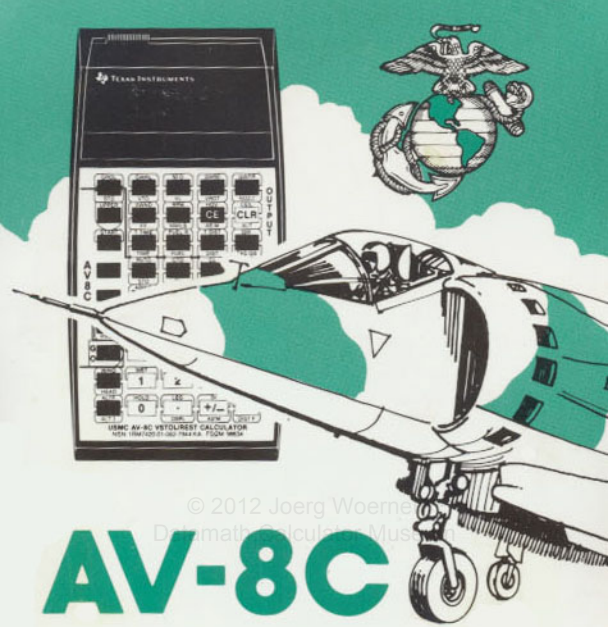

AV-8C

V/STOL-REST FLIGHT CALCULATOR

MCDONNELL AIRCRAFT COMPANY

MCDONNELL DOUGLAS

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FORWARD

The AV-8C V/STOL-REST Calculator has been designed to calculate the performance of the AV-8C aircraft easily, quickly, and accurately. In essence, the entire Performance Data Section of the NATOPS Flight Manual has been incorporated into the calculator. AV-8C performance data has been fitted mathematically for the calculator, while the fit for the NATOPS Manual is graphical. This introduces some differences in specific performance points but these differences are negligible.

The Calculator can be used for calculating all Vertical or Short Takeoff and Landing (V/STOL) and wingborne Range, Endurance, Speed, and Time (REST). The engine characteristics of an individual aircraft can be entered, to provide the aircraft's maximum V/STOL capabilities to the pilot.

Although the calculator is programmed specifically for the AV-8C most of the functions are also applicable to the AV-8A and TAV-8A. All V/STOL calculations except for VTO and VL are applicable to all three models. REST calculations may be used for all three models. (The Drag index must be increased by 2.5 for TAV-8A performance). The Bingo calculations *cannot* be used for the TAV-8A.

1. GENERAL DESCRIPTION

1.1 CALCULATOR CAPABILITIES

For V/STOL operations the calculator:

Calculates:

- Vertical, Rolling Vertical, Short, and Conventional Takeoff performance.
- Vertical, Slow, and Conventional Landing performance.
- Hover performance.

Accounts for:

- Individual aircraft characteristics of relative hover performance, relative jet pipe temperature, and jet pipe temperature limiter settings.
- Ambient temperature and pressure, wind, ground roll available, and available distance to (from) 50 foot altitude.
- Gross weight, wet or dry engine operation, nozzle braking, and engine fan speed.

Provides:

- Maximum VTO and VL gross weight.
- Ground roll and 50 foot altitude distances for a given gross weight, as well as gross weights for given ground roll and 50 foot altitude distances.
- Short Lift engine rating as well as reduced power, STO performance.

- Nozzle angle, nozzle rotation and liftoff speeds, tire limited gross weight, and crosswind components.

For REST operations the calculator:

Calculates:

- Constant Mach-altitude cruise, constant altitude cruise and endurance, and optimum altitude cruise and endurance performance.
- Combat ceiling, and climb performance between any two altitudes.
- Idle and instrument penetration descent performance between any two altitudes.
- Constant and optimum altitude emergency Bingo performance.

Accounts for:

- Gross weight, drag index, and wind speed and direction.
- Gross weight change due to fuel usage.
- In-flight refuelling and gross weight change due to store drops.

Provides:

- Time, fuel, and distance.
- Indicated airspeed and Mach number, true airspeed, groundspeed, and altitude.

- Fuel flow and specific range.
- Time and fuel required for cruise flight between any two points, including correction for wind.
- Cumulative time, fuel, distance and gross weight change for multiple leg calculations.

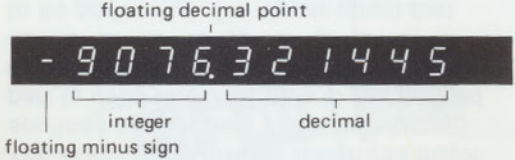
In addition, it can be used as a basic four-function calculator for calculating gross weight, drag index, relative hover performance, fuel totals, etc.

1.2 CALCULATOR FACE

A fold-out picture of the calculator is attached to the last page of this manual. It can be referred to when a calculator is not handy.

Display

The display provides numerical information complete with negative sign and decimal point. It flashes on and off to indicate an overflow, underflow, or error condition. An entry can contain as many as 10 digits. All digits entered after the tenth are ignored.



Keyboard

The keyboard is divided into three major sections by function. The lower (green) part is used to INPUT data to the desired calculation. In the center (tan) part the user chooses the type of CALCulation to be performed. The upper (grey) part selects the OUTPUT from the calculation.

The keys are labeled in two ways. Basic calculator functions are molded into the keys, while AV-8C functions are printed on the keyboard. The two unlabeled keys are inoperative.

1.3 AV-8C MODULE

All of the equations and logic for the AV-8C V/STOL-REST calculations are contained in the CROM (Constant Read Only Memory) AV-8C module. The calculator will not operate correctly if the module is damaged or missing.

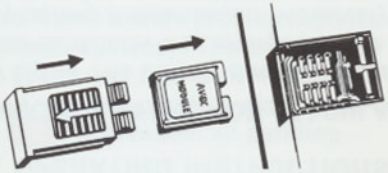
The AV-8C module is installed in the calculator at the factory, and it is a good idea to leave the module in place in the calculator. Be sure to follow these instructions only if you must remove or replace the module.

CAUTION

Be sure your body is free of static electricity before handling the module.

This is especially true when the charger is connected, because this grounds the calculator. Just touch some metal object to electrically discharge your body before touching the module. The contents of a module can be severely damaged by static discharges.

1) Turn the calculator OFF. Loading or unloading a module can short the contacts, causing serious damage if the calculator is ON during loading or unloading.
2) Slide out the small panel covering the module compartment at the bottom of the back of the calculator. (See Diagram below.) Again, eliminate all static charges before handling the module.
3) Remove the module. Turn the calculator over and let the module fall out into your hand.
4) Insert the module, notched end first, with the labeled side up, into the compartment.
5) Replace the cover panel, securing the module against the contacts.



2. OPERATING INSTRUCTIONS

2.1 BASIC FOUR-FUNCTION CALCULATOR

Power Up — The battery pack furnished with the calculator was charged at the factory before it was issued. However, due to self-discharging that happens in all batteries, it may require some charging before initial operation. If while the calculator is first in use, the display becomes dim or erratic, the battery pack needs to be charged.

Turn the calculator off, plug in the charger and wait a few minutes. Then proceed. The calculator can be operated while the battery pack is being charged.

Slide the ON/OFF switch at the top of the calculator to the ON position. There should be a single zero in the display showing that the calculator is ready for action. To check the calculator's display, press the decimal point [.] and the change sign [+/—] keys, then press [8] repeatedly to fill the display. Note that the decimal point and minus sign progress to the left each time an eight is pressed.

Up to 10 digits can be entered into calculator at any one time for either positive or negative numbers. All digits entered after the tenth are ignored. Notice

that the minus sign always stays immediately to the left of the negative number.

Whenever the limits of the display are exceeded or the calculator is asked to do something it cannot do, the display flashes. This flashing is stopped by pressing either the clear entry CE or clear CLR key.

Data Entry Keys 0 thru 9, ·, and +/−

Numbers are entered into the calculations with these data entry keys. As any number is entered, the decimal point stays to the right of the entry until the decimal point key is pressed. The fractional part of the number is then keyed in, and the decimal point floats to the left with it. To change the sign of a number in the display, push the change sign key +/− once. (Pressing +/− twice changes the sign back again.)

Four-Function Operation Keys + , − , X , ÷ , and =

Basic arithmetic is handled with these 5 operation keys. The calculator has an entry method which makes problem solution with these keys easy. The problem is keyed in the way it is written, = is pressed, and the result is displayed. When = is pressed, all pending

operations (things waiting to happen inside the calculator) are completed and the result is displayed.

