Various notes on Phantasy Star 1 for a TAS.

Haven't found any serious game-breaking bugs, like the inventory glitches in 2, 3, or 4… but there IS an interesting glitch on the GBA version of PS1 from the Phantasy Star Collection. Something's not right with the battle hit calculations (e.g., the variability in hit damage isn't working), and it causes guaranteed dodges for certain values of DEF, relative to each monster's ATT. Perhaps this bug can be exploited to ensure quick/easy kills of certain enemies? See here:
https://docs.google.com/spreadsheets/d/1I_3aCC80L2HrXj_rqBzYplSxK5ZiZsIt1nNnKcS8iPo/edit?usp=sharing

Phantasy Star 1 New TAS Route
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1. Same as old route up to hovercraft
2. get hovercraft, noah cure noah, transer
3. hospital noah, get flute
4. Skure, buy gun, equip, transer
5. Uzo, Tarzimal cave, fight 1x 3 RD SLIME, equip TIT SWD, flute
6. Walk back to Uzo
7. Uzo, buy 2x saber, noah cure alis myau odin, cola noah, equip alis saber, hospital noah
8. Route to Casba cave, fight 13x 8 BARBRIANs total on route to/from cave
9. Blue dragon
10. Magic lamp, 1 transer
11. Silv claw
12. XP GRIND
13. Dr Mad
14. Sell swd, axe, sabers
15. Dezoris cave chest - NEED 12000 BY HERE
16. Back to old route

Phantasy Star 1 TAS Routing
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1. Camineet dungeon: 50 MST
2. 2x 1 Scorp (+26 MST)
3. Parolit: Buy IRON SWD (75), equip
4. 1x 2 Scorp (+26 MST)
5. Camineet heal
6. 3x 2 Scorp (+78 MST)
7. Camineet heal
8. Path to Scion, fight 10x 2 Scorp (+260 MST)
9. Scion: Sell SHT SWD (15), Re-enter, Buy 1 flash, 1 transer, SECRETS (requires 3 attempts). (MST now 112)
10. Camineet heal, Laconian pot (top left house)
11. Spaceport: Passport (Y, N, N, Y) (MST now 12)

12. Paseo: MYAU (Right shop, N, Y)
13. Medusa cave: ODIN, Compass [10 MST chest??]
14. Path to Eppi: North house (Y); fight any 4 Scorp (+52 MST) on route
15. Path to Camineet, fight any 4 Scorp on route (need 136 MST total before Camineet)
16. Camineet dungeon DNGN KEY
17. Camineet: Buy 2 flash and 2 transer (136 MST)
18. Path to Naula cave: fight any 4 Scorp on route (need 280 for cake; => from 14-18 need 8 sets of 4 Scorp total)
19. Naula cave: Cake (280 MST), leave, transer
20. Paseo: Talk to governor, SACCUBUS (run, run, att)
21. Naharu cave: 2000 MST chest, 50 MST chest, flash chest, flash chest, NOAH
22. Naharu cave: Path out, fight 3x 1 Red Slime (+93 MST), burger chest **[NECESSARY?]**, transer (MST now 2155)
23. Camineet heal
24. 11x 4 Scorp (11x 52 = 572 MST) (MST now 2727)
25. Camineet: heal, buy 4 flash and 6 transer (MST now 2359)
26. Spaceport passage to Gothic, visit church
27. Triada: Talk to Luveno 3x (Y)
28. Bortevo cave (over lava): 100 MST chest
29. Path to Albion (E, N, W), fight 3x 5 Scorpius (405 MST) on route (MST now 2864) **[LOAR: SILVER FANG?]**
30. Albion: Buy POLYMTRL (1600), Noah CURE Noah, transer
31. Gothic: Hospital heal Noah (MST now 1239), go to passage, Noah CURE party, talk to assistant, leave
32. Bortevo (over lava): blue house, use POLYMTRL get Hapsby, transer
33. Gothic: talk to Luveno, pay 1200, talk 3x, Spaceship to Uzo
34. Uzo: top left house (N)
35. Casba (via cave): right house above shops (Y), Alis HEAL party, transer **[CAVE: 500 MST chest? 5000 MST chest?]**
36. Bortevo (over lava): closest house, SEARCH, get Hovercraft, transer
37. Gothic: bottom left, SEARCH, get Flute, spaceship to Uzo, hovercraft E to Tarzimal cave
38. Tarzimal cave: 3000 MST chest, 500 MST chest, TIT SWD chest **[MAY NOT NEED]**, 500 MST chest, Noah CURE Noah, flute, transer
39. Gothic: hospital heal Noah, spaceship Skure (MST now 4015)
40. Skure cave: 500 MST chest
41. Skure: left shop, buy LASR GUN (4120), equip Alis TIT SWD **[MAY NOT NEED]**, Odin LASR GUN, burger Alis **[?]**, transer, spaceship Uzo
42. 8x 8 BARBRIAN (MST now 6091) **[COULD BE REDUCED / UNNECESSARY?]**
43. Uzo: left shop, 2x LGT SABR (2x 2980) **[CAN BUY EARLIER IF CASBA CAVE MST GET? 1 here, 1 from dragon?]**, Noah CURE Alis Myau Odin, Colas on Noah, equip Alis LGT SABR, hospital Noah (MST now 74)
44. Path to Casba cave: fight 13x 8 BARBRIAN total on route to-from cave->Uzo (MST total 9508) **[COULD BE REDUCED / UNNECESSARY?]**
45. Casba cave: Cola party, fight BLUE DRAGON, att/att/att/fire, final round att/att/att/att, Noah CURE party, Cola, flute **[RED DRAGON / LIGHT SABER HERE?]**

