ASTP MISSION PROFILE BRIEFING
Houston, Texas
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Participants:
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REIM All right. Ladies and gentlemen, let's get started here. We are running a little behind. Our next briefer is Ken Young who will brief you on the mission profile, the orbital trajectory, and so forth. Ken.

YOUNG Thank you, Milt. I'm going - now that Gene has told you all about the mission, I'm not going to tell you about the mission. Really, I'm going to stress the trajectory side of the planning and try to go through very briefly and let you ask questions afterwards, if that is more efficient to do it that way. Next slide please.

First I want to refresh some of your memory about some common definitions or terms you may hear about frequently when we are talking about trajectories and particularly when we get into the Soyuz terms or the ways the Russians are talking about some of them that are a little different. First one is the old standby revolution and this isn't the Bolshevik Revolution or the American Revolution, but as you all know we measure orbits by - orbit count by successive crossings of the 80° west longitude and we have traditionally always done this in the U.S. Since the Earth is rotating to the east, consequently after so many revs, 15 in this case for ASTP, you actually - the Apollo travels 16 inertial orbits, 16 times around the center of the Earth, but since the Earth is going with it, you lose a rev every day. Now, the Russians call their revolutions - they have marked them from one ascending node to the next ascending node, which in essence is a inertial count because it doesn't matter if the Earth is rotating, it's still the time it takes to get from here to here and that is essentially the same as an inertial orbit count. So consequently, there will be some confusion I'm afraid during the mission - discussion about which rev you are on. It depends on whether you are talking American or Soyuz type revs. We call these orbit counts, but just keep that in mind. Next slide.

Kind of tied in with that is the rendezvous term we use, M-number, and this is our way - actually it is a computer type number that we have used for years way back in Gemini and it's in essence an inertial rev count to designate what orbit - after how many inertial orbits you will rendezvous. This mission is M of 30 nominal, which means from the time of insertion we count - the first M number is the first apogee and then it is 29 apogees later essentially - is the rendezvous rev for the nominal mission and I've got a note here and you can't read it all, but since you are losing this one rev per day it will actually be the 29th Apollo revolution that the rendezvous occurs on. Now for the alternate launch opportunities we do an M of 14 or in the fifth opportunity an M of 13 rendezvous. These are 1-day rendezvous and since you don't lose this one rev until the 16th

orbit your rendezvous are actually after 14 and 13 orbits - revolutions respectively. So I hope that will keep things from being too confused. Enough said about that now. Next slide.

The launch window for the ASTP mission, the yearly launch window that is the calendar date launch timing is fairly complicated. It is tied up the way we arrived at the time the Soyuz launch is tied in with their requirements for - the Soyuz requirements for deorbit and landing lighting constraints. And also Apollo requirements for abort landing lighting in the North Atlantic. And by much negotiation of these constraints we have arrived at this kind of yearly launch window. Of course, right now all plans are to launch on the 15th of July and the time of Soyuz launch would be 12:20 GMT, which is in the afternoon at about 15:20 Moscow time. GMT is 3 hours earlier than Moscow time and 5 hours later than central daylight time. The Soyuz is launched first and about 7.5 hours later at 19:50 GMT the first Apollo launch opportunity occurs and that will be at 2:50 central daylight time, in other words about three o'clock Houston time, in July. Now if we don't get off on that day, we have four alternate opportunities that come approximately 23.5 hours later, successive days later. And due to the regression of the Soyuz plane, they come about 25 minutes earlier in the day as this thing tries to denote. The significant thing I think about this plot is that if the launch were to slip into the winter or something, we will be following a curve along like this that changes the time of launch. So every day we slip from July 15 the launch time will change in terms of GMT. The relation between the two remains the same, of course. As soon as the Soyuz gets into orbit then things are fixed essentially, and Apollo gets its opportunity 7.5 hours later, then 23.5 hours after that, and so forth. This little jump here on October 2nd is due to a change in the Soyuz deorbit lighting constraints for the particular orbit that they want to deorbit on. This was necessary to get us a winter launch opportunity. We had to change the constraints a little bit because you follow this curve on down and we would get into some unacceptable Apollo abort lighting situations. Next slide.

Okay. In terms of these alternate launch opportunities, I've put together this summary chart. I've got Soyuz ground elapsed time in hours across the top here, then we show each Apollo opportunity, this being the nominal, of course, which comes 7.5 hours into the Soyuz mission. The first nominal rendezvous is a 2-day rendezvous and then for the alternate days, due to the fact that we are kind of constrained on the end by consumables considerations we cut the rendezvous down to 1 day for these alternate days so we can get there for the second opportunity; for example, at the same time we will get there on the first opportunity. And consequently can still have 2 days of docked activity. For the first three opportunities we do it

that way. The fourth and fifth opportunities the Soyuz has to land here after 6 days in orbit so we have got to cut down the time that they will stay docked. I won't go into the details of that. I'm not sure how much Dick Truly might get into the crew activities involved in these docked periods, but I don't plan to say a lot about them. These are definitely different mission plans, activities than the first three. Of course, we don't anticipate really ever having to use these opportunities. I won't go through the rest of this because the next slide will show you the nominal mission sequence. Day 1: first of all, let me say, also, that we talk in terms of this being a 9-day Apollo mission and that is 9 days of the elapsed time in orbit, since we can not - the first day is day 1 and you end up landing on the start of the 10th crew day. So you may hear 10 days some places and 9 others; officially we call it a 9-day mission. The Soyuz as I said will launch into the 51.8° inclination. This is about 100 to 125 mile, nautical mile, standard insertion orbit for the Soyuz on about the fourth orbit nominally; they will do a corrective maneuver to adjust for whatever insertion dispersions and so forth that they have had. It's expected that this would be a very small maneuver. Then 7.5 hours after their launch at 19:50 GMT, which is 2:50 our time, the Apollo launches. And, of course, it goes into essentially the same inclination plane as the Soyuz and the insertion orbit is 81- by 90-nautical-mile orbit, which is lower than the Skylab apogee that we used. The Skylab was 120. The extraction of the docking module is in the first big task after they get into orbit and that begins at about an hour after insertion. They come off after the end of the booster and turn around and dock with the docking module and then at 10:04 Soyuz GET, which is about 2.5 hours after Apollo launch, the module is extracted and they do a small maneuver to get away from the Saturn 5-IVB stage. Then shortly thereafter, I think it is about an hour or so after that, the first major Apollo maneuver is done and this circularizes Apollo's orbit at 90 nautical miles. That is to enable us to set up the geometry for the rendezvous. Then at 13:12 the first major phasing maneuver occurs and Apollo goes into an elliptic orbit that's really not that different from the one the Soyuz is in; it's not a lot higher than the Soyuz orbit and that is to accommodate the nominal phasing situation. If I could have the other slide up here, this gives you a ground-track view of that with Apollo launch out at KSC as the Soyuz comes through on the start of its sixth orbit. And the Soyuz is way over here just going over Russia at the time Apollo launches, or inserts, I'm sorry, at launch time the Soyuz is out here about 40 west. It has already passed the Cape about 10 minutes earlier. It passes southeast of the Cape, actually it goes over the Grand Bahama Islands. This is the nominal phasing situation and it is about a 60° phase angle. Then the phasing maneuver occurs here on the fourth Apollo rev after the circ burn here on the third Apollo rev. And if there is a plane change

necessary, which we don't anticipate, that would come about a rev after the - three quarters of a rev after the phasing maneuver. I can come back to this if you have any questions.

SPEAKER Maybe I missed it, but what ...?

YOUNG What's the length?

SPEAKER Maybe I missed it, but for any given day what is the length of the launch window?

YOUNG Eight minutes.

SPEAKER Eight.

YOUNG For Apollo, yes; the Soyuz has a 10-minute window. I don't know whether they have any reason for that or that they heard we have an 8-minute window and they said they had a 10-minute window. But of course, if they delay 10 minutes that slips everything in 10 minutes.

SPEAKER Why are they waiting till M = 30 for the rendezvous? Are they capable of doing it earlier?

YOUNG That's a good question. Let me go to the next - oh, let me just cover this one here. The second day the only major maneuver that occurs, Soyuz goes into the final circular orbit of 225 kilometers which is about 120 nautical miles, and Apollo spends most of that day checking out the docking module and doing these unilateral experiments, which I won't go into. And then toward the end of that day we will probably have to do a small phasing correction maneuver. Okay. In answer to your question, why we are going 2 days to rendezvous; this is a compromise that we had to negotiate with the Russians quite a bit and it essentially boils down to two things. One is their insistence that the docking occur over their territory such that they could watch with real time telemetry the docking system performance and, let's see, let me skip this thing right now, it is a little complicated anyway. Go to the next slide.

I can show you the ground track in the next one. It turns out that their reasoning to get docked over their territory kind of conflicts with our normal planning for rendezvous because it is - we like to dock over our territory is what it amounts to. And here is where the docking will occur as you can see it's on orbits that are really not ideal from our network standpoint of being good tracking orbits and they wanted to dock even earlier, they wanted to dock on - like a rev that came through here two or three revs earlier, but we pushed them more toward the west and compromised on docking on this rev and this is equivalent to the 14th Apollo rev here. Of course, in this case, this - it is the

29th, but once we got that settled we planned a 14th orbit rendezvous and then it turned out that they didn't want to do their circularization maneuver on the first day like on about their sixth orbit as we originally planned. They preferred to do it in the traditional place they always do it and that is their 17th orbit and we did not want them doing it right in the middle of our final rendezvous maneuvers, which is what would happen if we were to go M of 14 here. So the solution was to add a whole day to the whole thing and let them circularize the 14th rev. which occurs right down in this territory and then a day later when we come back through this same rev we finish the run, rendezvous, and dock. And now in the other alternate days as said, we drop back to the 14th rev solution because they have already circularized, of course.

