 27.8 | 0 | 0.0 | 1 | 5.6 | 2 | 11.1 | 0 | 0.0 | 0 |
| PCAP | 268 | 185 | 84 | 61 | 33.0 | 23.8 | 1 | 0.5 | 13 | 7.0 | 8 | 4.3 | 30 | 16.2 | 2 |
| phascon | 214 | 153 | 61 | 45 | 29.4 | 29.4 | 0 | 0.0 | 21 | 13.7 | 13 | 8.5 | 17 | 11.1 | 3 |
| PP | 47 | 29 | 21 | 9 | 31.0 | 17.2 | 0 | 0.0 | 3 | 10.3 | 0 | 0.0 | 3 | 10.3 | 1 |
| prelem | 21 | 7 | 6 | 5 | 71.4 | 28.6 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 14.3 | 0 |
| prmxsol | 11 | 3 | 8 | 6 | 200.0 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| PRNOPN | 37 | 23 | 12 | 5 | 21.7 | 21.7 | 0 | 0.0 | 0 | 0.0 | 4 | 17.4 | 0 | 0.0 | 0 |
| prout | 27 | 18 | 9 | 6 | 33.3 | 77.8 | 0 | 0.0 | 0 | 0.0 | 3 | 16.7 | 3 | 16.7 | 0 |
| prsecpa | 42 | 24 | 6 | 3 | 12.5 | 29.2 | 0 | 0.0 | 1 | 4.2 | 1 | 4.2 | 1 | 4.2 | 0 |
| prsol | 22 | 8 | 10 | 7 | 87.5 | 37.5 | 0 | 0.0 | 0 | 0.0 | 1 | 12.5 | 0 | 0.0 | 0 |
| pvtab | 83 | 40 | 31 | 25 | 62.5 | 22.5 | 0 | 0.0 | 0 | 0.0 | 3 | 7.5 | 2 | 5.0 | 0 |
| pvtint | 38 | 29 | 10 | 7 | 24.1 | 20.7 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 5 | 17.2 | 1 |
| QINTER | 15 | 3 | 7 | 2 | 66.7 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| QU | 332 | 176 | 153 | 68 | 38.6 | 30.1 | 0 | 0.0 | 16 | 9.1 | 0 | 0.0 | 35 | 19.9 | 2 |
| rdchar | 41 | 26 | 17 | 12 | 46.2 | 15.4 | 0 | 0.0 | 1 | 3.8 | 3 | 11.5 | 0 | 0.0 | 0 |
| rdtimeh | 357 | 230 | 61 | 53 | 23.0 | 25.7 | 0 | 0.0 | 22 | 9.6 | 27 | 11.7 | 1 | 0.4 | 3 |
| rdval | 27 | 12 | 9 | 8 | 66.7 | 25.0 | 0 | 0.0 | 0 | 0.0 | 1 | 8.3 | 0 | 0.0 | 0 |
| readdeb | 40 | 29 | 9 | 3 | 10.3 | 27.6 | 0 | 0.0 | 3 | 10.3 | 2 | 6.9 | 3 | 10.3 | 0 |
| REAFILE | 381 | 221 | 113 | 47 | 21.3 | 22.6 | 0 | 0.0 | 33 | 14.9 | 3 | 1.4 | 34 | 15.4 | 2 |
| redmx | 16 | 7 | 4 | 3 | 42.9 | 28.6 | 0 | 0.0 | 0 | 0.0 | 1 | 14.3 | 0 | 0.0 | 0 |
| REL | 131 | 93 | 50 | 28 | 30.1 | 21.5 | 1 | 1.1 | 6 | 6.5 | 1 | 1.1 | 16 | 17.2 | 1 |
| reqifil | 17 | 11 | 6 | 5 | 45.5 | 18.2 | 0 | 0.0 | 1 | 9.1 | 1 | 9.1 | 0 | 0.0 | 0 |
| reqofil | 20 | 14 | 7 | 6 | 42.9 | 28.6 | 0 | 0.0 | 1 | 7.1 | 1 | 7.1 | 1 | 7.1 | 0 |
| resconv | 36 | 21 | 11 | 6 | 28.6 | 28.6 | 0 | 0.0 | 0 | 0.0 | 2 | 9.5 | 0 | 0.0 | 0 |
| sat | 5 | 3 | 3 | 2 | 66.7 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| SATX | 28 | 14 | 9 | 4 | 28.6 | 28.6 | 0 | 0.0 | 1 | 7.1 | 0 | 0.0 | 1 | 7.1 | 0 |
| scdulpo | 5 | 3 | 8 | 7 | 233.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| SETDX | 7 | 4 | 5 | 4 | 100.0 | 50.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| setmat | 14 | 5 | 9 | 8 | 160.0 | 60.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| SETSOL | 31 | 17 | 12 | 9 | 52.9 | 23.5 | 0 | 0.0 | 0 | 0.0 | 1 | 5.9 | 0 | 0.0 | 0 |