46. Gothic: top left shop, buy MAGC LAMP (1400), 2x transer, hospital Alis Myau Noah (MST now 7912)
47. Loar (use hovercraft): top left shop, buy SILV CLAW (1620), equip Odin LGT SABR, Myau SILV CLAW
48. GRIND TIME: Hovercraft west, fight 96x 3 EVILDEAD, east to beach, equip Odin LASR GUN, hovercraft **[FASTER: fight in CAVE!]**
49. Albion: cave, DR MAD (N), fire/wall/att/fire, att/att/att/fire, att/att/att/fire, att, leave, Alis equip TIT SWD, transer
50. Gothic: top left shop, sell IRN SWD (37) and IRN AXE (32) and 2x LGT SABR (2x 1490), spaceship Skure (MST now 11785)
51. Dezoris caves: cave 1 100 MST chest, cave 4 fight 6x 3 WIGHT, leave all their chests except 1
52. Twintown: bottom left shop, buy ICE DIGGR (12000) (MST now 5)
53. Ice digger cave 4 -> cave 5, cave 5 -> Corona tower
54. Corona tower: Eclipse torch (Y), Myau EXIT, walk to cave 5, ice digger SW to Aero Prism cave
55. Aero Prism cave: fight TITAN, fire/att/att/wind, att/att/att/wind, att, Myau EXIT, ice digger cave 3, ice digger TREE
56. Laerma TREE: drop Cola (need space) **[USE EARLIER? SELL IN CAMINEET?]**, use ECLIPSE TORCH, Alis FLY
57. Camineet: (right) sell Cola, Ice digger, (left) buy 2x CRC SLD (2x 1400), (mid) buy 8 burger **[THREE?]**, free heal
58. Scion: buy 2x ZIR ARMR (2x 1000), **[must have 1020 remaining for later revives]** north to prison
59. Baya malay prison: equip CRC SLD and ZIR ARMR to Alis and Odin, Noah OPEN, Robotcop (N), att, no chest, cave>lava>tower
60. Baya malay: Noah OPEN, ignore chest, Darmor (Y,Y,Y,N,N), flute
61. Baya malay: Noah OPEN, LGT SABR chest, Myau TRAP, exit to sky, equip LGT SABR Alis, use PRISM then NUTS
62. fight GOLD DRAGON: fire/att/att/fire, fire/att/att/att, att
63. Palace: fight SHADOW, att/wall/att/att, att
64. LASSIC door: Myau CURE x2 **[ONLY NEEDED ONE HERE]**, BURGER x3, Noah OPEN
65. fight LASSIC (N): fire/cure(Noah)/att/wind, fire/cure(Odin)/att/wind, fire/dead/att/wind, att
66. flute, transer, revive x3 = 1020 MST, spaceship Uzo, NW then Hovercraft over to Paseo, rest before Governor's house
67. fight DARK FALZ:
    - fire/cure/att/wind
    - fire/cure/att/fire
    - fire/cure/att/fire
    - fire/cure/att/fire
    - fire/cure/att/fire (1 falz dead)
    - fire/cure/att/fire
    - att/att/att/fire
    - att/att/att/fire (WIN!)

