Best Track Committee Re-Analysis Comments for 1967
Responses to Comments in boldface and indented – Chris Landsea – April 2020

General comments:

1. Several of the microfilm (MF) maps contain pictures of a text product called "Tropical Analysis" (referred to in the write-up as "Satellite bulletin") that a) looks like it contains information on tropical cyclones and disturbances, and b) may have been a part of the Weather Bureau operational products suite of the time. Please contact the National Center for Environmental Information to see if they can find an archive of this product, which could be very useful in the re-analysis.

These "Tropical Analysis" text products from NHC are an older version of the current "Tropical Weather Discussion". However, obtaining and going through six months' worth of these products is beyond the scope of this project.

2. Please include a general comment at the start of the revised write-up that this was the first year that a file of non-developing depression was available, which greatly increased the number of systems to be examined. Also note that many of the systems in that file do not meet the current criteria to be called tropical cyclones.

Agreed and so added.

3. Two systems (AL161967 and AL281967) have impressive appearances in satellite imagery to the point where it appears possible that they were tropical storms. However, neither system has the multiple observations of tropical-storm force winds (or the pressure equivalents) that have been necessary for past upgrades to a tropical storm. Nor, at this stage of the satellite era, are there satellite intensity estimates available. This highlights a possible weakness in the standards for handling these systems.

The Committee needs to have a discussion on how to better handle these cases where satellite imagery may be the necessary second piece of data to make a system a tropical storm (including attempting to estimate the imagery using the Dvorak technique?).

Based upon the Committee's recommendation, we will now add in new tropical storms/subtropical storms based upon at least one ship report (wind/pressure) along with satellite imagery. Previously, two observationally based pieces of evidence were required.

1967 AL011967, Tropical Depression:

1. On the MF map for 1200 UTC 10 June, is that a 30 kt observation near Swan Island, or is that a plot of the gust from Swan Island over a 15 kt regular observation? If it is a valid 30 kt datum, please log it in the ship highlights section. The Committee also notes that there is a 25 kt observation well to the southeast of the center on the same map.

The 30 kt observation (drawn lightly and larger) is a top of the boundary layer or 1000 mb wind observed from the radiosonde launched at that location.

2. The Committee otherwise concurs with the proposed track.

Agreed.

1967 AL021967, Tropical Depression:

1. The Committee concurs with the removal of this system from HURDAT. The write-up should probably say that the system occurred between the Greater Antilles and Bermuda rather than generally north of the Greater Antilles.

Agreed and so adjusted.

1967 AL031967, Unnamed Tropical Storm:

1. Given the upper-level trough mentioned in the Climatological Data write-up on 16 June, should the system be classified as subtropical for part of its life cycle? Please provide the appropriate upper-level maps when available.

Yes, based upon the upper-level maps, the system has been re-classified as subtropical from the 15th and the 16th, then transitioned to a tropical storm around 00Z on the 17th.

2. Please re-check the position of the Wilmington radar fix for 1200 UTC 16 June. First, this appears to be well east of the actual track of the cyclone. Second, is the given position actually in range of the Wilmington radar?

The system is too far from the radar to obtain a meaningful center fix and is not weighted in the reanalysis.

3. The Committee otherwise concurs with the proposed changes, including the upgrade to a tropical storm and the extension of the track as an extratropical low. Have the 35 kt ship observations undergone a quality check?

Unfortunately, ship *Colina (2337)* only reported one time in conjunction with this storm.

4. Please examine the data from land stations in coastal South and North Carolina and include them in the land highlights section. Does this system now count as a tropical storm landfall in the United States, and if so, can the impact be confirmed by land station data?

The available land stations were obtained from the EV2 website at NCEI. No South Carolina or North Carolina stations had any tropical storm force winds or low pressures. This is not surprising given the small size of the system and its minimal tropical storm status. The system is now listed as a new tropical storm landfall.

1967 AL041967, Tropical Depression:

1. The Committee concurs with removing this system from HURDAT.

Agreed.