SPEAKER That doesn't sound like a whole lot of negotiation to me. That sounds like we are doing pretty much what they wanted.

YOUNG Well, it was a pretty valid requirement for them to be over there to telemeter for the docking. And like I said, they would have preferred it over these stations and we backed them off to the edge of their coverage, so that much of it was negotiation and we really couldn't argue, especially when we found that we were going to use the ATS satellite, ATS-6 satellite, and we get coverage over this whole side of the Earth from like right in here all the way over here, so our telemetry is satisfied by that. Now the other compromise that we felt like they had good reasons for systemwise, or for some reason to allow them to go ahead and do their maneuver on the 17th orbit rather than force them back to a kind of a novel approach to circularizing on their first day. I frankly think they want a day to check out their onboard systems before they do any major maneuvers is what it really amounts to. We relented on that, too.

SPEAKER Excuse me, I noticed the ground elapsed time always refers to Soyuz launch. Is that the way it's going to be in the mission?

YOUNG Yes.

SPEAKER They are going to date the clocks on the Apollo to match the ground elapse of the Soyuz?

YOUNG That's right, with the exception of the first 8 hours after Apollo launch we will be working in Apollo GET. Then you will switch back to Soyuz GET and then for the deorbit of the Apollo we switch back to a time from deorbit. PET they call it.

SPEAKER That will be some big gaps for data analysts?

YOUNG Well, no.

SPEAKER Theoretical gaps?

YOUNG It's not gaps, but it gets a bit confusing. It's really handier to work in Soyuz GET, since it's the first one launched and we did a similar thing for Skylab.

REIM Do you have a question, Reed?

REED What happens if for some reason they have no circ?

YOUNG Not a whole lot. It is not a major catastrophe. I mean we will have to make a pretty big adjustment in that phasing adjustment that I showed on this previous slide. If for some reason they didn't circularize, of course, that would mean they have got something wrong, that would be the biggest worry. As far as going ahead and rendezvousing in that lower orbit it's no big problem to us, and we have looked at that situation.

SPEAKER Do you have a mission rule about that, is there anything that says no or yes, or what?

YOUNG We have a rule trajectorywise that says what we are supposed to do. What is not settled that I know of is how the two sides will decide, you know, whether it is wise to continue, because obviously they have had some kind of problem. Because they have continued - see, they may miss the 17th orbit, but they have a backup, they have plans to do it on the 18th and/or the 19th if they get into some kind of ground control problem. So if they just flat can't do their maneuver, that indicates that they have got a real serious propulsion problem, probably. And probably the rule is to go ahead and rendezvous because they might not be able to deorbit. So I think the rule would be to just continue. It would mean a big, a new big phasing maneuver but it really would not change the rest of the rendezvous particularly. Any other questions on this?

SPEAKER Over which country will the first televised handshake take place? I read something about Spain, is that correct?

YOUNG I think - Dick can you answer that? I've got the time of it here, of the handshake, but I don't recall exactly where it is over the Earth.

TRULY I've got the time too but I don't ...

YOUNG I think it's probably on this rev right as you come through here, over Madrid, you are probably right about Spain. I don't know. Since it is central daylight time, which is roughly just a few minutes after our launch time so it's in the afternoon, 2 days after launch, so it probably is this next rev. Let me go ahead and finish with the final rendezvous sequence unless you have some real questions, I won't get into detail of what each one of these maneuvers does. It is the Skylab rendezvous sequence. First here on the start of the third day you do the NC-2 maneuver, which is the final phasing maneuver in effect that just lowers the Apollo apogee down 20 miles below the Soyuz orbit, and sets up the final phasing for the NCC and the NSR couples, pair of maneuvers, these two, which set up the final exact phasing situation for the coelliptic orbit with the Apollo 10 miles below the Soyuz orbit, and in a circular cocentric orbit. Then about an hour after that NSR maneuver - By the way, all three of these are SPS maneuvers; they're pretty small like 20 to 30 feet per second in that which is about a second or less than a second SPS burn, about an hour after this one in the terminal phase intercept maneuver occurs, which is over here as we go down through Australia. And then about 30 minutes later after a couple of midcourse correction maneuvers with the RCS, the braking begins at a range of about 1 mile, very similar to the Skylab setup. And by this time here, the Apollo should be stationkeeping right behind the Soyuz. I say behind because the Soyuz is traveling backwards and the Apollo will come up and go around to get into position for the docking. And they have to perform some attitude roll maneuvers by both vehicles in this time frame, such that this ATS satellite can be acquired by Apollo's antenna. And then they dock here as we come over the Russian ground stations. And after that - that occurs at this GMT, GET I'm sorry - after that they do the crew transfer and the first greeting is at this time, then the Apollo commander and the docking module pilot go into the Soyuz a few minutes later and then they return about an hour and a half later to Apollo. Then the next day is totally a joint activities crew transfer day, and Dick Truly will tell you some of those details. Next slide please.

The fifth day is pretty well taken up by joint experiments or joint tests that involve trajectory maneuvers. The first one comes when we do the first undocking at 95 hours and 42 minutes. If I can have the other slide please. This is to start the solar eclipse, artifical solar eclipse, experiment, which is a joint experiment. It begins - I'm traveling this way with the two spacecraft docked and oriented such that the engine bell of the Apollo points at the sunline and as you come to sunrise they are in this position, which is essentially still an in-plane, it is slightly yawed out because the position of the Sun is slightly out of the plane - and the idea is

about a minute and a half after, or a minute and 15 seconds after sunrise on the vehicles the Apollo undocks and backs off in the direction of the Sun such that the shadow of Apollo stays on the Soyuz module and covers the window. And shortly after the undocking, which, of course, gets a small delta V from the undocking spring or unlatching, the Apollo does a couple of short bursts with the RCS to move it away from the Soyuz out to a distance of approximately 220 meters. During which time the two spacecraft are approaching the Earth terminator, sunrise over the Earth, and the Soyuz will take coronal photography around this shadow. In other words, the Sun will be obscured by the Apollo and they will take photography of the corona. And then once that is completed Apollo stops its motion away by thrusting back toward the Soyuz and a few minutes later, roughly 5 or 10 minutes later will redock with the - reapproach the Soyuz and do the second docking. And this second docking occurs here at 96:20, so you can see the total time they are undocked is roughly 30 minutes. And the second docking is a test docking to let the Soyuz be the active docking system and throw the latches, capture latches, and so forth and that also will occur within the telemetry of the Russian ground stations. Then about a rev later the - well, it's almost, it's really two revs later - the final undocking occurs and then shortly after that we go into the ultraviolet absorption experiment, which involves quite a few maneuvers and takes about 3.5 hours to complete. If I could have the other slide up here, I could briefly describe the UVA sequence.

This is a time line relative to the Soyuz GET and it also shows on here the orbital travel around, measured from the equator 0 and 280, 360 I'm sorry. The experiment requires that data be taken as the vehicles cross near the equator, near the - between the 20° latitude lines. I'm sure they probably discussed this morning what the UVA experiment is. It is the reflection of a light source from Apollo onto the Soyuz mirrors, and it comes back and is gathered in by Apollo to study the ultraviolet absorption of the upper atmosphere. Anyway the desire is to get data both in the plane of the vehicles and out of plane and so the first two maneuver sequences is to get out-of-plane data at different ranges. So the undocking occurs, the two vehicles stationkeep - the Apollo stationkeeps a few meters away, about 50 meters away, from the Soyuz and then maneuvers out of plane 150 meters to the south and during this 5 or 6 minutes of time, it shoots this light beam to the reflectors on the Soyuz and gathers the data as they cross near the equator. Then it comes back into plane and stationkeeps again, during the daylight period here until the next darkness period, and then maneuvers toward the north out of plane to 500 meters, takes data as it crosses the equator and then comes back into plane. These are by the way, these are very small maneuvers, like tenths-of-a-foot-per-second type of maneuvers to achieve these ranges and gets back in plane, stationkeeps until prior to the next darkness period, then

there is a requirement to separate from the Soyuz for the final time. Soyuz will take some photography, motion picture photography, of the Apollo as it turns around, and it does a 360° pitch to photograph it. And then the last UVA data take is a 1000-meter range, in-plane data take.

If I could have the next slide there and show the relative motion of the two vehicles during that period. They are initially the Apollo - this is in the direction of motion. Apollo is stationkeeping about 50 meters out in front of the Soyuz and the Apollo thrusts down a real small maneuver and does a 360° pitch right in here about 8 minutes after that, or 5 to 8 minutes after that, the Soyuz takes the photography and then Apollo makes another small, roughly a half-a-meter-per-second burn that puts it in a relative motion so that about 30 minutes later it crosses above the Soyuz at about 1000-meter range here. These are meters scale. And during that time it shoots the light source down at the reflector that is on top of the Soyuz and they make the final data collection. This maneuver also serves as a final separation maneuver between the two vehicles. In essence, it puts the Apollo a little bit above, but mainly it just begins to fall behind, it falls behind the Soyuz at about, I think it is about 5 miles per orbit from then on. So the next day the two vehicles essentially are conducting unilateral activities. I think there is a press conference that next day, by the way, in-orbit press conference. Next slide please.