A universally accepted set of rules is applied by the calculator when mixed operations are used in one calculation regardless of the order of input:

- Multiplications and divisions are completed first, followed by
- Additions and subtractions.
- Finally, the = key completes all operations.

For example, the calculation: 3 — 2 X 14 ÷ 7 + 10 = has only one right answer. (It's 9.) This problem can be keyed into the calculator directly, left to right, to get the correct answer.

Section 3.4 contains a sample gross weight and Drag Index buildup which illustrates four function calculator operation.

General Clear CLR

The CLR key clears the display and cancels any calculations in progress. It also stops a flashing display.

Clear Entry CE

The CE key clears a bad entry from the display so the correct entry may be made. For example, if you want to enter 17.8 but key in 18.8 instead, press CE to clear

the display and enter the complete correct number. CE clears the display but does not affect calculations in progress.

The CE key does not clear the display if the number in the display has been generated by the calculator or if a function key (such as X, + etc) has been pressed after the number is entered. It does stop a flashing display.

2.2 V/STOL-REST OPERATION

Operation of the calculator in the V/STOL-REST mode is straightforward. Individual aircraft/engine performance and ambient conditions are input, the desired maneuver is selected, and the required results are available as output. Most of the maneuvers in the Performance Data section of the AV-8A, TAV-8A and AV-8C NATOPS Flight Manual (NAVAIR 01-AV8A-1) are handled by the calculator.

The calculator is divided into three sections: INPUT, CALCulate and OUTPUT. This separation by function simplifies operation and reduces the possibility of error in operating the calculator.

The REST calculations in the AV-8C V/STOL-REST calculator are applicable to the AV-8C and AV-8A. If 2.5 is added to the Drag Index the calculations are also applicable to the TAV-8A. The Bingo

calculations, ABING and OBING are for the AV-8C. AV-8C Bingo calculations will be slightly conservative for the AV-8A but cannot be used for the TAV-8A.

Of the V/STOL functions, only VTO and VL are peculiar to the AV-8C. All other V/STOL functions are applicable to the AV-8C, AV-8A and TAV-8A. Do NOT use the AV-8C calculator to compute VTO or VL for the AV-8A or TAV-8A.

2.2.1 GENERAL

Start Procedure

Use the following key sequence to enter the V/STOL REST mode:

CLR UPPER START 2 GO UPPER START .* (if the display flashes, repeat)

This sequence sets the standard input conditions (Page 14). It is used at turn on and for resetting the V/STOL-REST mode. (See Section 2.3.) Once the calculator has been turned on and the start procedure keyed in, any V/STOL or REST calculation can be made.

Function Control

The two V/STOL-REST function control keys are GO and UPPER.

**The start procedure has been changed from the AV-8A calculator to preclude inadvertant use with the AV-8A CROM module.*

The [GO] key begins all V/STOL-REST functions and must be pressed first for all inputs, calculations, and outputs. [UPPER] switches the calculator from the lower (white) functions to the upper (orange) functions. Thus, the key sequence [GO] [UPPER] (Function) is used to address one of the upper functions.

EXAMPLES:

30 [GO] [OATC] — Enters 30°C as the outside air temperature.

68 [GO] [UPPER] [OATF] — Enters 68°F as the outside air temperature.

If [UPPER] is inadvertently pressed, it can be corrected by pressing [UPPER] again; pressing [UPPER] twice is the same as not pressing it at all.

Display Key [DSPL]

In the V/STOL-REST mode the calculator display normally has a fixed number of digits to the right of the decimal. This display format may not be suitable for use as a four function calculator. Keying in [GO] [DSPL] clears the fixed-decimal format and gives the display a floating decimal point and shows all significant digits.

Standard Conditions STD

When changing from V/STOL to REST, or from REST to V/STOL, standard conditions must be reset by using the key sequence GO STD.

Standard conditions set by the calculator are:

OATF	Outside Air Temperature	59.	°F
OATC	Outside Air Temperature	15.	°C
INHG	Ambient Pressure	29.92	in. Hg
SLRPM	Engine Fan Speed	90	% RPM

The values of the engine status inputs (RJPT , JPTL and RHOV) are not changed by the STD routine. Standard values are set during the Start Procedure and new values can be input at any time. They are retained until they are changed or the start procedure is used again.

The standard Engine status conditions set by the start procedure are:

RJPT	Relative Jet Pipe Temperature	0°C
JPTL	Jet Pipe Temperature Limiter Settings	740°C wet 710°C dry
RHOV	Relative Hover Performance	0%

All other inputs are set to 0. These include dry engine operation, conventional landings without nozzle braking and leg mode for REST calculations.

Inputs

Inputs can be entered in any order.

Inputs for both V/STOL and REST are made by keying in the numbers and sign [+/−], then [GO] or [GO] [UPPER] and the input function.

Example:

The sequence [5], [+/−], [GO], [UPPER], [OATF] enters −5°F into the calculator.

The process is repeated until all desired inputs are loaded.

WARNING

Failure to press the [GO] button when entering input values may lead to erroneous results. If there is any doubt about an input, reenter it.

As inputs are made, they appear in the display. Due to varying fixed-decimal modes, the echoed input may have superfluous zeroes after the decimal. This display peculiarity does not affect the operation of the calculator.

Review Mode

The review mode allows the user to check the values of the inputs either before or after calculations. To enter this mode press [GO] [RVEW] . The input can then be recalled by pressing the normal sequence for that input. For example (after the start procedure)

[GO] [RVEW]	puts the calculator in the Review Mode
[GO] [UPPER] [JPTL]	740.710 in the display
[GO] [OATC]	15. in the display

In the review mode, the inputs can only be checked — they cannot be changed. The calculator is returned to the normal operating mode by pressing GO UPPER NORM . Selecting any CALCulate operation will also clear the review mode and return the calculator to the normal mode. (Note: Some inputs are changed during certain calculations. These are discussed on page 36.)

Calculations

After the required inputs have been entered, calculations are run by keying in GO or GO UPPER and the function. The calculations will take from 3 to 30 seconds, during which time the display will appear blank. (Actually, there will be a very faint "[" at the left side of the display.) When the calculation is complete, the display will show "0" and the available outputs will be stored, ready to be called up to the display.

Outputs

After a calculation is complete (display is "0"), output values may be displayed by keying in GO or GO UPPER and the output function. For example, after a climb calculation (GO CLMB) has been made and the calculator displays "0", the results of the calculation can be displayed using the following procedures:

- GO TIME causes the time to climb to be displayed,
- GO FUEL causes the fuel to climb to be displayed,
- GO DIST causes the distance to climb to be displayed.

Outputs can be called in any order and as often as desired.

2.2.2 V/STOL CALCULATIONS

The Vertical or Short Takeoff and Landing calculations include Vertical, Short and Conventional takeoffs and landings, Rolling Vertical Takeoff and Hover. Ambient conditions (temperature, atmospheric pressure and wind) and the individual aircraft engine characteristics are accounted for in the calculations.

The V/STOL functions are:

VTO	Vertical Takeoff
VL	Vertical Landing
HOV	Hover
RVTO	Rolling Vertical Takeoff
STO	Short Takeoff
CTO	Conventional Takeoff
SL	Slow Landing
CL	Conventional Landing

The VTO, VL, and HOV functions are located in the OUTPUT portion of the calculator. Each of these functions calculates a single output which is displayed immediately. The other functions are initiated in the CALC section and generate several outputs which may be examined using the output keys.

The VTO and VL functions are based on AV-8C Lift Improvement Devices (LIDs) and are, therefore, NOT applicable to the AV-8A or TAV-8A. The other V/STOL functions are applicable to the AV-8A and TAV-8A.

The inputs and outputs for each of the V/STOL functions are tabulated on page 20.

Flashing "2"

The display will flash "2" when a V/STOL calculation is attempted using water at an outside air temperature less than —5°C.

V/STOL inputs and outputs

	VTO & VL	RVTO	STO	CTO	SL	CL	HOV
Inputs:							
OATF or OATC	X	X	X	X	X	X	X
PALT or INHG	X	X	X	X	X	X	X
HEAD			O	O	O	O	
WIND	O		O	O	O	O	
RJPT	X	X	X	X			X
JPTL	X	X	X	X			
RHOV	X	X	X	X	X		X
WET or DRY	X	X	X	X			X
SLRPM					X		
STORPM			O				
GW		X	X	X	X	X	
NZBK						O	
GND			O	O	O		
DT50		O	O		O		
Outputs							
GROL			●	●	●	●	
GWRL			●	●	●		
50'D		●	●	●	●	●	
GW50		●	●		●		
GWTR				●		●	
VTO (WEIGHT)	●						
VL (WEIGHT)	●						
VROT				●			
NOZ ∡			●				
RPM			●		●		
XWND			●	●	●	●	

X Required Inputs O Optional Inputs

Inputs

Inputs can be entered in any order.