1967 AL051967, Tropical Depression:

1. The Committee concurs with removing this system from HURDAT.

Agreed.

1967 AL061967, Tropical Depression:

1. The Committee concurs with removing this system from HURDAT.

Agreed.

1967 AL071967, Tropical Depression:

1. The Committee concurs with removing this system from HURDAT.

Agreed.

1967 AL081967, Tropical Depression:

1. The Committee concurs with removing this system from HURDAT.

Agreed.

1967 AL091967, Tropical Depression:

1. The Committee concurs with removing this system from HURDAT.

Agreed.

1967 AL101967, Tropical Depression:

1. The Committee concurs with removing this system from HURDAT.

Agreed.

1967 AL111967, Hurricane Arlene:

1. The Committee favors keeping the proposed genesis time of 1800 UTC 28 August, since that is also the time originally used in HURDAT. However, since the write-up says it was operationally upgraded to a depression on 27 August, the re-analysis case for the 28 August genesis needs to be more strongly stated.

Satellite images on the 27th indicated that the tropical disturbance was becoming better organized but synoptic observations showed that it did not have a closed circulation. Satellite images on the 28th indicated that the system had become better organized, showing an exposed low-level circulation with most of the convection to the east and south of the center. The first position is analyzed at 18Z on the 28th as a 30 kt tropical depression, same as originally shown in HURDAT. This is partly corroborated by the sparse synoptic observations over the central Atlantic.

2. The recon highlights on 30 August do not match what is written in the 1967 Monthly Weather Review season summary, where it is stated that a Navy aircraft found 70 mph winds near the center on the afternoon of 30 August. Please clarify this if possible.

It is now noted in the writeup that the MWR account indicates 70 m.p.h winds [60 kt], which is not consistent with the vortex message in the storm wallet. The reanalysis is not sure which is correct, though more weight is placed on the pressure, rather than either peak wind estimate.

3. The Committee concurs with the other proposed changes.

Agreed.

1967 AL121967, Hurricane Chloe:

1. On the intensity graph, the plotted fixes seem to be off by 6 h.

No worries. These plots are made available to the public; just for your use.

2. The Committee concurs with the proposed earlier genesis.

Agreed.

3. The Committee concurs with the reduced intensities on 9-11 September and the delayed upgrade to a hurricane.

Agreed.

4. While the Committee concurs that the data justifies an increase in intensity on 18 September, it is concerned that the proposed 90 kt is too high given the high latitude of the system and some decrease in central core organization see in satellite imagery. 85 kt would probably be better.

Agreed. 85 kt is adopted on the 18th.

4a. In the metadata summary for 18 September, it states that "Many ships reported sustained winds up to hurricane force". Since there is only one 65-kt observation in the ship highlights, this is confusing. If there are more hurricane-force observations, please include them. If not, please re-write this.

Changed to: "Many ships reported sustained winds of 35 to 60 kt with one report of hurricane-force on the 18th."

5. The Committee suspects that Chloe underwent an earlier extratropical transition. However, given that the inner core data early on 21 September is insufficient to explicitly show this, the proposed time of transition at 1200 UTC looks good.

Agreed.

1967 AL131976, Hurricane Beulah:

1. The Committee does not concur with delaying genesis until 1800 UTC 6 September. The wind shifted from northwest to southwest at Barbados between 0000-0600 UTC 6 September, suggesting that a center passed north of the island during that time. If the available data conclusively shows that no circulation existed at the original HURDAT genesis time, then an alternative would be 0000 UTC 6 September. Otherwise, please leave it at the current HURDAT time.

Agreed. The observations at 12Z on the 5th – the original genesis time – are ambiguous as to whether genesis had occurred. Therefore the original genesis time is retained.

2. There seems to have been no use of the land data from the Lesser Antilles in the re-analysis, as shown by no land station highlights. What were the significant winds and low pressures in the Antilles as the system moved through?

Station highlights are only included if there were winds of at least 35 kt or pressure of 1005 mb or less. There were no significant observations noted.