The seventh day, beginning the seventh crew day after 6 days in orbit the Soyuz performs its land - deorbit and landing sequence and lands just northeast of the launch site. If I can have the ground track here, I will show you essentially where that occurs. The Soyuz deorbit maneuver occurs right in here just as they get to the Ascencion tracking zone. It is theoretically possible that Ascencion could track them with a passive radar, but there is no plan to do that, that I know of. The Apollo will be trailing by about 150 to 200 miles behind at this time and then the Soyuz goes on in and lands here in Kazakhstan at about 70 east, 50 north. Their launch site is right here off the Aral Sea at about 46 north and 63 east. And that completes their mission, of course. Then the eighth and ninth days, Apollo continues unilateral experiments, the most significant trajectorywise of which is the Doppler - MA-089 Doppler Tracking Experiment. This is done in conjunction with jettisoning the docking module, which has to be gotten rid of before the landing, deorbit, so it occurs the day before deorbit. And what happens here is we jettison the docking module, a few minutes later the Apollo makes a small SFS burn of about 20 feet per second to move about 300 kilometers away from the docking module and then it does essentially an equal opposite maneuver to stop that separation and sit at roughly 300 kilometers distance for the next 18 hours, and the vhf on the Apollo is used to track the tumbling docking

better orbit solution for their vehicle, of course, than we do. But that is a factor. We planned to track them early in the mission with several of our stations as sort of a backup.

SHEPARD C-band only?

YOUNG C-band only. Of course, they have a transponder that they are tracking with and, of course, all they get is when they pass over Russia, so their tracking is limited to that one part of the geometry. But we, as you probably know, we just conducted a tracking experiment with them on Soyuz 16, which was very successful and shows that each side, believe it or not, can determine orbits very well. Mark.

BLOOM Forgive me if this was asked while I was out, but - when the Soviets performed their deorbit burn you said that the American spacecraft would be 200 miles behind.

YOUNG I think it is roughly 200 miles.

SPEAKER I assume that they eventually catch up. Is there any chance that they will see them? Will they overfly them?

YOUNG No. We looked at that and as soon as the Soyuz does its maneuver it's "do svidaniya", it's gone. We looked at even looking from the Apollo at their deorbit maneuver, but 200 miles range is just beyond any seeable - you might see a speck is what it amounts to.

SPEAKER Where is the Soyuz during the Apollo launch?

YOUNG At lift-off? It is over the mid-Atlantic, about 40 west and about 50 north. It has already passed the Cape of about 10 minutes earlier. It will be - it comes in about 200 miles southeast of Cape Kennedy, Cape Canaveral and passes right over the Grand Bahama Islands is the closest approach. Mark Bloom.

BLOOM At what point can the Apollo astronauts begin to talk to the Soyuz astronauts?

SPEAKER Okay, that is a good question. I forgot. In my haste to go through the rendezvous there is a vhf ranging device between the two, of course, and it is spec-rated at I believe - at 150 kilometers, but they expect to really work further out than that. But we start doing tracking with it, tracking of the Soyuz, right after the NC-2 maneuver when they are roughly 100 miles apart.

SPEAKER Is that the only way that they can talk to each other or can it be looped through the ground and back upwards?

YOUNG They can loop it through the ground's control.

SPEAKER So theoretically, the cosmonauts could be talking to the astronauts at launch.

YOUNG That is possible. I don't know what the plans are.

SPEAKER No, no I just meant that the - it is theoretical.

YOUNG Yes. I think it's kind of unlikely other than saying "Come on up," or something like that because you know the crew is pretty busy during countdown. Any more questions?

SPEAKER Regarding the usage of the ATS satellite, this will eliminate some of the LOS data and then will we still have a dump capability, an onboard recorder. When will this be used?

YOUNG Well, they'll dump most of the data through the ATS, you know - yes, they can do that and then, of course, if something happens and they don't have that link, they can still dump it the way they always have, but, of course, the ground coverage is much less than Apol - Skylab, since the orbit is so much lower.

SPEAKER One more question. What will be the length of passes that for example Madrid would record?

YOUNG About 5 minutes.

SPEAKER That is all?

YOUNG Maximum. Yes.

SPEAKER What about through the ATS, how long will they run?

YOUNG ATS you would normally get acquisition for roughly 50 minutes.

SPEAKER Fifty minutes.

YOUNG Yes, it is really good. Now there are some passes where the Apollo antenna is not pointed in the right direction, so you only get part of that 50 minutes. But that is taken care of with maneuvers every once in a while. In short, the ATS really improves the data collection communications just orders of magnitude from the normal STDN coverage.

module, and this is done for a couple of purposes, experiment purposes, one of which is tied in with the - determining some of the subtle harmonics of the Earth perturbations the Geodynamics Experiment and then you have this Doppler Tracking Experiment, which I can't explain what exactly they hope to learn from that. Maybe the experiment people can explain it. That - by the way, the tracking interval begins at about this time and ends about 14, I think it is 14 hours later, which you do during the sleep period of the astronauts, all of that is done automatically and the crew is asleep most of that time. Then the start of the 10th crew day, the Apollo does its deorbit maneuver and splashes down west of the Hawaiian Islands - if I could have that last slide - the deorbit maneuver occurs down here southwest of Australia, on a pass that comes through like this. And then about 40 minutes later we land - just west of the Hawaiian chain at this position. And that ends what essentially is the 9 days in orbit. It is about 1.5 hours longer than exactly a 9-day mission. And I guess that's all I need to say about that one. The crew will be recovered essentially in the same manner as the Skylab recoveries. There isn't quite the urgency to pick them up, since they have only been in orbit 9 days versus 80 days on Skylab and so forth. Recovery might take a little different form; I think they are going to have some press conferences onboard the recovery ship or something like that.

SPEAKER ...

YOUNG That's not my job. Any questions?

REIM We do have a few copies of the slides. They are back there, on the table if anybody wants to get one and there are some updated astronaut and cosmonaut biographies back there, also. Now we'll take a few questions here. Al Shepard.

SHEPARD Yes, on the tracking of the Soyuz, how much tracking inputs do you get from our U.S. station?

YOUNG Yes, we have got - several of the U.S. stations have the C-band or passive radar capability to track the Soyuz and -

SHEPARD By means of updating the Soyuz state vector here or do you get that piped in from -

YOUNG We get that piped in from Russia at the prime -

SHEPARD Compared to their REFSMMAT or compared to ours?

YOUNG Well, they will send us their vector and we will compare it with our data. In essence, they normally will have much

SPEAKER What is the prime ground station that will be used by NASA for ATS-6?

YOUNG The ground station?

SPEAKER The prime ground station for ATS-6.

YOUNG Butrago, Spain, right outside of Madrid. I think there is a backup one on TV in Italy. I am not real conversant with all of those details, but it is in Spain.

SPEAKER We will get further satellite transmissions - gets the TV back here, doesn't it?

YOUNG Yes. Oh yes. They send it through Andover or somewhere out of Europe for the stuff coming from Russia, too.

SPEAKER Now, along those lines though, are you going to use enhancement process for all your TV stuff, like was done in the past? Or is it going to -

YOUNG Well, I don't know. They have done a lot of ... I can't really - Roy Neal knows.

NEAL Yes, they told us they were planning to use the local, the NASA enhancement system, not the image transform system that has been used in the past.

YOUNG Well, I know that the TV out of Russia has to get transformed in Europe somewhere and then it comes over here and I think they do something with it in building 8.

NEAL That is a translation system rather than an enhancement system. That has to be translated so that we can use it for U.S. or stateside distribution or other nations for that matter. We're talking here of enhancing the picture somewhat and that will be the NASA system that I gather is going to be used.

YOUNG Yes, I think that's right.

REEM Any more questions? Okay. We will take a 5-minute break and then we will get back in here with Dick Truly on the in-flight crew activities.