Ambient Conditions:

OATF	°Fahrenheit	Outside Air Temperature
OATC	°Centigrade	Outside Air Temperature
PALT	Feet	Pressure Altitude
INHG	Inches of Mercury	Ambient Pressure
HEAD	Degrees	Runway Heading or Course
WIND	Degrees Knots	Wind Direction and Speed

The outside air temperature can be input as either OATC or OATF. (The calculator converts OATF to OATC for use in the computations.) Atmospheric pressure may be entered as INHG directly, or as PALT, which the calculator will convert to INHG.

HEAD is used to input runway heading for V/STOL calculations or aircraft course

for REST calculations, WIND is used to input wind direction and speed. WIND is entered as a six digit number: DDD.SSS, where DDD is the direction from which the wind is blowing in degrees and SSS is the wind speed in knots. (270.020 is a 20 knot wind from 270 degrees.)

In V/STOL mode headwind (or tailwind) is used in the STO, CTO, VTO, SL, CL, and VL calculations.

Engine Parameters:

RJPT	°Centigrade	Relative Jet Pipe Temperature
JPTL	Wet °C. Dry °C	Jet Pipe Temperature Limiter Settings
RHOV	%	Relative Hover Performance
WET	—	Select Wet Engine Operation
DRY	—	Select Dry Engine Operation
SLRPM	% RPM	Slow Landing Engine Fan Speed
STORPM	% RPM	Reduced Power STO Engine Fan Speed

RJPT, JPTL and RHOV are initialized by the start procedure and may be changed at any time. They are not affected by the STD key.

The WET and DRY keys control water use for V/STOL calculations. The WET key selects wet operation and places a "1" in the display. The DRY key selects dry operation and places a "0" in the display. Use of the WET or DRY keys is independent of the number in the display when the key is selected.

In the review mode the WET and DRY keys will display either a "1" (on) or a "0" (off) depending upon which key has been selected. That is, if dry operation has been selected the review mode display for WET will be "0" (off) and for DRY it will be "1" (on). If WET has been selected the review mode display for WET will be "1" and for DRY it will be "0".

SLRPM sets the limiting RPM for slow landing (SL) calculations. SLRPM is set to 90% by the STD routine.

STORPM allows Short Takeoff (STO) calculations which are based on RPM less than the Short Lift (Wet or Dry) engine ratings. STO calculations are based on the smallest of the Short Lift RPM limit, Short Lift JPT limited RPM or the input

STORPM . If STORPM is "0", the Short Lift rating is used. The STD routine sets STORPM = 0.

Initial Condition Inputs

GW	Pounds	Gross Weight
GND	Feet	Limiting Ground Roll Distance
DT50	Feet	Limiting Distance To/From 50 Foot Altitude
NZBK	—	Nozzle Braking For Conventional Landing

GW is required for V/STOL calculations. GND and DT50 are optional.

The NZBK input controls the use of nozzle braking for conventional landing calculations. An entry of "1" to NZBK selects nozzle braking. Any other input turns NZBK off. In Review mode NZBK will display either "1" (on) or "0" (off).

Outputs

Outputs can be called in any order and as often as desired.

GROL	Feet	Ground Roll
GWRL	Pounds	Gross Weight — Limited by GND Input

50'D	Feet	Distance To/From 50 Foot Altitude
GW50	Pounds	Gross Weight — Limited by DT50 Input
GWTR	Pounds	Gross Weight — Limited by Tires
VROT	Knots	Nozzle Rotation Velocity/Liftoff Speed
NOZ ∡	Degrees	Engine Nozzle Angle for STO
XWND	Knots	Cross Wind Component (Right (+), Left (—))
RPM	%RPM	Engine Fan Speed for STO or SL
VTO	Pounds	Vertical Takeoff Gross Weight
VL	Pounds	Vertical Landing Gross Weight
HOV	Pounds or %RPM.°C	Hover Weight or Hover RPM and JPT

GROL, 50'D, VROT and NOZ ∡ are based on the GW input. VROT is the nozzle rotation speed for STO calculations, or liftoff speed for CTO calculations.

GWRL is calculated only if GND has been input.

GW50 is calculated only if DT50 has been input. For the slow landing GROL,

GWRL , 50'D , and GW50 are calculated using the input value of the engine fan speed (% RPM), SLRPM. RPM provides the limiting fan speed for STO or the required fan speed (based on the GND input) for SL calculations. VTO and VL and HOV do not require a calculation key to be pushed, but *cause the calculation to be made* and the result is displayed immediately. After the inputs are loaded GO VTO calls up maximum vertical takeoff weight, and GO VL calls up maximum vertical landing weight. There are no other outputs.

In the case of Hover calculations the value in the display when GO UPPER HOV is keyed in determines what calculations will be made and what answer will be displayed:

(a) Key in the hover weight and GO UPPER HOV. The answer will be displayed as RRRR.TTT, where RRRR is the required engine % RPM times 10 and TTT is the JPT in °C.

(b) Key in the engine hover % RPM and GO UPPER HOV. The hover gross weight will be displayed.

(c) Key in [.], the jet pipe temperature in hover (JPT/1000), and [GO] [UPPER] [HOV]. The display will show the hover gross weight.

There are no other outputs. [HOV] can be used to calculate the relative hover performance and relative JPT of an aircraft following a hover check. Perform the hover check and note hover weight, JPT, and RPM. Key in the start procedure then enter [INHG] or [PALT], [OATC] or [OATF] and [WET] or [DRY]. Key in the actual engine % RPM and [GO] [UPPER] [HOV]. The display result is the nominal hover weight. Note this number and press [GO] [UPPER] [HOV] again, without changing the display. The result is the nominal RPM (±.3%) and the nominal JPT. The relative hover performance and relative JPT may then be found from:

$$RHOV = \frac{GW\ actual}{GW\ nominal} X100 - 100$$

$$RJPT = JPT_{actual} - JPT_{nominal}$$

This procedure is a simplification of the suggested procedure for the AV-8A calculator. The results of either procedure are identical.

Section 3.1 presents sample hover check calculations.

Operational Performance Corrections

> **NOTE:**
>
> All assumptions, corrections and procedures found in the AV-8A, TAV-8A and AV-8C NATOPS FLIGHT MANUAL (NAVAIR 01-AV-8A-1 and the AV-8A, TAV-8A and AV-8C NATOPS POCKET CHECKLIST (NAVAIR 01-AV-8A-1B) apply to the performance calculated with this calculator. For shipboard performance corrections, refer to the AV-8C SHIPBOARD OPERATING BULLETIN.

NATOPS corrections are as follows

For VTO

Subtract the following correction from the VTO weight under the conditions shown. If more than one correction is applicable, subtract only the largest.

- VTO to be followed by a hover — 500 pounds

- Maximum bleed demands likely to be encountered due to gusting or veering wind or operating near crosswind limit and:
  - RPM limited (before PPC 38) — up to 700 pounds
  - RPM limited (after PPC 38) — up to 350 pounds
  - JPT limited using maximum performance technique from obstacle critical site — 600 pounds

For RVTO

Subtract the following correction from the RVTO weight under the conditions shown. If more than one correction is applicable, subtract only the largest. Maximum bleed demands likely to be encountered due to gusting or veering wind or operating near crosswind limit and:

- RPM limited (before PPC 38) — up to 700 pounds
- RPM limited (after PPC 38) — up to 350 pounds
- JPT limited from obstacle critical site — 600 pounds

For STO

For maximum performance STO with c.g. aft of 13.1% MAC, the nozzle angle is 50°.

The nozzle rotation speed is determined in the same manner as for a normal STO with nozzle angle greater than 50°.

For STO with 300 gallon external fuel tanks, add 5 knots to the calculated nozzle rotation speed.

Subtract the applicable correction from the STO weight when maximum bleed demands are likely to be encountered due to gusting or veering wind or operating near crosswind limit and:

- RPM limited (before PPC 38) — up to 700 pounds
- RPM limited (after PPC 38) — up to 350 pounds
- JPT limited using maximum performance technique from obstacle critical site — 600 pounds

For VL

For night or restricted site operations with less than 35 gallons of water, use dry vertical landing capability.