3. The Committee favors a 75 kt intensity at 1800 UTC 8 September due to Beulah undergoing rapid intensification and the observed very small eye diameter.

Agreed. The intensity is adjusted upward.

4. Due to the small core size and rapid intensification, the Committee would prefer a 125 kt intensity at 0000 UTC 10 September. After that, it generally concurs with the proposed changes due to the documented eyewall replace cycle. However, the 15 kt decrease from 1800 UTC 10 September to 0000 UTC 11 September seems a bit much. Can this be smoothed?

Agreed for both.

5. Have you contacted the meteorological service of the Dominican Republic to see if they concur with Beulah not actually making landfall on the Barahona Peninsula?

The Meteorological Service of the Dominican Republic have no additional information regarding Beulah, including whether the eye made landfall on the Barahona Peninsula.

6. Please re-examine some of the intensities on 12-13 September, as the decrease from 50 kt at 1800 UTC 12 September to 35 kt at 0000 UTC 13 September seems abrupt. Perhaps the 1000 mb pressure at 1200 UTC 12 September would be better fit by a 45-kt intensity?

Agreed, so changed.

6a. The write-up mentions that the recon fix at 2345 UTC had a 1004 mb central pressure. However, the pressure was not included in the aircraft highlights section. Please correct this.

This fix has now been added.

7. On 13-14 September, there are discrepancies between the re-analyzed intensities stated in the write-up and those in the HURDAT extract. One example is 1200 UTC 14 September, where the write-up states 60 kt and the extract shows 55 kt. Please correct this, and if possible smooth out the best track intensities on 14 September.

The best track for 12Z on the 14th is now corrected to be 60 kt.

8. The Committee concurs with the proposed intensity changes on 15-17 September, except see below for the increased landfall intensity in Mexico.

8a. Regarding the 954 mb pressure observation in Cozumel: First, the write-up should be modified to show that this was an official ob from the Meteorological Service of Mexico. Second, can it be determined from the data record what the wind was at the time of the lowest pressure? Third, have you contacted the Meteorological Service of Mexico to see if they concur

with the upgrade to a major hurricane? Pending these items, the Committee concurs with the proposed increased landfall intensity.

Agreed to indicate that the observations came from the Meteorological Service of Mexico. Unfortunately, we do not know the wind at the time of the pressure minimum. The Meteorological Service of Mexico does not have a concern about the proposed upgrade of Beulah to a major hurricane landfall in Mexico.

9. In the write-up for 18 September, please provide the estimated radius of maximum winds (RMW) from the aircraft fix eye diameters and discuss how they influence the intensity determination. Pending this, the Committee concurs with the proposed reductions in intensity for this day. However, is it possible to smooth out the intensities a little by making the 0600 UTC intensity 80 kt?

The 22 nm eye diameter corresponds with roughly a 15 nm RMW, which is near the value expected for this latitude and central pressure. Thus no alterations are done from the pressure-wind relationship based upon the RMW size. Agreed to make the 06Z intensity 80 kt.

10. The Committee has an issue with the addition of an intermediate point for the 923 mb pressure near 0300 UTC 19 September, namely why there isn't a similar point for the 923 mb fix at 2031 UTC 18 September. While it is not keeping to the letter of how the pressure fixes are supposed to be used, the best action in this case is probably to keep the 923 mb pressure for 0000 UTC 19 September along with the 140 kt winds.

Agreed.

11. The Committee tentatively concurs with the proposed reduction in landfall intensity to 110 kt. However, could the 952 mb pressure in Raymondville also be used to estimate a landfall pressure using appropriate inland decay rates? This could result in some tweaking of the landfall intensity.

Yes, running the Ho et al. inland pressure decay model yields 938 mb +/- 5 mb. This is further collaboration that the 940 mb is a reasonable value.

12. The Committee concurs with the proposed revised dissipation phase of Beulah.

Agreed.

1967 AL141967, Hurricane Doria:

1. Please provide the appropriate upper-air maps for Doria, especially during the genesis stage.

200 mb maps included from 4th through 8th of September.