END OF TRANSCRIPTION

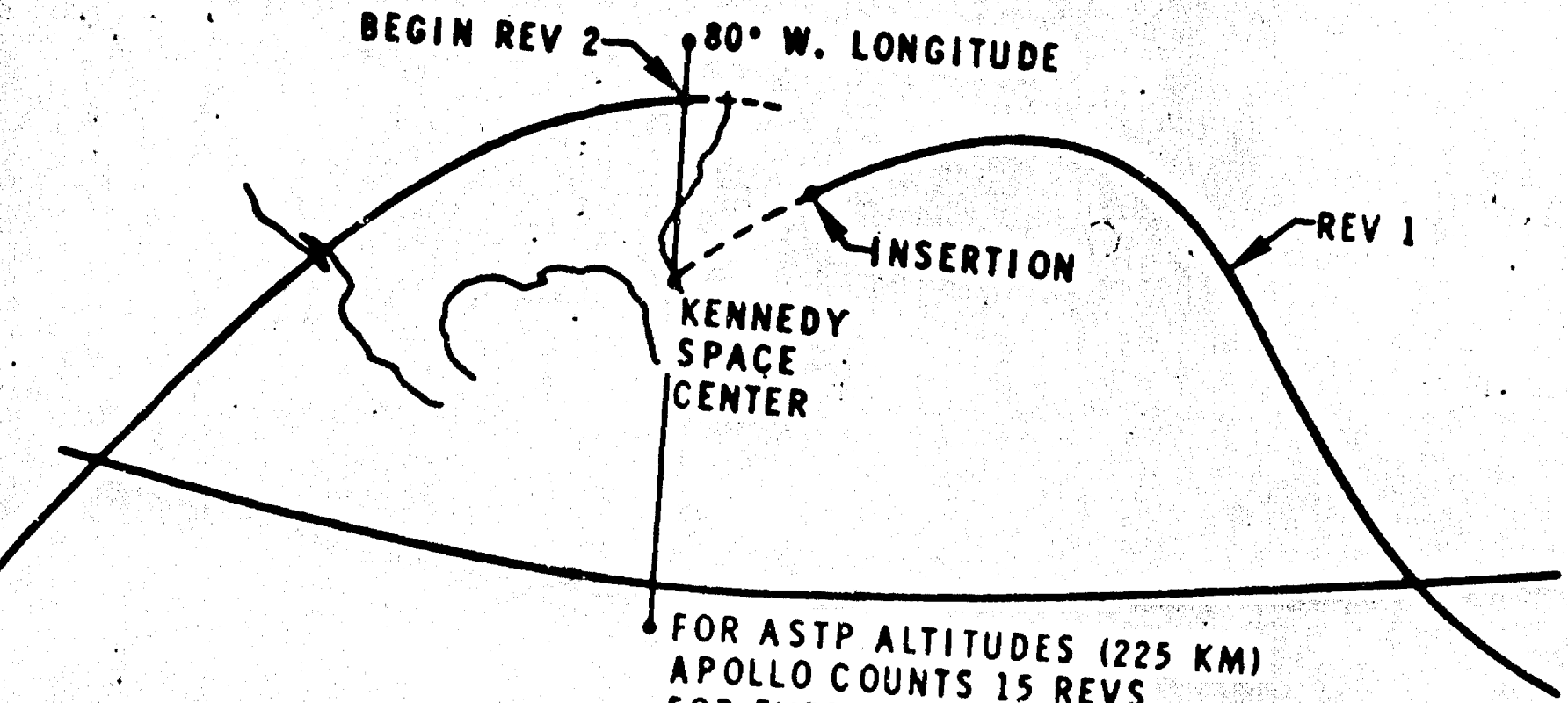
NASA S 74 36195

# ASTP MISSION PROFILE

K. YOUNG

# DEFINITIONS

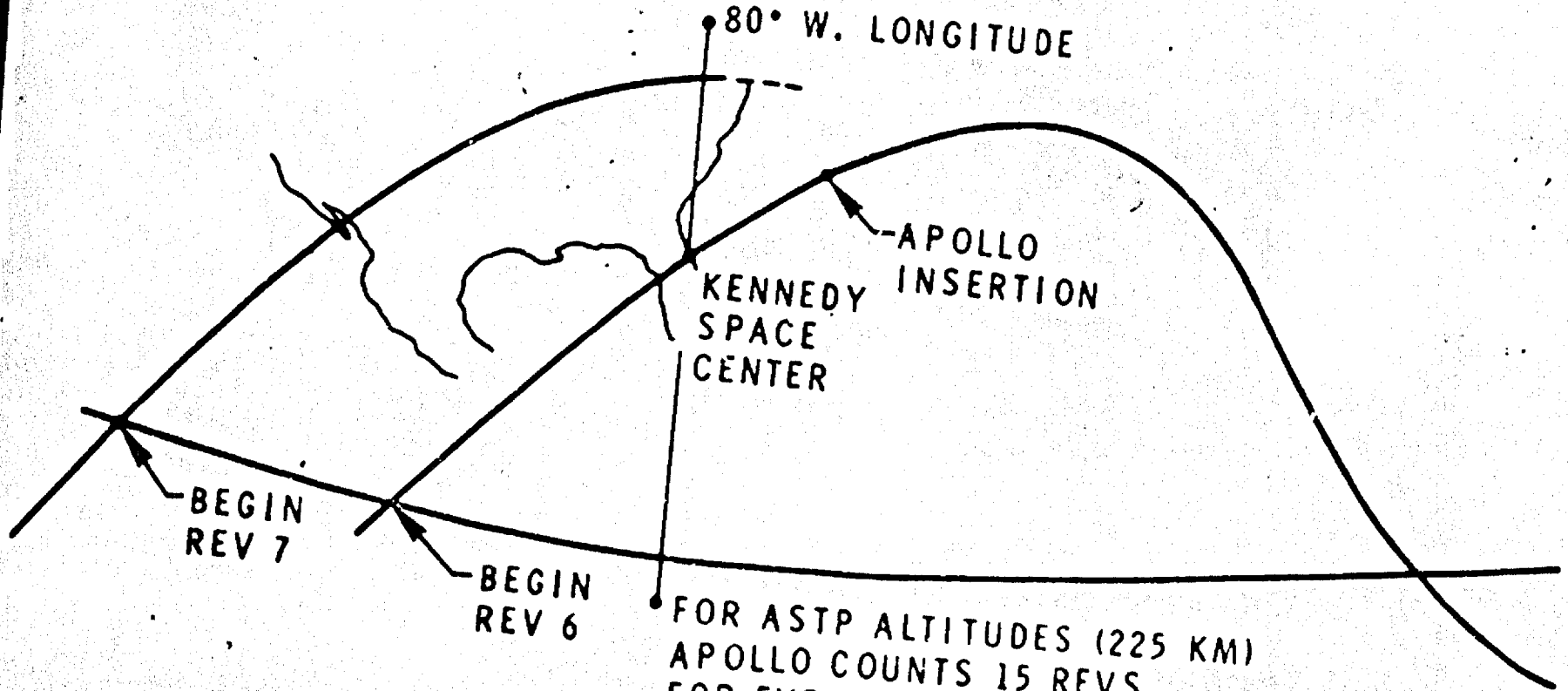
REVOLUTION (AS DEFINED BY THE U.S. FOR APOLLO)




FOR ASTP ALTITUDES (225 KM)
APOLLO COUNTS 15 REVS
FOR EVERY 16 INERTIAL ORBITS (AS
COUNTED BY U.S.S.R. FOR SOYUZ)

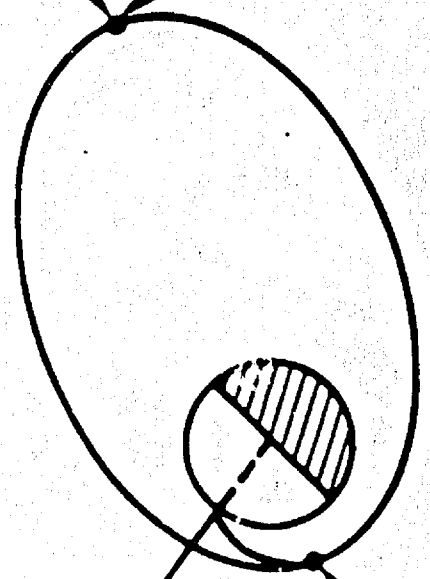
# DEFINITIONS

REVOLUTION (AS DEFINED BY THE U. S. S. R. FOR SOYUZ)




FOR ASTP ALTITUDES (225 KM)
APOLLO COUNTS 15 REVS
FOR EVERY 16 INERTIAL ORBITS (AS
COUNTED BY USSR FOR SOYUZ)