2.2.3 REST CALCULATIONS

The Range, Endurance, Speed and Time calculations include most of the Wing-borne performance from the NATOPS Manual; cruise, endurance, climbs, descents and emergency Bingo calculations. REST functions may be run

either as independent cases in which the inputs are retained after each calculation* (HOLD mode) or as a series of related calculations (mission planning) in which each calculation sets up most of the inputs for the next case (LEG mode). In the mission planning mode, adjustments can be made to account for inflight refueling, store drops, etc., and it is possible to "back track" to correct a calculation.

The REST functions are:

MACR	Constant Mach-Altitude Cruise
ACR	Optimum Cruise at Constant Altitude
OPCR	Optimum Cruise at Optimum Cruise Altitude
AEND	Optimum Endurance at Constant Altitude
OEND	Optimum Endurance at Optimum Endurance Altitude
CLMB	Climb
IDLE	Idle Descent
INST	Instrument Penetration Descent
OBING	Optimum Altitude Bingo
ABING	Constant Altitude Bingo
CEIL	Combat Ceiling

**Unlike the AV-8A calculator which erased all REST inputs after each calculation*

The CEIL function is located in the OUTPUT portion of the keyboard. Like the VTO and VL functions it calculates a single output which is displayed immediately.

Standard atmosphere and average engine performance are assumed for all REST calculations. Wind corrections can be made to all cruise and endurance calculations and to the cruise legs of the Bingo calculations.

The REST portion of the AV-8C V/STOL REST calculator, with the exception of the Bingo calculations, is applicable to the AV-8A, and AV-8C and (if 2.5 is added to the drag index) to the TAV-8A. The Bingo calculations are applicable to the AV-8C but may be used for the AV-8A (the answers will be slightly conservative). Bingo calculations cannot be used for the TAV-8A.

The inputs and outputs for each REST function are tabulated on Page 33.

	MACR	ACR AEND	OPCR OEND	CLMB IDLE INST	OBING ABING	CEIL(1)
Inputs:						
ALTI	X	X		X	X	
ALTF				X		
GW	X	X	X	X		X
DI	X	X	X	X		X
FUEL(2)	X	X	X		X	
AS.M	X					
DIST.F	X	X	X			
HEAD & WIND (Optional)	X	X	X		X	
Outputs:						
FF	X	X	X		X	
NM/LB	X	X	X		X	
AS.M	X	X	X	X	X	
ALT	X	X	X	X	X	
T TIME(3)	X	X	X	X	X	
FUEL R(3)	X	X	X	X	X	
T DIST(3)	X	X	X	X	X	
GW(3)	X	X	X	X	X	
FUEL	X	X	X	X	X	
DIST	X	X	X	X	X	
TAS.GS	X	X	X		X	
CEIL (Altitude)						X

NOTES

(1) CEIL is a combined function-output. GO UPPER CEIL performs the calculation and displays the only output.

(2) The FUEL input is used only in the Leg mode.

(3) The T TIME, FUEL R, T DIST and GW outputs are used only in the LEG mode.

Inputs (Can be entered in any order.)

WIND	Degrees.Knots	Wind Direction and Speed
HEAD	Degrees	Course
ALTI	Feet	Present Altitude or Initial Altitude for Climb or Descent
ALTF	Feet	Final Altitude for Climb or Descent
GW	Pounds	Initial Gross Weight
DI	—	Drag Index
FUEL	Pounds	Initial Mission Fuel
AS.M	Knots or Mach	Indicated Airspeed, Mach Number or True Airspeed
DIST.F	Nautical Miles or (Pounds/ 10,000)	Distance or Fuel for the Next Calculation

WIND is input as DDD.SSS, where DDD is the wind direction and SSS is the wind speed.

AS.M is a multiple input key. Indicated airspeed (entry greater than 1.0), Mach number (entry from 1.0 to 0.) or true airspeed (negative entry) may be entered.

DIST.F is also a multiple input key for the distance or the fuel to be used in the next cruise or endurance calculation. The fuel entry must be divided by 10,000; that is, a DIST.F input of .2500 represents 2500 pounds of fuel. (NOTE — Each DIST.F input will be either a distance or a fuel. It cannot be both.) A DIST.F input of 300.25 will be interpreted as a distance of 300.25 NM; not as a distance of 300 NM and a fuel of 2500 pounds. If both distance and fuel are input (using two entries to DIST.F) the last one entered will be used in the calculation.

Rest Input Retention

One important difference between the AV-8A and AV-8C V/STOL-REST calculators lies in the way the inputs to REST calculations are handled. In the AV-8A calculator the inputs are erased after each REST calculation and all inputs had to be re-entered for the next calculation. In the AV-8C calculator, the inputs are retained.

However, in the AV-8C calculator the AS.M, ALTI, and GW inputs may be modified during the calculation. For example, operations which calculate an optimum Mach number (ACR, OPCR, AEND or OEND) replace the AS.M input with the calculated Mach number. Similarly, operations which calculate an optimum altitude replace the ALTI input with the calculated altitude.

Changes to the GW input depend on whether the calculation is run in HOLD or LEG mode, which will be described later. Other cases in which the ALTI or AS.M inputs will be changed during REST calculations are:

- Constant Mach-Altitude Cruise (MACR) an AS.M input which represents an indicated or true airspeed will be converted to Mach number.
- Climb or Descent (CLMB, IDLE, INST) the final altitude (ALTF) will replace the ALTI input.

These input changes are primarily used to simplify mission planning (Leg mode) calculations by setting up the inputs for the next calculation based on the results of the last calculation.

Review Mode In Rest Calculations

In general, REST inputs which are recalled

in the RVEW mode will show the current value of the inputs; that is, the values which will be used in the next calculation. The exceptions to this are:

- ALTI - the RVEW mode displays the altitude used as the input in the preceeding calculation. This altitude may have been changed during the calculation. The current value of the ALTI input (to be used in the next calculation unless it is changed) may be found in the ALT output.
- GW, FUEL - the RVEW mode for these inputs displays the last value entered from the keyboard. The current values of these inputs may be found in the GW or FUEL R outputs.

Outputs (Can be called in any order as often and as desired.)

FF	Pounds/ Minute	Fuel Flow
NM/LB	Nautical Miles/Pound	Specific Range
AS.M	Knots.Mach	Indicated Airspeed and Mach Number
ALT	Feet	Altitude

(continued on next page)

T TIME	Minutes	Total Mission Time
FUEL R	Pounds	Mission Fuel Remaining
T DIST	Nautical Miles	Total Mission Distance
GW	Pounds	Gross Weight
TIME	Minutes	Time
FUEL	Pounds	Fuel
DIST	Nautical Miles	Distance
TAS.GS	Knots.Knots	True Airspeed and Ground Speed
CEIL (Altitude)	Feet	Combat Ceiling

AS.M and TAS.GS are combination display output keys. AS.M has the format AAA.MM, where AAA is indicated airspeed in knots and MM is the Mach number. TAS.GS has a format TTT.GGG, where TTT is true airspeed in knots and GGG is groundspeed in knots. For Bingo calculations, T DIST is also a combination

display with a format TOT.DES where TOT is the total Bingo distance and DES is the descent distance.

The outputs T TIME, FUEL R, T DIST and GW are used for calculations in the Leg mode and contain the accumulated data for all the mission segments. The remaining outputs (except for CEIL) are for the last segment calculated.

CEIL is a combined calculate-output similar to VTO and VL. It requires no previous calculations and the result is displayed immediately.

Flashing 3

The display will flash "3" after MACR calculation if the input AS.M is less than the maximum endurance Mach number.

Mode Control — HOLD and LEG

The HOLD and LEG keys are used to select the operating mode for REST calculations. The use of either of these keys is independent of the number in the display when the key is selected. Both keys place a "1" in the display to indicate the selection is complete. In the review mode the HOLD and LEG keys will display either a "1" (ON) or a "0" (OFF) depending upon which mode has been selected. That is, if HOLD mode has been selected, the

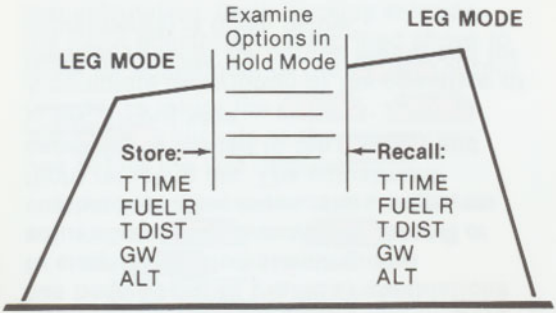
review mode display for LEG will be "0" (OFF); for HOLD the display will be "1" (ON)

NOTE

After the start procedure or GO STD, the calculator will be in the LEG mode.