Found disassemblies of PS1 that the labels in the assembly notes below come from.
1. https://www.romhacking.net/documents/723/
2. http://www.pscave.com/dow/disassemblies/PS1_Disasm.zip (is same as above)
3. https://github.com/lory90/ps1disasm (same as above but possibly updated)
4. Maxim on smspower has another

Frames

Dungeons
 ~36-38 frames to move fwd/back
 ~47-49 frames to turn left/right
 ~82 frames to fade out/in (e.g. door transition)
Non-dungeon
 ~15-17 frames to walk a tile

JP rom addresses (some differ to US)

0CC6 = GameMode_LoadMap
0C9D = LABEL_B41 = loads interaction
61DF = Map_RunRandomBattles
0C64 = GameMode_Map
066A = UpdateRNGSeed
6275 = LABEL_5FF9
85A0 = LABEL_B03_85A0 = picks encounter? adds RNG value to 85A0 to select
8470 = B03_MapEncounterIDList

RAM values (offset C if looking at full mem, e.g. 0202 = C202)

0202 gameMode
        03 intro
        08 mapLoad
        09 map
        0A dungeonLoad
        0B dungeon
        0C actionLoad
        0D action
0204,0205 joypad (04 for held, 05 for pressed)
020C,020D RNG seed
0212 paused = FF, unpaused = 00
021B fade timer
0267 selected character (battle?)
0269,026A menu cursor position
026B,026C menu option selected
026E # of menu options

029D battle flag (00 false, FF true)
02A0-02AB battle turn order, 8x enemies + 4x chars; 02AC = battling flag?
02C2 selected character menu
02C4 selected inv item
02C5 dialogue #s (e.g. xp, mst)
02C7 # enemies in battle
02C8-02CF enemy name
02D0 battle xp
02DD battle meseta?
02E5 ... battle related?
02E6 battle enemy type
0300,0301 x movement (pixels?)
0304,0305 y movement (pixels?)
0308,030E... something to do with random battles??
0311,0312 y movement (tiles?)
0313,0314 x movement (tiles?)
040x = party member 1 (alis)
041x = party member 2 (myau)
042x = party member 3 (odin)
043x = party member 4 (noah)
044x = enemy1 data (09=meseta?) (045x-04Bx = enemies 2-8)
04C0-04D7 = inventory slots
04E0,04E1 meseta
04E2 = number of occupied inventory slots (24 max)
04F0 = party member count
0500-0600 dialogue flags
0502 = laconian pot dialogue flag
0506 = noah dialogue flag
0600-???? = chests, scripted dungeon encounter dialogues

0400 alis status alive/dead 00=dead, 01 = alive
0401 alis current hp
0402 alis current mp
0403 alis xp (and 0404)
0405 alis level
0406 alis max hp
0407 alis max mp
0408 alis att
0409 alis def
040A alis weapon (best = 0E = laconia sword)
040B alis armour (best = 16 = diamond armor)
040C alis shield (best = 20 = laconia shield)
040D alis unused?
040E alis battle spells
040F alis map spells

0810, 0811 alis sprite/movement?
080D, 080E alis sprite/movement?

---Items---
00 = nothing
01 = Wood cane
02 = Short sword
03 = Iron sword
04 = Wand   *Noah's best weapon*
05 = Iron Fang
06 = Iron axe
07 = Titanium sword
08 = Ceramic sword
09 = Needle gun
0A = Silver Fang   *Myau's best weapon*
0B = Heat gun
0C = Light Sabre
0D = Laser gun
0E = Laconia sword   *Alis' best weapon*
0F = Laconia Axe   *Odin's best weapon*
10 = Leather Armor
11 = White mantle
12 = Light Suit
13 = Iron Armor
14 = Thick Fur   *Myau's best armor*
15 = Zirconia Armor
16 = Diamond Armor   *Alis' best armor*
17 = Laconia Armor   *Odin's best Armor*
18 = Frade Mantle   *Noah's best armor*
19 = Leather Shield
1A = Bronze Shield
1B = Iron Shield
1C = Ceramic Shield
1D = Gloves   *Myau's best shield*
1E = Laser Shield   *Noah's best shield*
1F = Mirror Shield   *Odin's best shield*
20 = Laconia Shield *Alis' best shield*
21 = Landrover
22 = Hovercraft
23 = Ice digger
24 = Cola
25 = Burger
26 = Flute
27 = Flash
28 = Escaper
29 = Transfer