2. The Committee does not concur with the earlier genesis time as a tropical cyclone. While the temperature gradients near the center may not have been strong, the overall circulation is shaped more like an extratropical low with well defined cold and warm fronts. The recommendation is to keep the time of tropical transition the same as currently in HURDAT, but include the positions on 4-7 September as an extratropical and then a subtropical low. The subtropical phase might be best started on 6-7 September.

Agreed. The system is now indicated to be extratropical on the 4th and 5th, transitioning to subtropical on the 6th and 7th.

2a. In the 4 September write-up, please change "cold front extending to the southeast" to cold front extending to the southwest".

Corrected.

3. Please check with Dave Roth on the proposed pressures of the outermost closed isobar (POCI) on 7-8 September and 11-14 September, and use these to revise the proposed intensities, if necessary.

These POCI have been incorporated into the reanalysis. Intensities on the 11th through the 15th have been increased.

4. Please re-write the first sentence of the re-analysis section on 11 September to make it more succinct.

So changed.

5. The Committee concurs with the reduced intensities on 12-13 September and the later upgrade to hurricane strength.

Agreed.

6. What was the reason for making the intensity 80 kt at 1200 UTC 14 September given that the aircraft fix used for the peak intensity was near 1800 UTC?

Agreed to make the peak intensity beginning at 18Z on the 14th.

7. Please provide the justification for saying that the 980 mb fix at 2141 UTC 14 September was not at the center.

A penetration center fix reported a central pressure of 980 mb at 2141Z on the 14th but it appears that it missed the central pressure given it being several millibars higher than immediately preceding and subsequent fixes, thus it has been removed from HURDAT.

8. In the 15 September re-analysis section, please re-write the part starting in "Satellite images showed that Doria had lost in organization".

Revised.

9. Please provide more discussion of the 99 kt ship report on 16 September and why it doesn't seem to be used in the re-analysis.

The 99 kt ship report at 00Z appears to be unrealistic, given the aircraft reconnaissance observations. Thus this is not weighted in the intensity assessment.

10. At the end of the discussion paragraph on September 16, the phrase "producing sustained tropical-storm-force-winds along Delaware, Maryland, Virginia, and North Carolina" should be reworded as "producing sustained tropical storm-force winds along the coasts of Delaware, Maryland, Virginia, and North Carolina." At the end of the discussion paragraph on September 18, did you mean "Doria lost most" or "Doria lost all of its convection"?

So changed on the 16th. "Doria lost most".

11. What surface pressures were available from the U. S, landfall area, and how did they influence the analyzed landfall intensity?

The lowest pressure measured from the U.S. landfall was 1000 mb at Cape Henry at 2015Z on the 16th, a couple hours before landfall. While this was close to the center, it was not a central pressure and did not play a role in determining landfall intensity.

12. What were the other storms to hit North Carolina on a south or southwest track?

XXX – Sandy?

13. The Committee concurs with the proposed remnant low dissipation.

Agreed.

1967 AL151967, Tropical Depression:

1. The Committee concurs with the proposed changes to this system

Agreed.

1967 AL161967, Tropical Depression:

1. (See general point 3.) Between the satellite images and the 1004 mb recon data, it is possible that this system became a tropical storm on 28-29 September. However, there are currently insufficient other observations to justify an upgrade in HURDAT. Due to that, the Committee concurs with the proposed changes.

Agreed to upgrade the system to a tropical storm based upon the combination of satellite imagery and the 1004 mb recon data.

1967 AL171967, Tropical Depression:

1. The Committee concurs with leaving this system a tropical depression and accepts the proposed track.

Agreed.

1967 AL181967, Tropical Storm Edith:

1. A couple of typographical errors: In the September 26 discussion, the ATSR section has "neat" in the second line typed instead of "near", which makes more sense. In the last line of the September 30 discussion, Edith is spelled as Edit.

Corrected.