Running REST calculations in HOLD or LEG mode will only affect the T TIME, FUEL R, T DIST and GW outputs. The other REST outputs will be the same for either mode. When the calculations are run in the HOLD mode, T TIME, FUEL R, T DIST and GW are not changed during calculations. In the LEG mode the TIME output is added to T TIME and the DIST output is added to T DIST. The FUEL output is subtracted from FUEL R and from GW Thus, after each calculation in the LEG mode these outputs are updated, with the Total Time (T TIME) and the Total Distance (T DIST) being increased and the Fuel Remaining (FUEL R) and Gross Weight (GW) being decreased to account for fuel consumption. An example of a series of calculations in the LEG mode is given in Section 3.3 of the sample problems.

The HOLD and LEG modes can be used in conjunction to examine options at any point in planning a mission. Begin the mission calculations in the LEG mode. When you want to examine options put the calculator in the HOLD mode (GO UPPER HOLD). This retains the current T TIME , FUEL R , T DIST and GW outputs and also stores the current ALT output. Any number of options may be calculated while in the HOLD mode. To continue the mission planning return to LEG mode (GO UPPER LEG). The conditions (i.e. T TIME , FUEL R , T DIST , GW and ALT) are reset to what they were after the last LEG mode calculation. The selected option can then be rerun in the LEG mode. This is illustrated below.



Input Adjustments

The capability of adjusting certain inputs has been added to the REST calculations to simplify mission planning. The adjustments may account for takeoff or combat fuel allowances, store drops, in-flight refueling etc. The adjustment capability is limited to the FUEL and GW input keys.

A complete description of the operation of these keys (both for normal inputs and for adjustments) is given below.

FUEL The first entry after the startup procedure or GO STD is stored as the FUEL R output. All subsequent entries are treated as adjustments and are added to (or subtracted from) both the FUEL R and the GW output. Thus a positive adjustment represents an increase in FUEL R and in GW (in-flight refueling) and a negative adjustment represents a decrease in FUEL R and in the GW output (a fuel allowance).

GW Any entry greater than 10,000 pounds is used as the input gross weight. An entry less than 10,000 pounds is treated as an adjustment to the current gross weight input. The normal gross weight adjustment will be a reduction (negative number) to represent a weapons release.

NOTE

A gross weight adjustment representing an external weapons release does *not* change the current Drag Index input (DI). The Drag Index should be changed to reflect the new aircraft configuration.

In the review mode RVEW the FUEL and GW inputs will display the last value entered with the input keys (either an input or an adjustment). The current (adjusted) value of the inputs may be found in the FUEL R or GW outputs.

Back Tracking

The back tracking capability is used to avoid having to rerun a series of LEG mode calculations when an error is found in the last calculation. Back tracking extends the input adjustments described above to allow for adjustment of the T DIST output.

In order to return the T DIST, FUEL R and GW outputs to the values they had before the last calculation:

1) Add the Fuel calculated for the last Leg to FUEL R and GW using the FUEL input adjustment.
   GO FUEL (Fuel Output)
   GO UPPER FUEL (Fuel Adjustment Input)

2) Subtract the distance calculated for the last Leg.

GO DIST (Distance Output)

+/− (Change the sign to get a negative display)

GO DIST.F (DIST.F Input)

A negative entry to DIST.F will reduce T DIST but will have no effect on the current DIST.F input.

There is no provision for correcting the T TIME output.

Bingo Calculations ABING and OBING

The ground rules for the emergency Bingos are:

1) The calculations are for the AV-8C. The answers are slightly conservative for the AV-8A.
2) Maximum thrust climb at 350 KIAS to 0.81 Mach number, then hold 0.81 Mach.
3) Descent at idle thrust and 230 KIAS.
4. Fuel includes 200 pounds allowance for vertical landing and 600 pounds reserve.
5) DI = 10 (empty pylons and guns and ammo).
6) Bingo calculations may be run with the calculator in either HOLD or LEG mode.

ABING calculates the Bingo performance with the cruise leg at the input altitude; OBING calculates performance based on a climb to, and cruise at, an optimum altitude. The inputs to the Bingo calculations are the initial altitude (ALTI) and the FUEL . HEAD and WIND inputs affect the cruise portion only.

The outputs T TIME , FUEL R and T DIST refer to the total values for the climb, cruise and descent legs. T DIST is a combination display with the format TTT.DDD where TTT is the total range and DDD is the descent distance (both in nautical miles).

The outputs FF , NM/LB , AS.M , ALT , TIME , FUEL , DIST and TAS.GS refer to the cruise leg only.

2.3 IN CASE OF DIFFICULTY

Symptom	Remedy
Display flashes "2" during V/STOL calculation.	Water used when outside air temperature is below −5°C. Press CLR, select DRY operation or raise the outside air temperature, and repeat calculation.

(continued on next page)

Symptom	Remedy
Display flashes "3" during MACR Calculation.	Input Mach number less than calculated endurance Mach number. Press CLR, correct the inputs, and repeat calculation.
Display flashes or produces incorrect results when running V/STOL-REST program.	Improper start procedure. Use start procedure again. Refer to Section 2.2.1 of this manual. Improper operating procedure. Check related portion of Section 2 . Program module not properly installed. Refer to Section 1.4 of this manual.
Display flashes each time the V/STOL-REST program is called.	Program module not properly installed. Refer to Section 1.4 of this manual.

Display flashes "± 9.9999999 99." (The number of decimal places may vary)	Division by zero. Press CE or CLR. Calculation entry or result overflow. Press CE or CLR.
Display flashes "± 1.-99."	Calculation entry or result underflow. Press CE or CLR.
Display flashes last entered number.	Two operation keys (+, −, ×, ÷) pressed in succession, or operation key followed by equal key (=). Press CE or CLR.
Display shows erratic numbers, grows dim, or goes blank.	The battery pack is probably discharged. Refer to the appendix of this manual.

3. SAMPLE PROBLEMS

The following sample problems have been included to demonstrate the capabilities of the V/STOL-REST Calculator and to help you gain proficiency in its use. All of the step-by-step procedures have not been included in this section, therefore it is important that the GENERAL DESCRIPTION and OPERATING INSTRUCTIONS (Sections 1 and 2) be read prior to attempting to work these problems. The answers to the sample problems worked on the electronic calculator should agree exactly with the answers given in this manual.

Although the inputs (and outputs) of the problems in this section follow a consistent order to facilitate comparisons, it is not necessary to follow any specific order of inputs (or outputs). Optional inputs which are not used are noted by ( ). The value within the parenthesis is set by GO STD or the start procedure.

3.1 HOVER CHECK

(a) Calculate the relative hover performance and relative jet pipe temperature after a hover check where:

Outside air temperature	20	°C
Ambient pressure	29.50	In. Hg
Aircraft hover weight	15250.	LB
Recorded fan RPM	95.7	%
Recorded JPT	658.	°C

Enter the ambient conditions (OATC and INHG) and set RHOV = O to get nominal engine performance. Place the recorded RPM in the display and press GO UPPER HOV. The result is the nominal engine hover weight (15016 LB). Pressing GO UPPER HOV again (without changing the display) results in the nominal engine conditions for hover (954.645).

The relative hover is then:

RHOV = 15250 ÷ 15016 x 100-100 = 1.558 (use 1.6%)

The relative JPT is:

RJPT = 658-645 = 13°C

(b) Hover Check Conditions:

Outside air temperature	55.	°F
Pressure altitude	1300.	FT
Hover weight	15780.	LB
Recorded RPM	98.4	%
Recorded JPT	681.	°C

Results:

Relative hover	-1.4	%
Relative JPT	18	°C

(c) Hover Check Conditions:

Outside air temperature	41.	°F
Ambient pressure	28.72	In. Hg
Hover weight	16830.	LB
Recorded RPM	97.7	%
Recorded JPT	601.	°C
Water	ON	

Results:

Relative hover	3.0	%
Relative JPT	-10	°C

(d) Hover Check Conditions:

Outside air temperature	9.	°C
Ambient pressure	30.05	In. Hg
Hover weight	14690.	LB
Recorded RPM	91.8	%
Recorded JPT	599.	°C

Results:

Relative hover	2.0	%
Relative JPT	9	°C

3.2 V/STOL PROBLEMS

Problems (a) thru (c) can be used for both vertical takeoff and vertical landing.