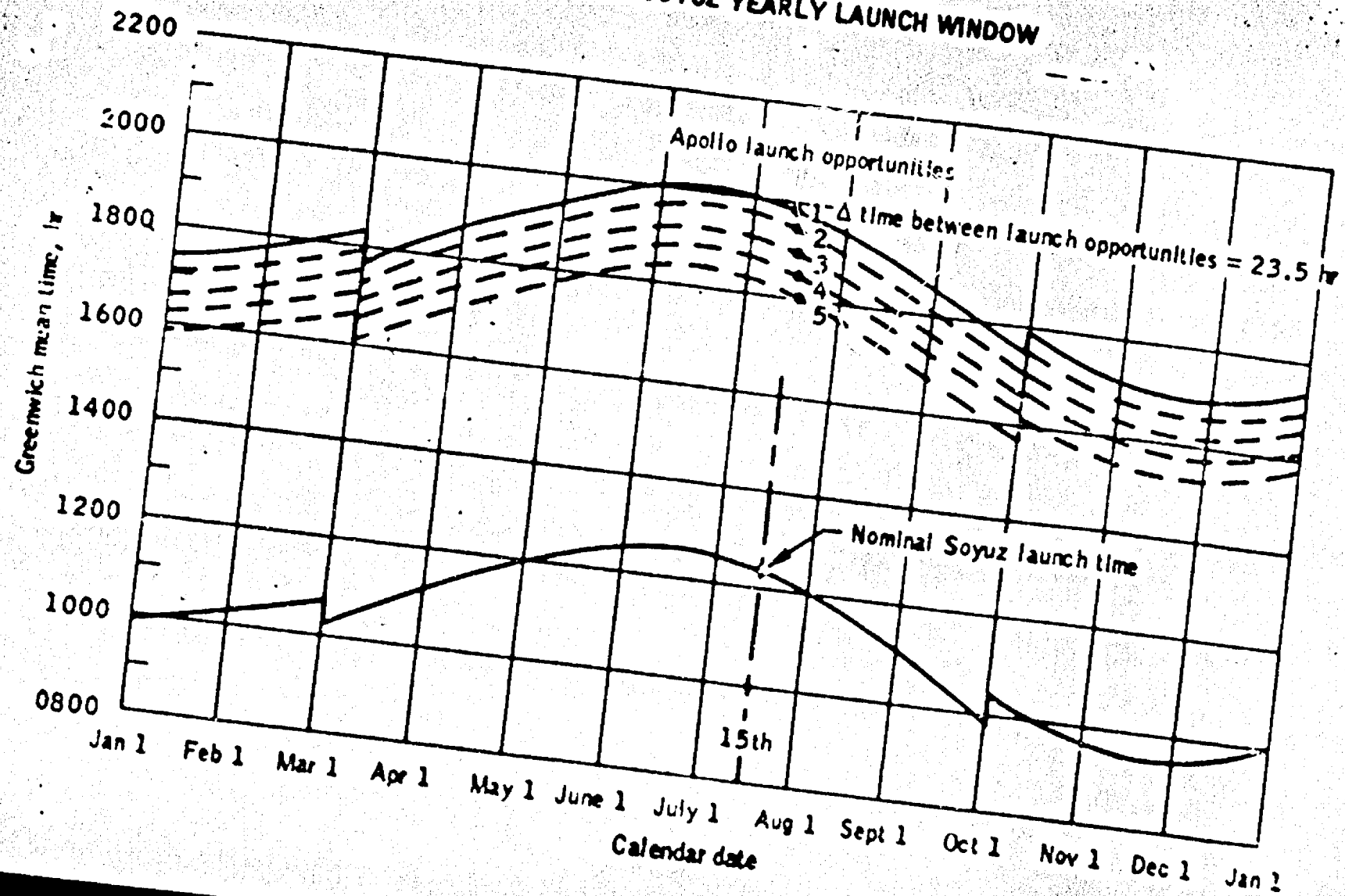
# M = RENDEZVOUS ORBIT NUMBER



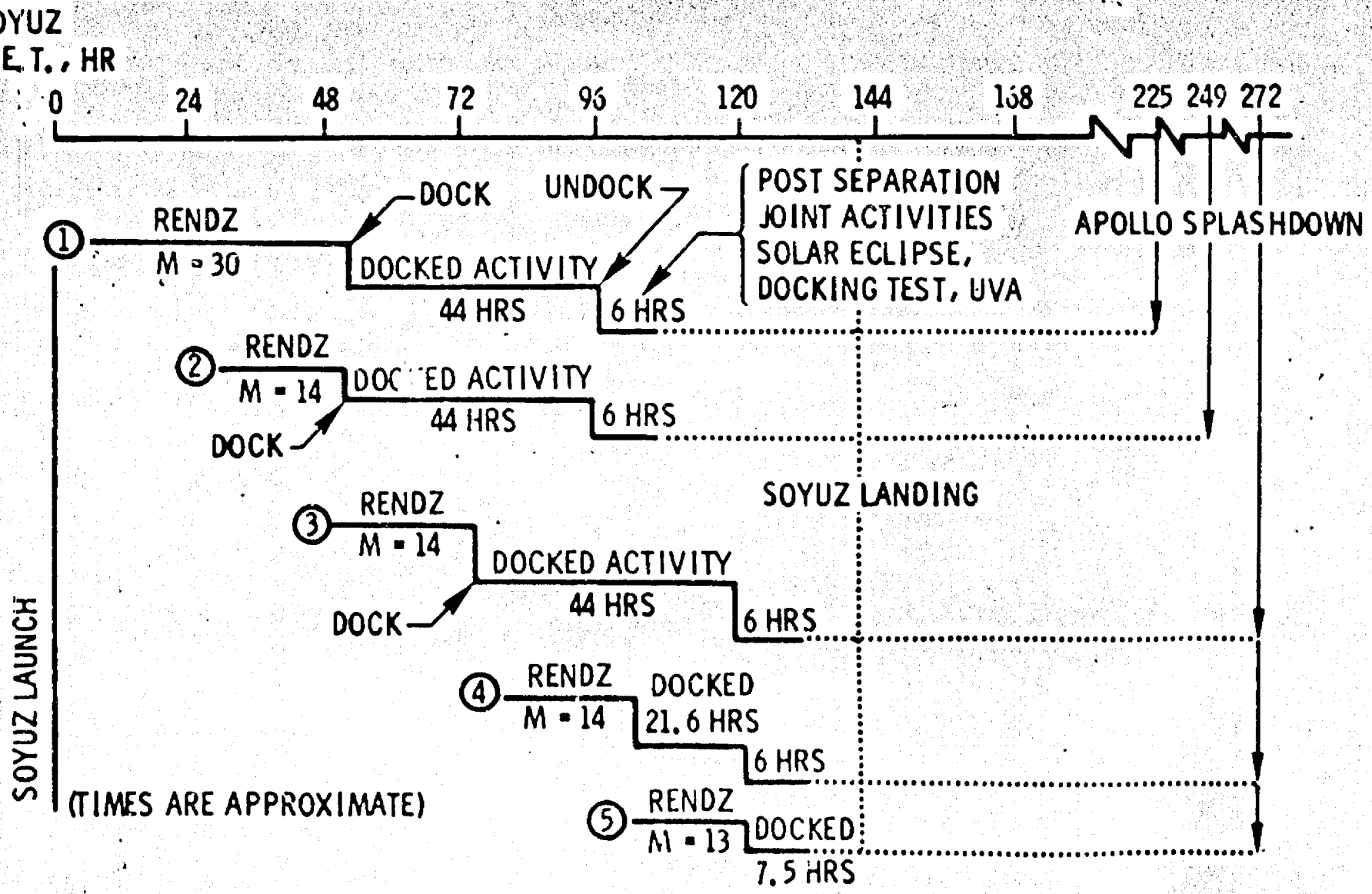

M = 14 OR 13 INDICATES RENDEZVOUS OCCURS IN 14TH OR 13TH APOLLO ORBIT (ALSO 14TH OR 13TH REV SINCE 1 REV IS NOT LOST UNTIL 16TH ORBIT)

M = 30 INDICATES RENDEZVOUS OCCURS IN 30TH APOLLO ORBIT (NOTE THAT THIS WILL BE 29TH APOLLO REVOLUTION)

## APOLLO AND SOYUZ YEARLY LAUNCH WINDOW



# APOLLO LAUNCH OPPORTUNITIES AND MISSION PROFILES



# NOMINAL MISSION PROFILE

- DAY 1

  SOYUZ L/O 1220 GMT - 51.8°, 188 × 228 KM

  SOYUZ 1st MANEUVER - 4th ORBIT - NOMINALLY ZERO

  APOLLO L/O 1950 GMT ($7^h30^m$ SOYUZ G.E.T.) - 51.8°, 150 × 167 KM

  EXTRACTION OF DOCKING MODULE $10^h04^m$ S.G.E.T.

  APOLLO CIRCULARIZATION MANEUVER, 167 × 167 KM

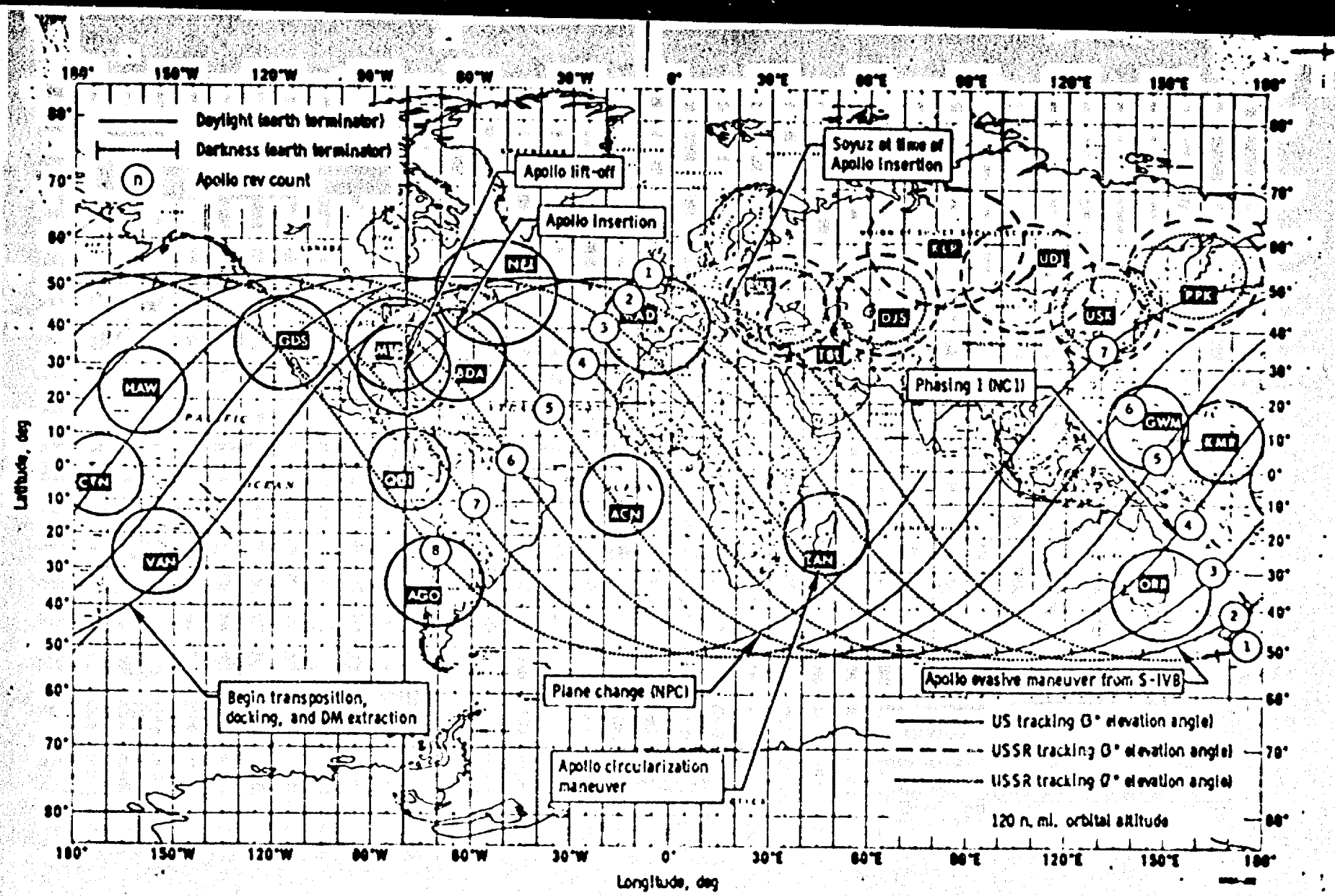
  APOLLO PHASING MANEUVER (NC1), $13^h12^m$ S.G.E.T., 167 × 230 KM