2A = Magic Hat
2B = Alsulin
2C = Polymeteral
2D = Dungeon Key
2E = Sphere
2F = Eclipse Torch
30 = Aero Prism
31 = Nuts
32 = Hapsby the Robot
33 = Road Pass
34 = Passport
35 = Compass
36 = Cake
37 = Letter
38 = Laconia Pot
39 = Magic Lamp
3A = Amber Eye
3B = Gas Shield
3C = Crystal
3D = M System
3E = Miracle Key
3F - FF = Debug

Labels, routines, notes etc for .asm
NOTE: in emu, RAM is 0000-2000, but in asm, RAM is C000-E000

WaitForVInt = 0052; stores A into 0208 until IRQ

LABEL_44C = 044C; multiply routine (HL = A * DE)

UpdateRNGSeed = 05B1; seed at 020C-020D, returns a random number in reg A

Dungeon_GetEncounter = 5FD8; gets monster type! Not just for dungeons!
   -   Loads some data bank / encounter pool stuff
   -   update RNG (05B1)
   -   turn into number between 0 and 7 (1 of 8 monster possibilities for each pool?)
   -   add to HL (e.g., 8180, available monster types data start point) to get monster type
   -   5FF3: put monster type into 02E6
   -   Put FF into A (for battle flag?)
   -   (returns to 0B2D in GameMode_Map for map battles)

GameMode_Map = 0B08?
   -   Calls Map_RunRandomBattles (5F63)
   -   Calls B41 if A not zero

Map_RunRandomBattles = 5F63
 - info stored in 02E5 (encounter pool??)
 - 85A0 + (enemy type, e.g. 05 for scorp) = enemy data? pointers?
 - A = 10 + value in 85Ax enemy data (3 for scorp)
 - ^ that * 8 (= 104 for scorp)
 - 8470 + ^ that + reg BC = more enemy data addresses? (8470 = map encounter ID list)
 - … stuff. Runs on into Dungeon_GetEncounter (5FD8)

LABEL_B41 = 0B41; battle on
  -    Sets battle flag (029D)
  -    Sets game mode to Interaction ($0C)
  -    Clears 026F - 027F
  -    Clears 0800 - 0900

LABEL_100F = 100F; boss check
  -    Puts enemy type into reg A
  -    Checks if it's DARKFALZ (?)
  -    Sets reg C to $92 or $89 for then writing into C004

LABEL_1027 = 1027; resets turn orders (02A0-02AB)

LABEL_1055 = 1055; sets battle flag (029D) = true
  -    Sets C267 and C2D4 = 0
  -    Calls LABEL_30C3
  -    Calls LABEL_2ED9

LABEL_11B5 = 11B5; randomly selects enemy?
LABEL_69F7 = 69F7; puts HL into A into enemy type (C2E6) … check this?

LABEL_49E6 = 49E6; sets enemy type to DR.MAD ($47)
LABEL_4C70 = 4C70; sets enemy type to SACCUBUS ($4A)
LABEL_5157 = 5157; sets enemy type to N.FARMER ($08)
LABEL_521D = 521D; sets enemy type to ROBOTCOP ($2E)
LABEL_52A4 = 52A4; sets enemy type to TARANTUL ($16)
LABEL_534B = 534B; sets enemy type to ROBOTCOP ($2E)
LABEL_53BF = 53BF; sets enemy type to ROBOTCOP ($2E)
LABEL_5430 = 5430; sets enemy type to TARZIMAL ($31)
LABEL_54D0 = 54D0; sets enemy type to SHADOW ($3E)
LABEL_54FB = 54FB; sets enemy type to LASSIC ($48)
LABEL_5595 = 5595; sets enemy type to EVILHEAD ($2B)
LABEL_55A9 = 55A9; sets enemy type to DEZORIAN ($1B)
LABEL_55BB = 55BB; sets enemy type to SERPENT ($26)
LABEL_55E1 = 55E1; sets enemy type to N.FARMER ($08)
LABEL_5619 = 5619; sets enemy type to DARKFALZ ($49)
LABEL_7972 = 7972; sets enemy type to ANTLION ($19)
LABEL_4497 = 4497; sets enemy type to GD.DRAGN ($46)