(a) VTO / VL

INPUTS:

OATF	INHG	RJPT	JPTL
65.	29.21	5.	732.703

RHOV	DRY	WIND
-1.5		230.020

RESULTS:

VTO (Display)	VL (Display)
15733.	14829.

(b) VTO / VL

INPUTS:

OATF	INHG	RJPT	JPTL
65.	29.21	5.	732.703

RHOV	WET	WIND
-1.5		230.020

RESULTS:

VTO (Display)	VL (Display)
17232.	16869.

Problem (b) is the same as (a) with the addition of wet engine operation, and (b) can be run immediately after (a) by keying GO UPPER WET.

(c) VTO / VL

INPUTS:

OATC	PALT	RJPT	JPTL
30.	1000.	10.	730.720

RHOV	WET	WIND
-2.		090.010

RESULTS:

VTO (Display)	VL (Display)
16166.	16108.

(d) RVTO

INPUTS:

OATF	INHG	DT50	RJPT
65.	29.21	290.	5.

JPTL	RHOV	GW	DRY
732.703	-1.5	16230.	

RESULTS:

50'D	GW50
423.	15818.

(e) STO

INPUTS:

OATF	INHG	GND	DT50
22.	30.05	(0.)	(0.)

RJPT	JPTL	RHOV	GW
-17.	745.715	1.3	20950.

HEAD	WIND	WET	STORPM
(0.)	(0.)		(0.)

RESULTS:

Flashing "2" because wet engine operation is prohibited below -5°C (23°F). This is true of the hover and all takeoff calculations.

(f) STO

INPUTS:

OATC	PALT	GND	DT50
30.	1000.	(0.)	(0.)

RJPT	JPTL	RHOV	GW
10.	730.720	-2.	21780.

HEAD	WIND	DRY	STORPM
(0.)	(0.)		(0.)

RESULTS:

XWND	GROL	GWRL	50'D
0.	1719.	0.	3046.

GW50	VROT	NOZ ∡	RPM
0.	135.	55.	98.6

(g) STO

INPUTS: (Add GND and DT50 to problem (f).)

OATC	PALT	GND	DT50
30.	1000.	850.	2000.

RJPT	JPTL	RHOV	GW
10.	730.720	−2.	21780.

HEAD	WIND	DRY	STORPM
(0.)	(0.)		(0.)

RESULTS:

XWND	GROL	GWRL	50'D
0.	1719.	17675.	3046.

GW50	VROT	NOZ	RPM
18679.	135.	55.	98.6

This problem can be run immediately after (f) by loading GND and DT50, pressing GO STO, and displaying the results. The same "add-on" procedure can be used for the next two sample problems.

(h) STO

INPUTS: (Add water (WET) to problem (g).)

OATC	PALT	GND	DT50
30.	1000.	850.	2000.

RJPT	JPTL	RHOV	GW
10.	730.720	−2.	21780.

HEAD	WIND	WET	STORPM
(0.)	(0.)		(0.)

RESULTS:

XWND	GROL	GWRL	50'D
0.	1412.	18954.	2570.

GW50	VROT	NOZ ∡	RPM
19946.	123.	55.	102.9

(i) STO

INPUTS: (Add HEAD, WIND and STORPM to problem h.)

OATC	PALT	GND	DT50
30.	1000.	850.	2000.

RJPT	JPTL	RHOV	GW
10.	730.720	-2.	21780.

HEAD	WIND	WET	STORPM
120.	50.012		99.

RESULTS:

XWND	GROL	GWRL	50'D
-11.	1642.	17959.	2927.

GW50	VROT	NOZ ∡	RPM
18980.	134.	55.	99.0

The XWND result can be displayed at any time after HEAD and WIND are entered.

(j) CTO

INPUTS:

OATC	INHG	GND	RJPT
21.	28.74	1500.	-17.

JPTL	RHOV	GW	HEAD
745.703	2.1	18350.	90.

WIND WET
310.010

RESULTS:

XWND	GROL	GWRL	50'D
-6.	1876.	16721.	2950.

GWTR	VROT
18152.	155.

Notice that since the takeoff gross weight exceeds the tire limited gross weight the takeoff should not be made.

(k) SL

INPUTS:

OATC	INHG	SLRPM	GND
30.	29.92	92.	1600.

DT50	RHOV	GW	HEAD
3200.	-0.5	17000.	270.

WIND
300.030

RESULTS:

XWND	GROL	GWRL	50'D
15.	1411.	18046.	2761.

GW50	RPM
19630.	95.3

(l) CL

INPUTS:

OATC	INHG	NZBK	GW
15.	29.92	1.	19500.

HEAD	WIND
100.	120.018

RESULTS:

XWND	GROL	50'D	GWTR
6.	5075.	7594.	23591.

3.3 REST SAMPLE PROBLEMS

The REST samples are presented in two groups; a set of individual problems run in HOLD mode and a set of problems which simulate mission planning in LEG mode. The HOLD mode problems may be run in any order. The LEG mode problems must be run in the order presented.

In the HOLD mode samples all inputs are shown for each problem including those which were entered for preceeding problems and do not change during the calculations. For example, HOLD is listed as an input for each case. However after HOLD is first entered it remains until it is changed.

In the LEG mode samples, only those inputs required for each case are shown. Inputs which do not change from the preceeding case are not re-entered.

HOLD MODE CALCULATIONS

Cruise Calculations

(a) OPCR

INPUTS:

GW	DI	DIST.F	HOLD
24000.	20.	.2000	

OUTPUTS:

FF	NM/LB	AS.M	ALT
56.	.135	278.78	33014.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	24000.

TIME	FUEL	DIST	TAS.GS
36.	2000.	270.	455.455

(b) OPCR

INPUTS:

GW	DI	DIST.F	HOLD
18000.	10.	400.	

OUTPUTS:

FF	NM/LB	AS.M	ALT
39.	.199	244.81	40439.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	18000.

TIME	FUEL	DIST	TAS.GS
52.	2013.	400.	465.465

(c) OPCR

INPUTS:

GW	DI	DIST.F	HOLD
18000.	10.	400.	

HEAD	WIND
100.	320.020

OUTPUTS:

FF	NM/LB	AS.M	ALT
39.	.205	244.81	40439.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	18000.

TIME	FUEL	DIST	TAS.GS
50.	1948.	400.	465.481

Comments

This problem is identical to problem (b) except for the wind corrections. HEAD and WIND are the only new inputs required. Note that the wind corrections affect NM/LB, FUEL (in this problem) and TAS.GS. If the DIST.F input had been fuel (as in problem (a)) the outputs NM/LB, DIST and TAS.GS would be affected by the wind correction.

(d) OPCR

INPUTS:

GW	DI	DIST.F	HOLD
24000.	20.	.2000	

HEAD	WIND
315.	260.030

OUTPUTS:

FF	NM/LB	AS.M	ALT
56.	.130	278.78	33014.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	24000.

TIME	FUEL	DIST	TAS.GS
36.	2000.	260.	455.438

Comments

This problem is the same as (problem (a)) except for the wind correction.

(e) OPCR

INPUTS:

GW	DI	DIST.F	HOLD
24000.	20.	0.	

HEAD	WIND
0.	0.

OUTPUTS:

FF	NM/LB	AS.M	ALT
59.	.129	284.78	32152.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	24000.

TIME	FUEL	DIST	TAS.GS
0.	0.	0.	457.457

Comments

This is an example with DIST.F = 0 (no fuel or distance entered). The output values give the cruise conditions at the input gross weight.

(f) ACR

INPUTS:

ALTI	GW	DI	DIST.F
10000.	18000.	10.	400.

HOLD

OUTPUTS:

FF	NM/LB	AS.M	ALT
48.	.113	280.51	10000.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	18000.

TIME	FUEL	DIST	TAS.GS
74.	3546.	400.	323.323

(g) MACR

INPUTS:

ALTI	GW	AS.M	DI
10000.	18000.	.8	10.

DIST	HOLD
400.	

OUTPUTS:

FF	NM/LB	AS.M	ALT
102.	.083	448.80	10000.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	18000.

TIME	FUEL	DIST	TAS.GS
47.	4797.	400.	510.510

(h) MACR

INPUTS:

ALTI	GW	AS.M	DI
10000.	18000.	448.	10.

DIST	HOLD
400.	

OUTPUTS:

FF	NM/LB	AS.M	ALT
102.	.083	448.80	10000.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	18000.