- DAY 2

  APOLLO INDEPENDENT EXPERIMENTS
  - MA-010 MULTIPURPOSE FURNACE
  - MA-014 ELECTROPHORESIS - GERMAN
  - MA-083 EXTREME UV SURVEY
  - MA-048 SOFT X-RAY
  - MA-107 BIOSTACK
  - MA-128 GEODYNAMICS
  - MA-147 ZONE FORMING FUNGI
  - MA-136 EARTH OBSERVATIONS

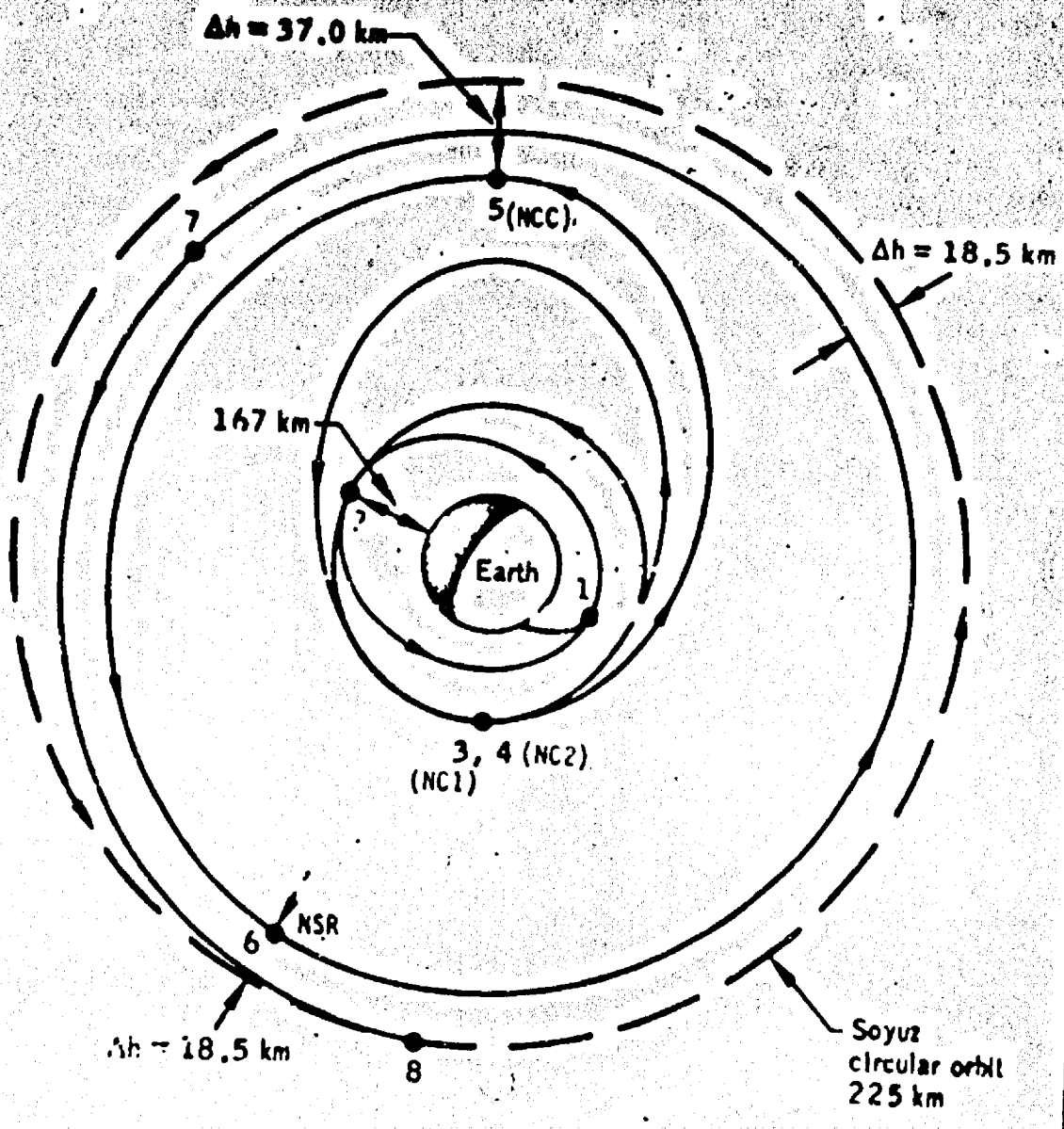
  SOYUZ CIRCULARIZATION MANEUVER, 17th ORBIT, 225 × 225 KM

  APOLLO PHASING CORRECTION MANEUVER - NOMINALLY ZERO



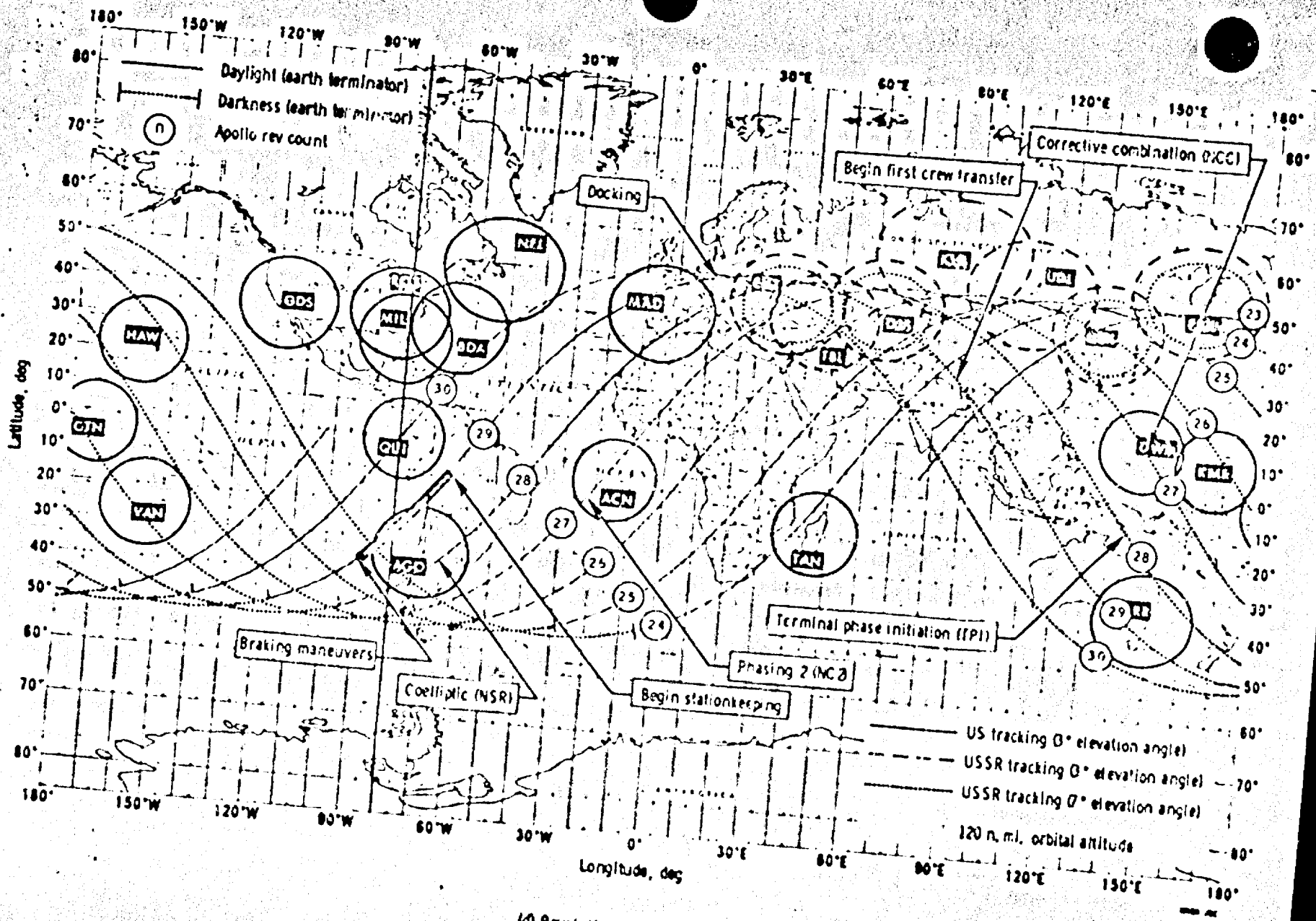

(a) Revolutions 1 through 8.

Figure 3. - Apollo ground tracks for the first Apollo launch opportunity.




1 Insertion - 150 by 167 km
2 Circularization
3 Phasing 1 (NC1)
4 Phasing 2 (NC2)
5 Corrective combination (NCC)
6 Coelliptic (NSR)
7 TPI
8 Braking (TPF)

Orbit geometry of a typical six-impulse coelliptic maneuver sequence for the first Apollo launch opportunity.




60 Revolutions 23 through 30.

Figure 1. - Continued.