2. The Committee recognizes the possibility based on aircraft data that the system became a tropical storm on 26 September and then weakened for a day. However, the forecasters of the time apparently had the same data we have and decided in post-analysis that the system was not a tropical storm on 26 September. Based on that, we'll keep the system a tropical depression on 26 September.

Agreed.

3. The Committee believes that based on the 1000 mb central pressure a 45-kt peak intensity is more appropriate.

Agreed to change the peak intensity to 45 kt.

4. The Committee concurs with the rest of the proposed changes.

Agreed.

1967 AL191967, Hurricane Fern:

1. The Committee concurs with the proposed changes for this system. Does the Meteorological Service of Mexico have any information on Fern's landfall there?

Unfortunately, the Meteorological Service of Mexico has no additional information regarding Fern's landfall.

1967 AL201967, Tropical Depression:

1. The Committee concurs with removing this system from HURDAT.

Agreed.

1967 AL211967, Tropical Storm Ginger:

1. The Committee concurs with the proposed changes to this system. The origin of the 1002 mb pressure in HUDAT is mysterious.

Agreed.

1967 AL221967, Tropical Depression:

1. Please coordinate with David Roth on a potential extratropical phase for this system.

Agreed to indicate an extratropical phase from 18Z on the 10th through 00Z on the 13th.

2. Please provide the appropriate upper-air maps for this system.

200 mb charts have been added for the 7th through the 11th.

3. The Committee otherwise concurs with the proposed changes.

Agreed.

1967 AL231967, Unnamed Tropical Storm:

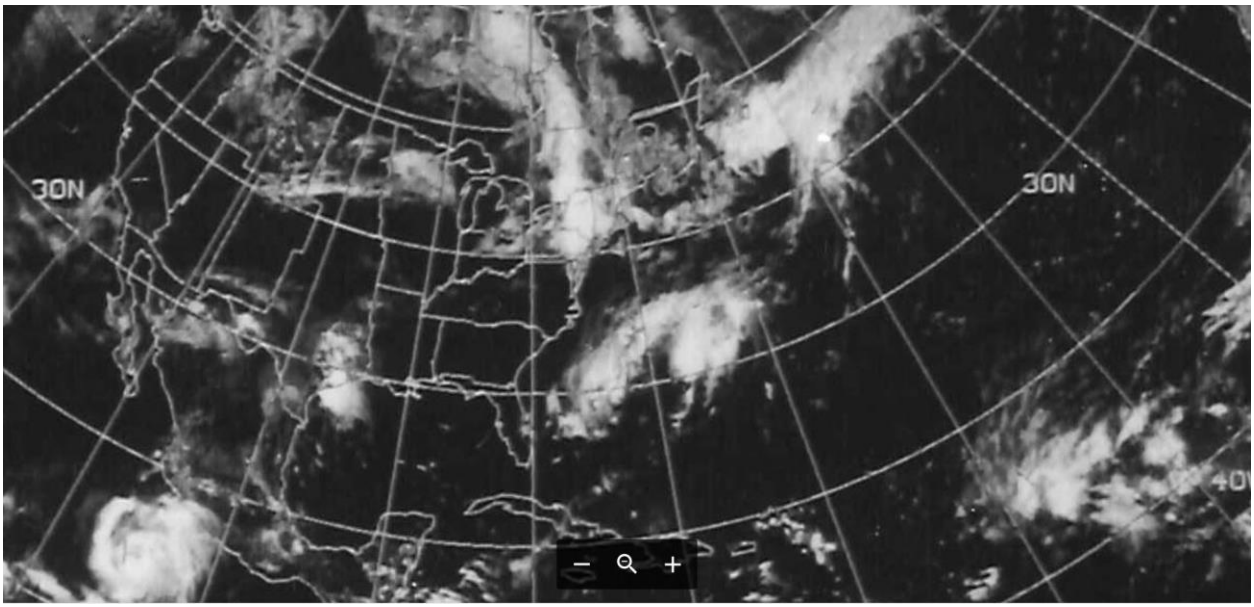
1. Please provide the appropriate upper-air maps for this system.