TIME	FUEL	DIST	TAS.GS
47.	4791.	400.	509.509

Comments

This problem is identical to problem (g) except for the AS.M input is the indicated airspeed rather than Mach number.

(i) MACR

INPUTS:

ALTI	GW	AS.M	DI
10000.	18000.	−510.	10.

DIST	HOLD
400.	

OUTPUTS:

FF	NM/LB	AS.M	ALT
102.	.083	448.80	10000.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	18000.

TIME	FUEL	DIST	TAS.GS
47.	4794.	400.	509.509

Comments

This problem is also identical to problem (g) except that the negative AS.M input represents the true airspeed (510 KTAS).

(j) MACR

INPUTS:

ALTI	GW	AS.M	DI
10000.	18000.	.4	10.

DIST	HOLD
400.	

Comments

The display should give a flashing "3". This indicates that the input AS.M is less than the calculated optimum endurance Mach number.

Endurance Calculations

(a) OEND

INPUTS:

GW	DI	DIST.F	HOLD
24000.	20.	.2000	

OUTPUTS:

FF	NM/LB	AS.M	ALT
54.	.125	279.68	26076.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	24000.

TIME	FUEL	DIST	TAS.GS
37.	2000.	251.	409.409

(b) AEND

INPUTS:

ALTI	GW	DI	DIST.F
10000.	18000.	10.	.2500

HOLD

OUTPUTS:

FF	NM/LB	AS.M	ALT
43.	.110	243.44	10000.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	18000.

TIME	FUEL	DIST	TAS.GS
59.	2500.	274.	280.280

Climb, Descent and Ceiling Calculations

(a) CLMB

INPUTS:

GW	DI	ALTI	ALTF
20000.	10.	15000.	35000.

HOLD

OUTPUTS:

FF	NM/LB	AS.M	ALT
0.	0.000	350.81	35000.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	20000.

TIME	FUEL	DIST	TAS.GS
4.	296.	27.	0.000

(b) IDLE

INPUTS:

GW	DI	ALTI	ALTF
20000.	10.	35000.	15000.

HOLD

OUTPUTS:

FF	NM/LB	AS.M	ALT
0.	0.000	230.00	15000.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	20000.

TIME	FUEL	DIST	TAS.GS
8.	154.	43.	0.000

(c) INST

INPUTS:

GW	DI	ALTI	ALTF
20000.	10.	35000.	15000.

HOLD

OUTPUTS:

FF	NM/LB	AS.M	ALT
0.	0.000	300.00	15000.

T TIME	FUEL R	T DIST	GW
0.	0.	0.	20000.

TIME	FUEL	DIST	TAS.GS
3.	85.	22.	0.000

(d) CEIL

INPUTS:

GW	DI
20000.	10.

OUTPUTS:

(Display) 40613.

Leg Mode Calculations

The following sample problems illustrate REST calculations in the LEG mode. This mode is used for mission planning and the problems present a climb-cruise-descent type mission with combat fuel allowance and weapons drop. As these problems represent related calculations, they must be run in the order presented.

> **NOTE**
>
> Always key in [GO] [STD] before starting LEG mode calculations to clear all REST inputs and outputs.

The aircraft configuration used in these calculations is (3) MK-82 SE + (2) MK-83 LDGP + guns and ammunition. The gross weight and drag index buildup for this configuration is given in Section 3.4.

(a) Input Operations

INPUTS:

GW	DI	FUEL	LEG
22320.	17.5	5161.	

OUTPUTS:

FF	NM/LB	AS.M	ALT
0.	0.000	0.00	0.

T TIME	FUEL R	T DIST	GW
0.	5161.	0.	22320.

TIME	FUEL	DIST	TAS.GS
0.	0.	0.	0.000

Comments

The Calculator is in the LEG mode after GO STD.

(b) Input Operations

INPUTS:

FUEL
-400.

OUTPUTS:

FF	NM/LB	AS.M	ALT
0.	0.000	0.00	0.

T TIME	FUEL R	T DIST	GW
0.	4761.	0.	21920.

TIME	FUEL	DIST	TAS.GS
0.	0.	0.	0.000

Comments

The FUEL entry in problem (a) initialized the FUEL R output. All subsequent FUEL entries are adjustments. In this case 400 pounds of fuel is to be removed for a takeoff fuel allowance. Note that both FUEL R and GW are reduced by 400 pounds.

(c) CLMB

INPUTS:

ALTF
35000.

OUTPUTS:

FF	NM/LB	AS.M	ALT
0.	0.000	350.81	35000.

T TIME	FUEL R	T DIST	GW
6.	4107.	46.	21266.

TIME	FUEL	DIST	TAS.GS
6.	654.	46.	0.000

Comments

The GW and DI inputs remain from the previous problem. The STD routine sets ALTI to Sea Level, therefore ALTF is the only input required. The TIME and DIST outputs have been added to T TIME and T DIST and both GW and FUEL R have been reduced by the FUEL output.

(d) ACR

INPUTS:

DIST.F
150.

OUTPUTS:

FF	NM/LB	AS.M	ALT
50.	.151	267.79	35000.

T TIME	FUEL R	T DIST	GW
26.	3117.	196.	20276.

TIME	FUEL	DIST	TAS.GS
20.	990.	150.	453.453

Comments

Actually we really wanted to cruise 90 nm at optimum altitude so . . . . .

(e) Input Operations

INPUTS:

FUEL	DIST.F
990.	-150.

OUTPUTS:

FF	NM/LB	AS.M	ALT
50.	.151	267.79	35000.

T TIME	FUEL R	T DIST	GW
26.	4107.	46.	21266.

TIME	FUEL	DIST	TAS.GS
20.	990.	150.	453.453

Comments

This is an example of the back tracking capabilities. FUEL R, T DIST and GW have been reset to what they were before the 150 NM calculation.

T TIME will remain 20 minutes too high for the remainder of this set of calculations.

(f) OPCR

INPUTS:

DIST.F
90.

OUTPUTS:

FF	NM/LB	AS.M	ALT
50.	.150	267.79	35199.

T TIME	FUEL R	T DIST	GW
38.	3509.	136.	20668.

TIME	FUEL	DIST	TAS.GS
12.	598.	90.	454.454

Comments

The cruise ALT is now set up as ALTI for the next calculation.

(g) IDLE

INPUTS:

ALTF
0.

OUTPUTS:

FF	NM/LB	AS.M	ALT
0.	0.000	230.00	0.

T TIME	FUEL R	T DIST	GW
49.	3276.	195.	20435.

TIME	FUEL	DIST	TAS.GS
11.	233.	59.	0.000

(h) Input Operations

INPUTS :

FUEL	GW	DI
-900.	-3680.	9.5

OUTPUTS:

FF	NM/LB	AS.M	ALT
0.	0.000	230.00	0.

T TIME	FUEL R	T DIST	GW
49.	2376.	195.	15855.

TIME	FUEL	DIST	TAS.GS
11.	233.	59.	0.000

Comments

The FUEL input represents a combat fuel allowance. The GW input represents a weapons drop. DI must be changed to reflect the new aircraft configuration.

Bingo Calculations

(a) [ABING]

INPUTS:

ALTI	FUEL
10000.	1200.

OUTPUTS:

FF	NM/LB	AS.M	ALT
44.	0.117	266.48	10000.

T TIME	FUEL R	T DIST	GW
11.	1200.	53.014	0.

TIME	FUEL	DIST	TAS.GS
8.	329.	39.	307.307

Comments

The [T TIME], [FUEL R] and [T DIST] outputs represent totals for cruise and descent legs. All other outputs refer to the cruise leg only. The [T DIST] display indicates total range is 53 NM, start descent 14 NM from end.

(b) OBING

INPUTS:

ALTI	FUEL
10000.	1200.

OUTPUTS:

FF	NM/LB	AS.M	ALT
39.	0.153	266.58	20000.

T TIME	FUEL R	T DIST	GW
12.	1200.	60.034	0.

TIME	FUEL	DIST	TAS.GS
3.	135.	21.	356.356

Comments

This example shows that the maximum range for problem (a) is reached by climbing to and cruising at 20000 feet. The T TIME, FUEL R and T DIST outputs are totals for the climb, cruise, and descent legs.

(c) OBING

INPUTS:

ALTI	FUEL
20000.	2000.

OUTPUTS:

FF	NM/LB	AS.M	ALT
35.	0.220	231.81	42695.

T TIME	FUEL R	T DIST	GW
39.	2000.	251.105	0.