| SIGMA | 15 | 8 | 13 | 9 | 112.5 | 25.0 | 0 | 0.0 | 1 | 12.5 | 0 | 0.0 | 1 | 12.5 | 0 |
| stidel | 21 | 15 | 10 | 9 | 60.0 | 20.0 | 0 | 0.0 | 0 | 0.0 | 1 | 6.7 | 1 | 6.7 | 0 |

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|---------|-----|-----|-----|-----|-------|------|---|-----|---|------|----|------|---|------|---|
| supst | 60 | 18 | 25 | 23 | 127.8 | 27.8 | 0 | 0.0 | 0 | 0.0 | 3 | 16.7 | 0 | 0.0 | 0 |
| SUPSTX | 112 | 71 | 23 | 20 | 28.2 | 18.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 |
| THYME | 11 | 9 | 2 | 2 | 22.2 | 22.2 | 0 | 0.0 | 1 | 11.1 | 0 | 0.0 | 1 | 11.1 | 0 |
| TIMEA | 31 | 26 | 22 | 18 | 69.2 | 34.6 | 0 | 0.0 | 2 | 7.7 | 0 | 0.0 | 7 | 26.9 | 0 |
| timehou | 158 | 56 | 51 | 46 | 82.1 | 21.4 | 0 | 0.0 | 0 | 0.0 | 5 | 8.9 | 0 | 0.0 | 1 |
| timing | 38 | 21 | 26 | 23 | 109.5 | 19.0 | 0 | 0.0 | 0 | 0.0 | 1 | 4.8 | 0 | 0.0 | 0 |
| tmstp | 77 | 46 | 25 | 20 | 43.5 | 34.8 | 0 | 0.0 | 1 | 2.2 | 5 | 10.9 | 2 | 4.3 | 1 |
| typeflu | 110 | 70 | 25 | 16 | 22.9 | 25.7 | 0 | 0.0 | 2 | 2.9 | 3 | 4.3 | 2 | 2.9 | 1 |
| vcovis | 11 | 5 | 29 | 25 | 500.0 | 40.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| vcowat | 91 | 40 | 30 | 23 | 57.5 | 40.0 | 0 | 0.0 | 0 | 0.0 | 5 | 12.5 | 0 | 0.0 | 1 |
| vdulpor | 74 | 39 | 36 | 26 | 66.7 | 35.9 | 0 | 0.0 | 0 | 0.0 | 6 | 15.4 | 0 | 0.0 | 1 |
| veos | 51 | 27 | 18 | 10 | 37.0 | 25.9 | 0 | 0.0 | 0 | 0.0 | 3 | 11.1 | 3 | 11.1 | 0 |
| veos2p | 148 | 102 | 43 | 33 | 32.4 | 28.4 | 0 | 0.0 | 4 | 3.9 | 5 | 4.9 | 4 | 3.9 | 2 |
| veosc | 43 | 15 | 16 | 6 | 40.0 | 26.7 | 0 | 0.0 | 0 | 0.0 | 1 | 6.7 | 0 | 0.0 | 1 |
| veosg | 111 | 80 | 20 | 9 | 11.3 | 23.8 | 0 | 0.0 | 2 | 2.5 | 4 | 5.0 | 1 | 1.3 | 1 |
| veosl | 99 | 74 | 18 | 8 | 10.8 | 24.3 | 0 | 0.0 | 3 | 4.1 | 3 | 4.1 | 3 | 4.1 | 2 |
| visco | 5 | 3 | 2 | 1 | 33.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| viss | 5 | 3 | 2 | 1 | 33.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| visw | 5 | 3 | 12 | 10 | 333.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| vitlkup | 36 | 27 | 27 | 20 | 74.1 | 33.3 | 0 | 0.0 | 0 | 0.0 | 3 | 11.1 | 0 | 0.0 | 0 |
| vmulti | 43 | 17 | 17 | 9 | 52.9 | 23.5 | 0 | 0.0 | 1 | 5.9 | 1 | 5.9 | 2 | 11.8 | 0 |
| vmultia | 163 | 80 | 48 | 32 | 40.0 | 41.3 | 0 | 0.0 | 0 | 0.0 | 6 | 7.5 | 0 | 0.0 | 1 |
| vmultif | 515 | 269 | 143 | 116 | 43.1 | 35.3 | 0 | 0.0 | 0 | 0.0 | 36 | 13.4 | 2 | 0.7 | 7 |