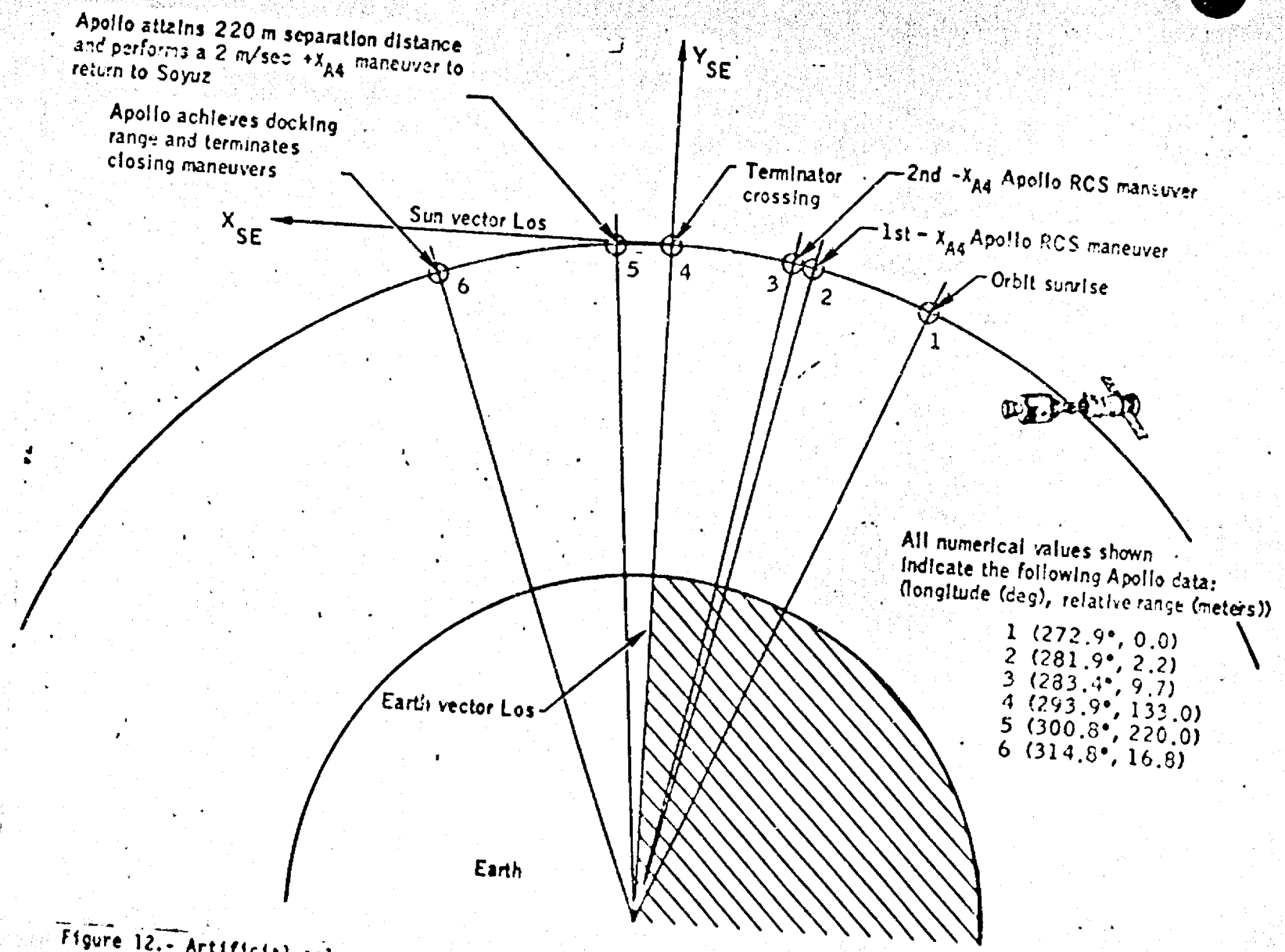



Figure 12.- Artificial solar eclipse orbit profile during the Apollo 57th revolution and Soyuz 65th orbit.

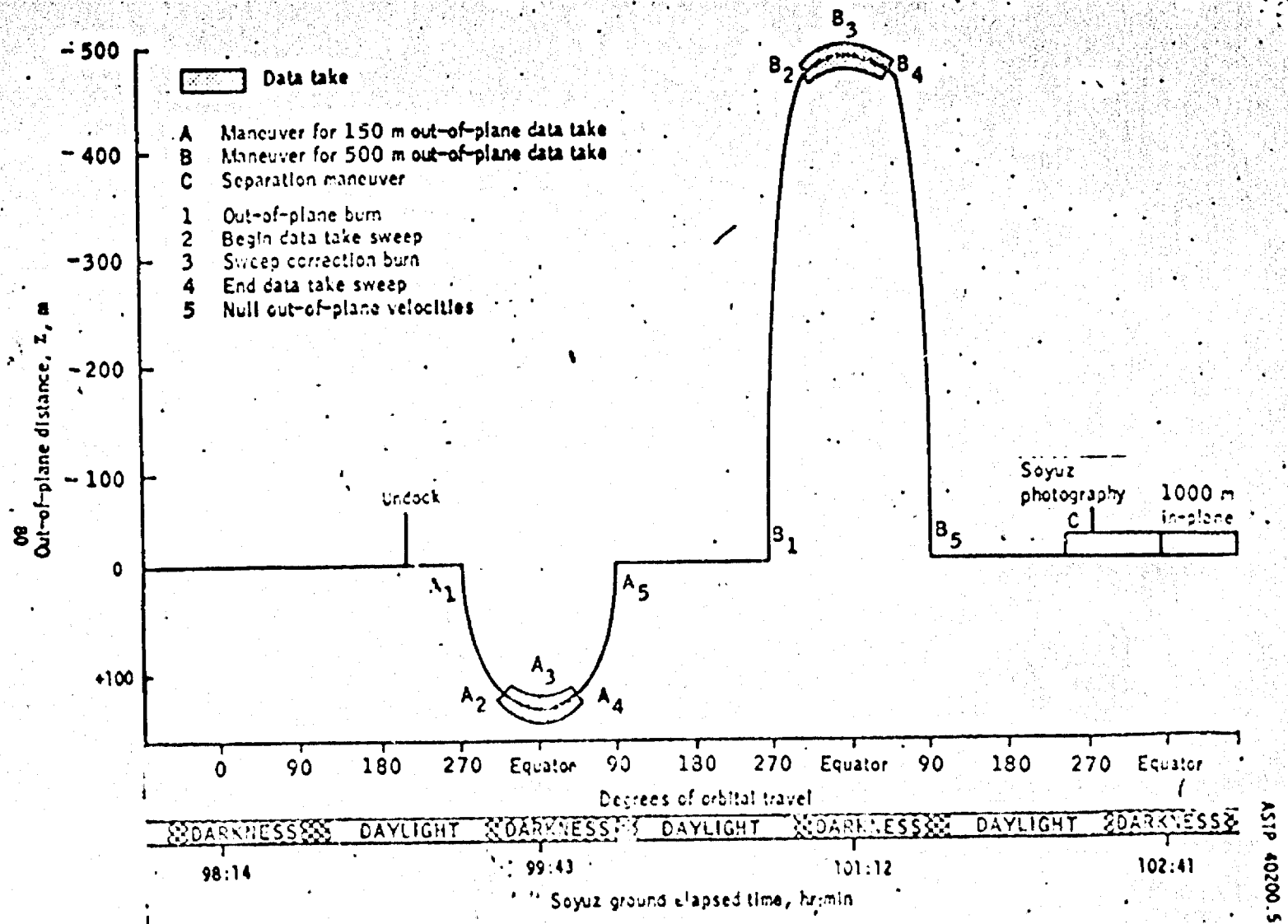
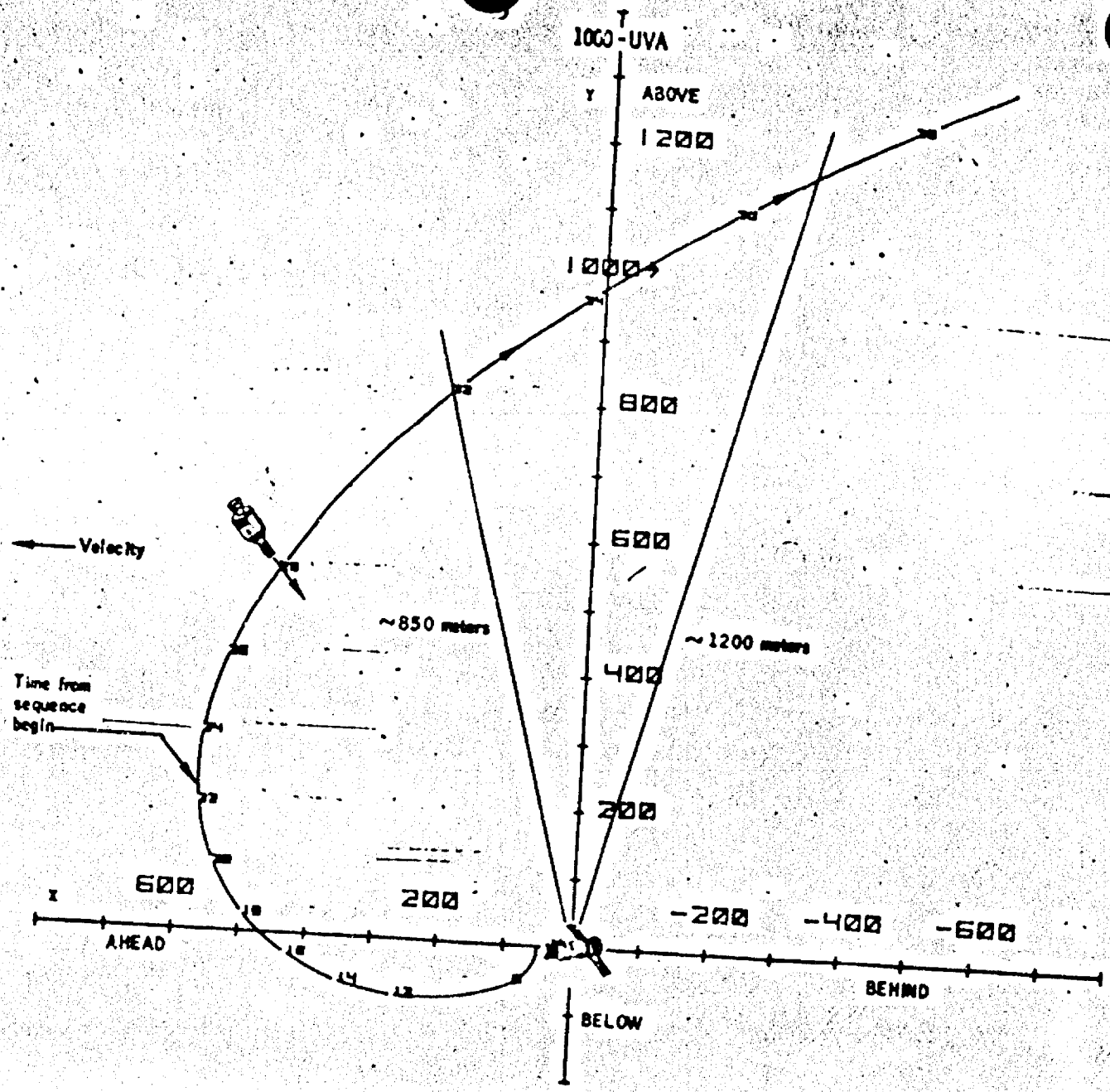



Figure 18.- EVA maneuver profile.