LABEL_5FF9 = 5FF9; sets battle flag (029D) = false

LABEL_5FFE = 5FFE; battle prep, uses RAM 0800, 0801, sys bus 'bank' 3
 - resets enemy RAM data (0440-04BF)
 - A = value at 02E6 (enemy type)
 - HL = A * 32
 - DE = 867F (enemy data address)
 - HL += DE (offset to get to correct enemy data?) = 871F for SCORPION
 - DE = 02C8 (enemy name address), BC = 0008 (name length), copy name into RAM
 - DE = 0258 (enemy data address?), BC = 0008 (length), copy data into RAM
 - B = value at HL (?), HL++
 - A = value at HL (enemy type?), HL++
 - H = value at HL (pointer?)
 - L = A, A = B
 - store A in FFFF
 - DE = 6000
 - call routine at 03FA (?), calls 0407, loops until IRQ
  - heads into 80xx+ range, gets values from 0001, 000A, 0004, 012E, 0002, 006E... more
  - back to 01AA, jmp to 0143, puts A into 0208, stack stuff, looping...
 - not sure … sprites?

LABEL_6075 = 6075; # of enemies (1-8) generator (max is stored in reg B, from data bank)

LABEL_607F = 607F; prep enemy data from sys bus (8XX3+)
 - stores # enemies in 02C7 and in register B for looping
 - stores HP in reg A, Att in reg D, Def in reg E, then swaps DE into HL

LABEL_6095 = 6095; loops enemy data into RAM starting at 0440, each takes 16 bytes
 - 0: 1 = alive, 0 = dead; 1: HP (current); 6: HP (max); 8: Att; 9: Def
 - stores item drop in 02DF
 - calls multiply routine 044C for meseta, stores in 02DD
 - stores chest trap chance (0-255) into 02E0
 - calls multiply routine 044C for exp, stores in 02D0
 - stores enemy flags in 02E8 (talk,magTalk,rope,prot,mystery)
 - stores run chance (0-255) in 02E7
 - stores 00 in 02E1 and C5 (197) in 02E2 ???
 - calls routine 576A twice (?)
 - HL = C240, DE = C220; copies of data
 - BC = 0020 (32 * LDIR for copying 0220-0240 to 0240-0260)
 - A = 10
 - wait for v interrupt (0052)

1251:
   - Updates RNG, turns into number between 0-31
   - If equal to current char level, A = 255 - A (so between 32-255)

- If >= char level, retry

125E: updating monster health value
 - calls 7BAC (screen flash?)
 - add current monster health to A (high value A, wraps to low value, would be same as subtracting FF-A from health)
 - check for 0
 - update health, and if Z flag reset also life status, and $D

15C2: updating character health value
 - similar to monster one 125E but no flash

1579: monster attacking character
 - similar to character one 121D

121D: character attacking monster
 - put attack value into A
 - check if alive
 - put A into C, rotate right and carry A, reduce to 0-127, add C to A, jump if C reset or put FF into A
 - i think the above ensures minimum attack value and max of 255?
 - call 1279 (updates RNG? calls 429. adds some min values to A for attack?)
 - put A into C
 - put defense value into A
 - call 1279
 - A = A - C
 - jump to 125E (updating monster health value) if C set
 - otherwise... dodged?

576A: ??? not sure
  - stores 89 in 0287 and C2 in 0288 <- pointers?
  - C28B in DE, 000E in BC (for 14 loops of LDIR)
  - stores 00 in 0289
  - stores FF in 028A
  - 14x LDIR (for copying 0289 through 0299)
  - stores 00 in 0217 and C9 in 0218 <- pointers?
  - stores 80 in 0219 and C9 in 021A <- pointers?
  - IY = C800
  - BC = 0800
  - A = IY+0
  - turn A into 0-7 value
  - increments IY by 0020 until A non-zero? (or rather, Z flag changes)
  - HL = 5825 <-- what starts here in sys BUS? bunch of pointers to routines?
  - calls routine 00E6
    - A = 2 * A + 25
    - L = A

- A = H + A (+ carry flag)
- A = A - L
- H = A
- A = value at address in HL
- HL++
- H = value at address in HL
- L = A
- jumps to routine at HL (5DA0)
  - calls routine at 5DA7
    - A = value at address 029F, OR A, RET Z
  - A = IY+01 (=0881?)
- returns to 579F (?)
- bleh... giving up here.