| vpcap | 83 | 43 | 34 | 26 | 60.5 | 25.6 | 0 | 0.0 | 0 | 0.0 | 5 | 11.6 | 1 | 2.3 | 1 |
| vpctem | 41 | 23 | 9 | 3 | 13.0 | 39.1 | 0 | 0.0 | 0 | 0.0 | 3 | 13.0 | 0 | 0.0 | 0 |
| vpvtint | 64 | 34 | 19 | 15 | 44.1 | 20.6 | 0 | 0.0 | 0 | 0.0 | 5 | 14.7 | 0 | 0.0 | 1 |
| vrelp | 51 | 32 | 24 | 14 | 43.8 | 25.0 | 0 | 0.0 | 0 | 0.0 | 2 | 6.3 | 1 | 3.1 | 0 |
| vsat | 120 | 45 | 49 | 42 | 93.3 | 31.1 | 0 | 0.0 | 0 | 0.0 | 8 | 17.8 | 0 | 0.0 | 1 |
| vsatl | 12 | 9 | 8 | 7 | 77.8 | 11.1 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| vsupst | 90 | 44 | 41 | 32 | 72.7 | 36.4 | 0 | 0.0 | 0 | 0.0 | 7 | 15.9 | 0 | 0.0 | 0 |
| vvisco | 64 | 35 | 18 | 7 | 20.0 | 17.1 | 0 | 0.0 | 0 | 0.0 | 1 | 2.9 | 0 | 0.0 | 1 |
| vvis | 16 | 9 | 5 | 2 | 22.2 | 33.3 | 0 | 0.0 | 0 | 0.0 | 1 | 11.1 | 0 | 0.0 | 0 |
| vvisw | 24 | 14 | 7 | 2 | 14.3 | 28.6 | 0 | 0.0 | 0 | 0.0 | 1 | 7.1 | 0 | 0.0 | 0 |
| vxinter | 13 | 5 | 5 | 2 | 40.0 | 40.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| WRIFI | 62 | 14 | 39 | 23 | 164.3 | 21.4 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 7.1 | 0 |
| wrmxtr | 80 | 14 | 35 | 27 | 192.9 | 35.7 | 0 | 0.0 | 0 | 0.0 | 1 | 7.1 | 0 | 0.0 | 0 |
| wrtimh | 152 | 62 | 32 | 26 | 41.9 | 38.7 | 0 | 0.0 | 0 | 0.0 | 9 | 14.5 | 0 | 0.0 | 1 |
| xinter | 7 | 3 | 22 | 19 | 633.3 | 33.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| zsgbfa | 11 | 5 | 3 | 2 | 40.0 | 20.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| zsgbsl | 10 | 5 | 1 | 0 | 0.0 | 20.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |

Legend of Metrics in Report

loc -- lines of code
sloc -- number of executable statements
cmnt -- total number of comments
ncomt -- number of non-blank COMMENT statements
 $100 * ncomt / sloc$ -- percent, nonblank comments to number of executable statements
 $100 * vg2 / sloc$ -- percent, extended complexity of number of executable statements
cgoto -- number of COMPUTED GO TO statements
 $100 * cgoto / sloc$ -- percent, computed GOTO's to number of executable statements
ugoto -- number of UNCONDITIONAL GO TO statements
 $100 * ugoto / sloc$ -- percent, unconditional GOTO's to number of executable statements
bIF -- number of BLOCK IF statements
 $100 * bif / sloc$ -- percent, Block IF statements to number of executable statements
lIF -- number of LOGICAL IF statements
 $100 * lif / sloc$ -- percent, logical IF statements to number of executable statements
Bhat -- Halstead's predicted number of errors in writing code