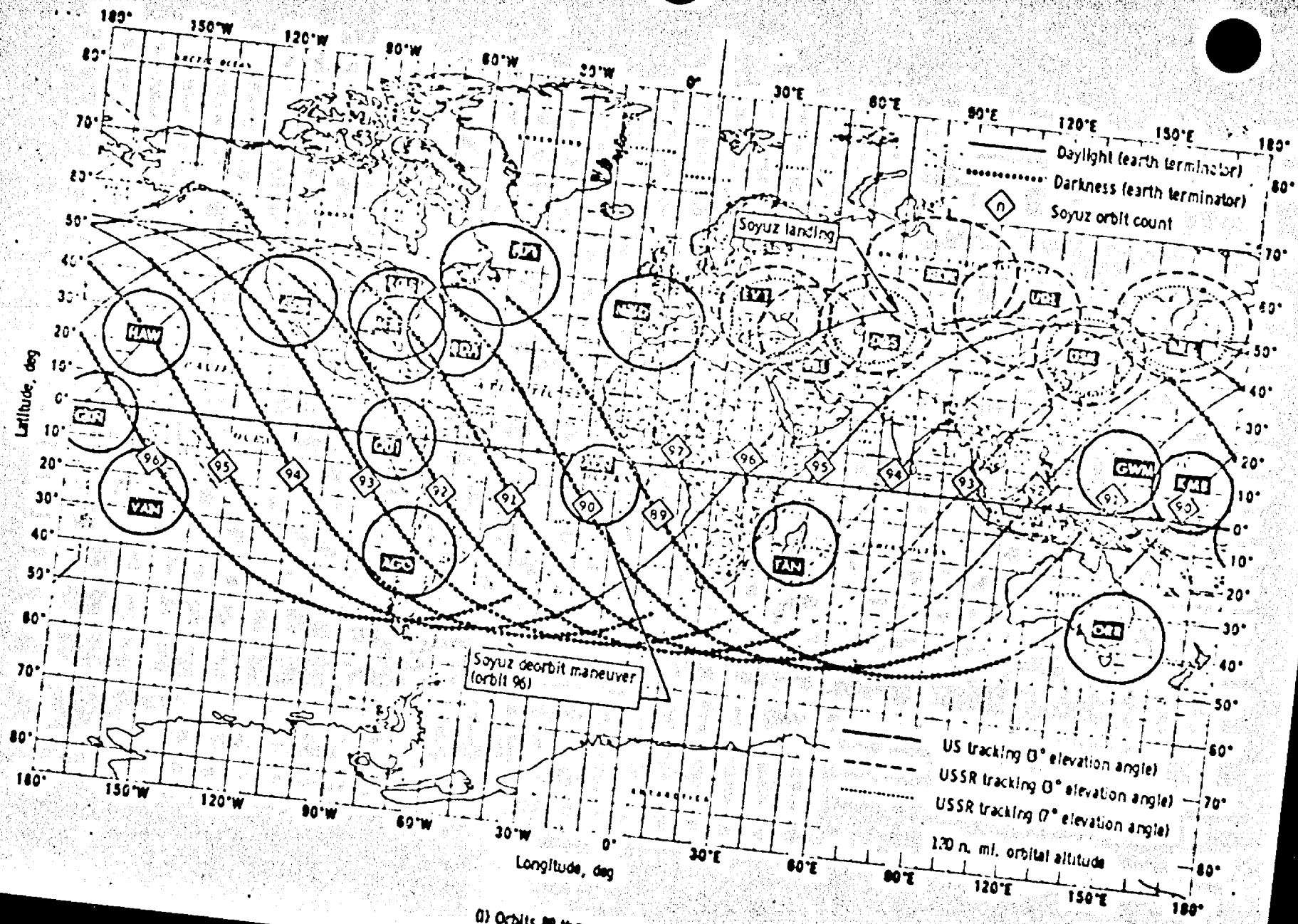

1000-UVA
Y
ABOVE
1200
1000
800
600
400
200
Velocity
~850 meters
~1200 meters
Time from sequence begin
X
600
200
-200
-400
-600
AHEAD
BEHIND
BELOW

ASTP 40200.5

NASA S 74 36201

# NOMINAL MISSION PROFILE (CONCLUDED)

- DAY 7
  - SOYUZ LANDING $142^h 30^m$ S. G.E.T.
  - APOLLO EXPERIMENTS
- DAY 8
  - APOLLO EXPERIMENTS
- DAY 9
  - APOLLO EXPERIMENTS
  - DOCKING MODULE JETTISON { MA-089 DOPPLER TRACKING; 204:40 S. G.E.T. }
- DAY 10
  - APOLLO SPLASHDOWN $225^h$ S. G.E.T.
    WEST OF HAWAIIAN ISLANDS




(j) Orbits 89 through 96.

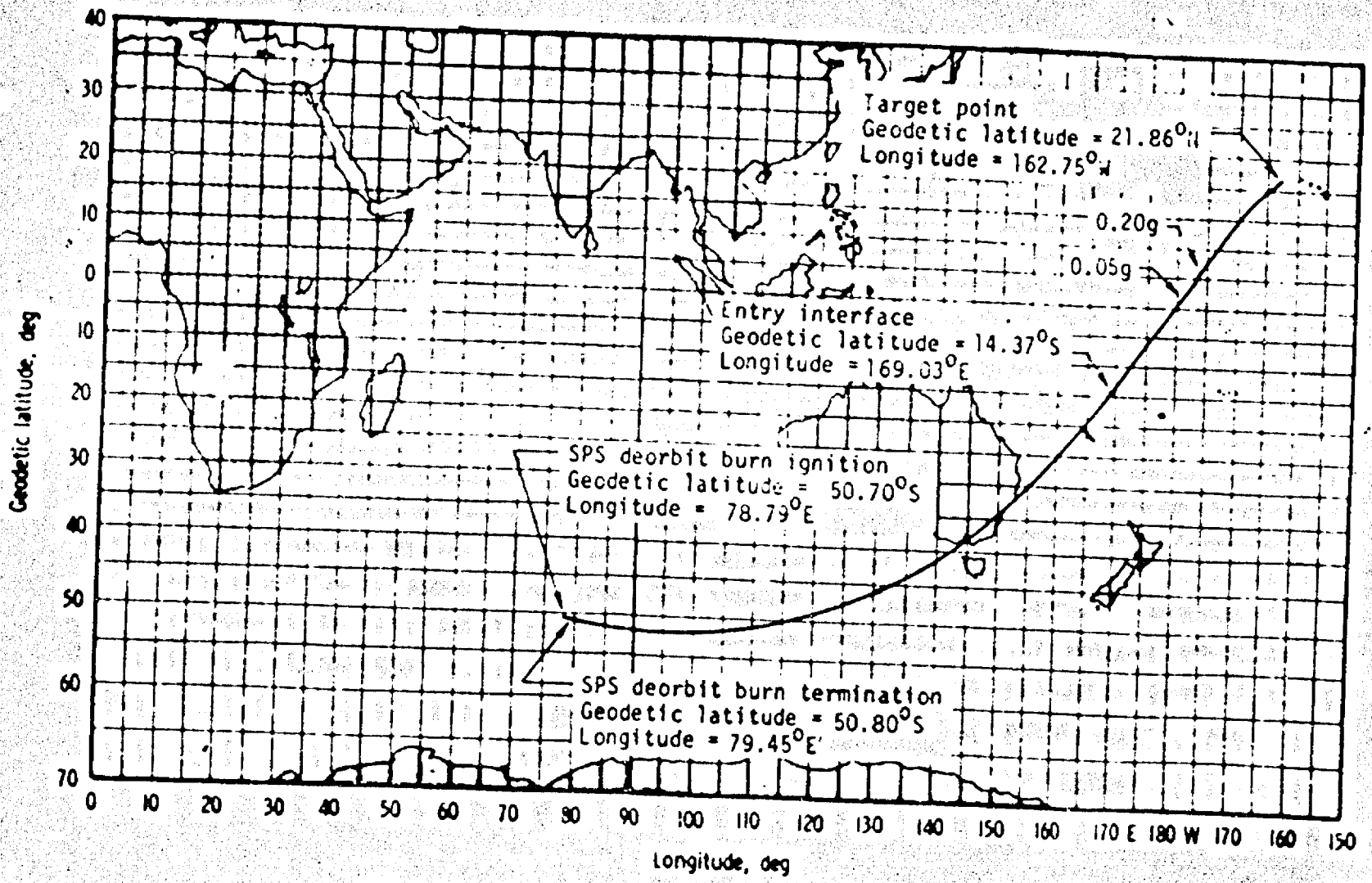



Figure 14.-Entry ground trace for an SPS deorbit maneuver.

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