TIME	FUEL	DIST	TAS.GS
15.	525.	116.	464.464

3.4 WEIGHT AND DRAG INDEX

Build up the weight and drag index for a configuration of (2) MK-83 LDGP, (3) MK-82 SE and (2) guns and ammunition. Assume an Operating Weight Empty (OWE) of 12,200 lb and full internal fuel, but no water.

From the NATOPS Manual

	Unit Weight (LB)	Unit Drag (DI)
MK-83 LDGP	985	1.3
MK-82 SE	570	1.8
Gun Pod	463	1.25
Outboard Pylon	72	1.75
Inboard Pylon	77	1.25
Centerline Pylon	55	1.0

Weight:

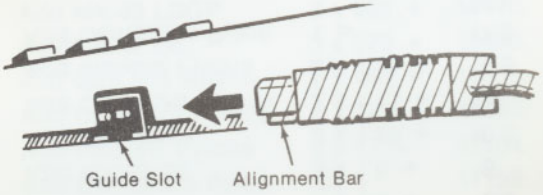
Comment	Key In	Display
OWE	12200 +	12200.
Add MK-83 LDGP	2 x 985 +	14170.
Add MK-82 SE	3 x 570 +	15880.
Add Gun and Ammo	2 x 463 +	16806.
Add Outboard Pylons	2 x 72 +	16950.
Add Inboard Pylons	2 x 77 +	17104.
Add Centerline Pylon	55 +	17159.
Add Internal Fuel	5161 =	22320. Total Weight

Drag Index:

Comment	Key In	Display
MK-83 LDGP	2 x 1.3 +	2.6
Add MK-82 SE	3 x 1.8 +	8.
Add Gun Pods	2 x 1.25 +	10.5
Add Outboard Pylons	2 x 1.75 +	14.
Add Inboard Pylons	2 x 1.25 +	16.5
Add Centerline Pylon	1 =	17.5 Total Drag Index

Battery and Charger

Normal Operations — To ensure maximum portable operating time, connect the AC9131 Adapter/Charger to a standard 115V/60 Hz outlet, then plug it into the calculator and charge the battery pack at least 4 hours with the calculator OFF or 10 hours with the calculator ON. The adapter/charger and battery pack may become warm when used on AC power. This is normal. When the battery pack is fully charged, the calculator will operate approximately 2 to 3 hours before recharging is necessary. However, don't hesitate to connect the adapter/charger if you suspect the battery pack is nearly discharged. A dim, erratic or blank display indicates that the battery pack is near discharge. Rechargeable batteries normally have a life of 2 to 3 years or about 500 to 1,000 recharge cycles.



Make certain alignment bar on adapter plug matches guide slot in calculator.

Periodic Recharging

Although the calculator will operate indefinitely with the adapter/charger connected, the rechargeable battery pack can lose its storage capacity if it is not allowed to discharge occasionally. For maximum battery life, it is recommended that you operate the calculator as a portable at least twice a month, allowing the batteries to almost completely discharge, then recharge accordingly.

Excessive Battery Discharging

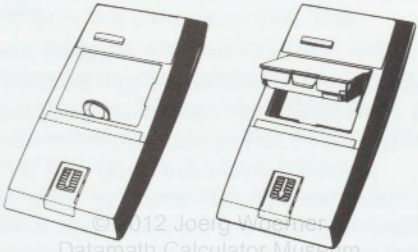
If the calculator is left on for an extended period of time after the battery pack is discharged (accidentally left on overnight, for example), connect the adapter/charger for at least 24 hours with the calculator OFF. If this does not restore normal battery operation, the battery pack should be replaced. Repeated occurrences of total discharging will permanently damage the battery pack.

Storage

If the calculator is stored or unused for several weeks, the battery pack will probably need recharging before portable use. The battery pack will not leak corrosive material; therefore, it is safe to store the calculator with the battery pack installed.

Battery Pack Replacement

The battery pack can be quickly and simply removed from the calculator. Turn the calculator off. Place a small coin in the slot on the back of the calculator. A slight prying motion will pop the slotted end of the pack out of the calculator. The pack can then be removed entirely from the calculator.



The exposed metal contacts on the battery pack are the battery terminals. Care should always be taken to avoid shorting the batteries. These terminals should be cleaned periodically with a pencil eraser to remove any corrosion that may have accumulated.

To reinsert the battery pack, place the rounded part of the pack into the pack opening so that the small step on the end of the pack will then be next to the module compartment. A small amount of pressure on the battery pack will snap it properly into position.

NOTES:

NOTES:

Cut out one of the following cards and insert into the slot on the calculator between the display and keyboard.

V/STOL-REST Start-up Procedure

CLR UPPER START 2 GO UPPER START

V/STOL-REST Start-up Procedure

CLR UPPER START 2 GO UPPER START

V/STOL-REST Start-up Procedure

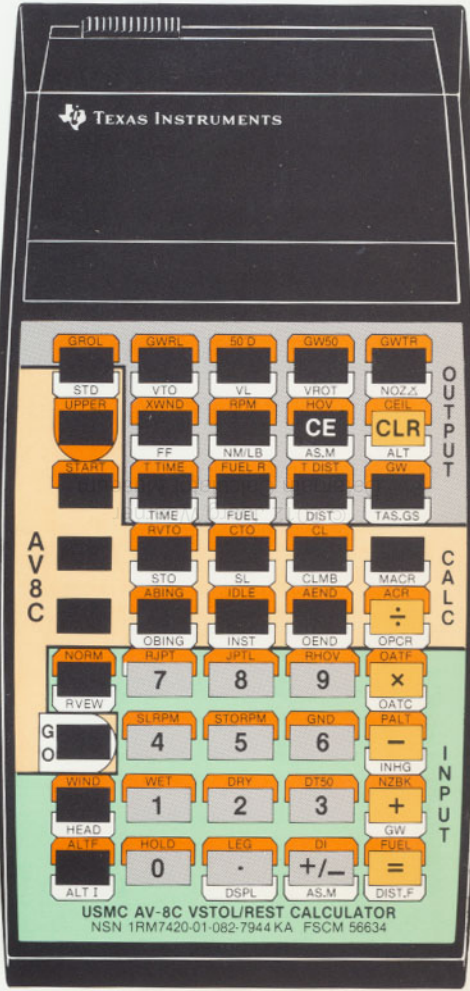
CLR UPPER START 2 GO UPPER START

V/STOL-REST Start-up Procedure

CLR UPPER START 2 GO UPPER START

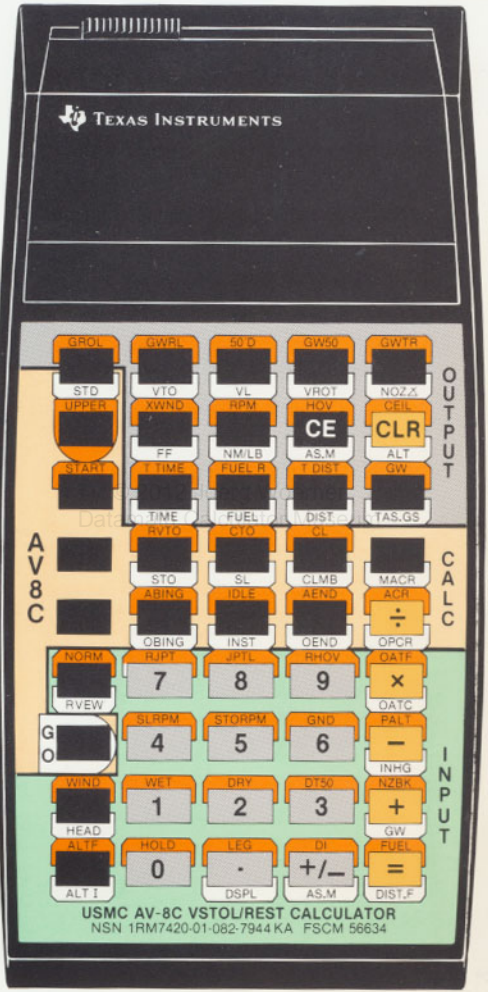
V/STOL-REST Start-up Procedure

CLR UPPER START 2 GO UPPER START



USMC AV-8C VSTOL/REST CALCULATOR

NSN 1RM7420-01-082-7944 KA FSCM 56634


TEXAS INSTRUMENTS
GROL
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GWRL
VTO
50'D
VL
GW50
VROT
GWTR
NOZ,Z
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UPPER
XWND
FF
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NM/LB
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USMC AV-8C VSTOL/REST CALCULATOR
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