200 mb charts have been added for the 14th through the 18th.

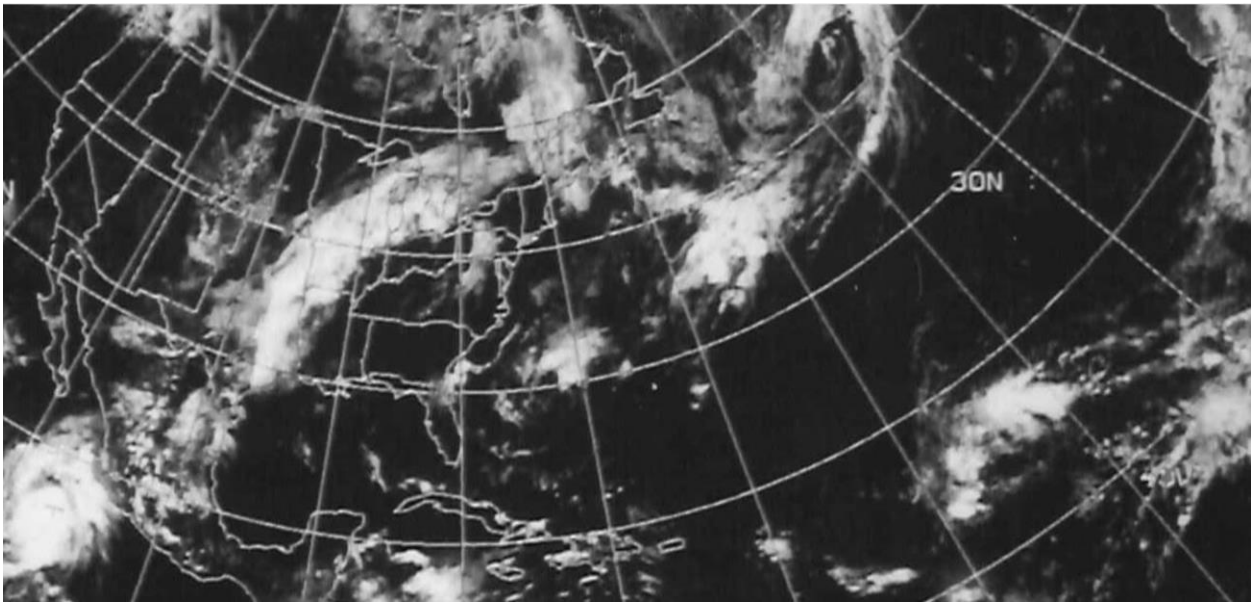
2. This system requires more analysis on the sequence of events given the significant discrepancies between the proposed best track and what the Mariners Weather Log has. The

most likely scenario is that two low pressure areas formed in close proximity, with one becoming the storm the re-analysis tracks and the other becoming the MWR's storm. This scenario is supported by these satellite images:

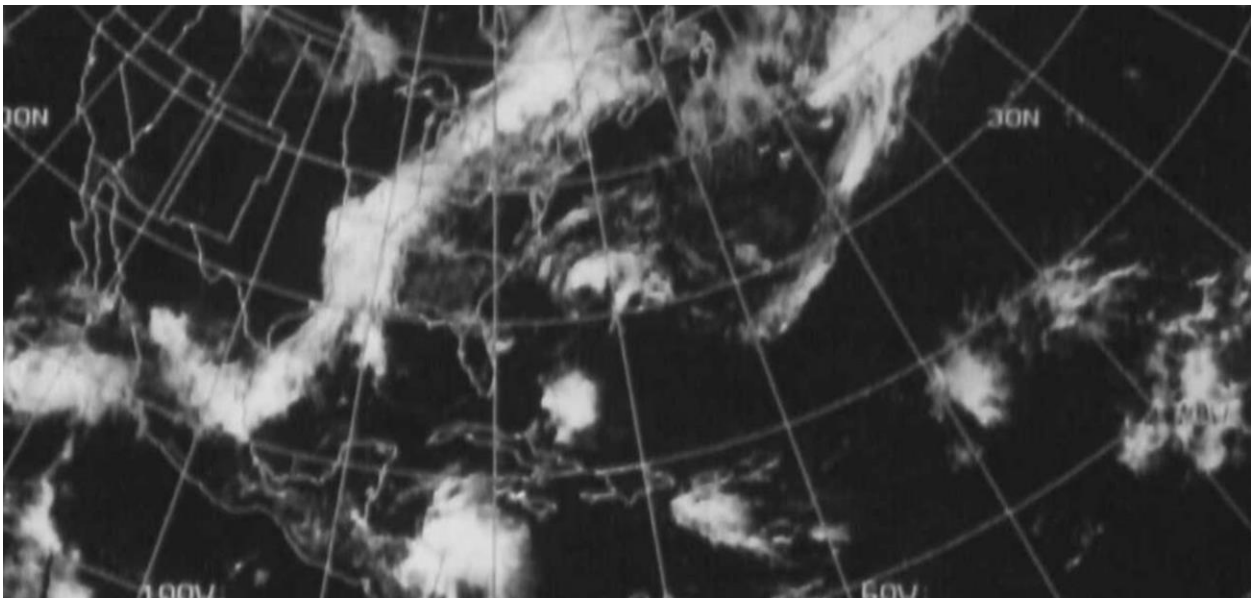
14 October:



15 October:



16 October:



These images definitely support the proposed best track, but the evolution of the second low pressure system needs to be better documented.

The evolution of the second system is now more fully described.

3. While the Committee has no issues with the other proposed changes, it will await the request additional re-analysis before it approves the changes for HURDAT.

Agreed.

1967 AL241967, Tropical Depression:

1. The Committee concurs with the proposed changes to this system

Agreed.

1967 AL251967, Hurricane Heidi:

1. Did the remains of Tropical Depression AL241967 play any role in the genesis of Heidi?

This is unlikely given that 48 hour elapsed after the dissipation of TD AL24 and the genesis of Heidi. Satellite imagery and the microfilm analyses show a separate tropical wave moving in from the east were associated with Heidi's formation.

2. Given the 60 kt ship report at 0200 UTC 22 October, should the intensity be increased to 60 kt earlier than currently proposed?

No, given the extremely high pressure of the system on the 22nd (1006 mb). We are already going way above the pressure-wind relationship. We are interpreting that report to not be representative of the circulation of the tropical storm and instead a transient occurrence (i.e., squall line, outflow boundary).

3. Is the rise in the central pressure on 24 October sufficient to justify the proposed decreased intensities?

Yes, the pressure rose from 992 mb 18Z on the 23rd (70 kt) to 999 mb 12Z on the 24th (65 kt).

4. The Committee concurs with the rest of the proposed changes, including the later extratropical transition and dissipation.

Agreed.

1967 AL261967, Tropical Depression:

1. The Committee concurs with removing this system from HURDAT.

Agreed.

1967 AL271967 - New, Tropical Storm:

1. The Committee concurs with the addition of this system.

Agreed.

2. Please re-examine the positions of the cyclone on 21 June. The analyzed positions are south of 30N, but satellite imagery suggests the center was north of 30N.

Agreed to move positions farther north on the 21st.

3. In the 22 June write-up, "Weakening to a tropical storm" should be "Weakening to a tropical depression".

So changed.

1967 AL281967 - New, Tropical Storm:

1. (See general point 3.) This system is another where the satellite imagery suggests it was a tropical storm, but the more conventional data does not have enough evidence to justify

the upgrade - no observed 35-kt or better winds and only one measured pressure that infers such winds. Pending the resolution of general point 3, this system should be included in HURDAT as a tropical depression instead of a tropical storm.

As discussed in the opening notes, systems are now added into HURDAT2 based upon one supporting surface observation in conjunction with satellite imagery.

1967 Additional Notes:

1. The Committee concurs with leaving all of the listed suspect systems out of HURDAT.

Agreed.